
DIVISION ONE - STANDARDS FOR DRAINAGE AND GRADING

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DIVISION ONE - STANDARDS FOR DRAINAGE AND GRADING

SECTION 1.1 GENERAL

Sec. 1.1.1 PURPOSE AND SCOPE

It is the general purpose of these standards that waters generated by storms be transmitted from surface runoff into a system of waterways and disposed of in such a manner that adjacent improvements, existing or proposed, will be free from flood hazard from a 10, 25 or 100-year storm, whichever is indicated by these standards. Flood hazard is defined as potential damage by water having sufficient depth or velocity to damage improvements or to deposit or scour soil other than within channels or designated waterways.

Sec. 1.1.2 PLAN SUBMITTAL PROCESS

- 1.1.2.1 The developer's engineer shall submit a drainage study together with a conforming grading plan for the proposed drainage system to the City Engineer, for review and approval prior to grading construction.
- 1.1.2.2 An Engineer's Estimate, based on "unit" prices approved by the City Engineer, shall be submitted and approved for the determination of plan check and inspection fees for multi-lot projects such as residential developments. For projects involving a single site with grading, the determination of grading plan check, permits, and inspection fees shall be based on calculated grading quantities.
- 1.1.2.3 All plan check fees shall be paid to the Office of the City Engineer prior to the approval of any improvement plans.
- 1.1.2.4 An improvement plan checklist and two (2) sets of "blue-lines" shall be submitted for plan checking.
- 1.1.2.5 Grading plans and supporting calculations shall be submitted by the developer's engineer to the City Engineer, for review and approval prior to construction.
- 1.1.2.6 Drainage studies shall include calculations, signed by a registered civil engineer, defining development hydrology (including any applicable off-site hydrology), and demonstrating pipe hydraulics for the development.
- 1.1.2.7 Plans are subject to multiple checks until they are amended to the satisfaction of the City Engineer.
- 1.1.2.8 Grading plans being submitted for "Final Signature" shall be submitted in ink on film or vellum. Once signed by the City Engineer, the developer's engineer shall be responsible for submitting three (3) sets of "blue-lines", to the Office of the City Engineer, at least 48 hours prior to the start of construction.

- 1.1.2.9 **As-Built Drawings:** Upon completion of the improvements and prior to final acceptance of the development the developer's engineer shall submit "As Built, Record Drawings" to the Office of the City Engineer, showing changes from the original drawings and the "as-built" locations of any underground facilities constructed or encountered with the grading or storm drain plans. The "as-built" plans shall be submitted on film or mylar with either hand notations or computer generated notation. All notations shall completely illustrate the as-built condition in a neat, complete, and legible manner.

Sec. 1.1.3 WAIVER OF REVIEW PROCESS

There are no provisions for the waiver of the review process for drainage improvement plans or grading plans.

Sec. 1.1.4 ALTERNATIVE DESIGN

- 1.1.4.1 The design standards in this Division are to be deemed to be minimal. Alternate designs may be permissible, as determined by the City Engineer for designs of equal or higher quality. The City Engineer may allow such exceptions as he may find to be reasonably required by the circumstances of the case, to be in the public interest and in conformity with the general objectives of these standards.
- 1.1.4.2 The provisions of this manual are not intended to prevent the use of any material or method of construction not specifically prescribed by this manual if such alternate has been submitted to and has been approved by the City Engineer.
- 1.1.4.3 The City Engineer may approve alternate designs, if such alternate is found to be for the purpose intended and at least the equivalent of that prescribed in this manual in quality, strength, capacity, durability, safety, and effectiveness.

Sec. 1.1.5 ENFORCEMENT

- 1.1.5.1 Provisions of these standards for grading & drainage shall be enforceable by the City Engineer, the City Building Official, and their duly authorized representatives.

Sec. 1.1.6 DEFINITIONS, TERMS, AND ABBREVIATIONS

Whenever any of the following words, expressions or pronouns are used in these minimum standards, they shall be understood to have the meanings given below:

ACCESS	The safe, adequate, and usable ingress/egress (entrance/exit) to a property or use.
ASTM	American Standards for Testing Materials.
BACKFILL	Soil materials used to fill an excavation.
BENCH	A relatively level step excavated into sloping natural ground on which engineered fill or embankment fill is to be placed
BORROW	Earth material which must be acquired from outside the site of work to make for deficient areas which cannot be completed from excavation within work limits

BUILDING PERMIT	Written permission required by the city for the construction, repair, alteration, addition, removal or demolition to a building or structure.
CALTRANS	California State Department of Transportation
CERTIFICATE OF OCCUPANCY	A document issued by the City Building Official allowing the occupancy or use of a permitted structure or site.
CITY	The City of Shafter or the City Council for the City of Shafter.
CITY BUILDING OFFICIAL	The City Building Official for the City of Shafter
CITY ENGINEER	The City Engineer for the City of Shafter, or a duly authorized representative.
CLEARING	The removal of vegetation from a site by physical or mechanical means.
COMPACTION	The densification of materials by mechanical means.
CONDUIT	For the purposes of drainage, conduit refers to an underground pipe constructed for the purpose of conveying fluids
CONVEYANCE SYSTEM	Natural and man-made drainage features that collect, contain, and convey surface water. Natural drainage features include swales, streams, rivers, lakes, and wetlands. Man-made features include gutters, ditches, pipes, and detention/retention facilities,
CUT	See excavation.
DEDICATION	The deliberate appropriating of land by an owner(s) for any general and public uses, reserving to themselves no other rights than such as are compatible with the full exercise and enjoyment of the public uses to which the property is to be devoted. The intent to dedicate will be evidenced presentation of a deed.
DEVELOPER	The applicant for a development permit, his successors, and/or assignees.
DEVELOPER AGREEMENT	An agreement between the City and the Developer, which contains work descriptions, estimated costs, responsibilities for the work performance and an expiration date.
DEVELOPMENT	Any man-made change of improved or unimproved real estate, the construction, reconstruction, conversion, structural alteration, relocation, or enlargement of any structure; any mining, excavation, landfill, clearing, or land disturbance; or any use or extension of the use of land.
DIRECTOR	Director of the Public Works Department or designee, including the City Engineer and City inspectors.

EARTH MATERIAL	Any rock and/or natural soil exclusive of any decomposable matter.
EARTHWORK	Excavation, fill and back fill, compaction, and grading.
EASEMENT	Interest in land which does not include any rights of possession. A right of one owner of land to make lawful and beneficial use of the land of another created by an express or implied agreement.
EROSION	The wearing away of the ground surface as a result of movement of wind, water, and/or ice.
EXCAVATION	The mechanical removal of earth material.
EXISTING GRADE	The elevation in relationship to mean sea level
FEMA	Federal Emergency Management Agency.
FILL	Soil materials used to raise existing grades.
FINISH GRADE	The final elevation of the ground surface after development.
FLOOD OR FLOODING	A general and temporary condition of partial or complete inundation of normally dry land areas from the overflow of flood waters, or the unusual and rapid accumulation or runoff of surface waters from any source.
FLOOD HAZARD	Potential damage by water having sufficient depth or velocity to damage improvements or to deposit or scour soil other than within channels or designated waterways
GRADE	The vertical location of the ground surface to a predetermined elevation datum.
GRADING PERMIT	A document allowing or authorizing the initiation of grading, excavation, or related earthwork according to City Policies, Procedures, and Ordinances in conformity to the approved plan(s).
GRADING	Any act by which soil is cleared, stripped, stockpiled, excavated, scarified, filled, or any combination thereof.
IMPERVIOUS SURFACE	Any surface that cannot be effectively and easily penetrated by water
IMPROVEMENTS	Any improvement to public, real, or personal property, including but not limited to, installation of streets, roads, pedestrian/bike facilities, streetlights; landscape features; sewer and waterlines; bridge structures; storm drainage facilities; and traffic control devices.
INFILTRATION	The passage or movement of water into the soil subsurface.
INVERT	The lowest point in the internal cross section of a pipe or other culvert.

LOT	The smallest platted parcel of real property created by a legal subdivision.
OBSTRUCTION	Any obstacle of whatever kind or nature and shall include, but shall not be limited to, structures, power poles, telephone or telegraphic poles and appurtenances, pipe lines, conduits and canals.
OSHA	Occupational Safety and Health Administration
PERMITTEE	Any person, governmental agency, or other entity that is performing, or plans to perform, permitted work within the City.
PERVIOUS SURFACE	Any surface that can be effectively and easily penetrated by water
PLANS	The plans, profiles, cross sections, elevations, details, and supplementary specifications, signed by a licensed professional engineer and approved by the Director, showing the location, character, dimensions, and details of the work to be performed.
RIGHT OF WAY	A strip of land acquired by reservation, dedication, forced dedication, prescription, or condemnation and intended to be occupied by a road, crosswalk, railroad, electric transmission lines, oil or gas pipeline, water line, sanitary sewer, storm sewer, or other similar public accesses or public uses; Definition includes the right of one to pass over the property of another.
ROAD	Synonymous with street.
ROUGH GRADE	The stage of construction at which the grade approximately conforms to the permitted plan.
RUNOFF	Rainfall not absorbed by soil. Could also include unnatural sources of water (landscaping sprinklers, etc.) which must also be mitigated.
SITE PLAN	The graphical plan, usually in map form, prepared pursuant the construction of a development.
SITE	For purposes of this manual, a specific location on which any construction work is performed.
SLOPE	An inclined ground surface the inclination of which may be expressed as the ratio of horizontal distance to vertical distance.
SOIL	Naturally occurring surface deposits overlying bedrock. Storm water: The waters derived from rain falling or snow melting within a tributary drainage basin, flowing over the surface of the ground or collected in a storm water drainage system.

STANDARD DETAIL	Drawings approved by the City Council and adopted by said Council as part of these standards.
STORM DRAIN	Often buried pipe or conduit, also referred to as storm sewer that conveys storm drainage, also includes, manholes, catch basins, inverted siphons, and culverts. See also Waterway
STORM WATER DETENTION	The temporary storage of storm water runoff in ponds, parking lots, depressed grassy areas, rooftops, buried underground tanks, etc., for future release. Used to delay and attenuate flow, normally drained between storms.
STORM WATER RETENTION	Similar to detention except the facility may have a permanent pool of water or wetland that does not drain between storms.
STREET	Includes roads and highways. The terms street, road, and highway are used interchangeably and refer to the rights of way used for vehicular traffic, whether improved or unimproved
SUBGRADE	The undisturbed earth or the compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.
WATERWAY	A natural channel, artificial (man-made) channel, or closed conduit which provides a course for drainage water to flow.

SECTION 1.2 GENERAL POLICY

Sec. 1.2.1 FLOOD PROTECTION

- 1.2.1.1 All facilities constructed within a new development in the City of Shafter shall be protected against flooding.
- 1.2.1.2 Protection shall mean that all facilities, structures, or potentially damaged improvements within a development shall be a minimum of one (1) foot above the design water surface elevation of the design-year storm.
- 1.2.1.3 Flood protection shall be achieved through the design & construction of adequate surface drainage, waterways, and basins whenever required by this standard.
- 1.2.1.4 Construction of an improved waterway by reaches will be allowed only where determined feasible by the City Engineer. Interim construction of the improved reach upstream and downstream may be required by the City Engineer to the extent he may deem necessary to assure functioning of the improved reach and to be compatible with the full improvement which may ultimately be required in the area.
- 1.2.1.5 Upon request of the City Engineer, the developer's engineer shall submit calculations demonstrating that proposed facilities within the development will be protected from flooding as described above.

Sec. 1.2.2 FLOW ONTO ADJACENT PROPERTIES

- 1.2.2.1 Each improvement shall be designed so as to not increase the flow of storm water onto adjacent properties except as otherwise provided in this section.
- 1.2.2.2 Increased flow may be permissible in downstream channels provided that the developer furnish downstream facilities adequate to handle the total flow without adverse affect on other properties and/or shall obtain downstream easements, all to the satisfaction of the City Engineer.

Sec. 1.2.3 DESIGNING FOR OFF-SITE STORM WATER RUNOFF

- 1.2.3.1 **Off Site Watershed:** When pre-development conditions are such that offsite areas contribute runoff to the onsite development, the flows from offsite must be mitigated in a manner consistent with this manual. This flow, originating from offsite, shall be received into the development without diversion onto adjacent property or causing more than one foot rise in pre-development water surface upstream or downstream of the development, and shall either be discharged in a manner as similar as possible to the pre-existing condition downstream of the development or be mitigated using the same facilities as the development.
- 1.2.3.2 **Diversion:** Diversion of storm water will only be allowed by a development so as to conform to any "Comprehensive Drainage Plan" which may be in place at the time the tentative map is filed with the City.

Unless diversion of storm water is required to conform to a comprehensive drainage plan, storm water shall be received and discharged at the locations which existed prior to development and as nearly as possible in the manner which existed prior to development. Should diversion be required, sufficient work shall be done upstream

and/or downstream to provide all affected properties at least the same level of flood protection as existed prior to the diversion.

Sec. 1.2.4 CONFORMANCE WITH COMPREHENSIVE DRAINAGE PLANS

- 1.2.4.1 When a comprehensive drainage plan, as provided for in Section 66483 et seq. of the Subdivision Map Act, has been adopted for proposed development area, the developer shall conform to the plan unless specific alterations are approved by the City Engineer.

Sec. 1.2.5 CLOSED CONDUITS

- 1.2.5.1 Closed conduits are the preferred method of storm water conveyance and shall be required for all waterways unless alternate methods are expressly approved or required by the City Engineer. Requests for approval shall be made in writing.
- 1.2.5.2 Any system of underground drainage facilities, other than closed conduit, shall be made in writing to the City Engineer.
- 1.2.5.3 The City Engineer is empowered to require closed conduits and shall approve the design thereof, in accordance with the intent of these Engineering Standards.

Sec. 1.2.6 CONSTRUCTED CHANNELS

- 1.2.6.1 Generally speaking, constructed channels and waterways are prohibited unless expressly allowed by the City Engineer.
- 1.2.6.2 Constructed channels shall be protected as approved by the City Engineer. Any other landscaping shall be designed for minimum maintenance and risk to the general public. Plant materials and arrangements thereof shall be subject to the approval of the City Engineer and the Planning Department.

Sec. 1.2.7 PRIVATELY MAINTAINED DRAINAGE SYSTEMS

- 1.2.7.1 All drainage facilities constructed outside of public right-of-way shall be maintained by the property owner in accordance with all applicable state and local laws.

Sec. 1.2.8 DESIGN AIDS

- 1.2.8.1 Certain design aids are referenced to within these standards and shall be used where expressly so required and otherwise may be used in designing drainage facilities. Other design aids referred to be used where required. Additional aids may be used, upon approval, from approved sources or generally accepted references.

SECTION 1.3 CLASSIFICATION OF WATERWAYS

Sec. 1.3.1 GENERAL

- 1.3.1.1 A **waterway** is defined as any natural channel, artificial (man-made) channel, or closed conduit which provides a course for drainage water to flow.
- 1.3.1.2 Waterways subject to these design standards shall be classified as defined below. A waterway may be subdivided into reaches, each of which may be of a different classification; however, each reach of a waterway so subdivided shall be of a length which is reasonable to adequately analyze the storm drain facilities.
- 1.3.1.3 Waterways are designated as being major, secondary, or local based on the tributary watershed area as follows:
- a) **Major Waterways** have drainage areas of over four square miles.
 - b) **Secondary Waterways** have drainage areas between one and four square miles.
 - c) **Local Waterways** have drainage areas of less than one square mile.
- 1.3.1.4 A given waterway, therefore, will be classed as Local in its upper reaches, then change to the Secondary classification at a point where the drainage area exceeds one square mile and then change again to the Major classification at a point where the drainage area exceeds four square miles.

SECTION 1.4 HYDROLOGIC DESIGN

Sec. 1.4.1 GENERAL

- 1.4.1.1 Hydrologic design shall be predicated upon full urban development of the tributary watershed. Lands which are undeveloped at the time of design shall be assumed to be fully developed as residential unless a publicly proposed development, proposed zone change, the General Plan, or applicable specific plan indicates a more intense land use.
- 1.4.1.2 Cemeteries, publicly owned parks, publicly owned golf courses, and similar publicly owned areas may be considered as pervious areas to the extent that they are actually pervious, except as publicly proposed plans show that the body having jurisdiction intends to alter the existing use of the area so as to make the surface less pervious.
- 1.4.1.3 Average recurrence interval is defined as the average number of years, over a long period of time, between actual occurrences of a hydrological event of a given or greater magnitude. Flood flows to be used for the design of waterways, channels and closed conduits shall have minimum average recurrence intervals as follow:
- a) **Major waterways** shall be designed for an average recurrence interval of 100 years.
 - b) **Secondary Waterways** shall be designed for an average recurrence interval of 25 years.
 - c) **Local Waterways** shall be designed for an average recurrence interval of 10 years.

Sec. 1.4.2 METHOD OF COMPUTATION OF DISCHARGE FOR DRAINAGE AREAS.

- 1.4.2.1 **Local Waterways:** The "Alternative Rational Method" shall be used as the method of computation to determine the discharge of local waterways. The methods and data detailed within the Kern County Hydrology Manual Appendix VII, latest edition, shall be used in addition to the following.
- a) Initial Time of Concentration (T_c)
 - (1) Initial Time of Concentration for R-1 & R-2 zoning shall be 15 minutes (roof to gutter) plus the time necessary for runoff to make its way through the initial area.
 - (2) Initial Time of Concentration for R-3, or any commercial or industrial developments zoning shall be 10 minutes (roof to gutter) plus the time necessary for runoff to make its way through the initial area.
 - b) Intensity (I)
 - (1) Rainfall Intensity for 5, 10, 25, 50, & 100 year events shall be per the Rainfall Intensity Duration Frequency Chart recreated in City standard detail D-1 from data found in the Kern County Hydrology Manual.

- c) Impervious Area (a_i)
 - (1) Acceptable design values of impervious area values are shown in City standard detail D-1 or from data found in the Kern County Hydrology Manual.
- d) Runoff Coefficient (C)
 - (1) Runoff Coefficient calculations account for runoff from pervious areas ($1-a_i$) as well as runoff from impervious areas (a_i) when the rainfall intensity is greater than the soil infiltration rate (i.e. when $I > F_p$). When the rainfall intensity falls below the soil infiltration rate (when $I < F_p$), the runoff coefficient is a function of the impervious area only.
 - (2) Runoff Coefficient shall be determined either from the formulas shown in City standard detail D-1 or from formulas and data found in the Kern County Hydrology Manual.

1.4.2.2 **Secondary Waterways:** When off-site drainage areas increase the size of the watershed to over one square mile, the methodology set forth in Section D of the Kern County Hydrology Manual shall be applied as directed by the City Engineer.

1.4.2.3 **Major Waterways:** For all watersheds of four square miles or greater, the runoff shall be determined using one of the following methods as directed by the City Engineer.

- a) US Army Corps of Engineers Hydrologic Center computer model HEC-1 or equivalent.
- b) Soil Conservation Methods as detailed in Technical Release No. 55 "Urban Hydrology for Small Watersheds."
- c) Hydrologic methods as described in the "Kern County Hydrology Manual"

SECTION 1.5 HYDRAULIC DESIGN

Sec. 1.5.1 GENERAL

- 1.5.1.1 For the solution of hydraulic design problems commonly encountered, generally accepted references should be consulted. For uncommon design problems not susceptible to solution by the above-mentioned references, the design engineer shall provide such reference, treatise, model study report, or prototype test as is necessary to confirm his hydraulic design.

Sec. 1.5.2 DESIGN STORM FREQUENCY

- 1.5.2.1 **5 Year Event:** Design depth of flow in gutters shall not exceed six (6) inches the 5-year flow. Street capacities and depth of flow can be determined using the Gutter Flow Charts found in Section D of the Kern County Hydrology Manual.
- 1.5.2.2 **10 Year Event:** Where the 5 Year Event discharge exceeds six (6) inches in gutters, a storm drain or other facilities, including inlets, shall be provided. Storm drain or other facilities shall be designed to convey the entire 10-year flows.
- 1.5.2.3 **25 Year Event:** Secondary waterways shall be designed for an average recurrence interval of 25 years with freeboard.
- 1.5.2.4 **100 Year Event:** Major waterways shall be designed for an average recurrence interval of 100 years with freeboard.
- 1.5.2.5 Freeboard requirements for each waterway type are discussed in Section 1.5.4 and Section 1.5.5.

Sec. 1.5.3 MANNING'S "N" VALUES

- 1.5.3.1 Manning's "n" values for design shall be as follows:

Plastic Pipe (PVC, HDPE)	n=.011
Concrete (steel troweled or smooth-form finish), concrete pipe, vitrified clay pipe (VCP)	n=.013
Concrete (wood float or broomed finish, including pneumatically applied mortar)	n=.015
Asphaltic concrete	n=.016
Road mix pavement	n=.018
Corrugated metal pipe	n=.024
Sack concrete rip-rap	n=.030
Grouted rock rip-rap	n=.030
Loose rock rip-rap	n=.035
Grassy Channels	n=.035

For natural channels, landscape channels or materials not covered above, "n" values shall be submitted by the design engineer for approval by the City Engineer.

Sec. 1.5.4 CLOSED CONDUIT SYSTEMS

- 1.5.4.1 **Major and secondary waterways** placed within a closed conduit system shall have a minimum of 1-foot clearance between the design water surface and the soffit of the conduit. The design depth on circular conduits shall not exceed 0.80 of the diameter of the conduit for major and secondary waterways.
- 1.5.4.2 **Local waterways** placed in closed conduit systems may be designed for full conduit capacity and pressure flow. The hydraulic entrance condition at a closed conduit local waterway shall be such that the 10 year discharge will have the specified freeboard in the upstream channel or waterway. The entrance to the closed conduit local waterway may be submerged provided that the above criteria is satisfied.
- 1.5.4.3 **Hydraulic Gradient:** the hydraulic grade line for closed conduit systems shall conform to the following provisions;
- a) At inlets and non-pressure type manholes the hydraulic grade line shall be not less than 0.5-foot below the normal gutter surface elevation.
 - b) In addition to normal friction losses, energy losses due to entrance and exit conditions, bends and transitions shall be computed and considered.
 - c) At locations where conduits are stubbed out for future extension, the design hydraulic grade line shall be low enough to allow proper drainage of the tributary area with a minimum of 1.5 feet below general existing ground level.
 - d) Hydraulic grade line for conduits draining into retention or detention basins shall be designed to the half design depth elevation of the basin or the outlet pipe soffit elevation, whichever is greater.
 - e) Energy losses due to debris load caused by splitting flow at entrance to or within a closed conduit system shall be computed in the same manner as obstruction losses in open channels.
- 1.5.4.4 **Supercritical Flow:** For conduits designed for supercritical flow, the energy grade line shall not be above ground level at inlets or non-pressure type manholes.

Sec. 1.5.5 CONSTRUCTED CHANNELS

- 1.5.5.1 General:
- a) Constructed channels and waterways shall be designed to carry the quantity of flow determined as set forth in Section 1.4.2 with the minimum freeboard between the design water surface and the top of bank of 0.5 feet or 0.2 of the specific energy, whichever is greater (see Section 1.5.5.2 for superelevation). When the minimum freeboard does not provide the necessary differential head to allow adequate gravity drainage for projected development of the tributary areas, the design water surface shall be lowered sufficiently to allow such areas to drain to the channel by gravity, except where levees are permitted.

- b) The water surface profile shall be computed and plotted for all constructed channels.

1.5.5.2 **Superelevation:** Prior to computing the required freeboard, superelevation of the water surface on curves shall be determined, and the design water surface adjusted accordingly. Constructed channels shall not be designed with a slope in the range of + 20% of critical slope unless added freeboard for instability waves is provided.

1.5.5.3 **Supercritical Flow:** Channels designed for supercritical flow shall have their subsequent depth below the top of bank.

1.5.5.4 **Bridge Crossings:**

- a) Channels shall be designed taking into account the energy losses due to existing and projected road crossings or other obstructions to be placed within the channels. Energy losses for bridge piers, interior walls in multiple box culverts, or other obstruction within the channel shall be predicated upon the obstruction width plus 2-feet of debris allowance for each obstruction. For bridge piers or multiple box culverts, in lieu of the 2 feet of debris allowance on the full height of the pier or interior walls, such piers or walls may be extended upstream on a 2 to 1 downward slope to the channel invert, and debris considered as obstructing only the upper 1/4 of the design depth of flow at the pier or wall.
- b) Bridges, culverts and utility crossings which span major and secondary open channels and which are existing, planned or projected at the time of channel design shall have a minimum clearance from soffit to design water surface of 1.0-foot and shall cause no encroachment on the specified minimum freeboard in the upstream channel or waterway. Channel shall be designed with proper allowance for hydraulic losses for all such planned or projected future crossing to maintain clearance and freeboard as specified above.
- c) In the case where a crossing is proposed over an existing channel where the hydraulic effect of the crossing was not considered in design of the channel, minor encroachment on freeboard may be permitted provided it can be shown that such encroachment would not adversely affect gravity drainage of adjacent tributary areas. Modification of the existing channel and special attention to the design of piers or other obstructions placed in the channel may be required to keep an encroachment on freeboard at an acceptable level.

Sec. 1.5.6 CULVERTS

1.5.6.1 All culverts shall be designed to carry runoff in accordance with the following:

- a) The runoff generated from a 10 Year Event shall not exceed the soffit of the culvert(s)
- b) The runoff generated from a 100 Year Event shall be allowed to run over the top of roadway up to 1.5 feet of specific energy measured at the crown. If the specific energy measured at the crown exceeds 1.5 feet, additional culverts are required.

Sec. 1.5.7 INVERTED SIPHONS

- 1.5.7.1 Inverted siphons are Type 4 Submerged Culverts consisting of two drainage inlets or catch basins connected by a closed conduit. Inverted siphons are used in lieu of cross gutters where these standards do not allow cross gutters. Their design, ultimate capacity, and construction is subject to the standards contained herein and the approval on the City Engineer.

SECTION 1.6 WATERWAY REQUIREMENTS

Sec. 1.6.1 GENERAL

- 1.6.1.1 Structural design of waterways and other drainage facilities placed within road, highway or street rights of way shall be subject to the approval of the City Engineer. Structural design of all other waterways and other drainage facilities shall conform to accepted engineering practices and to the criteria set forth below.
- 1.6.1.2 At the upstream end of channels, waterways, and closed conduits, construction shall be done so as to conform the new work to the existing waterway. This construction shall be such that hydraulic conditions in the upstream waterway will not be altered in a way which would cause degradation, erosion or other undesirable effects.
- 1.6.1.3 At the downstream end of a reach of constructed channel, waterway or closed conduit, interim works shall be constructed as necessary to insure proper operation of the project works. Excavation shall be performed in the downstream reach as necessary to insure complete gravity drainage of the project until the downstream reach is constructed to an ultimate design.
- 1.6.1.4 Insofar as is practicable, catch basins, manholes, inlet structures, etc., shall conform to City standards. Variances from these standards must be approved by the City Engineer.
- 1.6.1.5 Any required right of way for drainage facilities shall be conveyed to the City in one of the following forms, as directed by the City Engineer:
- a) Separate parcel easement dedicated on a subdivision map
 - b) Easement dedicated on a subdivision map as part of adjacent lots
 - c) Fee simple or easement offered or granted by separate documents.
- 1.6.1.6 All work shall be done in accordance with the California Department of Transportation Standard Specifications, current edition, unless specifically noted otherwise by these standards.

Sec. 1.6.2 CLOSED CONDUITS

- 1.6.2.1 **Inside Dimension:** The minimum inside dimension for a closed conduit shall be 18 inches, for publicly maintained systems. For privately maintained systems the minimum inside dimension shall be 12 inches.
- 1.6.2.2 **Manholes:** Manholes shall be provided at all junctions, at intervals not to exceed 600 feet along the conduit, and at all bends sharper than 15 degrees. Bends of 15 degrees or less may be constructed with pre-formed angled sections or by placing conduit along a curve using standard beveled pipe.
- 1.6.2.3 **Alignment:** The alignment of closed conduits shall be as nearly straight as practicable. The closed conduit shall be placed within the traveled way whenever possible. Alignments outside of the traveled way shall be as approved by the City Engineer, upon written request of the design engineer.
- 1.6.2.4 **Cover:** Closed conduits, including non-reinforced and cast-in-place concrete pipe, shall be structurally designed to withstand earth and surcharge loads normally

anticipated. The clearance between top of pipe and ground shall be sufficient to prevent displacement of, or damage to, the conduit by all loading and land uses. A minimum of 2 feet of cover will be required in all cases, without special consideration of the design engineer. The cover required within road rights of way shall be to the satisfaction of the City Engineer.

1.6.2.5 **Slope:** Minimum slopes for closed conduit shall be 0.0011 foot per foot to provide for self cleaning.

1.6.2.6 **Minimum Useful Life:** Conduits shall be designed to have a minimum useful life of 50 years.

1.6.2.7 **Acceptable Conduit Materials:**

- a) **Cast In Place (CIP) Concrete Pipe** conforming to the California Department of Transportation Standard Specifications, Section 63, current edition.
- b) **Reinforced Concrete Pipe (Class III or equivalent)** conforming to the California Department of Transportation Standard Specifications, Section 65, current edition. Rubber gasketed joints are required.
- c) **Non-Reinforced Concrete Pipe** (36 inch diameter or less) conforming to the California Department of Transportation Standard Specifications, Section 65-1.02A, current edition. Rubber gasketed joints are required.
- d) **High Density Polyethylene (HDPE)** large diameter profile wall pipe conforming to ASTM F894. Installation of pipe shall be in accordance with ASTM D2321. Only Class I, II and III embedment materials will be considered suitable.
- e) **Polyvinyl chloride (PVC)** large diameter profile wall pipe conforming to ASTM F794. Installation of pipe shall be in accordance with ASTM D2321. Only Class I, II and III embedment materials will be considered suitable.
- f) **Polyvinyl chloride (PVC)** SDR-35 solid wall pipe is allowable for 18 inch diameter pipe.

1.6.2.8 **Unacceptable Conduit Materials:**

- a) **Metal Conduits** including corrugated metal pipe will not be acceptable in closed conduit system.

1.6.2.9 **Right of Way Requirements:**

- a) A right-of-way sufficient to contain the closed conduit and appurtenances plus a minimum of five feet on each side, measured from the edge of the conduit or drainage structure, shall be provided but in no case shall the right-of-way be less than 15-feet in width.
- b) Whenever possible, rights-of-way for conduits shall be adjacent to property lines and outside of areas where structures are planned. Under no circumstances shall closed conduits and appurtenances be constructed less than 10-feet from any planned or existing structure.
- c) Rights-of-way for interim work shall be provided as described in Section 1.6.1.5 and as directed by the City Engineer.

Sec. 1.6.3 CONSTRUCTED CHANNELS

- 1.6.3.1 **General:** In the event approval is obtained to use constructed channels in lieu of closed conduits, the channel or waterway shall conform to the provisions in the following sections and restrictions placed at the time of approval.
- 1.6.3.2 **Minimum Centerline Radii** for curves in constructed channels and waterways shall be three times the top width of the design water surface. Minimum inside radii for maintenance roads shall be 40 feet.
- 1.6.3.3 **Minimum Bottom Width** of constructed channel shall be 8 feet for lined channels without maintenance road and 10 feet for rock slope protected channels or grassed channels. For constructed waterways having side slopes 4 to 1 or flatter, a triangular channel may be permitted.
- 1.6.3.4 **Side Slopes:** Grassed channels or rock slope protected channels shall have side slopes 2 to 1 or flatter. Concrete lined channels shall have side slopes 1.5 to 1 or flatter unless designed structurally to resist all lateral loads applied to the bank lining. Channels shall have flatter side slopes if soil instability appears probable from field investigation. Design of slopes in unstable soils shall be predicated upon results of an investigation by a registered professional engineer qualified in soils engineering.
- 1.6.3.5 **Bank Protection** shall be provided in constructed channels in accordance with the criteria shown on the City's standard drawings. Velocities referred to on the typical sections are in each case the mean velocity of a 10-year storm flow in the cross section. The term "stress areas" as used in these standards shall refer to those locations where the erosion potential is greater than a straight, uniform channel reach, and includes junctions, transitions, and curves whose centerline radii are less than six times the width of the design water surface unless the engineer can show that the erosion potential is not excessive. Stress area protection shall extend downstream from the end of the stress area a distance equal to 10 times the design water depth.
- 1.6.3.6 **Channel Lining Materials:** Any of the channel lining materials specified below may be used for bank protection:
- a) Low-growing grass, which will form a thick, dense sod. The proposed grass mixture is to be submitted to and approved by the City Engineer.
 - b) Rock slope protection facing class, Method B Placement.
 - c) Concreted-rock slope protection, facing class, Method B Placement.
 - d) Sacked concrete slope protection
 - e) Concrete slope paving
 - f) Air-blown mortar with welded wire mesh reinforcing.
- 1.6.3.7 **Drop Structures:** At drop structures or in other locations where a *hydraulic jump* may occur, bank protection shall be provided downstream from the jump for a minimum distance of 6 times the sequent depth. This protection shall cover the channel invert and extend to the height of the sequent depth and may be either concrete, concreted-rock slope protection, sacked concrete slope protection or air-blown mortar. A minimum distance of 10-feet shall be provided with rock slope

protection immediately downstream from the lined reach covering the same cross section as required for the lining.

- 1.6.3.8 **Bottom Stabilization** or protection may also be required where velocities are sufficient to cause invert erosion. Earth channels, in those areas not otherwise protected will generally be required to be seeded with low-growing grass to establish a vegetative cover to the top of channel banks.
- 1.6.3.9 **Design Velocities:** Lower limiting velocities may be required for the design of channels constructed in certain soils, where the circumstances require. For any velocity and hydraulic stress combination, the materials shown for a condition of higher velocity and stress may be used in lieu of those typical sections.
- 1.6.3.10 **Drainage Within Right-of-Way:** Drainage facilities shall be so constructed and areas adjacent to channels so graded that side drainage will enter in a manner which will prevent erosion, substantiated by the Geotechnical Engineer, within the rights-of-way. This will often require constructed side inlets and collector ditches to carry side flow to inlets.
- 1.6.3.11 **Side Inlets** shall convey the flow under maintenance roads in culverts to the main channel invert, except that this requirement may be waived for waterways which have side slopes 4 to 1 or flatter. Closed conduits may be used for this purpose. Where closed conduits are not required for side drainage in waterways, other facilities such as lined valley gutters shall be provided to prevent erosion within the waterway.
- 1.6.3.12 **Tributary Waterways:**
- a) Tributary waterways shall be conveyed under maintenance roads in closed conduit where such flows can be conveyed in 48-inch diameter or smaller storm drain. Larger tributary waterways may be placed in closed conduit for maintenance road crossing, or they may enter the main channel in properly designed open channel junction structures.
 - b) Major and secondary tributary waterways generally shall enter the main channel at an angle not exceeding 25 degrees from being parallel to flow in the main channel, and such junctions shall be designed in accordance with a momentum analysis of the flows.
 - c) Where open channel tributaries cross maintenance roads, a convenient turn-around area shall be provided for maintenance vehicles. Minimum diameter of a turn-around shall be 40 feet.
- 1.6.3.13 **Right of Way Requirements:**
- a) Right-of-way for constructed channels with side slopes steeper than four horizontal to one vertical shall be provided as follows:
 - b) For channels with top width greater than fifty feet, top width of channel plus twenty feet on each side for continuous maintenance roads and interceptor ditches. If interceptor ditches are not needed, fifteen feet of right-of-way on each side in addition to the top width of the channel will be considered adequate.
 - c) For channels with top width fifty feet or less, one side of the channel need only be provided right-of-way for an interceptor ditch, nine feet, or if an interceptor ditch is not needed, five feet. The other side of the channel will meet the requirements of (b) above for right-of-way.

- d) The right-of-way provided shall also include any cut slopes which may be required to allow for difference in elevation between the maintenance road and natural ground, except that if the adjacent natural ground is graded down to the maintenance way on slope of 4 to 1 or flatter the slopes need not be included within the right-of-way.
- e) Right-of-way for constructed channels with side slopes 4 to 1 or flatter shall be sufficient to contain the top width of the channel plus a minimum of five feet on each side.
- f) Where open-channel tributaries are permitted to cross the maintenance road, as described in Chapter VI, additional right-of-way shall be provided to accommodate a minimum 40-foot diameter turn-around.
- g) At intersections of the channel with public roads, sufficient right-of-way shall be provided to permit access from the public road to the maintenance road. In the event that the right-of-way does not intersect a public road or projected public road, a turn-around or a 15-foot wide access right-of-way shall be provided from a public road to the channel right-of-way at intervals not to exceed one channel mile.
- h) Right-of-way for concrete lined channels not having maintenance roads shall extend to 0.5-foot outside the top of bank, with a 15-foot wide access right-of-way provided to the channel from a public road at intervals along the channel, generally not more than 2,000 feet apart. Such access shall extend to channel invert by means of a concrete access ramp having a maximum slope of 15 percent.
- i) The right-of-way for landscaped constructed waterways may be the same as that designated for unlined constructed channels or, at the option of the developer or the City, right-of-way for such waterways may be increased as desired to provide additional area for planting or other landscaping. For such waterways whose side slopes are 4 to 1 or flatter, the right of way shall equal or exceed that shown in City standard detail D-7.
- j) Where interim construction, upstream or downstream of a project reach, is required, all easements or rights-of-way, temporary or permanent, necessary to accomplish such work shall be acquired by the developer, at the direction of the City Engineer.

1.6.3.14

Fencing Requirements for Channels:

- a) Fencing requirements for constructed channels shall conform to all applicable sections of the City's Zoning Ordinance.
- b) For constructed channels, chain link fencing meeting the requirements of the city standards shall be installed on each side of the right-of-way. At all road intersections fencing shall prevent public access to channels or culverts, and 14-foot wide chain link drive gates shall be provided at all points of access to maintenance ways, or to channels not requiring maintenance ways.
- c) For minor channels with depths less than 1.5 feet, the City Engineer may waive the fence requirement.
- d) Fences adjacent to streets at or near intersections shall conform to all "line of sight" ordinances of the Municipal Code.

Sec. 1.6.4 CROSS GUTTERS

- 1.6.4.1 Street cross gutters may be used only at entrances to cul-de-sacs and other short streets provided the tributary area is no more than 7 acres of residential (R-1) development or equivalent. Equivalent non R-1 acreage shall be that acreage which produces the same area of landscape irrigation runoff as 7 acres of R-1. For estimation purposes R-1 will produce 5 lots each at 25' x 60' landscape runoff per acre (7,500 S.F. per acre).
- 1.6.4.2 Cross gutters will not be permitted across arterials, collectors, or local streets with anticipated traffic volumes greater than 200 vehicles per day.
- 1.6.4.3 Mid-block cross gutters will not be permitted. Inverted siphons will be accepted and shall be designed to pass the required design flow in the gutter.
- 1.6.4.4 **Design Criteria:** Cross gutters shall conform the provisions set forth in Division IV, Standards for Streets and Traffic Circulation.

Sec. 1.6.5 CULVERTS

- 1.6.5.1 Culvert design and construction shall be allowable only upon the approval of the City Engineer. The type of flow in a culvert along with the location of control (inlet or outlet) shall be as approved by the City Engineer.
- 1.6.5.2 Culverts are considered to be Closed Conduits, and shall be subject to the same material and construction standards applicable to Closed Conduits.
 - a) *Exception:* Slope minimum slope shall be 0.01, and shall be obtained when possible.
- 1.6.5.3 Minimum culvert length shall be from toe of slope to toe of slope.
- 1.6.5.4 Entrance & exit protections against erosion shall be provided in accordance with acceptable practices.

Sec. 1.6.6 INVERTED SIPHON

- 1.6.6.1 Inverted siphon design and construction shall be allowable only upon the approval of the City Engineer.
- 1.6.6.2 All material and construction standards required for closed conduits, catch basins, drainage inlets, and storm drain manholes, if applicable, are applicable to conduits for culverts.
- 1.6.6.3 In addition, pipe joint shall be watertight, and shall be demonstrated as watertight in accordance with Section 65 of the Caltrans Standard Specifications at the request of the City Engineer.
- 1.6.6.4 Inverted siphon shall be allowed:
 - a) where these standards do not allow the construction of cross gutters,

- b) where the drainage study does not show the need for storm drain facilities that terminate into a detention or retention basin, and
- c) when redesign does not relocate the drainage crossing to a place where a cross gutter can be used.

SECTION 1.7 DRAINAGE BASINS

Sec. 1.7.1 DEFINITIONS

- 1.7.1.1 **Retention Basin** - Any drainage facility which is used a terminal facility for the storage of runoff shall be classified as a retention basin.
- 1.7.1.2 **Detention Basin** - A holding basin designed for the temporary storage of runoff from a high intensity storm. The basin automatically drains when the storm subsides and the downstream facilities can accommodate the flows from the basin.
- 1.7.1.3 **Retardation Basin** - Synonymous with Detention Basin.

Sec. 1.7.2 DESIGN CRITERIA

- 1.7.2.1 **Retention Basin Design Volume:** Unless otherwise directed by the City Engineer, for projects requiring special design criteria, storm water retention basins shall be based upon the runoff from the Ten Year five-day storm event and a volume of nuisance water determined by the engineer. No runoff generated on site from the design storm or from nuisance flows will be allowed to leave the site unless downstream drainage disposal facilities exist to handle the flow. The retention of upstream off-site flows shall not be considered to reduce the size of the required on-site retention facilities or mitigate the runoff from the proposed development. An evaluation of the runoff volumes associated with the site in its existing condition shall not reduce the size of the required drainage facilities.
- 1.7.2.2 The retention basin capacity shall be based upon the following formula:

$$V = 0.12 (D_{10}) (a_i) (A)$$

where:

V	Design volume (acre-ft)	
D ₁₀	10 year 24 hour Depth of Rainfall (inches)	= 1.4 in (for City of Shafter) see Kern County Hydrology Manual sheet D-3.
a _i	average percentage of impervious area (decimal equivalent)	see Kern County Hydrology Manual sheet C-3 or City standard detail D-1
A	drainage area (acres)	

- 1.7.2.3 **Retention Basin Freeboard:** Freeboard shall be required for all retention basins having a design water depth exceeding 18 inches. Six (6) inches of freeboard will be required when the design ponding depth within the basin is four (4) feet or less. For basins with a design ponding depth greater than four (4) feet the amount of freeboard required shall be one (1) foot. Freeboard shall be measured from the lowest gutter inlet or top of bank, whichever is lower.
- 1.7.2.4 **Detention Basins:** Detention basins require special design consideration. The engineer shall have the design method approved by the Office of the City Engineer prior to designing the facility.

- 1.7.2.5 **Layout:** Basin layout and design shall be per City standard detail D-2.
- 1.7.2.6 **Percolation Rate:** No basin will be permitted unless it shall be shown to the satisfaction of the City Engineer by approved test and analysis of soil borings, by a registered Civil Engineer that the design volume of the basin will completely drain within five days. Percolation tests for this requirements shall be approved by the Office of the City Engineer.
The method would be generally as follows:
- a) The infiltration rate shall be determined using a Flooding type infiltrometer.
- b) Divide depth of basin by infiltration rate to determine percolation time.
- 1.7.2.7 **Depth:** Maximum depth of a retention or detention basin shall be eight (8) feet from the Design Water Surface to the bottom, unless allowed otherwise by the City Engineer. The Design Water Surface is either one (1) foot below the lowest flowline elevation of all the drainage inlets allowing runoff into the basin, or is one (1) foot below the top of slope of the basin, whichever is lower.
- 1.7.2.8 **Slope:** The maximum allowable slope for a retention basin shall be 2 units horizontal to 1 unit vertical, regardless of the recommendations made by a soils engineer.
- 1.7.2.9 **Slope Stability:** Slope stability analysis by a registered professional engineer qualified in soils engineering will be required for all basins with water depths exceeding 8 feet, or basin depths exceeding ten (10) feet measured from top of slope to bottom of sump.

Sec. 1.7.3 ACCESS

- 1.7.3.1 An equipment access ramp to the bottom of the retention basin shall be provided when the design depth exceeds 18 inches or when the facility is intended for City maintenance.
- 1.7.3.2 The ramp shall be a minimum of 12 feet wide with a maximum slope of 15%.
- a) *Exception* - When the design ponding depth is 4 feet or less, the maximum slope on the ramp may be increased to 20%.
- 1.7.3.3 Ramps shall not be designed to convey drainage water into the sump.
- 1.7.3.4 Access gate shall be provided and shall be positioned near the top of the access ramp. Minimum width of the access gate shall be 14 feet wide.

Sec. 1.7.4 FENCING REQUIREMENTS

- 1.7.4.1 Fencing requirements for basins shall conform to all applicable sections of the City's Zoning Ordinance and to City's Standard Drawings.
- 1.7.4.2 Fencing requirement for basins fronting public right of way shall meet the requirements of Division V, Standards for Landscaping, Section 5.2.3, "WALLS".
- 1.7.4.3 Fences adjacent to streets at or near intersections shall conform to all "line of sight" ordinances of the Municipal Code and Division Four, Standards for Streets and Traffic Circulation, Section 4.3.3, "LINE OF SIGHT".

Sec. 1.7.5 RIGHT-OF-WAY

- 1.7.5.1 The right-of-way required for the retention or detention basin shall be deeded to the City. Beneficiaries or trustees under Deeds of Trust shall sign the deed. Reversionary clauses will not be permitted.

SECTION 1.8 STORM DRAIN CONSTRUCTION PLANS

Storm drain construction plans shall contain all notes, details and specifications necessary to complete the proposed work. For sake of simplicity, Storm Drain Plans can be combined with Street Plans whenever applicable. Maximum sheet size shall be 24" x 36". Project information shall include, but not be limited to the following:

Sec. 1.8.1 COVER SHEET

- Project Title
- Vicinity Map
- Key Map drawn to a scale of 1" = 200' (approx)
- Engineer's Certificate with seal and license expiration date
- General Notes - see Section 1.8.4
- Special Notes - particular to the project
- Material Specifications
- Legend
- Bench Mark
- Sheet Index
- Total number of sheets
- Materials list - show Engineer's Estimate of Quantities
- City Engineer's Approval/Signature Block
- Developer's name and address/Engineer's address and contact person/Legal Description

Engineer's Certificate:

I hereby certify that these plans and specifications comply with City of Shafter ordinances, standards, and design criteria, and that they include all improvement requirements of the Advisory Agency or other review board.

I am responsible for all calculations and drawings on these plans and any errors, omissions, or violations of those ordinances, standards, and design criteria shall be corrected during construction.

Sec. 1.8.2 PLAN AND PROFILE

- Horizontal and vertical scales on each sheet (1' = 50' & 1" = 10' maximum)
- North arrow
- Storm drain line location relative to centerline or property line
- Pipe size and slope
- Relation to existing or proposed pipes, utilities, etc. - show by cross sections with verified depths
- Required utility separations
- Lateral size to catch basins
- Stationing (centerline) - from south to north and west to east; coincident with street stationing; show 100 foot interval ticks on street centerline
- Manhole locations - not to exceed maximum distance
- Conforms to master drainage plan
- Connection to existing storm drain lines or structures
- Construction phasing limits shown

Sec. 1.8.3 **DETAIL SHEETS**

Provide Details as Applicable

- SD-1 Storm Drain Manhole
- SD-2 Manhole Frame and Cover
- SD-3 Catch Basin Type "A"
- SD-4 Catch Basin Type "C"
- SD-5 Storm Drain Junction Box
- SD-6 Catch Basin Gutter Depressions
- SD-7 Pipe Saddle Detail
- SD-10 Under Sidewalk Drain

- D-1 Rational Method Determination Data
- D-2 Drainage Basin & Outfall Structure
- D-3 Channel Protection
- D-4 Channel Protection
- D-5 Right of Way for Channel Construction
- D-6 Landscaped Constructed Channel
- D-7 Right of Way for Constructed Channel
- D-8 Right of Way for Lined Channel Construction

- Tie-in Details - as approved by City Engineer
- Other Details as required by City Engineer

Sec. 1.8.4 **SAMPLE GENERAL NOTES**

General notes shall include all necessary notes to convey the intent of the City of Shafter Drainage Standards, the project at hand, and as directed by the City Engineer. They shall include, but not be limited to the following.

- 1.8.4.1 24 hour inspection notice - Prior to the start of any phase of construction, the Office of the City Engineer shall be given at least 24 hours notice. Phone: (661) 746-2065.
- 1.8.4.2 Compaction test note - Compaction testing shall be the responsibility of the developer/subdivider/contractor. The number and location of required test shall be determined by the City Engineer.
- 1.8.4.3 Contractor shall call Underground Service Alert (USA) and the City of Shafter Department of Public Works at least two (2) working days prior to the start of construction to mark the locations of existing utility lines.
USA Phone: (800) 642-2444
City of Shafter: (661) 746-2065
- 1.8.4.4 Contractor shall obtain all necessary permits before start of construction. A permit shall be obtained from the Office of the City Engineer for all work to be performed in city right-of-way.
- 1.8.4.5 The locations of existing utilities and underground pipelines shown on these plans are approximate only. The contractor shall determine the exact location of all existing utilities and underground pipelines before commencing work. Contractor assumes all liability for any and all damages to existing utilities occasioned by his failure to exactly locate, preserve, and protect any and all underground utilities and pipelines.
- 1.8.4.6 Any trenching conducted within this project shall be backfilled and compacted in accordance with the City's Standard Drawings.

- 1.8.4.7 The contractor shall remove and/or relocate all obstructions within the street right-of-way as directed by the City Engineer.
- 1.8.4.8 Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including the safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; that the contractor shall defend, indemnify, and hold the owner, engineer, and the City of Shafter harmless from any and all liability, real or alleged, in connection with the performance of work on this project, excepting the liability arising from the sole negligence of the owner/engineer/City of Shafter.
- 1.8.4.9 All construction work shall be performed in accordance with City of Shafter Standards, the State of California, Department of Transportation Standard Specifications, and as directed by the City Engineer.

SECTION 1.9 GRADING CONSTRUCTION

Sec. 1.9.1 PURPOSE AND SCOPE

This chapter establishes the minimum acceptable standards for the design of grading operations within new developments in the City of Shafter. Minor deviations from these standards may be permitted where warranted in the opinion of the City Engineer.

Sec. 1.9.2 GENERAL POLICY

1.9.2.1 **Recognized Standards:** All grading design and operations shall conform to the latest edition of the following standards and regulations;

- a) **California Building Code**, Chapter 18, "Foundations & Retaining Walls" and Appendix Chapter 33, "Excavation and Grading", latest edition, in regards to site development, building construction, foundation requirements, slopes, and similar usage.
- b) All applicable "Grading" sections of the **California Department of Transportation Standard Specifications**, in regards to street construction or similar usage. For more information, refer to Division 4.0, "Standards for Streets and Traffic Circulation" of this Subdivision Engineering & Design Manual.
- c) These engineering standards.
- d) When a discrepancy occurs between the above referenced standards these engineering standards shall govern, unless specifically noted otherwise by the City Engineer.

1.9.2.2 **Engineered Grading:**

- a) All grading operations requiring greater than 5,000 cubic yards of earthwork, or grading operations involving special conditions or unusual hazards, as determined by the City Engineer, shall be designated as "Engineered Grading"
- b) City Building Official may require a development to be designated "Engineered Grading" when it is believed that geological factors are involved.
- c) Projects involving "Engineered Grading" shall submit to the City Engineer the following:
 - (1) Grading Plan showing the work to be performed, project extent, notes, details, references to applicable codes, references to soils reports and the recommendations contained therein, existing grades, proposed grades, and other pertinent information. See section 1.10 for more information.
 - (2) A "Soils Engineering Report" performed by a registered civil engineer specializing in geotechnical engineering.
 - (3) An "Engineering Geology Report" that provides adequate description of the geology of the site and any recommendations regarding the effect of the geological conditions on the proposed development.
- d) Prior to construction, applicant shall pay fees and receive a grading permit in accordance with Section 1.9.2.4

1.9.2.3 **Regular Grading:**

- a) All grading operations that are not designated as “Engineered Grading” shall be designated as “Regular Grading”.
- b) Projects involving “Regular Grading” shall submit to the City Engineer the following:
 - (1) Grading Plan showing the work to be performed, project extent, notes, details, references to applicable codes, references to soils reports and the recommendations contained therein, existing grades, proposed grades, and other pertinent information. See section 1.10 for more information.
- c) Prior to construction, applicant shall pay fees and receive a grading permit in accordance with Section 1.9.2.4

1.9.2.4 **Permits:**

- a) **Public Right-of-Way:** No person shall do any grading or demolition within public right-of-way without first having obtained an approved grading plan and an encroachment permit from the Office of the City Engineer.
- b) **Private Property:** No person shall commence grading operations without first having obtained an approved grading plan and permit from the Office of the City Engineer.
- c) **Fees:** Grading plan review and permit fees shall be paid in accordance with the City’s adopted fee schedule at the time the permit is requested.

1.9.2.5 **Erosion Control:**

- a) All slopes in excess of three feet shall be prepared and maintained to control against erosion. This control may consist of effective planting.
- b) Erosion control measures for slopes within public rights-of-way shall be as approved by the Planning Director and the City Engineer.
- c) Erosion control for slopes on private property shall be in place prior to the issuance of an occupancy permit or final approval.

1.9.2.6 **Completion of Work:**

The following shall be required for projects involving “Engineered Grading”

- a) **Rough Grade Certification** - Prior to the issuance of a building permit, the developer shall submit the following certifications:
 - (1) Design Engineer shall certify that project was rough graded in substantial conformance with Chapter 33 of the California Building Code and the final approved grading plan.
 - (2) Soils Engineer shall certify that, to the best of their knowledge, the project was rough graded in substantial conformance with Chapter 33 of the California Building Code and the approved soils engineering report. In addition a report shall be submitted to the City showing locations & elevations of field density tests, summaries of field & laboratory tests, other substantiating data, and comments on any changes made during the grading and their effect on the recommendations made in the approved engineering investigative report or the approved grading plan.
 - (3) Rough grade certification form shall be as approved by the City Engineer.

- b) **Final Grade Certification** - Prior to the final approval of the development, issuance of an occupancy permit, or acceptance by the City, the developer shall submit the following certifications:
 - (1) Design Engineer shall certify that project was completed in accordance with Chapter 33 of the California Building Code and the final approved grading plan. In addition, Design Engineer shall prepare and submit to the City of Shafter as-built grading plan showing original ground elevations, as-graded ground service elevations, lot drainage patterns, and the locations and elevations of surface and subsurface drainage facilities.
 - (2) Grading Contractor shall certify that the project was completed in accordance with Chapter 33 of the California Building Code and the as built grading plan.
 - (3) Final grade certification form shall be as approved by the City Engineer.

Sec. 1.9.3 DESIGN CRITERIA

1.9.3.1 Cut / Fill Slopes:

- a) All cut and fill slopes supporting structures shall be no steeper than 1 unit vertical in 2 units horizontal. All other slopes shall conform to the same restriction unless the developer's engineer furnishes a soils engineering report stating that the site has been investigated and giving an opinion that a steeper slope will be stable and not create a hazard to public or private property.
- b) All cut and fill slopes for public roads shall be contained within public rights-of-way, unless slope easements are given to the City as directed by the City Engineer.
- c) Cut and fill slopes occurring on adjacent property to the development shall not be allowed without the express written consent of the adjacent property owner, subject to the approval of the City Engineer.
- d) Cuts over eight (8) feet in depth may require slope stability analysis in accordance with Section 1.7.2.9 of these engineering design standards.

1.9.3.2 Grading Setbacks:

- a) The top of slopes, within residential subdivisions, shall occur two (2) foot beyond the higher of the two lots property line (see the City standard detail G-2). Slope from the higher grade to the lower grade shall be as stated in Section 1.9.3.1.
- b) At the site boundary line, the top of slopes shall occur two (2) foot beyond the higher of the two grades. Slope from the higher grade to the lower grade shall be as stated in Section 1.9.3.1.
- c) Grading shall also meet the setback requirements as discussed in Appendix Chapter 33 of the California Building Code.

1.9.3.3 Building Pads:

- a) **Overexcavation & Recompaction:**
 - (1) Unless specified otherwise by a soils report, all areas in the site on which structures are to be placed must be excavated to a depth of one (1) feet below bottom of proposed footings and recompacted, for a minimum distance of five (5) feet in all directions from the foundations of the structure.
 - (2) Depth of overexcavation may be increased by City Building Official.

- b) Pad Elevation:
 - (1) Building finish pad elevations shall be the higher of either of the following:
 - (a) Building finish pad elevation shall be established so that the finish floor elevation is a minimum of twelve (12) inches plus 2% slope from the lowest adjacent flowline to the finish floor in accordance with chapter 18, section 1806.5.5 of the 2001 California Building Code.
 - (b) Building finish pad elevations shall be established to allow a 1% drainage swale to be constructed from the middle of the lot's backyard to the street.
- c) Compaction:
 - (1) All fills and areas on which structures are to be placed shall be compacted to a minimum of 90 percent of maximum density.
 - (2) Measurement of in place compaction shall be determined by test methods referenced in California Building Code appendix Chapter 33, Section 3305, and so certified by tests and report from the soils engineer.
 - (3) Soils testing shall be the responsibility of the developer. Location and frequency of the tests shall be determined by City Engineer.
- d) Fill Material:
 - (1) All fill material shall be subject to the approval of the soils engineer and the City of Shafter.

SECTION 1.10 GRADING CONSTRUCTION PLANS

Grading construction plans shall contain all notes, details and specifications necessary to complete the proposed work. Maximum sheet size shall be 24" x 36". Project information shall include, but not be limited to the following:

Sec. 1.10.1 COVER SHEET

- Project Title
- Vicinity Map
- Engineer's Certificate with seal and license expiration date
- Number of sheets
- General Notes - see Section 1.10.4
- Special Notes - particular to the project
- Legend
- Bench Mark - as directed by City Engineer
- Materials list - show Engineer's Estimated Earthwork Quantities
- City Engineer's Approval/Signature Block
- Developer's name and address/Engineer's address and contact person/Legal Description

Sec. 1.10.2 PLAN SHEET(S)

- Horizontal scale (1' = 50' maximum)
- North arrow
- Street names
- Lot Numbers
- Existing Ground Contours
- Flowline elevations at each property line
- Flowline grades
- Street & Right-of-way dimensions
- Pad Limit Line (setback line)
- Pad Elevations for each lot
- Cut & Fill Slopes
- Limits of Grading Operations
- Construction phasing limits shown
- Proposed Storm Drain System
- Existing underground utilities, pipes, and structures
- Proposed Block walls
- Proposed Siphons and Cross Gutters

Sec. 1.10.3 DETAILS REQUIRED:

Details may be shown on cover and/or plan sheets.

- D-2 Drainage Basin & Outfall Structure
- G-1 Typical Residential Lot Grading
- G-2 Typical Lot Grading Details

- Street Sections - depicting pavement sections and rough grade line
- Section at Property Line / Project Boundary
- Section showing sloping between lots for multi-lot grading plans

- Other Details as required by City Engineer

Sec. 1.10.4 SAMPLE GENERAL NOTES

General notes shall include all necessary notes to convey the intent of the City of Shafter Grading Standards, the project at hand, and as directed by the City Engineer. They shall include, but not be limited to the following.

- 1.10.4.1 24 hour inspection notice - Prior to the start of any phase of construction, the Office of the City Engineer shall be given at least 24 hours notice. Phone: (661) 746-2065.
- 1.10.4.2 Compaction test note - Compaction testing shall be the responsibility of the developer/subdivider/contractor. The number and location of required test shall be determined by the City Engineer.
- 1.10.4.3 Contractor shall call Underground Service Alert (USA) and the City of Shafter Department of Public Works at least two (2) working days prior to the start of construction to mark the locations of existing utility lines.
USA: (800) 642-2444
City of Shafter: (661) 746-2065
- 1.10.4.4 Contractor shall obtain all necessary permits before start of construction. A city encroachment permit shall be obtained from the Office of the City Engineer for all work to be performed in the City right-of-way.
- 1.10.4.5 The locations of existing utilities and underground pipelines shown on these plans are approximate only. The contractor shall determine the exact location of all existing utilities and underground pipelines before commencing work. Contractor assumes all liability for any and all damages to existing utilities occasioned by his failure to exactly locate, preserve, and protect any and all underground utilities and pipelines.
- 1.10.4.6 Any trenching conducted within this project shall be backfilled and compacted in accordance with the City Standards.
- 1.10.4.7 The contractor shall remove and/or relocate all obstructions within the street right-of-way as directed by the City Engineer.
- 1.10.4.8 Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including the safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; that the contractor shall defend, indemnify, and hold the owner, engineer, and the City of Shafter harmless from any and all liability, real or alleged, in connection with the performance of work on this project, excepting the liability arising from the sole negligence of the owner/engineer/City of Shafter.
- 1.10.4.9 All construction work shall be performed in accordance with City of Shafter Standards, the State of California, Department of Transportation Standard Specifications, the recommendations contained in the preliminary soils report for the development, appendix Chapter 33 of the California Building Code, and as directed by the City Engineer.

Sec. 1.10.5 SAMPLE GRADING NOTES

- 1.10.5.1 All existing improvements that are removed, damaged, or undercut shall be repaired or replaced as directed by the City Engineer, at the contractor's expense.
- 1.10.5.2 The Office of the City Engineer shall be notified 24 hours in advance of the placement of any fill material.
- 1.10.5.3 Fill material shall be subject to the approval of the soils engineer.

- 1.10.5.4 Contractor is responsible for the grading of lot pad areas to within 0.1' of the design elevations.
- 1.10.5.5 All areas in the site on which structures are to be placed must be compacted to 90% relative density, for a minimum distance of 5' in all directions from the foundations of the structure.
- 1.10.5.6 All fill material shall be moisture conditioned to at least 2% above optimum moisture and compacted to 90% relative density, as determined by test methods referenced in California Building Code appendix Chapter 33, Section 3305, and so certified by tests and report from the soils engineer.
- 1.10.5.7 The design engineer shall exercise sufficient supervisory control during grading operations to insure compliance with the plans, specifications, and code within his purview.
- 1.10.5.8 The placement of fill shall be in 6" maximum lifts, compacted with heavy compaction equipment approved by the City Engineer, unless specifically recommended otherwise in the preliminary soils report.
- 1.10.5.9 Compaction in proposed pavement areas should be the same as for the building pads, and should extend to a minimum distance of 2' beyond the outside edges of pavements.
- 1.10.5.10 All cut and fill slopes shall not be steeper than 2 horizontal to 1 vertical.
- 1.10.5.11 All fill areas to be cleared of all vegetation and other unsuitable material for a structural fill and the areas shall be scarified to a depth of 6", unless specifically noted otherwise in the preliminary soils report.
- 1.10.5.12 All slopes in excess of three feet shall be prepared and maintained to control against erosion.
- 1.10.5.13 Surface drainage to be 1% minimum, except as waived by City Engineer.
- 1.10.5.14 Grading work shall be supervised as engineered grading in accordance with Chapter 33 of the California Building Code.
- 1.10.5.15 During grading, reasonable searching should be performed for concealed subsurface obstructions. All abandoned subsurface obstructions should be removed. If the terminus of any abandoned piping is outside the project limits, the piping should be removed within the project and properly capped at the project boundary.
- 1.10.5.16 Dust Control: It shall be the contractor's responsibility to prevent a dust nuisance originating from the site of work as a result of his operations during the effective period of this contract. Preventative measures to be taken by the contractor shall include but not be limited to the following;
 - a) Water shall be applied to all unpaved areas as required to prevent the surfaces from becoming dry enough to permit dust formation.
 - b) Paved surfaces over which vehicular traffic is permitted to travel shall be kept free of dirt.
- 1.10.5.17 Contractor to coordinate with the inspector and developer, the location of the borrow or spoils prior to beginning construction.



ROUGH GRADE CERTIFICATE

CALIFORNIA BUILDING CODE

SECTION 3318.1

PROJECT DESCRIPTION: _____

PROJECT LOCATION: _____

All sections must be filled out & signed prior to issuance of a building permit

DESIGN ENGINEER	DATE: _____
I hereby certify that, to the best of my knowledge, the work performed on the above listed project within my area of responsibility was rough graded in substantial conformance with Chapter 33 of the California Building Code and the final approved grading plan.	
Signature _____	Business Name _____
Type or Print Name _____	Business Address _____
Phone / Fax _____	City, State, Zip _____
CA Registration Number _____	SEAL

SOILS ENGINEER	DATE: _____
I hereby certify that, to the best of my knowledge, the work performed on the above listed project within my area of responsibility was rough graded in substantial conformance with Chapter 33 of the California Building Code and the approved soils engineering report prepared by _____ dated _____ and signed by _____. In addition, I have prepared and submitted to the City of Shafter a report showing locations & elevations of field density tests, summaries of field & laboratory tests, other substantiating data and comments on any changes made during the grading and their effect on the recommendations made in the approved engineering investigative report or the approved grading plan.	
Signature _____	Business Name _____
Type or Print Name _____	Business Address _____
Phone / Fax _____	City, State, Zip _____
CA Registration Number _____	SEAL

Effective: February 15, 2005



FINAL GRADE CERTIFICATE
CALIFORNIA BUILDING CODE
SECTION 3318.1

PROJECT DESCRIPTION: _____

PROJECT LOCATION: _____

All sections must be filled out & signed prior to acceptance of work

DESIGN ENGINEER	DATE: _____
I hereby certify that, to the best of my knowledge, the work performed on the above listed project within my area of responsibility was done in accordance with Chapter 33 of the California Building Code and the final approved grading plan.	
_____ Signature	_____ Business Name
_____ Type or Print Name	_____ Business Address
_____ Phone / Fax	_____ City, State, Zip
_____ CA Registration Number	SEAL

GRADING CONTRACTOR	DATE: _____
I hereby certify that the grading work performed is in substantial conformance with Chapter 33 of the California Building Code and the approved grading plan.	
_____ Signature	_____ Business Name
_____ Type or Print Name	_____ Business Address
_____ Phone / Fax	_____ City, State, Zip
	_____ CA Contractors Lic#
	_____ Expiration

Effective: February 15, 2005