City of Carlsbad

Engineering Standards

Volume 1
General Design Standards

2022 Edition

CITY OF CARLSBAD ENGINEERING STANDARDS

VOLUME 1 - GENERAL DESIGN STANDARDS
TABLE OF CONTENTS

CITY OF CARLSBAD ENGINEERING STANDARDS

VOLUME 1 - GENERAL DESIGN STANDARDS
REVISIONS/ADDENDUM

REVISIONS/ADDENDUM		
CHAPTER/ PAGE/DWG.	**ITEM**	**REVISION DATE**
Chapter 1, Page 4	Table A – City of Carlsbad Street Design Criteria	10/19/05
Chapter 7	Incorporate LID to grading standards	3/24/08
Chapter 6	Various revisions throughout	6/30/08
Chapter 1	Table A, minimum easement width	11/30/09
Chapter 3	Public street standards, street light standards	11/30/09
Chapter 4	Revisions to Caltrans references, private street standards	11/30/09
Chapter 2	Revisions to digital submittal standards	2/24/12
General	Added statement declaratory of current policy to TOC	11/21/12
Chapters 1-7	Update general design criteria, accessibility standards, intersection max slopes, BMP Design Manual reference	2/16/16
Chapters 1-7	Various revisions throughout	4/29/2022
Chapter 3	3.10 Street Lights	6/30/2023
Chapter 1	General Requirements	1/12/2024
Chapter 6	Various revisions throughout	5/30/2024
Chapter 3	Add Section 3.19 Right-of-Way Encroachments	10/02/2024

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CHAPTER 1 – GENERAL REQUIREMENTS

1. These criteria shall apply to all public and private projects within the City of Carlsbad which is subject to the review of the City Engineer, which is hereby defined as the "*City Engineer or designee".*

2. All drawings shall be on standard size sheets (24" x 36") with standard City title block. The margin at the 24" right side of the sheet shall be one inch; the balance of the margins shall be one-half inch. All lettering shall be 1/10" or larger for machine lettering. California coordinates shall be computed and included for each plan.

3. All title sheets shall have an index or key map clearly indicating the sheet numbers issued. All index maps shall be drawn showing overall layout of the water, recycled water, sewer (including required future extensions), storm drain, fire hydrants, and street signing and lighting systems. The California licensed Engineer of Work (EOW) should utilize City Standard sheets, General Notes, and Erosion Control Plans to expedite the plan-check process. These sheets are available at the Engineering counter. They are also available in digital AutoCAD data file format on the City's Land Development Engineering, Codes, Standards and Policies web-page at:
https://www.carlsbadca.gov/departments/community-development/land-development-engineering/engineering-codes-standards-policies

4. Each sheet is to be signed and sealed by a Registered Civil Engineer. Complex structural, electrical or mechanical installations shall also be signed by the Registered Engineer doing the design. When a soils report is required, plans shall be signed by the Soils Engineer and/or Geologist. In addition, all calculations, plats and reports shall be signed and sealed by the engineer responsible for the design.

5. Revisions made after original approval by the City Engineer shall be initialed by the EOW and submitted to the City Engineer for approval. Plan revisions must be approved by the City Engineer or designee prior to construction of the revised improvement.

6. All grading and improvements are to be designed and constructed in accordance with the Carlsbad Engineering Standards, San Diego Regional Standard Drawings (SDRSD), San Diego County Hydrology Manual, San Diego County Map Processing Manual, City of Carlsbad Technical Guidelines for Geotechnical Reports, City of Carlsbad BMP Design Manual, and San Diego County Hydraulic Design Manual, all latest editions.

7. Public projects, public facilities, and private streets subject to the development standards provided in Table 'C' of Carlsbad Municipal Code Section 21.45.060, must also comply with the Standard Specifications for Public Works Construction (SSPWC), California Department of Transportation Traffic and Highway Design Manuals, and American Association of State Highway and Transportation Officials Design Policies.

8. Profiles shall be shown on the top of sheets. Vertical curves shall show curve length and P.I. elevation, in addition to normal stationing and elevations.

9. Normally, the scales for improvement plans shall be 1" = 40' for the horizontal and 1" = 4' for the vertical. The vertical scale should be changed to 1" = 8' or other appropriate scale where grades are steep. For complex plans, the scale shall be 1" = 20' or larger when necessary for clarity.

10. Improvement and grading plans shall be prepared in indelible ink on mylar drafting film or reproduced by photo mylar (sepia, ammonia mylar or vellum are unacceptable) unless otherwise approved by the City Engineer. Additionally, digital copies of the plans shall be submitted per the City of Carlsbad "Standards for the Digital Submittal of Maps and Plans" available at the Land Use Engineering counter and attached herewith in Chapter 2.

11. Public easements shall be a minimum of 20' in width for single utility facilities or 30’ in width for two facilities unless a lesser width is specifically authorized by the City Engineer. Approved means of all-weather access to the easement must be provided. Utility and drainage easements parallel to side lot lines shall be laid out so that the easement is all on one lot. Easements between existing and/or future dwelling units or building structures shall be a minimum of 20' in width for single facilities.

12. Drainage calculations and maps in accordance with these City standards, the San Diego County Hydrology Manual, and the San Diego County Hydraulic Design Manual shall accompany all plans submitted for review, unless the requirement is specifically waived.

13. All plans, calculations and reports are to be checked by the EOW for consistency, accuracy, clarity and conformity with City Standard Specifications, drawings, and design criteria before submission for City review and approval. The EOW is responsible for coordinating plans with their clients’ Architect, Landscape Architect, professional engineers of other disciplines, utility companies and permitting agencies.

14. All plans, calculations and reports submitted for review shall be accompanied by a letter of transmittal, submittal checklist, and all applicable fees based on the Engineer's Estimate of quantities and costs.

15. During final approval submittal, EOW shall submit digital (pdf) copies of all calculations/reports/studies in accordance with city submittal checklists to the satisfaction of the City Engineer. Digital copies shall include color resolution from the original document used to distinguish symbols, photographs, tables, exhibits, etc.

16. The original check prints shall accompany revised plans resubmitted for review.

17. Original drawings shall become the property of the City upon being signed by the City Engineer.

18. The original drawing shall be revised to reflect as-built conditions by the EOW prior to final acceptance of the work by the City.

19. The EOW shall submit maps of any proposed subdivision, drawn to a scale of 1" = 500', prior to City approval of the final subdivision map. These maps will be used to update City of Carlsbad Fire Department run books.

20. The number of sheets submitted should normally be limited to that required for clarity of presentation. Separate drawings for streets, water, storm drains, and sewers will not normally be accepted.

21. Improvement plans shall show all existing trees within the street parkway and within 5' outside the right-of-way and specifically designate those to be removed. Any tree within the right-of-way to be removed must have specific approval to do so by the City Engineer.

22. The Carlsbad Engineering Standards are prepared and maintained by the City Engineer with input from affected departments. The standards establish uniform policies and procedures for the design of public improvements. It is not intended as, nor does it establish, a mandatory

standard for these designs. The policies established in the engineering standards are for the information and use by Engineers, designers and city staff. The standards are subject to amendment as conditions and experience warrant. Special situations may call for variation from the standards, to the satisfaction of the City Engineer. The standards are not a substitute for engineering knowledge, experience or judgment. It is not intended that any standard of conduct or duty toward the public shall be created or imposed by the publication of these standards.

23. All plans, specifications, and supporting documents shall be signed and sealed by the Engineer in responsible charge of the work prior to City Engineer's approval. Each sheet shall be signed and sealed, except that bound documents may be signed and sealed on their first page. Additionally, the first sheet of each set of plans shall have the following certificate:

"DECLARATION OF RESPONSIBLE CHARGE"

I hereby declare that I am the Engineer of Work for this project, that I have exercised responsible charge of the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with current standards.

I understand that the check of project drawings and specifications by the City of Carlsbad does not relieve me, as Engineer of Work, of my responsibilities for project design.

_____
Firm

_____
Address

_____
City, State, Zip

_____
Telephone

_____
Email

_____
By R.C.E.# Exp. Date

_____
Date

24. After City Engineer's approval of a set of plans, if a new engineer assumes responsible charge of the work, he/she shall add, sign, and seal the following statement in each sheet:

"ASSUMPTION OF RESPONSIBLE CHARGE"

As of _____, I hereby assume responsible charge for design changes to this drawing.

_____

By R.C.E.# Exp. Date

_____

Firm

_____

Address

_____

City, State, Zip

_____

Telephone

CHAPTER 2 – STANDARDS FOR THE DIGITAL SUBMITTAL OF MAPS AND PLANS

2.1 INTRODUCTION

The City of Carlsbad maintains a Geographic Information System (GIS) for use by all City Departments. Major components of the GIS are parcels and public works facilities. To improve the efficiency of data collection and use in city operations such as development processing services, public works maintenance and operations, public safety activities (Police/Fire) and habitat protection, the City of Carlsbad requires the submission of digital copies along with the required number of hard copies for the submittal of all Final Maps, Grading Plans, and Improvement Plans. These requirements do not affect in any way existing requirements of other departments regarding map/plan processing. See Section 4 for details of data file content and organization.

Exceptions from these requirements may be made with the written permission of the City Engineer.

For further information or clarification of this specification, contact:

Transportation Department, City of Carlsbad
1635 Faraday Avenue
Carlsbad CA 92008
(442) 339-2746
transportation@carlsbadca.gov

2.2 DATA FORMAT FOR DIGITAL SUBMITTALS

The acceptable formats for digital submittal of the data are:

AutoCAD Release 2021 or more recent (Autodesk) .dwg or .dxf format

2.3 BASIS OF BEARINGS AND COORDINATE REFERENCE

The basis of bearings and all coordinates of data submitted to the City must be in reference to the California Coordinate System - 1983, Zone VI, 1991.35 Epoch, North American Datum of 1983 (NAD83) based on ties to the **City of Carlsbad Survey Control Network** monuments as published on **Record of Survey Map No. 17271**, filed in the office of the San Diego County Recorder on February 8, 2002. The coordinate ties in the digital submission must meet third order accuracy from the control monuments to the project boundary. The project boundary will be located in the California Coordinate System at a common tie point. All other coordinates and line work will be scaled to ground distances and be within 0.5 feet of the true California Coordinate System values. For vertical control, the NGVD 29 datum is still in effect.

When using AutoCAD to verify the project site location use the “Xref” command with the “CBD_ROS_NAD83.dwg” and “City Map_NAD83.dwg” then insert point (0,0,0).

2.4 DATA LAYERING REQUIREMENTS

Final Maps, Parcel Maps - will consist of:

- file(s) of the entire map submittal area;
- layers description (digital file/ hard copy)

Improvement Plans - will consist of:

- file(s) of the entire plan submittal area;
- layers description (digital file/ hard copy)

Grading Plans - will consist of:

- file(s) of the entire plan submittal area;
- layers description (digital file/ hard copy)

NOTE: The model space of the submitted drawings should contain the entire project (showing property lines, improvements, etc.) and it should not be divided into sheets (used for plotting purposes).

The City of Carlsbad Standard layers are as described in Table 2.1 – Final Maps, Parcel Maps, Table 2.2 – Improvement Plans, and Table 2.3 – Grading Plans. Digital submittals are to follow the City of Carlsbad layer format or be accompanied by a digital file or hardcopy sheet describing layer names and symbol descriptions.

TABLE 2.1 – FINAL MAPS, PARCEL MAPS

LAYER NAME	LAYER CONTENTS
ACREAGE	net acreage text
BASE	north arrow, location map, etc.
COORD	coordinate values & tic marks
COV	cover sheet information
EASE	public/private easement lines
FLOOD	100-year flood lines and text
HATCH	hatching & shading
LOTS	lot lines, other property lines, and associated text
MON	monumentation markers and associated text
POS	procedure of survey lines and associated text
ROW	right-of-way easement lines and associated text
STCL	street centerline lines and associated text
STREAM	streams
STROW	street right-of-way lines and associated text
THALWEG	watercourse thalwegs

TABLE 2.2 – IMPROVEMENT PLANS

LAYER NAME	LAYER CONTENTS
ACCESS	access covers (size, type, % grade)
APN	assessor parcel number text
BASE	north arrow, location map, etc.
COORD	coordinate values & tic marks
COV	cover sheet information
CURB	curbs, berms, sidewalks
EASE	public/private easement lines
EXGRDIDX	existing grade index contours & text
EXTGRADE	existing grade contours and text
FINGRADE	finished grade contours and text
FINGRDIDX	finish grade index contours & text
FLOOD	100-year flood lines and associated text
FLOW	swales, direction of flow
FTPRINT	footprints of buildings
GRID	grid & grid numerical values for street & utility profiles
HATCH	hatching & shading
INOUT	inlets/outlets
IRRCOND	irrigation conduit
IRRCONTR	irrigation controllers
IRRPIPE	irrigation pipe
LANDSCPLT	landscape planting
LANDSCTXT	landscape text
LOTS	lot lines, other property lines, and associated text
MEDIAN	medians
MON	monumentation markers and associated text
PERCENT	percentages
POS	procedure of survey text and associated text
PUBELECOH	public utilities - electrical: overhead
PUBELECUG	public utilities - electrical: underground
PUBGAS	public utilities - gas distribution
PUBHYDR	public utilities - fire hydrants
PUBTELE	public utilities - telephone boxes
PUBTV	public utilities - cable TV
PUBWATER	public utilities - water supply
RAMP	ramps
RECWPROF	reclaimed water profile
ROW	right-of-way easement lines
SEWERSYS	sewer main and associated text
SEWPROF	sewer profile
SPOTELEV	spot elevations markers and text

LAYER NAME	LAYER CONTENTS
STCL	street centerline lines and associated text
STLIGHT	electroliers
STLTCOND	street lighting conduits & junction boxes
STORMDRN	culvert and storm drain profiles and associated text
STPROF	street profile
STREAM	streams
STRMPROF	storm drain profile
STROW	street right of way lines and associated text
STSIGN	street name signs
STSTRIPE	traffic striping
THALWEG	watercourse thalwegs
TREE	trees (4” diameter or greater)
TSIGCOND	traffic signal conduit
TSIGN	regulatory & advisory signs
TSIGNAL	traffic signals
TSIGNAL	traffic signals and associated text
WALKS	footprints of walks
WATPROF	water line profile
XTREE	trees to be removed

TABLE 2.3 – GRADING PLANS

LAYER NAME	LAYER CONTENTS
ACCESS	access covers (size, type, % grade)
APN	assessor parcel number text
BASE	north arrow, location map, etc.
COORD	coordinate values & tic marks
COV	cover sheet information
CURB	curbs, berms, sidewalks
EASE	public/private easement lines
EXGRDIDX	existing grade index contours & text
EXTGRADE	existing grade contours and text
FINGRADE	finished grade contours and text
FINGRDIDX	finish grade index contours & text
FLOOD	100-year flood lines and text
FLOW	swales, direction of flow
FTPRINT	footprints of buildings
HATCH	hatching & shading
INOUT	inlets/outlets
LANDSCPLT	landscape planting
LANDSCTXT	landscape text
LOTS	lot lines, other property lines, and associated text
MEDIAN	medians
PERCENT	percentages
POS	procedure of survey text and associated text
PUBGAS	public utilities - gas distribution
PUBHYDR	public utilities - fire hydrants
PUBTELE	public utilities - telephone boxes
PUBWATER	public utilities - water supply
RAMP	ramps
ROW	right-of-way easement lines and associated text
SEWERSYS	sewer main and associated text
SPOTELEV	spot elevations markers and text
STCL	street centerline lines and associated text
STORMDRN	culvert and storm drain profiles and associated text
STREAM	streams
STROW	street right-of-way lines and associated text
THALWEG	watercourse thalwegs
TREE	trees (4” diameter or greater)
TSIGNAL	traffic signals
TSIGNAL	traffic signals and associated text
WALKS	footprints of walks
XTREE	trees to be removed

2.5 ACCEPTABLE MEDIA

The City will accept submissions of the required digital files on the following media:

- PC-formatted Compact Disk (CD)
- PC-formatted Digital Versatile Disk (DVD)
- USB Flash Drive
- Data Sharing Software (i.e. Drop-Box, OneDrive, Sharefile, etc.)

The submitter will be responsible for archival of the digital data until final acceptance. If possible, do not archive (compress) the files.

All media will be submitted with labels indicating the following information:

Project Name / Number Date
Company
Contact Name / Telephone Number / Email
File Names (see below for file naming conventions)

Submissions must include all necessary files, including external reference (Xref) files and fonts. AutoCAD's Pack N Go or E-Transmit utility can support packaging all referenced files into a single location.

2.6 FILE NAMING CONVENTIONS

The files will be named according to the plan name with the extension .DWG or .DXF for CAD- type files. Examples:

Carlsbad Tract Map No. 98-93	CT9893.dwg
Minor Subdivision 89-01	MS8901.dwg
Improvement Plan 360-3B	I360-3B.dwg
Grading Plan 360-3A	G360-3A.dwg

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CHAPTER 3 – PUBLIC STREET AND TRAFFIC STANDARDS

3.1 WIDTHS

A. All street classifications shall conform to the latest adopted Mobility Element of the General Plan and any special plan thereto.

B. Street widths shall be in accordance with Table A. Any Local (neighborhood), Village, Neighborhood Connector, School or Industrial street wider than 36 feet including parking on both sides of street (or 20 feet excluding parking areas) shall require speed management best management practices designs as approved by the City Engineer.

C. Intersections may require special design and the study shall conform with the California Manual on Uniform Traffic Control Devices (CA MUTCD), Section 4C.01b and 01c regarding intersection control. An engineering study shall include consideration of a roundabout (yield control). If a roundabout is determined to provide a viable and practical solution, it shall be studied in lieu of, or in addition to a traffic control signal. Refer to the California Department of Transportation (Caltrans) website for more information on the Traffic Operations Policy Directive 13-02, Intersection Control Evaluation (ICE), and other resources for the evaluation of intersection traffic control strategies: http://www.dot.ca.gov/hq/traffops/liaisons/ice.html

D. Where feasible, when streets are improved for only one-half width, the unimproved half shall drain away from the paved section and shall be provided with a paved ditch or adequate drainage facility, as approved by the City Engineer. A 2" x 6" redwood header shall be required at the edge of paving.

E. Where half-street improvements are required for streets, the developer of the first half is required to install the half-street section plus 12' of additional paving except for secondary, prime or major arterials.

F. Local residential streets may be required to incorporate traffic calming measures as approved by the City Engineer. These measures may include curb extensions, chokers, pavement treatment, medians, round-a-bouts, speed bumps and traffic circles. Special Fire Department and Police Department approvals may be required.

3.2 GRADES

A. Vertical curves are required when grade breaks exceed 1.5%.

B. Normal crown slope on asphalt concrete (AC) pavement shall be 2.0%.

C. The design, layout and location of pedestrian ramps shall comply with federal, state and local accessibility requirements. Engineer shall design pedestrian ramps and crossings in accordance with PROWAG, Caltrans Design guidelines (latest version) to the satisfaction of the City Engineer. Engineer shall incorporate additional detail and/or construction notes on the plans to address these requirements. In special circumstances, consult with a Certified Accessibility Specialist person (CASp).

D. Grades greater than 10% shall be constructed of Portland Cement Concrete and shall have a rough texture surface. Grades steeper than 12% or 12% grades in excess of 400' in length require the prior approval of the City Engineer and the Fire Marshal.

E. All street plans shall extend horizontal and vertical design a minimum of 200' beyond property line to demonstrate the feasibility of future extension. For collector streets and above, an extension of a minimum 500' shall be shown. Longer extensions may be

required by the City Engineer. For newly developing areas, an alignment study may be required with each project to show "overall circulation picture."

F. For all collector-to-arterial and arterial-to-arterial intersections, the improvement plans shall include a 20-scale plan view of the intersection detailing surface elevations on 10' x 10' grid locations. Extend grid elevations to a minimum of 50' beyond the Beginning of Curb Return (BCR) (similar requirements for collector-to-collector intersections may be required.)

G. All street widening plans shall include working copies of cross-sections not to exceed 50' on center. Additional cross-sections may be required where design situations develop.

3.3 ALIGNMENT

A. Streets shall normally intersect at right angles. Local streets shall have at least 50' of tangent adjacent to an intersection, measured from extension of the curb face. Collectors shall have at least 100'. An angle of intersection more than 10° from a right angle requires special approval and design. Hillside terrain and arterial roadways require a special design.

B. The centerline of streets entering upon opposite sides of any given street shall normally be offset by at least 200' for local residential streets measured from centerline to centerline. Cul-de-sac streets shall normally be designated as "T" type intersections and may be offset at 150'.

C. Single-entry developments may be permitted when the single-entry street meets the following standards:

1) With special approval of the City Fire Marshal and City Engineer, a 36-foot curb-to-curb residential street that serves 20 or less units. If any portion of an adjacent lot is impacted by a Fire Hazard/Fire Suppression Zone, a 42-foot curb-to-curb distance is required.

2) With special approval of the City Fire Marshal and City Engineer, a 40-foot curb-to-curb residential street that serves 50 or less units, where all units are equipped with automatic fire sprinkler systems. If any portion of an adjacent lot is impacted by a Fire Hazard/Fire Suppression Zone, a 42-foot curb-to-curb distance is required.

3) With special approval of the City Fire Marshal and City Engineer, an arterial meeting all the following conditions:

a) The length of street does not exceed one-half mile.
b) Traffic volume at entrance does not exceed 3000 average daily traffic (ADT).
c) All buildings are equipped with automatic fire sprinkler systems

4) With special approval of the City Fire Marshal and City Engineer a 52-foot wide curb-to-curb industrial street meeting all the following conditions:

a) The length of street does not exceed one-half mile.
b) Traffic volume at entrance does not exceed 3000 ADT.
c) All buildings are equipped with automatic fire sprinkler systems

D. Minimum length of tangent between reversing curves shall be 100'. A lesser length may be used for local streets or hillside streets with the approval of the City Engineer.

E. All corner returns for local and residential collector streets shall have a minimum 20' property line radius; arterial streets shall have a minimum property line radius of 25'. Arterial streets may require special design.

3.4 STRUCTURAL SECTION

A. Design shall reflect a 20-year service life in accordance with the latest edition of the Caltrans Highway Design Manual.

B. The preliminary design structural section shall be based upon recommendations contained in the preliminary soils report. Verification tests and core samples are required. When sub-grade is exposed, specific "R" value tests shall be performed in accordance with California Test Method (CTM) 301 by a qualified soils laboratory at locations approved by the City. If recommendations are less than the minimum thickness for the proposed roadway, the City's minimum standard structural section shall be used in accordance with Table A and Volume 3, Supplemental Standard Drawing GS-17. In either case, the City Engineer shall review the "R" value tests and approve the recommendations for thickness of the structural section prior to placement of base and asphaltic concrete pavement.

C. Sub-grade samples having R-values less than 12 require special design by the soils engineer. Lime treatment may be considered if the subgrade is to be lime treated then it shall be rerun using hydrated lime and both the non-treated and treated samples shall be submitted for review and approval. Percent lime for R-value tests will be determined by the soils engineer. The sulfate content of the soil to be treated will be determined by CTM 417 and reported. Caltrans form TL-361 shall be submitted with structural section submittal. The minimum lime treated subgrade thickness shall be 8". The lime treated section shall be in accordance with Section 301-5, SSPWC. The soils engineer shall supervise and provide quality control during the soil stabilization process.

D. Extend aggregate base of roadway under curb/gutter to 6" behind back of curb. Thickness of aggregate base shall be the same as the approved structural section to a maximum of 6".

3.5 CURBS

A. Use 6" curb face with typical 12" gutter (or as otherwise specified by the City Engineer (SDRSD G-2) unless 8" is required for drainage.

B. Median curbs shall be per GS-18.

3.6 CROSS-GUTTERS

A. All cross-gutters shall be 10' minimum width and conform with San Diego Regional Standard Drawing G-12, unless otherwise approved by the City Engineer.

B. No cross-gutters shall be allowed on streets classified above collector. Any variance will require the specific approval of the City Engineer.

C. Mid-block cross gutters are only allowed with specific approval of the City Engineer and shall be designed in accordance with San Diego Regional Standard Drawing G-13, unless otherwise approved by the City Engineer.

D. A minimum of 6” of AB under the cross gutter shall be required or more per the soil engineer’s recommendation.

3.7 SIDEWALKS

A. Sidewalks shall be installed along both sides of all streets except hillside streets and shall be located non-contiguous with the curb for local residential streets unless an alternate location is approved by the City Engineer.

B. The minimum width for sidewalks in any zone shall be 6.0' or as approved by the City Engineer. A 4.0' minimum clearance shall be maintained around all obstructions such as street lights, mailboxes, fire hydrants, guardrail, etc. Transitions at obstacles shall be four-to-one (4:1). Sidewalks around curb returns shall be widened on all collector and above designated arterials to provide for future traffic signals, street lights and mounting posts and handicap ramps.

C. Sidewalk ramps shall be required at all intersections where sidewalks are required and shall conform with the plans and Standard Drawings or as directed by the City Engineer.

D. Meandering sidewalks require prior approval from the City Engineer.

3.8 SIGHT DISTANCE

A. Roadway Sight Distance: Sight distances shall be in accordance with the latest edition of the Caltrans Highway Design Manual.

B. Intersection Sight Distance: The design of intersection sight distance within the City will be governed by Topic 405 of the Caltrans Highway Design Manual with the following additions and clarifications:

1) Local/collector intersections and above follow Caltrans requirements. Signalized intersections must be designed with corner sight distance requirements.

2) The edge of traveled way shall be the extension of the face of curb for the purposes of determining driver setbacks. Where temporary or interim connections are made to roads without curbs and gutters, the travel way shall be the edge of pavement.

3.9 STREET TREES AND LANDSCAPING

A. All parkways and medians shall be landscaped and irrigated as required by City of Carlsbad Landscape Manual, Standard Drawing GS-8, and applicable Municipal Code.

B. All plans for median landscape and irrigation systems intended for public right-of-way maintenance by the City of Carlsbad shall be drawn on City standard mylar sheets and shall be filed with the improvement plans for the respective project. All other (private) landscape and irrigation plans shall be separated for review and approval by the Planning Director.

C. All irrigation system plans shall delineate water main connection, meter location and all valves and backflow preventers.

D. All irrigation system plans shall include flow calculations for each specific head proposed

and estimated coverage/saturation projections.

E. All medians shall include drainage systems to drain runoff water, but not surface flow across streets. Medians shall be straight graded, not crowned, even in super-elevated streets. All stamped concrete shall have thickened edges and use 4" x 4" or 6" x 6" x #10 x #10 welded wire mesh. Felt shall be used on all weakened plane joints.

F. All landscape shall be designed, installed and maintained to ensure adequate provision for corner sight distances.

G. The following items shall not be located in the median: controller cabinets, backflow preventer, water meters, or any equipment which projects above the surface.

3.10 STREET LIGHTS

The main purpose of roadway and street lighting is to provide better safety, security, and commerce through increased visibility of the roadway at night. Although lighting from a safety and security standpoint is viewed as a positive, there are drawbacks such as cost, light pollution, maintenance, energy use, etc. This street light standard is designed to provide benefits for public safety, security, and commerce.

A. General:

1) Street lighting shall conform to the most current version of the Caltrans Standard Specifications and Standard Plans, and the City of Carlsbad Standard Special Provisions for Construction.

2) City of Carlsbad street lighting design standards apply to both private and public streets and is intended for all new development and re-development projects within the City of Carlsbad.

B. Spacing:

1) For new construction or re-development of existing roadways, the street light spacing shall be as identified in Table B.

2) For intersection lighting, refer to Table B notes.

3) The City Engineer will have the final decision on the lighting levels that will be required (i.e. more or less lighting) based on street classification, night-time pedestrian use, special circumstances, the characteristics of the surrounding area, and the proposed development.

C. Luminaire:

1) Luminaires shall be light-emitting diodes (LED) and cobra head style. In areas with decorative street lighting (e.g., the Mission Bell style along El Camino Real), a decorative fixture with the same lighting characteristics as defined in this section and Table B shall be used. The designer shall obtain approval from the City of Carlsbad on the decorative fixture to be used.

2) Luminaires shall be Type III Distribution as defined by the Illuminating Engineering Society of North America (IESNA) and Type IV Distribution for cul-de-sacs, as appropriate and/or as directed by the City Engineer.

3) Luminaires shall be full cutoff so that light is not projected above the horizontal plane of the fixture. External shields or reflectors are not allowed.

4) Luminaires at signalized, safety intersection streets shall have a maximum Correlated Color Temperature (CCT) of 4000K.

5) Luminaires on local residential streets shall have a maximum CCT of 3000K.

6) Luminaires shall have an ANSI C136.41 compliant NEMA 7 pin receptacle for use with photo controls and smart lighting applications.

D. Street Light Standard:

1) Street light poles shall be round, pre-stressed concrete utilizing an anchor base. The surface treatment shall be exposed concrete aggregate with a graffiti-resistant coating.

2) Street light foundations shall be in accordance with San Diego Regional Standard Drawing (SDRSD) E-1 and E-2 for standard concrete poles with no additional mounted appurtenances. If equipment or additional appurtenances are to be mounted, the street light pole foundation shall be specifically designed by a civil engineer.

3) Street light poles in arterial or commercial areas shall have a height of 26 feet.

4) Street light poles in residential areas shall have a height of 24 feet.

5) Mast arms shall be aluminum or galvanized steel with a length of 8 feet.

6) Luminaire mounting height shall be between 1.5’ and 2.5’ from the top of pole.

TABLE A
CITY OF CARLSBAD STREET LIGHTING REQUIREMENTS

STREET CLASSIFICATION	PEDESTRIAN CLASSIFICATION LOW[4]	PEDESTRIAN CLASSIFICATION MEDIUM[4]	PEDESTRIAN CLASSIFICATION HIGH[4]
Major Arterial Curb-to-curb width: 82' to 100'	12,500 Min. Lumens Staggered[1]		
Collector/Arterial Connector Curb-to-curb width: 64' to 82'	12,500 Min. Lumens Staggered[1] *Description: Industrial*	12,500 Min. Lumens Staggered[1] *Description: Arterial Connector, Neighborhood Connector*	12,500 Min. Lumens Staggered[1] *Description: Identity, Employment/Transit Connector, Coastal*
Local Curb-to-curb width: 0' to 64'	3,900 Min. Lumens Staggered[1] *Description: Industrial, Local Neighborhood*	3,900 Min. Lumens Staggered[1] *Description: Local/Neighborhood Near a Park, Neighborhood Connector*	3,900 Min. Lumens Staggered[1] *Description: Identity, Village, Employment/Transit Connector*
Cul-de-sac Curb-to-curb width: 0' to 64'	3,900 Min. Lumens Staggered[1] *Description: Local/Neighborhood*		

NOTES:

1. Spacing is the distance between luminaires on the same side of the roadway and shall be guided by illuminance level as required in the latest edition of IESNA Roadway Lighting Manual or as directed by the City Engineer.
2. Areas of sensitive environmental or scenic concern shall require special treatment (e.g., adjacent to ocean, lagoons, and wildlife refuges) as determined by the City of Carlsbad.
3. Special circumstances may require additional lighting to provide for public safety. Examples of special circumstances include, but are not limited to: roundabouts; hidden driveway locations; high use crossings; high use driveways; very large intersections; road hazards such as dips and curves; public and private gathering points; bus stops; and others. Coordinate with the City for lighting regarding special circumstances.
4. Pedestrian Classification will ultimately be a judgment made by the City of Carlsbad. The following is guidance provided from ANSI/IES RP-8-14 “Recommended Practice for Roadway Lighting”:
   - Pedestrian Classification Low – areas with very low volumes of night pedestrian usage (i.e., 10 or fewer pedestrian per hour). Examples include residential, rural and semi-rural areas, and industrial.
   - Pedestrian Classification Medium – areas where lesser numbers of pedestrians utilize the streets at night (i.e., 10 to 100 pedestrians per hour). Examples include downtown office areas, neighborhood shopping, and parks.
   - Pedestrian Classification High – areas with significant numbers of pedestrians expected to be on the sidewalks or crossing the streets during darkness (i.e., over 100 pedestrians per hour). Examples include downtown urban areas, transit terminals, near theaters, near concert halls, and “The Village.”

3.11 TRAFFIC SIGNALS

A. The developer shall submit a design for the construction or modification of traffic signals which are required as a condition of that development. The design shall be in accordance with the Caltrans Standard Specifications and Standard Plans, California Manual on Uniform Traffic Control Devices (CA MUTCD), and the City of Carlsbad Standard Special Provisions for Construction (CCSSPC).

B. All work at or near an intersection shall include interim traffic control and replacement of loop and/or other in-pavement detectors if damaged or modified.

C. Interconnect Fiber Optic conduit and cable and advance warning devices shall be incorporated into all traffic signal designs and construction as required by the City Traffic Engineer or designated representative.

D. Prior to beginning design of a traffic signal plan or modification to an existing signal, a pre-design meeting shall be held with the City Traffic Engineer or designated representative.

E. All traffic signals shall incorporate Type 352i ATC Traffic Signal Cabinet, 2070 ATC controller with Trafficware Scout software or Type 332 Traffic Signal Cabinet, 2070 ATC controller with Trafficware Scout software. Detection type shall be video, radar, or inductive loop, and Emergency Vehicle Preemption Equipment (EVPE) that is compatible with the existing City of Carlsbad Fire Department emergency vehicle pre-emption emitters and radios. Traffic signal cabinet shall be aluminum and type III-BF meter service pedestals shall conform to Caltrans requirements and SDG&E Service Guide specifications. When loop detection is directed for use, Type D/E shall be used for limit line detection and Type E shall be used for advance detection (Caltrans Standard Plan E8-5B). Each advance inductive loop shall have individual Detector Lead-in Cable (DLC) run back to the controller cabinet. Video, radar, and/or other in-pavement wireless detection system may be required for advanced vehicle detection in lieu of loop detection. Pan-tilt-zoom (PTZ) camera may be required at the direction of the City Traffic Engineer. Traffic Signal Communication equipment to be determined based on location and site-specific needs.

F. All traffic signal plans or intersection design plans shall include the ultimate layout of the intersection shown. Existing, proposed and future improvements shall be shown, including utilities. An interim signing and striping plan shall be required as necessary.

G. Prior to installation of any traffic signal, written authorization from the City Traffic Engineer shall be obtained. A note to this effect shall be placed on the cover page of the signal plans.

H. All traffic signal plans shall be submitted as a separate set of improvement plans for the associated project. Plan-check fees shall be paid for this review. Therefore, include a separate estimate of construction costs with submittal.

I. For new traffic signal installations, signal cable shall be installed in lieu of individual conductors.

J. For traffic signal locations involving new or relocated pole locations and/or cabinets, new signal cable shall replace existing individual conductors as determined by the City Traffic Engineer or designated representative.

K. Electrical service location shall be obtained from SDG&E and shown on plans.

3.12 TRAFFIC SIGNING AND STRIPING

A. All collector and arterial street improvement plans shall include traffic striping and signing designs on a separate sheet(s) (1"= 40'-scale recommended).

B. All striping and signing plans shall conform to the latest edition of the California Manual on Uniform Traffic Control Devices (CA MUTCD) and Standard Drawings. Additionally, street signs shall meet the requirements outlined in the "City of Carlsbad Street Sign Information and Specifications" available at the Engineering counter and attached herewith in Appendix "B".

C. All traffic signing and striping plans shall be reviewed along with the complete set of improvement plans for the associated project. Plan-check fees shall cover this review. Include estimate of construction costs with submittal.

D. All permanent signage shall be reflective per ASTM Designation D4956 and shall use Type IV prismatic reflective sheeting (High Intensity Primastic or equal) unless otherwise specified. R1-1 "STOP"", R1-2 "YIELD", R2-1 "SPEED LIMIT" and street name signs shall use Type IX prismatic cube-corner reflective sheeting (Diamond Grade VIP or equal).

E. All pavement legends shall be the latest version of the Caltrans stencils.

F. Limit lines and crosswalks shall be field located. Crosswalks shall be high visibility "continental" style per CA MUTCD Figure 3B-19 and have 10' inside dimension unless otherwise specified. Each crosswalk marking shall be 2' wide with a spacing of 3' between markings. Crosswalk markings shall be parallel to the direction of vehicular travel. A 12" white limit line shall be installed at a minimum of 4 feet in advance of the marked crosswalk.

G. All crosswalks, limit lines, stop bars, pavement arrows and pavement legends including bike lane legends and shared lane use markings shall be thermoplastic unless otherwise specified. Preformed thermoplastic arrows, legends and markings shall not be acceptable.

H. The size of signs shall be based on the recommended sign sizes found in the CA MUTCD.

I. Sign posts shall be square perforated steel tubing with breakaway base per San Diego Regional Standard Drawing M-45.

J. The contractor shall furnish and install street name and traffic signs to the satisfaction of the City Traffic Engineer.

K. Wait at least 7 days after paving to spray first coat of striping. Wait an additional 7 days for second coat, per Greenbook standards.

L. Two street name signs shall be located on one Telespar post at every intersection, except signalized intersections. Lettering on ground-mounted street name signs with a speed limit of 25 mph or less shall be 4” upper-case and 3” lower-case. Lettering on all other ground-mounted street name signs shall be 6” upper-case and 4.5” lower-case. Supplemental lettering such as suffixes, block numbers and directional arrows shall be at least 3” high. Street name for public streets shall have white lettering on green background. Street name signs for private streets shall have black lettering on white background.

M. "STOP" signs (R1-1) and STOP AHEAD (W3-1) signs shall be located on local collector intersections and above, where required by the City Engineer. STOP signs shall be augmented with a 12” white limit line and a STOP pavement legend at each location.

N. "NO OUTLET" (W14-2) sign shall be used when the end of the cul-de-sac cannot be seen from the intersection.

O. Other signs ("NO PARKING" or other regulatory signs) may be required by the City Engineer.

P. Where an R6-1 “ONE WAY” sign is installed on a raised median, the bottom of the sign shall be 18” above the finished surface of the median.

Q. Where an OM1-3 object marker and an R4-7 “KEEP RIGHT” sign are installed on a raised median, the bottom of the OM1-3 object marker shall be 24” above the finished surface of the median.

R. Where OM1-3 object marker and an R4-7 “KEEP RIGHT” sign are installed on a median less than 3 feet wide, the OM1-3 object marker shall be 12”x12” and the R4-7 sign shall be 18”x24”.

S. All median noses and flares shall be painted yellow.

T. Street lights shall be shown on signing and striping plans.

U. Whenever possible, mount signs on street light poles. When a sign is attached to a pole, it shall be mounted using a standard City of Carlsbad approved mounting bracket with straps.

V. Green paint for bicycle lane enhancement shall be EF Series WB GRN Fast Dry 1952F Type I and II, Product Code 183, Product Color Green (34108) by Ennis Flint or approved equal. Paint shall meet Federal Specification TT-P-1952F Type I and II.

3.13 TRAFFIC CONTROL PLANS

A. Pavement markings shall be in conformance with the criteria as presented in the latest edition of the California Manual on Uniform Traffic Control Devices.

B. All crosswalks, limit lines, pavement arrows and pavement legends shall be thermoplastic unless otherwise specified. All pavement arrows and legends shall be the latest version of the Caltrans Standard Plans stencil.

C. Fire hydrant pavement markers shall be included in construction of any project in

conformance with SDRSD M-19.

D. When roadway improvement will impact an existing roadway in a manner not covered by the California Department of Transportation Highway Design Manual or California Manual on Uniform Traffic Control Devices, improvement plans shall include traffic control/detour plans. Prior to design of control/detour plans, a pre-design meeting should be held with Engineering Department staff.

E. Detour plans and traffic control plans shall be based upon the latest edition of the California Manual on Uniform Traffic Control Devices and the Standard Specifications for Public Works Construction (Green Book). These detour plans shall be submitted accompanying improvement plans for the proposed development and conform to the provisions of Engineering Policy 29.

F. Any deviation from approved traffic control plans shall be approved by the City Traffic Engineer or designated representative prior to change in field.

3.14 GUARDRAILS

A. Guardrails shall be provided for arterials along the tops of slopes adjacent to roadways in accordance with Chapter 1 of the California Department of Transportation Traffic Safety Systems Guidance or as required by the City Traffic Engineer. Guardrails may be required on local or collector streets on the outside of curves where slopes and vehicle speeds warrant.

B. Typically, sidewalks shall be located behind guardrails.

C. Guardrails shall conform with SDRSD M-30. Additional right-of-way may be required to accommodate flare sections.

D. Guardrails shall not encroach into required intersection sight-distance corridor areas.

3.15 DRIVEWAYS

Development Type	Maximum*	Minimum*	Type
Residential	30 Feet	12 Feet	5-1/2" PCC
Multi-Family Residential	34 Feet	24 Feet	7-1/2" PCC
Commercial	40 Feet	24 Feet	7-1/2" PCC
Maximum Width:	Residential - 40% of lot frontage Commercial and Industrial - 50% of lot frontage		

Typical X = 3' "X" being the dimension of curb height transition.

*Clear width measured at bottom of "X", modification may be permitted if approved by the City Traffic Engineer.

A. Minimum clear distance between driveways on same property: 2'.

B. Minimum clear distance from property line: 3' if sidewalk is contiguous to curb, 0’ if non-

contiguous.

C. Minimum distance from curb return: 0' - no encroachment.

D. Minimum distance from fire hydrant, street lights and other aboveground utilities: 5'.

E. Grades - see GS-15.

F. A minimum of 6” approved base material shall be placed under all driveways within the right-of-way.

G. Driveways within cul-de-sacs may require special design.

NOTE: All dimensions (A-D) are to the top of "X" unless otherwise noted.

3.16 MONUMENTATION

A. Centerline monuments (SDRSD M-10A-C) shall be installed at the P.I. of all curves if found within the paved roadway (otherwise at the E.C. and B.C.), at the centerline intersection of all streets, at the radius point of all cul-de-sacs, where the boundary line crosses a street centerline and at a maximum of 1000’ on straight runs. A 5.0' offset may be used to avoid conflicts with access covers. Monuments shall be shown on improvement plans.

B. Survey tie information shall be submitted to the City Engineer for all public streets monumented. Said information shall be submitted and accepted by the City Engineer prior to release of monumentation securities.

3.17 HILLSIDE STREETS

A. Hillside streets shall be designed on a case-by-case basis in accordance with the general guidelines established in these Standards and Chapter 21.95 of the Carlsbad Municipal Code (Hillside Ordinance).

B. Hillside streets shall be defined as those streets which traverse landforms with a slope in excess of 25% and do so in an environmentally sensitive manner. Special consideration may also be given to streets which traverse lands with slopes between 15% and 25% with the approval of the City Engineer.

C. Hillside street design criteria are as shown on Table A. Modifications may be made to these criteria with the approval of the City Engineer on a case-by-case basis. Such modifications may include:

1) Split roadways which step down the hillside and reduce grading quantities.

2) Off-set crown or tipped roadway sections.

3) Deletion of sidewalks on one or both sides.

4) Reduction of tangent requirements or introduction of compound, broken back or reversed curves.

D. Where street widths have been reduced, the use of parking bays and scenic view turnouts are recommended.

E. Consistent with the Hillside Ordinance, the use of "notch" or "gunsight" road cuts through hills shall be avoided.

F. A skid resistant top course asphalt overlay will be required on all hillside streets when grades exceed 7% or where horizontal curve radii are less than 200'.

3.18 STREET WIDTH AND IMPROVEMENT STANDARDS VARIANCE

A. Where the literal interpretation and enforcement of these standards would result in environmental degradation or be inconsistent with the general purpose of these standards, formal written requests to vary from these standards shall be made to the City Engineer.

In all cases, the variance shall be in harmony with the general purpose and intent of the standards and with the health, safety and general welfare of the public.

B. The areas wherein the design standards for street widths and improvements may be deleted or modified, may include, but not be limited to, narrowing the right-of-way width, narrowing of the roadway width, deletion of sidewalks, deletion of curbs, separation of opposing traffic lanes around sensitive environmental features, reduction of lighting standards in sensitive environmental habitats and other design modifications consistent with the conditions and intent of this section.

C. Design standard variances as determined by the City Engineer may include, but not be limited to, street width, median width, sidewalk deletions, horizontal alignments, vertical alignments, environmental issues, or design variations that could lead to a substantial conformance issue, driveway locations, and street accessory improvements.

D. Before a standards variance may be granted, it shall be determined:

1) That there are extraordinary or unusual circumstances or conditions applicable to the situation or surrounding property necessitating a variance of the standards.

2) The variance will not cause substantial drainage problems.

3) The variance will not conflict with existing or future traffic and parking demands or pedestrian or bicycle use.

4) The variance will not be detrimental to the public welfare or injurious to the property or improvements in the vicinity in which the variance is granted.

5) That the granting of such variance will not adversely affect the comprehensive general plan.

E. The applicant or other affected party may file an appeal of the decision to the City Council within ten (10) days of the City Engineer's written decision.

3.19 PUBLIC RIGHT-OF-WAY ENCROACHMENTS

A. The public right-of-way are unique public resources managed by the city for the benefit of the public. These public resources require proper management to: maximize utility, provide for the appropriate and orderly use, and ensure public health, safety and welfare.

B. A public right-of-way encroachment is any non-standard object and/or obstacle placed or constructed upon, over or within the public right-of-way, which is owned or controlled by an entity other than the City of Carlsbad or an authorized utility. The city allows certain encroachments if they do not interfere with the public’s use of the public right-of-way and do not otherwise compromise public health, safety or welfare.

C. A Right-of-Way Encroachment Agreement, consistent with Carlsbad Municipal Code §11.16.060(C), is required for such encroachments.

D. The following public right-of-way encroachments are typically allowed:

- Decorative concrete and pavers
- Landscaping and irrigation lines
- Stormwater facilities
- Awnings affixed to buildings
- Private drainage connecting to public drainage
- Retaining walls that are necessary for allowing pedestrian and vehicular access over steep portions of the right-of-way

E. The following public right-of-way encroachments are not allowed:

- Fences, walls, gates, and pilasters
- Private monument signs
- Retaining walls, other than those necessary for pedestrian and vehicular access
- Permanent structures such as sheds, patio covers, decks, and poles

TABLE B
CITY OF CARLSBAD
STREET DESIGN CRITERIA

DESIGN CLASSIFICATION	ARTERIAL [15]	ARTERIAL	ARTERIAL CONNECTOR	NEIGHBORHOOD CONNECTOR	INDUSTRIAL / VILLAGE	LOCAL	CUL-DE-SAC	ALLEY	HILLSIDE
ANTICIPATED ADT RANGES	**40,000 OR MORE**	**20,000 TO 40,000**	**10,000 TO 20,000**	**2,000 TO 10,000**	**----**	**20 TO 2,000**	**20 TO 1000**	**----**	**----**
Design Speed	60 MPH	50 MPH	40 MPH	30 MPH	25 MPH	20 MPH	20 MPH	10 MPG	20 MPH
Minimum Spacing of Intersections (including right-turn in/out) (in feet)	2,600	1,200	600	300	300	150 T's others 200	150 T's others 200	----	150
Right-of-Way Width (in feet)	126	102	84	60 or 68, or wider	72 [16]	60/68[11]	56[12]/60/68[11]	24	64
Private Access to Adjoining Property	None	None	Where no other access is possible	Limited, subject to approval	Limited, subject to approval	O.K.	O.K.	O.K.	Limited, subject to approval
Curb-to-Curb Distance (in feet) [13]	106 (18' median)								
Minimum Traffic Index	9	8.5	8.0	6.0	7.0	5.0	4.5	4.0	5.0
Minimum Structural Section (in inches) [6] [14]	6 AC 6 AB	5 AC 6 AB	4 AC 6 AB	4 AC 6 AB	4 AC 6 AB	4 AC 6 AB[10]	4 AC 6AB[10]	5-1/2" PCC [8]	4 AC 4 AB[10]
Stopping Sight Distance [5] (in feet)	580	430	300	200	200	150	150	----	125[2]
Corner Sight Distance [9] (in feet)	660	550	440	330	330	275	275	----	220
Maximum Centerline Grade (not thru intersections)[4]	7%	7%	10%	12%[3]	8%	12%[10]	12%[10]	----	15%[10]
Minimum Flowline Grade[7]	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%

NOTES:

(1) N.A.
(2) Reduction to 100' with approval of the City Engineer.
(3) Grades greater than 10% will require specific approval, chip seal, etc.
(4) Maximum intersection grades must comply with federal, state, and local accessibility standards, subject to City Engineer approval. Consult with PROWAG, Caltrans accessibility guidelines or a Certified Accessibility Specialist person (CASp).
(5) Stopping Sight Distance per Caltrans Highway Design Manual Topic 201 and Volume 3 Section 8 in Chapter 3 of City Standards.
(6) Assumes no superelevation; includes standard crossfall.
(7) Minimum grade of 2.0% is encouraged. If 1.0% minimum is not possible, special construction may be used with City Engineer approval. Gutter line of cul-de-sac bulbs and knuckles shall have minimum grade of 1.0%. Typical centerline grades at the upper reach of cul-de-sacs shall be 2% minimum.
(8) Alley sections shall conform to SDRSD G-21.
(9) Corner Sight Distance per Caltrans Highway Design manual Topic 405 and Volume 3 Section 8 in Chapter 3 of City Standards.
(10) PCC pavement required for grades over 10%
(11) 28-foot clear travel way required where adjacent lots contain any portion of a Fire Hazard Zone/Fire Suppression Zone within the property line.
(12) 36-foot curb-to-curb distance permissible when serving 24 or fewer lots and where adjacent lots do not contain any portion of a Fire Hazard Zone/Fire Suppression Zone within the property line.
(13) As approved by the City Engineer.
(14) Minimum pavement structural section shall be per Volume 3, Supplemental Standard Drawing GS-17.
(15) El Camino Real, Palomar Airport Road, Rancho Santa Fe Road and Melrose Drive.
(16) Reduction in right-of-way width per City Engineer approval.

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CHAPTER 4 – PRIVATE STREET AND DRIVEWAY STANDARDS

4.1 ACCESS AND CIRCULATION

All commercial, industrial, and multi-unit residential driveways shall conform with the following:

A. All driveways shall be designed and constructed to preclude the necessity for vehicles entering the driveway to maneuver or stack within the traveled way or to use the traveled way as a circulation element.

B. All driveways having an ADT greater than 40, or more than four (4) units, shall provide an approved turn-around or internal circulation to preclude vehicles backing onto a public or private street. Perpendicular or diagonal parking shall be discouraged on a high use driveway (see definition in Section 7) or the private street that it serves.

C. Unless approved deceleration lanes are provided, all driveways, except residential, shall have a queuing area for in-bound traffic located off the traveled way that serves the driveway. The queuing area shall be no less than 10 feet wide by 20 feet long. Driveway queuing areas shall be provided at the rate of one per 1000 ADT or any fraction thereof (i.e., 3500 ADT = 80'). Queuing depth shall be measured from face of curb.

D. No parking spaces, intersections or other decision points shall be located in or served by a driveway queuing area.

E. Driveway spacing shall conform to the following:

1) No driveway will be allowed onto prime or major arterial streets unless no other access is available to the lot(s) being served. If no other access is available, a right in/out only driveway will be allowed. In this case, high use driveways must be designed with deceleration lanes. For medium and high use driveways, the right in/out driveway must be located at a point no less than one-half the required intersection spacing from any other intersection or other medium or high use driveway. Properties located such that the preceding spacing requirements cannot be met shall obtain access to the public street system via the following methods in descending order of preference:

a) Via an extension of a public street through adjacent properties. This method is preferred only when said extension is a logical addition to the public street system and meets City Design Criteria.

b) Via a private road with a non-revocable easement granted to the property being served.

c) Via a driveway on the subject property that, while otherwise not meeting the requirements of this policy, is located optimally to reduce side friction and traffic hazards on the arterial street.

*Medium and high use driveways so allowed shall be made available to adjacent properties through non-exclusive easement or by dedication of a frontage road connecting the driveway and the adjacent properties.

2) *Low use driveway - shall be located per Public Street Design Criteria.

3) Joint use driveways shall be used wherever feasible. The burden of showing joint use driveways to be infeasible is on the developer. The developer must show the joint driveway to be physically impossible or that the adjacent owner has rejected, in writing, a bona fide, good faith offer for purchase of the right.

F. *High use, multi-residential and commercial driveways shall be constructed in accordance with SDRSD G-17 except that the concrete apron shall be 7-1/2" thick. Dimension R shall be 15 feet. *Low use and medium use driveways shall be constructed in accordance with SDRSD G-14B, Throat width shall be no less than 24 feet for residential projects and 30 feet for commercial or industrial projects. Throat width shall be no more than 36 feet for residential projects and 40 feet for commercial or industrial projects. The apron length shall be no less than the throat width. Spacing for high use driveways shall be treated the same as a street intersection.

G. Driveways should be designed for 15 mph safe speed with sufficient sight distances. Maximum center line grades are as follows:

1) *Low use driveways shall have a maximum grade of +15%.

2) *Medium use driveways shall have a maximum grade of +12%.

3) *High use driveways shall have a maximum grade of +12%.

Vertical curves (minimum 5-foot length) shall be provided when grade break exceeds 5%. Fire Marshal may require PCC pavement for grades over 10%.

*(See Section 4.7 for driveway use definitions)

H. All driveways shall be provided, at a minimum, with stopping sight distance in accordance with the City of Carlsbad Street Design Criteria in Chapter 1.

I. Except as required by Section E.(1) above, deceleration lanes will be required or approved only on a case-by-case basis.

J. Driveways not otherwise clearly distinguishable from a public street shall be clearly and permanently marked and posted as private.

K. Except for deceleration lane circumstances, the angle of intersection of street and driveway shall not vary more than 10 degrees from a right angle. When the ADT for a driveway exceeds 40, the queuing area shall be within the 10-degree skew and shall be a tangent section.

L. Driveway widths and percentage of frontage shall be in conformance with City Standards for Public Streets.

M. Where private streets meet public streets, Public Street Standards shall apply (access, ramps, and utilities).

N. Reciprocal access for adjacent lots shall be provided where feasible (future development shall be considered).

O. Circulation Design shall vary depending upon land use. For example, if a site changes from commercial to industrial (or vice versa) the parking, access and circulation will also change to accommodate the specific land use.

P. Dead end parking aisles over 150' deep shall have adequate turn-around space to accommodate a maximum 3-point turn for a standard passenger vehicle. No dead-end parking aisles shall have a depth over 200’.

Q. Industrial and large commercial projects shall provide for semi-tractor trailer circulation and loading. The design vehicle shall be a semi-tractor trailer per California Department of Transportation Highway Design Manual, Figure 404.5B.

R. Office, small commercial and light industrial, projects shall provide access and circulation for a 42' truck or bus per California Department of Transportation Highway Design Manual, Figure 404.5F.

S. All commercial and industrial projects shall provide access and circulation to trash enclosures. The design vehicle parameters and turning radius for a trash truck shall be the same as the truck or bus design mentioned above, Figure 404.5F.

T. All loading zones, truck bays and turn-arounds shall be free of parking stalls and obstructions. Loading zones shall not obstruct free movement and circulation of passenger cars.

U. Any street wider than 36 feet including parking on both sides of street (or 20 feet excluding parking areas) shall require speed management best management practices designs as approved by the City Engineer.

V. Intersections may require special design and the study shall conform with CA MUTCD, Section 4C.01b and 01c regarding intersection control. An engineering study shall include consideration of a roundabout (yield control). If a roundabout is determined to provide a viable and practical solution it shall be studied in lieu of, or in addition to, a traffic control signal. Refer to the Caltrans (http://www.dot.ca.gov/hq/traffops/liaisons/ice.html) for more information on the Traffic Operations Policy Directive 13-02, Intersection Control Evaluation (ICE) and other resources for the evaluation of intersection traffic control strategies.

4.2 ENTRANCES TO PLANNED DEVELOPMENTS

Entrances to planned developments shall be designed in accordance with the following criteria:

A. For private street entrances that include medians:

1) Median widths shall be a minimum of 4 feet and a maximum of 8 feet.

2) Median nose shall be located 15 feet minimum from the prolongation of the face of curb of the intersecting street.

3) No portions of a private median shall be allowed in the public right- of-way.

4) No rolled curbs allowed in medians unless specifically approved as a traffic calming device or as directed by the City Engineer.

5) Enhanced paving may be allowed in public right-of-way with the approval of the City Engineer and issuance of an encroachment agreement.

6) Lane widths shall be 14 feet minimum and 16 feet maximum.

B. For planned developments which include gated or guarded entrances:

1) Gated and guarded entrances shall meet all the above criteria.

2) A minimum queuing distance of 20 feet shall be provided for each 1,000 ADT or fraction thereof (i.e., 40 feet for 1001 ADT).

3) All medians shall be designed in accordance with AASHTO turning radii for P-vehicle. No more than a 3-point turn in accordance with the turning requirements of Figure 404.5F truck or bus.

4) Where the design includes a guard house, there should be enough street width so that entering vehicles can make a U-turn just past the guard house to allow turnaround if the guard has denied them entry. Provide AASHTO P-vehicle turning radius to accommodate the U-turns.

4.3 WIDTHS AND ALIGNMENT

A. Residential private street and drive aisle widths shall be as follows:

1)	Private streets [(from 21.45.060]	Minimum Width Curb-to-Curb
	Two (2) lanes, parking on both sides	34/42* feet
2)	Drive aisles	
	Two (2) lanes, no parking	20/28* feet

* 28-foot clear travel way required where adjacent lots contain any portion of a Fire Hazard/Fire Suppression Zone

B. Commercial/industrial parking lots and driveways:

1) Minimum aisle widths shall be in accordance with Section 21.44.050 of the Carlsbad Municipal Code.

2) Aisle width adjacent to buildings where truck loading bays are not provided shall be a minimum of 32' wide.

3) One-way aisles shall require specific approval of the City Engineer.

C. All circulation routes as described above must be designed in accordance with City Standards and to the following design criteria:

1) Private street and private driveway traveled way widths shall conform with alignment criteria for public streets and/or Carlsbad Ordinance Section 21.45.060.

2) Standard curve radius as defined in Table A of the Street Design Criteria may be reduced provided adequate intersection sight distance is maintained in accordance with Caltrans Highway Design Manual, Topic 405.1. The sight distance corridor must be exclusive of parking, heavy landscape over 30" in height or fenced areas.

3) Right angle curves are permitted within the following guidelines:

a) Provision is made to retain stopping sight distance per Caltrans Highway Design Manual.

b) The maximum skew for the right-angle curve does not depart more than 10 degrees from the 90-degree angle.

c) The 90-degree angle curves are not located at or near the entrance to projects with high or medium use driveways/streets. Ninety-degree curves are discouraged on high use driveways/streets.

d) The standard knuckle design may be eliminated on apartment and condominium projects and planned developments with the City Engineer's approval.

4) A series of right angle turns or reversing curves are discouraged and will be allowed only with specific approval of the City Engineer. Standard tangent distances per Street Design Criteria Section 3(D) shall be required on all reversing curves.

4.4 SIDEWALKS

A. All private streets and driveways shall provide for pedestrian and handicapped access (accessibility requirements) to all units or buildings proposed.

B. Unless otherwise approved, sidewalks are required on both sides of all private streets and drives to provide access to all units, parking and recreation areas in a planned development or condominium project. Sidewalk circulation throughout the site is required although not necessarily adjacent to the curb.

Sidewalks may be eliminated under the following circumstances:

1) Private driveways/streets that are not through streets and have an entire street length less than 150 feet and access a maximum of 12 units.

2) Private driveways/streets that are not through streets which access eight (8) units or less and do not exceed 300 feet of entire street length.

3) Private drive aisles providing direct access to garages, carports and parking stalls in multi-family projects exceeding a density of ten (10) dwelling units per acre.

4) Single loaded streets may eliminate sidewalks on the side opposite the units when it is not needed to provide for a logical pedestrian circulation.

C. The City Engineer reserves the right of final determination of sidewalk locations and roadway design issues consistent with City Standards.

D. Typically, the private sidewalks, streets or driveways are dedicated as "public utility and access easements." Water, sewer, gas and electric, cable television, telephone and storm drain facilities may be included within this general easement. Utility districts may require special easement requirements.

4.5 DRAINAGE

A. Concrete swales between parking lot aisles are discouraged. Tipped sections with concrete curb and gutters are preferred.

B. Hydrology and hydraulic design shall be in accordance with the San Diego County Hydrology Manual and the San Diego County Hydraulic Design Manual. Pipe sizing, material specifications and pre-fabricated structures shall be designed by a California licensed Civil Engineer and are subject to approval of the City Engineer.

C. Concentrated site drainage may not surface flow across sidewalks onto public or private streets.

D. Special design shall be required for all parking lots which, by design, may retain storm waters to reduce downstream flooding.

E. Public storm drains may be included within the "general utility and access easement" if specifically approved by the City Engineer.

F. Maximum fall across parking areas shall be five percent (5%).

4.6 STRUCTURAL SECTION

A. Private streets shall be constructed with the same structural sections as public streets.

B. Parking lots and driveways shall be designed based upon a traffic index of 4.5 and the "R" value of the soil(s) at the project site as determined by a Registered Soils Engineer. Minimum section shall be 4" asphalt concrete. Modifications of this Standard may be made if approved by the City Engineer.

C. Truck routes through parking lots or aisles with an ADT greater than 500 shall be designed with a traffic index of 5.0. All routes leading to trash enclosures shall be designed for heavy loading, minimum 4" A.C. over 6" approved aggregate base. The level loading area in front of trash enclosures shall be concrete with a minimum thickness of 7-1/2 inches in conformance with GS-16.

4.7 DEFINITIONS

A. Driveway: Includes those portions of public and private property used to provide access from public right-of-way to private property and the areas on public and private property

used to queue or stack arriving and departing vehicles. Driveways are the points of interface between the public/private circulation systems.

B. Traveled Way: Includes all public streets and all private streets or drives serving more than 50 units or an average daily trip load of 500 or more.

C. Residential Driveway: Includes all low use driveways for single family, duplex, twin homes, or low use driveways which do not have truck access to a trash dumpsite.

D. Low Use Driveway: Includes all driveways with an average daily trip (ADT) load less than or equal to 200, except residential driveways.

E. Medium Use Driveway: Includes all driveways with an ADT load greater than 200 and less than 500.

F. High Use Driveway: Includes all driveways with an ADT greater than or equal to 500.

NOTE: All other Standards for the City of Carlsbad shall apply to private streets. Variations from these Standards may be allowed with the approval of the City Engineer.

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CHAPTER 5 – DRAINAGE AND STORM DRAIN STANDARDS

5.1 GENERAL

A. All drainage design and requirements shall be in accordance with the latest City of Carlsbad BMP Design Manual (see Volume 5), Jurisdictional Runoff Management Plan (JRMP), Drainage Master Plan, the San Diego County Hydrology Manual and the San Diego County Hydraulic Design Manual, and the requirements of the City Engineer, and be based on full (build-out) development of upstream tributary basins. The references listed below provide hydrologic data that may be used for planning-level support of projects.

Drainage Master Plan:

https://www.carlsbadca.gov/departments/community-development/land-development-engineering/engineering-codes-standards-policies

FEMA Flood Insurance Study:

https://msc.fema.gov/

B. Public storm drain facilities shall be designed to carry the 10-year six-hour storm underground. All road cross-sections must have the capacity to convey the peak discharge from a 100-year design event without causing damage to property adjacent to the right-of-way. In practice, this means that the peak 100-year discharge must be contained within the limits of the right-of-way of the road cross section. In addition to the other criteria listed, on-grade curb inlets shall be designed to intercept the 85 percent or greater of the 10-year six-hour peak flow rate. Sump curb inlets shall be designed to convey the 100-year six-hour storm while adhering to other criteria listed in this section. All roadway culverts shall be designed to accommodate a 100-year six-hour storm with a one-foot freeboard at entry conditions such as inlets and head walls. A roadway culvert is defined as pipe, box, or other structure that conveys non-local drainage (e.g., drainage in ditch) through the roadway right-of-way.

C. The use of underground storm drain systems, in addition to standard curb and gutter shall be required:

1) When flooding or street overflow during 100-year six-hour storm cannot be maintained within the right-of-way of the road cross-section.

2) When 100-year six-hour storm flow from future upstream development (as proposed in the existing General Plan) will cause damage to structures and improvements.

3) When existing adequate drainage facilities are available for use (adjacent and downstream of the proposed development).

4) When more than one travel lane of arterial streets would be obstructed by 10-year 6-hour storm water flow, or when greater than a 10-foot width of travel lane (5 feet each side of crown, typically) would be obstructed by 10-year 6-hour storm water flow.

5) Special consideration will be required for super-elevated streets.

D. The use of underground storm drain systems may be required:

1) When the water level in streets at the design storm is within 1" of top of curb during a 100-year, 6-hour storm event.

2) When velocity of water in streets exceeds 11 FPS.

3) When the water travels on surface street improvements for more than 1,000' during a 100-year, 6-hour storm event.

E. The type of drainage facility shall be selected based on the physical and cultural adaptability to the proposed land use. Open channels may be considered in lieu of underground systems when the peak flow exceeds the capacity of a 48" diameter RCP. Fencing of open channels may be required as determined by the City Engineer.

F. Permanent drainage facilities and right-of-way, including access, shall be provided from development to point of approved disposal.

G. Storm Drains constructed at a depth of 15' or greater measured from finish grade to the top of pipe or structure shall be considered deep storm drains and should be avoided if possible. When required, special design consideration will be required to the satisfaction of the City Engineer. Factors considered in the design will include:

1) Oversized specially designed access holes/air shafts
2) Line encasements
3) Oversizing lines
4) Increased easement requirements for maintenance access
5) Water-tight joints
6) Additional thickness of storm drain

The project designer should meet with the plan-checker prior to initiation of design to review design parameters.

H. Concentrated drainage from lots or areas greater than 0.5 acres shall not be discharged to City streets unless specifically approved by the City Engineer.

I. Diversion of drainage from natural or existing basins is discouraged.

J. Drainage design shall comply with the City's Jurisdictional Urban Runoff Management Plan (JRMP) requirements of the National Pollutant Discharge Elimination System (NPDES) permit, City BMP Design Manual, San Diego County Hydrology Manual, and the San Diego County Hydraulic Design Manual.

5.2 HYDROLOGY

A. Off site, use a copy of the latest edition City 400-scale topographic mapping. Show existing culverts, cross-gutters and drainage courses based on field review including topographic survey with invert elevation measurements and review of as-built drawings. Indicate the direction of flow; clearly delineate each drainage basin showing the area and discharge and the point of concentration.

B. On site, use the grading plan. If grading is not proposed, then use a 100- scale plan or greater enlargement. Show all proposed and existing drainage facilities and drainage courses. Indicate the direction of flow. Clearly delineate each drainage basin showing the area and discharge and the point of concentration.

C. Use the charts in the San Diego County Hydrology Manual for finding the "Tc" and "I". For small areas, a five minute "Tc" may be utilized with prior approval of the City Engineer.

D. Use the existing or ultimate development, whichever gives the highest "C" factor.

E. Use the rational formula Q = CIA for watersheds less than 0.5 square mile unless an alternate method is approved by the City Engineer. For watersheds in excess of 0.5 square mile, the method of analysis shall be approved by the City Engineer prior to submitting calculations.

5.3 HYDRAULICS

A. Street - provide:

1) Depth of gutter flow and width of spread calculations.

2) Inlet calculations with adequate capacity for the peak from the 10-year six-hour storm event.

3) Show gutter flow Q, inlet Q, and bypass Q for the 100-year six-hour peak on a plan of the street.

B. Storm Drain Pipes and Open Channels - provide:

1) Hydraulic loss calculations for: entrance, friction, junction, access holes, bends, angles, reduction and enlargement.

2) Analyze existing conditions upstream and downstream from proposed system, to be determined by the City Engineer on a case-by-case basis. Upstream conditions that contribute run-on to the site should always be analyzed. If development increases the peak flow rate above pre-developed conditions and onsite detention is not provided than downstream needs to be analyzed to determine if there is adequate capacity for the proposed increase.

3) Calculate critical depth and normal depth for open channel flow conditions.

4) Design for non-silting velocity of 2 FPS in a two-year frequency storm unless otherwise approved by the City Engineer.

5) All pipes, curbs inlets, catch basins and outlets shall show HGL, velocity and Q value(s) for the applicable (10-yr or 100-year) design storm.

6) Confluence angles shall be maintained between 45° and 90° from the main upstream flow. Flows shall not oppose main line flows.

7) The HGL in storm drain pipe shall be below the finish grade elevations and shall be below the inlet entrance elevation (i.e., shall not impede flow into an inlet).

1. In the event the HGL cannot be contained below finished grade elevation due

to downstream constraints and upon City Engineer approval, manhole locking lids shall be used per San Diego Regional Standard Drawing M-4.

8) See Chapter 5, Section 1 for placement of inlets criteria.

5.4 INLETS

A. Curb inlets at a sump condition should be designated for two CFS per lineal foot of opening when headwater may rise to the top of curb.

B. Curb inlets on a continuous grade should be designed based on the following equation:

$$Q = 0.7\ L\ (a + y)^{3/2}$$

Where: y = depth of flow in approach gutter in feet

a = depth of depression of flow line at inlet in feet

L = length of clear opening in feet (maximum 30 feet)

Q = flow in CFS, use 100-year design storm minimum

C. Grated inlets should be avoided and not located in bicycle lanes. When necessary, the design should be based on the Hydraulic Engineering Circular No. 22. All grated inlets shall be bicycle proof.

D. All catch basins shall have an access hole in the top unless access through the grate section satisfactory to the City Engineer is provided.

E. Catch basins/curb inlets shall be located to eliminate, whenever possible, cross gutters. Catch basins/curb inlets shall not be located within 5' of any curb return or driveway, or as approved by the City Engineer.

F. Local depressions shall not encroach into bike lane or drive lane and will only dip at the curb inlet a maximum of 2 inches.

G. Minimum connector pipe for public drainage systems shall be 18".

H. Flow through inlets may be used when pipe size is 24" or less and open channel flow characteristics exist.

5.5 STORM DRAINS

A. Minimum pipe slope shall be .005 (.5%) unless otherwise approved by the City Engineer.

B. Minimum storm drain, within public right-of-way, size shall be 18" diameter.

C. Provide cleanouts at 300' maximum spacing, at angle points and at breaks in grade greater than 1%. For pipes 48" in diameter and larger, a maximum spacing of 500' may be used.

D. When the difference between storm drain clean-out Type A dimensions “V” and “Z” is greater than 18”, a storm drain clean-out Type B shall be used. Refer to SDRSD D-09 for storm drain clean-out Type A and SDRSD D-10 for storm drain clean-out Type B.

E. The material for storm drains shall be reinforced concrete pipe designed in conformance with San Diego County Flood Control District's design criteria, as modified by Carlsbad Standard Specifications. Corrugated steel pipe shall not be used. Plastic/rubber collars shall be prohibited.

F. Horizontal curve design shall conform to manufacturer recommended specifications. Vertical curves require prior approval from the City Engineer.

G. Storm drain inlets shall be located away from areas that have higher pollution potential, including trash enclosures, grease bins, high traffic areas, areas intended for storage, and areas intended for commercial or industrial processes.

H. Non-storm water flow is not allowed in curb and gutter, storm drain pipe, or other system designed to convey storm water runoff. Non-storm water flow shall be eliminated, if possible, or conveyed to the sewer with an approved permit (e.g., Wastewater Discharge Permit).

I. The pipe invert elevations, slope, pipe profile line and hydraulic grade line for design flows shall be delineated on the mylar of the improvement plans. Any utilities crossing the storm drain shall also be delineated.

The strength classification of any pipe shall be shown on the plans. Minimum D-load for RCP shall be 1350 in all City streets or future rights- of-way. Minimum D-load for depths less than 2', if allowed, shall be 2000 or greater.

J. For all drainage designs not covered in these Standards, the current San Diego County Hydrology Manual and the San Diego County Hydraulic Design Manual shall be used.

K. For storm drain discharging into unprotected or natural channel, proper energy dissipation measures shall be installed to prevent damage to the channel or erosion. In cases of limited access or outlet velocities greater than 18 fps, a concrete energy dissipater per SDRS D-41 will be required.

L. In some cases, it may be necessary to connect a public storm drain into a private basin. For this case, the responsible party for the private basin accepts responsibility for flows from the storm drain and the increase in maintenance of the basin that may result.

M. The use of detention basins to even out storm peaks and reduce piping is permitted with substantiating engineering calculation and proper maintenance agreements. Detention basins shall be fenced.

N. Desiltation measures for silt caused by development shall be provided and cleaned regularly during the rainy season (October 1 to April 30) and after major rainfall as required by the City Engineer or designee. Adequate storage capacity as determined by the City Engineer shall be maintained at all times.

O. Protection of downstream or adjacent properties from incremental flows (caused by change from an undeveloped to a developed site) shall be provided. Such flows shall not be concentrated and directed across unprotected adjacent properties unless an easement and storm drains or channels to contain flows are provided.

P. Unprotected downstream channels shall have erosion and grade control structures installed to prevent degradation, erosion, alteration or downcutting of the channel banks.

Q. Storm drain pipes designed for flow meeting or exceeding 20 feet per second will require additional cover over invert reinforcing steel as approved by the City Engineer.

R. Storm drain pipe under pressure flow for the design storm, i.e., HGL above the soffit of the pipe, shall meet the requirements of ASTM C76, C361, C443 for water-tight joints in the sections of pipe calculated to be under pressure and an additional safety length beyond the pressure flow point. Such safety length shall be determined to the satisfaction of the City Engineer taking into consideration such factors as pipe diameter, Q and velocity.

S. An all-weather access road from a paved public right-of-way shall be constructed to all drainage and utility improvements. The following design parameters are required: Maximum grade 14%, 15 MPH speed, gated entry, minimum paved width 12 feet, 38' minimum radius, paving shall be a minimum of 4" AC over 4" Class II AB, turnaround required if over 300'. Work areas should be provided as approved by the plan-checker. Access roads should be shown on the tentative project approval to ensure adequate environmental review.

T. Engineers are encouraged to gravity drain all lots to the street without use of a yard drain system. On projects with new street improvements proposed, a curb outlet per SDRSD D-27 shall be provided for single- family residential lots to allow yard drains to connect to the streets gutter.

CHAPTER 6 – DESIGN CRITERIA FOR SEWER FACILITIES

Prior to preparation of improvement plans, Engineer of Work shall submit a preliminary layout of the sewer system for review and approval by the City Engineer. Basis of design shall be demonstrated for the development type and density and corresponding sewer flow generation factors and the following design criteria.

6.1 SEWER FLOW GENERATION FACTORS

A. Flow Rate Generation – The values in the latest adopted Sewer Master Plan shall govern:

1) An Equivalent Dwelling Unit (EDU) = 200 gal/day, Average Daily Flow (ADF)

2) For ADF less than 100,000 gal/day, a peaking factor (PF) of 2.5 multiplied times the ADF shall be used to determine Peak Daily Flow (PDF). PDF = ADF x 2.5

a) Residential: Single Family and Multi-Family Residence = 1 EDU

b) Commercial Property: 1 EDU/1,800 square feet of building space

i) To convert raw land to square feet of building space, assume 30% coverage. This could vary significantly dependent development constraints.

ii) To convert improved pads to square feet of building space, assume 40% of coverage.

c) Industrial Property:

i) 1 EDU/5,000 square feet of warehouse space

ii) 1 EDU/1,800 square feet of office space

iii) To convert raw land to square feet of building space, assume 30% coverage. This could vary significantly dependent issues such as environmental restrictions.

iv) To convert improved pads to square feet of building space, assume 40% of coverage.

v) Assume 60% of building space is warehouse, and 40% is office space.

6.2 SEWER MAIN DEPTH AND SIZE

A. Sewer main depth and size shall be as shown below unless approved by the City Engineer.

B. Minimum depth, finish grade to top of pipe: 6 feet

C. Maximum depth, finish grade to top of pipe: 15 feet

D. Design calculations shall be submitted as a basis for pipe size and bedding design. (Manning's "n" for all types of pipe shall be = 0.013).

E. Minimum pipe diameter of sewer main shall be 8 inches. A 6-inch sewer main may be allowed on cul-de-sac streets with a maximum of 10 units.

F. A decrease in the pipe diameter in the downstream direction of flow will not be allowed

without hydraulic calculations and prior approval of the City Engineer.

G. Residential (multiple-unit single-family and multi-family), commercial and industrial developments shall complete wastewater hydraulic modeling as required by the City Engineer prior to discretionary project approval. Any sewer main shown to be deficient at or downstream of the development's connection point shall be replaced with larger diameter pipe as indicated by hydraulic modeling.

H. All sewer laterals and gravity sewer main invert elevations shall be shown in profile on the improvement plans. Show stationing of manholes and laterals, invert elevations at manholes and lateral connections, and the distance, pipe size, pipe type, standard dimension ratio and pipe slope of sewer main segments.

I. All sewer mains 15" and greater pipe diameters shall require special design subject to City Engineer approval.

6.3 SEWER LATERALS

A. Use 4" minimum diameter pipe for each sewer lateral to single-family residences.

B. Use 6" minimum diameter pipe for sewer laterals for all other development types and sized for the drainage fixture units in accordance with the latest adopted California Plumbing Code or for the proposed industrial use water demand.

C. Sewer lateral depth at the property line shall be 5 feet (top of pipe to finish grade @ top of curb).

D. Sewer laterals shall be constructed in accordance with the Carlsbad Standard Drawings. The minimum horizontal distance from water services, fire hydrants, driveways, light standards, electrical utilities, etc. is 10 feet. Special approval is required for horizontal clearance less than specified herein.

1) Install at a right angle or radial to the main.

2) Laterals shall <u>not</u> be located in driveways.

3) No connections shall be permitted on laterals other than as allowed by the Standard Drawings.

4) Location of property cleanout: See Standard Drawing No. S-7.

5) If the lowest sanitary sewer fixture in a building structure is lower than 2-feet above the nearest upstream manhole cover, then the owner must provide a backwater valve on the sewer lateral to prevent sewage backflow into the structure. The valve must be installed in a valve box for accessibility and be visible from the public right-of-way. The property owner shall be responsible for the installation and maintenance of the backwater valve. The backwater valve shall be shown on the precise grading and improvement plans.

6) Install sewer laterals using wye fittings, or manholes as required, sized and located as shown on the Approved Plans.

7) Laterals shall be bedded, backfilled and compacted in the same manner as the sewer main they are connected to.

8) Sewer laterals cannot be connected to gravity mains of equal or lesser diameter. Sewer lateral diameter that meets or exceeds the gravity main shall require upsizing of the gravity main as required by the City Engineer.

6.4 MATERIALS FOR PIPE AND FITTINGS

A. Gravity sewer pipe and fittings shall be PVC conforming to ASTM D3034 for diameters 4" through 15" and ASTM F679 for 18" through 24" with integral bell and gasketed joints (gasket and spigot end joint design). Pipe shall be made of PVC plastic having a cell classification of 12454-B or 12364-B as defined in ASTM D1784 and shall have SDR of 35 or thicker, and a minimum stiffness of 46 psi according to ASTM D2412.

B. All fittings and accessories shall be as manufactured and finished by the pipe manufacturer with joints or joining systems compatible with that of the pipe.

C. PVC pipe joints shall be elastomeric gasket joints conforming to Standard Specifications for Public Works (Greenbook) most recent edition. Rubber gaskets shall be factory installed and conform to ASTM F477. Pipe joints shall have been tested and meet watertight performance requirements of ASTM D3212, "Joints for Pipe Using Flexible Elastomeric Seals".

D. PVC pressure pipe conforming to AWWA C900 or HDPE pipe conforming to AWWA C906 shall be used for gravity sewer pipelines with depths of 30 feet or greater or as required by the City Engineer for special installations. Engineering calculations shall be submitted for approval to demonstrate that the pipe material and wall thickness will accommodate the anticipated earth and live loads.

E. Service connections to the sewer main shall be watertight and not protrude into the sewer pipe. All materials used to make the service connections shall be compatible with the pipe materials to be joined and shall be corrosion proof.

F. Couplings used for repair or transition to dissimilar pipe materials shall be approved by the City Engineer and provide a corrosion proof watertight seal.

G. Use of other pipe and fitting materials and types may be required by the City Engineer for special designs for accessibility constraints of adjacent improvements, deep installations, trenchless construction methods or other site conditions. Refer to the Approved Materials List in Volume 2 for alternative materials.

6.5 DESIGN CRITERIA FOR PIPE VELOCITY, SLOPE AND FLOW DEPTH

A. Gravity sewer pipelines shall be designed for a minimum velocity of 2 feet/second. Velocity, unless otherwise stated, shall be calculated from peak dry weather flow.

B. Pipe slope shall be established to satisfy the minimum velocity criterion. Maximum velocities greater than 12 ft/second should be avoided.

Slopes for 6- through 12-inch diameter pipe, unless otherwise approved by the City Engineer:

1) 6” pipe, minimum slope = 2%
2) 8" pipe, minimum slope = 0.50%
3) 10" pipe, minimum slope = 0.40%
4) 12" pipe, minimum slope = 0.30%

Pipe slope for 12-inch diameter or larger pipe shall be designed to meet flow and velocity criteria and shall be approved by the City Engineer. Pipelines with horizontal curvature may require increases slope to achieve minimum required velocities.

C. Gravity sewer mains of any diameter shall convey peak hour dry weather flow at depths of 50% of pipe diameter (d/D = 0.5) or less. Existing sewer mains not meeting this criterion shall be replaced with larger diameter pipe.

D. Gravity sewer mains of any diameter shall convey peak wet weather flow at flow depths of 75% of pipe diameter (d/D = 0.75) or less. Existing sewer mains not meeting this criterion shall be replaced with larger diameter pipe.

E. Peak sewer flow rates do not include infiltration or inflow (I/I). Infiltration is defined as the addition of groundwater into the sewer collection system and inflow is the addition of storm water into the sewer collection system. Because sewer collection system I/I is dependent on many factors including season, age of system, pipe material and joint types, root intrusion, and presence of storm water flow, I/I flow rate estimates will vary. The design of sewer mains connecting to sewer systems known to have I/I, or are susceptible to I/I, shall utilize peak wet weather flow estimates from the latest adopted Sewer Master Plan or perform wet weather flow monitoring as directed by the City Engineer.

6.6 HORIZONTAL AND VERTICAL LAYOUT

A. Streets: See City of Carlsbad Standard Drawing No. GS-6 for location.

B. Alley: The centerline offset between the alley and the sewer main shall be three feet (3') minimum.

C. Private Street: Sewer mains in private streets shall require special design consideration for access.

D. Horizontal Curves: SDR 35, PVC pipe may be curved horizontally through longitudinal bending with the following limitations:

Pipe Diameter	Min. Radius of Curvature
6-inch	150 feet
8-inch	200 feet
10-inch	250 feet
12-inch	300 feet
15-inch	375 feet

The City Engineer shall approve the minimum curvature for larger diameter pipe.

E. Vertical Curves: Vertical curves shall be permitted only when specifically approved by the City Engineer. A profile drawing showing depth of cover, radius of curvature and design constraints that prevent the use of straight pipe segments shall be prepared for review and approval.

F. Utility Clearances: Show all underground utilities in both plan and profile. Provide 12" minimum vertical separation and 10' horizontal separation between sewer and all other utilities unless otherwise approved by the City Engineer. Greater separation may be required from natural gas, fuel or other "critical" pipelines in accordance with the standards of the utility agency. Separation of potable water and non-potable fluid pipelines shall comply with the California Code of Regulations, Section 64572.

G. Any public sewer that would be situated, upon development or improvement of a property, beneath curbs/gutters, sidewalks, landscaped areas or less than 5 feet from subsurface structures or stormwater infiltration devices shall be replaced and relocated per current engineering design standards to a traveled lane in the public right-of-way and at least 5 feet away from such improvements.

6.7 MANHOLES AND CLEANOUTS

A. Manholes: Shall be located at areas described as follows:

1) Maximum spacing of manholes shall be three hundred fifty feet (350') for mains twelve inches (12") and smaller and five hundred feet (500') for mains over twelve inches (12") unless otherwise approved by the City Engineer.

2) Install manholes at all changes in slope that exceed 2% and show inlet and outlet inverts on all manholes.

3) Install manholes at all changes in horizontal direction.

4) Install manholes at all intersections of mains.

5) Install manholes at changes of pipe sizes.

6) Install manholes at the end of all sewer mains.

7) All standard manholes shall be a minimum of five feet (5') in diameter with no steps. Manholes shall be sequentially numbered on the plans with manhole numbers beginning at the lowest invert. Three-foot stubs shall be provided for future connections and main extensions.

8) New manholes shall be polymer concrete unless otherwise approved by the City Engineer.

9) Rehabilitation or modification of existing manholes shall use epoxy coating under the following conditions or when required by the City Engineer:

a) Manhole depth is 15-feet or greater;

b) Manholes on sewer lines 15-inch and greater;

c) Slope of sewer pipe coming into the manhole is greater than 7%;

d) Change in slope at the manhole is 5% or greater;

e) All force main discharge manholes;

f) The immediate upstream and downstream manholes of inverted siphons;

g) Drop manholes.

10) Install manholes for all lateral connections 8-inch diameter and larger. Install wye's for 6-inch diameter and smaller lateral connections.

11) When intercepting flows from smaller pipelines in manholes, set invert of a smaller main at ¾ of the depth of the larger main.

12) Locking manhole lids may be required in unpaved areas as directed by the City Engineer.

13) The top cone shall be 6" below finished subgrade. Place circular steel covers on the manholes during subgrade preparation and placement of base rock to keep the sewer system clean. Additionally, place plywood sheeting inside the manhole and above the channel during road work above live sewer manholes to prevent debris from entering the sewer line.

14) In unpaved areas, set the sewer manhole frames and covers 6" above finished grade with concrete ring and marker post marked "SEWER" in accordance with the Standard Drawings.

B. Cleanouts: Extend beyond permanent pavement when street is a temporary dead end. Refer to the Standard Drawings and the Approved Materials List for type of cap and box.

6.8 CONNECTIONS TO EXISTING MANHOLES

A. New connections to existing manholes where stubs have not been provided shall be made by core drilling through the walls and base in accordance with the Standard Drawings.

B. For pipe junctions at manholes with different diameter pipes, set the invert of the smaller main at ¾ of the depth of the larger main. Uniformly transition the slope and curvature of the channels in accordance with the Standard Drawings.

6.9 SLOPE PROTECTION

A. Sewer pipelines in slopes inclined at 20 percent or greater shall be constructed with cut-off walls per SDRSD SP-05 or SP-07, spaced as follows:

1) 36-foot maximum center-to-center spacing on 20 percent to 35 percent grades;

2) 24-foot maximum center-to-center spacing on 35 percent to 50 percent grades; and

3) 16-foot maximum center-to-center spacing on grades over 50 percent.

6.10 ACCESSIBILITY AND EASEMENTS

A. All sewer mains not located within the public right-of-way shall be located within a public utility and access easement granted to the City.

B. Public sewer easement widths shall be 20 feet minimum for 12" and smaller diameter pipe with a maximum depth of 10 feet to pipe invert. Greater pipe diameters or depths shall require wider easement widths which shall be determined by the City Engineer.

C. All weather access roads must be provided to all sewer main appurtenances (manholes, cleanouts, junction structures, etc.). Access roads shall be a minimum of 20 feet wide, with a maximum 15 percent slope, and shall have a minimum asphalt concrete or Portland cement concrete road section designed for H-20 loading. Where access roads are not for the exclusive use of sewer maintenance vehicles, the road shall be designed to maintain pedestrian and/or vehicular access (as applicable) during sewer main repair and maintenance operations and shall be a minimum of 24 feet wide. The minimum centerline turning radius for access roads shall be 35 feet for right angle turns and 50 feet for turnarounds.

6.11 MISCELLANEOUS REQUIREMENTS

A. New sewer mains, laterals and appurtenances shall remain plugged and/or disconnected until the City authorizes their connection or use.

B. Maintenance or replacement of sewer laterals from the sewer main to the building shall be the responsibility of the property owner.

C. Sewer laterals constructed from the property line to the building shall comply with the California Plumbing Code as adopted by the City.

1) The vertical riser at the cleanout shall be stubbed and capped 3 feet above rough grade during grading and/or construction of the project.

2) All work will be inspected by a City Representative.

3) A three-inch (3") high letter "S" shall be stamped on the curb face at all sewer lateral locations.

6.12 GENERAL GUIDELINES FOR SEWER FORCE MAINS

A. The Engineer of Work shall submit a preliminary design report showing the alignment, pipe size, pressure conditions, pipe materials, a layout plan including surge protection design and flow analysis for review and approval by the City Engineer prior to the preparation of improvement plans.

B. Minimum pipe cover for sewer force mains shall be 48 inches from top of pipe to ultimate finished grade. Top of pipe profile shall be shown on the improvement plans.

C. Show all other underground utilities in both plan and profile. Provide 12" minimum vertical separation and 10' horizontal separation between sewer force mains and all other utilities unless otherwise approved by the City Engineer. Greater separation may be required from

natural gas, fuel or other “critical” pipelines in accordance with the standards of the utility agency. Separation of potable water and non-potable fluid pipelines shall comply with the California Code of Regulations, Section 64572.

D. Sewer force mains shall be High Density Polyethylene (HDPE) pipe manufactured in accordance with ASTM F714; PVC or fusible PVC pipe, or ductile iron pipe with polyethylene or ceramic liner and exterior corrosion control as approved by the City Engineer. Pressure class of pipe shall be determined in accordance with the design standards presented in Volume 3. The operating pressure of HDPE and PVC pipe force mains shall not exceed 67% of rated pipe pressure.

E. Where possible, force mains shall be designed with a continuous uphill slope without intermediate high points. If high points are not avoidable, provide combination sewage air release valves per the Approved Materials List.

F. Dual force mains will be required, unless otherwise approved in writing.

G. Force mains outside of paved roadways shall require access road and access easements (if applicable) in accordance with the requirements of this chapter.

H. At the discretion of the City Engineer, force mains longer than 1-mile or with excessive detention times may require the use of chemical addition to prevent odors at the discharge location of the force main.

6.13 GENERAL GUIDELINES FOR SEWER LIFT STATIONS

A. New sewer lift stations shall be avoided if at all possible and shall not be incorporated into the City’s sewer system unless deemed essential by the City Engineer.

B. The Engineer of Work shall meet with the City Engineer prior to the preparation of plans to assess the feasibility of utilizing a lift station for a given area.

C. Access roads for maintenance (vactor) trucks shall be incorporated for all sewer lift stations as required in this chapter.

D. Prepare a basis of design report and submit to the City Engineer for review and approval. The report shall include, at a minimum, the description of the design criteria, flow computations, design calculations, head-capacity curves for pumps and the force main system, transient pressure (surge) analysis/recommendation, identification of right-of-way requirements, number of properties and development type served, listing of permit requirements, geotechnical investigation and cost estimate based on unit costs and quantities for major elements of work. Submit all component submittals for the review of and approval by the City Engineer. In addition, the following design elements shall be developed:

1) Site development
2) Structural design
3) Architectural design
4) Hydraulic analysis
5) Mechanical design

6) Electrical design with emergency generator
7) Instrumentation and process control
8) Corrosion control
9) Odor control
10) Noise control

E. The hydraulic analysis shall include calculations of the system curve. The system curve shall be plotted on the pump curve with the operating point identified. Every effort shall be made to select a pump that operates at its best efficiency point. Peak and average flows shall be considered in pump selection. Submit manufacturer data sheets for mechanical and electrical equipment in the basis of design report.

F. Pumps shall be solids handling, non-clog, self-cleaning pumps selected from the Approved Material List, no substitutes.

G. If the pump station is being designed with built-in expansion capability, an economic analysis shall be submitted. The analysis shall consider capital costs as well as the operational cost of the lift station. Design assumptions (e.g., cost of electricity, cost of money, design life) shall be determined in consultation with the City of Carlsbad.

H. General design requirements for sewer lift stations smaller than 3 MGD shall be as follows:

1) Convey the ultimate peak wet weather flow rate including inflow and infiltration and meet the latest requirements of the “Hydraulic Institute”. No premanufactured or prefabricated lift stations will be permitted.

2) Utilize a “dry-pit/wet-well” type unless approved otherwise by the City Engineer. Wet wells shall be constructed of polymer concrete, when feasible, or lined with an approved epoxy coating.

3) Provide a minimum of 3 pumps of equal size (1 duty and 2 standby). If a duplex lif station is determined acceptable by the City Engineer, provide two pumps for alternating duty and a spare pump. Lift stations with more than 1 duty pump shall also provide an additional 2 standby pumps of equal size.

I. Lift stations larger than 1 MGD total capacity shall utilize an onsite odor control system. Smaller lift stations may require odor control equipment as determined by the City Engineer.

J. Lift stations 1 MGD and larger shall be permitted by the San Diego County Air Pollution Control District (APCD). Engineer of Work shall apply for a permit to construct, forward a copy of the approved permit to the City, and adhere to all terms and conditions. Upon construction completion and prior to APCD inspection, EOW shall notify the City of completed construction in writing. Once APCD has inspected and verified compliance with the permit requirements, the EOW shall file notice of construction completion and forward the Permit to Operate to the City.

K. Provide an emergency bypass connection for portable pumping equipment.

L. Provide an emergency generator to supply backup power (100%) to all lift station facilities.

M. Provide an in-line magnetic flow meter and isolation valve with fault alarm system on the discharge force main that shall be compatible with the City's SCADA system.

N. Manifold piping shall consist of ceramic epoxy lined and epoxy coated ductile iron pipe of suitable pressure class.

O. Provide ventilation with a minimum of 12 air changes per hour.

P. Provide suitable vehicle access and security fencing, lighting and surveillance camera.

Q. Develop system head curves for two pipe roughness "C" values, C=120 to ensure adequate flow, and a C=150 for ensuring adequate driver horsepower and pump characteristics.

R. Perform a surge analysis of the pumping system simulating a power failure and submit to the City for review and approval.

S. Provide an emergency storage volume, separate from the wet well operating volume, for storage of two hours of peak wet weather flow. The total pump station sewage storage volume (i.e., volume of the wet well above the station High Level alarm to the lowest sewage spill point) can be achieved by the following measures, in order of preference, individually or in combination:

1) Provide additional storage in the wet well above the operating volume

2) Provide a separate overflow tank

3) Provide storage in the inlet line to the lowest spill level (only with prior approval). This measure will not be allowed in locations where the lowest drainage fixture elevation of any building served by the influent sewer is less than 2 feet above the rim elevation of the nearest sewer manhole on the influent sewer.

CHAPTER 7 – GRADING, SITE DRAINAGE AND LOW IMPACT DEVELOPMENT (LID) STANDARDS

7.1 SOILS REPORTS

A. A preliminary soils report is required with the submittal of all grading plans. The City Engineer may waive the requirement for the preliminary report for grading projects which have cut or fill with a height of five feet or less or where it can be shown that the preliminary report is not needed to ensure the protection of the health, safety or welfare of the public. All soil reports shall be bound within sturdy covers and signed and sealed by a registered engineer competent in the field of soils engineering. The report shall be neat and logically ordered and include an index, the City project ID, name and location of the project, the name, address and telephone number of the firm which prepared the report and the date of the report. Each page of the report shall be numbered.

B. The preliminary soils report must be current and must reference the specific project proposed for development. Reports over one year old at time of grading plan submittal and/or reports which reference a different grading proposal must be made current by submittal of an amended report or by submittal of a signed and sealed letter from the soils engineer stating that the findings and conclusions of the previous report are current and valid for the present proposed project. The preliminary soils report shall at a minimum include the following:

1) A written description of the proposed project or grading work to be done and a preliminary site plan

2) A location map and geologic history of the site and surrounding region including a synopsis of the existing soil and groundwater conditions, description of the type, depth and lateral extent of existing vegetation, description of the seismic setting and proximity of nearby faults and potential geologic hazards, a description of prior grading, presence or history of groundwater at the site

3) A description of the testing performed on-site including the number and locations of test pits, exploratory borings or geophysical exploration methods, a map showing the location of the test sites, type and depth of exploratory excavations or borings, depth of groundwater table or zones of wetness, evidence of seismic or landslide activity, and an explanation and evaluation of all field tests performed

4) Soil profiles

5) A description of the laboratory testing of soil samples including a description of the sample locations, reason for performing the test and an explanation and evaluation of the test results

6) Calculations to determine the stability of slopes which exceed twenty feet in height or with inclinations steeper than two horizontal to one vertical

7) A summary of the conclusions and recommendations as to the suitability of the site for the proposed project, any building restrictions, evaluation of unsuitable materials and remedial grading or other proposed mitigation measures, type and placement of subsurface drains or other measures to mitigate the occurrence of groundwater or saturation of soils from

irrigation, foundation recommendations including seismic design parameters and estimated settlement, soil corrosion potential and recommendations for earth retaining structures and pavements

8) A set of recommended specifications for the grading work to be done on the site.

7.2 SLOPES

A. No cut or fill slope shall be steeper than two horizontal to one vertical unless specifically approved by the City Engineer. The City Engineer may approve a slope steeper than two to one under the following conditions:

1) The cut or fill slope will be stable and not create a hazard to public or private property;

2) The steeper slope is determined by the City Engineer to be necessary to reduce the overall environmental or aesthetic impacts of the grading project;

3) The overall project grading is consistent with the provisions of the Hillside Grading Ordinance;

4) A soils report prepared by a registered engineer qualified in the field of soils engineering is submitted which report shall provide calculations indicating that the proposed slope will have a factor of safety of 1.5 or greater for both deep seated and surficial failures under saturated soil conditions.

B. Cut and fill slopes shall be set back from site boundaries in accordance with City of Carlsbad Standard Drawing GS-14.

C. Buildings and structure foundations shall be set back from cut or fill slopes in accordance with City of Carlsbad Standard Drawing GS-15, or as specifically approved by the City Engineer.

D. Terrace drains shall be installed on all manufactured slopes exceeding thirty feet in height. The City Engineer may waive this requirement for slopes with a longitudinal length of one hundred feet or less, or upon the recommendation of a registered soils engineer or geologist that such terrace drain is not necessary for stability or erosion protection. Terrace drains shall be designed to prevent deposition of sediment or other materials within the concrete drain. The minimum longitudinal slope shall be two percent and maximum slope shall be twelve percent. Drainage terraces exceeding eight feet in width need only be paved for a width of eight feet, provided such pavement provides for a minimum channel depth as required to convey the design flow, but not less than one foot. Down drains or drainage outlets shall be provided at approximately 300-foot intervals along the drainage terrace. All such down drains or outlets shall be designed to safely convey the intercepted waters to the point of disposal.

7.3 SITE DRAINAGE

A. All drainage facilities shall be designed to carry surface waters to the nearest practical street, storm drain or natural water course approved by the City Engineer. When discharging concentrated flows onto natural ground, the Engineer of Work shall provide

appropriate calculations to determine the erosive effects at the point of discharge and immediately downstream from the discharge point. If erosive velocities will occur at the discharge point or immediately downstream, then an appropriately designed rip-rap or other energy dissipating device shall be installed to mitigate the erosive effects.

B. Graded building pads shall have a minimum slope of one percent towards an adjoining street or an approved drainage course. A lesser slope may be approved by the City Engineer where special drainage provisions are made. In such cases, the City Engineer may require a supporting recommendation by a registered soils engineer.

C. Berms, swales or other methods and devices shall be provided at the top of cut and fill slopes to prevent surface waters from overflowing onto and damaging the slope face. Special drainage provisions shall be made where a building or structure exists within five feet of the top of a slope.

7.4 LOW IMPACT DEVELOPMENT (LID)

A. All development projects shall be developed with LID Integrated Management Practices (IMPs) to mimic the site's natural hydrological function. LID uses decentralized, site-based planning and design strategies to manage the quantity and quality of storm water runoff. LID attempts to reduce the amount of runoff by mimicking the natural hydrologic function of the site. LID focuses on minimizing impervious surfaces and promoting infiltration and evaporation of runoff before it can leave the location of origination. Using small, economical landscape features, LID techniques work as a system to filter, slow, evaporate, and infiltrate surface runoff at the source (reference Mull, K.K., (2005, December) *Selling Low Impact Development: Audiences, Messages, and Media*).

B. LID Design shall generally be in accordance with the latest edition of the County of San Diego *Low Impact Development Handbook, Stormwater Management Strategies* and *Low Impact Development Appendices, San Diego Considerations and LID Fact Sheets.* For additional literature on LID and best management practices consult the reference materials listed in the latest edition of the County of San Diego *Low Impact Development Literature Index.*

C. Stormwater infiltration plans, including permeable pavement, should be reviewed by a qualified, licensed professional to provide a professional opinion regarding the potential adverse geological conditions created by implementation of the plans. Geotechnical conditions such as: slope stability, expansive soils, compressible soils, seepage, groundwater level, and loss of foundation or pavement subgrade strength should be addressed, and where appropriate, mitigation recommendations should be provided. The impact on existing, proposed, and future improvements including buildings, roads and manufactured slopes must be included in the review.

D. For projects subject to Priority Development Project requirements, a Storm Water Quality Management Plan (SWQMP) prepared in accordance with Title 15 of the Carlsbad Municipal Code and the City's BMP Design Manual (see Volume 5 of the Engineering Standards) shall be submitted concurrent with all development permits, as triggered by thresholds in the Municipal Permit, latest version. The SWQMP shall describe in detail all proposed LID IMPs to be incorporated into the site design for the proposed development.

E. Engineer shall prepare and submit a Single Sheet BMP (SSBMP) plan prepared in accordance with the Storm Water Quality Management Plan (SWQMP). Refer to Volume 5 of the Engineering Standards. Any structural BMP plan shall be clearly labeled as such on the construction drawings (grading, improvement, landscape or building) highlighting the BMPs incorporated within the respective plan. Refer to the latest template title sheets available on the city's website. The developer/owner/applicant shall be responsible for the construction and/or implementation of all BMPs as shown on the post construction BMP site plan whether or not such BMPs are reflected on the respective construction plans. No changes are to be made to the SSBMP site plan without the express approval of the City Engineer or designated representative.

F. Bioretention basins designed as structural BMP shall include educational signage regarding their purpose as a permanent treatment facility for water quality purposes. Signage locations shall be listed in the SSBMP Exhibit.