DESIGN CRITERIA

for Improvements in Public Right-of-Ways and City Easements

City of Santa Clara

Public Works Department

April 2015

City of Santa Clara
Public Works Department

DESIGN CRITERIA

APPROVED BY:

_____
RAJEEV BATRA
DIRECTOR OF PUBLIC WORKS/CITY ENGINEER

DATE: _____

Acknowledgement of contributions

Our sincere thanks to the staffs of the
Public Works Department, Water and Sewer Utilities Department, and Electric Department for their contributions.

CITY OF SANTA CLARA
PUBLIC WORKS DEPARTMENT

DESIGN CRITERIA

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1. SCOPE

This Design Criteria has been prepared by the City of Santa Clara (City) to aid Consulting Engineers and/or Developers (referred to herein as Consulting Engineer) in preparing plans for construction of City public improvements in the public right-of-way and City easements. This Design Criteria is not intended to be a textbook nor a substitute for engineering knowledge, experience, or judgment. This Design Criteria sets forth minimum design standards and other requirements of the City. This Design Criteria is not meant to limit the Consulting Engineer in exercising good judgment where higher design standards would be appropriate. It shall be the Consulting Engineer's responsibility to determine the design necessary to fulfill his/her obligation to safeguard the public's health, safety, and welfare.

Deviations, if any, from this Design Criteria, and the reasons for the deviations, shall be noted in writing when plans are submitted. Approval of deviations from this Design Criteria may be applied for and will be reviewed prior to submittal of the plans.

Note: This Design Criteria is to be considered minimum requirements. The City continues to review its design requirements and will make amendments to this Design Criteria from time to time as required. At the discretion of the City, individual projects may be subject to additional requirements.

2. PROCEDURE

Prior to the first plan submittal, the Consulting Engineer shall contact the appropriate Principal Engineer to arrange a "pre-design coordination meeting". The meeting will be with the Consulting Engineer and appropriate City staff from the Land and Property Development Division (LPD), Traffic Division, Street Maintenance Division, Water and Sewer Utilities Department, Electric Department, and Fire Department to review conceptual plans, summarize the project design requirements, and answer questions before actual design begins.

For an established fee, the City will provide the Consulting Engineer with copies of any available prints of existing sanitary sewer and storm drain lines and established street grades (i.e., Block Books and Record Drawings), Bench Marks, Standard Details, and this Design Criteria. Design standards for electric facilities and street lighting, as well as improvement plans of existing electric utilities, street lighting, and City fiber optic systems, may be obtained from the City Electric Department. Design standards, Standard Details, and specifications for water facilities, as well as improvement plans of existing water facilities, may be obtained from the City Water and Sewer Utilities Department. Most of the documents noted above, except for the Record Drawings, may be viewed or downloaded from the City's website. Location of all other utilities may be obtained from the appropriate utility company or facility owner.

The location and elevation of existing utilities shall be verified (potholing may be required) in the field by the Consulting Engineer and shown on the plans.

The on-site drainage, drainage design calculations, and grading plan shall be submitted as part of the storm drain analysis (not as part of the public improvement plans). This plan shall show the overland release of storm water without flooding the buildings. This plan shall also show the building pad elevations on the same datum as the public improvement plans.

The plans and design calculations are subject to the review and approval of various City departments. The Consulting Engineer shall submit the required number of 100% complete plan sets, currently eight (8) sets, and design calculations, currently two (2) sets. The plans submitted for review shall be stamped with the seal of the Engineer-of-Record or Architect-of-Record and the "FOR PLAN CHECK ONLY" notation on each plan sheet. The design calculations submitted for review shall be stamped with the seal of the Engineer-of-Record or Architect-of-Record and the "FOR REVIEW ONLY" notation on the cover sheet. The submittal shall also include the construction cost estimate for the work in the public right-of-way and City easements and a cover letter stating the deviation(s) from this Design Criteria and the City's Standard Details (if any), purpose of the submittal, and the location of the project. Submittal shall be directed to the Principal Engineer of LPD. Incomplete plans or design calculations will be returned to the Consulting Engineer without review. The various City departments will review the plans and design calculations and identify needed changes (if any). The Consulting Engineer shall revise the plans and design calculations accordingly and re-submit the plans and design calculations for further City review.

When the plans and design calculations are completed, reviewed, approved, stamped with the seal, signed, and dated by the Consulting Engineer or Architect-of-Record and the plans are signed by the appropriate City Departments, the required number of plan sets, currently twenty-two (22) full size sets, and the required number of design calculations, currently two (2) sets, shall be submitted to the Principal Engineer of LPD. The reproducible plans shall be printed on bond paper with a minimum bond weight of 20 pounds. These prints shall be used as the construction drawings.

Once the required numbers of plan sets and design calculations have been submitted, the Contractor shall contact the Engineering Department - Field Services Division to schedule the pre-construction meeting.

After the pre-construction meeting, the Contractor must obtain an Encroachment Permit before starting any work. The Encroachment Permit is issued once the following requirements have been met and the plans have been signed by the appropriate City departments.

A. Development fees and Encroachment Permit fees are paid and Bonds are posted.

B. Proper Contractor's Insurance with Endorsements is approved and City Business License is filed.

Upon completion and acceptance of the construction project, the Consulting Engineer shall supply the City with Record Drawings that reflect "as-built" conditions in both hardcopy and electronic PDF format. The hardcopy drawings shall be reproduced on quality 20-pound bond paper with a minimum brightness of 92 and produce good quality prints. The Record Drawings shall become the property of the City.

3. PLANS

Plans shall comply with the following requirements:

3.1 All plans shall be on 24-inch by 36-inch sheets (D-size) with a 1-1/2-inch margin on the left side and a 1/2-inch margin on the top, bottom and right sides. No information shall be placed outside of the border lines, except the drawing's plot stamp along the left border. Plans with a profile shall have only a single profile. The profile shall be placed below the corresponding plan view with matching stations.

3.2 Plans shall be good quality prints produced from the original. At the discretion of the Director of Public Works/City Engineer, plans may be rejected for poor quality. Plans that are illegible or difficult to read will be rejected.

3.3 The scale for improvement plans (plan and profile) shall be in English units and shall generally be a scale of 1" = 20' for the horizontal and 1" = 2' for the vertical. For street improvement plans encompassing more than 500 linear feet of work, a scale of 1" = 40' for the horizontal is allowable if an acceptable plan clarity is maintained. Scales other than 1" = 20' and 1" = 40' may be allowed with prior approval from the Director of Public Works/City Engineer. The Consulting Engineer/Architect and Developer should carefully consider the scale chosen for a plan such that the necessary plan details are not crowded. Plans with crowded notes and details may be rejected by the City and may be required to be redrawn to a larger scale.

3.4 All lettering shall have a minimum height of 0.1 inch. Letter style shall be clear, legible and uniform. Lettering should closely conform to the ANSI Y14.2-1980 standards. Extreme styling of lettering and fonts, such as architectural scripts, are not acceptable. Plans may be rejected for inappropriate lettering.

3.5 In general, new improvements shall be shown with bold unbroken lines and existing improvements be shown with lighter, broken, dashed or screened lines.

3.6 In general, work shown in plan view on sheets shall be oriented so that North is either at the top or left of the sheet.

3.7 Generally, centerline stationing shall increase North to South and West to East (left to right on the sheet).

3.8 The following shall be shown on all sheets:

A. Sheet number and total number of sheets in project (i.e., Sheet 1 of 6);

B. Initials of persons drawing, designing, and checking;

C. Scale (horizontal and vertical);

D. Title Block;

E. Responsible Registered Engineer's stamp with name, license number, signature, and the date of signing. This is required on the final plans before the plans are signed by the various City departments;

F. Date of plan preparation;

G. The City Tracing Number as provided by the Engineering Department for developer projects. This number shall be placed on the lower right hand corner of each sheet, inside the border line, lettered in bold print, and at least 3/10ths of an inch in height; and

H. No information shall be placed outside of the border lines, except the drawing's plot stamp along the left border.

3.9 The first sheet shall be a title sheet and shall contain the following:

A. Location map: a line drawing showing project within a generally larger area of the City. Note: electronic map copies and photocopies of common road maps are not acceptable;

B. Title, descriptive of proposed improvements (both in large print on top center of the sheet and in the title box);

C. Sheet Index;

D. Legend: show only those legend symbols that apply to the plans. See Exhibit "A" for a sample set of "Typical Legend Symbols";

E. Abbreviations: Show only those abbreviations that apply to the plans. Use "Typical Abbreviations" shown on Exhibit "B";

F. Applicable items of the latest revised "General Notes" shown on Exhibit "C" and other appropriate notes;

G. City Bench Mark number, description, elevation, and current datum year. All elevations on plan shall be on the current City bench system. Contact the Engineering Department to obtain the current Bench Mark description, location, and elevation for the Bench Mark(s) near the project site. City Bench Mark information is also available on the City website, http://santaclaraca.gov. Go to "Government", then "Departments", then "Public Works", then "Technical Documents";

H. The City "Site Number" as provided by the Engineering Department for developer projects. This number shall be the same size as and be placed near the City Tracing Number;

I. Certificate of Approval:

APPROVED: Rajeev Batra
Director of Public Works/City Engineer
City of Santa Clara

_____ Date: _____
Public Works Department

REVIEWED:

_____ Date: _____
Land and Property Development Division

_____ Date: _____
Traffic Engineering Division

_____ Date: _____
Street Maintenance Division

_____ Date: _____
Silicon Valley Power

_____ Date: _____
Water and Sewer Utilities Department

The following statement shall appear with the Certificate of Approval:

"This approval does not mean the Director of Public Works/City Engineer nor the City can accept any part or parts of the work done under or in conjunction with these plans that have not been properly indicated."

Note: Signatures of additional Department/Division Heads are required if their respective facilities are being designed within a proposed public works project;

J. A Key Map is required for large projects. The Key Map, large enough in scale (1" = 100' is desirable) to show the entire project area with existing ground contours; general layout of existing and proposed streets; lot lines and numbers; direction of gutter flow; pipe sizes of existing and proposed storm drain and sanitary sewer systems, including manholes and catch basins; electroliers; poles; fire hydrants; indexed sheet numbers; Bench Mark location(s); and any other pertinent features or proposed improvements which can be reasonably shown. The Key Map shall be on a separate sheet or in multiple sheets for very large project areas.

For Assessment Districts the Key Map shall, in addition to the above, show the District Boundary and Parcel Numbers within the District; and

K. The following Developer information:

Contact Person: _____

Company Name: _____

Address: _____

_____

_____

Telephone No.: _____

Fax No.: _____

E-mail: _____

3.10 Cross sections showing both existing and proposed grades, at least within the public right-of-way and City easements, shall be provided if required by the Engineering Department. Some cross sections such as conforms and at driveway centerlines may need to extend beyond the right-of-way lines. The cross sections are to be clear and legible. Cross sections shall be provided for the following locations:

A. At all stations (100 foot intervals);

B. At the beginning and end of the improvements;

C. At existing driveway centerlines;

D. At conform sections; and

E. At other locations necessary for design.

3.11 All new improvements shall be referenced to the centerline stationing. Stationing shall be shown for the following:

A. Beginning and end of improvements;

B. Centerline intersections;

C. Curb returns;

D. Beginning (BC) and end (EC) of horizontal curves;

E. Grade breaks;

F. Manholes, clean-outs, and inlets;

G. Sewer laterals;

H. Beginning and end of curb, gutter and/or sidewalk removal and installation;

I. All water service structures (water valves, hydrants, blow offs, air reliefs, services, etc.);

J. All electrical system structures (street lights, junction boxes, vaults, transformers, poles, etc.);

K. All other utility and private system structures (telephone, cable, gas, communication companies, etc.);

L. Driveway centerlines;

M. Traffic signals and controllers; and

N. Beginning (BVC) and end (EVC) of vertical curves and point of intersection (PI).

This is not meant to be a complete list; other pertinent features shall also be stationed.

For work on existing streets, or for the extension of existing streets, the Consulting Engineer shall use the established centerline stationing. For work on new streets, or work on existing streets without established stationing, the Consulting Engineer shall begin centerline stationing from a City standard monument beyond the limits of the work. Wherever possible, the start of the centerline stationing shall be at a monument at the intersection of the centerlines of two streets.

Stationing of facilities shall require full station identification. For example, a proposed driveway centerline at station 5+32.00 should be noted as "5+32.00" not just "+32.00" nor "5+32".

In general, new facilities and design features shall be stationed to the nearest one-hundredth of a foot. Existing facilities and design features shall be surveyed and stationed to the nearest one-tenth of a foot. Elevations for both new and existing facilities and design features shall be indicated to the nearest one-hundredth of a foot.

3.12 The following shall be shown on the plans where applicable:

A. Names of all proposed and existing streets;

B. Plan and profile of street and underground improvements;

C. Street right-of-way width, curb face to curb face dimension, centerline to curb face dimension, property line to curb face dimension, and easement lines, if any;

D. Street centerline with full station identification. Station identification should stand out on the plan. Lettering should be bold and/or larger than standard plan lettering. Use full station identification (i.e., “5+00" rather than "5");

E. Curve data (delta, tangent, radius, and length);

F. Elevations of existing and proposed top of curbs at all grade breaks, BC, EC, beginning and end of improvements, and every half station (50-foot intervals);

G. Elevation of all inverts at all catch basins, ends of pipes, and manholes on both storm drain and sanitary sewer systems;

H. The slope of street centerlines, top of curbs (where top of curb slope is different than centerline slope), storm drains, and sanitary sewers shall be shown on the profile view. Top of curb slopes and flow lines at curb cuts (i.e., driveways, curb ramps, etc.) shall also be shown on the plan view. All slope indications shall include an arrow denoting the direction of flow. Use of "+" and "-" signs to denote direction is not acceptable;

I. Existing pipe lines (note material type and size), utilities, irrigation systems, poles, trees, pull boxes, manholes, obstacles, edges of existing pavement, monuments, pavement types, etc.;

J. Lot numbers corresponding to the tract map on new subdivision work, Assessor's Parcel Number and owner's name on lots in existing developed areas, and Assessment Number on Assessment District Projects;

K. In general, new improvements shall be shown with bold unbroken lines and existing improvements be shown with lighter broken, dashed or screened lines. See Exhibit "A" for “Typical Legend Symbols”;

L. Trench sections for joint trenches;

M. Detail of material, thicknesses and method of backfill for all trenches within pavement areas (including slurry seal) if different than City Standard Details; and

N. City limits and other jurisdictions' right-of-way lines.

3.13 The following profile information shall be shown on the plans where applicable:

A. Horizontal and vertical scales shall be noted on the profile view;

B. Horizontal stationing above and below profile view, as well as datum elevations on each end of sheet. It must be clear which profile grid line represents which datum elevation. All full stations shall align with major grid lines. Datum elevations (at least every other foot if not every foot) shall align with major grid lines. Stationing of corresponding plan and profile views shall align vertically for straight station line alignments;

C. Size (diameter and length), slope, and material of all pipes, culverts, etc;

D. Label all profiles shown;

E. Slope and direction of fall of all grade lines (use arrow indications);

F. All utilities shall be shown in the profile view with stationing and elevations for catch basin inverts, top of curbs, manhole rims and inverts, and clean-out rims and inverts. Flow lines and top of pipes shall be shown;

G. Stationing and elevation of the following: Beginning (BC) and end (EC) of horizontal curve, beginning of vertical curve (BVC), end of vertical curve (EVC), point of intersection of vertical curve (PIVC), transitional sections, grade breaks, beginning and end of improvements;

H. The slope of street centerlines, top of curbs (where top of curb slope is different from centerline slope), storm drains and sanitary sewers. All slope indications shall include an arrow denoting the direction of flow. Use of "+" and "-" signs to denote direction is not acceptable;

I. Elevations at 25-foot intervals on vertical and horizontal curves; and

J. Extension of profiles 100 feet past each end of improvements.

3.14 A "typical section" shall be shown for each street width and pavement section. Transverse conforms shall be shown in the typical section. The typical section shall show the conform between the back of walk and property line. The design R-value(s) for all materials used to develop the structural pavement section and Traffic Indices (T.I.) shall be placed directly below the typical section. The installation of slurry seal shall be indicated for all trench work, potholes, asphalt concrete repairs, and street widenings.

3.15 In lieu of some details, the Consulting Engineer/Architects or Developer may reference, on the plans, individual City Standard Details. These details should not be included on the plans. City Standard Details are available from the Engineering Department for a nominal fee, or can be accessed on the City website.

3.16 Provide design calculations for storm drain and sanitary sewer systems.

4. STREET DESIGN

4.1 Minimum standard right-of-way and roadway widths (face of curb to face of curb) shall be as follows:

	Residential	Industrial	Commercial
Right-of-Way	60 Feet	68 Feet	84 Feet
Roadway Width	40 Feet	48 Feet	64 Feet

4.2 Property line radii at intersecting streets shall be as follows:

A. If one of the intersecting street right-of-way widths is 70 feet or less in width, the property line radius shall be a minimum of 20 feet.

B. If both intersecting street right-of-way widths are greater than 70 feet, the property line radius shall be a minimum of 40 feet.

C. In special situations, the property line radius shall be subject to individual design contingent on approval by the Director of Public Works/City Engineer.

4.3 Structural pavement sections shall be designed to conform to Topic 633, Engineering Procedures for New and Reconstruction Projects, of Chapter 630, FLEXIBLE PAVEMENT, of the State of California Highway Design Manual. The safety factor needed for gravel equivalent increase shall be 0.07 feet for a base type of Aggregate Base. The asphaltic concrete layer of a structural pavement section shall be designed such that it will accommodate at least 40 percent of the total required Gravel Equivalent. The structural pavement sections shall not be less than 3 inches of asphalt concrete over 12 inches of Class 2 aggregate base or 8 inches of full depth asphalt concrete.

A soils report of the subgrade or basement soil, along with calculations for structural pavement sections, shall be submitted by the Consulting Engineer. In lieu of a soils report, and with the permission of the Engineering Department, the Consulting Engineer may assume an R-value of 5 for native soil (i.e., subgrade or basement soil).

4.4 Traffic Indices (TI) are to be supplied by the Director of Public Works/City Engineer. Minimum typical TI shall be as follows:

Residential cul-de-sacs & loop streets:	4
Residential collector streets:	5

Industrial streets:	6
Major streets:	6-9

Streets with bus traffic or substantial truck traffic will have significantly greater TI values than otherwise similar streets.

The design of the structural pavement section for trenches shall use a TI value that is 0.5 higher than the TI value for the street as supplied by the Director of Public Works/City Engineer (i.e., TI value for trench pavement replacement = TI value for street plus 0.5).

4.5 Minimum allowable street grades:

South of State Highway 101:	0.3%
North of State Highway 101:	0.25%
Around Curb Returns:	0.5%

Undulated street grades shall have a favorable fall to the low point of the drainage basin such that a grade line drawn through the high points of the undulation would not be less than 0.05% grade. The elevation at any low point must not be more than six (6) inches below the lower adjacent high point elevation.

Cul-de-sacs shall drain toward the intersecting street.

4.6 In areas of street widening, the cross slope shall be designed between 2% and 4%. Greater cross slopes may be allowed only with the permission of the Director of Public Works/City Engineer.

4.7 When the vehicle travel way of an existing street is being reduced (i.e., installation of "traffic calming" features) the effect of grade changes to the street must be investigated and clearly indicated on the plans. The cross slope shall be designed between 2% and 4%.

4.8 Vertical curves shall be used whenever a 1.5% grade differential or more occurs. Vertical curves shall be 200 feet minimum.

4.9 Existing street monuments shall not be disturbed and shall be protected during construction. If the plans show an existing street monument is to be disturbed or has the potential of being disturbed, a Corner Record shall be filed with the Santa Clara County Recorder's Office as required by the Subdivision Map Act to preserve the location of said street monument.

4.10 Standard City Monuments shall be placed on the street centerline at every street intersection, angle point, center of cul-de-sac, and beginning and ending of all horizontal curves.

4.11 The centerline profile of the through street shall be continuous through the intersection. The cross street centerline profile shall meet the through street cross slope at the centerline except when the through street pavement width is 60 feet or more. In this case, the cross street centerline profile shall meet the through street cross slope at 10 feet from the face of curb of the through street with the cross street profile sloping away from the through street.

4.12 Medians with landscaping shall require curbing. The top of curbs shall be constructed 8.5 inches above street surface grade, or in areas of median extension, match the existing curbing height as allowed by the Director of Public Works/City Engineer. Depending on the scope of the project root barriers and/or median subdrains may be required by the Director of Public Works/City Engineer.

4.13 Slurry seal shall be required on newly paved streets, trenches, potholes, and street widenings. The slurry seal shall extend 12 inches beyond the limits of pavement reconstruction.

5. SANITARY SEWER DESIGN

5.1 Pipe material shall conform to Section 02062, FURNISHING AND INSTALLING OF PIPE, of the City's Technical Provisions. For pipe sizes 24 inches in diameter or less, use vitrified clay pipe. For pipe sizes greater than 24 inches in diameter, fully lined reinforced concrete pipe may be used. Polyvinyl Chloride (PVC) SDR 26 pipe 12 inches or less may be used. PVC pipe larger than 12 inches in diameter may be used upon approval by the Director of Public Works/City Engineer.

5.2 In general, sanitary sewers shall be placed in every street with a 5-foot offset from street centerline on the side opposite the storm drain.

5.3 Minimum cover over mains shall be 6 feet from finished grade.

5.4 Design:

A. Coefficient of friction "n":

Vitrified Clay Pipe:	0.013
Reinforced Concrete Pipe:	0.013
Polyvinyl Chloride Pipe:	0.011

B. Minimum pipe diameter:

Residential:	8"
Commercial:	10"
Industrial:	12"

C. Sufficient slope shall be used to provide a minimum flow velocity of 2 feet per second when flowing full or half full.

D. Minimum average design flows:

Residential:	245 gallons / unit / day
Commercial:	Based on predicted use. *
Industrial:	Based on predicted use. *
Hospital:	150 gallons / bed / day

* See San Jose – Santa Clara Water Pollution Control Plant Sewage Coefficient List available in the Engineering Department – Land and Property Development Division.

The above flows were used to design the present trunk system. For developments with substantially higher flows (electronics manufacture, data centers, high-rise developments, canning plants, etc.) the anticipated flows shall be used in both the design of the sanitary sewer lateral and in supplementing the existing sanitary sewer system.

E. For design of pipes, the Proposed Development Peak Flow shall not be less than 2.5 times the computed average flow as determined in Subsection 5.4D above. The Design Flow (total peak flow) shall be as determined in Subsection 5.4G below. Sanitary sewers shall be considered full at a d/D (ratio of liquid depth to pipe diameter) value of 0.75 or greater.

F. Sanitary Sewer Hydraulic Model Run:

If required by the City, developer shall submit complete sanitary sewer (SS) information (i.e., building use, square footage, point of connection to the public system, and 24-hour average and peak SS flow graphs for the peak day, showing average daily and peak daily SS flows). Developer shall also provide seasonal peak, if it differs from daily peak. For a fee, the proposed development impact to the modeled trunk sanitary sewer system will be evaluated using the City's Sanitary Sewer Hydraulic Model for the trunk sanitary sewer system. If there is not enough capacity in the existing modeled trunk sanitary sewer system, the developer will be required to upgrade the sanitary sewer system as determined by the City. The required sanitary sewer upgrades will be at developer's expense.

G. Field Monitoring for Non-modeled Sanitary Sewer Lines:

If required by the City, the sanitary sewer mains serving the site not included in the City's Sanitary Sewer Hydraulic Model shall be monitored in the field by the developer at developer's expense to evaluate proposed development impact to said sanitary sewer mains. If there is not enough capacity in the sanitary sewer system, the developer will be required to upgrade the sanitary sewer system as determined by the City. The required sanitary sewer upgrades will be at developer's expense.

Prior to any flow monitoring work, the proposed monitoring location(s) shall be reviewed and approved by the Director of Public Works/City Engineer. Flow monitoring measurements to determine average and peak flows, in existing pipes, shall be done over a period of at least seven (7) consecutive days with continuous mechanical/electronic measurements in a manner acceptable to the Director of Public Works/City Engineer.

An Encroachment Permit (EP) is required to allow developer to monitor the sanitary sewer flows.

. Design flow determination shall be as follows:

$Q_D = Q_M + Q_{WWGWI} + Q_{RDI/I} + Q_{PD}$

Where:

Q	=	Flow
D	=	Design
M	=	Monitored
WWGWI	=	Wet Weather Groundwater Infiltration
RDI/I	=	Rainfall-Dependent Infiltration and Inflow
PD	=	Proposed Development

Q_D	=	Design Flow
Q_M	=	The Monitored Peak Flow or 2.5 times the Monitored Average Flow, whichever is greater.
Q_{WWGWI}	=	The gpd/acre value is obtained by using Figure 3-3 on page 3-5 (see Exhibit "D" of this Design Criteria) and Table 3-2 on page 3-11 (see Exhibit "E" of this Design Criteria) of the Sanitary Sewer Capacity Assessment Report, May 2007. Multiply the factor by the Tributary Area served by the sanitary sewer main being monitored.
$Q_{RDI/I}$	=	Same as Q_{WWGWI} above. For now, use 1,000 gpd/acre.
Q_{PD}	=	Proposed Development Peak Flow.

5.5 At all changes of direction, a drop in flow line shall be installed equal to the velocity head times the ratio of angular change to 90 degrees.

$$\frac{V^2}{2g} \quad x \quad \frac{A^o}{90^o} \quad = \quad \text{Head Loss} \quad = \quad \text{drop in flow line*}$$

Where:

V	=	velocity in ft./sec
g	=	acceleration of gravity (32.17 ft./sec^2)
A^o	=	the angular change in degrees

*If junction is fully shaped, this value may be reduced by 30%. This value shall not be less than 0.1 foot.

5.6 Where minor mains connect to trunk main, the crown of the minor main shall match the crown of the trunk main.

5.7 A drop in hydraulic grade line (HGL) shall be provided for head losses due to transitions such as bends, pipe size changes, grade changes, and at drainage structures (e.g., manholes).

5.8 The sanitary sewer system shall be designed as a complete grid system.

5.9 In general, sanitary sewer main lines should be designed such that all other parallel facilities have at least an eight-foot clear distance separation. Sanitary sewer main lines that have large diameters or are deeper/shallower in elevation may require greater separation from other facilities as determined by the Director of Public Works/City Engineer.

5.10 Curved sanitary sewer conduit shall not be used except when written permission is obtained from the Director of Public Works/City Engineer.

5.11 Cross connections between the storm drainage system and the sanitary sewer system are prohibited.

5.12 Drainage structures (e.g., manholes) shall be located at the following points:

A. Change in direction;

B. Change in slope;

C. Change in size;

D. Intersection of mains;

E. Changes in pipe material;

F. A nominal spacing of 450 feet with a maximum spacing of 500 feet;

G. Upstream end of lines; and

H. Where laterals are the same size as the main or are 8 inches or larger.

5.13 The Standard Manhole (as shown in the City Standard Details) is applicable in most cases where a drainage structure is required. However, the drainage structure shall be individually designed for any of the following conditions:

A. Through mains larger than 39” with less than a 5 degree change in alignment;

B. 27" or larger through mains with a 5 degree or larger change in alignment;

C. Side mains larger than 24"; and

D. Other special conditions as identified by the Director of Public Works/City Engineer.

5.14 Laterals:

A. Laterals for residential dwellings up to four (4) units shall be at least 4 inches in diameter. All others will be 6 inches or larger;

B. Laterals shall have a minimum slope of 2% and be installed at right angles or radial to street right-of-way;

C. Laterals with clean-outs shall be provided to every lot and known future developments; and

D. Lateral to main connections:

1. Connection to a manhole shall be made wherever possible. Manhole connections shall be as follows:

i. When lateral and main are constructed at the same time, the lateral and main crowns shall have the same elevation.

ii. When connecting to an existing manhole, the outside bottom of lateral pipe shall be at or above the manhole shelf. The maximum height of lateral flow line above the manhole shelf floor shall be one and one half feet (see City Standard Details).

2. When main and lateral are constructed at the same time, and a manhole connection is not possible, a wye connection is to be used as shown in the City Standard Details.

3. A 4” or 6” lateral connection to an existing larger main shall be made by the "Tap-tite" method as shown in the City Standard Details.

4. Lateral cover measured from top of curb shall not be less than 4.5 feet.

5. Siphon connections to main are prohibited;

E. Clean-outs shall be installed on all sanitary sewer laterals at the street right-of-way or easement line as shown in the City Standard Details. If the sanitary sewer lateral is 8 inches or larger, a manhole shall be used in place of a clean-out; and

F. On-site sanitary sewer pump system force mains shall not discharge directly into the City's sanitary sewer system.

5.15 Grit Traps:

A. Grit traps shall be placed just upstream of siphons and at other locations as determined by the Director of Public Works/City Engineer.

B. Grit traps shall be designed with adequate capacity to accommodate the peak flow(s) of the sanitary sewer main(s) discharging into the grit trap.

6. STORM DRAINAGE DESIGN

6.1 The storm drain pipe system shall be designed to convey the 10-year event flow. The storm drain pipe system near storm drain pump stations, as determined by the Director of Public Works/City Engineer, shall be designed to convey the 100-year event flow.

6.2 When a proposed development increases the storm discharge such that it will surcharge the existing storm drain system and/or breach the discharge capacity limit of the existing pump station, the developer shall upgrade/supplement the existing storm drain system and/or existing pump station to accommodate the proposed development.

6.3 For runoff calculations, use the Rational Method of Design (Q = CIA) where:

Q = Runoff in cubic feet per second (CFS)

C = Runoff coefficient or percentage of rainfall running off a given drainage area. In general: Parks 0.3; Residential 0.4 to 0.5; Industrial 0.6 to 0.9; Commercial 0.6 to 0.8. The Consulting Engineer shall determine and submit the backup information used to calculate the C factor(s) along with the storm drain pipe design calculation.

I = Intensity of rainfall in inches per hour as determined by time of concentration (Tc). Use the Intensity-Duration-Frequency (IDF) Graph for a mean annual precipitation of 14 inches (see Exhibit "F" for Graph) as published in the Santa Clara County Drainage Manual 2007 (Figure B-2).

A = Drainage area in acres

Tc = Time required for water to flow from the most remote part of the drainage area to the outlet point under consideration. Use ten minutes start time plus 0.5 ft./sec overland plus 1 ft./sec in gutters plus pipe flow time or formulas found in Santa Clara County Drainage Manual 2007.

6.4 Use County of Santa Clara Standard Form DM-2 (see Exhibit "G") found in the Santa Clara County Drainage Manual 2007 for tabulating design calculation and pipe size selection. Submit completed form DM-2 and tributary area drainage map with improvement plans. Hydrology software providing similar inputs and outputs may be used, if accepted by the Director of Public Works/City Engineer.

6.5 Pipe slope shall generally be parallel with the ground gradient of the drainage basin.

6.6 Roughness coefficient (n) for Reinforced Concrete Pipe shall be 0.013.

6.7 A drop in hydraulic grade line (HGL) shall be provided for head losses due to transitions such as bends, pipe size changes, grade changes, and at drainage structures (e.g., manholes).

6.8 Curved storm drain conduit shall not be used except when written permission is obtained from the Director of Public Works/City Engineer.

6.9 Full flow velocity shall not be less than 2 fps.

6.10 Maximum flow velocity shall be 10 fps.

6.11 Minimum size of conduit shall be 12-inch inside diameter.

6.12 Storm conduit generally shall be located 5 feet from the street centerline on the side opposite the sanitary sewer.

6.13 Pipe material shall be reinforced concrete pipe with minimum strength of Class III (1350-D). Pipe shall be Class V in areas of high electrolysis (e.g., north of Highway 101).

6.14 Minimum cover over pipe shall be 2 feet to street subgrade for mains, and 2 feet to lip of gutter for catch basin laterals.

6.15 In general, storm drain main lines should be designed such that all other parallel facilities have at least an eight-foot clear distance separation. Pipelines that have large diameters or are deeper/shallower in elevation may require greater separation from other facilities as determined by the Director of Public Works/City Engineer.

6.16 Drainage structures (e.g., manholes) shall be located at the following points:

A. Changes in direction;

B. Changes in slope;

C. Changes in size;

D. Intersections of mains and laterals (unless a concrete lug connection is permitted by the Director of Public Works/City Engineer as shown in the City Standard Details);

E. Changes in pipe material; and

F. A nominal spacing of 450 feet with a maximum spacing of 500 feet.

6.17 The Standard Manhole (as shown in the City Standard Details) is applicable in most cases where a drainage structure is required. However, the drainage structure shall be individually designed for any of the following conditions:

A. Through mains larger than 39” with less than a 5 degree change in alignment;

B. 27" or larger through mains with a 5 degree or larger change in alignment;

C. Side mains larger than 24"; and

D. Other special conditions as identified by the Director of Public Works/City Engineer.

6.18 Street pickup points shall not exceed 1,000-foot intervals. Use City standard curb inlet catch basins; or Type "A" catch basins, with approval of the Director of Public Works/City Engineer.

6.19 Maximum depth of City standard catch basins shall be eight feet. Deeper inlet structures require individual designs and approval by the Director of Public Works/City Engineer.

6.20 Backflow protection devices shall be provided whenever the pipe system discharges into a flood control channel in which the 100-year event water surface elevation is higher than the lowest natural ground elevation of the drainage basin. Whenever this occurs, an overflow release protection system, such as culvert, channel, or drainage swale, shall be provided for the ultimate delivery of water to a flood control facility.

6.21 A backflow preventive device shall be provided for on-site storm drain laterals when an on-site elevation of a pick-up point is more than 6 inches below the lowest top of curb on the fronting street(s). The backflow device shall be located in a private structure outside the street right-of-way and maintained by the property owner.

6.22 Private property connections to the City storm system shall be first authorized by proper permits and then connected to the City's storm drain system either directly at an existing or new manhole or to the back of an existing catch basin or, if no storm drain exists, by means of curb face drainage, if permitted by the Director of Public Works/City Engineer.

6.23 Force main delivery from on-site pump systems shall not flow directly through curb face, nor into City storm drain system.

6.24 Cross connections between the sanitary sewer system and the storm drainage system are prohibited.

6.25 Storm drain lines shall be constructed by new development or redevelopment up to the property and include capacity for the upstream watershed area.

6.26 Storm drain lines shall be constructed downstream to a point of adequate discharge.

6.27 Pipe stubs with plugs shall be provided at points of known future extensions.

6.28 Outfalls and work within the Santa Clara Valley Water District (SCVWD) right-of-way are subject to approval and issuance of permits by the SCVWD.

6.29 Hydraulic grade analysis for design of new outfall and pipeline shall take into consideration the 10-year and 100-year storm event water surface elevations of the receiving river or creek. Consulting Engineer may obtain the water surface elevations of the receiving river or creek from the SCVWD.

7. WATER SYSTEM DESIGN (POTABLE AND RECYCLED)

7.1 The Consulting Engineer shall perform the preliminary layout of the Project water system. This preliminary layout shall show the locations of the existing water facilities and the proposed locations for the new facilities. The preliminary design shall be drawn on the street improvement plans and submitted to the City Water and Sewer Utilities Department for review and Final Design.

7.2 The Consulting Engineer shall work with the City Water and Sewer Utilities Department to arrive at a Final Design for the Project water system improvements.

7.3 The Consulting Engineer shall be responsible for reviewing the Final Design and shall note any conflicts with other Project improvements. Working together with the City Water and Sewer Utilities Department, all conflicts shall be eliminated.

7.4 The Consulting Engineer shall draw, on the street improvement plans, the plan and profile of the Final Design of the Project water system as reviewed and approved by the City Water and Sewer Utilities Department.

7.5 The Consulting Engineer shall use the following general design criteria for preparing public improvement plans for the Project water system. For special or complex situations, the City Water and Sewer Utilities Department should be contacted for direction.

A. Depth Requirements:

The typical depth of new potable and recycled water mains from top of near side curb (or finished grade for non-standard or non-street locations) to invert of the pipe is as listed below:

a) 4-inch pipe - 3.50 feet
b) 6-inch pipe - 3.70 feet
c) 8-inch pipe - 4.10 feet
d) 10-inch pipe - 4.50 feet
e) 12-inch pipe - 5.00 feet
f) Pipe over 12 inches - top of pipe at 4.0 feet below finished grade

A minimum cover of 3.0 feet from finished grade to top of pipe.

A minimum cover of 2.0 feet from scarified sub-grade to top of pipe during construction.

For 2 inches and smaller copper tubing - 2.0 feet below scarified sub-grade.

For horizontal alignment, the centerline of the potable/recycled water main shall be located 6 feet from face of curb into the street. Other situations should be reviewed with the Water and Sewer Utilities Department prior to beginning of design.

B. Minimum Horizontal Clearance Requirements:

From potable water mains, services and facilities:*

a) To all sanitary sewer mains, manholes, and laterals - 10 feet
b) To all recycled water mains, services, and facilities - 10 feet
c) To all trees - 10 feet**
d) To other utilities and general conflicts - 5 feet

* If both pipes are 12 inches diameter or smaller, the clearance dimension noted above shall be measured from center to center of the pipes. If either pipe is larger than 12" diameter, clearance shall be the clear distance between the pipes.

** A note shall be placed on the landscape drawings to indicate that there is a 10' clearance requirement from trees and public water, recycled water and sewer facilities (i.e., mains, FH's, WM's, sewer manholes, C/O's, etc.) unless City-approved Tree Root Barriers (TRB) are utilized. TRB's must be 5' from the public facility. The TRB's must be shown on the plans and the TRB criteria must be included on the plans.

Provide a minimum of 12 inches of clearance around water meter boxes from any above-ground structures such as mail boxes, or fences.

C. Minimum Vertical Clearance Requirement:

Vertical clearance when crossing typical conflicts shall be 12 inches minimum from outside of pipe to outside of pipe (or conduit). For crossings with less than 12 inches clearance, a concrete saddle shall be installed (see City Standard Details).

D. Improvement Plan Requirements:

Show both plan and profile views, and stationing or other means of locating all water facilities (i.e. water valves, tees, reducers, service taps, fire hydrants, etc.) with the station and item called out. The plans shall include but not be limited to the following:

a) The plan view shall include all existing and proposed utilities and appropriate surface features within or near the street right-of-way as necessary (i.e., curb and gutter, sidewalks, driveways, trees within approximately 15 feet of proposed facilities, utility poles, sanitary sewer laterals, easements, etc.). Where these items may appear to be close or in conflict with the water facility some means of identifying the proper clearance shall be used.

b) The profile view shall include the existing grade above the water main (or top of near-side curb or street centerline with a typical street section). It shall also identify and show all crossings with no conflicts and station and elevation of the water main at each full station and change of slope. Any parallel utility closer than 10 feet to the proposed main shall be shown in profile also.

E. Other Miscellaneous Requirements:

To clear conflicts, the pipe should be gradually deflected up or down sufficiently in advance to cross with the proper clearance without using fittings. In cases where this is not possible standard fittings shall be used.

Use air release valves at locations where the peak of the deflected pipe is more than one pipe diameter above the general elevation of the main. Air release valve cabinets shall be located in landscaped or non-paved areas behind the sidewalk at the nearest most convenient location.

Main line gate valves should be installed at tees for branching mains, large services, and fire hydrants, and at approximately:

a) Every 1,000 feet where few services are installed.

b) After every three major connections to the water system (i.e., water services greater than 3 inches, fire services, and fire hydrants).

c) After every two fire hydrants with no other services.

Fire hydrants are generally placed at 300 to 350 feet intervals on the same side of the street as the main. Typically, hydrant locations are at (or near) the returns of street intersections, 7 feet minimum from driveways, on property lines between properties, etc. The Fire Department requires 3 feet of clearance around all fire hydrants.

Any other utility crossing the public water main is required to cross at or near 90 degrees.

Water meters shall be located in landscaped or non-paved areas with a minimum of 12 inches clearance from above-ground structures such as mailbox posts or fences on all sides of the meter box. They shall be located in front of the property to be served.

Provide minimum 3 feet clearance around all above-grade water utilities. Include bollards as needed to protect the utilities.

Refer to Water Department Standard Drawings and Specifications for additional details.

For any variation from these design criteria the Design Engineer should consult with the Water Department for approval.

8. ELECTRIC UTILITY AND JOINT TRENCH DESIGN

8.1 Electric utility plans shall be drawn on half-tone sheets of the street improvement layout ("base sheets"). These half-tone sheets shall show the major existing and proposed street improvements without the extensive notes and details found on the final street improvement plans. Electric utility plans shall conform to the latest City Electric Department's UG 1000, UG 1250, and SD 1800 standards.

8.2 The Consulting Engineer shall prepare preliminary electric utility plans which shall include locations of existing and proposed electric facilities. The Consulting Engineer shall submit a set of the electric utility design for City review (see PROCEDURE, page 1). These plans shall be reviewed by the City Electric Department.

8.3 The Consulting Engineer shall be responsible for the final design of the elevation and alignment and exact location of the electric utility facilities. Elevations shall be provided for tops of manhole rims, corners of vaults and transformer pads, streetlight foundations, and other electric substructures.

8.4 The Consulting Engineer shall draw the final electric utility plans base sheets, incorporating the City's comments and directions.

8.5 Proposed electric facilities shall be stationed on the same centerline stationing as the civil improvements. All dimensions needed to accurately locate facilities shall be included on the plans.

8.6 The electric utility plans may have a separate legend from the civil plans.

8.7 The Consulting Engineer may reference any of the Standard Details contained in the latest revision of the UG 1000 by note on the plans. The Standard Details do not need to be shown on the plans.

8.8 Any trench section designed for the project, which is not detailed in the latest revision of the UG 1000, must be detailed on the plans.

8.9 At each location of intersections of underground conduits (e.g., street crossings) an installation profile detail shall be required to show exact location of all vaults, manholes, boxes, conduit sweeps, vertical clearances from other facilities, trench locations, etc. Note: conduits of differing diameter may have different minimum sweep radii.

8.10 All potential conflicts with any underground facility shall require a profile view of the conflict area.

9. HORIZONTAL DIRECTIONAL DRILLING (HDD) – MINIMUM REQUIREMENTS.

9.1 General

9.1.1 The use of HDD shall be at the discretion of the Director of Public Works/City Engineer at all times.

9.1.2 Displacement HDD shall not be allowed for reamed diameter of bore hole greater than six inches (6”).

9.2 A Geotechnical Report shall accompany a submittal of HDD plans requiring reamed diameter of bore hole greater than 6”.

A. The Geotechnical Report shall:

1. Be prepared and signed by a State of California Registered Geotechnical Engineer.

2. Be based on information gathered along the proposed layout of the HDD installation at the discretion of the Registered Geotechnical Engineer. Sufficient number of test borings should be included in the geotechnical investigation. Depth of test borings should extend to depth zones of utilities that potentially may be impacted by the HDD.

3. Specifically address the potential impacts (if any) on the surface improvements and existing underground improvements the proposed HDD project may have (based on the existing soil conditions). Alternative layouts and profiles must be considered to minimize the impacts to the existing facilities (surface and underground).

4. Provide drilling fluid recommendations.

5. Provide a general reaming operation recommendations and limitations.

6. Specify the minimum horizontal clearance (from reamed perimeter of the borehole to the outer perimeter of the utility) from the existing utilities when the proposed HDD runs parallel to the existing utilities.

7. Specify the minimum vertical clearance when crossing existing utilities.

8. Specify the minimum depth of cover.

B. A condensed version of the geotechnical report (signed and stamped by Registered Geotechnical Engineer) including conclusions and recommendations to be included in the plans for HDD. A letter from the Registered Geotechnical Engineer certifying that the plans comply with the requirements of the geotechnical report may be submitted with plans in lieu of condensed geotechnical report.

9.3 Civil HDD Plans

A. The Civil HDD Plans shall:

1. Conform to the Geotechnical Report conclusions and recommendations at time of submittal.

2. Be signed and stamped by a State of California Registered Civil Engineer.

3. Specify minimum radius of curvature, taking into accounts the proposed material and equipment to be used.

4. Specify maximum entry angles.

B. HDD shall be located outside the roadway pavement, in the Public Utility Easements (PUE), landscape areas, and sidewalk areas, if possible. If it is not possible to locate the proposed HDD outside the roadway pavement, locate as close to the existing curb and gutter as possible.

C. The drill path alignment should be as straight as possible to minimize the frictional resistance during pull back and maximize the installation length during a single pull.

D. The following minimum clearances (from reamed perimeter of the borehole to the outer perimeter of the utility) shall be used as a guideline. The Geotechnical Report conclusions and recommendations or the City's determination shall be followed, if more restrictive

1. Locate HDD 8 feet clear (horizontally) from the existing storm drain and sanitary sewer mains. Minimum of 5 feet horizontal clearance shall be maintained from water mains, except when at the same elevation as water mains, 8 feet horizontal clearance shall be maintained. Minimum of 5 feet horizontal clearance shall be maintained from electrical conduits, boxes, and vaults.

2. Use the following chart for minimum depth of cover (in the pavement and sidewalk areas) and minimum clearance when crossing utilities (storm drain, sanitary sewer, water, electrical, gas, etc.). Crossing shall be at 90-degree.

Bore Diameter	**Min. Depth of Cover**	**Min. Clearance from Crossing Utilities**
6" or less	4'	3'
14" or less	6'	5'
24" or less	10'	7'
48" or less	25'	15'

9.4 Construction Phase

A. The contractor shall provide a "Letter of Training" from the manufacturer of the HDD equipment to the City Public Works Inspector at the pre-construction meeting or one week prior to starting the work which proves completion of the minimum course in the operations and safety of HDD equipment as contained in the HDD Equipment Manufacturer's Operator's Manual. The training shall be provided by the HDD equipment manufacturer, HDD equipment authorized dealer, or manufacturer's authorized trainer. Operators having Caltrans form TR-0770, "Proof of Training", satisfy this requirement.

B. All crossings with existing utilities with less than 6 feet separation shall be potholed or accurately located by other means.

C. When the depth of the existing utility is unknown, the utility must be potholed.

D. At the pre-construction meeting, or one week prior to starting the work, the Contractor shall provide the following:

1. Specify tracking system used and its capability for both the forward drilling and the backream.

2. A written verification of experience and qualifications of the tracker. Experience shall include a minimum of 5 previous jobs and/or 1,000 feet of tracking experience with references.

3. Specify HDD equipment used and its capability.

4. Names of the HDD operator and the responsible tracker.

5. Proposed methods to control, collect, transport, and dispose of drilling fluids and spoils.

6. Emergency procedures for inadvertently boring into a live electric conduit, natural gas line, water line, sanitary sewer line, storm drain line, fiber optic cables, or any other utility in the ground (private or public). Procedures must comply with all applicable regulations.

E. Geotechnical Engineer shall review the Contractor's submittal and comment on suitability of the proposed equipment with respect to the subsurface conditions described in the geotechnical report and provide a letter of compliance to the City.

F. Contractor shall provide for the tracking and plotting of the HDD operations at all times.

1. Tracker shall check for electrical interference along drill path prior to construction operations for necessary adjustments to a pre-drill plan.

2. Tracker shall provide continuous monitoring and plotting of pilot bore to establish a general running line and pull back operations to establish final location of the installed line.

9.5 As-built Drawings

A. Contractor shall provide the City with As-Built Drawings, meeting the following minimum criteria:

1. As-Built Drawings shall show the layout and profile at a minimum horizontal scale of 1"=40' and vertical scale of 1"=10'.

2. As-Built Drawings shall be based upon the plot information provided by the tracker.

3. As-Built Drawings must show new construction, clearances and existing improvements (sidewalk, curb, gutter, roadway, utilities, etc.).

9.6 References

A. Bueno, Sharon M. (1999), "Directional Crossing Contractor Association (DCCA) Roundtable – What Do Industry Leaders Have to Say About Safety, Contracts and Rollups?" *Directional Drilling* Magazine, Dec., p. 18.

B. California Department of Transportation, "HDD Operator Certification Project (January 18, 2000)".

C. California Department of Transportation, "Guidelines and Specifications for Horizontal Directional Drilling Installations 2000", pp. 12-22."

D. Twohing, M.A., "The Directional Crossing Contractor Association (DCCA) Directional Crossing Survey Standards 1998", p. 5.

E. U.S. Army Corps of Engineers, "Guidelines for Trenchless Technology: Cured-in-Place (CIPP), Fold-and-Formed Pipe (FFP), Mini-Horizontal Directional Drilling (Mini-HDD), and Microtunneling", Construction Productivity Advancement Research (CPAR) Program (Final Report, September 1995).

F. DCM/Joyal Engineering, Review Comments – City of Santa Clara Draft Minimum S.O.P. Requirements for H.D.D. Installation, Marc Gelinas/David Mathy, June 27, 2000.

G. Geotechnical Comments, Proposed City of Santa Clara Draft Requirements – HDD-SOP, Hallenbeck & Associates, Adel Kasim, Ph.D., G.E., June 1, 2000.

EXHIBIT A

Typical Legend Symbols

Note: Include only the "proposed" and "existing" legend symbols that are actually used on the plans. Symbols other than what is shown in this Exhibit may be used subject to approval.

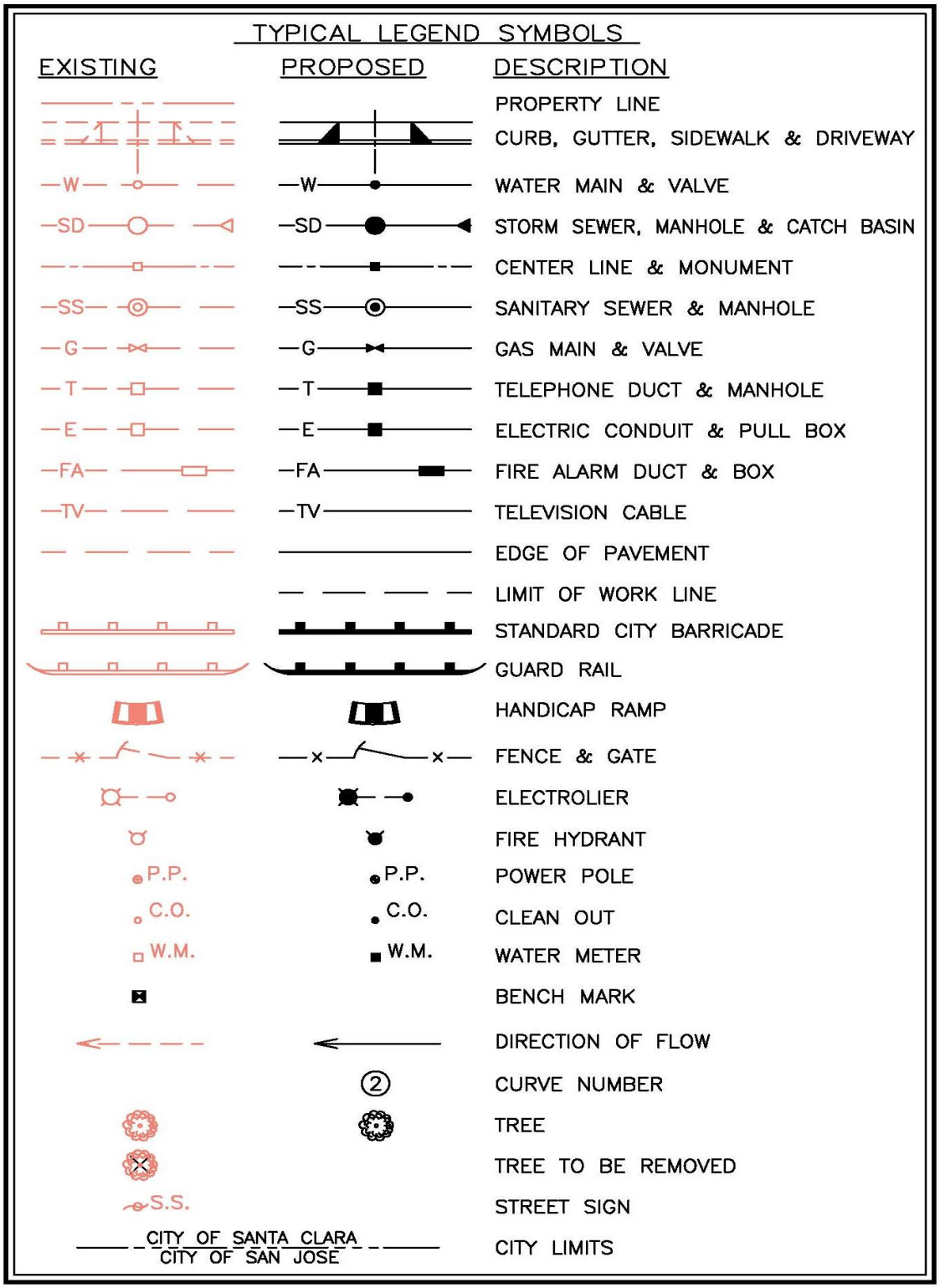

EXHIBIT B

Typical Abbreviations

Note: Show only those abbreviations that are actually used on the plans.

A	
AB	aggregate base
ABBC	asbestos bonded bituminous coated
Abn	abandon
Abut	abutment
AC	asphalt concrete
ACB	asphalt concrete base
ACP	asbestos cement pipe
ADL	added dead load
Adj	adjust
Alt	alternate
Approx	approximate
AS	aggregate subbase
Ave	avenue
Avg	average
@	at
B	
BC	begin horizontal curve
BCR	begin curve return
Beg	begin
Bit Ctd	bituminous coated
Bk	back
Bkf	backfill
Bldg	building
Blvd	boulevard
BM	bench mark
Bot	bottom
Br	bridge
Brg	bearing
BTU	british thermal unit
BVC	begin vertical curve
C	
CAP	corrugated aluminum pipe
C-C	center to center
CG	center of gravity
Chnl	channel
CI	cast iron
CIP	cast iron pipe
CIPCP	cast in place concrete pipe
CL	chain link
Cl	class
Clr	clear, clearance
CM	corrugated metal
CMP	corrugated metal pipe
Co	county
Col	column
Conc	concrete
Cond	conduit
Const	construct, construction
Cont	continuous
Coord	coordinate
Cr	creek
CSP	corrugated steel pipe
CTB	cement treated base
CTPB	cement treated permeable base
CTPM	cement treated permeable material
Ctrs	centers
Culv	culvert
CL	centerline
D	
D	depth
Dbl	double
Deg	degree
Det	detail, detour
DI	drainage inlet, drop inlet
Dia	diameter
Diaph	diaphragm
Dist	distance, district
Dr	drive
Dwy	driveway
E	
E	east
Ease	easement
EB	eastbound
EC	end horizontal curve
ECR	end curb return
Elec	electrolier
Elect	electric
Elev	elevation
Emb	embankment
Engr	engineer
EP	edge of pavement
EVC	end vertical curve
Exc	excavation
Exist, (E)	existing
Exp	expansion, expressway
Exp Jt	expansion joint
Ext	exterior

F	
F & C	frame and cover
F & G	frame and grate
Fdn	foundation
FG	finished grade
FH	fire hydrant
Fig	figure
FL	flow line
FS	finished surface
Ftg	footing
Fwy	freeway
G	
g	acceleration due to gravity
Ga	gage
Galv	galvanized
GR	guard railing
GSP	galvanized steel pipe
Gtr	gutter
H	
H	height
h, hr	hour
hdwl	headwall
HMA	hot mixed asphalt
Horiz	horizontal
HP	high point, horsepower
HW	headwall
Hwy	highway
I	
IB	imported borrow
ID	inside diameter
Int	interior
Inv	invert
Irr	irrigation
J	
Jct	junction
JP	joint pole
JS	junction structure
Jt	joint
K	
L	
L	length
Ln	lane
Loc	location
LS	lump sum
Lt	left

M	
Maint	maintenance
Max	maximum
Med	median
MH	manhole
Min	minimum
Misc	miscellaneous
Mod	modified, modify
Mon	monument
Mtl	material
N	
N	north
NB	northbound
No.	number (must have period)
Nos.	numbers (must have period)
NTS	not to scale
O	
OC	overcrossing
OD	outside diameter
OH	overhead
Opp	opposite
P	
P	page
PAP	perforated aluminum pipe
PB	pull box
PC	point of curvature
PCC	point of compound curve
PCP	perforated concrete pipe
PCVC	point of compound vertical curve
Ped	pedestrian
Ped OC	pedestrian overcrossing
Ped UC	pedestrian undercrossing
PI	point of intersection
PJP	partial joint penetration
P/L	property line
POC	point of horizontal curve
POT	point of tangent
POVC	point of vertical curve
PP	power pole
PPP	perforated plastic pipe
PRC	point of reverse curve
PRF	pavement reinforcing fabric
PRVC	point of reverse vertical curve
PS&E	plans, specifications and estimates
PSP	perforated steel pipe
PT	point of tangency
PVC	polyvinyl chloride
Pvmt	pavement

Q	
Qty	quantity
R	
R	radius
RCP	reinforced concrete pipe
Rd	road
Reinf	reinforced
Ret	retaining
Rev	revised
Rdwy	roadway
RP	radius point
RR	railroad
Rt	right
Rte	route
RW	redwood
R/W	right of way
S	
S	south
SB	southbound
SD	storm drain
Sec	second
Sht	sheet
Sim	similar
Specs	specifications
St	street
Sta	station
Std	standard
Str	structure
Surf	surfacing
SW	sidewalk
Swr	sewer
Sym	symmetrical
T	
Tan	tangent
TC	top of curb
TCB	traffic control box
Tel	telephone
Temp	temporary
TG	top of grade
Tot	total
TP	telephone pole
Trans	transition
TS	traffic signal
Typ	typical
U	
UC	undercrossing
UD	underdrain
UON	unless otherwise noted
UP	underpass
V	
V	valve
Var	variable
VC	vertical curve
VCP	vitrified clay pipe
Vert	vertical
Vol	volume
W	
W	west
WB	westbound
WM	wire mesh
WS	water surface
WSP	welded steel pipe
Wt	weight
WV	water valve
WW	wing wall
X	
X sec	cross section
Xing	crossing
Y	
Yr	year
Yrs	Years
Z	

EXHIBIT C

General Notes

1. All materials and workmanship shall conform to the City's Standard Details, Standard Specifications, and General Requirements.

2. Contractor shall secure an Encroachment Permit from the City Engineering Department and pay appropriate fee prior to commencement of work. All work within the public right-of-way shall be done under a single Encroachment Permit.

3. It is the Contractor's responsibility to verify the location of all existing utilities with the appropriate utility agencies prior to the commencement of construction. Contractor shall notify all public and private utility owners 48 hours prior to commencement of work adjacent to the utility. Contact Underground Services Alert (USA) at 811 or 800-227-2600.

4. All sidewalk, curb, and gutter damaged as a result of the project shall be removed and replaced to the nearest score mark or as directed by the City Engineer. Installation of new sidewalk, curb and gutter against existing improvements shall require a sidewalk contact joint (dowels required).

5. Partial replacement of a driveway is not allowed. A driveway that has been cut or damaged must be replaced in its entirety. The new replacement driveway must meet current City Standards which may affect on-site improvements and/or require a sidewalk easement.

6. Unless otherwise directed by the City Engineer in the field: at each location where new curb/gutter is to be installed on an existing street (driveway installation, driveway abandonment, curb ramp installation, curb face drainage installation, etc.) pavement reconstruction shall be required. An 18-inch wide band of pavement shall be removed and replaced along the entire length of curb/gutter installation. Removal depth (saw cuts required) shall be to the base material on streets with A.C. or P.C.C. pavement four inches (4") or less in thickness. Removal depth shall be two inches (2") minimum on streets with A.C. (grind) and four inches (4") minimum on streets with P.C.C. (saw cut) pavement thickness greater than four inches (4"). Replace with A.C. or P.C.C. (dowels required) to match existing pavement.

7. Slurry seal shall be required on all new street pavement (e.g., trench work, potholes, and street widenings). Slurry seal shall extend twelve inches beyond the limit of pavement reconstruction.

8. The Contractor shall notify, by circular, all business establishments and residences located in areas affected by the work at least forty-eight (48) hours prior to start of construction. Circular shall be subject to the approval of the City Engineer.

9. All manholes, valve boxes, monument boxes, and other structures in the pavement area shall be adjusted to finish grade before paving final lift.

10. Grade breaks on curbs on sidewalks are to be rounded off on form work and finished surfacing.

11. It is the Contractor's responsibility to replace all street monuments or lot corner pipes disturbed during the process of construction. If a street monument has the potential of being disturbed, a Corner Record shall be filed with the Santa Clara County Surveyor (per Section 8773.2 of the Public Land Surveyors Act) as required by the Subdivision Map Act to preserve the location of said street monument. Contractor shall, at his/her expense, hire a Civil engineer with Land Surveyor privileges or a Land Surveyor to perform the work.

12. All surplus and unsuitable material shall be removed from public right-of-way.

13. Contractor shall provide adequate dust control and keep mud and debris off the public right-of-way at all times.

14. All trenches and excavations shall be constructed in strict compliance with the applicable sections of California and Federal O.S.H.A. requirements and other applicable safety ordinances. Contractor shall bear full responsibility for trench shoring design and installation.

15. Existing utilities shown are based upon record information and are approximate in location and depth. The Contractor shall pothole all existing utilities that may be affected by new facilities in this contract, verify actual location and depth, and report potential conflicts to the Engineer prior to excavating for new facilities.

16. Contractor shall perform his construction and operation in a manner, which will not allow harmful pollutants to enter the storm drain system. To ensure compliance, the Contractor shall implement the appropriate Best Management Practice (BMP) as outlined in the brochures entitled "Best Management Practice for the Construction Industry" issued by the Santa Clara Valley Nonpoint Source Pollution Control Program, to suit the construction site and job condition.

17. Overnight parking of construction equipment in the public right-of-way shall not be permitted, except at location(s) approved by the City Traffic Engineer.

18. All sanitary sewer and/or storm drain mains to be abandoned shall be filled with sand or control density fill (CDF) and plugged at each end with a 6" thick wall of Class "A" P.C.C.

19. Abandonment of sanitary sewer lateral at the property line shall include the complete removal of the Christy Box, all vertical pipes and the 45º Wye. The remaining lateral ends shall be plugged with 6" thick wall of Class "A" P.C.C., ensuring no concrete enters the main. Abandonment of sanitary sewer lateral at the main will occur when lateral connects at a manhole or as determined by the City. Plug the lateral ends with 6" thick wall of Class "A" P.C.C., and fill lateral with sand or control density fill (CDF), making a smooth trowel finish on the inside wall of the manhole for manhole connections.

20. Unless otherwise noted, Class 2 A.B. under curb, gutter, and street sections paved with asphalt concrete shall be compacted to 95% relative compaction (minimum).

21. Near completion of the Project, contractor shall replace damaged curb and gutter along Project frontage as directed by the City Engineer.

EXHIBIT D

Figure 3-3 of Sanitary Sewer Capacity Assessment Report, May 2007

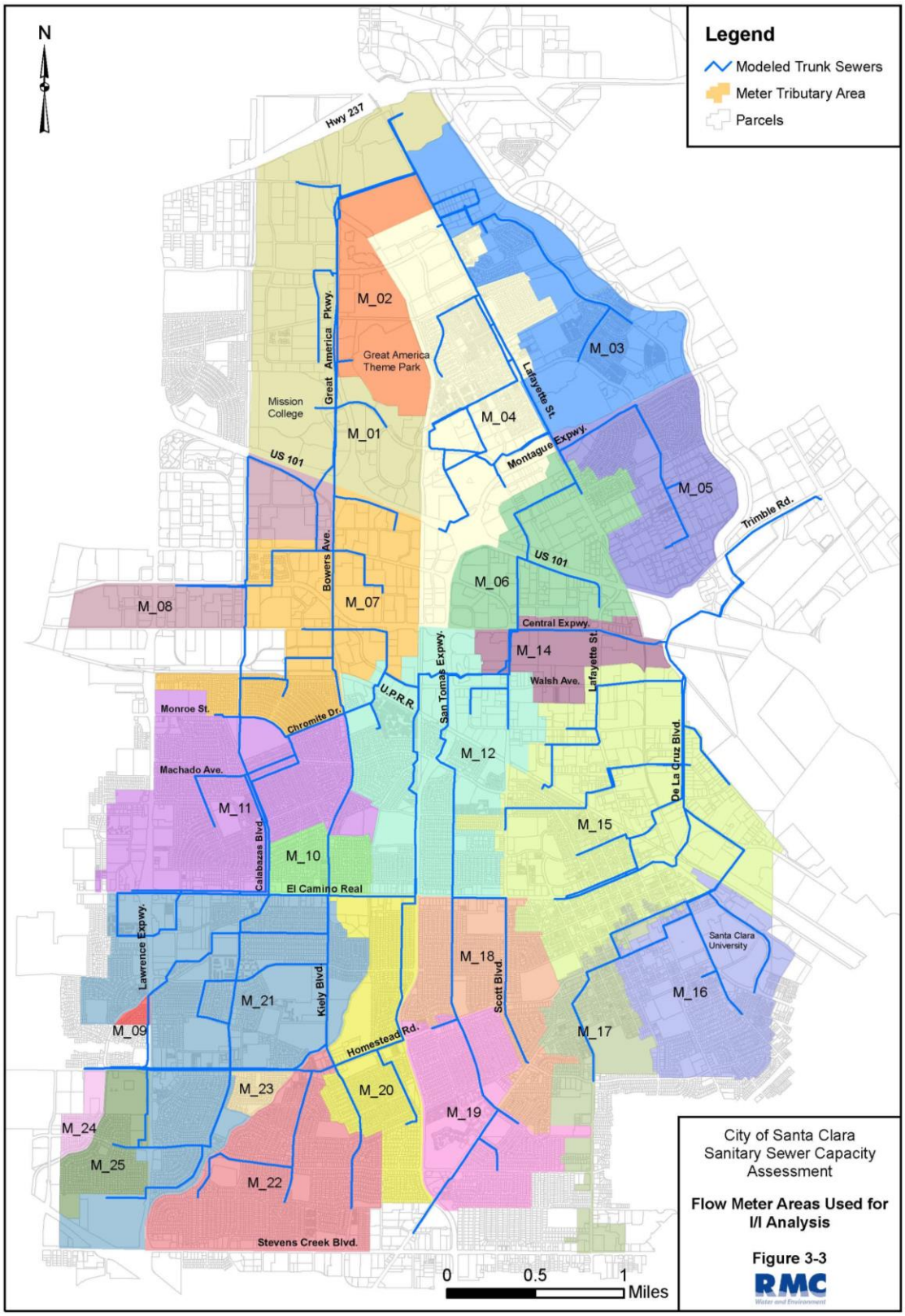

EXHIBIT E

Table 3-2 of Sanitary Sewer Capacity Assessment Report, May 2007

Table 3-2 GWI and RDI/I Parameters by Meter Area

Meter Area[a]	Dry Weather GWI[b] (gpd/acre)	Wet Weather GWI[c] (gpd/acre)	R1 RDI/I Vol. (%) (2 hrs. to peak)	R2 RDI/I Vol. (%) (6 hrs. to peak)	R3 RDI/I Vol. (%) (12 hrs. to peak)
M_01	0	0	0.5	0.8	0.8
M_02	0	0	0.5	0.8	0.8
M_03	0	0	0.6	0.1	0.1
M_04	500	1,300	0.6	0.1	0.1
M_05	700	1,000	0.6	0.1	0.1
M_06	0	0	0.6	0.1	0.1
M_07	1,900	1,900	0.3	0.5	0.5
M_08	0	0	0.3	0.5	0.5
M_09	0	0	0.6	0.1	0.1
M_10	0	0	0.6	0.1	0.1
M_11	1,600	2,300	0.9	1.7	6.0
M_12	0	0	0.9	1.0	0.5
M_14	0	0	0.6	0.1	0.1
M_15	300	700	1.0	0.2	0.2
M_16	900	1,600	1.0	0.2	0.2
M_17	200	200	0.6	0.1	0.1
M_18	0	0	0.8	1.0	0.1
M_19	0	0	0.3	0.1	0.1
M_20	0	0	0.6	0.1	0.1
M_21	0	0	0.6	0.1	0.1
M_22	0	0	0.6	0.1	0.1
M_23	0	0	0.6	0.1	0.1
M_24	0	0	0.6	0.1	0.1
M_25	0	0	0.6	0.1	0.1
CuSD	0	0	0.5	0.2	0.4

(a) See Figure 3-3.
(b) Represents GWI during non-rainfall periods (e.g., early to mid-February) of the 2006 flow monitoring period.
(c) Represents GWI immediately following rainfall events.

EXHIBIT F

Santa Clara County Drainage Manual 2007

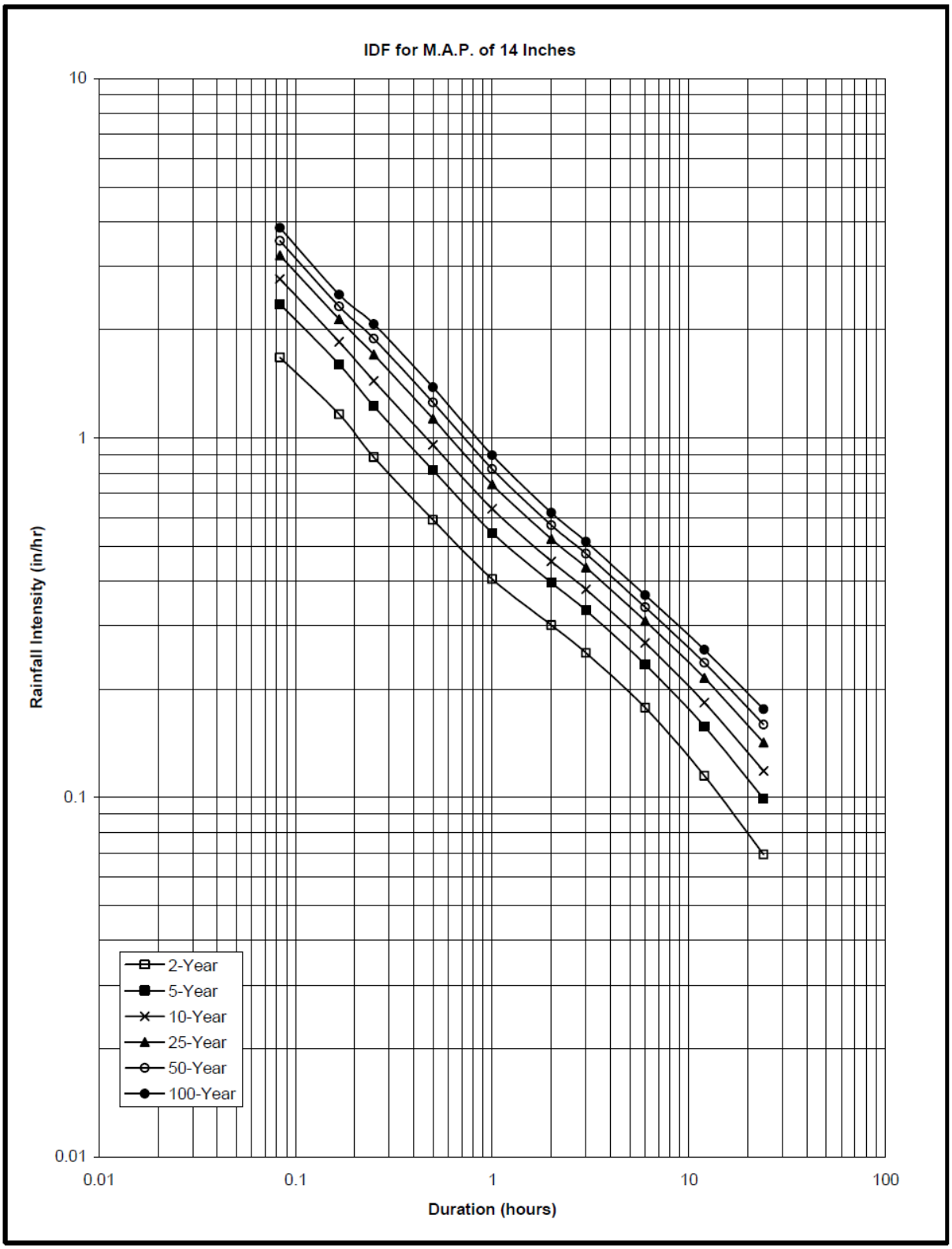

Figure B-2: IDF for M.A.P. of 14 Inches

EXHIBIT G

Standard Form DM-2: Santa Clara County Drainage Manual 2007

Runoff Coefficient (based on Santa Clara County Drainage Manual):

Land Use _____ Weighted C-Value = _____

Rainfall Curves: Source _____

Return Period _____ years (County minimum standard = 10 years)

Time of Concentration (improved): Gutter Time _____ min. Total Inlet Time _____ min.

Pipe (minimum standard size = 12" diameter): Type _____ Manning's "n" _____

Minimum Velocity at Design Flow, V = _____ fps (min. standard velocity = 2.6 ft/sec.)

Attach map showing boundaries of drainage areas, runoff coefficients, inlet locations, Q's, slope, point of concentration, existing and proposed drainage facilities. If, under normal conditions, pipe will flow full at any point in the system, attach plot of hydraulic grade line.

county of santa clara

DEPARTMENT OF PUBLIC WORKS

APPROVED: _____ DIRECTOR

STANDARD FORM DM-2

Drainage Manual

STORM DRAIN DESIGN BY RATIONAL METHOD

Project Location | Computations by | Date

Type of Development | Total Area (Acres)

Remarks | Signature of Applicant

Concentration Point	Discharge (Q) cfs	Ground Slope *	Pipe Slope, S	∑ Product Area * Coefficient	Duration, min. (Time of Concentration)	Rainfall Intensity, I (inches/hr.)	Runoff, cfs Q = CIA	Length, ft.	Pipe Diameter, in.	Slope, percent	Depth of Flow, D/d	Hydraulic Radius, ft.	Velocity, fps	$V^2/2g$	Flow Time, min.	Fall, ft.	Flow Time, min.	Invert Elevation, ft.		Finished Grade Elevation, ft.		Minimum Cover, ft.	Location of Point of Minimum Contact, ft.	Cut, ft.		Remarks
																		In	Out	In	Out			In	Out	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16										
			1 X 2	3 ÷ 4	5 ÷ 15		4 X 6								8/13	8 X 10										

EXAMPLE

Figure C-1: Calculation Sheet, Storm Drain Design by Rational Method