Attachment IV-1

Sizing for Flow-Based Treatment Controls

Section B—Sizing Flow-Based Treatment Controls based on the California Stormwater BMP Handbook Flow Approach

This method uses the Rational Method equation to determine the design flow:

$$Q=CIA$$

Where:
Q = the design flow in cubic feet per second (cfs),
C = the drainage area runoff coefficient,
I = the design intensity (in/hr), and
A = the drainage area for the BMP (acres)

Step 1. Determine the drainage area for the BMP, A = _____ acres

Step 2 Determine the runoff coefficient, C = _____ from Table 3a or 3b

It is more accurate to compute an area-weighted "C-factor" based on the surfaces in the drainage area (Table 3a), if possible, than to assume a composite "C-factor" such as those in Table 3b, especially for small drainage areas.

Step 3. Determine from Figure 1 the mean annual precipitation (MAP_{site}) at the project site location: (see Section II. Step 4 for more explanation.)

MAP_{site} = _____inches

Step 4 Identify the reference rain gage closest to the project site from the following list and record the MAP_{gage}:

MAP_{gage} = _____inches

Reference Rain Gages	**Mean Annual Precipitation (MAP_{gage}) (in)**
San Jose Airport	13.9
Palo Alto	13.7
Gilroy	18.2
Morgan Hill	19.5

Step 5 Determine the rain gage correction factor for the precipitation at the site using the information from **Step 3** and **Step 4**.

Correction Factor = MAP_{site} /MAP_{gage} = (**Step 3**)/(**Step 4**)

Correction Factor = _____

Attachment IV-1

Sizing for Flow-Based Treatment Controls

Section B—California Stormwater BMP Handbook Flow Approach (continued)

Step 6 Select the design intensity, I, for the reference gage closest to the site from the following list:

I, Design Rainfall Intensity = _____ in/hour

Gages	85th Percentile Hourly Rainfall Intensity (in/hr)	Design Rainfall Intensity (I) (in/hr)
San Jose Airport	0.087	0.17
Palo Alto	0.096	0.19
Gilroy	0.11	0.21
Morgan Hill	0.12	0.24

The design intensity is twice the 85th percentile Hourly Rainfall Intensity.

Step 7. Determine the corrected design rainfall intensity (I) for the site:

Design intensity (site) = Correction factor * Design rainfall intensity for closest rain gage

Design intensity (site) = (**Step 5**) * (**Step 6**) = _____in/hr

Step 8. Determine the design flow (Q) using the Rational Method equation:

Q = C*I*A

Q = (**Step 2**) * (**Step 7**) * (**Step 1**)

Q = _____ acres-in/hr

Design Flow, Q = _____cfs[1].

[1] No conversion factor for correct units is needed for the rational formula because (1 acre-in/hr) * (43,560 sq.ft/acre) * (1ft/12 in) * (1hr/3600 sec) ≈ 1 ft^3/ sec or cfs.

Table 3a – Estimated Runoff Coefficients for Various Surfaces During Small Storms (CDM, 2003)

Surface	Runoff Coefficient (C Factor)
Concrete	0.80
Asphalt	0.70
Pervious Concrete	0.60
Cobbles	0.60
Pervious Asphalt	0.55
Natural Stone (without grout)	0.25
Turf Block	0.15
Brick (without grout)	0.13
Unit Pavers on Sand	0.10
Crushed Aggregate	0.10
Grass	0.10
Roofs (from WEF/ASCE, 1992)	0.75

Notes: The above C-factors were estimated by selecting the lower range of the best available C-factor for each paving surface. These C-factors are only appropriate for small storm treatment BMP design, and should not be used for flood control sizing. Where available, locally developed small storm C-factors for various surfaces should be used.

Table 3b – Estimated Composite Runoff Coefficients for Small Storms by Land Use (WEF/ASCE, 2003)

Description of Area		Runoff Coefficient (C Factor)
Business:	Neighborhood	0.50
	Downtown	0.70
Residential:	Single Family	0.30
	Multi-unit, detached	0.40
	Apartment	0.50
	Multi-unit, attached	0.60
Industrial:	Light	0.50
	Heavy	0.60
Parks, cemeteries		0.10
Playgrounds		0.20
Unimproved		0.10

Notes: The above C-factors were estimated by selecting the lower range of the runoff coefficients listed for various land uses in WEF/ASCE, 1992. Where available, locally developed small storm C-factors for various land uses should be applied.

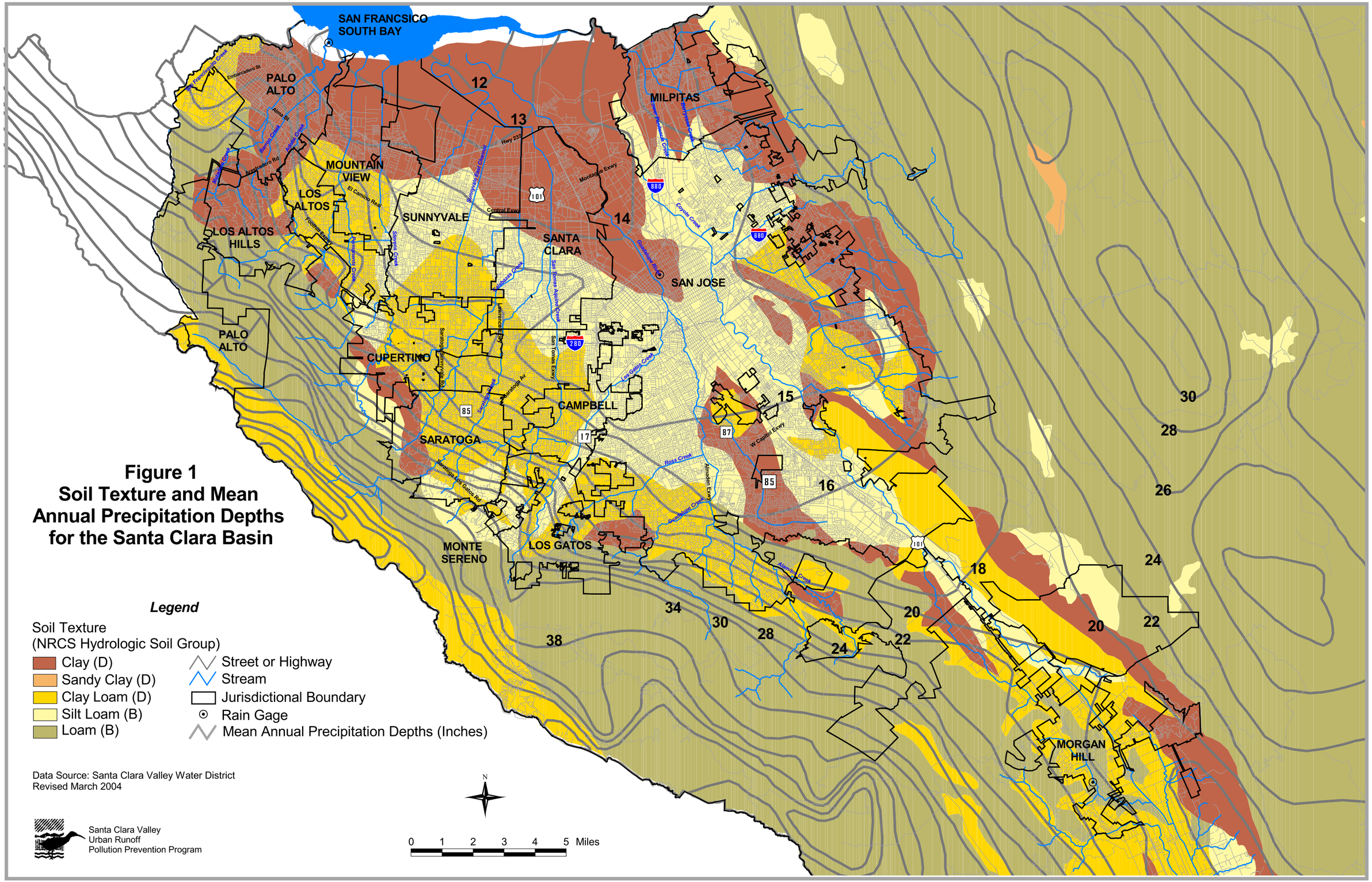

Figure 1
Soil Texture and Mean Annual Precipitation Depths for the Santa Clara Basin