

Town of Atherton

Drainage Criteria

- A. Standard Specifications**
- B. Storm Drain Design Standards**
 - 1. Project Documents**
 - 2. Hydrologic Criteria**
 - 3. Hydraulic Criteria**
- C. Additional Permit and Notification Requirements**
- D. Basement Construction Hydraulic Criteria**
- E. Criteria References**

Tables

Tables 1A – 1D	Precipitation Values
Table 2	Adjustment of Intensities with Mean Annual Precipitation

Appendix

Exhibit 1	Mean Annual Precipitation (MAP) Isohyetals
Exhibit 2	Groundwater Map
Attachment A	NPDES Permit Requirements Checklist
Attachment B	Operation and Maintenance Agreement

Town of Atherton Drainage Criteria

The following Manual of Standards for Storm Drainage supplements Chapter 8.50 and 8.54 of the Atherton Municipal Code (MC).

A. STANDARD SPECIFICATIONS

Storm drain facilities, manholes and appurtenances shall meet product and installation requirements listed in the current Caltrans Standard Specifications and Standard Plans, current APWA “Standard Plans for Public Works Construction” (commonly referred to as “The Green Book”) and associated Specifications. Standard details from Bay Area Cities and Agencies may be used with prior approval of the City Engineer.

B. STORM DRAIN DESIGN STANDARDS

1. PROJECT DOCUMENTS

- a) A Drainage Area Master Plan, Storm Water Management Plan and Storm Water Pollution Prevention Plan are to be submitted with all Improvement Plans. Exemptions to this requirement are listed in MC Chapter 8.54. The three plans each must be signed and stamped by a Professional Civil Engineer registered in the State of California.

- b) Drainage Area Master Plans shall include the following information:
 - 1) A scaled Engineering topographic map for the on-site drainage. The on-site drainage map shall document that either, (1) proposed improvements do not block subsurface or overland flow across the property, or, (2) appropriate drainage facilities are proposed to direct subsurface and overland flows around existing and proposed improvements.

 - 2) A second map of appropriate scale, preferably 1"= 100' scale, as necessary to show large offsite drainage basins.

3) Delineated and labeled project site plan showing all existing drainage basins, both before and after development. The boundaries of the site plan shall extend a minimum of 10 feet outside the property line, and to the centerline of all adjacent streets and channels.

4) The area in acres and the flow (Q) in cubic feet per second (cfs) of all drainage entering and leaving the site before and after development for the design storm event with associated calculations.

5) Drainage area and peak rate flows for all the drainage facilities for the design storm and 100-year storm. Hydrologic computations shall be provided that document flow rates.

6) Hydraulic computations for channel, structure and pipe sizing. Hydraulic gradients (for proposed structures or systems) shall be shown on a set of drainage plans.

7) A schedule for drainage improvements. For projects that construct greater than 5,000 square feet impervious area, stormwater detention facilities shall be in-place prior to construction of the impervious area. The schedule shall document that structures have required freeboard and that off-site flows are able to pass through the property without increasing off-site water levels through all phases of project construction.

8) For any project that will include excavation of soils, depth to groundwater shall be reported. For portions of the Town east of Alameda de las Pulgas, groundwater depth from either Plate 2 or from a site specific Geotechnical investigation may be used. For areas west of Alameda de las Pulgas, a Geotechnical investigation is required that includes depth to groundwater.

9) A Geotechnical Report or additional soils information may be required at the discretion of the City Engineer. The Geotechnical Report is required if percolation is included as a Treatment Measure or if the lowest point of

excavation is within 10 feet of the groundwater table. The Geotechnical Report shall include documentation of the soil percolation rate at the treatment measure location.

10. An Arborist Report shall be submitted in conjunction with the Storm Drain Report. The Storm Drain Report shall state measures proposed to comply with drainage recommendations contained within the Arborist Report.

c) Storm Water Management Plans shall include the following information:

1) A project description including graphics from the Drainage Area Master Plan.

2) The hydrologic setting of the site including flows from the Drainage Area Master Plan.

3) A listing of stormwater quality opportunities and constraints.

4) Best Management Practices for Source Control that would be implemented as a part of the project. A checklist shall be provided showing Town mandated source control measures. A description of supplemental source control measures shall be provided.

5) Best Management Practices for Treatment of site runoff that would be implemented as a part of the project. Calculations shall be included that document compliance with Regional Water Quality Control Board C.3 Permit with San Mateo County. The C.3 Stormwater Technical Guidance Manual can be acquired from San Mateo County Water Pollution Prevention Program (STOPPP) at www.flowstobay.org.

A Monitoring and Maintenance Program shall be provided that includes an agreement to be recorded in the County property roles stating that the property owner will maintain the Source Control and Treatment measures. The plan shall include monitoring and cleanout access points. The plan shall provide for the facility being operable for the life-time of the system.

- d) Storm Water Pollution Prevention Plans shall be provided prior to start of construction. Projects with less than 5,000 square feet of impervious area shall include the San Mateo County, Construction BMP Plan Sheet, currently found at: <http://www.flowstobay.org/pdfs/bmp/Construction%20Series/SWPPP.pdf>.

For projects with a development area greater than 5,000 square feet of impervious area, the Construction BMP Plan Sheet shall be supplemented with the following information:

- 1) A project description including graphics from the Drainage Area Master Plan.
- 2) The hydrologic setting of the site including flows from the Drainage Area Master Plan.
- 3) A listing of pollutants at the site during construction.
- 4) Best Management Practices for Source Control that will be implemented during construction.
- 5) Best Management Practices for Treatment of site runoff that will be implemented as a part of the project in compliance with both the San Mateo Countywide National Pollution Discharge Elimination System (NPDES) municipal stormwater permit CAS002992 1 and Waste Discharge Requirements (WDRS) for Discharge of Storm Water Runoff Associated with Construction Activity NPDES General Permit No. CAS000002 and with future amendments and revisions to these permits. Calculations shall be included that document that proposed construction and post-construction measures are in compliance with both of these permits.
- 6) A schedule stating dates or actions that trigger the need for source control and treatment measures.

7) If applicable based on the area of the project, the Notice of Intent and WDID Number for the project.

2. HYDROLOGIC CRITERIA

a) On-site structures, on-site drainage facilities and on-site bridges shall be designed to convey the peak design flows for the following storm return periods for the total tributary basin area with full build-out based on general plan land use and shall provide the following freeboard.

1) Drainage Systems 25-year event with at least 0.50 feet freeboard at lip of inlets.

2) Bridge Structures The abutment for the bridge shall be on the overbank at least five feet from the top of bank. At the abutment, there shall be at least 1 foot of freeboard to the lowest elevation on the bottom of the structure for the 100-year event or largest flood of record, whichever is greater. Alternatively, at least 1 foot of freeboard shall be provided above the higher of, (1) the top of bank of the Atherton Channel, and (2) the proposed overbank elevation 5 feet from the channel. If the top of bank/overbank elevation is used, the 1 foot freeboard shall be maintained between the top of bank and the abutment.

3) Buildings on Property Minimum Finished Floor Elevation at least one foot adjacent to Creeks above top of bank or 100 year flood elevation, if and Channels that is determined.

4) All Other Structures Project shall provide at least 1 foot freeboard to the minimum finished floor during a 100-year flood

based on a combination of overland flow and flow through the storm drain system. The Director of Public Works may allow the minimum finished floor elevation to be lower provided flood proofing is included that accommodates water levels up to one foot above the 100-year water level.

The level of protection may be required to be greater than the minimum cited above if, in the opinion of the Director of Public Works, project failure would cause potential loss of life and/or unreasonable economic loss.

- b) Documentation shall be provided that site improvements shall not increase water levels on upstream properties during the 2, 10, and 100-year storm events. Documentation shall show that runoff to the property and site runoff both have positive drainage across the site, and that runoff is directed away from on-lot structures.
- c) The Town requires stormwater detention for the purpose of reducing peak flows to downstream creeks and channels. Stormwater detention is required for projects that create or replace greater than 5,000 square feet impervious surface, with no credit given for existing impervious surface that is removed. Stormwater detention shall be based on storing 2-inches of rainfall over the proposed impervious area. The peak release rate shall be the 48-hour inflow volume over a 36 to 48-hour period. A higher rate of release is allowed if the calculated orifice size would be less than 1 inch diameter for a gravity release or less than that pumped by a 1/3 horsepower pumping unit, in which case, these minimum sizes are acceptable. Storage is required in all portions of the Town and within the Atherton Channel Drainage District. Detention basins may discharge to groundwater, gravity flow to the Town storm drain system, which includes gutter flow if no storm drain line is present, or be pumped to the Town storm drain system.
- d) Percolation from detention ponds is allowed only if a Geotechnical Report shows that there will be at least a 10-foot separation from the groundwater table and that

percolating water will not seep onto other properties. Raising the groundwater table by seepage is accepted. If the bottom of the storage basin is within 10 feet of the groundwater table or affects seepage to other properties, a low permeability barrier designed to mitigate the effects of the seepage is required. Infiltration devices shall be located at least 100 feet away from water supply wells.

If percolation is used, the Geotechnical Report shall verify that all soils to the groundwater level will percolate at the minimum rate recommended for design.

- e) Use of the Rational Method is satisfactory for small drainage areas (< 200 acres). Analyses for projects with drainage areas greater than 200 acres shall be based on Hydrograph Methods following procedures listed in either the current, at the time of permit application, (1) Santa Clara County Drainage Manual or (2) Bay Area Hydrographic Model.
- f) For areas less than 200 acres, use rational formula $Q=CIA$ to determine the peak flow rate. The rainfall intensity shall be calculated using the following equations:

$$I_{2\text{-year}} = 3.67 * K_2 / \text{Time of Concentration}^{0.50}$$
$$I_{10\text{-year}} = 6.18 * K_2 / \text{Time of Concentration}^{0.50}$$
$$I_{25\text{-year}} = 7.39 * K_2 / \text{Time of Concentration}^{0.50}$$
$$I_{100\text{-year}} = 9.61 * K_2 / \text{Time of Concentration}^{0.51}$$

Where K_2 is the correction factor for the Town of Atherton, which varies with Mean Annual Precipitation (MAP). Tables 1A, 1B, 1C, 1D and 2 present data used for the intensity-duration-frequency equation. Tables 1B lists the precipitation values for the San Francisco Bay Area modified for the Town of Atherton, 10-year event, with a Mean Annual Precipitation (MAP) of 18 inches. Exhibit 1 shows the MAP within Atherton. Table 2 is the adjustment in rainfall intensity with respect to different MAPs.

g) Runoff Coefficients shall be as follows:

"C" Factor (10-Year Event)	Description
0.30	Parks and Open Areas
0.50	Residential (R-1) Areas (predominate in Atherton)
0.70	Multiple Dwelling and Single-Family Attached Areas
0.90	Paved Areas
0.95	Roof Area

The 10-year Runoff Coefficients shall be multiplied by 1.1 for the 25-year event and by 1.25 for the 100-year event. The maximum runoff coefficient is 1.0.

(For combined paved and unpaved areas, a "weighted" C-factor shall be used, with a maximum C-coefficient of 1.0 used in the weighting equation.)

Runoff Coefficients for the Town of Atherton are assumed to be 0.5 for Residential suburban land uses. Specific exceptions are for schools, parks and other large land uses that are within the Town, and shall be calculated accordingly. The Runoff Coefficient of 0.5 was established by Nolte in the Town-wide Drainage Study dated June 28, 2001.

h) An initial time of concentration at the first catch point or concentration point of 5 minutes shall be used for steep (greater than 4:1 slope) and/or small (less than 100 feet to inlet) drainage areas and 10 minutes otherwise. The time of concentration shall be increased using the calculated flow time in pipe or drainage swale. For large drainage areas, the initial time of concentration is estimated from the equation below:

$$T_c = 10 + 0.0078 \left(\frac{L^{3/2}}{H^{1/2}} \right)^{0.77}$$

where: L = the maximum length of travel, in feet.

H = the difference in elevation along the effective slope line, in feet.

Tc = the time of concentration, in minutes.

i) Runoff to Adjoining Property

Runoff may flow to adjoining property so long as it meets all three of the following conditions:

- 1) The peak flow rate is consistent with the pre-development runoff pattern.
- 2) The portion of the flow associated with project development is detained in accordance with Town Requirements.
- 3) The flow is spread consistent with the pre-development release from the site.

Flow may be concentrated at a release point provided that an easement or written agreement is obtained from the downstream property owner. If an easement is not obtained, the peak flow rate and velocity at the property boundary shall be less than or equal to the pre-project condition peak flow and velocity for the 2, 10, 25 and 100-year storm events.

3. HYDRAULIC CRITERIA

a) Starting Water Level – Piped System

- 1) Discharge to a Creek or Channel – Where practical, the systems are analyzed using the peak 25-year water levels for Atherton Channel and Redwood Creek, whichever is applicable. In lieu of analyzing the 25-year water level in the Channel, a water level at the top of the channel bank may be used.
- 2) Discharge to (1) a Town Storm Drainage System, or (2) curb side system where a drainage system is not present – The on-lot drainage system shall be evaluated using a starting water level that is the 25-year water level in the downstream system. If approved by the City Engineer in advance, the 25-year water level in the off-site system may be determined using the following simplifying approaches:

- i. If discharging to a storm drain, a starting water level 1 foot below the rim elevation at the connection point may be used.
 - ii. If discharging to a roadside ditch, a starting water level 0.25 feet above edge of pavement may be used.
 - iii. If discharging through a curb drain to a gutter, a water level 0.5 feet above gutter flow line may be used.
- 3) Discharge to Storage Area – Storm drain systems sized to convey runoff to a storage facility shall be sized based on the storage facility being full at the peak of the storm event unless detailed hydrographic analyses are provided based on the methodology presented in the Santa Clara County Drainage Manual or Bay Area Hydrograph Model.
- b) The effect of debris, erosion, and channel bedload during flood flows shall be considered in the design of culverts and bridge structures.
- c) Where pump stations are used, discharge shall leave site as gravity flow with an air break provided, i.e., by a catch basin, that will: (a) protect the property by allowing the pumped flow to safely flow out if the gravity portion is clogged, and (b) readily indicate that the gravity portion of the system is clogged.
- d) All drainage facilities, including treatment devices, shall completely dewater within 96 hours of the end of a rainfall event. Pumping facilities may be required to assure that complete dewatering occurs within 96 hours.
- e) All drainage facilities draining into the channel or other drainage system that may cause backflow above the lowest rim in the drainage system during a 100-year storm event shall include a backflow prevention device. The top of bank may be used in-lieu of calculating a 100-year water level.

f) Hydraulic Analysis and Design

Storm drainage and flood protection systems must be sized so that design flows can be collected, conveyed, and safely discharged to receiving waters while meeting general drainage and freeboard requirements. Hydraulic analysis shall be conducted following current, at the time of permit application, Santa Clara County Drainage Manual guidelines. For drainage areas under 5 acres, overland flow depths may be calculated using Manning's Equation with normal depth. For drainage areas greater than 5 acres, a steady state, two dimensional flow model, such as the Army Corps of Engineers River Analysis System, HEC-RAS computer model shall be used.

C. Additional Permit and Notification Requirements

1. Every project shall provide the Town with a completed 'NPDES Permit Compliance Checklist' (Attachment "A"). The checklist shows the requirements needed in order to prevent stormwater pollution as part of the San Mateo Countywide Water Pollution Prevention Program (SMCWPPP).
2. Projects with a disturbed land area (graded, cleared, or otherwise impacted) over one acre will need to obtain a Notice of Intent (NOI) with the State Water Resources Control Board, and must prepare a Stormwater Pollution Prevention Plan (SWPPP) and Stormwater Management Plan.
3. Developers are required to sign an Operations and Maintenance Agreement for any new permanent control measures. The Operations and Maintenance Agreement shall be based on the Town's model Operations and Maintenance agreement (Attachment B).
4. San Mateo County Mosquito Abatement District shall be notified of location. See the County's Vector Control Plan for guidance on how to address potential mosquito breeding habitat.

D. Basement Construction Hydraulic Criteria

1. Basement construction shall not impact groundwater within the Town. If any portion of a building is constructed below the existing ground surface, measures shall be taken to not impede seepage or groundwater flows. Construction shall not release contaminants into the groundwater. Measures to maintain seepage and groundwater flow around the basement include placement of a subdrain consisting of drain rock and perforated pipe that allows passage of flows around subsurface structures. Measures to prevent contamination of groundwater include placement of protective barriers to prevent the release of construction materials into the groundwater.
2. Pumping of groundwater to the Town drainage system during construction is accepted for a period not to exceed two weeks. If pumping is required for more than two weeks, pumping shall be to injection wells or by other means, with the approval of the City Engineer. For purposes of this requirement, a Geotechnical Engineer shall certify a Historical High Groundwater Level. The Geotechnical Engineer shall incorporate the groundwater levels presented in Exhibit 2. Seepage water, direct rainfall and nuisance flows may be pumped from the site at any time, however, the pump intake may not be lower than the historical high groundwater elevation except for during the two week period of allowed groundwater pumping.
3. No groundwater pumping is acceptable after completion of construction. Seepage water, direct rainfall and nuisance flows may be pumped from the site at any time, however, the pump intake may not be lower than the historical high groundwater elevation.
4. Basement areas shall be hydraulically isolated from runoff that would occur during a 100-year storm event. Runoff includes Creek flows and overland flows from upstream drainage areas. Calculations shall show that there is at least 1 foot of freeboard protecting all entrances to the basement. The 100-year water level shall consider local overland flow, regional drainage and Creek water levels.

5. All basement access points including ventilation facilities, windows, doors, etc. must either be (1) at least one foot above the 100-year water level, or (2) protected by waterproof barriers that provide one foot protection above the 100-year water level.
6. Calculations shall be provided that document that the building can withstand loadings, including buoyancy, based on a water level at the 100-year overland flow water level.

E. Criteria References

1. The design of storm drainage facilities shall conform to standard accepted engineering practices. Common reference texts are:

"Handbook of Hydraulics," King & Brater

"Street and Highway Drainage," The Institute of Transportation, University of California

"Highway Design Manual," CalTrans

"Practices in Detention of Urban Stormwater Runoff, Special Report No. 43," American Public Works Association '

Suggested Criteria for Hydrologic Design of Storm Drainage Facilities in the San Francisco Bay Region, California, "United States Department of the Interior, Geological Survey

ASCE Manual of Engineering Practice No. 37

"Open-Channel Hydraulics," V.T. Chow

"HEC-1 Flood Hydrograph Package," U.S. Army Corps of Engineers

"HEC-2 Water Surface Profile Users Manual" U.S. Army Corps Engineers

"A Guide to Hydrologic Analysis Using SCS Methods," McCuen