

SECTION 5

DRAINAGE STUDIES & IMPROVEMENT PLANS

GENERAL

This first revision to the Drainage Management Plan (DMP) of the City of Palmdale establishes the Hydrologic and Hydraulic requirements for development within the City limits in accordance with revised procedures developed by the County of Los Angeles Department of Public Works and adopted by the City of Palmdale. This DMP constitutes a departure from the previous methodology used to perform hydrology calculations for predeveloped and post developed conditions of project sites. Engineers shall prepare Hydrology and Hydraulic Studies in accordance with this plan.

PROCEDURES

1. It is the policy of the City of Palmdale that each development consisting of five (5) acres or greater (lot acreage plus adjoining half street widths) in size shall mitigate for on-site storm runoff as required by drainage law. In addition, nuisance flows generated on-site shall be mitigated in every development regardless of size.
2. Peak flow mitigation shall be accomplished by utilizing detention, extended detention (ED), or retention basin. Other methods of peak runoff attenuation will be considered on a case-by-case basis. A detention basin shall be required if the outlet of the new system discharges to a main line storm drain. An ED basin is required if the new system will be discharging to surface street. A retention basin may be required if the project has no surface route to outlet flows provided that the soil is capable of percolating dry in 7 days and the basin shall have storage capacity to contain flows generated by a Capital Flood.
3. If an acceptable surface route such as a street is present or to be constructed, the ED basin shall be designed for 25-year storm event and equipped with a duplex pump system capable of discharging a maximum "Q" no greater than the gutter line capacity of the street, not to exceed 85% of pre-developed rainfall excess.
4. In areas where the water table is greater than 50 feet in depth from the ground surface, drywells may be utilized to mitigate for nuisance water runoff subject to an investigation and recommendations of a qualified Soils Engineer. Drywells are not allowed if the distance between the settling basin invert and the water table is or will be less than 10 feet.
5. A filtration device meeting the requirements of NPDES Phase II will be required for all drywells located within half a mile from Amargosa Creek and or Anaverde Creek. A filtration device meeting the requirements of NPDES Phase II permit will be required for developments discharging directly to Amargosa or Anaverde Creek.
6. Drywells may be allowed in the detention or ED basin if the basin can be drained within 24 hours given City policy discharge limitations.
 - 6.1. Nonstructural flood protection measures (flood plain management regulations or flood control works) will be used within the Little Rock Creek and Big Rock

Creek Watersheds as well as at upstream portions of all watersheds including Portal Ridge, Amargosa, Anaverde, Pearland, Little Rock and Big Rock drainage areas.

- 6.2. For those areas identified within Special Flood Hazard Zones as shown on current Flood Insurance Rate Maps (FIRM) published by FEMA, or other identified flood plain management areas, development within the floodway (see 'floodway' definition) as determined based on the capital flood will not be allowed. Development within the floodplain but outside of the floodway will be allowed, as provided by Federal Regulations, at the current general plan land use designations.

HYDROLOGIC PROTECTION LEVELS

1. Capital Flood Protection shall be based on runoff resulting from a rainfall with a probability of occurrence of once in 50 years. The following shall be designed for the Capital Flood:
 - 1.1. All regional facilities as described in the City of Palmdale Drainage Master Plan or as modified by the City Engineer.
 - 1.2. Natural Watercourses
 - 1.3. Open channels, closed conduits, bridges, dams, detention basins and debris basins, which are constructed in or intercept flow from natural watercourses.
 - 1.4. Floodways.
 - 1.5. Natural depressions or sumps. A secondary overflow or spillway will be provided for all sump areas.
 - 1.6. Culverts under arterial highways, except interim low flow culverts constructed for the purpose of eliminating cross gutters.
 - 1.7. The lowest finish floor elevation of all habitable structures shall be a minimum of one foot above the maximum water level resulting from a Capital Flood.
2. 25-Year and 10-Year Storm Event designations
 - 2.1. All master plan and local drainage facilities will generally be designed so that:
 - 2.2. The peak runoff from a 25-year storm will be contained within the street right-of-way (ROW) (see Figure 5-1).
 - 2.3. The peak runoff from a 10-year storm will be contained within the street curbs (see Figure 5-2).
 - 2.4. For undivided major and secondary streets or highways, one ten (10) foot lane in the center will be clear of water for a 10-year storm. For divided highways, one ten (10) foot lane in each direction will be clear of water for the peak runoff from a 10-year storm at ultimate development conditions (see Figure 5-3). Subdivisions adjacent to highways with pre-existing flooding will be considered on a case-by-case basis.

- 2.5. If a storm drain is required in order to meet any of the three conditions listed above, it shall be designed for a minimum capacity of the peak flow from a 10-year storm. If a facility identified in the Master Plan of Drainage is proposed through the project, the developer may be required to construct the facility.

HYDROLOGIC DESIGN STANDARDS AND PROCEDURES

1. The design of all master plan and local facilities will be in accordance with the following standards and procedures:
2. Hydrologic calculations will be performed in accordance with the Los Angeles County Department of Public Works Hydrologic Method Addendum to the 1991 Hydrology/Sedimentation Manual.
3. Soil Classification shall be based on most current soil classification studies or Figure 5-5 for all watersheds with the exception of Anaverde Watershed upstream of the Palmdale Boulevard (SR 138) where Figure 5-6 and 5-7 applies.
4. Design frequencies will be as described under "Hydrologic Protection Levels".
5. Where applicable the design shall include provisions for future extension of the drainage system to serve the entire drainage basin.

Required submittals - Improvement Plan Stage

1. Pre-developed and Developed Condition Hydrology maps on an English scale of 1 in = 500 ft or 1 in = 200 ft showing the entire drainage area tributary to a point of concentration which can be a master plan drainage facility, a regional drainage facility, or street. It will show the entire tributary area with contours/elevations, drainage area sizes in acres, catch basins, lateral pipes, mainline pipes, and the pertinent discharge data. Appropriate soil classifications and land use information will also be submitted.
2. Grading plan of the site.
3. Hydrology calculations shall show points of concentration, area (sub-areas and cumulative area), soil type, time of concentration, isohyetal map showing rainfall contour, percent impervious, sub area runoff, total runoff, conveyance facility size, length, slope, flow line used in the calculations and other characteristics. Additionally, detention, or retention basin design calculations shall be submitted.
4. Hydrology Study will be stamped and signed by a Registered Civil Engineer. Two copies of the above will be submitted in the form of a report stating the objective, methodology, analysis, conclusion and all pertinent input and output files in F0601, Basin Routing, and all hydraulic calculations.

Required submittals. - Tentative Map Stage prior to review by the Development Advisory Board (DAB)

1. A preliminary drainage study shall be submitted to the City at the time of Tentative Map submittal. The submittal shall be in the form of a report, including drainage maps.

2. At this stage, runoff peak discharge rates should be calculated as stated above and revised as needed during development stage. For the preliminary submittal only, basin volumes may be assumed as one acre foot for each 10 acres of single-family residential land use and 1 acre-foot for each 5 acres of multi-family residential, commercial and industrial land uses.
3. The requirements for this stage may result in facilities sized smaller than those based on detailed hydrologic studies as described herein. Approval of a Tentative Map based on the requirements stated herein will in no way represent approval of the final drainage design. The final drainage facilities will be designed based on the proposed development per the requirements shown herein.

HYDRAULIC STANDARDS AND PROCEDURES

1. General Hydraulic Criteria

- 1.1. Hydraulic calculations will be in accordance with "Los Angeles County Flood Control District Design Manual, Hydraulic", latest edition. Substitute City Engineer where the manual calls for the District's Design Division.
- 1.2. Closed conduits - may be designed as flowing full and may be allowed to flow under pressure if the hydraulic grade line is sufficiently below the street surface to intercept catch basin flows with a minimum of 0.5 ft. freeboard in the catch basin below the gutter flow line.
- 1.3. In any street or highway, the depth of water at curb times the velocity shall not exceed six. When this condition cannot be met, catch basins will be required to intercept the flow.
- 1.4. Where debris may be expected, the design flows will be increased by an appropriate bulking factor.
- 1.5. All closed conduit designed to flow under pressure, including connector conduit from catch basins to main line storm drains, shall be constructed with watertight gasket-type joints per section 306 of the Standard Specifications for Public Works Construction published by the American Public Works Association (APWA).

2. Design Requirements for Manholes

- 2.1. Spacing - Manholes shall be located at beginning or ending of curves, pipe size changes, angle points, junctions and as required for maintenance.
- 2.2. Conduit diameter 30 inches or smaller, manholes shall be spaced at intervals of approximately 300 feet. Where the proposed pipe is less than 30 inches in diameter and the horizontal alignment has numerous bends or angle points, the manhole spacing shall be reduced to approximately 200 feet.
- 2.3. Pipe diameter larger than 30" but smaller than 45", manholes shall be spaced at intervals of approximately 400 feet.

- 2.4. Pipe diameter 45" or larger: manholes shall be spaced at intervals of approximately 500 feet.
- 2.5. The spacing requirements shown above apply regardless of design velocities. Deviation from the above criteria shall be subject to City Engineer's approval.
- 2.6. Location – manholes shall not be located in street intersections where possible, especially when one or more streets are heavily traveled. In situations where the proposed pipe is to be aligned both in easement and in the street right-of-way, manholes shall be located in street right-of-way, wherever possible. Manholes shall be located as close to changes in grade as feasible when the following conditions exist:
 - 2.6.1. The upstream pipe has a steeper slope than the downstream conduit and the change in grade is greater than 10 percent of the upstream slope. Sediment tends to deposit at the point where the change in grade occurs.
 - 2.6.2. Transitioning to a smaller downstream pipe due to an abruptly steeper slope downstream. Smaller downstream pipe shall not be allowed except extreme downstream conditions require the use of smaller pipe. This is subject to approval of the City Engineer. In cases where the flow is discontinuous, as in flows passing through a basin, this requirement does not apply.
- 2.7. Design – When the design flow in a pipe flowing full has a velocity of 20 fps or greater, or is supercritical in a pipe flowing half full, the total horizontal angle of divergence or convergence between the walls of the manhole and its center line shall not exceed 5 degrees 45 minutes.
- 2.8. Pressure Manholes – Pressure manholes shall not be allowed. Exceptions may be made on a case-by-case basis with written approval of the City Engineer.
- 2.9. Deep Manholes - A manhole shaft safety ledge shall be provided in all instances when the manhole shaft is 20 feet or greater in depth. Installation shall be in accordance with Los Angeles County Flood Control District Std. Dwg. 2-D430 or APWA Std. 330-1.
3. Inlets into Main Line Drains - Lateral pipe entering a main line pipe storm drain generally shall be connected radially. Lateral pipe entering a main line box structure shall conform to the following:
 - 3.1. Invert of lateral pipe 24 inches or less in diameter shall be no more than five feet above the invert.
 - 3.2. Invert of lateral pipe 27 inches or larger in diameter shall be no more than 18 inches above the invert, with the exception that catch basin connector pipe less than 50 feet in length may be no more than five feet above the invert.
4. Minimum Pipe Size - Mainline shall be 24 inches and catch basin connector pipe shall be 18 inches. In cases where the pipe may carry significant amounts of debris, the minimum diameter of main line pipe shall be 36 inches.

5. Minimum Slope - The minimum slope for main line pipe shall be .001 (.10 percent) unless otherwise approved by the City Engineer. Pipe design shall allow for sufficient velocity to prevent silting. For debris carrying storm drains, the minimum pipe slope shall be 0.03 (3 percent). If the surface grade is less than 3 percent, a debris basin will be required upstream of the area which does not meet this criteria.
6. Inlet Structures - An inlet structure shall be provided for storm drains originating in natural channels. The structure shall generally consist of a headwall, wing walls to protect the adjacent banks from erosion, and a paved inlet apron with a minimum 4 feet deep cutoff wall. The apron slope should be limited to a maximum of 2:1. Wall heights should conform to the height of the water with one foot of freeboard upstream of the inlet, and be adequate to protect both the fill over the drain and the embankments. Headwall and wing wall fencing and protection barrier or trash rack shall be provided to prevent public entry. The trash rack should be used for inlets 48-inches (diameter or width) and smaller. For inlets larger than 48- inches a special designed trash rack may be required.
7. If debris is prevalent, barriers consisting of vertical 3-inch or 4-inch diameter steel pipe spaced at 1/3 the main line diameter or width to a maximum of 30 inches on centers should be embedded in concrete immediately upstream of the inlet apron.
8. Outlet Structures – When a storm drain outlets into a natural channel, an outlet structure shall be provided which prevents erosion and property damage. This outlet structure shall be designed with a cutoff wall having a minimum depth of 3 feet. Velocity and direction of flow at the outlet should agree as closely as possible with the existing channel velocity. Fencing and protection barrier shall be provided.
9. When the discharge velocity is low, or sub-critical, the outlet structure shall consist of a headwall, wing walls, and an apron. The apron may consist of a concrete slab, or grouted rip-rap with a minimum of 3 foot deep cutoff wall.
10. When the discharge velocity is high, or supercritical, the designer shall provide for bank protection around the outlet and an energy dissipator.
11. Protection Barriers and Trash Racks - A protection barrier is a means of preventing access to storm drains. Protection barriers may consist of large, heavy breakaway gates, single horizontal bars across catch basin openings, or chain link fencing around an inlet of an exposed outlet. Protection barriers shall be provided wherever necessary to prevent unauthorized access to storm drains. Trash racks are normally used for 48" or smaller conduits. It shall be the designer's responsibility to provide for a protection barrier or trash rack, or both, appropriate for each situation.
12. Debris Barriers – A debris barrier or deflector is a means of preventing large debris, such as tree limbs, logs, boulders, and refuse, from entering a storm drain and plugging the conduit. The debris barrier should have openings wide enough to allow as much small debris as possible to pass through and yet narrow enough to protect the smallest conduit in the system downstream of the barrier. It shall be the designer's responsibility to provide a debris barrier or deflector appropriate for each situation.

13. Other Closed Conduit Criteria

13.1. Angle of Confluence – In general, the angle of confluence between main line and lateral shall not exceed 45 degrees, and as an additional requirement, shall not exceed 30 degrees under any of the following conditions:

13.1.1. Where the flow (Q) in the proposed lateral exceed 10 percent of the main line flow.

13.1.2. Where the velocity of flow in the proposed lateral is 20 fps or greater.

13.1.3. Where the size of the proposed lateral is 60 inches or greater.

13.1.4. Where hydraulic calculations indicate excessive head losses may occur in the main line due to the confluence.

14. Connector pipe (not lateral pipe) may be joined to main line pipe at angles greater than 30 degrees up to a maximum of 90 degrees provided none of the above conditions exist. Connections shall not be made to main line pipe, which may create conditions of adverse flow in the connector pipes.

15. The velocity in pipe shall not exceed 40 fps. For velocities from 20-30 fps, the minimum cover over steel in the pipe shall be 1/2 inch greater than the normal cover (1-1/2 inch minimum). For velocities from 30-40 fps, the minimum cover over the steel in the pipe shall be 1 inch greater than the normal cover (2 inch minimum).

16. Open Channels – Open channels will be designed in accordance with “Los Angeles County Flood Control District Design Manual, Hydraulic” dated March 1982 or latest edition. Amargosa Creek and Anaverde Creek channels will be designed with soft bottom except where alignment through development necessitates reinforced box culverts. Design Q will be based on Master Plan of Drainage update of 1996 or latest revision. Other agencies such as California Department of Fish and Game (CDFG), and Lahontan Regional Water Quality Control Board (LRWQCB) have requirements that must be satisfied by developments bordering these creeks. Builders shall coordinate with the City and these other agencies to comply with habitat mitigation, hydraulic, and water quality requirements for channelization. Channelization is required to contain floodwaters in the floodway and the floodplain. Builder must submit and obtain a Conditional Letter of Map Revision (CLOMR) to FEMA that will remove the development from the floodplain. The Builder shall obtain a Letter of Map Revision (LOMR) from FEMA prior to requesting City for Certificate of Occupancy.

Required Submittals

1. Plan and profile of the drainage system including all catch basin and connectors with hydraulic data. Main line called out as LINE “A”, other connectors or lateral lines called out in letters of descending order.
2. Plot of hydraulic grade line on all profiles.
3. Catch basin calculations (sizing and water surface elevation).

4. Hydraulic grade line calculations for all lines. See Hydraulic Manual for proper determination of control.

PEAK FLOW REDUCTION FACILITIES

Peak flow reduction facilities will consist of ultimate facilities identified in the Master Plan of Drainage Update dated August 1996 and interim facilities, which will accommodate development before the ultimate facilities are in place. Peak flow reduction facilities may include retention basins, flow-by or flow through detention basins, extended detention basins. Retarding basins are no longer allowed.

Where the upstream watershed is undeveloped, the basins will be sized to accommodate undeveloped condition flows from the upstream tributary area and developed condition flows from the development itself.

Where the upstream watershed is developed, the method of handling the flows from the upstream tributary area will be determined based on the existing conditions with consideration of the Master Plan of Drainage and Comprehensive Plan facilities.

1. Retention Basins

Mitigation for a development with no surface outlet route requires a retention basin with storage capacity for a 50-year storm event (sump condition).

2. Extended Detention Basins

Mitigation facility for a development with surface street outlet route requires an ED basin with storage capacity designed for a 25-year storm and a wet-well with duplex hydraulic pump system meeting the following principal requirements:

- 2.1. Minimum discharge diameter shall be 3 inches able to pass 2 ½ inches solids. Maximum outflow will be limited to gutter capacity of the street.
- 2.2. Submersible electrically operated centrifugal pumps.
- 2.3. Disconnect system permits installation and removal without entering wet well.
- 2.4. Operates in a Class I, Group D, Division I location as defined in Section 501-8 of National Electric Code (NEC). Systems that require auxiliary components such as constant submergence, electrical interlocks, or wet well ventilation to operate in stated condition above are not acceptable.
- 2.5. Capacity in GPM, TDH, Speed, voltage, and HP as required by design engineer.
- 2.6. Impeller shall be trimmed to meet specified system flow and head conditions. Oversized impellers designed for greater pumping capacity than required are not acceptable.
- 2.7. Determine required storage by routing inflow hydrograph obtained for developed condition in a given storm event.
- 2.8. Proper non-erosive emergency spillways directing flow away from private properties shall be provided.

3. Detention Basins

Detention basins will be allowed only if the outlet will connect to a storm drainage facility or discharge directly to Amargosa or Anaverde Creek. Detention basins shall be designed such that no more than 85 percent of the predeveloped peak flow rates for the 2, 5, 10, 25, 50-year storm will discharge downstream. All conveyances, which outfalls or discharges to Amargosa or Anaverde Creek must be filtered in accordance with NPDES Phase II - Lahontan Regional Water Quality Control Board requirements.

Use the following multiplication factors with the 50-year 24-hour rainfall isohyetal maps developed for the hydrology manual addendum to determine the appropriate rainfall for the given frequency:

1-year 24-hour	0.283
2-year 24-hour	0.387
5-year 24-hour	0.584
10-year 24-hour	0.714
25-year 24-hour	0.878
50-year 24-hour	1.000
100-year 24-hour	1.122
500-year 24-hour	1.402

- 3.1. Use soil class A03 for F0601 simulations to determine “Q” and hydrograph volume for “first flush”.
- 3.2. Required Retention, Extended Detention and Detention Basin Characteristics and Features
- 3.3. A spillway or an overflow structure will be provided to discharge 125 percent of 25-year storm runoff without flooding upstream development. Basin outflow shall not be allowed to run uncontrolled over a pedestrian facility or sidewalk. This does not apply to emergency overflow provisions.
- 3.4. Entrance facilities shall be designed for the 25-year storm developed conditions except for sump conditions in which case the design will be for the 50-year storm developed condition.
- 3.5. Nuisance Water shall not be introduced into retention or a detention basin except as stated previously. A ribbon gutter or bypass flow device shall be installed in the basin to ensure that any nuisance water, which bypasses drywells, will also bypass detention and retention basins. Development must mitigate all nuisance water generated on site.

- 3.6. All detention basins shall incorporate a gravity drain of sufficient size or capacity to drain the detention basin dry given the allowed discharge of 85 percent of pre-developed peak flow.
- 3.7. All weirs, orifices, spillways, under drains, and other control or design features which are subject to malfunction due to collection of trash or debris shall be protected and the design of such features shall be clearly and adequately shown on the grading or storm drain plans.
- 3.8. Interim mitigating basins will be constructed as close to the Master Plan facilities as possible so that they can be eliminated in the future upon completion of the ultimate facilities.
- 3.9. A one-foot (12 inches) minimum freeboard will be required in mitigating basins. Determine maximum water surface elevation from basin routing; add 12 inches to that elevation to establish the emergency spillway elevation.
- 3.10. Basin side slopes shall be 2 hor to 1 ver (50 percent) if basin will not function dually as a park, otherwise all side slopes shall be 5 hor to 1 ver (20 percent) or flatter.
- 3.11. Retention, ED, and detention basin designs will incorporate a 15-foot wide all weather drive access road to the basin floor to facilitate maintenance. The slope of the access road shall be 15 percent or flatter. Proper turning radius or a hammerhead shall be provided. The paved section shall be 12 feet wide and shall have a structural section of 3-inch AC over 4-inch aggregate base compacted to 95% or 5-inch PCC over aggregate base.
- 3.12. For flow-by detention basins, a reinforced concrete low flow channel shall be provided from basin inlet(s) to basin outlet.
- 3.13. For retention basins an approved energy dissipator shall be provided at the basin's inlet to preclude erosion. In addition, those basins which incorporate retention storage, shall have a bypass flow device to carry nuisance water around and out of the basins should upstream drywells fail.
- 3.14. All basins shall be fenced with a 6-foot high fence or wall approved by the City Planning Department. Access to the basins shall be gated (15 ft. minimum width, double-leaf) and locked.
- 3.15. All storm mitigation basins shall be operational prior to issuance of the first Certificate of Occupancy.

NUISANCE WATER MANAGEMENT

1. Nuisance Water Flow Generation

- 1.1. The design generation rate for nuisance water in single-family residential areas is 160 gal/household/day including a safety and longevity factor of 4.0. For calculations involving nuisance water, flows generated by applying this rate to the number of households upstream shall not be additive with offsite flows. Flow

generated by sub drains, or from any other anticipated sources onsite shall be provided for.

- 1.2. Nuisance water generation rates for multi-family, commercial and industrial areas will be determined on a case-by-case basis.
- 1.3. Nuisance water shall be intercepted and disposed of whenever design flow depth in the gutter exceeds 3/4 inch or 6.6 gpm, whichever is less. Flow depth shall be calculated using Manning's Equation with $n=0.014$ (same as cast-in-place concrete). Nuisance water inlets shall be sited to provide maximum utility and to minimize flows to cross gutters and detention basins. Nuisance water generated on-site will not be allowed to flow off-site as surface flow. Near and far side inlets may be combined to flow to a single dry-well disposal device.
- 1.4. For infill developments, all parcels one (1) acre or larger in size will be responsible for mitigation of flow generated by such development.

2. Drywell Guidelines

- 2.1. The City of Palmdale permits the use of drywells to dispose of nuisance water where such drywells have been designed and constructed according to the guidelines of this policy. Disposal capabilities of drywells shall not be considered in reducing the storage or detention volume necessary for detention or retention basins.
- 2.2. Toxic wastes will not be disposed of in nuisance water drywells. In some cases, the City Engineer may require separators or other treatment devices.

3. Drywell Design and Construction

- 3.1. The standard drywell is the Maxwell Plus System (see Engineering Std. D1.2) or equal. The standard drywell system shall include an interceptor well upstream of the drywell(s).
- 3.2. Drywells will be offset a nominal distance of 20 feet from any surface inlet. When a drywell is constructed in conjunction with a surface inlet, the diameter of the connecting pipe from the interceptor well to the drywell shall be a maximum of 4 inches.
- 3.3. Drywells constructed in a landscaped area shall have a rim elevation 2.0 inches above the finished elevation. Design of drywells in detention basins will not be allowed nor designed for storm water disposal.
- 3.4. Drywells will remain sealed until all paving or landscaping is completed (or until new grass is stable) to prevent unnecessary sediment from being deposited in the drywell.
- 3.5. Drywells will have a minimum settling chamber depth of 25 feet plus 10 feet of penetration with a large 4-foot diameter hole into the permeable clay-free, sand, gravel, and cobbles, 30-inch bolt down cast-iron ring and grate/cover. Settling chamber depth may be varied, subject to the approval of the City Engineer. Drywells will be spaced a minimum of 75 feet center to center.

3.6. The minimum distance between a drywell and water well shall be 300 feet.

3.7. Drywell design shall be in accordance with City of Palmdale Std. No. D-1.2

3.8. Drywell Performance and Inspection

3.8.1. A Soils Engineer or an Engineering Geologist shall perform percolation tests on each drywell installed to verify its capability to dispose of the anticipated inflows.

3.8.2. The consultant will determine the approximate number of drywells at the design stage of the tract based on estimates by the Soils Engineer substantiated by an adequate number of percolation tests. The proposed drywells shall be shown on the grading plan. Drywells may not be allowed in areas where known percolation problems exist. For such areas, percolation tests may be required at all proposed drywell locations at the Tentative Map feasibility stage. The consultant shall determine the final number of drywells after percolation tests is completed by the Soils Engineer or Engineering.

3.9. The Public Works Department Engineering Inspectors shall inspect each well site prior to placement of the concrete liner, filter rock backfill and drainage components.

3.10. The field-testing for the completed drywells shall be monitored and reported by a Soils Engineer or Engineering Geologist. A copy of this report must be submitted to the City Engineer for approval certifying that the system meets its requirements prior to the release of bonds for the development served by the drywell.

3.11. Testing shall be done as follows:

3.11.1. Disposal systems will be presaturated for at least 24 hours in advance of testing by filling with water to the top rim elevation allowing any trapped air to escape.

3.11.2. Sidewalls will be cleaned of any clay or silt prior to testing.

3.11.3. After the 24-hour presaturation period has passed the system will be again filled with water. As the water level drops, the time of water level change at ten (10) percent intervals of the well chamber depth will be recorded.

3.11.4. The capacity of the system shall be calculated using the following formula:

$$C_s = (10771 \times A \times \Delta h) / \Delta t$$

Where:

C_s = Capacity of the system (gpd)

A = Horizontal cross-sectional area (sf)

Delta h = Vertical drop (ft) of water level during the test of the well

Delta t = Time (minutes) for water level to drop h

3.12. Location Near Water Wells and Saturated Zones - Dry wells may not be constructed closer than 300 feet to a water well, and may not be deeper than 10 feet above any saturated zone.

3.13. Statement Appearing on all Plans Involving Drywells

"All drywells shown on this project shall be maintained by the owners where their locations are on private property or through the creation of a Landscape Assessment District when approved by the City. Drywells will be replaced by the owners when they cease to drain standing surface water in a 24 hour period or are deemed to be obsolete by the City. Regular maintenance of the drywell settling chamber is required to achieve proper operation of the drywell and shall be performed annually or more often depending upon its location and shall be performed by the owner or district as applicable".

3.14. Impermeable/Low Permeability Soils

3.14.1. Where subsurface conditions are such that drywells cannot be expected to perform to the minimum standards established herein, alternative disposal methods will be considered by the City. The location of suitable sites for disposal, even if off-site, is required. The effectiveness of the off site disposal areas must be demonstrated.

3.14.2. The Soils Engineer shall provide a seal depth for the drywells. That seal depth shall be determined by laboratory tests to determine the depth of potential hydro collapsible soils.

DEFINITIONS

1. Natural Watercourses. A natural watercourse is a path along which water flows as a result of natural topographic features. Furthermore, for the purposes of this plan, a natural watercourse drains a watershed greater than 100 acres and also meets one or more of the following conditions during a 50-year storm event:

1.1. Will have flow velocity greater than 5 fps

1.2. Will have flow depths greater than 1.5 feet

1.3. The water surface elevations is within a foot of the lowest floor elevation of adjacent habitable structure, if such water surface elevations would result from construction of facilities designed with less than a 50-year storm.

- 1.4. If it is desirable to develop adjacent to a natural creek and leave the creek undisturbed, the following shall be the minimum requirements:
2. **Setbacks:** Setbacks shall be determined by providing a HecRas model of the existing condition and contours of the creek, 50-year design flows (Q design) per the Master Plan of Drainage Update of 1996 or latest revision, and river stations every 50 feet or better. The model should clearly show matching upstream and downstream creek conditions. The boundary of the high waters created shall be submitted and be satisfactory to the City and California Department of Fish and Game (CDFG) and will define the boundary of the creek. The setback from that boundary shall be determined by projecting an additional ten (10) feet horizontally and from that point a slope of 2: 1 until natural ground is intercepted.
3. **Flood area:** The area described in the preceding paragraph, including the area for setback, shall be designated as a "FLOOD AREA" on the map.
4. **Irrevocable offer of dedication:** The developer shall provide an irrevocable offer of dedication for drainage purposes to the City for the land designated as a flood area.
5. **Depression or Sump.** A depression or sump is an area for which there is no surface route to outlet flows. Furthermore, for the purposes of the plan, a depression or sump also meets one or more of the following conditions:
 - 5.1. Would have a ponded water surface elevation, during a Capital Flood, within one foot of the finished floor elevation of adjacent habitable structures, if such elevation would result from construction of facilities with less than a Capital Flood capacity. This condition does not apply if there is a surface route for outflow such that the ponded water surface cannot reach the finished floor elevation of adjacent structures during a Capital Flood.
 - 5.2. In a roadway, would have a ponded water surface elevation higher than the elevation of the public right of way line if facilities with less than a Capital Flood capacity were constructed. This condition applies to flows, which reach the roadway upstream of the sump and are conveyed to the sump by the roadway.
 - 5.3. Has a ponded depth of three feet or greater,
 - 5.4. An exception is made for fenced or walled detention or retention basins.
6. **Extended detention (ED).** Extended detention basins are depressed basins that temporarily store a portion of stormwater runoff following a storm event. Water is controlled by means of a hydraulic control structure (wet well and duplex pumps) to restrict outlet discharge. The ED basins and detention basins normally do not have a permanent water pool between storm events. The objectives of both systems are to remove particulate pollutants and to reduce maximum runoff values associated with development to less than their predevelopment levels. Detention basin facilities may be berm-encased areas or excavated basins.
7. **Floodway.** The floodway is the channel of a stream plus any adjacent floodplain areas, which must be kept free of encroachment so that the 50-year storm runoff

can be carried without substantial increases in flood heights. Such increase in height will not exceed one (1) foot.

8. The floodway, as defined in this Plan, does not correspond to the floodways defined in FEMA maps.

HYDROLOGY CHECK LIST

1. Pre-developed or Existing Condition Hydrology Map
 - 1.1. Scale 1" = 500' or 200'
 - 1.2. Entire drainage basin shown in relation to a City of Palmdale drainage facility
 - 1.3. Contours/elevation to define drainage area
 - 1.4. Existing land use
 - 1.5. F0601 nodes labeled and consistent with F0601 simulation
 - 1.6. Existing storm drain system
 - 1.7. Pertinent discharge data
 - 1.8. Storm drain facilities clearly shown.
 - 1.9. Pertinent discharge data.
 - 1.10. Flow lines used in calculations.
 - 1.11. Basin location and type of basin noted, basin surface area, and basin storage in AF.
 - 1.12. Emergency spillway.
2. Developed Condition Hydrology Map
 - 2.1. All of the above items, plus
 - 2.2. Proposed road system clearly shown.
 - 2.3. Street grades noted.
 - 2.4. Typical street sections.
3. Hydrology Calculations
 - 3.1. Sealed and signed by RCE with expiration date noted.
 - 3.2. Time of concentration (Tc) calculations.
 - 3.3. Predevelopment peak discharge and hydrograph at on-site outfall(s) for 2-, 5-, 10-, and 25-year storms (plus 50-year as required) for on-site and any off-site upstream sub areas traversing project site as shown on the Master Plan of Drainage tributary map).

3.4. Post development peak discharge and hydrograph at on-site outfall(s) for 2-, 5-, 10- and 25-year storms (plus 50-year as required) for on-site and any off-site upstream sub areas traversing project site as shown on the Master Plan of Drainage tributary map).

4. Hydraulic Calculation

4.1. Basin routing for multiple storms.

4.2. Ten-year storm water runoff contained within curb to curb.

4.3. Twenty-five year storm water runoff contained within ROW.

4.4. Lowest floor of habitable structure is at least one foot above 50-year water surface.

4.5. Basin overflow spillway calculations.

4.6. Catch basin sizing.

4.7. Outlet Works outflow rating and calculations.

4.8. If applicable, sediment/debris basin storage.

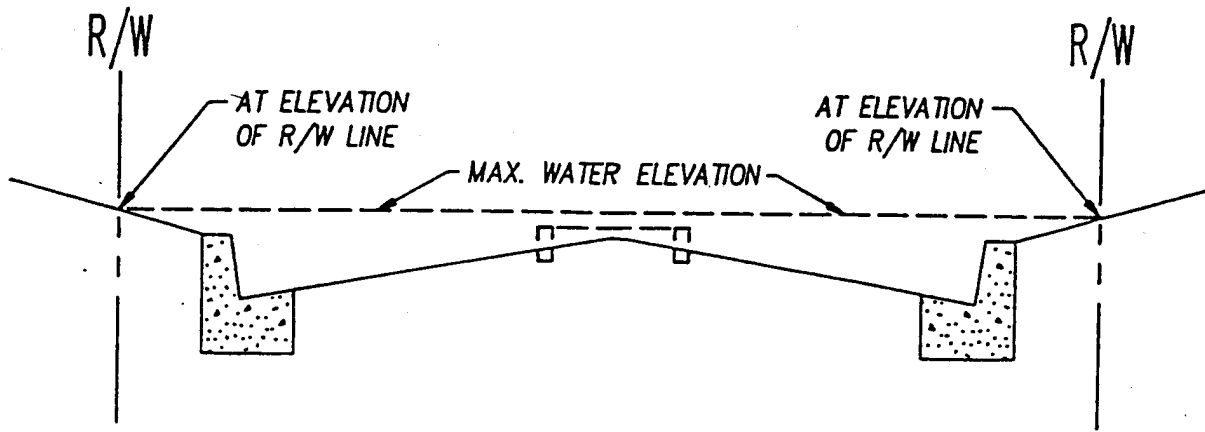
5. Miscellaneous

5.1. Soil map.

5.2. Isohyetal map.

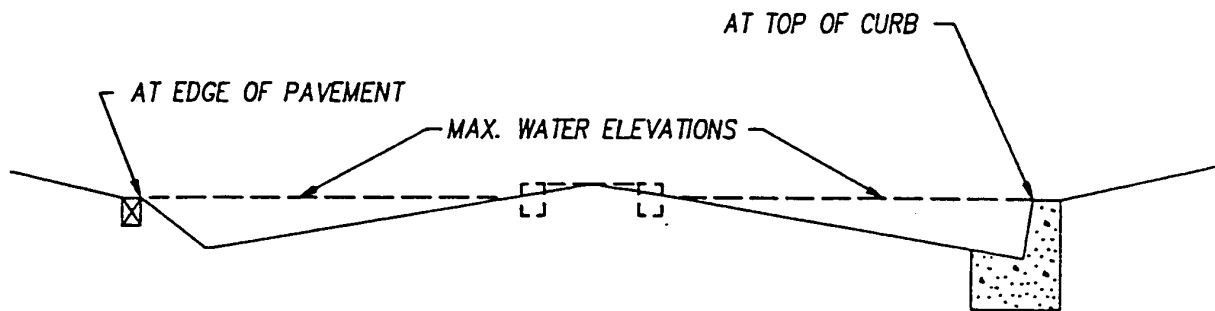
5.3. Percolation test reports.

5.4. Conditions of Approval for the development.



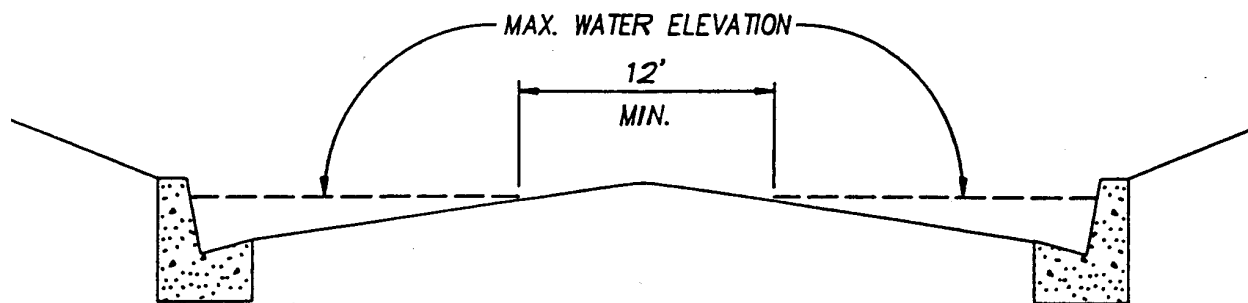
Maximum water elevation shall be based on runoff from a 25-year frequency storm and shall apply to all cases including streets and highways

FIGURE 5-1. Flooded Roadway to Right-of-Way Line Requirements.

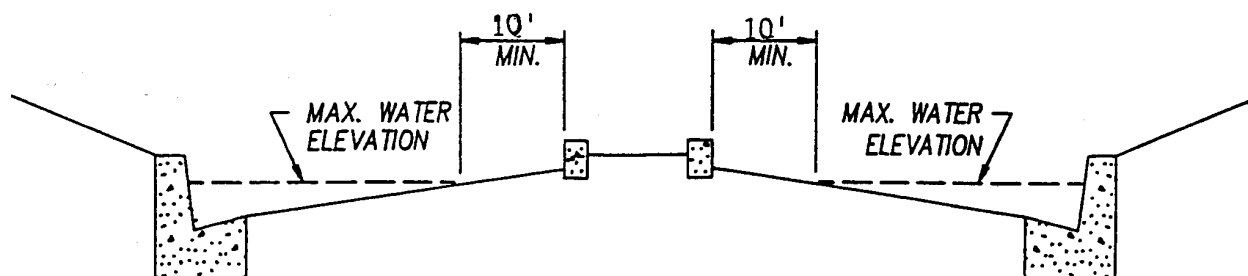


For roadways with slope gradient, maximum water elevation shall be based on runoff from a 10 -year frequency storm

FIGURE 5-2. Flooded Roadway to Top of Curb or Edge of Pavement Requirements



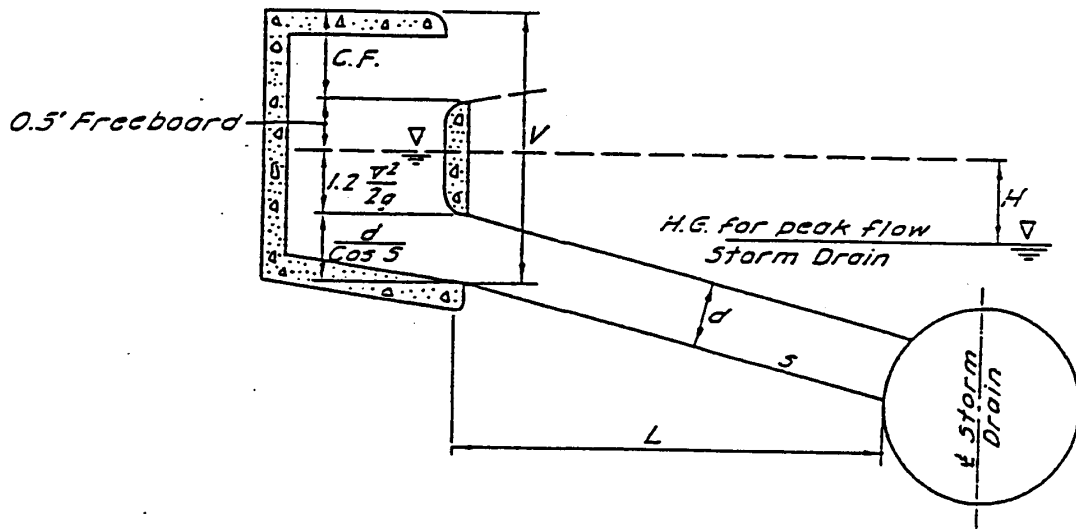
Major and secondary undivided highways



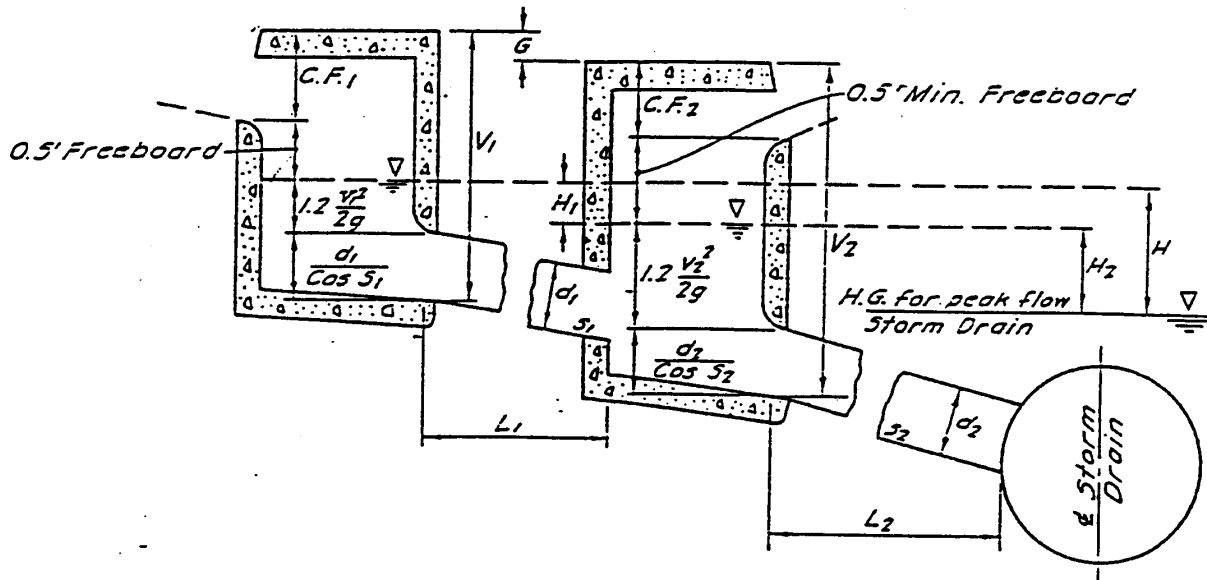
Divided Highways and Streets

Maximum water elevation shall be based on runoff from a 10-year frequency storm and shall apply to all cases including highways in sump condition.

FIGURE 5-3. Minimum Non-Flooded Roadway Width Requirements



SINGLE CATCH BASINS



CATCH BASINS IN SERIES

FIGURE 5-4. Catch Basins Freeboard Requirements

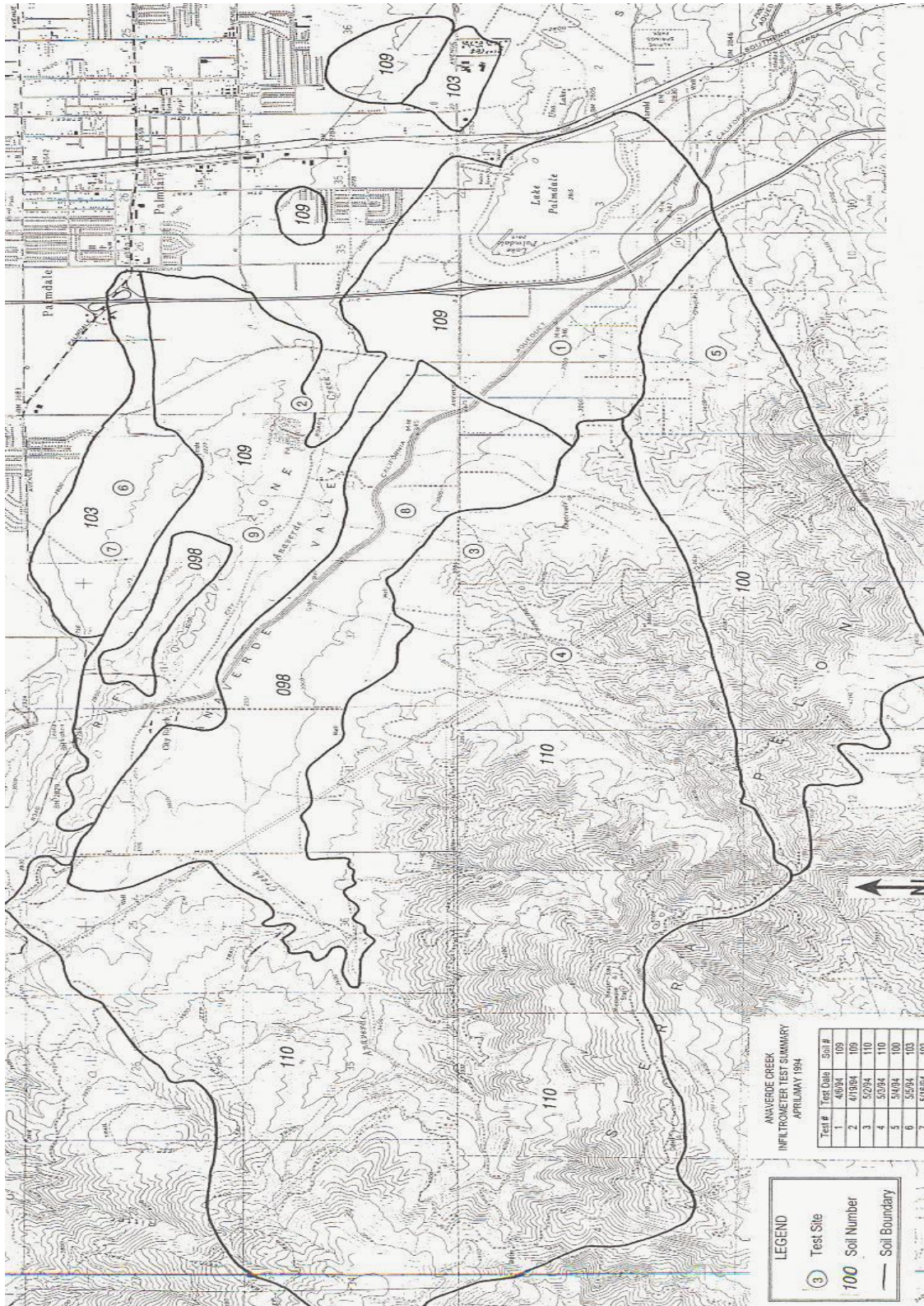


FIGURE 5-6. Soil Classification for Anaverde Watershed Upstream of Palmdale Blvd.
(see soil runoff coefficient rainfall intensity data for input to F0601)

IONAL	MODIFIED	PALMDALE	ANAVERDE	BASIN	LARAIN.DAT										
0981	14	7 000	000 100	001 100	1000 100	2100 150	2120 220	2200 280	2300						
0981	14	14 330	2400 420	2700 470	3000 520	3500 550	4000 600	5500 620	7000						
1001	14	7 000	000 100	001 100	600 210	800 310	1000 470	1500 580	2000						
1001	14	14 680	2800 700	3000 735	3500 775	4300 800	5000 810	5700 820	7000						
1031	14	7 000	000 100	001 100	1000 150	1025 250	1060 400	1300 450	1400						
1031	14	14 500	1650 570	2100 640	2700 700	3500 750	4500 783	5500 810	7000						
1091	14	7 000	000 100	001 100	250 150	275 200	300 300	350 400	500						
1091	14	14 500	750 600	1150 700	1750 780	2500 850	3500 900	5000 920	7000						
1101	14	7 000	000 100	001 100	315 270	400 430	600 520	800 600	1100						
1101	14	14 675	1450 740	2000 820	3000 865	4000 890	5000 900	6000 900	7000						
1111	14	7 000	000 346	500 391	1000 435	2100 467	2120 513	2200 552	2300						
1111	14	14 585	2400 645	2700 679	3000 714	3500 736	4000 772	5500 789	7000						
1121	14	7 000	000 346	500 358	600 453	800 533	1000 656	1500 735	2000						
1121	14	14 805	2800 818	3000 842	3500 869	4300 885	5000 892	5700 900	7000						
1131	14	7 000	000 346	500 391	1000 426	1025 495	1060 605	1300 640	1400						
1131	14	14 678	1650 730	2100 780	2700 821	3500 855	4500 877	5500 895	7000						
1141	14	7 000	000 229	100 298	250 344	275 388	300 473	350 564	500						
1141	14	14 651	750 733	1150 808	1750 864	2500 911	3500 943	5000 956	7000						
1151	14	7 000	000 229	100 315	315 457	400 593	600 668	800 732	1100						
1151	14	14 788	1450 836	2000 891	3000 921	4000 937	5000 944	6000 944	7000						
J103	40														
J103	40	7 0	0 100	017 200	069 300	156 400	278 500	433 600	632						
J103	40	14 700	848 800	1099 900	13511000	16041050	17711100	19811110	2035						
J103	40	211120	21091130	21841135	22221140	22831145	23501147	23771148	2391						
J103	40	281149	24271150	24631151	25001152	25361153	25721154	25881155	2601						
J103	40	351160	26471170	26871180	27201190	27521210	28151230	28761260	2954						
J103	40	401300	30391340	31031400	31591440	31701500	3170								
J253	40														
J253	40	7 0	0 100	022 200	085 300	192 400	340 500	532 600	765						
J253	40	14 700	1042 800	1360 900	17221000	21041050	23001100	25171110	2581						
J253	40	211120	26511130	27351135	27781140	28381145	29101147	29391148	2954						
J253	40	281149	29961150	30401151	30841152	31281153	31721154	31861155	3198						
J253	40	351160	32411170	33001180	33471190	33891210	34691230	35421260	3640						
J253	40	401300	37471340	38271400	38971440	39101500	3910								
J503	40														
J503	40	7 0	0 100	028 200	111 300	251 400	446 500	698 600	1005						
J503	40	14 700	1368 800	1786 900	22611000	28041050	30821100	33721110	3437						
J503	40	211120	35071130	35841135	36291140	36881145	37481147	37841148	3803						
J503	40	281149	38521150	39011151	39511152	40001153	40491154	40661155	4081						
J503	40	351160	41271170	41991180	42571190	43131210	44191230	45161260	4645						
J503	40	401300	47861340	48911400	49831440	50001500	5000								

FIGURE 5-7. Runoff Coefficients for Soil Types Anaverde Watershed Upstream of Palmdale Blvd.