APPENDIX 3

VOLUME AND FLOW RATE CALCULATIONS

LOS ANGELES COUNTY - SAN DIMAS DEVELOPMENT

8/25/2009

Mitigation Volume Calculation

$V_M = (2{,}722.5\ ft^3 / acre) * [(A_I)(0.9) + (A_P + A_U)(C_U)]$

#	Drainage Area	Total Area	% Impervious	A_I (acres)	C_D	A_P (acres)	A_U (acres)	C_U	Conversion Factor	V_M (cubic feet)	V_M (acre-feet)
1	WQ Basin #1	54.7	30%	16.41	0.900	38.29	0.00	0.1000	2722.50	**50,633**	**1.16**
2	WQ Basin #2	22.86	30%	6.86	0.900	16.00	0.00	0.1000	2722.50	**21,160**	**0.49**
3	WQ Basin #3	2.95	30%	0.89	0.900	2.07	0.00	0.1000	2722.50	**2,731**	**0.06**
4			30%	0.00	0.900	0.00	0.00	0.1000	2722.50	**0**	**0.00**
5			30%	0.00	0.900	0.00	0.00	0.1000	2722.50	**0**	**0.00**

Conceptual Water Quality Basin Sizing

#	Name	Treatment Required (ft^3)	Treatment Volume Required (acre-ft)	Sizing Depth (ft)	Original Basin Footprint (SF)	Volume @ 20% Contingency (acre-ft)	Footprint @ 20% Contingency (acres)	Footprint @ 20% Contingency (SF)
1	WQ Basin #1	50,633	1.16	5.0	**10,127**	1.4	0.3	**12,152**
2	WQ Basin #2	21,160	0.49	5.0	**4,232**	0.6	0.1	**5,078**
3	WQ Basin #3	2,731	0.06	2.0	**1,365**	0.1	0.0	**1,638**
4	0	0	0.00	5.0	**0**	0.0	0.0	**0**
5	0	0	0.00	5.0	**0**	0.0	0.0	**0**

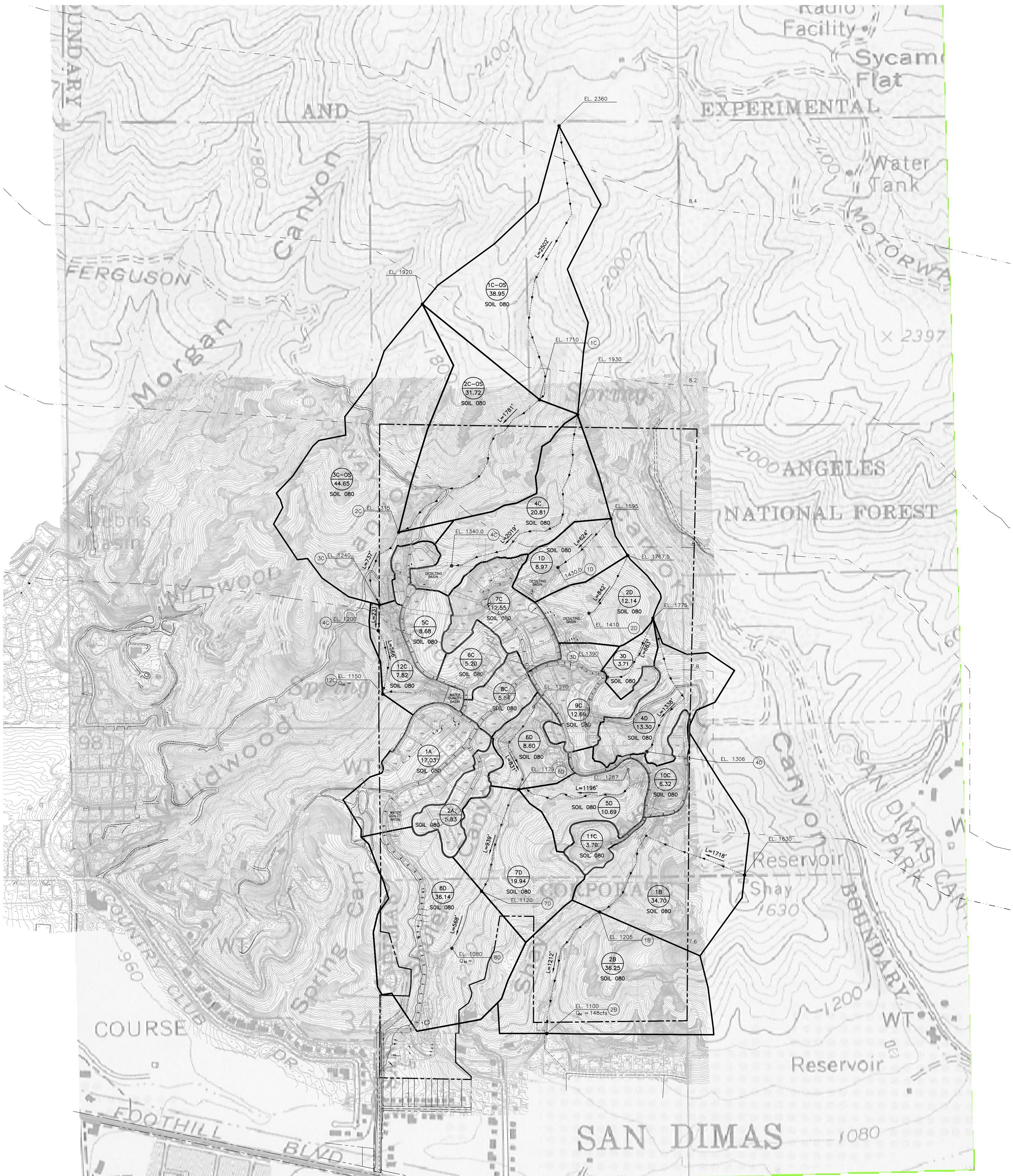
Mitigation Flow Rate Calculation

$Q_{PM} = C_D * I_X * A_{Total} * (1.008333\ ft^3\text{-hour} / acre\text{-inches-seconds})$

#	Name	% Impervious	C_D	I_X (in/hr)	A_{total} (acres)	Conversion Factor	Q_{PM} (cfs)
1	WQ Basin #1	30%	0.340	0.20	54.70	1.008	**3.75**
2	WQ Basin #2	30%	0.340	0.20	22.86	1.008	**1.57**
3	WQ Basin #3	30%	0.340	0.20	2.95	1.008	**0.20**
4	0	#DIV/0!	#DIV/0!	0.20	0.00	1.008	**#DIV/0!**
5	0	#DIV/0!	#DIV/0!	0.20	0.00	1.008	**#DIV/0!**

Project	Subarea	Area (acres)	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.)	Tc-calculated (min.)	Intensity (in./hr)	Cu	Cd	Flowrate (cfs)	Tc Equation
SD1	1A	28.73	0.21	50	80	3176	0.1483	7.7	14	2.83	0.65	0.7	57	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
SD1	2A	35.64	0.09	50	80	2766	0.17028	7.7	12	3.04	0.67	0.69	75	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
SD1	3A	32.38	0.01	50	80	1721	0.06915	7.7	11	3.17	0.68	0.68	70	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
SD1	4A	34.58	0.21	50	80	3602	0.07912	7.6	17	2.55	0.63	0.69	61	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
SD1	5A	8.8	0.09	50	80	314	0.00163	7.6	7	3.87	0.72	0.74	25	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
SD1	1B	34.7	0.09	50	80	1718	0.24738	7.7	8	3.68	0.71	0.73	93	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
SD1	2B	32.24	0.01	50	80	1212	0.08663	7.55	8	3.61	0.71	0.71	83	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
SD1	1C	38.95	0.01	50	80	2502	0.25979	8.3	10	3.58	0.71	0.71	99	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
SD1	2C	31.72	0.01	50	80	1778	0.22216	8.1	8	3.87	0.72	0.72	88	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
SD1	3C	43.51	0.01	50	80	778	0.0964	8	6	4.38	0.75	0.75	143	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
SD1	4C	34.72	0.21	50	80	3557	0.21929	8	13	3.05	0.67	0.72	76	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135
SD1	5C	41.05	0.21	50	80	3526	0.17158	7.85	14	2.89	0.66	0.71	84	Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

Area (acres)	Intensity (in./hr)	Cd	Q
28.73	2.83	0.7	57.4
35.64	3.04	0.69	75.4
32.38	3.17	0.68	70.4
34.58	2.55	0.69	61.3
8.8	3.87	0.74	25.4
34.7	3.68	0.73	94.0
32.24	3.61	0.71	83.3
38.95	3.58	0.71	99.8
31.72	3.87	0.72	89.1
43.51	4.38	0.75	144.1
34.72	3.05	0.72	76.9
41.05	2.89	0.71	84.9



LEGEND

EXISTING MAJOR WATERSHED BOUNDARY
EXISTING SUB DRAINAGE AREA BOUNDARY
EXISTING FLOW PATH

DIRECTION OF FLOW
C17 — DRAINAGE AREA DESIGNATION
70.21 — ACRES
340 — NODE DESIGNATION
L=300' — LENGTH OF EXISTING FLOW PATH
Q_{50} — CALCULATED 50-YEAR STORM RUNOFF

NORTH
SCALE: 1"=300'

FUSCOE ENGINEERING
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 • fax 949.474.5315
www.fuscoe.com

CANYON OAKS
TENTATIVE TRACT
PROPOSED DRAINAGE HYDROLOGY MAP

SHEET
1 of 1

APPENDIX 4

STORM WATER OBSERVATION REPORT FORM

STORMWATER OBSERVATION REPORT FORM

- STANDARD URBAN STORMWATER MITIGATION PLAN (SUSMP) -
- SITE SPECIFIC MITIGATION PLAN -

***STORMWATER OBSERVATION** means the visual observation of the stormwater related Best Management Practices (BMPs) for conformance with the approved SUSMP/Site Specific Mitigation Plan at significant construction stages and at completion of the project. Stormwater observation does not include or waive the responsibility for the inspections required by Section 108 or other sections of the City of Los Angeles Building Code*.

***STORMWATER OBSERVATION** must be performed by the engineer or architect responsible for the approved SUSMP/Site Specific Mitigation Plan or designated staff in their employment.*

***STORMWATER OBSERVATION REPORT** must be signed and stamped (see below) by the engineer or architect responsible for the approved SUSMP and submitted to the city prior to the issuance to the certificate of occupancy.*

Project Address:	Building Permit No.:
Name of Engineer or Architect responsible for the approved SUSMP/Site Specific Mitigation Plan:	Phone Number:
Name of SUSMP/Site Specific Mitigation Plan Observer:	Phone Number:

I DECLARE THAT THE FOLLOWING STATEMENTS ARE TRUE TO THE BEST OF MY KNOWLEDGE:

1. I AM THE ENGINEER OR ARCHITECT RESPONSIBLE FOR THE APPROVED SUSMP/SITE SPECIFIC MITIGATION PLAN, AND

2. I, OR DESIGNATEDSTAFF UNDER MY RESPONSIBLECHARGE, HAS PERFORMED THE REQUIRED SITE VISITS AT EACH SIGNIFICANT CONSTRUCTIONSTAGE AND AT COMPLETION TO VERIFY THAT THE BEST MANAGEMENT PRACTICES AS SHOWN ON THE APPROVED PLAN HAVE BEEN CONSTRUCTEDAND INSTALLEDIN ACCORDANCEWITH THE APPROVED SUSMP/SITE SPECIFIC MITIGATION PLAN.

Stamp of Engineer or Architect responsible for the approved SUSMP

APPENDIX 5

MASTER COVENANT AND AGREEMENT

RECORDING REQUESTED BY:
City of San Dimas

WHEN RECORDED MAIL TO:

City Clerk
City of San Dimas
245 East Bonita Avenue
San Dimas, CA 91773

SPACE ABOVE THIS LINE FOR RECORDER'S USE

MAINTENANCE COVENANT FOR STANDARD URBAN STORMWATER MITIGATION (SUSMP) REQUIREMENTS

Pursuant to Chapter 14.11 of the Municipal Code of **San Dimas** relating to the control of pollutants carried by stormwater runoff, structural and/or treatment control Best Management Practices (BMP's) have been installed on the following property:

LEGAL DESCRIPTION

ASSESSOR'S ID # _____TRACT NO._____LOT NO. _____
ADDRESS: _____
_____

I (we)_____, hereby certify that I (we) am (are) the legal owner (s) of
(Legal Name of Property Owners)
property indicated above, and as such owners for the mutual benefit of future purchasers, their heirs, successors, and assigns, do hereby fix the following protective conditions to which their property, or portions thereof, shall be held, sold and/or conveyed.

That owner(s) shall maintain the drainage devices such as paved swales, bench drains, inlets, catch basins, downdrains, pipes and water quality devices on the property indicated above and as shown on plans permitted by the City of San Dimas, in a good functional condition to safeguard the property owners and adjoining properties from damage and pollution.

That owner(s) shall conduct maintenance inspection of all Structural or Treatment Control BMP's on the property at least once a year and retain proof of the inspection. Said maintenance inspection shall verify the legibility of all required stencils and signs and shall repaint and label as necessary.

That owner(s) shall provide printed educational materials with any sale of the property which provide information on what stormwater management facilities are present, the type(s) and location(s) of maintenance signs that are required, and how the necessary maintenance can be performed.

Owner(s):

By: _____ Date:_____

By: _____ Date: _____

(PLEASE ATTACH NOTARY)

APPENDIX 6

SAMPLE
MASTER TERMINATION OF COVENANT AND AGREEMENT

Recording requested by and mail to:

Name: _____

Address: _____

_____

_____

********** Space Above This Line For Recorder's Use **********

MASTER TERMINATION OF COVENANT AND AGREEMENT
REGARDING ON-SITE BMP MAINTENANCE

The undersigned hereby certifies I am (we are) the owner(s) of the hereinafter legally described real property located in the City of Los Angeles, County of Los Angeles, State of California (please give the legal description):

_____

Site Address _____

We do hereby, with approval of the City of Los Angeles, Bureau of Sanitation, terminate the covenant and agreement entered into with the City of Los Angeles as recorded on the _____ day of _____ 20 _____, as Document No. _____.

This covenant and agreement is terminated for the reason that:

_____

_____

_____ _____
(Print Name of Property Owner) (Print Name of Property Owner)

_____ _____
(Signature of Property Owner) (Signature of Property Owner)

Dated this _____ day of _____ 20____.

Termination approved by: _____ Date: _____
(Watershed Protection Division)

********** Space Below This Line For City of Los Angeles Notary's Use **********

ALL-PURPOSE ACKNOWLEDGMENT

STATE OF CALIFORNIA, COUNTY OF LOS ANGELES

On _____ before me, _____ (name and title of officer), personally appeared _____, personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

_____ (SEAL)
Notary Public Signature

INSTRUCTIONS FOR FILING TERMINATION OF COVENANT AND AGREEMENT FORMS

Note: **This Termination of Covenant & Agreement Form is to be used to terminate existing Covenant & Agreement Forms for *Ministerial and Discretionary Projects*.**

1. Fill out, in BLACK INK ONLY, one copy of the Termination of Covenant and Agreement Form.

2. Property owner(s) must print and sign their name(s).

3. Submit the completed Termination of Covenant & Agreement (C&A) Form to the Watershed Protection Division Bureau of Sanitation for termination approval and signature – **City staff signature must be notarized**.

4. Record the C&A Form with the Los Angeles County Registrar-Recorder and obtain a certified copy. County Recorder located at:

    1) 12400 Imperial Highway
    Norwalk, CA 90650
    (Near the intersection of the 5 and 605 freeways)

    2) 14340 Sylvan Street
    Van Nuys, CA 91401
    (Near Van Nuys City Hall)

5. Return the certified copy of the recorded form to the Watershed Protection Division requiring the covenant (should be a purple stamp on the back of the last document recorded).

APPENDIX 7

TREATMENT CONTROL BMP OPERATION & MAINTENANCE PLAN SUPPLEMENT

Inspection and Maintenance Checklist
WATER QUALITY / DETENTION BASINS

Date: _____ Property: _____

Type of Inspection: ☐ After Storm ☐ Weekly ☐ Monthly ☐ Annual

BMP Location (ID): _____

Part / Location	Conditions When Maintenance is Needed	Problem Observed?		Comments
		Y	N	
Basin floor & side slopes	Trash and debris present; Sediment accumulation is greater than 10%; erosion or damage is present on floor or side slopes; mosquitoes or other vector issues are present			
Vegetation	Vegetation is overgrown or showing signs of disease; weeds are present; replant as needed			
Inlet & Outlet Structures	Accumulated sediment, trash or debris; damage to structure is observed; water does not drain within 72 hours			

IF "YES" IS CHECKED ON ANY OF THE ABOVE INSPECTION ITEMS, MAINTENANCE IS REQUIRED

Detail of Maintenance Scheduled/Performed:

Inspection performed by:

Name: _____

Signature: _____

Extended Detention Basin TC-22

Design Considerations

- Tributary Area
- Area Required
- Hydraulic Head

Description

Dry extended detention ponds (a.k.a. dry ponds, extended detention basins, detention ponds, extended detention ponds) are basins whose outlets have been designed to detain the stormwater runoff from a water quality design storm for some minimum time (e.g., 48 hours) to allow particles and associated pollutants to settle. Unlike wet ponds, these facilities do not have a large permanent pool. They can also be used to provide flood control by including additional flood detention storage.

Targeted Constituents

☑	Sediment	▲
☑	Nutrients	●
☑	Trash	■
☑	Metals	▲
☑	Bacteria	▲
☑	Oil and Grease	▲
☑	Organics	▲

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

California Experience

Caltrans constructed and monitored 5 extended detention basins in southern California with design drain times of 72 hours. Four of the basins were earthen, less costly and had substantially better load reduction because of infiltration that occurred, than the concrete basin. The Caltrans study reaffirmed the flexibility and performance of this conventional technology. The small headloss and few siting constraints suggest that these devices are one of the most applicable technologies for stormwater treatment.

Advantages

- Due to the simplicity of design, extended detention basins are relatively easy and inexpensive to construct and operate.
- Extended detention basins can provide substantial capture of sediment and the toxics fraction associated with particulates.
- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

relationships resulting from the increase of impervious cover in a watershed.

Limitations

- Limitation of the diameter of the orifice may not allow use of extended detention in watersheds of less than 5 acres (would require an orifice with a diameter of less than 0.5 inches that would be prone to clogging).
- Dry extended detention ponds have only moderate pollutant removal when compared to some other structural stormwater practices, and they are relatively ineffective at removing soluble pollutants.
- Although wet ponds can increase property values, dry ponds can actually detract from the value of a home due to the adverse aesthetics of dry, bare areas and inlet and outlet structures.

Design and Sizing Guidelines

- Capture volume determined by local requirements or sized to treat 85% of the annual runoff volume.
- Outlet designed to discharge the capture volume over a period of hours.
- Length to width ratio of at least 1.5:1 where feasible.
- Basin depths optimally range from 2 to 5 feet.
- Include energy dissipation in the inlet design to reduce resuspension of accumulated sediment.
- A maintenance ramp and perimeter access should be included in the design to facilitate access to the basin for maintenance activities and for vector surveillance and control.
- Use a draw down time of 48 hours in most areas of California. Draw down times in excess of 48 hours may result in vector breeding, and should be used only after coordination with local vector control authorities. Draw down times of less than 48 hours should be limited to BMP drainage areas with coarse soils that readily settle and to watersheds where warming may be determined to downstream fisheries.

Construction/Inspection Considerations

- Inspect facility after first large to storm to determine whether the desired residence time has been achieved.
- When constructed with small tributary area, orifice sizing is critical and inspection should verify that flow through additional openings such as bolt holes does not occur.

Performance

One objective of stormwater management practices can be to reduce the flood hazard associated with large storm events by reducing the peak flow associated with these storms. Dry extended detention basins can easily be designed for flood control, and this is actually the primary purpose of most detention ponds.

Dry extended detention basins provide moderate pollutant removal, provided that the recommended design features are incorporated. Although they can be effective at removing some pollutants through settling, they are less effective at removing soluble pollutants because of the absence of a permanent pool. Several studies are available on the effectiveness of dry extended detention ponds including one recently concluded by Caltrans (2002).

The load reduction is greater than the concentration reduction because of the substantial infiltration that occurs. Although the infiltration of stormwater is clearly beneficial to surface receiving waters, there is the potential for groundwater contamination. Previous research on the effects of incidental infiltration on groundwater quality indicated that the risk of contamination is minimal.

There were substantial differences in the amount of infiltration that were observed in the earthen basins during the Caltrans study. On average, approximately 40 percent of the runoff entering the unlined basins infiltrated and was not discharged. The percentage ranged from a high of about 60 percent to a low of only about 8 percent for the different facilities. Climatic conditions and local water table elevation are likely the principal causes of this difference. The least infiltration occurred at a site located on the coast where humidity is higher and the basin invert is within a few meters of sea level. Conversely, the most infiltration occurred at a facility located well inland in Los Angeles County where the climate is much warmer and the humidity is less, resulting in lower soil moisture content in the basin floor at the beginning of storms.

Vegetated detention basins appear to have greater pollutant removal than concrete basins. In the Caltrans study, the concrete basin exported sediment and associated pollutants during a number of storms. Export was not as common in the earthen basins, where the vegetation appeared to help stabilize the retained sediment.

Siting Criteria

Dry extended detention ponds are among the most widely applicable stormwater management practices and are especially useful in retrofit situations where their low hydraulic head requirements allow them to be sited within the constraints of the existing storm drain system. In addition, many communities have detention basins designed for flood control. It is possible to modify these facilities to incorporate features that provide water quality treatment and/or channel protection. Although dry extended detention ponds can be applied rather broadly, designers need to ensure that they are feasible at the site in question. This section provides basic guidelines for siting dry extended detention ponds.

In general, dry extended detention ponds should be used on sites with a minimum area of 5 acres. With this size catchment area, the orifice size can be on the order of 0.5 inches. On smaller sites, it can be challenging to provide channel or water quality control because the orifice diameter at the outlet needed to control relatively small storms becomes very small and thus prone to clogging. In addition, it is generally more cost-effective to control larger drainage areas due to the economies of scale.

Extended detention basins can be used with almost all soils and geology, with minor design adjustments for regions of rapidly percolating soils such as sand. In these areas, extended detention ponds may need an impermeable liner to prevent ground water contamination.

The base of the extended detention facility should not intersect the water table. A permanently wet bottom may become a mosquito breeding ground. Research in Southwest Florida (Santana et al., 1994) demonstrated that intermittently flooded systems, such as dry extended detention ponds, produce more mosquitoes than other pond systems, particularly when the facilities remained wet for more than 3 days following heavy rainfall.

A study in Prince George's County, Maryland, found that stormwater management practices can increase stream temperatures (Galli, 1990). Overall, dry extended detention ponds increased temperature by about 5°F. In cold water streams, dry ponds should be designed to detain stormwater for a relatively short time (i.e., 24 hours) to minimize the amount of warming that occurs in the basin.

Additional Design Guidelines

In order to enhance the effectiveness of extended detention basins, the dimensions of the basin must be sized appropriately. Merely providing the required storage volume will not ensure maximum constituent removal. By effectively configuring the basin, the designer will create a long flow path, promote the establishment of low velocities, and avoid having stagnant areas of the basin. To promote settling and to attain an appealing environment, the design of the basin should consider the length to width ratio, cross-sectional areas, basin slopes and pond configuration, and aesthetics (Young et al., 1996).

Energy dissipation structures should be included for the basin inlet to prevent resuspension of accumulated sediment. The use of stilling basins for this purpose should be avoided because the standing water provides a breeding area for mosquitoes.

Extended detention facilities should be sized to completely capture the water quality volume. A micropool is often recommended for inclusion in the design and one is shown in the schematic diagram. These small permanent pools greatly increase the potential for mosquito breeding and complicate maintenance activities; consequently, they are not recommended for use in California.

A large aspect ratio may improve the performance of detention basins; consequently, the outlets should be placed to maximize the flowpath through the facility. The ratio of flowpath length to width from the inlet to the outlet should be at least 1.5:1 (L:W) where feasible. Basin depths optimally range from 2 to 5 feet.

The facility's drawdown time should be regulated by an orifice or weir. In general, the outflow structure should have a trash rack or other acceptable means of preventing clogging at the entrance to the outflow pipes. The outlet design implemented by Caltrans in the facilities constructed in San Diego County used an outlet riser with orifices

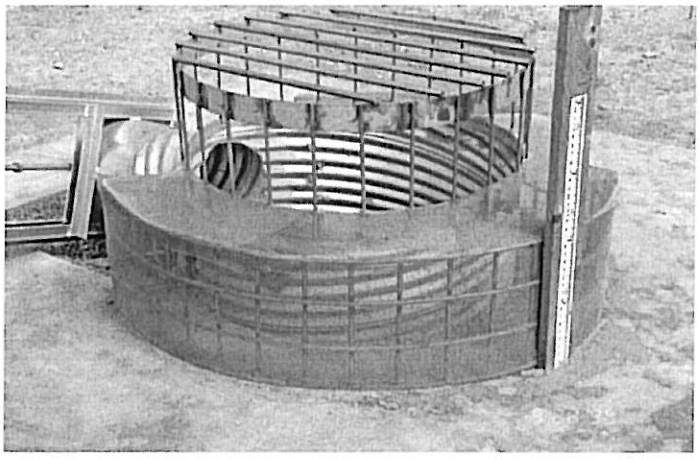


Figure 1
Example of Extended Detention Outlet Structure

sized to discharge the water quality volume, and the riser overflow height was set to the design storm elevation. A stainless steel screen was placed around the outlet riser to ensure that the orifices would not become clogged with debris. Sites either used a separate riser or broad crested weir for overflow of runoff for the 25 and greater year storms. A picture of a typical outlet is presented in Figure 1.

The outflow structure should be sized to allow for complete drawdown of the water quality volume in 72 hours. No more than 50% of the water quality volume should drain from the facility within the first 24 hours. The outflow structure can be fitted with a valve so that discharge from the basin can be halted in case of an accidental spill in the watershed.

Summary of Design Recommendations

(1) Facility Sizing - The required water quality volume is determined by local regulations or the basin should be sized to capture and treat 85% of the annual runoff volume. See Section 5.5.1 of the handbook for a discussion of volume-based design.

Basin Configuration – A high aspect ratio may improve the performance of detention basins; consequently, the outlets should be placed to maximize the flowpath through the facility. The ratio of flowpath length to width from the inlet to the outlet should be at least 1.5:1 (L:W). The flowpath length is defined as the distance from the inlet to the outlet as measured at the surface. The width is defined as the mean width of the basin. Basin depths optimally range from 2 to 5 feet. The basin may include a sediment forebay to provide the opportunity for larger particles to settle out.

A micropool should not be incorporated in the design because of vector concerns. For online facilities, the principal and emergency spillways must be sized to provide 1.0 foot of freeboard during the 25-year event and to safely pass the flow from 100-year storm.

(2) Pond Side Slopes - Side slopes of the pond should be 3:1 (H:V) or flatter for grass stabilized slopes. Slopes steeper than 3:1 (H:V) must be stabilized with an appropriate slope stabilization practice.

(3) Basin Lining – Basins must be constructed to prevent possible contamination of groundwater below the facility.

(4) Basin Inlet – Energy dissipation is required at the basin inlet to reduce resuspension of accumulated sediment and to reduce the tendency for short-circuiting.

(5) Outflow Structure - The facility's drawdown time should be regulated by a gate valve or orifice plate. In general, the outflow structure should have a trash rack or other acceptable means of preventing clogging at the entrance to the outflow pipes.

The outflow structure should be sized to allow for complete drawdown of the water quality volume in 72 hours. No more than 50% of the water quality volume should drain from the facility within the first 24 hours. The outflow structure should be fitted with a valve so that discharge from the basin can be halted in case of an accidental spill in the watershed. This same valve also can be used to regulate the rate of discharge from the basin.

The discharge through a control orifice is calculated from:

$$Q = CA(2g(H-H_o))^{0.5}$$

where: Q = discharge (ft^3/s)
C = orifice coefficient
A = area of the orifice (ft^2)
g = gravitational constant (32.2)
H = water surface elevation (ft)
H_o= orifice elevation (ft)

Recommended values for C are 0.66 for thin materials and 0.80 when the material is thicker than the orifice diameter. This equation can be implemented in spreadsheet form with the pond stage/volume relationship to calculate drain time. To do this, use the initial height of the water above the orifice for the water quality volume. Calculate the discharge and assume that it remains constant for approximately 10 minutes. Based on that discharge, estimate the total discharge during that interval and the new elevation based on the stage volume relationship. Continue to iterate until H is approximately equal to H_o. When using multiple orifices the discharge from each is summed.

(6) Splitter Box - When the pond is designed as an offline facility, a splitter structure is used to isolate the water quality volume. The splitter box, or other flow diverting approach, should be designed to convey the 25-year storm event while providing at least 1.0 foot of freeboard along pond side slopes.

(7) Erosion Protection at the Outfall - For online facilities, special consideration should be given to the facility's outfall location. Flared pipe end sections that discharge at or near the stream invert are preferred. The channel immediately below the pond outfall should be modified to conform to natural dimensions, and lined with large stone riprap placed over filter cloth. Energy dissipation may be required to reduce flow velocities from the primary spillway to non-erosive velocities.

(8) Safety Considerations - Safety is provided either by fencing of the facility or by managing the contours of the pond to eliminate dropoffs and other hazards. Earthen side slopes should not exceed 3:1 (H:V) and should terminate on a flat safety bench area. Landscaping can be used to impede access to the facility. The primary spillway opening must not permit access by small children. Outfall pipes above 48 inches in diameter should be fenced.

Maintenance

Routine maintenance activity is often thought to consist mostly of sediment and trash and debris removal; however, these activities often constitute only a small fraction of the maintenance hours. During a recent study by Caltrans, 72 hours of maintenance was performed annually, but only a little over 7 hours was spent on sediment and trash removal. The largest recurring activity was vegetation management, routine mowing. The largest absolute number of hours was associated with vector control because of mosquito breeding that occurred in the stilling basins (example of standing water to be avoided) installed as energy dissipaters. In most cases, basic housekeeping practices such as removal of debris accumulations and vegetation

management to ensure that the basin dewaters completely in 48-72 hours is sufficient to prevent creating mosquito and other vector habitats.

Consequently, maintenance costs should be estimated based primarily on the mowing frequency and the time required. Mowing should be done at least annually to avoid establishment of woody vegetation, but may need to be performed much more frequently if aesthetics are an important consideration.

Typical activities and frequencies include:

- Schedule semiannual inspection for the beginning and end of the wet season for standing water, slope stability, sediment accumulation, trash and debris, and presence of burrows.
- Remove accumulated trash and debris in the basin and around the riser pipe during the semiannual inspections. The frequency of this activity may be altered to meet specific site conditions.
- Trim vegetation at the beginning and end of the wet season and inspect monthly to prevent establishment of woody vegetation and for aesthetic and vector reasons.
- Remove accumulated sediment and re-grade about every 10 years or when the accumulated sediment volume exceeds 10 percent of the basin volume. Inspect the basin each year for accumulated sediment volume.

Cost

Construction Cost

The construction costs associated with extended detention basins vary considerably. One recent study evaluated the cost of all pond systems (Brown and Schueler, 1997). Adjusting for inflation, the cost of dry extended detention ponds can be estimated with the equation:

$$C = 12.4V^{0.760}$$

where: C = Construction, design, and permitting cost, and
V = Volume (ft^3).

Using this equation, typical construction costs are:

$ 41,600 for a 1 acre-foot pond

$ 239,000 for a 10 acre-foot pond

$ 1,380,000 for a 100 acre-foot pond

Interestingly, these costs are generally slightly higher than the predicted cost of wet ponds (according to Brown and Schueler, 1997) on a cost per total volume basis, which highlights the difficulty of developing reasonably accurate construction estimates. In addition, a typical facility constructed by Caltrans cost about $160,000 with a capture volume of only 0.3 ac-ft.

An economic concern associated with dry ponds is that they might detract slightly from the value of adjacent properties. One study found that dry ponds can actually detract from the

perceived value of homes adjacent to a dry pond by between 3 and 10 percent (Emmerling-Dinovo, 1995).

Maintenance Cost

For ponds, the annual cost of routine maintenance is typically estimated at about 3 to 5 percent of the construction cost (EPA website). Alternatively, a community can estimate the cost of the maintenance activities outlined in the maintenance section. Table 1 presents the maintenance costs estimated by Caltrans based on their experience with five basins located in southern California. Again, it should be emphasized that the vast majority of hours are related to vegetation management (mowing).

Table 1 Estimated Average Annual Maintenance Effort

Activity	Labor Hours	Equipment & Material ($)	Cost
Inspections	4	7	183
Maintenance	49	126	2282
Vector Control	0	0	0
Administration	3	0	132
Materials	-	535	535
Total	**56**	**$668**	**$3,132**

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Denver Urban Drainage and Flood Control District. 1992. *Urban Storm Drainage Criteria Manual—Volume 3: Best Management Practices*. Denver, CO.

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Information Resources

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Center for Watershed Protection (CWP). 1997. *Stormwater BMP Design Supplement for Cold Climates*. Prepared for U.S. Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds. Washington, DC.

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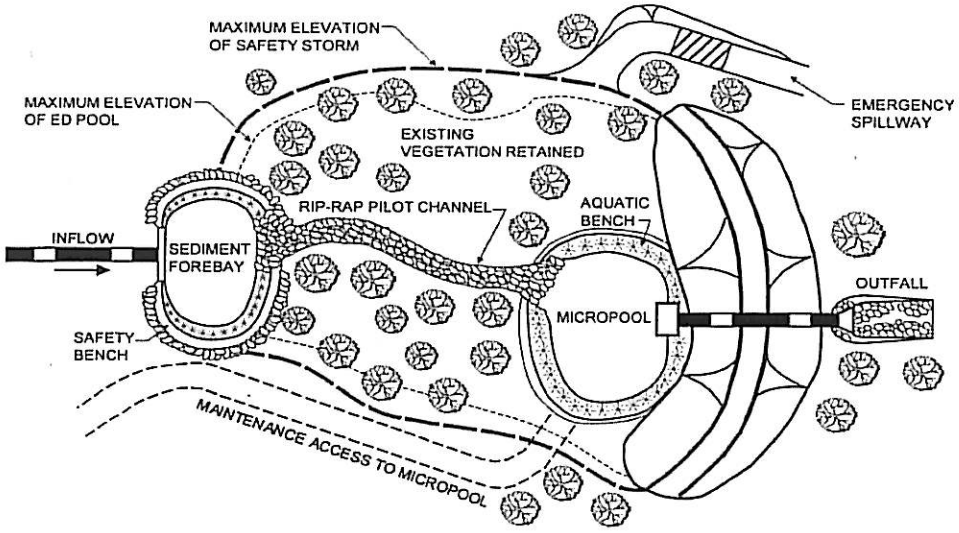
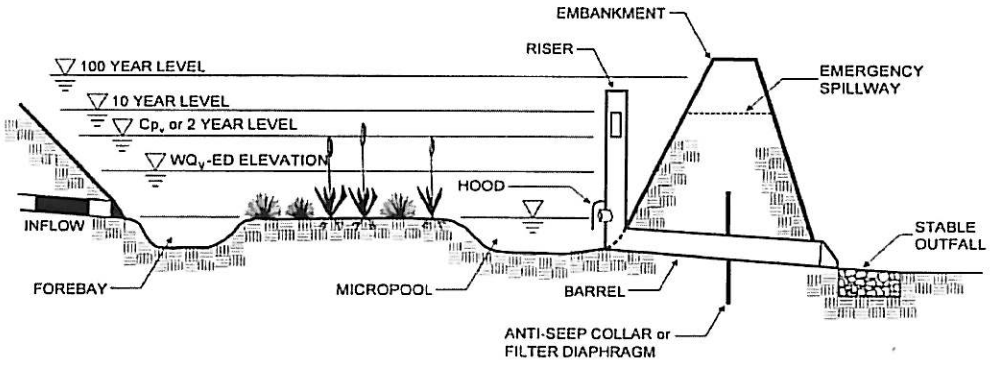


PLAN VIEW



PROFILE

Schematic of an Extended Detention Basin (MDE, 2000)

APPENDIX 8

RECORD OF INSPECTIONS

BMP Inspection and Maintenance Log

Inspection Date	BMP Inspected	Maintenance Performed? (Y/N)	Inspector

APPENDIX 9

SOURCE CONTROL BMP FACT SHEETS

Site Design & Landscape Planning SD-10

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

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Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain

barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

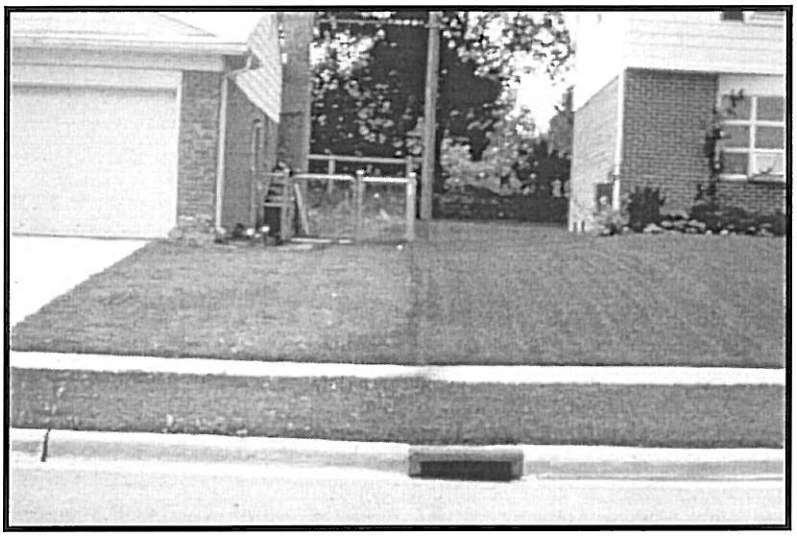
Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

Efficient Irrigation SD-12



Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

APPENDIX 10

PUBLIC EDUCATION MATERIALS

Storm Drains are for Rain...

More than 50% of the automotive oil sold to do-it-yourself oil changers is not recycled. There are more than 600 State-certified used oil collection centers within Los Angeles County.

Never dispose of automotive fluids in the street or gutter. Take them to your local auto parts store, gas station or repair shop, or a household hazardous waste Roundup for recycling.

...not automotive fluids.

1(888)CLEAN LA
www.888CleanLA.com

Car Care Tips:

You can keep your car running smoothly and efficiently, and at the same time help prevent stormwater pollution by taking these easy steps...

- When changing vehicle fluids — motor oil, transmission, brake and radiator fluids — drain them into separate drip pans to avoid spills. Do not combine these fluids. Do not dispose of these fluids in the street, gutter or garbage. It is illegal.
- If a spill occurs, use kitty litter, sawdust or cornmeal for cleanup. Do not hose or rinse with water.
- Recycle all used vehicle fluids. Call 1(888)CLEAN LA or visitwww.888CleanLA.com for the location of an auto parts store or gas station that recycles these fluids, or for the location of a local household hazardous waste Roundup.
- Regularly check and maintain your car to keep it running safely and efficiently. Water runoff from streets, parking lots and driveways picks up oil and grease drippings, asbestos from brake linings, zinc from tires and organic compounds and metals from spilled fuels and carries them to the ocean.

PROJECT Pollution PREVENTION

Printed on recycled paper

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PROJECT Pollution PREVENTION

Printed on recycled paper

Are You a Litter Bug and Don't Know It?

Take our quiz!

Have you ever...

- Dropped a cigarette butt or trash on the ground?
- Failed to pick up after your dog while out on a walk?
- Overwatered your lawn after applying fertilizers/pesticides?
- Disposed of used motor oil in the street, gutter or garbage?

If you answered **yes** to any of these actions, then **YOU ARE A LITTER BUG!**

Each of these behaviors contribute to stormwater pollution, which contaminates our ocean and waterways, kills marine life and causes beach closures.

You can become part of the solution!
To find out how, flip this card over.

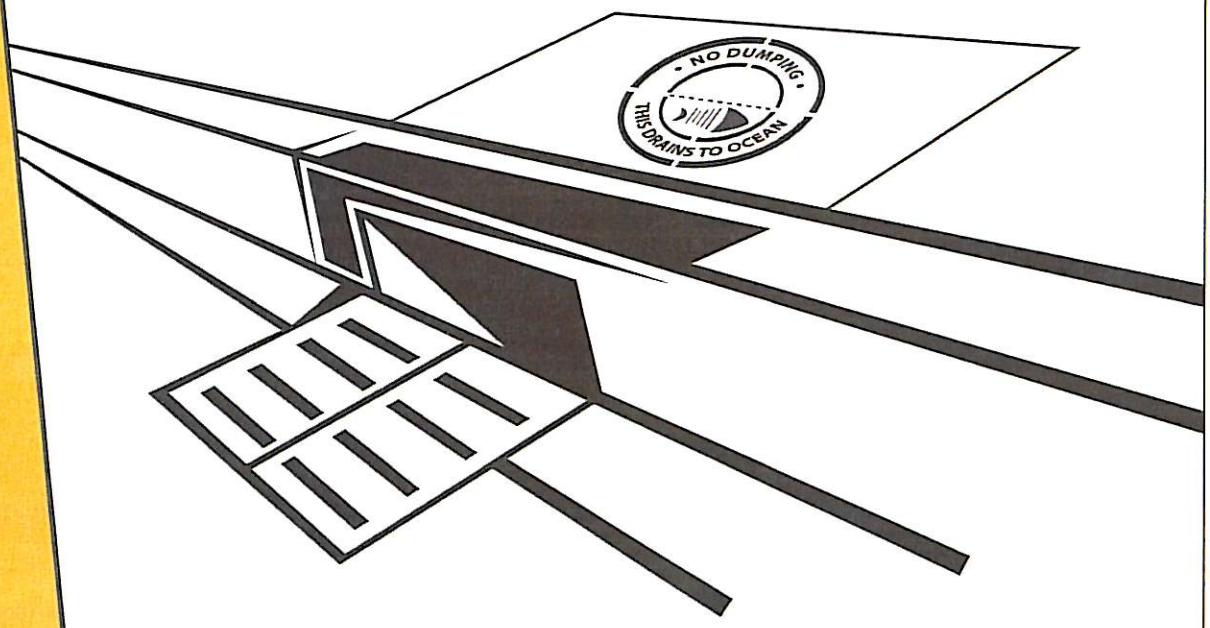
For more information, call or visit:

1 (888) CLEAN LA
www.888CleanLA.com

PROJECT Pollution PREVENTION

Follow these simple steps to prevent stormwater pollution:

- Put your garbage where it belongs — in the trash can.
- Pick up after your dog when out on a walk.
- Reduce pesticide and fertilizer use; don't overwater after application or apply if rain is forecast.
- Dispose of used motor oil at an oil recycling center or at a free Household Hazardous Waste/E-Waste collection event.



A message from the County of Los Angeles Department of Public Works.
Printed on recycled paper.

Don't Paint the Town Red!

Storm drains are for rain...
they're not for paint disposal.

More than **197,000** times each month, L.A. County residents wash their dirty paint brushes under an outdoor faucet.

This dirty rinse water flows into the street, down the storm drain and straight to the ocean — **untreated**.

Remember to clean water-based paint brushes in the sink, rinse oil-based paint brushes with paint thinner, and take old paint and paint-related products to a Household Hazardous Waste/E-Waste collection event.

1 (888) CLEAN LA
www.888CleanLA.com

Tips for Paint Clean-Up:

L.A. County residents can help solve the stormwater pollution problem by taking these easy steps when working with paint and paint-related products...

- Never dispose of paint or paint-related products in the gutters or storm drains. This is called illegal dumping. Take them to a Household Hazardous Waste/E-Waste collection event. Call 1 (888) CLEAN LA or visit www.888CleanLA.com to locate an event near you.
- Buy only what you need. Reuse leftover paint for touch-ups or donate it to a local graffiti abatement program. Recycle or use excess paint.
- Clean water-based paint brushes in the sink.
- Oil-based paints should be cleaned with paint thinner. Filter and reuse paint thinner. Set the used thinner aside in a closed jar to settle-out paint particles.
- Store paints and paint-related products in rigid, durable and watertight containers with tight-fitting covers.

PROJECT Pollution PREVENTION

A message from the County of Los Angeles Department of Public Works.
Printed on recycled paper.

Storm Drains are for Rain...

More than 200,000 times each month, lawns and gardens throughout LA County are sprayed with pesticides. Overwatering or rain causes pesticides on leaves and grass to flow into the storm drain and to the ocean — untreated.

Please use pesticides wisely, not before a rain, and water carefully.

...not pesticides.

1(888)CLEAN LA
www.888CleanLA.com

Pesticide Tips:

You can keep your lawn and garden green and at the same time solve the pollution problem by taking these easy steps...

- Never dispose of lawn or garden chemicals in storm drains. This is called illegal dumping. Take them to a household hazardous waste roundup. Call 1(888)CLEAN LA or visit www.888CleanLA.com to locate a roundup or collection facility near you.
- More is not better. Use pesticides sparingly. "Spot" apply, rather than "blanket" apply.
- Read labels! Use only as directed.
- Use non-toxic products for your garden and lawn whenever possible.
- If you must store pesticides, make sure they are in a sealed, water-proof container that cannot leak.
- When watering your lawn, use the least amount of water possible so it doesn't run into the street and carry pesticide chemicals with it. Don't use pesticides before a rain storm. You will not only lose the pesticide, but also will be harming the environment.

PROJECT Pollution PREVENTION

Printed on recycled paper

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More than 200,000 times each month, lawns and gardens throughout LA County are sprayed with pesticides. Overwatering or rain causes pesticides on leaves and grass to flow into the storm drain and to the ocean — untreated.

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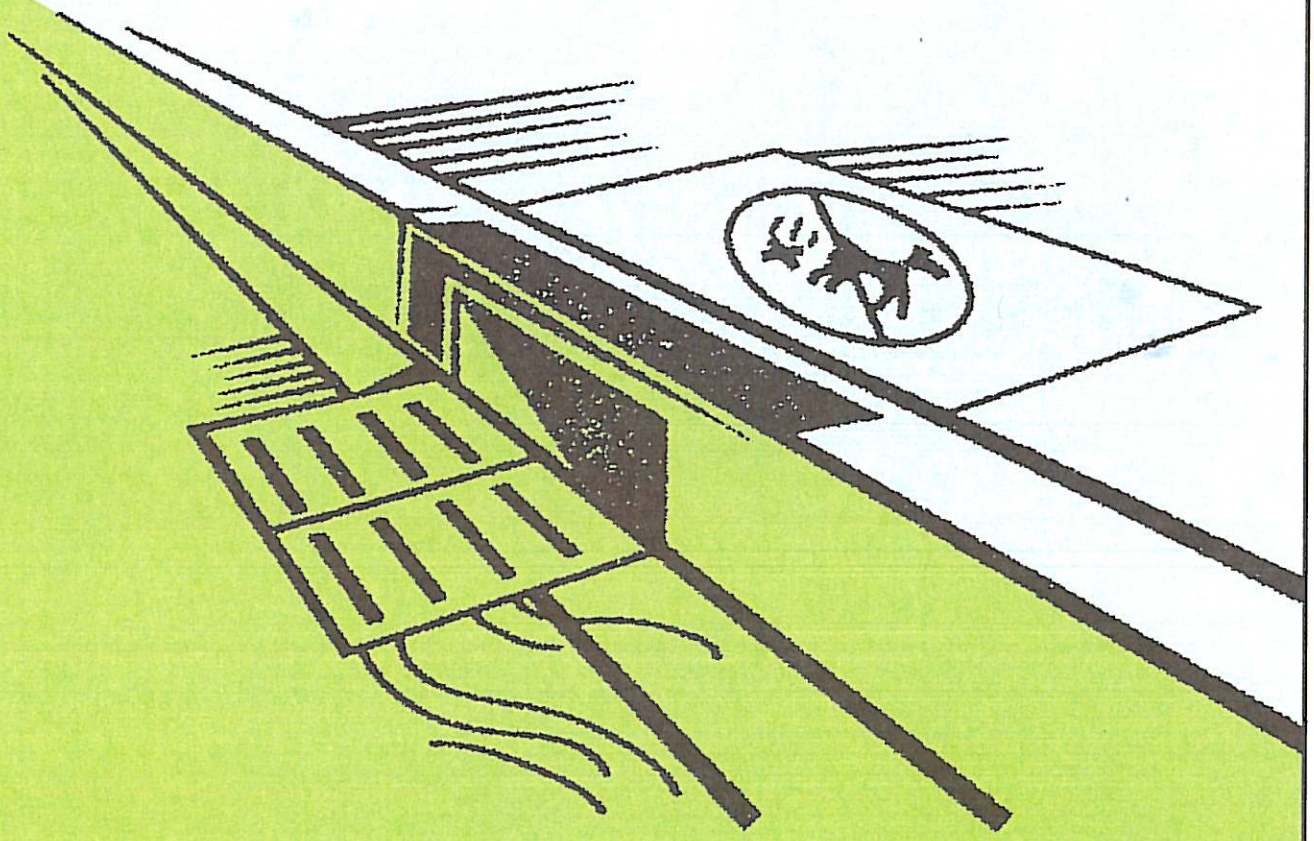
PROJECT Pollution PREVENTION

Printed on recycled paper

Pick Up After Your Pooch!



Storm drains are for rain...
they're not pooper scoopers.

L.A. County residents walk a dog without picking up the droppings more than **62,000** times per month.

Disease-causing dog waste washes from the ground and streets into storm drains and flows straight to the ocean — untreated.

Remember to bring a bag and clean up after your dog.

1 (888) CLEAN LA
www.888CleanLA.com

Tips for Dog Owners:

Dog owners can help solve the stormwater pollution problem by taking these easy steps...

- Clean up after your dog every single time.
- Take advantage of the complimentary waste bags offered in dispensers at local parks.
- Ensure you always have extra bags in your car so you are prepared when you travel with your dog.
- Carry extra bags when walking your dog and make them available to other pet owners who are without.
- Teach children how to properly clean up after a pet. Encourage them to throw the used bags in the nearest trash receptacle if they are away from home.
- Put a friendly message on the bulletin board at the local dog park to remind pet owners to clean up after their dogs.
- Tell friends and neighbors about the ill effects of animal waste on the environment. Encourage them to clean up after their pets as well.

PROJECT Pollution PREVENTION

Storm Drains are for Rain...

Stormdrains take runoff directly to creeks and the ocean without treatment. Pool chemicals can harm our natural creeks and waterways. Anything going into our stormdrains that isn't rainwater contributes to stormwater pollution, which contaminates our creeks and ocean, kills marine life and causes beach closures.

...not pool chemicals

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

Swimming Pool Tips

Follow these simple steps to prevent stormwater pollution...

- Make sure all chemicals are dissipated before draining a pool or spa
- Do not drain pools within 5 days of adding chemicals
- Never backwash a filter into the street or stormdrain
- Cleanup chemical spills with absorbent, don't wash it down the drain
- Dispose of leftover chemicals and paints through a licensed hazardous waste disposal provider

PROJECT Pollution PREVENTION

Storm Drains are for Rain...

More than 50% of the automotive oil sold to do-it-yourself oil changers is not recycled. There are more than 600 State-certified used oil collection centers within Los Angeles County.

Never dispose of automotive fluids, recyclable products, or household hazardous wastes into the street or gutter. Take them to your local auto repair station, recycling center or a household hazardous waste roundup.

...they're not recycling centers.

1(888)CLEAN LA
www.888CleanLA.com

Recycling Tips:

You can help keep your community clean, protect our area waterways and make the beaches safe for ocean swimmers by putting recyclable materials where they belong — at a recycling center or household hazardous waste roundup. Never throw or pour anything into the streets or gutters...

- When changing vehicle fluids – transmission, hydraulic and motor oil, brake and radiator fluid – drain them into a drip pan to avoid spills. Do not combine these fluids. Do not dispose of them in the street, gutter or in the garbage. It is illegal.
- Recycle all used vehicle fluids. Call 1(888)CLEAN LA or visit www.888CleanLA.com for the location of a center that recycles these fluids, or for the location of a local household hazardous waste Roundup.
- Other materials that should be taken to a household hazardous waste Roundup are: paint and paint-related materials, household cleaners, batteries, pesticides and fertilizers, pool chemicals, and aerosol products.
- Aluminum, glass, plastic and newspapers should be placed in your curbside recycling bin or taken to a local recycling center.

Printed on recycled paper

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- Aluminum, glass, plastic and newspapers should be placed in your curbside recycling bin or taken to a local recycling center.

Printed on recycled paper

PROJECT Pollution PREVENTION

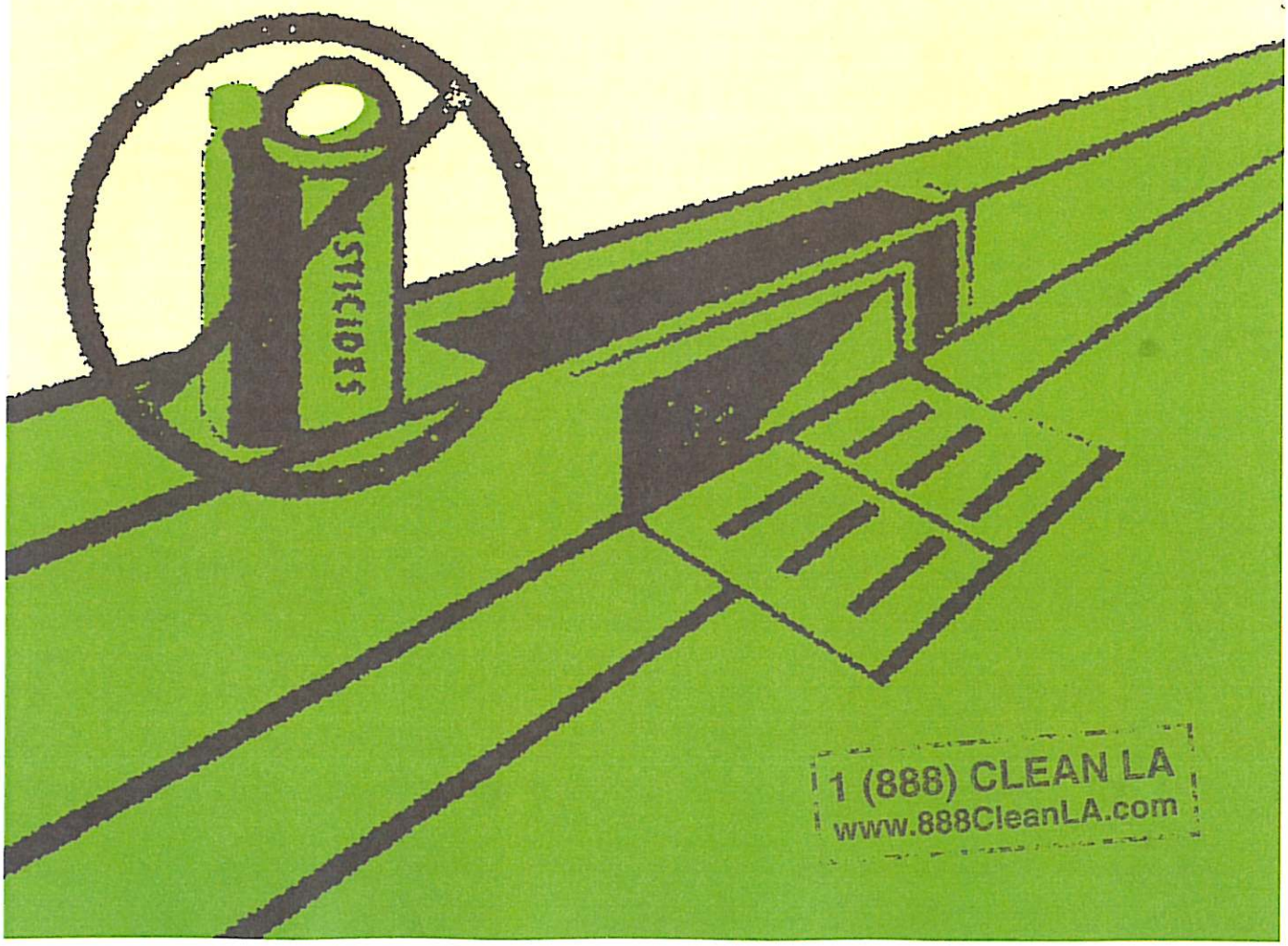
A Yard is a Terrible Thing to Waste!

Storm drains are for rain...**not yard waste.**

Residential yard waste represents about **13 percent** of the total waste generated in L.A. County.

Pesticides, fertilizer and yard waste such as leaves and mowed grass wash from the ground and streets into storm drains and flow straight to the ocean — **untreated.**

Remember to use pesticides and fertilizer wisely and pick-up yard waste.



Tips For Yard Care:

L.A. County residents can help solve the stormwater pollution problem by taking these easy steps...

- Do not over-fertilize and do not use fertilizer or pesticides near ditches, gutters or storm drains.
- Do not use fertilizer or pesticides before a rain.
- Follow the directions on the label carefully.
- Use pesticides sparingly — more is not better. "Spot" apply, rather than "blanket" apply.
- When watering your lawn, use the least amount of water possible so it doesn't run into the street carrying pesticides and other chemicals with it.
- Use non-toxic products for your garden and lawn whenever possible.
- If you must store pesticides or fertilizer, make sure they are in a sealed, water-proof container in a covered area to prevent runoff.
- Do not blow, sweep, hose or rake leaves or other yard trimmings into the street, gutter or storm drain.

PROJECT pollution PREVENTION

A message from the County of Los Angeles Department of Public Works.
Printed on recycled paper.

APPENDIX 11

SOILS/ GEOTECHNICAL REPORT

PIC ENVIRONMENTAL SERVICES

A DIVISION OF PETROLEUM INDUSTRY CONSULTANTS, INC.
2619 Sierra Way, La Verne, CA 91750
Phone: (909) 593-2427 ▪ Fax (909) 593-2105
Email: picenv@verizon.net

May 5, 2008

John Scott
NJD, Limited
3300 East First Avenue, Suite 510
Denver, CO 80206

Greetings;

Re: Percolation Testing Results
Potential Leach Field Installation
NJD Project
TTM No. 70583
315 Acres Project
North of Foothill Blvd.
San Dimas, CA 91773

At your request, PIC Environmental Services (PIC) submits this letter and attachments to confirm favorable percolation testing results for the referenced property. It is PIC's understanding that NJD, Limited has been asked by the City of San Dimas to confirm favorable percolation testing results at the subject property in the event that one or more future leach fields needs to be constructed onsite. As documented in the attached report, PIC conducted percolation testing in 1998 within the NJD Project site. Favorable percolation testing results were used by Mr. McHenry to facilitate construction of a leach field onsite at that time. In consideration of favorable testing results in 1998 and similar lithology throughout the NJD Project site, PIC concludes that all development parcels within the property are suitable for installation of future leach fields, if needed. PIC appreciates the opportunity to be of service. Please advise if you have questions.

Respectfully submitted,

J. Tim Hersch
California Professional Geologist #4082
President

REGISTERED GEOLOGIST
J. TIM HERSCH
#4082
STATE OF CALIFORNIA

Attachments

PIC ENVIRONMENTAL SERVICES
A DIVISION OF PETROLEUM INDUSTRY CONSULTANTS, INC.
1768 ARROW HIGHWAY, SUITE 102, LA VERNE, CALIFORNIA 91750
909/596-3355 FAX: 909/596-0515

October 22, 1998

Sandy McHenry
617 Brinwood
San Dimas, CA 91773

Dear Mr. McHenry:

SUBJECT: PERCOLATION TEST FOR PROPOSED LEACH FIELD
Map Book 8665 Page O1 Parcels 004 & 005
San Dimas, CA

INTRODUCTION:

PIC Environmental Services (PIC) was contracted by Mr. Sandy McHenry, the property owner, to conduct a percolation test in the area of a proposed leach field located in parcels 004 & 005, San Dimas, California. The location of the site relative to surrounding streets and landmarks is shown on Figure 1; Site Location Map.

Percolation tests were performed in the area of the proposed leach field to evaluate soil capacity to dispose of sewage effluent for the proposed residential project. One test trench and one percolation test pit were excavated at locations shown on Figure 2. The test trench was excavated by backhoe to a maximum depth of 10 feet. The test trench was used to determine the potential presence of groundwater within a three foot depth zone below the bottom of the proposed leach field. The percolation test pit was excavated via a backhoe to a depth of 7.8 feet (94 inches) below existing ground surface. The soils encountered during excavation were logged and recorded by PIC registered geologist, Hamid Khorzani. The soils are classified in accordance with the Unified Soil Classification System (see attached Unified Soil Classification System). Detailed logs of the test pit and trench are presented on attached Boring Logs.

Test Procedures

One percolation test was performed at the location of the proposed leach pit as shown on Figure 2; Site Location Map.

Prior to performing the percolation test, the bottom and sides of the trench were scratched to remove any smeared soil surface and to provide a natural soil interface into which water may percolate. After removing loose material from the test trench, approximately six (6) inches of gravel was placed at the bottom of the trench to protect the bottom from scouring and sediment.

The test trench was filled with clear water to a minimum depth of four feet above the gravel and left to soak overnight for pre-saturation and to allow the soil to swell. Percolation tests were conducted about twenty four (24) hours later after the water was first added to the trench. The trench was then filled to a depth of 18 inches above the bottom of the trench with clear water (12 inches above the top of gravel). Depth readings were recorded every 30 minutes for 4 hours to determine the percolation rate. The final 30 minute reading for the trench is the percolation rate for that period. Water was refilled to its initial level after each 30 minute reading. The results of this percolation test are summarized on the attached table "Report of Percolation Test."

Conclusions and Recommendations:

The results of field percolation tests indicate a percolation rate of 3.97 minutes per inch for the percolation test pit. Percolation rates exceeding 60 minutes per inch are considered unacceptable for use in disposal fields. As a result, the proposed area is suitable for a leach field.

The following design criteria for sewage disposal are provided for reference as minimum requirements.

Parameter	Minimum Requirements
Design Percolation Rate: (3.97 minutes/inch was measured)	60 minutes/inch or faster
Required Absorption Area:	330 square feet/bedroom
Leaching Area Needed:	660 square feet
Minimum Septic Tank Size:	750 gallons

In a case where the depth of filter material below the pipe exceeds the standard six inch depth, credit may be given for the added absorption area provided in deeper trenches with a resultant decrease in length of trench. The following table provides the percentage of length of standard absorption trench based on six inch increments of increase in depth of filter material.

PERCENTAGE OF LENGTH OF STANDARD TRENCH

Depth of Gravel Below Pipe in Inches	*Trench Width*					
	12"	*18"*	*24"*	*36"*	*48"*	*60"*
12	75	78	80	83	86	89
18	60	64	66	71	75	79
24	50	54	57	62	66	70
30	43	47	50	55	60	64
36	37	41	44	50	54	58
42	33	37	40	45	50	54

Based upon the results of PIC's percolation test and trench sizing allowances in the above table, we recommend one trench measuring 3 feet wide, 7 feet deep (30" gravel below pipe, 6" surrounding and above pipe, 12" compacted soil above gravel), and 200 feet long, to be located south of the existing barn leading to the proposed bathroom house project.

The exact location of the sewage disposal system should consider set back requirements in accordance with Table I-1 of the Uniform Plumbing Code. A plot plan drawn to scale with proper dimensions, showing location of all proposed retaining walls, drainage channels, utility lines, paved areas, structures and property lines with relation to the private sewage disposal system should be prepared.

Should you have any questions or comments regarding the procedures or results outlined in this report, please don't hesitate to call us at 909/596-3355.

Respectfully submitted,

J. Tim Hersch
California Registered Geologist #4082
President

Attachment

REGISTERED GEOLOGIST
J. TIM HERSCH
#4082
STATE OF CALIFORNIA

REPORT OF PERCOLATION TEST	Proposed Leach Field Map Book 8665 Page 01 Parcels 004 & 005 San Dimas, CA

Soil Profile

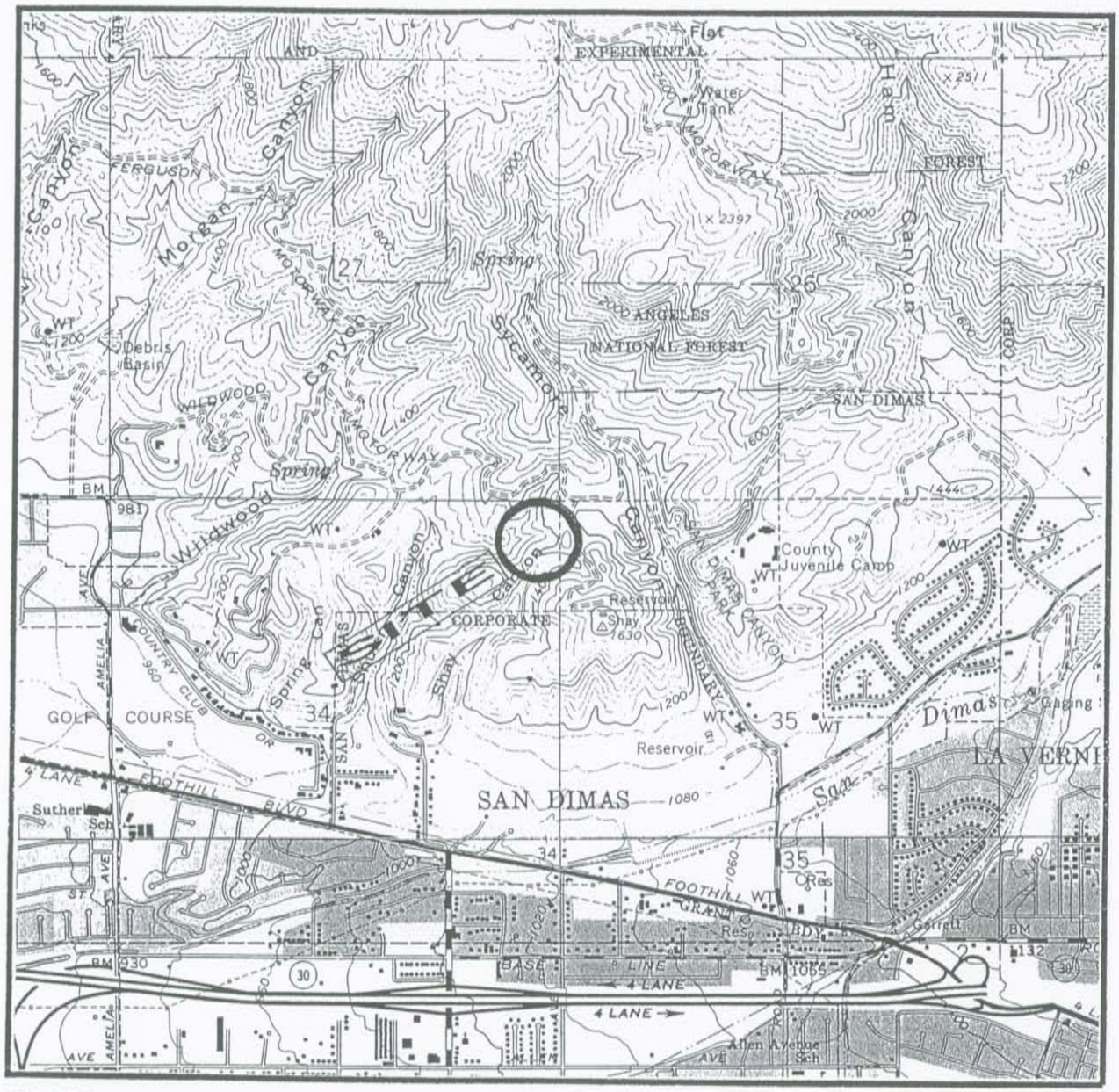
Leach pit	
0-12"	MH
12"-36"	CL
36"-84"	MH

Stabilized Infiltration Rate (min/in): Leach Pit 3.97 Minutes/inch

Data Obtained From Percolation Tests

Time Minutes	PIT #1		
	Depth to Water Below Surface In Inches	Water Drop Amount In Inches	Thickness of water above pit bottom – Inches
Initial	76		18
30	76	8	18
60	76	7.5	18
90	76	7.5	18
120	76	7.5	18
150	76	7.5	18
180	76	7.5	18
210	76	7.5	18
240	76	7.5	18

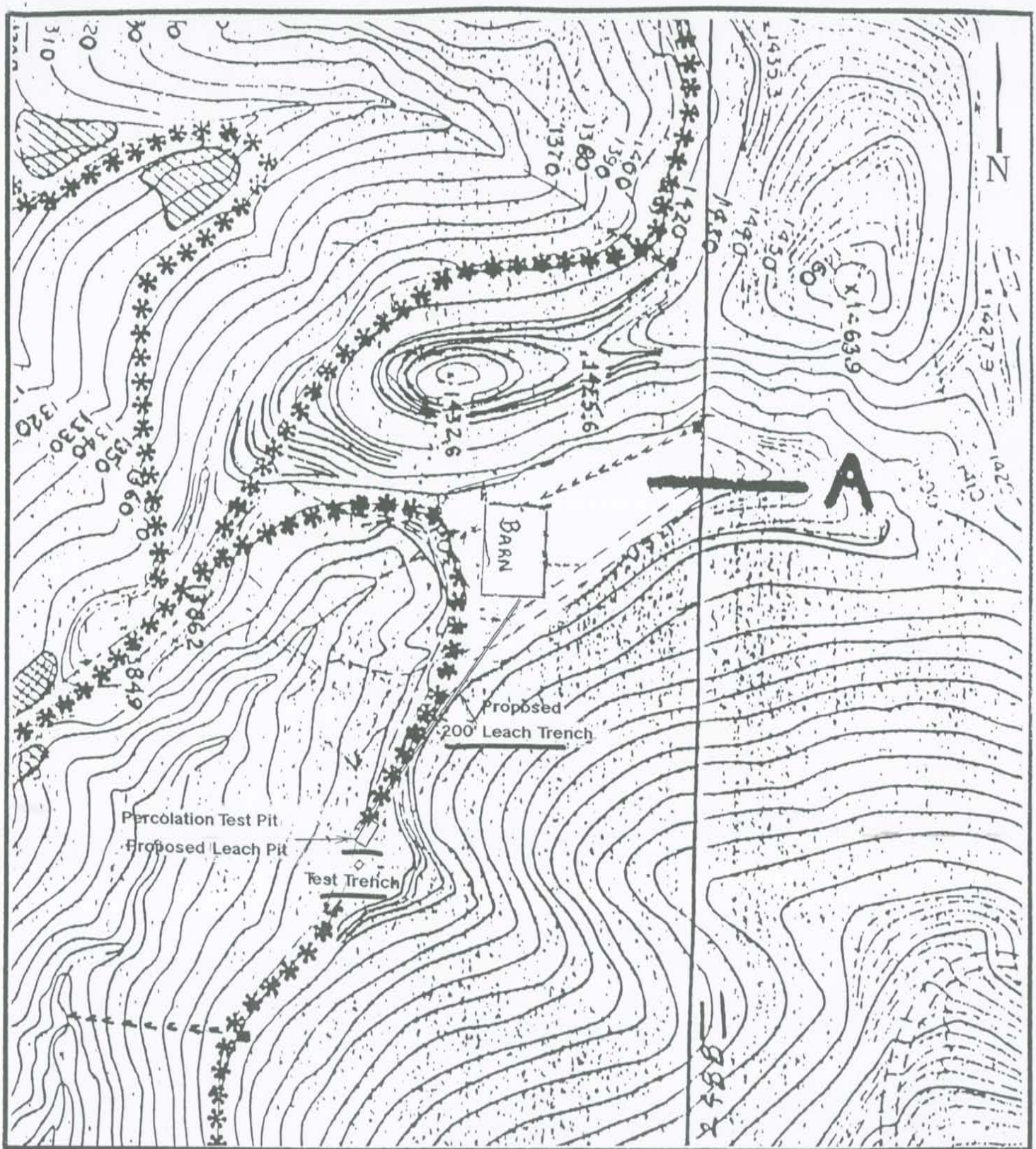
Table – McHenry Report



SOURCE: U.S.G.S. TOPOGRAPHIC QUADRANGLE
WHITTIER, CALIFORNIA
7.5 MINUTE SERIES

⊕ SITE LOCATION
SCALE 1":24,000'

PIC ENVIRONMENTAL SERVICES 1768 ARROW HIGHWAY- SUITE # 102 LA VERNE, CA 91750	0 1000 2000 SCALE IN FEET	SITE LOCATION MAP U.S.G.S. TOPOGRAPHIC MAP	
CLIENT: SANDY McHENRY	FILE:	PROJECT MANAGER:	PROJECT NO.: E001
LOCATION: Map Book 8665 PG 01 Parcels 004+005, San Dimas, CA	DRAFTED BY:	DATE: 9/98	FIGURE: 1



PIC ENVIRONMENTAL SERVICES 1768 ARROW HIGHWAY- SUITE # 102 LA VERNE, CA 91750	0 100 SCALE IN FEET	SITE LOCATION MAP (DETAIL)	
CLIENT: SANDY McHENRY	FILE:	PROJECT MANAGER:	PROJECT NO.: E001
LOCATION: Map Book 8665 PG 01 Parcels 004+005, San Dimas, CA	DRAFTED BY:	DATE: 9/98	FIGURE: 2

PROJECT: E001

LOCATION: San Dimas, CA

BORING DATE: 9/16/1998

Percolation Test Pit

DATUM: GROUND SURFACE

DIP: 90

LOGGED: HK

DEPTH SCALE METRES	DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	DEPTH B.G.S. (ft)	Samples ID	Samples Type	Samples G symbols	Samples "N" Value	Concentration
0	0	Backhoe	GROUND SURFACE							LEL ◆ Moisture Content ◆ Gas Concentration ■ 0 20 40 60 80 100
			Silt with Rock Fragments.		0.0			MH		
	2		Clay with Rock Fragments.		1.0			CL		
1					3.0					
	4		Silt with Shale Rock Fragments.					MH		
	6									
2			END OF EXPLORATION @ 7.00ft		7.0					
	8									
3	10									
	12									
4										
	14									
	16									
5										

NO INSTALLATION

END OF EXPLORATION

DRAWN: HK

PIC

CHECKED: JTH

PROJECT: E001

LOCATION: San Dimas, CA

BORING DATE: 9/16/1998

Test Trench

DATUM: GROUND SURFACE

DIP: 90

LOGGED: HK

DEPTH SCALE METRES	DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	DEPTH B.G.S. (ft)	Samples ID	Type	G symbols	"N" Value	Concentration LEL ◆ Moisture Content ● Gas Concentration ■ 0 20 40 60 80 100
0	0	Backhoe	GROUND SURFACE							
			Silt with Rock Fragments.		0.0			MH		●
	2		Clay with Rock Fragments.		1.0			CL		●
1	4				3.0					
	6		Silt with Shale Rock Fragments.					MH		●
2	8									
3	10		END OF EXPLORATION @ 10.00ft		10.0					
	12									
4	14									
	16									
5										

PIC ENVIRONMENTAL SERVICES

NO INSTALLATION

END OF EXPLORATION

DRAWN: HK

PIC

CHECKED: JTH

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions				Group Symbols	Typical Names
1	2			3	4
Coarse-grained Soils: More than half of meterila is larger than No. 2 sieve size. The No. 200 sieve size is about the smallest particle visible to the naked eye.	Gravels: More than half of coarse fraction is larger than No. 4 sieve size. (For visual classification, the 1/4-in. size may be used as equivalent to the No. 4 sieve size.)	Clean Gravels (Little or no fines)		GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
				GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		Gravels with Fines (Appreciable amount of fines)		GM	Silty gravels, gravel-sand-silt mixture.
				GC	Clayey gravels, gravel-sand-clay mixtures.
	Sands: More than half of coarse fraction is smaller than No. 4 sieve size	Clean Sands (Little or no fines)		SW	Well-graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands or gravelly sands, little or no fines.
		Sands with Fines (Appreciable amount of fines)		SM	Silty sands, sand-silt mistures.
				SC	Clayey sands, sand-clay mixtures.
Fine-grained Soils: More than half of material is smaller than No. 200 sieve size.					
	Soils and Clays: Liquid limit is less than 50	Silts and Clays		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
				OL	Organic silts and organic silty clays of low plasticity.
	Soils and Clays: Liquid limit is greater than 50			MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
				CH	Inorganic clays of high plasticity, fat clays.
				OH	Organic clays and silts of medium to high plasticity.
Highly Organic Soils				Pt	Peat and other highly organic soils.