COURTYARD & TOWNPLACE SUITES
APN NO. 2061-004-030

PRELIMINARY DRAINAGE ANALYSIS & LID PLAN

Agoura Hills, CA

May 5, 2016

CLIENT: Huntington Hotel Group

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WORK ORDER NO.: 2064112900

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ATTACHMENTS

INTRODUCTION

The hotel development for Courtyard & TownPlace Suites is located on a 5.5 acre lot within the limits of Agoura Hills. The site is bounded by the 101 Freeway to the north, an animal shelter to the west, a razed development to the east, and Agoura Road to the south. The site is currently undeveloped and comprised of oak trees, grass, and shrubs. The existing drainage pattern surface flows from the northeast to the southwest. The project will consist of three-story hotel structure, parking lots along the perimeter of the site, and a courtyard with a swimming pool at the center.

Vicinity Map (Figure A)

APPROACH

The objective of this drainage and LID report is to address the performance criteria required and demonstrate compliance with the current MS4 Permit for the Coastal Watersheds of Los Angeles County (Order No. R4-2012-0175 / NPDES Permit No. CAS004001; adopted on November 8, 2012), through the Department of Public Works' Low Impact Development Standards Manual (LID

Manual), dated February 2014, and mitigate the hydrologic impact of the development to the existing storm drain system. To achieve these goals, the following are proposed:

- Improve water quality and mitigate potential water quality impacts caused by the land development, through the implementation of Best Management Practices (BMPs), prior to discharging off-site. Based on the proposed improvements, the development will disturb an area greater than one acre and will add more than 10,000 square feet of impervious surface area. Therefore, the site is considered a Designated Project as defined in the LID Manual.

- Minimize the impacts of the development on the existing drainage system by attenuating the developed condition peak flows to the allowable discharge rate ($Q_{allowable}$) determined by the Los Angeles County Department of Public Works. Mitigation of any increase in flow rate can be achieved by on-site detention.

Below is a summary of the process proposed to address water quality prior to discharging stormwater runoff off-site, in compliance with the currently adopted MS4 Permit:

- Determine the design volume (SWQDv), using the larger runoff value determined from the following methods below:

    1. The 0.75-inch, 24-hour rain event.

    2. The 85th percentile, 24-hour rain event.

- Feasibility of BMPs would be analyzed in order of following priority:

    1. Infiltration Systems

    2. Stormwater Capture and Use

    3. High Efficiency Biofiltration/Bioretention Systems

    4. Combination of Any of the Above

- Alternative Compliance Measures: Biofiltration facilities shall be sized to capture and treat 150% of the design capture volume (or the equivalent flow) if infiltration and stormwater and capture and re-use is deemed infeasible.

The proposed drainage concept and post-construction BMPs addresses the regional and local requirements regarding stormwater quality and developmental impact to the existing drainage system. The proposed treatment of runoff, designed in compliance with the County of Los Angeles Department of Public Works Stormwater Best Management Practice Design and Maintenance Manual, is accomplished through biofiltration. Mitigation of increased flows is achieved through on-site stormwater detention.

HYDROLOGY

The stormwater runoff generated from the site is accepted by a Los Angeles County storm drain line (Lindero Canyon Concrete Conduit: LA County Flood Control District Dwg. No. 421-D2.3). The $Q_{allowable}$ was requested from the Department of Public Works Hydraulic Analysis Section and received a response of 1.44 cfs per acre. Therefore, the project site will be limited to a total discharge of 7.93 cfs.

The post-development peak flows were calculated using the Los Angeles County HydroCalc Calculator. A hydrograph of the 50-year storm event was calculated to determine the detention volume required when the discharge off-site is restricted to the $Q_{allowable}$. The detention facility is further discussed in a later section of the report. A Drainage Area Map depicting the watershed for the post-development condition is included in the Attachments section. The 50-year rainfall depth and soil number for the site was determined from the 50-year, 24-hour isohyet of the Thousand Oaks region,

- 50-year Rainfall Isohyet: 7.4 inches
- Soil No. 028

The maps are located in Appendix B – Hydrologic Maps of the Los Angeles County Department of Public Works Hydrology Manual, dated January 2006 (Hydrology Manual). A copy of the Thousand Oaks map is provided in the Attachments for reference.

In the post-development condition, improvements are depicted on the Drainage Area Map - Proposed Condition. Drainage Area “A” (5.51 acres) has a total imperviousness of 66% in the post-development condition. The following is a summary of the site’s post-development characteristics:

- Drainage Area: 5.51 acres
- Flow Path Length: 590 ft
- Flow Path Slope: 0.020 ft/ft
- Percent Imperviousness: 66%
- Tc50-yr: of 6 minutes.
- Peak Intensity: 4.05 in/hr
- Undeveloped Runoff Coefficient: 0.67
- Developed Runoff Coefficient: 0.82

- Peak Flow Rate: 18.37 cfs
- Runoff Volume: 2.182 ac-ft (95,056 cu-ft)

The resulting stormwater flow and volume for the post-development condition are summarized in Table 1. The peak discharge is mitigated to the $Q_{allowable}$ after routing the flows through an on-site detention basin.

Table 1 – Peak Discharge Summary

Drainage Condition	Acreage	Q_{10} (cfs)	Q_{50} (cfs)
Without Detention	5.51	10.88	18.37
With Detention	5.51	7.93	7.93

Note: $Q_{allowable}$ = 1.44 cfs / acre (provided LA County)

HYDRAULICS

The on-site storm drain system has been designed to convey the stormwater runoff of a 10-year storm event, and overland flow for larger events. Discharge off-site will be limited to the allowable "Q" specified by the County. For storm events generating runoff in excess of the limit, attenuation is achieved by routing the flows through an underground detention basin (See Detention Facility section under the Site Assessment for BMP's heading for more information).

Runoff from the project site will be directed into an existing County reinforced concrete box storm drain. Existing storm drain information was obtained from County of Los Angeles record drawing for Lindero Canyon Concrete Conduit (LACFCD Drawing No. 421-D2.3). Two laterals are stub out of the main line to accept flows from the project site:

- 30" CMP at Lindero Canyon Station 39+66
    - HGL elevation at main line: 845.2' +/-
- 60" CMP at Lindero Canyon Station 41+30
    - HGL elevation at main line: 850.8' +/-

The allowable "Q" for the project site was determined by the County to 7.93 cfs (1.44 cfs/acre). An orifice plate within a cast-in-place weir structure will restrict the discharge off-site. The starting hydraulic grade line elevations for the proposed on-site storm drain system is equal to the top of weir elevation (4.9 ft of ponding) within the cast-in-place weir structure on-site. This elevation represents the maximum ponding of water within the structure prior to spilling over into the detention basin. The on-site storm drain system shall be adequately sized to convey the flows from storms up to the 10-year storm event. Larger flows will be conveyed towards the detention basin via surface flow and concrete gutters. Refer to Section 2 - Hydraulic Calculations for the results of the preliminary hydraulic analysis.

STORMWATER QUALITY DESIGN

The Stormwater Quality Design Volume (SWQDv) for the project is calculated by referencing the Section 6 of the County LID Manual. As stated in the "Approach" section of the report, the design storm, from which the SWQDv is calculated, is defined as the greater of:

- The 0.75-inch, 24-hour rain event; or
- The 85th percentile, 24-hour rain event as determined from the Los Angeles County 85th percentile precipitation isoheytal map.

<u>Calculate the Design Volume</u>:

Method 1 – The volume of runoff produced from a 0.75 inch storm event.

- LA County HydroCalc Calculator Subarea Parameters (Developed):
  - Area = 5.51 acres
  - Proportion Impervious = 0.66
  - Soil Type = 028
  - Rainfall Isohyet = 0.75 in
  - Flow Path Length = 590 ft
  - Flow Path Slope = 0.020
- Calculation Results
  - Intensity = 0.18 in/hr
  - Undeveloped Runoff Coefficient (Cu) = 0.1
  - Developed Runoff Coefficient (Cd) = 0.63
  - Tc Value = 36 min
  - Peak Flow Rate = 0.61 cfs * 1.5 = <u>0.92 cfs</u> (0.17 cfs / acre)
  - 24-Hour Runoff Volume = <u>0.214 ac-ft (9,343 ft^3)</u>
- With infiltration on-site infeasible, BMPs shall be sized to capture and treat 150% of the design capture volume:

  1.5 * 9,343 ft^3 = <u>14,015 ft^3</u>

Method 2 – The volume of runoff produced from the 85th percentile, 24-hour rain event, as determined from the Los Angeles County 85th percentile precipitation isohyetal map:

- LA County HydroCalc Calculator Subarea Parameters (Developed):
  - Area = 5.51 acres
  - Proportion Impervious = 0.66

- Soil Type = 028
- Rainfall Isohyet = 0.95 in
- Flow Path Length = 590 ft
- Flow Path Slope = 0.020

- Calculation Results
  - Intensity = 0.24 in/hr
  - Undeveloped Runoff Coefficient (Cu) = 0.10
  - Developed Runoff Coefficient (Cd) = 0.63
  - Tc Value = 30 min
  - Peak Flow Rate = 0.85 cfs * 1.5 = 1.28 cfs (0.23 cfs / acre)
  - 24-Hour Runoff Volume = 0.272 ac-ft (11,835 ft^3)

- With infiltration on-site infeasible, BMPs shall be sized to capture and treat 150% of the design capture volume:

  1.5 * 11,835 ft^3 = 17,753 ft^3

SITE ASSESSMENT FOR BMPS

The location of the project site and the soil characteristics described in the Updated Geotechnical Investigation demonstrates the technical infeasibility of using infiltration / retention BMPs. Infeasibility criteria that apply to the site include, but are not limited to the following:

- Per the recommendations in Section 8.1.8 of the geotechnical report dated May 20, 2015, prepared by Geocon West, Inc., infiltration of stormwater is not feasible and would be considered detrimental to the project due to the likely impermeable nature of the bedrock underlying the site.
- Groundwater level in the area is approximately 10 ft below existing ground.
- Soils have “low” to “medium” expansion potential.
- The project would not provide sufficient irrigation water demand of stored stormwater runoff due to limited landscaping and planting of low water-use vegetation.

Demonstrating technical infeasibility for infiltration and stormwater capture, the project will implement alternative compliance measures by on-site biofiltration of 1.5 times the volume of the SWQDv that is not reliably retained on-site.

Biofiltration Sizing (LID Manual – Appendix E):

Calculate the design volume:

- V_B = 1.5 x ($SWQD_V$ – V_R)

$= 1.5 \times (11{,}835\ ft^3 – 0) = \underline{17{,}753\ ft^3}$

Where:

V_B	=	Biofiltration design volume (ft^3)
$SWQD_V$	=	Stormwater Quality Design Volume, SWQDv (ft^3)
V_R	=	Volume of stormwater runoff reliably retained on-site (ft^3)

Determine the bottom surface area of the bioretention (at base of side slopes), A:

Calculate the surface area:

- d $= t_p \times (f_{design} / 12)$; solve for detention time

  $t_p = (d \times 12) / f_{design}$

  $= (1.5\ ft \times 12) / 5\ in/hr = \underline{3.6\ hrs}$

  Where:

d	=	Ponding depth (max 1.5 ft) [ft]; use 1.5 ft
t_p	=	Time for the selected ponding depth to filter through the planting media (max 96 hr) [hr]
f_{design}	=	Planting media long-term, in-place infiltration rate (min 5 in/hr) [in/hr]

- A $= V_B / d$

  $= 17{,}7531\ ft^3 / 1.5\ ft = \underline{11{,}836\ ft^2}$

  Where:

A	=	Bottom surface area of biofiltration area (ft^2)
V_B	=	Biofiltration design volume (ft^3)
d	=	Ponding depth (max 1.5 ft) [ft]

Based on the project's land-use, the project will have to treat all the pollutants of concern depicted on Table 7-3, which include suspended solids, total phosphorus, total nitrogen, total Kjeldahl nitrogen, cadium (total), chromium (total), copper (total), lead (total), zinc (total). However, the fact sheet for BIO-1: Biofiltration in Appendix E of the LID Manual contains a table (refer to Table – 2 below) depicting the pollutants of concern treated by biofiltration. Of the ones listed on Table

7-3, only total nitrogen, total Kjeldahl nitrogen, Chromium (total), and lead (total) are addressed by this type of BMP.

Table 7-3. Typical Pollutants of Concern by Land Use [(1)]

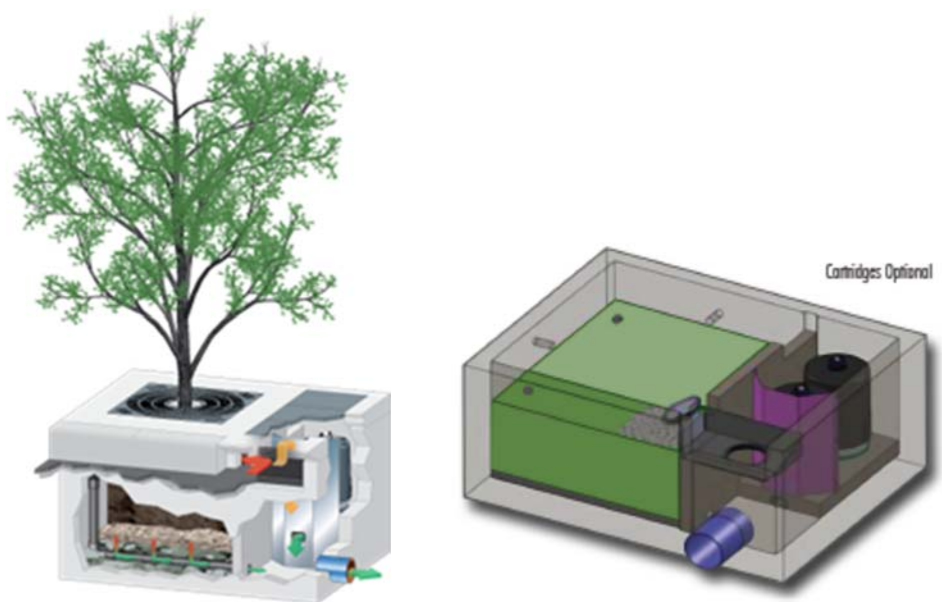
Land Use	Pollutants of Concern [(2)]								
	Suspended Solids	Total Phosphorus	Total Nitrogen	Total Kjeldahl Nitrogen	Cadmium, Total	Chromium, Total	Copper, Total	Lead, Total	Zinc, Total
High Density Single Family Residential	X	X			(4)	(4)	X	X	X
Multi-Family Residential	X				(4)	(4)	X		X
Mixed Residential	X	X	X		(4)	(4)	X	X	X
Commercial	X	X	X	X	(4)	(4)	X	X	X
Industrial	X	X	X	X	(4)	(4)	X	X	X
Critical Facilities [(3)]	X	(4)	(4)	(4)	(4)	(4)	X	X	X
Transportation (streets, roads)	X	X	X	X	(4)	(4)	X	X	X
Institutional (educational facilities)	X				(4)	(4)	X		X

Table 2 – BIO-1: Biofiltration Stormwater Quality Control Measure Fact Sheet

Pollutant of Concern	Treated by Biofiltration?
Suspended solids	No
Total phosphorus	No
Total nitrogen	Yes
Total Kjeldahl nitrogen	Yes
Cadmium, total	No
Chromium, total	Yes
Copper, total	No
Lead, total	Yes
Zinc, total	No

Therefore, treatment in the form of VEG-3: Tree-Well Filter (UrbanGreen Biofilter, by Contech Engineered Solutions) will be used to address stormwater runoff quality from the project site, which is included in the list of proprietary stormwater BMPs acceptable for maintenance by LACDPW (http://dpw.lacounty.gov/wmd/bmp/accepted_bmps.cfm). This type of BMP can provide a high level of treatment and partial runoff reduction capability above and beyond tradition designs.

Included in the Attachments is a copy of the technical white paper evaluation of stormwater quality performance, provided by Contech. All the required pollutants to be treated are addressed in the report (refer to page 23 of the white paper), except for total nitrogen and lead. However, a regulatory manager from Contech stated that “lead is not a common concern these days since leaded gasoline was phased out so long ago. It’s more dense and more likely to be sorbed to particles versus zinc and copper so lead removal is typically better”. Additionally, they have nitrogen removal data from North Carolina where total nitrogen removal was about 40%. This data will be released with the final report hopefully in the next month. The Peak Flow Rate calculated previously was 0.85 cfs * 1.5 = 1.28 cfs. According to Contech’s sizing chart this will require four 8’ x 16’ UrbanGreen Biofilters, each with a treatment capacity of 0.398 cfs and a bypass capacity of 3.4 cfs.

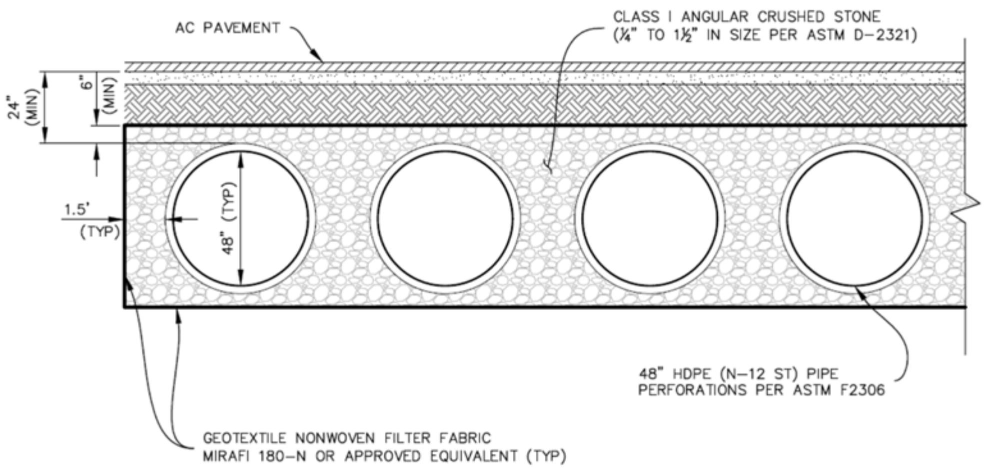


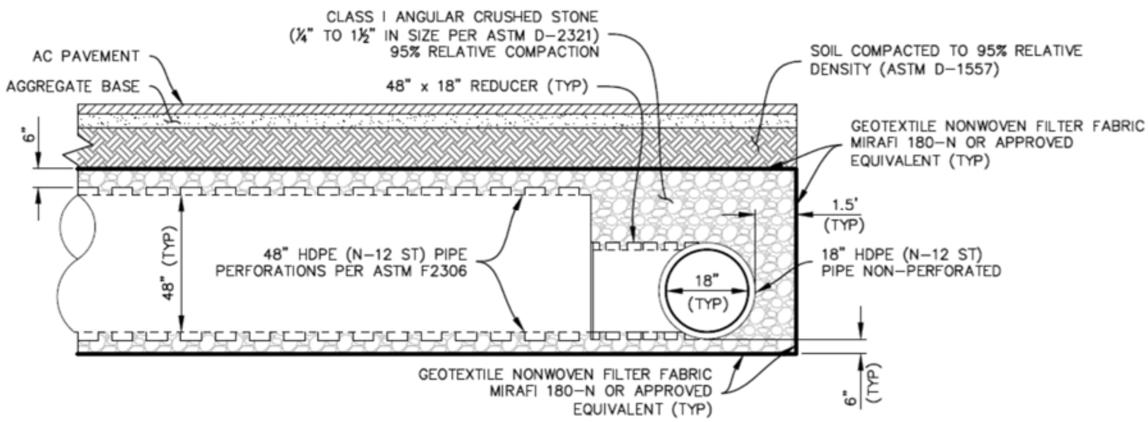
UrbanGreen Biofilter (Figure B)

Detention Facility

To maximize the useable area of the site, a proprietary subsurface detention facility will be utilized, in close proximity to the downstream end of the on-site storm drain. This would allow for the majority of the on-site runoff to be routed through the detention basin prior to discharge into the County storm drain system. The detention basin system will be comprised of three rows of 48” diameter HDPE pipe, encased in clean, crushed, angular stone; Each row will be about 92 ft in length, for a total of 276 ft, which will provide the required detention volume of approximately 3,469 ft^3 for the project. The detention facility will be similar to what is depicted in Figure C below.

The runoff discharged off-site will be limited to the $Q_{allowable}$ (1.44 cfs/acre) determined by the County, as discussed previously in the Approach Section of the report. A restrictor plate with a 1.00' diameter orifice will restrict the discharge off-site to less than or equal to 7.93 cfs. As water backs up, ponding will occur until spilling over the weir, and into the detention basin area. Refer to the Drainage Are Map – Proposed Condition for the layout of the cast-in-place weir structure.



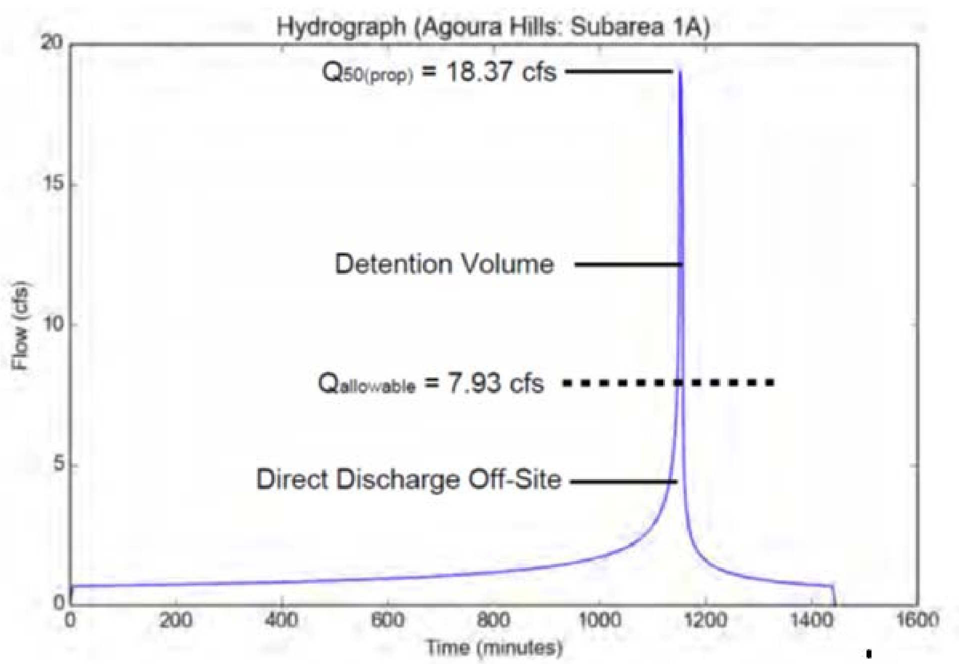


Detention Facility (Figure C)

Table 7 – Detention Storage Volume Required

Storm Time (min)	Inflow Q (cfs)	Outflow Q (cfs)	Δ Q (cfs)	Increment Volume (cu. ft)	Σ Volume (cu. ft)
1148.4	7.84	7.84	0.00	0.00	0.00
1148.6	7.98	7.93	0.05	0.60	0.60
1148.8	8.13	7.93	0.20	2.45	3.06
1149.0	8.30	7.93	0.37	4.42	7.48
1149.2	8.47	7.93	0.54	6.53	14.01
1149.4	8.66	7.93	0.73	8.79	22.80
1149.6	8.87	7.93	0.94	11.22	34.02
1149.8	9.08	7.93	1.15	13.86	47.87
1150.0	9.32	7.93	1.39	16.72	64.60
1150.2	9.59	7.93	1.66	19.87	84.46
1150.4	9.87	7.93	1.94	23.34	107.80
1150.6	10.20	7.93	2.27	27.21	135.01
1150.8	10.56	7.93	2.63	31.58	166.59
1151.0	10.98	7.93	3.05	36.59	203.17
1151.2	11.46	7.93	3.53	42.31	245.48
1151.4	12.01	7.93	4.08	49.00	294.48
1151.6	12.72	7.93	4.79	57.49	351.96
1151.8	13.72	7.93	5.79	69.49	421.45
1152.0	16.39	7.93	8.46	101.49	522.94
1152.2	17.61	7.93	9.68	116.10	639.04
1152.4	17.97	7.93	10.04	120.44	759.48
1152.6	18.17	7.93	10.24	122.89	882.37
1152.8	18.29	7.93	10.36	124.32	1006.69
1153.0	18.35	7.93	10.42	125.07	1131.76
1153.2	18.37	7.93	10.44	125.29	1257.05
1153.4	18.35	7.93	10.42	125.09	1382.14
1153.6	18.31	7.93	10.38	124.54	1506.68
1153.8	18.24	7.93	10.31	123.67	1630.36
1154.0	18.14	7.93	10.21	122.52	1752.88
1154.2	18.02	7.93	10.09	121.10	1873.98
1154.4	17.88	7.93	9.95	119.43	1993.41
1154.6	17.72	7.93	9.79	117.52	2110.93
1154.8	17.54	7.93	9.61	115.36	2226.29
1155.0	17.34	7.93	9.41	112.96	2339.25
1155.2	17.12	7.93	9.19	110.32	2449.57
1155.4	16.88	7.93	8.95	107.42	2556.98

1155.6	16.62	7.93	8.69	104.25	2661.23
1155.8	16.33	7.93	8.40	100.79	2762.02
1156.0	16.02	7.93	8.09	97.03	2859.05
1156.2	15.67	7.93	7.74	92.93	2951.98
1156.4	15.28	7.93	7.35	88.24	3040.22
1156.6	14.85	7.93	6.92	83.10	3123.32
1156.8	14.38	7.93	6.45	77.42	3200.74
1157.0	13.85	7.93	5.92	71.09	3271.83
1157.2	13.26	7.93	5.33	63.93	3335.77
1157.4	12.57	7.93	4.64	55.63	3391.40
1157.6	11.73	7.93	3.80	45.60	3437.00
1157.8	10.59	7.93	2.66	31.90	3468.91
1158.0	**7.86**	**7.86**	**0.00**	**0.00**	**3468.91**



Subarea "A" Hydrograph (Figure D)

HYDROMODIFICATION

The development of a site typically increases the impervious area and alters the existing drainage pattern, which results in an increase in runoff generated on-site and adversely impacts the downstream stormwater conveyance system. Consequently, the changes upstream can cause the escalation of stream and channel bank instability and erosion due to increased runoff volumes, flow durations, and higher stream velocities. Therefore, hydromodification requirements necessitate projects to fully mitigate off-site drainage impacts caused by hydromodification and changes in water quality, flow velocity, flow volume, and depth/width of flow. However, the project will limit the flow into the County storm drain to the allowable Q and runoff will be discharged directly to a concrete/engineered storm drain. The project will limit the discharge to the allowable Q and runoff will be discharged directly to a concrete/engineered storm drain. Furthermore, the project does not discharge into a natural drainage system but into a reinforced concrete box (Lindero Canyon conduit), which is not susceptible to hydromodification impacts, per Section VI.D.7.c.iv. (Hydromodification Control Criteria) of the current MS4 Permit. Per correspondences with the Hydraulic Analysis Section of the County Department of Public Works, the hydromodification requirement will be addressed when application for the connection permit is submitted and reviewed. It will be put into consideration then.

Additionally, one of the requirements to implement on-site biofiltration is to the achieve enhanced nitrogen removal capability if the proposed project will discharge into a receiving water that is included in the 303(d) List of impaired water quality-limited water bodies due to nitrogen compounds or related effects. However, based on the pollutant assessments for water bodies downstream of the Lindero Canyon conduit (Lindero Creek and Medea Creek; pollutant assessments are included in the Attachments for reference), the pollutants of concern are algae, benthic-macroinvertebrate bioassessments, coliform bacteria, invasive species, scum/foam-unnatural, sedimentation/siltation, selenium, and trash. The biofiltration BMP to be implemented on-site achieves the removal of the required pollutants generated by the type of land-use, flow velocity reduction, and provides some stormwater volume reduction through evapotranspiration.

OVERLAND ESCAPE

The proposed storm drain system and overland flow shall be designed to convey runoff generated on-site up to the 50-year storm event and route the flow through the detention facility. In the event the storm drain system is incapacitated due to clogged inlets or drain lines, the grading of the site provides an overland escape route southwesterly towards the site discharge-point, via surface flow. The finish floor elevations of the structures shall be accounted for in determining the spillover elevations of water ponding on-site.

SUMMARY AND CONCLUSIONS

The following summarizes how the overall concept of the site drainage and the implementation of the proposed BMP measures address the current MS4 Permit requirements stated in the beginning of the report:

- To address the potential water quality impacts caused by the development of the site, the project will implement biofiltration, sized at 1.5 times the SWQDv, to treat stormwater runoff prior to discharging off-site.

- The project site will provide an on-site detention facility to restrict the discharge into the Lindero Canyon conduit to the allowable Q specified by the County. Flows in excess of the $Q_{allowable}$ will be detained on-site for storms up to the 50-year event.

- The hydromodification impacts of the development on the downstream drainage system is addressed through the implementation of a detention basin to reduce the runoff generated on-site to the $Q_{allowable}$ and biofiltration devices for the treatment of pollutants of concern. The biofiltration BMP achieves the removal of the required pollutants generated by the type of land-use, flow velocity reduction, and provides some stormwater volume reduction through evapotranspiration.

- Runoff will be conveyed through the site in a storm drain system and overland flow sized for the 50-year storm event. However, should the storm drain system fail overland escape is provided by routing surface flows southwesterly towards the project discharge-point.

The conclusions of the drainage analyses conducted for the project site demonstrates that through the implementation of the proposed measures discussed in this report, the requirements of the current MS4 Permit have been adequately addressed.

SECTION 1 – HYDROLOGY CALCULATIONS

Peak Flow Hydrologic Analysis

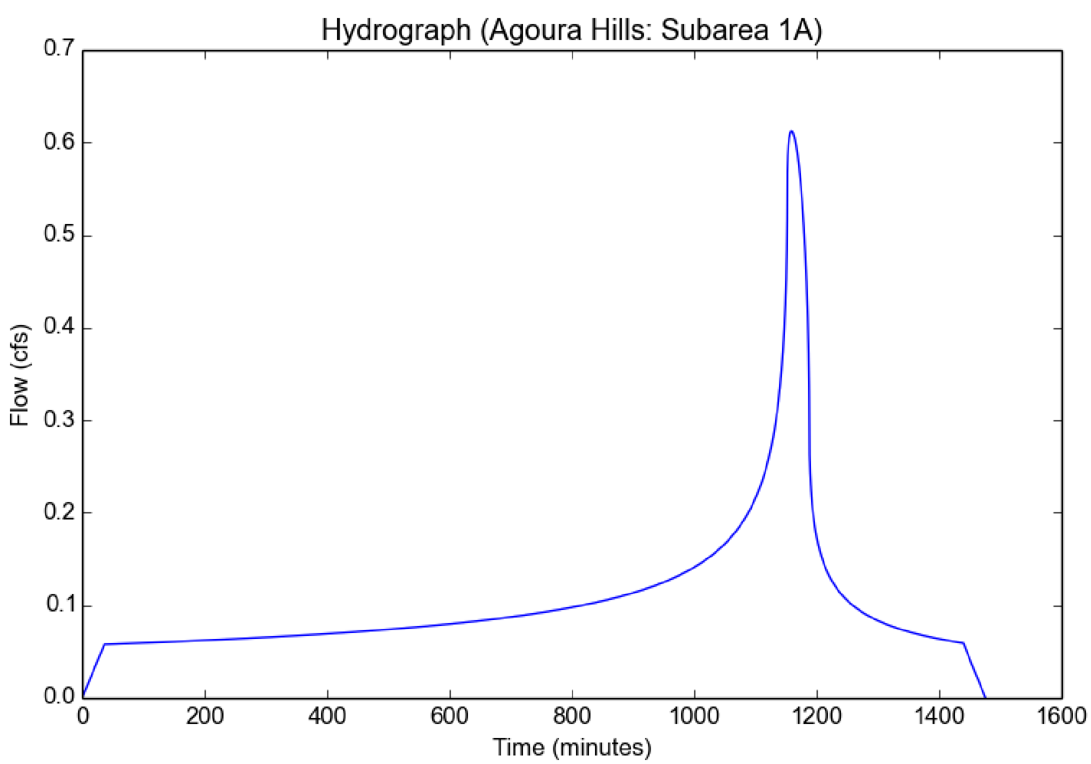
File location: C:/Users/TJ/Desktop/Agoura Hills - 0.75 Inch.pdf
Version: HydroCalc 0.3.1

Input Parameters

Project Name	Agoura Hills
Subarea ID	Subarea 1A
Area (ac)	5.51
Flow Path Length (ft)	590.0
Flow Path Slope (vft/hft)	0.02
0.75-inch Rainfall Depth (in)	0.75
Percent Impervious	0.66
Soil Type	28
Design Storm Frequency	0.75 inch storm
Fire Factor	0
LID	True

Output Results

Modeled (0.75 inch storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.1769
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.628
Time of Concentration (min)	36.0
Clear Peak Flow Rate (cfs)	0.6123
Burned Peak Flow Rate (cfs)	0.6123
24-Hr Clear Runoff Volume (ac-ft)	0.2145
24-Hr Clear Runoff Volume (cu-ft)	9342.9111



Peak Flow Hydrologic Analysis

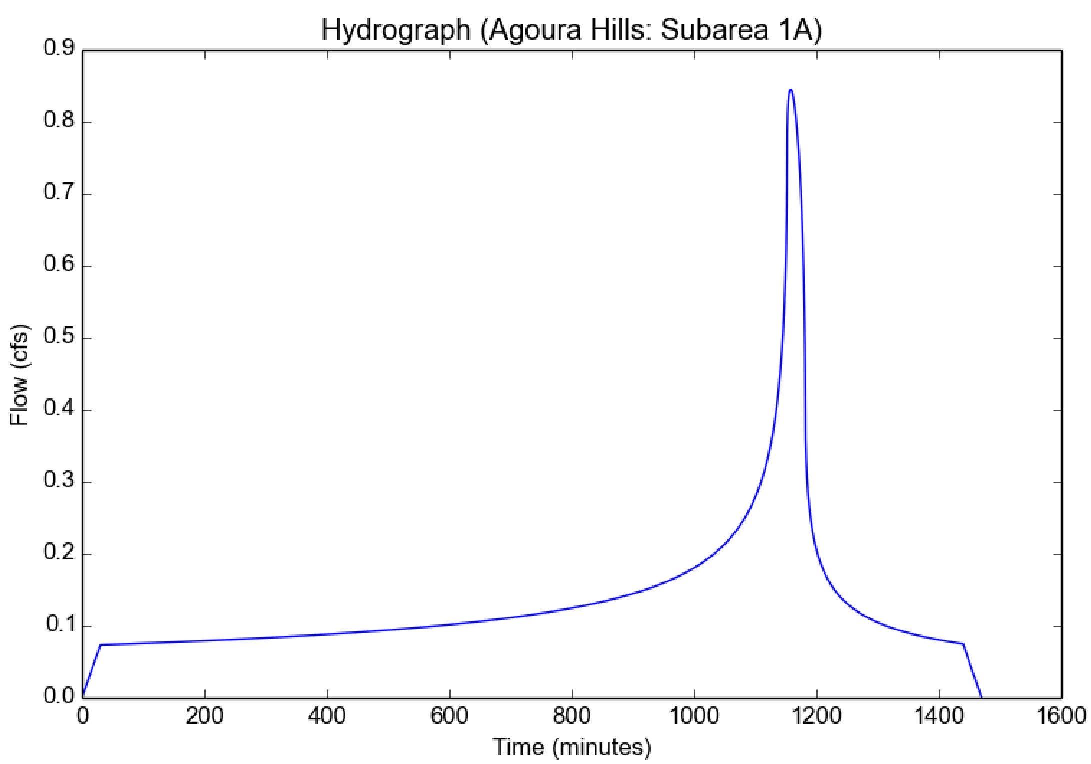
File location: C:/Users/TJ/Desktop/Agoura Hills - 85th Percentile.pdf
Version: HydroCalc 0.3.1

Input Parameters

Project Name	Agoura Hills
Subarea ID	Subarea 1A
Area (ac)	5.51
Flow Path Length (ft)	590.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	0.95
Percent Impervious	0.66
Soil Type	28
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.95
Peak Intensity (in/hr)	0.2442
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.628
Time of Concentration (min)	30.0
Clear Peak Flow Rate (cfs)	0.8449
Burned Peak Flow Rate (cfs)	0.8449
24-Hr Clear Runoff Volume (ac-ft)	0.2717
24-Hr Clear Runoff Volume (cu-ft)	11834.2935



Peak Flow Hydrologic Analysis

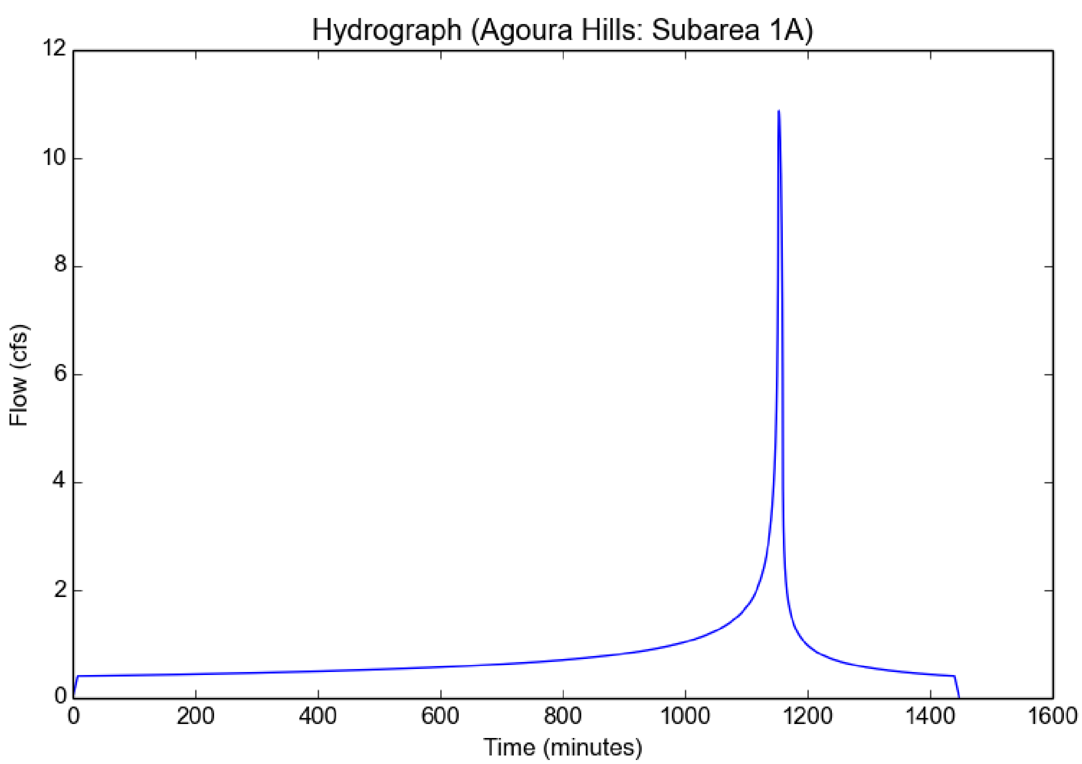
File location: C:/Users/TJ/Desktop/Agoura Hills - 10-yr.pdf
Version: HydroCalc 0.3.1

Input Parameters

Project Name	Agoura Hills
Subarea ID	Subarea 1A
Area (ac)	5.51
Flow Path Length (ft)	590.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	7.4
Percent Impervious	0.66
Soil Type	28
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	5.2836
Peak Intensity (in/hr)	2.5275
Undeveloped Runoff Coefficient (Cu)	0.5501
Developed Runoff Coefficient (Cd)	0.781
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	10.8771
Burned Peak Flow Rate (cfs)	10.8771
24-Hr Clear Runoff Volume (ac-ft)	1.5415
24-Hr Clear Runoff Volume (cu-ft)	67146.4548



Peak Flow Hydrologic Analysis

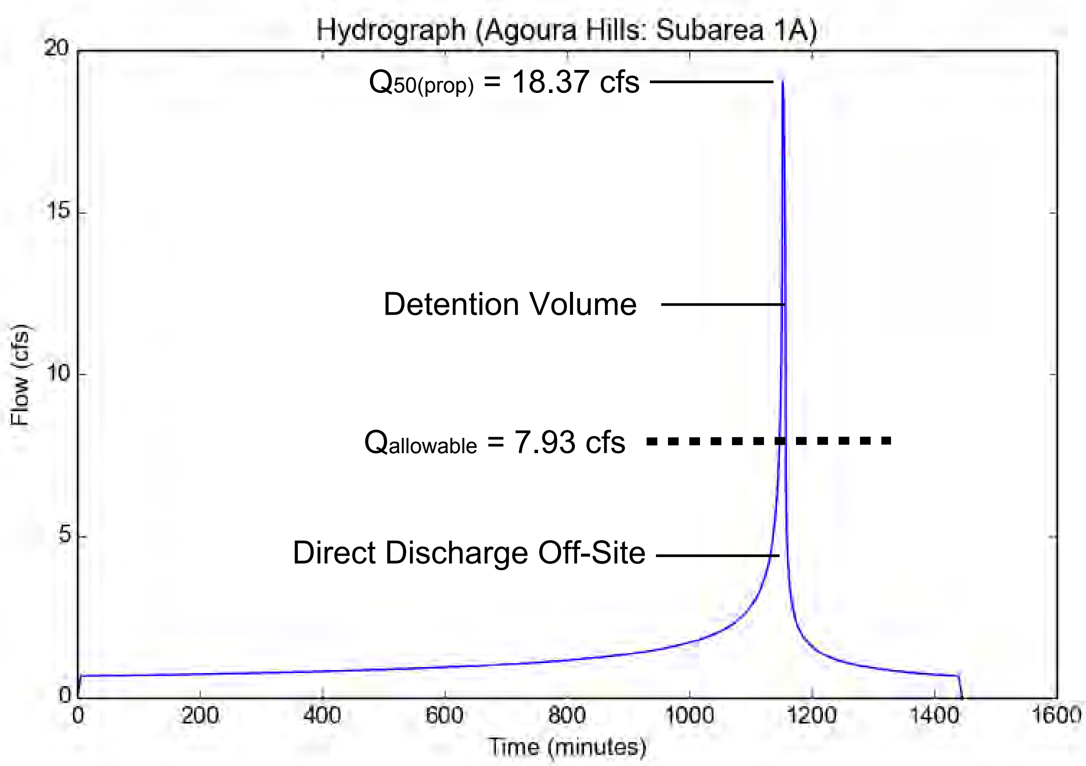
File location: C:/Users/tsantos/Desktop/Documents/Plans/2064112900/Drainage/Attachments/HydroCalc_50-Yr Storm.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Agoura Hills
Subarea ID	Subarea 1A
Area (ac)	5.51
Flow Path Length (ft)	590.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	7.4
Percent Impervious	0.66
Soil Type	28
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	7.4
Peak Intensity (in/hr)	4.0525
Undeveloped Runoff Coefficient (Cu)	0.6727
Developed Runoff Coefficient (Cd)	0.8227
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	18.3708
Burned Peak Flow Rate (cfs)	18.3708
24-Hr Clear Runoff Volume (ac-ft)	2.1822
24-Hr Clear Runoff Volume (cu-ft)	95056.4315



SECTION 2 – HYDRAULIC CALCULATIONS

Detention Basin Discharge Orifice

Cross Section for Circular Orifice - 1

Project Description

Solve For	Discharge

Input Data

Discharge	7.93	ft^3/s
Headwater Elevation	4.90	ft
Centroid Elevation	0.50	ft
Tailwater Elevation	0.00	ft
Discharge Coefficient	0.60	
Diameter	1.00	ft

Cross Section Image

Detention Basin Discharge Orifice

Worksheet for Circular Orifice - 1

Project Description

Solve For	Discharge

Input Data

Headwater Elevation	4.90	ft
Centroid Elevation	0.50	ft
Tailwater Elevation	0.00	ft
Discharge Coefficient	0.60	
Diameter	1.00	ft

Results

Discharge	7.93	ft^3/s
Headwater Height Above Centroid	4.40	ft
Tailwater Height Above Centroid	-0.50	ft
Flow Area	0.79	ft^2
Velocity	10.10	ft/s

On-site Storm Drain Line

Cross Section for Circular Pipe - 1

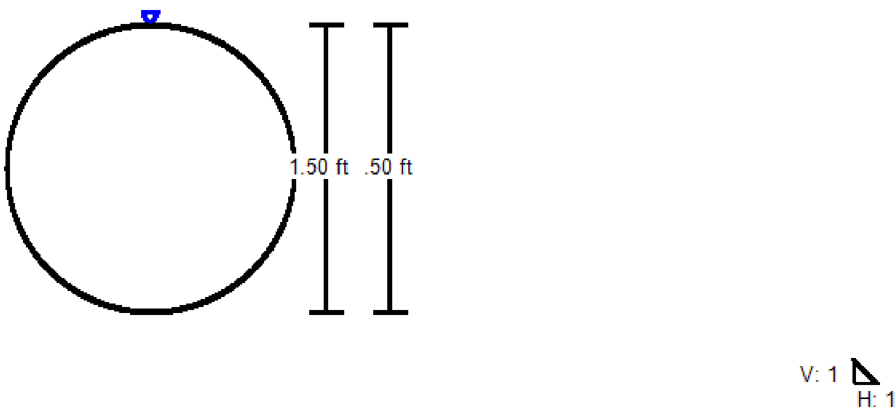
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02000	ft/ft
Normal Depth	1.50	ft
Diameter	1.50	ft
Discharge	14.85	ft³/s

Cross Section Image



On-site Storm Drain Line

Worksheet for Circular Pipe - 1

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02000	ft/ft
Normal Depth	1.50	ft
Diameter	1.50	ft
Discharge	14.85	ft³/s

Results

Discharge	14.85	ft³/s
Normal Depth	1.50	ft
Flow Area	1.77	ft²
Wetted Perimeter	4.71	ft
Hydraulic Radius	0.38	ft
Top Width	0.00	ft
Critical Depth	1.40	ft
Percent Full	100.0	%
Critical Slope	0.01729	ft/ft
Velocity	8.41	ft/s
Velocity Head	1.10	ft
Specific Energy	2.60	ft
Froude Number	0.00	
Maximum Discharge	15.98	ft³/s
Discharge Full	14.85	ft³/s
Slope Full	0.02000	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

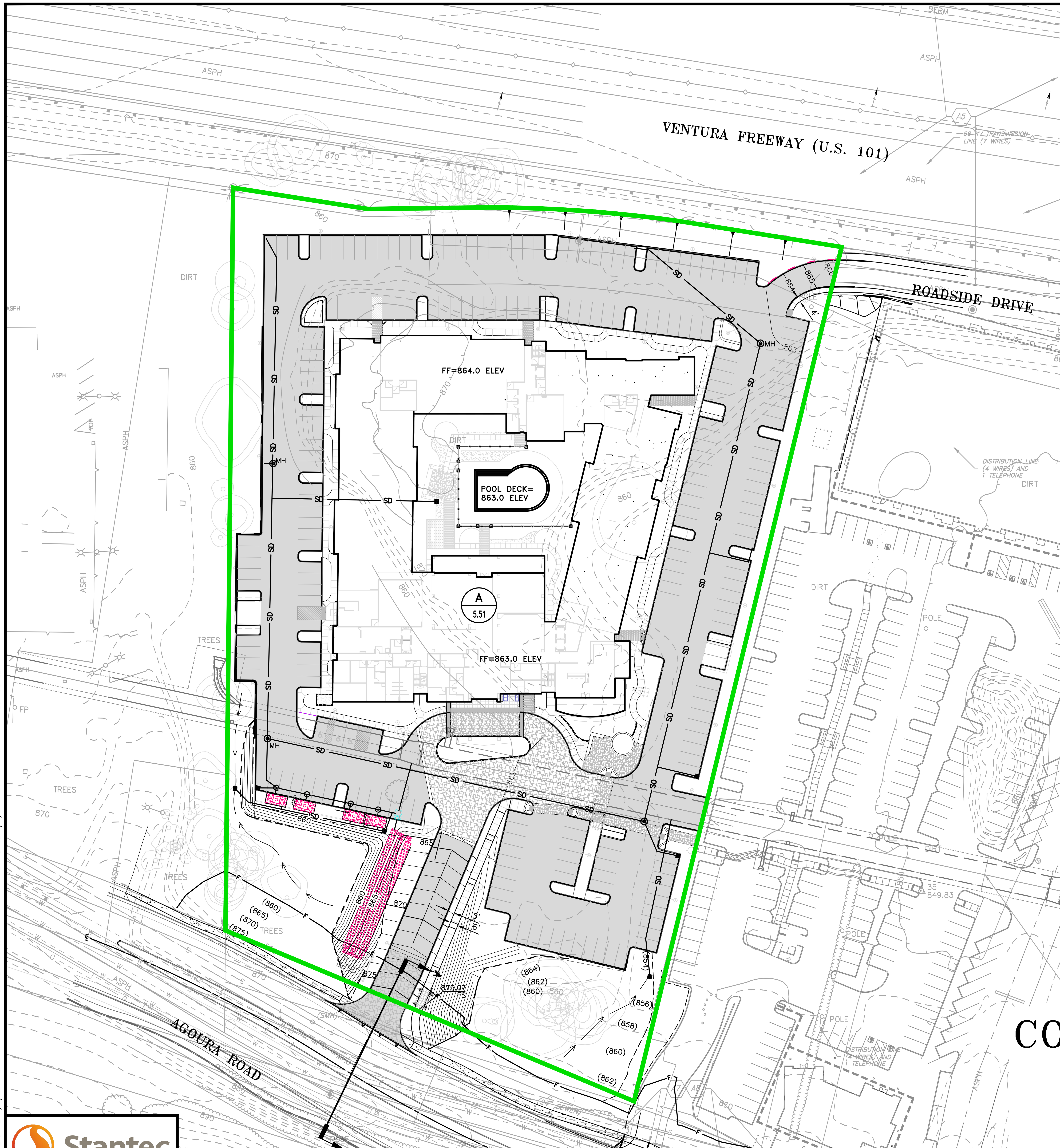
Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

Worksheet for Circular Pipe - 1

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.50	ft
Critical Depth	1.40	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.01729	ft/ft

SECTION 3 – DRAINAGE AREA MAP



LEGEND

(green line)	DRAINAGE AREA BOUNDARY
—— SD ——	PROPOSED STORM DRAIN
(symbol)	STORMGATE VAULT
(symbol)	STORMGATE MANHOLE
(symbol)	BIOFILTER
(symbol)	DETENTION BASIN
A / 5.51	DRAINAGE AREA DESIGNATION / AREA (ACRES)

IMPERVIOUS TOTAL = 157,272 SF / 3.61 AC

PERVIOUS TOTAL = 82,744 SF / 1.90 AC

TOTAL GROSS SITE AREA = 240,016 SF / 5.51 AC

DRAINAGE AREA (POST-DEVELOPMENT)				
SUBAREA	ACREAGE (AC)	Q_{10} (CFS)	Q_{50} (CFS)	$Q_{ALLOWABLE}$ (CFS)
A	5.51	10.88	18.37	7.93

NOTE: $Q_{ALLOWABLE}$: 1.44 CFS / ACRE

N

SCALE: 1"=40'

0 40 80 120

COURTYARD & TOWNPLACE SUITES
APN NO. 2061-004-030
DRAINAGE AREA MAP

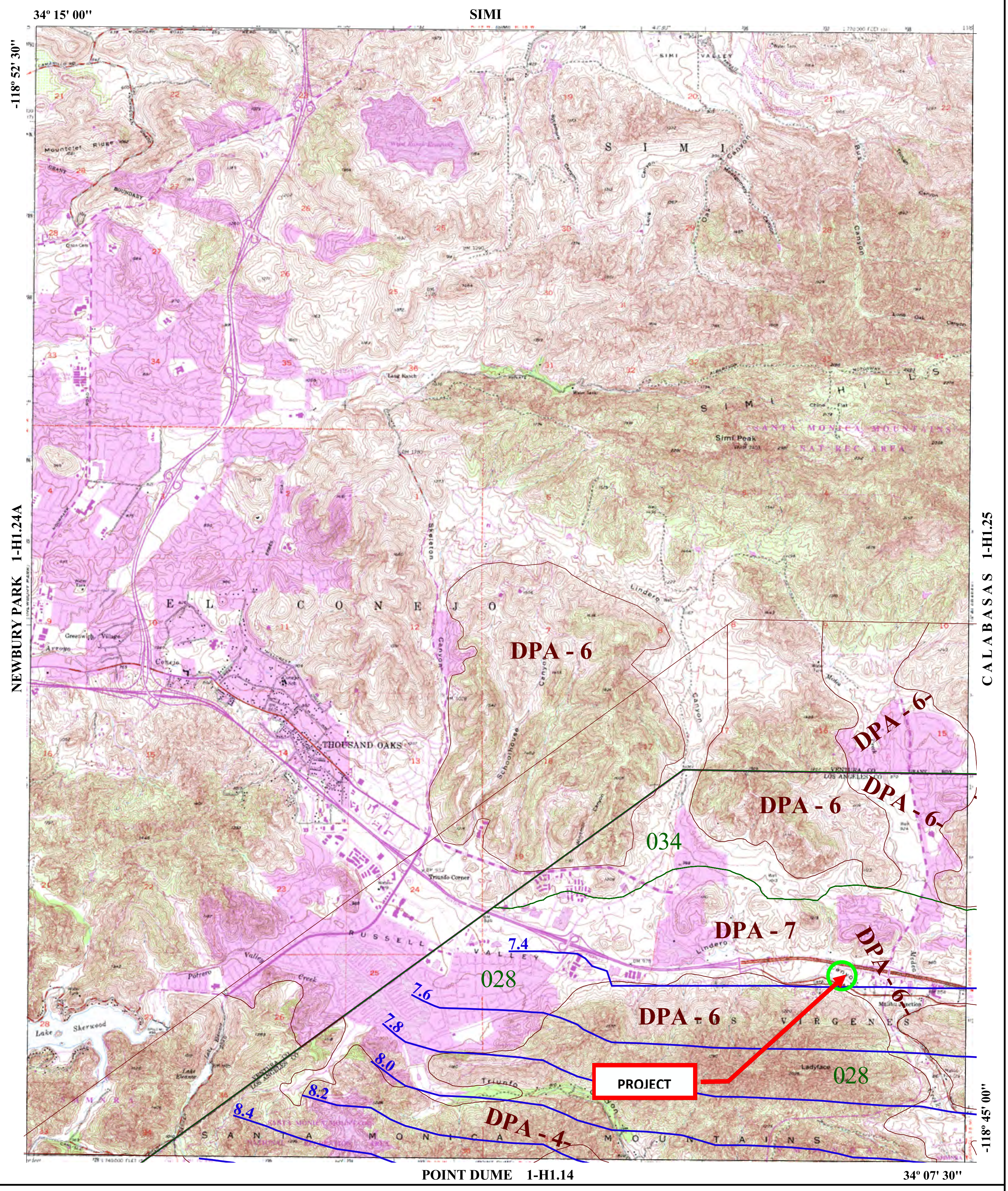
CITY OF AGOURA HILLS, CALIFORNIA

MAY 5, 2016

Stantec
1327 Del Norte Road, Suite 200, Camarillo, CA 93010
Phone: (805) 981-0706 Fax: (805) 981-0251

SHEET 1 OF 1

SECTION 4 – REFERENCE MATERIALS



016	SOIL CLASSIFICATION AREA
7.2	INCHES OF RAINFALL
DPA - 6	DEBRIS POTENTIAL AREA

1 0 1 2 Miles

25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714

THOUSAND OAKS
50-YEAR 24-HOUR ISOHYET

1-H1.24

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

Frequency	Multiplication Factor
2-yr	0.387
5-yr	0.584
10-yr	0.714
25-yr	0.878
50-yr	1.000
100-yr	1.122
500-yr	1.402

Table 5.3.1
Rainfall Frequency Multiplication Factors

Appendix B contains isohyetal maps for the 50-year, 24-hour rainfall depth. The isohyetal contour lines are spaced at intervals of two-tenths of an inch. The spatial rainfall distributions for the county design storms were converted to grid data for use with Geographic Information System (GIS) compatible hydrologic models.

5.4 DESIGN STORM

The three components of the design storm include the IDF equation, the unit hyetograph curve, and the isohyets. These components are used to define the design storm for a particular location and frequency. As an example, consider the 25-year design storm for the Palmer Canyon watershed in Figure 5.4.1. Subarea 1A of this watershed, shown in Figure 5.4.2, will be used for the sample calculations.

1. Compute the area between successive isohyetal lines and multiply by the average of the isohyet values. Table 5.4.1 shows the areas between isohyets for Subarea 1A.

2. The sum of these precipitation-area values divided by the total subarea area provides the area weighted average rainfall depth. The average rainfall should be calculated to the nearest two-tenths of an inch. Table 5.4.1 contains the calculations for the isohyetal values in this subarea.

It may be noted that for small subareas, the isohyet nearest the centroid of the subarea usually equals the design depth. Selecting the isohyets nearest the subarea centroid is an acceptable method for determining the design rainfall for subareas of approximately 40 acres.

Department of Public Works
dpw.lacounty.gov

search our site...

Hydrology Map

A GIS viewer application to view the data for the hydrology manual.

LAYERS

- 50yr Two Tenths (Rainfall)
- DPA Zones
- Soils 2004
- TG Page
- [x] Final 85th Percentile, 24-hr Rainfall
- Final 95th Percentile, 24-hr Rainfall
- 1-year, 1-hour Rainfall Intensity

SEARCH

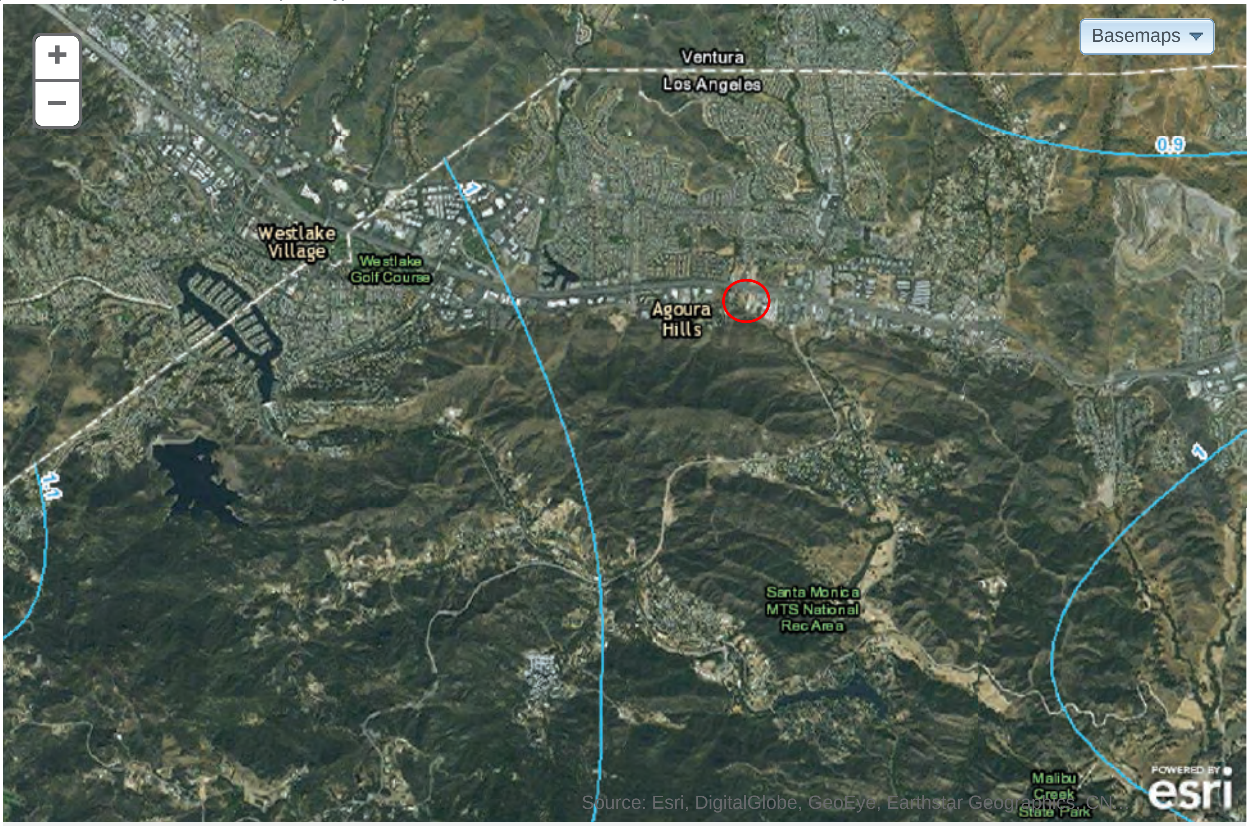
Zoom to TG Page:

557

Enter Address, Cross Street, or Parcel No.:

(ex: 900 S. Fremont Ave., Fremont@Valley, 5342005904)

Search



Map Tips

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5.5 Topanga Formation

The fill, alluvial soils and terrace deposits are underlain by Tertiary age sedimentary bedrock of the Topanga Formation (Weber, 1984). As observed in the borings, the bedrock is yellowish brown to olive, thinly bedded siltstone and claystone with localized thin interbeds of fine-grained sandstone that contain thin gypsum stringers and iron oxidation staining along bedding planes and joint surfaces. The Topanga Formation bedrock was encountered in all four borings and the majority of the prior AGS explorations with minimum depths below ground surface ranging from 4 feet to 18 feet.

5.6 Conejo Volcanics

Geocon did not encounter bedrock of the Tertiary age Conejo Volcanics during the on-site investigation; however, AGS presents information on this formation where it exists in the southern part of the subject property. According to AGS, the fill and alluvial deposits are underlain by Conejo Volcanics within the southern portion of the Site. Conejo Volcanics were encountered at 19.5 feet below ground surface on the subject property in AGS boring B-4.

6. GROUNDWATER

Based on a review of the Seismic Hazard Zone Report for the Thousand Oaks 7.5 Minute Quadrangle, Los Angeles and Ventura Counties, California (California Division of Mines and Geology [CDMG], 2000), the historically highest groundwater level in the area is approximately 10 feet beneath the ground surface. Groundwater information presented in this document is generated from data collected in the early 1900's to the late 1990s. Based on current groundwater basin management practices, it is unlikely that groundwater levels will ever exceed the historic high levels.

Groundwater seepage was not encountered during the field investigation performed by Geocon. However, several borings excavated as part of the previous AGS investigation encountered minor groundwater seepage. AGS indicated that these groundwater occurrences were highly variable and subject to local subsurface conditions. AGS encountered groundwater in borings B-10 and B-13 at depths of 8 and 9 feet below the ground surface, respectively. It is our opinion that the groundwater encountered previously at the site does not represent the static groundwater table but exists in the near surface sediments as discontinuous perched zones of groundwater within the sandy alluvial soils. The amount of seepage in these granular zones may fluctuate seasonally or groundwater seepage conditions may develop where none previously existed, especially after seasonal rainfall or in areas where impermeable fine-grained soils are heavily irrigated. In addition, recent requirements for stormwater infiltration could result in shallower seepage conditions in the immediate site vicinity. Proper surface drainage of irrigation and precipitation will be critical for future performance of the project. Recommendations for drainage are provided in the *Surface Drainage* section of this report (see Section 8.19).

BIO-1: Biofiltration

Definition

A biofiltration area is a vegetated shallow depression that is designed to receive and treat stormwater runoff from downspouts, piped inlets, or sheet flow from adjoining paved areas. A shallow ponding zone is provided above the vegetated surface for temporary storage of stormwater runoff. During storm events, stormwater runoff accumulates in the ponding zone and gradually infiltrates the surface and filters through the biofiltration soil media before being collected by an underdrain system.

Stormwater runoff treatment occurs through a variety of natural mechanisms as stormwater runoff filters through the vegetation root zone. In biofiltration areas, microbes and organic material in the biofiltration soil media help promote the adsorption of pollutants (e.g., dissolved metals and petroleum hydrocarbons) into the soil matrix. Plants utilize soil moisture and promote the drying of the soil through transpiration. Biofiltration areas are typically planted with native, drought-tolerant plant species that do not require fertilization and can withstand wet soils for at least 96 hours.

A schematic of a typical biofiltration area is presented in Figure E-7.

LID Ordinance Requirements

Biofiltration can be used as an alternative compliance measure.

Pollutant of Concern	Treated by Biofiltration?
Suspended solids	No
Total phosphorus	No
Total nitrogen	Yes
Total Kjeldahl nitrogen	Yes
Cadmium, total	No
Chromium, total	Yes
Copper, total	No
Lead, total	Yes
Zinc, total	No

Source: Treatment Best Management Practices Performance, Los Angeles Regional Water Quality Control Board, December 9, 2013.

Advantages

- Has a low cost for installation
- Enhances site aesthetics
- Requires little maintenance

Disadvantages

- May require individual owner/tenants to perform maintenance

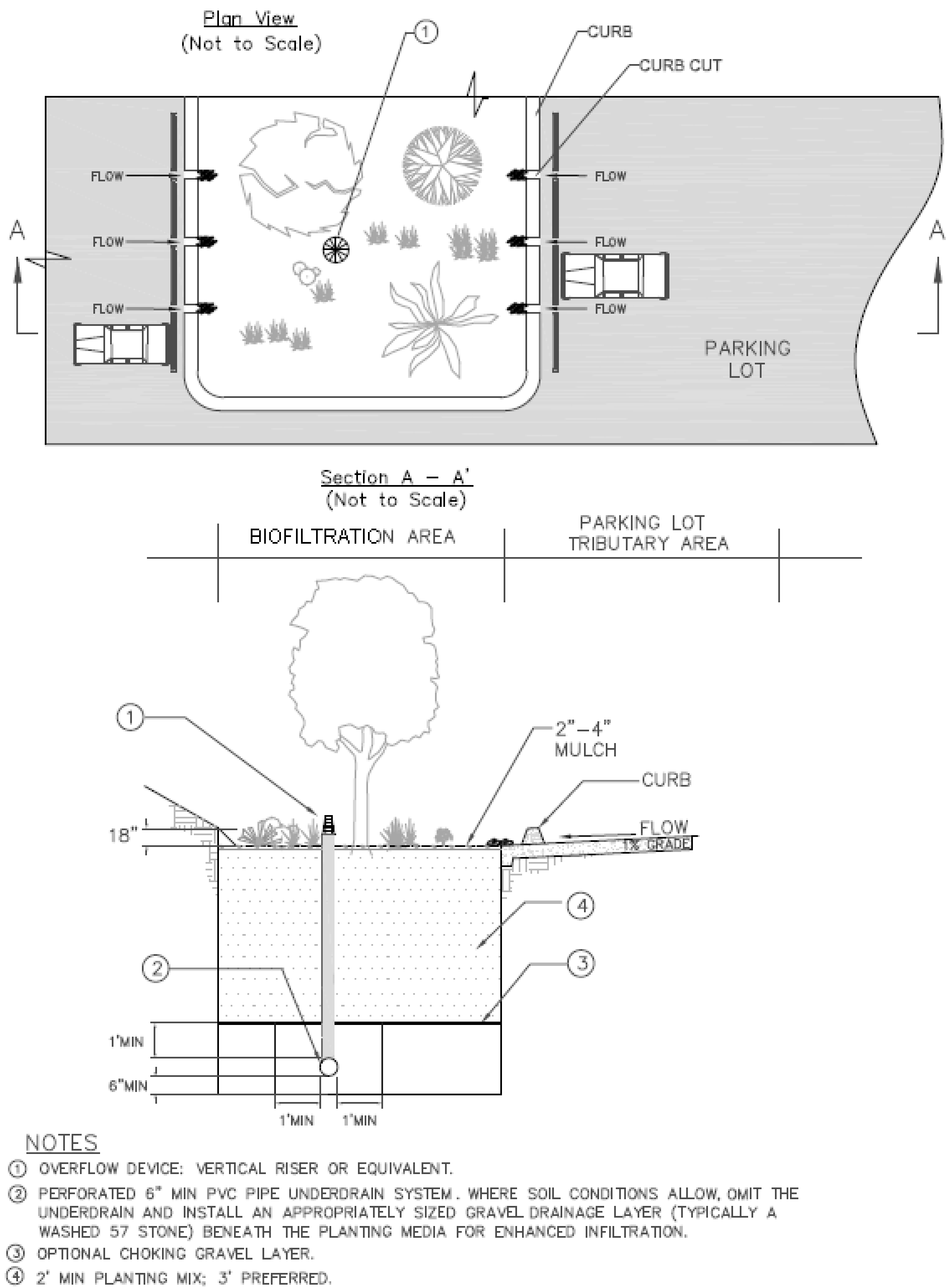


Figure E-7. Biofiltration Area Schematic

Office Use Only	
☐ Sent	Initials:
☐ Fax ☒ Email ☐ Other:	
Date:	Time:

LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS

DESIGN DIVISION ☐HYDRAULIC ANALYSIS UNIT

INFORMATION REQUEST SUMMARY

INFORMATION REQUESTED BY

Requester's Name: Tristan Santos
Company: Stantec Consulting Services Inc.
Phone Number: 805-981-0706 Fax Number: 805-981-0251
Email: Tristan.Santos@stantec.com

Method of Contact: ☐ Walk-in ☐ Phone ☐ Fax ☒ Email ☐ Prelim. Mtg. Date: 06/30/15

Intended Use: Allowable discharge for sizing of onsite detention

Proposed Project Type: Commercial Acreage Involved: 5.5 acres

Will information be used in any litigation? ☐ YES ☒ NO
Case Info Name: ______ No: ______ Location: ______

Requester's Signature: [signature]

INFORMATION REQUESTED (Attach site map if available)

LACFCD Facility: Name: Lindero Canyon Drawing No. 421-D2.3 (PD018011)
Unit: ______ Line: ______ Station: 39+66 & 41+30
City: Agoura Hills
Street/Cross-street: 29508 Roadside Drive
Thomas Guide: Page: 557 Grid: J-6 ☒ Site Map/Plans Submitted
Info. Requested: Allowable discharge from project site

BELOW SECTION TO BE COMPLETED BY THE HYDRAULIC ANALYSIS UNIT

INFORMATION PROVIDED: *Allowable q per acre.*

REFERENCES SEARCHED: *Lindero Canyon hydrology and calculations.*

COMMENTS, ETC: *Allowable q per acre = 1.44 cfs.*

FOLLOW-UP REQUIRED:

INFORMATION PROVIDED BY: *Diana Velez* [signature] Date: *07/07/2015*
INFORMATION REVIEWED BY: *Ambrose C. Ajaelo PE* Date: *07/07/2015*

From:	Ambrose Ajaelo
To:	Santos, Tristan
Cc:	Diana Velez
Subject:	RE: Allowable q response - Lindero Canyon Strom Drain
Date:	Monday, July 13, 2015 11:02:55 AM

Dear Tristan,

Yes you are limited to the allowable q per acre given in the response Diana gave you. This flow is based on the design capacity of the drainage infrastructure you plan to connect to. About the hydromodification you mention below. It will be helpful if you bring this issue up when you actually apply for your connection permit. It will be put into consideration then.

Ambrose C. Ajaelo PE.

Record Custodian

Hydraulic Analysis Section,

Design Division, DPW, LA County

Email: aajaelo@dpw.lacounty.gov

Phone: 626-458-7860

Fax: 626-458-7827

From: Santos, Tristan [mailto:Tristan.Santos@stantec.com]
Sent: Monday, July 13, 2015 10:33 AM
To: Diana Velez
Cc: Ambrose Ajaelo
Subject: RE: Allowable q response - Lindero Canyon Strom Drain

Good morning Diana,

If our discharge into the County storm drain line is limited to the allowable q of 1.44 cfs per acre, are hydromodification requirements still applicable? The project will limit the discharge to the allowable q and runoff will be discharged directly to a concrete/engineered storm drain. Downstream of the Lindero Canyon line, I am not sure if it discharges into receiving water that is not susceptible to hydromodification impacts. Please advise.

Thank you,

Tristan Santos
Stantec
Phone: (805) 981-0706 x.801
Fax: (805) 981-0251
Tristan.Santos@stantec.com

From: Diana Velez [mailto:DVELEZ@dpw.lacounty.gov]
Sent: Tuesday, July 07, 2015 4:22 PM
To: Santos, Tristan
Cc: Ambrose Ajaelo
Subject: Allowable q response - Lindero Canyon Strom Drain

Good afternoon Tristan,

Please see attached PDF for response on the allowable q you requested for your project in Agoura Hills.
Please let me know if you have any further questions.

Thank you so much for your patience and this valuable opportunity to serve you.

Diana Velez
Hydraulic Analysis Section,
Design Division, DPW, LA County
(626) 458-7985
(626) 458-7827 FAX

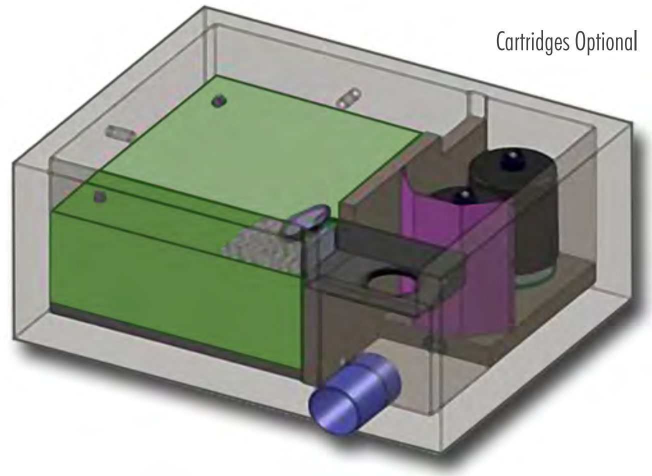
REGION	WATER BODY NAME	WATER TYPE	WATERSHED* CALWATER / USGS HUC	• POLLUTANT ◦ POTENTIAL SOURCES *Relevant Notes*	ESTIMATED AREA ASSESSED	FIRST YEAR LISTED	TMDL REQUIREMENT STATUS**	DATE***
4	Lindero Creek Reach 1	River & Stream	40423000 / 18070104	• Algae ◦ Agriculture-animal ◦ Atmospheric Deposition ◦ Golf course activities ◦ Groundwater Loadings ◦ Irrigated Crop Production ◦ Major Municipal Point Source -dry and/or wet weather discharge ◦ Onsite Wastewater Systems (Septic Tanks) ◦ Urban Runoff/Storm Sewers	3 Miles	1996	5B	2003
				• Benthic-Macroinvertebrate Bioassessments ◦ Source Unknown	3 Miles	2010	5A	2021
				• Coliform Bacteria ◦ Nonpoint Source	3 Miles	1996	5B	2006
				• Invasive Species ◦ Nonpoint Source ◦ Point Source	3 Miles	2010	5A	2021
				• Scum/Foam-unnatural ◦ Agriculture-animal ◦ Atmospheric Deposition ◦ Golf course activities ◦ Groundwater Loadings ◦ Irrigated Crop Production ◦ Major Municipal Point Source -dry and/or wet weather discharge ◦ Onsite Wastewater Systems (Septic Tanks) ◦ Urban Runoff/Storm Sewers	3 Miles	1996	5B	2003
				• Selenium ◦ Nonpoint Source	3 Miles	1996	5A	2019

REGION	WATER BODY NAME	WATER TYPE	WATERSHED* CALWATER / USGS HUC	POLLUTANT / POTENTIAL SOURCES / *Relevant Notes*	ESTIMATED AREA ASSESSED	FIRST YEAR LISTED	TMDL REQUIREMENT STATUS**	DATE***
				• Trash ◦ Nonpoint Source	3 Miles	1996	5A	2019
4	Lindero Creek Reach 2 (Above Lake)	River & Stream	40425000 / 18070104	• Algae ◦ Agriculture-animal ◦ Atmospheric Deposition ◦ Golf course activities ◦ Groundwater Loadings ◦ Irrigated Crop Production ◦ Major Municipal Point Source -dry and/or wet weather discharge ◦ Onsite Wastewater Systems (Septic Tanks) ◦ Urban Runoff/Storm Sewers	4.5 Miles	1998	5B	2003
				• Coliform Bacteria ◦ Source Unknown	4.5 Miles	1998	5B	2006
				• Scum/Foam-unnatural ◦ Agriculture-animal ◦ Atmospheric Deposition ◦ Golf course activities ◦ Groundwater Loadings ◦ Irrigated Crop Production ◦ Major Municipal Point Source -dry and/or wet weather discharge ◦ Onsite Wastewater Systems (Septic Tanks) ◦ Urban Runoff/Storm Sewers	4.5 Miles	1998	5B	2003
				• Selenium ◦ Nonpoint Source	4.5 Miles	1998	5A	2019
				• Trash ◦ Nonpoint Source	4.5 Miles	1998	5A	2019

REGION	WATER BODY NAME	WATER TYPE	WATERSHED* CALWATER / USGS HUC	• POLLUTANT ◦ POTENTIAL SOURCES *Relevant Notes*	ESTIMATED AREA ASSESSED	FIRST YEAR LISTED	TMDL REQUIREMENT STATUS**	DATE***
				◦ **Urban Runoff/Storm Sewers**				
4	McGrath Lake	Lake & Reservoir	40311000 / 18070103	• Chlordane (sediment) ◦ **Nonpoint Source**	20 Acres	1996	5A	2019
				• DDT (sediment) ◦ **Nonpoint Source**	20 Acres	1996	5A	2019
				• Dieldrin (sediment) ◦ **Nonpoint Source** *Historical use of pesticides and lubricants, storm water runoff/aerial deposition from agricultural fields.*	20 Acres	2002	5A	2019
				• Fecal Coliform ◦ **Agriculture** ◦ **Landfills** ◦ **Natural Sources**	20 Acres	2002	5A	2019
				• PCBs (Polychlorinated biphenyls) (sediment) ◦ **Nonpoint Source** *Historical use of pesticides and lubricants, storm water runoff/aerial deposition from agricultural fields.*	20 Acres	2002	5A	2019
				• Sediment Toxicity ◦ **Nonpoint Source**	20 Acres	1996	5A	2019
4	Medea Creek Reach 1 (Lake to Confl. with Lindero)	River & Stream	40424000 / 18070104	• Algae ◦ **Agriculture-animal** ◦ **Atmospheric Deposition** ◦ **Golf course activities** ◦ **Groundwater Loadings** ◦ **Irrigated Crop Production** ◦ **Major Municipal Point Source -dry and/or wet weather discharge**	2.6 Miles	1996	5B	2003

REGION	WATER BODY NAME	WATER TYPE	WATERSHED* CALWATER / USGS HUC	• POLLUTANT ◦ POTENTIAL SOURCES *Relevant Notes*	ESTIMATED AREA ASSESSED	FIRST YEAR LISTED	TMDL REQUIREMENT STATUS**	DATE***
				◦ Onsite Wastewater Systems (Septic Tanks) ◦ Urban Runoff/Storm Sewers				
				• Coliform Bacteria ◦ Nonpoint Source	2.6 Miles	1996	5B	2006
				• Sedimentation/Siltation ◦ Source Unknown	2.6 Miles	2002	5A	2019
				• Selenium ◦ Nonpoint Source	2.6 Miles	1996	5A	2019
				• Trash ◦ Nonpoint Source	2.6 Miles	1996	5A	2019
4	Medea Creek Reach 2 (Abv Confl. with Lindero)	River & Stream	40423000 / 18070104	• Algae ◦ Agriculture-animal ◦ Atmospheric Deposition ◦ Golf course activities ◦ Groundwater Loadings ◦ Irrigated Crop Production ◦ Major Municipal Point Source -dry and/or wet weather discharge ◦ Onsite Wastewater Systems (Septic Tanks) ◦ Urban Runoff/Storm Sewers	5.4 Miles	1996	5B	2003
				• Benthic-Macroinvertebrate Bioassessments ◦ Source Unknown	5.4 Miles	2010	5A	2021
				• Coliform Bacteria ◦ Nonpoint Source	5.4 Miles	1996	5B	2006
				• Invasive Species ◦ Nonpoint Source ◦ Point Source	5.4 Miles	2010	5A	2021

UrbanGreen™ BioFilter Sizing Chart: Southern California



Inline Model contains an internal bypass that routes peak flows around the treatment components.					
Vault Size Click on sizes below to download standard details	Media Surface Area (ft^2)	StormFilter Cartridges	Treatment Capacity (Q_{LID}, cfs)	Treatment Area (impervious acres)	Bypass Capacity (cfs)
Biofiltration Only – 42" Rim to Invert Out					
4X6	17	No	0.039	0.22	2.00
6X8	41	No	0.095	0.52	2.00
6X12	65	No	0.151	0.83	2.00
8X16	121	No	0.280	1.54	2.00
Biofiltration & Cartridge Filtration – 49" Rim to Invert Out					
4X6	13	Yes – 1X27" Tall	0.080	0.44	2.00
6X8	32	Yes – 2X27" Tall	0.174	0.96	3.40
6X12	56	Yes – 2X27" Tall	0.230	1.27	3.40
8X16	107	Yes – 3X27" Tall	0.398	2.19	3.40

NOTES:

1. Treatment area based on Water Quality Storm Intensity of i = .20"/hr
2. Treatment area assumes a runoff coefficient of 0.9
3. Biomedia infiltration rate of 100"/hr and StormFilter Cartridge flow rate of 22.5gpm

   E.g., Area = .25 acres: .9 x .20"/hr x .25ac = .0045cfs therefore use a 6' x 8' UGBF without cartridges or 4' x 6' UGBF with cartridges
4. **Alternate configurations, sizes, and depths available. Call your local Contech Project Consultant for details.**
5. Please contact your Contech representative for final approval of layout and design
6. Engineer of record is responsible for conformance to local regulations
7. ***UrbanGreen BioFilter can be designed to allow incidental infiltation where feasible on site***

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for
Santa Monica Mountains National Recreation Area

29508 Roadside Drive, Agoura Hills CA

July 1, 2015

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map


118° 46' 8" W
118° 46' 1" W
336910
336940
336970
337000
337030
337060
337090
34° 8' 48" N
34° 8' 40" N
3779840
3779810
3779780
3779750
3779720
3779690
3779660
3779630
3779600
101
254
437
Agoura Rd
Map Scale: 1:1,220 if printed on A portrait (8.5" x 11") sheet.
Meters
0 15 30 60 90
Feet
0 50 100 200 300
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Santa Monica Mountains National Recreation Area
Survey Area Data: Version 13, Sep 29, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Nov 21, 2014—Dec 23, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Santa Monica Mountains National Recreation Area (CA692)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
254	Urban land-Xerorthents, fill complex, 0 to 30 percent slope, freeway	0.1	1.3%
437	Urban land-Cropley, fill complex 0 to 8 percent slopes, commercial	5.4	98.7%
Totals for Area of Interest		**5.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Santa Monica Mountains National Recreation Area

254—Urban land-Xerorthents, fill complex, 0 to 30 percent slope, freeway

Map Unit Setting

National map unit symbol: 2lpf9
Elevation: 30 to 1,970 feet
Mean annual precipitation: 14 to 24 inches
Mean annual air temperature: 60 to 64 degrees F
Frost-free period: 290 to 350 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land, freeway: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land, Freeway

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Pavement human transported material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8

Minor Components

Xerorthents, fill

Percent of map unit: 10 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex

437—Urban land-Cropley, fill complex 0 to 8 percent slopes, commercial

Map Unit Setting

National map unit symbol: 2lpfq
Elevation: 20 to 2,000 feet
Mean annual precipitation: 14 to 24 inches
Mean annual air temperature: 60 to 64 degrees F
Frost-free period: 290 to 350 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Urban land: 80 percent
Cropley, fill, and similar soils: 15 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Pavement and buildings human transported material over residuum

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8

Description of Cropley, Fill

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Alluvium derived from shale

Typical profile

A - 0 to 2 inches: sandy loam
Bt1 - 2 to 10 inches: gravelly sandy clay loam
2Bt2 - 10 to 14 inches: clay
3Bt3 - 14 to 30 inches: sandy clay loam
4Btk - 30 to 37 inches: clay loam
5Bss - 37 to 69 inches: clay

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 4
Hydrologic Soil Group: C

Ecological site: Coastal Terrace 14-16" p.z. (R020XD047CA)

Minor Components

Rincon

Percent of map unit: 4 percent
Landform: Terraces, alluvial fans, fan remnants
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Hill 16-20" p.z. (R020XD043CA)

Xerorthents

Percent of map unit: 1 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf