DRAINAGE CONCEPT / HYDROLOGY STUDY / SUSMP

for

YOUNG NAK RETREAT CENTER

CUP 03-221-5

24100 Pine Canyon Road in the Lake Hughes Area of

Los Angeles County, California

RECEIVED
JAN 24 2008
PROCESSING CENTER
LAND DEVELOPMENT DIVISION

HOVELL & PILARSKI ENGINEERING, INC.
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under the supervision of:

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January 21, 2008

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No. 33118
Exp. 6-30-2008
CIVIL
STATE OF CALIFORNIA

DRAINAGE CONCEPT / HYDROLOGY STUDY / SUSMP
APPROVED FOR AREA AND Q ONLY
APPROVED BY: RCE NO. 51146 DATE: 1/28/08
CHECKED BY: DATE: 01/28/08
LAND DEVELOPMENT DIVISION
LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS

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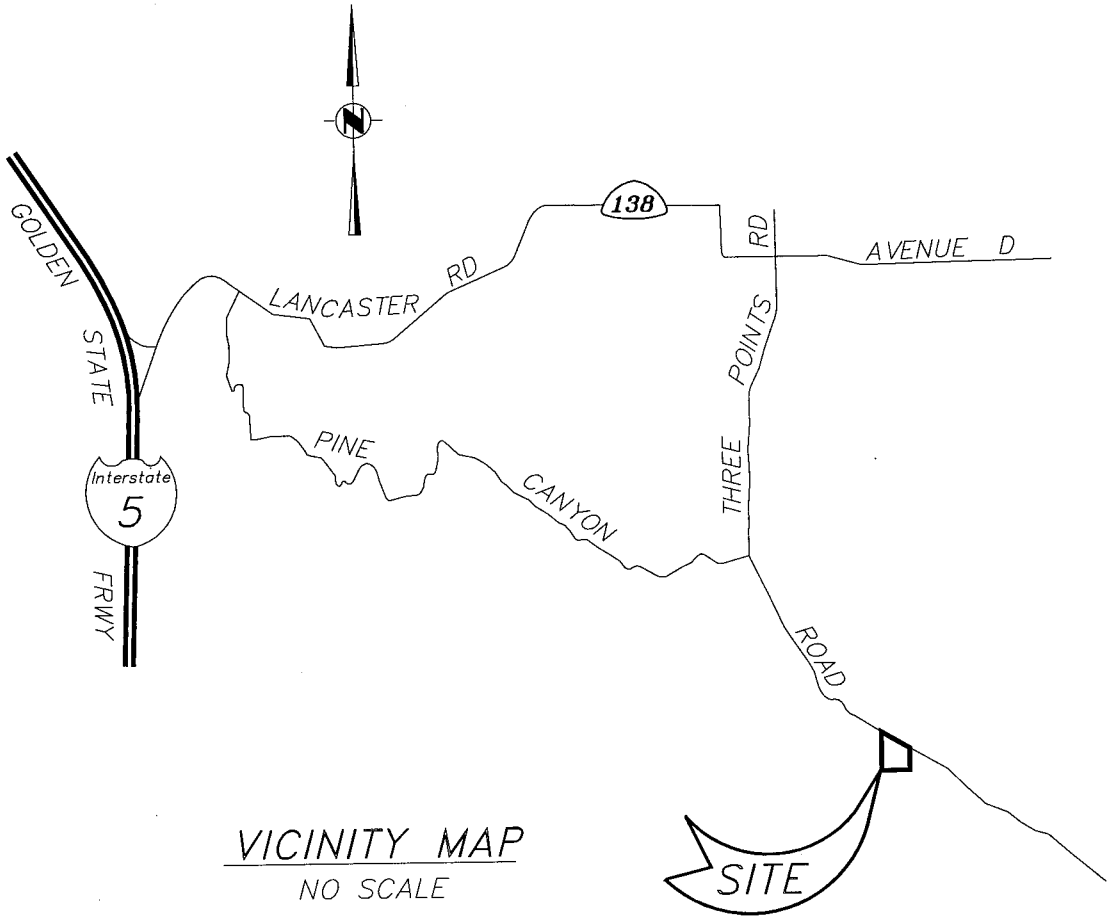


VICINITY MAP
NO SCALE

INTRODUCTION

The Young Nak Retreat Center is located on the south side of Pine Canyon Road about 10 miles east of Highway 5 in rural northern Los Angeles County. The existing site improvements include a caretaker's residence, several older mobile home-type structures and small buildings, and various paved drives. Adjoining parcels remain undeveloped in all directions. The site is generally rectangularly shaped, containing about 31 acres.

Proposed improvements include a new parking lot area with a small office and gift shop near the northwest corner of the site, as well as a dormitory building, a cafeteria and pool area, an amphitheater, a chapel and meeting rooms.

The project lies outside of the Special Flood Hazard Area (SFHA) within Zone C as shown on FIRM (Flood Insurance Rate Map) Community Panel Number 065043 0050 B. No approvals from FEMA are required for the project.

DRAINAGE / SUSMP

The site slopes northerly at about 8%. Existing improvements are scattered throughout the site, lying mostly south and west of the open center area. Minor localized swales control onsite runoff. Existing natural grasses in the unimproved center area of the site serve as a natural filter for the runoff. Two onsite ponds lie near Pine Canyon Road with surface areas in the range of 4,000 to 8,000 square feet each. During a storm these two small ponds would grow larger, becoming one pond. The pond capacity is approximately 180,000 cubic feet (or about 4.1 acre-ft.) before overtopping. If more runoff were delivered to the pond than could be stored, runoff would spill toward a 24" CMP culvert under Pine Canyon Road and ultimately overtop the road. An existing natural blueline channel on the north side of the road conveys the runoff further north and then east.

An offsite watershed of 357 acres (Subarea Σ16A) directs runoff from the mountainside canyon south of the site toward the southerly property boundary. This canyon is named "Devils Gulch" on the USGS quadrangle map. Hydrology calculations for the canyon indicate there would be a significant flow in a capital storm (50-yr storm), however only narrow, shallow flow paths of a low capacity exist. Therefore, this canyon runoff during a capital storm would sheet flow at a shallow depth, one to two feet, for the width of the canyon bottom, about 240 feet. In the absence of improvements to protect the site, damage to the older structures, and any new ones, could occur.

The proposed project includes a channel that would collect and convey the offsite capital storm around the existing and proposed buildings and site improvements, and deliver it to the open area between the buildings and the northerly property line at Pine Canyon Road. The proposed channel is to be trapezoidal in shape, with 2:1 side slopes, a 15-foot wide bottom and a minimum height of five feet. Height will be increased as needed for super-elevated reaches. The channel will be lined with Vmax^3 P550, a synthetic turf reinforcement mat, and re-vegetated with native materials. Specifications regarding the mat material can be found at the *North American Green* Vmax^3 website at www.vmax3.com/products/p550.tpl with portions included at the end of this report.

A second offsite watershed of about 44 acres (Subareas 17E and 18E) directs runoff from two smaller canyons along the westerly site boundary. This runoff is also apparent as shallow flow, but would likely not impact existing buildings due to flow path location. However proposed improvements for the current project could be affected. Therefore, a similar channel is proposed that will direct runoff northerly around the improvements to a natural open area between the proposed improvements and the northerly property line at the south side of Pine Canyon Road. This channel will also be trapezoidal in shape and have 2:1 side slopes, a 6-foot wide bottom and a minimum height of three feet. Height will be increased as needed for super-elevated reaches. The channel will be lined with Vmax^3 SC250 turf reinforcement mat, and re-vegetated with native materials.

Onsite storm water from paved and improved areas will be conveyed by surface sheet flow to the privately maintained grassey open area. These filtering grasses will act as a BMP, in compliance with the Los Angeles County SUSMP requirements for cleaning of storm water runoff from paved areas. Additionally, the new parking area near the northwest corner of the site will have a sump catch basin to collect runoff from portions of Subarea 18E. This catch basin will be fit with a filtration device to clean the storm water from the improved portion of the subarea, being privately maintained.

An additional area of offsite and onsite runoff of about 8 acres (Subarea 21F) is directed to the easterly property line. This small watershed is not impacted by the proposed project improvements. The dividing line between Subareas 19A and 21F is the location of a natural division between watersheds, where the majority of runoff is conveyed northerly, with the remainder runoff conveyed easterly. This division is apparent on the Burnt Peak Quad Map and the exhibits provided herein.

An offsite hydrology map at 500-scale is provided in the pocket at the back of this report. A 60-scale Drainage Concept Plan and Onsite Hydrology Map, also included in the pocket, shows the site topography, existing and proposed improvements, limits of subareas and flow paths. Hydrologic printouts from this report have been added to the map sheets to assist the map use.

METHODOLOGY

-- Rational Method - Tc calculation per LACDPW regression equation

-- Modified Rational Method - MORA calculation per LACDPW regression equation

-- Debris Production Rates per LACDPW Hydrology Manual P-6

-- Method for calculating Standard Urban Stormwater Mitigation Plan (SUSMP) flow rates and volumes based on 0.75 inches of rainfall per LACDPW handout work sheets.

SUMMARY OF Q_{50} IMPACT

	(Pre-Development)			(Post-Development)			
Subarea #	Drainage Area (acs)	Q_{50}(cfs) Burned	Q_{50}(cfs) B&B	Drainage Area (acs)	Q_{50}(cfs) Burned	Q_{50}(cfs) B&B	Qpm (cfs)
Σ16A	357	1378.7	2054.3	357	1378.7	2054.3	
17E	21	76.1	123.3	21	76.1	23.3	
Σ18E	44	162.1	262.6	44	162.1	262.6	0.21
19A	17	69.2	-	17	69.2	-	1.68
Σ20AE	418	1561.2	2280.1	418	1549.0	2280.2	
21F	8	35.6	57.7	8	35.6	57.7	

B&B = burned and bulked

SUMMARY OF Q_{25} IMPACT

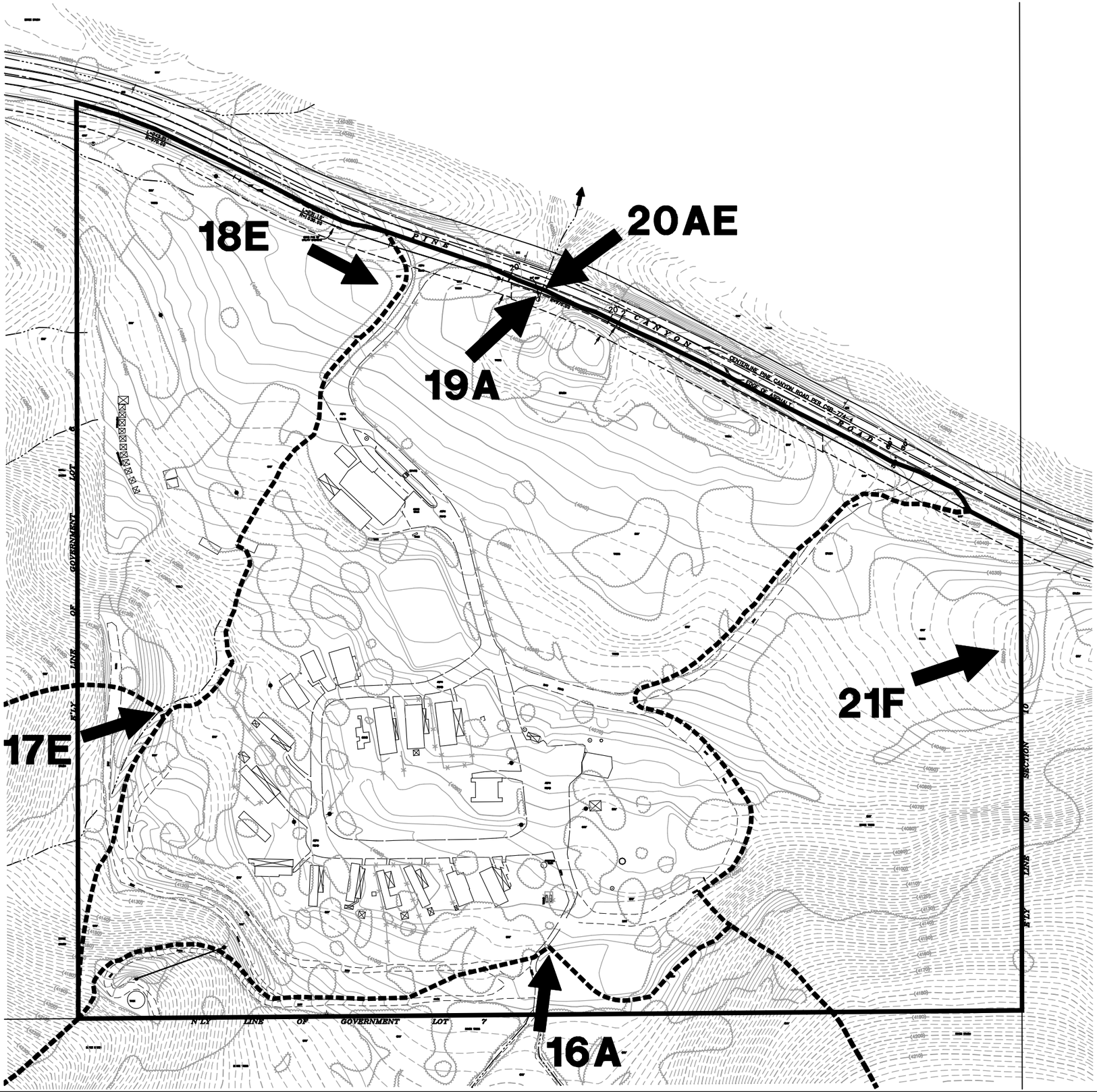
	(Pre-Development)		(Post-Development)	
Subarea #	Drainage Area (acs)	Q_{25} (cfs)	Drainage Area (acs)	Q_{25} (cfs)
Σ16A	357	1160.8	357	1160.8
17E	21	64.0	21	64.0
Σ18E	44	135.2	44	135.2
19A	17	61.3	17	61.3
Σ20AE	418	1310.4	418	1310.5
21F	8	31.4	8	31.4

SUMMARY OF Q_2 IMPACT

Subarea #	(Pre-Development) Drainage Area (acs)	(Pre-Development) Q_2 (cfs)	(Post-Development) Drainage Area (acs)	(Post-Development) Q_2 (cfs)
Σ16A	357	325.3	357	325.3
17E	21	15.9	21	15.9
Σ18E	44	34.2	44	34.3
19A	17	16.3	17	16.3
Σ20AE	418	369.7	418	369.9
21F	8	6.9	8	6.9

CONCLUSION

The drainage concept / hydrology study / SUSMP shows no increase in drainage area or runoff quantities for Q_{50}, Q_{25}, or Q_2 resulting from development of the Young Nak Retreat Center. All runoff is contained on the south side of Pine Canyon Road, as is the existing condition. The proposed channels, both southerly and westerly on the project, are designed to safely convey the runoff to the natural outfall areas, without flow of runoff into the development areas. Stormwater runoff generated on the new parking lot will be treated by a catch basin filter. Natural grassey areas will contribute to the additional cleaning of runoff from the existing improved areas.

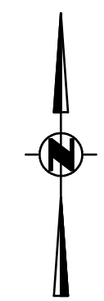


PRE-DEVELOPMENT SITE HYDROLOGY MAP

SCALE: 1" = 150'

SUBAREA #	DRAINAGE AREA(ac)	Q50(cfs) BURNED	Q50(cfs) BURNED & BULKED
16A*	357	1366.6	2036.2
17E*	21	76.1	123.3
18E*	44	162.1	262.6
19A	17	69.2	
20AE	418	1549.0	2262.3
21F*	8		

*Remainder of Subarea Shown on Offsite Hydrology Map



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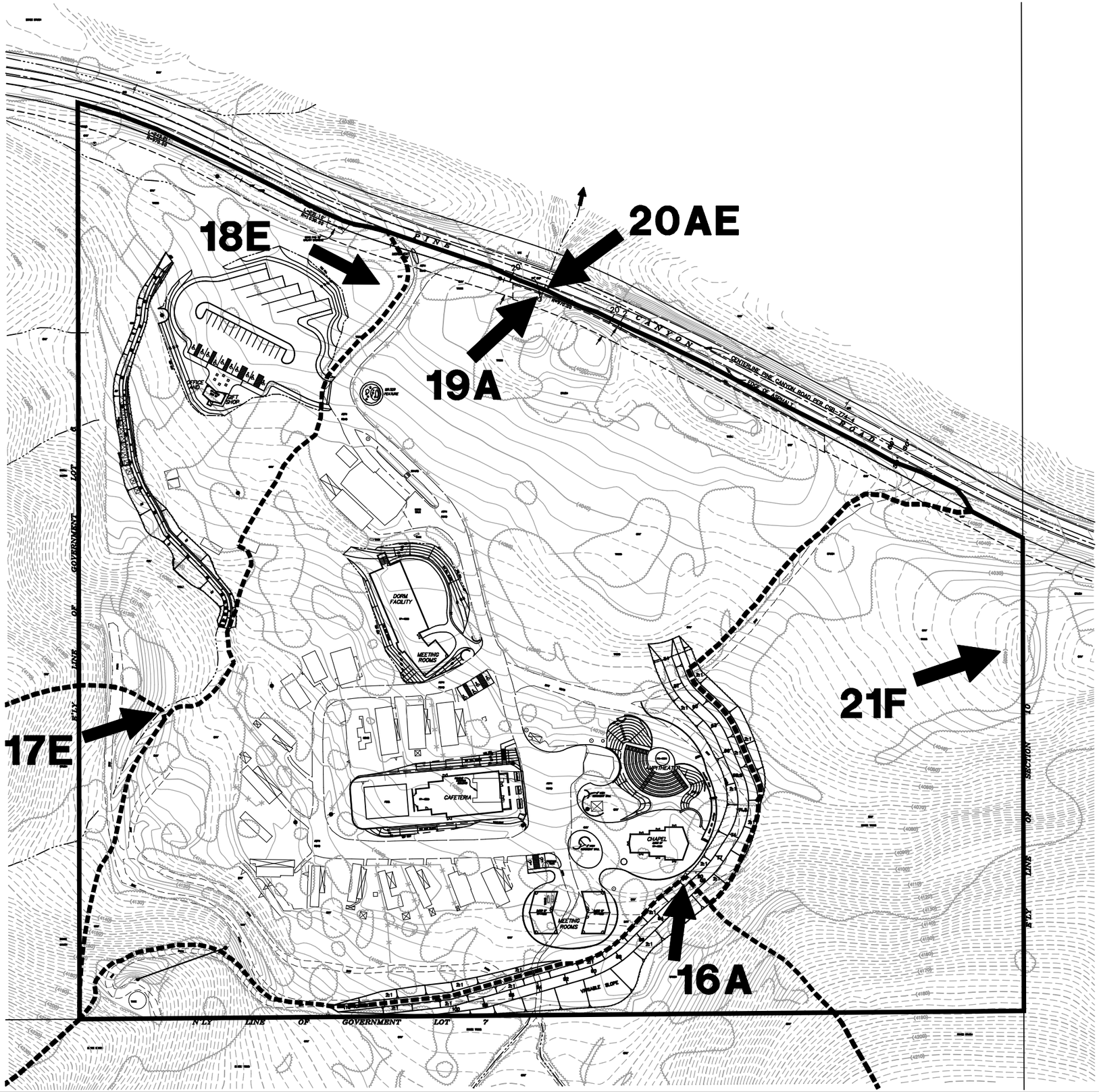
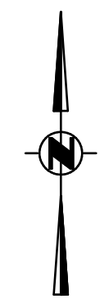


POST-DEVELOPMENT SITE HYDROLOGY MAP

SCALE: 1" = 150'

SUBAREA #	DRAINAGE AREA(ac)	Q50(cfs) BURNED	Q50(cfs) BURNED & BULKED	Qpm(cfs)
Σ16A*	357	1366.6	2036.2	
17E*	21	76.1	123.3	
Σ18E*	44	162.1	262.6	
19A	17	69.2		1.68
Σ20AE	418	1549.0	2262.3	
21F*	8			

*Remainder of Subarea Shown on Offsite Hydrology Map



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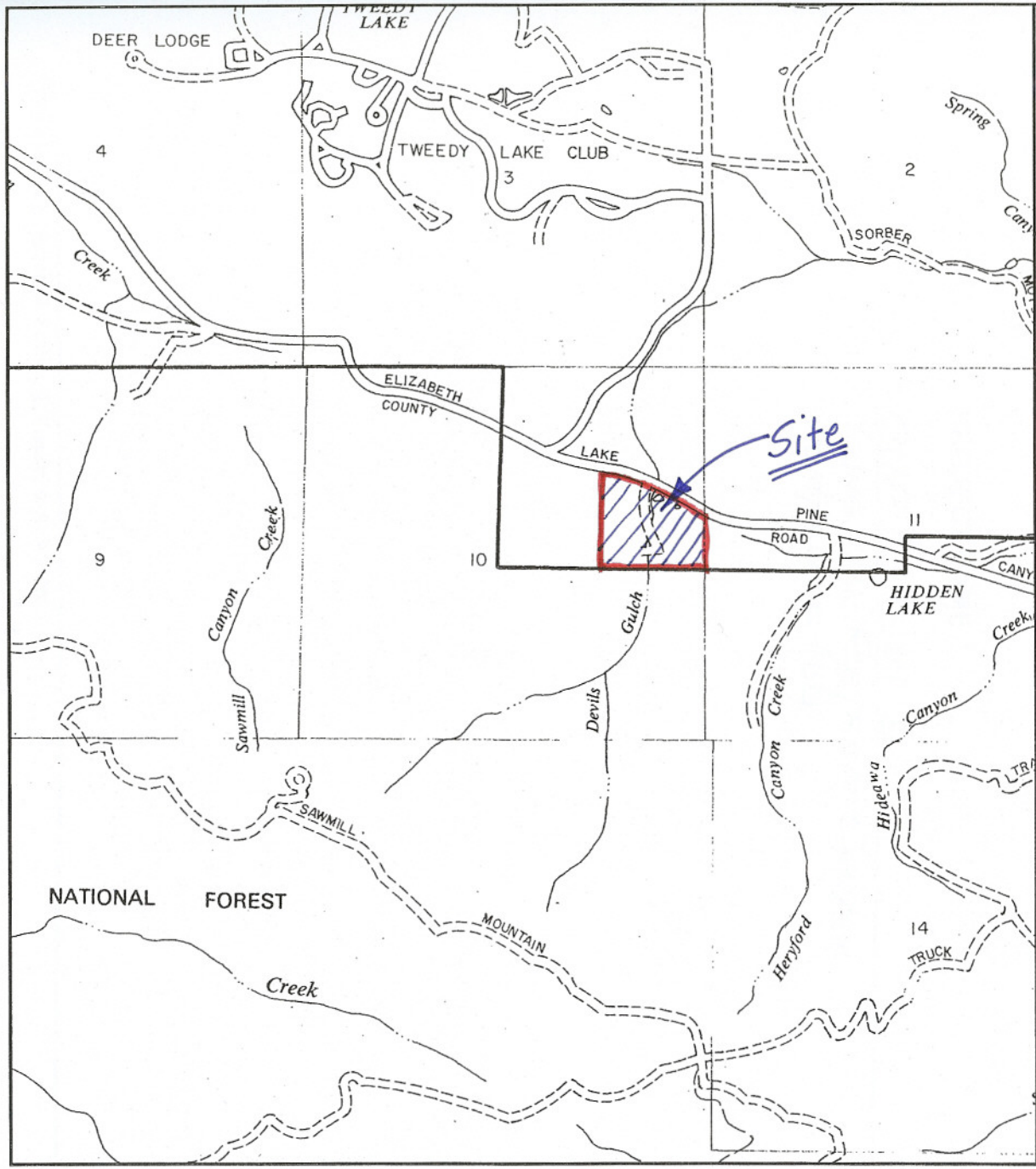


APPROXIMATE SCALE

2000 0 2000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

LOS ANGELES COUNTY, CALIFORNIA

(UNINCORPORATED AREAS)

PANEL 50 OF 1275

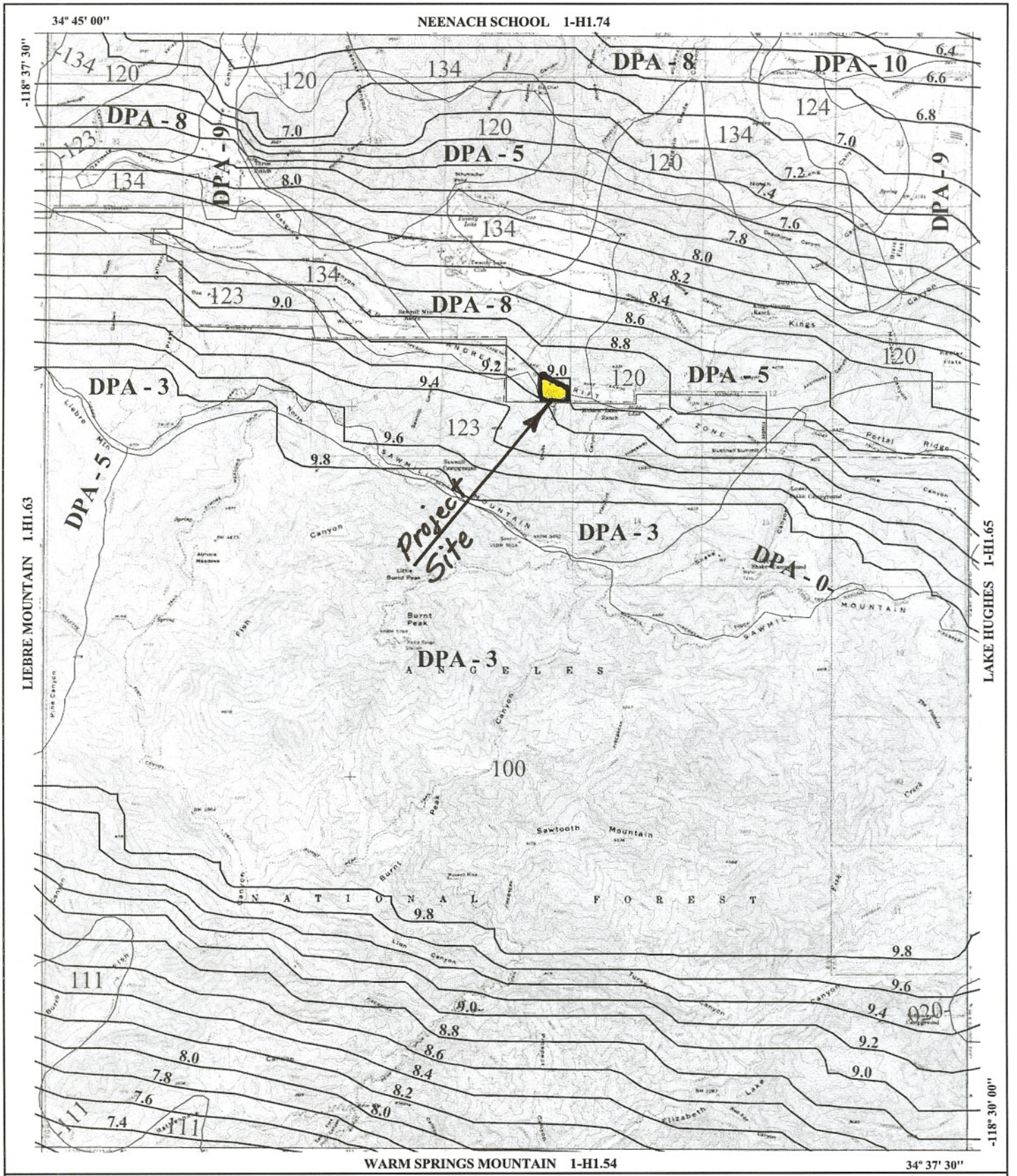
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
065043 0050 B

EFFECTIVE DATE:
DECEMBER 2, 1980

federal emergency management agency
federal insurance administration

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



016 SOIL CLASSIFICATION AREA

7.2 INCHES OF RAINFALL

DPA - 6 DEBRIS POTENTIAL AREA

N W E S

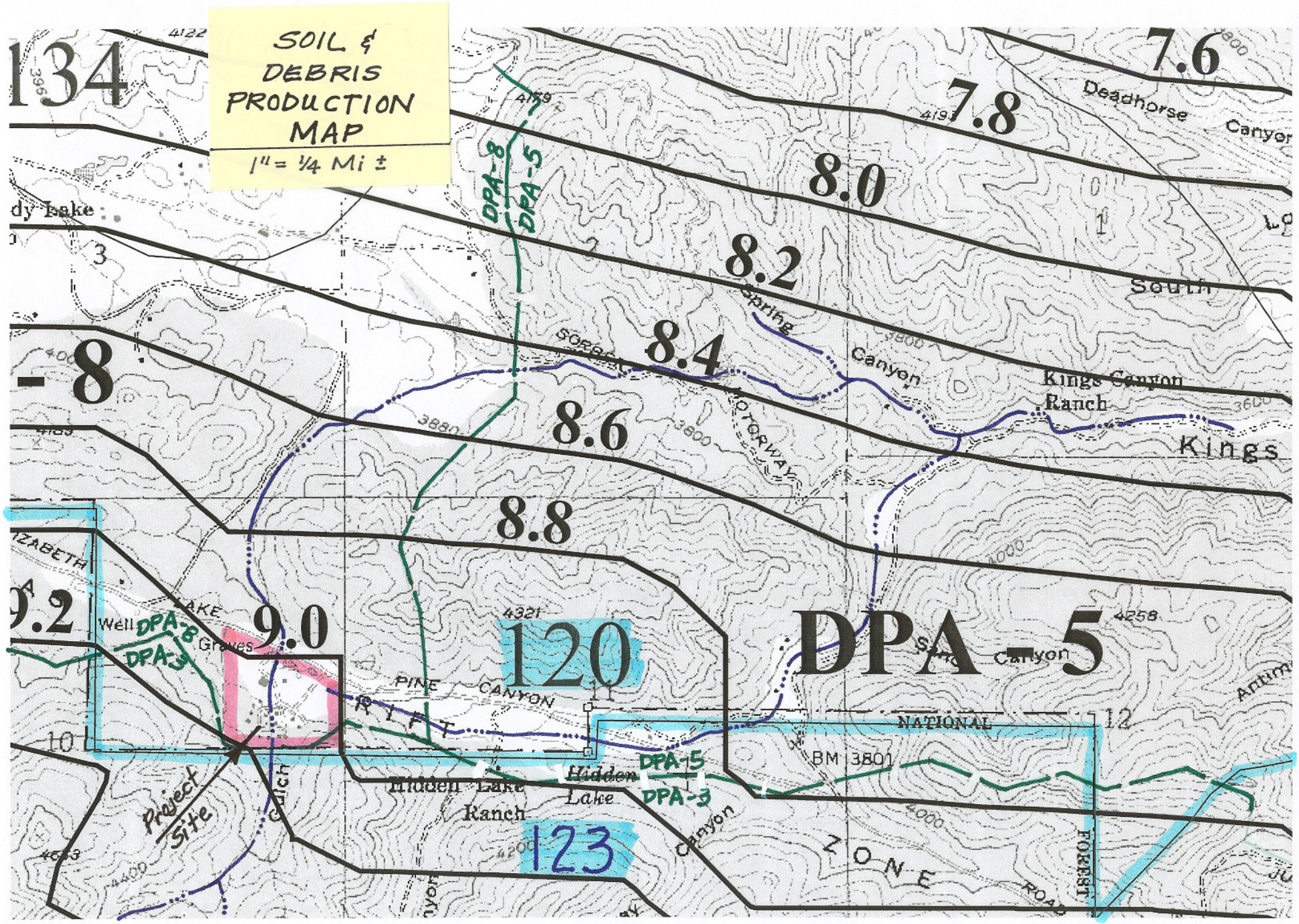
1 0 1 2 Miles

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

BURNT PEAK
50-YEAR 24-HOUR ISOHYET

1-H1.64

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works


SOIL & DEBRIS PRODUCTION MAP
1" = ¼ Mi ±
134
7.6
7.8
8.0
8.2
8.4
8.6
8.8
9.0
9.2
-8
120
123
DPA-5
DPA-8
DPA-3
Deadhorse
Canyon
South
Spring
Canyon
Kings Canyon
Ranch
Kings
Well
Graves
PINE
CANYON
RIFT
Hidden Lake
Ranch
Hidden
Lake
Project Site
Gulch
Canyon
NATIONAL
FOREST
ZONE
ROAD
BM 3801
4321
4258
4159
4193
3880
3800
3600
4000
4200
4400
4453

1" = ¼ mi ±

Tc Calculation Tables - Existing Condition

Tc CALCULATION
FOR
Existing YOUNG NAK RETREAT CENTER

Project	Subarea	Area (acre	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft	Isohyet (in	Tc-calcula	Intensity (i	Cu	Cd	Flowrate (cfs)
1892	1a	38	0.01	50	123	1800	0.372	9.8	6	5.37	0.88	0.88	179.57
1892	2a	25	0.01	50	123	1200	0.246	9.4	5	5.61	0.88	0.88	123.42
1892	3b	43	0.01	50	123	1950	0.431	9.6	6	5.26	0.88	0.88	199.04
1892	4b	8	0.01	50	123	850	0.218	9.4	5	5.61	0.88	0.88	39.49
1892	6a	27	0.01	50	123	2000	0.34	9.4	7	4.79	0.87	0.87	112.52
1892	7a	32	0.01	50	123	2200	0.1818	9.4	8	4.5	0.86	0.86	123.84
1892	8c	30	0.01	50	123	1700	0.479	9.8	6	5.37	0.88	0.88	141.77
1892	9c	19	0.01	50	123	1400	0.189	9.6	6	5.26	0.88	0.88	87.95
1892	10d	21	0.01	50	123	1600	0.45	9.8	5	5.85	0.89	0.89	109.34
1892	11d	18	0.01	50	123	1500	0.227	9.6	6	5.26	0.88	0.88	83.32
1892	13c	26	0.01	50	123	2300	0.243	9.4	8	4.5	0.86	0.86	100.62
1892	15a	30	0.01	50	123	1900	0.1895	9.2	7	4.69	0.87	0.87	122.41
1892	16a	40	0.01	50	123	2050	0.208	9.2	8	4.4	0.86	0.86	151.36
1892	17e	21	0.01	50	123	2600	0.223	9.2	9	4.16	0.86	0.86	75.13
1892	18e	23	0.01	50	123	2300	0.202	9.2	8	4.4	0.86	0.86	87.03
1892	19a	17	0.42	50	120	1000	0.04	9.2	7	4.69	0.74	0.81	64.58
1892	21f	8	0.01	50	120	1100	0.205	9.2	6	5.04	0.75	0.75	30.24

Tc CALCULATION
FOR
Existing YOUNG NAK RETREAT CENTER

Project	Subarea	Area (acre	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft	Isohyet (in	Tc-calcula	Intensity (i	Cu	Cd	Flowrate (cfs)
1892	1a	38	0.01	25	123	1800	0.372	8.6	7	4.38	0.86	0.86	143.14
1892	2a	25	0.01	25	123	1200	0.246	8.3	6	4.55	0.86	0.86	97.83
1892	3b	43	0.01	25	123	1950	0.431	8.4	7	4.28	0.86	0.86	158.27
1892	4b	8	0.01	25	123	850	0.218	8.3	5	4.95	0.87	0.87	34.45
1892	6a	27	0.01	25	123	2000	0.34	8.3	7	4.23	0.86	0.86	98.22
1892	7a	32	0.01	25	123	2200	0.1818	8.3	9	3.76	0.85	0.85	102.27
1892	8c	30	0.01	25	123	1700	0.479	8.6	6	4.71	0.87	0.87	122.93
1892	9c	19	0.01	25	123	1400	0.189	8.4	6	4.6	0.87	0.87	76.04
1892	10d	21	0.01	25	123	1600	0.45	8.6	6	4.71	0.87	0.87	86.05
1892	11d	18	0.01	25	123	1500	0.227	8.4	7	4.28	0.86	0.86	66.25
1892	13c	26	0.01	25	123	2300	0.243	8.3	9	3.76	0.85	0.85	83.1
1892	15a	30	0.01	25	123	1900	0.1895	8.1	8	3.87	0.85	0.85	98.69
1892	16a	40	0.01	25	123	2050	0.208	8.1	8	3.87	0.85	0.85	131.58
1892	17e	21	0.01	25	123	2600	0.223	8.1	10	3.49	0.83	0.83	60.83
1892	18e	23	0.01	25	123	2300	0.202	8.1	9	3.67	0.84	0.84	70.9
1892	19a	17	0.42	25	120	1000	0.04	8.1	7	4.13	0.72	0.8	56.17
1892	21f	8	0.01	25	120	1100	0.205	8.1	6	4.44	0.73	0.73	25.93

Tc CALCULATION
FOR
Existing YOUNG NAK RETREAT CENTER

Project	Subarea	Area (acre	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft	Isohyet (in	Tc-calcula	Intensity (i	Cu	Cd	Flowrate (cfs)
1892	1a	38	0.01	2	123	1800	0.372	3.8	13	1.45	0.7	0.7	38.57
1892	2a	25	0.01	2	123	1200	0.246	3.6	12	1.42	0.7	0.7	24.85
1892	3b	43	0.01	2	123	1950	0.431	3.7	14	1.36	0.69	0.69	40.35
1892	4b	8	0.01	2	123	850	0.218	3.6	9	1.63	0.72	0.72	9.39
1892	6a	27	0.01	2	123	2000	0.34	3.6	15	1.28	0.68	0.68	23.5
1892	7a	32	0.01	2	123	2200	0.1818	3.6	18	1.18	0.66	0.66	24.92
1892	8c	30	0.01	2	123	1700	0.479	3.8	12	1.5	0.71	0.71	31.95
1892	9c	19	0.01	2	123	1400	0.189	3.7	13	1.41	0.7	0.7	18.75
1892	10d	21	0.01	2	123	1600	0.45	3.8	12	1.5	0.71	0.71	22.37
1892	11d	18	0.01	2	123	1500	0.227	3.7	13	1.41	0.7	0.7	17.77
1892	13c	26	0.01	2	123	2300	0.243	3.6	18	1.18	0.66	0.66	20.25
1892	15a	30	0.01	2	123	1900	0.1895	3.5	17	1.17	0.66	0.66	23.17
1892	16a	40	0.01	2	123	2050	0.208	3.5	18	1.14	0.66	0.66	30.1
1892	17e	21	0.01	2	123	2600	0.223	3.5	21	1.06	0.64	0.64	14.25
1892	18e	23	0.01	2	123	2300	0.202	3.5	19	1.11	0.65	0.65	16.59
1892	19a	17	0.42	2	120	1000	0.04	3.5	16	1.21	0.38	0.6	12.34
1892	21f	8	0.01	2	120	1100	0.205	3.5	17	1.17	0.37	0.38	3.56

Hydrology Printouts - Existing Condition

Program Package Serial Number:
11/28/06 FILE: 501892 INPUT DATA: English Units RAINFALL SOIL FILE: English (In) OUTPUT DATA: English Units PAGE 1
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT PROG F0601M

Existing

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 50 SOIL DATA FILE: C:\Program Files\CIVILDESLA\scr_soilx_34.dat

YOUNG NAK RETREAT CENTER 50YR. STORM DAY 4

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
5	1A	38.0	181.11	38.0	181.11	1	1200.	.24600	.00	.00	0.	323	6	A49	.01
5	2A	25.0	126.29	63.0	274.92	0	0.	.00000	.00	.00	0.	323	5	A47	.01
5	3B	43.0	200.35	43.0	200.35	1	850.	.21800	.00	.00	0.	323	6	A48	.01
5	4B	8.0	40.41	51.0	225.89	0	0.	.00000	.00	.00	0.	323	5	A47	.01
5	5AB	51.0	225.89	114.0	500.80	1	850.	.13500	.00	.00	0.	323	0	A47	.00
5	6A	27.0	113.08	141.0	601.14	2	650.	.09200	.00	.00	0.	323	7	A47	.01
5	7A	32.0	125.50	173.0	712.17	0	0.	.00000	.00	.00	0.	323	8	A47	.01
5	8C	30.0	142.98	30.0	142.98	1	1400.	.18900	.00	.00	0.	323	6	A49	.01
5	9C	19.0	88.53	49.0	206.73	0	0.	.00000	.00	.00	0.	323	6	A48	.01
5	10D	21.0	110.97	21.0	110.97	1	1500.	.22700	.00	.00	0.	323	5	A49	.01
5	11D	18.0	83.87	39.0	169.61	0	0.	.00000	.00	.00	0.	323	6	A48	.01
5	12CD	39.0	169.61	88.0	375.20	1	1050.	.13330	.00	.00	0.	323	0	A48	.00
5	13C	26.0	101.97	114.0	464.22	0	0.	.00000	.00	.00	0.	323	8	A47	.01
5	14AC	114.0	464.22	287.0	1176.39	2	700.	.08600	.00	.00	0.	323	0	A47	.00
5	15A	30.0	122.90	317.0	1268.37	2	1000.	.08000	.00	.00	0.	323	7	A46	.01
5	16A	40.0	153.10	357.0	1378.72	2	1000.	.04000	.00	.00	0.	323	8	A46	.01
5	17E	21.0	76.11	21.0	76.11	2	700.	.08570	.00	.00	0.	323	9	A46	.01
5	18E	23.0	88.03	44.0	162.07	2	500.	.04000	.00	.00	0.	323	8	A46	.01
5	19A	17.0	69.22	374.0	1404.24	0	0.	.00000	.00	.00	0.	123	7	A46	.42
5	20AE	44.0	160.92	418.0	1561.22	0	0.	.00000	.00	.00	0.	123	0	A46	.00
5	21F	8.0	35.57	8.0	35.57	0	0.	.00000	.00	.00	0.	323	6	A46	.01

LEGEND:

BF = Bulking Factor

BF @ 16A = 1.49
BF @ 20AE = 1.48
BF @ 17E, 18E & 21E = 1.62

$Q_b = Q_{50 BURNED}$

$Q_{bb} = Q_{50 BURNED \& BULKED}$

$Q_{bb} = (Q_b)(BF)$

CALCULATIONS (Q_{bb})

ΣQ_{bb} (16A) $= (1378.7)(1.49) = 2054.3$ cfs

ΣQ_{bb} (17E) $= (76.1)(1.62) = 123.3$ cfs

ΣQ_{bb} (18E) $= (162.1)(1.62) = 262.6$ cfs

ΣQ_{bb} (21F) $= (35.6)(1.62) = 57.7$ cfs

ΣQ_{bb} (20AE) $= \frac{(418-17)}{418}(1561.2)(1.48) + \left(\frac{17}{418}\right)(1561.2) = 2280.1$ cfs

Program Package Serial Number:
11/28/06 FILE: 251892 INPUT DATA: English Units RAINFALL SOIL FILE: English (In) OUTPUT DATA: English Units PAGE 1
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT PROG F0601M

Existing

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 25 SOIL DATA FILE: C:\Program Files\CIVILDESLA\scr_soilx_34.dat

YOUNG NAK RETREAT CENTER 25YR. STORM DAY 4

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
5	1A	38.0	144.61	38.0	144.61	1	1200.	.24600	.00	.00	0.	323	7	A43	.01
5	2A	25.0	100.72	63.0	230.29	0	0.	.00000	.00	.00	0.	323	6	A42	.01
5	3B	43.0	159.35	43.0	159.35	1	850.	.21800	.00	.00	0.	323	7	A42	.01
5	4B	8.0	35.85	51.0	184.04	0	0.	.00000	.00	.00	0.	323	5	A42	.01
5	5AB	51.0	184.04	114.0	412.39	1	850.	.13500	.00	.00	0.	323	0	A42	.00
5	6A	27.0	100.06	141.0	496.86	2	650.	.09200	.00	.00	0.	323	7	A42	.01
5	7A	32.0	104.80	173.0	593.84	0	0.	.00000	.00	.00	0.	323	9	A42	.01
5	8C	30.0	124.06	30.0	124.06	1	1400.	.18900	.00	.00	0.	323	6	A43	.01
5	9C	19.0	76.55	49.0	177.46	0	0.	.00000	.00	.00	0.	323	6	A42	.01
5	10D	21.0	86.84	21.0	86.84	1	1500.	.22700	.00	.00	0.	323	6	A43	.01
5	11D	18.0	66.70	39.0	140.54	0	0.	.00000	.00	.00	0.	323	7	A42	.01
5	12CD	39.0	140.54	88.0	318.00	1	1050.	.13330	.00	.00	0.	323	0	A42	.00
5	13C	26.0	85.15	114.0	387.25	0	0.	.00000	.00	.00	0.	323	9	A42	.01
5	14AC	114.0	387.25	287.0	980.04	2	700.	.08600	.00	.00	0.	323	0	A42	.00
5	15A	30.0	101.29	317.0	1056.89	2	1000.	.08000	.00	.00	0.	323	8	A41	.01
5	16A	40.0	135.05	357.0	1160.82	2	1000.	.04000	.00	.00	0.	323	8	A41	.01
5	17E	21.0	63.95	21.0	63.95	2	700.	.08570	.00	.00	0.	323	10	A41	.01
5	18E	23.0	73.41	44.0	135.13	2	500.	.04000	.00	.00	0.	323	9	A41	.01
5	19A	17.0	61.31	374.0	1181.69	0	0.	.00000	.00	.00	0.	123	7	A41	.42
5	20AE	44.0	134.05	418.0	1310.44	0	0.	.00000	.00	.00	0.	123	0	A41	.00
5	21F	8.0	31.38	8.0	31.38	0	0.	.00000	.00	.00	0.	323	6	A41	.01

Program Package Serial Number:
11/28/06 FILE: 2Y1892 INPUT DATA: English Units RAINFALL SOIL FILE: English (In) OUTPUT DATA: English Units PAGE 1
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT PROG F0601M

Existing

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 2 SOIL DATA FILE: C:\Program Files\CIVILDESLA\scr_soilx_34.dat

YOUNG NAK RETREAT CENTER 2YR. STORM DAY 4

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
5	1A	38.0	40.52	38.0	40.52	1	1200.	.24600	.00	.00	0.	323	13	A19	.01
5	2A	25.0	26.21	63.0	64.44	0	0.	.00000	.00	.00	0.	323	12	A18	.01
5	3B	43.0	44.21	43.0	44.21	1	850.	.21800	.00	.00	0.	323	14	A19	.01
5	4B	8.0	9.85	51.0	52.72	0	0.	.00000	.00	.00	0.	323	9	A18	.01
5	5AB	51.0	52.72	114.0	117.16	1	850.	.13500	.00	.00	0.	323	0	A18	.00
5	6A	27.0	24.94	141.0	139.54	2	650.	.09200	.00	.00	0.	323	15	A18	.01
5	7A	32.0	26.52	173.0	164.47	0	0.	.00000	.00	.00	0.	323	18	A18	.01
5	8C	30.0	33.46	30.0	33.46	1	1400.	.18900	.00	.00	0.	323	12	A19	.01
5	9C	19.0	20.26	49.0	50.68	0	0.	.00000	.00	.00	0.	323	13	A19	.01
5	10D	21.0	23.42	21.0	23.42	1	1500.	.22700	.00	.00	0.	323	12	A19	.01
5	11D	18.0	19.19	39.0	39.70	0	0.	.00000	.00	.00	0.	323	13	A19	.01
5	12CD	39.0	39.70	88.0	90.38	1	1050.	.13330	.00	.00	0.	323	0	A19	.00
5	13C	26.0	21.55	114.0	109.29	0	0.	.00000	.00	.00	0.	323	18	A18	.01
5	14AC	114.0	109.29	287.0	273.21	2	700.	.08600	.00	.00	0.	323	0	A18	.00
5	15A	30.0	25.76	317.0	296.13	2	1000.	.08000	.00	.00	0.	323	17	A18	.01
5	16A	40.0	33.15	357.0	325.29	2	1000.	.04000	.00	.00	0.	323	18	A18	.01
5	17E	21.0	15.92	21.0	15.92	2	700.	.08570	.00	.00	0.	323	21	A18	.01
5	18E	23.0	18.51	44.0	34.17	2	500.	.04000	.00	.00	0.	323	19	A18	.01
5	19A	17.0	16.27	374.0	336.84	0	0.	.00000	.00	.00	0.	123	16	A18	.42
5	20AE	44.0	34.05	418.0	369.70	0	0.	.00000	.00	.00	0.	123	0	A18	.00
5	21F	8.0	6.87	8.0	6.87	0	0.	.00000	.00	.00	0.	323	17	A18	.01

Tc Calculation Tables - Proposed Condition

Tc CALCULATION
FOR
PROPOSED YOUNG NAK RETREAT CENTER

Project	Subarea	Area (acre:	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.	Tc-calculat	Intensity (ir	Cu	Cd	Flowrate (c
1892	1a	38	0.01	50	123	1800	0.372	9.8	6	5.37	0.88	0.88	179.57
1892	2a	25	0.01	50	123	1200	0.246	9.4	5	5.61	0.88	0.88	123.42
1892	3b	43	0.01	50	123	1950	0.431	9.6	6	5.26	0.88	0.88	199.04
1892	4b	8	0.01	50	123	850	0.218	9.4	5	5.61	0.88	0.88	39.49
1892	6a	27	0.01	50	123	2000	0.34	9.4	7	4.79	0.87	0.87	112.52
1892	7a	32	0.01	50	123	2200	0.1818	9.4	8	4.5	0.86	0.86	123.84
1892	8c	30	0.01	50	123	1700	0.479	9.8	6	5.37	0.88	0.88	141.77
1892	9c	19	0.01	50	123	1400	0.189	9.6	6	5.26	0.88	0.88	87.95
1892	10d	21	0.01	50	123	1600	0.45	9.8	5	5.85	0.89	0.89	109.34
1892	11d	18	0.01	50	123	1500	0.227	9.6	6	5.26	0.88	0.88	83.32
1892	13c	26	0.01	50	123	2300	0.243	9.4	8	4.5	0.86	0.86	100.62
1892	15a	30	0.01	50	123	1900	0.1895	9.2	7	4.69	0.87	0.87	122.41
1892	16a	40	0.01	50	123	2050	0.208	9.2	8	4.4	0.86	0.86	151.36
1892	17e	21	0.01	50	123	2600	0.223	9.2	9	4.16	0.86	0.86	75.13
1892	18e	23	0.04	50	123	2300	0.202	9.2	8	4.4	0.86	0.86	87.03
1892	19a	17	0.42	50	120	1000	0.04	9.2	7	4.69	0.74	0.81	64.58
1892	21f	8	0.01	50	120	1100	0.205	9.2	6	5.04	0.75	0.75	30.24

Tc CALCULATION
FOR
PROPOSED YOUNG NAK RETREAT CENTER

Project	Subarea	Area (acre:	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.	Tc-calculat	Intensity (ir	Cu	Cd	Flowrate (cfs)
1892	1a	38	0.01	25	123	1800	0.372	8.6	7	4.38	0.86	0.86	143.14
1892	2a	25	0.01	25	123	1200	0.246	8.3	6	4.55	0.86	0.86	97.83
1892	3b	43	0.01	25	123	1950	0.431	8.4	7	4.28	0.86	0.86	158.27
1892	4b	8	0.01	25	123	850	0.218	8.3	5	4.95	0.87	0.87	34.45
1892	6a	27	0.01	25	123	2000	0.34	8.3	7	4.23	0.86	0.86	98.22
1892	7a	32	0.01	25	123	2200	0.1818	8.3	9	3.76	0.85	0.85	102.27
1892	8c	30	0.01	25	123	1700	0.479	8.6	6	4.71	0.87	0.87	122.93
1892	9c	19	0.01	25	123	1400	0.189	8.4	6	4.6	0.87	0.87	76.04
1892	10d	21	0.01	25	123	1600	0.45	8.6	6	4.71	0.87	0.87	86.05
1892	11d	18	0.01	25	123	1500	0.227	8.4	7	4.28	0.86	0.86	66.25
1892	13c	26	0.01	25	123	2300	0.243	8.3	9	3.76	0.85	0.85	83.1
1892	15a	30	0.01	25	123	1900	0.1895	8.1	8	3.87	0.85	0.85	98.69
1892	16a	40	0.01	25	123	2050	0.208	8.1	8	3.87	0.85	0.85	131.58
1892	17e	21	0.01	25	123	2600	0.223	8.1	10	3.49	0.83	0.83	60.83
1892	18e	23	0.04	25	123	2300	0.202	8.1	9	3.67	0.84	0.84	70.9
1892	19a	17	0.42	25	120	1000	0.04	8.1	7	4.13	0.72	0.8	56.17
1892	21f	8	0.01	25	120	1100	0.205	8.1	6	4.44	0.73	0.73	25.93

Tc CALCULATION
FOR
PROPOSED YOUNG NAK RETREAT CENTER

Project	Subarea	Area (acre:	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.	Tc-calculat	Intensity (ir	Cu	Cd	Flowrate (cfs)
1892	1a	38	0.01	2	123	1800	0.372	3.8	13	1.45	0.7	0.7	38.57
1892	2a	25	0.01	2	123	1200	0.246	3.6	12	1.42	0.7	0.7	24.85
1892	3b	43	0.01	2	123	1950	0.431	3.7	14	1.36	0.69	0.69	40.35
1892	4b	8	0.01	2	123	850	0.218	3.6	9	1.63	0.72	0.72	9.39
1892	6a	27	0.01	2	123	2000	0.34	3.6	15	1.28	0.68	0.68	23.5
1892	7a	32	0.01	2	123	2200	0.1818	3.6	18	1.18	0.66	0.66	24.92
1892	8c	30	0.01	2	123	1700	0.479	3.8	12	1.5	0.71	0.71	31.95
1892	9c	19	0.01	2	123	1400	0.189	3.7	13	1.41	0.7	0.7	18.75
1892	10d	21	0.01	2	123	1600	0.45	3.8	12	1.5	0.71	0.71	22.37
1892	11d	18	0.01	2	123	1500	0.227	3.7	13	1.41	0.7	0.7	17.77
1892	13c	26	0.01	2	123	2300	0.243	3.6	18	1.18	0.66	0.66	20.25
1892	15a	30	0.01	2	123	1900	0.1895	3.5	17	1.17	0.66	0.66	23.17
1892	16a	40	0.01	2	123	2050	0.208	3.5	18	1.14	0.66	0.66	30.1
1892	17e	21	0.01	2	123	2600	0.223	3.5	21	1.06	0.64	0.64	14.25
1892	18e	23	0.04	2	123	2300	0.202	3.5	19	1.11	0.65	0.66	16.85
1892	19a	17	0.42	2	120	1000	0.04	3.5	16	1.21	0.38	0.6	12.34
1892	21f	8	0.01	2	120	1100	0.205	3.5	17	1.17	0.37	0.38	3.56

Hydrology Printouts - Proposed Condition

Program Package Serial Number:
11/29/06 FILE: 501892 INPUT DATA: English Units RAINFALL SOIL FILE: English (In) OUTPUT DATA: English Units PAGE 1

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT PROG F0601M

PROPOSED

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = SOIL DATA FILE: C:\Program Files\CIVILDESLA\scr_soilx_34.dat

YOUNG NAK RETREAT CENTER 50YR.

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	STORM DAY 4 RAIN ZONE	PCT IMPV
5	1A	38.0	181.11	38.0	181.11	1	1200.	.24600	.00	.00	0.	323	6	A49	.01
5	2A	25.0	126.29	63.0	274.92	0	0.	.00000	.00	.00	0.	323	5	A47	.01
5	3B	43.0	200.35	43.0	200.35	1	850.	.21800	.00	.00	0.	323	6	A48	.01
5	4B	8.0	40.41	51.0	225.89	0	0.	.00000	.00	.00	0.	323	5	A47	.01
5	5AB	51.0	225.89	114.0	500.80	1	850.	.13500	.00	.00	0.	323	0	A47	.00
5	6A	27.0	113.08	141.0	601.14	2	650.	.09200	.00	.00	0.	323	7	A47	.01
5	7A	32.0	125.50	173.0	712.17	0	0.	.00000	.00	.00	0.	323	8	A47	.01
5	8C	30.0	142.98	30.0	142.98	1	1400.	.18900	.00	.00	0.	323	6	A49	.01
5	9C	19.0	88.53	49.0	206.73	0	0.	.00000	.00	.00	0.	323	6	A48	.01
5	10D	21.0	110.97	21.0	110.97	1	1500.	.22700	.00	.00	0.	323	5	A49	.01
5	11D	18.0	83.87	39.0	169.61	0	0.	.00000	.00	.00	0.	323	6	A48	.01
5	12CD	39.0	169.61	88.0	375.20	1	1050.	.13330	.00	.00	0.	323	0	A48	.00
5	13C	26.0	101.97	114.0	464.22	0	0.	.00000	.00	.00	0.	323	8	A47	.01
5	14AC	114.0	464.22	287.0	1176.39	2	700.	.08600	.00	.00	0.	323	0	A47	.00
5	15A	30.0	122.90	317.0	1268.37	2	1000.	.08000	.00	.00	0.	323	7	A46	.01
5	16A	40.0	153.10	357.0	1378.72	2	1000.	.04000	.00	.00	0.	323	8	A46	.01
5	17E	21.0	76.11	21.0	76.11	2	700.	.08570	.00	.00	0.	323	9	A46	.01
5	18E	23.0	88.09	44.0	162.13	2	500.	.04000	.00	.00	0.	323	8	A46	.04
5	19A	17.0	69.22	374.0	1404.24	0	0.	.00000	.00	.00	0.	123	7	A46	.42
5	20AE	44.0	160.98	418.0	1561.29	0	0.	.00000	.00	.00	0.	123	0	A46	.00
5	21F	8.0	35.57	8.0	35.57	0	0.	.00000	.00	.00	0.	323	6	A46	.01

CALCULATION(Qbb)

ΣQ_{bb} (16A) $= (1378.7)(1.42) = 2054.3$ cfs

ΣQ_{bb} (17E) $= (76.1)(1.62) = 123.3$ cfs

ΣQ_{bb} (18E) $= (162.1)(1.62) = 262.6$ cfs

ΣQ_{bb} (21F) $= (35.6)(1.62) = 57.7$ cfs

ΣQ_{bb} (20AE) $= \left(\frac{418-17}{418}\right)(1561.3)(1.48) + \left(\frac{17}{418}\right)(1561.3) = 2280.2$ cfs

Program Package Serial Number:
11/29/06 FILE: 251892 INPUT DATA: English Units RAINFALL SOIL FILE: English (In) OUTPUT DATA: English Units PAGE 1
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT PROG F0601M

PROPOSED

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = SOIL DATA FILE: C:\Program Files\CIVILDESLA\scr_soilx_34.dat
YOUNG NAK RETREAT CENTER 25YR.

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	STORM DAY 4 RAIN ZONE	PCT IMPV
5	1A	38.0	144.61	38.0	144.61	1	1200.	.24600	.00	.00	0.	323	7	A43	.01
5	2A	25.0	100.72	63.0	230.29	0	0.	.00000	.00	.00	0.	323	6	A42	.01
5	3B	43.0	159.35	43.0	159.35	1	850.	.21800	.00	.00	0.	323	7	A42	.01
5	4B	8.0	35.85	51.0	184.04	0	0.	.00000	.00	.00	0.	323	5	A42	.01
5	5AB	51.0	184.04	114.0	412.39	1	850.	.13500	.00	.00	0.	323	0	A42	.00
5	6A	27.0	100.06	141.0	496.86	2	650.	.09200	.00	.00	0.	323	7	A42	.01
5	7A	32.0	104.80	173.0	593.84	0	0.	.00000	.00	.00	0.	323	9	A42	.01
5	8C	30.0	124.06	30.0	124.06	1	1400.	.18900	.00	.00	0.	323	6	A43	.01
5	9C	19.0	76.55	49.0	177.46	0	0.	.00000	.00	.00	0.	323	6	A42	.01
5	10D	21.0	86.84	21.0	86.84	1	1500.	.22700	.00	.00	0.	323	6	A43	.01
5	11D	18.0	66.70	39.0	140.54	0	0.	.00000	.00	.00	0.	323	7	A42	.01
5	12CD	39.0	140.54	88.0	318.00	1	1050.	.13330	.00	.00	0.	323	0	A42	.00
5	13C	26.0	85.15	114.0	387.25	0	0.	.00000	.00	.00	0.	323	9	A42	.01
5	14AC	114.0	387.25	287.0	980.04	2	700.	.08600	.00	.00	0.	323	0	A42	.00
5	15A	30.0	101.29	317.0	1056.89	2	1000.	.08000	.00	.00	0.	323	8	A41	.01
5	16A	40.0	135.05	357.0	1160.82	2	1000.	.04000	.00	.00	0.	323	8	A41	.01
5	17E	21.0	63.95	21.0	63.95	2	700.	.08570	.00	.00	0.	323	10	A41	.01
5	18E	23.0	73.50	44.0	135.22	2	500.	.04000	.00	.00	0.	323	9	A41	.04
5	19A	17.0	61.31	374.0	1181.69	0	0.	.00000	.00	.00	0.	123	7	A41	.42
5	20AE	44.0	134.14	418.0	1310.54	0	0.	.00000	.00	.00	0.	123	0	A41	.00
5	21F	8.0	31.38	8.0	31.38	0	0.	.00000	.00	.00	0.	323	6	A41	.01

Program Package Serial Number:
11/29/06 FILE: 2Y1892 INPUT DATA: English Units RAINFALL SOIL FILE: English (In) OUTPUT DATA: English Units PAGE 1

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT PROG F0601M

PROPOSED

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = SOIL DATA FILE: C:\Program Files\CIVILDESLA\scr_soilx_34.dat

YOUNG NAK RETREAT CENTER 2YR.

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	STORM DAY 4 RAIN ZONE	PCT IMPV
5	1A	38.0	40.52	38.0	40.52	1	1200.	.24600	.00	.00	0.	323	13	A19	.01
5	2A	25.0	26.21	63.0	64.44	0	0.	.00000	.00	.00	0.	323	12	A18	.01
5	3B	43.0	44.21	43.0	44.21	1	850.	.21800	.00	.00	0.	323	14	A19	.01
5	4B	8.0	9.85	51.0	52.72	0	0.	.00000	.00	.00	0.	323	9	A18	.01
5	5AB	51.0	52.72	114.0	117.16	1	850.	.13500	.00	.00	0.	323	0	A18	.00
5	6A	27.0	24.94	141.0	139.54	2	650.	.09200	.00	.00	0.	323	15	A18	.01
5	7A	32.0	26.52	173.0	164.47	0	0.	.00000	.00	.00	0.	323	18	A18	.01
5	8C	30.0	33.46	30.0	33.46	1	1400.	.18900	.00	.00	0.	323	12	A19	.01
5	9C	19.0	20.26	49.0	50.68	0	0.	.00000	.00	.00	0.	323	13	A19	.01
5	10D	21.0	23.42	21.0	23.42	1	1500.	.22700	.00	.00	0.	323	12	A19	.01
5	11D	18.0	19.19	39.0	39.70	0	0.	.00000	.00	.00	0.	323	13	A19	.01
5	12CD	39.0	39.70	88.0	90.38	1	1050.	.13330	.00	.00	0.	323	0	A19	.00
5	13C	26.0	21.55	114.0	109.29	0	0.	.00000	.00	.00	0.	323	18	A18	.01
5	14AC	114.0	109.29	287.0	273.21	2	700.	.08600	.00	.00	0.	323	0	A18	.00
5	15A	30.0	25.76	317.0	296.13	2	1000.	.08000	.00	.00	0.	323	17	A18	.01
5	16A	40.0	33.15	357.0	325.29	2	1000.	.04000	.00	.00	0.	323	18	A18	.01
5	17E	21.0	15.92	21.0	15.92	2	700.	.08570	.00	.00	0.	323	21	A18	.01
5	18E	23.0	18.67	44.0	34.32	2	500.	.04000	.00	.00	0.	323	19	A18	.04
5	19A	17.0	16.27	374.0	336.84	0	0.	.00000	.00	.00	0.	123	16	A18	.42
5	20AE	44.0	34.21	418.0	369.85	0	0.	.00000	.00	.00	0.	123	0	A18	.00
5	21F	8.0	6.87	8.0	6.87	0	0.	.00000	.00	.00	0.	323	17	A18	.01

MODIFIED RATIONAL METHOD HYDROLOGY - STORM YEAR = 50 SOIL DATA FILE: [illegible]

YOUNG NAK RETREAT CENTER STORM DAY 4

LOCATION		SUBAREA AREA(Ac)	SUBAREA Q(CFS)	TOTAL AREA(Ac)	TOTAL Q(CFS)	CONV TYPE	CONV LNGTH(Ft)	CONV SLOPE	CONV SIZE(Ft)	CONV Z	CONTROL Q(CFS)	SOIL NAME	TC	RAIN ZONE	PCT IMPV
5	1A	38.0	181.11	38.0	181.11	1	1200.	.24600	.00	.00	0.	323	6	A49	.01
5	2A	25.0	126.29	63.0	274.92	0	0.	.00000	.00	.00	0.	323	5	A47	.01
5	3B	43.0	184.38	43.0	184.38	1	850.	.21800	.00	.00	0.	323	7	A48	.01
5	4B	8.0	40.41	51.0	212.61	0	0.	.00000	.00	.00	0.	323	5	A47	.01
5	5AB	51.0	212.61	114.0	485.92	1	850.	.13500	.00	.00	0.	323	0	A47	.00
5	6A	27.0	113.08	141.0	587.41	2	650.	.09200	.00	.00	0.	323	7	A47	.01
5	7A	32.0	125.50	173.0	699.03	0	0.	.00000	.00	.00	0.	323	8	A47	.01
5	8C	30.0	142.98	30.0	142.98	1	1400.	.18900	.00	.00	0.	323	6	A49	.01
5	9C	19.0	88.53	49.0	206.73	0	0.	.00000	.00	.00	0.	323	6	A48	.01
5	10D	21.0	110.97	21.0	110.97	1	1500.	.22700	.00	.00	0.	323	5	A49	.01
5	11D	18.0	83.87	39.0	169.61	0	0.	.00000	.00	.00	0.	323	6	A48	.01
5	12CD	39.0	169.61	88.0	375.20	1	1050.	.13330	.00	.00	0.	323	0	A48	.00
5	13C	26.0	101.97	114.0	464.22	0	0.	.00000	.00	.00	0.	323	8	A47	.01
5	14AC	114.0	464.22	287.0	1163.25	2	700.	.08600	.00	.00	0.	323	0	A47	.00
5	15A	30.0	122.90	317.0	1255.10	2	1000.	.08000	.00	.00	0.	323	7	A46	.01
5	16A	40.0	153.10	357.0	1366.60	2	1000.	.04000	.00	.00	0.	323	8	A46	.01
5	17E	21.0	76.11	21.0	76.11	2	700.	.08570	.00	.00	0.	323	9	A46	.01
5	18E	23.0	88.03	44.0	162.07	2	500.	.04000	.00	.00	0.	323	8	A46	.01
5	19A	17.0	69.22	374.0	1392.00	0	0.	.00000	.00	.00	0.	123	7	A46	.42
5	20AE	44.0	160.92	418.0	1548.98	0	0.	.00000	.00	.00	0.	123	0	A46	.00
5	21F	8.0	35.57	8.0	35.57	0	0.	.00000	.00	.00	0.	323	6	A46	.01

<u>LEGEND:</u>

B.F = Bulking Factor

$Q_b = Q_{50\,BURNED}$

$Q_{bb} = Q_{50\,BURNED\ \&\ bulked}$

BF @ E16A = 1.49
BF @ 20AE = 1.48
BF @ 17E, 18E & 21F = 1.62

$$Q_{bb} = (Q_b)(B.F.)$$

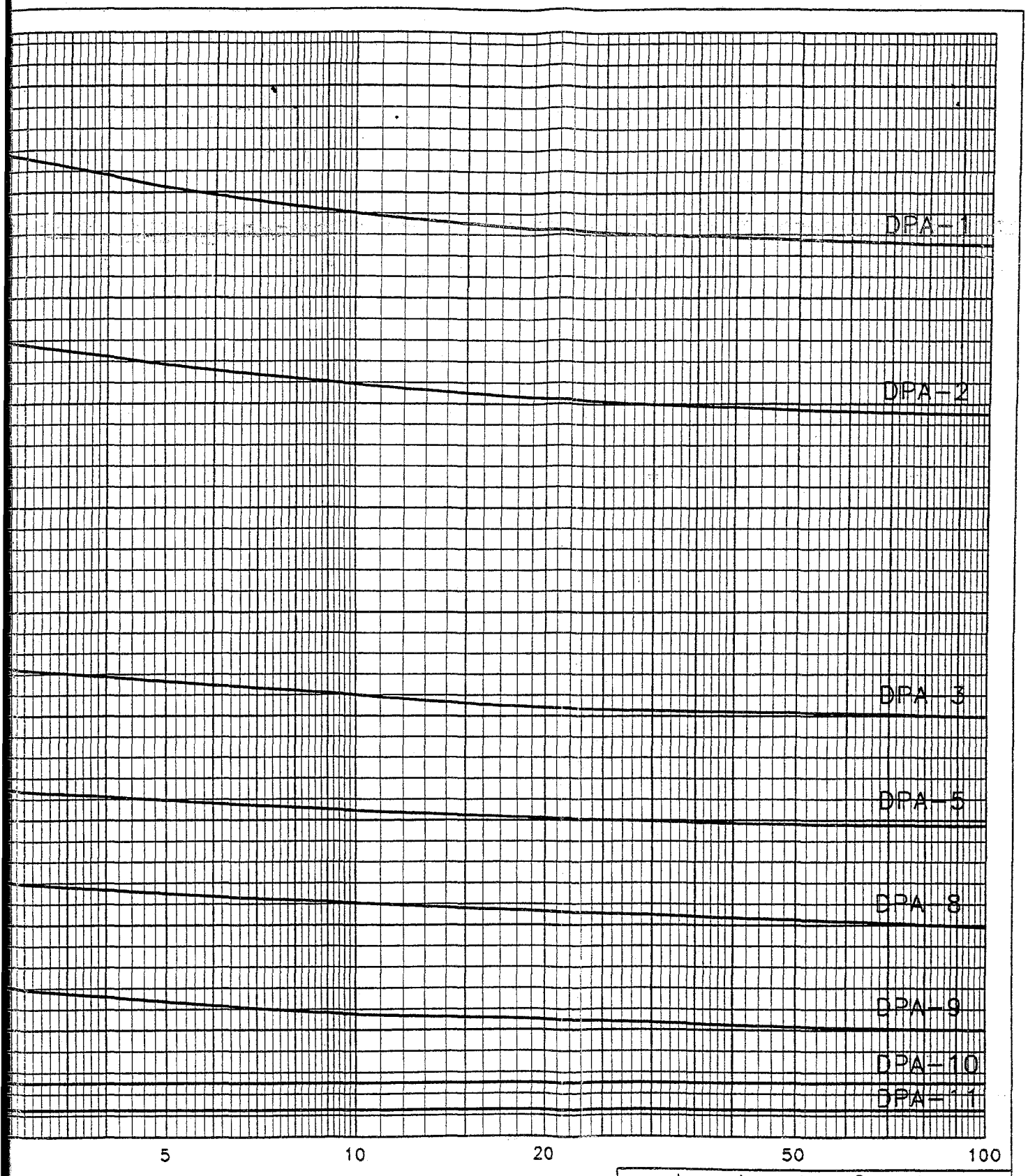
$$EQ_{bb\,(16A)} = (1366.6)(1.49) = 2036.23 \text{ cfs}$$

$$Q_{bb\,(17E)} = (76.11)(1.62) = 123.30 \text{ cfs}$$

$$EQ_{bb\,(18E)} = (162.07)(1.62) = 262.55 \text{ cfs}$$

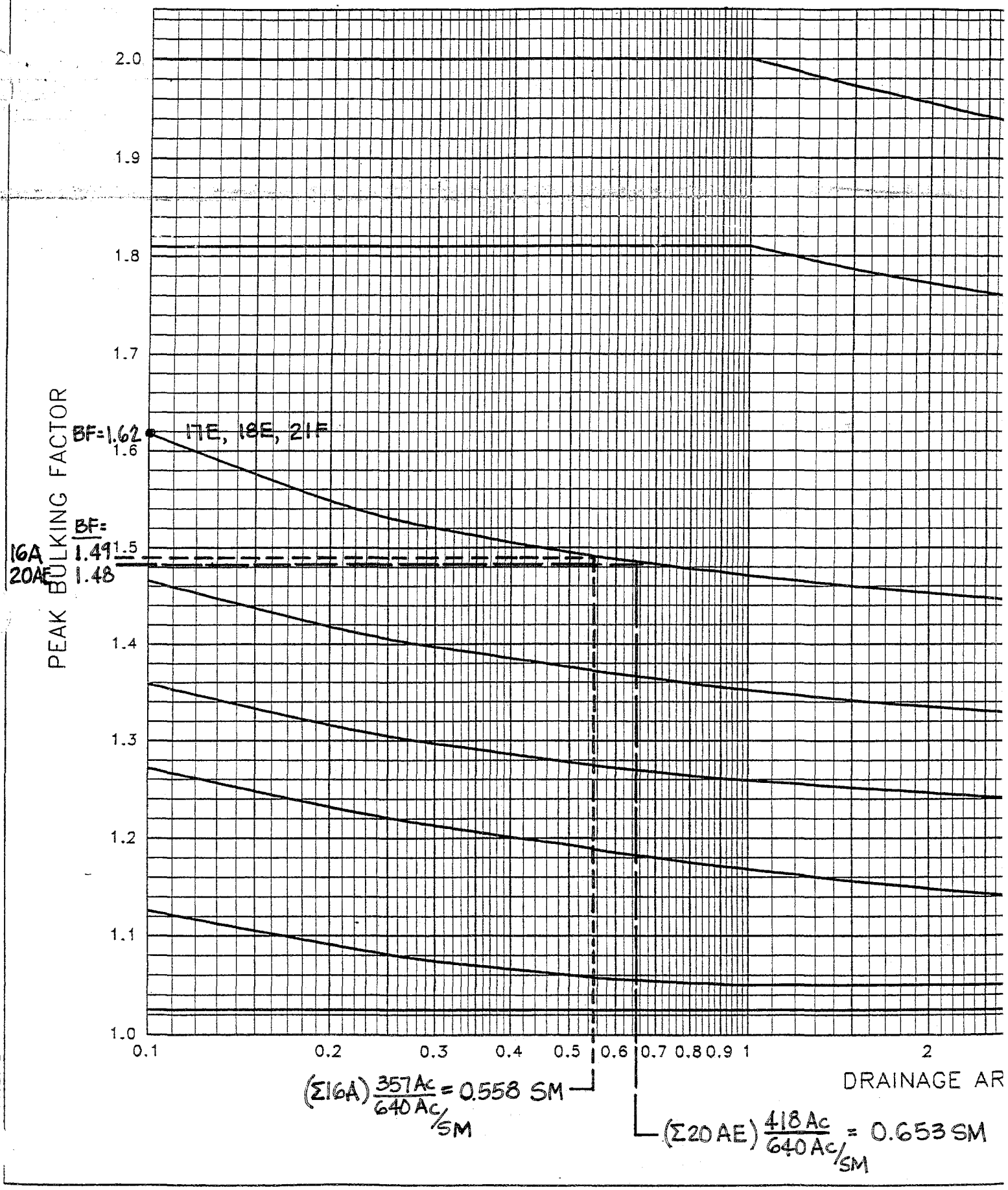
$$Q_{bb\,(21F)} = (35.57)(1.62) = 57.62 \text{ cfs}$$

$$Q_{bb\,(20AE)} = \frac{(418-17)}{418}(1548.98)(1.48) + \left(\frac{17}{418}\right)(1548.98) = 2262.25 \text{ cfs}$$



Los Angeles County
Department of Public Works

PEAK BULKING FACTORS
for Antelope Valley


PEAK BULKING FACTOR
2.0
1.9
1.8
1.7
BF=1.62
17E, 18E, 21F
1.6
BF=
16A 1.49
1.5
20AE 1.48
1.4
1.3
1.2
1.1
1.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
2
DRAINAGE AR
(Σ16A) 357 Ac / 640 Ac/SM = 0.558 SM
(Σ20AE) 418 Ac / 640 Ac/SM = 0.653 SM

.H4.SPG

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

A.1 METHOD FOR CALCULATING STANDARD URBAN STORMWATER MITIGATION PLAN FLOW RATES AND VOLUMES BASED ON 0.75-INCHES OF RAINFALL: WORKSHEET

PROJECT NAME

CUP 03-221-5
YOUNG NAK RETREAT CENTER
PORTION OF 1BE

NOMENCLATURE

A_I	=	Impervious Area (acres)
A_P	=	Pervious Area (acres)
A_U	=	Contributing Undeveloped Upstream Area (acres)
A_{Total}	=	Total Area of Development and Contributing Undeveloped Upstream Area (acres)
C_D	=	Developed Runoff Coefficient
C_U	=	Undeveloped Runoff Coefficient
I_X	=	Rainfall Intensity (inches / hour)
Q_{PM}	=	Peak Mitigation Flow Rate (cfs)
T_C	=	Time of Concentration (minutes, must be between 5-30 min.)
V_M	=	Mitigation Volume (ft^3)

EQUATIONS

$A_{Total} = A_I + A_P + A_U$

$A_I = (A_{Total}$ * % of Development which is Impervious)

$A_P = (A_{Total}$ * % of Development which is Pervious)

$A_U = (A_{Total}$ * % of Contributing Undeveloped Upstream Area***)

$C_D = (0.9 * \text{Imp.}) + [(1.0 - \text{Imp.}) * C_U]$ If $C_D < C_U$, use $C_D = C_U$

$Q_{PM} = C_D * I_X * A_{Total} * (1 \text{ hour} / 3{,}600 \text{ seconds}) * (1 \text{ ft} / 12 \text{ inches}) * (43{,}560 \text{ ft}^2 / 1 \text{ acre})$

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

$T_C = 10^{-0.507} * (C_D * I_X)^{-0.519} * \text{Length}^{0.483} * \text{Slope}^{-0.135}$

$V_M = (0.75 \text{ inches}) * [(A_I)(0.9) + (A_P + A_U)(C_U)] * (1 \text{ ft} / 12 \text{ inches}) * (43{,}560 \text{ ft}^2 / 1 \text{ acre})$

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

***** Contributing Undeveloped Upstream Area is an area where stormwater runoff from an undeveloped upstream area will flow directly or indirectly to the Post-Construction Best Management Practices (BMPs) proposed for the development. This additional flow must be included in the flow rate and volume calculations to appropriately size the BMPs.**

PROVIDE PROPOSED PROJECT CHARACTERISTICS

A_{Total}	2.1	Acres
Type of Development	PARKING LOT & UNDEVELOPED SLOPES	
Predominate Soil Type #	123	
% of Project Impervious	42	
% of Project Pervious	58	
% of Project Contributing Undeveloped Area	60	
A_I	0.8	Acres
A_P	0.1	Acres
A_U	1.2	Acres

DETERMINING THE PEAK MITIGATED FLOW RATE (Q_{PM}):

In order to determine the peak mitigated flow rate (Q_{PM}) from the new development, use the Los Angeles County Department of Public Works *Hydrology Manual*. Use the Modified Rational Method for calculating the peak mitigation Q_{PM} for compliance with the Standard Urban Stormwater Mitigation Plan (SUSMP). Use attached Table 1 for all maximum intensity (I_X) values used.

By trial and error, determine the time of concentration (T_C), as shown below:

CALCULATION STEPS:

1. Assume an initial T_C value between 5 and 30 minutes.

T_C 30 minutes

2. Using Table 1, look up the assumed T_C value and select the corresponding I_X intensity in inches/hour.

I_X 0.193 inches/hour

3. Determine the value for the Undeveloped Runoff Coefficient, C_U, using the runoff coefficient curve corresponding to the predominant soil type.

C_U 0.226

4. Calculate the Developed Runoff Coefficient, $C_D = (0.9 * \text{Imp.}) + [(1.0 - \text{Imp.}) * C_U]$

C_D 0.509

5. Calculate the value for $C_D * I_X$

$C_D * I_X$ 0.098

6. Calculate the time of concentration, $T_C = 10^{-0.507} * \underbrace{(C_D * I_X)}_{0.098}{}^{0.519} * \text{Length}^{0.483} * \text{Slope}^{-0.135}$ (Length = 500', Slope = 0.076)

Calculated T_C 30 minutes

7. Calculate the difference between the initially assumed T_C and the calculated T_C, if the difference is greater than 0.5 minutes. Use the calculated T_C as the assumed initial T_C in the second iteration. If the T_C value is within 0.5 minutes, round the acceptable T_C value to the nearest minute.

TABLE FOR ITERATIONS:

Iteration No.	Initial T_C (min)	I_X (in/hr)	C_V	C_D	C_D*I_X (in/hr)	Calculated T_C (min)	Difference (min)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable T_C value 30 minutes

8. Calculate the Peak Mitigation Flow Rate,

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

0.098 2.1

Q_{PM} 0.2 cfs

TABLE 1

INTENSITY - DURATION DATA FOR 0.75-INCHES OF RAINFALL
FOR ALL RAINFALL ZONES

Duration, T_C (min)	Rainfall Intensity, I_X (in/hr)
5	0.447
6	0.411
7	0.382
8	0.359
9	0.339
10	0.323
11	0.309
12	0.297
13	0.286
14	0.276
15	0.267
16	0.259
17	0.252
18	0.245
19	0.239
20	0.233
21	0.228
22	0.223
23	0.218
24	0.214
25	0.210
26	0.206
27	0.203
28	0.199
29	0.196
30	0.193

DETERMINING THE VOLUME (V_M)

In order to determine the volume (V_M) of stormwater runoff to be mitigated from the new development, use the following equation:

$$V_M = (2{,}722.5\ ft^3 / acre) * [(\underset{0.8}{A_I})(0.9) + (\underset{1.3}{A_P} + A_U)(\underset{0.226}{C_U})] = 2760\ ft^3 = 102\ C.Y.$$

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

A.1 METHOD FOR CALCULATING STANDARD URBAN STORMWATER MITIGATION PLAN FLOW RATES AND VOLUMES BASED ON 0.75-INCHES OF RAINFALL: WORKSHEET

PROJECT NAME

CUP 03-221-5
Young Nak Retreat Center
19A

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

NOMENCLATURE

A_I	=	Impervious Area (acres)
A_P	=	Pervious Area (acres)
A_U	=	Contributing Undeveloped Upstream Area (acres)
A_{Total}	=	Total Area of Development and Contributing Undeveloped Upstream Area (acres)
C_D	=	Developed Runoff Coefficient
C_U	=	Undeveloped Runoff Coefficient
I_X	=	Rainfall Intensity (inches / hour)
Q_{PM}	=	Peak Mitigation Flow Rate (cfs)
T_C	=	Time of Concentration (minutes, must be between 5-30 min.)
V_M	=	Mitigation Volume (ft^3)

EQUATIONS

$A_{Total} = A_I + A_P + A_U$

$A_I = (A_{Total} * \%\text{ of Development which is Impervious})$

$A_P = (A_{Total} * \%\text{ of Development which is Pervious})$

$A_U = (A_{Total} * \%\text{ of Contributing Undeveloped Upstream Area***})$

$C_D = (0.9 * \text{Imp.}) + [(1.0 - \text{Imp.}) * C_U]$ If $C_D < C_U$, use $C_D = C_U$

$Q_{PM} = C_D * I_X * A_{Total} * (1\text{ hour} / 3{,}600\text{ seconds}) * (1\text{ ft} / 12\text{ inches}) * (43{,}560\text{ ft}^2 / 1\text{ acre})$

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

$T_C = 10^{-0.507} * (C_D * I_X)^{-0.519} * \text{Length}^{0.483} * \text{Slope}^{-0.135}$

$V_M = (0.75\text{ inches}) * [(A_I)(0.9) + (A_P + A_U)(C_U)] * (1\text{ ft} / 12\text{ inches}) * (43{,}560\text{ ft}^2 / 1\text{ acre})$

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

***** Contributing Undeveloped Upstream Area is an area where stormwater runoff from an undeveloped upstream area will flow directly or indirectly to the Post-Construction Best Management Practices (BMPs) proposed for the development. This additional flow must be included in the flow rate and volume calculations to appropriately size the BMPs.**

PROVIDE PROPOSED PROJECT CHARACTERISTICS

A_{Total}	17.0	Acres
Type of Development	Church & Park	
Predominate Soil Type #	123	
% of Project Impervious	42	
% of Project Pervious	58	
% of Project Contributing Undeveloped Area	0	
A_I	7.1	Acres
A_P	9.9	Acres
A_U	0	Acres

DETERMINING THE PEAK MITIGATED FLOW RATE (Q_{PM}):

In order to determine the peak mitigated flow rate (Q_{PM}) from the new development, use the Los Angeles County Department of Public Works *Hydrology Manual*. Use the Modified Rational Method for calculating the peak mitigation Q_{PM} for compliance with the Standard Urban Stormwater Mitigation Plan (SUSMP). Use attached **Table 1** for all maximum intensity (I_X) values used.

By trial and error, determine the time of concentration (T_C), as shown below:

CALCULATION STEPS:

1. Assume an initial T_C value between 5 and 30 minutes.

T_C 30 minutes

2. Using Table 1, look up the assumed T_C value and select the corresponding I_X intensity in inches/hour.

I_X 0.193 inches/hour

3. Determine the value for the Undeveloped Runoff Coefficient, C_U, using the runoff coefficient curve corresponding to the predominant soil type.

C_U 0.226

4. Calculate the Developed Runoff Coefficient, $C_D = (0.9 * \text{Imp.}) + [(1.0 - \text{Imp.}) * C_U]$

C_D 0.509

5. Calculate the value for $C_D * I_X$

$C_D * I_X$ 0.098

6. Calculate the time of concentration, $T_C = 10^{-0.507} * \underbrace{(C_D * I_X)}_{0.098}{}^{-0.519} * \text{Length}^{0.483} * \text{Slope}^{-0.135}$

Calculated T_C 45 minutes 1000' 0.04

7. Calculate the difference between the initially assumed T_C and the calculated T_C, if the difference is greater than 0.5 minutes. Use the calculated T_C as the assumed initial T_C in the second iteration. If the T_C value is within 0.5 minutes, round the acceptable T_C value to the nearest minute.

TABLE FOR ITERATIONS:

Iteration No.	Initial T_C (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr)	Calculated T_C (min)	Difference (min)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable T_C value 30 minutes

8. Calculate the Peak Mitigation Flow Rate,
   $Q_{PM} = \underbrace{C_D * I_X}_{0.098} * A_{Total}$ 17 * (1.008333 ft^3-hour / acre-inches-seconds)

Q_{PM} 1.68 cfs

TABLE 1

INTENSITY - DURATION DATA FOR 0.75-INCHES OF RAINFALL
FOR ALL RAINFALL ZONES

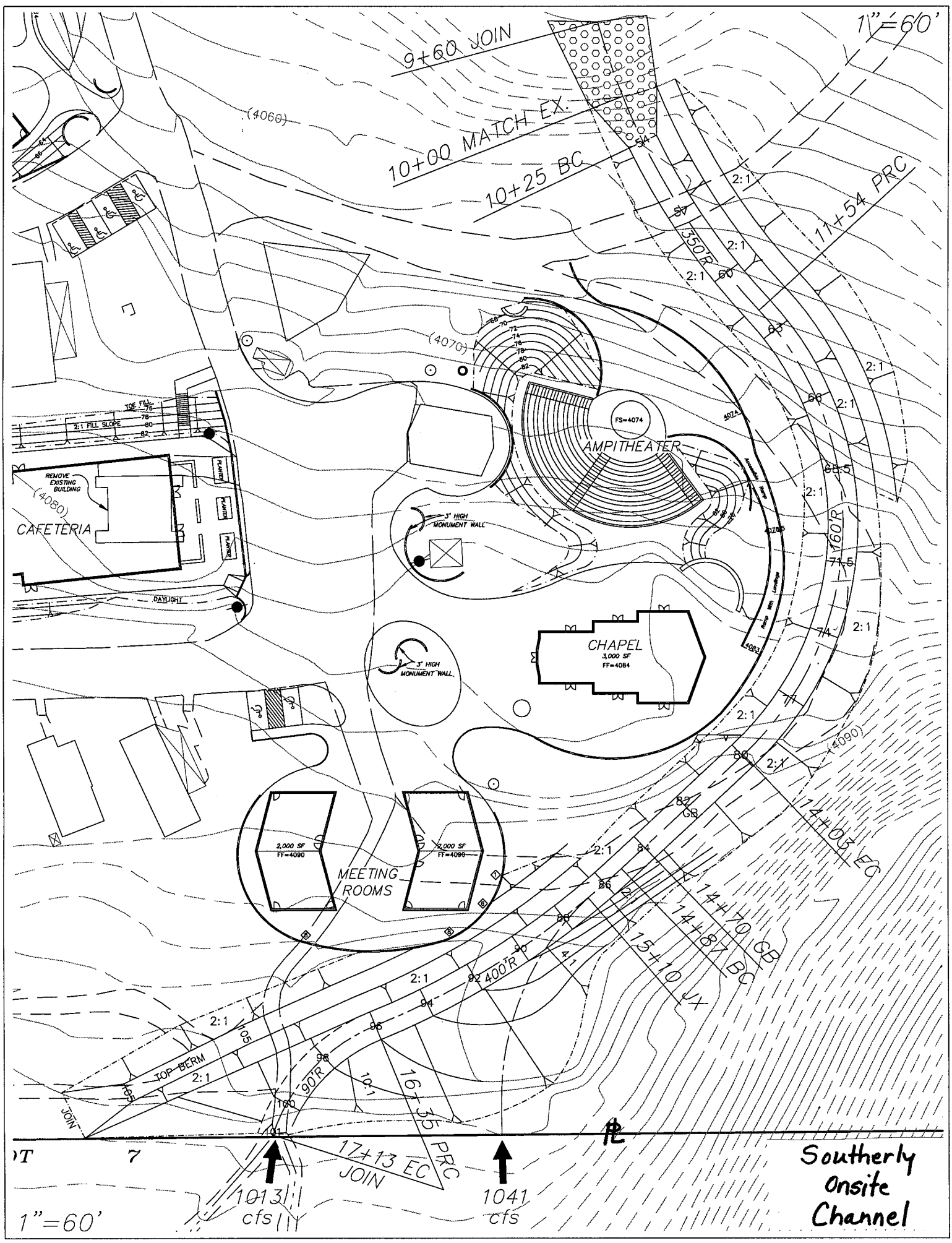
Duration, T_C (min)	Rainfall Intensity, I_X (in/hr)
5	0.447
6	0.411
7	0.382
8	0.359
9	0.339
10	0.323
11	0.309
12	0.297
13	0.286
14	0.276
15	0.267
16	0.259
17	0.252
18	0.245
19	0.239
20	0.233
21	0.228
22	0.223
23	0.218
24	0.214
25	0.210
26	0.206
27	0.203
28	0.199
29	0.196
30	0.193

DETERMINING THE VOLUME (V_M)

In order to determine the volume (V_M) of stormwater runoff to be mitigated from the new development, use the following equation:

$$V_M = (2{,}722.5\ ft^3 / acre) * [\underbrace{(A_I)}_{7.1}(0.9) + \underbrace{(A_P + A_U)}_{9.9}\underbrace{(C_U)}_{0.226}] = 23{,}488\ ft^3 = 877\ C.Y.$$

Southerly Onsite Channel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FS=4074
CHAPEL
3,000 SF
FF=4084
CAFETERIA
REMOVE EXISTING BUILDING
TOE FILL
2:1 FILL SLOPE
PLANTER
DAYLIGHT
3' HIGH MONUMENT WALL
MEETING ROOMS
2,000 SF
FF=4090
TOP BERM
JOIN
16+35 PRC
17+13 EC
JOIN
14+03 EC
14+70 CB
14+87 BC
15+10 VX
GB
1013 cfs
1041 cfs
Southerly Onsite Channel

```
T1 Young Nak Church Retreat Center                                                  0
T2 24100 Pine Canyon Road
T3 Southerly Onsite Channel
SO    960.0004046.000  1                          4046.000
R    1000.0004052.000  1      .060                                  -6.548
R    1025.0004054.000  2      .060                                  -4.093
R    1154.0004062.000  2      .025                                 -21.118
R    1403.0004080.000  2      .025                                  89.167
R    1442.0004082.000  2      .025                                    .000
R    1470.0004084.000  2      .025                                    .000
R    1487.0004085.200  2      .025                                    .000
R    1510.0004086.800  2      .025                                   3.295
JX   1540.0004089.200  2  3   .025 1041.000         4086.800        -20.0        4.297
R    1635.0004096.000  4      .025                                  13.608
R    1713.0004101.000  3      .025                                 -49.656
REMJoin Natural Ground at Southerly PL
SH   1713.0004101.000  3                          4102.100
CD   1  1   0    .000  10.000   55.00040.00040.000   .00
CD   2  1   0    .000  10.000   15.000 2.000 2.000   .00
CD   3  1   0    .000  10.000   40.00020.00020.000   .00
CD   4  1   0    .000  10.000   15.00010.000 2.000   .00
Q          1013.000   .0
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FILE: yn.WSW                              W S P G W  - EDIT LISTING - Version 14.06              Date:12-19-2007  Time: 4:42: 3
                                     WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                PAGE    1
 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
 CODE   NO   TYPE PIER/PIP WIDTH    DIAMETER  WIDTH              DROP

 CD      1    1      0     .000   10.000   55.000  40.000 40.000    .00
 CD      2    1      0     .000   10.000   15.000   2.000  2.000    .00
 CD      3    1      0     .000   10.000   40.000  20.000 20.000    .00
 CD      4    1      0     .000   10.000   15.000  10.000  2.000    .00
                                                W S P G W                                                          PAGE NO   1
                           WATER SURFACE PROFILE - TITLE CARD LISTING
HEADING LINE NO 1 IS -
                             Young Nak Church Retreat Center
HEADING LINE NO 2 IS -
                             24100 Pine Canyon Road
HEADING LINE NO 3 IS -
                             Southerly Onsite Channel
                                                W S P G W                                                          PAGE NO   2
                           WATER SURFACE PROFILE - ELEMENT CARD LISTING
 ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                    U/S DATA   STATION    INVERT  SECT                                      W S ELEV
                                960.000 4046.000    1                                        4046.000
 ELEMENT NO   2 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                          RADIUS    ANGLE     ANG PT  MAN H
                               1000.000 4052.000    1               .060                        350.005   -6.548      .000     0
WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS
 ELEMENT NO   3 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                          RADIUS    ANGLE     ANG PT  MAN H
                               1025.000 4054.000    2               .060                        349.962   -4.093      .000     0
 ELEMENT NO   4 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                          RADIUS    ANGLE     ANG PT  MAN H
                               1154.000 4062.000    2               .025                        349.993  -21.118      .000     0
 ELEMENT NO   5 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                          RADIUS    ANGLE     ANG PT  MAN H
                               1403.000 4080.000    2               .025                        159.999   89.167      .000     0
 ELEMENT NO   6 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                          RADIUS    ANGLE     ANG PT  MAN H
                               1442.000 4082.000    2               .025                           .000     .000      .000     0
 ELEMENT NO   7 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                          RADIUS    ANGLE     ANG PT  MAN H
                               1470.000 4084.000    2               .025                           .000     .000      .000     0
 ELEMENT NO   8 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                          RADIUS    ANGLE     ANG PT  MAN H
                               1487.000 4085.200    2               .025                           .000     .000      .000     0
 ELEMENT NO   9 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT               N                          RADIUS    ANGLE     ANG PT  MAN H
                               1510.000 4086.800    2               .025                        399.940    3.295      .000     0
 ELEMENT NO  10 IS A JUNCTION          *         *     *     *                 *                  *                 *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3        Q4     INVERT-3 INVERT-4  PHI 3  PHI 4
                               1540.000 4089.200    2     3     0   .025  1041.000      .000  4086.800      .000 -20.000     .000
                                                                                                RADIUS    ANGLE
                                                                                               400.017   4.297
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WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS
 ELEMENT NO  11 IS A REACH            *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               1635.000 4096.000    4              .025                        399.993   13.608      .000     0
                                                      W S P G W                                                      PAGE NO   3
                           WATER SURFACE PROFILE - ELEMENT CARD LISTING
WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS
 ELEMENT NO  12 IS A REACH            *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                          RADIUS    ANGLE     ANG PT  MAN H
                               1713.000 4101.000    3              .025                         90.001  -49.656      .000     0
 REMARKS: Join Natural Ground at Southerly PL
 ELEMENT NO  13 IS A SYSTEM HEADWORKS                 *                     *
                    U/S DATA   STATION    INVERT  SECT                                   W S ELEV
                               1713.000 4101.000    3                                    4102.100
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Program Package Serial Number: 1985

WATER SURFACE PROFILE LISTING Date:12-19-2007 Time: 4:59:26

Young Nak Church Retreat Center
24100 Pine Canyon Road
Southerly Onsite Channel

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
960.000	4046.000	1.671	4047.671	2054.00	10.09	1.58	4049.25	2.22	2.18	188.67	10.000	55.000	****	0 .0
22.539	.1500					.1500	3.38	3.89	1.71	1.67	.060	.00	****	TRAP
982.539	4049.381	1.671	4051.052	2054.00	10.09	1.58	4052.63	2.22	2.18	188.67	10.000	55.000	****	0 .0
10.061	.1500					.1419	1.43	3.89	1.71	1.67	.060	.00	****	TRAP
992.600	4050.890	1.717	4052.607	2054.00	9.68	1.45	4054.06	2.08	2.18	192.33	10.000	55.000	****	0 .0
3.248	.1500					.1257	.41	3.79	1.62	1.67	.060	.00	****	TRAP
995.848	4051.377	1.770	4053.147	2054.00	9.23	1.32	4054.47	1.93	2.18	196.59	10.000	55.000	****	0 .0
1.655	.1500					.1104	.18	3.70	1.53	1.67	.060	.00	****	TRAP
997.503	4051.625	1.825	4053.450	2054.00	8.80	1.20	4054.65	1.79	2.18	200.96	10.000	55.000	****	0 .0
1.003	.1500					.0970	.10	3.62	1.44	1.67	.060	.00	****	TRAP
998.506	4051.776	1.881	4053.656	2054.00	8.39	1.09	4054.75	1.67	2.18	205.45	10.000	55.000	****	0 .0
.645	.1500					.0853	.05	3.55	1.35	1.67	.060	.00	****	TRAP
999.151	4051.873	1.938	4053.811	2054.00	8.00	.99	4054.80	1.55	2.18	210.05	10.000	55.000	****	0 .0
.416	.1500					.0749	.03	3.49	1.27	1.67	.060	.00	****	TRAP
999.567	4051.935	1.997	4053.932	2054.00	7.62	.90	4054.83	1.44	2.18	214.78	10.000	55.000	****	0 .0
.256	.1500					.0658	.02	3.44	1.20	1.67	.060	.00	****	TRAP
999.823	4051.973	2.058	4054.031	2054.00	7.27	.82	4054.85	1.34	2.18	219.62	10.000	55.000	****	0 .0
.136	.1500					.0579	.01	3.40	1.13	1.67	.060	.00	****	TRAP

Program Package Serial Number: 1985

WATER SURFACE PROFILE LISTING Date:12-19-2007 Time: 4:59:26

Young Nak Church Retreat Center
24100 Pine Canyon Road
Southerly Onsite Channel

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
999.958	4051.994	2.120	4054.114	2054.00	6.93	.75	4054.86	1.24	2.18	224.59	10.000	55.000	****	0 .0
.042	.1500					.0508	.00	3.36	1.06	1.67	.060	.00	****	TRAP
1000.000	4052.000	2.185	4054.185	2054.00	6.60	.68	4054.86	1.16	2.18	229.76	10.000	55.000	****	0 .0
1000.000	4052.000	4.220	4056.220	2054.00	20.77	6.70	4062.92	1.59	6.30	31.88	10.000	15.000	2.00	0 .0
4.466	.0800					.1785	.80	5.81	2.08	5.12	.060	.00	2.00	TRAP
1004.466	4052.357	4.096	4056.453	2054.00	21.62	7.26	4063.71	1.69	6.30	31.38	10.000	15.000	2.00	0 .0
4.787	.0800					.2020	.97	5.79	2.19	5.12	.060	.00	2.00	TRAP
1009.253	4052.740	3.954	4056.694	2054.00	22.68	7.99	4064.68	1.83	6.30	30.82	10.000	15.000	2.00	0 .0
4.382	.0800					.2307	1.01	5.78	2.33	5.12	.060	.00	2.00	TRAP
1013.635	4053.091	3.816	4056.907	2054.00	23.78	8.78	4065.69	1.98	6.30	30.26	10.000	15.000	2.00	0 .0
4.052	.0800					.2637	1.07	5.79	2.48	5.12	.060	.00	2.00	TRAP
1017.687	4053.415	3.682	4057.097	2054.00	24.95	9.66	4066.76	2.13	6.30	29.73	10.000	15.000	2.00	0 .0
3.775	.0800					.3015	1.14	5.82	2.64	5.12	.060	.00	2.00	TRAP
1021.462	4053.717	3.552	4057.269	2054.00	26.16	10.63	4067.90	2.31	6.30	29.21	10.000	15.000	2.00	0 .0
3.538	.0800					.3448	1.22	5.86	2.81	5.12	.060	.00	2.00	TRAP
1025.000	4054.000	3.426	4057.426	2054.00	27.44	11.69	4069.12	2.49	6.30	28.70	10.000	15.000	2.00	0 .0
129.000	.0620					.0663	8.55	5.92	2.99	3.45	.025	.00	2.00	TRAP
1154.000	4062.000	3.359	4065.359	2054.00	28.16	12.31	4077.67	5.69	6.30	28.44	10.000	15.000	2.00	0 .0
29.819	.0723					.0682	2.03	9.05	3.10	3.31	.025	.00	2.00	TRAP

Program Package Serial Number: 1985

WATER SURFACE PROFILE LISTING Date:12-19-2007 Time: 4:59:26

Young Nak Church Retreat Center
24100 Pine Canyon Road
Southerly Onsite Channel

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1183.819	4064.156	3.372	4067.528	2054.00	28.01	12.18	4079.71	5.64	6.30	28.49	10.000	15.000	2.00	0 .0
110.805	.0723					.0634	7.03	9.01	3.08	3.31	.025	.00	2.00	TRAP
1294.624	4072.166	3.497	4075.663	2054.00	26.71	11.07	4086.74	5.22	6.30	28.99	10.000	15.000	2.00	0 .0
52.166	.0723					.0555	2.89	8.71	2.89	3.31	.025	.00	2.00	TRAP
1346.790	4075.937	3.625	4079.562	2054.00	25.46	10.07	4089.63	4.83	6.30	29.50	10.000	15.000	2.00	0 .0
32.910	.0723					.0485	1.60	8.45	2.71	3.31	.025	.00	2.00	TRAP
1379.700	4078.316	3.758	4082.073	2054.00	24.28	9.15	4091.23	4.47	6.30	30.03	10.000	15.000	2.00	0 .0
23.300	.0723					.0424	.99	8.22	2.55	3.31	.025	.00	2.00	TRAP
1403.000	4080.000	3.894	4083.894	2054.00	23.15	8.32	4092.21	.00	6.30	30.58	10.000	15.000	2.00	0 .0
39.000	.0513					.0374	1.46	3.89	2.39	3.63	.025	.00	2.00	TRAP
1442.000	4082.000	4.016	4086.016	2054.00	22.21	7.66	4093.67	.00	6.30	31.06	10.000	15.000	2.00	0 .0
3.437	.0714					.0348	.12	4.02	2.27	3.32	.025	.00	2.00	TRAP
1445.437	4082.246	4.046	4086.292	2054.00	21.98	7.50	4093.80	.00	6.30	31.18	10.000	15.000	2.00	0 .0
13.680	.0714					.0321	.44	4.05	2.24	3.32	.025	.00	2.00	TRAP
1459.117	4083.223	4.191	4087.414	2054.00	20.96	6.82	4094.24	.00	6.30	31.76	10.000	15.000	2.00	0 .0
10.883	.0714					.0281	.31	4.19	2.10	3.32	.025	.00	2.00	TRAP
1470.000	4084.000	4.340	4088.340	2054.00	19.99	6.20	4094.54	.00	6.30	32.36	10.000	15.000	2.00	0 .0
1.264	.0706					.0261	.03	4.34	1.98	3.33	.025	.00	2.00	TRAP

Program Package Serial Number: 1985

WATER SURFACE PROFILE LISTING Date:12-19-2007 Time: 4:59:26

Young Nak Church Retreat Center
24100 Pine Canyon Road
Southerly Onsite Channel

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1471.264	4084.089	4.360	4088.449	2054.00	19.86	6.13	4094.58	.00	6.30	32.44	10.000	15.000	2.00	0 .0
8.691	.0706					.0242	.21	4.36	1.96	3.33	.025	.00	2.00	TRAP
1479.955	4084.703	4.514	4089.216	2054.00	18.94	5.57	4094.79	.00	6.30	33.05	10.000	15.000	2.00	0 .0
7.045	.0706					.0212	.15	4.51	1.84	3.33	.025	.00	2.00	TRAP
1487.000	4085.200	4.672	4089.872	2054.00	18.06	5.06	4094.94	1.11	6.30	33.69	10.000	15.000	2.00	0 .0
5.403	.0696					.0187	.10	5.78	1.73	3.35	.025	.00	2.00	TRAP
1492.403	4085.576	4.822	4090.398	2054.00	17.28	4.64	4095.04	1.03	6.30	34.29	10.000	15.000	2.00	0 .0
4.787	.0696					.0165	.08	5.86	1.64	3.35	.025	.00	2.00	TRAP
1497.190	4085.909	4.990	4090.899	2054.00	16.48	4.22	4095.12	.96	6.30	34.96	10.000	15.000	2.00	0 .0
3.828	.0696					.0144	.06	5.95	1.54	3.35	.025	.00	2.00	TRAP
1501.018	4086.175	5.162	4091.337	2054.00	15.71	3.83	4095.17	.89	6.30	35.65	10.000	15.000	2.00	0 .0
3.010	.0696					.0127	.04	6.05	1.45	3.35	.025	.00	2.00	TRAP
1504.029	4086.385	5.339	4091.724	2054.00	14.98	3.49	4095.21	.82	6.30	36.36	10.000	15.000	2.00	0 .0
2.302	.0696					.0111	.03	6.16	1.36	3.35	.025	.00	2.00	TRAP
1506.331	4086.545	5.521	4092.066	2054.00	14.28	3.17	4095.23	.76	6.30	37.09	10.000	15.000	2.00	0 .0
1.683	.0696					.0097	.02	6.29	1.28	3.35	.025	.00	2.00	TRAP
1508.013	4086.662	5.709	4092.371	2054.00	13.62	2.88	4095.25	.71	6.30	37.84	10.000	15.000	2.00	0 .0
1.135	.0696					.0085	.01	6.42	1.20	3.35	.025	.00	2.00	TRAP

Program Package Serial Number: 1985

WATER SURFACE PROFILE LISTING Date:12-19-2007 Time: 4:59:26

Young Nak Church Retreat Center
24100 Pine Canyon Road
Southerly Onsite Channel

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1509.148	4086.741	5.901	4092.642	2054.00	12.99	2.62	4095.26	.66	6.30	38.61	10.000	15.000	2.00	0 .0
.646	.0696					.0075	.00	6.56	1.13	3.35	.025	.00	2.00	TRAP
1509.794	4086.786	6.099	4092.885	2054.00	12.38	2.38	4095.27	.61	6.30	39.40	10.000	15.000	2.00	0 .0
.206	.0696					.0066	.00	6.71	1.06	3.35	.025	.00	2.00	TRAP
1510.000	4086.800	6.304	4093.104	2054.00	11.80	2.16	4095.27	.57	6.30	40.22	10.000	15.000	2.00	0 .0
JUNCT STR	.0800							6.87	1.00		.025	.00	2.00	TRAP
---------- WARNING - Junction Analysis - Large Lateral Flow(s)----------														
1540.000	4089.200	1.742	4090.942	1013.00	31.47	15.38	4106.32	2.20	4.28	21.97	10.000	15.000	2.00	0 .0
JUNCT STR	.0800							3.94	4.58		.025	.00	2.00	TRAP
1540.000	4089.200	7.056	4096.256	1013.00	2.50	.10	4096.35	.06	3.42	99.67	10.000	15.000	****	0 .0
2.544	.0716					.0003	.00	7.12	.22	1.96	.025	.00	2.00	TRAP
1542.544	4089.382	6.865	4096.247	1013.00	2.63	.11	4096.35	.07	3.42	97.38	10.000	15.000	****	0 .0
2.468	.0716					.0003	.00	6.93	.23	1.96	.025	.00	2.00	TRAP
1545.012	4089.559	6.679	4096.237	1013.00	2.75	.12	4096.35	.07	3.42	95.14	10.000	15.000	****	0 .0
2.391	.0716					.0004	.00	6.75	.25	1.96	.025	.00	2.00	TRAP
1547.403	4089.730	6.497	4096.226	1013.00	2.89	.13	4096.36	.08	3.42	92.96	10.000	15.000	****	0 .0
2.314	.0716					.0004	.00	6.57	.26	1.96	.025	.00	2.00	TRAP

Program Package Serial Number: 1985

WATER SURFACE PROFILE LISTING Date:12-19-2007 Time: 4:59:26

Young Nak Church Retreat Center
24100 Pine Canyon Road
Southerly Onsite Channel

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1549.717	4089.896	6.319	4096.214	1013.00	3.03	.14	4096.36	.08	3.42	90.83	10.000	15.000	****	0 .0
2.238	.0716					.0005	.00	6.40	.28	1.96	.025	.00	2.00	TRAP
1551.955	4090.056	6.146	4096.201	1013.00	3.18	.16	4096.36	.09	3.42	88.75	10.000	15.000	****	0 .0
2.161	.0716					.0006	.00	6.24	.30	1.96	.025	.00	2.00	TRAP
1554.115	4090.210	5.977	4096.187	1013.00	3.33	.17	4096.36	.10	3.42	86.72	10.000	15.000	****	0 .0
.688	.0716					.0006	.00	6.07	.31	1.96	.025	.00	2.00	TRAP
1554.803	4090.260	5.922	4096.182	1013.00	3.38	.18	4096.36	.10	3.42	86.07	10.000	15.000	****	0 .0
HYDRAULIC JUMP														
1554.803	4090.260	1.680	4091.940	1013.00	24.03	8.97	4100.91	2.05	3.42	35.16	10.000	15.000	****	0 .0
3.765	.0716					.1326	.50	3.73	3.87	1.96	.025	.00	2.00	TRAP
1558.568	4090.528	1.668	4092.197	1013.00	24.28	9.15	4101.35	2.08	3.42	35.02	10.000	15.000	****	0 .0
11.858	.0716					.1441	1.71	3.75	3.92	1.96	.025	.00	2.00	TRAP
1570.426	4091.377	1.612	4092.990	1013.00	25.46	10.07	4103.06	2.25	3.42	34.35	10.000	15.000	****	0 .0
10.248	.0716					.1645	1.69	3.86	4.17	1.96	.025	.00	2.00	TRAP
1580.674	4092.111	1.558	4093.669	1013.00	26.71	11.08	4104.74	2.43	3.42	33.69	10.000	15.000	****	0 .0
9.063	.0716					.1879	1.70	3.98	4.44	1.96	.025	.00	2.00	TRAP
1589.737	4092.760	1.505	4094.264	1013.00	28.01	12.18	4106.45	2.62	3.42	33.06	10.000	15.000	****	0 .0
8.150	.0716					.2148	1.75	4.12	4.72	1.96	.025	.00	2.00	TRAP

Program Package Serial Number: 1985

WATER SURFACE PROFILE LISTING Date:12-19-2007 Time: 4:59:26

Young Nak Church Retreat Center
24100 Pine Canyon Road
Southerly Onsite Channel

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1597.887	4093.343	1.454	4094.797	1013.00	29.38	13.40	4108.20	2.83	3.42	32.44	10.000	15.000	****	0 .0
7.420	.0716					.2455	1.82	4.28	5.02	1.96	.025	.00	2.00	TRAP
1605.307	4093.874	1.404	4095.278	1013.00	30.81	14.74	4110.02	3.05	3.42	31.84	10.000	15.000	****	0 .0
6.820	.0716					.2806	1.91	4.46	5.34	1.96	.025	.00	2.00	TRAP
1612.127	4094.363	1.355	4095.718	1013.00	32.32	16.22	4111.93	3.30	3.42	31.26	10.000	15.000	****	0 .0
6.315	.0716					.3209	2.03	4.65	5.69	1.96	.025	.00	2.00	TRAP
1618.443	4094.815	1.308	4096.123	1013.00	33.89	17.84	4113.96	3.56	3.42	30.70	10.000	15.000	****	0 .0
5.882	.0716					.3671	2.16	4.87	6.05	1.96	.025	.00	2.00	TRAP
1624.325	4095.236	1.262	4096.498	1013.00	35.55	19.62	4116.12	3.85	3.42	30.15	10.000	15.000	****	0 .0
5.505	.0716					.4200	2.31	5.11	6.44	1.96	.025	.00	2.00	TRAP
1629.829	4095.630	1.218	4096.848	1013.00	37.28	21.58	4118.43	4.15	3.42	29.62	10.000	15.000	****	0 .0
5.171	.0716					.4807	2.49	5.37	6.86	1.96	.025	.00	2.00	TRAP
1635.000	4096.000	1.175	4097.175	1013.00	13.58	2.86	4100.04	7.19	1.96	87.00	10.000	40.000	****	0 .0
3.781	.0641					.0641	.24	8.37	2.58	1.17	.025	.00	****	TRAP
1638.781	4096.242	1.175	4097.417	1013.00	13.58	2.86	4100.28	7.19	1.96	87.00	10.000	40.000	****	0 .0
53.616	.0641					.0681	3.65	8.37	2.58	1.17	.025	.00	****	TRAP
1692.397	4099.679	1.139	4100.818	1013.00	14.16	3.11	4103.93	7.70	1.96	85.57	10.000	40.000	****	0 .0
20.603	.0641					.0773	1.59	8.84	2.73	1.17	.025	.00	****	TRAP

Program Package Serial Number: 1985

WATER SURFACE PROFILE LISTING Date:12-19-2007 Time: 4:59:26

Young Nak Church Retreat Center
24100 Pine Canyon Road
Southerly Onsite Channel

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1713.000	4101.000	1.100	4102.100	1013.00	14.85	3.42	4105.52	8.31	1.96	84.00	10.000	40.000	****	0 .0

Young Nak Church Retreat Center
24100 Pine Canyon Road
Southerly Onsite Channel

```
 960.00    .I WCES       H                                                    .    R
 965.93    .                                                                  .
 971.86    .                                                                  .
 977.79    .                                                                  .
 983.72    .    I WC ES       H                                               .    R
 989.65    .                                                                  .
 995.57    .      I  W S        H                                            .    R
1001.50    .       I WCES        H                                           .    R
1007.43    .       I  WES        H                                           .    R
1013.36    .       I  W S        H                                           .    R
1019.29    .        I WCS        H                                           .    R
1025.22    .        I WCS        H                                           .    R
1031.15    .        I  WS         H                                          .    R
1037.08    .        I  WS         H                                          .    R
1043.01    .        I  WS         H                                          .    R
1048.94    .        I     W S     HE                                         .    R
1054.87    .        I     W SC    H E                                        .    R
1060.80    .         I    W  SC    H E                                       .    R
1066.72    .         I     W SC    H   E                                     .    R
1072.65    .          I    W  S     H   E                                    .    R
1078.58    .          I    W  SC    H     E                                  .    R
1084.51    .           I   W   S    H      E                                 .    R
1090.44    .                                                                  .
1096.37    .                                                                  .
1102.30    .                                                                  .
1108.23    .                                                                  .
1114.16    .                                                                  .
1120.09    .                                                                  .
1126.02    .                                                                  .
1131.94    .                                                                  .
1137.87    .                                                                  .
1143.80    .                                                                  .
1149.73    .                                                                  .
1155.66    .                     I   W   C   SH       E                       .    R
1161.59    .                                                                  .
1167.52    .                                                                  .
1173.45    .                                                                  .
1179.38    .                                                                  .
1185.31    .                        I   W   C   SH       E                    .    R
1191.24    .                                                                  .
1197.17    .                                                                  .
1203.09    .                                                                  .
1209.02    .                                                                  .
1214.95    .                                                                  .
1220.88    .                                                                  .
1226.81    .                                                                  .
1232.74    .                                                                  .
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1238.67    .                                                                  .
1244.60    .                                                                  .
1250.53    .                                                                  .
1256.46    .                                                                  .
1262.39    .                                                                  .
1268.31    .                                                                  .
1274.24    .                                                                  .
1280.17    .                                                                  .
1286.10    .                                                                  .
1292.03    .                                                                  .
1297.96    .                          I   W   C   SH      E                   .    R
1303.89    .                                                                  .
1309.82    .                                                                  .
1315.75    .                                                                  .
1321.68    .                                                                  .
1327.61    .                                                                  .
1333.54    .                                                                  .
1339.46    .                                                                  .
1345.39    .                                                                  .
1351.32    .                               I    W   C S  H    E               .    R
1357.25    .                                                                  .
1363.18    .                                                                  .
1369.11    .                                                                  .
1375.04    .                                                                  .
1380.97    .                                   I    W   C S  H   E            .    R
1386.90    .                                                                  .
1392.83    .                                                                  .
1398.76    .                                                                  .
1404.69    .                                     I     W  C    H  E           .    R
1410.61    .                                                                  .
1416.54    .                                                                  .
1422.47    .                                                                  .
1428.40    .                                                                  .
1434.33    .                                                                  .
1440.26    .                                                                  .
1446.19    .                                        I     W  C    H E          .    R
1452.12    .                                         I    W  C    H E          .    R
1458.05    .                                                                  .
1463.98    .                                          I     W  C    HE         .    R
1469.91    .                                                                  .
1475.83    .                                           I     W  C    HE        .    R
1481.76    .                                           I     W  C    HE        .    R
1487.69    .                                            I     W  C    H        .    R
1493.62    .                                             I     W S    H        .    R
1499.55    .                                             I      WSC   EH       .    R
1505.48    .                                              I     W S   EH       .    R
1511.41    .                                              I      WSC  E H      .    R
1517.34    .                                              I       WS  E H      .    R
1523.27    .                                              I       WS  E H      .    R
1529.20    .                                               I       W  E H      .    R
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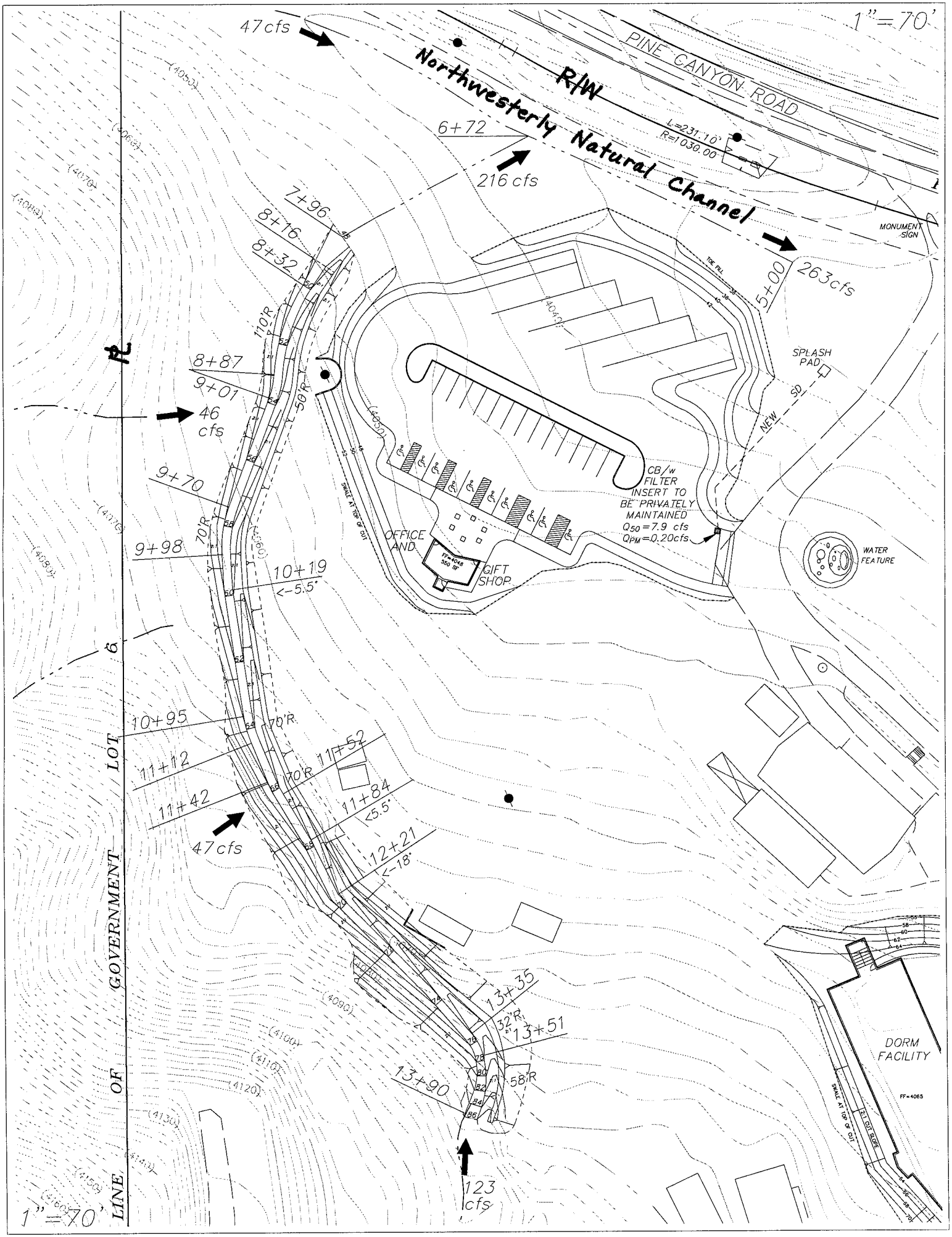
1535.13    .                                                   I       WS  E H                            .    R
1541.06    .                                                   I       WS  E H                            .    R
1546.98    .                                                   I        W  E H                            .    JX
1552.91    .                                                      I  W  S       H         E                 .    JX
1558.84    .                                                      I    C    W   H                          .    R
1564.77    .                                                      I    C    W   H                          .    R
1570.70    .                                                       I   C    W   H                          .    R
1576.63    .                                                       I    C   W    H                          .    R
1582.56    .                                                       I    C   W    H                          .    R
1588.49    .                                                       I    C   W    H                          .    R
1594.42    .                                                        I   C   W    H                          .    R
1600.35    .                                                        I   C   W    H                          .    R
1606.28    .                                                        I W CS       HE                         .    R
1612.20    .                                                        I W  S        HE                        .    R
1618.13    .                                                         I W  S        H E                      .    R
1624.06    .                                                          I W  CS       H   E                   .    R
1629.99    .                                                           I W  CS       H    E                  .    R
1635.92    .                                                            I W  CS       H     E               .    R
1641.85    .                                                             I W C S      H        E            .    R
1647.78    .                                                             I W  C S      H          E         .    R
1653.71    .                                                              I W  C S      H           E       .    R
1659.64    .                                                              I W  C  S     H              E    .    R
1665.57    .                                                               I W  C S      H                E.    R
1671.50    .                                                                IWC  E     S H                  .    R
1677.43    .                                                                IW C E     S  H                 .    R
1683.35    .                                                                                               .
1689.28    .                                                                                               .
1695.21    .                                                                     IWC  E      SH            .    R
1701.14    .                                                                                               .
1707.07    .                                                                                               .
1713.00    .                                                                      I WC   E     SH           .    R

          4046.000  4053.243  4060.486  4067.729  4074.973  4082.216  4089.459  4096.702  4103.945  4111.188  4118.432
```

N O T E S

1. GLOSSARY
   - I = INVERT ELEVATION
   - C = CRITICAL DEPTH
   - W = WATER SURFACE ELEVATION
   - S = SUPER-ELEVATION
   - H = HEIGHT OF CHANNEL
   - E = ENERGY GRADE LINE
   - X = CURVES CROSSING OVER
   - B = BRIDGE ENTRANCE OR EXIT
   - Y = WALL ENTRANCE OR EXIT
2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY

Northwesterly Natural Channel


1"=70'
47cfs
Northwesterly Natural Channel
R/W
PINE CANYON ROAD
L=231.10'
R=1030.00
6+72
216 cfs
7+96
8+16
8+32
110'R
8+87
9+01
58'R
46 cfs
9+70
70'R
9+98
10+19
<-5.5°
10+95
70'R
11+12
11+52
70'R
11+42
11+84
<5.5°
47cfs
12+21
<-18°
13+35
32'R
13+51
13+90
58'R
123 cfs
5+00
263cfs
MONUMENT SIGN
SPLASH PAD
NEW SD
CB/w FILTER INSERT TO BE PRIVATELY MAINTAINED
Q50=7.9 cfs
QPM=0.20cfs
OFFICE AND GIFT SHOP
FF=4048
WATER FEATURE
DORM FACILITY
FF=4065
SWALE AT TOP OF CUT
LINE OF GOVERNMENT LOT 6

```
T1 Young Nak Church Retreat Center                                                0
T2 24100 Pine Canyon Road
T3 Northwesterly Natural Channel
SO    500.0004034.000  1                          4034.000
TS    567.0004036.000  2      .025                                  .000
TS    611.0004037.000  3      .025                                  .000
TS    731.0004039.100  4      .025                                  .000
SH    731.0004039.100  4                          4039.100
CD   1  5   0    .000            .00   .00   .00   .00   .00   .00   .00   .00   .00
.00
CD   2  5   0    .000            .00   .00   .00   .00   .00   .00   .00   .00   .00
.00
CD   3  5   0    .000            .00   .00   .00   .00   .00   .00   .00   .00   .00
.00
CD   4  5   0    .000            .00   .00   .00   .00   .00   .00   .00   .00   .00
.00
PTS  1 5   .000 36.000 31.500 34.000 41.000 34.000 45.500 34.100 55.500 36.000
PTS  2 6   .000 40.000  5.000 38.000 16.000 36.000 38.000 36.000 46.000 38.000
PTS      53.000 40.000
PTS  3 6   .000 42.000  5.000 40.000 24.000 38.000 46.000 37.300 51.000 37.300
PTS      69.000 42.000
PTS  4 5   .000 42.000 19.000 40.000 44.000 39.100 57.000 40.000 66.000 42.000
Q           263.000   .0
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FILE: yn-west.WSW                        W S P G W  - EDIT LISTING - Version 14.06              Date:12-24-2007  Time:11: 9:15
                                   WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                PAGE    1
 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
 CODE   NO   TYPE PIER/PIP WIDTH    DIAMETER  WIDTH              DROP

 CD      1    5      0        .000
 CD      2    5      0        .000
 CD      3    5      0        .000
 CD      4    5      0        .000
FILE:                                    W S P G W  - EDIT LISTING - Version 14.06              Date:12-24-2007  Time:11: 9:15
                                   WATER SURFACE PROFILE - CROSS SECTION POINT LISTING                               PAGE    2
   CARD  SECT  NO OF    X(1) , Y(1)    X(2) , Y(2)    X(3) , Y(3)    X(4) , Y(4)    X(5) , Y(5)    X(6) , Y(6)    X(7) , Y(7)
   CODE   NO   POINTS   X(8) , Y(8)    X(9) , Y(9)   X(10) ,Y(10)   X(11) ,Y(11)    X(N) , Y(N)   X(N+1),Y(N+1)  X(35) ,Y(35)

   PTS     1     5        .000  36.000   31.500  34.000   41.000  34.000   45.500  34.100   55.500  36.000
   PTS     2     6        .000  40.000    5.000  38.000   16.000  36.000   38.000  36.000   46.000  38.000   53.000  40.000
   PTS     3     6        .000  42.000    5.000  40.000   24.000  38.000   46.000  37.300   51.000  37.300   69.000  42.000
   PTS     4     5        .000  42.000   19.000  40.000   44.000  39.100   57.000  40.000   66.000  42.000
                                                W S P G W                                                          PAGE NO   1
                            WATER SURFACE PROFILE - TITLE CARD LISTING
HEADING LINE NO 1 IS -
                              Young Nak Church Retreat Center
HEADING LINE NO 2 IS -
                              24100 Pine Canyon Road
HEADING LINE NO 3 IS -
                              Northwesterly Natural Channel
                                                W S P G W                                                          PAGE NO   2
                            WATER SURFACE PROFILE - ELEMENT CARD LISTING
 ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                     U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                 500.000 4034.000    1                                      4034.000
 ELEMENT NO   2 IS A TRANSITION        *         *     *
                     U/S DATA   STATION    INVERT  SECT              N                          RADIUS   ANGLE
                                 567.000 4036.000    2              .025                           .000     .000
 ELEMENT NO   3 IS A TRANSITION        *         *     *
                     U/S DATA   STATION    INVERT  SECT              N                          RADIUS   ANGLE
                                 611.000 4037.000    3              .025                           .000     .000
 ELEMENT NO   4 IS A TRANSITION        *         *     *
                     U/S DATA   STATION    INVERT  SECT              N                          RADIUS   ANGLE
                                 731.000 4039.100    4              .025                           .000     .000
 ELEMENT NO   5 IS A SYSTEM HEADWORKS                  *                       *
                     U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                 731.000 4039.100    4                                     4039.100
```

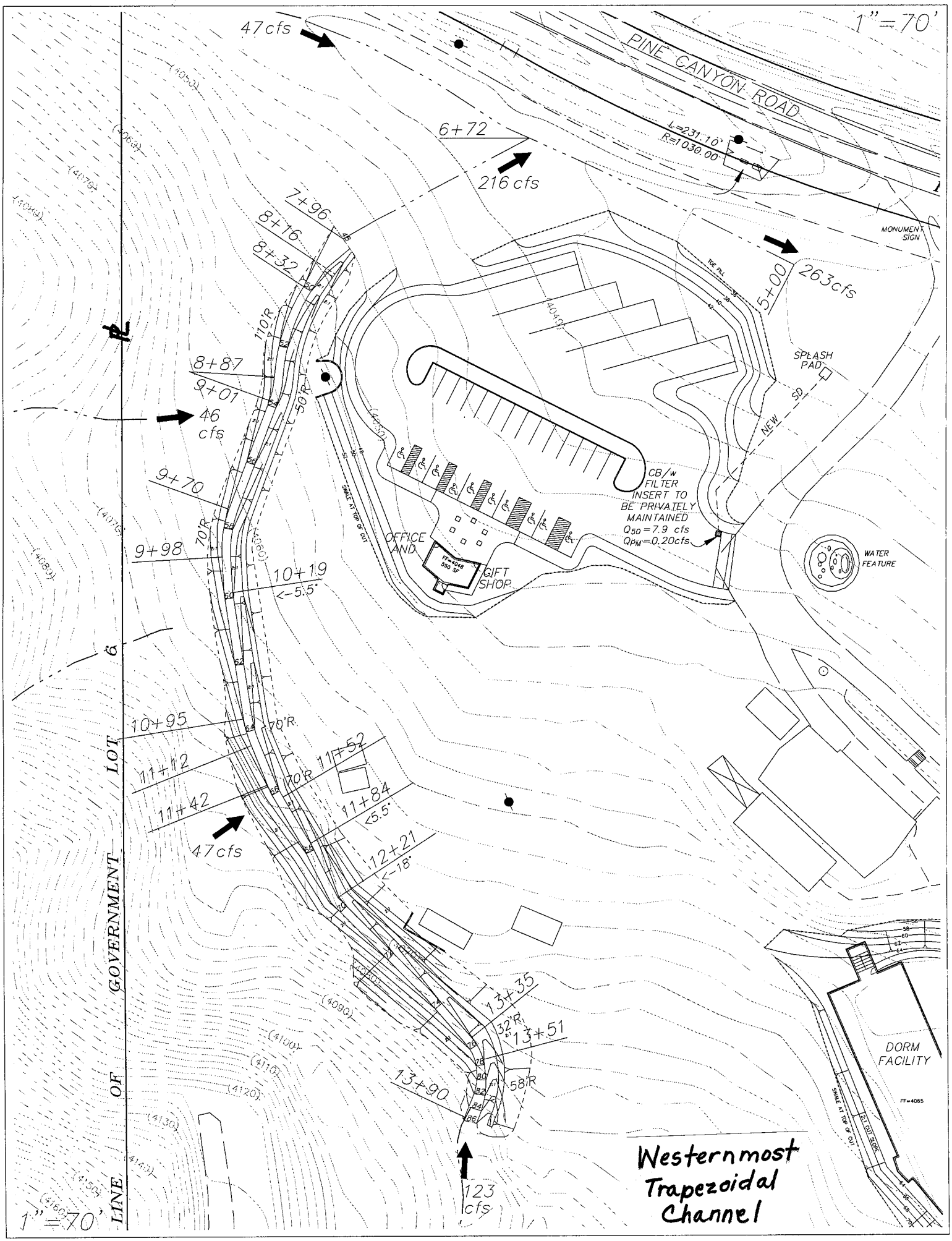
Program Package Serial Number: 1985

WATER SURFACE PROFILE LISTING Date:12-24-2007 Time:11:10:14

Young Nak Church Retreat Center
24100 Pine Canyon Road
Northwesterly Natural Channel

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
500.000	4034.000	1.153	4035.153	263.00	8.98	1.25	4036.40	.00	1.56	37.70			1	0 .0
TRANS STR	.0299					.0279	1.87	1.15	1.79		.025			IR-OPEN
567.000	4036.000	1.110	4037.110	263.00	8.69	1.17	4038.28	.00	1.47	32.55			2	0 .0
TRANS STR	.0227					.0226	.99	1.11	1.59		.025			IR-OPEN
611.000	4037.000	1.323	4038.323	263.00	7.92	.97	4039.30	.00	1.61	37.98			3	0 .0
TRANS STR	.0175					.0153	1.84	1.32	1.49		.025			IR-OPEN
731.000	4039.100	1.593	4040.693	263.00	5.62	.49	4041.18	.00	1.59	47.69			4	0 .0

Westernmost Trapezoidal Channel


1"=70'
PINE CANYON ROAD
L=231.10'
R=1030.00
47cfs
6+72
216 cfs
7+96
8+16
8+32
110'R
8+87
9+01
46 cfs
50'R
9+70
9+98
70'R
10+19
<-5.5'
10+95
70'R
11+12
11+52
11+42
70'R
11+84
<5.5'
47cfs
12+21
<-18'
13+35
32'R
13+51
13+90
58'R
123 cfs
5+00
263cfs
MONUMENT SIGN
SPLASH PAD
NEW SD
CB/w FILTER INSERT TO BE PRIVATELY MAINTAINED
Q_{50}=7.9 cfs
Q_{PM}=0.20cfs
OFFICE AND GIFT SHOP
FF=4048
550 SF
WATER FEATURE
DORM FACILITY
FF=4065
SWALE AT TOP OF CUT
LINE OF GOVERNMENT LOT 6
1"=70'
Westernmost Trapezoidal Channel

```
T1 Young Nak Church Retreat Center                                          0
T2 24100 Pine Canyon Road
T3 Westernmost Trapezoidal Channel
SO    796.0004048.000  1                          4048.000
TS    816.0004049.000  2      .025                                  .000
TS    832.0004050.000  3      .025                                  .000
R     887.0004053.000  3      .025                               -28.648
R     901.0004053.900  3      .025                                11.459
JX    970.0004056.000  3  4   .025   46.000         4057.600         70.0         .000
R     998.0004058.900  3      .025                               -22.918
R    1019.0004059.900  3      .025                                -5.500
R    1095.0004063.800  3      .025                                  .000
R    1112.0004064.400  3      .025                               -13.915
R    1142.0004065.800  3      .025                                  .000
R    1152.0004066.200  3      .025                                -8.185
JX   1184.0004067.800  3  4   .025   47.000         4067.000         70.0         .000
R    1221.0004069.800  3      .025                                 5.500
R    1335.0004075.800  3      .025                               -18.000
R    1351.0004077.800  3      .025                                28.648
R    1390.0004086.000  3      .025                                38.526
SH   1390.0004086.000  3                          4086.000
CD   1  1   0    .000   1.000   16.00040.00040.000   .00
CD   2  1   0    .000   4.000    7.000 2.000 2.000   .00
CD   3  1   0    .000   4.000    6.000 2.000 2.000   .00
CD   4  1   0    .000   2.000    1.000 4.00016.000   .00
Q           123.000   .0
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WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

CARD CODE	SECT NO	CHN TYPE	NO OF PIER/PIP	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	1	0	.000	1.000	16.000	40.000	40.000	.00										
CD	2	1	0	.000	4.000	7.000	2.000	2.000	.00										
CD	3	1	0	.000	4.000	6.000	2.000	2.000	.00										
CD	4	1	0	.000	2.000	1.000	4.000	16.000	.00										

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

Young Nak Church Retreat Center

HEADING LINE NO 2 IS -

24100 Pine Canyon Road

HEADING LINE NO 3 IS -

Westernmost Trapezoidal Channel

WATER SURFACE PROFILE - ELEMENT CARD LISTING

```
ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                U/S DATA   STATION    INVERT  SECT                                W S ELEV
                            796.000 4048.000    1                                 4048.000
ELEMENT NO   2 IS A TRANSITION        *         *     *
                U/S DATA   STATION    INVERT  SECT              N                       RADIUS   ANGLE
                            816.000 4049.000    2              .025                        .000     .000
ELEMENT NO   3 IS A TRANSITION        *         *     *
                U/S DATA   STATION    INVERT  SECT              N                       RADIUS   ANGLE
                            832.000 4050.000    3              .025                        .000     .000
ELEMENT NO   4 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                       RADIUS    ANGLE     ANG PT  MAN H
                            887.000 4053.000    3              .025                      110.000  -28.648      .000     0
ELEMENT NO   5 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                       RADIUS    ANGLE     ANG PT  MAN H
                            901.000 4053.900    3              .025                       70.001   11.459      .000     0
ELEMENT NO   6 IS A JUNCTION          *         *     *     *                 *                 *               *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3        Q4     INVERT-3 INVERT-4  PHI 3  PHI 4
                            970.000 4056.000    3     4     0   .025    46.000      .000  4057.600      .000  70.000     .000
                                                                                                RADIUS    ANGLE
                                                                                                  .000    .000
ELEMENT NO   7 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                       RADIUS    ANGLE     ANG PT  MAN H
                            998.000 4058.900    3              .025                       70.001  -22.918      .000     0
ELEMENT NO   8 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                       RADIUS    ANGLE     ANG PT  MAN H
                           1019.000 4059.900    3              .025                      218.766   -5.500      .000     0
ELEMENT NO   9 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                       RADIUS    ANGLE     ANG PT  MAN H
                           1095.000 4063.800    3              .025                        .000     .000      .000     0
ELEMENT NO  10 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                       RADIUS    ANGLE     ANG PT  MAN H
                           1112.000 4064.400    3              .025                       69.998  -13.915      .000     0
ELEMENT NO  11 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                       RADIUS    ANGLE     ANG PT  MAN H
                           1142.000 4065.800    3              .025                        .000     .000      .000     0
ELEMENT NO  12 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                       RADIUS    ANGLE     ANG PT  MAN H
                           1152.000 4066.200    3              .025                       70.001   -8.185      .000     0
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WATER SURFACE PROFILE - ELEMENT CARD LISTING

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ELEMENT NO  13 IS A JUNCTION          *         *     *     *                 *                   *               *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3        Q4     INVERT-3 INVERT-4  PHI 3  PHI 4
                           1184.000 4067.800    3     4     0   .025    47.000      .000  4067.000      .000  70.000     .000
                                                                                                RADIUS    ANGLE
                                                                                                  .000    .000
ELEMENT NO  14 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                           RADIUS    ANGLE     ANG PT  MAN H
                           1221.000 4069.800    3              .025                         385.444    5.500      .000     0
ELEMENT NO  15 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                           RADIUS    ANGLE     ANG PT  MAN H
                           1335.000 4075.800    3              .025                         362.873  -18.000      .000     0
ELEMENT NO  16 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                           RADIUS    ANGLE     ANG PT  MAN H
                           1351.000 4077.800    3              .025                          32.000   28.648      .000     0
ELEMENT NO  17 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                           RADIUS    ANGLE     ANG PT  MAN H
                           1390.000 4086.000    3              .025                          58.001   38.526      .000     0
ELEMENT NO  18 IS A SYSTEM HEADWORKS                  *                       *
                U/S DATA   STATION    INVERT  SECT                                   W S ELEV
                           1390.000 4086.000    3                                     4086.000
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Program Package Serial Number: 1985

WATER SURFACE PROFILE LISTING Date: 1- 4-2008 Time: 5:21: 1

Young Nak Church Retreat Center
24100 Pine Canyon Road
Westernmost Trapezoidal Channel

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
796.000	4048.000	.494	4048.494	216.00	12.23	2.32	4050.82	.00	.95	55.51	1.000	16.000	****	0 .0
TRANS STR	.0500					.1264	2.53	.49	3.82		.025	.00	****	TRAP
816.000	4049.000	1.459	4050.459	216.00	14.93	3.46	4053.92	.00	2.44	12.84	4.000	7.000	2.00	0 .0
TRANS STR	.0625					.0531	.85	1.46	2.48		.025	.00	2.00	TRAP
832.000	4050.000	1.632	4051.632	216.00	14.28	3.17	4054.80	.94	2.57	12.53	4.000	6.000	2.00	0 .0
24.128	.0545					.0460	1.11	2.57	2.29	1.58	.025	.00	2.00	TRAP
856.128	4051.316	1.683	4052.999	216.00	13.70	2.92	4055.91	.88	2.57	12.73	4.000	6.000	2.00	0 .0
14.752	.0545					.0406	.60	2.56	2.17	1.58	.025	.00	2.00	TRAP
870.880	4052.121	1.743	4053.864	216.00	13.06	2.65	4056.51	.81	2.57	12.97	4.000	6.000	2.00	0 .0
9.460	.0545					.0356	.34	2.56	2.04	1.58	.025	.00	2.00	TRAP
880.340	4052.637	1.805	4054.441	216.00	12.46	2.41	4056.85	.75	2.57	13.22	4.000	6.000	2.00	0 .0
6.660	.0545					.0312	.21	2.56	1.92	1.58	.025	.00	2.00	TRAP
887.000	4053.000	1.868	4054.868	216.00	11.88	2.19	4057.06	1.10	2.57	13.47	4.000	6.000	2.00	0 .0
2.120	.0643					.0281	.06	2.96	1.80	1.52	.025	.00	2.00	TRAP
889.120	4053.136	1.904	4055.040	216.00	11.57	2.08	4057.12	1.05	2.57	13.61	4.000	6.000	2.00	0 .0
3.155	.0643					.0254	.08	2.95	1.74	1.52	.025	.00	2.00	TRAP
892.275	4053.339	1.970	4055.309	216.00	11.03	1.89	4057.20	.97	2.57	13.88	4.000	6.000	2.00	0 .0
2.466	.0643					.0223	.05	2.94	1.64	1.52	.025	.00	2.00	TRAP

Program Package Serial Number: 1985

WATER SURFACE PROFILE LISTING Date: 1- 4-2008 Time: 5:21: 1

Young Nak Church Retreat Center
24100 Pine Canyon Road
Westernmost Trapezoidal Channel

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
894.741	4053.498	2.038	4055.536	216.00	10.52	1.72	4057.25	.90	2.57	14.15	4.000	6.000	2.00	0 .0
1.922	.0643					.0195	.04	2.94	1.54	1.52	.025	.00	2.00	TRAP
896.663	4053.621	2.108	4055.729	216.00	10.03	1.56	4057.29	.84	2.57	14.43	4.000	6.000	2.00	0 .0
1.481	.0643					.0171	.03	2.95	1.45	1.52	.025	.00	2.00	TRAP
898.144	4053.716	2.180	4055.897	216.00	9.56	1.42	4057.32	.78	2.57	14.72	4.000	6.000	2.00	0 .0
1.114	.0643					.0150	.02	2.96	1.36	1.52	.025	.00	2.00	TRAP
899.258	4053.788	2.255	4056.042	216.00	9.12	1.29	4057.33	.72	2.57	15.02	4.000	6.000	2.00	0 .0
.804	.0643					.0132	.01	2.97	1.28	1.52	.025	.00	2.00	TRAP
900.062	4053.840	2.331	4056.170	216.00	8.69	1.17	4057.34	.67	2.57	15.32	4.000	6.000	2.00	0 .0
.537	.0643					.0116	.01	3.00	1.20	1.52	.025	.00	2.00	TRAP
900.599	4053.874	2.409	4056.283	216.00	8.29	1.07	4057.35	.62	2.57	15.64	4.000	6.000	2.00	0 .0
.304	.0643					.0101	.00	3.03	1.13	1.52	.025	.00	2.00	TRAP
900.902	4053.894	2.490	4056.383	216.00	7.90	.97	4057.35	.57	2.57	15.96	4.000	6.000	2.00	0 .0
.098	.0643					.0089	.00	3.06	1.06	1.52	.025	.00	2.00	TRAP
901.000	4053.900	2.573	4056.473	216.00	7.53	.88	4057.35	.00	2.57	16.29	4.000	6.000	2.00	0 .0
JUNCT STR	.0304							3.11	1.00		.025	.00	2.00	TRAP
970.000	4056.000	1.250	4057.250	170.00	16.00	3.98	4061.23	1.62	2.26	11.00	4.000	6.000	2.00	0 .0
9.530	.1036					.0773	.74	2.87	2.87	1.17	.025	.00	2.00	TRAP

Program Package Serial Number: 1985

WATER SURFACE PROFILE LISTING Date: 1- 4-2008 Time: 5:21: 1

Young Nak Church Retreat Center
24100 Pine Canyon Road
Westernmost Trapezoidal Channel

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
979.530	4056.987	1.287	4058.274	170.00	15.41	3.69	4061.96	1.53	2.26	11.15	4.000	6.000	2.00	0 .0
8.203	.1036					.0685	.56	2.81	2.73	1.17	.025	.00	2.00	TRAP
987.733	4057.837	1.335	4059.171	170.00	14.69	3.35	4062.52	1.41	2.26	11.34	4.000	6.000	2.00	0 .0
5.849	.1036					.0599	.35	2.75	2.56	1.17	.025	.00	2.00	TRAP
993.582	4058.442	1.384	4059.826	170.00	14.01	3.05	4062.87	1.31	2.26	11.54	4.000	6.000	2.00	0 .0
4.418	.1036					.0524	.23	2.69	2.41	1.17	.025	.00	2.00	TRAP
998.000	4058.900	1.435	4060.335	170.00	13.36	2.77	4063.11	.39	2.26	11.74	4.000	6.000	2.00	0 .0
21.000	.0476					.0495	1.04	1.82	2.26	1.44	.025	.00	2.00	TRAP
1019.000	4059.900	1.425	4061.325	170.00	13.48	2.82	4064.15	.00	2.26	11.70	4.000	6.000	2.00	0 .0
34.923	.0513					.0487	1.70	1.43	2.29	1.42	.025	.00	2.00	TRAP
1053.923	4061.692	1.448	4063.140	170.00	13.20	2.71	4065.85	.00	2.26	11.79	4.000	6.000	2.00	0 .0
27.591	.0513					.0443	1.22	1.45	2.23	1.42	.025	.00	2.00	TRAP
1081.514	4063.108	1.501	4064.608	170.00	12.59	2.46	4067.07	.00	2.26	12.00	4.000	6.000	2.00	0 .0
13.486	.0513					.0388	.52	1.50	2.09	1.42	.025	.00	2.00	TRAP
1095.000	4063.800	1.555	4065.355	170.00	12.00	2.24	4067.59	1.02	2.26	12.22	4.000	6.000	2.00	0 .0
17.000	.0353					.0365	.62	2.57	1.96	1.57	.025	.00	2.00	TRAP
1112.000	4064.400	1.548	4065.948	170.00	12.08	2.26	4068.21	.00	2.26	12.19	4.000	6.000	2.00	0 .0
.504	.0467					.0368	.02	1.55	1.98	1.45	.025	.00	2.00	TRAP

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WATER SURFACE PROFILE LISTING Date: 1- 4-2008 Time: 5:21: 1

Young Nak Church Retreat Center
24100 Pine Canyon Road
Westernmost Trapezoidal Channel

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1112.504	4064.424	1.549	4065.972	170.00	12.07	2.26	4068.23	.00	2.26	12.19	4.000	6.000	2.00	0 .0
12.244	.0467					.0344	.42	1.55	1.98	1.45	.025		.00	2.00 TRAP
1124.748	4064.995	1.605	4066.600	170.00	11.51	2.06	4068.66	.00	2.26	12.42	4.000	6.000	2.00	0 .0
7.828	.0467					.0302	.24	1.60	1.86	1.45	.025		.00	2.00 TRAP
1132.576	4065.360	1.662	4067.022	170.00	10.97	1.87	4068.89	.00	2.26	12.65	4.000	6.000	2.00	0 .0
5.457	.0467					.0264	.14	1.66	1.75	1.45	.025		.00	2.00 TRAP
1138.033	4065.615	1.721	4067.336	170.00	10.46	1.70	4069.03	.00	2.26	12.89	4.000	6.000	2.00	0 .0
3.967	.0467					.0231	.09	1.72	1.64	1.45	.025		.00	2.00 TRAP
1142.000	4065.800	1.782	4067.582	170.00	9.97	1.54	4069.13	.75	2.26	13.13	4.000	6.000	2.00	0 .0
3.307	.0400					.0205	.07	2.54	1.54	1.51	.025		.00	2.00 TRAP
1145.307	4065.932	1.833	4067.765	170.00	9.59	1.43	4069.19	.71	2.26	13.33	4.000	6.000	2.00	0 .0
3.015	.0400					.0182	.05	2.54	1.47	1.51	.025		.00	2.00 TRAP
1148.321	4066.053	1.897	4067.950	170.00	9.15	1.30	4069.25	.66	2.26	13.59	4.000	6.000	2.00	0 .0
2.164	.0400					.0159	.03	2.55	1.38	1.51	.025		.00	2.00 TRAP
1150.485	4066.139	1.963	4068.103	170.00	8.72	1.18	4069.28	.61	2.26	13.85	4.000	6.000	2.00	0 .0
1.515	.0400					.0140	.02	2.57	1.30	1.51	.025		.00	2.00 TRAP
1152.000	4066.200	2.031	4068.231	170.00	8.32	1.07	4069.31	.00	2.26	14.13	4.000	6.000	2.00	0 .0
JUNCT STR	.0500					.0335	1.07	2.13	1.22		.025		.00	2.00 TRAP

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WATER SURFACE PROFILE LISTING Date: 1- 4-2008 Time: 5:21: 1

Young Nak Church Retreat Center
24100 Pine Canyon Road
Westernmost Trapezoidal Channel

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1184.000	4067.800	1.172	4068.972	123.00	12.57	2.46	4071.43	.18	1.89	10.69	4.000	6.000	2.00	0 .0
37.000	.0541					.0535	1.98	1.35	2.32	1.17	.025	.00	2.00	TRAP
1221.000	4069.800	1.176	4070.976	123.00	12.52	2.43	4073.41	.19	1.89	10.71	4.000	6.000	2.00	0 .0
39.579	.0526					.0549	2.17	1.36	2.30	1.18	.025	.00	2.00	TRAP
1260.579	4071.883	1.156	4073.039	123.00	12.80	2.54	4075.58	.19	1.89	10.63	4.000	6.000	2.00	0 .0
26.057	.0526					.0608	1.58	1.35	2.37	1.18	.025	.00	2.00	TRAP
1286.636	4073.254	1.114	4074.368	123.00	13.42	2.80	4077.17	.21	1.89	10.46	4.000	6.000	2.00	0 .0
14.040	.0526					.0696	.98	1.32	2.53	1.18	.025	.00	2.00	TRAP
1300.676	4073.993	1.073	4075.066	123.00	14.08	3.08	4078.14	.23	1.89	10.29	4.000	6.000	2.00	0 .0
9.855	.0526					.0798	.79	1.30	2.69	1.18	.025	.00	2.00	TRAP
1310.531	4074.512	1.033	4075.545	123.00	14.76	3.38	4078.93	.25	1.89	10.13	4.000	6.000	2.00	0 .0
7.712	.0526					.0915	.71	1.28	2.87	1.18	.025	.00	2.00	TRAP
1318.243	4074.918	.994	4075.912	123.00	15.48	3.72	4079.64	.27	1.89	9.98	4.000	6.000	2.00	0 .0
6.399	.0526					.1050	.67	1.26	3.06	1.18	.025	.00	2.00	TRAP
1324.643	4075.255	.957	4076.212	123.00	16.24	4.10	4080.31	.29	1.89	9.83	4.000	6.000	2.00	0 .0
5.505	.0526					.1205	.66	1.25	3.26	1.18	.025	.00	2.00	TRAP
1330.148	4075.545	.921	4076.466	123.00	17.03	4.50	4080.97	.31	1.89	9.68	4.000	6.000	2.00	0 .0
4.852	.0526					.1383	.67	1.23	3.48	1.18	.025	.00	2.00	TRAP

Program Package Serial Number: 1985

WATER SURFACE PROFILE LISTING Date: 1- 4-2008 Time: 5:21: 1

Young Nak Church Retreat Center
24100 Pine Canyon Road
Westernmost Trapezoidal Channel

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1335.000	4075.800	.886	4076.686	123.00	17.86	4.96	4081.64	3.84	1.89	9.54	4.000	6.000	2.00	0 .0
3.784	.1250					.1501	.57	4.73	3.71	.93	.025	.00	2.00	TRAP
1338.784	4076.273	.878	4077.151	123.00	18.05	5.06	4082.21	3.91	1.89	9.51	4.000	6.000	2.00	0 .0
12.216	.1250					.1637	2.00	4.79	3.76	.93	.025	.00	2.00	TRAP
1351.000	4077.800	.845	4078.645	123.00	18.93	5.57	4084.21	2.34	1.89	9.38	4.000	6.000	2.00	0 .0
10.148	.2103					.1637	1.66	3.19	4.01	.80	.025	.00	2.00	TRAP
1361.148	4079.934	.878	4080.812	123.00	18.05	5.06	4085.87	2.16	1.89	9.51	4.000	6.000	2.00	0 .0
6.283	.2103					.1426	.90	3.04	3.76	.80	.025	.00	2.00	TRAP
1367.431	4081.255	.913	4082.168	123.00	17.21	4.60	4086.77	1.99	1.89	9.65	4.000	6.000	2.00	0 .0
4.442	.2103					.1242	.55	2.90	3.53	.80	.025	.00	2.00	TRAP
1371.873	4082.189	.949	4083.138	123.00	16.41	4.18	4087.32	1.84	1.89	9.80	4.000	6.000	2.00	0 .0
3.363	.2103					.1082	.36	2.79	3.31	.80	.025	.00	2.00	TRAP
1375.236	4082.896	.986	4083.882	123.00	15.65	3.80	4087.68	1.69	1.89	9.94	4.000	6.000	2.00	0 .0
2.651	.2103					.0943	.25	2.68	3.10	.80	.025	.00	2.00	TRAP
1377.887	4083.453	1.024	4084.478	123.00	14.92	3.46	4087.93	1.56	1.89	10.10	4.000	6.000	2.00	0 .0
2.146	.2103					.0823	.18	2.59	2.91	.80	.025	.00	2.00	TRAP
1380.033	4083.905	1.064	4084.968	123.00	14.23	3.14	4088.11	1.44	1.89	10.26	4.000	6.000	2.00	0 .0
1.768	.2103					.0718	.13	2.51	2.73	.80	.025	.00	2.00	TRAP

Program Package Serial Number: 1985

WATER SURFACE PROFILE LISTING Date: 1- 4-2008 Time: 5:21: 1

Young Nak Church Retreat Center
24100 Pine Canyon Road
Westernmost Trapezoidal Channel

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1381.801	4084.276	1.105	4085.381	123.00	13.56	2.86	4088.24	1.33	1.89	10.42	4.000	6.000	2.00	0 .0
1.474	.2103					.0626	.09	2.44	2.56	.80	.025	.00	2.00	TRAP
1383.275	4084.586	1.147	4085.733	123.00	12.93	2.60	4088.33	1.23	1.89	10.59	4.000	6.000	2.00	0 .0
1.238	.2103					.0547	.07	2.38	2.40	.80	.025	.00	2.00	TRAP
1384.512	4084.846	1.190	4086.036	123.00	12.33	2.36	4088.40	1.14	1.89	10.76	4.000	6.000	2.00	0 .0
1.044	.2103					.0477	.05	2.33	2.26	.80	.025	.00	2.00	TRAP
1385.557	4085.066	1.235	4086.301	123.00	11.76	2.15	4088.45	1.05	1.89	10.94	4.000	6.000	2.00	0 .0
.883	.2103					.0417	.04	2.29	2.12	.80	.025	.00	2.00	TRAP
1386.440	4085.251	1.281	4086.533	123.00	11.21	1.95	4088.48	.97	1.89	11.13	4.000	6.000	2.00	0 .0
.746	.2103					.0364	.03	2.25	1.99	.80	.025	.00	2.00	TRAP
1387.186	4085.408	1.329	4086.737	123.00	10.69	1.77	4088.51	.90	1.89	11.32	4.000	6.000	2.00	0 .0
.628	.2103					.0318	.02	2.23	1.87	.80	.025	.00	2.00	TRAP
1387.813	4085.540	1.378	4086.918	123.00	10.19	1.61	4088.53	.83	1.89	11.51	4.000	6.000	2.00	0 .0
.526	.2103					.0278	.01	2.21	1.75	.80	.025	.00	2.00	TRAP
1388.339	4085.651	1.429	4087.080	123.00	9.72	1.47	4088.55	.77	1.89	11.72	4.000	6.000	2.00	0 .0
.436	.2103					.0243	.01	2.20	1.65	.80	.025	.00	2.00	TRAP
1388.775	4085.742	1.481	4087.224	123.00	9.26	1.33	4088.56	.71	1.89	11.93	4.000	6.000	2.00	0 .0
.356	.2103					.0213	.01	2.19	1.55	.80	.025	.00	2.00	TRAP

Program Package Serial Number: 1985

WATER SURFACE PROFILE LISTING Date: 1- 4-2008 Time: 5:21: 1

Young Nak Church Retreat Center
24100 Pine Canyon Road
Westernmost Trapezoidal Channel

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1389.131	4085.817	1.535	4087.352	123.00	8.83	1.21	4088.56	.66	1.89	12.14	4.000	6.000	2.00	0 .0
.285	.2103					.0186	.01	2.19	1.45	.80	.025	.00	2.00	TRAP
1389.416	4085.877	1.591	4087.468	123.00	8.42	1.10	4088.57	.61	1.89	12.36	4.000	6.000	2.00	0 .0
.222	.2103					.0163	.00	2.20	1.37	.80	.025	.00	2.00	TRAP
1389.638	4085.924	1.648	4087.572	123.00	8.03	1.00	4088.57	.57	1.89	12.59	4.000	6.000	2.00	0 .0
.164	.2103					.0143	.00	2.21	1.28	.80	.025	.00	2.00	TRAP
1389.802	4085.958	1.707	4087.665	123.00	7.66	.91	4088.58	.52	1.89	12.83	4.000	6.000	2.00	0 .0
.112	.2103					.0125	.00	2.23	1.21	.80	.025	.00	2.00	TRAP
1389.914	4085.982	1.767	4087.749	123.00	7.30	.83	4088.58	.48	1.89	13.07	4.000	6.000	2.00	0 .0
.065	.2103					.0109	.00	2.25	1.13	.80	.025	.00	2.00	TRAP
1389.979	4085.996	1.830	4087.825	123.00	6.96	.75	4088.58	.45	1.89	13.32	4.000	6.000	2.00	0 .0
.021	.2103					.0096	.00	2.28	1.06	.80	.025	.00	2.00	TRAP
1390.000	4086.000	1.895	4087.895	123.00	6.63	.68	4088.58	.42	1.89	13.58	4.000	6.000	2.00	0 .0

Young Nak Church Retreat Center
24100 Pine Canyon Road
Westernmost Trapezoidal Channel

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796.00    .IWH   E                                                          .    TX
800.27    .                                                                 .
804.55    .                                                                 .
808.82    .                                                                 .
813.09    .                                                                 .
817.37    .  I  W  C  H  E                                                  .    TX
821.64    .                                                                 .
825.91    .                                                                 .
830.19    .                                                                 .
834.46    .    I   W S   H E                                                .    R
838.73    .                                                                 .
843.01    .                                                                 .
847.28    .                                                                 .
851.55    .                                                                 .
855.83    .                                                                 .
860.10    .       I   W SC  HE                                              .    R
864.37    .                                                                 .
868.65    .                                                                 .
872.92    .         I   W S   HE                                            .    R
877.19    .                                                                 .
881.47    .           I   W S  HE                                           .    R
885.74    .                                                                 .
890.01    .           I    W S  H                                           .    R
894.29    .            I   W CS H                                           .    R
898.56    .            I    WCS EH                                          .    R
902.83    .             I   W CS H                                           .    R
907.11    .             I    WCS H                                           .    R
911.38    .             I    WCS EH                                          .    R
915.65    .             I     WS EH                                          .    R
919.93    .             I     WCSEH                                          .    R
924.20    .             I     WCSEH                                          .    R
928.47    .              I    WCSEH                                          .    R
932.75    .              I     WSEH                                          .    JX
937.02    .                                                                 .
941.29    .                                                                 .
945.57    .                                                                 .
949.84    .                                                                 .
954.12    .                                                                 .
958.39    .                                                                 .
962.66    .                                                                 .
966.94    .                                                                 .
971.21    .                  I  W CS  H  E                                  .    R
975.48    .                                                                 .
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 979.76    .                    I  W C S H  E                                    .    R
 984.03    .                                                                     .
 988.30    .                      I  W CS  H E                                   .    R
 992.58    .                                                                     .
 996.85    .                       I   W CS  HE                                  .    R
1001.12    .                        I   WSC   H                                  .    R
1005.40    .                                                                     .
1009.67    .                                                                     .
1013.94    .                                                                     .
1018.22    .                                                                     .
1022.49    .                           I  W C   HE                               .    R
1026.76    .                                                                     .
1031.04    .                                                                     .
1035.31    .                                                                     .
1039.58    .                                                                     .
1043.86    .                                                                     .
1048.13    .                                                                     .
1052.40    .                                                                     .
1056.68    .                              I   WC    H                            .    R
1060.95    .                                                                     .
1065.22    .                                                                     .
1069.50    .                                                                     .
1073.77    .                                                                     .
1078.04    .                                                                     .
1082.32    .                                 I   W C   H                         .    R
1086.59    .                                                                     .
1090.86    .                                                                     .
1095.14    .                                   I   W S  EH                       .    R
1099.41    .                                                                     .
1103.68    .                                                                     .
1107.96    .                                                                     .
1112.23    .                                     I  W C   H                      .    R
1116.50    .                                     I  W C   H                      .    R
1120.78    .                                                                     .
1125.05    .                                      I   WC   H                     .    R
1129.32    .                                                                     .
1133.60    .                                       I   WC  EH                    .    R
1137.87    .                                                                     .
1142.14    .                                       I    WC  EH                   .    R
1146.42    .                                        I   WCS EH                   .    R
1150.69    .                                        I    WS E H                  .    R
1154.96    .                                        I    WCSE H                  .    R
1159.24    .                                         I   WCSE H                  .    R
1163.51    .                                         I    W E H                  .    JX
1167.78    .                                                                     .
1172.06    .                                                                     .
1176.33    .                                                                     .
1180.60    .                                                                     .
1184.88    .                                              I WSC   EH             .    R
1189.15    .                                                                     .
1193.42    .                                                                     .
1197.70    .                                                                     .
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1201.97   .                                                                                  .
1206.24   .                                                                                  .
1210.52   .                                                                                  .
1214.79   .                                                                                  .
1219.06   .                                                                                  .
1223.34   .                                                I  WSC   EH                       .    R
1227.61   .                                                                                  .
1231.88   .                                                                                  .
1236.16   .                                                                                  .
1240.43   .                                                                                  .
1244.71   .                                                                                  .
1248.98   .                                                                                  .
1253.25   .                                                                                  .
1257.53   .                                                                                  .
1261.80   .                                                    I  WSC   EH                   .    R
1266.07   .                                                                                  .
1270.35   .                                                                                  .
1274.62   .                                                                                  .
1278.89   .                                                                                  .
1283.17   .                                                                                  .
1287.44   .                                                        I WSC    H                .    R
1291.71   .                                                                                  .
1295.99   .                                                                                  .
1300.26   .                                                                                  .
1304.53   .                                                         I  W C    H              .    R
1308.81   .                                                                                  .
1313.08   .                                                           I WSC    HE            .    R
1317.35   .                                                                                  .
1321.63   .                                                            I WSC    H E          .    R
1325.90   .                                                            I  W C    H E         .    R
1330.17   .                                                             I WS C    H  E       .    R
1334.45   .                                                                                  .
1338.72   .                                                              I W C    H S  E     .    R
1342.99   .                                                               I W C    H S  E    .    R
1347.27   .                                                                                  .
1351.54   .                                                                  I W  C  S H    E .    R
1355.81   .                                                                                  .
1360.09   .                                                                                  .
1364.36   .                                                                        I W C  S H   E .    R
1368.63   .                                                                           I W C  S H  E .    R
1372.91   .                                                                              I W C  S H  E .    R
1377.18   .                                                                                I W C S  H E .    R
1381.45   .                                                                                 I W C S  H E .    R
1385.73   .                                                                                  I  WC S   H .    R
1390.00   .                                                                                   I  WC S  H .    R
        4048.000  4052.200  4056.400  4060.600  4064.800  4069.000  4073.200  4077.400  4081.600  4085.800  4090.000
```

N O T E S

1. GLOSSARY
   - I = INVERT ELEVATION
   - C = CRITICAL DEPTH
   - W = WATER SURFACE ELEVATION
   - S = SUPER-ELEVATION
   - H = HEIGHT OF CHANNEL
   - E = ENERGY GRADE LINE
   - X = CURVES CROSSING OVER
   - B = BRIDGE ENTRANCE OR EXIT
   - Y = WALL ENTRANCE OR EXIT
2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY

DISCUSSION - TURF REINFORCEMENT MAT

The proposed project includes the construction of two channels that would collect and convey the offsite capital storm around the site improvements, delivering it to the open area between the buildings and the northerly property line at Pine Canyon Road.

The ±700-foot long Southerly Onsite Channel will be trapezoidal in shape, with 2:1 side slopes, a 15-foot wide bottom and a minimum height of five feet. Height will be increased as needed for super-elevated reaches. Average velocities range from 20 to 25 feet per second. The channel will be lined with a synthetic turf reinforcement mat, *North American Green's* Vmax^3 P550, and re-vegetated with native plant materials. Specifications regarding the turf reinforcement mat are provided on the following pages. The native seed mix to be used for re-vegetation will be determined by a biologist, and spread under the direction of the biologist. The native seed mix will be applied to all disturbed areas in the vicinity of the channel. WSPG calculations on Page 3-1, etc. provide data for this southerly channel.

The ±600-foot long Westerly Trapezoidal Channel will have 2:1 side slopes, a 6-foot wide bottom and a minimum height of three feet. Height will be increased as needed for super-elevated channel reaches. Average velocities range from 10 to 15 feet per second. The channel will be lined with Vmax^3 SC250 turf reinforcement mat, and re-vegetated with native materials. Specifications regarding this mat material are shown on pages that follow. Native seed mix will be used to re-vegetate the channel, and all disturbed areas in the vicinity of the channel, in the manner previously described. WSPG calculations on Page 3-22, etc. provide data for this westerly channel.

A natural area of wide shallow flow is noted as the Northwesterly Natural Channel in the WSPG calculations on Page 3-17, etc. The flow width in the capital storm averages about 40 feet, with velocities averaging about 8 feet per second and depths less than 1.5 feet. The natural state of the existing area of flow is best served by leaving it undisturbed, free from surface linings, as are proposed above for the man-made channels on the site.

1:1 & Greater Slopes

Ultra High Flow Channels

Shorelines

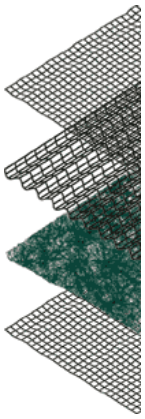
P550®

Permanent Turf Reinforcement Mat

Ultra-high Performance
Equivalent to Concrete
The New Maximum in Vegetation Reinforcement

North American Green's P550 is comprised of a permanent, ultra high strength three-dimensional matting structure incorporated with a 100% polypropylene fiber matrix. The P550 is designed to provide both long-term, pre-vegetated erosion protection and permanent turf reinforcement in a wide variety of applications, including extreme flow channels, spillways, stream banks and shorelines.

The 100% polypropylene fiber matrix augments the permanent matting's initial mulching and erosion control properties as well as its permanent vegetation reinforcement capabilities. Proven in laboratory and field research, the P550 drives the shear resistance of vegetation to over 14 lbs / ft^2 (672 Pa.) – establishing a new maximum for vegetation reinforcement! The P550 is the ultimate choice for extending the use of vegetation in extreme erosion control projects.



TOP NET
Black UV Stabilized Polypropylene
24 lbs / 1,000 ft^2 approximate weight

CENTER NET
Black UV Stabilized Polypropylene Corrugated
24 lbs / 1,000 ft^2 approximate weight

MATRIX MATERIAL
100% UV Stabilized Polypropylene

BOTTOM NET
Black UV Stabilized Polypropylene
24 lbs / 1,000 ft^2 approximate weight

THREAD
Black UV Stabilized Polypropylene

DIMENSIONS
Width: 6.50 ft (2 m)
Length: 55.50 ft (16.90 m)
Area: 40 yd^2 (33.40 m^2)
Weight: 52.00 lbs (23.59 kg) +/- 10%

Download Technical Specifications PDF

Maximum Value with Vmax^3 P550

Cost Comparison	P550	Concrete
Materials	$12,800-16,000	$42,600
Labor	$8,500-10,700	$28,500
Total Installed Cost	$21,300-26,700 ($12-15 yd^2/$14-18 m^2)	$71,100 ($40 yd^2/$48 m^2)

MAXIMUM SAVINGS OF $49,800

* Based on costs for protecting a 16 ft X 1,000 ft (4.8 m X 305 m) drainage channel.
* Costs shown in U.S. Dollars. Costs may vary based on location.

P550 Product Application Guide*

Applications	Limiting Shear Stress lb/ft^2 (Pa) Flow Duration				Permissible Velocity ft/s (m/s)		Typical Projects	FHWA FP-03 TRM Categories
	Bare Soil		Vegetated					
	0.5 hr	50 hr	0.5 hr	50 hr	Unvegetated	Vegetated		
1:1 & Greater Slopes Extreme High Flow Channels 36-Month Vegetation Grow-in Period or When Sparse Vegetation Stand Is Expected	4.0 (191)	3.25 (156)	14.0 (672)	12.0 (576)	12.5 (3.8)	25 (7.6)	Spillways, Swales, High Flow Drainage Areas, Shoreline Protection	Types 5.A, B and C

* This guide is for general purposes only. Actual product selection and design should be developed using North American Green's Erosion Control Materials Design Software (ECMDS®).
* All unvegetated and vegetated Vmax^3 performance values are based on laboratory research utilizing test methods similar to those detailed in ASTM D 6459-00.

All Vmax3 products have been tested by AASHTO's National Transportation Product Evaluation Program for RECPs.
GSA Contract Number GS-07F-8870D : 04/01/2004-03/31/2009

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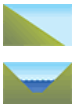
Performance Profile | Problems Solved



1:1 & Greater Slopes

Medium to High Flow Channels

Stream Banks

SC250®

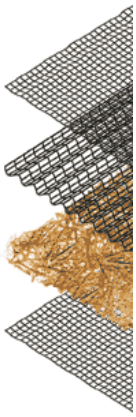
Permanent Turf Reinforcement Mat

High Performance
Exceeds to 24" Rock Riprap
A Step Above Temporary Erosion Control Blankets

North American Green's SC250 is comprised of a permanent, high strength three-dimensional matting structure incorporated with a straw/coconut fiber matrix. It is designed to provide both extended term, pre-vegetated erosion protection and permanent turf reinforcement in a wide variety of applications, including severe slopes, high flow channels and stream banks.

The straw/coconut fiber matrix enhances the permanent matting's initial mulching and erosion control performance for up to 24 months. Proven in laboratory and field research, the permanent matting's high strength 3-D structure increases the shear resistance of vegetation up to 10 lbs / ft^2 (480 Pa).

With even the toughest stand of unreinforced grasses typically failing at shear stress levels of 3.7 lbs / ft^2, the SC250 more than doubles the shear resistance of any vegetation. This enables the SC250 to be used in many applications where rock riprap and concrete were once the only viable alternatives.



TOP NET
Black UV Stabilized Polypropylene
5 lbs / 1,000 ft^2 approximate weight

CENTER NET
Black UV Stabilized Polypropylene Corrugated
24 lbs / 1,000 ft^2 approximate weight

MATRIX MATERIAL
70% Straw / 30% Coconut

BOTTOM NET
Black UV Stabilized Polypropylene
5 lbs / 1,000 ft^2 approximate weight

THREAD
Black UV Stabilized Polypropylene

DIMENSIONS
Width: 6.50 ft (2 m)
Length: 55.50 ft (16.90 m)
Area: 40 yd^2 (33.40 m^2)
Weight: 34.00 lbs (15.42 kg) +/- 10%

Download Technical Specifications PDF

Maximum Value with Vmax^3 SC250

Cost Comparison	SC250	24" (0.6 m) Rock Riprap
Materials	$6,400-8,500	$21,500
Labor	$4,300-5,700	$14,200
Total Installed Cost	$10,700-14,200 ($6-8 yd^2/$7-10 m^2)	$35,700 ($20 yd^2/$24 m^2)

MAXIMUM SAVINGS OF $25,000

* Based on costs for protecting a 16 ft X 1,000 ft (4.8 m X 305 m) drainage channel.
* Costs shown in U.S. Dollars. Costs may vary based on location.

SC250 Product Application Guide*

Applications	Limiting Shear Stress lb/ft^2 (Pa) Flow Duration				Permissible Velocity ft/s (m/s)		Typical Projects	FHWA FP-03 TRM Categories
	Bare Soil		Vegetated					
	0.5 hr	50 hr	0.5 hr	50 hr	Unvegetated	Vegetated		
1:1 & Greater Slopes	3.0 (144)	2.5 (120)	10.0 (480)	8.0 (383)	9.5 (2.9)	15 (4.6)	Roadside Ditches, Golf Course Swales, Stream Bank Protection	Types 5.A, B and C
Medium to High Flow Channels								
24-Month Vegetation Grow-in Period								

* This guide is for general purposes only. Actual product selection and design should be developed using North American Green's Erosion Control Materials Design Software (ECMDS®).
* All unvegetated and vegetated Vmax^3 performance values are based on laboratory research utilizing test methods similar to those detailed in ASTM D 6459-00.

All Vmax3 products have been tested by AASHTO's National Transportation Product Evaluation Program for RECPs.
GSA Contract Number GS-07F-8870D : 04/01/2004-03/31/2009

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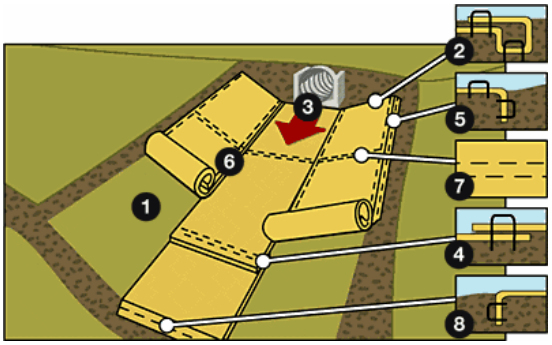
Vmax³ Installation Instructions | Channels

Installation instructions are available in the following formats:

CAD format: Download .dwg file

PDF format: Download .pdf file



1. Prepare soil before installing blankets, including any necessary application of lime, fertilizer, and seed.

2. Begin at the top of the slope by anchoring the blanket in a 6" (15cm) deep x 6" (15cm) wide trench with approximately 12" (30cm) of blanket extended beyond the up-slope portion of the trench. Anchor the blanket with a row of staples/stakes approximately 12" (30cm) apart in the bottom of the trench. Backfill and compact the trench after stapling. Apply seed to compacted soil and fold remaining 12" (30cm) portion of blanket back over seed and compacted soil. Secure blanket over compacted soil with a row of staples/stakes spaced approximately 12" (30cm) apart across the width of the blanket.

3. Roll center blanket in direction of water flow on bottom of channel. Blankets will unroll with appropriate side against soil surface. All blankets must be securely fastened to soil surface by placing staples/stakes in appropriate locations as shown in the staple pattern guide. When using the Dot System™, staples/stakes should be placed through each of the colored dots corresponding to the appropriate staple pattern.

4. Place blankets end over end (shingle style) with a 4"–6" (10cm–15cm) overlap. Use a double row of staples staggered 4" (10cm) apart and 4" (10cm) on center to secure blankets.

5. Full length edge of blankets at top of side slopes must be anchored with a row of staples/stakes approximately 12" (30cm) apart in a 6" (15cm) deep x 6" (15cm) wide trench. Backfill and compact the trench after stapling.

6. Adjacent blankets must be overlapped approximately 2"–5" (5cm–12.5cm) (depending on blanket type) and stapled.

7. In high flow channel applications, a staple check slot is recommended at 30 to 40 foot (9m–12m) intervals. Use a double row of staples staggered 4" (10cm) apart and 4" (10cm) on center over entire width of channel.

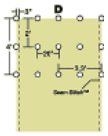
8. The terminal end of the blankets must be anchored with a row of staples/stakes approximately 12" (30cm) apart in a 6" (15cm) deep x 6" (15cm) wide trench. Backfill and compact the trench after stapling.

Staple Pattern Guides

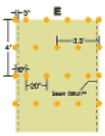
Staple pattern guides are available in the following formats:

CAD format: Download .dwg file

PDF format: Download .pdf file



3.4 Staples / yd^2
(4.1 Staples / m^2)



3.75 Staples / yd^2
(4.5 Staples / m^2)

For detailed specific recommendations, contact your nearest authorized North American Green distributor or call North American Green Technical Services.

All Vmax3 products have been tested by AASHTO's National Transportation Product Evaluation Program for RECPs.
GSA Contract Number GS-07F-8870D : 04/01/2004-03/31/2009

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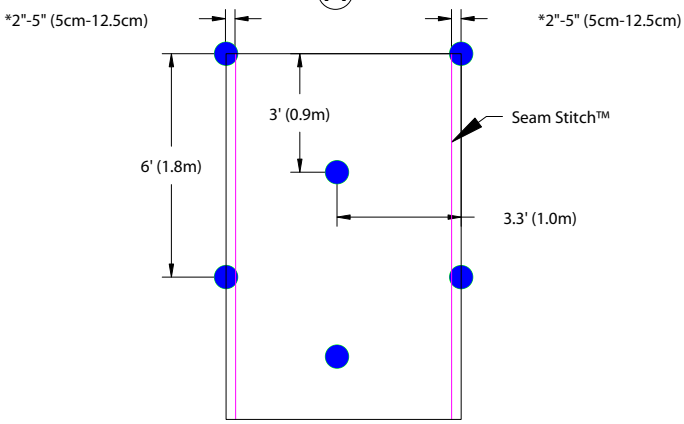
STAPLE PATTERN GUIDE

6.5' and 6.67' roll widths only

A



0.7 STAPLES PER SQ. YD.
(0.8 STAPLES PER SQ. M)
For blankets with the optional North American Green DOT System® place staples/stakes through each of the BLUE colored dots.

NORTH AMERICAN GREEN®
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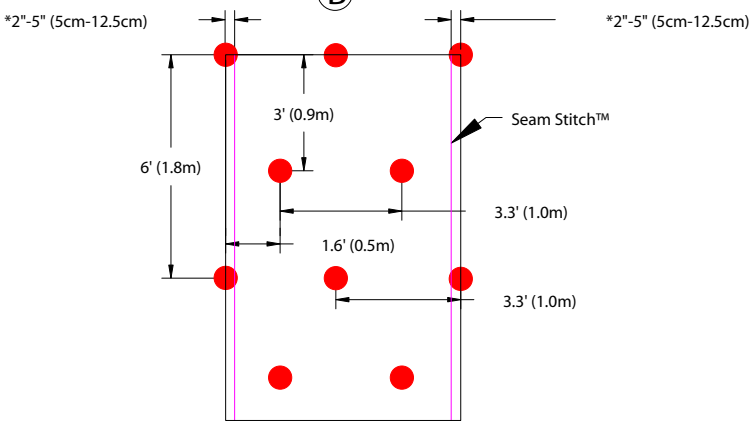
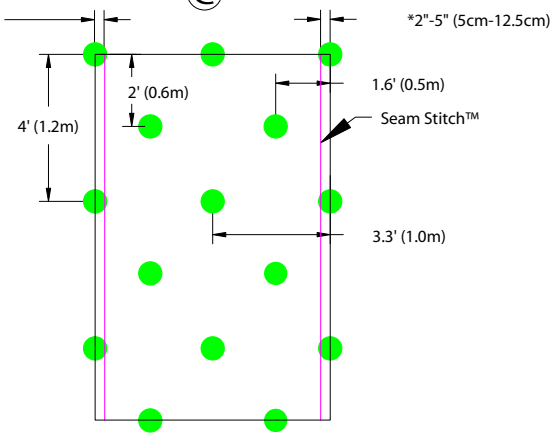
B



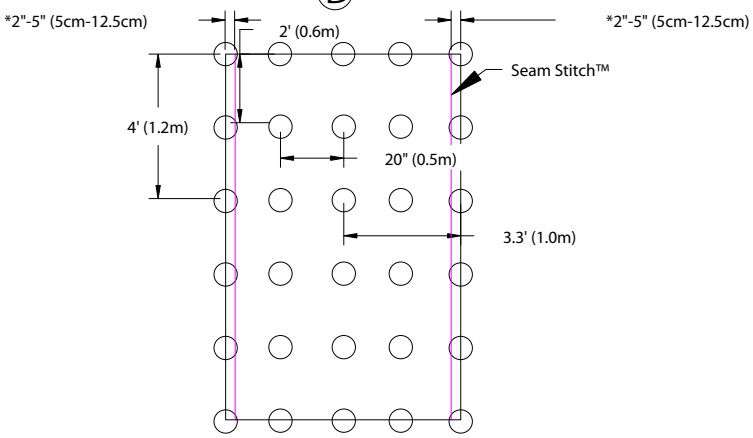
1.15 STAPLES PER SQ. YD.
(1.35 STAPLES PER SQ. M)
For blankets with the optional North American Green DOT System® place staples/stakes through each of the RED colored dots.

C



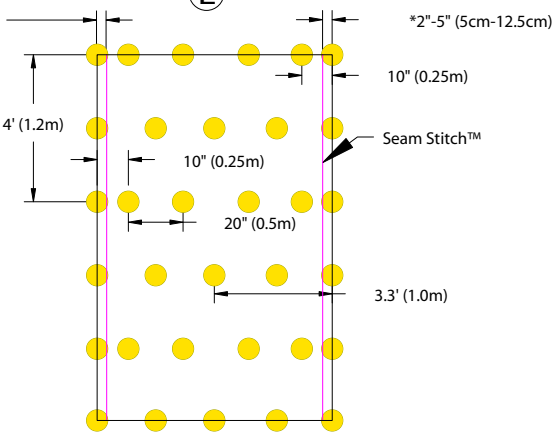
1.7 STAPLES PER SQ. YD.
(2.0 STAPLES PER SQ. M)
For blankets with the optional North American Green DOT System® place staples/stakes through each of the GREEN colored dots.

D



3.4 STAPLES PER SQ. YD.
(4.1 STAPLES PER SQ. M)
For blankets with the optional North American Green DOT System® place staples/stakes through each of the WHITE colored dots.

E



3.75 STAPLES PER SQ. YD.
(4.5 STAPLES PER SQ. M)
For blankets with the optional North American Green DOT System® place staples/stakes through each of the YELLOW colored dots.

*Location of Seam Stitch™ will vary depending on North American Green product type: