NOTE: REFER TO ATTACHMENT 1C: DMA EXHIBITS IN NEWLAND SIERRA TM-5597 STORM WATER QUALITY MANAGEMENT PLAN FOR 100 SCALE DEPICTION OF BROW DITCHES AND STORM DRAIN SYSTEM

AVOIDANCE/ BYPASS EXHIBIT 2 OF 4

NEWLAND SIERRA CCSYA

FUSCOE ENGINEERING
6390 Greenwich Dr., Suite 170, San Diego, California 92122
tel 858.554.1500 ∘ fax 858.597.0335 ∘ www.fuscoe.com

NOTE: REFER TO ATTACHMENT 1C: DMA EXHIBITS IN NEWLAND SIERRA TM-5597 STORM WATER QUALITY MANAGEMENT PLAN FOR 100 SCALE DEPICTION OF BROW DITCHES AND STORM DRAIN SYSTEM

AVOIDANCE/ BYPASS EXHIBIT 3 OF 4

NEWLAND SIERRA CCSYA

200' 0' 100' 200' 400'
SCALE: 1" = 200'

FUSCOE ENGINEERING
6390 Greenwich Dr., Suite 170, San Diego, California 92122
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NOTE: REFER TO ATTACHMENT 1C: DMA EXHIBITS IN NEWLAND SIERRA TM-5597 STORM WATER QUALITY MANAGEMENT PLAN FOR 100 SCALE DEPICTION OF BROW DITCHES AND STORM DRAIN SYSTEM

AVOIDANCE/ BYPASS EXHIBIT 4 OF 4

NEWLAND SIERRA CCSYA

FUSCOE ENGINEERING

Appendix 4: S_P Calculations.

SEDIMENT SUPPLY POTENTIAL S_P

Pre-Development RUSLE Sediment Production

GLU	Area (ft^2)	$A_{soil-loss}$ (ton/ac/yr)	Pre_{RUSLE} (ton/yr)
CB-Agri/Grass-3	4835	10.6	1.18
CB-Agri/Grass-4	5829	13.5	1.81
CB-Forest-2	134200	8.8	27.11
CB-Forest-3	1663	10.6	0.40
CB-Forest-4	7970	13.6	2.49
CB-Scrub/Shrub-4	8053083	9.8	1811.76
CSP-Agri/Grass-4	500	10.1	0.12
CSP-Forest-3	1538	8.5	0.30
CSP-Forest-4	10491	10.2	2.46
CSP-Scrub/Shrub-4	20670	9.3	4.41

TOTAL PRE: **1852.03**

TOTAL POST: **1610.70** [(1) + (2)]

SY_{RUSLE} : **0.870**

SY_{NHD}: Change in Bed Sediment Yield per NHD Channel Change

L_{PRE} : 6800 ft (approx).

L_{POST} : 1400 ft (approx).

SY_{NHD} : **0.206**

SEDIMENT SUPPLY POTENTIAL S_P

$S_P = 0.7 \cdot SY_{RUSLE} + 0.3 \cdot SY_{NHD} =$ **0.671**

Post-Development RUSLE Sediment Production

GLU	Area (ft^2)	$A_{soil-loss}$ (ton/ac/yr)	$Post_{RUSLE}$ (ton/yr)
CB-Agri/Grass-3	4835	10.6	1.18
CB-Agri/Grass-4	5829	13.5	1.81
CB-Forest-2	31701	8.8	6.40
CB-Scrub/Shrub-4	6223575	9.8	1400.16

(1) TOTAL: 1409.55

Post-Development RUSLE Cut and Fill Slopes

GLU	Area (ft^2)	$A_{soil-loss}$ (1) (ton/ac/yr)	$Post_{RUSLE}$ (ton/yr)
CB- Cut slope (P=0.5)	988859	6.775	153.80
CB- Fill slope (P=0.25)	586967	3.388	45.65
CSP- Cut slope (P=0.5)	0	5.075	0.00
CSP- Fill slope (P=0.25)	29202	2.538	1.70

(1): A is assumed equal to average value of Agri/grass & Forest as it consists of landscape. Also, A includes Practice factor (0.5 for Cut, 0.25 for Fill).

Example: CB-Fill: $A = (13.5 + 13.6)/2 \cdot 0.25 = 3.388$

(2) TOTAL: 201.15

Appendix 5: E_P Calculations. Summary of Results.

Work Calculations, Pre-Development Conditions

Channel Slope:	0.0202		Channel Type:	Trapezoidal	
Channel n :	0.035		z:	2.125	: 1
Low flow Threshold:	81.455	cfs	Bottom width:	3	ft
Type of flow:	50% of Q_2		τ_c :	1.377	lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.
# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

Bin	*Date*	*Hour*	Q_{pre} (cfs)	*h (ft)*	*A (ft^2)*	R (ft)	V (ft/s)	τ (lb/ft^2)	W_{PRE}
1	*2/1/1993*	*17:00:00*	445.510	*3.959*	*45.17*	2.092	9.86	2.637	13.949
2	*2/10/1963*	*7:00:00*	335.893	*3.501*	*36.56*	1.880	9.19	2.370	9.087
3	*2/4/1994*	*9:00:00*	300.035	*3.330*	*33.56*	1.800	8.94	2.269	7.533
4	*3/4/1978*	*15:00:00*	283.916	*3.250*	*32.19*	1.763	8.82	2.222	6.848
5	*10/20/2004*	*11:00:00*	277.785	*3.219*	*31.67*	1.748	8.77	2.203	6.590
6	*1/4/1995*	*21:00:00*	273.868	*3.199*	*31.34*	1.739	8.74	2.192	6.426
7	*12/25/1983*	*11:00:00*	253.301	*3.091*	*29.57*	1.688	8.57	2.128	5.574
8	*2/14/1998*	*17:00:00*	251.099	*3.079*	*29.38*	1.683	8.55	2.121	5.484
9	*1/29/1980*	*5:00:00*	250.243	*3.074*	*29.31*	1.680	8.54	2.118	5.449
10	*1/11/1980*	*6:00:00*	238.037	*3.007*	*28.24*	1.649	8.43	2.079	4.955
11	*2/15/1986*	*2:00:00*	237.449	*3.004*	*28.19*	1.648	8.42	2.077	4.931
12	*8/26/2007*	*9:00:00*	232.347	*2.976*	*27.74*	1.634	8.38	2.060	4.726
13	*2/8/1993*	*3:00:00*	218.687	*2.897*	*26.53*	1.597	8.24	2.013	4.186
14	*8/26/2007*	*8:00:00*	217.507	*2.890*	*26.42*	1.594	8.23	2.009	4.139
15	*12/6/1966*	*20:00:00*	211.457	*2.854*	*25.88*	1.577	8.17	1.988	3.904
16	*1/9/2005*	*18:00:00*	211.216	*2.853*	*25.86*	1.576	8.17	1.987	3.894
17	*12/5/1966*	*8:00:00*	209.095	*2.840*	*25.66*	1.570	8.15	1.980	3.812
18	*1/16/1978*	*22:00:00*	206.460	*2.824*	*25.42*	1.563	8.12	1.970	3.710
19	*1/29/1980*	*4:00:00*	204.820	*2.814*	*25.27*	1.558	8.10	1.964	3.647
20	*12/5/1966*	*7:00:00*	204.472	*2.812*	*25.24*	1.557	8.10	1.963	3.634
21	*3/17/1982*	*18:00:00*	198.942	*2.778*	*24.74*	1.541	8.04	1.943	3.423
22	*1/11/2005*	*3:00:00*	198.142	*2.773*	*24.66*	1.539	8.03	1.940	3.392
23	*1/4/1995*	*20:00:00*	194.882	*2.753*	*24.36*	1.529	8.00	1.928	3.269
24	*11/9/2002*	*17:00:00*	193.440	*2.744*	*24.23*	1.525	7.98	1.922	3.215
25	*11/30/1982*	*13:00:00*	190.232	*2.723*	*23.93*	1.515	7.95	1.910	3.094
26	*9/10/1976*	*11:00:00*	182.894	*2.676*	*23.24*	1.493	7.87	1.882	2.822
27	*1/23/1969*	*12:00:00*	179.573	*2.654*	*22.92*	1.482	7.83	1.869	2.700
28	*2/14/1980*	*8:00:00*	179.519	*2.653*	*22.92*	1.482	7.83	1.868	2.698
29	*1/23/1969*	*11:00:00*	175.954	*2.629*	*22.58*	1.471	7.79	1.854	2.569
30	*2/15/1986*	*3:00:00*	173.519	*2.613*	*22.35*	1.463	7.76	1.844	2.481

Work Calculations, Post-Development Conditions

Channel Slope:	0.0202		Channel Type:	Trapezoidal	
Channel n :	0.035		z:	2.125	: 1
Low flow Threshold:	81.419	cfs	Bottom width:	3	ft
Type of flow:	50% of Q_2		τ_c :	1.377	lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.
# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

Bin	*Date*	*Hour*	Q_{post} (cfs)	*h (ft)*	*A (ft^2)*	R (ft)	V (ft/s)	τ (lb/ft^2)	W_{POST}
1	*2/1/1993*	*17:00:00*	386.760	*3.728*	*40.72*	1.985	9.50	2.502	11.341
2	*2/10/1963*	*7:00:00*	286.668	*3.264*	*32.43*	1.769	8.84	2.230	6.964
3	*2/4/1994*	*9:00:00*	251.791	*3.083*	*29.44*	1.684	8.55	2.123	5.512
4	*1/4/1995*	*21:00:00*	251.142	*3.079*	*29.38*	1.683	8.55	2.121	5.486
5	*3/4/1978*	*15:00:00*	249.746	*3.072*	*29.26*	1.679	8.53	2.117	5.429
6	*12/25/1983*	*11:00:00*	232.049	*2.974*	*27.72*	1.633	8.37	2.059	4.714
7	*1/29/1980*	*5:00:00*	231.891	*2.973*	*27.70*	1.633	8.37	2.058	4.708
8	*10/20/2004*	*11:00:00*	229.392	*2.959*	*27.48*	1.626	8.35	2.050	4.609
9	*8/26/2007*	*9:00:00*	220.544	*2.908*	*26.69*	1.602	8.26	2.020	4.258
10	*2/14/1998*	*17:00:00*	217.055	*2.888*	*26.38*	1.593	8.23	2.008	4.122
11	*1/11/1980*	*6:00:00*	209.498	*2.843*	*25.70*	1.572	8.15	1.981	3.828
12	*8/26/2007*	*8:00:00*	206.327	*2.823*	*25.41*	1.563	8.12	1.970	3.705
13	*12/5/1966*	*8:00:00*	200.576	*2.788*	*24.89*	1.546	8.06	1.949	3.485
14	*2/8/1993*	*3:00:00*	199.497	*2.782*	*24.79*	1.543	8.05	1.945	3.444
15	*2/15/1986*	*2:00:00*	197.724	*2.771*	*24.62*	1.538	8.03	1.938	3.377
16	*12/6/1966*	*20:00:00*	195.515	*2.757*	*24.42*	1.531	8.01	1.930	3.293
17	*12/5/1966*	*7:00:00*	191.767	*2.733*	*24.07*	1.520	7.97	1.916	3.152
18	*1/29/1980*	*4:00:00*	190.164	*2.723*	*23.92*	1.515	7.95	1.910	3.092
19	*1/16/1978*	*22:00:00*	188.022	*2.709*	*23.72*	1.509	7.93	1.902	3.012
20	*1/4/1995*	*20:00:00*	180.485	*2.660*	*23.01*	1.485	7.84	1.872	2.734
21	*12/5/1966*	*10:00:00*	177.491	*2.640*	*22.73*	1.476	7.81	1.860	2.625
22	*11/30/1982*	*13:00:00*	176.999	*2.636*	*22.68*	1.474	7.80	1.858	2.607
23	*1/11/2005*	*3:00:00*	176.512	*2.633*	*22.63*	1.473	7.80	1.856	2.589
24	*12/5/1966*	*9:00:00*	176.435	*2.633*	*22.63*	1.472	7.80	1.856	2.586
25	*2/15/1986*	*5:00:00*	167.848	*2.574*	*21.80*	1.445	7.70	1.821	2.278
26	*1/23/1969*	*12:00:00*	166.642	*2.565*	*21.68*	1.441	7.69	1.816	2.236
27	*2/15/1986*	*3:00:00*	162.318	*2.535*	*21.26*	1.426	7.63	1.798	2.084
28	*1/23/1969*	*11:00:00*	160.770	*2.524*	*21.11*	1.421	7.62	1.791	2.030
29	*3/17/1982*	*18:00:00*	157.588	*2.501*	*20.80*	1.410	7.58	1.777	1.921
30	*3/1/1983*	*17:00:00*	155.908	*2.489*	*20.63*	1.404	7.56	1.770	1.863

Work Calculations, Pre-Development Conditions

Channel Slope:	0.0202	Channel Type:	Trapezoidal	
Channel n :	0.035	z:	2.125	: 1
Low flow Threshold:	81.455 cfs	Bottom width:	3	ft
Type of flow:	50% of Q_2	τ_c :	1.377	lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.
# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

31	2/13/1992	6:00:00	172.873	2.608	22.28	1.461	7.76	1.842	2.458
32	12/5/1966	9:00:00	172.400	2.605	22.24	1.460	7.75	1.840	2.441
33	2/3/1998	17:00:00	172.265	2.604	22.23	1.459	7.75	1.839	2.436
34	3/1/1983	17:00:00	171.300	2.598	22.13	1.456	7.74	1.835	2.401
35	2/15/1986	5:00:00	170.852	2.595	22.09	1.454	7.73	1.833	2.385
36	12/5/1966	10:00:00	170.551	2.593	22.06	1.454	7.73	1.832	2.375
37	2/8/1993	2:00:00	168.742	2.580	21.89	1.448	7.71	1.825	2.310
38	2/16/1980	18:00:00	168.476	2.578	21.86	1.447	7.71	1.824	2.301
39	12/6/1966	19:00:00	162.837	2.539	21.31	1.428	7.64	1.800	2.102
40	2/27/1983	17:00:00	162.655	2.537	21.29	1.427	7.64	1.799	2.096
41	3/27/1991	3:00:00	162.418	2.536	21.27	1.427	7.64	1.798	2.088
42	1/3/1977	5:00:00	160.328	2.521	21.07	1.419	7.61	1.789	2.015
43	11/8/2002	17:00:00	159.242	2.513	20.96	1.416	7.60	1.785	1.978
44	1/7/1993	3:00:00	157.731	2.502	20.81	1.411	7.58	1.778	1.926
45	12/19/1984	19:00:00	156.661	2.494	20.70	1.407	7.57	1.773	1.889
46	1/9/1998	17:00:00	154.694	2.480	20.51	1.400	7.54	1.765	1.822
47	3/2/1980	22:00:00	153.059	2.468	20.35	1.394	7.52	1.758	1.767
48	12/2/1961	9:00:00	151.512	2.456	20.19	1.389	7.50	1.751	1.715
49	11/21/1963	5:00:00	151.305	2.455	20.17	1.388	7.50	1.750	1.708
50	3/1/1983	16:00:00	150.306	2.447	20.07	1.385	7.49	1.745	1.674
51	3/8/1975	10:00:00	150.024	2.445	20.04	1.384	7.49	1.744	1.665
52	11/22/1965	23:00:00	148.341	2.433	19.87	1.378	7.46	1.736	1.609
53	1/4/1995	19:00:00	146.896	2.422	19.73	1.372	7.45	1.730	1.561
54	12/29/2004	2:00:00	146.744	2.421	19.71	1.372	7.44	1.729	1.556
55	12/29/2004	1:00:00	146.574	2.419	19.70	1.371	7.44	1.728	1.551
56	1/18/1952	5:00:00	143.799	2.398	19.42	1.361	7.41	1.716	1.460
57	1/23/1969	13:00:00	143.193	2.393	19.35	1.359	7.40	1.713	1.441
58	3/1/1991	0:00:00	143.122	2.393	19.35	1.359	7.40	1.713	1.439
59	2/12/1992	18:00:00	142.781	2.390	19.31	1.357	7.39	1.711	1.428
60	3/5/1995	20:00:00	141.837	2.383	19.22	1.354	7.38	1.707	1.397
61	1/11/1980	7:00:00	141.241	2.378	19.16	1.352	7.37	1.704	1.378
62	2/6/1969	10:00:00	139.929	2.368	19.02	1.347	7.36	1.698	1.336

Work Calculations, Post-Development Conditions

Channel Slope:	0.0202	Channel Type:	Trapezoidal	
Channel n :	0.035	z:	2.125	: 1
Low flow Threshold:	81.419 cfs	Bottom width:	3	ft
Type of flow:	50% of Q_2	τ_c :	1.377	lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.
# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

31	2/27/1983	17:00:00	152.963	2.467	20.34	1.394	7.52	1.757	1.763
32	1/9/2005	18:00:00	151.179	2.454	20.16	1.388	7.50	1.749	1.704
33	11/9/2002	17:00:00	150.929	2.452	20.13	1.387	7.50	1.748	1.695
34	12/6/1966	19:00:00	146.806	2.421	19.72	1.372	7.44	1.729	1.558
35	3/27/1991	3:00:00	145.537	2.411	19.59	1.367	7.43	1.724	1.517
36	2/14/1980	8:00:00	144.018	2.400	19.44	1.362	7.41	1.717	1.468
37	3/5/1995	20:00:00	142.837	2.391	19.32	1.358	7.39	1.711	1.429
38	11/22/1965	23:00:00	142.818	2.391	19.32	1.358	7.39	1.711	1.429
39	3/2/1980	22:00:00	142.542	2.388	19.29	1.357	7.39	1.710	1.420
40	3/5/1995	21:00:00	140.975	2.376	19.13	1.351	7.37	1.703	1.370
41	9/10/1976	11:00:00	140.259	2.371	19.06	1.348	7.36	1.699	1.347
42	12/29/2004	2:00:00	138.815	2.359	18.91	1.343	7.34	1.692	1.301
43	1/23/1969	13:00:00	138.001	2.353	18.82	1.340	7.33	1.689	1.275
44	2/6/1969	10:00:00	137.743	2.351	18.80	1.339	7.33	1.687	1.267
45	1/4/1995	19:00:00	137.044	2.345	18.73	1.336	7.32	1.684	1.245
46	2/8/1993	2:00:00	135.328	2.332	18.55	1.329	7.30	1.676	1.192
47	1/11/1980	7:00:00	135.055	2.330	18.52	1.328	7.29	1.674	1.184
48	1/18/1952	5:00:00	131.218	2.299	18.12	1.314	7.24	1.656	1.067
49	2/3/1998	17:00:00	130.422	2.292	18.04	1.311	7.23	1.652	1.043
50	1/7/1993	3:00:00	129.964	2.288	17.99	1.309	7.22	1.650	1.029
51	3/5/1995	22:00:00	129.856	2.288	17.98	1.308	7.22	1.649	1.026
52	12/30/1951	7:00:00	129.236	2.282	17.92	1.306	7.21	1.646	1.007
53	3/21/1979	8:00:00	128.863	2.279	17.88	1.304	7.21	1.644	0.996
54	3/5/1995	16:00:00	128.707	2.278	17.86	1.304	7.21	1.643	0.992
55	12/2/1961	9:00:00	128.570	2.277	17.85	1.303	7.20	1.643	0.987
56	11/21/1963	5:00:00	128.276	2.275	17.82	1.302	7.20	1.641	0.979
57	1/3/1977	5:00:00	127.883	2.271	17.78	1.301	7.19	1.639	0.967
58	2/27/1983	18:00:00	127.833	2.271	17.77	1.300	7.19	1.639	0.966
59	2/20/1980	22:00:00	127.135	2.265	17.70	1.298	7.18	1.636	0.945
60	12/5/1966	6:00:00	125.300	2.250	17.51	1.290	7.16	1.626	0.892
61	2/18/1980	7:00:00	124.952	2.247	17.47	1.289	7.15	1.625	0.882
62	2/16/1980	19:00:00	124.677	2.245	17.44	1.288	7.15	1.623	0.874

Work Calculations, Pre-Development Conditions

Channel Slope:	0.0202	Channel Type:	Trapezoidal	
Channel n :	0.035	z:	2.125	: 1
Low flow Threshold:	81.455 cfs	Bottom width:	3	ft
Type of flow:	50% of Q_2	τ_c :	1.377	lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.
# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

63	*3/21/1979*	*8:00:00*	137.382	*2.348*	*18.76*	1.337	7.32	1.686	1.256
64	*12/9/1982*	*17:00:00*	136.331	*2.340*	*18.65*	1.333	7.31	1.681	1.223
65	*2/16/1980*	*19:00:00*	136.189	*2.339*	*18.64*	1.333	7.31	1.680	1.219
66	*3/5/1995*	*21:00:00*	135.414	*2.332*	*18.56*	1.330	7.30	1.676	1.195
67	*1/14/1993*	*4:00:00*	134.396	*2.324*	*18.45*	1.326	7.28	1.671	1.163
68	*12/30/1951*	*7:00:00*	134.282	*2.323*	*18.44*	1.325	7.28	1.671	1.160
69	*4/3/1958*	*11:00:00*	133.703	*2.319*	*18.38*	1.323	7.27	1.668	1.142
70	*2/20/1980*	*22:00:00*	132.626	*2.310*	*18.27*	1.319	7.26	1.663	1.109
71	*2/27/1983*	*18:00:00*	131.588	*2.302*	*18.16*	1.315	7.24	1.658	1.078
72	*3/21/1979*	*7:00:00*	131.431	*2.300*	*18.15*	1.314	7.24	1.657	1.073
73	*3/16/1958*	*8:00:00*	131.218	*2.299*	*18.12*	1.314	7.24	1.656	1.067
74	*1/18/1952*	*4:00:00*	131.122	*2.298*	*18.11*	1.313	7.24	1.655	1.064
75	*9/10/1976*	*12:00:00*	130.428	*2.292*	*18.04*	1.311	7.23	1.652	1.043
76	*12/5/1966*	*6:00:00*	129.799	*2.287*	*17.98*	1.308	7.22	1.649	1.024
77	*2/18/1980*	*7:00:00*	129.553	*2.285*	*17.95*	1.307	7.22	1.648	1.017
78	*3/5/1995*	*16:00:00*	129.458	*2.284*	*17.94*	1.307	7.22	1.647	1.014
79	*12/5/1966*	*5:00:00*	128.803	*2.279*	*17.87*	1.304	7.21	1.644	0.994
80	*11/22/1965*	*18:00:00*	128.723	*2.278*	*17.86*	1.304	7.21	1.644	0.992
81	*2/18/1980*	*5:00:00*	128.177	*2.274*	*17.81*	1.302	7.20	1.641	0.976
82	*2/11/1959*	*12:00:00*	127.128	*2.265*	*17.70*	1.298	7.18	1.636	0.945
83	*12/22/1982*	*19:00:00*	125.531	*2.252*	*17.53*	1.291	7.16	1.628	0.899
84	*1/23/1969*	*10:00:00*	124.714	*2.245*	*17.45*	1.288	7.15	1.623	0.875
85	*1/15/1978*	*0:00:00*	123.638	*2.236*	*17.33*	1.284	7.13	1.618	0.844
86	*11/30/2007*	*22:00:00*	123.483	*2.235*	*17.32*	1.283	7.13	1.617	0.840
87	*11/16/1972*	*15:00:00*	122.652	*2.228*	*17.23*	1.280	7.12	1.613	0.816
88	*2/20/1980*	*18:00:00*	122.574	*2.227*	*17.22*	1.279	7.12	1.613	0.814
89	*2/10/1963*	*14:00:00*	121.562	*2.218*	*17.11*	1.275	7.10	1.607	0.786
90	*11/25/1985*	*4:00:00*	121.493	*2.218*	*17.11*	1.275	7.10	1.607	0.784
91	*12/5/1966*	*4:00:00*	121.202	*2.215*	*17.07*	1.274	7.10	1.605	0.776
92	*4/14/2003*	*17:00:00*	121.109	*2.215*	*17.07*	1.273	7.10	1.605	0.773
93	*3/5/1995*	*22:00:00*	120.636	*2.211*	*17.01*	1.271	7.09	1.603	0.760
94	*2/11/1962*	*23:00:00*	119.781	*2.203*	*16.92*	1.268	7.08	1.598	0.737

Work Calculations, Post-Development Conditions

Channel Slope:	0.0202	Channel Type:	Trapezoidal	
Channel n :	0.035	z:	2.125	: 1
Low flow Threshold:	81.419 cfs	Bottom width:	3	ft
Type of flow:	50% of Q_2	τ_c :	1.377	lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.
# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

63	*2/13/1992*	*6:00:00*	124.341	*2.242*	*17.41*	1.286	7.14	1.622	0.864
64	*9/10/1976*	*12:00:00*	123.475	*2.235*	*17.31*	1.283	7.13	1.617	0.840
65	*3/8/1975*	*10:00:00*	123.272	*2.233*	*17.29*	1.282	7.13	1.616	0.834
66	*3/16/1958*	*8:00:00*	122.265	*2.224*	*17.19*	1.278	7.11	1.611	0.806
67	*12/5/1966*	*5:00:00*	122.158	*2.223*	*17.18*	1.278	7.11	1.610	0.803
68	*2/16/1980*	*18:00:00*	121.479	*2.218*	*17.10*	1.275	7.10	1.607	0.784
69	*11/8/2002*	*17:00:00*	120.430	*2.209*	*16.99*	1.271	7.09	1.602	0.754
70	*3/5/1995*	*17:00:00*	120.314	*2.208*	*16.98*	1.270	7.09	1.601	0.751
71	*2/10/1963*	*14:00:00*	119.974	*2.205*	*16.94*	1.269	7.08	1.599	0.742
72	*1/9/1998*	*17:00:00*	117.357	*2.182*	*16.67*	1.258	7.04	1.585	0.671
73	*11/22/1965*	*22:00:00*	117.084	*2.180*	*16.64*	1.257	7.04	1.584	0.664
74	*11/22/1965*	*18:00:00*	116.197	*2.172*	*16.54*	1.253	7.02	1.579	0.640
75	*11/16/1972*	*15:00:00*	115.704	*2.168*	*16.49*	1.251	7.02	1.577	0.627
76	*12/5/1966*	*11:00:00*	115.517	*2.166*	*16.47*	1.250	7.01	1.576	0.622
77	*12/19/1984*	*19:00:00*	115.441	*2.166*	*16.46*	1.250	7.01	1.575	0.620
78	*2/18/1980*	*5:00:00*	115.349	*2.165*	*16.45*	1.249	7.01	1.575	0.618
79	*2/15/1986*	*4:00:00*	115.341	*2.165*	*16.45*	1.249	7.01	1.575	0.617
80	*3/1/1983*	*16:00:00*	113.397	*2.148*	*16.24*	1.241	6.98	1.564	0.567
81	*3/21/1979*	*7:00:00*	113.262	*2.146*	*16.23*	1.241	6.98	1.564	0.564
82	*1/9/2005*	*20:00:00*	113.010	*2.144*	*16.20*	1.240	6.97	1.562	0.557
83	*1/29/1980*	*6:00:00*	112.591	*2.140*	*16.16*	1.238	6.97	1.560	0.547
84	*3/5/1995*	*12:00:00*	112.464	*2.139*	*16.14*	1.237	6.97	1.559	0.543
85	*12/29/2004*	*1:00:00*	109.903	*2.116*	*15.87*	1.226	6.93	1.546	0.480
86	*3/1/1991*	*0:00:00*	109.235	*2.110*	*15.80*	1.223	6.92	1.542	0.464
87	*2/12/1992*	*18:00:00*	107.681	*2.096*	*15.63*	1.216	6.89	1.533	0.426
88	*12/5/1966*	*12:00:00*	107.516	*2.095*	*15.61*	1.216	6.89	1.532	0.423
89	*11/29/1985*	*14:00:00*	107.264	*2.093*	*15.58*	1.215	6.88	1.531	0.417
90	*1/23/1969*	*14:00:00*	105.957	*2.081*	*15.44*	1.209	6.86	1.524	0.386
91	*1/5/1992*	*16:00:00*	105.788	*2.079*	*15.42*	1.208	6.86	1.523	0.382
92	*1/16/1978*	*23:00:00*	105.556	*2.077*	*15.40*	1.207	6.86	1.522	0.377
93	*12/9/1982*	*17:00:00*	105.435	*2.076*	*15.38*	1.207	6.85	1.521	0.374
94	*12/5/1966*	*13:00:00*	105.007	*2.072*	*15.34*	1.205	6.85	1.518	0.365

Work Calculations, Pre-Development Conditions

Channel Slope:	0.0202		Channel Type:	Trapezoidal	
Channel n :	0.035		z:	2.125	: 1
Low flow Threshold:	81.455	cfs	Bottom width:	3	ft
Type of flow:	50% of Q_2		τ_c :	1.377	lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.
# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

95	*2/26/2004*	*8:00:00*	119.415	*2.200*	*16.89*	1.266	7.07	1.596	0.727
96	*11/22/1965*	*22:00:00*	119.294	*2.199*	*16.87*	1.266	7.07	1.596	0.723
97	*3/5/1995*	*17:00:00*	119.107	*2.197*	*16.85*	1.265	7.07	1.595	0.718
98	*1/9/2005*	*20:00:00*	117.977	*2.188*	*16.73*	1.260	7.05	1.589	0.687
99	*3/2/1983*	*17:00:00*	117.729	*2.186*	*16.71*	1.259	7.05	1.587	0.681
100	*11/29/1985*	*14:00:00*	116.942	*2.179*	*16.62*	1.256	7.04	1.583	0.660
101	*3/24/1983*	*3:00:00*	116.469	*2.175*	*16.57*	1.254	7.03	1.581	0.647
102	*1/5/1992*	*16:00:00*	116.370	*2.174*	*16.56*	1.254	7.03	1.580	0.645
103	*11/30/1982*	*10:00:00*	115.603	*2.167*	*16.48*	1.251	7.01	1.576	0.624
104	*2/19/1980*	*21:00:00*	115.449	*2.166*	*16.46*	1.250	7.01	1.575	0.620
105	*6/1/1996*	*8:00:00*	115.448	*2.166*	*16.46*	1.250	7.01	1.575	0.620
106	*2/15/1986*	*4:00:00*	115.303	*2.164*	*16.45*	1.249	7.01	1.575	0.616
107	*1/11/2005*	*2:00:00*	115.168	*2.163*	*16.43*	1.249	7.01	1.574	0.613
108	*10/18/2004*	*9:00:00*	114.624	*2.158*	*16.38*	1.246	7.00	1.571	0.599
109	*11/16/1972*	*13:00:00*	114.401	*2.156*	*16.35*	1.245	7.00	1.570	0.593
110	*11/11/1972*	*8:00:00*	113.524	*2.149*	*16.26*	1.242	6.98	1.565	0.570
111	*3/5/1995*	*12:00:00*	113.437	*2.148*	*16.25*	1.241	6.98	1.565	0.568
112	*10/27/2004*	*5:00:00*	113.428	*2.148*	*16.25*	1.241	6.98	1.565	0.568
113	*1/13/1997*	*5:00:00*	112.356	*2.138*	*16.13*	1.237	6.96	1.559	0.541
114	*3/15/1952*	*22:00:00*	112.195	*2.137*	*16.11*	1.236	6.96	1.558	0.537
115	*1/11/1980*	*0:00:00*	111.699	*2.133*	*16.06*	1.234	6.95	1.555	0.524
116	*12/17/1957*	*6:00:00*	111.527	*2.131*	*16.04*	1.233	6.95	1.554	0.520
117	*3/22/1958*	*5:00:00*	111.289	*2.129*	*16.02*	1.232	6.95	1.553	0.514
118	*12/25/1988*	*0:00:00*	110.986	*2.126*	*15.98*	1.231	6.94	1.551	0.506
119	*12/18/1967*	*16:00:00*	110.884	*2.125*	*15.97*	1.230	6.94	1.551	0.504
120	*12/2/1952*	*1:00:00*	110.804	*2.125*	*15.97*	1.230	6.94	1.550	0.502
121	*3/28/1998*	*17:00:00*	110.683	*2.123*	*15.95*	1.230	6.94	1.550	0.499
122	*1/4/1995*	*18:00:00*	109.743	*2.115*	*15.85*	1.225	6.92	1.545	0.476
123	*1/16/1973*	*22:00:00*	109.147	*2.110*	*15.79*	1.223	6.91	1.541	0.461
124	*1/18/1952*	*6:00:00*	109.092	*2.109*	*15.78*	1.223	6.91	1.541	0.460
125	*11/11/1985*	*10:00:00*	108.807	*2.107*	*15.75*	1.221	6.91	1.540	0.453
126	*1/26/1956*	*21:00:00*	107.833	*2.098*	*15.64*	1.217	6.89	1.534	0.430

Work Calculations, Post-Development Conditions

Channel Slope:	0.0202		Channel Type:	Trapezoidal	
Channel n :	0.035		z:	2.125	: 1
Low flow Threshold:	81.419	cfs	Bottom width:	3	ft
Type of flow:	50% of Q_2		τ_c :	1.377	lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.
# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

95	*1/18/1952*	*6:00:00*	105.005	*2.072*	*15.34*	1.205	6.85	1.518	0.365
96	*2/17/1994*	*13:00:00*	102.597	*2.050*	*15.08*	1.194	6.81	1.505	0.312
97	*2/28/1970*	*18:00:00*	102.365	*2.047*	*15.05*	1.193	6.80	1.504	0.307
98	*1/14/1993*	*4:00:00*	102.335	*2.047*	*15.05*	1.193	6.80	1.503	0.306
99	*12/25/1988*	*0:00:00*	101.862	*2.043*	*14.99*	1.191	6.79	1.501	0.296
100	*4/3/1958*	*11:00:00*	101.853	*2.043*	*14.99*	1.191	6.79	1.501	0.296
101	*1/15/1978*	*0:00:00*	101.833	*2.042*	*14.99*	1.190	6.79	1.501	0.295
102	*11/30/1982*	*10:00:00*	101.670	*2.041*	*14.97*	1.190	6.79	1.500	0.292
103	*11/22/1996*	*2:00:00*	101.556	*2.040*	*14.96*	1.189	6.79	1.499	0.289
104	*11/30/2007*	*22:00:00*	101.377	*2.038*	*14.94*	1.188	6.78	1.498	0.286
105	*3/15/1952*	*22:00:00*	101.296	*2.037*	*14.93*	1.188	6.78	1.497	0.284
106	*1/18/1952*	*4:00:00*	101.048	*2.035*	*14.91*	1.187	6.78	1.496	0.279
107	*12/4/1974*	*10:00:00*	100.920	*2.034*	*14.89*	1.186	6.78	1.495	0.276
108	*12/22/1982*	*19:00:00*	100.443	*2.029*	*14.84*	1.184	6.77	1.493	0.266
109	*1/23/1969*	*10:00:00*	100.388	*2.029*	*14.83*	1.184	6.77	1.492	0.265
110	*12/5/1966*	*4:00:00*	99.907	*2.024*	*14.78*	1.182	6.76	1.489	0.255
111	*12/30/1951*	*6:00:00*	99.450	*2.020*	*14.73*	1.180	6.75	1.487	0.246
112	*3/1/1983*	*18:00:00*	99.325	*2.019*	*14.72*	1.179	6.75	1.486	0.244
113	*12/5/1966*	*20:00:00*	99.286	*2.018*	*14.71*	1.179	6.75	1.486	0.243
114	*2/19/1993*	*19:00:00*	99.172	*2.017*	*14.70*	1.178	6.75	1.485	0.241
115	*11/25/1985*	*4:00:00*	99.146	*2.017*	*14.70*	1.178	6.75	1.485	0.240
116	*2/11/1959*	*12:00:00*	98.826	*2.014*	*14.66*	1.177	6.74	1.483	0.234
117	*3/1/1991*	*1:00:00*	98.601	*2.012*	*14.64*	1.176	6.74	1.482	0.229
118	*1/15/1978*	*3:00:00*	97.711	*2.003*	*14.54*	1.172	6.72	1.477	0.212
119	*1/20/1962*	*18:00:00*	97.318	*2.000*	*14.50*	1.170	6.71	1.474	0.205
120	*2/20/1980*	*18:00:00*	97.214	*1.999*	*14.48*	1.169	6.71	1.474	0.203
121	*3/5/1995*	*18:00:00*	97.121	*1.998*	*14.47*	1.169	6.71	1.473	0.201
122	*1/15/1978*	*1:00:00*	96.667	*1.993*	*14.42*	1.167	6.70	1.471	0.192
123	*2/26/2004*	*8:00:00*	96.649	*1.993*	*14.42*	1.167	6.70	1.471	0.192
124	*10/27/2004*	*5:00:00*	96.615	*1.993*	*14.42*	1.166	6.70	1.470	0.191
125	*12/5/1966*	*16:00:00*	96.388	*1.991*	*14.39*	1.165	6.70	1.469	0.187
126	*1/15/1978*	*2:00:00*	96.323	*1.990*	*14.39*	1.165	6.70	1.469	0.186

Work Calculations, Pre-Development Conditions

Channel Slope:	0.0202		Channel Type:	Trapezoidal	
Channel n :	0.035		z:	2.125	: 1
Low flow Threshold:	81.455	cfs	Bottom width:	3	ft
Type of flow:	50% of Q_2		τ_c :	1.377	lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.
# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

127	*1/16/1978*	*23:00:00*	107.735	*2.097*	*15.63*	1.217	6.89	1.534	0.428
128	*11/22/1996*	*2:00:00*	107.436	*2.094*	*15.60*	1.215	6.89	1.532	0.421
129	*2/1/1996*	*3:00:00*	107.164	*2.092*	*15.57*	1.214	6.88	1.530	0.414
130	*1/16/1952*	*15:00:00*	106.545	*2.086*	*15.50*	1.211	6.87	1.527	0.400
131	*2/19/1993*	*19:00:00*	106.467	*2.085*	*15.50*	1.211	6.87	1.527	0.398
132	*1/29/1980*	*6:00:00*	106.325	*2.084*	*15.48*	1.211	6.87	1.526	0.395
133	*1/23/1969*	*14:00:00*	104.894	*2.071*	*15.33*	1.204	6.84	1.518	0.362
134	*2/19/1980*	*7:00:00*	104.236	*2.065*	*15.25*	1.201	6.83	1.514	0.347
135	*2/15/1992*	*14:00:00*	104.214	*2.065*	*15.25*	1.201	6.83	1.514	0.347
136	*3/10/2006*	*17:00:00*	104.132	*2.064*	*15.24*	1.201	6.83	1.514	0.345
137	*2/17/1994*	*13:00:00*	103.023	*2.054*	*15.12*	1.196	6.81	1.507	0.321
138	*3/1/1991*	*1:00:00*	102.862	*2.052*	*15.10*	1.195	6.81	1.506	0.317
139	*1/10/1978*	*7:00:00*	102.569	*2.049*	*15.07*	1.194	6.81	1.505	0.311
140	*2/27/1983*	*16:00:00*	102.231	*2.046*	*15.04*	1.192	6.80	1.503	0.304
141	*2/14/1995*	*10:00:00*	101.393	*2.038*	*14.94*	1.188	6.79	1.498	0.286
142	*1/12/1960*	*4:00:00*	101.349	*2.038*	*14.94*	1.188	6.78	1.498	0.285
143	*3/13/1996*	*7:00:00*	101.299	*2.037*	*14.93*	1.188	6.78	1.497	0.284
144	*2/11/1959*	*13:00:00*	101.030	*2.035*	*14.90*	1.187	6.78	1.496	0.278
145	*2/15/1992*	*15:00:00*	100.931	*2.034*	*14.89*	1.186	6.78	1.495	0.276
146	*3/1/1983*	*18:00:00*	100.855	*2.033*	*14.88*	1.186	6.78	1.495	0.275
147	*4/1/1982*	*12:00:00*	100.677	*2.032*	*14.87*	1.185	6.77	1.494	0.271
148	*2/23/1998*	*17:00:00*	100.583	*2.031*	*14.85*	1.185	6.77	1.493	0.269
149	*12/30/1951*	*6:00:00*	100.105	*2.026*	*14.80*	1.183	6.76	1.491	0.259
150	*11/14/1972*	*14:00:00*	100.000	*2.025*	*14.79*	1.182	6.76	1.490	0.257
151	*2/19/1980*	*22:00:00*	99.536	*2.021*	*14.74*	1.180	6.75	1.487	0.248
152	*12/5/1966*	*11:00:00*	98.900	*2.015*	*14.67*	1.177	6.74	1.484	0.235
153	*12/27/1984*	*3:00:00*	98.825	*2.014*	*14.66*	1.177	6.74	1.483	0.234
154	*1/15/1978*	*1:00:00*	98.791	*2.014*	*14.66*	1.177	6.74	1.483	0.233
155	*12/4/1974*	*10:00:00*	98.651	*2.012*	*14.64*	1.176	6.74	1.482	0.230
156	*3/4/1978*	*20:00:00*	98.167	*2.008*	*14.59*	1.174	6.73	1.479	0.221
157	*1/13/1957*	*7:00:00*	97.193	*1.998*	*14.48*	1.169	6.71	1.474	0.202
158	*12/18/1967*	*17:00:00*	96.982	*1.996*	*14.46*	1.168	6.71	1.472	0.198

Work Calculations, Post-Development Conditions

Channel Slope:	0.0202		Channel Type:	Trapezoidal	
Channel n :	0.035		z:	2.125	: 1
Low flow Threshold:	81.419	cfs	Bottom width:	3	ft
Type of flow:	50% of Q_2		τ_c :	1.377	lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.
# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

127	*2/15/1992*	*15:00:00*	96.125	*1.988*	*14.36*	1.164	6.69	1.467	0.182
128	*1/26/1956*	*21:00:00*	95.894	*1.986*	*14.34*	1.163	6.69	1.466	0.178
129	*1/11/1980*	*9:00:00*	95.395	*1.981*	*14.28*	1.161	6.68	1.463	0.169
130	*11/22/1996*	*3:00:00*	95.248	*1.980*	*14.27*	1.160	6.68	1.462	0.167
131	*1/9/2005*	*21:00:00*	95.239	*1.980*	*14.27*	1.160	6.68	1.462	0.166
132	*2/11/1959*	*13:00:00*	94.649	*1.974*	*14.20*	1.157	6.66	1.459	0.156
133	*3/2/1983*	*17:00:00*	94.605	*1.974*	*14.20*	1.157	6.66	1.458	0.155
134	*3/27/1991*	*4:00:00*	94.104	*1.969*	*14.14*	1.155	6.65	1.455	0.147
135	*3/22/1958*	*5:00:00*	93.937	*1.967*	*14.12*	1.154	6.65	1.455	0.144
136	*4/14/2003*	*17:00:00*	93.662	*1.964*	*14.09*	1.153	6.65	1.453	0.139
137	*1/29/1980*	*3:00:00*	93.566	*1.963*	*14.08*	1.152	6.64	1.452	0.138
138	*12/18/1967*	*17:00:00*	92.677	*1.955*	*13.98*	1.148	6.63	1.447	0.123
139	*1/16/1973*	*22:00:00*	92.558	*1.954*	*13.97*	1.147	6.63	1.446	0.121
140	*3/5/1995*	*13:00:00*	92.104	*1.949*	*13.92*	1.145	6.62	1.444	0.114
141	*3/24/1983*	*3:00:00*	92.090	*1.949*	*13.92*	1.145	6.62	1.443	0.114
142	*2/19/1980*	*22:00:00*	91.812	*1.946*	*13.89*	1.144	6.61	1.442	0.109
143	*1/20/1962*	*19:00:00*	91.659	*1.945*	*13.87*	1.143	6.61	1.441	0.107
144	*11/16/1972*	*13:00:00*	91.500	*1.943*	*13.85*	1.142	6.60	1.440	0.104
145	*1/13/1997*	*5:00:00*	91.485	*1.943*	*13.85*	1.142	6.60	1.440	0.104
146	*2/19/1980*	*21:00:00*	91.396	*1.942*	*13.84*	1.142	6.60	1.439	0.103
147	*2/1/1996*	*3:00:00*	91.284	*1.941*	*13.83*	1.141	6.60	1.439	0.101
148	*3/5/1995*	*15:00:00*	91.072	*1.939*	*13.81*	1.140	6.60	1.437	0.098
149	*2/2/1960*	*1:00:00*	90.843	*1.937*	*13.78*	1.139	6.59	1.436	0.095
150	*3/5/1995*	*14:00:00*	90.635	*1.935*	*13.76*	1.138	6.59	1.435	0.091
151	*2/11/1962*	*23:00:00*	90.406	*1.932*	*13.73*	1.137	6.58	1.433	0.088
152	*11/11/1972*	*8:00:00*	90.127	*1.930*	*13.70*	1.136	6.58	1.432	0.084
153	*11/11/1985*	*10:00:00*	89.944	*1.928*	*13.68*	1.135	6.57	1.430	0.081
154	*1/4/1995*	*18:00:00*	89.915	*1.927*	*13.68*	1.135	6.57	1.430	0.081
155	*3/8/1975*	*11:00:00*	89.895	*1.927*	*13.67*	1.135	6.57	1.430	0.081
156	*2/27/1983*	*16:00:00*	89.138	*1.920*	*13.59*	1.131	6.56	1.426	0.070
157	*1/11/1980*	*0:00:00*	88.788	*1.916*	*13.55*	1.129	6.55	1.423	0.066
158	*1/13/1957*	*7:00:00*	88.664	*1.915*	*13.54*	1.129	6.55	1.423	0.064

Work Calculations, Pre-Development Conditions

Channel Slope:	0.0202		Channel Type:	Trapezoidal	
Channel n :	0.035		z:	2.125	: 1
Low flow Threshold:	81.455	cfs	Bottom width:	3	ft
Type of flow:	50% of Q_2		τ_c :	1.377	lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.
# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

159	*1/15/1978*	*3:00:00*	96.894	*1.996*	*14.45*	1.168	6.71	1.472	0.197
160	*1/15/1978*	*2:00:00*	96.873	*1.995*	*14.45*	1.168	6.71	1.472	0.196
161	*3/27/1991*	*4:00:00*	96.672	*1.993*	*14.43*	1.167	6.70	1.471	0.192
162	*10/29/1974*	*5:00:00*	96.602	*1.993*	*14.42*	1.166	6.70	1.470	0.191
163	*1/9/2005*	*21:00:00*	95.769	*1.985*	*14.33*	1.163	6.69	1.465	0.176
164	*12/29/1991*	*16:00:00*	95.723	*1.984*	*14.32*	1.162	6.68	1.465	0.175
165	*3/1/1970*	*2:00:00*	95.573	*1.983*	*14.30*	1.162	6.68	1.464	0.172
166	*12/4/1987*	*23:00:00*	95.296	*1.980*	*14.27*	1.160	6.68	1.463	0.167
167	*11/15/1952*	*14:00:00*	95.187	*1.979*	*14.26*	1.160	6.67	1.462	0.165
168	*3/19/1981*	*21:00:00*	94.906	*1.976*	*14.23*	1.158	6.67	1.460	0.161
169	*2/28/1970*	*18:00:00*	94.684	*1.974*	*14.21*	1.157	6.67	1.459	0.157
170	*2/4/1958*	*20:00:00*	94.227	*1.970*	*14.16*	1.155	6.66	1.456	0.149
171	*11/20/1983*	*11:00:00*	94.026	*1.968*	*14.13*	1.154	6.65	1.455	0.145
172	*12/29/1992*	*21:00:00*	93.989	*1.968*	*14.13*	1.154	6.65	1.455	0.145
173	*11/29/1970*	*16:00:00*	93.872	*1.966*	*14.12*	1.154	6.65	1.454	0.143
174	*2/3/1958*	*21:00:00*	93.854	*1.966*	*14.11*	1.154	6.65	1.454	0.142
175	*3/20/1991*	*8:00:00*	93.722	*1.965*	*14.10*	1.153	6.65	1.453	0.140
176	*1/20/1962*	*18:00:00*	93.632	*1.964*	*14.09*	1.152	6.65	1.453	0.139
177	*3/13/1967*	*16:00:00*	93.539	*1.963*	*14.08*	1.152	6.64	1.452	0.137
178	*12/5/1966*	*12:00:00*	92.822	*1.956*	*14.00*	1.149	6.63	1.448	0.125
179	*1/8/1974*	*1:00:00*	92.814	*1.956*	*14.00*	1.149	6.63	1.448	0.125
180	*2/24/1969*	*3:00:00*	92.753	*1.955*	*13.99*	1.148	6.63	1.447	0.124
181	*1/26/1956*	*20:00:00*	92.460	*1.953*	*13.96*	1.147	6.62	1.446	0.119
182	*1/29/1980*	*3:00:00*	92.327	*1.951*	*13.95*	1.146	6.62	1.445	0.117
183	*12/5/1966*	*13:00:00*	92.324	*1.951*	*13.94*	1.146	6.62	1.445	0.117
184	*1/11/1980*	*9:00:00*	91.848	*1.947*	*13.89*	1.144	6.61	1.442	0.110
185	*12/5/1966*	*20:00:00*	91.833	*1.946*	*13.89*	1.144	6.61	1.442	0.110
186	*1/16/1993*	*7:00:00*	91.734	*1.945*	*13.88*	1.143	6.61	1.441	0.108
187	*2/8/1993*	*12:00:00*	91.704	*1.945*	*13.88*	1.143	6.61	1.441	0.108
188	*2/28/1991*	*16:00:00*	91.644	*1.945*	*13.87*	1.143	6.61	1.441	0.107
189	*1/19/1969*	*10:00:00*	91.267	*1.941*	*13.83*	1.141	6.60	1.438	0.101
190	*2/4/1958*	*14:00:00*	91.242	*1.941*	*13.82*	1.141	6.60	1.438	0.101

Work Calculations, Post-Development Conditions

Channel Slope:	0.0202		Channel Type:	Trapezoidal	
Channel n :	0.035		z:	2.125	: 1
Low flow Threshold:	81.419	cfs	Bottom width:	3	ft
Type of flow:	50% of Q_2		τ_c :	1.377	lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.
# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

159	*2/15/1986*	*6:00:00*	88.547	*1.914*	*13.52*	1.128	6.55	1.422	0.063
160	*11/22/1965*	*21:00:00*	88.513	*1.913*	*13.52*	1.128	6.55	1.422	0.062
161	*12/2/1952*	*1:00:00*	88.218	*1.911*	*13.49*	1.126	6.54	1.420	0.058
162	*12/18/1967*	*16:00:00*	88.141	*1.910*	*13.48*	1.126	6.54	1.419	0.057
163	*2/24/1969*	*3:00:00*	88.136	*1.910*	*13.48*	1.126	6.54	1.419	0.057
164	*1/16/1952*	*15:00:00*	88.096	*1.909*	*13.47*	1.126	6.54	1.419	0.057
165	*1/11/2005*	*2:00:00*	87.617	*1.905*	*13.42*	1.124	6.53	1.416	0.051
166	*3/28/1998*	*17:00:00*	87.336	*1.902*	*13.39*	1.122	6.52	1.414	0.047
167	*12/5/1966*	*19:00:00*	86.675	*1.895*	*13.32*	1.119	6.51	1.410	0.040
168	*1/29/1980*	*2:00:00*	86.578	*1.894*	*13.31*	1.118	6.51	1.410	0.039
169	*3/1/1970*	*4:00:00*	86.267	*1.891*	*13.27*	1.117	6.50	1.408	0.035
170	*11/29/1970*	*16:00:00*	85.800	*1.886*	*13.22*	1.115	6.49	1.405	0.030
171	*1/6/1979*	*4:00:00*	85.780	*1.886*	*13.22*	1.114	6.49	1.405	0.030
172	*10/18/2004*	*9:00:00*	85.655	*1.885*	*13.20*	1.114	6.49	1.404	0.029
173	*3/1/1991*	*4:00:00*	85.344	*1.882*	*13.17*	1.112	6.48	1.402	0.026
174	*12/3/1966*	*18:00:00*	84.639	*1.874*	*13.09*	1.109	6.47	1.398	0.019
175	*3/5/1995*	*11:00:00*	84.623	*1.874*	*13.09*	1.109	6.47	1.398	0.019
176	*12/17/1957*	*6:00:00*	84.574	*1.874*	*13.08*	1.109	6.47	1.397	0.019
177	*11/23/1965*	*2:00:00*	84.477	*1.873*	*13.07*	1.108	6.46	1.397	0.018
178	*2/14/1995*	*10:00:00*	84.473	*1.873*	*13.07*	1.108	6.46	1.397	0.018
179	*5/8/1977*	*21:00:00*	84.425	*1.872*	*13.06*	1.108	6.46	1.396	0.017
180	*3/10/2006*	*17:00:00*	84.403	*1.872*	*13.06*	1.108	6.46	1.396	0.017
181	*2/3/1958*	*21:00:00*	84.077	*1.869*	*13.03*	1.106	6.45	1.394	0.015
182	*12/27/1984*	*3:00:00*	84.001	*1.868*	*13.02*	1.106	6.45	1.394	0.014
183	*3/4/1978*	*20:00:00*	83.706	*1.865*	*12.98*	1.104	6.45	1.392	0.012
184	*3/13/1996*	*7:00:00*	83.706	*1.865*	*12.98*	1.104	6.45	1.392	0.012
185	*3/1/1970*	*3:00:00*	83.684	*1.865*	*12.98*	1.104	6.45	1.392	0.012
186	*2/15/1992*	*14:00:00*	83.152	*1.859*	*12.92*	1.101	6.44	1.388	0.008
187	*6/1/1996*	*8:00:00*	83.092	*1.858*	*12.92*	1.101	6.43	1.388	0.007
188	*2/10/1963*	*18:00:00*	83.042	*1.858*	*12.91*	1.101	6.43	1.388	0.007
189	*3/6/1995*	*0:00:00*	83.021	*1.858*	*12.91*	1.101	6.43	1.387	0.007
190	*2/15/1980*	*10:00:00*	82.978	*1.857*	*12.90*	1.101	6.43	1.387	0.007

Work Calculations, Pre-Development Conditions

Channel Slope:	0.0202		Channel Type:	Trapezoidal	
Channel n :	0.035		z:	2.125	: 1
Low flow Threshold:	81.455	cfs	Bottom width:	3	ft
Type of flow:	50% of Q_2		τ_c :	1.377	lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.

# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

191	*3/8/1975*	*11:00:00*	91.195	*1.940*	*13.82*	1.141	6.60	1.438	0.100
192	*2/15/1980*	*10:00:00*	91.092	*1.939*	*13.81*	1.140	6.60	1.437	0.098
193	*2/15/1980*	*9:00:00*	91.044	*1.939*	*13.80*	1.140	6.60	1.437	0.098
194	*3/22/1962*	*23:00:00*	91.010	*1.938*	*13.80*	1.140	6.60	1.437	0.097
195	*11/22/1996*	*3:00:00*	90.833	*1.937*	*13.78*	1.139	6.59	1.436	0.094
196	*2/2/1960*	*1:00:00*	90.767	*1.936*	*13.77*	1.139	6.59	1.435	0.093
197	*12/29/1965*	*20:00:00*	90.554	*1.934*	*13.75*	1.138	6.59	1.434	0.090
198	*11/29/1985*	*13:00:00*	90.457	*1.933*	*13.74*	1.137	6.58	1.434	0.089
199	*3/5/1995*	*18:00:00*	90.378	*1.932*	*13.73*	1.137	6.58	1.433	0.088
200	*2/10/1963*	*13:00:00*	89.936	*1.928*	*13.68*	1.135	6.57	1.430	0.081
201	*3/27/1991*	*2:00:00*	89.904	*1.927*	*13.68*	1.135	6.57	1.430	0.081
202	*2/10/1982*	*17:00:00*	89.319	*1.922*	*13.61*	1.132	6.56	1.427	0.073
203	*3/5/1995*	*13:00:00*	89.069	*1.919*	*13.58*	1.131	6.56	1.425	0.069
204	*3/16/1958*	*7:00:00*	89.052	*1.919*	*13.58*	1.131	6.56	1.425	0.069
205	*1/18/1955*	*17:00:00*	88.510	*1.913*	*13.52*	1.128	6.55	1.422	0.062
206	*1/13/1957*	*6:00:00*	88.460	*1.913*	*13.52*	1.128	6.55	1.421	0.061
207	*2/2/1960*	*0:00:00*	88.340	*1.912*	*13.50*	1.127	6.54	1.421	0.060
208	*3/15/1952*	*21:00:00*	88.254	*1.911*	*13.49*	1.127	6.54	1.420	0.059
209	*3/13/1967*	*23:00:00*	88.252	*1.911*	*13.49*	1.127	6.54	1.420	0.059
210	*1/16/1978*	*20:00:00*	87.629	*1.905*	*13.42*	1.124	6.53	1.416	0.051
211	*1/23/1969*	*18:00:00*	87.573	*1.904*	*13.42*	1.123	6.53	1.416	0.050
212	*12/5/1966*	*16:00:00*	87.442	*1.903*	*13.40*	1.123	6.52	1.415	0.049
213	*2/4/1958*	*13:00:00*	87.309	*1.901*	*13.39*	1.122	6.52	1.414	0.047
214	*3/8/1986*	*19:00:00*	87.078	*1.899*	*13.36*	1.121	6.52	1.413	0.044
215	*1/22/1969*	*20:00:00*	86.990	*1.898*	*13.35*	1.120	6.52	1.412	0.043
216	*2/21/2005*	*11:00:00*	86.864	*1.897*	*13.34*	1.120	6.51	1.412	0.042
217	*11/21/1978*	*18:00:00*	86.833	*1.897*	*13.33*	1.120	6.51	1.411	0.042
218	*3/5/1995*	*14:00:00*	86.619	*1.894*	*13.31*	1.119	6.51	1.410	0.039
219	*1/10/1998*	*17:00:00*	86.514	*1.893*	*13.30*	1.118	6.51	1.409	0.038
220	*3/5/1995*	*15:00:00*	85.977	*1.888*	*13.24*	1.115	6.49	1.406	0.032
221	*1/5/2008*	*6:00:00*	85.853	*1.887*	*13.22*	1.115	6.49	1.405	0.031
222	*1/29/1980*	*2:00:00*	85.713	*1.885*	*13.21*	1.114	6.49	1.404	0.030
223	*3/8/1974*	*12:00:00*	85.504	*1.883*	*13.19*	1.113	6.48	1.403	0.027

Work Calculations, Post-Development Conditions

Channel Slope:	0.0202		Channel Type:	Trapezoidal	
Channel n :	0.035		z:	2.125	: 1
Low flow Threshold:	81.419	cfs	Bottom width:	3	ft
Type of flow:	50% of Q_2		τ_c :	1.377	lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.

# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

191	*12/4/1987*	*23:00:00*	82.755	*1.855*	*12.88*	1.099	6.43	1.386	0.005
192	*2/20/1980*	*21:00:00*	82.707	*1.855*	*12.87*	1.099	6.43	1.385	0.005
193	*1/23/1969*	*18:00:00*	82.549	*1.853*	*12.85*	1.098	6.42	1.384	0.004
194	*10/20/2004*	*12:00:00*	82.402	*1.851*	*12.84*	1.098	6.42	1.384	0.003
195	*2/10/1963*	*13:00:00*	82.366	*1.851*	*12.83*	1.097	6.42	1.383	0.003
196	*1/5/2008*	*6:00:00*	82.119	*1.848*	*12.81*	1.096	6.41	1.382	0.002
197	*2/19/1980*	*7:00:00*	82.077	*1.848*	*12.80*	1.096	6.41	1.381	0.002
198	*2/4/1958*	*14:00:00*	81.993	*1.847*	*12.79*	1.096	6.41	1.381	0.002
199	*3/11/1995*	*9:00:00*	81.469	*1.842*	*12.73*	1.093	6.40	1.378	0.000

ΣW, post: 183.82

Work Calculations, Pre-Development Conditions

Channel Slope:	0.0202	Channel Type:	Trapezoidal
Channel n :	0.035	z:	2.125 : 1
Low flow Threshold:	81.455 cfs	Bottom width:	3 ft
Type of flow:	50% of Q_2	τ_c :	1.377 lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.
# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

224	*1/20/1962*	*19:00:00*	85.485	*1.883*	*13.18*	1.113	6.48	1.403	0.027
225	*2/20/1980*	*21:00:00*	85.365	*1.882*	*13.17*	1.112	6.48	1.402	0.026
226	*10/20/2004*	*12:00:00*	84.981	*1.878*	*13.13*	1.111	6.47	1.400	0.022
227	*1/12/1969*	*8:00:00*	84.947	*1.877*	*13.12*	1.110	6.47	1.400	0.022
228	*11/22/1965*	*21:00:00*	84.939	*1.877*	*13.12*	1.110	6.47	1.400	0.022
229	*1/25/1967*	*0:00:00*	84.789	*1.876*	*13.11*	1.110	6.47	1.399	0.021
230	*11/29/1970*	*15:00:00*	83.849	*1.866*	*13.00*	1.105	6.45	1.393	0.013
231	*1/9/1978*	*21:00:00*	83.601	*1.864*	*12.97*	1.104	6.44	1.391	0.011
232	*2/19/1980*	*17:00:00*	83.593	*1.864*	*12.97*	1.104	6.44	1.391	0.011
233	*3/13/1967*	*18:00:00*	83.260	*1.860*	*12.93*	1.102	6.44	1.389	0.009
234	*2/6/1978*	*9:00:00*	82.954	*1.857*	*12.90*	1.100	6.43	1.387	0.007
235	*2/6/1998*	*17:00:00*	82.743	*1.855*	*12.88*	1.099	6.43	1.386	0.005
236	*1/1/1982*	*11:00:00*	82.592	*1.853*	*12.86*	1.099	6.42	1.385	0.004
237	*3/1/1970*	*3:00:00*	82.432	*1.852*	*12.84*	1.098	6.42	1.384	0.004
238	*12/17/1978*	*21:00:00*	82.401	*1.851*	*12.84*	1.098	6.42	1.384	0.003
239	*3/11/1995*	*9:00:00*	82.369	*1.851*	*12.83*	1.097	6.42	1.383	0.003
240	*3/5/1995*	*8:00:00*	82.277	*1.850*	*12.82*	1.097	6.42	1.383	0.003
241	*3/1/1970*	*4:00:00*	81.920	*1.846*	*12.78*	1.095	6.41	1.380	0.001
242	*2/10/1982*	*13:00:00*	81.915	*1.846*	*12.78*	1.095	6.41	1.380	0.001
243	*12/27/1984*	*18:00:00*	81.746	*1.845*	*12.76*	1.094	6.40	1.379	0.001

ΣW, pre: 268.23

Work Calculations, Post-Development Conditions

Channel Slope:	0.0202	Channel Type:	Trapezoidal
Channel n :	0.035	z:	2.125 : 1
Low flow Threshold:	81.419 cfs	Bottom width:	3 ft
Type of flow:	50% of Q_2	τ_c :	1.377 lb/ft^2

Notes: Lower limit = upper limit = average flow = Q_{pre} as hourly flows are used. Duration = 1 hour.
# of bins = # of flow values larger than threshold. Date & hour provide if verification is desired.

SUMMARY

(a) ΣW_{PRE} :	268.23
(b) ΣW_{POST} :	183.82
(c) SY_{RUSLE} :	0.870
(d) SY_{NHD} :	0.206

E_P :	0.685	[(b)/(a)]
S_P :	0.671	[0.7(c)+0.3(d)]

E_P / S_P :	1.022

E_P / S_P < 1.1 : No Net Impact Achieved.

Appendix 6:

- Response to Comments, First Round
- Response to Comments Identified on 10/21/2016, Second Round

RESPONSE TO COMMENTS

1. REQUIREMENT - [<5% ENCROACHMENT ELEMENTS, PAGES 1 & 6]: Remove all references indicating that basins encroaching <5% into PCCSYAs are removed from further CCSYA consideration. Encroachment of <5% into CCSYAs does not eliminate a basins obligation to identify, avoid, and bypass the remaining 95% CCSYA. All associated text, table references, calculations, and exhibits should be revised to indicate that basins encroaching <5% (Basins 10, 13A, 16, 21, 25B, 27, 29A, 29B, and 29C) do contain CCSYAs that are effectively identified, avoided, and bypassed.

Response: *Basins encroaching < 5% into PCCSYAs are identified and the design avoids and protects the remaining > 95% of PCCSYAs. Those natural areas are almost always located downstream of the development in areas that will not be developed, or are by-passed into the downstream receiving POC without being treated (and hence removed of beneficial coarse sediments). Clarification is provided in the new version of the report.*

Action: *Update sections 2.2, page 1, and section 3, now page 7 of the report.*

1. REQUIREMENT - [ADJUSTMENT FACTOR, PAGE 5]: Impervious areas used to determine Adjustment Factors (AF) for each basin are not adequately supported. Please quantify impervious surfaces within each basin for which a threshold analysis is being performed. If this value is conservatively overestimated, provide adequate supporting information/description.

Response: *There is no need to estimate with a large degree of accuracy the AF value for two reasons: (a) at this point it is not know the precise impervious percentage as the project might change in final engineering and (b) it is not relevant to estimate the precise impervious percentage as the AF value changes very little with impervious percentage. A sensitivity analysis using the maximum plausible value of AF was prepared and included in Table 2 and in the bullet point explanation of page 4.*

Action: *Adjust bullet point of page 4 and include sensitivity analysis on AF on Table 2.*

2. REQUIREMENT - [D50 REFERENCE, PAGE 5]: The values presented for "theoretical" d50 are not adequately supported. It is unclear why these values are "theoretical", why they are correlated with braided equilibrium, and what geotechnical information was used to support the values. Provide clear reference to applicable geotechnical information (pebble count, sieve analysis, in-site jet testing results, and/or reference tables such as Fischenich, 2001) and provide additional supporting description/documentation demonstrating how d50 values were determined.

***Response**: After meeting with County personnel on 9/19/2016, it seems that it was clear that the intent of the report was to determine a minimum theoretical d_{50} that satisfies threshold channel conditions, per the explanation provided in the bullet point list (page 4). There was an error in the expression of d_{50} that will be corrected (it says: $d_{50} = (\omega/d_{50})^{4/3}$; it should say: $d_{50} = (\omega/16.7)^{4/3}$).*

***Action**: Correct the expression to calculate theoretical d_{50}.*

3. REQUIREMENT - [NATURAL DRAINAGE OBSERVATIONS LETTER FROM LEIGHTON: This letter states that due to underlying geology, the surficial surfaces should be considered armored. Armoring specifically refers to characteristics occurring at the surface of a streambed, so it is inappropriate to claim a stream is armored based on underlying geology. SCCWRP's TR606 Report does indicate that fine deposits from the top 1/2 inch of the surface may be omitted; however, the depth of surficial deposits is not specified/supported in the letter. The opinion set forth by Leighton inexplicably cites SCCWRP's TR606 Report by Bledsoe. This reference should be removed or further clarified. The letter states a d50 of larger than 24 inches and a permissible shear stress of 10 pounds per cubic foot. These values are not at all supported by any site investigation data and/or reference materials and incorrectly reference shear stress as force per cubic foot.

***Response:** The original letter had a typo when mentioning the shear stress (it should have said 10 pounds per square foot, and it says 10 pounds per cubic foot). A new letter prepared by Leighton that better explains the intent of the geologists has been included, where further explanation is provided. Also, a new section in the report (2.4.2.1 Considerations about Threshold Channel, Geology and Shear Stress) has been added, to deal with the analysis that allow the classification of POCs 13B, 19 and 26 as threshold channels based on the geologic characteristics. Please refer to new section 2.4.2.1.*

***Action:** Update the geologic letter and provide update. Prepare new section 2.4.2.1 to further explain the criteria in terms of selecting POCs 13B, 19 and 26 as threshold channels.*

4. REQUIREMENT - [POST-PROJECT GLU EXHIBIT, APPENDIX 3]: Provide a GLU map depicting all onsite and upstream critical coarse sediment GLUs in the pre-project condition. These maps must represent all applicable GLU types taken from Table A.4.2 of the WMAA document.

***Response:** A new map has been prepared to show GLU types in pre-development conditions. Appendix 4 S_P Table and Appendix 5 Summary Table have been corrected based upon the more accurate results from the new Pre-Development GLU Map.*

***Action:** Include a new GLU Pre-development map in Appendices. Correct Appendix 4: S_P Table and Appendix 5: Summary Table.*

5. REQUIREMENT - [PRE-PROJECT GLU EXHIBIT, APPENDICES 3]: Provide a GLU map depicting all onsite and upstream critical coarse sediment GLUs in the post-project condition. These maps must represent all applicable GLU types taken from Table A.4.2 of the WMAA document. If soil loss credit for cut/fill slopes is utilized for Post-Project condition, include appropriate additional GLU types.

Response: *A new map has been prepared to show GLU types in post-development conditions. Appendix 4 S_P Table and Appendix 5 Summary Table have been corrected based upon the more accurate results from the new Post-Development GLU Map.*

Action: *Include a new GLU Post-development map in Appendices. Correct Appendix 4: S_P Table and Appendix 5: Summary Table.*

6. REQUIREMENT - [POST DEVELOPMENT CCSYA EXHIBIT, APPENDIX 3]: Provide a single exhibit depicting all onsite and upstream CCSYAs that are effectively avoided AND allowed to pass through/around the project site in order to meet the no net impact standard.

Response: *The new Post-Development GLU map shows the overall location of the Storm Drain Inlets for Natural Runoff (Clean Line) and the overall configuration of the Storm Drain Clean Line (Green Line). Basically the project is designing 2 lines: a line system of stormwater to be treated in the BMPs (not shown for simplicity) and a clean water line to take all coarse sediment and natural runoff around the project and discharge it at the downstream end of 25A. Therefore, this exhibit is the same as the Post-Development GLU exhibit.*

Action: *Include a new GLU Post-development map in Appendices.*

7. REQUIREMENT - [NHD EXHIBIT, APPENDIX 3]: The NHD Exhibit provided does not provide sufficient information to verify the extent of NHD stream impacts. The streams must be clearly delineated and overlaid with the basin delineations and proposed improvements so quantifiable impacts can be confirmed. A shapefile of NHD streams is available for download through SANGIS.

Response: *A new exhibit showing the Pre and Post development NHD Creek has been prepared. As the post-development length is now better estimated (1,400 ft instead of 1,700 ft) calculations in Appendix 4 and the Summary Table of Appendix 5 have been updated.*

Action: *Include a new NHD Pre and Post Development Exhibit in Appendices. Correct Appendix 4: S_P Table and Appendix 5: Summary Table as the post-development NHD length has changed.*

8. REQUIREMENT - [AVOID AND BYPASS TEXT/CALCS/EXHIBITS]: Provide information/calculations / exhibits demonstrating how flows from preserved CCSYAs are routed through/around the project site at a minimum cleansing velocity. This can be performed by satisfying standard design criteria referenced in Appendix H.3.1 of the BMPDM or by demonstrating flows from coarse areas are routed through conveyances maintaining a peak 2 year storm velocity of 3 feet per second or more.

Response: *A new section (3.1 General Hydraulic Considerations of By-Pass Velocities) has been added to the report, where a mathematical criterion that demonstrates a velocity in excess of the minimum self-cleansing velocity for a peak flow with a return period 2 years of larger has been included. Self-cleansing calculations are based upon equation H.7.1 of the Appendix H plus standard Type A brow-ditch geometry as defined in the City of San Diego Drainage Manual*

Action: *Include demonstration of cleansing velocity for Type A brow-ditches in new Section 3.1.*

9. REQUIREMENT - [EP CALCULATIONS, APPENDIX 5]:: Provide discussion, supporting calculations, and/or references to justify the critical shear stress value of 1.377 lb/ft2 used for POC 25A. For reference, the reviewer has examined the County Channel Vulnerability calculator which indicates surfaces with a D50 of 11mm have a critical shear stress of 0.17 lb/ft2.

Response: *The sequence of equations in section 4.3 explains how the critical shear stress is calculated: h is obtained with equation (1), then A with (2), R with (3), V with (4) and τ with (5). The only constant information required is s (longitudinal slope), z (lateral slope of trapezoidal section), B (width at the bottom of trapezoidal section) and n (Manning's coefficient), while the variable peak flow (Q) determines a value of h (water depth), and consequently A (area), R (hydraulic radius), V (velocity) and τ (shear stress). A new section (4.3.1: Calculation of Critical Shear Stress) has been added where it specifically address the determination of critical shear stress value τ_C of 1.377 lb/ft^2.*

In regards to the second part of the question, once a channel has been defined as low susceptibility and such definition has been approved (Reach 3, POC 25A, 2015 Chang Study) d_{50} is no longer used, and the critical flow that produces incipient movement is associated with 50% of Q_2, with Q_2 determined with a continuous simulation model. Q_2 in this analysis was defined with SWMM for POC 25A (Q_2 = 162.91 cfs) and therefore 50% of Q_2 = 81.455 cfs defines the critical shear stress, regardless of d_{50}. Consequently, the critical shear stress associated with a d_{50} of 11 mm becomes irrelevant in the approved permit process once it has been established that the creek is low susceptibility.

Action: *Prepare new section 4.3.1 were a more detailed explanation of τ_C =1.377 lb/ft^2 is provided.*

10. SUGGESTION - [PDP SWQMP, Step 3.7.1]: Remove checkmark indicating project is in compliance through "Scenario 1" as it does not utilize the RPO Method. In the "Demonstrate No Net Impact"

row, add a checkmark next to "provide alternate mapping of CCSYAs" as GLU, Threshold, and De-Minimis refinement methods are used.

Action: *Suggestion 11 has been followed and checkmarks have been added and/or removed as suggested.*

11. SUGGESTION - [SUMMARY TEXT, PAGE 1]: Text incorrectly references Basin 27C as draining to South Fork of Gopher Canyon Creek. The text should actually reference 29C. This is simply a typo and is not reflected throughout the rest of the report.

Action: *Correct Text in report per suggestion.*

12. SUGGESTION - [SUMMARY TEXT, PAGE 1]: Text incorrectly references City BMPDM. The text should reference February County BMPDM. This is simply a typo as the methodology does in fact follow the County BMPDM process.

Action: *Correct typo in report per suggestion.*

13. SUGGESTION - [TABLE 2, PAGE 5]: It is very difficult to correlate the various reach ID's from multiple Chang reports to the POC ID's referenced in this report. At the very least, additional information should be provided on Table 2 indicating which of the two Chang reports the Reach info is derived from (January 2015 vs July 2016).

Action: *Indicate in report when Chang 2015 or Chang 2016 is referenced to avoid confusion, per suggestion 14.*

14. SUGGESTION - [EP CALCULATION, APPENDIX 4]: It is noted that the applicant has elected to perform additional analysis of flows outside the range of 0.5Q2 to Q10. This is acceptable but not required.

Action: *Author prefers to use the complete range as the BMPs also attenuate large peak flows. Suggestion appreciated, but calculations will not change as there is not a specific requirement to change them.*

Attachment 2d

Geomorphic Assessment of Receiving Channels

HYDROMODIFICATION SCREENING

FOR

NEWLAND SIERRA
(INITIAL 2015 REPORT)

February 7, 2017

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FOR REVIEW ONLY

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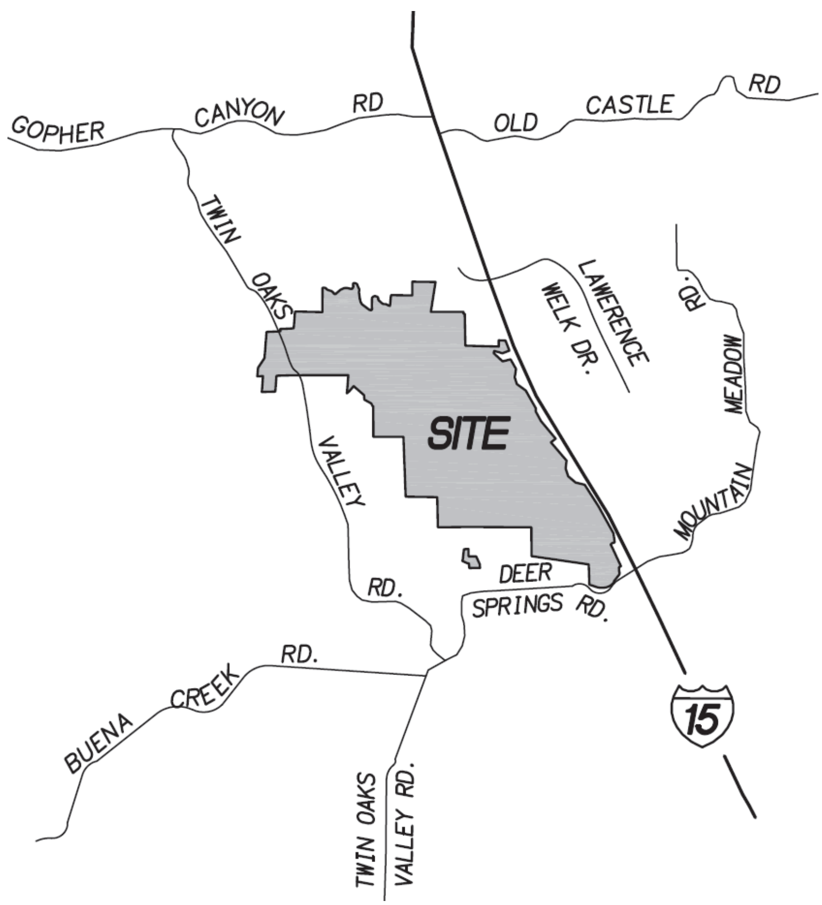
INTRODUCTION

The County of San Diego's March 2011, *Final Hydromodification Management Plan,* and January 8, 2011, *Standard Urban Stormwater Mitigation Plan* (SUSMP) outline low flow thresholds for hydromodification analyses. The thresholds are based on a percentage of the pre-project 2-year flow (Q_2), i.e., $0.1Q_2$ (low flow threshold and high susceptibility to erosion), $0.3Q_2$ (medium flow threshold and medium susceptibility to erosion), or $0.5Q_2$ (high flow threshold and low susceptibility to erosion). A flow threshold of $0.1Q_2$ represents a natural downstream receiving conveyance system with a high susceptibility to bed and/or bank erosion. This is the default value used for hydromodification analyses and will result in the most conservative (largest) on-site facility sizing. A flow threshold of $0.3Q_2$ or $0.5Q_2$ represents downstream receiving conveyance systems with a medium or low susceptibility to erosion, respectively. In order to qualify for a medium or low erosion susceptibility rating, a project must perform a channel screening analysis based on the March 2010, *Hydromodification Screening Tools: Field Manual for Assessing Channel Susceptibility,* developed by the Southern California Coastal Water Research Project (SCCWRP). The SCCWRP results are compared with the critical shear stress calculator results from the County of San Diego's BMP Sizing Calculator to establish the appropriate erosion susceptibility threshold of low, medium, or high.



Vicinity Map

This report provides hydromodification screening analyses for the Newland Sierra project for which a tentative map is being prepared by Fuscoe Engineering (Fuscoe). The project site consists of approximately 1,985 acres and is bounded by Interstate 15 on the east, Deer Springs Road on the south, and Twin Oaks Valley Road on the west, with a small portion of the northwestern edge of the site traversed by Twin Oaks Valley Road. Gopher Canyon Road is located approximately 1.5 miles north of the site's northern boundary, and approximately 2.5 miles north of proposed site development (see the Vicinity Map). The developed project will include seven neighborhoods (also referred to as planning areas for planning purposes) with a total of 2,135 single- and multi-family residential units with a variety of housing types as well as parks, a school, and commercial development. The seven planning areas will be designed to promote land stewardship and avoid the most sensitive biological, cultural, and topographical resources.

Under pre-project conditions, the site primarily contains undisturbed natural hillside areas, many portions of which are moderately to steeply sloping. Storm runoff from the undeveloped site primarily occurs as sheet flow on the natural ground surface before entering one of several natural hillside ravines or canyons. The runoff flows down the hillside areas and exits the site at various locations around its boundary. The runoff to the south, west, and southwest ultimately flows to Twin Oaks Valley Creek, the runoff to the northwest ultimately flows to the south fork of Gopher Canyon Creek, and the runoff to the north and east ultimately flows to the south fork of Moosa Canyon Creek.

The proposed project will create a large open space conservation area including approximately 1,200 acres of biological open space restoration. The flow patterns within the open space will be preserved by the project since this natural area is being preserved. In addition, the development footprint will generally maintain the pre-project flow directions in accordance with engineering requirements. The proposed on-site storm drain systems will have several discharge locations into the natural surrounding area. This report provides a downstream channel assessment for six of the discharge locations or points of compliance (labeled POC A through F on the Study Area Exhibit).

The SCCWRP screening tool requires both office and field work to establish the vertical and lateral susceptibility of a downstream receiving channel to erosion. The vertical and lateral assessments are performed independently of each other although the lateral results can be affected by the vertical rating. A screening analysis was performed to assess the low flow threshold for each POC.

This report is being submitted for the CEQA-level processing. During final engineering, the results herein shall be refined based on the final design. Vegetation will not be used as a grade control in the analyses. All of the project's POCs for which a lower threshold is desired shall be analyzed at final engineering.

The initial step in performing the SCCWRP screening analysis is to establish the domain of analysis and the study reaches within the domain. This is followed by office and field components of the screening tool along with the associated analyses and results. The following sections cover these procedures in sequence.

DOMAIN OF ANALYSIS

SCCWRP defines an upstream and downstream domain of analysis, which establish the study limits. The County of San Diego's HMP specifies the downstream domain of analysis based on the SCCWRP criteria. The HMP indicates that the downstream domain is the first point where one of these is reached:

- at least one reach downstream of the first grade control point (preferably second grade control location)
- tidal backwater/lentic waterbody
- equal order tributary
- accumulation of 50 percent drainage area for stream systems or 100 percent drainage area for urban conveyance systems (storm drains, hardened channels, etc.). This is also defined as a two-fold increase in drainage area (see Section 5.2 and 6.1 of the HMP).

The upstream limit is defined as:

- proceed upstream for 20 channel top widths or to the first grade control point, whichever comes first. Identify hard points that can check headward migration and evidence of active headcutting.

SCCWRP defines the maximum spatial unit, or reach (a reach is circa 20 channel widths), for assigning a susceptibility rating within the domain of analysis to be 200 meters (656 feet). If the domain of analysis is greater than 200 meters, the study area should be subdivided into smaller reaches of less than 200 meters for analysis. Most of the units in the HMP's SCCWRP analysis are metric. Metric units are used in this report only where given so in the HMP. Otherwise English units are used.

Downstream Domain of Analysis

The downstream domain of analysis locations for the study areas covered by this report have been determined by assessing and comparing the four bullet items above. As discussed in the Introduction, the project runoff will be collected by a series of proposed drainage facilities that outlet at several different locations around the site. Fuscoe has identified six specific locations to be analyzed by this report (see the Study Area Exhibit). A downstream domain of analysis has been identified below each of Fuscoe's six points of compliance (POCs A through F on the Study Area Exhibit). Each downstream domain of analysis location was selected as follows.

Per the first bullet item, the first permanent grade control in the natural drainage courses below each of the six POCs was located (see the Study Area Exhibit). For POC A, this occurs at the existing culvert under Deer Springs Road (see Figure 3) just over 230 feet south of POC A. For POC B, a grade control is created by a grouted riprap check dam (see Figure 7) approximately 430 feet below POC B in its downstream drainage course. For POC C, this occurs at a concrete driveway and underlying culverts approximately 520 feet south of POC C (see Figure 12). For

POCs D and E, a permanent grade control was not located in the downstream proximity, so this criteria was not used for establishing the downstream domain of analysis location for these two POCs. For POC F, the first permanent grade control occurs at a private driveway crossing containing a culvert (see Figure 21) approximately 780 feet downstream of the POC.

The second bullet item is the tidal backwater or lentic (standing or still water such as ponds, pools, marshes, lakes, etc.) waterbody location. Based on review of Google Earth, there is no tidal backwater or lentic waterbody near any of the six POCs. The nearest such waterbody is at Lake San Marcos, which is over 6.4 miles southwest of the site. Therefore, the second bullet item criteria will not govern over the other bullet item criteria for any of the POC's.

The final two bullet items are related to the tributary drainage area. This criteria applies to POC D and E. The other four POC's do not confluence with or accumulate a larger tributary area closer than their permanent grade control locations, so the final two bullet items will not govern for the other four POCs. The drainage area tributary to POC D covers 20.19 acres. The drainage course below POC D accumulates a 100 percent drainage area (i.e., a two-fold increase) approximately 580 feet downstream of POC D as shown on the Study Area Exhibit. In addition, the drainage course tributary to POC E confluences with a larger drainage course approximately 810 feet downstream of POC E. The Study Area Exhibit shows that the area tributary to the POC E drainage course covers 13.55 acres while the larger drainage course has a tributary area of 27.12 acres. Therefore, the equal order tributary criteria is met at the confluence.

From the above information, the downstream domain of analysis locations for the POCs are based on different criteria. For POCs A, B, C, and F, the locations are based on the permanent grade control criteria. For POCs A, C, and F, the associated natural drainage course enters a hardened culvert under a roadway. The culvert and roadway will prevent erosion of the upstream channel bed, so these are considered permanent grade controls. For POC B, the natural drainage course contains a grouted riprap check dam, which is a permanent grade control. The permanent grade control criteria requires that the downstream domain of analysis location extend one reach (20 channel top widths) below the grade control or preferably to the second downstream grade control. For POCs A, B, C, and F, the downstream domain of analysis location was selected at the second grade control. Note that for POC A, its second grade control is the grade control below POC B. For POC B, the second grade control is a short distance downstream of the check dam where the channel bed and banks are lined with large rock (see Figure 8). For POCs C and F, a downstream road crossing forms the second grade control (see Figures 15 and 24, respectively).

For POCs D and E, the closest criteria is met by the last two bullet items. The downstream domain of analysis for POC D is based on achieving a 100 percent (2-fold) increase in drainage area, while POC E is based on a confluence with an equal order tributary.

Upstream Domain of Analysis

The proposed drainage facilities tributary to POCs A, B, C, D, E, and F outlet into the uppermost end of their receiving drainage courses. Since the natural drainage courses do not extend upstream of the drainage facility outlets, the upstream domain of analysis location for these five POC's will be at each POC.

Study Reaches within Domain of Analysis
The entire domain of analysis contains six study reaches (see Study Area Exhibit). A study reach occurs below each POC. The following describes the six study reaches.

Reach 1 (235 feet long) is the study reach below POC A. It extends from the upstream domain of analysis location at POC A to the downstream domain of analysis location at the existing culvert under Deer Springs Road.

Reach 2 (430 feet long) is the study reach below POC B. It extends from the upstream domain of analysis location at POC B to the downstream domain of analysis location at the second grade control below POC B formed by the rock-lined channel.

Reach 3 (992 feet long) is the study reach below POC C. It extends from the upstream domain of analysis location at POC C to the downstream domain of analysis location at the second grade control below POC C at the existing culvert under Country Garden Lane.

Reach 4 (578 feet long) is the study reach below POC D. It extends from the upstream domain of analysis location at POC D to the downstream domain of analysis location where the tributary drainage area below POC D exceeds the tributary drainage area to POC D.

Reach 5 (810 feet long) is the study reach below POC E. It extends from the upstream domain of analysis location at POC E to the downstream domain of analysis location where the drainage course below POC E confluences with a larger drainage course.

Reach 6 (1,298 feet long) is the study reach below POC F. It extends from the upstream domain of analysis location at POC F to the downstream domain of analysis location at the second grade control below POC C F at a private driveway crossing.

Reaches 3, 5, and 6 are greater than the 656 foot (200 meters) maximum reach length described by SCCWRP. Review of topographic mapping, aerial photographs, and field conditions reveals that the physical (channel geometry and longitudinal slope), vegetative, hydraulic, and soil conditions within each of these three reaches are relatively uniform. Subdividing the reaches into smaller subreaches of less than 656 feet will not yield varying conclusions within a reach. Although the screening tool was applied across the entire length of each of these reaches, the results will be identical for shorter subreaches within each reach. During final engineering, the reach lengths can be shortened to 656 feet or less, as needed.

INITIAL DESKTOP ANALYSIS

After the domain of analysis is established, SCCWRP requires an "initial desktop analysis" that involves office work. The initial desktop analysis establishes the watershed area, mean annual precipitation, valley slope, and valley width. These terms are defined in Form 1, which is included in Appendix A. SCCWRP recommends the use of National Elevation Data (NED) to determine the watershed areas, valley slopes, and valley widths. The NED data is similar to

USGS mapping. For the project the following topographic mapping sources were used. Fuscoe provided their grading plans and 5-foot contour interval topographic mapping for the project site and adjacent areas. This mapping is more detailed that NED data, so will provide more accurate results. Fuscoe also provided their proposed condition drainage basin boundaries. There are two off-site locations (southeast and northwest) where the Fuscoe mapping did not extend far enough to cover the watershed areas. In these locations, USGS mapping was used. The mapping sources and proposed condition watershed delineations are included on the Study Area Exhibit in the map pocket. Fuscoe provided a separate exhibit with the existing condition watershed delineations, which is also included in the map pocket.

The mean annual precipitation was obtained from the rain gages closest to the site. These are the Western Regional Climate Center's Vista 1 NE and Valley Center 2 NNE gages (see Appendix A). The average annual rainfall measured at these gages for their periods of record are 13.1 and 17.5 inches, respectively. The "Rain Gages Nearest to Study Area" exhibit in Appendix A shows that the ratio of distances from the site to the Vista and Valley Center gages are approximately 1/3 and 2/3, respectively. The average annual rainfall values at each gage were interpolated based on the distance ratios to calculate an average annual rainfall at the site of 14.6 inches.

The valley slope and valley width were determined for each study reach from the 5-foot contour interval flown topographic mapping. NED data was not used because it is not very accurate for these parameters. The valley slope is the longitudinal slope of the channel bed along the flow line, so it is determined by dividing the elevation difference within a study reach by the length of the flow line. The valley width is the valley bottom width dictated by breaks in the hillslope. The valley slope and valley width within each reach along with the area are included in Table 1. The analyses discussed later in this report are based on the greater of the existing and proposed condition drainage areas to generate conservative (greater potential for erosion) results. In this case, the existing condition areas were used for Reach 1 and 4, while the proposed condition areas were used for Reach 2, 3, 5, and 6.

Reach	Existing Condition Drainage Area, sq. mi.	Proposed Condition Drainage Area, sq. mi.	Valley Slope, m/m	Valley Width, m
1	0.0244	0.0244	0.1021	3.7
2	0.7844	0.7544	0.0419	3.0
3	0.7735	0.7626	0.0202	6.1
4	0.0550	0.0636	0.1003	5.5
5	0.0280	0.0212	0.3630	5.5
6	0.2165	0.2049	0.0901	8.5

Table 1. Summary of Drainage Area, Valley Slope, and Valley Width

These values were input to a spreadsheet to calculate the simulated peak flow, screening index, and valley width index outlined in Form 1. The input data and results are tabulated in Appendix A. This completes the initial desktop analysis.

FIELD SCREENING

After the initial desktop analysis is complete, a field assessment must be performed. The field assessment is used to establish a natural channel's vertical and lateral susceptibility to erosion. SCCWRP states that although they are admittedly linked, vertical and lateral susceptibility are assessed separately for several reasons. First, vertical and lateral responses are primarily controlled by different types of resistance, which, when assessed separately, may improve ease of use and lead to increased repeatability compared to an integrated, cross-dimensional assessment. Second, the mechanistic differences between vertical and lateral responses point to different modeling tools and potentially different management strategies. Having separate screening ratings may better direct users and managers to the most appropriate tools for subsequent analyses.

The field screening tool uses combinations of decision trees and checklists. Decision trees are typically used when a question can be answered fairly definitively and/or quantitatively (e.g., d_{50} < 16 mm). Checklists are used where answers are relatively qualitative (e.g., the condition of a grade control). Low, medium, high, and very high ratings are applied separately to the vertical and lateral analyses. When the vertical and lateral analyses return divergent values, the most conservative value shall be selected as the flow threshold for the hydromodification analyses.

Vertical Stability

The purpose of the vertical stability decision tree (Figure 6-4 in the County of San Diego HMP) is to assess the state of the channel bed with a particular focus on the risk of incision (i.e., down cutting). The decision tree is included in Figure 31. The first step is to assess the channel bed resistance. There are three categories defined as follows:

1. Labile Bed – sand-dominated bed, little resistant substrate.

2. Transitional/Intermediate Bed – bed typically characterized by gravel/small cobble, Intermediate level of resistance of the substrate and uncertain potential for armoring.

3. Threshold Bed (Coarse/Armored Bed) – armored with large cobbles or larger bed material or highly-resistant bed substrate (i.e., bedrock).

Figures 25 through 30 contain photographs of the bed material along each of the six study reaches. A gravelometer is included in the photographs for reference. Each square on the gravelometer indicates grain size in millimeters (the squares range from 2 mm to 180 mm). Based on the photographs and site investigation, the bed material and resistance is generally within the transitional/intermediate bed category in all reaches. There was no evidence of a threshold bed condition. However, some bed areas contained smaller grain sizes found in a labile bed and some areas contained large boulders. A pebble count was performed that determined the median (d_{50}) bed material sizes for Reaches 1 through 6 varies from 11 to 180 millimeters (see Appendix B). Figure 6-4 in the County HMP indicates that a d_{50} of 16 mm or greater is within the transitional/intermediate bed category. Dr. Eric Stein from SCCWRP, who co-authored the *Hydromodification Screening Tools: Field Manual* in the *Final Hydromodification Management*

Plan (HMP), indicated that it would be appropriate to analyze channels with multiple factors that impact erodibility using the transitional/intermediate bed procedure. This requires the most rigorous steps and will generate the appropriate results for the size range.

Transitional/intermediate beds cover a wide susceptibility/potential response range and need to be assessed in greater detail to develop a weight of evidence for the appropriate screening rating. The three primary risk factors used to assess vertical susceptibility for channels with transitional/intermediate bed materials are:

1. Armoring potential – three states (Checklist 1)

2. Grade control – three states (Checklist 2)

3. Proximity to regionally-calibrated incision/braiding threshold (Mobility Index Threshold – Probability Diagram)

These three risk factors are assessed using checklists and a diagram (see Appendix B), and the results of each are combined to provide a final vertical susceptibility rating for the intermediate/transitional bed-material group. Each checklist and diagram contains a Category A, B, or C rating. Category A is the most resistant to vertical changes while Category C is the most susceptible.

Checklist 1 determines armoring potential of the channel bed. The channel bed along Reaches 1, 2, 3, 4, and 6 are within Category B, which represents intermediate bed material of unknown resistance or unknown armoring potential due to a surface veneer such as vegetation. Figures 1, 2, 9, 10, 11, and 13 show that Reaches 1 and 3 contain a fair to moderate cover of grasses, weeds, smaller brush, and scattered trees. Figures 25, 26, and 27 show the Reach 1, 2, and 3 channel bed material with a gravelometer, which all contain gravel-sized particles. The pebble count determined D_{50} values of 16, 32, and 11 mm, respectively, which is consistent with Category B (Category C pertains to a majority of surface material less than 2 mm). The soil was probed along the reaches and penetration was relatively difficult through the underlying layer. Figures 4, 5, 6, 16, 17, 20, 22, 23, and 24 show that Reaches 2, 4, and 6 contain a dense, uniform cover of mature vegetation including grasses, large brush, and large trees.

The channel bed along Reach 5 is within Category A on Checklist 1. The site visit and review of aerial photographs reveals that this area contains large, closely grouped rock outcroppings, which are evident in Figures 18 and 19. Figure 29 shows cobbles in Reach 5 and the pebble count reviewed a D_{50} of 180 mm, which is consistent with Category A. The rock results in a broad armor layer along the ground surface.

Checklist 2 determines grade control characteristics of the channel bed. Reach 1 does not contain natural nor manmade grade controls, so is in Category C. As verified with photographs (see Figures 4, 6, 7, and 8) and during a site investigation, Reach 2 has rock outcroppings along its lengths, so in within Category A. Reaches 4 and 5 are in the upper hillside area of the site, which is underlain with bedrock. This is documented in Leighton and Associates Inc's June 10, 2016 and December 15, 2016 letters, which states that "it is our opinion that the bed resistance of existing drainages can be considered to be a Coarse/Armored Bed that should not be susceptible to erosion due to the underlying hard rock (Bledsoe, 2010)." The December 2016 letter includes photographic records of the bedrock. Since Reach 4 has not been specifically analyzed by Leighton, Category B is assigned, but this could potentially be improved during final engineering with more geotechnical analyses. Reach 5 contains large rocks and boulders that were observed closely spaced and scattered throughout their channel beds. Therefore, Reach 5 is in Category A on Checklist 2. Finally, Reach 6 does not contain grade controls so is in Category C.

Reach 3 contains a grade control (roadway with culvert) approximately 520 feet from its upstream domain of analysis location and another grade control approximately 460 feet below the first grade control. The 4/S_V value for Reach 3 is 651 feet (4 ÷ 0.0419 = 198 meters or 651 feet). The grade controls are spaced closer than 651 feet, so Reach 3 is in Category B on Checklist 2.

The Screening Index Threshold is a probability diagram that depicts the risk of incising or braiding based on the potential stream power of the valley relative to the median particle diameter. The threshold is based on regional data from Dr. Howard Chang of Chang Consultants and others. The probability diagram is based on d_{50} as well as the Screening Index determined in the initial desktop analysis (see Appendix A). d_{50} is derived from a pebble count in which a minimum of 100 particles is obtained along transects at the site. A pebble count was performed for each of the six study reaches. The spacing of each sample location within a reach was estimated by dividing the total length of a representative reach by 100. This distance was paced off in the field and a sample taken. SCCRWP states that if fines less than ½-inch thick are at a sample point, it is appropriate to sample the coarser buried substrate.

Reach	D_{50}, mm	INDEX	50% Risk	Difference[1]
1	16	0.041	0.049	0.008
2	32	0.076	0.070	-0.006
3	11	0.036	0.038	0.002
4	64	0.061	0.101	0.040
5	180	0.154	0.165	0.011
6	64	0.093	0.101	0.008

[1]Positive Value Reflects Less Than 50% Probability of Incision

Table 2. Summary of Pebble Count, Screening Index, Risk of Incision

The d_{50} value is the particle size in which 50 percent of the particles are smaller and 50 percent are larger. The pebble count results for each study reach is included in Appendix B and summarized in Table 2. The screening index values (INDEX) for the reaches are tabulated on Form 1 in Appendix A and also included in Table 2. The Screening Index Threshold diagram in Appendix B provides 50% Risk values for various d_{50} values. These values are included in the last column of Table 2. If the INDEX value is less than the 50% Risk value, the reach has less than 50 percent probability of incising and falls within Category A. Table 2 shows that this is the case for all study reaches except Reach 2. Reach 2 is within Category C.

The overall vertical rating is determined from the Checklist 1, Checklist 2, and Mobility Index Threshold results. The scoring is based on the following values:

Category A = 3, Category B = 6, Category C = 9

The vertical rating score is based on these values and the equation:

$$\text{Vertical Rating} = [(\text{armoring} \times \text{grade control})^{1/2} \times \text{screening index score}]^{1/2}$$

Table 3 summarizes the checklist 1, 2, and 3 values for each reach as well as their vertical rating.

Reach	Checklist 1	Checklist 2	Checklist 3	Vertical Rating
1	6	9	3	4.7
2	6	3	9	6.2
3	6	6	3	4.2
4	6	6	3	4.2
5	3	3	3	3.0
6	6	9	3	4.7

Table 3. Overall Vertical Rating

The vertical rating for Reaches 3 through 5 is less than 4.5, so these reaches have a low threshold for vertical susceptibility. The vertical rating for Reach 1, 2, and 6 is between 4.5 and 7, so these reaches have a medium threshold for vertical susceptibility.

Lateral Stability

The purpose of the lateral decision tree (Figure 6-5 from County of San Diego HMP included in Figure 32) is to assess the state of the channel banks with a focus on the risk of widening. Channels can widen from either bank failure or through fluvial processes such as chute cutoffs, avulsions, and braiding. Widening through fluvial avulsions/active braiding is a relatively straightforward observation. If braiding is not already occurring, the next logical step is to assess the condition of the banks. Banks fail through a variety of mechanisms; however, one of the most important distinctions is whether they fail in mass (as many particles) or by fluvial detachment of individual particles. Although much research is dedicated to the combined effects of weakening, fluvial erosion, and mass failure, SCCWRP found it valuable to segregate bank types based on the inference of the dominant failure mechanism (as the management approach may vary based on the dominant failure mechanism). A decision tree (Form 4 in Appendix B) is used in conducting the lateral susceptibility assessment. Definitions and photographic examples are also provided below for terms used in the lateral susceptibility assessment.

The first step in the decision tree is to determine if lateral adjustments are occurring. The adjustments can take the form of extensive mass wasting (greater than 50 percent of the banks are exhibiting planar, slab, or rotational failures and/or scalloping, undermining, and/or tension cracks). The adjustments can also involve extensive fluvial erosion (significant and frequent bank cuts on over 50 percent of the banks). Neither mass wasting nor extensive fluvial erosion was evident within any of the reaches during a field investigation. As seen in the figures, the banks are either densely vegetated confirming that mass wasting and extensive fluvial erosion has not occurred, or are gently to moderately sloping with no erosion.

The next step in the Form 4 decision tree is to assess the consolidation of the bank material. The banks were moderate to well-consolidated. This determination was made because the ground surface was difficult to penetrate with a probe and/or the banks were densely vegetated as seen in the figures. In addition, the banks showed no evidence of crumbling and were composed of relatively well-packed particles.

Form 6 (see Appendix B) is used to assess the probability of mass wasting. Form 6 identifies a 10, 50, and 90 percent probability based on the bank angle and bank height. From the topographic mapping and site investigation, the average bank angles in all six reaches are equal to or flatter than 2:1 (26.6 degrees). Form 6 shows that the probably of mass wasting and bank failure has less than 10 percent risk for a 26.6 degree bank angle or less regardless of the bank height.

The final two steps in the Form 4 decision tree are based on the braiding risk determined from the vertical rating as well as the Valley Width Index (VWI) calculated in Appendix A. If the vertical rating is high, the braiding risk is considered to be greater than 50 percent. Excessive braiding can lead to lateral bank failure. For the six study reaches the vertical rating is low or medium, so the braiding risk is less than 50 percent. Furthermore, a VWI greater than 2 represents channels unconfined by bedrock or hillslope and, hence, subject to lateral migration. The VWI calculations in the spreadsheet in Appendix A show that the VWI for all six reaches is less than 2.

From the above steps, the lateral susceptibility rating is low for Reaches 1 through 6 (colored circles are included on the Form 4: Lateral Susceptibility Field Sheet decision tree sheets in Appendix B showing the decision path).

CONCLUSION

The SCCWRP channel screening tools were used to assess the downstream channel susceptibility for a portion of the Newland Sierra tentative map by Fuscoe Engineering. The project's storm runoff will be collected by proposed on-site drainage systems and conveyed to various outfalls. Fuscoe selected six of the outfalls (POC A through F) for this report. A downstream channel assessment for each POC was performed based on office analyses and field work. The assessments were based on the greater of the existing and proposed condition drainage areas since this will yield the most conservative (greater potential for erosion) results. The results indicate a low threshold for vertical susceptibility for Reaches 3 through 5. A medium threshold for vertical susceptibility was returned for Reach 1, 2, and 6. The results also indicate a low threshold for lateral susceptibility for Reaches 1 through 6. The County of San Diego requires that the worst case of the vertical and lateral susceptibilities be assumed. Therefore, a low overall threshold is applicable to Reaches 3 through 5, while a medium threshold is applicable to Reach

1, 2, and 6. Although only six outfalls were analyzed, it is anticipated that similar results would occur for the remaining proposed outfalls if they are analyzed in the future.

The HMP requires that these results be compared with the critical stress calculator results. The Critical Flow Calculator (spreadsheet provided by the County of San Diego) results are included in Appendix B for each of the six study reaches. The channel dimensions were estimated from the topographic mapping and site visit, while the additional input parameters are from Form 1 in Appendix A. The spreadsheet rounds off some values, but all the values were entered to the significant digits on Form 1. The critical stress results returned a low threshold for each reach. Therefore, the SCCWRP analyses will govern and demonstrate that a low overall threshold is applicable to Reach 3 through 5 (i.e., $0.5Q_2$), while a medium threshold is applicable to Reach 1, 2, and 6 (i.e., $0.3Q_2$).

This report is being submitted for the CEQA-level processing. During final engineering, the results herein shall be refined based on the final design. Vegetation will not be used as a grade control in the analyses. All of the project's POCs for which a lower threshold is desired shall be analyzed at final engineering.

Figure 1. Looking Downstream towards Reach 1 from Upper End near POC A

Figure 2. Looking Upstream towards Reach 1 from Lower End at Deer Springs Road