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Palmer Lake Basin Analysis

located in:

PIERCE COUNTY

prepared for:

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date:

June 15, 2018

Contents:

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MFW Project Number: 922

By the seal and signature here affixed, I certify that the enclosed report was accomplished under my direct supervision, and that I am currently a registered engineer of good standing in the State of Washington.

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Summary

Palmer Lake is located in Pierce County north of 2404 Lake Drive KP S. The discharge path of the lake has been historically modified multiple times. The purpose of this report is to recommend a permanent solution through the property at 2404 Lake Drive KP S.

The proposed concept is to provide a storm sewer system for the lake discharge. A portion of the southern development around Palmer Lake does not drain to the lake, but enters the 2404 Lake Drive KP S downstream of the lake discharge; and needs to be included in the storm sewer design.

The purpose of this study is to analysis the hydrology of the area, and provide minimum recommended pipe sizes for the storm sewer system.

A field review of the contributing basins was made on March 1, 2018. Lidar topographic maps and existing utility information were used to delineate the basins, in addition to observed conditions in the field. The basin is comprised of developed residential parcels. The analysis basins are divided into “Palmer Lake Basin” and “Downstream Basin”.

The contributing area to both basins was calculated to have a density of 2.9 DU/AC which equates to 34% impervious area according to Table 2.3.2 in Volume 3 of the DoE Stormwater Manual. Remaining area was split evenly between native timber and pasture (amended lawns) based on aerial photography of the basin.

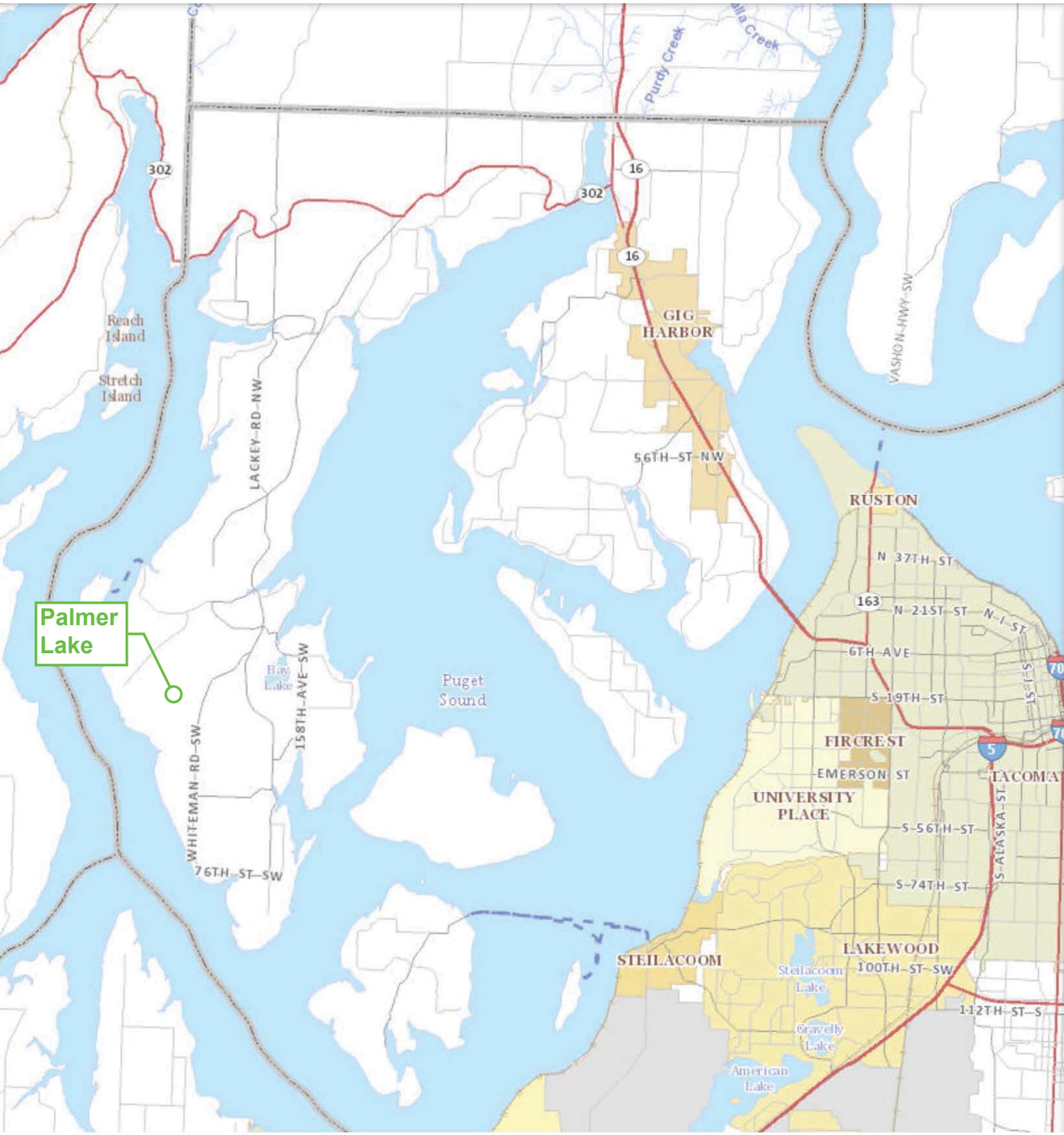
WWHM4 software was used to calculate the runoff expected for each basin. The Palmer Lake Basin is modeled with the lake as a detention facility, a 12” orifice outlet, and a conservative infiltration rate. A rise of 1-ft vertical of the lake is assumed to commence flooding conditions along the shoreline of the lake. The Downstream Basin is modeled as direct, un-detained, runoff.

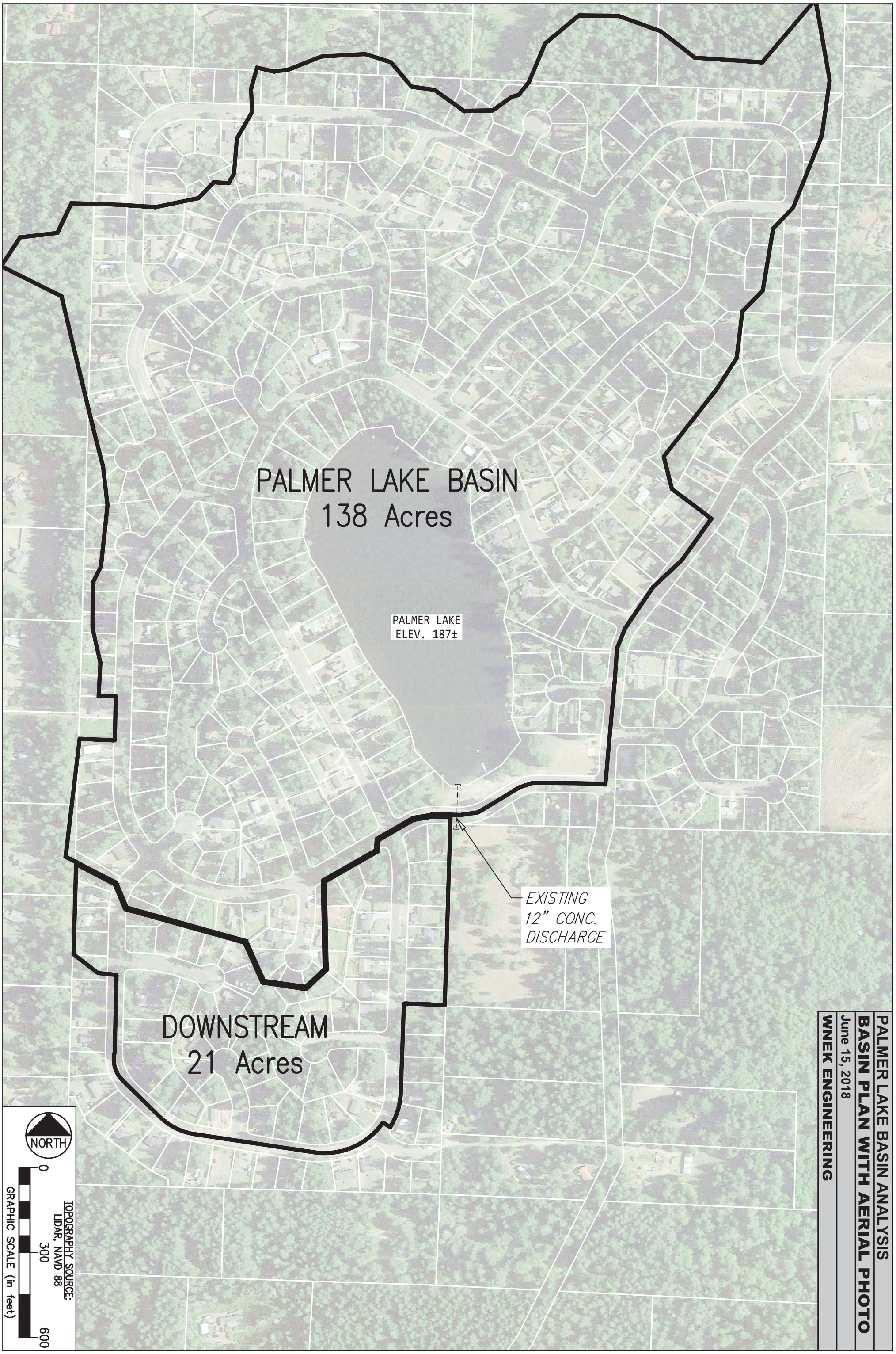
The predicted peak flow from the Palmer Lake Basin is 3.71 cfs, and 9.52 cfs for the Downstream basin. The maximum stage height above the high water mark was approximately 0.99-ft. The 12-inch pipe will flow at 85% capacity during a 100-year storm. The Downstream basin flow will be collected in an 18-inch CPEP which will flow at 68% capacity. The combination of both pipes will flow through an 18-inch pipe at 13.23 cfs and 85% capacity. This pipe will outlet to a man-made pond in the southeast corner of the project parcel. The flow velocity will be approximately 8.86 fps, and the outlet will be protected with riprap outfall protection as described in Table 4.5.1 of Volume 5 of the DoE Stormwater Manual.

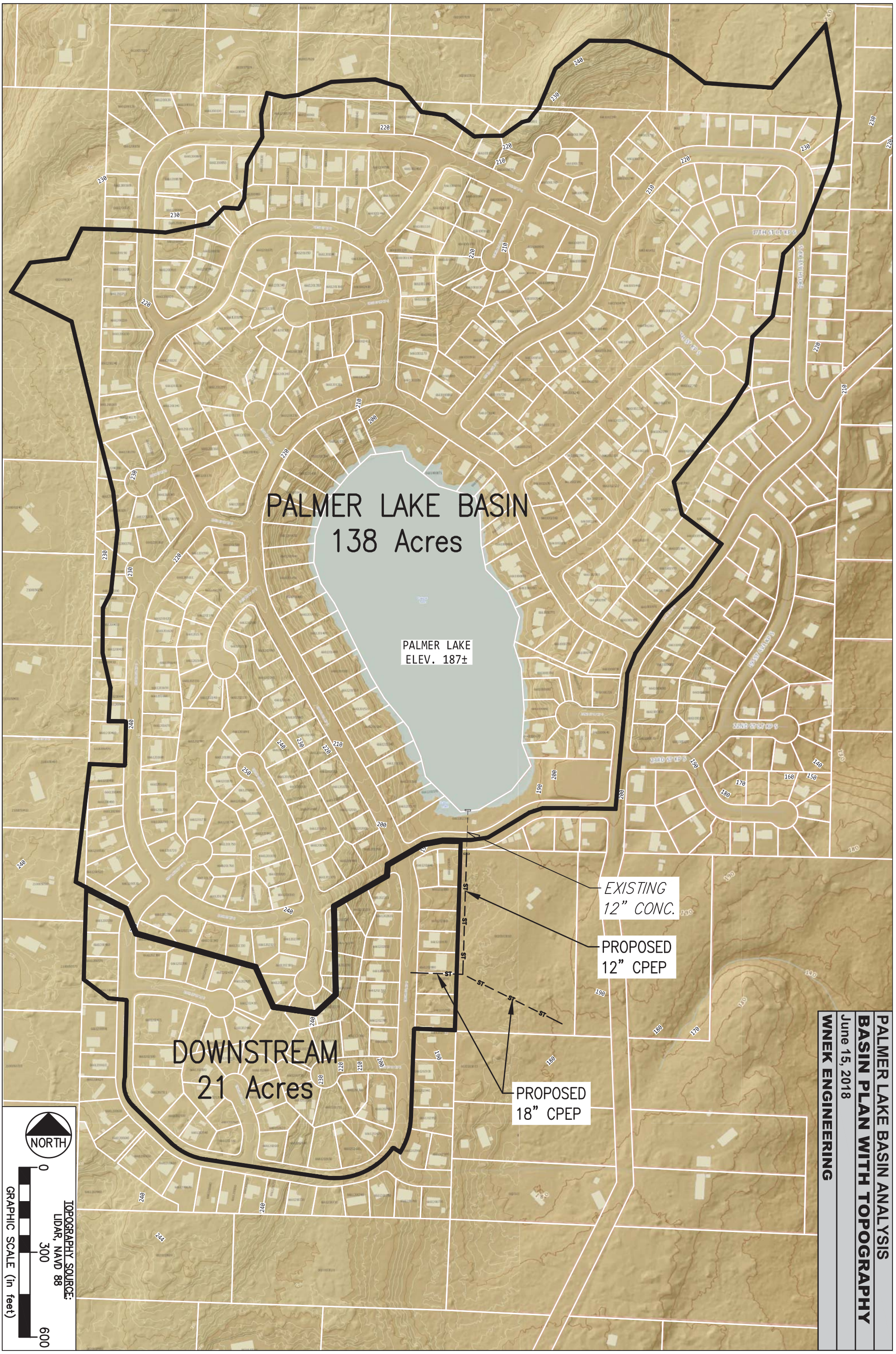
Recommendation

The existing 12” discharge pipe for Palmer lake is adequate. The proposed storm sewer should be at least 12” diameter until flow from the Downstream Basin is collected, where the storm sewer should increase to a 18” diameter pipe. If flow from the Downstream Basin is piped directly from the low point of 194th Ave. KP S, that system should be an 18” diameter pipe.

VICINITY MAP




PALMER LAKE BASIN
138 Acres
PALMER LAKE
ELEV. 187±
EXISTING
12" CONC.
DISCHARGE
DOWNSTREAM
21 Acres
NORTH
0
300
600
GRAPHIC SCALE (in feet)
TOPOGRAPHY SOURCE:
LIDAR, NAVD 88
PALMER LAKE BASIN ANALYSIS
BASIN PLAN WITH AERIAL PHOTO
June 15, 2018
WNEK ENGINEERING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June 15, 2018
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WWHM4

PROJECT REPORT

PALMER LAKE BASIN ANALYSIS

No flow control or water quality calculations are included in this report. This report is for conveyance sizing purposes only.

General Model Information

Project Name:	12 inch pipe
Site Name:	Palmer Lake
Site Address:	Palmer
City:	Palmer
Report Date:	6/15/2018
Gage:	McMillin
Data Start:	1948/10/01
Data End:	1996/09/30
Timestep:	Hourly
Precip Scale:	1.500
Version Date:	2018/01/19

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year
Low Flow Threshold for POC2:	50 Percent of the 2 Year
High Flow Threshold for POC2:	50 Year

Landuse Basin Data

Predeveloped Land Use

Palmer Lake Basin

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Forest, Flat	138
Pervious Total	138

Impervious Land Use	acre
Impervious Total	0
Basin Total	138

Element Flows To:

Surface	Interflow	Groundwater

Downstream Basin

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Forest, Flat	21
Pervious Total	21

Impervious Land Use	acre
Impervious Total	0
Basin Total	21

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Palmer Lake Basin

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Forest, Flat	41.045
A B, Pasture, Flat	41.045
Pervious Total	82.09

Impervious Land Use	acre
ROOF TOPS FLAT	42.288
POND	13.622
Impervious Total	55.91
Basin Total	138

Element Flows To:

Surface	Interflow	Groundwater
Palmer Lake Storage > HWM	Palmer Lake Storage > HWM	

Downstream Basin

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Forest, Flat	6.93
A B, Pasture, Flat	6.93
Pervious Total	13.86

Impervious Land Use	acre
ROOF TOPS FLAT	7.14
Impervious Total	7.14
Basin Total	21

Element Flows To:

Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

Palmer Lake Storage > HWM

Bottom Length: 1286.00 ft.
Bottom Width: 462.00 ft.
Depth: 20 ft.
Volume at riser head: 306.5560 acre-feet.
Infiltration On
Infiltration rate: 1.5
Infiltration safety factor: 0.25
Total Volume Infiltrated (ac-ft.): 7923.886
Total Volume Through Riser (ac-ft.): 2862.338
Total Volume Through Facility (ac-ft.): 10786.223
Percent Infiltrated: 73.46
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Side slope 1: 3 To 1
Side slope 2: 3 To 1
Side slope 3: 3 To 1
Side slope 4: 3 To 1
Discharge Structure
Riser Height: 19 ft.
Riser Diameter: 100 in.
Orifice 1 Diameter: 12 in. Elevation:0 ft.
Element Flows To:
Outlet 1 Outlet 2

Pond Hydraulic Table

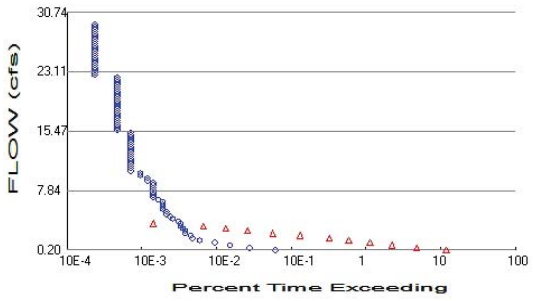
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	13.63	0.000	0.000	0.000
0.2222	13.69	3.036	1.842	5.157
0.4444	13.74	6.085	2.605	5.157
0.6667	13.80	9.146	3.190	5.157
0.8889	13.85	12.21	3.684	5.157
1.1111	13.90	15.30	4.119	5.157
1.3333	13.96	18.40	4.512	5.157
1.5556	14.01	21.50	4.873	5.157
1.7778	14.07	24.63	5.210	5.157
2.0000	14.12	27.76	5.526	5.157
2.2222	14.17	30.90	5.825	5.157
2.4444	14.23	34.06	6.109	5.157
2.6667	14.28	37.23	6.381	5.157
2.8889	14.34	40.41	6.641	5.157
3.1111	14.39	43.60	6.892	5.157
3.3333	14.45	46.81	7.134	5.157
3.5556	14.50	50.03	7.368	5.157
3.7778	14.56	53.26	7.595	5.157
4.0000	14.61	56.50	7.815	5.157
4.2222	14.67	59.75	8.029	5.157
4.4444	14.72	63.02	8.238	5.157
4.6667	14.78	66.30	8.441	5.157
4.8889	14.83	69.59	8.640	5.157
5.1111	14.89	72.89	8.834	5.157
5.3333	14.94	76.21	9.024	5.157
5.5556	15.00	79.53	9.210	5.157

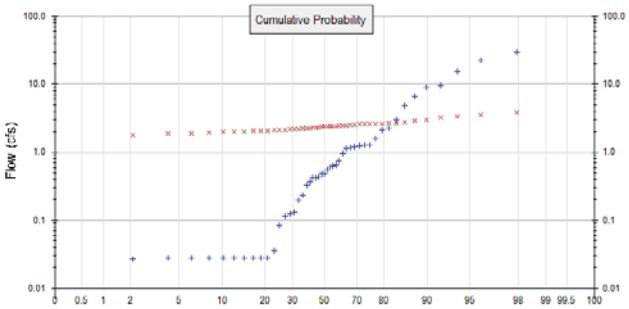
5.7778	15.05	82.87	9.392	5.157
6.0000	15.11	86.23	9.571	5.157
6.2222	15.17	89.59	9.747	5.157
6.4444	15.22	92.97	9.920	5.157
6.6667	15.28	96.36	10.09	5.157
6.8889	15.33	99.76	10.25	5.157
7.1111	15.39	103.1	10.42	5.157
7.3333	15.44	106.6	10.58	5.157
7.5556	15.50	110.0	10.74	5.157
7.7778	15.56	113.5	10.89	5.157
8.0000	15.61	116.9	11.05	5.157
8.2222	15.67	120.4	11.20	5.157
8.4444	15.73	123.9	11.35	5.157
8.6667	15.78	127.4	11.50	5.157
8.8889	15.84	130.9	11.65	5.157
9.1111	15.90	134.4	11.79	5.157
9.3333	15.95	138.0	11.93	5.157
9.5556	16.01	141.5	12.08	5.157
9.7778	16.07	145.1	12.21	5.157
10.000	16.13	148.7	12.35	5.157
10.222	16.18	152.3	12.49	5.157
10.444	16.24	155.9	12.62	5.157
10.667	16.30	159.5	12.76	5.157
10.889	16.35	163.1	12.89	5.157
11.111	16.41	166.7	13.02	5.157
11.333	16.47	170.4	13.15	5.157
11.556	16.53	174.1	13.28	5.157
11.778	16.59	177.7	13.41	5.157
12.000	16.64	181.4	13.53	5.157
12.222	16.70	185.1	13.66	5.157
12.444	16.76	188.9	13.78	5.157
12.667	16.82	192.6	13.90	5.157
12.889	16.88	196.3	14.02	5.157
13.111	16.93	200.1	14.14	5.157
13.333	16.99	203.9	14.26	5.157
13.556	17.05	207.7	14.38	5.157
13.778	17.11	211.4	14.50	5.157
14.000	17.17	215.3	14.62	5.157
14.222	17.23	219.1	14.73	5.157
14.444	17.29	222.9	14.85	5.157
14.667	17.34	226.8	14.96	5.157
14.889	17.40	230.6	15.07	5.157
15.111	17.46	234.5	15.19	5.157
15.333	17.52	238.4	15.30	5.157
15.556	17.58	242.3	15.41	5.157
15.778	17.64	246.2	15.52	5.157
16.000	17.70	250.1	15.63	5.157
16.222	17.76	254.1	15.73	5.157
16.444	17.82	258.0	15.84	5.157
16.667	17.88	262.0	15.95	5.157
16.889	17.94	266.0	16.05	5.157
17.111	18.00	270.0	16.16	5.157
17.333	18.06	274.0	16.26	5.157
17.556	18.12	278.0	16.37	5.157
17.778	18.18	282.0	16.47	5.157
18.000	18.24	286.1	16.57	5.157
18.222	18.30	290.1	16.68	5.157
18.444	18.36	294.2	16.78	5.157

18.667	18.42	298.3	16.88	5.157
18.889	18.48	302.4	16.98	5.157
19.111	18.54	306.5	20.35	5.157
19.333	18.60	310.6	34.18	5.157
19.556	18.66	314.8	53.81	5.157
19.778	18.72	318.9	77.72	5.157
20.000	18.78	323.1	105.0	5.157
20.222	18.84	327.3	134.9	5.157

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 138
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 82.09
Total Impervious Area: 55.91

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.405079
5 year	2.305633
10 year	5.834319
25 year	15.93486
50 year	30.743642
100 year	55.828672

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	2.345863
5 year	2.738498
10 year	2.984466
25 year	3.2841
50 year	3.501152
100 year	3.714137

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.322	2.370
1950	2.268	2.346
1951	8.943	3.364
1952	0.027	1.812
1953	0.486	2.100
1954	0.028	2.054
1955	0.028	2.241
1956	0.948	2.625
1957	0.422	2.561
1958	0.418	1.929

1959	0.232	2.141
1960	22.516	3.585
1961	1.214	2.318
1962	0.027	1.876
1963	29.362	2.667
1964	1.621	2.063
1965	0.555	2.357
1966	9.620	1.989
1967	4.769	2.467
1968	0.036	2.226
1969	0.113	2.538
1970	0.124	2.215
1971	0.437	2.371
1972	1.275	2.160
1973	0.027	2.259
1974	0.752	2.046
1975	1.175	2.308
1976	6.573	1.872
1977	0.028	2.158
1978	15.424	2.575
1979	1.135	2.481
1980	0.649	2.752
1981	0.369	2.307
1982	2.146	2.400
1983	0.198	3.217
1984	0.027	2.879
1985	0.028	2.136
1986	0.133	2.613
1987	1.275	3.897
1988	0.479	2.598
1989	0.615	1.982
1990	2.970	2.397
1991	0.083	2.997
1992	0.027	2.033
1993	0.629	2.677
1994	0.027	1.515
1995	0.028	2.422
1996	1.242	2.519

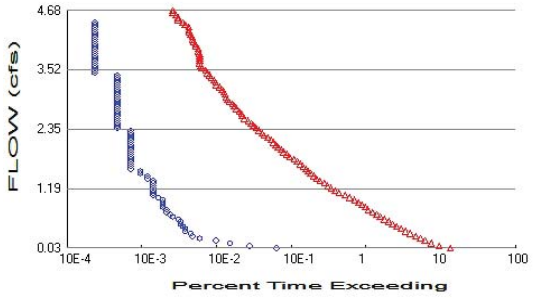
Ranked Annual Peaks

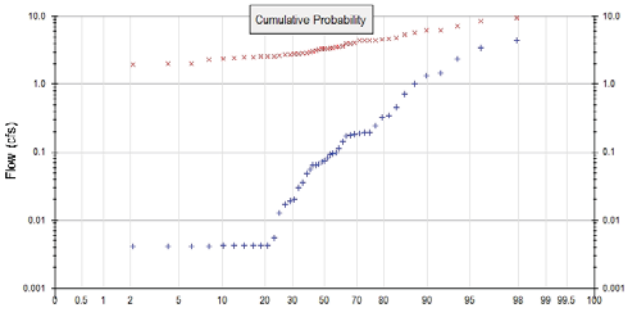
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	29.3619	3.8966
2	22.5155	3.5853
3	15.4238	3.3641
4	9.6205	3.2168
5	8.9432	2.9974
6	6.5731	2.8788
7	4.7692	2.7521
8	2.9702	2.6766
9	2.2678	2.6672
10	2.1460	2.6254
11	1.6213	2.6127
12	1.2754	2.5985
13	1.2748	2.5754
14	1.2419	2.5612
15	1.2137	2.5384
16	1.1755	2.5191

17	1.1349	2.4806
18	0.9482	2.4666
19	0.7524	2.4223
20	0.6491	2.4004
21	0.6291	2.3974
22	0.6154	2.3712
23	0.5547	2.3700
24	0.4863	2.3572
25	0.4789	2.3462
26	0.4371	2.3182
27	0.4223	2.3080
28	0.4183	2.3073
29	0.3687	2.2591
30	0.3223	2.2406
31	0.2324	2.2257
32	0.1981	2.2147
33	0.1333	2.1605
34	0.1238	2.1579
35	0.1129	2.1410
36	0.0830	2.1356
37	0.0357	2.1002
38	0.0277	2.0633
39	0.0277	2.0535
40	0.0277	2.0457
41	0.0275	2.0325
42	0.0275	1.9886
43	0.0275	1.9824
44	0.0274	1.9293
45	0.0273	1.8757
46	0.0273	1.8719
47	0.0269	1.8122
48	0.0266	1.5151

POC 2





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #2
Total Pervious Area: 21
Total Impervious Area: 0

Mitigated Landuse Totals for POC #2
Total Pervious Area: 13.86
Total Impervious Area: 7.14

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #2

Return Period	**Flow(cfs)**
2 year	0.061642
5 year	0.350857
10 year	0.887831
25 year	2.42487
50 year	4.67838
100 year	8.495667

Flow Frequency Return Periods for Mitigated. POC #2

Return Period	**Flow(cfs)**
2 year	3.357088
5 year	4.695774
10 year	5.700143
25 year	7.110359
50 year	8.267986
100 year	9.52136

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #2

Year	**Predeveloped**	**Mitigated**
1949	0.049	2.602
1950	0.345	3.302
1951	1.361	5.390
1952	0.004	2.006
1953	0.074	3.610
1954	0.004	3.325
1955	0.004	2.330
1956	0.144	3.014
1957	0.064	7.143
1958	0.064	2.672
1959	0.035	2.823

1960	3.426	8.382
1961	0.185	2.610
1962	0.004	2.499
1963	4.468	9.509
1964	0.247	2.852
1965	0.084	4.614
1966	1.464	6.205
1967	0.726	3.552
1968	0.005	3.941
1969	0.017	5.769
1970	0.019	2.484
1971	0.067	2.803
1972	0.194	2.702
1973	0.004	3.508
1974	0.114	4.871
1975	0.179	2.436
1976	1.000	4.035
1977	0.004	1.996
1978	2.347	6.246
1979	0.173	4.386
1980	0.099	3.119
1981	0.056	4.550
1982	0.327	3.350
1983	0.030	4.472
1984	0.004	2.934
1985	0.004	1.870
1986	0.020	2.923
1987	0.194	4.477
1988	0.073	3.408
1989	0.094	3.440
1990	0.452	2.571
1991	0.013	3.929
1992	0.004	2.695
1993	0.096	2.356
1994	0.004	1.958
1995	0.004	4.390
1996	0.189	3.209

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #2

Rank	Predeveloped	Mitigated
1	4.4681	9.5093
2	3.4263	8.3821
3	2.3471	7.1432
4	1.4640	6.2462
5	1.3609	6.2051
6	1.0003	5.7685
7	0.7257	5.3899
8	0.4520	4.8711
9	0.3451	4.6144
10	0.3266	4.5500
11	0.2467	4.4769
12	0.1941	4.4717
13	0.1940	4.3903
14	0.1890	4.3856
15	0.1847	4.0348
16	0.1789	3.9411
17	0.1727	3.9291

18	0.1443	3.6104
19	0.1145	3.5522
20	0.0988	3.5085
21	0.0957	3.4400
22	0.0936	3.4076
23	0.0844	3.3502
24	0.0740	3.3247
25	0.0729	3.3023
26	0.0665	3.2090
27	0.0643	3.1188
28	0.0637	3.0144
29	0.0561	2.9341
30	0.0490	2.9230
31	0.0354	2.8516
32	0.0301	2.8228
33	0.0203	2.8028
34	0.0188	2.7023
35	0.0172	2.6947
36	0.0126	2.6717
37	0.0054	2.6095
38	0.0042	2.6025
39	0.0042	2.5710
40	0.0042	2.4987
41	0.0042	2.4837
42	0.0042	2.4359
43	0.0042	2.3561
44	0.0042	2.3302
45	0.0042	2.0058
46	0.0042	1.9955
47	0.0041	1.9577
48	0.0041	1.8695

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0308	265	56846	21451	Fail
0.0778	116	40221	34673	Fail
0.1247	64	31730	49578	Fail
0.1717	41	25797	62919	Fail
0.2186	25	22511	90044	Fail
0.2655	20	19385	96925	Fail
0.3125	19	16582	87273	Fail
0.3594	16	14310	89437	Fail
0.4064	16	12484	78025	Fail
0.4533	15	10864	72426	Fail
0.5003	14	9581	68435	Fail
0.5472	14	8478	60557	Fail
0.5942	13	7511	57776	Fail
0.6411	11	6513	59209	Fail
0.6881	10	5908	59080	Fail
0.7350	9	5167	57411	Fail
0.7819	9	4527	50300	Fail
0.8289	8	4114	51425	Fail
0.8758	8	3710	46375	Fail
0.9228	8	3348	41850	Fail
0.9697	8	2980	37250	Fail
1.0167	7	2570	36714	Fail
1.0636	6	2216	36933	Fail
1.1106	6	1830	30500	Fail
1.1575	6	1619	26983	Fail
1.2044	6	1450	24166	Fail
1.2514	6	1301	21683	Fail
1.2983	6	1172	19533	Fail
1.3453	6	1016	16933	Fail
1.3922	5	923	18460	Fail
1.4392	5	839	16780	Fail
1.4861	4	763	19075	Fail
1.5331	4	707	17675	Fail
1.5800	3	657	21900	Fail
1.6270	3	605	20166	Fail
1.6739	3	553	18433	Fail
1.7208	3	508	16933	Fail
1.7678	3	460	15333	Fail
1.8147	3	404	13466	Fail
1.8617	3	367	12233	Fail
1.9086	3	333	11100	Fail
1.9556	3	307	10233	Fail
2.0025	3	282	9400	Fail
2.0495	3	263	8766	Fail
2.0964	3	244	8133	Fail
2.1433	3	225	7500	Fail
2.1903	3	204	6800	Fail
2.2372	3	182	6066	Fail
2.2842	3	171	5700	Fail
2.3311	3	155	5166	Fail
2.3781	2	142	7100	Fail
2.4250	2	131	6550	Fail
2.4720	2	123	6150	Fail
2.5189	2	112	5600	Fail

2.5659	2	100	5000	Fail
2.6128	2	93	4650	Fail
2.6597	2	91	4550	Fail
2.7067	2	85	4250	Fail
2.7536	2	78	3900	Fail
2.8006	2	73	3650	Fail
2.8475	2	69	3450	Fail
2.8945	2	62	3100	Fail
2.9414	2	59	2950	Fail
2.9884	2	57	2850	Fail
3.0353	2	55	2750	Fail
3.0822	2	53	2650	Fail
3.1292	2	50	2500	Fail
3.1761	2	46	2300	Fail
3.2231	2	42	2100	Fail
3.2700	2	41	2050	Fail
3.3170	2	39	1950	Fail
3.3639	2	36	1800	Fail
3.4109	2	34	1700	Fail
3.4578	1	32	3200	Fail
3.5048	1	30	3000	Fail
3.5517	1	27	2700	Fail
3.5986	1	26	2600	Fail
3.6456	1	25	2500	Fail
3.6925	1	25	2500	Fail
3.7395	1	25	2500	Fail
3.7864	1	25	2500	Fail
3.8334	1	25	2500	Fail
3.8803	1	24	2400	Fail
3.9273	1	24	2400	Fail
3.9742	1	22	2200	Fail
4.0211	1	22	2200	Fail
4.0681	1	21	2100	Fail
4.1150	1	20	2000	Fail
4.1620	1	20	2000	Fail
4.2089	1	19	1900	Fail
4.2559	1	18	1800	Fail
4.3028	1	18	1800	Fail
4.3498	1	18	1800	Fail
4.3967	1	16	1600	Fail
4.4437	1	15	1500	Fail
4.4906	0	13	n/a	Fail
4.5375	0	13	n/a	Fail
4.5845	0	12	n/a	Fail
4.6314	0	11	n/a	Fail
4.6784	0	11	n/a	Fail

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

Water Quality BMP Flow and Volume for POC #2

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

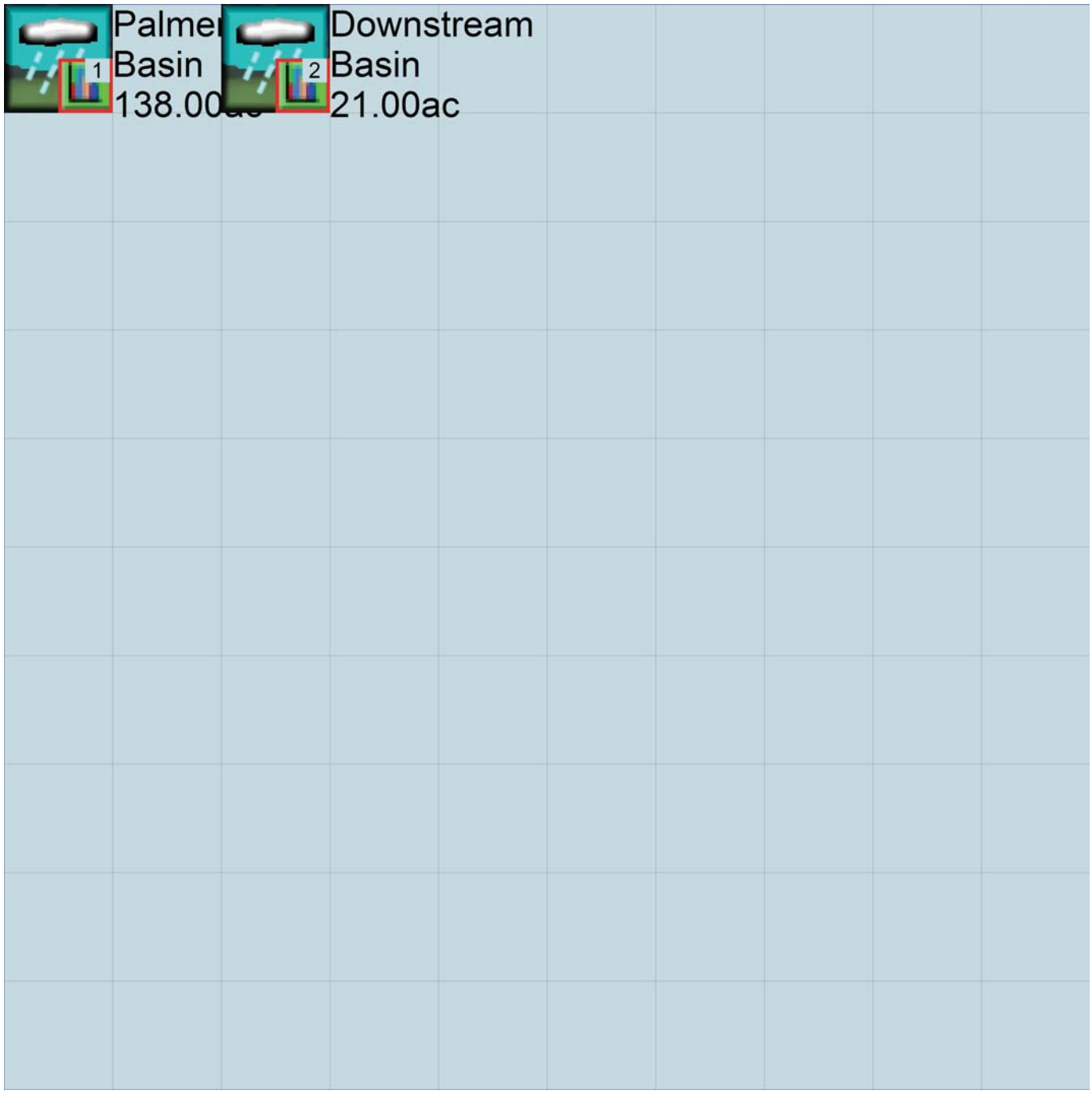
No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix

Predeveloped Schematic



Mitigated Schematic

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Palmer Lake Basin Analysis	WNEK ENGINEERING
Conveyance Capacity	June 15, 2018

Downstream Basin Pipe

Pipe Diameter	18	Inches
Pipe Material:	CPEP	
Pipe Manning Value:	0.011	
Pipe Slope:	1.50%	
Pipe Flow Rate:	9.52	CFS
Normal Depth:	11.51	Inches
Flow Area:	1.19	Sq. Ft.
Flow Velocity:	7.98	Ft/s
Pipe flows	68%	full at maximum discharge.

Model Storm Event: 100 year, 24 hour

Palmer Lake Pipe

Pipe Diameter	12	Inches
Pipe Material:	CPEP	
Pipe Manning Value:	0.011	
Pipe Slope:	1.00%	
Pipe Flow Rate:	3.71	CFS
Normal Depth:	11.51	Inches
Flow Area:	0.67	Sq. Ft.
Flow Velocity:	5.54	Ft/s
Pipe flows	85%	full at maximum discharge.

Model Storm Event: 100 year, 24 hour

Combined Flow, Palmer Lake & Downstream Basin

Pipe Diameter	18	Inches
Pipe Material:	CPEP	
Pipe Manning Value:	0.011	
Pipe Slope:	1.50%	
Pipe Flow Rate:	13.23	CFS
Normal Depth:	14.18	Inches
Flow Area:	1.49	Sq. Ft.
Flow Velocity:	8.86	Ft/s
Pipe flows	85%	full at maximum discharge.

Model Storm Event: 100 year, 24 hour