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AMENDMENT TO RED ROCK CANYON DRAINAGE BASIN DESIGN PLAN

RECEIVED

DEC 30 2005

Rapid City Growth
Management Department

PREPARED FOR:
CITY OF RAPID CITY
RAPID CITY, SOUTH DAKOTA

By

Boschee Engineering

December, 2005

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ENGINEERING DIVISION



FOR REVIEW ONLY

INTRODUCTION

GENERAL

This Amendment to the Red Rock Drainage Basin Design Plan has been prepared for the City of Rapid City by Boschee Engineering. The purpose of this amendment is to reevaluate the location of Detention Pond 101 based on current development within the Red Rock Drainage Basin.

All recommendations for the facilities evaluated made in this report supersede those given in the 1993 DBDP.

DESIGN PLAN LIMITATIONS

It was beyond the scope of work to provide final engineering drawings suitable for construction. Exceptions to this are Pond 101 and Pond 201 which were designed as part of this Amendment.

The design plan presented herein is conceptual and is intended to provide the general information necessary for the final working design of an efficient, planned system. The design plan is based on a practical hydraulic system which is suitable for further evaluation and implementation as the basin develops.

This AMENDMENT provides for only major drainage. Unless specifically addressed in the report, localized or minor drainage was beyond the scope of the study.

Note that the design plan runoff/routing analysis is considered an approximation since storms rarely follow ideal patterns and other factors such as ground cover, infiltration, and channel conditions may vary with time or from assumed conditions. The intent of a hydrologic runoff/routing analysis is to provide a reasonably dependable and consistent approximation of rainfall-runoff characteristics. It is also worth noting that the design analysis assumes unobstructed flow in pipes and channels.

HYDROLOGY AND HYDRAULICS

METHODOLOGY

The computer models used in the 1993 DBDP were used in the analysis and preparation of this AMENDMENT. Modeling input data was revised to account for the proposed changes discussed in this report.

COMPUTER MODEL REVISIONS

It was necessary to revise the 1993 DBDP sub-basin and flow network in order to model the proposed changes.

Figure 1 shows the updated sub-basin boundaries for the upper drainage basins in the Red Rock Drainage Basin. All land use conditions in this AMENDMENT are future land use conditions and assumed sub-basin imperviousness is included in the CUHP data. The 1993 DBDP also contains a map showing future assumed land use. These changes are described in the next section of this report

Figure 2 shows the updated flow routing network for the elements modified for this AMENDMENT. New elements 105 and 201 were added to the routing network. These changes are described in the next section of this report.

AMENDED DESIGN PLAN

GENERAL

The Amended Design Plan follows the conceptual plan recommended in the 1993 DBDP. The City of Rapid City directed that all metering dams be below the size regulated by the State of South Dakota as a Small Dam. It was also a requirement that flows downstream not be increased with this AMENDMENT. Major AMENDMENT changes thus made were the addition of Ponds 105, Pond 201 and relocating Pond 101. Note that all changes were made upstream of Element 2.

SUB-BASIN MODIFICATIONS

Sub-basin Z:

This sub-basin was added during the design of Detention Cell 102 to better reflect the flow patterns into the detention cell. Sub-basin Z was created by a reduction in the size of sub-basin J.

Sub-basin J:

Sub-basin J was also changed during the design of Detention Cell 102. This sub-basin was reduced in size to better reflect the flow patterns to Detention Cell 102. The reduction in sub-basin J was accounted for in sub-basin Z.

Sub-basin I:

Sub-basin I was reduced in size from 224 acres to 132.5 acres. This reduction was made to reflect the current development plans for this sub-basin.

Sub-Basin M:

Sub-basin M was increased in size to account for the acres lost in reduction of sub-basin I.

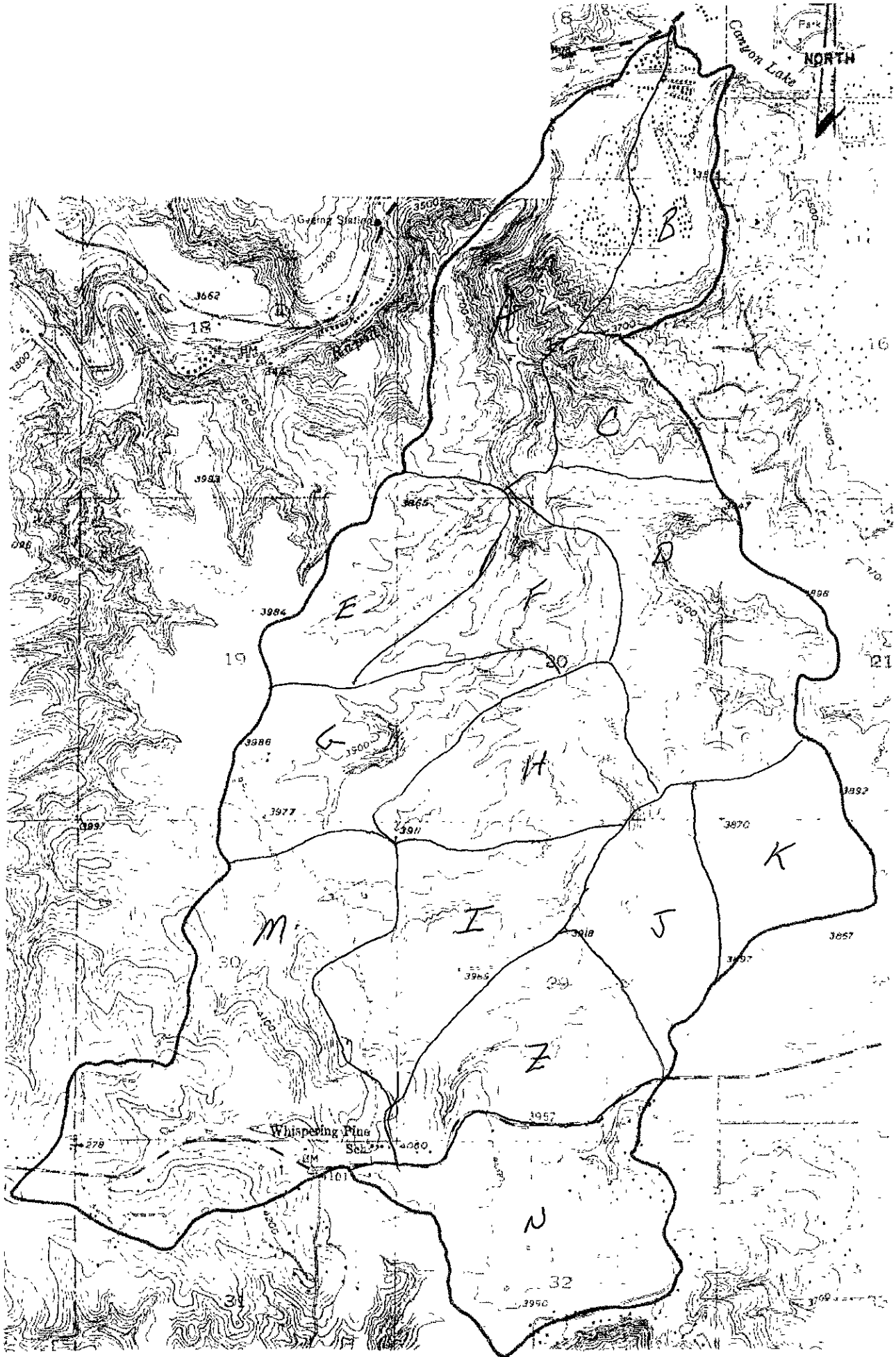


FIGURE 1: DRAINAGE BASINS MAP

INDIVIDUAL ELEMENT DESIGN

A discussion of each of the revised routing elements in the Red Rock Basin follows.

Element 24:

Element 24 was shortened in length. Element 24 in this run is an existing open channel beginning at the outlet of Detention Cell 105 and ending at Detention Cell 101. For this AMENDMENT Element 24 has a length of 3150 feet and a slope of 2.2 percent

Detention Cell 105:

Detention Cell 105 is modeled as a dry detention cell that will be created by replacing the existing box stand pipe structure with a 48- inch stand pipe, with an 18 – inch orifice. Additional grading will need to be completed to provide 25 acre-feet of storage in the pool area.

The peak 10 year outflow from Detention Cell 105 will be 85 cfs and the peak 100-year outflow will be 215 cfs.

Detention Cell 201:

Detention Cell 201 is modeled as a dry detention cell with an 8' x 6' box stand pipe structure with a 60- inch outlet pipe, with a 24 – inch orifice. During the 100-year event an earthen spillway will be used to discharge part of the 100-year peak. Additional grading will need to be completed to provide 11 acre-feet of storage in the pool area.

The peak 10 year outflow from Detention Cell 201 will be 238 cfs and the peak 100-year outflow will be 514 cfs.

Detention Cell 101:

Detention Cell 101 is modeled as a dry detention cell with 60- inch outlet pipe. Additional grading will need to be completed to provide 6 acre-feet of storage in the pool area.

The peak 10 year outflow from Detention Cell 201 will be 119 cfs and the peak 100-year outflow will be 325 cfs.

Flow Summaries:

Tables 1 through 3 summaries the flows at each element listed in the original DBDP and provides a comparison with the 2005 AMENDMENT for the 2-year, 10-year, and 100-year storm runoff events.

**Table 1.
2-YEAR FLOW SUMMARY**

CONVEYANCE ELEMENT #	2-YR EXISTING (cfs)	2-YR 1993 DESIGN PLAN (cfs)	2-YEAR, 2005 DESIGN PLAN AMENDMENT (cfs)
4	40	40	40.
104	38	38	38.
28	37	37	37.
103	35	35	35.
23	32	32	32.
3	67	67	67.
105	N A	N A	15.
102	36	36	36.
24	8	17	15.
22	35	35	35.
201	N A	N A	42.
101	62	65	29.
2	62	66	68.
27	3	43	43.
21	56	64	67.
26	2	32	32.
20	56	64	67.
25	2	31	31.
19	55	68	71.
18	59	89	92.
17	59	89	92.
16	59	89	92.
15	60	90	93.
152	60	90	93.
151	60	90	93.
144	60	90	93.
143	59	90	93.
142	59	90	93.
141	59	90	93.
13	59	90	92.
12	59	90	92.
11	59	90	92.
10	59	90	92.
1	63	97	99

**Table 10.
10-YEAR FLOW SUMMARY**

CONVEYANCE ELEMENT #	10-YR EXISTING (cfs)	10-YR 1993 DESIGN PLAN (cfs)	10-YEAR, 2005 DESIGN PLAN AMENDMENT (cfs)
4	167	167	167.
104	157	157	157.
28	155	156	155.
103	147	147	147.
23	143	144	143.
3	269	262	289.
105	N A	N A	85.
102	N A	N A	210.
24	112	110	82.
22	259	148	206.
201	460	385	238.
101	460	361	119.
2	460	385	350.
27	104	173	173.
21	448	360	346.
26	84	142	141.
20	448	360	346.
25	83	140	139.
19	512	422	384.
18	648	584	522.
17	647	584	522.
16	646	584	522.
15	671	611	549.
152	671	611	549.
151	670	611	549.
144	675	621	557.
143	676	621	557.
142	676	621	557.
141	673	620	555.
13	672	619	555.
12	671	619	555.
11	672	619	555.
10	671	619	555.
1	735	696	629.

Table 11.
100-YEAR FLOW SUMMARY

CONVEYANCE ELEMENT #	100-YR EXISTING (cfs)	100-YR 1993 DESIGN PLAN (cfs)	100-YEAR, 2005 DESIGN PLAN AMENDMENT (cfs)
4	426	427	426.
104	416	416	416.
28	411	411	411.
103	362	362	362.
23	353	354	353.
3	691	639	717.
105	N A.	N A	215.
102	691	416	399.
24	375	342	215.
22	652	406	395.
201	N A	N A	514.
101	1339	855	325.
2	1339	1097	833.
27	346	464	463.
21	1327	853	830.
26	310	410	409.
20	1326	853	829.
25	309	407	407.
19	1692	1057	1098.
18	2340	1798	1795.
17	2340	1799	1794.
16	2338	1797	1971.
15	2456	1922	1921.
152	2457	1924	1922.
151	2460	1925	1921.
144	2520	1996	1991.
143	2521	1996	1989.
142	2521	1995	1986.
141	2513	1989	1985.
13	2514	1989	1982.
12	2512	1987	1979.
11	2511	1985	1979.
10	2507	1984	1980.
1	2828	2337	2322.

2 RED ROCK CANYON DRAINAGE BASIN - 2 YEAR FULL DEVELOPED DRAINAGE ANALYSIS
 2005 AMENDMENT
 01100-YEAR 2 1.10

7001015.0RRCSBA001	RED ROCK CANYON SUBBASIN A	0.494	1.61	1.15	11.4	.030	0.35	0.05	4.80	.0011	.837	
7001015.0RRCSBB002	RED ROCK CANYON SUBBASIN B	0.225	1.14	0.46	25.7	.040	0.35	0.05	4.57	.0015	.696	
7001015.0RRCSBC003	RED ROCK CANYON SUBBASIN C	0.170	0.88	0.44	6.70	.057	0.30	0.05	4.89	.0008	.956	
7001015.0RRCSBD004	RED ROCK CANYON SUBBASIN D	0.378	1.30	0.66	8.50	.047	0.30	0.05	4.79	.0012	.835	
7001015.0RRCSBE005	RED ROCK CANYON SUBBASIN E	0.241	1.52	0.89	6.01	.048	0.25	0.05	4.79	.0012	.831	
7001015.0RRCSBF006	RED ROCK CANYON SUBBASIN F	0.278	1.31	0.62	4.50	.032	0.25	0.05	4.84	.0010	.876	
7001015.0RRCSBG007	RED ROCK CANYON SUBBASIN G	0.330	1.03	0.57	9.10	.052	0.30	0.05	4.43	.0015	.686	
7001015.0RRCSBH008	RED ROCK CANYON SUBBASIN H	0.316	1.25	0.59	8.80	.040	0.30	0.05	4.68	.0014	.742	
7001015.0RRCSBI009	RED ROCK CANYON SUBBASIN I	0.300	1.34	0.79	10.9	.029	0.30	0.05	3.98	.0018	.566	
7001015.0RRCSBJ010	RED ROCK CANYON SUBBASIN J	0.289	0.89	0.46	14.0	.022	0.30	0.05	4.54	.0017	.636	
7101015.0RRCSBJ015	RED ROCK CANYON SUBBASIN Z	0.089	0.56	0.24	28.0	.028	26.0	0.30	0.05	4.54	.0017	.636
7001015.0RRCSBK011	RED ROCK CANYON SUBBASIN K	0.408	1.13	0.57	19.6	.027	0.35	0.05	4.55	.0017	.638	
7001015.0RRCSBL012	RED ROCK CANYON SUBBASIN L	0.384	1.28	0.61	13.6	.041	0.35	0.05	3.79	.0018	.553	
7001015.0RRCSBM013	RED ROCK CANYON SUBBASIN M	0.811	2.14	1.46	11.1	.016	0.55	0.05	4.22	.0018	.581	
7001015.0RRCSBN014	RED ROCK CANYON SUBBASIN N	0.417	1.14	0.49	11.2	.026	0.35	0.05	3.57	.0018	.538	

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WATERSHED 1
RED ROCK CANYON DRAINAGE BASIN DESIGN PLAN - 2 YEAR DEVELOPED
BOSCHEE ENGINEERING 2005 AMENDMENT DECEMBER 2005

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70	0	0	5.0								
1	1										
2	1										
3	144										
4	18										
5	15										
6	18										
7	19										
8	19										
9	101										
10	201										
11	27										
12	3										
13	105										
14	4										
15	3										
0	1	0	0	3							
0	2	21	0	3							
0	3	102	0	3							
0	4	104	0	3							
0	10	1	0	1	40.0	1220.0	0.010	4.0	4.0	.035	8.0
0	11	10	0	1	40.0	520.0	0.010	4.0	4.0	.035	8.0
0	12	11	0	1	40.0	800.0	0.010	4.0	4.0	.035	8.0
0	13	12	0	1	40.0	1580.0	0.010	4.0	4.0	.035	6.0
0	141	13	0	1	32.0	1510.0	0.015	2.0	2.0	.056	7.5
0	142	141	0	1	20.0	500.0	0.018	2.0	0.0	.056	9.5
0	143	142	0	1	32.0	980.0	0.010	3.5	3.5	.044	7.0
0	144	143	0	1	20.0	670.0	0.017	1.0	1.0	.044	9.5
0	151	144	0	4	0.1	600.0	0.017	4.0	4.0	.056	3.0
					50.0	600.0	0.017	4.0	1.5	.056	10.0
0	152	151	0	4	5.0	410.0	0.017	1.0	8.0	.050	2.5
					34.5	410.0	0.017	1.0	2.5	.050	6.0
0	15	152	0	4	0.1	1410.0	0.017	5.0	5.0	.062	1.0
					11.0	1410.0	0.017	2.0	2.0	.062	12.0
0	16	15	0	4	0.1	880.0	0.021	5.0	5.0	.062	1.0
					11.0	880.0	0.021	2.0	2.0	.062	12.0
0	17	16	0	4	0.1	560.0	0.018	5.0	5.0	.062	1.0
					11.0	560.0	0.018	2.0	2.0	.062	12.0
0	18	17	0	4	0.1	620.0	0.019	5.0	5.0	.062	1.0
					11.0	620.0	0.019	2.0	2.0	.062	12.0
0	19	18	0	4	0.1	5420.0	0.024	5.0	5.0	.062	1.0
					11.0	5420.0	0.024	2.0	2.0	.062	12.0
0	20	19	0	4	0.1	970.0	0.019	5.0	5.0	.062	1.0
					11.0	970.0	0.019	2.0	2.0	.062	12.0
0	21	20	0	4	8.0	3890.0	0.015	1.0	1.0	.050	2.5
					25.0	3890.0	0.015	1.0	2.0	.050	12.0
0	22	201	0	4	0.1	3600.0	0.014	2.0	3.0	.050	5.0
					105.0	3600.0	0.014	1.5	15.0	.050	10.0
0	23	3	0	4	0.1	2080.0	0.018	8.0	4.0	.050	8.0
					96.0	2080.0	0.018	15.0	35.0	.050	8.0
0	24	101	0	1	0.1	3150.0	0.022	5.0	10.0	.050	20.0
0	25	18	0	1	0.1	1340.0	0.029	2.5	1.5	.062	20.0
0	26	25	0	4	0.1	3680.0	0.024	6.0	6.0	.062	2.5
					30.0	3680.0	0.024	2.0	10.0	.062	10.0
0	27	26	0	4	0.1	780.0	0.028	5.0	5.0	.062	3.0
					30.0	780.0	0.028	2.5	1.5	.062	10.0
0	28	103	0	4	0.1	1000.0	0.018	8.0	4.0	.050	8.0

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0	101	2	8	2	96.0	1000.0	0.018	15.0	35.0	.050	8.0
	0.0		0.0		.1	1.0	0.010	.0	.0	.016	0.1
	1.6		214.1		0.1		29.7	0.3	93.3	0.9	153.7
0	102	22	23	2	2.3		255.3	3.4	290.8	4.8	322.8
	0.0		0.0		.1	1.0	0.010	.0	.0	.016	0.1
	5.5		47.0		0.7		2.0	2.1	14.0	3.7	33.0
	12.8		210.0		6.9		75.0	8.7	108.0	10.7	160.0
	22.8		321.0		15.1		244.0	17.5	274.0	20.1	298.0
	35.5		390.0		25.7		341.0	28.8	356.0	31.9	374.0
	49.0		1100.0		39.3		408.0	43.3	428.0	47.7	600.0
0	103	23	8	2	50.0		2500.0	51.0	2800.0		
	0.0		0.0		.1	1.0	0.010	.0	.0	.016	0.1
	2.2		210.0		0.1		20.0	0.5	60.0	1.2	140.0
0	104	28	4	2	3.2		260.0	5.3	300.0	7.0	560.0
	0.0		0.0		.1	1.0	0.010	.0	.0	.016	0.1
	0.0		0.0		1.7		220.0	4.1	350.0	5.0	600.0
0	105	24	13	2	.1	1.0	0.010	.0	.0	.016	0.1
	0.0		0.0		0.1		9.5	0.4	15.3	0.8	19.5
	1.4		22.9		2.3		25.9	3.4	28.5	5.0	31.0
	7.0		118.8		9.5		156.3	15.6	185.5	20.3	210.3
	30.8		232.3								
0	201	2	10	2	.1	1.0	0.010	.0	.0	.016	0.1
	0.0		0.0		0.1		0.6	0.5	35.3	1.0	100.5
	1.6		153.7		2.4		218.7	3.4	259.2	5.0	294.2
	7.4		375.5		10.9		577.4				

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17 18

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101 102

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2 RED ROCK CANYON DRAINAGE BASIN - 10 YEAR FULL DEVELOPED DRAINAGE ANALYSIS
 2005 AMENDMENT
 01100-YEAR 10 1.86

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7001015.0RRCSBL012	RED ROCK CANYON SUBBASIN L	0.384	1.28	0.61	13.6	.041	0.35	0.05	3.79	.0018	.553	
7001015.0RRCSBM013	RED ROCK CANYON SUBBASIN M	0.811	2.14	1.46	11.1	.016	0.55	0.05	4.22	.0018	.581	
7001015.0RRCSBN014	RED ROCK CANYON SUBBASIN N	0.417	1.14	0.49	11.2	.026	0.35	0.05	3.57	.0018	.538	

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WATERSHED 1

RED ROCK CANYON DRAINAGE BASIN DESIGN PLAN - 10 YEAR DEVELOPED
BOSCHEE ENGINEERING 2005 AMENDMENT DECEMBER 2005

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70	0	0	5.0								
1	1										
2	1										
3	144										
4	18										
5	15										
6	18										
7	19										
8	19										
9	101										
10	201										
11	27										
12	3										
13	105										
14	4										
15	3										
0	1	0	0	3							
0	2	21	0	3							
0	3	102	0	3							
0	4	104	0	3							
0	10	1	0	1	40.0	1220.0	0.010	4.0	4.0	.035	8.0
0	11	10	0	1	40.0	520.0	0.010	4.0	4.0	.035	8.0
0	12	11	0	1	40.0	800.0	0.010	4.0	4.0	.035	8.0
0	13	12	0	1	40.0	1580.0	0.010	4.0	4.0	.035	6.0
0	141	13	0	1	32.0	1510.0	0.015	2.0	2.0	.056	7.5
0	142	141	0	1	20.0	500.0	0.018	2.0	0.0	.056	9.5
0	143	142	0	1	32.0	980.0	0.010	3.5	3.5	.044	7.0
0	144	143	0	1	20.0	670.0	0.017	1.0	1.0	.044	9.5
0	151	144	0	4	0.1	600.0	0.017	4.0	4.0	.056	3.0
					50.0	600.0	0.017	4.0	1.5	.056	10.0
0	152	151	0	4	5.0	410.0	0.017	1.0	8.0	.050	2.5
					34.5	410.0	0.017	1.0	2.5	.050	6.0
0	15	152	0	4	0.1	1410.0	0.017	5.0	5.0	.062	1.0
					11.0	1410.0	0.017	2.0	2.0	.062	12.0
0	16	15	0	4	0.1	880.0	0.021	5.0	5.0	.062	1.0
					11.0	880.0	0.021	2.0	2.0	.062	12.0
0	17	16	0	4	0.1	560.0	0.018	5.0	5.0	.062	1.0
					11.0	560.0	0.018	2.0	2.0	.062	12.0
0	18	17	0	4	0.1	620.0	0.019	5.0	5.0	.062	1.0
					11.0	620.0	0.019	2.0	2.0	.062	12.0
0	19	18	0	4	0.1	5420.0	0.024	5.0	5.0	.062	1.0
					11.0	5420.0	0.024	2.0	2.0	.062	12.0
0	20	19	0	4	0.1	970.0	0.019	5.0	5.0	.062	1.0
					11.0	970.0	0.019	2.0	2.0	.062	12.0
0	21	20	0	4	8.0	3890.0	0.015	1.0	1.0	.050	2.5
					25.0	3890.0	0.015	1.0	2.0	.050	12.0
0	22	201	0	4	0.1	3600.0	0.014	2.0	3.0	.050	5.0
					105.0	3600.0	0.014	1.5	15.0	.050	10.0
0	23	3	0	4	0.1	2080.0	0.018	8.0	4.0	.050	8.0
					96.0	2080.0	0.018	15.0	35.0	.050	8.0
0	24	101	0	1	0.1	3150.0	0.022	5.0	10.0	.050	20.0
0	25	18	0	1	0.1	1340.0	0.029	2.5	1.5	.062	20.0
0	26	25	0	4	0.1	3680.0	0.024	6.0	6.0	.062	2.5
					30.0	3680.0	0.024	2.0	10.0	.062	10.0
0	27	26	0	4	0.1	780.0	0.028	5.0	5.0	.062	3.0
					30.0	780.0	0.028	2.5	1.5	.062	10.0
0	28	103	0	4	0.1	1000.0	0.018	8.0	4.0	.050	8.0

Sw1005Amen

0	101	2	8	2	96.0	1000.0	0.018	15.0	35.0	.050	8.0
	0.0		0.0		.1	1.0	0.010	.0	.0	.016	0.1
	1.6		214.1		0.1		29.7	0.3	93.3	0.9	153.7
0	102	22	23	2	2.3		255.3	3.4	290.8	4.8	322.8
	0.0		0.0		.1	1.0	0.010	.0	.0	.016	0.1
	5.5		47.0		0.7		2.0	2.1	14.0	3.7	33.0
	12.8		210.0		6.9		75.0	8.7	108.0	10.7	160.0
	22.8		321.0		15.1		244.0	17.5	274.0	20.1	298.0
	35.5		390.0		25.7		341.0	28.8	356.0	31.9	374.0
	49.0		1100.0		39.3		408.0	43.3	428.0	47.7	600.0
0	103	23	8	2	50.0	2500.0		51.0	2800.0		
	0.0		0.0		.1	1.0	0.010	.0	.0	.016	0.1
	2.2		210.0		0.1		20.0	0.5	60.0	1.2	140.0
0	104	28	4	2	3.2		260.0	5.3	300.0	7.0	560.0
	0.0		0.0		.1	1.0	0.010	.0	.0	.016	0.1
	0.0		0.0		1.7		220.0	4.1	350.0	5.0	600.0
0	105	24	13	2	.1	1.0	0.010	.0	.0	.016	0.1
	0.0		0.0		0.1		9.5	0.4	15.3	0.8	19.5
	1.4		22.9		2.3		25.9	3.4	28.5	5.0	31.0
	7.0		118.8		9.5		156.3	15.6	185.5	20.3	210.3
	30.8		232.3								
0	201	2	10	2	.1	1.0	0.010	.0	.0	.016	0.1
	0.0		0.0		0.1		0.6	0.5	35.3	1.0	100.5
	1.6		153.7		2.4		218.7	3.4	259.2	5.0	294.2
	7.4		375.5		10.9		577.4				

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1	2	3	4	10	11	12	13	141	142	143	144	151	152	15	16
17	18	19	20	21	22	23	24	25	26	27	28	101	102	103	104
99	105	201													

ENDPROGRAM

2 RED ROCK CANYON DRAINAGE BASIN - 100 YEAR FULL DEVELOPED DRAINAGE ANALYSIS
 2005 AMENDMENT
 01100-YEAR 100 2.95

7001015.0RRCSBA001	RED ROCK CANYON SUBBASIN A	0.494	1.61	1.15	11.4	.030	0.35	0.05	4.80	.0011	.837	
7001015.0RRCSBB002	RED ROCK CANYON SUBBASIN B	0.225	1.14	0.46	25.7	.040	0.35	0.05	4.57	.0015	.696	
7001015.0RRCSBC003	RED ROCK CANYON SUBBASIN C	0.170	0.88	0.44	6.70	.057	0.30	0.05	4.89	.0008	.956	
7001015.0RRCSBD004	RED ROCK CANYON SUBBASIN D	0.378	1.30	0.66	8.50	.047	0.30	0.05	4.79	.0012	.835	
7001015.0RRCSBE005	RED ROCK CANYON SUBBASIN E	0.241	1.52	0.89	6.01	.048	0.25	0.05	4.79	.0012	.831	
7001015.0RRCSBF006	RED ROCK CANYON SUBBASIN F	0.278	1.31	0.62	4.50	.032	0.25	0.05	4.84	.0010	.876	
7001015.0RRCSBG007	RED ROCK CANYON SUBBASIN G	0.330	1.03	0.57	9.10	.052	0.30	0.05	4.43	.0015	.686	
7001015.0RRCSBH008	RED ROCK CANYON SUBBASIN H	0.316	1.25	0.59	8.80	.040	0.30	0.05	4.68	.0014	.742	
7001015.0RRCSBI009	RED ROCK CANYON SUBBASIN I	0.300	1.34	0.79	10.9	.029	0.30	0.05	3.98	.0018	.566	
7001015.0RRCSBJ010	RED ROCK CANYON SUBBASIN J	0.289	0.89	0.46	14.0	.022	0.30	0.05	4.54	.0017	.636	
7101015.0RRCSBJ015	RED ROCK CANYON SUBBASIN Z	0.089	0.56	0.24	28.0	.028	26.0	0.30	0.05	4.54	.0017	.636
7001015.0RRCSBK011	RED ROCK CANYON SUBBASIN K	0.408	1.13	0.57	19.6	.027	0.35	0.05	4.55	.0017	.638	
7001015.0RRCSBL012	RED ROCK CANYON SUBBASIN L	0.384	1.28	0.61	13.6	.041	0.35	0.05	3.79	.0018	.553	
7001015.0RRCSBM013	RED ROCK CANYON SUBBASIN M	0.811	2.14	1.46	11.1	.016	0.55	0.05	4.22	.0018	.581	
7001015.0RRCSBN014	RED ROCK CANYON SUBBASIN N	0.417	1.14	0.49	11.2	.026	0.35	0.05	3.57	.0018	.538	

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WATERSHED 1
RED ROCK CANYON DRAINAGE BASIN DESIGN PLAN - 100 YEAR DEVELOPED
BOSCHEE ENGINEERING 2005 AMENDMENT DECEMBER 2005

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0	1	0	0	3								
0	2	21	0	3								
0	3	102	0	3								
0	4	104	0	3								
0	10	1	0	1	40.0	1220.0	0.010	4.0	4.0	.035	8.0	
0	11	10	0	1	40.0	520.0	0.010	4.0	4.0	.035	8.0	
0	12	11	0	1	40.0	800.0	0.010	4.0	4.0	.035	8.0	
0	13	12	0	1	40.0	1580.0	0.010	4.0	4.0	.035	6.0	
0	141	13	0	1	32.0	1510.0	0.015	2.0	2.0	.056	7.5	
0	142	141	0	1	20.0	500.0	0.018	2.0	0.0	.056	9.5	
0	143	142	0	1	32.0	980.0	0.010	3.5	3.5	.044	7.0	
0	144	143	0	1	20.0	670.0	0.017	1.0	1.0	.044	9.5	
0	151	144	0	4	0.1	600.0	0.017	4.0	4.0	.056	3.0	
					50.0	600.0	0.017	4.0	1.5	.056	10.0	
0	152	151	0	4	5.0	410.0	0.017	1.0	8.0	.050	2.5	
					34.5	410.0	0.017	1.0	2.5	.050	6.0	
0	15	152	0	4	0.1	1410.0	0.017	5.0	5.0	.062	1.0	
					11.0	1410.0	0.017	2.0	2.0	.062	12.0	
0	16	15	0	4	0.1	880.0	0.021	5.0	5.0	.062	1.0	
					11.0	880.0	0.021	2.0	2.0	.062	12.0	
0	17	16	0	4	0.1	560.0	0.018	5.0	5.0	.062	1.0	
					11.0	560.0	0.018	2.0	2.0	.062	12.0	
0	18	17	0	4	0.1	620.0	0.019	5.0	5.0	.062	1.0	
					11.0	620.0	0.019	2.0	2.0	.062	12.0	
0	19	18	0	4	0.1	5420.0	0.024	5.0	5.0	.062	1.0	
					11.0	5420.0	0.024	2.0	2.0	.062	12.0	
0	20	19	0	4	0.1	970.0	0.019	5.0	5.0	.062	1.0	
					11.0	970.0	0.019	2.0	2.0	.062	12.0	
0	21	20	0	4	8.0	3890.0	0.015	1.0	1.0	.050	2.5	
					25.0	3890.0	0.015	1.0	2.0	.050	12.0	
0	22	201	0	4	0.1	3600.0	0.014	2.0	3.0	.050	5.0	
					105.0	3600.0	0.014	1.5	15.0	.050	10.0	
0	23	3	0	4	0.1	2080.0	0.018	8.0	4.0	.050	8.0	
					96.0	2080.0	0.018	15.0	35.0	.050	8.0	
0	24	101	0	1	0.1	3150.0	0.022	5.0	10.0	.050	20.0	
0	25	18	0	1	0.1	1340.0	0.029	2.5	1.5	.062	20.0	
0	26	25	0	4	0.1	3680.0	0.024	6.0	6.0	.062	2.5	
					30.0	3680.0	0.024	2.0	10.0	.062	10.0	
0	27	26	0	4	0.1	780.0	0.028	5.0	5.0	.062	3.0	
					30.0	780.0	0.028	2.5	1.5	.062	10.0	
0	28	103	0	4	0.1	1000.0	0.018	8.0	4.0	.050	8.0	

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0	101	2	8	2	96.0	1000.0	0.018	15.0	35.0	.050	8.0
	0.0		0.0		.1	1.0	0.010	.0	.0	.016	0.1
	1.6		214.1		0.1		29.7	0.3	93.3	0.9	153.7
0	102	22	23	2	.1	1.0	0.010	.0	.0	.016	0.1
	0.0		0.0		0.7		2.0	2.1	14.0	3.7	33.0
	5.5		47.0		6.9		75.0	8.7	108.0	10.7	160.0
	12.8		210.0		15.1		244.0	17.5	274.0	20.1	298.0
	22.8		321.0		25.7		341.0	28.8	356.0	31.9	374.0
	35.5		390.0		39.3		408.0	43.3	428.0	47.7	600.0
	49.0		1100.0		50.0		2500.0	51.0	2800.0		
0	103	23	8	2	.1	1.0	0.010	.0	.0	.016	0.1
	0.0		0.0		0.1		20.0	0.5	60.0	1.2	140.0
	2.2		210.0		3.2		260.0	5.3	300.0	7.0	560.0
0	104	28	4	2	.1	1.0	0.010	.0	.0	.016	0.1
	0.0		0.0		1.7		220.0	4.1	350.0	5.0	600.0
0	105	24	13	2	.1	1.0	0.010	.0	.0	.016	0.1
	0.0		0.0		0.1		9.5	0.4	15.3	0.8	19.5
	1.4		22.9		2.3		25.9	3.4	28.5	5.0	31.0
	7.0		118.8		9.5		156.3	15.6	185.5	20.3	210.3
	30.8		232.3								
0	201	2	10	2	.1	1.0	0.010	.0	.0	.016	0.1
	0.0		0.0		0.1		0.6	0.5	35.3	1.0	100.5
	1.6		153.7		2.4		218.7	3.4	259.2	5.0	294.2
	7.4		375.5		10.9		577.4				

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ENDPROGRAM