Urban Drainage and Flood Control District

Douglas County E-19 Surveys

SULPHUR GULCH BELOW WILLOW PARK DRIVE
ALERT ID: 2843
LID: SPHC2

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Introduction

HDR Engineering Inc. was contracted by the Urban Drainage and Flood Control District to survey and provide information about various flood warning stream gage sites in a manner consistent with National Weather Service E-19 procedures. On April 7, 2005, HDR personnel surveyed two sites. This report is a summary of the work done and information gathered for the Sulphur Gulch gage. Included in this report are elevations of critical points in the vicinity of the site, estimates of stages causing flood damage in vicinity of the gage, and a revised rating curve.

Site

The stream gage is located south of East Mainstreet on Sulphur Gulch. The ALERT ID number for this Gage is 2840 while the National Weather Service LID is SPHC2 and is referred to as Sulphur Gulch. Sulphur Gulch has a wide floodplain in the vicinity of this gage with a steep gradient. Potential flooding at the gage itself would consist of flooding of homes to the south of the gulch an flooding of a church to the north. Parker Town Hall and Downtown Parker are less than a mile downstream of this gage on the north side of the gulch. Figure 1 shows the location of the site on the Douglas County ALERT map.

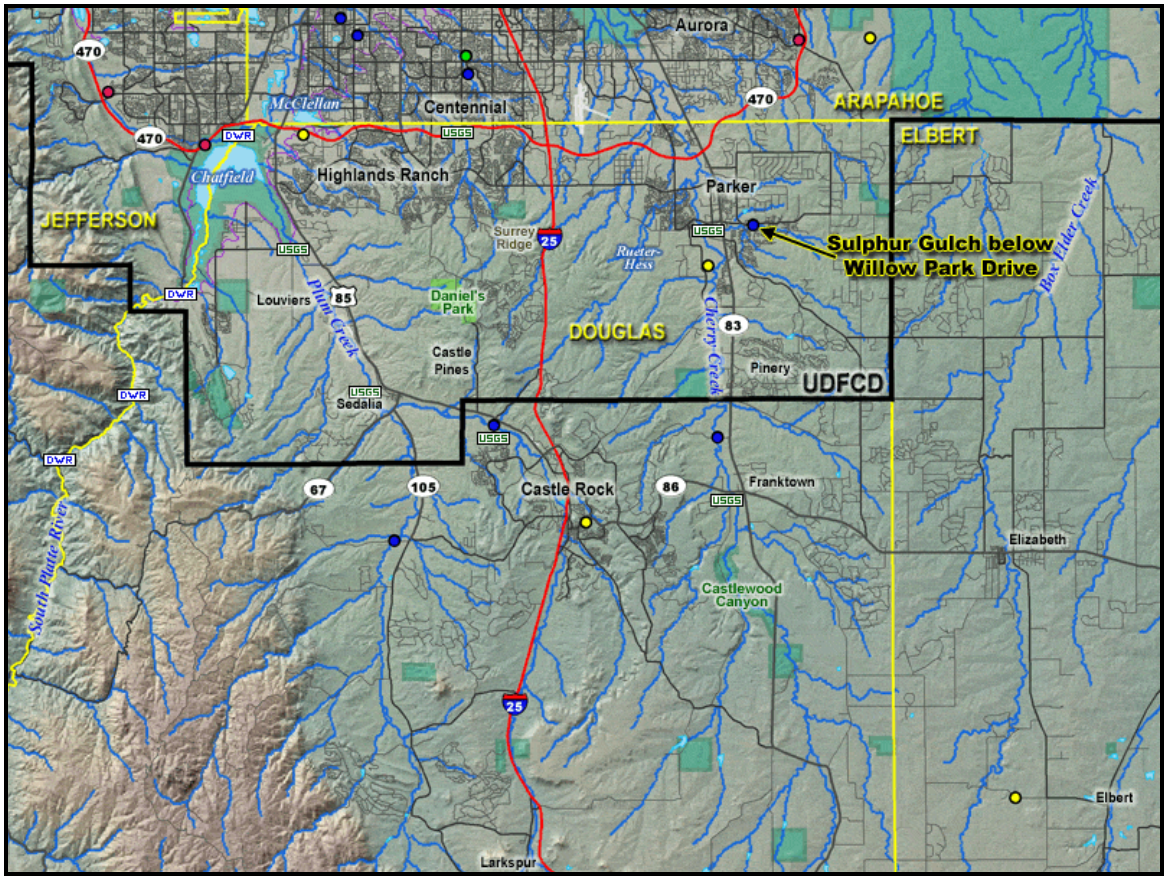

Figure 1 – Location Map

Surveyed locations

Ground elevations were surveyed along a cross section for a rating curve for the site. In addition, the elevations and locations of hazard locations, along with low flow channel water surface elevations up and downstream from the gage. Figure 2 shows locations of the surveyed points in the vicinity of the gage. The base of the ALERT transmitter was surveyed at an elevation of 100.00 for a temporary benchmark. The flow line elevation is 86.7 feet. The low flow channels banks will be overtopped at 8.7 feet above the invert elevation. Based on the water surface elevations in the low flow channel, the estimated channel energy slope is 0.1 percent.

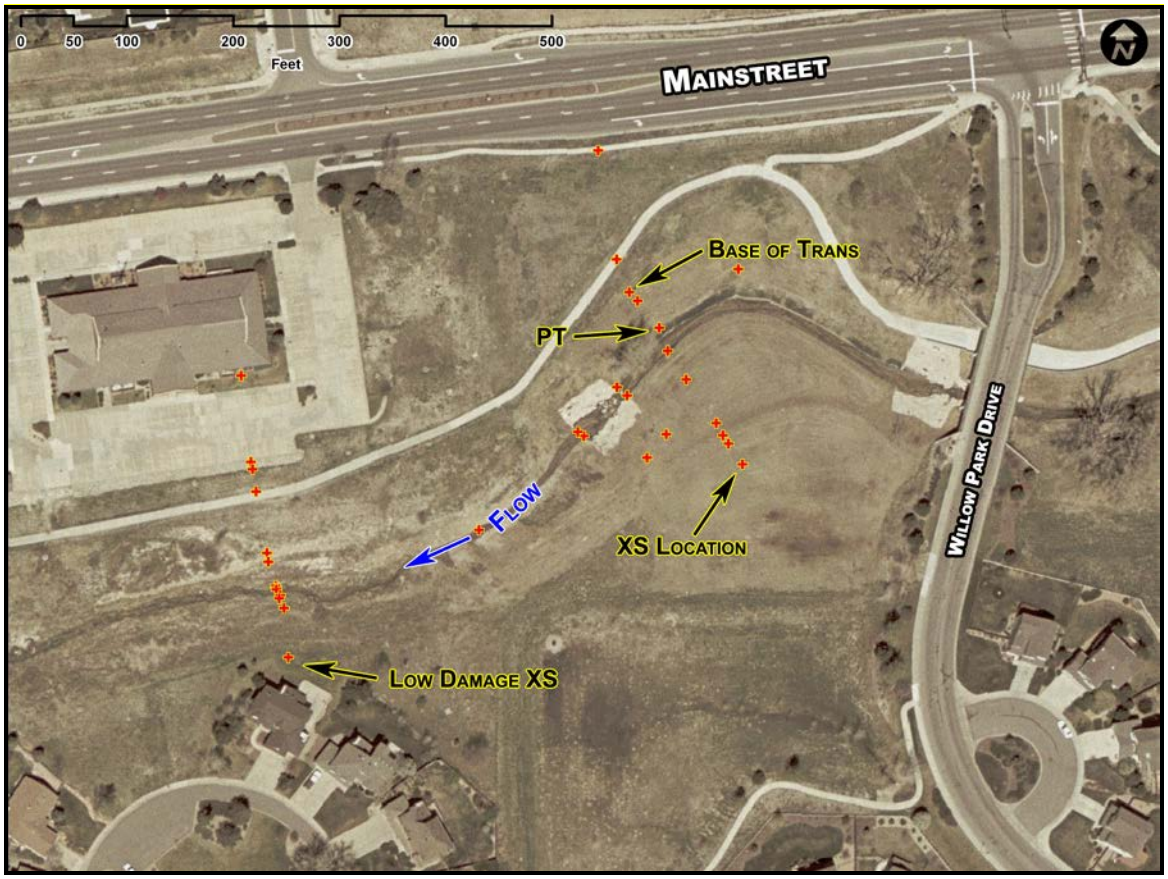

Figure 2 – Surveyed Points (Aerial - DRCOG 2004)

Rating Curve Development

Hydraulics for the existing bridge were evaluated using the HEC River Analysis System (HEC-RAS) program developed by the U.S. Army Corps of Engineers, Hydrologic Engineering Center[1]. HEC-RAS uses the standard step method to calculate water surface profiles. The following assumptions are used by HEC-RAS in computing water surface profiles:

- Steady flow;
- Gradually varied flow;
- One-dimensional flow;
- Channel slopes are small, less than 1:10

A rating curve was established for the gage using the surveyed cross-sections and the Army Corps of Engineers computer program HEC-RAS. The resulting rating curve from the analysis is in Table 1.

Q (cfs)	Depth (ft)	Comment
7400	12.77	500-Year
4600	11.02	100-Year
3600	9.90	50-Year
1800	7.56	10-Year
1500	7.04	
1000	6.02	
800	5.52	
600	4.94	
400	4.22	
300	3.78	
200	3.25	
150	2.93	
100	2.53	
75	2.29	
50	2.00	
25	1.61	
10	1.25	
5	1.07	
1	0.85	
0.1	0.75	

Table 1 – Rating Curve

[1] U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-RAS Water Surface Profiles, Computer Program, Davis, California, March 2001.

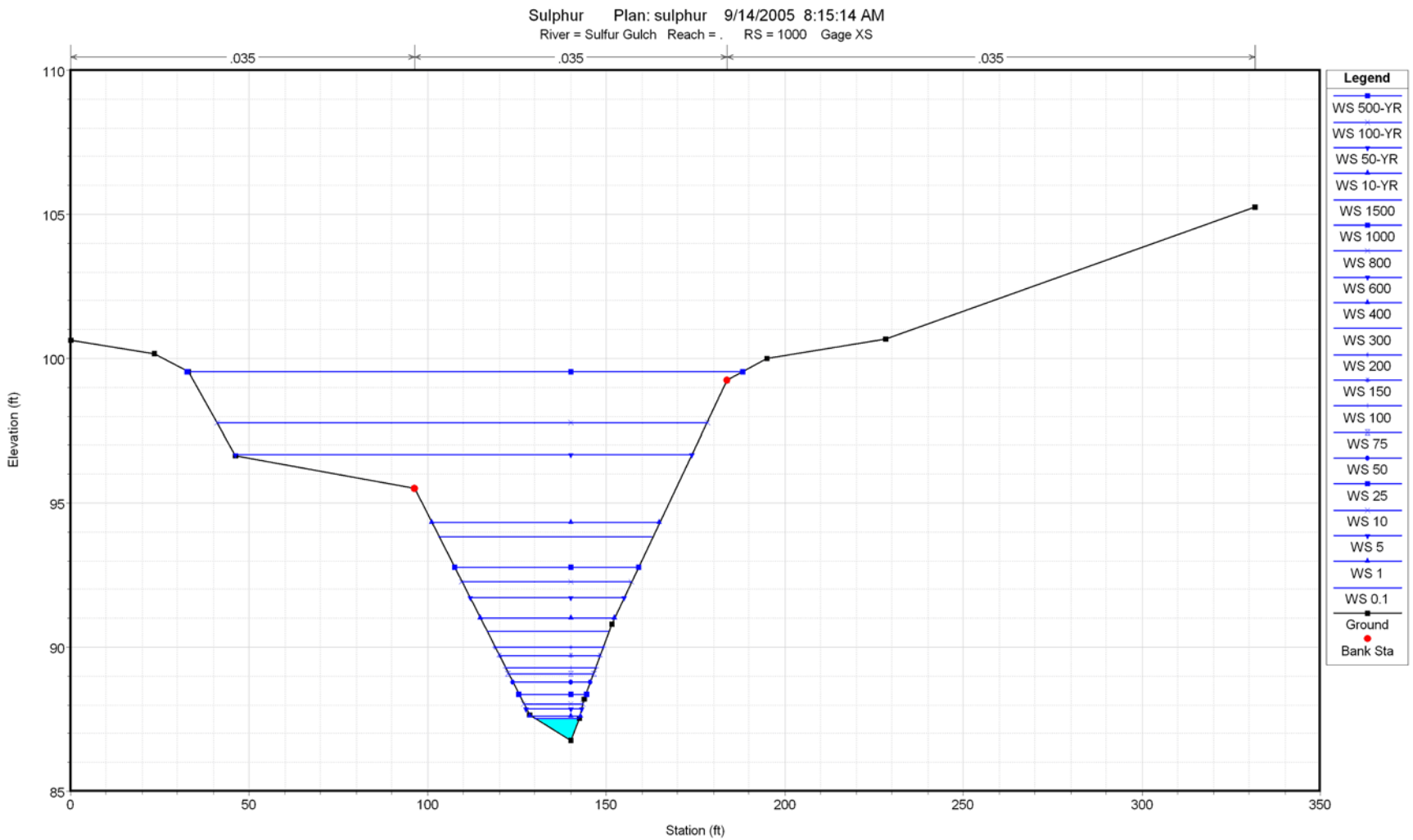

Figure 3 – HEC-RAS Cross Section with all Profiles

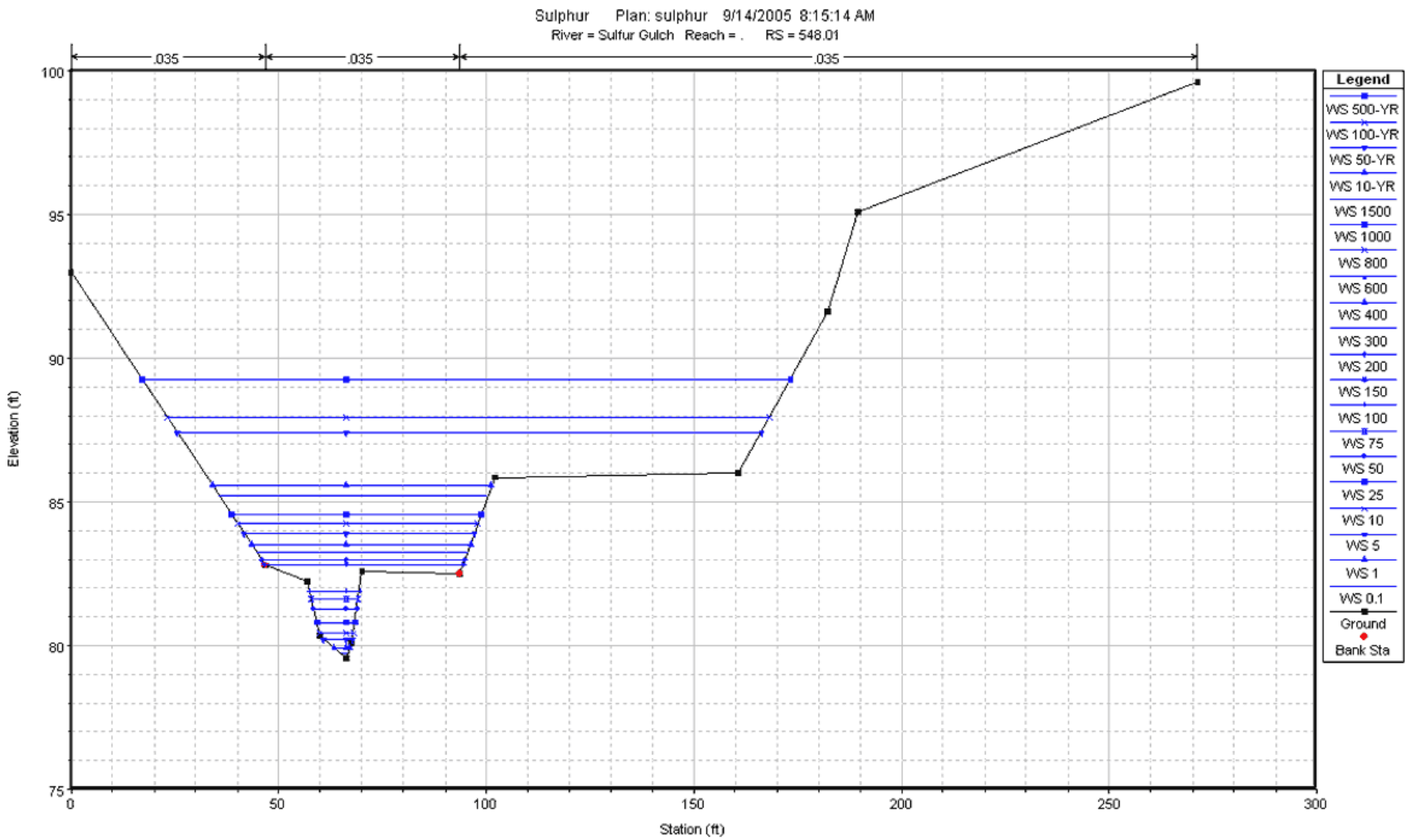

Figure 4 – HEC-RAS Low Damage Cross Section with all Profiles

River	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Sulphur Gulch	500-YR	7400	86.77	99.54		100.82	0.003522	9.57	861.02	155.60	0.61
Sulphur Gulch	100-YR	4600	86.77	97.79	95.90	98.80	0.003389	8.29	607.76	137.34	0.58
Sulphur Gulch	50-YR	3600	86.77	96.67		97.71	0.004030	8.26	458.91	127.84	0.62
Sulphur Gulch	10-YR	1800	86.77	94.33		95.07	0.004213	6.90	260.82	63.80	0.60
Sulphur Gulch	1500	1500	86.77	93.81		94.48	0.004132	6.55	229.03	59.73	0.59
Sulphur Gulch	1000	1000	86.77	92.79		93.31	0.003921	5.81	172.10	51.63	0.56
Sulphur Gulch	800	800	86.77	92.29		92.75	0.003795	5.43	147.23	47.67	0.54
Sulphur Gulch	600	600	86.77	91.71		92.09	0.003601	4.96	120.85	43.06	0.52
Sulphur Gulch	400	400	86.77	90.99		91.28	0.003287	4.35	92.03	37.39	0.49
Sulphur Gulch	300	300	86.77	90.55		90.79	0.003049	3.93	76.39	34.17	0.46
Sulphur Gulch	200	200	86.77	90.02		90.20	0.002711	3.38	59.23	30.47	0.43
Sulphur Gulch	150	150	86.77	89.70		89.84	0.002466	3.02	49.70	28.21	0.40
Sulphur Gulch	100	100	86.77	89.30		89.40	0.002114	2.55	39.15	25.47	0.36
Sulphur Gulch	75	75	86.77	89.06		89.14	0.001879	2.26	33.19	23.78	0.34
Sulphur Gulch	50	50	86.77	88.77		88.82	0.001556	1.88	26.56	21.75	0.30
Sulphur Gulch	25	25	86.77	88.38		88.41	0.001066	1.34	18.59	19.02	0.24
Sulphur Gulch	10	10	86.77	88.02		88.03	0.000578	0.82	12.22	16.69	0.17
Sulphur Gulch	5	5	86.77	87.84		87.84	0.000328	0.54	9.28	15.59	0.12
Sulphur Gulch	1	1	86.77	87.62		87.62	0.000048	0.17	6.02	14.07	0.04
Sulphur Gulch	0.1	0.1	86.77	87.52		87.52	0.000001	0.02	4.70	12.51	0.01

Table 2 – HEC-RAS Profile Output Table

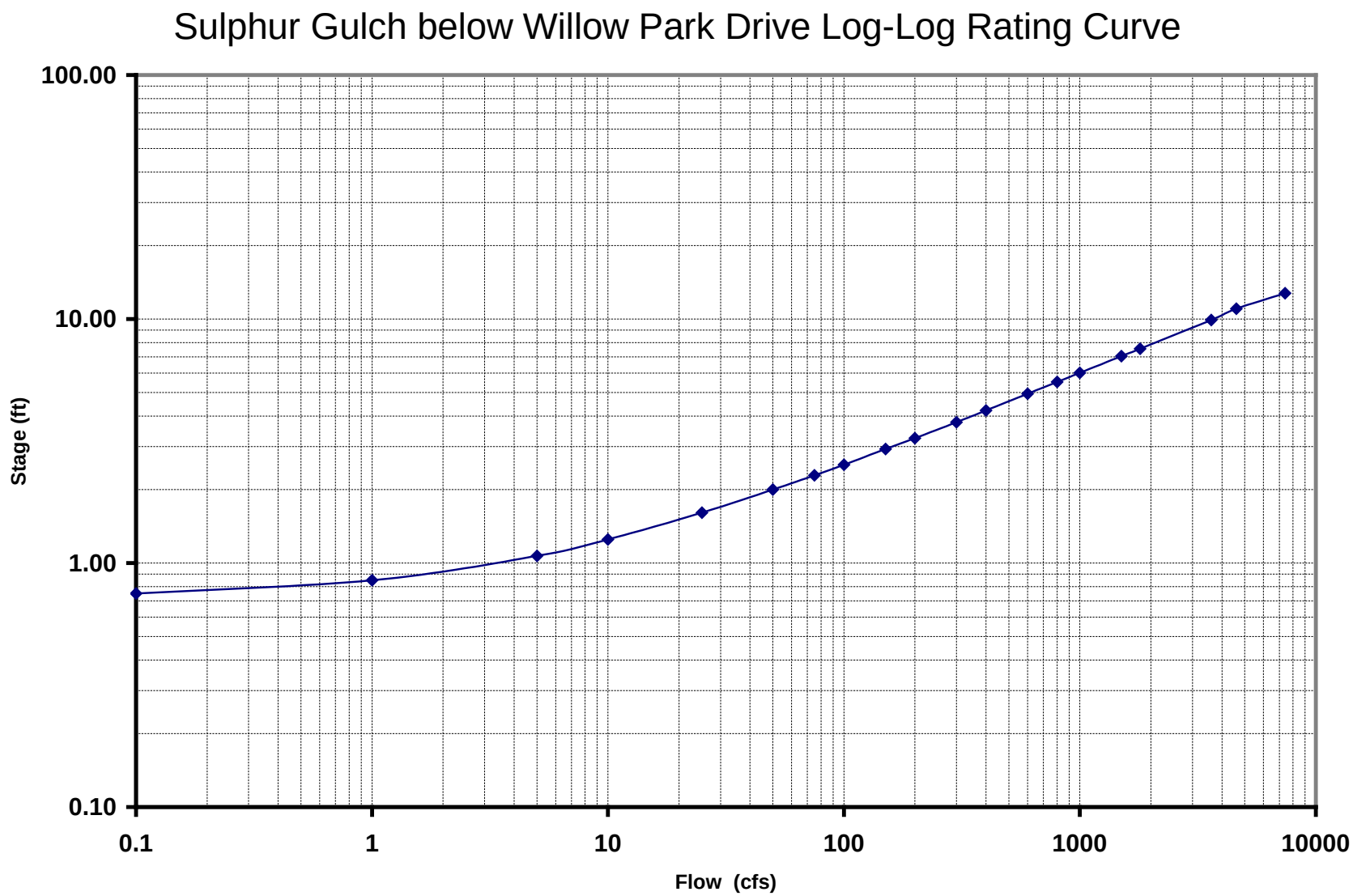

Figure 5 – HEC-RAS Log-Log Plot of Rating Table

Site photographs

Figure 6 – Panoramic View of Site, Looking Downstream, West (left), to Upstream, East (right)

Figure 7 – Looking Downstream

Figure 8 – Looking Upstream

Figure 8 – Looking Upstream at Drop Structure below Gage

Figure 9 – Looking Upstream from Standpipe

Study Data

According to the Douglas County Flood Insurance Study (FIS), the Haskins Gulch gage has a drainage area of approximately 110 square miles. The following table includes estimates of the frequency-discharge data interpolated between two reporting stations in the FIS Summary of Discharges table:

Frequency	Peak Discharge (cfs)
10-year	1,800
50-year	3,600
100-year	4,600
500-year	7,400

Table 3 – Frequency/Discharge Table

Historic records

There is limited information available for this gage. Since the gage installation date in December 2004, a peak stage of 2.3 feet above the invert was recorded on August 18, 2004.

Appendix

Sulphur Gulch

POINT_ID	EASTING	NORTHING	EASTING_M	NORTHING_M	ELEV	DESC
1000	9999.98	9999.98	-3048.03	3048.03	96.60	INST
1001	10028.53	9999.98	-3056.73	3048.03	96.68	BS
1002	9976.46	9926.61	-3040.86	3025.67	100.61	GR
1003	9969.97	9949.06	-3038.88	3032.51	100.16	GR
1004	9967.03	9958.12	-3037.99	3035.27	99.52	GR
1005	9962.16	9970.46	-3036.50	3039.03	96.65	GR
1006	9948.18	10018.48	-3032.24	3053.67	95.50	GR
1007	9938.31	10048.98	-3029.23	3062.97	87.64	GR
1008	9930.80	10058.07	-3026.94	3065.74	86.77	THALWAG
1009	9930.28	10060.37	-3026.79	3066.44	87.53	WATEDG
1010	9926.41	10060.66	-3025.61	3066.53	88.21	GR
1011	9926.46	10068.86	-3025.62	3069.02	90.81	CAP
1012	9920.03	10100.54	-3023.66	3078.68	99.23	GR
1013	9918.57	10111.74	-3023.22	3082.10	100.00	BASETRAN
1014	9902.14	10140.68	-3018.21	3090.92	100.68	BIKEPATH
1015	9834.33	10218.78	-2997.54	3114.72	105.24	ROAD
1016	9836.70	10046.50	-2998.26	3062.21	89.73	PIPEOUTLET
1017	9995.25	10064.08	-3046.59	3067.57	87.58	DROP
1018	9995.26	10051.86	-3046.59	3063.84	87.46	DROP
1019	10050.48	10059.01	-3063.42	3066.02	82.86	DROP
1020	10050.92	10065.90	-3063.56	3068.12	82.75	DROP
1021	10181.68	10079.19	-3103.42	3072.17	81.37	THALWAG
1022	10211.37	10344.97	-3112.46	3153.19	99.58	CHURCH
1023	10268.22	10286.40	-3129.79	3135.33	95.10	CRCHPARKING
1024	10272.56	10280.71	-3131.11	3133.60	91.58	GR
1025	10286.73	10264.62	-3135.43	3128.69	86.01	GR
1026	10325.34	10220.10	-3147.20	3115.13	85.83	GR
1027	10330.86	10213.89	-3148.88	3113.23	82.49	GR
1028	10343.72	10194.17	-3152.80	3107.22	82.56	GR
1029	10345.22	10192.15	-3153.26	3106.61	80.10	GR
1030	10346.14	10191.41	-3153.54	3106.38	79.54	THALWAG
1031	10348.18	10185.24	-3154.16	3104.50	80.34	GR
1032	10350.84	10184.01	-3154.97	3104.12	82.22	GR
1033	10354.94	10174.64	-3156.22	3101.27	82.79	GR
1034	10388.66	10142.28	-3166.50	3091.40	93.00	HOUSE1FTUP

Table 4 – Survey Data