



1.0 Introduction

This document describes basic procedures to follow when measuring stream flow using a cutthroat flume for the Water Quality Control Division (division).

2.0 Rationale

Selecting the most effective approach to measuring the flow of a stream is important to obtaining accurate measurements. In low flow scenarios, where water depth is too low to utilize flow meters, using Cutthroat flumes can be the most effective approach.

3.0 Flume Components:

The flume below is a BASKI collapsible Cutthroat Flume. It is designed for portability and rapid field installation. Figure 1- Baski Flume Components below illustrates a general flume deployment.

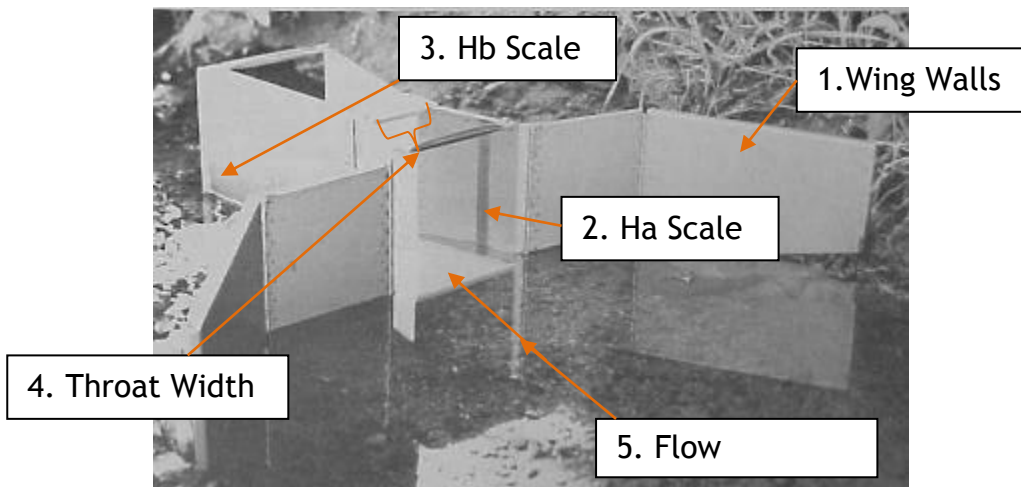


Figure 1- Baski Flume Components

The important flume components are described below:

1. Wing Walls - Directs stream flow through flume.
2. Ha Scale - Upstream vertical scale in tenths of feet.
3. Hb Scale - Downstream vertical scale in tenths of feet.
4. Throat Width - Value in inches. Division currently possesses one and four inch flumes.
5. Flow Direction - This is included to illustrate flume position.

4.0 Equipment and Supplies

The following list of items is necessary for deploying the flume effectively. They may not be applicable to all types of sampling events so additional equipment and supplies may be required.

- Cutthroat Flume
- Shovel
- Bucket (suggested)
- Flow Measurement Forms
- Writing Utensil
- Level

5.0 Installation and Measurement Procedure:

1. Select a portion of stream for measurement. There should not be stream braids, bends, and flow junctions immediately upstream of the intended flume location. The flow should be uniform without a surging or turbulent surface. The entirety of the flow needs to be directed through the flume.
2. Using the shovel and bucket collect dirt and moss that can be used to roughly seal the flume to limit surface water from going around or under the flume.
3. Place flume in the stream, parallel to flow, and ensure the flow is directed through the throat of the flume. The shorter section of the hourglass shape should be set upstream.
4. Spread wing walls (if included on flume).
5. Level the flume from upstream to downstream and from side to side using a portable level.
6. Fill the gaps where surface water is escaping from below or on the side of the flume with dirt, and moss previously collected in the bucket. This will prevent water from flowing outside of the flume.
7. Re-level flume. Items 6 and 7 may require iterations to complete.
8. Compare H_a , upstream water height value and H_b , downstream water height value.
9. If H_b value is greater than $\frac{1}{2}$ of the H_a value the flow downstream of the flume is obstructed. Remove any obstruction or select new location for flume. Return to step 5.
10. If H_b value is less than $\frac{1}{2}$ of the H_a value, then record following information:
 - a. Flume width: 1, 2, 4 or 8 inches
 - b. H_a value
 - c. H_b value
 - d. Estimated percent of flow escaping the flume
11. Remove flume from stream and store level.
12. To calculate flow rate in cubic feet per second or gallons per minute, use formulas or charts in Section 6.0.

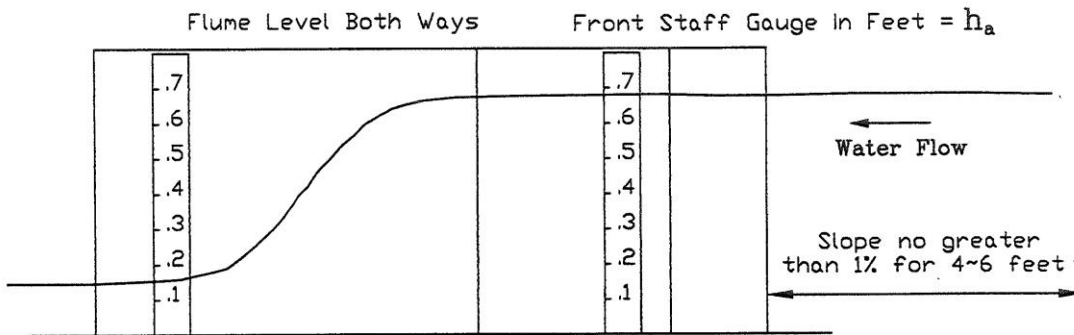
6.0 Baski Diagram and Flow Calculation Table

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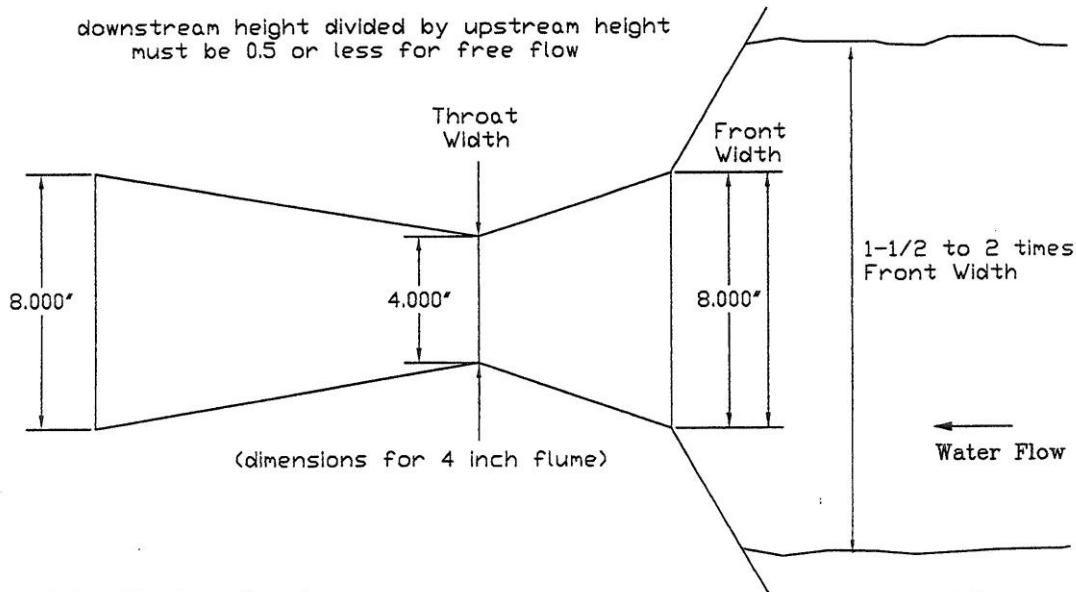
Denver, Colorado

18 inch long CUTTHROAT FLUME

THROAT WIDTH	FLOW RATE	
	CFS	GPM
1 INCH	$0.50 h_a^2$	$225 h_a^2$
2 INCH	$1.02 h_a^2$	$458 h_a^2$
4 INCH	$2.08 h_a^2$	$932 h_a^2$
8 INCH	$4.22 h_a^2$	$1900 h_a^2$



downstream height divided by upstream height must be 0.5 or less for free flow



information from Skogerboe

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Collapsible Cutthroat Flume

For free discharge, downstream height ÷ by upstream height must be less than 0.5.

Upstream Gauge (ft)	gpm				cfs			
	1"	2"	4"	8"	1"	2"	4"	8"
0.11	2.72	5.54	11.3	23	0.00605	0.0123	0.0252	0.0511
0.12	3.24	6.6	13.4	27.4	0.0072	0.0147	0.03	0.0608
0.13	3.8	7.74	15.8	32.1	0.00845	0.0172	0.0352	0.0713
0.14	4.41	8.98	18.3	37.2	0.0098	0.02	0.0408	0.0827
0.15	5.06	10.3	21	42.8	0.0113	0.0229	0.0468	0.0949
0.16	5.76	11.7	23.9	48.6	0.0128	0.0261	0.0532	0.108
0.17	6.5	13.2	26.9	54.9	0.0145	0.0295	0.0601	0.122
0.18	7.29	14.8	30.2	61.6	0.0162	0.033	0.0674	0.137
0.19	8.12	16.5	33.6	68.6	0.0181	0.0368	0.0751	0.152
0.2	9	18.3	37.3	76	0.02	0.0408	0.0832	0.169
0.21	9.92	20.2	41.1	83.8	0.0221	0.045	0.0917	0.186
0.22	10.9	22.2	45.1	92	0.0242	0.0494	0.101	0.204
0.23	11.9	24.2	49.3	101	0.0265	0.054	0.11	0.223
0.24	13	26.4	53.7	109	0.0288	0.0588	0.12	0.243
0.25	14.1	28.6	58.3	119	0.0313	0.0638	0.13	0.264
0.26	15.2	31	63	128	0.0338	0.069	0.141	0.285
0.27	16.4	33.4	67.9	139	0.0365	0.0744	0.152	0.308
0.28	17.6	35.9	73.1	149	0.0392	0.08	0.163	0.331
0.29	18.9	38.5	78.4	160	0.0421	0.0858	0.175	0.355
0.3	20.3	41.2	83.9	171	0.045	0.0918	0.187	0.38
0.31	21.6	44	89.6	183	0.0481	0.098	0.2	0.406
0.32	23	46.9	95.4	195	0.0512	0.104	0.213	0.432
0.33	24.5	49.9	101	207	0.0545	0.111	0.227	0.46
0.34	26	52.9	108	220	0.0578	0.118	0.24	0.488
0.35	27.6	56.1	114	233	0.0613	0.125	0.255	0.517
0.36	29.2	59.4	121	246	0.0648	0.132	0.27	0.547
0.37	30.8	62.7	128	260	0.0685	0.14	0.285	0.578
0.38	32.5	66.1	135	274	0.0722	0.147	0.3	0.609
0.39	34.2	69.7	142	289	0.0761	0.155	0.316	0.642
0.4	36	73.3	149	304	0.08	0.163	0.333	0.675
0.41	37.8	77	157	319	0.0841	0.171	0.35	0.709
0.42	39.7	80.8	164	335	0.0882	0.18	0.367	0.744

Flumetable

10/26/2001

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Collapsible Cutthroat Flume

For free discharge, downstream height ÷ upstream height must be less than 0.5.

Upstream Gauge (ft)	gpm 1"	gpm 2"	gpm 4"	gpm 8"	cfs 1"	cfs 2"	cfs 4"	cfs 8"
0.43	41.6	84.7	172	351	0.0925	0.189	0.385	0.78
0.44	43.6	88.7	180	368	0.0968	0.197	0.403	0.817
0.45	45.6	92.7	189	385	0.101	0.207	0.421	0.855
0.46	47.6	96.9	197	402	0.106	0.216	0.44	0.893
0.47	49.7	101	206	420	0.11	0.225	0.459	0.932
0.48	51.8	106	215	438	0.115	0.235	0.479	0.972
0.49	54	110	224	456	0.12	0.245	0.499	1.01
0.5	56.3	115	233	475	0.125	0.255	0.52	1.06
0.51	58.5	119	242	494	0.13	0.265	0.541	1.1
0.52	60.8	124	252	514	0.135	0.276	0.562	1.14
0.53	63.2	129	262	534	0.14	0.287	0.584	1.19
0.54	65.6	134	272	554	0.146	0.297	0.607	1.23
0.55	68.1	139	282	575	0.151	0.309	0.629	1.28
0.56	70.6	144	292	596	0.157	0.32	0.652	1.32
0.57	73.1	149	303	617	0.162	0.331	0.676	1.37
0.58	75.7	154	314	639	0.168	0.343	0.7	1.42
0.59	78.3	159	324	661	0.174	0.355	0.724	1.47
0.6	81	165	336	684	0.18	0.367	0.749	1.52
0.61	83.7	170	347	707	0.186	0.38	0.774	1.57
0.62	86.5	176	358	730	0.192	0.392	0.8	1.62
0.63	89.3	182	370	754	0.198	0.405	0.826	1.67
0.64	92.2	188	382	778	0.205	0.418	0.852	1.73
0.65	95.1	194	394	803	0.211	0.431	0.879	1.78
0.66	98	200	406	828	0.218	0.444	0.906	1.84
0.67	101	206	418	853	0.224	0.458	0.934	1.89
0.68	104	212	431	879	0.231	0.472	0.962	1.95
0.69	107	218	444	905	0.238	0.486	0.99	2.01
0.7	110	224	457	931	0.245	0.5	1.02	2.07
0.71	113	231	470	958	0.252	0.514	1.05	2.13
0.72	117	237	483	985	0.259	0.529	1.08	2.19
0.73	120	244	497	1013	0.266	0.544	1.11	2.25
0.74	123	251	510	1040	0.274	0.559	1.14	2.31

Flumetable
10/26/2001

7.0 Approval Signatures

X

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X

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