

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
BENEFICIAL USE FIELD REPORT

A. GENERAL INFORMATION

Permit No: 45-14136
Exam Date: 8/27/2018

1. Current Owner:
SIX S RANCH LLC 1354 E SIX S RANCH RD DECLO ID 83323 (208) 654-2564
2. Accompanied by: Nick Takas
Phone No: (208) 654-2564
Address: 1354 E SIX S RANCH RD, DECLO ID 83323
Relationship to Permit Holder: Ranch Manager

3. **SOURCE:**
MARSH CREEK

TRIBUTARY:
SNAKE RIVER

B. OVERLAP REVIEW

1. Other water rights with the same place of use: 45-14111; 45-14113; 45-14115; 45-14117; 45-14119; 45-14121; 45-14123; 45-14125; 45-14127; 45-14129; 45-14131 and 45-14133 (all rights listed are for water quality improvement; water quality improvement storage; wildlife and wildlife storage)
2. Other water rights with the same point-of-diversion: 45-14111; 45-14113; 45-14115; 45-14117; 45-14119; 45-14121; 45-14123; 45-14125; 45-14127; 45-14129; 45-14131 and 45-14133

C. DIVERSION AND DELIVERY SYSTEM**1. LOCATION OF POINT(S) OF DIVERSION:**

MARSH CREEK L2 (NW¼NE¼) Sec. 3, Twp 11S, Rge 25E, B.M. CASSIA County

Method of Determination: GPS measurement, satellite imagery and on-site inspection

2.

PLACE OF USE: WATER QUALITY IMPROVEMENT

Twp	Rge	Sec	NE				NW				SW				SE				Totals
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
10S	25E	34														X	X		

PLACE OF USE: WILDLIFE

Twp	Rge	Sec	NE				NW				SW				SE				Totals
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
10S	25E	34														X	X		

Method of Determination: Satellite imagery in ArcMap and on-site inspection.

3.

☒ Delivery System Diagram Attached (required). Indicate all major components and distances between components. Indicate weir size/pipe as applicable.

☒ Map Attached Showing Location(s) of point(s) of diversion and place(s) of use (required). Scale must be 1:24,000 or greater.

☒ Aerial Photo Attached (required for irrigation of 10+ acres).

☒ Photo of Diversion and System Attached

4.

Well or Diversion ID No.*	Motor Make	Hp	Motor Serial No.	Pump Make	Pump Serial No. or Discharge Size

*Code to correspond with No. on map and aerial photo

D. FLOW MEASUREMENTS

1.

Measurement Equipment	Type	Make	Model No.	Serial No.	Size	Calib. Date
Flume	Parshall				18"	

2. Measurements: The high water mark on the staff gauge on the 18" Parshall flume indicates the water level reaches a maximum height of 1.05 feet.

When Corey Skinner and I visited the ranch in 3/6/2017 the water level was at 0.65 feet where there is also a discernable water mark (see figure 2).

The ranch manager indicated water is typically diverted from 9/1 to 4/30 each year and provided the following measurements:

8/1/2017: 0 feet

10/27/2017: 0 feet

11/20/2017: 0.5 feet

12/8/2017: 0.6 feet

1/18/2018: 0.6 feet

3/5/2018: 0.6 feet

8/18/2018: 0 feet

E. FLOW

Additional Computation Sheets Attached

CALCULATIONS

Measured Method: Staff Gauge on Parshall flume: conversion from feet to cfs equation for 18" Parshall flume:

$Q = 4.00W h_a^{1.522(W^{0.026})}$ Where h_a = upper head in feet and W = flume throat width in feet (18" = 1.5)

High Water Mark of 1.05 feet: $Q = 4.00(1.5)(1.05)^{1.522(W^{0.026})} = \underline{6.468 \text{ cfs.}}$

At 0.65 feet: $Q = 4.00(1.5)(0.65)^{1.522(W^{0.026})} = \underline{3.093 \text{ cfs.}}$

F. VOLUME CALCULATIONS

1. Volume Calculations for Irrigation: N/A

$$V_{I.R.} = (\text{Acres Irrigated}) \times (\text{Irrigation Requirement}) =$$

$$V_{D.R.} = [\text{Diversion Rate (cfs)}] \times (\text{Days in Irrigation season}) \times 1.9835 =$$

$$V = \text{Smaller of } V_{I.R.} \text{ and } V_{D.R.} =$$

2. Volume Calculations for Other Uses: Wildlife/Water Quality Improvement: Based on the diversion time frame 9/1 to 4/30 reported by the ranch manager:

$$9/1 \text{ to } 02/28: 3.093 \text{ cfs } (1.9835 \text{ af/cfs})(181 \text{ days}) = 1110.4 \text{ AF}$$

$$3/1 \text{ to } 4/30: 6.468 \text{ cfs } (1.9835 \text{ af/cfs})(61 \text{ days}) = 782.6 \text{ AF}$$

$$1110.4 \text{ AF} + 782.6 \text{ AF} = \underline{1893 \text{ AF}}$$

G. NARRATIVE/REMARKS/COMMENTS

On 8/27/2018, Corey Skinner, Allison Inouye and I met with Nick Takas, Six S Ranch Manager, to go out and look at and record water levels at the pond diversions on the Six S Ranch associated with four permits for the purposes of potentially licensing the permits. During a previous visit to the ranch with Corey Skinner and Nick Talas on 3/6/2017, I had taken pictures of the 18" Parshall flume associated with this permit with water actively flowing through it, and I suspected that this permit could move forward to licensing. On 8/27/2018 Nick gave us some readings from the staff gauges at the various diversions for the previous year. The readings for this diversion that he reported are recorded in the measurement section of this report and in Attachment 1. I do need to note that his readings only reported staff gauge readings to one decimal position (tenths) and staff gauge readings should be recorded to the second decimal position (hundredths) for accuracy. This particular system diverts water from a reservoir through two siphon tubes into an open channel that flows into a system of ponds and then back out to Marsh Creek. This beneficial use of water as wildlife and water quality improvement provides a flow component through two ponds that are part of a larger pond system licensed under water rights 45-14111, 45-14113, 45-14115, 45-14117, 45-14119, 45-14121, 45-14123, 45-14125, 45-14127, 45-14129, 45-14131 and 45-14133. The existing rights provide for storage in the ponds (wildlife storage and water quality storage) and a flow component (wildlife, water quality improvement and diversion to storage), that provide for the filling of the ponds and evaporative losses from the ponds.

Nick indicated that typically, only one of the siphon tubes is utilized to divert water through the system and the second is utilized as needed. This seems to be reflected in the two major water marks on the flume at 0.65' and 1.05' on the staff gauge. I looked at Landsat imagery available during the beneficial use development period, 9/9/2008 – 10/1/2013, and Sentinel imagery for 2016 and 2017 and the imagery indicated that the reservoir the water is diverted from tends to be kept at a fairly consistent level year round. Nick also indicated that water is diverted through this pond system from 9/1 – 4/30 and both sets of imagery lend support to his statement, as the ponds appeared to dry up mid-summer in the imagery.

I calculated volume based on the idea that utilizing a siphon system from a reservoir that is kept at a consistent level should result in a fairly stable flow rate through the system. This is supported by the staff gauge readings that Nick reported and the two visible water marks at the flume. I looked at Water Masters Reports for Water District 45F, Marsh Creek, to try and assess when the water levels start to rise in Marsh Creek and take that into account for determining volume to be licensed under this permit. After considering creek flow rates, water marks on the flume, readings provided by Nick and the system design, I calculated the volume based on flow rates at the low water mark of 0.65' or 3.093 cfs from 9/1 to 2/28 and at the high water mark of 1.05' or 6.468 cfs from 3/1 to 4/30. It should also be noted that this water use is considered non-consumptive.

Looking at the existing permit, there is one condition on this permit, 029, that requires the permit holder to comply with fish screening or passage requirements for the Idaho Department of Fish and Game (IDFG). Looking at the backfile for this permit, I find a letter sent to the IDFG requesting comments and/or recommendations that was sent during the advertising of the application for permit (6/27/2008). However, no comments or recommendations were ever received from IDFG. This condition is typically only placed on permits at the request of IDFG. Additionally, Condition 029 isn't on any of the existing water rights for this system. It appears that it was placed on the permit inadvertently, and will be dropped at licensing. All other conditions on the permit will be carried forward, except for 01H which requires a lockable device, and it will be replaced by R02 as is recommended at licensing. Since there is a 2.67 cfs combined flow rate authorized from the existing water rights on this system, a condition limiting the combined flow of all water rights to 6.47 cfs from the diversion for this right will be placed on the license. It should be noted that the 2.67 cfs under the other rights can be potentially diverted at this diversion and/or three other different diversions. Therefore, the maximum capacity could potentially be diverted at this point of diversion under this license.

Recommend licensing 6.47 cfs for Water Quality Improvement and Wildlife combined; 1893.0 AF combined for volume and a Period of Use from 9/1 to 4/30.

Have conditions of permit approval been met? ☒ Yes ☐ No

H. RECOMMENDATIONS

1. Recommended Amounts

<u>BENEFICIAL USE</u>	<u>PERIOD OF USE</u>	<u>DIVERSION RATE</u>	<u>ANNUAL VOLUME</u>
WATER QUALITY IMPROVEMENT	09/01 to 04/30	6.47 CFS	1893.0 AF
WILDLIFE	09/01 to 04/30	6.47 CFS	1893.0 AF
	<u>Totals:</u>	6.47 CFS	1893.0 AF

2. Recommended Amendments

☐ Change P.D. as reflected above ☐ Add P.D. as reflected above ☒ None
☐ Change P.U. as reflected above ☐ Add P.U. as reflected above ☒ None

I. AUTHENTICATION

Field Examiner's Name Bill Mith Date 9-20-2018
 Reviewer _____ Date _____

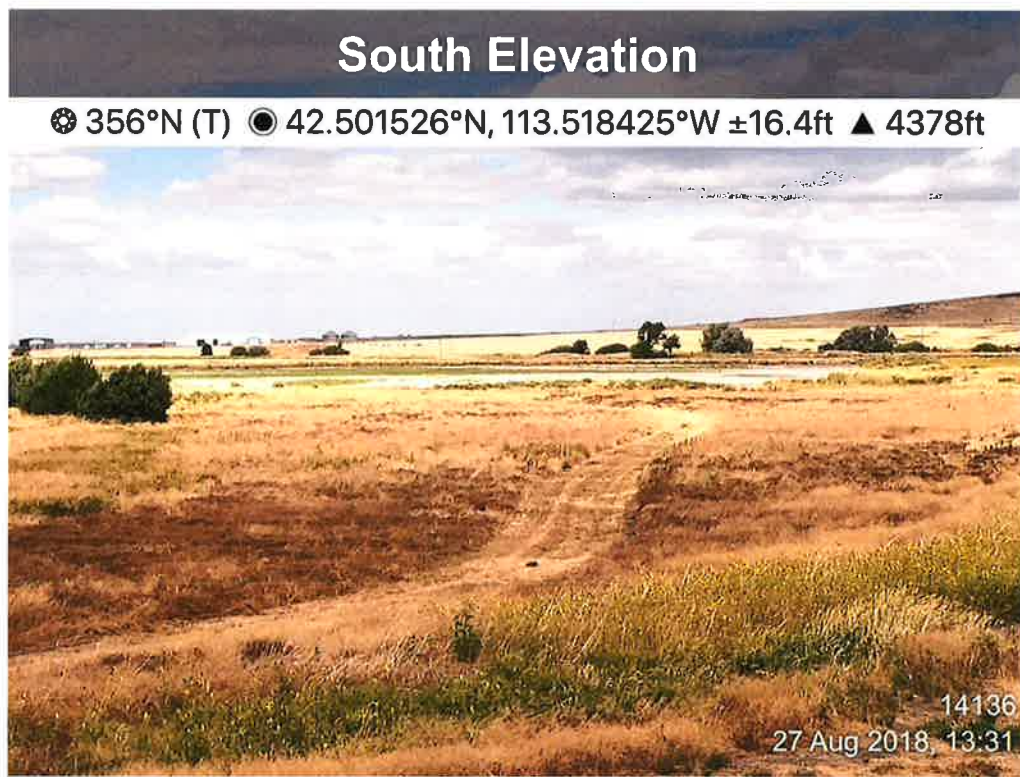


Figure 1: Bed of Southern Pond from Dam



Figure 2: Staff Gauge on Flume (3/6/2017)



Figure 3: Intake Siphon Tubes & Reservoir



Figure 4: 18" Parshall Flume & Observer

System Diagram



Field Exam 45-14136

**Attachment 1:
Staff Gauge Readings
From Six S Manager**

3/5/2018

Six S Ranch Wetlands Readings

Permit 45-14137

8/1/17 1.75

8/18/18 1.8

10/27/17 1.4

11/20/17 1.5

12/8/17 1.8

1/8/18 2.1

3/5/18 2.2

Permit 45-14136

8/1/17 0

8/18/18 0

10/27/17 0

11/20/17 .5

12/8/17 .6

1/8/18 .6

3/5/18 .6

Permit 45-14135

8/1/17 1.8

8/18/17 1.7

10/27/17 1.3

11/20/17 1.85

12/8/17 1.8

1/8/18 1.7

3/5/18 1.6

Permit 45-14134

8/1/17 1.35

8/18/17 1.35

10/27/17 1.7

11/20/17 2.21

12/8/17 2.1

1/8/18 2.3

3/5/18 1.8



18-Inch Parshall Flume Discharge Table

70% Submergence Transition

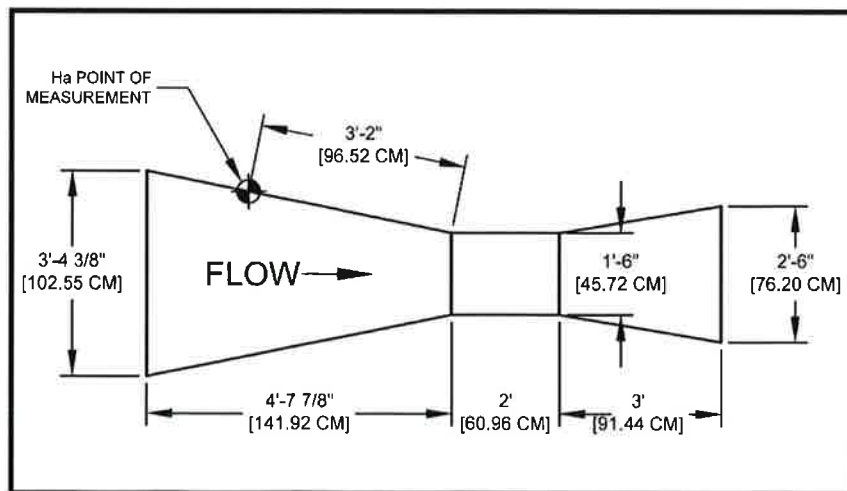
±3-5% Accuracy

Formulas (H in feet): $CFS = 6 H_{ft}^{1.538}$
 Formulas (H in meters): $L/S = 1056 H_m^{1.538}$

$GPM = 2693 H_{ft}^{1.538}$
 $M3/HR = 3803 H_m^{1.522}$

$MGD = 3.878 H_{ft}^{1.538}$

FEET	INCHES	METERS	CFS	GPM	MGD	L/S	M3/HR
0.01	0.12	0.0030	Excessive error due to fluid-flow properties and boundary conditions				
0.02	0.24	0.0061					
0.03	0.36	0.0091					
0.04	0.48	0.0122					
0.05	0.60	0.0152					
0.06	0.72	0.0183					
0.07	0.84	0.0213					
0.08	0.96	0.0244					
0.09	1.08	0.0274					
0.10	1.20	0.0305	0.1738	78.02	0.1124	4.923	17.71
0.11	1.32	0.0335	0.2013	90.34	0.1301	5.700	20.51
0.12	1.44	0.0366	0.2301	103.3	0.1487	6.517	23.45
0.13	1.56	0.0396	0.2603	116.8	0.1682	7.370	26.52
0.14	1.68	0.0427	0.2917	130.9	0.1885	8.260	29.72
0.15	1.80	0.0457	0.3243	145.6	0.2096	9.185	33.05
0.16	1.92	0.0488	0.3582	160.7	0.2315	10.14	36.50
0.17	2.04	0.0518	0.3932	176.5	0.2541	11.13	40.06
0.18	2.16	0.0549	0.4293	192.7	0.2775	12.16	43.75
0.19	2.28	0.0579	0.4665	209.4	0.3015	13.21	47.54
0.20	2.40	0.0610	0.5048	226.6	0.3263	14.30	51.44
0.21	2.52	0.0640	0.5442	244.2	0.3517	15.41	55.45
0.22	2.64	0.0671	0.5845	262.3	0.3778	16.55	59.56
0.23	2.76	0.0701	0.6259	280.9	0.4045	17.72	63.78
0.24	2.88	0.0732	0.6682	299.9	0.4319	18.92	68.09
0.25	3.00	0.0762	0.7115	319.3	0.4599	20.15	72.50
0.26	3.12	0.0792	0.7558	339.2	0.4884	21.40	77.01
0.27	3.24	0.0823	0.8009	359.5	0.5176	22.68	81.61
0.28	3.36	0.0853	0.8470	380.1	0.5474	23.99	86.31
0.29	3.48	0.0884	0.8940	401.2	0.5778	25.32	91.09
0.30	3.60	0.0914	0.9418	422.7	0.6087	26.67	95.97



Sources:

Water Measurement Manual, 3rd Edition, United States Department of the Interior, Bureau of Reclamation

ASTM D 1941-91 (2007): Standard Test Method for Open Channel Flow Measurement of Water with Parshall Flume



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±3-5% Accuracy

Formulas (H in feet): $CFS = 6 H_{ft}^{1.538}$
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 $M3/HR = 3803 H_m^{1.522}$

FEET	INCHES	METERS	CFS	GPM	MGD	L/S	M3/HR
0.31	3.72	0.0945	0.9905	444.5	0.6402	28.05	100.9
0.32	3.84	0.0975	1.040	466.8	0.6722	29.46	106.0
0.33	3.96	0.1006	1.091	489.4	0.7048	30.88	111.1
0.34	4.08	0.1036	1.142	512.4	0.7379	32.33	116.3
0.35	4.20	0.1067	1.194	535.8	0.7715	33.81	121.6
0.36	4.32	0.1097	1.247	559.5	0.8057	35.31	127.0
0.37	4.44	0.1128	1.300	583.6	0.8404	36.82	132.5
0.38	4.56	0.1158	1.355	608.0	0.8756	38.37	138.0
0.39	4.68	0.1189	1.410	632.8	0.9113	39.93	143.7
0.40	4.80	0.1219	1.466	657.9	0.9474	41.52	149.4
0.41	4.92	0.1250	1.523	683.4	0.9841	43.12	155.2
0.42	5.04	0.1280	1.580	709.2	1.0213	44.75	161.0
0.43	5.16	0.1311	1.638	735.3	1.0589	46.40	167.0
0.44	5.28	0.1341	1.697	761.8	1.0970	48.07	173.0
0.45	5.40	0.1372	1.757	788.6	1.1356	49.76	179.0
0.46	5.52	0.1402	1.817	815.7	1.1746	51.47	185.2
0.47	5.64	0.1433	1.879	843.1	1.2141	53.20	191.4
0.48	5.76	0.1463	1.940	870.9	1.2541	54.95	197.7
0.49	5.88	0.1494	2.003	898.9	1.2945	56.72	204.1
0.50	6.00	0.1524	2.066	927.3	1.3354	58.51	210.5
0.51	6.12	0.1554	2.130	956.0	1.3767	60.32	217.1
0.52	6.24	0.1585	2.195	985.0	1.4184	62.15	223.6
0.53	6.36	0.1615	2.260	1014	1.4606	64.00	230.3
0.54	6.48	0.1646	2.326	1044	1.503	65.87	237.0
0.55	6.60	0.1676	2.392	1074	1.546	67.75	243.8
0.56	6.72	0.1707	2.460	1104	1.590	69.66	250.6
0.57	6.84	0.1737	2.527	1134	1.634	71.58	257.5
0.58	6.96	0.1768	2.596	1165	1.678	73.52	264.5
0.59	7.08	0.1798	2.665	1196	1.722	75.48	271.6
0.60	7.20	0.1829	2.735	1227	1.768	77.45	278.7
0.61	7.32	0.1859	2.805	1259	1.813	79.45	285.9
0.62	7.44	0.1890	2.876	1291	1.859	81.46	293.1
0.63	7.56	0.1920	2.948	1323	1.905	83.49	300.4
0.64	7.68	0.1951	3.020	1356	1.952	85.54	307.8
0.65	7.80	0.1981	3.093	1388	1.999	87.60	315.2
0.66	7.92	0.2012	3.167	1421	2.047	89.68	322.7
0.67	8.04	0.2042	3.241	1454	2.095	91.78	330.2
0.68	8.16	0.2073	3.316	1488	2.143	93.90	337.9
0.69	8.28	0.2103	3.391	1522	2.191	96.03	345.5
0.70	8.40	0.2134	3.467	1556	2.241	98.18	353.3
0.71	8.52	0.2164	3.543	1590	2.290	100.3	361.0
0.72	8.64	0.2195	3.620	1625	2.340	102.5	368.9
0.73	8.76	0.2225	3.698	1660	2.390	104.7	376.8
0.74	8.88	0.2256	3.776	1695	2.440	106.9	384.8
0.75	9.00	0.2286	3.855	1730	2.491	109.2	392.8
0.76	9.12	0.2316	3.934	1766	2.543	111.4	400.9
0.77	9.24	0.2347	4.014	1801	2.594	113.7	409.0
0.78	9.36	0.2377	4.094	1838	2.646	116.0	417.2
0.79	9.48	0.2408	4.175	1874	2.699	118.2	425.5
0.80	9.60	0.2438	4.257	1911	2.751	120.6	433.8

Sources:

Water Measurement Manual, 3rd Edition, United States Department of the Interior, Bureau of Reclamation

ASTM D 1941-91 (2007): Standard Test Method for Open Channel Flow Measurement of Water with Parshall Flume



18-Inch Parshall Flume Discharge Table

70% Submergence Transition

±3-5% Accuracy

Formulas (H in feet): $CFS = 6 H_{ft}^{1.538}$
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$GPM = 2693 H_{ft}^{1.538}$
 $M3/HR = 3803 H_m^{1.522}$
 $MGD = 3.878 H_{ft}^{1.538}$

FEET	INCHES	METERS	CFS	GPM	MGD	L/S	M3/HR
0.81	9.72	0.2469	4.339	1947	2.804	122.9	442.2
0.82	9.84	0.2499	4.422	1984	2.858	125.2	450.6
0.83	9.96	0.2530	4.505	2022	2.912	127.6	459.1
0.84	10.08	0.2560	4.589	2059	2.966	130.0	467.6
0.85	10.20	0.2591	4.673	2097	3.020	132.3	476.2
0.86	10.32	0.2621	4.758	2135	3.075	134.7	484.8
0.87	10.44	0.2652	4.843	2174	3.130	137.2	493.5
0.88	10.56	0.2682	4.929	2212	3.186	139.6	502.3
0.89	10.68	0.2713	5.015	2251	3.242	142.0	511.1
0.90	10.80	0.2743	5.102	2290	3.298	144.5	519.9
0.91	10.92	0.2774	5.190	2329	3.354	147.0	528.8
0.92	11.04	0.2804	5.278	2369	3.411	149.5	537.8
0.93	11.16	0.2835	5.366	2408	3.468	152.0	546.8
0.94	11.28	0.2865	5.455	2448	3.526	154.5	555.9
0.95	11.40	0.2896	5.545	2489	3.584	157.0	565.0
0.96	11.52	0.2926	5.635	2529	3.642	159.6	574.2
0.97	11.64	0.2957	5.725	2570	3.700	162.1	583.4
0.98	11.76	0.2987	5.816	2610	3.759	164.7	592.7
0.99	11.88	0.3018	5.908	2651	3.818	167.3	602.0
1.00	12.00	0.3048	6.000	2693	3.878	169.9	611.4
1.01	12.12	0.3078	6.093	2734	3.938	172.5	620.8
1.02	12.24	0.3109	6.186	2776	3.998	175.2	630.3
1.03	12.36	0.3139	6.279	2818	4.058	177.8	639.8
1.04	12.48	0.3170	6.373	2860	4.119	180.5	649.4
1.05	12.60	0.3200	6.468	2903	4.180	183.2	659.0
1.06	12.72	0.3231	6.563	2945	4.241	185.9	668.7
1.07	12.84	0.3261	6.658	2988	4.303	188.6	678.4
1.08	12.96	0.3292	6.754	3031	4.365	191.3	688.2
1.09	13.08	0.3322	6.850	3074	4.427	194.0	698.1
1.10	13.20	0.3353	6.947	3118	4.490	196.7	707.9
1.11	13.32	0.3383	7.045	3162	4.553	199.5	717.8
1.12	13.44	0.3414	7.142	3206	4.616	202.3	727.8
1.13	13.56	0.3444	7.241	3250	4.680	205.1	737.8
1.14	13.68	0.3475	7.340	3294	4.744	207.9	747.9
1.15	13.80	0.3505	7.439	3339	4.808	210.7	758.0
1.16	13.92	0.3536	7.539	3383	4.872	213.5	768.2
1.17	14.04	0.3566	7.639	3428	4.937	216.3	778.4
1.18	14.16	0.3597	7.739	3473	5.002	219.2	788.6
1.19	14.28	0.3627	7.840	3519	5.067	222.0	798.9
1.20	14.40	0.3658	7.942	3564	5.133	224.9	809.3
1.21	14.52	0.3688	8.044	3610	5.199	227.8	819.7
1.22	14.64	0.3719	8.147	3656	5.265	230.7	830.1
1.23	14.76	0.3749	8.249	3702	5.332	233.6	840.6
1.24	14.88	0.3780	8.353	3749	5.398	236.6	851.2
1.25	15.00	0.3810	8.457	3795	5.466	239.5	861.7
1.26	15.12	0.3840	8.561	3842	5.533	242.4	872.4
1.27	15.24	0.3871	8.666	3889	5.601	245.4	883.0
1.28	15.36	0.3901	8.771	3936	5.669	248.4	893.7
1.29	15.48	0.3932	8.876	3984	5.737	251.4	904.5
1.30	15.60	0.3962	8.982	4031	5.805	254.4	915.3

Sources:

Water Measurement Manual, 3rd Edition, United States Department of the Interior, Bureau of Reclamation

ASTM D 1941-91 (2007): Standard Test Method for Open Channel Flow Measurement of Water with Parshall Flume



18-Inch Parshall Flume Discharge Table

70% Submergence Transition ±3-5% Accuracy

Formulas (H in feet): $CFS = 6 H_{ft}^{1.538}$
 Formulas (H in meters): $L/S = 1056 H_m^{1.538}$

$GPM = 2693 H_{ft}^{1.538}$
 $M3/HR = 3803 H_m^{1.522}$
 $MGD = 3.878 H_{ft}^{1.538}$

FEET	INCHES	METERS	CFS	GPM	MGD	L/S	M3/HR
1.31	15.72	0.3993	9.089	4079	5.874	257.4	926.2
1.32	15.84	0.4023	9.196	4127	5.943	260.4	937.1
1.33	15.96	0.4054	9.303	4175	6.013	263.5	948.0
1.34	16.08	0.4084	9.411	4224	6.082	266.5	959.0
1.35	16.20	0.4115	9.519	4272	6.152	269.6	970.0
1.36	16.32	0.4145	9.628	4321	6.223	272.7	981.1
1.37	16.44	0.4176	9.737	4370	6.293	275.8	992.2
1.38	16.56	0.4206	9.847	4419	6.364	278.9	1003
1.39	16.68	0.4237	9.957	4468	6.435	282.0	1015
1.40	16.80	0.4267	10.07	4518	6.506	285.1	1026
1.41	16.92	0.4298	10.18	4568	6.578	288.2	1037
1.42	17.04	0.4328	10.29	4618	6.650	291.4	1048
1.43	17.16	0.4359	10.40	4668	6.722	294.5	1060
1.44	17.28	0.4389	10.51	4718	6.794	297.7	1071
1.45	17.40	0.4420	10.63	4769	6.867	300.9	1083
1.46	17.52	0.4450	10.74	4819	6.940	304.1	1094
1.47	17.64	0.4481	10.85	4870	7.013	307.3	1106
1.48	17.76	0.4511	10.97	4921	7.087	310.5	1117
1.49	17.88	0.4542	11.08	4972	7.161	313.8	1129
1.50	18.00	0.4572	11.19	5024	7.235	317.0	1141
1.51	18.12	0.4602	11.31	5075	7.309	320.3	1152
1.52	18.24	0.4633	11.42	5127	7.383	323.5	1164
1.53	18.36	0.4663	11.54	5179	7.458	326.8	1176
1.54	18.48	0.4694	11.66	5231	7.533	330.1	1188
1.55	18.60	0.4724	11.77	5284	7.609	333.4	1200
1.56	18.72	0.4755	11.89	5336	7.684	336.7	1212
1.57	18.84	0.4785	12.01	5389	7.760	340.0	1224
1.58	18.96	0.4816	12.13	5442	7.836	343.4	1236
1.59	19.08	0.4846	12.24	5495	7.913	346.7	1248
1.60	19.20	0.4877	12.36	5548	7.990	350.1	1260
1.61	19.32	0.4907	12.48	5601	8.066	353.5	1272
1.62	19.44	0.4938	12.60	5655	8.144	356.8	1284
1.63	19.56	0.4968	12.72	5709	8.221	360.2	1296
1.64	19.68	0.4999	12.84	5763	8.299	363.6	1308
1.65	19.80	0.5029	12.96	5817	8.377	367.1	1321
1.66	19.92	0.5060	13.08	5871	8.455	370.5	1333
1.67	20.04	0.5090	13.20	5926	8.533	373.9	1345
1.68	20.16	0.5121	13.33	5980	8.612	377.4	1358
1.69	20.28	0.5151	13.45	6035	8.691	380.8	1370
1.70	20.40	0.5182	13.57	6090	8.770	384.3	1383
1.71	20.52	0.5212	13.69	6145	8.850	387.8	1395
1.72	20.64	0.5243	13.82	6201	8.930	391.3	1408
1.73	20.76	0.5273	13.94	6256	9.009	394.8	1420
1.74	20.88	0.5304	14.06	6312	9.090	398.3	1433
1.75	21.00	0.5334	14.19	6368	9.170	401.8	1446
1.76	21.12	0.5364	14.31	6424	9.251	405.4	1459
1.77	21.24	0.5395	14.44	6480	9.332	408.9	1471
1.78	21.36	0.5425	14.56	6537	9.413	412.5	1484
1.79	21.48	0.5456	14.69	6593	9.495	416.0	1497
1.80	21.60	0.5486	14.82	6650	9.576	419.6	1510

Sources:

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