BLACK ROCK
CONSULTING

TECHNICAL MEMORANDUM

To: **Central Oregon Irrigation District**
Regarding: **Pilot Butte Canal F-Lateral Piping Project Feasibility Study**
By: **Black Rock Consulting/Kevin L. Crew, P.E.**
Date: **October 2, 2014**

Black Rock Consulting was contracted by the Central Oregon Irrigation District to evaluate and report on the feasibility of the F-Lateral Piping Project. This project had been evaluated on a reconnaissance level in the Water Conservation Study provided to the District in April, 2013. This Feasibility Study provided a more detailed evaluation of the project including a series of field seepage loss measurements, detailed cross-sectional field survey, updated cost analysis, development of 80% design drawings, and updated permitting assessment. We have found that this project continues to be feasible and its benefits continue to outweigh costs based upon the assumptions indicated below.

Field Survey: In June, 2014, Black Rock Consulting developed a GPS data gathering plan and coordinated with COI staff for the field acquisition of data along the F-Lateral project segment and several hundred feet beyond on each end. This raw tabular data was provided to Black Rock Consulting by COI staff on June 25, 2014. A copy of this field data is included in Attachment 1.

Seepage Loss Measurements: During a single seepage loss measurement performed for the project area in 2012, the estimated seepage loss for that measurement was 7.5 CFS as published in the Water Conservation Project Study provided to the District in 2013. As recommended in that study, five additional seepage loss measurements were performed by COI staff during the 2014 irrigation season. These measurements were performed using a "Doppler Boat" system between June and July, 2014. Measurements were taken at the upper and lower end of the project area and turnout flows were also measured and accounted for in the final loss estimates. Detailed reporting from the "Doppler Boat" measurement and data collection system are included in Attachment 2 to this Technical Memorandum. A summary of the results are indicated below:

DATE	ESTIMATED SEEPAGE LOSS
6/4/14	6.6 CFS
6/13/14	6.84 CFS
6/20/14	6.50 CFS
7/11/14	4.98 CFS
7/18/14	6.84 CFS

Based upon our experience with canal seepage in Central Oregon, the variability that may be observed with canal seepage over time, measurement error, and the seepage loss estimated on July 11, 2014, we recommend that a loss of **five (5) CFS** be used as en estimate of total seepage loss for the project area.

Base Mapping, Design, and Hydraulic Analysis: Initial base mapping was developed using freeware and District aerial imagery products, establishment of an Oregon State coordinate base, utilization of Deschutes County GIS mapping, and development of a digital terrain model from the COI staff GPS data points acquired in the field.

Design progressed to an initial Preliminary Design iteration. At this design level, a simple hydraulic analysis was performed.

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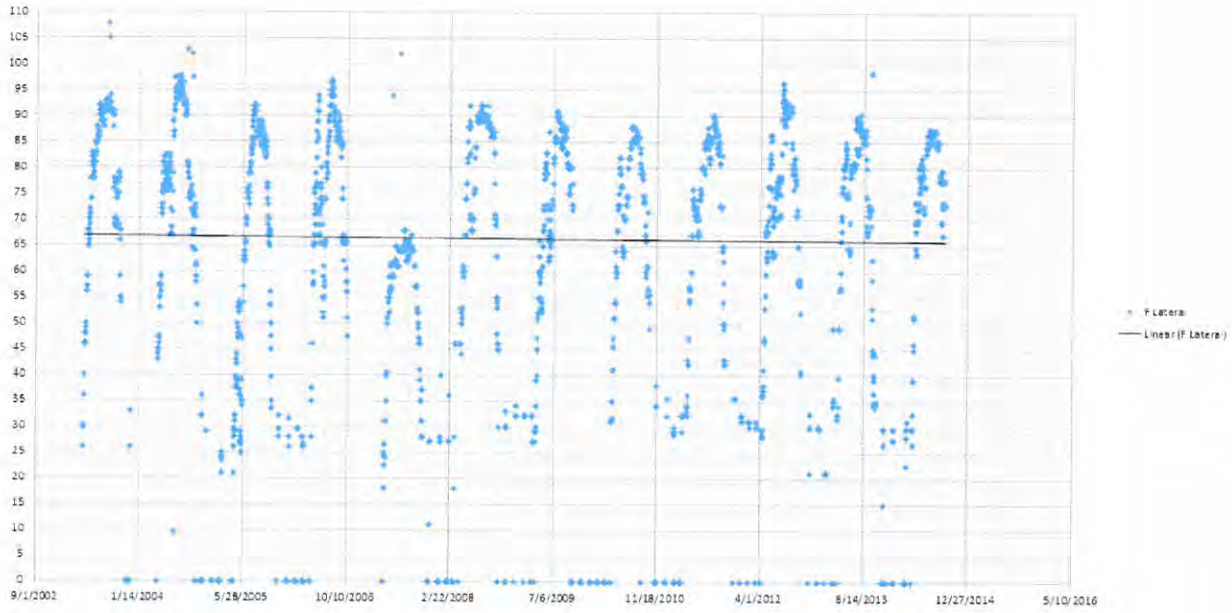

COI staff provided the last 12-years of flow record for the F-Lateral diversion. This data was graphed in the above point plot. As may be clearly seen in the graph, the maximal diversion from the PBC main canal into the F-Lateral is approximately 98 CFS or less. There are a few point anomalies, but the District's staff indicated that these were uncommon events caused by some historic head gate actuation for a minimal duration and this would not be necessary in the future. For the purposes of sizing the F-Lateral Piping Project pipe diameter, we assumed 100-CFS as a peak flow at the F-Lateral headgate. The District provided tabular information that indicated that 310 acres of irrigated land exist between the F-Lateral head-end and the project area, therefore we subtracted 6 CFS (approximately 9 GPM/irrigated acre) to establish the estimated peak flow rate entering the project area. This resulted in a balance of 100 CFS – 6 CFS = 94 CFS as a peak flow estimate for the project. COI concurred with this estimate, although COI emphasized that this calculation was not intended to limit the lateral capacity. For this reason, bank height increase at the top of the proposed project was included to insure that some additional canal capacity would exist if needed as prescribed by the water right of the lateral.

Given a 63-inch diameter DR 32.5 HDPE pipe, 94 CFS would create approximately 2.5-FT of frictional headloss (HWC=130) and with an estimated additional 0.5-FT of headloss for the square-edged entrance to the pipe, the total headloss was estimated to be 3-FT. The elevation differential across the project matches this at approximately 3-FT. 63-inches is the largest HDPE pipe diameter currently produced at more than one factory in the United States. This diameter has been discussed with the District and the District agrees that this pipe material and diameter is preferable to the use of a larger pipe of differing material such as Weholite. Weholite is only pressure rated to 15 PSI whereas solid wall 63-inch HDPE DR 32.5 pipe is rated at over 60 PSI.

Upon the completion of Preliminary Design evaluation and mapping, 80% design drawings at 1"=30' scale were prepared. These drawings are attached to the Technical Memorandum and were also submitted to COI for review. Any comments received will be incorporated into the 100% drawings prior to project construction, as required and agreed by COI.

Permitting Review: A permit review was performed in conjunction with District consultation. The project is located in a Federal right-of-way issued by the United States government for irrigation purposes. The lateral has been deemed by the District as non-jurisdictional waters of the United States, therefore has determined that the United States Army Corps of Engineers does not have jurisdiction. The canal is also annually dewatered during most of the winter months. Funding is anticipated to be through local or State of Oregon dollars. COI is a quasi-municipal organization and its principal is licensed under the State of

Oregon for professional engineering services including design and oversight of intake and discharge structures. For these reasons, to our knowledge there are no permits required for the construction of the proposed facilities. Should additional information become available that differs from the above, or as laws change over time, this permit evaluation should be reconsidered prior to construction of the project.

Cost Estimate and Benefit Versus Cost Analysis: The following cost estimate for the project is based upon the assumption that the Central Oregon Irrigation District will self perform the project. The pipe material estimate is based upon two recent quotations from competitive pipe suppliers that routinely furnish HDPE pipe and appurtenances in Central Oregon. The equipment and installation labor costs were built into the excavation, backfill and compaction unit cost. This unit cost also includes the cost of import material that will be necessary to complete the backfilling operation. Installation labor costs were also built into the various other items to be furnished and installed. The estimate is based upon recent similar experience for a similar project installation by COI (I-Lateral Project).

The benefit of the project is based upon the estimated value of a conserved acre-foot of water as determined by the Central Oregon Irrigation District. The benefit versus cost is a simple evaluation of present benefit value divided by the current cost estimate. A benefit versus cost value of greater than 1.0 generally indicates a project that should be pursued as the value outweighs the cost. For this project the B/C is 1.66 and therefore pursuit of the project is recommended.

CENTRAL OREGON IRRIGATION DISTRICT
F-LATERAL
RECONNAISSANCE LEVEL COST ESTIMATE

BLACK ROCK CONSULTING/COI REVIEW 10/01/2014 - Assumes COI Self-Performance

Construction Item	Quantity	Units	Cost/Unit	Subtotal Cost
Earthwork and General Construction				
1. Mobilization	1	%	of Total	$8,874.50
2. Clearing and Grubbing	1	LS	$10,000.00	$10,000.00
3. Excavation, Backfill, Compaction of Pipeline	12,500	CY	$20.00	$250,000.00
4. Restoration/Seeding	1	LS	$10,000.00	$10,000.00
Pipe (HDPE)				
5. 63" Dia. DR 32.5 Pipe Including Welding and Delivery	2,210	LF	$245.00	$541,450.00
Pipe Appurtenances				
6. Misc. Fittings, venting	1	LS	$20,000.00	$20,000.00
7. Furnish and install turnout assemblies, complete	1	EA	$10,000.00	$10,000.00
Inlet/Outlet Structures				
8. Reinforced Concrete Inlet/Trash Rack	1	LS	$25,000.00	$25,000.00
9. Reinforced Concrete Outlet Structure	1	LS	$15,000.00	$15,000.00
10. Rip-Rap	1	LS	$2,000.00	$2,000.00
11. U/S Bank Build	200	CY	$20.00	$4,000.00
SUBTOTAL				$896,324.50
Engineering Construction Management (Part-Time)	2	%	of subtotal	$17,926.49
Contingency	6	%	of subtotal	$53,779.47
TOTAL				**$968,030.46**

BENEFIT VERSUS COST ANALYSIS		
Conservation	CFS	5
Acre/Feet Based Upon COI Season Curve	AF	1605.00
Estimated Value/AF Conserved	$/AF	1,000
ESTIMATED BENEFIT		$1,605,000
ESTIMATED COST		$968,030
	B/C RATIO	**1.66**

ATTACHMENT 1

FIELD SURVEY DATA

CENTRAL OREGON IRRIGATION DISTRICT

PILOT BUTTE CANAL: F LATERAL WATER LOSS STDY AREA

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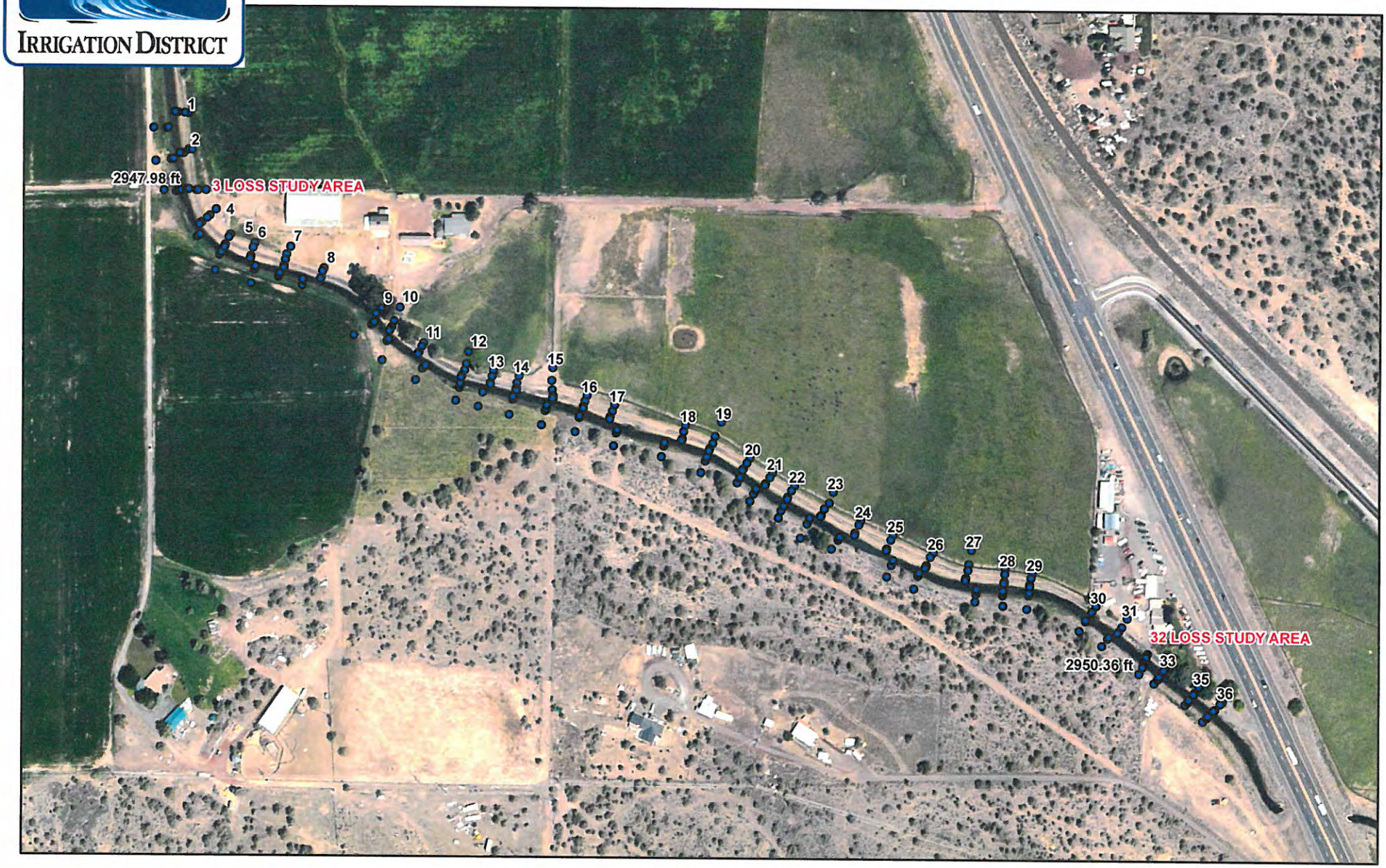

Date: 6/25/2014

0 150 300 600 Feet

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FID	DESCRIPTION	CROSS SECTION	DESCR	NORTHING	EASTING	ELEVATION
180	TOE BANK	1	EAST TOE BANK	969230.555	4742781.022	2948.569
181	TP BANK	1	EAST TP BANK	969231.3613	4742773.519	2950.539
182	TP BANK	1	EAST TP BANK	969232.6701	4742758.328	2951.539
183	SLOPE	1	EAST SLOPE	969233.3282	4742753.872	2950.186
184	TP WATER	1	EAST TP WATER	969233.4623	4742752.897	2950.135
185	EDGE WATER	1	EAST EDGE WATER	969233.8245	4742751.375	2948.295
190	BANK	1	WEST BANK	969197.0113	4742703.192	2951.070
191	TP BANK	1	WEST TP BANK	969197.5297	4742733.368	2950.250
192	TP WATER	1	WEST TP WATER	969197.7447	4742734.88	2950.069
193	TOE WATER	1	WEST TOE WATER	969198.3815	4742736.66	2948.137
174	TP BANK	2	EAST TP BANK	969141.075	4742771.242	2951.298
175	SLOPE	2	EAST SLOPE	969141.4712	4742765.464	2950.087
176	TP WATER	2	EAST TP WATER	969141.1508	4742763.14	2950.069
177	EDGE WATER	2	EAST EDGE WATER	969141.3848	4742762.049	2948.534
178	TP BANK	2	EAST TP BANK	969149.8538	4742783.761	2950.705
179	TOE BANK	2	EAST TOE BANK	969149.8076	4742790.35	2948.794
186	BANK	2	WEST BANK	969123.6669	4742708.807	2951.313
187	TP BANK	2	WEST TP BANK	969127.1739	4742743.055	2950.473
188	TP WATER	2	WEST TP WATER	969127.2976	4742744.47	2950.190
189	EDGE WATER	2	WEST EDGE WATER	969128.0744	4742747.979	2948.030
162	RIGHT PIPE NUT	3	WEST RIGHT PIPE NUT	969057.4466	4742727.308	2951.673
163	TP BANK	3	WEST TP BANK	969055.3445	4742754.53	2950.750
164	TP WATER	3	WEST TP WATER	969056.1531	4742758.116	2950.239
165	TOE WATER	3	WEST TOE WATER	969057.0739	4742760.321	2948.459
166	CL CANAL	3	CL CANAL	969058.5937	4742766.183	2947.980
167	TOE WATER	3	EAST TOE WATER	969059.9673	4742775.863	2948.176
168	TP WATER	3	EAST TP WATER	969060.0719	4742779.024	2950.190
169	SLOPE	3	EAST SLOPE	969060.3689	4742780.161	2950.547
170	TP BANK	3	EAST TP BANK	969060.5471	4742783.191	2951.131
171	TP BANK	3	EAST TP BANK	969058.4651	4742799.975	2951.159
172	TOE BANK	3	EAST TOE BANK	969058.1825	4742804.5	2950.091
173	BANK	3	EAST BANK	969058.4155	4742822.71	2949.351
158	TP BANK	4	WEST TP BANK	968953.8955	4742802.717	2951.284
159	SLOPE	4	WEST SLOPE	968957.3948	4742808.003	2950.331
160	TP WATER	4	WEST TP WATER	968958.5861	4742809.234	2950.133
161	EDGE WATER	4	WEST EDGE WATER	968958.5402	4742809.685	2948.336
194	TOE BANK	4	EAST TOE BANK	969000.9219	4742831.1	2949.053
195	BANK	4	EAST BANK	969015.4139	4742845.785	2949.875
196	TP BANK	4	EAST TP BANK	968996.8824	4742825.35	2951.103
197	TP BANK	4	EAST TP BANK	968985.9401	4742812.934	2950.934
198	TP WATER	4	EAST TP WATER	968983.1998	4742809.65	2950.405
199	EDGE WATER	4	EAST EDGE WATER	968981.0771	4742807.129	2947.840
153	BANK	5	WEST BANK	968877.6569	4742843.418	2952.430
154	TP BANK	5	WEST TP BANK	968912.1885	4742852.911	2951.247
155	SLOPE	5	WEST SLOPE	968917.4177	4742856.142	2950.511
156	TP WATER	5	WEST TP WATER	968918.5948	4742857.153	2950.265
157	EDGE WATER	5	WEST EDGE WATER	968918.9582	4742856.933	2948.140
200	TOE BANK	5	EAST TOE BANK	968958.8909	4742877.975	2948.759
201	TP BANK	5	EAST TP BANK	968952.004	4742874.138	2952.064
202	TP BANK	5	EAST TP BANK	968935.3456	4742865.879	2952.155
203	SLOPE	5	EAST SLOPE	968932.4152	4742865.182	2950.521
204	TP WATER	5	EAST TP WATER	968931.2404	4742864.514	2950.521
205	EDGE WATER	5	EAST EDGE WATER	968930.3309	4742864.221	2948.666
148	TP BANK	6	WEST TP BANK	968879.0298	4742931.898	2951.430
149	SLOPE	6	WEST SLOPE	968885.7711	4742933.547	2950.315
150	TP WATER	6	WEST TP WATER	968886.6683	4742933.463	2950.276
151	EDGE WATER	6	WEST EDGE WATER	968887.157	4742933.87	2948.316
152	BANK	6	WEST BANK	968848.6771	4742924.14	2952.689
206	TOE BANK	6	EAST TOE BANK	968939.2452	4742933.479	2948.629
207	TP BANK	6	EAST TP BANK	968929.5406	4742929.358	2952.742

208	TP BANK	6 EAST TP BANK	968910.4396	4742924.763	2952.335
209	SLOPE	6 EAST SLOPE	968905.9576	4742923.371	2950.562
210	TP WATER	6 EAST TP WATER	968904.9948	4742923.272	2950.448
211	EDGE WATER	6 EAST EDGE WATER	968904.0506	4742922.526	2948.935
144	TP BANK	7 WEST TP BANK	968862.9668	4742986.261	2951.788
145	SLOPE	7 WEST SLOPE	968869.4435	4742988.151	2950.498
146	TP WATER	7 WEST TP WATER	968870.9782	4742988.959	2950.467
147	EDGE WATER	7 WEST EDGE WATER	968872.6367	4742989.007	2948.312
212	BANK	7 EAST BANK	968931.6723	4743014.309	2947.511
213	TOE BANK	7 EAST TOE BANK	968914.5832	4743005.641	2948.705
214	TP BANK	7 EAST TP BANK	968902.0376	4743002.329	2951.298
215	TP BANK	7 EAST TP BANK	968889.4458	4742999.782	2951.497
216	SLOPE	7 EAST SLOPE	968886.8057	4742998.995	2950.703
217	TP WATER	7 EAST TP WATER	968885.6941	4742998.874	2950.585
218	EDGE WATER	7 EAST EDGE WATER	968884.7739	4742998.133	2948.445
140	TP BANK	8 WEST TP BANK	968844.5062	4743040.688	2951.756
141	SLOPE	8 WEST SLOPE	968854.3475	4743042.604	2950.308
142	TP WATER	8 WEST TP WATER	968855.7819	4743042.401	2950.532
143	EDGE WATER	8 WEST EDGE WATER	968858.0571	4743041.554	2948.321
219	TOE BANK	8 EAST TOE BANK	968883.6298	4743089.356	2948.986
220	TP BANK	8 EAST TP BANK	968875.9536	4743086.256	2951.047
221	TP BANK	8 EAST TP BANK	968862.6863	4743082.948	2952.166
222	TP WATER	8 EAST TP WATER	968860.3903	4743082.192	2950.732
223	EDGE WATER	8 EAST EDGE WATER	968859.2465	4743081.344	2948.680
135	BANK	9 WEST BANK	968732.6226	4743157.419	2954.145
136	TP BANK WEST OF ROCK	9 WEST TP BANK WEST OF ROCK	968756.3466	4743197.385	2952.067
137	SLOPE	9 WEST SLOPE	968760.4227	4743201.39	2950.892
138	TP WATER	9 WEST TP WATER	968761.0907	4743202.288	2950.812
139	TOE WATER	9 WEST TOE WATER	968761.6643	4743203.233	2948.886
224	TP BANK	9 EAST TP BANK	968792.9698	4743219.662	2951.682
225	TP BANK	9 EAST TP BANK	968783.2747	4743210.161	2951.439
226	TP WATER	9 EAST TP WATER	968781.3819	4743208.897	2950.604
227	TOE WATER	9 EAST TOE WATER	968780.94	4743207.594	2948.355
131	TP BANK	10 WEST TP BANK	968719.7001	4743232.394	2953.357
132	TP WATER	10 WEST TP WATER	968722.3556	4743235.869	2950.924
133	EDGE WATER	10 WEST EDGE WATER	968723.0581	4743236.518	2949.675
134	BANK EAST ROCK PILE	10 WEST BANK EAST ROCK PILE	968675.4565	4743221.135	2954.634
228	TOE BANK	10 EAST TOE BANK	968795.3858	4743261.528	2948.402
229	TP BANK	10 EAST TP BANK	968764.0881	4743248.063	2952.743
230	TP BANK	10 EAST TP BANK	968751.3913	4743243.112	2953.381
231	SLOPE	10 EAST SLOPE	968745.299	4743239.198	2951.150
232	TP WATER	10 EAST TP WATER	968743.6144	4743238.062	2950.901
233	TOE WATER	10 EAST TOE WATER	968742.2722	4743237.463	2948.321
126	BANK	11 WEST BANK	968631.6288	4743297.621	2954.289
127	TP BANK	11 WEST TP BANK	968657.4496	4743312.477	2953.063
128	SLOPE	11 WEST SLOPE	968662.4347	4743318.09	2951.000
129	TP WATER	11 WEST TP WATER	968663.423	4743318.426	2950.861
130	TOE WATER	11 WEST TOE WATER	968664.1908	4743318.969	2949.205
234	TOE BANK	11 EAST TOE BANK	968715.1367	4743315.046	2948.146
235	TP BANK	11 EAST TP BANK	968707.2577	4743311.616	2951.949
236	TP BANK	11 EAST TP BANK	968694.3861	4743305.458	2951.844
237	TP WATER	11 EAST TP WATER	968691.087	4743302.799	2950.974
238	TOE WATER	11 EAST TOE WATER	968690.4875	4743302.288	2948.914
121	BANK	12 WEST BANK	968585.47	4743388.343	2955.433
122	TP BANK	12 WEST TP BANK	968614.3531	4743395.857	2952.746
123	SLOPE	12 WEST SLOPE	968621.4849	4743397.974	2950.906
124	TP WATER	12 WEST TP WATER	968622.7303	4743398.03	2950.950
125	TOE WATER	12 WEST TOE WATER	968624.2141	4743398.143	2948.670
239	BANK	12 EAST BANK	968695.3601	4743416.68	2945.567
240	TOE BANK	12 EAST TOE BANK	968668.3159	4743412.037	2946.664
241	TP BANK	12 EAST TP BANK	968654.702	4743408.252	2952.208

242	TP BANK	12 EAST TP BANK	968642.4447	4743402.233	2951.932
243	TP WATER	12 EAST TP WATER	968639.3358	4743400.73	2951.096
244	EDGE WATER	12 EAST EDGE WATER	968638.1058	4743400.276	2949.115
117	EDGE WATER	13 WEST EDGE WATER	968609.0464	4743451.296	2948.285
118	TP WATER	13 WEST TP WATER	968608.4982	4743451.315	2950.956
119	TP BANK	13 WEST TP BANK	968604.1249	4743449.26	2951.651
120	BANK	13 WEST BANK	968572.0763	4743439.003	2954.229
245	TOE BANK	13 EAST TOE BANK	968653.8149	4743473.792	2946.492
246	TP BANK	13 EAST TP BANK	968640.851	4743470.786	2952.042
247	TP BANK	13 EAST TP BANK	968625.0949	4743466.496	2951.896
248	TP WATER	13 EAST TP WATER	968623.2359	4743466.184	2951.238
249	EDGE WATER	13 EAST EDGE WATER	968622.3682	4743465.997	2948.790
112	BANK	14 WEST BANK	968554.1061	4743509.794	2953.549
113	TP BANK	14 WEST TP BANK	968588.4474	4743517.403	2952.763
114	SLOPE	14 WEST SLOPE	968592.1745	4743517.143	2951.092
115	TP WATER	14 WEST TP WATER	968593.6853	4743517.062	2951.168
116	TOE WATER	14 WEST TOE WATER	968593.9408	4743517.329	2948.154
250	TOE BANK	14 EAST TOE BANK	968641.8671	4743531.196	2945.344
251	TP BANK	14 EAST TP BANK	968625.5723	4743526.401	2952.321
252	TP BANK	14 EAST TP BANK	968613.1485	4743525.024	2952.183
253	TP WATER	14 EAST TP WATER	968609.8215	4743524.785	2951.197
254	TOE WATER	14 EAST TOE WATER	968607.948	4743525.321	2948.965
106	BANK	15 WEST BANK	968562.9311	4743590.492	2954.235
107	TP BANK	15 WEST TP BANK	968567.6582	4743593.165	2953.617
108	SLOPE	15 WEST SLOPE	968574.6489	4743593.995	2951.627
109	TP WATER	15 WEST TP WATER	968575.8983	4743594.44	2951.083
110	EDGE WATER	15 WEST EDGE WATER	968576.4489	4743594.744	2949.632
111	BANK	15 WEST BANK	968531.0089	4743582.484	2954.936
255	BANK	15 EAST BANK	968660.7524	4743607.688	2942.991
256	TOE BANK	15 EAST TOE BANK	968631.6385	4743605	2945.517
257	TP BANK	15 EAST TP BANK	968610.1337	4743605.946	2952.910
258	TP BANK	15 EAST TP BANK	968597.8649	4743607.993	2952.816
259	SLOPE	15 EAST SLOPE	968593.4356	4743608.033	2951.499
260	TP WATER	15 EAST TP WATER	968591.6621	4743608.238	2951.227
261	TOE WATER	15 EAST TOE WATER	968591.2672	4743607.638	2949.256
103	BANK	16 WEST BANK	968515.8909	4743658.542	2955.528
104	TP BANK	16 WEST TP BANK	968548.1957	4743666.872	2953.671
105	SLOPE	16 WEST SLOPE	968552.7667	4743668.379	2951.154
262	TOE BANK	16 EAST TOE BANK	968597.9805	4743685.147	2947.863
263	TP BANK	16 EAST TP BANK	968585.8616	4743680.522	2952.159
264	TP BANK	16 EAST TP BANK	968573.0305	4743676.406	2952.044
265	TP WATER	16 EAST TP WATER	968570.5868	4743676.581	2951.263
266	EDGE WATER	16 EAST EDGE WATER	968569.8863	4743676.355	2949.272
98	BANK	17 WEST BANK	968485.3048	4743745.575	2955.892
99	TP BANK	17 WEST TP BANK	968513.9922	4743751.619	2954.761
100	SLOPE	17 WEST SLOPE	968518.6182	4743752.691	2952.191
101	TP WATER	17 WEST TP WATER	968519.8756	4743753.101	2951.451
102	TOE WATER	17 WEST TOE WATER	968521.1462	4743752.986	2949.442
267	TOE WATER	17 EAST TOE WATER	968577.5611	4743747.657	2948.287
268	TP BANK	17 EAST TP BANK	968563.1026	4743742.346	2952.418
269	TP BANK	17 EAST TP BANK	968550.8733	4743737.509	2952.667
270	SLOPE	17 EAST SLOPE	968547.4304	4743736.479	2951.454
271	TP WATER	17 EAST TP WATER	968546.2849	4743736.153	2951.289
272	EDGE WATER	17 EAST EDGE WATER	968545.0334	4743735.851	2949.164
93	BANK	18 WEST BANK	968461.2613	4743853.164	2954.603
94	SLOPE	18 WEST SLOPE	968485.1157	4743858.039	2953.076
95	SLOPE	18 WEST SLOPE	968491.0112	4743859.359	2951.554
96	TP WATER	18 WEST TP WATER	968493.0873	4743859.411	2951.054
97	EDGE WATER	18 WEST EDGE WATER	968493.5448	4743860.244	2949.468
273	TOE BANK	18 EAST TOE BANK	968532.7355	4743907.629	2947.175
274	TP BANK	18 EAST TP BANK	968518.3613	4743903.762	2953.127

275	TP BANK	18 EAST TP BANK	968502.7947	4743899.954	2952.726
276	SLOPE	18 EAST SLOPE	968499.9621	4743899.194	2951.618
277	TP WATER	18 EAST TP WATER	968499.0105	4743898.98	2951.399
278	TOE WATER	18 EAST TOE WATER	968498.3987	4743898.542	2949.499
88	BANK	19 WEST BANK	968426.6659	4743942.037	2954.679
89	TP BANK	19 WEST TP BANK	968452.8324	4743952.635	2953.955
90	SLOPE	19 WEST SLOPE	968459.1511	4743955.314	2951.688
91	TP WATER	19 WEST TP WATER	968460.6384	4743955.716	2951.264
92	TOE WATER	19 EAST TOE WATER	968462.5978	4743956.18	2949.134
279	BANK	19 EAST BANK	968539.9725	4743987.874	2945.035
280	TOE BANK	19 EAST TOE BANK	968508.6579	4743973.938	2947.479
281	TP BANK	19 EAST TP BANK	968492.7834	4743969.712	2953.066
282	TP BANK	19 EAST TP BANK	968480.3749	4743962.74	2952.903
283	SLOPE	19 EAST SLOPE	968477.8289	4743961.685	2951.776
284	TP WATER	19 EAST TP WATER	968476.9079	4743960.987	2951.360
285	EDGE WATER	19 EAST EDGE WATER	968475.8214	4743960.279	2949.599
84	TP BANK	20 WEST TP BANK	968404.2058	4744024.038	2955.082
85	SLOPE	20 WEST SLOPE	968414.4211	4744030.162	2952.167
86	TP WATER	20 WEST TP WATER	968415.8436	4744030.571	2951.432
87	TOE WATER	20 EAST TOE WATER	968416.8184	4744031.202	2949.824
286	TOE BANK	20 EAST TOE BANK	968459.1764	4744053.644	2948.434
287	TP BANK	20 EAST TP BANK	968448.0273	4744046.046	2952.857
288	TP BANK	20 EAST TP BANK	968435.3861	4744037.955	2952.561
289	TP WATER	20 EAST TP WATER	968433.3072	4744036.655	2951.441
290	TOE WATER	20 EAST TOE WATER	968432.1293	4744035.894	2950.002
79	BANK	21 WEST BANK	968363.6051	4744053.157	2955.685
80	TP BANK	21 WEST TP BANK	968378.8906	4744061.292	2954.406
81	SLOPE	21 WEST SLOPE	968388.2692	4744066.394	2952.001
82	TP WATER	21 WEST TP WATER	968389.3651	4744067.116	2951.407
83	TOE WATER	21 WEST TOE WATER	968390.3298	4744067.407	2949.470
291	TOE BANK	21 EAST TOE BANK	968426.1472	4744104.228	2948.298
292	TP BANK	21 EAST TP BANK	968416.7544	4744097.991	2952.517
293	TP BANK	21 EAST TP BANK	968402.7391	4744088.542	2952.363
294	TP WATER	21 EAST TP WATER	968400.5341	4744087.812	2951.507
295	EDGE WATER	21 EAST EDGE WATER	968398.9065	4744086.918	2949.463
74	BANK	22 WEST BANK	968326.5598	4744117.692	2955.901
75	TP BAKH	22 WEST TP BAKH	968342.6191	4744123.048	2954.072
76	SLOPE	22 WEST SLOPE	968352.05	4744128.515	2951.621
77	TP WATER	22 WEST TP WATER	968353.1277	4744129.06	2951.396
78	TOE WATER	22 WEST TOE WATER	968353.7269	4744129.767	2949.556
296	TOE BANK	22 EAST TOE BANK	968398.0132	4744153.938	2948.567
297	TP BANK	22 EAST TP BANK	968386.9457	4744146.883	2952.631
298	TP BANK	22 EAST TP BANK	968372.2733	4744138.438	2952.237
299	TP WATER	22 EAST TP WATER	968369.6355	4744137.45	2951.377
300	EDGE WATER	22 EAST EDGE WATER	968368.6924	4744136.981	2949.458
69	BANK	23 WEST BANK	968281.7604	4744167.198	2957.780
70	TP BANK	23 WEST TP BANK	968313.4928	4744182	2954.902
71	SLOPE	23 WEST SLOPE	968323.4028	4744187.417	2951.575
72	TP WATER	23 WEST TP WATER	968324.754	4744188.012	2951.283
73	TOE WATER	23 WEST TOE WATER	968326.0556	4744187.954	2949.626
301	BANK	23 EAST BANK	968384.1656	4744240.86	2946.266
302	TOE BANK	23 EAST TOE BANK	968360.2242	4744232.29	2947.315
303	TP BANK	23 EAST TP BANK	968347.2482	4744221.306	2952.715
304	TP BANK	23 EAST TP BANK	968332.4121	4744214.299	2952.384
305	TP WATER	23 EAST TP WATER	968330.7822	4744213.146	2951.602
306	EDGE WATER	23 EAST EDGE WATER	968329.9203	4744212.369	2949.911
64	BANK	24 WEST BANK	968256.911	4744237.786	2955.871
65	TP BANK	24 WEST TP BANK	968277.3268	4744252.588	2953.768
66	SLOPE	24 WEST SLOPE	968282.671	4744254.92	2952.016
67	TP WATER	24 WEST TP WATER	968283.3987	4744255.401	2951.467
68	EDGE WATER	24 WEST EDGE WATER	968284.3716	4744256.634	2949.963

307	TOE BANK	24	EAST TOE BANK	968321.6691	4744302.885	2948.899
308	TP BANK	24	EAST TP BANK	968312.0584	4744299.407	2952.147
309	TP BANK	24	EAST TP BANK	968293.2458	4744290.601	2953.199
310	SLOPE	24	EAST SLOPE	968289.7797	4744289.524	2951.793
311	TP WATER	24	EAST TP WATER	968288.2926	4744289.188	2951.681
312	TOE WATER	24	EAST TOE WATER	968287.9769	4744288.875	2950.141
59	BANK	25	WEST BANK	968195.0163	4744361.932	2956.421
60	TP BANK	25	WEST TP BANK	968221.7905	4744372.74	2955.372
61	SLOPE	25	WEST SLOPE	968230.6424	4744376.238	2951.975
62	TP WATER	25	WEST TP WATER	968231.4582	4744376.662	2951.821
63	EDGE WATER	25	WEST EDGE WATER	968232.7479	4744376.719	2951.122
313	TOE BANK	25	EAST TOE BANK	968289.1607	4744376.304	2949.267
314	TP BANK	25	EAST TP BANK	968278.5678	4744371.832	2953.463
315	TP BANK	25	EAST TP BANK	968257.9608	4744362.573	2953.350
316	TP WATER	25	EAST TP WATER	968255.6309	4744361.651	2951.886
317	TOE WATER	25	EAST TOE WATER	968254.8449	4744360.961	2950.797
54	BANK	26	WEST BANK	968168.4231	4744423.631	2956.756
55	TP BANK	26	WEST TP BANK	968197.109	4744432.165	2955.209
56	SLOPE	26	WEST SLOPE	968202.1909	4744434.34	2952.876
57	TP WATER	26	WEST TP WATER	968203.3092	4744434.75	2952.586
58	EDGE WATER	26	WEST EDGE WATER	968204.2146	4744435.226	2951.544
318	TOE BANK	26	EAST TOE BANK	968250.1357	4744467.218	2949.821
319	TP BANK	26	EAST TP BANK	968240.6903	4744460.254	2953.488
320	TP BANK	26	EAST TP BANK	968221.1847	4744451.582	2953.946
321	SLOPE	26	EAST SLOPE	968217.0178	4744449.929	2952.694
322	TP WATER	26	EAST TP WATER	968215.9608	4744449.619	2952.763
323	TOE WATER	26	EAST TOE WATER	968215.3067	4744448.781	2950.748
49	BANK	27	WEST BANK	968140.2126	4744561.135	2955.878
50	TP BANK	27	WEST TP BANK	968157.564	4744563.518	2955.652
51	SLOPE	27	WEST SLOPE	968164.7026	4744564.029	2954.142
52	TP WATER	27	WEST TP WATER	968166.9105	4744564.441	2952.858
53	EDGE WATER	27	WEST EDGE WATER	968168.1228	4744564.29	2951.427
324	BANK	27	EAST BANK	968256.8149	4744553.254	2947.225
325	TOE BANK	27	EAST TOE BANK	968224.6834	4744547.833	2949.464
326	TP BANK	27	EAST TP BANK	968211.4132	4744545.017	2953.946
327	TP BANK	27	EAST TP BANK	968193.5697	4744540.382	2954.092
328	SLOPE	27	EAST SLOPE	968191.4165	4744539.886	2953.268
329	TP WATER	27	EAST TP WATER	968189.5685	4744539.766	2953.069
330	TOE WATER	27	EAST TOE WATER	968188.6778	4744539.217	2951.201
44	BANK	28	WEST BANK	968131.6601	4744624.103	2955.016
45	TP BANK	28	WEST TP BANK	968155.5454	4744623.203	2955.034
46	SLOPE	28	WEST SLOPE	968162.6338	4744624.693	2953.514
47	TP WATER	28	WEST TP WATER	968164.0013	4744624.845	2952.915
48	EDGE WATER	28	WEST EDGE WATER	968165.3036	4744624.637	2951.424
331	TOE BANK	28	EAST TOE BANK	968213.8916	4744629.201	2951.148
332	TP BANK	28	EAST TP BANK	968203.4351	4744628.424	2954.475
333	TP BANK	28	EAST TP BANK	968186.0481	4744627.198	2954.194
334	SLOPE	28	EAST SLOPE	968184.1235	4744626.853	2953.568
335	TP WATER	28	EAST TP WATER	968182.4769	4744627.445	2953.085
336	EDGE WATER	28	EAST EDGE WATER	968181.9944	4744626.728	2951.326
40	BANK	29	WEST BANK	968124.3144	4744677.994	2955.256
41	TP BANK	29	WEST TP BANK	968154.8858	4744681.935	2954.728
42	TP WATER	29	WEST TP WATER	968159.6957	4744682.603	2953.315
43	EDGE WATER	29	WEST EDGE WATER	968160.9588	4744682.965	2951.129
337	TOE BANK	29	EAST TOE BANK	968204.5075	4744690.496	2950.585
338	TP BANK	29	EAST TP BANK	968194.1466	4744687.086	2954.323
339	TP BANK	29	EAST TP BANK	968179.4734	4744684.401	2954.553
340	TP WATER	29	EAST TP WATER	968175.8535	4744684.295	2953.461
341	EDGE WATER	29	EAST EDGE WATER	968175.5736	4744684.299	2951.094
36	BANK	30	WEST BANK	968075.641	4744795.959	2954.962
37	TP BANK	30	WEST TP BANK	968096.9472	4744810.813	2954.091

38	TP WATER	30	WEST TP WATER	968098.3531	4744811.315	2953.268
39	EDGE WATER	30	WEST EDGE WATER	968100.12	4744811.794	2951.506
342	CEMENT HEADGATE	30	EAST CEMENT HEADGATE	968120.1589	4744825.116	2954.667
343	EDGE WATER	30	EAST EDGE WATER	968118.4338	4744824.751	2950.990
344	TP BANK	30	EAST TP BANK	968131.9626	4744834.474	2954.146
32	BANK	31	WEST BANK	968041.7987	4744846.932	2954.733
33	TP BANK	31	WEST TP BANK	968058.1526	4744860.011	2954.444
34	TP WATER	31	WEST TP WATER	968060.3314	4744861.926	2953.196
35	EDGE WATER	31	WEST EDGE WATER	968061.2258	4744862.754	2951.926
345	TOE BANK	31	EAST TOE BANK	968104.4521	4744904.804	2948.961
346	TP BANK	31	EAST TP BANK	968084.2145	4744891.873	2954.330
347	TP BANK	31	EAST TP BANK	968074.4422	4744885.167	2953.986
348	TP WATER	31	EAST TP WATER	968072.636	4744883.562	2953.301
349	EDGE WATER	31	EAST EDGE WATER	968071.5445	4744882.474	2951.002
0	CL CANAL	32	CL CANAL	968012.8943	4744942.577	2950.361
13	TP BANK	32	EAST TP BANK	968024.2303	4744950.279	2954.768
14	TP WATER	32	EAST TP WATER	968020.952	4744948.515	2953.216
15	TOE WATER	32	EAST TOE WATER	968016.8388	4744947.253	2951.129
16	SLOPE	32	WEST SLOPE	968003.9764	4744942.047	2950.918
17	TP WATER	32	WEST TP WATER	967999.7524	4744940.894	2953.318
18	TP BANK	32	WEST TP BANK	967993.9972	4744939.069	2955.966
19	BANK	32	WEST BANK	967979.7933	4744931.676	2955.936
10	TP BANK	33	EAST TP BANK	967991.0578	4744990.901	2955.093
11	TP WATER	33	EAST TP WATER	967987.7615	4744988.014	2953.162
12	EDGE WATER	33	EAST EDGE WATER	967987.1145	4744987.506	2951.442
20	BANK	33	WEST BANK	967958.0132	4744965.705	2956.324
21	TP BANK	33	WEST TP BANK	967967.6215	4744973.506	2955.856
22	TP WATER	33	WEST TP WATER	967971.2753	4744975.794	2953.184
23	EDGE WATER	33	WEST EDGE WATER	967973.0541	4744976.367	2952.273
6	TP BANK	35	EAST TP BANK	967951.1826	4745065.87	2964.778
7	TP BANK	35	EAST TP BANK	967938.3238	4745056.969	2955.215
8	TP WATER	35	EAST TP WATER	967935.3672	4745055.228	2953.118
9	WATER BANK	35	EAST WATER BANK	967934.2985	4745054.294	2951.924
24	BANK	35	WEST BANK	967911.5049	4745034.983	2955.303
25	TP BANK	35	WEST TP BANK	967917.3219	4745041.358	2955.268
26	TP WATER	35	WEST TP WATER	967920.1656	4745043.266	2953.093
27	EDGE WATER	35	WEST EDGE WATER	967920.8784	4745043.543	2951.720
1	TOE BANK	36	EAST TOE BANK	967919.4775	4745119.687	2951.093
2	TP BANK	36	EAST TP BANK	967912.8898	4745114.04	2954.713
3	TP BANK	36	EAST TP BANK	967900.6736	4745101.952	2954.299
4	TP WATER	36	EAST TP WATER	967898.9177	4745100.573	2953.387
5	WATER EDGE	36	EAST WATER EDGE	967898.2482	4745099.547	2951.468
28	BANK	36	WEST BANK	967874.8267	4745075.225	2956.174
29	TP BANK	36	WEST TP BANK	967882.4247	4745083.982	2955.569
30	TP WATER	36	WEST TP WATER	967884.9193	4745086.119	2953.519
31	EDGE WATER	36	WEST EDGE WATER	967886.3653	4745087.254	2951.965

OPERATOR: DANIEL DOWNING
DATE: 6/24/2014

METADATA:
DATUM: NAD 83(2011)
PROJECTION: OREGON STATE PLANE SOUTH FIPS 3602
UNIT: TOPCON
GEOID: geoid2012A

TP = TOP
EDGE OF WATER = GPS INSIDE OF CANAL NOT AT THE TOE
TOE WATER = INSIDE OF CANAL AT EDGE OF THE TOE
SLOPE = DECLINE FROM TOP OF BANK TO THE EDGE OF THE WATER

CROSS SECTIONS: 3 AND 32 ARE THE LOCATIONS OF ELEVATION AND WATER LOSS STUDY AREAS

ATTACHMENT 2

DOPPLER BOAT WATER LOSS MEASUREMENT RESULTS

Station Number:
Station Name:

Meas. No:
Date: 07/25/2014

Party:	Width: 15.5 ft	Processed by:
Boat/Motor:	Area: 30.7 ft²	Mean Velocity: 2.71 ft/s
Gage Height: 0.00 ft	G.H.Change: 0.000 ft	Discharge: 83.2 ft³/s

Area Method: Avg. Course	ADCP Depth: 0.157 ft	Index Vel.: 0.00 ft/s	Rating No.: 1
Nav. Method: Bottom Track	Shore Ens.:10	Adj.Mean Vel: 0.00 ft/s	Qm Rating:
MagVar Method: (0.0°)	Bottom Est: Power (0.1667)	Rated Area: 0.000 ft²	Diff.: 0.000%
Depth: Composite	Top Est: Power (0.1667)	Control1:	
Discharge Method: None		Control2:	
% Correction: 0.00		Control3:	

Screening Thresholds:		ADCP:	
BT 3-Beam Solution: NO	Max. Vel.: 5.52 ft/s	Type/Freq.: StreamPro / 2000 kHz	
WT 3-Beam Solution: NO	Max. Depth: 2.41 ft	Serial #:	Firmware: 31.12
BT Error Vel.: 32.81 ft/s	Mean Depth: 1.98 ft	Bin Size: 4 cm	Blank: 3 cm
WT Error Vel.: 32.81 ft/s	% Meas.: 57.45	BT Mode: 10	BT Pings: 2
BT Up Vel.: 32.81 ft/s	Water Temp.: None	WT Mode: 12	WT Pings: 6
WT Up Vel.: 32.81 ft/s	ADCP Temp.: 65.4 °F	WV : 0	WO : 1, 4
Use Weighted Mean Depth: NO			

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location:

Project Name: flat 7-25-2014 study point 2_0(
Software: 2.13

Tr.#		Edge Distance L	Edge Distance R	#Ens.	Discharge Top	Discharge Middle	Discharge Bottom	Discharge Left	Discharge Right	Discharge Total	Width	Area	Time Start	Time End	Mean Vel. Boat	Mean Vel. Water	% Bad Ens.	% Bad Bins
002	L	1	1	55	18.4	48.1	12.8	2.65	2.19	84.2	15	31	13:15	13:16	0.26	2.74	4	0
003	R	1	1	51	17.3	46.0	11.8	2.58	2.26	80.0	15	30	13:16	13:17	0.27	2.65	4	0
004	L	1	1	61	18.3	48.3	12.4	2.51	2.19	83.7	16	31	13:18	13:19	0.23	2.67	3	0
005	R	1	1	53	18.4	47.6	12.7	2.61	2.26	83.5	16	31	13:19	13:20	0.26	2.72	4	0
006	L	1	1	56	18.2	48.3	11.9	2.54	2.40	83.4	15	30	13:21	13:22	0.25	2.75	4	0
007	R	1	1	56	18.6	48.3	12.6	2.61	2.19	84.4	16	31	13:22	13:23	0.25	2.70	4	0
Mean		1	1	55	18.2	47.8	12.4	2.58	2.25	83.2	16	31	**Total**	00:07	0.25	2.71	4	0
SDev		0	0	3	0.444	0.914	0.422	0.052	0.083	1.62	0.3	0.5			0.02	0.04		
SD/M		0.00	0.00	0.06	0.02	0.02	0.03	0.02	0.04	0.02	0.02	0.02			0.06	0.01		

Remarks:

Delivery 1 .40 cfs

91.2

83.2

8.00 cfs

-.40

7.60 cfs

Station Number:
Station Name:

Meas. No:
Date: 07/25/2014

Party:	Width: 21.0 ft	Processed by:
Boat/Motor:	Area: 50.6 ft²	Mean Velocity: 1.80 ft/s
Gage Height: 0.00 ft	G.H.Change: 0.000 ft	Discharge: 91.2 ft³/s

Area Method: Avg. Course	ADCP Depth: 0.157 ft	Index Vel.: 0.00 ft/s	Rating No.: 1
Nav. Method: Bottom Track	Shore Ens.:10	Adj.Mean Vel: 0.00 ft/s	Qm Rating:
MagVar Method: (0.0°)	Bottom Est: Power (0.1667)	Rated Area: 0.000 ft²	Diff.: 0.000%
Depth: Composite	Top Est: Power (0.1667)	Control1:	
Discharge Method: None		Control2:	
% Correction: 0.00		Control3:	

Screening Thresholds:		ADCP:	
BT 3-Beam Solution: NO	Max. Vel.: 4.39 ft/s	Type/Freq.: StreamPro / 2000 kHz	
WT 3-Beam Solution: NO	Max. Depth: 3.09 ft	Serial #:	Firmware: 31.12
BT Error Vel.: 32.81 ft/s	Mean Depth: 2.40 ft	Bin Size: 5 cm	Blank: 3 cm
WT Error Vel.: 32.81 ft/s	% Meas.: 65.61	BT Mode: 10	BT Pings: 2
BT Up Vel.: 32.81 ft/s	Water Temp.: None	WT Mode: 12	WT Pings: 6
WT Up Vel.: 32.81 ft/s	ADCP Temp.: 68.8 °F	WV : 0	WO : 1, 4
Use Weighted Mean Depth: NO			

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location:

Project Name: flat 7-25-2014 study point 1_0(
Software: 2.13

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
000	L	1	1	60	15.8	59.4	13.6	-0.035	0.989	89.7	21	52	12:46	12:47	0.30	1.74	3	1
001	R	1	1	62	15.5	57.2	14.1	-0.106	0.918	87.5	21	50	12:47	12:48	0.29	1.75	5	0
002	L	1	1	58	16.7	60.9	14.3	0.141	0.671	92.8	21	52	12:49	12:50	0.32	1.79	9	1
003	R	1	1	60	15.8	58.0	13.3	0.177	0.883	88.2	21	49	12:50	12:51	0.31	1.78	3	0
004	L	1	1	60	16.8	63.6	13.7	0.424	0.706	95.2	21	51	12:52	12:53	0.31	1.87	5	2
005	R	1	1	61	16.7	60.1	15.1	-0.141	0.600	92.3	21	50	12:53	12:54	0.31	1.84	3	0
006	L	1	1	60	16.7	61.2	14.3	0.318	0.848	93.3	21	50	12:54	12:55	0.31	1.85	5	0
007	R	1	1	62	16.1	57.6	14.7	0.212	0.812	89.4	21	50	12:56	12:57	0.30	1.79	3	1
008	L	1	1	64	16.7	61.0	14.2	-0.106	0.883	92.6	21	51	12:57	12:58	0.28	1.82	5	1
Mean		1	1	60	16.3	59.9	14.2	0.098	0.812	91.2	21	51	**Total**	00:12	0.30	1.80	5	1
SDev		0	0	2	0.509	2.05	0.576	0.204	0.127	2.60	0.3	0.8			0.01	0.05		
SD/M		0.00	0.00	0.03	0.03	0.03	0.04	2.08	0.16	0.03	0.01	0.02			0.04	0.03		

Remarks:

Station Number:
Station Name:

Meas. No:
Date: 07/18/2014

Party:
Boat/Motor:
Gage Height: 0.00 ft

Width: 20.8 ft
Area: 49.5 ft²
G.H.Change: 0.000 ft

Processed by:
Mean Velocity: 1.79 ft/s
Discharge: 88.6 ft³/s

Area Method: Avg. Course
Nav. Method: Bottom Track
MagVar Method: (0.0°)
Depth: Composite
Discharge Method: None
% Correction: 0.00

ADCP Depth: 0.157 ft
Shore Ens.:10
Bottom Est: Power (0.1667)
Top Est: Power (0.1667)

Index Vel.: 0.00 ft/s
Adj.Mean Vel: 0.00 ft/s
Rated Area: 0.000 ft²
Control1:
Control2:
Control3:

Rating No.: 1
Qm Rating:
Diff.: 0.000%

Screening Thresholds:
BT 3-Beam Solution: NO
WT 3-Beam Solution: NO
BT Error Vel.: 32.81 ft/s
WT Error Vel.: 32.81 ft/s
BT Up Vel.: 32.81 ft/s
WT Up Vel.: 32.81 ft/s
Use Weighted Mean Depth: NO

Max. Vel.: 14.0 ft/s
Max. Depth: 3.09 ft
Mean Depth: 2.38 ft
% Meas.: 64.94
Water Temp.: None
ADCP Temp.: 66.9 °F

ADCP:
Type/Freq.: StreamPro / 2000 kHz
Serial #:
Firmware: 31.12
Bin Size: 4 cm
Blank: 3 cm
BT Mode: 10
BT Pings: 2
WT Mode: 12
WT Pings: 6
WV : 0
WO : 1, 4

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location:

Project Name: flat 7-18-2014 study pnt 1_005
Software: 2.13

Tr.#		Edge Distance L	Edge Distance R	#Ens.	Discharge Top	Discharge Middle	Discharge Bottom	Discharge Left	Discharge Right	Discharge Total	Width	Area	Time Start	Time End	Mean Vel. Boat	Mean Vel. Water	% Bad Ens.	% Bad Bins
000	L	1	1	68	16.3	56.0	13.4	-0.247	0.706	86.2	21	50	11:28	11:30	0.28	1.74	4	2
001	R	1	1	59	17.2	60.7	13.9	-0.212	0.706	92.3	21	49	11:30	11:31	0.31	1.89	3	2
002	L	1	1	58	15.9	56.0	13.6	-0.212	0.777	86.1	21	50	11:31	11:32	0.33	1.71	5	0
003	R	1	1	64	17.0	58.9	14.5	0.283	0.848	91.5	21	50	11:33	11:34	0.28	1.82	5	0
004	L	1	1	71	16.7	59.1	13.4	0.141	0.812	90.1	21	49	11:34	11:35	0.26	1.83	6	1
005	R	1	1	67	16.5	56.4	14.2	0.177	1.13	88.4	21	50	11:36	11:37	0.28	1.78	3	0
006	L	1	1	73	15.6	54.7	13.1	-0.071	0.989	84.4	21	50	11:37	11:39	0.27	1.70	10	1
007	R	1	1	69	16.1	56.5	13.4	0.000	0.953	87.0	21	50	11:39	11:40	0.26	1.75	4	1
008	L	1	1	74	17.3	59.3	13.8	-0.035	0.812	91.2	20	48	11:41	11:42	0.26	1.89	11	1
Mean		1	1	67	16.5	57.5	13.7	-0.020	0.859	88.6	21	49	**Total**	00:13	0.28	1.79	6	1
SDev		0	0	6	0.598	2.00	0.432	0.189	0.140	2.82	0.4	0.6			0.02	0.07		
SD/M		0.00	0.00	0.09	0.04	0.03	0.03	9.61	0.16	0.03	0.02	0.01			0.08	0.04		

Remarks: Deliver .56 cfs.

6.84 Loss

Station Number:
Station Name:

Meas. No:
Date: 07/18/2014

Party:	Width: 15.2 ft	Processed by:
Boat/Motor:	Area: 29.9 ft²	Mean Velocity: 2.72 ft/s
Gage Height: 0.00 ft	G.H.Change: 0.000 ft	Discharge: 81.2 ft³/s

Area Method: Avg. Course	ADCP Depth: 0.157 ft	Index Vel.: 0.00 ft/s	Rating No.: 1
Nav. Method: Bottom Track	Shore Ens.:10	Adj.Mean Vel: 0.00 ft/s	Qm Rating:
MagVar Method: (0.0°)	Bottom Est: Power (0.1667)	Rated Area: 0.000 ft²	Diff.: 0.000%
Depth: Composite	Top Est: Power (0.1667)	Control1:	
Discharge Method: None		Control2:	
% Correction: 0.00		Control3:	

Screening Thresholds:		ADCP:	
BT 3-Beam Solution: NO	Max. Vel.: 4.94 ft/s	Type/Freq.: StreamPro / 2000 kHz	
WT 3-Beam Solution: NO	Max. Depth: 2.38 ft	Serial #:	Firmware: 31.12
BT Error Vel.: 32.81 ft/s	Mean Depth: 1.97 ft	Bin Size: 4 cm	Blank: 3 cm
WT Error Vel.: 32.81 ft/s	% Meas.: 57.28	BT Mode: 10	BT Pings: 2
BT Up Vel.: 32.81 ft/s	Water Temp.: None	WT Mode: 12	WT Pings: 6
WT Up Vel.: 32.81 ft/s	ADCP Temp.: 66.9 °F	WV : 0	WO : 1, 4
Use Weighted Mean Depth: NO			

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location:

Project Name: flat 7-18-2014 study pnt 2_005
Software: 2.13

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
000	L	1	1	68	18.1	47.9	11.9	2.51	2.33	82.7	15	30	11:55	11:56	0.20	2.77	3	0
001	R	1	1	59	18.2	47.2	12.3	2.61	2.12	82.5	15	30	11:57	11:58	0.24	2.74	3	0
002	L	1	1	65	17.7	46.5	11.5	2.54	2.22	80.4	15	30	11:58	11:59	0.21	2.65	3	0
003	R	1	1	53	18.5	47.4	13.1	2.90	2.15	84.1	15	30	11:59	12:00	0.25	2.78	4	0
004	L	1	1	59	18.6	48.2	12.4	3.00	2.26	84.4	16	31	12:01	12:02	0.25	2.75	3	0
005	R	1	1	65	17.3	45.5	11.6	2.65	2.30	79.5	15	30	12:02	12:03	0.21	2.65	3	0
006	L	1	1	66	18.4	47.6	12.4	2.47	2.26	83.0	15	30	12:03	12:05	0.21	2.74	3	0
007	*R*	*1*	*1*	*58*	*16.7*	*44.2*	*11.0*	*2.54*	*2.37*	*76.8*	*15*	*29*	*12:05*	*12:06*	*0.24*	*2.68*	*3*	*0*
008	L	*1*	*1*	*66*	*17.1*	*44.4*	*11.6*	*2.61*	*2.26*	*77.8*	*15*	*29*	*12:06*	*12:08*	*0.22*	*2.70*	*3*	*0*
Mean		1	1	62	17.8	46.5	12.0	2.65	2.25	81.2	15	30	**Total**	00:12	0.22	2.72	3	0
SDev		0	0	5	0.678	1.50	0.621	0.181	0.079	2.73	0.3	0.7			0.02	0.05		
SD/M		0.00	0.00	0.08	0.04	0.03	0.05	0.07	0.03	0.03	0.02	0.02			0.08	0.02		

Remarks:

Discharge for transects in *italics* have a total Q more than 5% from the mean

Station Number:
Station Name:

Meas. No:
Date: 07/11/2014

Party:	Width: 15.4 ft	Processed by:
Boat/Motor:	Area: 29.6 ft²	Mean Velocity: 2.74 ft/s
Gage Height: 0.00 ft	G.H.Change: 0.000 ft	Discharge: 81.2 ft³/s

Area Method: Avg. Course	ADCP Depth: 0.157 ft	Index Vel.: 0.00 ft/s	Rating No.: 1
Nav. Method: Bottom Track	Shore Ens.:10	Adj.Mean Vel: 0.00 ft/s	Qm Rating:
MagVar Method: (0.0°)	Bottom Est: Power (0.1667)	Rated Area: 0.000 ft²	Diff.: 0.000%
Depth: Composite	Top Est: Power (0.1667)	Control1:	
Discharge Method: None		Control2:	
% Correction: 0.00		Control3:	

Screening Thresholds:		ADCP:	
BT 3-Beam Solution: NO	Max. Vel.: 6.10 ft/s	Type/Freq.: StreamPro / 2000 kHz	
WT 3-Beam Solution: NO	Max. Depth: 2.34 ft	Serial #:	Firmware: 31.12
BT Error Vel.: 32.81 ft/s	Mean Depth: 1.93 ft	Bin Size: 4 cm	Blank: 3 cm
WT Error Vel.: 32.81 ft/s	% Meas.: 57.26	BT Mode: 10	BT Pings: 2
BT Up Vel.: 32.81 ft/s	Water Temp.: None	WT Mode: 12	WT Pings: 6
WT Up Vel.: 32.81 ft/s	ADCP Temp.: 66.3 °F	WV : 0	WO : 1, 4
Use Weighted Mean Depth: NO			

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location:

Project Name: flat 7-11-2014 study point 2_0(
Software: 2.13

Tr.#		Edge Distance L	Edge Distance R	#Ens.	Discharge Top	Discharge Middle	Discharge Bottom	Discharge Left	Discharge Right	Discharge Total	Width	Area	Time Start	Time End	Mean Vel. Boat	Mean Vel. Water	% Bad Ens.	% Bad Bins
000	R	1	1	52	18.4	46.8	12.1	2.44	2.05	81.8	15	29	10:01	10:02	0.27	2.77	4	0
001	L	1	1	48	18.2	46.3	11.9	2.47	2.33	81.2	15	29	10:02	10:03	0.28	2.80	4	0
002	R	1	1	49	17.9	45.8	11.1	2.33	2.26	79.5	16	30	10:04	10:04	0.29	2.66	4	0
003	L	1	1	51	18.2	46.3	11.8	2.30	2.12	80.8	15	30	10:05	10:05	0.27	2.71	4	0
004	R	1	1	49	18.2	46.8	11.2	2.33	2.05	80.5	15	30	10:06	10:07	0.28	2.70	4	0
005	L	1	1	57	18.2	45.9	12.4	2.54	2.22	81.3	15	29	10:07	10:08	0.25	2.78	4	0
006	R	1	1	48	18.2	45.9	11.9	2.54	2.22	80.7	16	30	10:08	10:09	0.29	2.69	4	0
007	L	1	1	52	18.8	48.0	12.1	2.47	2.22	83.6	15	30	10:09	10:10	0.27	2.81	4	0
Mean		1	1	50	18.3	46.5	11.8	2.43	2.19	81.2	15	30	**Total**	00:08	0.27	2.74	4	0
SDev		0	0	3	0.246	0.731	0.454	0.098	0.102	1.18	0.2	0.3			0.01	0.06		
SD/M		0.00	0.00	0.06	0.01	0.02	0.04	0.04	0.05	0.01	0.01	0.01			0.05	0.02		

Remarks: Delivery 1). 56
2). 76
1.32

6.3
-1.32
4.98

Station Number:
Station Name:

Meas. No:
Date: 07/11/2014

Party:	Width: 21.4 ft	Processed by:
Boat/Motor:	Area: 49.6 ft²	Mean Velocity: 1.76 ft/s
Gage Height: 0.00 ft	G.H.Change: 0.000 ft	Discharge: 87.5 ft³/s

Area Method: Avg. Course	ADCP Depth: 0.157 ft	Index Vel.: 0.00 ft/s	Rating No.: 1
Nav. Method: Bottom Track	Shore Ens.:10	Adj.Mean Vel: 0.00 ft/s	Qm Rating:
MagVar Method: (0.0°)	Bottom Est: Power (0.1667)	Rated Area: 0.000 ft²	Diff.: 0.000%
Depth: Composite	Top Est: Power (0.1667)	Control1:	
Discharge Method: None		Control2:	
% Correction: 0.00		Control3:	

Screening Thresholds:		ADCP:	
BT 3-Beam Solution: NO	Max. Vel.: 5.28 ft/s	Type/Freq.: StreamPro / 2000 kHz	
WT 3-Beam Solution: NO	Max. Depth: 3.01 ft	Serial #:	Firmware: 31.12
BT Error Vel.: 32.81 ft/s	Mean Depth: 2.32 ft	Bin Size: 4 cm	Blank: 3 cm
WT Error Vel.: 32.81 ft/s	% Meas.: 65.07	BT Mode: 10	BT Pings: 2
BT Up Vel.: 32.81 ft/s	Water Temp.: None	WT Mode: 12	WT Pings: 6
WT Up Vel.: 32.81 ft/s	ADCP Temp.: 66.6 °F	WV : 0	WO : 1, 4
Use Weighted Mean Depth: NO			

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location:

Project Name: flat 7-11-2014 study point 1_0(
Software: 2.13

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
000	L	1	1	59	16.0	55.0	12.8	0.212	0.600	84.6	22	51	09:36	09:37	0.35	1.65	15	1
001	R	1	1	51	17.0	58.4	13.1	0.177	0.918	89.6	22	51	09:38	09:38	0.37	1.77	2	0
002	L	1	1	59	16.9	57.4	13.6	-0.212	0.671	88.3	22	50	09:39	09:40	0.34	1.77	10	1
003	R	1	1	56	17.2	57.8	14.2	0.247	0.530	90.0	21	48	09:40	09:41	0.36	1.88	7	0
004	L	1	1	55	15.9	56.4	12.7	0.141	0.812	86.0	21	50	09:41	09:42	0.37	1.73	7	1
005	R	1	1	53	16.4	56.4	12.8	0.318	0.777	86.8	21	49	09:43	09:44	0.35	1.77	4	0
006	L	1	1	53	16.8	58.6	13.2	0.106	0.742	89.5	21	50	09:44	09:45	0.35	1.81	9	1
007	R	1	1	52	15.9	54.5	12.9	-0.071	0.918	84.1	21	49	09:45	09:46	0.34	1.70	2	1
008	L	1	1	54	17.0	57.9	13.4	-0.247	0.530	88.5	21	49	09:47	09:48	0.33	1.80	6	0
Mean		1	1	54	16.6	56.9	13.2	0.075	0.722	87.5	21	50	**Total**	00:11	0.35	1.76	7	1
SDev		0	0	3	0.516	1.46	0.481	0.203	0.150	2.20	0.5	1.0			0.01	0.07		
SD/M		0.00	0.00	0.05	0.03	0.03	0.04	2.73	0.21	0.03	0.02	0.02			0.04	0.04		

Remarks:

Station Number:
Station Name:

Meas. No:
Date: 05/09/2005

Party:	Width: 21.2 ft	Processed by:
Boat/Motor:	Area: 48.5 ft²	Mean Velocity: 1.82 ft/s
Gage Height: 0.00 ft	G.H.Change: 0.000 ft	Discharge: 88.3 ft³/s

Area Method: Avg. Course	ADCP Depth: 0.157 ft	Index Vel.: 0.00 ft/s	Rating No.: 1
Nav. Method: Bottom Track	Shore Ens.:10	Adj.Mean Vel: 0.00 ft/s	Qm Rating:
MagVar Method: (0.0°)	Bottom Est: Power (0.1667)	Rated Area: 0.000 ft²	Diff.: 0.000%
Depth: Composite	Top Est: Power (0.1667)	Control1:	
Discharge Method: None		Control2:	
% Correction: 0.00		Control3:	

Screening Thresholds:		ADCP:	
BT 3-Beam Solution: NO	Max. Vel.: 7.35 ft/s	Type/Freq.: StreamPro / 2000 kHz	
WT 3-Beam Solution: NO	Max. Depth: 2.94 ft	Serial #:	Firmware: 31.12
BT Error Vel.: 32.81 ft/s	Mean Depth: 2.29 ft	Bin Size: 5 cm	Blank: 3 cm
WT Error Vel.: 32.81 ft/s	% Meas.: 64.51	BT Mode: 10	BT Pings: 2
BT Up Vel.: 32.81 ft/s	Water Temp.: None	WT Mode: 12	WT Pings: 6
WT Up Vel.: 32.81 ft/s	ADCP Temp.: 67.1 °F	WV : 0	WO : 1, 4
Use Weighted Mean Depth: NO			

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location:

Project Name: flat 6-20-2014 study point 1_0(
Software: 2.13

Tr.#		Edge Distance L	Edge Distance R	#Ens.	Discharge Top	Discharge Middle	Discharge Bottom	Discharge Left	Discharge Right	Discharge Total	Width	Area	Time Start	Time End	Mean Vel. Boat	Mean Vel. Water	% Bad Ens.	% Bad Bins
000	L	1	1	60	16.7	58.7	15.0	0.212	0.848	91.5	21	49	17:22	17:23	0.32	1.88	7	2
001	R	1	1	60	17.1	59.2	14.5	-0.177	0.918	91.5	21	49	17:23	17:25	0.30	1.86	3	1
002	L	1	1	62	16.7	56.9	14.5	-0.141	0.636	88.6	22	50	17:25	17:26	0.33	1.78	16	1
003	R	1	1	55	15.6	54.7	13.2	0.071	0.777	84.3	21	48	17:27	17:28	0.34	1.75	4	1
004	L	1	1	54	15.9	55.2	13.8	0.071	0.494	85.4	20	47	17:29	17:29	0.37	1.81	7	2
005	R	1	1	53	16.6	57.0	14.1	0.071	0.565	88.2	21	48	17:30	17:31	0.34	1.83	2	1
006	L	1	1	59	15.9	54.7	13.8	0.177	0.742	85.3	21	48	17:32	17:33	0.32	1.79	3	1
008	R	1	1	54	16.9	58.2	14.5	-0.141	0.600	90.1	22	49	17:34	17:35	0.37	1.84	6	2
009	L	1	1	60	16.6	58.0	13.9	0.318	0.671	89.6	21	48	17:35	17:36	0.31	1.86	5	0
Mean		1	1	57	16.4	57.0	14.1	0.051	0.695	88.3	21	48	**Total**	00:14	0.33	1.82	6	1
SDev		0	0	3	0.518	1.73	0.546	0.173	0.138	2.70	0.5	0.8			0.02	0.04		
SD/M		0.00	0.00	0.06	0.03	0.03	0.04	3.39	0.20	0.03	0.02	0.02			0.08	0.02		

Remarks:

88.3
80.8
7.50
-1.00
6.50 loss

.76 delivery 1
.24 delivery 2
1 cfs

Station Number:
Station Name:

Meas. No: 016
Date: 05/09/2005

Party:	Width: 15.5 ft	Processed by:
Boat/Motor:	Area: 29.8 ft²	Mean Velocity: 2.71 ft/s
Gage Height: 0.00 ft	G.H.Change: 0.000 ft	Discharge: 80.8 ft³/s

Area Method: Avg. Course	ADCP Depth: 0.157 ft	Index Vel.: 0.00 ft/s	Rating No.: 1
Nav. Method: Bottom Track	Shore Ens.:10	Adj.Mean Vel: 0.00 ft/s	Qm Rating:
MagVar Method: (0.0°)	Bottom Est: Power (0.1667)	Rated Area: 0.000 ft²	Diff.: 0.000%
Depth: Composite	Top Est: Power (0.1667)	Control1:	
Discharge Method: None		Control2:	
% Correction: 0.00		Control3:	

Screening Thresholds:		ADCP:	
BT 3-Beam Solution: NO	Max. Vel.: 5.09 ft/s	Type/Freq.: StreamPro / 2000 kHz	
WT 3-Beam Solution: NO	Max. Depth: 2.36 ft	Serial #:	Firmware: 31.12
BT Error Vel.: 32.81 ft/s	Mean Depth: 1.92 ft	Bin Size: 4 cm	Blank: 3 cm
WT Error Vel.: 32.81 ft/s	% Meas.: 56.96	BT Mode: 10	BT Pings: 2
BT Up Vel.: 32.81 ft/s	Water Temp.: None	WT Mode: 12	WT Pings: 6
WT Up Vel.: 32.81 ft/s	ADCP Temp.: 67.9 °F	WV : 0	WO : 1, 4
Use Weighted Mean Depth: NO			

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location:

Project Name: flat 6-20-2014 study point 200
Software: 2.13

Tr.#		Edge Distance L	Edge Distance R	#Ens.	Discharge Top	Discharge Middle	Discharge Bottom	Discharge Left	Discharge Right	Discharge Total	Width	Area	Time Start	Time End	Mean Vel. Boat	Mean Vel. Water	% Bad Ens.	% Bad Bins
001	R	1	1	54	18.0	45.3	11.9	2.58	2.12	79.8	15	29	18:35	18:36	0.25	2.72	4	0
002	L	1	1	53	18.3	45.9	12.5	2.51	2.19	81.4	16	30	18:36	18:37	0.28	2.69	4	0
003	R	1	1	49	18.0	45.4	11.9	2.90	2.08	80.4	15	29	18:41	18:42	0.30	2.75	4	0
006	L	1	1	52	18.5	46.8	12.4	2.37	2.08	82.2	15	30	18:45	18:46	0.26	2.77	4	0
007	R	1	1	54	18.2	45.4	12.1	2.51	1.94	80.2	16	30	18:46	18:47	0.26	2.66	4	0
008	L	1	1	52	17.9	45.3	11.5	2.47	2.01	79.3	15	29	18:48	18:48	0.26	2.72	4	0
009	R	1	1	51	18.1	45.6	11.8	2.33	2.12	79.9	15	29	18:49	18:50	0.27	2.74	4	0
010	L	1	1	55	18.6	46.7	12.3	2.47	2.05	82.1	15	30	18:50	18:51	0.25	2.76	4	0
011	R	1	1	49	18.6	47.5	11.8	2.26	2.05	82.2	15	30	18:51	18:52	0.29	2.79	4	0
012	L	1	1	49	18.0	46.0	11.7	2.30	2.19	80.2	15	30	18:52	18:53	0.28	2.70	4	0
013	R	1	1	45	18.7	46.9	12.0	2.30	2.08	82.0	16	31	18:53	18:54	0.32	2.68	4	0
015	R	1	1	48	17.9	45.2	11.8	2.30	2.05	79.3	16	30	18:56	18:57	0.29	2.66	4	0
016	L	1	1	51	18.4	46.2	12.2	2.30	2.12	81.1	16	30	18:57	18:58	0.28	2.67	4	0
Mean		1	1	50	18.3	46.0	12.0	2.43	2.08	80.8	15	30	**Total**	00:22	0.28	2.71	4	0
SDev		0	0	3	0.286	0.725	0.299	0.175	0.068	1.12	0.2	0.5			0.02	0.04		
SD/M		0.00	0.00	0.06	0.02	0.02	0.02	0.07	0.03	0.01	0.02	0.02			0.07	0.02		

Remarks:

Station Number:
Station Name:

Meas. No:
Date: 06/13/2014

Party:	Width: 15.4 ft	Processed by:
Boat/Motor:	Area: 29.5 ft²	Mean Velocity: 2.74 ft/s
Gage Height: 0.00 ft	G.H.Change: 0.000 ft	Discharge: 80.8 ft³/s

Area Method: Avg. Course	ADCP Depth: 0.157 ft	Index Vel.: 0.00 ft/s	Rating No.: 1
Nav. Method: Bottom Track	Shore Ens.:10	Adj.Mean Vel: 0.00 ft/s	Qm Rating:
MagVar Method: (0.0°)	Bottom Est: Power (0.1667)	Rated Area: 0.000 ft²	Diff.: 0.000%
Depth: Composite	Top Est: Power (0.1667)	Control1:	
Discharge Method: None		Control2:	
% Correction: 0.00		Control3:	

Screening Thresholds:		ADCP:	
BT 3-Beam Solution: NO	Max. Vel.: 4.83 ft/s	Type/Freq.: StreamPro / 2000 kHz	
WT 3-Beam Solution: NO	Max. Depth: 2.33 ft	Serial #:	Firmware: 31.12
BT Error Vel.: 32.81 ft/s	Mean Depth: 1.92 ft	Bin Size: 4 cm	Blank: 3 cm
WT Error Vel.: 32.81 ft/s	% Meas.: 56.45	BT Mode: 10	BT Pings: 2
BT Up Vel.: 32.81 ft/s	Water Temp.: None	WT Mode: 12	WT Pings: 6
WT Up Vel.: 32.81 ft/s	ADCP Temp.: 60.9 °F	WV : 0	WO : 1, 4
Use Weighted Mean Depth: NO			

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location:

Project Name: flat 6-13 study point 2_002w0(
Software: 2.13

Tr.#		Edge Distance L	Edge Distance R	#Ens.	Discharge Top	Discharge Middle	Discharge Bottom	Discharge Left	Discharge Right	Discharge Total	Width	Area	Time Start	Time End	Mean Vel. Boat	Mean Vel. Water	% Bad Ens.	% Bad Bins
000	L	1	1	49	18.4	46.5	12.5	2.44	2.33	82.2	15	30	13:35	13:35	0.28	2.78	4	0
001	R	1	1	52	18.2	45.5	12.3	2.44	2.30	80.7	15	29	13:36	13:37	0.26	2.75	4	0
002	L	1	1	48	19.1	47.8	12.6	2.51	2.33	84.3	16	30	13:37	13:38	0.29	2.79	4	0
003	R	1	1	42	17.6	44.6	11.5	2.79	2.15	78.6	15	29	13:38	13:39	0.33	2.68	5	0
004	L	1	1	45	18.9	47.1	12.6	2.40	2.22	83.2	16	30	13:39	13:40	0.30	2.79	4	0
005	R	1	1	44	17.8	44.6	12.3	2.61	2.22	79.6	15	29	13:40	13:41	0.31	2.70	5	0
006	L	1	1	47	17.7	44.4	12.2	2.47	2.08	78.9	15	29	13:41	13:42	0.29	2.72	4	0
007	R	1	1	46	18.2	45.4	12.4	2.68	2.22	81.0	15	30	13:42	13:43	0.30	2.74	4	0
008	L	1	1	46	17.7	44.5	11.8	2.51	2.05	78.5	15	29	13:44	13:44	0.30	2.68	4	0
Mean		1	1	46	18.2	45.6	12.2	2.54	2.21	80.8	15	30	**Total**	00:09	0.29	2.74	4	0
SDev		0	0	3	0.532	1.25	0.378	0.130	0.101	2.09	0.2	0.3			0.02	0.04		
SD/M		0.00	0.00	0.06	0.03	0.03	0.03	0.05	0.05	0.03	0.01	0.01			0.07	0.02		

Remarks:

.76 for delivery

88.4 reading 1
80.8 reading 2
7.6 loss
- .76 delivery
6.84 loss

7.6 = 6.84

Station Number:
Station Name:

Meas. No:
Date: 06/13/2014

Party:	Width: 21.4 ft	Processed by:
Boat/Motor:	Area: 48.7 ft²	Mean Velocity: 1.81 ft/s
Gage Height: 0.00 ft	G.H.Change: 0.000 ft	Discharge: 88.4 ft³/s

Area Method: Avg. Course	ADCP Depth: 0.157 ft	Index Vel.: 0.00 ft/s	Rating No.: 1
Nav. Method: Bottom Track	Shore Ens.:10	Adj.Mean Vel: 0.00 ft/s	Qm Rating:
MagVar Method: (0.0°)	Bottom Est: Power (0.1667)	Rated Area: 0.000 ft²	Diff.: 0.000%
Depth: Composite	Top Est: Power (0.1667)	Control1:	
Discharge Method: None		Control2:	
% Correction: 0.00		Control3:	

Screening Thresholds:		ADCP:	
BT 3-Beam Solution: NO	Max. Vel.: 4.61 ft/s	Type/Freq.: StreamPro / 2000 kHz	
WT 3-Beam Solution: NO	Max. Depth: 2.93 ft	Serial #:	Firmware: 31.12
BT Error Vel.: 32.81 ft/s	Mean Depth: 2.28 ft	Bin Size: 4 cm	Blank: 3 cm
WT Error Vel.: 32.81 ft/s	% Meas.: 64.96	BT Mode: 10	BT Pings: 2
BT Up Vel.: 32.81 ft/s	Water Temp.: None	WT Mode: 12	WT Pings: 6
WT Up Vel.: 32.81 ft/s	ADCP Temp.: 62.6 °F	WV : 0	WO : 1, 4
Use Weighted Mean Depth: NO			

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location:

Project Name: flat 6-13 study point 1_002w0C
Software: 2.13

Tr.#		Edge Distance L	Edge Distance R	#Ens.	Discharge Top	Discharge Middle	Discharge Bottom	Discharge Left	Discharge Right	Discharge Total	Width	Area	Time Start	Time End	Mean Vel. Boat	Mean Vel. Water	% Bad Ens.	% Bad Bins
000	L	1	1	58	17.2	59.0	13.6	-0.141	0.812	90.4	22	50	13:09	13:10	0.34	1.82	10	0
001	R	1	1	54	17.2	57.6	13.5	0.071	0.848	89.2	21	49	13:10	13:11	0.34	1.83	6	0
002	L	1	1	59	17.8	59.5	14.4	0.071	0.671	92.4	21	49	13:11	13:12	0.31	1.88	7	1
003	R	1	1	62	17.4	58.5	13.3	0.141	0.848	90.2	22	49	13:13	13:14	0.30	1.85	5	1
004	L	1	1	58	16.9	56.3	13.4	-0.071	0.530	87.1	21	49	13:14	13:15	0.32	1.78	7	2
005	R	1	1	59	17.1	58.3	12.8	0.283	0.388	88.9	22	49	13:15	13:16	0.32	1.82	3	1
006	L	1	1	51	16.8	57.3	12.9	0.283	0.777	88.0	21	48	13:17	13:18	0.37	1.82	4	1
007	R	1	1	55	16.6	55.5	12.5	-0.141	0.636	85.1	21	48	13:18	13:19	0.33	1.77	2	1
008	L	1	1	50	16.1	54.6	12.6	-0.071	0.742	84.0	21	48	13:20	13:21	0.36	1.74	6	1
Mean		1	1	56	17.0	57.4	13.2	0.047	0.695	88.4	21	49	**Total**	00:11	0.33	1.81	6	1
SDev		0	0	4	0.488	1.64	0.589	0.166	0.156	2.66	0.3	0.5			0.02	0.04		
SD/M		0.00	0.00	0.07	0.03	0.03	0.04	3.52	0.22	0.03	0.01	0.01			0.06	0.02		

Remarks:

Station Number:
Station Name:

Meas. No:
Date: 05/16/2005

Party:	Width: 15.4 ft	Processed by:
Boat/Motor:	Area: 28.3 ft²	Mean Velocity: 2.63 ft/s
Gage Height: 0.00 ft	G.H.Change: 0.000 ft	Discharge: 74.5 ft³/s

Area Method: Avg. Course	ADCP Depth: 0.157 ft	Index Vel.: 0.00 ft/s	Rating No.: 1
Nav. Method: Bottom Track	Shore Ens.:10	Adj.Mean Vel: 0.00 ft/s	Qm Rating:
MagVar Method: (0.0°)	Bottom Est: Power (0.1667)	Rated Area: 0.000 ft²	Diff.: 0.000%
Depth: Composite	Top Est: Power (0.1667)	Control1:	
Discharge Method: None		Control2:	
% Correction: 0.00		Control3:	

Screening Thresholds:		ADCP:	
BT 3-Beam Solution: NO	Max. Vel.: 5.32 ft/s	Type/Freq.: StreamPro / 2000 kHz	
WT 3-Beam Solution: NO	Max. Depth: 2.23 ft	Serial #:	Firmware: 31.12
BT Error Vel.: 32.81 ft/s	Mean Depth: 1.84 ft	Bin Size: 3 cm	Blank: 3 cm
WT Error Vel.: 32.81 ft/s	% Meas.: 57.70	BT Mode: 10	BT Pings: 2
BT Up Vel.: 32.81 ft/s	Water Temp.: None	WT Mode: 12	WT Pings: 6
WT Up Vel.: 32.81 ft/s	ADCP Temp.: 64.6 °F	WV : 0	WO : 1, 4
Use Weighted Mean Depth: NO			

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location:

Project Name: flat 6-4 study point 2_000w00(
Software: 2.13

Tr.#		Edge Distance L	Edge Distance R	#Ens.	Discharge Top	Discharge Middle	Discharge Bottom	Discharge Left	Discharge Right	Discharge Total	Width	Area	Time Start	Time End	Mean Vel. Boat	Mean Vel. Water	% Bad Ens.	% Bad Bins
000	R	1	1	54	17.1	43.3	10.5	2.15	1.94	74.9	15	28	17:50	17:51	0.25	2.64	4	0
001	L	1	1	58	16.9	43.0	10.1	2.01	1.98	74.1	16	29	17:51	17:52	0.24	2.56	3	0
002	R	1	1	52	16.5	41.5	10.2	2.37	1.98	72.5	15	28	17:53	17:54	0.26	2.57	4	0
003	L	1	1	50	17.4	43.8	10.8	2.19	1.91	76.2	15	28	17:54	17:55	0.27	2.71	4	0
004	R	1	1	50	17.2	43.0	10.9	2.15	1.87	75.1	16	28	17:55	17:56	0.26	2.65	4	0
005	L	1	1	53	17.3	43.8	10.6	2.37	1.91	75.9	16	29	17:57	17:58	0.25	2.64	4	0
006	R	1	1	50	17.3	43.3	11.1	2.30	1.87	76.0	16	29	17:58	17:59	0.28	2.63	4	0
007	L	1	1	52	16.6	42.8	9.99	2.19	1.94	73.5	15	28	17:59	18:00	0.25	2.60	4	0
008	R	1	1	52	16.2	42.1	9.36	2.30	1.91	71.8	15	28	18:01	18:02	0.26	2.58	4	0
009	L	1	1	56	17.0	43.3	10.5	2.22	1.94	75.0	15	28	18:02	18:03	0.24	2.68	4	0
Mean		1	1	52	17.0	43.0	10.4	2.22	1.92	74.5	15	28	**Total**	00:12	0.25	2.63	4	0
SDev		0	0	3	0.383	0.744	0.509	0.109	0.038	1.50	0.2	0.4			0.01	0.05		
SD/M		0.00	0.00	0.05	0.02	0.02	0.05	0.05	0.02	0.02	0.01	0.01			0.05	0.02		

Remarks:

81.9 reading 1
74.5 reading 2
.80 delivery
6.6 Loss

Station Number:
Station Name:

Meas. No:
Date: 05/16/2005

Party:	Width: 21.4 ft	Processed by:
Boat/Motor:	Area: 47.0 ft²	Mean Velocity: 1.75 ft/s
Gage Height: 0.00 ft	G.H.Change: 0.000 ft	Discharge: 81.9 ft³/s

Area Method: Avg. Course	ADCP Depth: 0.157 ft	Index Vel.: 0.00 ft/s	Rating No.: 1
Nav. Method: Bottom Track	Shore Ens.:10	Adj.Mean Vel: 0.00 ft/s	Qm Rating:
MagVar Method: (0.0°)	Bottom Est: Power (0.1667)	Rated Area: 0.000 ft²	Diff.: 0.000%
Depth: Composite	Top Est: Power (0.1667)	Control1:	
Discharge Method: None		Control2:	
% Correction: 0.00		Control3:	

Screening Thresholds:		ADCP:	
BT 3-Beam Solution: NO	Max. Vel.: 8.34 ft/s	Type/Freq.: StreamPro / 2000 kHz	
WT 3-Beam Solution: NO	Max. Depth: 2.88 ft	Serial #:	Firmware: 31.12
BT Error Vel.: 32.81 ft/s	Mean Depth: 2.20 ft	Bin Size: 4 cm	Blank: 3 cm
WT Error Vel.: 32.81 ft/s	% Meas.: 63.81	BT Mode: 10	BT Pings: 2
BT Up Vel.: 32.81 ft/s	Water Temp.: None	WT Mode: 12	WT Pings: 6
WT Up Vel.: 32.81 ft/s	ADCP Temp.: 66.0 °F	WV : 0	WO : 1, 4
Use Weighted Mean Depth: NO			

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location:

Project Name: flat 6-5 study point 1_000r.mm
Software: 2.13

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
000	R	1	1	61	16.6	54.2	12.5	0.177	0.600	84.1	22	47	17:15	17:16	0.31	1.77	3	0
001	L	1	1	55	16.5	52.5	12.7	0.071	0.671	82.6	21	45	17:17	17:18	0.36	1.82	4	1
002	R	1	1	62	17.0	54.7	12.5	0.106	0.671	85.0	21	47	17:18	17:19	0.30	1.82	2	0
003	L	1	1	56	16.8	52.8	13.3	0.247	0.459	83.6	22	48	17:20	17:20	0.33	1.73	5	0
004	R	1	1	57	16.6	52.5	13.0	-0.071	0.636	82.7	22	47	17:21	17:22	0.32	1.77	4	0
005	L	1	1	62	15.6	50.1	12.1	0.141	0.636	78.6	21	47	17:24	17:25	0.30	1.66	15	0
006	R	1	1	62	15.9	50.4	12.4	0.071	0.636	79.4	21	47	17:25	17:26	0.30	1.70	2	0
008	R	1	1	66	16.6	53.0	12.7	0.106	0.459	82.9	21	47	17:28	17:29	0.30	1.78	6	1
009	L	1	1	61	15.6	50.3	12.2	0.071	0.494	78.6	21	47	17:30	17:31	0.32	1.67	15	0
Mean		1	1	60	16.4	52.3	12.6	0.102	0.585	81.9	21	47	**Total**	00:15	0.31	1.75	6	0
SDev		0	0	4	0.525	1.69	0.384	0.087	0.088	2.43	0.3	0.8			0.02	0.06		
SD/M		0.00	0.00	0.06	0.03	0.03	0.03	0.86	0.15	0.03	0.01	0.02			0.07	0.03		

Remarks:

Station Number:
Station Name:

Meas. No:
Date: 05/10/2005

Party:	Width: 21.1 ft	Processed by:
Boat/Motor:	Area: 45.4 ft²	Mean Velocity: 1.71 ft/s
Gage Height: 0.00 ft	G.H.Change: 0.000 ft	Discharge: 77.6 ft³/s

Area Method: Avg. Course	ADCP Depth: 0.157 ft	Index Vel.: 0.00 ft/s	Rating No.: 1
Nav. Method: Bottom Track	Shore Ens.:10	Adj.Mean Vel: 0.00 ft/s	Qm Rating:
MagVar Method: (0.0°)	Bottom Est: Power (0.1667)	Rated Area: 0.000 ft²	Diff.: 0.000%
Depth: Composite	Top Est: Power (0.1667)	Control1:	
Discharge Method: None		Control2:	
% Correction: 0.00		Control3:	

Screening Thresholds:		ADCP:	
BT 3-Beam Solution: NO	Max. Vel.: 7.75 ft/s	Type/Freq.: StreamPro / 2000 kHz	
WT 3-Beam Solution: NO	Max. Depth: 2.83 ft	Serial #:	Firmware: 31.12
BT Error Vel.: 32.81 ft/s	Mean Depth: 2.15 ft	Bin Size: 4 cm	Blank: 3 cm
WT Error Vel.: 32.81 ft/s	% Meas.: 62.79	BT Mode: 10	BT Pings: 2
BT Up Vel.: 32.81 ft/s	Water Temp.: None	WT Mode: 12	WT Pings: 6
WT Up Vel.: 32.81 ft/s	ADCP Temp.: 63.1 °F	WV : 0	WO : 1, 4
Use Weighted Mean Depth: NO			

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location:

Project Name: flat 5-14 study point 1_000r.mi
Software: 2.13

Tr.#		Edge Distance L	Edge Distance R	#Ens.	Discharge Top	Discharge Middle	Discharge Bottom	Discharge Left	Discharge Right	Discharge Total	Width	Area	Time Start	Time End	Mean Vel. Boat	Mean Vel. Water	% Bad Ens.	% Bad Bins
001	R	1	1	92	15.9	49.3	12.5	0.247	0.565	78.5	21	45	17:21	17:23	0.20	1.76	4	1
002	L	1	1	72	16.0	47.7	11.9	0.283	0.565	76.4	21	45	17:23	17:25	0.27	1.70	8	1
003	R	1	1	74	15.8	48.3	12.5	-0.035	0.636	77.1	21	45	17:25	17:26	0.26	1.71	5	2
004	L	1	1	66	16.6	49.8	13.2	0.141	0.565	80.4	21	46	17:27	17:28	0.29	1.75	5	2
005	R	1	1	70	16.0	49.2	12.5	-0.106	0.459	78.0	21	46	17:28	17:30	0.27	1.70	3	1
006	L	1	1	71	15.1	48.7	11.4	-0.283	0.530	75.4	21	45	17:30	17:31	0.29	1.68	14	1
007	R	1	1	69	16.0	49.1	12.4	0.106	0.388	77.9	21	46	17:31	17:33	0.27	1.69	1	1
008	L	1	1	68	16.0	48.0	12.6	0.177	0.459	77.3	21	45	17:33	17:34	0.28	1.71	4	1
Mean		1	1	72	15.9	48.8	12.4	0.066	0.521	77.6	21	45	**Total**	00:13	0.27	1.71	6	1
SDev		0	0	8	0.417	0.712	0.542	0.193	0.080	1.48	0.3	0.6			0.03	0.03		
SD/M		0.00	0.00	0.11	0.03	0.01	0.04	2.91	0.15	0.02	0.01	0.01			0.11	0.02		

Remarks:

.88 cfs for delivery Between Points.
171 on weir

77.6 point 1
73.3 point 2
.88 delivery
3.42 loss

Station Number:
Station Name:

Meas. No:
Date: 05/10/2005

Party:	Width: 19.1 ft	Processed by:
Boat/Motor:	Area: 35.3 ft²	Mean Velocity: 2.08 ft/s
Gage Height: 0.00 ft	G.H.Change: 0.000 ft	Discharge: 73.3 ft³/s

Area Method: Avg. Course	ADCP Depth: 0.157 ft	Index Vel.: 0.00 ft/s	Rating No.: 1
Nav. Method: Bottom Track	Shore Ens.:10	Adj.Mean Vel: 0.00 ft/s	Qm Rating:
MagVar Method: (0.0°)	Bottom Est: Power (0.1667)	Rated Area: 0.000 ft²	Diff.: 0.000%
Depth: Composite	Top Est: Power (0.1667)	Control1:	
Discharge Method: None		Control2:	
% Correction: 0.00		Control3:	

Screening Thresholds:		ADCP:	
BT 3-Beam Solution: NO	Max. Vel.: 10.2 ft/s	Type/Freq.: StreamPro / 2000 kHz	
WT 3-Beam Solution: NO	Max. Depth: 2.37 ft	Serial #:	Firmware: 31.12
BT Error Vel.: 32.81 ft/s	Mean Depth: 1.85 ft	Bin Size: 4 cm	Blank: 3 cm
WT Error Vel.: 32.81 ft/s	% Meas.: 57.65	BT Mode: 10	BT Pings: 2
BT Up Vel.: 32.81 ft/s	Water Temp.: None	WT Mode: 12	WT Pings: 6
WT Up Vel.: 32.81 ft/s	ADCP Temp.: 63.2 °F	WV : 0	WO : 1, 4
Use Weighted Mean Depth: NO			

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location:

Project Name: flat 5-14 study point 2_000w0(
Software: 2.13

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
001	R	1	1	66	17.0	42.1	11.7	-0.106	2.22	72.9	19	35	18:16	18:17	0.25	2.07	6	0
002	L	1	1	84	17.7	43.9	11.9	-0.283	2.01	75.3	20	36	18:17	18:19	0.21	2.08	14	0
003	R	1	1	73	17.5	42.9	11.8	-0.141	2.15	74.3	19	36	18:19	18:21	0.25	2.08	8	1
004	L	1	1	75	17.1	41.2	11.9	0.247	2.12	72.6	20	36	18:21	18:22	0.23	2.03	3	1
005	R	1	1	67	16.6	41.0	11.4	-0.071	1.98	71.0	19	36	18:23	18:24	0.25	1.99	4	0
006	L	1	1	87	17.2	41.7	12.2	-0.177	2.01	73.0	18	34	18:24	18:26	0.21	2.18	17	1
007	R	1	1	74	16.8	41.7	11.5	0.141	2.22	72.5	19	36	18:26	18:27	0.23	2.02	3	1
008	L	1	1	76	17.6	43.3	11.8	-0.106	2.12	74.7	19	35	18:28	18:29	0.24	2.13	8	1
Mean		1	1	75	17.2	42.2	11.8	-0.062	2.11	73.3	19	35	**Total**	00:12	0.24	2.08	8	1
SDev		0	0	7	0.399	1.02	0.234	0.173	0.096	1.40	0.6	0.8			0.02	0.06		
SD/M		0.00	0.00	0.10	0.02	0.02	0.02	2.80	0.05	0.02	0.03	0.02			0.07	0.03		

Remarks:

PROJECT 80% DRAWINGS

CENTRAL OREGON IRRIGATION DISTRICT
F LATERAL PIPING PROJECT

VICINITY MAP

SURVEY DATA

PROVIDED BY CENTRAL OREGON IRRIGATION DISTRICT
SURVEY DATE: JUNE 2014
SURVEY NOT VERIFIED BY BLACK ROCK CONSULTING

UTILITY NOTIFICATION

IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO CONTACT "UNDERGROUND LOCATE SERVICE" AT 1-800-332-2344 AT LEAST 48 BUSINESS-DAY HOURS PRIOR TO THE START OF CONSTRUCTION FOR LOCATION OF POWER, GAS, OIL, CABLE TV, AND TELEPHONE UNDERGROUND FACILITIES. THE CONTRACTOR WILL ALSO BE RESPONSIBLE FOR CONTACTING THE APPROPRIATE PUBLIC AGENCY FOR LOCATION OF ALL UNDERGROUND FACILITIES.

PIPE MATERIAL LIST

63" DR 32.5 HDPE – 2,206 L.F.

SHEET INDEX

SHEET C-1 – COVER
SHEET C-2 – PLAN/PROFILE STA:1+74–STA:8+00
SHEET C-3 – PLAN/PROFILE STA:8+00–STA:18+00
SHEET C-4 – PLAN/PROFILE STA:18+00–STA:24+00
SHEET C-5 – DETAILS
SHEET C-6 – DETAILS

80% CD

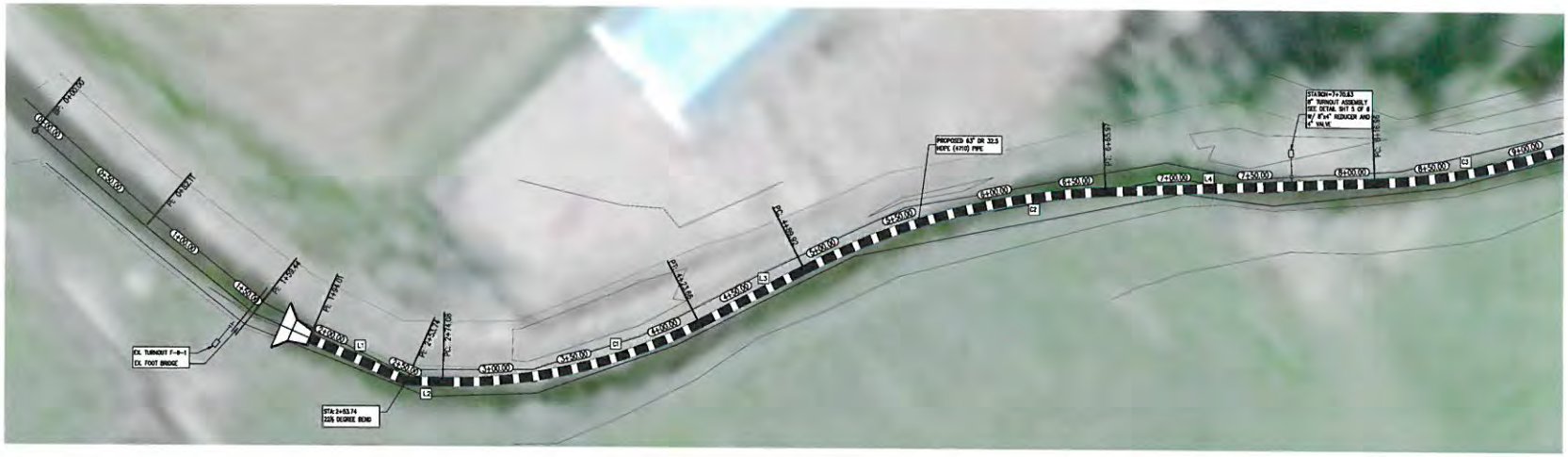
CENTRAL OREGON IRRIGATION DISTRICT
F LATERAL PIPING PROJECT

BLACK ROCK CONSULTING
20380 HALFWAY ROAD STE. #1
BEND, OREGON 97701
(541) 480-6257

DESIGN: MS CHECKED: MS
DRAWN: MS
DATE:
REVISIONS

SHEET C1 OF 6

OREGON PROFESSIONAL ENGINEER 17,428 PRELIMINARY NOT FOR CONSTRUCTION DEC. 29, 1980 KEVIN L. CROUSE
EXPIRES: 31 DECEMBER, 2015

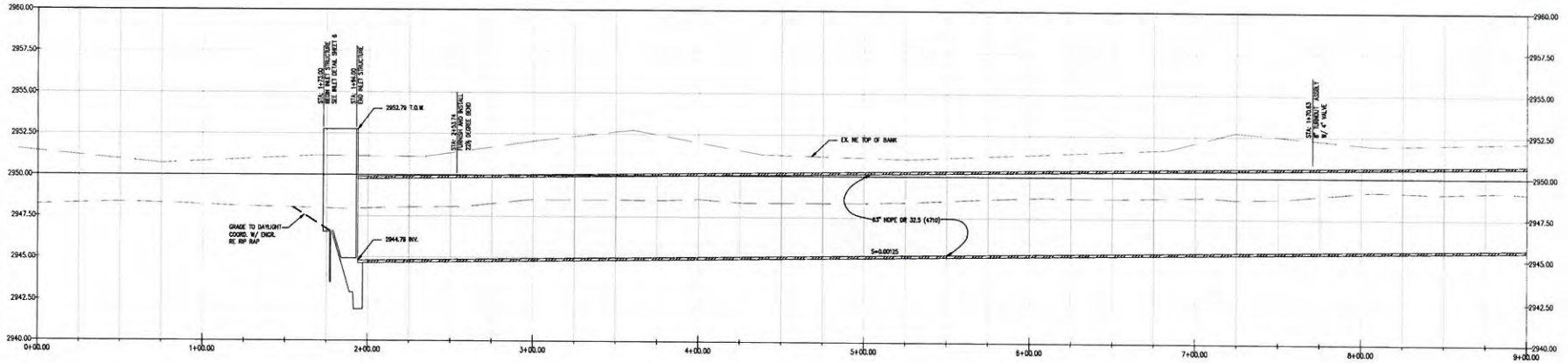


PLAN

SCALE:
HOR: 1"=30' VER: 1"=3'
0 30

Line Table						
Line #	Length	Direction	Starting Northing	Starting Easting	Ending Northing	Ending Easting
L1	58.73	S24° 26' 22"E	969027.047	4742782.395	968972.666	4742807.108
L2	20.34	S46° 56' 22"E	968972.666	4742807.108	968958.778	4742821.970
L3	66.28	S75° 30' 22"E	968887.515	4742951.720	968870.931	4743015.673
L4	151.00	S50° 17' 22"E	968791.374	4743171.328	968694.901	4743287.487

Curve Table									
Curve #	Length	Radius	Delta	Chord Direction	Chord Length	Starting Northing	Starting Easting	Ending Northing	Ending Easting
C1	149.56	300.00	28.57	S61° 13' 22"E	148.03	968958.778	4742821.970	968887.515	4742951.720
C2	176.05	400.00	25.22	N62° 53' 53"W	174.63	968791.374	4743171.328	968870.931	4743015.673
C3	165.02	360.00	26.26	S63° 25' 17"E	163.58	968694.901	4743287.487	968621.712	4743433.778



PROFILE

80% CD

CENTRAL OREGON IRRIGATION DISTRICT
F LATERAL PIPING PROJECT

BLACK ROCK
CONSULTING
20380 HALFWAY ROAD STE. #1
BEND, OREGON 97701
(541) 480-6257

DESIGN: kc CHECKED: kc
DRAWN: ak
DATE:

REVISIONS

SHEET C2 OF 6

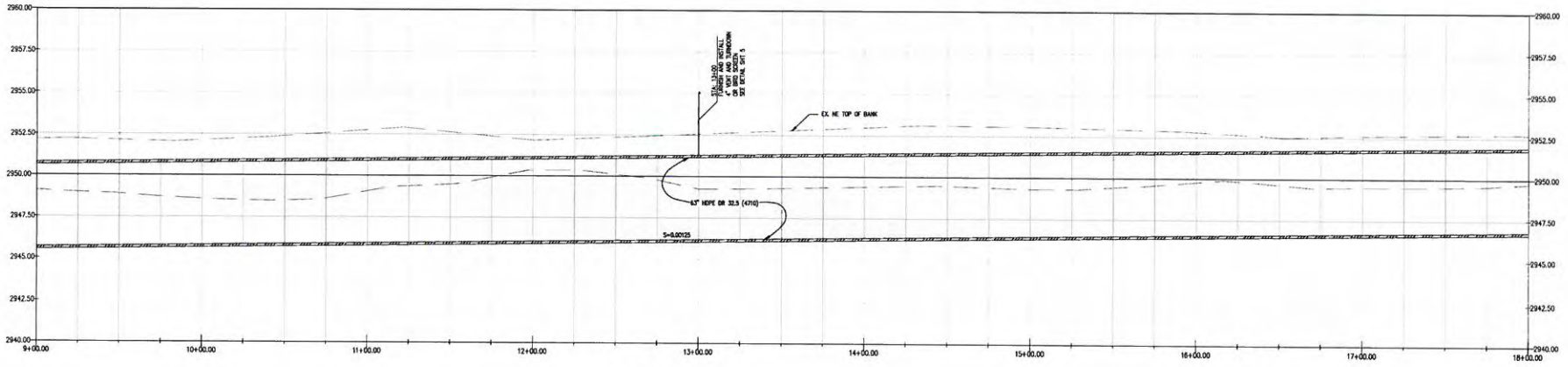
REGISTERED PROFESSIONAL ENGINEER
17,428
PRELIMINARY
OREGON
SEPT. 29, 1994
KEVIN L. CROWE
EXPIRES: 31 DECEMBER, 2015

PLAN

SCALE:
HOR: 1"=30' VER: 1"=3'
0
30

Line Table						
Line #	Length	Direction	Starting Northing	Starting Easting	Ending Northing	Ending Easting
L5	167.44	S76° 33' 11"E	968821.712	4743433.778	968582.775	4743598.828
L6	308.98	S77° 41' 08"E	968577.405	4743616.148	968485.444	4743911.140
L7	166.83	S58° 32' 12"E	968448.828	4743991.902	968381.843	4744134.053
L8	313.54	S84° 34' 55"E	968343.782	4744167.437	968208.326	4744452.433

Curve Table								
Curve #	Length	Radius	Delta	Chord Direction	Chord Length	Starting Northing	Starting Easting	Ending Northing	Ending Easting
C4	20.25	330.00	3.87	N74° 37' 10"W	20.25	968577.405	4743616.148	968582.775	4743598.828
C5	88.90	360.00	14.15	N65° 36' 40"W	88.67	968448.828	4743991.902	968485.444	4743911.140
C6	37.98	360.00	6.05	S81° 33' 34"E	37.97	968381.843	4744134.053	968343.782	4744167.437



PROFILE

80% CD

CENTRAL OREGON IRRIGATION DISTRICT
F LATERAL PIPING PROJECT

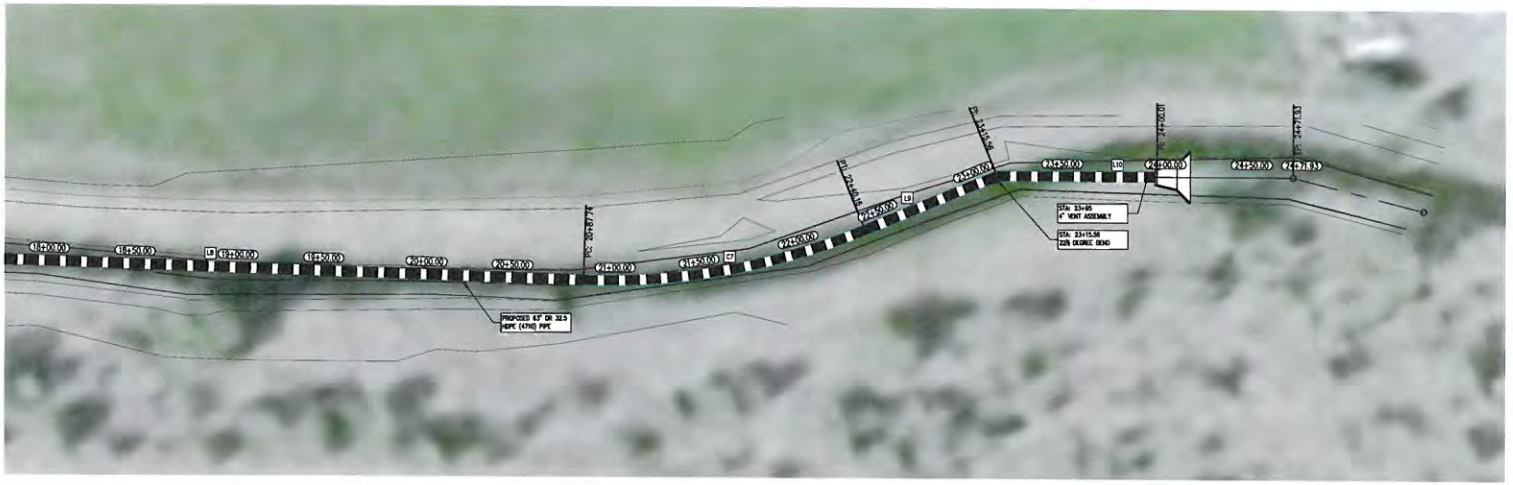
BLACK ROCK CONSULTING
20380 HALFWAY ROAD STE. #1
BEND, OREGON 97701
(541) 480-6257

DESIGN: MC CHECKED: MC
DRAWN: MA
DATE:

REVISIONS

SHEET C3 OF 6

REGISTERED PROFESSIONAL ENGINEER
OREGON
17,429
PRELIMINARY
NOT FOR CONSTRUCTION
DEC. 29, 2015
KEVIN L. CROOK
EXPIRES: 31 DECEMBER, 2015

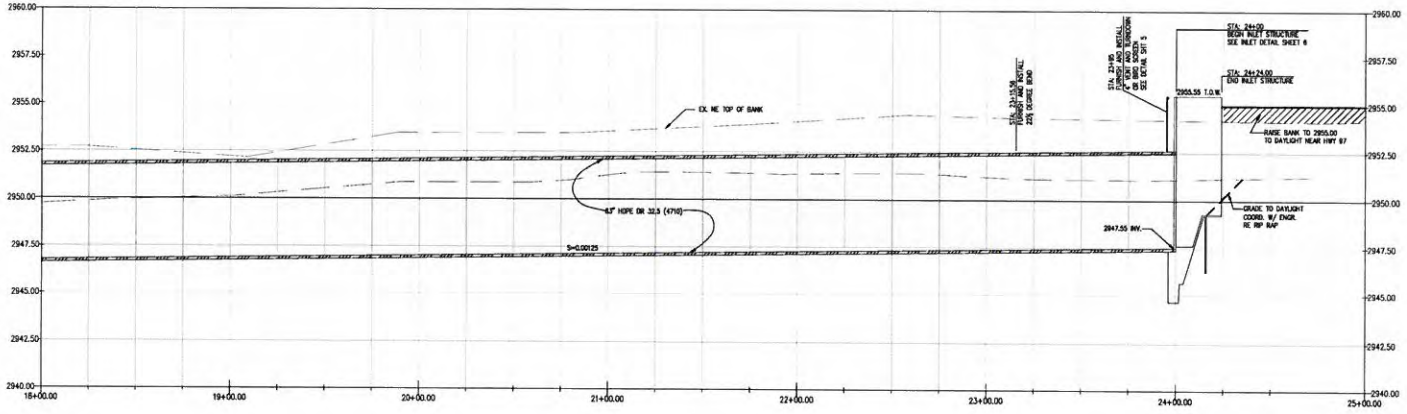


PLAN

SCALE:
HOR:1"=30' VER:1"=3'
0 30

Line Table						
Line #	Length	Direction	Starting Northing	Starting Easting	Ending Northing	Ending Easting
L8	315.54	S84° 34' 55"E	968343.782	4744167.437	968208.326	4744452.433
L9	75.40	S88° 50' 26"E	968173.552	4744599.868	968172.028	4744675.050
L10	84.45	S66° 20' 28"E	968172.028	4744675.050	968138.136	4744752.402

Curve Table									
Curve #	Length	Radius	Delta	Chord Direction	Chord Length	Starting Northing	Starting Easting	Ending Northing	Ending Easting
C7	152.42	360.00	24.26	S76° 42' 41"E	151.29	968208.326	4744452.433	968173.552	4744599.868



PROFILE

80% CD

CENTRAL OREGON IRRIGATION DISTRICT
F LATERAL PIPING PROJECT

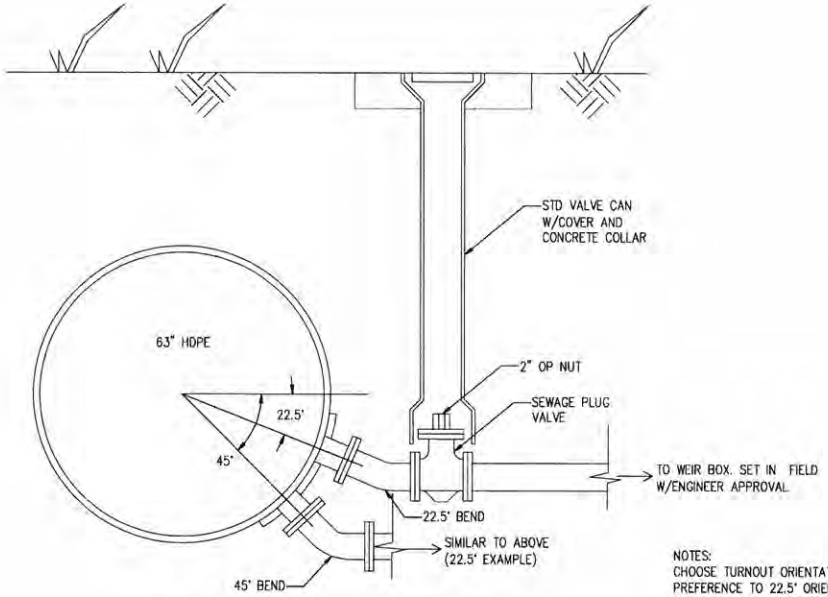
BLACK ROCK CONSULTING
20380 HALFWAY ROAD STE. #1
BEND, OREGON 97701
(541) 480-6257

DESIGN: MC CHECKED: MC
DRAWN: MB
DATE:

REVISIONS

SHEET C4 OF 6

REGISTERED PROFESSIONAL ENGINEER
17,423
PRELIMINARY
NOT FOR CONSTRUCTION
KEVIN L. CREW
EXPIRES: 31 DECEMBER, 2015

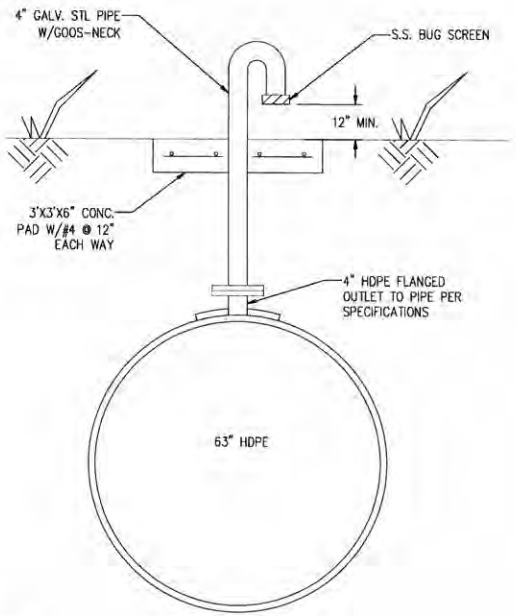


TURNOUT DETAIL - SIZE VARIES

1"=1'-0"

NOTES:
CHOOSE TURNOUT ORIENTATION IN FIELD W/ENGINEER. PREFERENCE TO 22.5° ORIENTATION VERSUS 45° ORIENTATION TO AVOID SEDIMENTATION.

TURN OUT F-9 REQUIRES AN 8" OULET @ 63" PIPE, 8" 22½° BEND, 8"x4" REDUCER, 4" SEWAGE PLUG VALVE AND 4" PIPE TO IRRIGATION SERVICE.



AIR VENT DETAIL

1"=1'-0"

80% CD

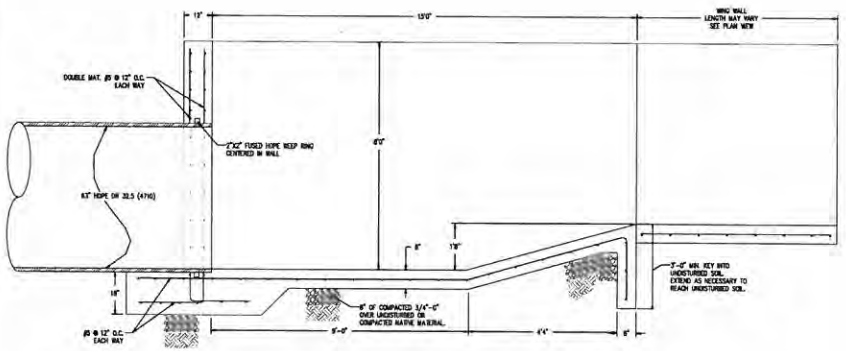
CENTRAL OREGON IRRIGATION DISTRICT
F LATERAL PIPING PROJECT

BLACK ROCK
CONSULTING
20380 HWY 20 WEST, SUITE #1
BEND, OREGON 97701
(541) 480-6257

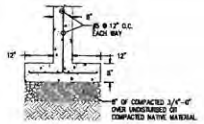
DESIGN: MC CHECKED: MC
DRAWN: MS
DATE:
REVISIONS

SHEET C5 OF 6

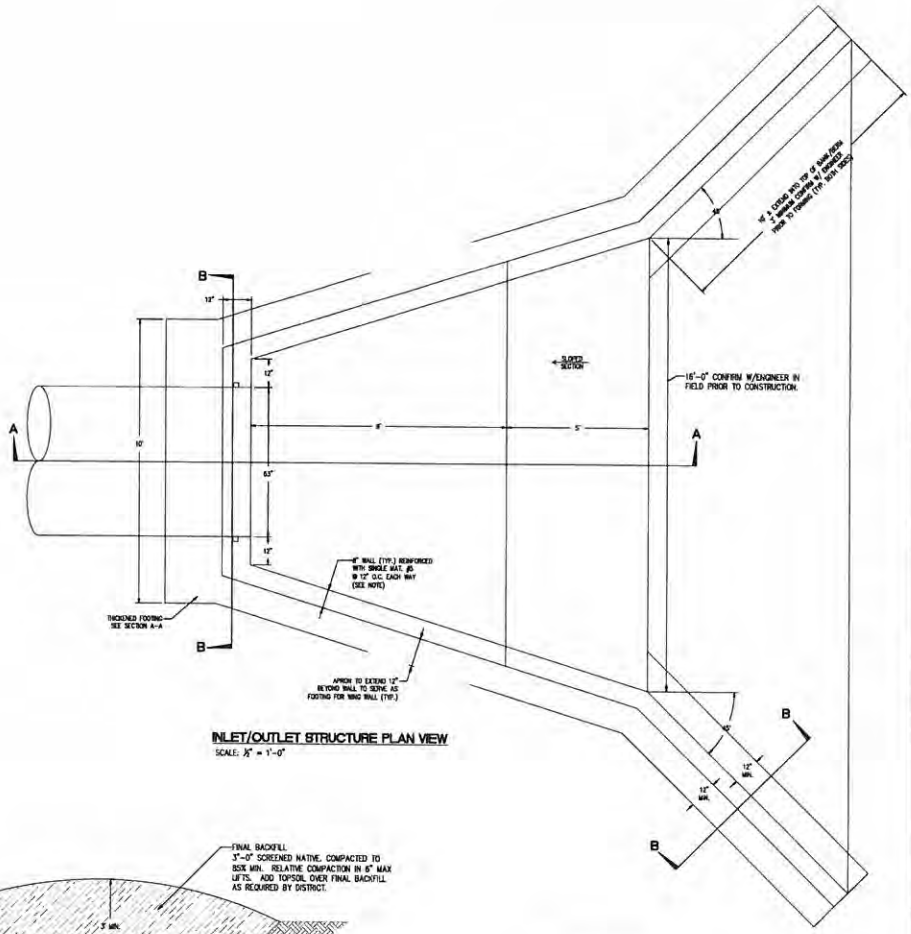
REGISTERED PROFESSIONAL ENGINEER
STATE OF OREGON
PRELIMINARY
NOT FOR CONSTRUCTION
KEVIN L. CROOK
EXPIRES: 31 DECEMBER, 2015



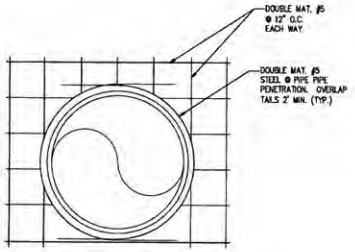
INLET/OUTLET STRUCTURE SECTION A-A



SECTION B-B



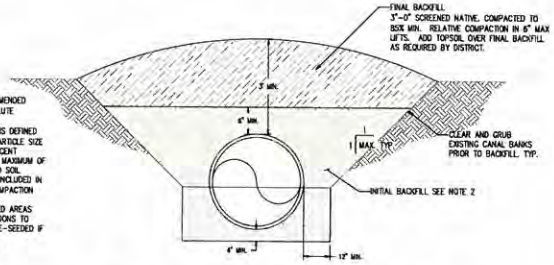
INLET/OUTLET STRUCTURE PLAN VIEW
SCALE: 3/8" = 1'-0"



TYPICAL REINFORCEMENT DETAIL
SECTION B-B

NOTES:

1. A MINIMUM BACKFILL COVER OF 36" IS RECOMMENDED ALTHOUGH 30" SHOULD BE CONSIDERED ABSOLUTE MINIMUM.
2. INITIAL BACKFILL (SELECT BEDDING MATERIAL) IS DEFINED AS "SANDS AND GRAVELS WITH A MAXIMUM PARTICLE SIZE OF 1 INCH CONTAINING A MAXIMUM OF 12 PERCENT NON-COHESIVE FINES. SANDS SHALL HAVE A MAXIMUM OF 45 PERCENT PASSING THE #40 SIEVE. UNIFIED SOIL CLASSIFICATION OF GW, GP, SW, AND SP ARE INCLUDED IN THIS CLASS." COMPACT TO 85% MIN. REL. COMPACTION ASTM D-1557.
3. UPON COMPLETION OF BACKFILL, ALL DISTURBED AREAS SHALL BE GRADED WITHOUT SURFACE DEPRESSIONS TO BLEND WITH THE SURROUNDING AREAS, AND RE-SEEDED IF NECESSARY.
4. INSTALL TRACER WIRE IF DESIRED BY DISTRICT



TRENCH CONFIGURATION AT EXISTING CANAL DETAIL
NTS

STRUCTURAL NOTES

1. CONCRETE AND REINFORCING STEEL SHALL BE AS PER THESE DRAWINGS.
2. F'c=3500 psi, 28 DAY MINIMUM.
3. ALL KEYS INTO BANK AND CHANNEL BOTTOM SHALL BE POURED AGAINST UNDISTURBED MATERIAL OR BACKFILLED WITH WELL MIXED BENTONITE ENTRAINED MATERIAL (3% BENTONITE)
4. RECOMMEND ¾" CHAMFERS ON ALL EXPOSED UPPER WALL CORNERS.
5. CONFIRM INLET AND OUTLET GEOMETRY WITH ENGINEER IN FIELD PRIOR TO CONSTRUCTION.
6. CENTRAL OREGON IRRIGATION DISTRICT SHALL BE RESPONSIBLE FOR THE PROVISION AND INSTALLATION OF AN INTAKE TRASH RACK.
7. COORDINATE CONCRETE MIX DESIGN AND PLACEMENT WITH CONCRETE SUPPLIER FOR MASS CONCRETE AND THERMAL CONSIDERATIONS.
8. ALL HOLES AND DEPRESSIONS FROM SNAP-TIES SHALL BE PATCHED AND REPAIRED.
9. CONTINUOUS WATER STOPS SHALL BE INSTALLED BETWEEN THE FLOOR AND THE WALL, USE 6-INCH SIZE BETWEEN BOTTOM FLOORS AND THE WALLS.
10. CONCRETE MIX DESIGN SHALL INCLUDE CONSIDERATIONS FOR COLD WEATHER. COORDINATE WITH ENGINEER AND CONCRETE SUPPLIER
11. IF COLD WEATHER CONDITIONS OCCUR DURING CONCRETE PLACEMENT AND CURING, FOLLOW ACI GUIDELINES FOR COLD WEATHER

80% CD

CENTRAL OREGON IRRIGATION DISTRICT
F LATERAL PIPING PROJECT

BLACK ROCK CONSULTING
20380 HALFWAY ROAD SITE #1
BEND, OREGON 97701
(541) 480-6257

DESIGN: MC
DRAWN: MK
CHECKED: MC
DATE:
REVISIONS

SHEET C6 OF 6

REGISTERED PROFESSIONAL ENGINEER
17,483
PRELIMINARY
NOT FOR CONSTRUCTION
DEC. 31, 2015
KEVIN L. CROOK
EXPIRES: 31 DECEMBER, 2015