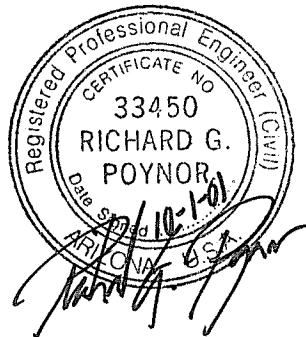


WHISPERING CANYONS P.A.D. SEWER ANALYSIS

PREPARED FOR:
Old Capital Investments, L.L.C.
136 Gail Gardner Way
Prescott, AZ 86305
(520) 541-1109



DESIGN: Richard G. Poynor, P.E.
DATE: October 1st, 2001



LYON ENGINEERING
Civil Engineers • Land Surveyors

4620 N. 16th Street
Suite E-110
Phoenix, AZ 85016
602-776-9513
Fax: 602-776-6691

121 W. Navajo Drive
Suite C
Prescott, AZ 86301
928-776-1750
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WHISPERING CANYONS SEWER REPORT

I. PROJECT DESCRIPTION

Whispering Canyons (WC) is a master planned community located approximately 9 miles north of Prescott, Arizona, covering portions of Sections 33 & 34 of Township 16 North, Range 3 West, of the Gila and Salt River Basin. Accessed by Williamson Valley Road at the Northeast corner of the project, WC is bordered by the Inscription Canyon community to the North, Talking Rock Community to the West, the Prescott National Forest to the Southwest, and several unsubdivided parcels to the Southeast and East. WC encompasses 894 acres of rolling terrain with elevations ranging from 4755 to 5300 feet above sea level. See Exhibit 1 for vicinity map.

II. LAND USES

Whispering Canyons will include 400 lots ranging in size from 0.5 acres to 5.2 acres. An additional lot will be provided for a community center. See Exhibit 2.

III. OVERVIEW

The Inscription Canyon Sanitary Sewer District (ICSSD) will serve Whispering Canyons. The ICSSD currently contains an on-site sewage treatment plant with capacity above and beyond the additional capacity required for WC. See Exhibit 2 for the location of the treatment plant.

Whispering Canyons has 3 distinct design scenarios that must be analyzed for its development. First, all lots within WC will be serviced by a low pressure sewer (LPS) system using Barnes pumps and design criteria, See Section 1 and Exhibit 2. Second, flow from the LPS will fall into a gravity sewer system that that will require a capacity analysis, See Section 2 and Exhibit 2. Third, the gravity flow from WC will fall into a new lift station that will pump into the existing Inscription Canyon Sewage Treatment Facility, See Section 3 and design Point A on Exhibit 2.

VI. CONCLUSION

Referring to Sections 1 thru 3 of the report you can see that Lyon Engineering has used the most up to date ADEQ standards and specifications pertaining to waste water design flows and lift station design. Any changes to this report will be submitted in addendum form to the Yavapai County Environmental Services Department and ADEQ.

SECTION 1 – LOW PRESSURE SEWER (LPS) DESIGN

DESIGN CRITERIA:

The ADEQ Engineering Bulletin No. 11 was used for all design criteria as follows:

Capita per Dwelling Unit: 2.5 persons (single family home)

Flow per Capita: 100 gpd (gallons per day)

Peaking Factor: Peaking factors were not used in the design of the low pressure sewer since the Barnes LPS software adjusts for the maximum number of pumps that will be running at any point in time based on the number of homes on the system. See Exhibit 3.

Number of Lots: *401

(* - Note: WC contains 400 single-family lots and 1 tract for a future community center. For ease of calculation the community center was calculated as a single family home. This figure is conservative since the community center will have less than the Average Daily Flow of a home.)

LOCATION MAP

NOT TO SCALE

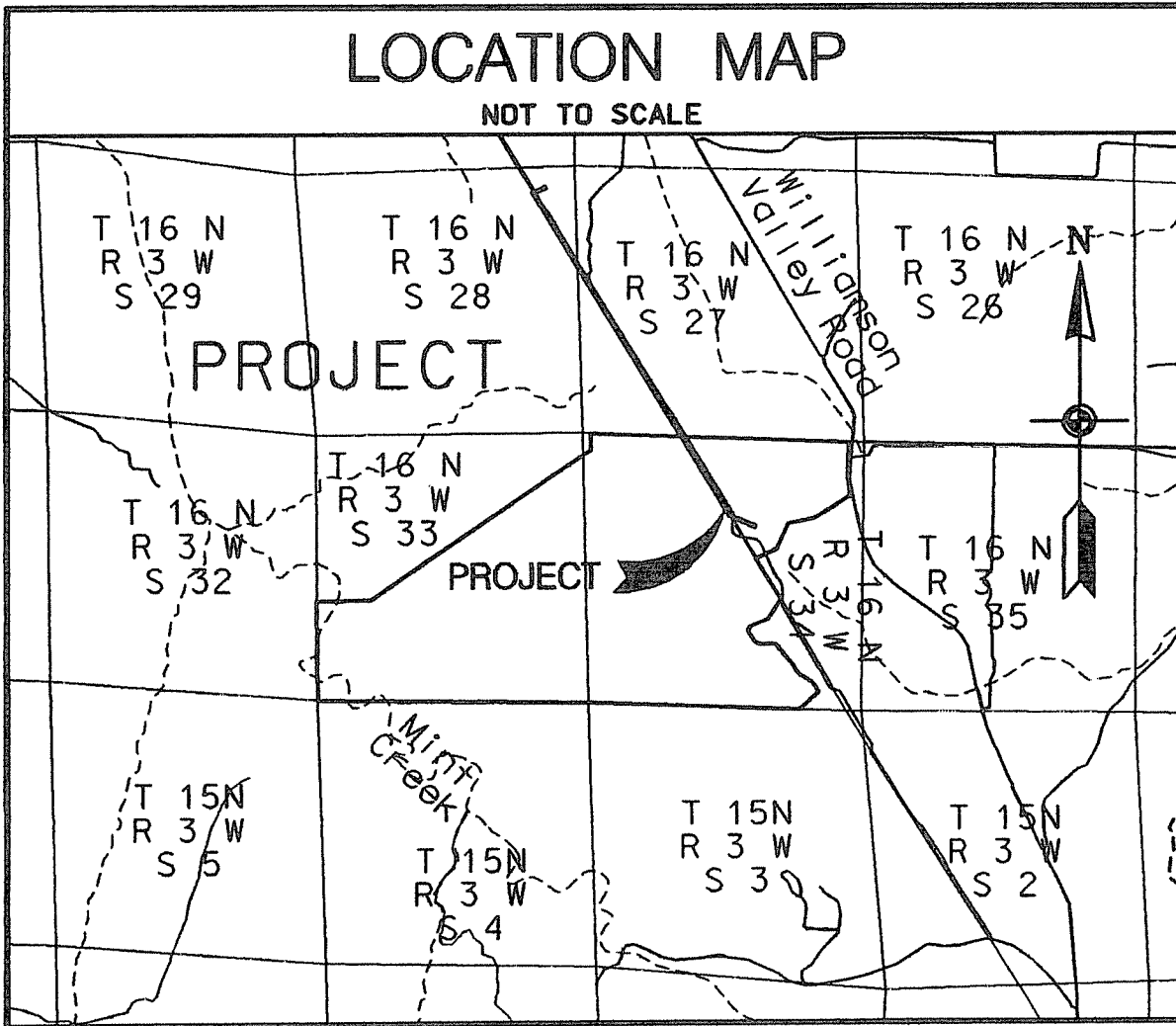


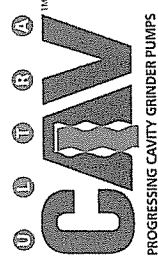
EXHIBIT 1

PIPING SUMMARY DATA	
Pipe Size	Total Length (feet)
1.25"	0
1.5"	30649
2.0"	13437
3.0"	2380
4.0"	3899
6.0"	1781
8.0"	0
10.0"	0
12.0"	0
14.0"	0
16.0"	0
18.0"	0
20.0"	0
24.0"	0



Barnes Pumps Inc.
 420 Third Street
 Piqua, Ohio 45356

www.Barnes-PS.com



Project Location: Yavapai County, AZ
 Project Name: Whispering Canyons

Enter "C" Value In Red Box Below

PIPE SEGMENT NUMBER	FLOWS INTO SEGMENT	NUMBER OF (EDU's)	ACCUM EDU's CONNECTED	Enter "C" Value In Red Box Below		PIPE LENGTH (FEET)	MAX FLOW (GAL/MIN)	PIPE SIZE (INCH)	PIPE ID (INCHES)	MAX VELOCITY (FT/SEC)	FRICTION FACTOR (FT/C.FT)	FR LOSS THIS PIPE (FEET)	ACCUM FL (FEET)	MAX HEAD REQUIRED (FEET)	PIPE SEGMENT NUMBER	HOURS TO DISCHARGE
				LOW DATUM in Segment	HIGH DATUM in Segment											
1	4	1	1	4992	5010	238	15.50	1.50	1.592	2.50	1.64	3.90	39.88	57.88	1.00	0.77
2	3	3	3	4930	5010	607	16.50	1.50	1.592	2.66	1.84	11.17	57.68	137.68	2.00	0.86
3	4	3	6	4964	5010	487	18.00	1.50	1.592	2.90	2.16	10.53	46.51	92.51	3.00	0.47
4	12	0	7	5000	5010	532	18.50	1.50	1.592	2.98	2.28	12.11	35.97	45.97	4.00	0.32
5	6	3	3	4920	5010	367	16.50	1.50	1.592	2.66	1.84	6.76	54.05	144.05	5.00	0.64
6	12	5	8	4947	5010	980	19.00	1.50	1.592	3.06	2.39	23.43	47.30	110.30	6.00	0.41
7	8	3	3	4988	5010	129	16.50	1.50	1.592	2.66	1.84	2.37	31.39	53.39	7.00	0.35
8	11	2	5	4964	5010	172	17.50	1.50	1.592	2.82	2.05	3.53	29.01	75.01	8.00	0.27
9	10	3	3	4956	5010	73	16.50	1.50	1.592	2.66	1.84	1.34	37.37	91.37	9.00	0.36
10	11	5	8	4938	5010	441	19.00	1.50	1.592	3.06	2.39	10.54	36.02	108.02	10.00	0.31
11	12	0	13	5000	5010	183	21.50	2.00	2.049	2.09	0.88	1.61	25.48	35.48	11.00	0.21
12	16	0	28	5000	5010	813	29.00	2.00	2.049	2.82	1.53	12.46	23.87	33.87	12.00	0.17
13	14	3	3	4932	5010	168	16.50	1.50	1.592	2.66	1.84	3.09	34.26	112.26	13.00	0.39
14	15	6	9	4894	5010	757	19.50	1.50	1.592	3.14	2.51	18.99	31.17	147.17	14.00	0.29
15	16	1	10	4934	5010	100	20.00	2.00	2.049	1.95	0.77	0.77	12.18	88.18	15.00	0.13
16	25	0	38	5000	5010	922	34.00	2.50	2.445	2.32	0.87	8.03	11.41	21.41	16.00	0.10
17	18	3	3	4950	5010	209	16.50	1.50	1.592	2.66	1.84	3.85	19.83	79.83	17.00	0.38
18	21	2	5	4982	5010	384	17.50	1.50	1.592	2.82	2.05	7.88	15.98	43.98	18.00	0.24
19	20	3	3	5000	5010	114	16.50	1.50	1.592	2.66	1.84	2.10	15.35	25.35	19.00	0.24
20	21	3	6	4982	5010	238	18.00	1.50	1.592	2.90	2.16	5.15	13.25	41.25	20.00	0.17
21	25	6	17	4982	5010	455	23.50	2.00	2.049	2.29	1.04	4.72	8.10	36.10	21.00	0.10
22	23	3	3	4984	5010	137	16.50	1.50	1.592	2.66	1.84	2.52	24.73	50.73	22.00	0.32
23	24	6	9	5000	5010	605	19.50	1.50	1.592	3.14	2.51	15.18	22.21	32.21	23.00	0.23
24	25	5	14	4986	5010	398	22.00	2.00	2.049	2.14	0.92	3.66	7.03	31.03	24.00	0.10
25	0	0	69	5000	5010	560	49.50	3.00	3.042	2.18	0.60	3.38	3.38	13.38	25.00	0.03

PIPE SEGMENT NUMBER	FLOWS INTO SEGMENT	NUMBER OF (EDU's)	ACCU M EDU's	150		CONTROL DATUM of Segment	PIPE LENGTH (FEET)	MAX FLOW (GAL/MIN)	PIPE SIZE (INCH)	PIPE ID (INCHES)	MAX VELOCITY (FT/SEC)	FRICTION FACTOR (F/T.C.FT)	FR LOSS THIS PIPE (FEET)	ACCU M FL (FEET)	MAX HEAD REQUIRED (FEET)	PIPE SEGMENT NUMBER	HOURS TO DISCHARGE
				LOW DATUM in Segment	HIGH DATUM in Segment												
26	27	3	3	5060	5102	98	16.50	1.50	1.592	2.66	1.84	1.80	53.38	95.38	26.00	0.41	
27	28	6	9	5022	5102	397	19.50	1.50	1.592	3.14	2.51	9.96	51.57	131.57	27.00	0.35	
28	29	9	18	5004	5102	673	24.00	2.00	2.049	2.33	1.08	7.26	41.62	139.62	28.00	0.27	
29	30	1	19	5000	5102	116	24.50	2.00	2.049	2.38	1.12	1.30	34.35	136.35	29.00	0.18	
30	40	0	19	5084	5102	235	24.50	2.00	2.049	2.38	1.12	2.64	33.05	51.05	30.00	0.16	
31	32	3	3	4996	5008	113	16.50	1.50	1.592	2.66	1.84	2.08	25.39	37.39	31.00	0.30	
32	35	4	7	4988	5008	331	18.50	1.50	1.592	2.98	2.28	7.53	23.31	43.31	32.00	0.23	
33	34	3	3	4978	5008	177	16.50	1.50	1.592	2.66	1.84	3.26	20.88	50.88	33.00	0.30	
34	35	1	4	4980	5008	95	17.00	1.50	1.592	2.74	1.95	1.85	17.62	45.62	34.00	0.19	
35	36	7	18	4986	5008	661	24.00	2.00	2.049	2.33	1.08	7.13	15.77	37.77	35.00	0.14	
36	39	1	19	5004	5008	42	24.50	2.00	2.049	2.38	1.12	0.47	8.64	12.64	36.00	0.05	
37	38	3	3	5022	5022	116	16.50	1.50	1.592	2.66	1.84	2.14	14.70	12.56	37.00	0.20	
38	39	2	5	5016	5016	214	17.50	1.50	1.592	2.82	2.05	4.39	12.56	12.56	38.00	0.13	
39	0	4	28	5002	5008	533	29.00	2.00	2.049	2.82	1.53	8.17	8.17	14.17	39.00	0.05	
40	46	0	116	5084	5102	776	73.00	3.00	3.042	3.22	1.24	9.61	30.41	48.41	40.00	0.13	
41	42	3	3	5014	5102	196	16.50	1.50	1.592	2.66	1.84	3.61	35.72	123.72	41.00	0.44	
42	45	2	5	5032	5102	421	17.50	1.50	1.592	2.82	2.05	8.64	32.11	102.11	42.00	0.32	
43	44	3	3	5052	5102	112	16.50	1.50	1.592	2.66	1.84	2.06	30.26	80.26	43.00	0.30	
44	45	3	6	5040	5102	219	18.00	1.50	1.592	2.90	2.16	4.74	28.20	90.20	44.00	0.23	
45	46	3	14	5027	5102	290	22.00	2.00	2.049	2.14	0.92	2.66	23.47	98.47	45.00	0.16	
46	56	0	130	5084	5102	480	80.00	4.00	3.998	2.04	0.39	1.86	20.80	38.80	46.00	0.11	
47	48	3	3	5010	5102	210	16.50	1.50	1.592	2.66	1.84	3.87	36.53	128.53	47.00	0.43	
48	51	1	4	5010	5102	144	17.00	1.50	1.592	2.74	1.95	2.80	32.67	124.67	48.00	0.30	
49	50	3	3	5018	5102	128	16.50	1.50	1.592	2.66	1.84	2.36	35.08	119.08	49.00	0.38	
50	51	1	4	5032	5102	147	17.00	1.50	1.592	2.74	1.95	2.86	32.73	102.73	50.00	0.30	
51	52	1	9	5012	5102	215	19.50	1.50	1.592	3.14	2.51	5.39	29.87	119.87	51.00	0.23	
52	55	1	10	5018	5102	154	20.00	2.00	2.049	1.95	0.77	1.19	24.47	108.47	52.00	0.18	
53	54	3	3	5040	5102	123	16.50	1.50	1.592	2.66	1.84	2.26	28.10	90.10	53.00	0.28	
54	55	1	4	5030	5102	131	17.00	1.50	1.592	2.74	1.95	2.55	25.84	97.84	54.00	0.21	
55	56	4	18	5038	5102	403	24.00	2.00	2.049	2.33	1.08	4.35	23.29	87.29	55.00	0.14	
56	61	0	148	5084	5102	480	89.00	4.00	3.998	2.27	0.47	2.27	18.94	36.94	56.00	0.09	
57	58	3	3	5048	5102	146	16.50	1.50	1.592	2.66	1.84	2.69	26.72	80.72	57.00	0.31	
58	60	3	6	5048	5102	197	18.00	1.50	1.592	2.90	2.16	4.26	24.03	78.03	58.00	0.22	
59	60	3	3	5028	5102	246	16.50	1.50	1.592	2.66	1.84	4.53	24.30	98.30	59.00	0.32	
60	61	2	11	5036	5102	385	20.50	2.00	2.049	1.99	0.81	3.10	19.77	85.77	60.00	0.16	
61	73	0	159	5084	5102	521	94.50	4.00	3.998	2.41	0.53	2.75	16.67	34.67	61.00	0.07	
62	63	3	3	4986	5102	223	16.50	1.50	1.592	2.66	1.84	4.11	58.85	174.85	62.00	0.54	
63	64	6	9	4996	5102	567	19.50	1.50	1.592	3.14	2.51	14.22	54.75	160.75	63.00	0.40	
64	68	3	12	5012	5102	313	21.00	2.00	2.049	2.04	0.84	2.64	40.53	130.53	64.00	0.28	
65	66	3	3	5037	5102	192	16.50	1.50	1.592	2.66	1.84	2.43	55.07	120.07	65.00	0.45	
66	67	6	9	5030	5102	516	19.50	1.50	1.592	3.14	2.51	12.94	52.64	124.64	66.00	0.36	
67	68	4	13	5032	5102	205	21.50	2.00	2.049	2.09	0.88	1.80	39.69	109.69	67.00	0.25	
68	72	0	26	5084	5102	219	27.50	2.00	2.049	2.68	1.39	3.04	37.89	55.89	68.00	0.22	

PIPE SEGMENT NUMBER	FLOW INTO SEGMENT	NUMBER OF (EDU's)	ACCUM EDU's CONNECTED	LOW DATUM	CONTROL DATUM	PIPE LENGTH (FEET)	MAX FLOW (GAL/MIN)	PIPE SIZE (INCH)	PIPE ID (INCHES)	MAX VELOCITY (FT/SEC)	FRICTION FACTOR (F/T.C.FT)	FR LOSS THIS PIPE (FEET)	ACCUM FL (FEET)	MAX HEAD REQUIRED (FEET)	PIPE SEGMENT NUMBER	HOURS TO DISCHARGE
69	70	3	3	4996	5102	227	16.50	1.50	1.592	2.66	1.84	4.18	60.16	69.00	0.58	
70	71	6	9	5012	5102	687	19.50	1.50	1.592	3.14	2.51	17.23	55.98	70.00	0.43	
71	72	3	12	5044	5102	463	21.00	2.00	2.049	2.04	0.84	3.90	38.75	71.00	0.29	
72	73	7	44	5058	5102	2055	37.00	2.50	2.445	2.53	1.02	20.93	78.85	72.00	0.19	
73	76	0	203	5084	5102	412	116.50	4.00	3.998	2.98	0.78	3.21	13.91	73.00	0.06	
74	75	3	3	5066	5102	146	16.50	1.50	1.592	2.66	1.84	2.69	20.46	74.00	0.24	
75	76	3	6	5062	5102	327	18.00	1.50	1.592	2.90	2.16	7.07	17.78	75.00	0.15	
76	129	0	209	5084	5102	616	119.50	4.00	3.998	3.05	0.82	5.03	10.70	76.00	0.05	
77	0	3	3	5010	5074	916	16.50	1.50	1.592	2.66	1.84	16.86	16.86	77.00	0.58	
78	79	8	9	5080	5134	1020	19.50	1.50	1.592	3.14	2.51	25.59	83.46	78.00	0.61	
79	83	4	13	5120	5134	751	21.50	2.00	2.049	2.09	0.88	6.61	57.88	79.00	0.39	
80	81	3	3	4996	5062	160	16.50	1.50	1.592	2.66	1.84	2.76	14.45	80.00	0.19	
81	0	6	9	5014	5062	466	19.50	1.50	1.592	3.14	2.51	11.69	11.69	81.00	0.10	
82	83	4	13	5062	5134	493	21.50	1.50	1.592	3.46	3.01	14.82	66.08	82.00	0.32	
83	92	1	27	5134	5134	524	28.50	2.00	2.049	2.77	1.48	7.78	51.26	83.00	0.25	
84	85	3	3	5160	5230	303	16.50	1.50	1.592	2.66	1.84	5.58	87.19	84.00	0.76	
85	86	6	9	5174	5230	1137	19.50	1.50	1.592	3.14	2.51	28.52	81.62	85.00	0.56	
86	91	2	11	5184	5184	324	20.50	2.00	2.049	1.99	0.81	2.61	53.09	86.00	0.32	
87	88	3	3	5138	5166	360	16.50	1.50	1.592	2.66	1.84	6.63	70.10	87.00	0.69	
88	90	4	7	5156	5166	417	18.50	1.50	1.592	2.98	2.28	9.49	63.47	88.00	0.46	
89	90	3	3	5130	5166	440	16.50	1.50	1.592	2.66	1.84	8.10	62.08	89.00	0.63	
90	91	1	11	5166	5166	434	20.50	2.00	2.049	1.99	0.81	3.50	53.98	90.00	0.35	
91	92	4	26	5152	5160	487	28.00	2.00	2.049	2.72	1.44	6.99	50.48	91.00	0.25	
92	109	2	55	5134	5134	1587	42.50	2.50	2.445	2.90	1.32	20.90	43.49	92.00	0.20	
93	94	3	3	5042	5116	168	16.50	1.50	1.592	2.66	1.84	2.91	37.58	93.00	0.35	
94	95	6	9	5048	5116	429	19.50	1.50	1.592	3.14	2.51	10.76	34.67	94.00	0.25	
95	109	2	11	5066	5116	163	20.50	2.00	2.049	1.99	0.81	1.31	23.91	95.00	0.16	
96	99	2	2	5168	5250	680	16.50	1.50	1.592	2.58	1.74	11.82	67.86	96.00	1.11	
97	98	3	3	5172	5250	612	16.50	1.50	1.592	2.66	1.84	11.27	70.84	97.00	0.94	
98	99	1	4	5210	5250	182	17.00	1.50	1.592	2.74	1.95	3.54	59.57	98.00	0.55	
99	102	2	8	5218	5250	539	19.00	1.50	1.592	3.06	2.39	12.89	56.03	99.00	0.46	
100	101	3	3	5192	5250	519	16.50	1.50	1.592	2.66	1.84	9.55	69.87	100.00	0.84	
101	102	5	8	5204	5250	718	19.00	1.50	1.592	3.06	2.39	17.17	106.31	101.00	0.51	
102	105	0	16	5205	5250	138	23.00	2.00	2.049	2.24	1.00	1.38	43.15	102.00	0.33	
103	104	3	3	5222	5250	244	16.50	1.50	1.592	2.66	1.84	4.49	51.41	103.00	0.56	
104	105	2	5	5234	5250	251	17.50	1.50	1.592	2.82	2.05	5.15	46.92	104.00	0.41	
105	108	2	23	5222	5250	477	26.50	2.00	2.049	2.58	1.30	6.19	41.77	105.00	0.31	
106	107	3	3	5180	5220	393	16.50	1.50	1.592	2.66	1.84	7.23	64.98	106.00	0.73	
107	108	5	8	5164	5220	927	19.00	1.50	1.592	3.06	2.39	22.16	113.75	107.00	0.48	
108	109	3	34	5200	5220	1669	32.00	2.50	2.445	2.19	0.78	12.99	35.58	108.00	0.26	
109	112	0	100	5116	5116	537	65.00	3.00	3.042	2.87	1.00	5.37	22.59	109.00	0.12	
110	111	3	3	5132	5132	157	16.50	1.50	1.592	2.66	1.84	2.89	34.82	110.00	0.32	
111	112	6	9	5110	5116	586	19.50	1.50	1.592	3.14	2.51	14.70	31.93	111.00	0.22	

PIPE SEGMENT NUMBER	FLWS INTO SEGMENT	NUMBER OF (EDU's)	ACCUM EDU's	LOW DATUM	CONTROL DATUM	PIPE LENGTH (FEET)	MAX FLOW (GAL/MIN)	PIPE SIZE (INCH)	PIPE ID (INCHES)	MAX VELOCITY (FT/SEC)	FRICTION FACTOR (FT/C.FT)	FR LOSS THIS PIPE (FEET)	ACCUM FL (FEET)	MAX HEAD REQUIRED (FEET)	PIPE SEGMENT NUMBER	HOURS TO DISCHARGE
112	117	0	109	5116	5116	507	69.50	3.00	3.042	3.07	1.13	5.73	17.23	112.00	0.10	
113	114	3	3	5058	5116	128	16.50	1.50	1.592	2.66	1.84	2.36	29.52	113.00	0.33	
114	115	6	9	5064	5116	316	19.50	1.50	1.592	3.14	2.51	7.93	27.16	114.00	0.25	
115	116	9	18	5054	5116	623	24.00	2.00	2.049	2.33	1.08	6.72	19.24	115.00	0.18	
116	117	1	19	5106	5116	91	24.50	2.00	2.049	2.38	1.12	1.02	12.51	116.00	0.09	
117	119	0	128	5116	5116	311	79.00	4.00	3.998	2.02	0.38	1.18	11.49	117.00	0.08	
118	119	3	3	5138	5138	392	16.50	1.50	1.592	2.66	1.84	7.22	17.53	118.00	0.32	
119	128	0	131	5084	5102	760	80.50	4.00	3.998	2.06	0.39	2.99	10.31	119.00	0.07	
120	121	3	3	5052	5102	390	16.50	1.50	1.592	2.66	1.84	7.18	29.12	120.00	0.45	
121	122	6	9	5068	5102	493	19.50	1.50	1.592	3.14	2.51	12.37	21.94	121.00	0.20	
122	128	3	12	5080	5102	267	21.00	2.00	2.049	2.04	0.84	2.26	9.58	122.00	0.10	
123	124	3	3	5106	5114	180	16.50	1.50	1.592	2.66	1.84	3.31	23.13	123.00	0.31	
124	125	6	9	5104	5114	374	19.50	1.50	1.592	3.14	2.51	9.38	19.82	124.00	0.19	
125	127	2	11	5100	5102	132	20.50	2.00	2.049	1.99	0.81	1.06	10.44	125.00	0.11	
126	127	2	2	5092	5102	195	16.00	1.50	1.592	2.58	1.74	3.39	12.77	126.00	0.27	
127	128	1	14	5090	5102	223	22.00	2.00	2.049	2.14	0.92	2.05	9.38	127.00	0.08	
128	129	0	157	5084	5102	319	93.50	4.00	3.998	2.39	0.52	1.65	7.33	128.00	0.04	
129	139	0	366	5084	5102	402	198.00	6.00	6.031	2.22	0.28	1.13	5.67	129.00	0.03	
130	124	2	2	5190	5190	1245	16.00	1.50	1.592	2.58	1.74	21.65	41.47	130.00	1.38	
131	132	3	3	5160	5188	76	16.50	1.50	1.592	2.66	1.84	1.40	52.08	131.00	0.50	
132	133	6	9	5182	5188	511	19.50	1.50	1.592	3.14	2.51	12.82	50.68	132.00	0.45	
133	134	8	17	5134	5172	768	23.50	2.00	2.049	2.29	1.04	7.97	37.86	133.00	0.34	
134	137	0	19	5134	5134	625	24.50	2.00	2.049	2.38	1.12	7.01	29.89	134.00	0.23	
135	136	3	3	5150	5184	243	16.50	1.50	1.592	2.66	1.84	4.47	35.36	135.00	0.42	
136	137	3	6	5138	5168	370	18.00	1.50	1.592	2.90	2.16	8.00	30.88	136.00	0.27	
137	138	5	30	5100	5130	769	30.00	2.00	2.049	2.92	1.63	12.55	22.88	137.00	0.15	
138	139	5	35	5084	5102	723	32.50	2.50	2.445	2.22	0.80	5.79	10.33	138.00	0.09	
139	0	0	401	5086	5105	1379	215.50	6.00	6.031	2.42	0.33	4.54	4.54	139.00	0.02	
140																

SECTION 2 – GRAVITY SEWER DESIGN

DESIGN CRITERIA:

The maximum flow the gravity sewer for Whispering Canyons can encounter is the maximum flow that can be produced from the Low Pressure Sewer system. Flow from the LPS empties into a manhole located outside the Whispering Canyons Boundary, See Exhibit 2. This is the only point of flow into the gravity system. All gravity mains will be 8" in size therefore the only design scenario that needs to be analyzed is the minimum slope condition. This condition will be the minimum slope that any reach of gravity sewer can be designed for in the plans and built to in the field.

Maximum Flow from the LPS system: 215.5 gpm (See Section 1 Pipe Segment 139)

Max. Flow into Whispering Canyons Gravity Sewer = 215.5 gpm ~ Use 216 gpm

*Full flow capacity of 8" sewer main at Mannings $n=0.013$ & $S=0.40\%$: 343 gpm

(Note: This Mannings number is very conservative, actual capacity will be greater.)

(* See attached calculation sheet at the end of this section for the full flow capacity of an 8" PVC sewer using FlowMaster by Haestad Methods.

Capacity Check: 216 gpm < 343 gpm, OK

(The minimum slope used in the gravity sewer plans for WC is 0.498% OK)

8" GRAVITY SEWER CAPACITY AT S=0.40%
Worksheet for Circular Channel

Project Description	
Worksheet	8" GRAVITY CA
Flow Element	Circular Channe
Method	Manning's Formi
Solve For	Full Flow Capac

Input Data	
Mannings Coeffic	0.013
Slope	0.4000 %
Diameter	8 in

Results	
Depth	0.67 ft
Discharge	343 gpm
Flow Area	0.3 ft ²
Wetted Perime	2.09 ft
Top Width	0.00 ft
Critical Depth	0.41 ft
Percent Full	100.0 %
Critical Slope	0.8035 %
Velocity	2.19 ft/s
Velocity Head	0.07 ft
Specific Energ	0.74 ft
Froude Numbe	0.00
Maximum Disc	369 gpm
Discharge Full	343 gpm
Slope Full	0.4000 %
Flow Type	N/A

SECTION 3 – SEWER LIFT STATION

DESIGN CRITERIA:

The Whispering Canyons Sewer Lift Station will be placed next to the existing Inscription Canyon Sewage Treatment Plant. Flow from the WC gravity sewer outfalls into this lift station, See Exhibit 2. No other flows will enter this Lift Station.

The ADEQ Engineering Bulletin No. 11 was used for all sewer lift station design criteria.

➤ **Solving for Lift Station Capacity Required**

Max flow to WC Lift Station = Max Flow to WC Gravity Sewer = $q = \boxed{216 \text{ gpm}}$
(see previous section)

➤ **Checking for Adequate Velocity and Solving for Detention Required**

$q = 216 \text{ gpm} \sim 5.5 \text{ ft/s}$ in 4" DIP pipe

(4 ft/s in 4" force main is minimum recommended velocity per ADEQ)

Volume of Wet Well Required = $V_w = \frac{\theta q}{4}$ (per ADEQ)

$\theta = 15$ minutes minimum (per ADEQ criteria), Use **20 minutes**

$\boxed{5.5 \text{ ft/s} > 4 \text{ ft/s, OK ADEQ}}$

$V_w = \frac{\theta q}{4} = \frac{(20)(216)}{4} = \boxed{1080 \text{ gallons} \sim 144.4 \text{ cf}}$

Using a 6' Diameter Manhole solve for usable storage required:

$\Pi r^2 = (3.14)(3)^2 = 28.26 \text{ sf}$

Depth: $144.4 \text{ cf} \div 28.26 \text{ sf} = 5.1 \text{ ft}$

$\boxed{\text{Use } 5.1 \text{ ft of retention} + 1.5 \text{ ft of submersible depth}}$

➤ **Solving for TDH Required from Lift Station**

Pump Elevation: 4984.8

Inlet elevation into treatment plant: 5005.60

Static head from Pump to Treatment Plant Outlet: $5005.60 - 4984.8 = \boxed{21.1 \text{ ft}}$

Submersed Depth: $\boxed{1.5 \text{ ft}}$ (worst case minimum depth of NPSHA to pumps)

C Coefficient: 130

Friction loss @ C=130 thru 36 lf 4" DIP: $\boxed{1.1 \text{ ft}}$ (see FlowMaster data this section)

Lift station headloss per fittings using the equation: $h = K \frac{v^2}{2g}$

Q = 216 gpm

v = velocity in 4" DIP force main = 5.5 ft/s

g = gravitational acceleration constant = 32.2 ft/s²

K = Energy Loss Coefficients per Tables B-6 and B-7 in back of Section

Going in order from pump discharge (See plan set)

90° Bend:	K=0.3	~	h=0.14 ft
90° Bend:	K=0.3	~	h=0.14 ft
Check Valve, Rubber:	K=2	~	h=0.94 ft
Ball Valve:	K=0.04	~	h=0.02 ft
90° Bend:	K=0.3	~	h=0.14 ft
Tee, Branch:	K=0.75	~	h=0.35 ft
			$\boxed{h=1.73 \text{ ft, Total}}$

TDH Required = (h_{s-out} + h_{f-out-LS} + h_{f-out-feed line}) - (NPSHA)

TDH Required = 21.1 ft + 1.73 ft + 1.1 ft - 1.5 ft = $\boxed{22.4 \text{ ft}}$

□ **On-Site Lift Station Criteria**

$\boxed{\text{L.S. must produce 216 gpm @ 22.4 ft TDH}}$

See pump data and curve this section.

Note: I diffuser bar with a compressor for aeration will be installed in the lift station to avoid septic conditions. This bar will run continuously (except during pump cycles) and cannot be removed from the system until pump cycles are less than 30 minutes apart per ADEQ. A note will be placed in the O&M manual to flush the wet well by filling it with a water hose and letting the pumps cycle once each on a weekly basis. This procedure will not be suspended until cycle times are less than 6 hours apart.

HEADLOSS IN 4" DIP FROM L.S. TO PLANT
Worksheet for Pressure Pipe

Project Description	
Worksheet	4" LIFT STATION LINE
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Elevation at 2

Input Data	
Pressure at	0.00 psi
Pressure at	0.00 psi
Elevation at	0.00 ft
Length	36.00 ft
C Coefficient	130.0
Diameter	4 in
Discharge	216 gpm

Results	
Elevation at 2	-1.13 ft
Headloss	1.13 ft
Energy Grade at	0.47 ft
Energy Grade at	-0.65 ft
Hydraulic Grade	0.00 ft
Hydraulic Grade	-1.13 ft
Flow Area	0.1 ft ²
Wetted Perimeter	1.05 ft
Velocity	5.51 ft/s
Velocity Head	0.47 ft
Friction Slope	0.1294 %

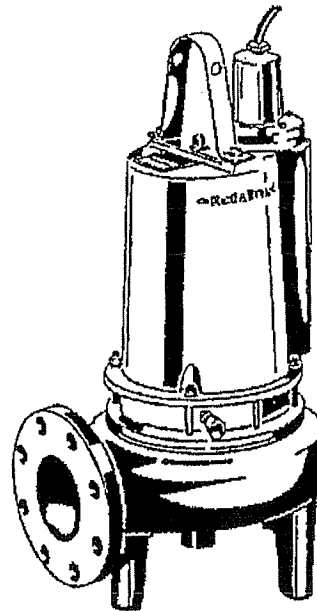
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BARNES® 4SE

SUBMERSIBLE NON-CLOG PUMPS
3" Spherical Solids Handling

Specifications:

DISCHARGE:	4" (102mm) 125 lb, Horizontal
LIQUID TEMPERATURE:	104°F (40°C) Continuous.
VOLUTE:	Cast Iron ASTM A-48, Class 30.
MOTOR HOUSING:	Cast Iron ASTM A-48, Class 30.
SEAL PLATE:	Cast Iron ASTM A-48, Class 30.
IMPELLER: Design:	2 Vane, Open, With Pump Out Vanes On Back Side. Dynamically Balanced. ISO G6.3.
Material:	Cast Iron ASTM A-48 Class 30.
SHAFT:	416 Stainless Steel
SQUARE RINGS:	Buna-N
DIAPHRAGM:	Buna-N
HARDWARE:	300 Series Stainless Steel
PAINT:	Air Dry Enamel.
SEAL: Design:	Double Mechanical in Oil-Filled Pressure Equalized Reservoir.
Material:	Rotating Face - Carbon Stationary Face - Ceramic Elastomer - Buna-N
CABLE ENTRY:	Hardware - 300 Series Stainless Steel
SPEED:	25 ft. (7.6M) Cord. Epoxy Sealed Housing with Secondary Pressure Grommet For Sealing And Strain Relief. 1150 or 1750 RPM (Nominal).
UPPER BEARING: Design:	Sleeve
Lubrication:	Oil
Load:	Radial
LOWER BEARING: Design:	Single Row, Ball
Lubrication:	Oil
Load:	Radial & Thrust
MOTOR: Design:	NEMA L-Single Phase, NEMA B-Three Phase Torque Curve. Completely Oil-Filled, Squirrel Cage Induction. Class B.
Insulation:	Permanent Split Capacitor (PSC). Includes Overload Protection In Motor.
SINGLE PHASE:	Tri Voltage 200-230/460; Require Overload Protection to be Included In Control Panel.
THREE PHASE:	N/O, Requires Relay in Control Panel. N/C, Requires Relay in Control Panel. For three phase units ONLY.
MOISTURE SENSOR:	
TEMPERATURE SENSOR:	
OPTIONAL EQUIPMENT:	Seal Material, Impeller Trims, Additional Cable, CSA Listed.



Series: 4SE 1.9 & 2.8HP
1150 RPM
Series: 4SE 2.8, 3.7, 5.0HP
1750 RPM

(OPTIONAL)
 CSA Canadian Standards Association
 File No. LR16567

Description:

SUBMERSIBLE NON-CLOG SEWAGE PUMP DESIGNED FOR TYPICAL RAW SEWAGE APPLICATIONS.

Sample Specifications: Section 1 Page 8.

CRANE®

PUMPS & SYSTEMS

A Crane Co. Company

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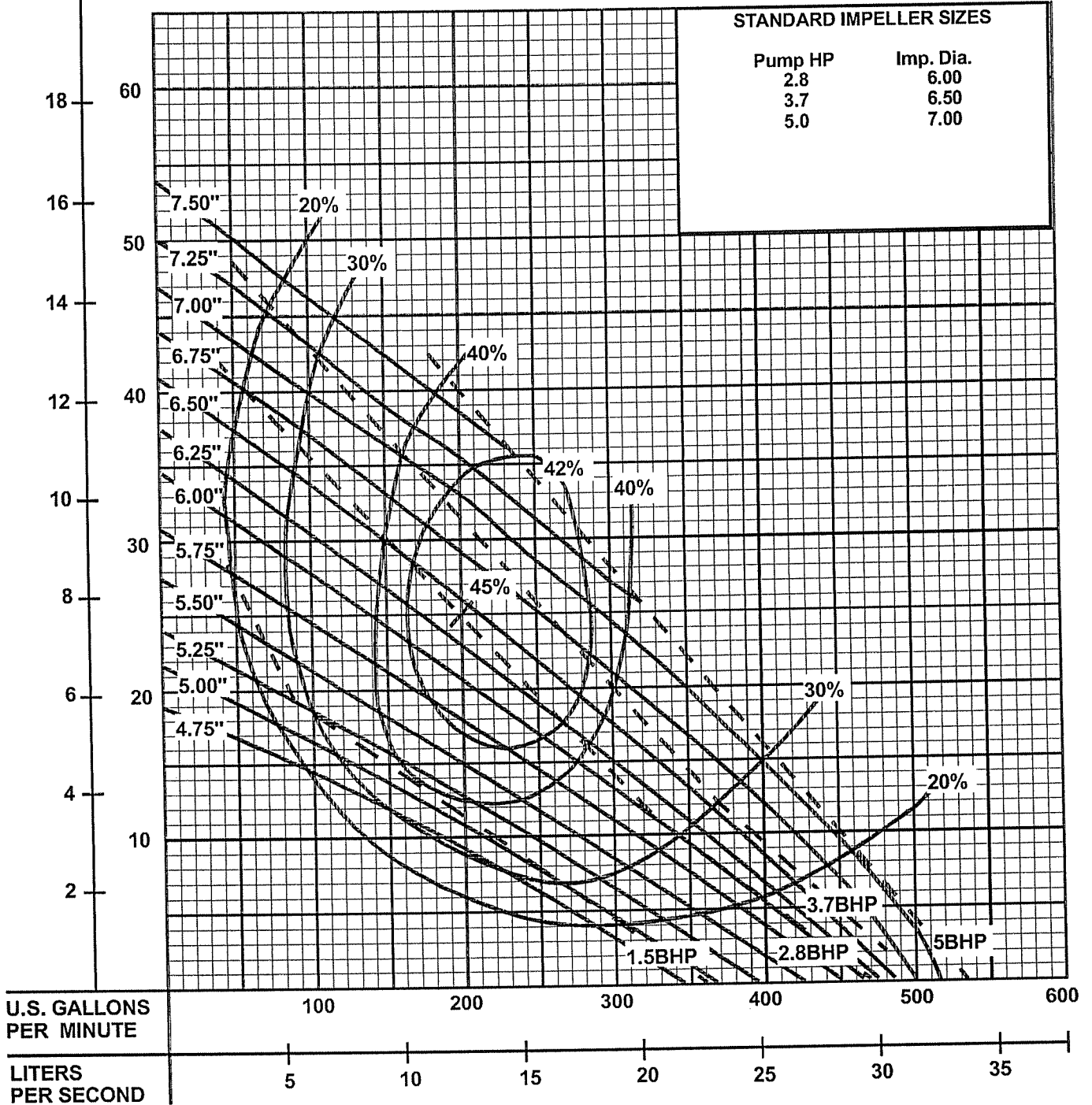
Submersible Wastewater
 Pump Association
SWPA
MEMBER

PERFORMANCE CURVE

Series: 4SE, 2.8, 3.7 & 5.0HP, 1750RPM

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TOTAL HEAD
MTRS | FT



Testing is performed with water, specific gravity of 1.0 @ 68° F, other fluids may vary performance.



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PUMP DATA SHEET
 Crane/Barnes

Selection file: (untitled)
Catalog: BARNES60.MPC v.1

Design Point: Flow: 216 US gpm
 Head: 23 ft

Fluid: Water Temperature: 60 °F
 SG: 1
 Viscosity: 1.122 cP
 Vapor pressure: 0.2568 psi_a
 Atm pressure: 14.7 psi_a

Pump: 03NONCLOG - 1800 **Size:** 4SE37*4L
 Speed: 1750 rpm Dia: 6.5 in

Limits: Temperature: --- °F Sphere size: 3 in
 Pressure: --- psi_g Power: --- bhp

NPSHa: --- ft

Specific Speed: Ns: --- Nss: ---

Piping: System: ---
 Suction: --- in
 Discharge: --- in

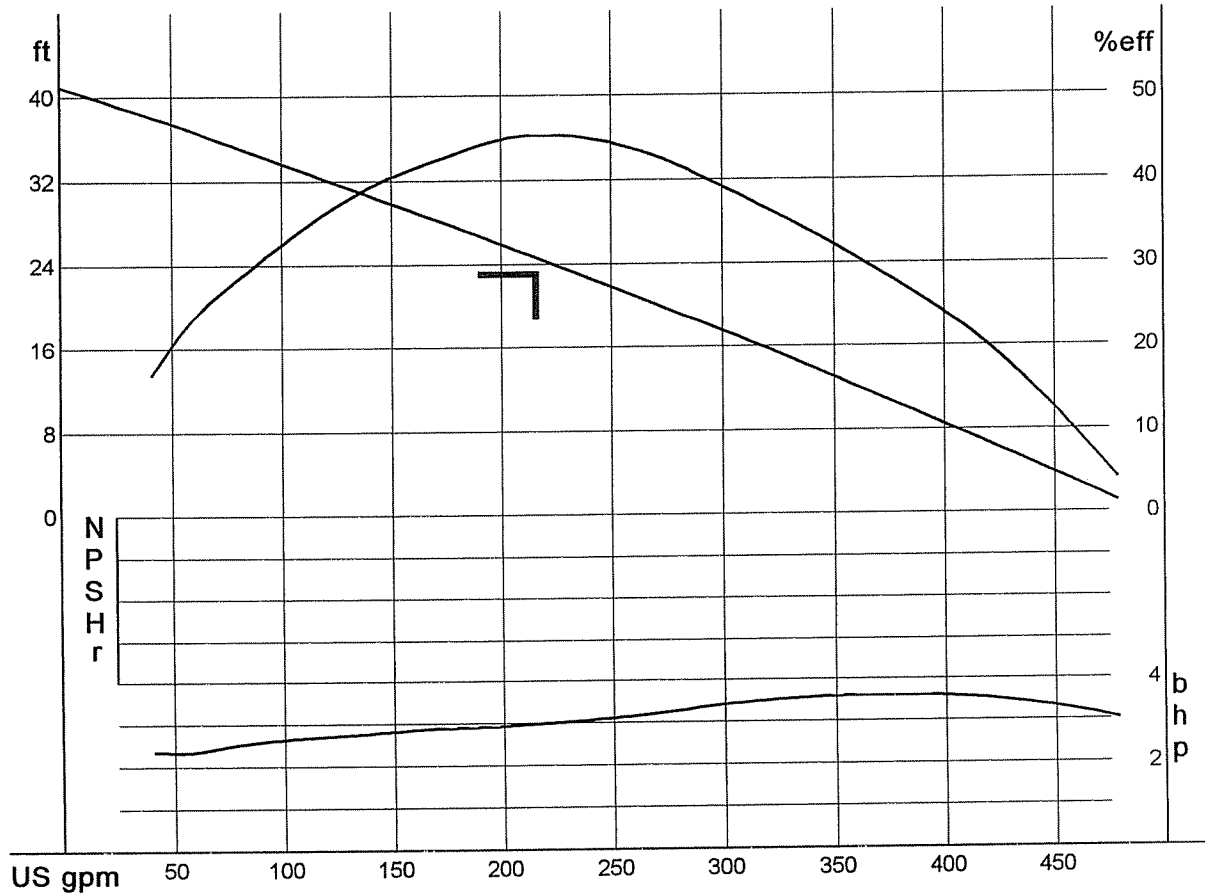
Dimensions: Suction: --- in Discharge: 4 in

Temp. 104°F (40°C) Continuous.

---- Data Point ----
 Flow: 216 US gpm
 Head: 24.6 ft
 Eff: 45%
 Power: 2.98 bhp
 NPSHr: - ft

-- Design Curve --
 Shutoff Head: 40.9 ft
 Shutoff dP: 17.7 psi
 Min Flow: - US gpm
 BEP: 45% eff
 @ 205 US gpm
 NOL Pwr: 3.6 bhp
 @ 364 US gpm

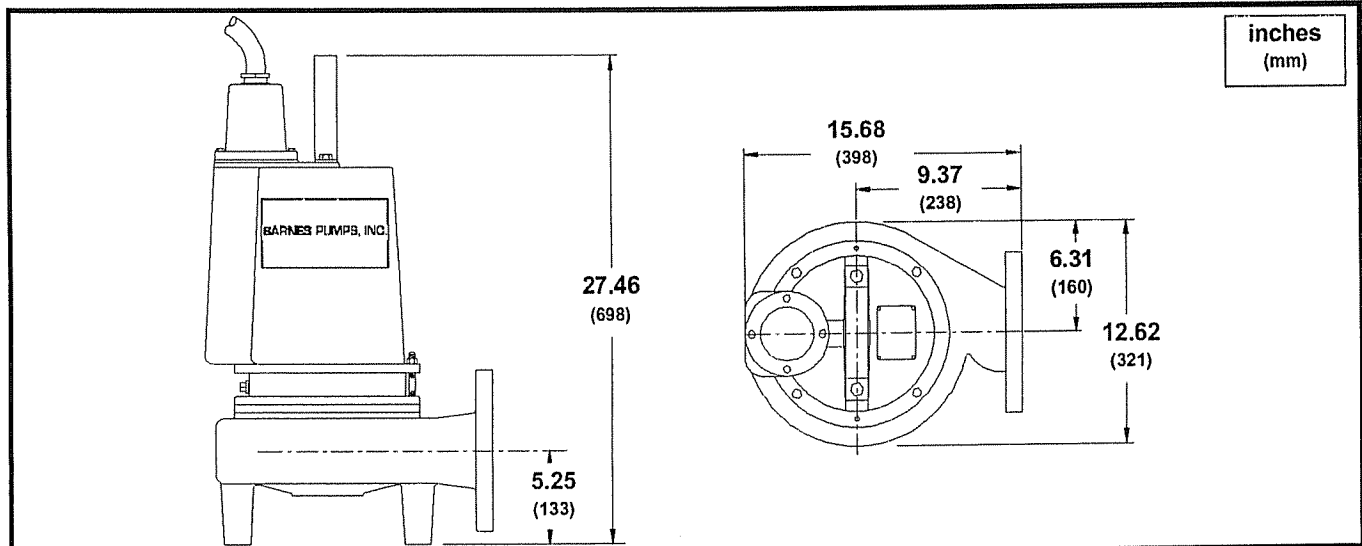
-- Max Curve --
 Max Pwr: 3.6 bhp
 @ 364 US gpm



--- PERFORMANCE EVALUATION ---

Flow	Speed	Head	Pump	Power	NPSHr	Motor	Motor	Hrs/yr	Cost
US gpm	rpm	ft	%eff	bhp	ft	%eff	kW		/kWh
259	1750	21	43	3.16	---				
216	1750	24.6	45	2.98	---				
173	1750	28	42	2.88	---				
130	1750	31.3	37	2.72	---				
86.4	1750	34.6	29	2.56	---				

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MODEL NO.	PART NO.	HP	VOLT	PH	RPM (NOM)	NEMA START CODE	FULL LOAD AMPS	LOCKED ROTOR AMPS	CORD SIZE	CORD TYPE	CORD O.D.
4SE1926L	084602	1.9	230	1	1150	D	8.3	35.0	10/3	SO	0.690
4SE1996L	084604	1.9	200-230	3	1150	E/G	5.8/5.0	26.1/30.0	10/4	SO	0.750
4SE1946L	084605	1.9	460	3	1150	G	2.5	15.0	10/4	SO	0.750
4SE1956L	089300	1.9	575	3	1150	G	2.0	12.0	10/4	SO	0.750
4SE2826L	088825	2.8	230	1	1150	A	13.5	31.0	10/3	SO	0.690
4SE2896L	088826	2.8	200-230	3	1150	F/H	9.2/8.4	38.2/44.0	10/4	SO	0.750
4SE2846L	088827	2.8	460	3	1150	H	4.2	22.0	10/4	SO	0.750
4SE2856L	088828	2.8	575	3	1150	H	3.4	17.6	10/4	SO	0.750
4SE2824L	084606	2.8	230	1	1750	A	12.6	23.0	10/3	SO	0.690
4SE2894L	084608	2.8	200-230	3	1750	C/F	9.2/8.0	31.3/36.0	10/4	SO	0.750
4SE2844L	084609	2.8	460	3	1750	F	4.0	18.0	10/4	SO	0.750
4SE2854L	089301	2.8	575	3	1750	F	3.2	14.4	10/4	SO	0.750
4SE3724L	084610	3.7	230	1	1750	A	20.0	29.0	10/3	SO	0.690
4SE3794L	084611	3.7	200-230	3	1750	D/G	16.1/14.0	47.0/54.0	10/4	SO	0.750
4SE3744L	084612	3.7	460	3	1750	G	7.0	27.0	10/4	SO	0.750
4SE3754L	089302	3.7	575	3	1750	G	5.6	21.6	10/4	SO	0.750
4SE5024L	088821	5.0	230	1	1750	A	28.0	59.0	10/3	SO	0.690
4SE5094L	088822	5.0	200-230	3	1750	B/D	20.9/19.0	48.6/56.0	10/4	SO	0.750
4SE5044L	088823	5.0	460	3	1750	D	9.0	28.0	10/4	SO	0.750
4SE5054L	088824	5.0	575	3	1750	E	8.3	23.0	10/4	SO	0.750

Standard Units:

Moisture/Temperature sensor cable for all phase models is 18/5 SO, 0.476 OD.)

CSA Listed Units:

(Optional - CSA Listed Power Cable for 3 Phase models is 10/4 SOW, 0.745 O.D.)

(Optional - CSA Listed Temperature sensor cable for all phase models is 18/5 SOW, 0.476 O.D.)

IMPORTANT !

- 1.) PUMP MAY BE OPERATED "DRY" FOR EXTENDED PERIODS WITHOUT DAMAGE TO MOTOR AND/OR SEALS.
- 2.) THIS PUMP IS APPROPRIATE FOR THOSE APPLICATIONS SPECIFIED AS CLASS I DIVISION II HAZARDOUS LOCATIONS.
- 3.) THIS PUMP IS NOT APPROPRIATE FOR THOSE APPLICATIONS SPECIFIED AS CLASS I DIVISION I HAZARDOUS LOCATIONS.
- 4.) INSTALLATIONS SUCH AS DECORATIVE FOUNTAINS OR WATER FEATURES PROVIDED FOR VISUAL ENJOYMENT MUST BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE ANSI/NFPA 70 AND/OR THE AUTHORITY HAVING JURISDICTION. THIS PUMP IS NOT INTENDED FOR USE IN SWIMMING POOLS, RECREATIONAL WATER PARKS, OR INSTALLATIONS IN WHICH HUMAN CONTACT WITH PUMPED MEDIA IS A COMMON OCCURRENCE.



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