

OLIVENHAIN MUNICIPAL WATER DISTRICT 4S RANCH/RANCHO CIELO SEWER BUILD-OUT FLOW STUDY

DRAFT TECHNICAL MEMORANDUM No. 1

Date:

December 28, 2007 – 1st DRAFT March 7, 2008 – 2nd DRAFT March 19, 2008 – FINAL DRAFT

March 25 2008 - FINAL

Subject:

SEWER BUILD-OUT FLOW STUDY

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EXECUTIVE SUMMARY

In support of our overall 4S Ranch/Rancho Cielo Sewer Build-Out Flow Study (Study), Infrastructure Engineering Corporation (IEC) developed build-out sewer flow projections for both the 4S Ranch and Rancho Cielo developments based upon flow monitoring data collected as part of this Study. The sewer flow data was used to develop sewer unit duty factors based upon existing levels of development. These duty factors were then used to estimate the sewer flow at the ultimate or build-out level of development. Build-out sewer flows for the Study area are summarized in Table 1.

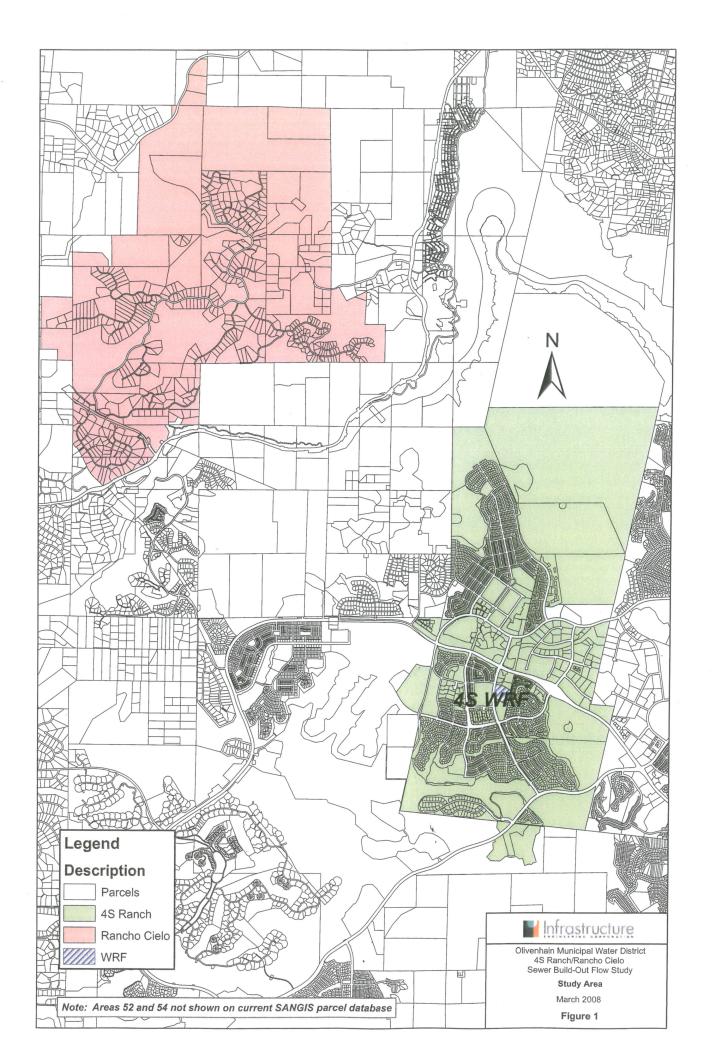
Table 1 - Build-Out Sewer Flow Projections

Area	Flow (mgd)	
4S Ranch	1.37	
Rancho Cielo	0.25	
Totals	1.62	

BACKGROUND

The District's 4S Ranch Water Recycling Facility (4S WRF) is located within the 4S Ranch development and has a treatment capacity of 2 million gallons per day. The 4S WRF provides treatment for both the 4S Ranch and Rancho Cielo developments, The 4S WRF, 4S Ranch area, and Rancho Cielo area are shown on Figure 1.

The Study area is approximately 60 percent built-out and the existing sewer flows experienced by the District have been less than those planned for through master planning studies. Therefore, the District is performing this flow study to quantify the sewer flow characteristics of the developed areas and apply them to undeveloped areas to estimate the ultimate or build-out flow of the area tributary to the 4S WRF.





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DRY WEATHER FLOW MONITORING

IEC utilized Downstream Services Incorporated (DSI) to collect dry weather flow data at 17 sites for a period of 14 days. Sites were selected based upon existing level of development and land use type to help quantify flow characteristics with each development. 15 sites were selected in the 4S area, with the remaining two sites in the Rancho Cielo Area. The flow monitoring sites are shown in Figure 2 for 4S and Figure 3 for Rancho Cielo.

Land Use data provided as part of the 4S Ranch Master Development Plan was used to select sites within the 4S area. The Master Development Plan land use is shown in Figure 4.

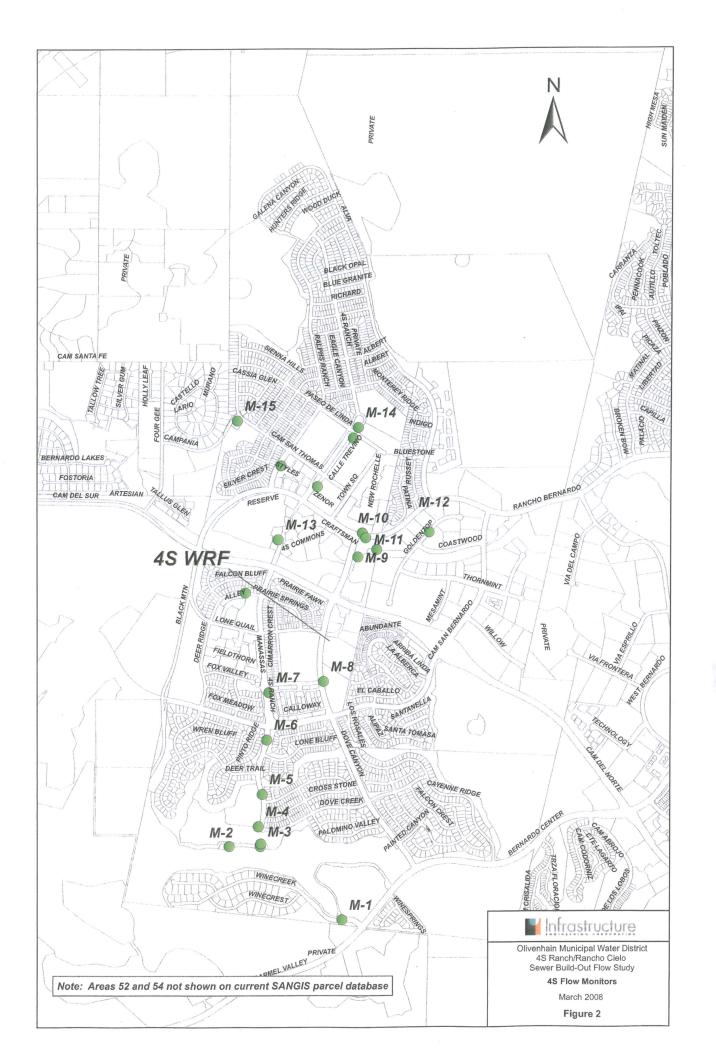
A summary of the flow monitoring results for each meter is presented in Table 2.

Table 2 - Flow Monitoring Results Summary

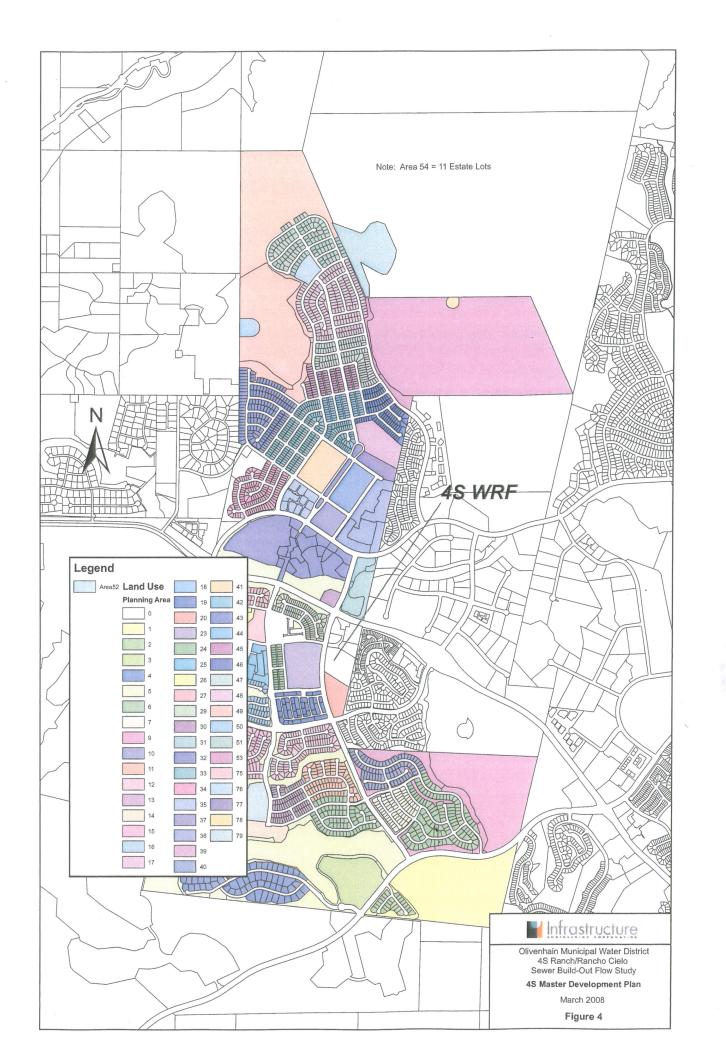
Table 2 - From Worldoning Results Summary						
Meter	Area	Planning Area Number(s)	Description	Average Daily Flow (GPD)	Peak Daily Flow (GPD)	Peak Factor
1	48	2, 3	Middle School/Single Family	12,991	51,000	3.9
2	48	5, 15, 16	Single Family	741,468	1,969,000	2.7
3	48	5, 6, 11, 13	Single Family	171,850	397,000	2.3
4	48	79	Elementary School	2,758	16,000	5.8
5	48	SFD	Single Family	233,301	416,000	1.8
6	48	25, 26, 27, 29, and 75	Single Family/Multi Family	99,017	344,000	3.5
7	48	19	Multi Family	6,051	32,000	5.3
8	48	20	Multi Family	19,022	64,000	3.4
9	48	M-9	Industrial/Warehouse/Manufacturing	108,576	258,000	2.4
10	48	38	Multi Family	14,908	60,000	4.0
11	48	38	Multi Family	16,630	54,000	3.2
12	48	Res/Condo	436 Condo Units	53,498	162,000	3.0
13	48	32	MF/Commercial	15,537	81,000	5.2
14	48	39	Elementary School	1,779	7,000	3.9
15	48	33, 34, 37, 40, 41	Single Family, Multi Family, Commercial	163,807	328,000	2.0
16	Rancho Cielo	17	Estate Residential	70,054	163,000	2.3
17	Rancho Cielo	17	Estate Residential	7,352	39,000	5.3

The average to peak flow data was plotted on a graph to develop a peak dry weather curve, based upon the existing flows. The peak curve and associated flow monitoring points are shown on Figure 5. The peak dry flow to average flow ratio can be quantified through the following peak equation:

Peak Factor = 21.1*(Average Dry Weather Flow in GPD)^{-0.1782}

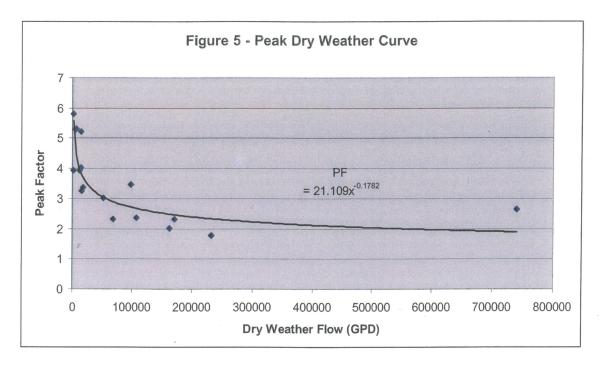








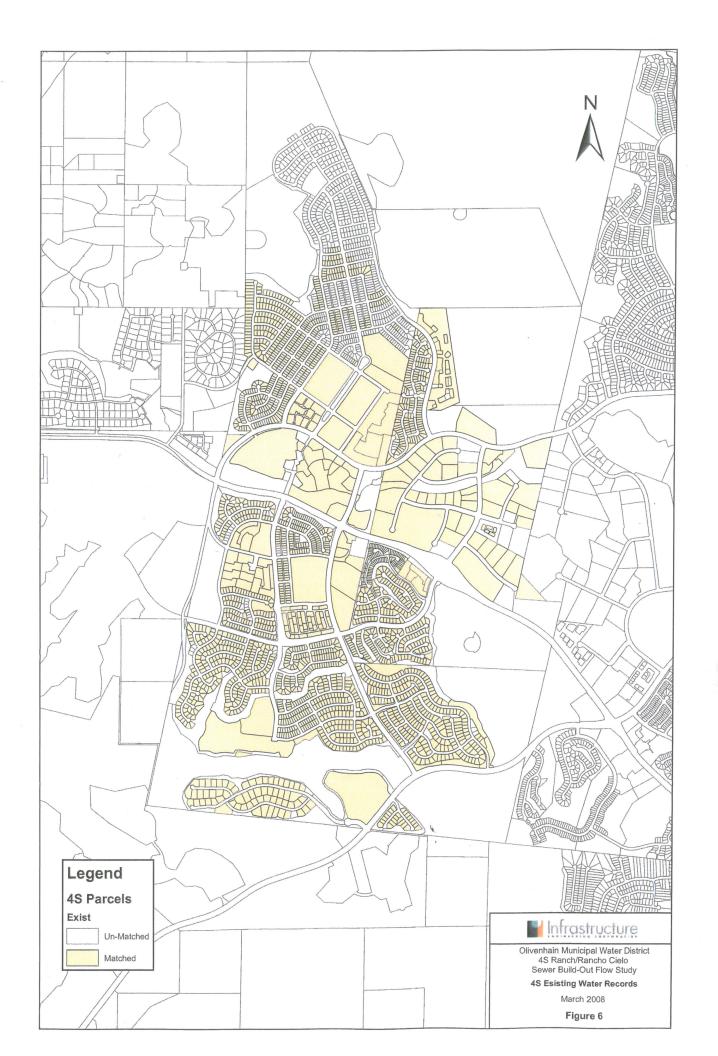
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WATER CONSUMPTION ANALYSIS

Water Consumption records for the period of July 2005 to October 2007 were analyzed to determine water use characteristics by land use type for developed parcels within the 4S and Rancho Cielo Areas. Meter consumption records were attached to a parcel in the District's existing GIS database to spatially locate each account. The accounts for each planning area or land use type were then summarized to calculate unit water duty factors in terms of gallons per day per acre (gpd/acre) or gallons per day per dwelling unit (gpd/du). Parcels within the 4S area that were matched to a water account are shown in Figure 6 and parcels within the Rancho Cielo area that were matched to a water account are shown in Figure 7.

A summary of the water consumption analysis for each land use type are provided in the following tables.







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Table 3 - Water Consumption Analysis for Single Family Land Use

	T dible 5	Water Com	sumption Analysis ic		L dilliny 23.	Water	Water
Planning			Water Consumption	Land Use	Dwelling	Duty	Duty
Area	Area (ac)	Description	(GPD)	Type	Units	(GPD/AC)	(GPD/DU)
2	5.4	SFD	13,971	SF	24	2,577	582
4	32.8	SFD	46,482	SF	64	1,418	726
6	44.2	SFD	135,181	SF	185	3,055	731
7	10.5	SFD	32,922	SF	56	3,140	588
10	14.3	SFD	45,881	SF	73	3,203	629
11	14.2	SFD	47,072	SF	75	3,305	628
12	16.9	5067-6	52,868	SF	108	3,123	490
13	10.7	SFD	35,115	SF	82	3,275	428
15	21.2	5067-5	76,894	SF	121	3,634	635
16	25.8	5067-4	90,194	SF	123	3,498	733
18	14.2	5067-3	49,642	SF	92	3,507	540
24	4.2	5067-8	15,044	SF	34	3,546	442
27	11.2	5067-1	40,354	SF	65	3,594	621
29	9.6	5067-2	36,436	SF	80	3,802	455
34	15.6	SFD	39,042	SF	117	2,497	334
42	2.6	SFD	6,265	SF	23	2,386	272
43	26.4	SFD	68,184	SF	150	2,584	455
44	4.9	SFD	13,123	SF	40	2,678	328
45	2.4	SFD	6,668	SF	17	2,819	392
46	2.1	SFD	4,806	SF	17	2,248	283
47	8.3	SFD	20,575	SF	54	2,474	381
Total 4S	297.7	-	876,720	.	1600	2,945	548
M-16 & M- 17	273.3	SFD	224 002	C.F.	1.4.1	859	1 666
M-16	115.3		234,903	SF	141		1,666
M-17		SFD	144,922	SF	69	1,256	2,100
	133.6	SFD	89,981	SF	56	673	1,607
Total RC Grand	522.3	-	469,807	-	266	900	1,766
Total	819.9378	_	1,346,526		1866	1,642	722



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Table 4 - Water Consumption Analysis for Multi Family Land Use

Planning Area	Area (ac)	Description	Water Consumption (GPD)	Land Use Type	Dwelling Units	Water Duty (GPD/AC)	Water Duty (GPD/DU)
19	11.5	5266	28,179	MF	133	2,448	212
20	7.3	MF Low	22,898	MF	120	3,122	191
25	17.9	5296	25,598	MF	202	1,428	127
37	14.2	MF/Commercial	7,741	MF	128	547	60
38	25.1	MF	22,965	MF	310	914	74
40	35.5	MF	5,807	MF	107	164	54
Totals	111.6	-	113,187		1,000	1,014	113

Table 5 - Water Consumption Analysis for Commercial/Industrial Land Use

Planning Area	Area (ac)	Description	GPD	Land Use Type	GPD/AC
32	27.0	Manufacturing/Commercial	40,177	COM	1,488
33	12.4	Commercial	33,623	COM	2,701
M-9	111.0	Commercial/Industrial/Manufacturing/Warehouse	117,302	COM	1,057
Totals	150.5		191,102.6	-	1,270

Table 6 - Water Consumption Analysis for Schools

Planning Area	Area (ac)	Description	Water Consumption (GPD)	Land Use Type	Student Count	Water Duty (GPD/Student)	Water Duty (GPD/AC)
3	23.0	Middle School	36,783	SCH	927	40	1,600
39	13.4	Elementary School	18,725	SCH	775	24	1,396
79	10.2	Elementary School	10,678	SCH	973	11	1,051
Totals	46.6	-	66,187		2,675	25	1,421

FLOW MONITORING DATA ANALYSIS

Using the water consumption data calculated above with the collected flow monitoring data, a return-to sewer ratio and associated sewer duty factors were calculated for each meter. As not all sites metered data for one land use type, the meters that did isolate a land use type were used to develop sewer duty factors for Single Family, Multi Family, Commercial, and School land use categories. The flow monitoring data analysis for each of the monitoring sites is presented in Table 7.



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Table 7 - Flow Monitoring Data Analysis

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Meter	Area	Planning Area Number	Description	Units	Average Daily Sewer Flow (GPD)	Water Consumption . (gpd)	Return to Sewer Ratio (%)	GPD/ Unit ³
1	4S	2	Single Family	24	3,576	13,971	26%	149
1	48	3	School	927	9,415	36,783	26%	10
3 ¹	4S	5, 6, 11, 13	Single Family		171,850	-	-	-
4	48	79	Elementary School	973	2,758	10,678	26%	11
5	48	12, 15, 16	Single Family	539	109,211	431,986	25%	203
6	4S	25, 26, 27, 29, and 75	Single Family/Multi Family	313	73,944	562,878	13%	236
7	48	19	Multi Family	133	6,051	28,179	21%	45
8	48	20	Multi Family	120	19,022	22,898	83%	159
9	48	M-9	Industrial/Warehouse/Manufacturing	N/A	108,576	117,302	93%	N/A
10	48	38	Multi Family	310	14,908	22,965	65%	48
11	48	38	Multi Family	310	16,630	22,965	72%	54
12	4S	Res/Condo	436 Condo Units	426	53,498	854,324	6%	126
13	48	32	MF/Commercial	N/A	15,537	16,707	93%	N/A
14 ²	4S	39	Elementary School	775	1,779	18,725	10%	2
15	4S	33, 34, 37, 40, 41	Single Family, Multi Family, Commercial	1653	163,807	1,335,534	12%	99
16	RC	17	Estate Residential	193	53,230	234,903	23%	276
17	RC	17	Estate Residential	86	7,352	89,981	8%	85

¹Meter 3 experienced a hydraulic issue and the results are not valid

ADDITIONAL FLOW MONITORING DATA

Preliminary planning level build-out results developed by IEC predicted a build-out flow of approximately 1.6 mgd. This is roughly equivalent to the amount of wet weather storage for the 4S WWTP. Therefore, the Districted wanted to collect additional flow data to validate and verify the accuracy of the flow projections. IEC collected flow data at 7 additional sites. Two of these sites were repeated from the previous study to collect data that was inadequate from a hydraulics standpoint. These included sites M-3 and M-17 from the previous flow study. The remaining 5 sites focused on multi-family and higher density residential land use categories. The additional flow monitoring sites are shown on Figures 8 and 9. Results from the additional flow monitors are summarized in Table 8

²Meter 14 experienced extremely low flows and the results are not valid

³GPD/Unit is GPD/DU for residential land use , GPD/Student for Schools, and GPD/acre for Commercial.







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Table 8 - Additional Flow Monitoring Results Summary

Meter	Development	Planning Area Number	Description	Average Daily Flow (GPD)	Peak Daily Flow (GPD)	Peak Factor	
2-1	4S	2	Single Family	7,111	51,000	7.2	
2-2	4S	5, 6, 11, 13	Single Family	366,400	823,759	2.2	
2-3	48	35	Multi Family	31,339	97,404	3.1	
2-4	4S	37	Multi Family	14,911	41,239	2.8	
2-5	4S	40	Multi Family	3,435	13,406	3.9	
2-6	4S	25, 26, 27, 29, and 75	Single Family/Multi Family	22,456	72,396	3.2	
2-7	Rancho Cielo	17	Estate Residential	11,606	63,626	5.5	

SEWER DUTY FACTOR CALIBRATION

Using the parcel-level GIS land use database, developed as part of this project, each flow monitor basin was calibrated to the field data collected in each flow study. Unit duty factors were adjusted to match the flow monitoring data and examined to ensure that they fell within the normal range of expected values. In the rare cases where duty factors were significantly lower or higher than that expected, factors were adjusted accordingly so that they fell within industry standard ranges. As a secondary calibration measure, calibrated duty factors were assigned to developed parcels to calculate the existing flows to the 4S WWTP. The average 4S WWTP flow for the months of October, November, and December of 2007 was .91 mgd. The planning-level flows for existing developed parcels based upon calibrated duty factors was also .91 mgd. Existing calibrated flows and planning-level ultimate flows are summarized in Table 9.

Table 9- Build-Out Sewer Flow Projections

Area	Existing Flow (mgd)	Build-out Flow (mgd)	% of Build- out
4S Ranch	0.88	1.37	64.2%
Rancho Cielo	0.04	0.25	16.3%
Totals	0.92	1.62	56.9%

RECOMMENDED SEWER DUTY FACTORS

Based upon the flow monitoring results and the calibration effort described above, the following Sewer duty factors are recommended for projecting build-out flows tributary to the 4S WTP.



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Table 10 - Recommended Sewer Duty Factors

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Description	Duty Factor
Elementary/Middle School	10 gpd/student
High School	30 gpd/student
Single Family 4S	250 gpd/du
Single Family RC	280 gpd/du
Multi Family	160 gpd/du
Commercial	1,000 gpd/ac
Commercial - PA 33	1,800 gpd/ac

The above recommendations fall within the typical ranges established in Chapter 3 of the M&E Wastewater Engineering Reference.

BUILD-OUT FLOW PROJECTIONS

Using the Recommended Sewer Duty Factors in Table 8 with the designated land use categories in the 4S and Rancho Cielo Areas, Sewer Flows were developed for the ultimate or build-out time increment, assuming that every parcel within the 4S and Rancho Cielo areas builds to the maximum allowable density. Table 11 summarizes the build-out flow projections for the Study area.

Table 11 - Build-Out Sewer Flow Projections

Area	Flow (mgd)
4S Ranch	1.37
Rancho Cielo	0.25
Totals	1.62