The CYBERNET model consists of a data file arrayed in a specific format describing the hydraulic, physical, and geographic characteristics of the distribution network. These parameters include pipe size and length, hydraulic factors, and ground elevations. The data file also describes the operating conditions including demand, reservoir levels, and pump operation. CYBERNET utilizes AutoCAD® for a graphical presentation of input and output data.

The first step in developing the Florence CYBERNET model was to prepare a schematic of the pipe network. The schematic is a graphical representation of the key pipes in the system using numbered lines for pipes. Each junction node where pipes meet was also numbered. The key components in the existing system model included:

- All pipes 6 inches and larger in diameter.
- All existing pumping stations.
- The existing Florence reservoirs.
- Connections to the Heceta Water District.

After the system components were entered along with ground elevations, initial model runs were performed to determine that the model accurately simulated the conditions in the field. Verification of the model was conducted by comparing predicted to actual pressures developed at the reservoirs and the groundwater treatment plant at the end of 24th Street. Correlation within 1.0 psi was achieved indicating the model is sufficiently accurate.

EXISTING SYSTEM ANALYSIS

The model shows the existing distribution system maintains pressure above 30 psi in most areas at the peak hour demand. Modeling for this condition is quite conservative as peak hour demands are rarely experienced even during the height of the summer usage. There are a few localized areas where pressures fall below 30 psi as shown on Figure 4-2. According to the model simulation, one marginal pressure area is located in the eastern portion of Florentine Estates. Another marginal pressure area is found at the north end of 13th Street. Only one unacceptable (less than 20 psi) low pressure area was indicated at the top of Rhodo View Dunes Estates. Since this location is currently served by a booster pumping station, this modeling result may not be valid. Tabular results of computer simulations are included in Appendix E. These results show the head loss between nodes and the pressure at each node for the system modeled.

FUTURE SYSTEM ANALYSIS

Multiple computer runs were made while inserting various new piping configurations into the existing system. It was determined that with the addition of two new 12-inch distribution lines running from east to west across the northern service area, adequate pressures could be maintained in the future. A booster pumping station will also be required on 42nd Street. Although Figure 4-3 does not indicate deficient pressures in the area, it is believed pressures there may be marginal, depending on the type of development. The recommended piping configuration is shown in Figure 4-3 located at the end of this chapter. Some areas immediately south of the first service level near Highway 101 will have marginal pressures at peak demands but they can be easily served from the first service level in the future.

The alignment of the proposed east-west interties can be varied considerably from that shown to accommodate existing or future land use, ownership, or existing improvements. With the model established, it is a simple task to test alternative alignments during the preliminary design process.

STORAGE SYSTEM IMPROVEMENTS

Design criteria established earlier in this chapter state that storage must be provided to accommodate peak hour flows as well as fire flow. This section discusses the current storage requirements, future storage requirements, and alternative storage reservoir construction types and their costs.

CURRENT STORAGE REQUIREMENTS

The current requirement for storage as determined by the criteria established earlier in this chapter is 5.5 million gallons. This storage is based on 3 days of annual average demand plus fire flow for 15 hours. The current storage capacity totals 4.75 million gallons as described in Chapter 1. The existing 250,000 gallon reservoir located on Spruce Street is scheduled for demolition within the next 10 years. At present, the city can rely on additional storage from the Heceta water system as long as the intertie is operative.

FUTURE STORAGE REQUIREMENTS

By the year 2020, a total of 11.2 million gallons of storage will be required to serve the study area–an increase of approximately 6.5 million gallons over the existing capacity. This storage should be distributed throughout the service area to maximize reliability in the event of fire or natural disaster. Discussions with plant staff indicate a preference for ground level reservoirs with supplemental pumping if required. Elevated reservoirs are typically costly to construct. In addition, they are costly to maintain due to the high cost of recoating.

The city may have the opportunity to acquire property from the county immediately to the west of Clear Lake. This site includes a ridge near an existing Heceta Water District reservoir. Other possible locations are within the limits of a new wellfield in the northeastern portion of the study area. Although this terrain is relatively low-lying, ground level reservoirs and a booster pumping station would be an option. A similar approach was used for the two 2.0 million gallon reservoirs adjacent to the Sand Pines Golf Course.

STORAGE COSTS

Tables 4-16 and 4-17 show the costs for both steel and concrete storage tank construction. Typically, steel tanks are more cost effective to construct in the smaller sizes. However, they often require painting every 5 to 7 years, especially in a marine environment. Concrete tanks require little maintenance but usually have a higher first cost, depending upon the availability of an experienced concrete tank contractor. The decision regarding tank materials should be made

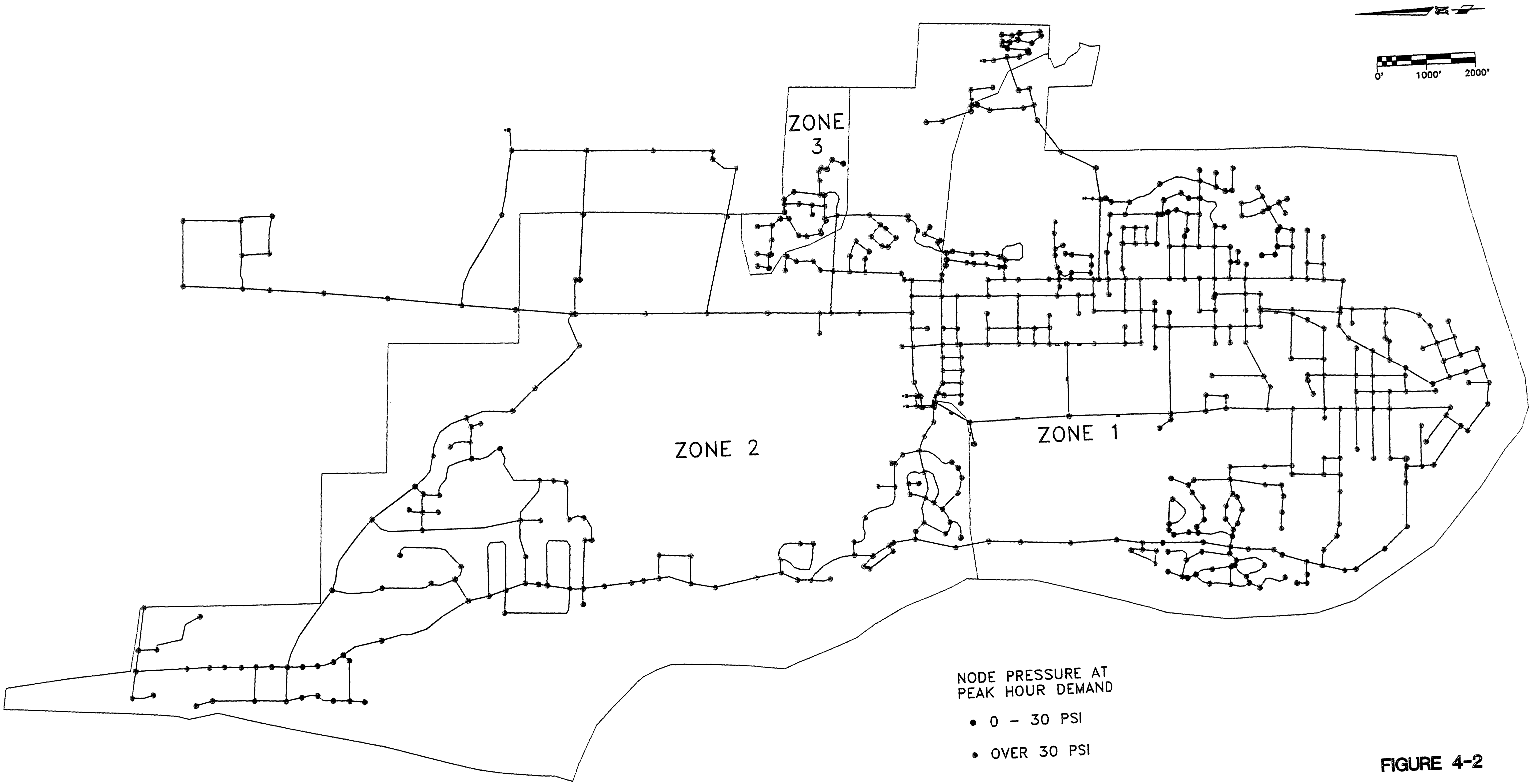


FIGURE 4-2

EXISTING DISTRIBUTION SYSTEM ANALYSIS

during the preliminary design phase. At that time, the advantages of various concrete tank design construction techniques such as pre-stressed, post-tensioned, or precast can be evaluated. For both steel and concrete construction, economies of scale can provide significant savings in building larger tanks.

Table 4-16. Steel Storage Reservoir Construction Costs

Size, million gallons	Capital cost, dollars	Cost, dollars/gallon
1.0	400,000	0.40
2.0	520,000	0.26
3.0	660,000	0.22

Table 4-17. Concrete Storage Reservoir Construction Costs

Size, million gallons	Capital cost, dollars	Cost, dollars/gallon
1.0	688,000	0.69
2.0	1,033,000	0.52
3.0	1,341,000	0.45

Reservoirs that cannot be located on high ground must be provided with booster pumping stations to provide supplemental system pressure. Such booster stations are typically provided with multiple pumps to meet both average and peak pumping needs. Average pumping requirements are met with small, continuously operating pumps. Higher flows are provided by larger capacity pumps with backup power provided by an emergency generator. Variable speed drives should be considered during preliminary design so that the pumping system can meet variable pressure and flow requirements.

The existing booster pumping station adjacent to the Sand Pines Golf Course was built for approximately $100,000 in 1991. For a future low-level reservoir system, approximately $150,000 should be allocated to accommodate inflation and to meet the need for higher pumping capacity.

CHAPTER 5

RECOMMENDED PLAN

Previous chapters have described the existing water system and developed water system treatment, distribution, and storage needs. This chapter provides the recommended plan for expansion of the Florence water system to meet future needs. Cost of improvements are presented along with options for phasing.

RECOMMENDED WATER SYSTEM IMPROVEMENTS

Recommended improvements for the water treatment, distribution, and storage systems are included in this section.

WATER TREATMENT IMPROVEMENTS

Chapter 2 identified a maximum day demand of 7.7 million gallons per day (mgd) at the end of the study period. Three sources for this water were discussed in Chapter 4 including optimization and expansion of the existing groundwater treatment plant, a new surface water source on Clear lake, and a new groundwater source in the northern portion of the study area.

Optimization and Expansion of the Existing Water Treatment Plant

This option includes modifications to the following process areas in the existing plant:

- Contact chamber
- Filters
- Chemical feed system
- Operations building

These improvements are currently under construction. The total cost of these improvements is estimated at approximately $371,400 and will result in increased reliability, safety, as well as higher output from the existing units. It is expected that production from the existing units can be increased by 30 percent with a reduction in chemical use and operator attention. Media loss from existing filters will be greatly reduced. This will minimize operation costs and customer complaints as well.

In addition, three new wells will be added providing approximately 0.5 mgd additional source capacity, with one well in reserve. Three greensand filters, in conjunction with the modified existing filters, will provide a total of 3.0 mgd with one filter out of service. The cost for the new wells and filters is expected to be approximately $1,065,000. The total project cost for the plant optimization and expansion is estimated at $1,436,400.

New Water Supply and Treatment

Limitations on the aquifer at the existing treatment plant site will require at least one additional source be developed. Clear Lake was assessed as a potential surface water source and it is expected that 2.5 mgd can be withdrawn from the lake during peak summer periods without excessive drawdown. With such a plant on Clear Lake, 2.2 mgd additional capacity would be required by the end of the planning period to provide a maximum of 7.7 mgd. Without a plant on Clear Lake, 4.7 mgd of additional capacity will be required. Chapter 4 included a detailed comparison of the present worth costs of constructing and operating the following options:

Option		Present worth
1	A 2.5 mgd surface water facility on Clear Lake supplemented with a 2.2 mgd groundwater source and treatment system	$11,765,000
2	A 4.7 mgd groundwater source and treatment system	$ 11,446,000

Evaluation of Options. The present worth costs of each option are essentially the same. Noncost factors should then weigh heavily in the selection of the recommended option. Environmental impacts, ease of implementation, reliability, permitting, and regulatory aspects, flexibility, and aesthetics should all be considered.

Environmental Impacts. Both options can be developed to minimize environmental impacts. During severe drought periods, an option using Clear Lake would need to address the potential for drawdown in the lake. This would be managed by limiting water withdrawals during critical periods. An option relying solely on groundwater could potentially pose concerns for environmental impacts to local private wells depending upon localized influences to the aquifer.

Ease of Implementation. Although the Division of Health has mandated that filtration be provided to any surface water source on Clear Lake, it is not clear that an agreement can be reached between the city and Heceta Water District. Yet siting a new wellfield in the north Florence area, even a 150-acre facility, may also pose a significant challenge. For this reason, both alternatives could be ranked equal with regards to ease of implementation.

Reliability. Being able to rely on both surface and groundwater sources would be ideal for a water utility. Contamination of both type sources simultaneously would be highly unlikely. However, it is unknown what drawdown due to pumping would be considered acceptable to all parties associated with Clear Lake. If the drawdown level was less than the 1.5 feet assumed, the economics of the Clear Lake alternative would shift. An option with includes two widely separated ground water systems would still offer significant reliability. The technologies associated with treatment of both surface and groundwater are equally reliable.

Permits and Regulatory Aspects. Development of a wellfield will require a groundwater protection plan regardless of size. No major permitting difficulties are anticipated in development of a surface water plant on Clear Lake.

Flexibility. A surface water plant on Clear Lake would increase the flexibility of the Florence water supply program. Contamination from an accidental spill in the region of a wellfield could curtail pumping for an extended period. A surface water source could add to the diversity of Florence's water supply. However, with the dual wellfield option, the separation of the new and existing wellfields and the large number of wells proposed would offer less, but adequate flexibility.

Aesthetics. A new water treatment plant on Clear Lake would require visual screening and architectural treatment to blend with the natural surroundings. Similarly, a new wellfield and groundwater treatment facility should also be designed to fit into the surrounding area. The larger size of the groundwater system may pose a more significant challenge.

Selection of Recommended Supply and Treatment Option. The ranking of the options with respect to the criteria discussed above are summarize in Table 5-1. A ranking of 1 is the highest.

Table 5-1. Summary of Treatment Alternative Rankings

	Option 1 - Clear Lake and 2.2 mgd wellfield	Option 2 - 4.7 mgd wellfield
Environmental impact	2	2
Ease of implementation	2	2
Reliability	2	3
Permits and regulatory aspects	2	2
Flexibility	2	3
Aesthetics	2	2
Total	12	14

Table 5-1 marginally supports the selection of Option 1, a surface water treatment plant on Clear Lake with a new 2.2 mgd wellfield in the north Florence area. Assuming the necessary political and institutional agreements can be reached, this alternative would be the preferred choice. However, with costs and noncost criteria ranking so closely, either alternative should be considered workable.

The total capital cost for the surface water plant and the 2.2 mgd wellfield would be approximately $7,624,000. The surface water plant on Clear Lake would include the features shown in Figure 5-1. It would be equipped with a laboratory, chemical storage and feed areas, and a filtration process area. It is assumed that a full basement clearwell would be utilized to provide the required chlorination detention time.

Provisions should be made during the design process to maintain continued operation of the existing Clear Lake facility during construction. After the new surface water plant is completed, the entire Heceta Water District will be served by the new Clear Lake facility. Most of the planned expansion within the Heceta Water District is included in the Florence study area. The Water Facilities Plan for Heceta Water District projects the peak flow requirements for the District outside of the Urban Growth Boundary to be only 0.48 mgd or about 6 percent of Florence's future water demand. These flows could be readily accommodated within the recommended plan.

The wellfield and groundwater treatment facility would be similar to the existing facility. It is expected that larger filter units will be used in the new facility to minimize the number of units and the associated piping and controls costs. The current chemical feed, flow measurement, and filter operations would be refined in designing the new groundwater treatment system.

FUTURE WATER DISTRIBUTION SYSTEM

According to both the Cybernet modeling effort and discussions with city staff, the existing water distribution system is essentially adequate. Minor modifications are necessary to address current localized low pressure areas. As growth continues, the majority of the new connections will be in the north Florence area. At present, a serviceable distribution grid exists in this area.

Two east-west interties will be necessary to meet peak hour demands at the design year. One intertie will extend west approximately 5,400 feet from 43rd and Highway 101 west to Rhododendron Drive. The other will extend approximately 7,700 feet west from Heceta Beach Road east to Highway 101. Both mains should be 12 inch diameter. The project costs for these mains are shown in Table 5-2.

Table 5-2. Water Distribution Main Improvements Project Costs

	43rd/ Rhododendron	Heceta Beach/ Hwy 101	Combined project costs
Pipeline construction, $70/linear foot	378,000	540,000	
Contingency, 25 percent	95,000	135,000	
Subtotal	473,000	675,000	
Engr, admin, legal, 20 percent	95,000	135,000	
Total project cost	568,000	810,000	$1,378,000

With these additions, adequate pressures can be maintained when future development infills normal distribution piping within the north Florence area. Figure 5-2 shows the existing distribution network and proposed new distribution mains. This information is also included in Figure 4-3, the large scale drawing provided at the end of this report.

FUTURE STORAGE RESERVOIRS

Providing a diversity of storage is key to maintaining a reliable municipal water supply system. When the 250,000 gallon reservoir is removed near the city shop, all the city storage will be located in two locations. While this situation is adequate for current needs as long as the Heceta Water District storage is intertied, future growth in the north Florence area will require additional

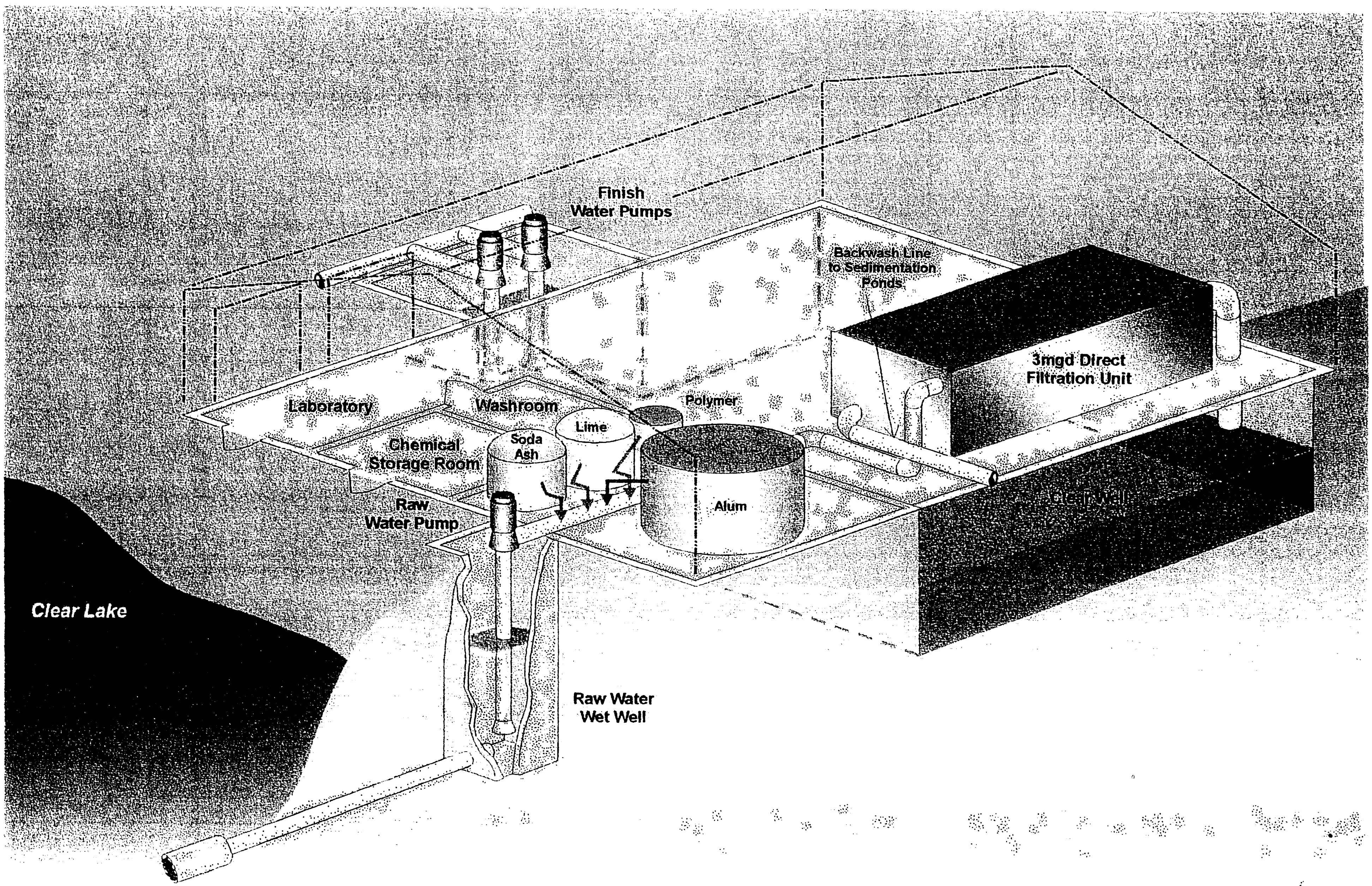


Figure 5-1
Proposed Clear Lake Surface Water Treatment Plant

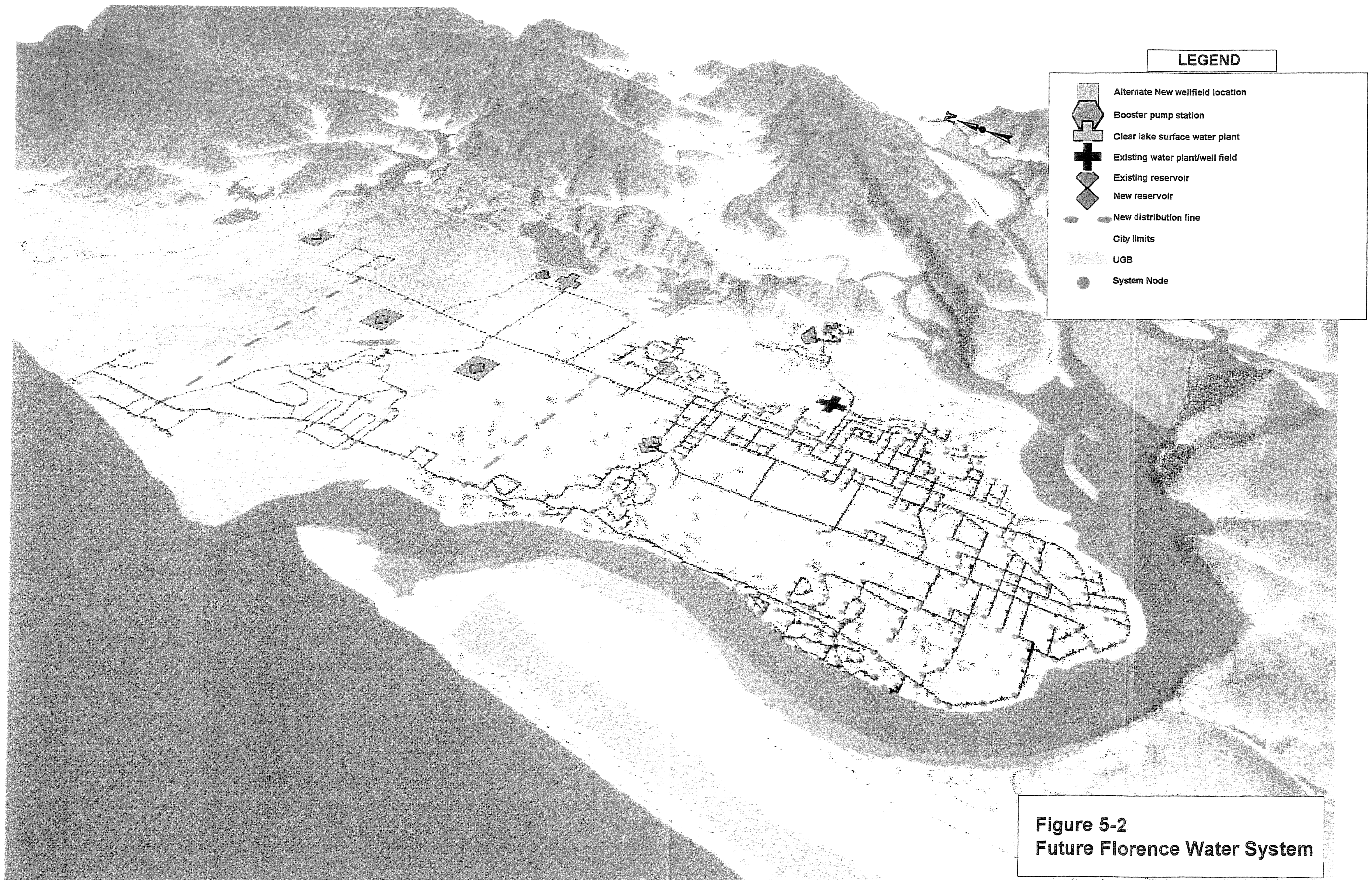


Figure 5-2
Future Florence Water System

storage in the north portion of the city. Approximately 6.5 million gallons (mg) of new storage will be required by the end of the planning period. The actual locations and sizing of future reservoirs must be selected in response to actual growth patterns. However, there are two likely locations that should be given strong consideration as development proceeds.

Recognizing that high level storage is preferable, the city may wish to purchase from the county a piece of property that includes a ridge above Clear Lake. The proposed surface water treatment plant could pump directly to a 2.0 mg reservoir at this location. There is a limited amount of high level ground in the north Florence area to site additional reservoirs. An option would be to site the remaining reservoirs adjacent to the new north Florence wellfield discussed previously. The potential wellfields and 4.5 mg of storage reservoirs are shown on Figure 5-2. These reservoirs would be equipped with pumping stations to maintain pressure throughout the first level pressure zone. The costs for these facilities are shown in Table 5-3.

Table 5-3. Storage Reservoir Costs

Item	Cost
2.0 mg Reservoir	520,000
(2) 2.25 mg Reservoirs	1,170,000
(1) Pumping station	150,000
Subtotal	1,840,000
Contingency, 25 percent	460,000
Construction subtotal	2,300,000
Engineering, administration and legal, 20 percent	460,000
Total project cost	2,760,000

RECOMMENDED PLAN COSTS

Cost have been developed for each of the components of the recommend plan. A description of the improvements and a summary of the project costs are presented below.

Water Supply and Treatment

Existing water plant optimization	$ 371,400
Existing water plant expansion	$1,065,000
New Clear Lake surface water treatment	$4,058,000
New north Florence wellfield	$3,566,000

Water Distribution

43rd/Rhododendron	$ 568,000
Heceta Beach/Hwy 101	$ 810,000
42nd St. booster pumping station	$ 30,000

Water Storage

2.0 mg reservoir near Clear Lake	$ 780,000
Two 2.25 mg reservoirs in north Florence area	$1,755,000
Booster pump station	$ 225,000
Total estimated costs for recommended improvements including contingency, engineering, administration, and legal costs	$13,228,400

PHASING OF RECOMMENDED IMPROVEMENTS

The need for new supply and storage will be determined to a large degree by growth within the study area. However, to determine logical project phasing, other issues should be considered.

- The Health Division has notified Heceta Water District they can no longer operate their existing facility without surface water treatment.
- Siting a new wellfield will require major coordination between the city, county, the U.S. Forest Service, or multiple private landowners. Negotiations for such a facility could require more than one year.
- Florence's existing groundwater treatment plant is in need of repair now. Excess operating costs have resulted from failure of key process elements.
- Larger projects typically are more cost effective. Such economies of scale result in part by the mandatory overhead functions required of the contractor, design engineer, and project administrator.

Figure 5-3 presents a phasing plan which recognizes the above concerns.

Phase 1 would begin immediately and include the plant optimization and the new treatment facility on Clear Lake. It is assumed that the Health Division will approve of this timing and allow the existing Clear Lake facility to operate in the interim. At least a 2.0 million gallon reservoir would be built near Clear Lake during the same project. Design and construction of these improvements could be completed by the end of the year 2000. The total estimated project cost would be approximately $5,209,400.

Phase 2 would not be needed until approximately the year 2007. The existing treatment plant should be expanded at that time. Interties for the water distribution system will likely be necessary. A booster pumping station on 42nd Street will also be required. The land acquisition process for the new well field and reservoir location should be pursued during this period. Design and construction of these facilities would require approximately 2 years. The total project cost exclusive of land would be approximately $2,473,000.

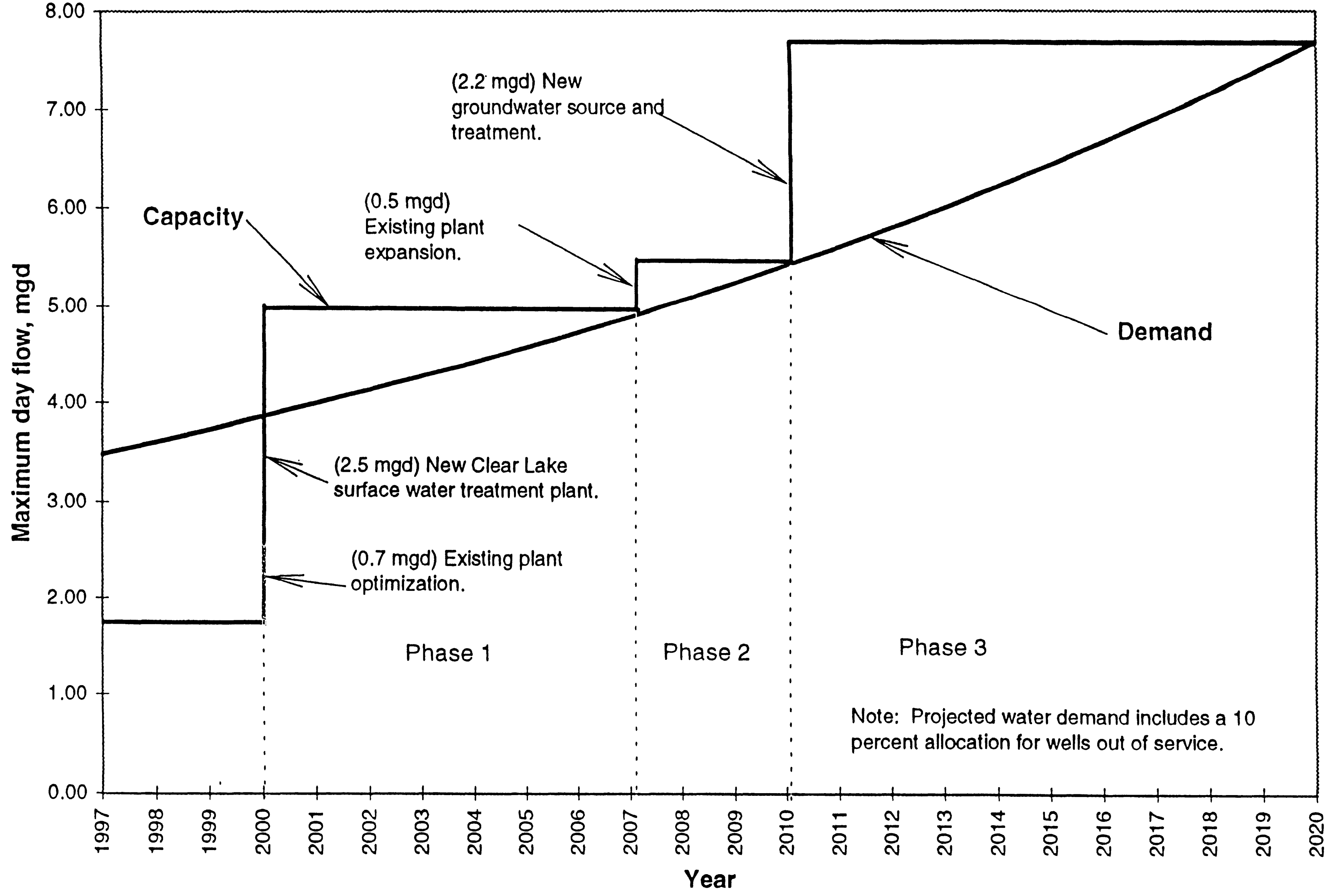


Figure 5-3. Florence Water Demand and Capacity Projections

Phase 3 source capacity would not be needed until about the year 2010. This phase would include development of the wellfield and groundwater treatment plant, the two 2.25 million gallon reservoirs, and the booster pumping station. Two and one half years should be allocated for the design and construction of this facility. The total estimated project cost is $5,546,000.

In the event it is not feasible for the city and Heceta Water District to develop a facility at Clear Lake, the phasing shown in Figure 5-3 could be easily modified to include a large wellfield in two phases in the north Florence area in lieu of a Clear Lake treatment plant and a smaller wellfield.

A

APPENDIX A

REMOTE CHLORINE FILTER BROCHURE

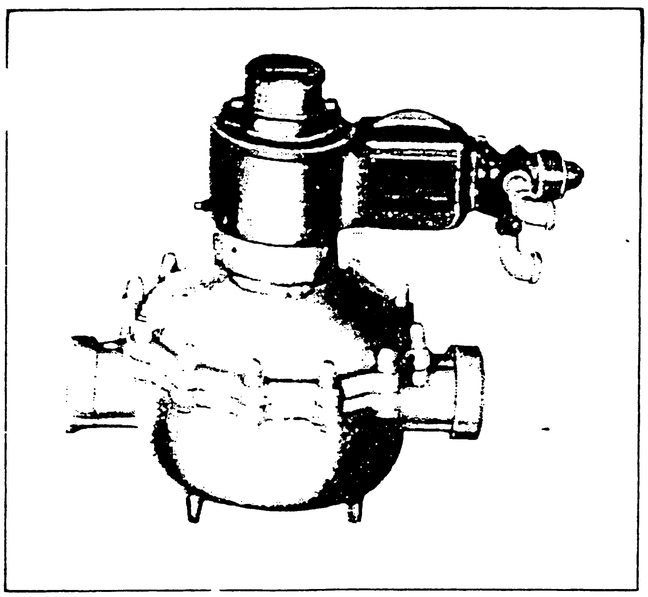
Model 1410

Basic Description

The Model 1410 control consists of a gear box and 3-way pilot valve mounted on a specified meter. The control is mounted between the meter body and the meter register and changes the rotary motion of the meter into a reciprocating motion which operates the pilot valve and controls remotely mounted Model 1261 diaphragm pump either hydraulically or pneumatically.

Four Model 1261 pumps can be simultaneously operated from a single Model 1410 control.

Materials of Construction: The gear box is constructed of cast iron with a cast brass pilot valve body and carbon valve slug. This combination of materials provides many years of dependable service with minimum maintenance.



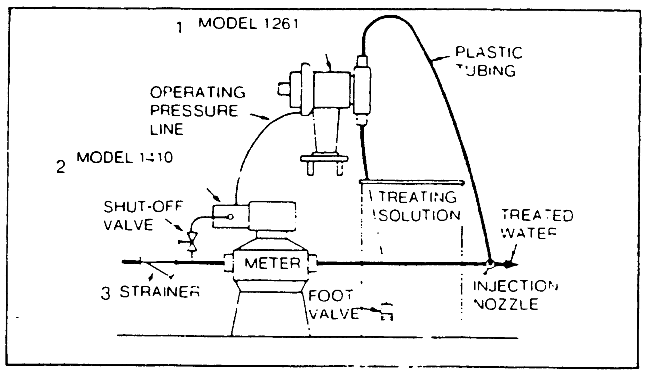
Model 1410 Control and Meter

Gearing: Engineered gearing used within the Model 1410 control is available in a wide range of ratios allowing the system to be tailored to the customer's particular application.

Registers used with the Model 1410 control are straight reading odometer type.

Typical Installation

Complete metering pump system consists of three main components, (1) Model 1261 feed pump; (2) Model 1410 pilot valve mounted on (3) meter. As main line flow passes through the meter, the pilot valve first admits operating fluid to the impulse diaphragm causing a stroke of the pump diaphragm. A spring returns the pump diaphragm and impulse diaphragm to its original position, thus expelling operating fluid through the pilot valve to drain. Pump stroking rate, and therefore feed rate, increases or decreases in proportion to main line flow rate. The 1262 pump may be located adjacent to the chemical solution tank and main line.



FlowProportional

No electricity requir

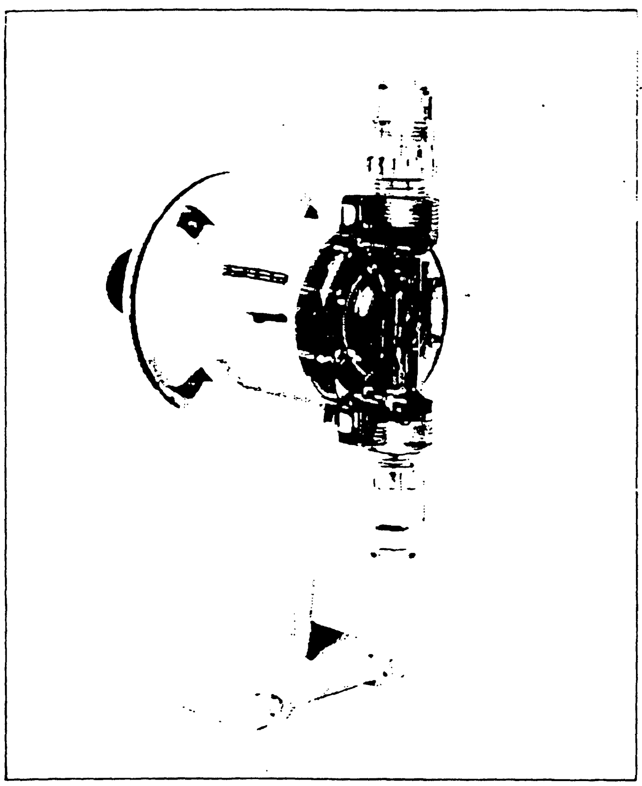
Specification Data

Basic Description - Model 1261

Specially designed porportioning diaphragm pump for feeding chemical solutions to water systems and industrial processes for treating, blending and diluting. It may also be used for sampling or shot feeding in response to electric eye or switch.

The Model 1261 is an air-or water-operated diaphragm metering pump capable of handling most chemical solutions at pressures to 200 psig.

Treatment chemicals or additives are injected in exact proportion to a varying flow. The unit is actuated either by a Model 1410 control mounted on a mechanically actuated meter for flow-responsive operation, or by a repeat cycle timer and solenoid valve for specific feed rates.



Model 1261

Product Features:

Diaphragm Design: Totally eliminates loss of process fluid.

Wide Range: Choice of two sizes of pumping heads with capacities of 1.7 or 12 cc per stroke.

Corrosion Resistance: Pumping heads available in Tyril®, PVC or stainless steel. Tyril and PVC heads are available with foot valve, injection nozzle and tubing, or 1/2" pipe thread. Stainless steel heads have 1/2" pipe thread.

Power Requirement: No external power is needed since feeder is actuated by hydraulic pressure in pipe line (minimum 25 psig line pressure required). Unit may be operated utilizing plant air supply.

Mounting: Easily mounted on floor or wall.

Feed Rate: Rates may be quickly and simply changed from 0 to 100% while unit is in operation by adjusting the stroke adjustment screw on the rear portion of the Model 1261.

Delivery Characteristics

Model	Del. per stroke cc	Max. strokes per minute water oper.	Max. strokes per minute air oper.	Discharge press. max. PSI	Max. viscosity centipoises
1261-1X-90X0	1 7	30	60	200	25
1261-2X-90X0	12.0	30	60	125	30

B

APPENDIX B

MONTHLY AVERAGE PERFORMANCE DATA FROM APRIL 1995 TO DECEMBER 1996

Water System: City of Florence
Source of Water: Wells
Chlorine Product Used: Gas

Month: A il 1995
No. of Services: 2,000
Strength as Tested: 100%

Water Supt: K-Lan [illegible]
Make & Type of Chlorination: V-100 Wallace & Tiernan

DATE	Master Meter Reading (x 1000)	Water Production in M.G.D.	CL_2 Scale Reading in Pounds	CL_2 Used in Pounds	Chlorine Residual Tests A.M.	Chlorine Residual Tests P.M.	KWH Meter Read	REMARKS
1	893208	.764	1170	60	.67	.68		
2	893972	.818	1110	60	.66	.73		
3	894790	.784	1050	60	.80	.68		
4	895574	.755	990	60	1.06	.84		
5	896329	.230	930	60	.89	.65		
6	896559	.896	870	70	.52	.63		
7	897455	.648	800	70	.68	.62		
8	898103	.909	760	60	.54	.55		
9	899012	.908	700	60	.65	.63		
10	899920	.922	640	60	.60	.46		
11	900842	.857	580	60	.66	.58		
12	901699	.626	520	50	.52	.50		
13	902325	.636	470	50	.58	.62		
14	902961	.621	420	50	.50	.62		
15	903582	.630	370	40	.49	.52		
16	904212	.696	330	50	.58	.67		
17	904908	.890	280	60	.62	.70		
18	905798	.424	220	40	.80	.79		
19	906222	.864	180	60	.69	.77		
20	907086	.649	80	50	.53	.47		
21	907738	.622	30	50	.56	.62		
22	908360	.695	4,000	50	.68	.56		
23	909055	.947	3980	60	.60	.50		
24	910002	.895	3920	60	.68	.40		
25	910897	.688	3,860	40	.46	.49		
26	911585	.752	3820	60	.80	.63		
27	912337	.891	3760	60	.56	.62		
28	913228	.924	3700	60	.50	.48		
29	914152	.903	3640	60	.55	.63		
30	915055	.951	3580	60	.59	.58		
31								

27.795

Water System: City of Florence
Source of Water: Wells
Chlorine Product Used: Gas

Month: May, 1995
No. of Services: 2,000
Strength as Tested: 100%

Water Supt: K. Laufear
Make & Type of Chlorination: Wallace & Tiernan - V-100

DATE	Master Meter Reading (x 1000)	Water Production in M.G.D.	CL_2 Scale Reading in Pounds	CL_2 Used in Pounds	Chlorine Residual Tests A.M.	P.M.	KWH Meter Read	REMARKS
1	158620	.947	3520	60	.52	.40		
2	159658	.911	3460	60	.53	.51		
3	160646	1.02	3400	70	.54	.56		
4	161764	.852	3330	40	.63	.55		
5	162708	.826	3270	60	.69	.70		
6	163534	.773	3210	60	.79	.54		
7	164392	.800	3160	60	1.0	.69		
8	165276	.704	3100	50	.69	.58		
9	166058	.761	3050	50	.68	.62		
10	166903	.893	3000	50	.62	.52		
11	167784	.703	2950	50	.53	.68		
12	168565	.757	2900	50	.71	.75		
13	169406	.740	2850	50	.75	.48		
14	170228	.765	2800	50	.73	.68		
15	171078	.721	2750	40	.70	.61		
16	171879	.772	2710	30	.67	.68		
17	172736	.742	2680	50	.28	.62		
18	173560	.766	2630	50	.74	.68		
19	174411	1.09	2580	50	.68	.58		
20	175621	1.24	2530	60	.62	.56		
21	176997	1.15	2470	70	.53	.67		
22	178273	1.1	2400	60	.40	.57		
23	179490	1.07	2340	60	.59	.62		
24	180683	1.0	2280	70	.55	.63		
25	181801	1.09	2210	70	.54	.60		
26	183021	1.06	2140	70	.51	.70		
27	184205	1.23	2070	70	.45	.43		
28	185562	1.09	2000	70	.25	.97		
29	186768	1.1	1930	70	.74	.63		
30	188000	1.18	1860	80	.54	.83		
31	189314	1.39	1780	100	.91	.60		

29.04

[illegible] - WATER TREATMENT PLANT - MONTHLY REPORT

MONTH June '95 SOURCE OF WATER Wells # OF SERVICES 2,000

DATE	METER READINGS		M. G. D.		CHLORINE DATA				FLUORIDE DATA			CHEMICAL USAGE	
	PLANT FLOW	WELL FLOW	H_2O USAGE	WASH H_2O USAGE	SCALE READING	USAGE (IN #)	A.M. TEST	P.M. TEST	POUNDS CHARGE	GALLONS USED	FINAL TEST	KM04 GALLONS	NA_2CO_3 POUNDS
1	919742	190849	1.19	.130	1680	90	.65	.45		45	1.03	35	200
2		192169	1.07	.180	1590	70	.82	.49		55	.98	30	200
3		193353	1.13	.12	1520	60	.84	.53	83#	50	.98	30	200
4		194605	1.31	.14	1460	80	.51	.59		55	1.03	35	200
5		190053	1.08	.120	1380	70	.63	.71		50	1.08	29	200
6		197254	.93	.100	1310	70	.32	.58	51#	40	.99	24	200
7		198288	.98	.100	1240	60	.31	.63		50	.98	27	200
8		199371	1.06	.111	1180	70	.52	.64		50	1.01	29	200
9		200545	1.02	.110	1110	70	.50	.61		45	.93	26	200
10		201671	1.03	.110	1040	70	.53	.71	61#	45	.99	25	200
11		202815	.900	.100	970	50	.69	.74		50	1.08	25	200
12		203815	.851	.094	920	60	.59	.49		50	1.08	30	200
13		204760	.850	.094	800	70	.43	.23		50	1.02	24	200
14		205704	.856	.095	790	60	.58	.63	64#	45	1.06	24	200
15		206655	.853	.094	730	60	.61	.72		50	.96	27	200
16		207602	.835	.092	670	60	.68	.66		50	.98	27	200
17		208529	.849	.094	610	60	.63	.65	48#	40	1.01	26	200
18		209472	.808	.089	550	60	.62	.74		40	.95	23	200
19		210369	.876	.097	490	60	.73	.76		50	.98	24	200
20		211342	.851	.094	430	60	.50	.45		50	.94	25	200
21		212287	.827	.091	360	70	.69	.42	59#	45	.98	20	200
22		213205	1.1	.120	300	80	.79	.59		50	1.07	28	200
23		214433	1.1	.120	230	80	.61	.63		50	.89	30	200
24		215652	1.14	.120	150	80	.37	.46	48#	50	1.03	30	200
25		216915	1.19	.130	3920	80	.68	.77		40	1.0	39	200
26		218241	1.33	.130	3840	80	.88	.64		40	1.05	46	300
27		219574	1.22	.130	3760	80	.91	.82		50	.99	35	300
28		220930	1.46	.160	3680	90	.50	.62		50	1.05	48	300
29		222558	1.81	.200	3590	120	.68	.53		60	.89	57	300
30		224571	1.67	.180	3470	110	.53	.66	98#	50	1.10	50	300
31			[illegible]	3.47		[illegible]							
TOTALS													

COMMENTS: Plant flow meter broken - Parts on the way -
6/24 - two new Cl_2 cylinders @ 4,000# net weight

CITY OF FLORENCE WATER TREATMENT PLANT - MONTHLY REPORT

MONTH July, 1995 SOURCE OF WATER Wells # OF SERVICES 2,000

DATE	METER READINGS		M. G. D.		CHLORINE DATA				FLUORIDE DATA			CHEMICAL USAGE	
	PLANT FLOW	WELL FLOW	H_2O USAGE	WASH H_2O USAGE	SCALE READING	USAGE (IN #)	A.M. TEST	P.M. TEST	POUNDS CHARGE	GALLONS USED	FINAL TEST	KM04 GALLONS	NA_2CO_3 POUNDS
1		226417	1.53	.18	3360	100	.76	.72		50	1.12	45	300
2		228113	1.63	.18	3260	110	.62	.71		50	1.03	50	300
3		229918	1.23	.13	3150	90	.67	.59	49#	50	1.07	50	300
4		231285	1.59	.17	3060	110	.68	.84		60	.96	78	300
5		233041	1.58	.17	2950	110	.69	.59		70	1.01	42	300
6		234789	1.31	.14	2840	100	.78	.62	59#	55	1.0	38	300
7		236234	1.48	.16	2740	90	.87	.60		55	.98	42	300
8		237870	1.32	.14	2650	80	.66	.72		55	1.09	40	300
9		239327	1.38	.15	2570	100	.86	.63	54#	50	.97	40	200
10		240853	1.51	.16	2470	100	.60	.56		50	1.09	40	200
11		242524	1.53	.16	2370	100	.58	.68		60	1.01	30	200
12		244213	1.54	.17	2270	100	.63	.58	52#	50	.99	45	300
13		245919	1.61	.17	2170	110	.68	.60		55	1.01	45	300
14		247700	1.44	.16	2060	110	.73	.74		50	1.03	35	300
15		249294	1.55	.17	1950	100	.76	.73		55	.92	37	300
16		251014	1.52	.16	1850	110	.58	.63		50	.99	40	300
17		252699	1.57	.17	1740	110	.80	.64	86#	45	.98	39	300
18		254441	1.51	.16	1630	100	.62	.63		45	1.01	30	300
19		256115	1.57	.17	1530	100	.63	.72		50	1.0	36	300
20		257859	1.66	.16	1430	100	.67	.67		50	.97	32	300
21		259518	1.69	.16	1330	100	.71	.73	66#	50	1.09	30	300
22		261211	1.52	.16	1230	100	.69	.74		50	.98	34	300
23		262894	1.61	.17	1130	100	.65	.62		55	1.14	46	300
24		264667	1.52	.16	1030	100	.68	.59		60	1.01	40	300
25		266346	1.39	.15	930	90	.68	.76	70#	50	1.13	40	300
26		267890	1.54	.17	840	100	.61	.79		55	.99	42	300
27		269601	1.62	.18	740	100	.69	.65		55	1.07	48	300
28		271402	1.58	.17	640	110	.58	6.2	52#	50	.98	40	300
29		273152	1.59	.17	530	100	.67	.74		50	.98	40	300
30		274915	1.75	.19	430	100	.78	.83		60	1.03	40	300
31		276854	1.46	.16	330	110	.74	.63		50	1.01	30	300
TOTALS			47.33	5.25									

COMMI :

MONTH Aug. '95 SOURCE OF WATER Wells # OF SERVICES 2,000

DATE	METER READINGS		M. G. D.		CHLORINE DATA				FLUORIDE DATA			CHEMICAL USAGE	
	PLANT FLOW	WELL FLOW	H_2O USAGE	WASH H_2O USAGE	SCALE READING	USAGE (IN #)	A.M. TEST	P.M. TEST	POUNDS CHARGE	GALLONS USED	FINAL TEST	KM04 GALLONS	NA_2CO POUND
1		278475	1.61	.17	220	100	.75	.66	66#	50	.98	30	300
2		280225	1.57	.17	120	100	.73	.70		55	1.09	65	300
3		281991	1.60	.17	20/4,000	100	.60	.58		55	1.02	45	300
4		283763	1.41	.14	3900	100	.71	.68	52#	50	.99	38	300
5		285174	1.34	.14	3800	80	.83	.58		50	1.06	40	300
6		286654	1.36	.15	3720	100	.72	.68		60	1.02	37	300
7		288163	1.30	.14	3620	90	.73	.48		55	1.09	35	300
8		289598	1.21	.13	3530	90	.69	.72		45	1.05	26	300
9		290940	1.38	.15	3440	90	.71	.67	86#	45	.90	29	300
10		292473	1.53	.17	3350	90	.66	.73		50	1.10	25	300
11		294165	1.53	.17	3260	100	.68	.70		45	.99	35	300
12		295862	1.65	.18	3160	110	.72	.63		55	1.01	37	300
13		297690	1.72	.19	3050	100	.63	.58	64#	50	.97	43	300
14		299596	1.80	.19	2950	110	.48	.43		50	.98	53	300
15		301584	1.73	.19	2840	110	.73	.62		55	.97	52	300
16		303502	1.44	.16	2730	110	.63	.58		55	1.02	40	300
17		305106	1.26	.13	2620	100	.83	.61	69#	45	1.01	30	300
18		306497	1.36	.15	2520	100	.63	.78		50	.99	45	300
19		308009	1.23	.13	2420	100	.51	.68		45	1.04	35	300
20		309367	1.59	.17	2320	100	.75	.73		55	1.01	45	300
21		311130	1.26	.13	2220	90	.78	.66	64#	45	1.03	35	300
22		312521	1.21	.13	2130	90	.76	.63		50	1.08	32	300
23		313860	1.21	.13	2040	80	.52	.68		55	1.0	33	300
24		315199	1.22	.10	1960	60	.50	.63		50	1.06	35	300
25		316519	1.47	.10	1900	60	.69	.60	66#	50	1.02	36	300
26		318088	1.24	.13	1840	90	.74	.68		50	1.03	34	300
27		319454	1.18	.10	1750	90	.89	.63		50	.98	30	300
28		320738	1.20	.10	1660	80	.69	.77		45	1.03	30	300
29		322034	1.14	.11	1580	80	.57	.63		50	.94	39	300
30		323287	1.15	.11	1500	80	.61	.58		55	1.02	33	300
31		324545	1.15	.10	1420	70	.66	.73		50	.97	32	300
TOTALS			42.85										

COMMENTS: 8/3 · Two new Cl_2 cylinders @ 4,000# net weight.

CITY OF FLORENCE WATER TREATMENT PLANT MONTHLY REPORT

MONTH Sept. '95 SOURCE OF WATER Wells # OF SERVICES 2,000

DATE	METER READINGS: PLANT FLOW	METER READINGS: WELL FLOW	M. G. D.: H_2O USAGE	M. G. D.: WASH H_2O USAGE	CHLORINE DATA: SCALE READING	CHLORINE DATA: USAGE (IN #)	CHLORINE DATA: A.M. TEST	CHLORINE DATA: P.M. TEST	FLUORIDE DATA: POUNDS CHARGE	FLUORIDE DATA: GALLONS USED	FLUORIDE DATA: FINAL TEST	CHEMICAL USAGE: KM04 GALLONS	CHEMICAL USAGE: NA_2CO_3 POUNDS
1		325794	1.15	.10	1350	80	.54	.68	66#	50	.99	32	300
2		327041	1.02	.10	1270	70	.68	.73		50	1.01	29	300
3		328158	1.01	.10	1200	50	.68	.58		35	.99	19	300
4		329173	.777	.070	1150	50	.67	.59		35	.98	21	300
5		329950	.747	.070	1100	50	.71	.68		35	1.02	19	300
6		330767	1.20	.11	1050	70	.68	.58	70#	55	1.11	31	300
7		332078	1.30	.13	980	90	.65	.68		50	1.08	30	300
8		333504	1.27	.14	890	90	.68	.53		50	1.01	35	300
9		334914	1.33	.11	800	90	.71	.67		58	1.08	32	300
10		336356	1.26	.11	710	90	.68	.58		50	.98	28	300
11		337752	1.35	.12	620	80	.54	.68	83#	50	1.06	36	300
12		339190	1.33	.11	540	80	.63	.56		50	1.03	44	300
13		340629	1.28	.11	460	80	.71	.68		50	1.08	32	300
14		342020	1.30	.11	380	90	.78	.51		50	.94	38	300
15		343428	1.37	.11	290	90	.73	.66	66#	50	.99	40	300
16		344908	1.21	.11	200	90	.76	.60		50	1.03	30	300
17		346227	1.21	.11	110	80	.68	.53		50	1.01	36	300
18		347556	1.29	.13	3920	80	.56	.63		50	1.08	38	300
19		248978	1.28	.13	3840	90	.61	.72	66#	45	1.06	34	300
20		350389	1.31	.13	3750	90	.54	.68		50	.98	32	300
21		351826	1.48	.14	3660	90	.76	.58		50	1.10	35	300
22		353450	1.37	.13	3570	100	.68	.72		55	1.01	35	300
23		354951	1.30	.13	3470	90	.53	.63		50	1.06	36	300
24		356378	1.19	.12	3380	80	.66	.58		50	1.03	40	300
25		357687	1.31	.13	3300	80	.71	.62	100#	40	1.02	39	300
26		359123	1.33	.13	3220	90	.64	.53		55	.97	35	300
27		360579	1.20	.11	3130	90	.56	.60		45	1.01	25	300
28		361888	1.34	.12	3040	90	.77	.61	46#	50	.98	37	300
29		363352	1.35	.12	2950	90	.55	.62		50	1.03	38	300
30		364821	1.22	.12	2860	90	.66	.69		50	1.08	30	300
31			37.										
TOTALS			37.[illegible]										

COMMENTS: 9/17. Two new Cl_2 cylinders @ 4,000 # net

[illegible]

C"TY OF FLORENCE - WATER TRI TMENT PLANT - MONTHLY RE RT

MONTH Oct. '95 SOURCE OF WATER Wells # OF SERVICES 2,000

DATE	METER READINGS		M. G. D.		CHLORINE DATA				FLUORIDE DATA			CHEMICAL USAGE	
	PLANT FLOW	WELL FLOW	H_2O USAGE	WASH H_2O USAGE	SCALE READING	USAGE (IN #)	A.M. TEST	P.M. TEST	POUNDS CHARGE	GALLONS USED	FINAL TEST	KM04 GALLONS	NA_2CO_3 POUNDS
1		366162	1.19	.12	2770	80	.72	.60		45	1.01	28	300
2		367470	1.16	.12	2690	80	.63	.65	64#	45	1.04	33	300
3		368754	1.32	.13	2610	80	.72	.61		50	1.03	37	300
4		370205	1.14	.12	2530	90	.69	.72		50	.98	30	300
5		371460	1.28	.12	2440	80	.61	.66	48#	50	1.08	35	300
6		372862	1.26	.13	2360	90	.67	.62		55	1.02	40	300
7		374247	1.14	.12	2270	80	.77	.63		50	1.04	30	300
8		375511	1.23	.12	2190	80	.68	.71		50	.96	30	300
9		376865	1.14	.11	2110	90	.64	.59		45	1.05	35	300
10		378110	1.26	.12	2020	60	.56	.61	83#	45	.98	30	300
11		379499	1.12	.11	1960	60	.76	.60		50	.99	35	300
12		380731	1.23	.12	1900	80	.71	.68		50	1.10	35	300
13		382082	1.15	.11	1820	80	.77	.71		50	1.14	25	300
14		383346	1.24	.12	1740	80	.58	.67		50	1.04	35	300
15		384704	1.02	.11	1660	80	.71	.64		50	1.02	28	300
16		385831	1.07	.11	1580	60	.76	.63	98#	40	1.02	32	300
17		387014	1.08	.12	1520	80	.50	.72		45	1.08	30	300
18		388213	1.21	.12	1440	80	.73	.66		50	1.0	34	300
19		389546	.930	.10	1360	60	.62	.68		55	1.07	31	300
20		390582	.990	.10	1300	70	.51	.69	62#	50	1.06	25	300
21		391671	.850	.11	1230	80	.56	.63		50	1.01	24	300
22		392631	.927	.11	1150	70	.68	.61		50	1.07	24	300
23		393569	.890	.11	1080	70	.69	.50	49#	45	.99	22	300
24		394570	.874	.11	1010	70	.67	.72		50	.98	10	300
25		395554	.920	.10	940	70	.64	.70		50	1.07	24	300
26		396577	.988	.10	870	70	.67	.62	49#	50	1.04	24	300
27		397565	1.10	.12	800	80	.74	.68		50	1.05	20	300
28		398783	1.15	.12	720	80	.69	.72		50	1.06	35	300
29		400049	1.12	.12	640	80	.60	.73		45	.97	30	300
30		401284	1.08	.12	560	80	.72	.63	62#	45	1.08	20	300
31		402485	1.11	.12	480	80	.68	.79		45	1.06	23	300
TOTALS													

COMMENTS:

CITY OF FLORENCE - WATER TREATMENT PLANT - MONTHLY REPORT

MONTH Nov. 95 SOURCE OF WATER Wells # OF SERVICES 2,200

DATE	METER READINGS: PLANT FLOW	METER READINGS: WELL FLOW	M. G. D.: H_2O USAGE	M. G. D.: WASH H_2O USAGE	CHLORINE DATA: SCALE READING	CHLORINE DATA: USAGE (IN #)	CHLORINE DATA: A.M. TEST	CHLORINE DATA: P.M. TEST	FLUORIDE DATA: POUNDS CHARGE	FLUORIDE DATA: GALLONS USED	FLUORIDE DATA: FINAL TEST	CHEMICAL USAGE: KM04 GALLONS	CHEMICAL USAGE: NA_2CO_3 POUNDS
1	—	403717	1.05	.104	400	80	.71	.72		45	1.05	22	300
2	METER	404876	.866	.085	320	60	.53	.68		50	.98	18	300
3	REPAIRED	405832	.772	.076	260	60	.51	.63	61#	55	1.02	22	300
4	BY	406690	.803	.082	200	60	.68	.53		55	1.07	15	200
5	FACTORY	407493	.793	.078	140	60	.53	.58		50	.98	15	200
6	—	408286	.734	.082	80	60	.66	.71	52#	45	1.08	20	300
7	919745	409102	.768	.077	20/4,000	60	.52	.50		50	.99	25	300
8	920513	410030	.870	.087	3940	60	.61	.72		55	1.10	35	300
9	921383	410987	.906	.086	3880	70	.56	.73	50#	50	1.02	35	300
10	922289	411979	.881	.087	3810	70	.69	.58		50	1.01	30	300
11	923170	412947	.874	.085	3730	70	.58	.70		50	.98	25	300
12	924044	413506	.878	.091	3660	70	.67	.71		50	1.04	50	300
13	924922	414875	.914	.100	3590	70	.66	.58	66#	40	1.07	40	300
14	925836	415889	.891	.089	3520	60	.43	.58		50	1.03	40	300
15	926727	416864	.893	.094	3460	80	.68	.44		50	.99	41	300
16	927620	417856	1.13	.123	3380	80	.71	.72		45	1.03	72	300
17	928749	419108	.895	1.05	3300	70	.79	.67	61#	30	.97	24	300
18	929644	420115	1.15	.120	3230	80	.65	.71		45	1.01	25	300
19	930796	421392	1.07	.110	3150	80	.68	.60		50	1.03	28	300
20	931863	422570	.950	.11	3070	80	.74	.68		45	.95	25	300
21	932974	423792	1.10	.120	2990	80	.77	.68	56#	45	.99	26	300
22	934076	425016	.712	.071	2910	50	.58	.66		50	1.02	15	300
23	934788	425799	.676	.054	2860	70	.57	.68		60	.93	10	200
24	935464	426529	.684	.078	2790	60	.69	.71		50	1.02	14	200
25	936148	427279	.651	.066	2730	60	.59	.62		50	1.03	16	200
26	936799	428008	.620	.084	2670	60	.69	.73		50	.99	15	200
27	937419	428712	.781	.129	2610	60	.61	.79	99#	40	1.10	15	200
28	938200	429662	.915	.110	2550	70	.78	.68		50	.99	25	300
29	939115	430655	.997	.156	2480	80	.89	.80		45	1.06	25	300
30	940112	431808	1.02	1.19	2400	80	.86	.82		45	1.00	10	300
31			26.24	4.87		2010							
TOTALS													

COMME 11/7 - Two new Cl_2 cylinders @ 4[illegible] # net / Plant flow meter refu[illegible] d
11/7 - [illegible] / [illegible]

1 NTH Dec. '95 SOURCE OF WA_R Wells # OF SERVICES 2,_20

DATE	METER READINGS		M. G. D.		CHLORINE DATA				FLUORIDE DATA			CHEMICAL USAG	
	PLANT FLOW	WELL FLOW	H_2O USAGE	WASH H_2O USAGE	SCALE READING	USAGE (IN #)	A.M. TEST	P.M. TEST	POUNDS CHARGE	GALLONS USED	FINAL TEST	KM04 GALLONS	NA_2CO POUND
1	941136	433000	1.06	.141	2320	80	.83	1.09	59#	45	.97	15	300
2	942194	434199	.908	.172	2240	80	.93	1.0		45	.99	20	300
3	943102	435288	.998	.140	2160	80	.98	.90		50	1.02	20	300
4	944100	436430	.990	.110	2080	80	.77	.86	46#	45	1.13	24	300
5	945090	437549	.657	.081	2,000	60	.72	.89		45	1.03	16	300
6	945747	438287	.650	.086	1940	50	.46	.95		55	1.02	15	200
7	946397	439023	.635	.080	1890	50	.49	.58		50	1.06	15	200
8	947032	439742	.693	.082	1820	60	.71	.76		50	.98	15	400
9	947725	440527	.646	.087	1760	60	.93	.67	83#	45	1.04	10	~~0~~
10	948371	441260	.600	.074	1700	60	.80	.62		50	1.12	20	200
11	948971	441934	.871	.0964	1640	40	.60	.68		50	.96	20	200
12	949842	442898	.139	.013	1600	40	.74	.63		10	.87	10	200
13	949981	443388	.903	.090	1560	50	.96	.84		35	.98	45	200
14	950884	445728	1.026	.102	1510	90	.90	.77		50	1.04	50	200
15	951910	448983	1.18	.118	1420	100	.55	.50		65	.99	50	200
16	953097	452403	1.12	.110	1320	80	.80	.65	99#	35	1.14	~~0~~	200
17	954220	455533	1.18	.110	1240	100	.99	.58		50	1.12	45	300
18	955395	458973	.949	.095	1130	80	.82	.74		50	1.10	37	300
19	956344	462072	1.05	.105	1050	90	.83	.61		55	1.12	23	200
20	957391	462072	1.11	.110	960	90	.88	.78	60#	60	1.01	20	200
21	958502	462072	.885	.088	870	80	.83	.93		65	1.05	20	200
22	959348	462072	.849	.085	790	90	.66	.80		55	.97	25	200
23	960197	462072	.764	.076	700	80	.88	.72		50	1.01	16	200
24	960961	462072	.878	.087	620	90	.80	.99		50	.89	30	200
25	961839	462141	.732	.073	530	80	.71	.68	93#	30	.98	15	200
26	962571	462141	.652	.059	450	60	.78	.73		25	1.07	15	200
27	963273	462852	.666	.063	390	60	.98	.57		45	.95	12	200
28	963889	463657	.680	.068	330	70	.79	.63		50	1.02	16	200
29	964569	464503	.602	.082	260	60	.78	.82		45	1.03	12	200
30	965171	465187	.660	.068	200	50	.75	.70		40	1.10	15	200
31	965831	465930	.667	.102	150	60	.88	.63		35	.89	21	200
TOTALS			25.39										

COMMENTS: 12/24. influent meter repaired.

CITY OF FLORENCE - WATER TREATMENT PLANT - MONTHLY REPORT

MONTH Jan. '96 SOURCE OF WATER Wells # OF SERVICES 2,200

DATE	METER READINGS		M. G. D.		CHLORINE DATA				FLUORIDE DATA			CHEMICAL USAG	
	PLANT FLOW	WELL FLOW	H_2O USAGE	WASH H_2O USAGE	SCALE READING	USAGE (IN #)	A.M. TEST	P.M. TEST	POUNDS CHARGE	GALLONS USED	FINAL TEST	KM04 GALLONS	NA_2 CC POUND
1	966500	466701	.636	.080	90	70	.76	.82	90#	50	.99	14	200
2	967136	467417	.740	.107	20/4,000	70	.42	.68		45	1.10	18	200
3	967876	468264	.849	.089	3930	70	.81	.63		45	.98	22	200
4	968725	469202	.853	.087	3860	70	.88	.71		40	.92	20	200
5	969578	470142	.840	.090	3790	70	.68	.89	59#	40	1.07	21	200
6	970418	471072	.892	.093	3720	70	.83	.74		45	1.18	25	200
7	971310	472057	.437	.043	3650	50	.88	.77		40	1.10	14	200
8	971747	472641	.921	.110	3600	70	.71	.83		45	1.09	15	300
9	972668	473690	1.08	.10	3530	70	.59	.75	52#	40	.99	20	300
10	973747	474871	1.07	.090	3460	70	.68	.58		45	1.05	25	300
11	974816	476038	.962	.088	3390	70	.82	.73		35	1.04	35	300
12	975778	477091	1.03	.10	3320	90	.81	.78		45	1.02	15	300
13	976807	478221	.950	.080	3230	80	.89	.73		50	1.18	20	300
14	977757	479257	.943	.097	3150	70	.81	.76	70#	40	1.02	30	300
15	978700	480300	.923	.097	3080	70	.68	.74		45	1.01	25	300
16	979623	481321	.998	.082	3010	70	.88	.76		40	1.04	35	300
17	980621	482406	.944	.106	2940	70	.69	.88		40	1.11	25	300
18	981565	483458	.817	.071	2870	60	.76	.80	54#	30	1.02	20	300
19	982382	484346	.856	.060	2810	70	.74	.81		40	.98	30	300
20	983237	485262	.746	.080	2740	60	.71	.66		45	1.02	24	300
21	983983	486088	.731	.080	2680	60	.80	.76		40	1.04	26	300
22	984714	486899	.723	.093	2620	60	.73	.89	51#	35	1.09	20	300
23	985437	487715	.806	.084	2560	60	.88	.79		40	1.08	25	
24	986243	488605	.889	.093	2500	40	.68	.73		40	1.07	30	300
25	987039	489494	.771	.120	2460	60	.99	.83		40	1.04	25	300
26	987810	490390	.820	.160	2400	70	.90	.98		45	1.02	25	300
27	988630	491378	.777	.078	2330	60	.28	.54	66#	45	1.0	35	300
28	989407	492243	.753	.087	2270	70	.74	.81		40	1.08	25	300
29	990160	493083	.762	.111	2200	70	.64	.76		35	.98	25	300
30	[illegible]922	493956	.819	.118	2130	70	.76	.78		45	.85	25	300
31	991741	494893	.940	.12	2000	70	.77	.83	54#	45	1.02	20	500
TOTALS			26.27	2.7		19[illegible]			496				

COMMEN[illegible] 1/2 - Two new [illegible] @ 4000# [illegible]

... WATER TREATMENT PLANT - MONTHLY REPORT

MONTH Feb '96 SOURCE OF WATER Wells # OF SERVICES 2,000

DATE	METER READINGS		M. G. D.		CHLORINE DATA				FLUORIDE DATA			CHEMICAL USAGE	
	PLANT FLOW	WELL FLOW	H_2O USAGE	WASH H_2O USAGE	SCALE READING	USAGE (IN #)	A.M. TEST	P.M. TEST	POUNDS CHARGE	GALLONS USED	FINAL TEST	KM04 GALLONS	NA_2CO POUND
1	992681	495958	1.09	.110	1990	70	.89	.78		45	1.08	15	500
2	993700	497155	.937	.123	1920	70	.87	.77		40	1.11	20	500
3	994707	498219	1.02	.120	1850	70	.86	.73		45	1.06	45	400
4	995726	499364	.977	.103	1780	80	.81	.78		40	1.10	35	300
5	996703	500446	1.08	.130	1700	70	.72	.73		45	1.04	30	400
6	997779	501663	1.140	.140	1630	80	.62	.79	86#	45	1.03	36	400
7	998922	502950	1.130	.110	1550	80	.86	.89		45	.96	39	400
8	000050	504197	1.09	.20	1470	90	.81	.78		45	1.02	35	500
9	01140	505488	1.09	.090	1380	80	.78	.63		45	1.02	39	400
10	2226	506671	1.07	.100	1300	80	.70	.72		45	.98	41	400
11	3300	507843	1.07	.090	1220	80	.82	.77		45	1.03	35	400
12	4368	509006	1.02	.10	1140	80	.81	.78	88#	40	1.04	34	400
13	5391	510132	1.05	.090	1060	80	.72	.88		45	1.01	36	400
14	6439	511281	1.06	.090	980	80	.73	.71		45	1.02	35	400
15	7494	512436	.885	.102	900	60	.77	.82		50	.99	33	400
16	8379	513423	.886	.130	840	60	.62	.73		45	1.08	24	400
17	9265	514444	.831	.110	780	80	.56	.63	75#	50	1.01	28	400
18	10096	515392	.813	.140	700	60	.74	.60		50	1.02	28	400
19	10909	516347	.725	.139	640	70	.65	.73		45	1.09	25	400
20	11634	517211	.827	.140	570	70	.81	.65		45	1.07	35	400
21	12461	518180	.784	.10	500	70	.68	.72	62#	45	.96	30	300
22	13245	519066	.689	.085	430	60	.71	.68		45	1.08	20	200
23	13934	519840	.799	.098	370	60	.73	.73		50	.98	18	200
24	14733	520737	.806	.099	310	70	.81	.78		45	1.02	22	200
25	15539	521642	.715	.117	240	70	.73	.80		45	1.07	18	200
26	16254	522474	.763	.112	170	60	.83	.79	77#	40	.96	17	100
27	17017	523349	.859	.058	110	70	.85	.72		45	1.08	20	100
28	17876	524266	.851	.067	4000	70	.67	.78		45	1.04	19	100
29	18727	525184	.860	.086	3930	70	.72	.82		50	.97	21	100
30													
31			26.92	2.99		2,000			388				
TOTALS													

COMMENTS:

CITY OF FLORENCE - WATER TREATMENT PLANT - MONTHLY REPORT

MONTH march '96 SOURCE OF WATER wells # OF SERVICES 2,200

DATE	METER READINGS		M. G. D.		CHLORINE DATA				FLUORIDE DATA			CHEMICAL USAG	
	PLANT FLOW	WELL FLOW	H_2O USAGE	WASH H_2O USAGE	SCALE READING	USAGE (IN #)	A.M. TEST	P.M. TEST	POUNDS CHARGE	GALLONS USED	FINAL TEST	KM04 GALLONS	NA_2CO POUND
1	19587	526130	.921	.089	3870	70	.81	.74	59#	45	.99	19	100
2	20508	527142	.896	.089	3790	80	.66	.71		50	1.03	23	100
3	21404	528127	.740	.091	3710	60	.79	.68		45	1.03	16	100
4	22144	528938	.854	.110	3650	70	.62	.79		45	.98	21	100
5	22998	529922	.845	.105	3580	70	.60	.74	61#	45	.97	19	100
6	23843	530872	.849	.096	3510	70	.67	.61		50	.99	24	100
7	24692	531817	.887	.097	3440	60	.81	.69		50	.95	17	100
8	25579	532801	.799	.090	3380	60	.63	.72		40	.98	20	100
9	26378	533600	.888	.105	3320	80	.67	.83		50	.93	30	100
10	27266	534683	.847	.077	3240	80	.83	.75		45	.92	25	100
11	28113	535607	.846	.089	3180	60	.84	.85	93.5#	45	1.01	20	100
12	28959	536542	.850	.089	3120	60	.70	.71		45	1.12	25	100
13	29809	537481	.838	.094	3040	80	.72	.69		50	1.04	25	100
14	30647	538413	.846	.094	2980	60	.55	.63		45	.98	20	100
15	31493	539353	.843	.097	2900	60	.72	.68		45	.97	25	100
16	32336	540293	.846	.086	2840	80	.70	.68		50	.99	25	100
17	33182	541225	.862	.102	2760	80	.67	.63	93.5#	45	.95	20	100
18	34044	542189	.854	.105	2700	60	.64	.68		50	.97	25	100
19	34898	543148	.863	.112	2640	80	.85	.83		50	1.02	20	100
20	35761	544123	.825	.120	2560	60	.89	.80		45	1.04	23	100
21	36586	545068	.941	.140	2500	80	.82	.80	62#	45	1.02	22	100
22	37527	546157	1.03	.160	2420	80	.77	.65		50	1.18	27	100
23	38553	547346	.957	.123	2340	70	.80	.76		45	1.10	24	100
24	39510	548424	.886	.111	2270	70	.66	.71		40	1.02	25	100
25	40396	549421	.991	.110	2200	70	.78	.73	59#	45	1.11	20	100
26	41387	550533	.978	.112	2130	70	.73	.67		45	1.09	25	100
27	42365	551626	1.0	.10	2060	100	.66	.61		55	1.0	30	100
28	43369	553386	.890	.089	1960	80	1.3	.68		50	.101	20	100
29	44259	556506	1.09	.10	1880	80	.83	.71		50	1.03	24	100
30	45349	557126	.0842	.084	1800	60	.83	.71		50	1.08	21	100
31	46191	557126	.818	.081	1740	70	.63	.73	95#	45	1.0	23	100
TOTALS			27.42	3.14		2,210			523				

COMMEN 3/29 - Influent meter not [illegible] - Sent to factory - [illegible]

... WATER TREATMENT PLANT - MONTHLY REPORT

MONTH April '96 SOURCE OF WATER Wells # OF SERVICES 2,200

DATE	METER READINGS: PLANT FLOW	METER READINGS: WELL FLOW	M. G. D.: H_2O USAGE	M. G. D.: WASH H_2O USAGE	CHLORINE DATA: SCALE READING	CHLORINE DATA: USAGE (IN #)	CHLORINE DATA: A.M. TEST	CHLORINE DATA: P.M. TEST	FLUORIDE DATA: POUNDS CHARGE	FLUORIDE DATA: GALLONS USED	FLUORIDE DATA: FINAL TEST	CHEMICAL USAGE: KM04 GALLONS	CHEMICAL USAGE: NA_2CO_3 POUNDS
1	47009	557126	.802	.089	1670	70	.67	.65		45	1.16	22	100
2	47811		.829	.083	1600	80	.72	.83		30	1.08	22	100
3	48640		.638	.068	1520	60	.68	.71		40	1.06	23	100
4	49278		.636	.068	1460	60	.73	.66		50	1.12	17	100
5	49917		.902	.118	1400	70	.71	.80	69#	50	1.0	23	100
6	50816		.821	.082	1330	70	.75	.81		50	1.11	20	100
7	51637		.801	.088	1260	60	.77	.70		50	.98	20	100
8	52438		.859	.090	1200	70	.68	.71		50	1.03	20	100
9	53297		.822	.088	1130	60	.69	.63		50	1.18	21	100
10	54119		.845	.099	1070	70	.74	.81	83#	45	.98	25	100
11	54964		.845	.089	1,000	70	.81	.85		45	1.05	15	100
12	55809		.864	.088	930	60	.88	.62		50	1.15	20	100
13	56673		.850	.089	870	70	.71	.68		50	1.11	20	100
14	57523		.833	.089	800	70	.68	.59		45	1.04	18	100
15	58356		.808	.088	730	60	.61	.78	78#	45	1.08	16	100
16	59164		.855	.100	670	70	.74	.81		45	1.10	16	100
17	60015		.795	.080	600	60	.88	.66		45	.97	15	100
18	60814		.840	.102	540/2,000	60	.71	.63		50	1.01	20	100
19	61654		.891	.107	2480	70	.58	.74	59#	50	1.20	15	100
20	62545		.844	.108	2410	60	.79	.84		50	1.02	20	100
21	63389		.745	.080	2350	60	.74	.81		55	1.12	20	100
22	64134		.832	.089	2320	80	.49	.56		55	1.13	20	100
23	64966		.813	.088	2240	40	.61	.55		20	1.06	25	100
24	65779		.812	.088	2200	60	.69	.45		50	1.09	15	100
25	66591		.817	.090	2140	80	.73	.59	93.5#	50	1.14	20	100
26	67408		.839	.094	2060	60	.68	.72		50	1.13	22	100
27	68247		.803	.091	2000	60	.57	.66		55	1.07	20	100
28	69050		.795	.080	1940	60	.73	.66		50	1.10	18	100
29	69845		.796	.080	1880/2000	60	.71	.67	67#	50	1.09	18	100
30	70641		.823	.090	3820	60	.77	.59		50	1.12	22	100
31													
TOTALS			24.245										

COMMENTS: Well flow meter broken. In to factory for repair

CITY OF FLORENCE - WATER TREATMENT PLANT - MONTHLY REPORT

MONTH May '96 SOURCE OF WATER wells # OF SERVICES 2,200

DATE	METER READINGS		M. G. D.		CHLORINE DATA				FLUORIDE DATA			CHEMICAL USAGE	
	PLANT FLOW	WELL FLOW	H_2O USAGE	WASH H_2O USAGE	SCALE READING	USAGE (IN #)	A.M. TEST	P.M. TEST	POUNDS CHARGE	GALLONS USED	FINAL TEST	KM04 GALLONS	NA_2CO POUND
1	71464	}	.822	.088	3760	60	.76	.63		50	1.10	20	100
2	72286		.909	.100	3700	70	.78	.66		50	1.08	25	100
3	73195		1.02	.102	3630	70	.68	.53	66#	50	1.10	25	100
4	74216		.893	.090	3560	70	.77	.58		50	1.09	20	100
5	75109	557128	.907	.097	3490	70	.67	.68		50	1.08	25	100
6	76016	557128	1.0	.10	3420	70	.69	.68	50#	50	1.0	30	100
7	77020	557615	1.0	.10	3350	70	.69	.80		50	1.11	30	100
8	78020	558294	1.01	.101	3280	70	.75	.89		50	1.01	30	100
9	79028	558979	1.22	.120	3210	80	.83	.61	50#	50	.99	30	100
10	80245	559839	1.32	.130	3130	90	.55	.68		55	1.07	30	100
11	81569	560786	1.20	.120	3040	100	.78	.83		60	1.09	30	100
12	82772	561656	1.25	.125	2940	80	.71	.79		60	1.10	35	100
13	84025	562584	1.23	.123	2860	90	.78	.82	75#	50	1.05	33	100
14	85250	563457	.822	.082	2770	70	.72	.83		50	1.07	20	100
15	86072	564006	.685	.068	2700	60	.73	.66		55	1.16	10	100
16	86757	564443	1.11	.111	2640	80	.85	.63		65	1.05	26	100
17	87870	565263	1.27	.127	2560	90	.73	.75	73#	50	1.21	39	100
18	89144	566201	1.19	.120	2470	90	.82	.66		55	1.19	30	100
19	90243	567090	1.01	.10	2380	80	.77	.68		50	1.10	20	100
20	91355	567845	1.10	.110	2300	80	.69	.76	51#	50	1.04	17	100
21	92451	568659	.855	.085	2220	70	.82	.67		50	1.01	18	100
22	93306	569285	.766	.076	2150	60	.93	.71		40	1.10	20	100
23	94072	569839	1.04	.10	2090	80	.58	.77		50	1.06	20	100
24	95115	570604	1.14	.114	2010	80	.81	.88	63#	50	1.07	20	100
25	96260	571441	1.05	.105	1930	90	.73	.70		55	1.13	25	100
26	97310	572225	.965	.96	1840	80	.61	.79		45	1.10	20	100
27	98275	572970	1.06	.10	1760	80	.81	.68		55	1.07	21	100
28	99333	573781	1.14	.110	1680	90	.82	.71	68#	30	1.01	29	100
29	110473	574652	1.15	.115	1590	80	.88	.64		50	1.09	30	100
30	101645	575525	1.39	.130	1510	90	.72	.74		50	1.09	30	100
31	103012	576548	1.33	.130	1420	90	.88	.71		50	1.0	35	100
TOTALS			32.65	3.03									

COMMEN

MONTH June '96 SOURCE OF WATER Wells # OF SERVICES 2,200

DATE	METER READINGS		M. G. D.		CHLORINE DATA				FLUORIDE DATA			CHEMICAL USAGE	
	PLANT FLOW	WELL FLOW	H_2O USAGE	WASH H_2O USAGE	SCALE READING	USAGE (IN #)	A.M. TEST	P.M. TEST	POUNDS CHARGE	GALLONS USED	FINAL TEST	KM04 GALLONS	NA_2CO_3 POUNDS
1	104346	577559	1.30	.130	1330	100	.83	.69		60	1.09	30	100
2	105650	578553	1.29	.120	1230	90	.67	.73		50	1.02	35	100
3	106941	579516	1.34	.130	1140	100	.62	.76	93#	50	1.08	30	100
4	108277	580521	1.31	.130	1040	100	.89	.73		55	1.10	45	100
5	109591	581518	1.36	.130	940	100	.77	.80		55	1.12	45	100
6	110954	582550	1.33	.133	840	100	.82	.88	52#	50	1.06	50	100
7	112280	583566	1.44	.104	740	100	.88	.89		50	.93	45	100
8	113724	584657	1.37	.130	640	100	.83	.80		55	1.09	45	100
9	115098	585706	1.25	.120	540	100	.81	.79		50	.98	35	100
10	116345	586644	1.13	.100	440	100	.84	.89	67#	50	1.07	25	100
11	117477	587534	1.18	.100	340	80	.78	.83		50	1.07	35	100
12	118654	588410	1.30	.130	260	100	.69	.75		50	1.06	28	100
13	119958	589420	1.37	.130	160	100	.67	.81		55	1.09	42	100
14	121333	590551	1.40	.140	60/4,000	110	.68	.77	67#	50	1.10	40	100
15	122742	591697	1.41	.140	3890	110	.79	.80		55	1.01	40	100
16	124138	592760	1.31	.130	3780	120	.71	.83		55	1.08	45	100
17	125447	593840	1.36	.170	3660	110	.82	.78	52#	50	.93	35	100
18	126809	594927	1.39	.140	3550	120	.81	.89		55	1.10	40	100
19	128199	596047	1.38	.150	3430	100	.88	.81		55	1.03	38	100
20	129576	597171	1.38	.150	3330	100	.84	.79		55	1.09	40	100
21	130961	598287	1.36	.140	3230	100	.78	.71	70#	50	.99	40	100
22	132323	599404	1.35	.150	3130	100	.77	.82		50	1.10	40	100
23	133678	600547	1.23	.130	3030	90	.86	.71		50	1.0	36	100
24	134911	601541	1.28	.151	2940	100	.71	.82		55	1.10	40	100
25	136188	602602	1.22	.140	2840	100	.83	.81	70#	50	.93	39	100
26	137406	603637	1.21	.140	2740	100	.92	.81		50	1.06	33	100
27	138617	604659	1.26	.151	2640	100	.75	.83		60	.98	37	100
28	139880	605723	1.04	.108	2540	80	.81	.80	52#	50	1.15	25	100
29	140926	606543	1.06	.110	2460	80	.93	.73		50	1.0	15	100
30	141986	607448	1.16	.130	2380	80	.69	.83		60	1.06	30	100
31			38.777										
TOTALS				4.30		2970							

COMMENTS: 6/14 - Two new Cl_2 cylinders @ 4,000 # net
6/3 - Drained and cleaned NaF feed tank & transfer pum...

CITY OF FLORENCE - WATER TREATMENT PLANT - MONTHLY REPORT

MONTH July '96 SOURCE OF WATER Wells # OF SERVICES 2,200

DATE	METER READINGS		M. G. D.		CHLORINE DATA				FLUORIDE DATA			CHEMICAL USAG	
	PLANT FLOW	WELL FLOW	H_2O USAGE	WASH H_2O USAGE	SCALE READING	USAGE (IN #)	A.M. TEST	P.M. TEST	POUNDS CHARGE	GALLONS USED	FINAL TEST	KM04 GALLONS	NA_2CO POUND
1	143148	608371	1.17	.123	2300	80	.53	.77		50	1.06	30	100
2	144416	609454	1.33	.158	2210	100	.66	.79	70#	55	1.08	40	100
3	145743	610555	1.12	.120	2110	90	.78	.81		50	1.06	38	100
4	146559	611483	1.18	.128	2020	90	.89	.77		50	1.02	22	100
5	148034	612475	1.25	.150	1930	90	.90	.81	50#	50	1.11	20	100
6	149289	613518	1.19	.138	1840	90	.82	.80		50	.98	30	100
7	150482	614491	1.20	.138	1750	80	.83	.85		50	1.02	26	100
8	151685	615476	1.14	.130	1670	80	.84	.79		50	1.06	29	100
9	152820	616454	1.25	.151	1580	100	.84	.63	66#	50	1.09	25	100
10	154065	617545	1.20	.143	1480	90	.63	.81		50	.98	35	100
11	155268	618604	1.23	.151	1390	90	.88	.82		50	1.07	35	100
12	156499	619676	1.35	.158	1300	100	.68	.73	50#	50	1.10	40	100
13	157850	620869	1.41	.149	1200	100	.81	.79		50	1.03	44	100
14	159260	622093	1.25	.143	1100	100	.78	.88		50	1.05	40	100
15	160514	623178	1.25	.143	1000	100	.72	.83		50	1.06	48	100
16	161769	624299	1.30	.152	900	100	.86	.81		50	1.10	40	100
17	162067	625452	1.19	.126	800	100	.85	.76	83#	50	1.13	32	100
18	164260	626564	1.28	.137	700	100	.63	.77		50	1.03	40	100
19	165540	627602	1.34	.162	600	100	.69	.78		50	.97	50	100
20	166879	628857	1.22	.148	500	100	.88	.79		55	1.10	40	100
21	168095	629936	1.17	.121	400	100	.73	.79		50	1.0	45	100
22	169263	630951	1.48	.163	300	120	.81	.73	86#	50	1.06	25	100
23	170740	632244	1.17	.128	180	110	.84	.72		50	1.08	30	100
24	171910	633283	1.14	.122	70/4,000	100	.26	.66		50	1.10	35	100
25	173052	634291	1.14	.122	3900	100	.89	.67	49#	50	1.11	35	100
26	174193	635330	1.29	.141	3800	100	.73	.81		50	.97	40	100
27	175483	636494	1.30	.142	3700	110	.79	.85		40	1.01	30	100
28	176777	637658	1.02	.090	3590	100	.88	.79		55	1.12	30	100
29	177800	638620	1.21	.138	3490	100	.81	.72		45	.99	35	100
30	179010	639727	1.35	.128	3390	110	.89	.78		50	1.05	30	100
31	180765	640829	1.15	.121	3280	100	.88	.70	100#	45	1.02	25	100
TOTALS			38.27	4.26		3020							

COMMEN 7/31 - Cleaned NaF tank & pump / 7/24 - 2 new Cl2 cylinder

...OF FLORENCE - WATER TREATMENT PLANT - MONTHLY REPORT

MONTH August, '96 SOURCE OF WATER wells # OF SERVICES 2,200

DATE	METER READINGS: PLANT FLOW	METER READINGS: WELL FLOW	M.G.D.: H_2O USAGE	M.G.D.: WASH H_2O USAGE	CHLORINE DATA: SCALE READING	CHLORINE DATA: USAGE (IN #)	CHLORINE DATA: A.M. TEST	CHLORINE DATA: P.M. TEST	FLUORIDE DATA: POUNDS CHARGE	FLUORIDE DATA: GALLONS USED	FLUORIDE DATA: FINAL TEST	CHEMICAL USAGE: KM04 GALLONS	CHEMICAL USAGE: NA_2CO_3 POUNDS
1	181511	641908	1.21	.135	3180	100	.78	.67		55	1.08	30	100
2	182723	642999	1.27	.133	3080	100	.69	.77		50	1.18	32	100
3	183988	644176	1.20	.136	2980	100	.88	.79		60	1.10	30	100
4	185192	645282	1.03	.112	2880	100	.72	.68		50	1.06	30	100
5	186226	646238	1.18	.122	2790	100	.81	.78	83#	50	1.16	37	100
6	187404	647341	.990	.082	2680	90	.73	.80		45	1.11	23	100
7	188394	648224	1.20	.131	2590	90	.81	.73		45	1.03	35	100
8	189588	649268	1.32	.142	2500	110	.87	.77		60	1.02	35	100
9	190917	650421	1.47	.159	2390	45	.89	.81	66#	45	1.0	35	100
10	192387	651720	.382	.039	2280	60	.81	.76		10	1.03	20	100
11	192769	652706	1.51	.159	2220	100	.83	.77		65	1.06	30	100
12	194279	653288	1.39	.144	2120	100	.78	.82		40	1.08	40	100
13	195675	654484	1.35	.142	2020	130	.34	.88	50#	45	1.20	35	100
14	197025	655629	1.32	.130	1890	120	.92	.84		45	1.06	45	100
15	198349	656751	1.32	.130	1770	150	.91	.80		40	1.16	25	100
16	199644	657898	1.26	.120	1620	120	.95	1.2		45	1.07	35	100
17	200926	659012	1.26	.120	1500	100	1.03	.98		50	1.05	30	100
18	202188	660133	1.23	.140	1400 *	100	1.52	1.23		35	1.16	40	100
19	203417	661236	1.18	.120	3300	100	.90	.86	86#	45	1.16	.32	100
20	204192	662297	1.16	.118	3230	100	.91	.83		45	1.09	28	100
21	205775	663335	1.27	.123	3130	110	.81	.86		45	1.15	36	100
22	207023	664454	1.28	.121	3020	100	.80	.73		45	1.06	29	100
23	208306	665506	1.25	.120	2920	110	.78	.82	59#	40	.98	30	100
24	209559	666699	1.33	.130	2810	110	.86	.88		45	1.10	35	100
25	210886	667914	1.05	.100	2700	100	.81	.76		45	1.0	20	100
26	211935	668892	1.22	.120	2600	90	.86	.91		40	1.09	30	100
27	213156	670004	1.20	.110	2510	90	.81	.83		45	1.08	30	100
28	214351	671073	1.14	.139	2420	100	.78	.86	70#	40	1.02	35	100
29	215488	672106	1.20	.116	2320	90	.87	.81		45	1.10	30	100
30	216685	673163	1.23	.117	2230	100	.78	.88		45	1.03	30	100
31	217915	674269	1.16	.111	2130	100	.82	.73		45	1.12	30	100
TOTALS			37.56										

COMMENTS: 8/18 - changed exhausted Cl_2 cylinder - 2,000 # net weight

CITY OF FLORENCE - WATER TREATMENT PLANT - MONTHLY REPORT

MONTH Sept. 96 SOURCE OF WATER wells # OF SERVICES 2,200

DATE	METER READINGS		M. G. D.		CHLORINE DATA				FLUORIDE DATA			CHEMICAL USAG	
	PLANT FLOW	WELL FLOW	H_2O USAGE	WASH H_2O USAGE	SCALE READING	USAGE (IN #)	A.M. TEST	P.M. TEST	POUNDS CHARGE	GALLONS USED	FINAL TEST	KM04 GALLONS	NA_2CO POUND
1	219072	675335	1.11	.100	2030	90	.76	.83		45	.98	27	100
2	220183	676349	1.06	.089	1940	90	.82	.80		40	1.06	24	100
3	221242	677340	1.08	.090	1850	90	.88	.79	86#	40	1.09	24	100
4	222321	678335	1.18	.100	1760	90	.84	.78		45	1.01	25	100
5	223502	679385	1.15	.102	3670	80	.85	.73		50	1.08	22	100
6	224647	680413	1.14	.109	3590	90	.76	.81		45	1.12	30	100
7	225836	681500	1.13	.101	3500	90	.79	.89		45	1.08	27	100
8	226965	682520	1.11	.098	3410	80	.85	.82		40	1.13	21	100
9	228070	683486	1.12	.100	3330	90	.78	.81	88#	45	1.08	27	100
10	229187	684483	1.12	.101	3240	90	.74	.82		45	1.09	24	100
11	230307	685533	.911	.088	3150	90	.71	.73		45	1.09	25	100
12	231409	686544	1.08	.092	3060	90	.83	.88		45	1.02	20	100
13	232489	687557	1.01	.090	2970	90	.75	.81		40	1.04	15	100
14	233498	688534	1.01	.090	2880	90	.82	.85		35	1.08	30	100
15	234510	689549	1.15	.098	2790	90	.85	.87		55	1.01	10	100
16	235660	690521	.999	.091	2700	80	.84	.64	96#	60	1.14	20	100
17	236659	691482	.986	.090	2620	100	.67	.69		70	1.16	20	100
18	237645	692449	.986	.090	2520	80	.88	.87		60	1.06	20	100
19	238631	693413	.482	.092	2440	100	.83	.81		65	1.0	25	100
20	239613	694372	1.04	.100	2340	80	.57	.79		60	1.13	20	100
21	240655	695389	.998	.093	2260	100	.81	.89		65	1.09	20	100
22	241653	696376	.921	.091	2160	90	.75	.88		60	1.05	21	100
23	242517	697275	1.04	.098	2070	80	.38	.52		55	1.08	22	100
24	243612	698252	1.08	.096	1990/2000	80	.59	.63		55	1.10	18	100
25	244689	699260	1.09	.098	3910	90	.66	.76	100#	45	1.0	22	100
26	245782	700278	1.08	.097	3820	90	.73	.68		50	1.07	22	100
27	246859	701281	1.23	.103	3730	90	.78	.81		50	1.18	20	100
28	248030	702389	1.10	.092	3640	90	.80	.73		45	1.06	20	100
29	249194	703410	1.06	.090	3550	90	.73	.69		45	1.06	24	100
30	250255	703892	1.05	.091	3460	80	.71	.73	76#	40	1.12	21	100
31			31.07	2.86		2650							
TOTALS													

COMMEN 9/24 - changed 1 ton cylinder 9/25 - cleaned NaF tank & feed - [illegible]

CITY OF FLORENCE - WATER TREATMENT PLANT - MONTHLY REPORT

MONTH Oct. 96 SOURCE OF WATER Wells # OF SERVICES 2,200

DATE	METER READINGS: PLANT FLOW	METER READINGS: WELL FLOW	M. G. D.: H_2O USAGE	M. G. D.: WASH H_2O USAGE	CHLORINE DATA: SCALE READING	CHLORINE DATA: USAGE (IN #)	CHLORINE DATA: A.M. TEST	CHLORINE DATA: P.M. TEST	FLUORIDE DATA: POUNDS CHARGE	FLUORIDE DATA: GALLONS USED	FLUORIDE DATA: FINAL TEST	CHEMICAL USAGE: KM04 GALLONS	CHEMICAL USAGE: NA_2CO_3 POUNDS
1	251301	705351	1.06	.092	3380	80	.64	.77		45	1.06	25	100
2	252359	706338	1.05	.091	3300	80	.77	.72		50	1.04	18	100
3	253404	707317	1.09	.091	3220	90	.79	.82		50	1.02	27	100
4	254494	708346	1.16	.093	3130	90	.81	.79	61#	50	1.11	20	100
5	255051	709418	1.07	.092	3040	90	.76	.82		50	1.06	25	100
6	256719	710433	.942	.089	2950	80	.77	.83		45	1.02	20	100
7	257661	711333	.999	.090	2870	90	.72	.80		45	.97	20	100
8	258600	712332	1.06	.091	2780	80	.66	.72		50	1.02	24	100
9	259716	713329	1.06	.091	2700	80	.61	.76	80#	45	1.08	21	100
10	260780	714334	1.06	.091	2620	80	.62	.73		55	1.12	20	100
11	261837	715327	1.11	.098	2540	90	.72	.81		55	1.18	23	100
12	262443	716426	1.02	.090	2450	90	.81	.73		50	1.09	22	100
13	263661	717357	.956	.089	2360	90	.76	.80		50	1.08	19	100
14	264918	718259	1.01	.090	2270	80	.65	.74	85#	45	1.0	16	100
15	265930	719241	.961	.089	2190	90	.71	.73		50	1.09	23	100
16	266891	720160	1.0	.090	2100	90	.59	.68		50	1.01	20	100
17	267895	721114	.942	.090	2010	70	.62	.77		50	1.19	25	100
18	268837	722042	.900	.088	3940	70	.63	.71		50	1.08	19	100
19	269737	722860	.867	.081	3870	70	.81	.78	85#	50	1.02	20	100
20	270604	723632	.696	.062	3800	70	.74	.82		50	1.14	16	100
21	271300	724269	.863	.082	3730	70	.71	.75		50	1.12	15	100
22	272163	725079	.875	.083	3660	70	.69	.77	48#	50	.99	17	100
23	273038	725880	.864	.083	3590	80	.55	.68		50	1.03	16	100
24	273902	726674	.853	.082	3510	70	.88	.79		50	1.05	22	100
25	274755	727442	.959	.088	3440	80	.77	.68		50	1.10	18	100
26	275703	728300	.860	.081	3360	80	.82	.73		50	1.01	16	100
27	276563	729079	.786	.076	3280	70	.81	.71		40	1.06	20	100
28	277349	729810	.787	.072	3210	70	.78	.81	96#	45	1.08	16	100
29	278136	730573	.850	.083	3140	80	.79	.80		50	1.10	20	100
30	278986	731350	.861	.084	3060	70	.77	.79		60	1.02	17	100
31	279847	732146	.858	.084	2990	80	.56	.72		50	1.11	18	100
TOTALS			29.43	2.76		2470							

COMMENTS: 10/17- changed exhausted CL_2 cylinder.
10/28- cleaned ... [illegible]

CITY OF FLORENCE - WATER TREATMENT PLANT - MONTHLY REPORT

MONTH Nov. 96 SOURCE OF WATER Wells # OF SERVICES 2,200

DATE	METER READINGS		M. G. D.		CHLORINE DATA				FLUORIDE DATA			CHEMICAL USAGE	
	PLANT FLOW	WELL FLOW	H_2O USAGE	WASH H_2O USAGE	SCALE READING	USAGE (IN #)	A.M. TEST	P.M. TEST	POUNDS CHARGE	GALLONS USED	FINAL TEST	KM04 GALLONS	NA_2CO_3 POUNDS
1	280705	732936	.867	.085	2910	70	.82	.76	64#	45	1.50	21	50
2	281572	733757	.902	.089	2840	80	.78	.83		50	1.06	17	50
3	282474	734588	.786	.076	2760	80	.72	.66		50	1.08	15	50
4	283260	735311	.848	.084	2680	80	.63	.72		50	1.02	16	50
5	284108	736103	.867	.086	2600	70	.82	.77	66#	50	1.08	16	50
6	284975	736899	.872	.087	2530	80	.76	.80		50	1.10	20	50
7	285847	737692	.840	.084	2450	80	.80	.73		50	.98	20	50
8	286687	738453	.919	.090	2370	80	.83	.76		50	1.02	15	50
9	287606	739287	.884	.087	2290	80	.79	.81	66#	50	1.10	20	50
10	288490	740092	.833	.083	2210	80	.72	.80		50	1.13	17	50
11	289323	740839	.801	.078	2130	70	.77	.82		50	1.10	16	50
12	290124	741589	.814	.080	~~2060~~ 2000	70	.72	.81	49#	40	1.02	16	50
13	290938	742297	.832	.085	3990	70	.84	.78		55	1.18	16	50
14	291770	743030	.815	.081	3920	70	.81	.69		55	1.28	16	50
15	292585	743746	.868	.087	3850	70	.76	.78	49#	50	1.09	19	50
16	293453	744515	.775	.075	3780	70	.81	.71		50	1.19	13	50
17	294228	745216	.765	.076	3710	70	.76	.81		50	1.10	16	50
18	294993	745893	.684	.066	3640	60	.81	.77		50	1.23	16	50
19	295677	746493	.559	.056	3580	50	.51	.68		45	1.31	15	50
20	296236	746997	.906	.088	3530	70	.62	.73	81#	40	1.19	17	50
21	297142	747813	.920	.090	3460	80	.88	.69		55	1.21	24	50
22	298062	748600	.981	.097	3380	80	.92	.70		55	1.12	22	50
23	299043	749533	.887	.087	3300	70	.73	.81		50	1.09	22	50
24	299930	750344	.762	.076	3230	60	.84	.72		50	1.21	16	50
25	300692	751070	.866	.086	3170	70	.80	.76	83#	45	1.01	19	50
26	301558	751877	.868	.086	3100	70	.86	.73		50	1.15	17	50
27	302426	752678	.833	.082	3020	70	.79	.82		50	1.16	18	50
28	303259	753441	.859	.086	2960	70	.83	.74		55	1.09	20	50
29	304118	754241	.822	.082	2890	70	.81	.78	66#	50	1.21	20	50
30	304940	755025	.845	.084	2820	70	.76	.82		50	1.19	28	50
31													
TOTALS			25.06	2.47		21[illegible]							

COMMENTS 11/12 - Changed exhausted to cylinder.

CITY OF FLORENCE - WATER TREATMENT PLANT - MONTHLY REPORT

MONTH Dec. 96 SOURCE OF WATER Wells # OF SERVICES 2,200

DATE	METER READINGS: PLANT FLOW	METER READINGS: WELL FLOW	M. G. D.: H_2O USAGE	M. G. D.: WASH H_2O USAGE	CHLORINE DATA: SCALE READING	CHLORINE DATA: USAGE (IN #)	CHLORINE DATA: A.M. TEST	CHLORINE DATA: P.M. TEST	FLUORIDE DATA: POUNDS CHARGE	FLUORIDE DATA: GALLONS USED	FLUORIDE DATA: FINAL TEST	CHEMICAL USAGE: KM04 GALLONS	CHEMICAL USAGE: NA_2CO_3 POUNDS
1	305785	755828	.816	.080	2750	70	.82	.79		50	1.21	22	50
2	306601	756602	.774	.070	2680	70	.81	.73	50#	45	1.32	17	50
3	307375	757288	.822	.082	2610	70	.83	.77		50	1.21	17	50
4	308197	758001	.698	.069	2540	60	.85	.72		50	1.18	16	50
5	308805	758588	.596	.056	2480	60	.88	.78		50	1.10	10	50
6	309261	759142	.560	.055	2420	50	.82	.87	81#	50	1.24	14	50
7		759711	.510	.056	2370	60	.85	.81		50	1.10	16	50
8		760277	.492	.050	2310	60	.82	.79		50	1.19	10	50
9		760769	.506	.050	2250	50	.77	.86	33#	45	1.18	18	50
10		761315	.505	.050	2200	50	.75	.81		40	1.01	14	50
11		761898	.632	.070	2150	70	.72	.82		40	1.20	18	50
12		762600	.641	.070	~~2080~~ 4080	70	.76	.81		40	1.14	18	50
13		763311	.731	.082	4010	70	.63	.77	54#	40	1.10	27	50
14		764124	.456	.072	3940	70	.76	.81		45	1.08	17	50
15		764852	.601	.060	3870	60	.72	.84		30	1.17	15	50
16		765513	.658	.067	3810	70	.87	.73		45	1.08	15	50
17		766241	.600	.067	3740	70	.84	.82	50#	40	1.16	20	50
18		766971	.652	.071	3670	70	.86	.88		45	1.07	20	50
19		767697	.651	.071	3600	70	.78	.82		50	1.12	16	50
20		768419	.668	.070	3530	70	.71	.82		45	1.08	17	50
21		769157	.680	.070	3460	60	.83	.71	59#	40	1.10	15	50
22		769808	.582	.060	3400	60	.75	.83		40	1.02	15	50
23		770550	.650	.070	3340	70	.84	.71		50	1.13	18	150
24		771270	.632	.070	3270	70	.73	.74		50	1.08	24	50
25		771972	.456	.040	3200	60	.88	.79	75#	45	1.10	10	50
26		772468	.581	.050	3140	50	.93	.73		35	1.21	13	50
27		773009	.524	.058	3090	50	.83	.78		50	.99	17	50
28		773501	.500	.050	3040	50	.77	.81		45	1.08	13	50
29		774141	.443	.040	2990	50	.79	.70		45	1.0	10	50
30		774624	.619	.068	2940	60	.72	.83	57#	45	1.16	17	50
31		775311	.596	.060	2880	70	.75	.80		40	1.10	16	50
TOTALS			19.09	1.96		1940							

COMMENTS: 12/7 - effluent meter, under water - not working

C

APPENDIX C

CLEAR LAKE WATER SOURCE ASSESSMENT TECHNICAL MEMORANDUM

BROWN AND CALDWELL

TECHNICAL MEMORANDUM 1.1

DATE:	May 21, 1997	13-4686
TO:	Ken Lanfear, City of Florence	
PREPARED BY:	Jim Oliver, Brown and Caldwell	
REVIEWED BY:	John Holroyd; Brown and Caldwell	
PROJECT:	Water Facilities Plan	

CLEAR LAKE WATER SOURCE ASSESSMENT

CONTENTS

INTRODUCTION

OBJECTIVE

The objective of this study was to review available information in previous studies and calculate a detailed estimate of the sustainable yield of water withdrawals from Clear Lake. The water use evaluation focused on the time period during the critical peak use months of June through September to examine the potential for Clear Lake level declines during the peak water use summer months.

Water balance modeling was used to estimate potential declines to Clear Lake based on future water demand scenarios. The water balance approach involves assessment of all of the inflows and outflows to the Clear Lake watershed to calculate potential lake level decline due to increased municipal lake withdrawals. Based on the results of previous studies, a conceptual hydrologic cycle was developed for the Clear Lake watershed. Water inflows and outflows were quantified and included in a water balance model. Estimated lake level declines for June through September were calculated based on the difference between daily inflows and outflows. The water balance model was used to estimate the effects of future water use scenarios.

Presented in this technical memorandum is: (1) summary of the previous investigations used the evaluation; (2) conceptual hydrologic cycle for the Clear Lake watershed; (3) inflow/outflow parameter estimates; (4) results of the water balance modeling; and (5) conclusions and recommendations regarding further modeling and sustainable lake withdrawals.

ACKNOWLEDGMENTS

This technical report has been prepared by Brown and Caldwell on behalf of the City of Florence, Oregon. The work is part of a contract for Water Facilities Plan, Preliminary and Final Design and Construction Services. The scope of work was approved by the City of Florence on January 10, 1997.

PREVIOUS INVESTIGATIONS

FLORENCE DUNAL AQUIFER STUDY

In 1982, Lane County and Lane County of Governments (LCOG) published a study of the Florence dunal aquifer funded by an EPA-208 Water Pollution Control Act Grant. The study entitled "*North Florence Dunal Aquifer,*" examined the aquifer in detail with regards to geology, hydrology, hydrogeology, and water quality. The purpose of the study was to determine if the increase in on-site sewage systems could impact the aquifer as a safe water drinking supply. The report summarized the regional geology, hydrogeology, water quality, and surface drainage. The investigation included the installation and sampling of groundwater monitoring wells, seismic investigation, and numerical modeling of groundwater flow. The report recommended that the aquifer be designated as a sole source aquifer and regulatory limitations be placed on nutrient loadings to maintain high quality lake water.

PHOSPHOROUS ACCUMULATION IN CLEAR LAKE WATERSHED

As a follow-up to the North Florence Dunal Aquifer report, a report entitled "*Phosphorus Accumulation in the Clear Lake Watershed*" was prepared by the Lane County Land Management Division. The report evaluated the average annual water balance for Clear Lake and potential for nutrient accumulation in the lake. In addition, a summer water balance for Clear Lake was developed that calculated a summer deficit of approximately 0.8 cubic feet per second (cfs). This deficit was estimated to cause summer declines in Clear Lake of 0.01 feet per day or approximately 1 foot at the end of the summer season. As part of the evaluation, a numerical model of groundwater flow was developed to simulate the recharge from the dunal aquifer into the lake. Conclusions from the report specified that continued development along Clear Lake would cause an increase in phosphorus levels in Clear Lake.

WATER SUPPLY PLAN

A water supply plan update was prepared by HGE, Incorporated in June of 1992 (HGE, 1992). The plan outlines the City of Florence water service area and projected future water use demands. The plan recommends upgrading the treatment facilities for withdrawals from Clear Lake and expanding the current well field for future groundwater supplies. Numerical simulations of groundwater flow were performed to predict the effects of additional well field withdrawals on the regional groundwater system.

CLEAR LAKE SYSTEM

HYDROGEOLOGY

The Florence Dunal aquifer is an accumulation of aeolian sand that rests on a ancient wave cut terrace of the Flournoy Formation (LCOG, 1982). Along the section of the coast of Oregon from Coos Bay to Heceta Head, the terrace has been warped downward below sea level and an extensive accumulation of sands deposited on it. In the Florence area, the terrace is cut into the marine sandstones, siltstones, and mudstones of the Eocene Flournoy Formation. These rocks are often rhythmically bedded grading from fine sands to siltstone to mudstone. The sands are in a matrix of fine clays with some calcite cementing. The over all composition makes the Flournoy Formation relatively impermeable to groundwater (LCOG, 1982)

Seismic investigations in the area around the Florence area found the presence of a bedrock high northwest of Clear Lake. The explanation provided for this bedrock high is a buried stack, such as Haystack Rock at Bandon Beach. The total thickness of the dunal aquifer and the contour of the bedrock, with exception of the bedrock high, was found to be a fairly uniform surface of the Flournoy Formation approximately 100 to 200 feet thick.

The sands of the North Florence Dunal Aquifer system are relatively uniform and permeable. Based on aquifer tests performed in the area, the sands tend to show higher permeabilities in the horizontal than vertical direction and do not show a discernible degree of anisotropy. Evaluation of groundwater movement using tritium as a natural tracer show that water moves rapidly through the groundwater system and in some areas the residence time may be less than 30 years (LCOG, 1982)

The presence of the bedrock high causes infiltrating groundwater to move to the east towards the Flournoy Formation outcrop to the east. Groundwater is impeded at the outcrop and flows upward to form Clear Lake. In the remaining portions of the aquifer, groundwater follows the slope of the terrace towards the Pacific Ocean.

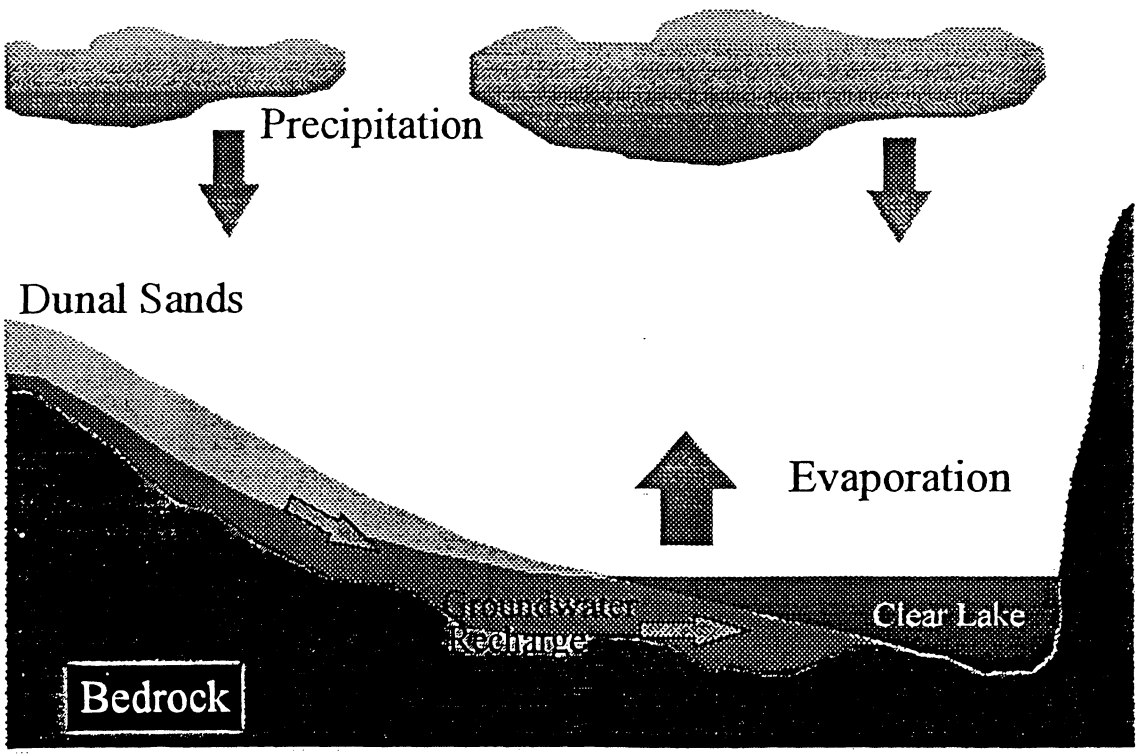
CLEAR LAKE HYDROLOGIC CYCLE

The hydrologic cycle is a generalized model of the occurrence, fate, and interactions of water at, below, and above the surface of the earth. Principal components of the global hydrologic cycle include precipitation, interception of precipitation by vegetation, overland flow, infiltration, soil moisture storage, groundwater storage, groundwater flow, surface water impoundment, evaporation, transpiration from vegetation, and ultimately runoff or stream flow. Transfers of water from the oceans to the atmosphere to the land surface, ultimately returning to the oceans as stream flow, are governed by this conceptual model.

Concept of Dynamic Equilibrium

The Clear Lake/Dunal Aquifer System is maintained in a state of dynamic equilibrium. In the area west of Clear Lake, precipitation falls on the dunal sands, infiltrates to the groundwater, and enters the groundwater system as aquifer recharge. Once water has entered the groundwater system it flows eastward following the slope of the bedrock towards Clear Lake. Because there is no exit for the water at the bedrock outcrop, groundwater is forced to the surface to become Clear Lake (see Figure 1). As the level of Clear Lake increases, water flows to the south to Munsel Lake. In its simplest form, it is analogous to a bathtub. Groundwater recharge would equate to water from the spout. If more water comes into the tub than is used, it will fill up and spill over the sides. If same amount of water enters the tub as is used in the tub, the level remains constant. Conversely, if more water is used in the tub than flows in from the spout, then the level in the tub drops.

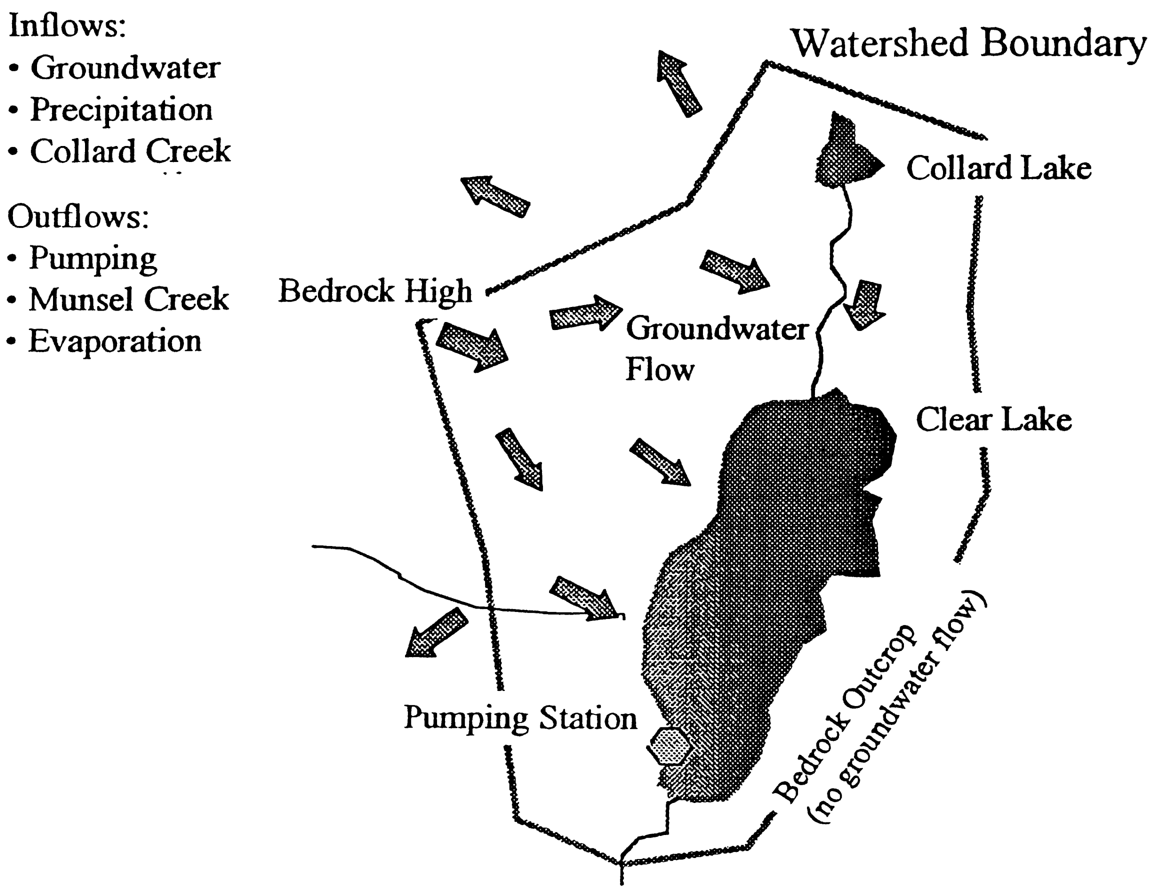
Figure 1. Hydrologic Cycle of Florence Dunal Aquifer in Cross Section.



Cross sectional view of dunal aquifer shows precipitation infiltrating into the permeable dunal sands and flowing on top of bedrock as groundwater to recharge Clear Lake. Losses include evaporation to the atmosphere and flow out of Clear Lake.

The mathematical representation of this equilibrium or "balance" is the inflows minus the outflows equals the change in storage (inflow-outflow = Δ storage). The inflows represent rainfall, aquifer recharge, stream flow, and runoff. Outflows include evaporation, stream flow, and municipal water use. Clear Lake represents the storage term, and changes in inflow or outflow may modify the level of Clear Lake.

Figure 2. Clear Lake Watershed Boundary.



The presence of the bedrock high northeast of Clear Lake causes a groundwater divide. Precipitation on the eastern side of the bedrock high flows east towards Clear Lake. The presence of the groundwater divide causes the Clear Lake watershed to be a closed system with a finite water resources.

Due to the presence of the bedrock high to the northeast of Clear Lake, the watershed is a closed system (see Figure 2). Precipitation that falls east of the bedrock high infiltrates into the permeable dunal sands and becomes recharge to Clear Lake. Precipitation that falls outside the Clear Lake watershed flows towards the Pacific Ocean. The limits of the watershed define the total water resources available to Clear Lake.

ASSESSMENT OF CLEAR LAKE WATER WITHDRAWALS

WATER BALANCE APPROACH

Water balance modeling is a method used to understand the relationship between major components of the hydrologic cycle. The general principle behind the water balance approach is that the total volume of water remains constant as it moves through the Florence Dunal Aquifer system. Therefore, the inflows to the aquifer system (e.g., precipitation, stream flow aquifer recharge) are equal to the outflows (e.g., pumping, evaporation, stream flow) plus or minus any change in storage (e.g., Clear Lake). Water balance modeling is simply an accounting of the inflows, outflow, and changes to storage on an average basis. Some of the factors are easily quantifiable (i.e., pumping, precipitation), while other factors are much more difficult to measure or quantify (i.e., recharge, aquifer flux). Water balance modeling is an ideal method to gain a conceptual understanding of the hydrologic system and aid in identifying potential changes to water storage over time.

Water Balance Modeling

Water balance modeling was conducted by performing a daily accounting of the inflows and outflows through the Clear Lake system during the high water demand time period (June through September). In the winter months when water demand is low and precipitation is high, an excess of water flows out of Clear Lake to Munsel Lake. However, in the summer months, water demand and evaporation increase, and precipitation decreases; water ceases to flow out of Clear Lake. When there is no flow out of Clear Lake and water withdrawals are greater than inflows, a change in storage will result (i.e., lake level decline).

Previous studies have calculated a water balance for the Clear Lake system. However, these balances were prepared to evaluate annual nutrient flushing and were based on average annual estimates. Due to significant variations in the water balance from the winter to summer months, evaluation of the annual water balance is not relevant to potential Clear Lake level decline. During the winter months when there is excess available water, Clear Lake will recover from summer declines then start to flow out of the lake to Munsel Lake. This water is lost out of the system and is not available as storage in the summer months.

Presented below is a summary of inflows, outflow, and storage assumptions used for the modeling effort. The water balance is calculated on a daily basis for inflows, outflows, and storage. Values that are monthly averages are equally divided throughout the month.

INFLOWS

Precipitation

Based on precipitation data provided in the North Florence Dunal Aquifer Study (LCOG, 1982), precipitation in the Florence area is approximately 60 to 80 inches per year. The average annual rainfall for the time period of 1941 through 1981 was 69 inches with 80 percent of the rainfall occurring between October through March. Because the focus of this study was on the summer season, the average monthly rainfall estimates for June through September were used. The average annual monthly rainfall as presented in North Florence Dunal Aquifer Study (LCOG, 1982) is presented below.

Table 1. Average Monthly Rainfall for Florence Aquifer.

Month	Florence Aquifer Average Monthly Rainfall (inches of rain per month)
January	10.9
February	8.1
March	7.5
April	3.8
May	2.8
June	2.1
July	.9
August	1.0
September	3.5
October	6.3
November	9.7
December	11.1

From: North Florence Dual Aquifer Study, LCOG, 1982, Figure 7.

Precipitation was calculated as an inflow for Clear Lake surface only. It was assumed that during the summer months no significant water would enter the system as run off because antecedent soil moisture conditions would capture water as infiltration. In addition, precipitation that would fall on the dunal sands are accounted for in the aquifer recharge.

Aquifer Recharge

Aquifer recharge was estimated from the following two methods: (1) recharge estimates for the watershed; and (2) calculation of aquifer flux from water level contour maps. The Clear Lake aquifer system is based on the Clear Lake watershed boundary from the North Florence Dunal Aquifer Study (LCOG, 1982). The watershed boundary includes both Clear Lake and Collard Lake (see Figure 2). Aquifer recharge is calculated for the entire watershed, and flows from Collard Lake are assumed to be hydraulically connected to Clear Lake as aquifer discharge, or surface stream flow.

Using the recharge method, the aquifer discharge to Clear Lake should be approximately equal to the recharge rate (assuming changes in storage are insignificant) (Ferris et al., 1962). Assuming an area of dunal sands of approximately 520 acres and an average recharge rate of 4.36 feet/year (LCOG, 1982) the discharge to Clear Lake and Collard Lake is 2 million gallons per day (mgd).

An alternative method to calculate aquifer recharge uses a flow net analysis of the groundwater flux. The flow net is based on flux of groundwater through the aquifer from points of higher head (elevation) to lower head. The volume of water that moves throughout the aquifer is equal to the change in head per unit distance multiplied by the cross sectional area of flow. The mathematical quantification of this principle is known as Darcy's Law and is expressed as:

$$Q = K * I * A$$

where: Q = flow in cubic feet per day

K = hydraulic conductivity in feet per day

I = hydraulic gradient in feet per foot

*A = aquifer width * depth in feet*

This principle allows use of the water-table elevation contour maps to assess the volume and direction of groundwater flow. Hydraulic conductivity (K) describes the ease with which water can pass through an aquifer.

Hydraulic conductivities used in the water balance modeling were estimated from values included in the numerical model developed for the Florence Dunal aquifer (LCOG, 1982). Hydraulic gradients were estimated from water-level elevation contour maps prepared for the Florence Dunal aquifer (LCOG, 1982; Figures 22 and 23). Aquifer saturated thicknesses were calculated from estimated depth to bedrock from the seismic survey and measured water-level elevations. The dunal sands portion of the watershed was divided into "flow tubes" from point of recharge to point of discharge. The summation of each stream tube contribution equals the estimated daily flux of aquifer recharge to the Clear Lake system. A summary of the flow net calculations is presented in Table 2. For purposes of the water balance modeling, the flow net method was selected as a more representative and conservative estimate of aquifer recharge.

Table 2. Flow Net Analysis for Aquifer Recharge

Flow Tube	Hyd. Cond.	Gradient	Width	Depth	Aquifer Recharge
	ft/day	ft/ft	ft	ft	ft^3/day
1	80	0.005	1,000	65	26,000
2	70	0.005	1,000	65	22,750
3	80	0.004	1,000	55	17,600
4	100	0.003	2,000	90	54,000
5	100	0.005	1,500	50	37,500
6	100	0.01	1,100	40	44,000
Total					201,850

Daily Aquifer Recharge 201,805 ft^3/day ≅ 1.5 mgd

Stream Flow From Collard Lake

The North Florence Dunal Aquifer Study report (LCOG, 1982) reports a stream flow from Collard Lake to Clear Lake of approximately 0.8 cfs, or 0.5 mgd during the summer months. There is an elevation difference of approximately 15 feet from the outlet of Collard Lake to the inlet of Clear Lake and this stream flow may be due to groundwater discharging to surface water. For purposes of the water balance model, no flow was assumed to be discharged from Collard Lake to Clear Lake to avoid the possibility of "double accounting" for this water in both stream flow and aquifer recharge.

OUTFLOWS

Evaporation

Evaporation was estimated from average monthly free surface evaporation from the Newport, Oregon, recording station. The averaging period is from 1948 through 1989. Monthly average values were converted to daily values. Evaporation was calculated from the lake surface only, evaporation from the bedrock outcrop, and dunal sands was considered insignificant. The estimated evaporation rates for June, July, August, and September were 3.62 inches, 4.17 inches, 3.75 inches, and 2.71 inches, respectively.

Water District Withdrawals

Projected withdrawals for Clear Lake were based on the measured average daily pumping by the Heceta Water District for 1991 through 1996. For the water balance modeling, the daily 5-year average of Clear Lake withdrawal for June 1 through September 30 was used. A summary of the average daily pumping records for June 1 through September 30, 1991, through 1996 is included in Appendix A. The 5-year average represents the base level of pumping from Clear Lake. Future withdrawals were estimated from this base and are presented in Figure 3.