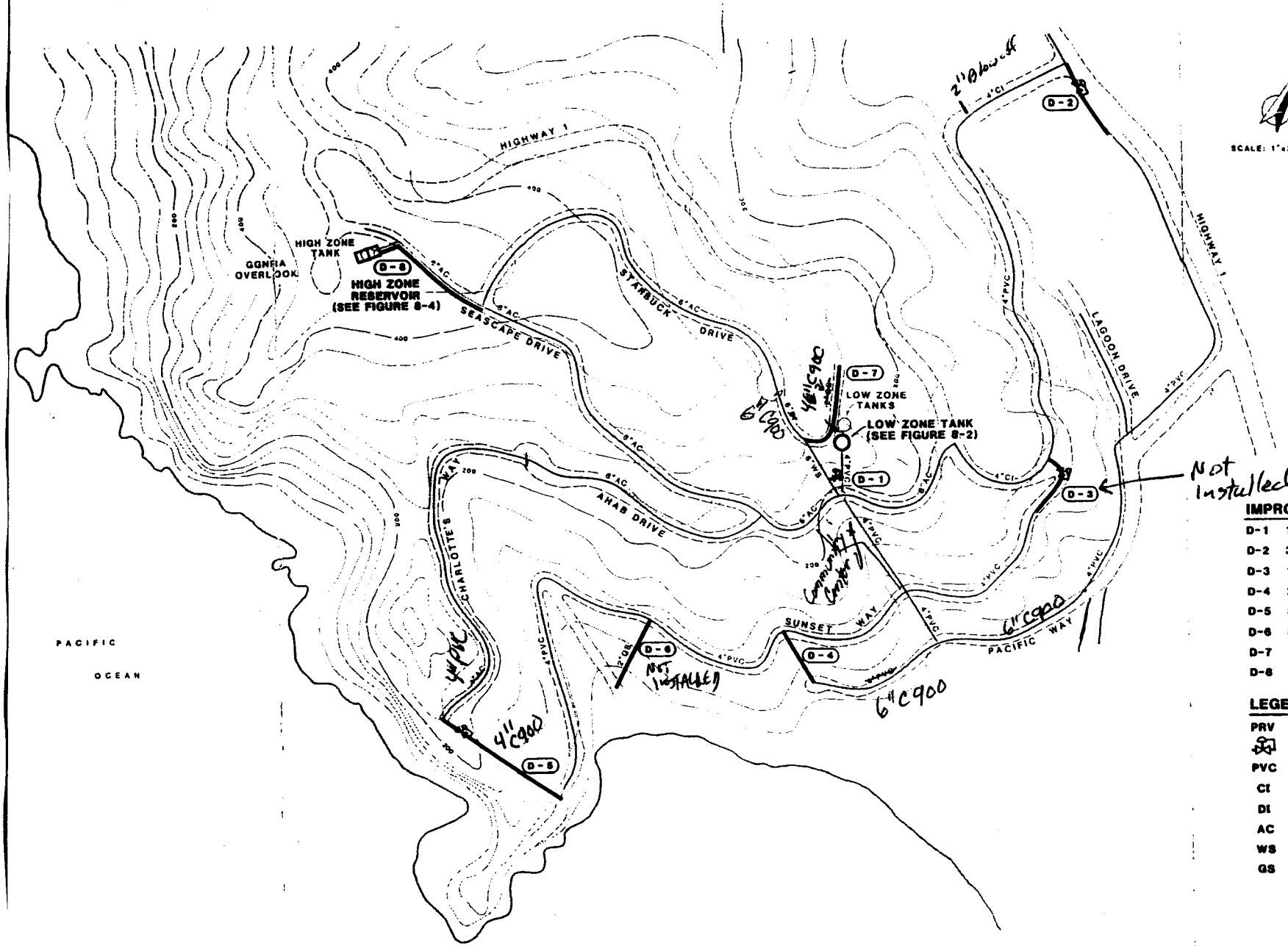


IMPROVEMENTS

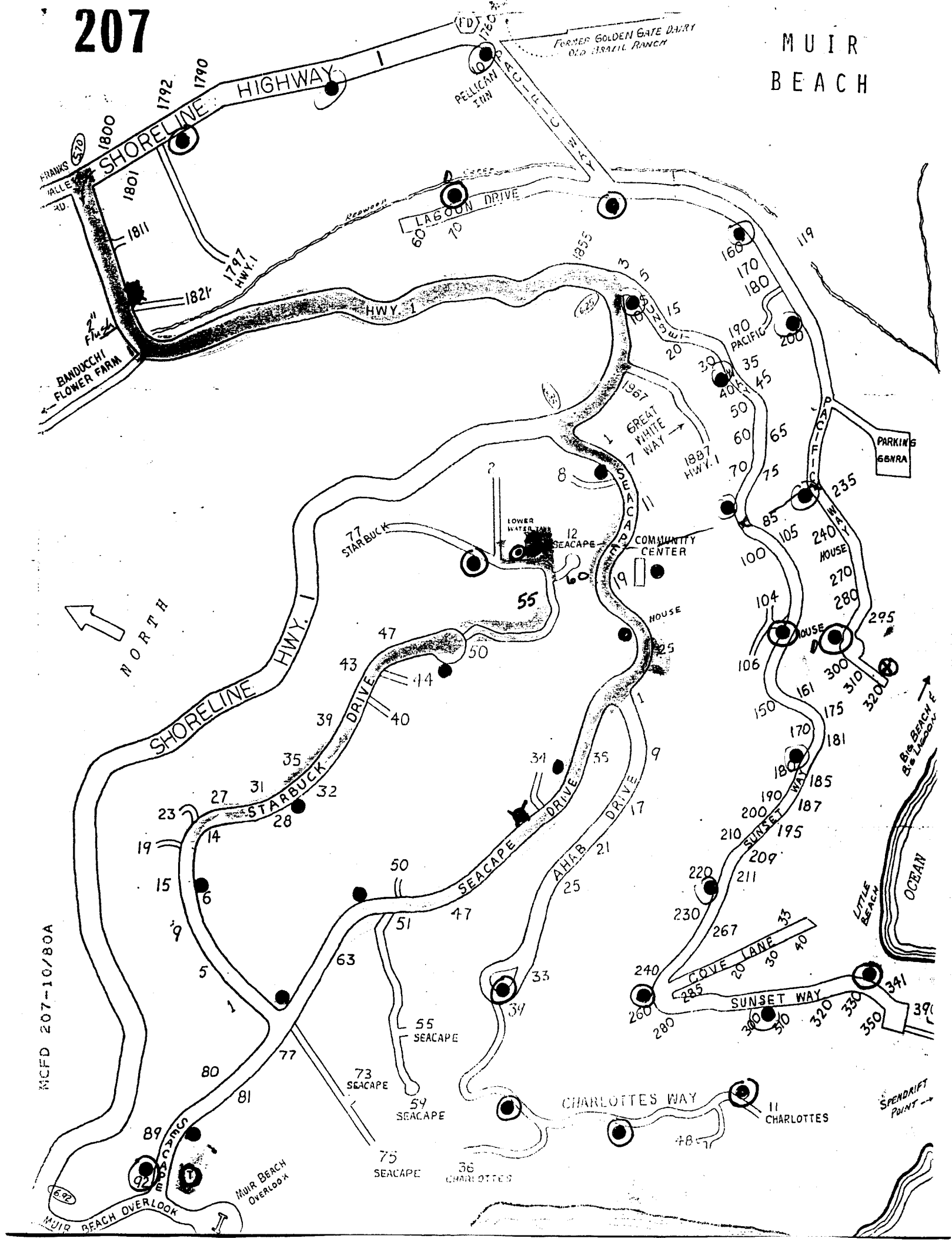
D-1	100'-4"PVC W/PRV
D-2	330'-6"PVC W/PRV
D-3	190'-6"PVC W/PRV
D-4	250'-4"PVC
D-5	500'-4"PVC W/PRV
D-6	300'-4"PVC
D-7	370'-4"PVC
D-8	470'-8"PVC

LEGEND

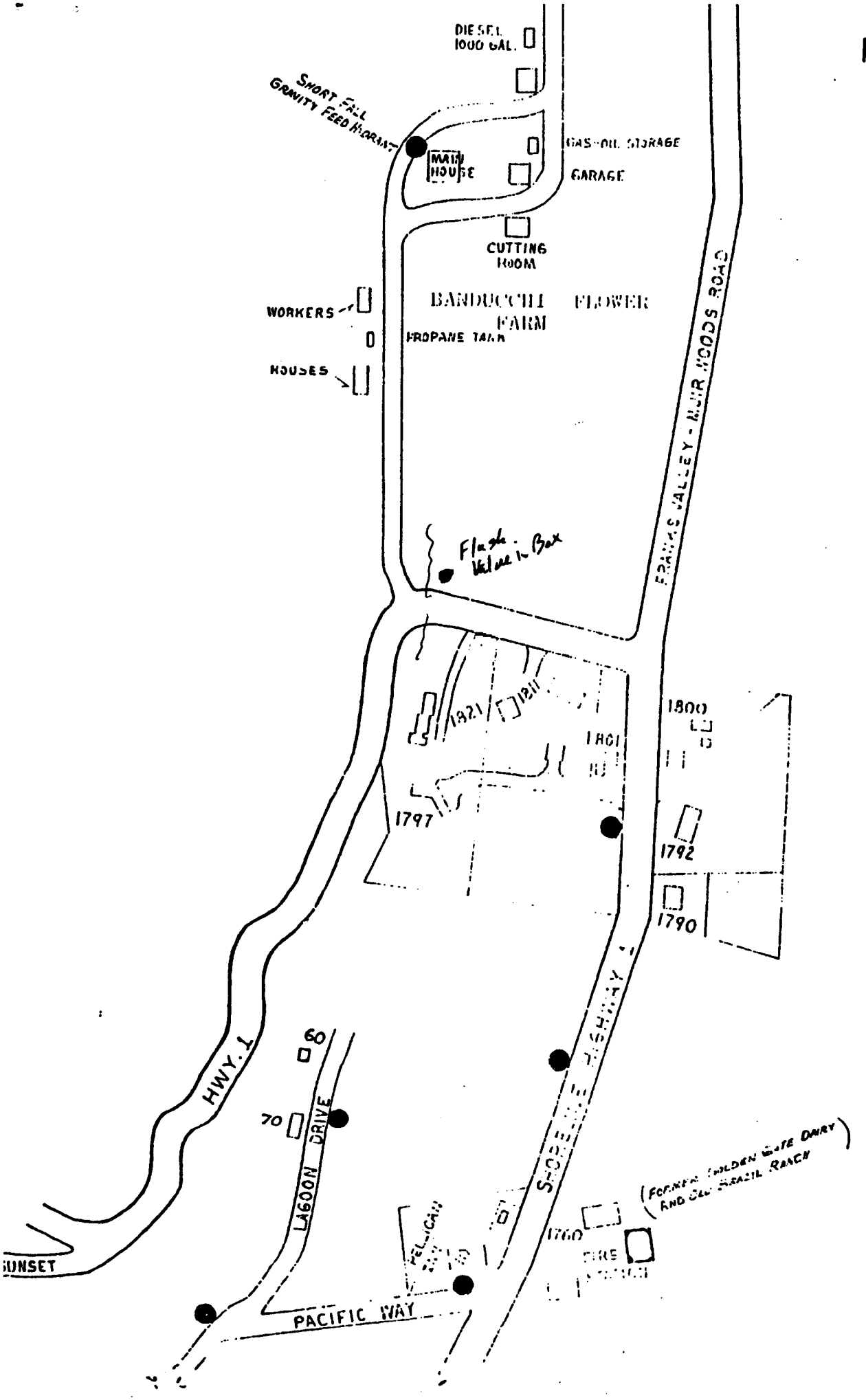
PRV	PRESSURE REGULATOR VALVE STATION
	PRESSURE REGULATOR VALVE
PVC	POLYVINYL CHLORIDE PIPE
CI	CAST IRON PIPE
DI	DUCTILE IRON PIPE
AC	ASBESTOS CEMENT PIPE
WS	WELDED STEEL PIPE
GS	GALVANIZED STEEL PIPE

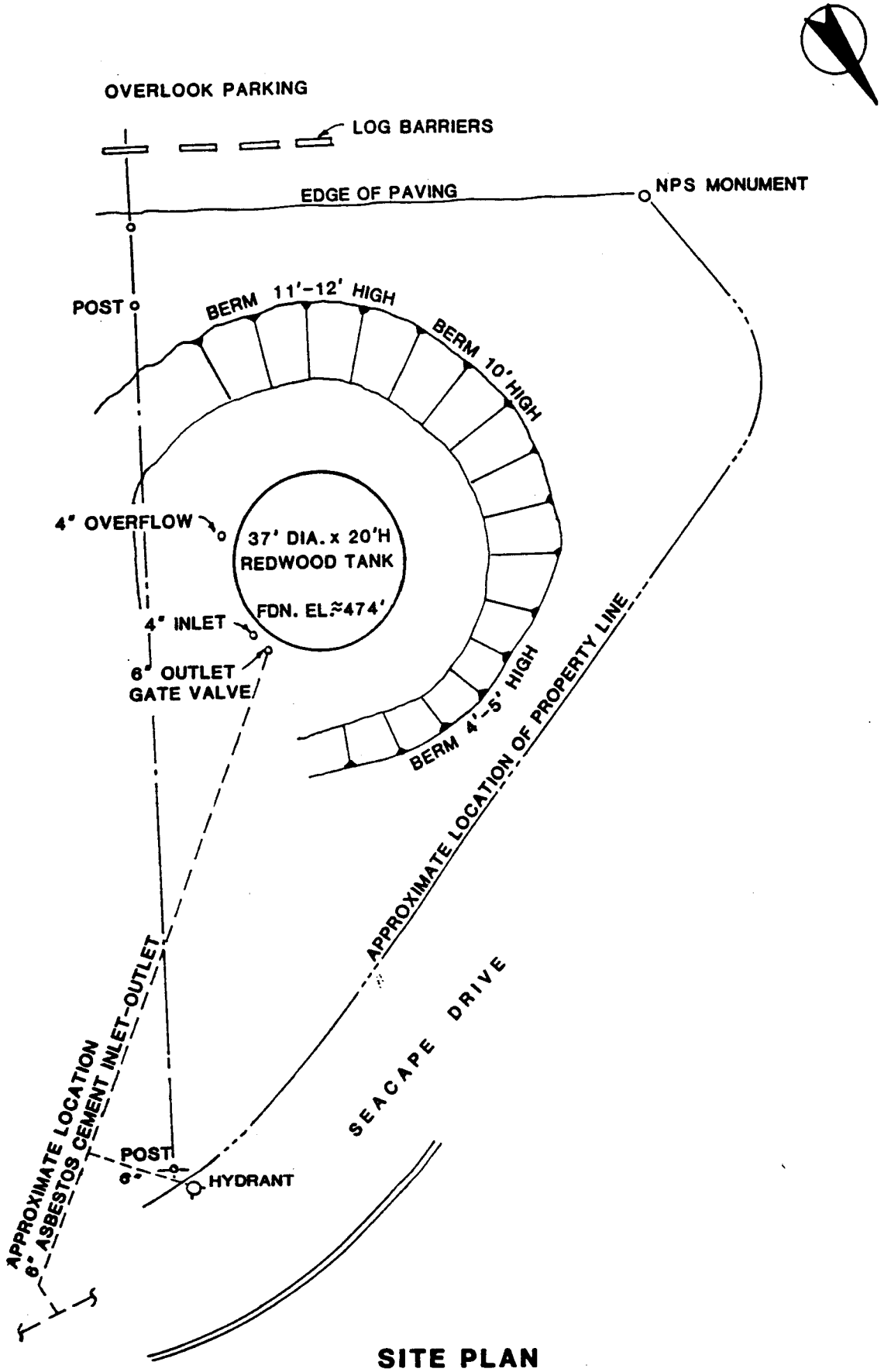
FIGURE 9-1

PROPOSED DISTRIBUTION SYSTEM IMPROVEME


207
MUIR BEACH
SHORELINE HIGHWAY 1
FORMER GOLDEN GATE DAIRY
OLD ISRAEL RANCH
PELICAN INN
FRANKS VALLEY RD.
LAGOON DRIVE
HWY. 1
BANDUCCHI FLOWER FARM
2" Flush
GREAT WHITE WAY
PACIFIC WAY
PARKING
SEACAPE
COMMUNITY CENTER
LOWER WATER TANK
STARBUCK
SHORELINE HWY. 1
NORTH
STARBUCK DRIVE
SEACAPE DRIVE
AHAB DRIVE
SUNSET WAY
COVE LANE
CHARLOTTES WAY
MUIR BEACH OVERLOOK
BIG BEACH & LAGOON
LITTLE BEACH
OCEAN
SPENDRIFT POINT
HOUSE
CHARLOTTES
MCFD 207-10/80A

MUIR BEACH SECTION

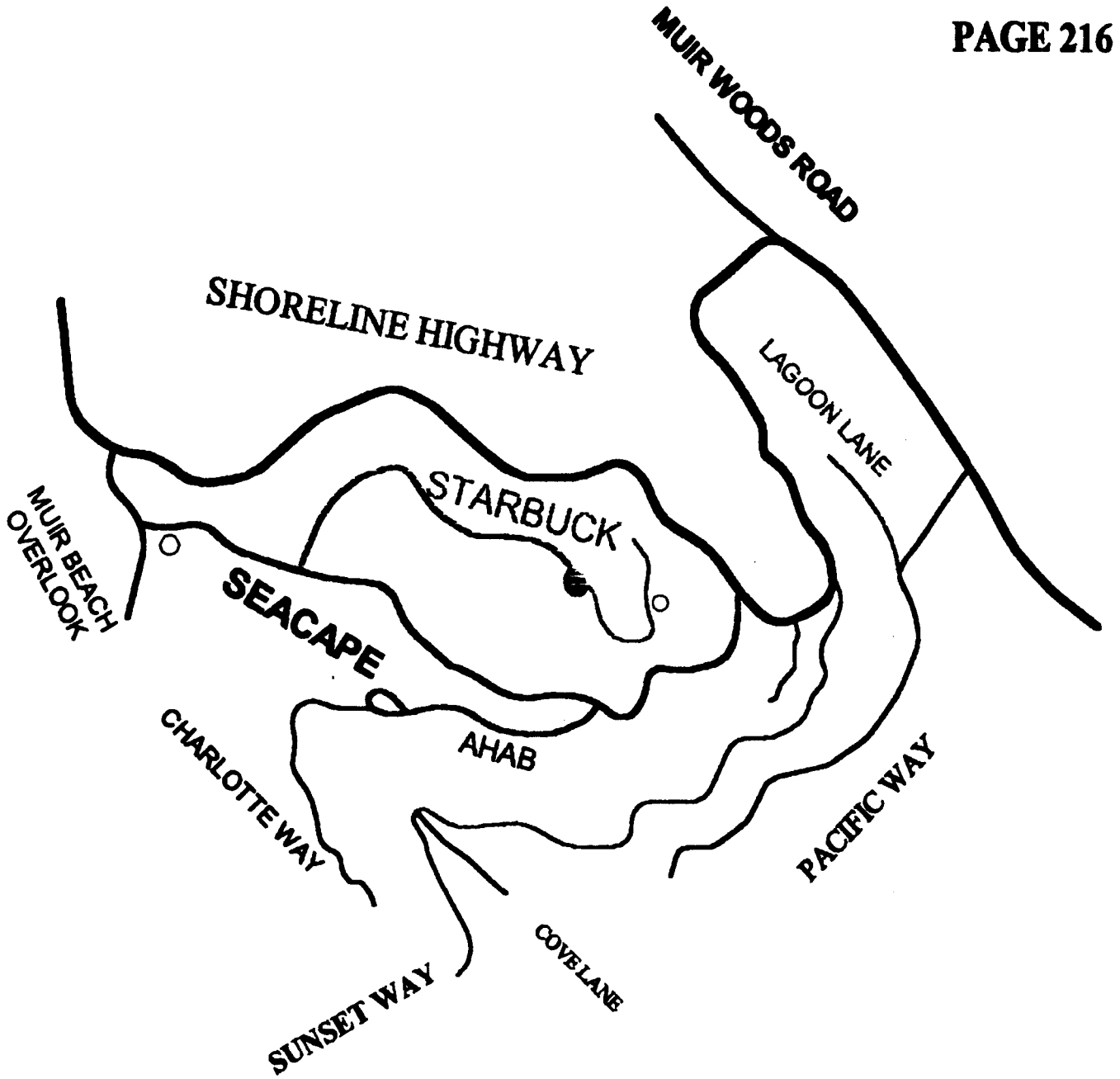




SITE PLAN

FIGURE 4-5

EXISTING HIGH ZONE TANK



MUIR BEACH AREA

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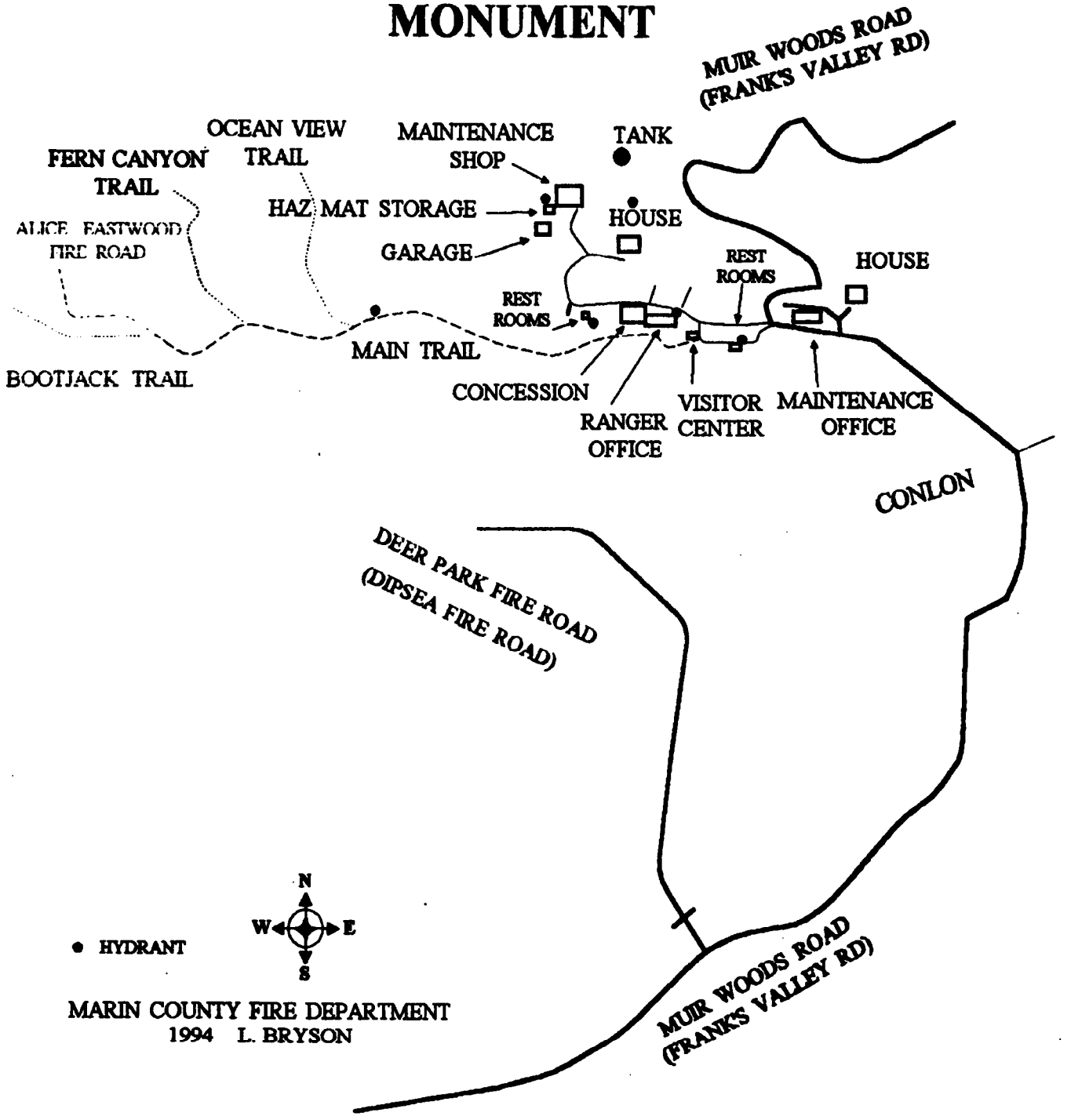
• HYDRANT

MARIN COUNTY FIRE DEPARTMENT
1994 L. BRYSON

MUIR WOODS NATIONAL MONUMENT



MARIN COUNTY FIRE DEPARTMENT
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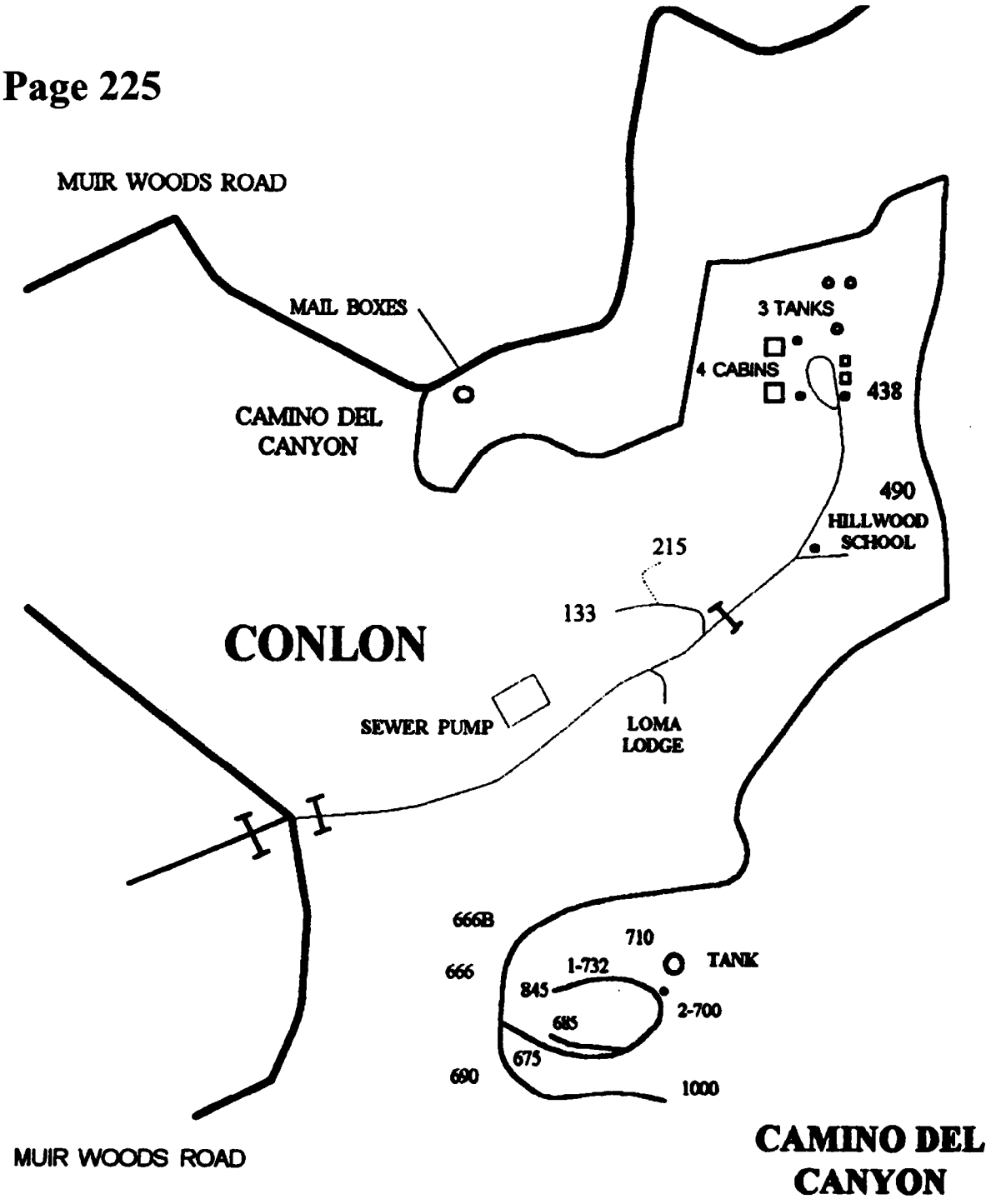
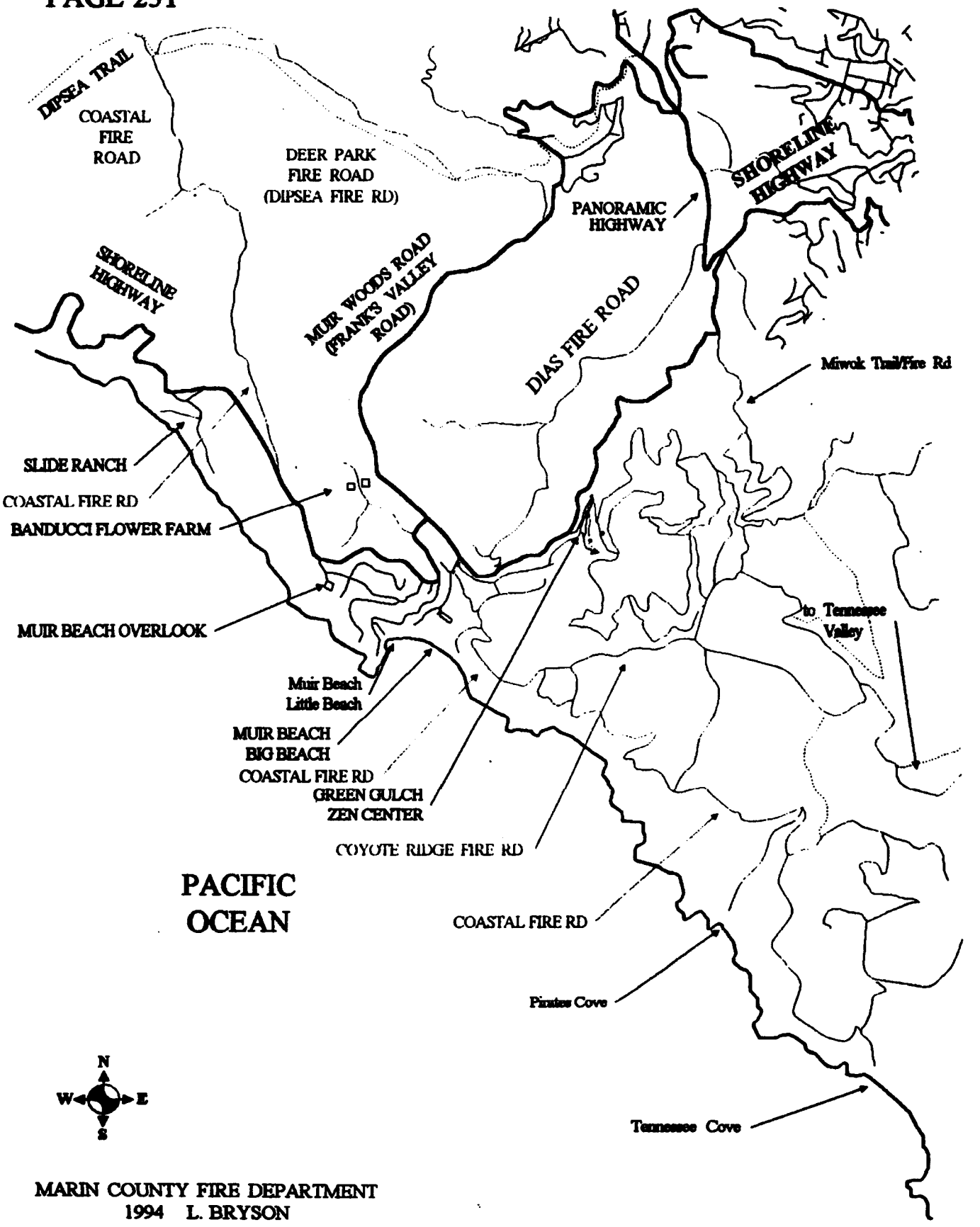
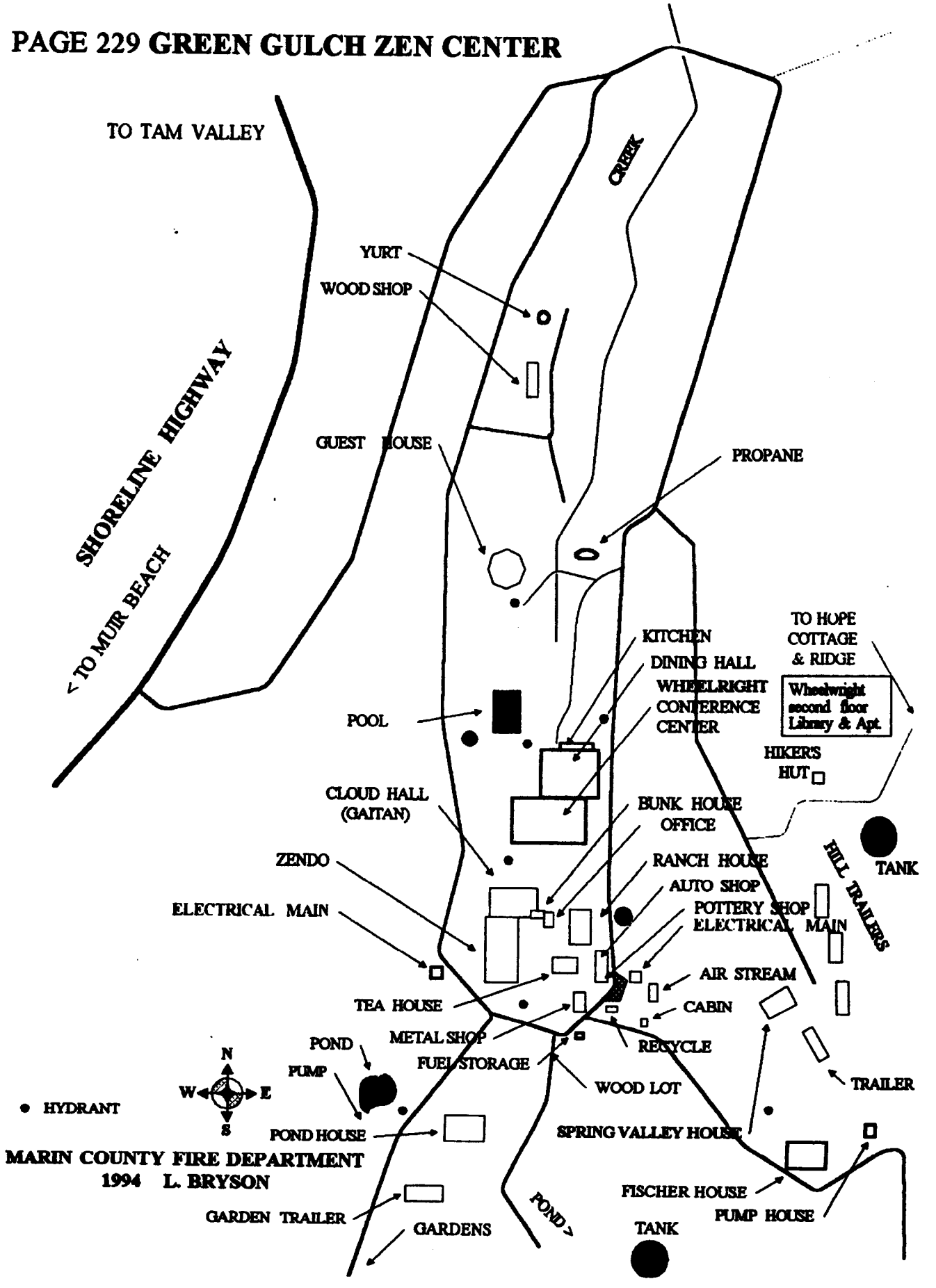


MARIN COUNTY FIRE DEPARTMENT 1994
LARRY BRYSON

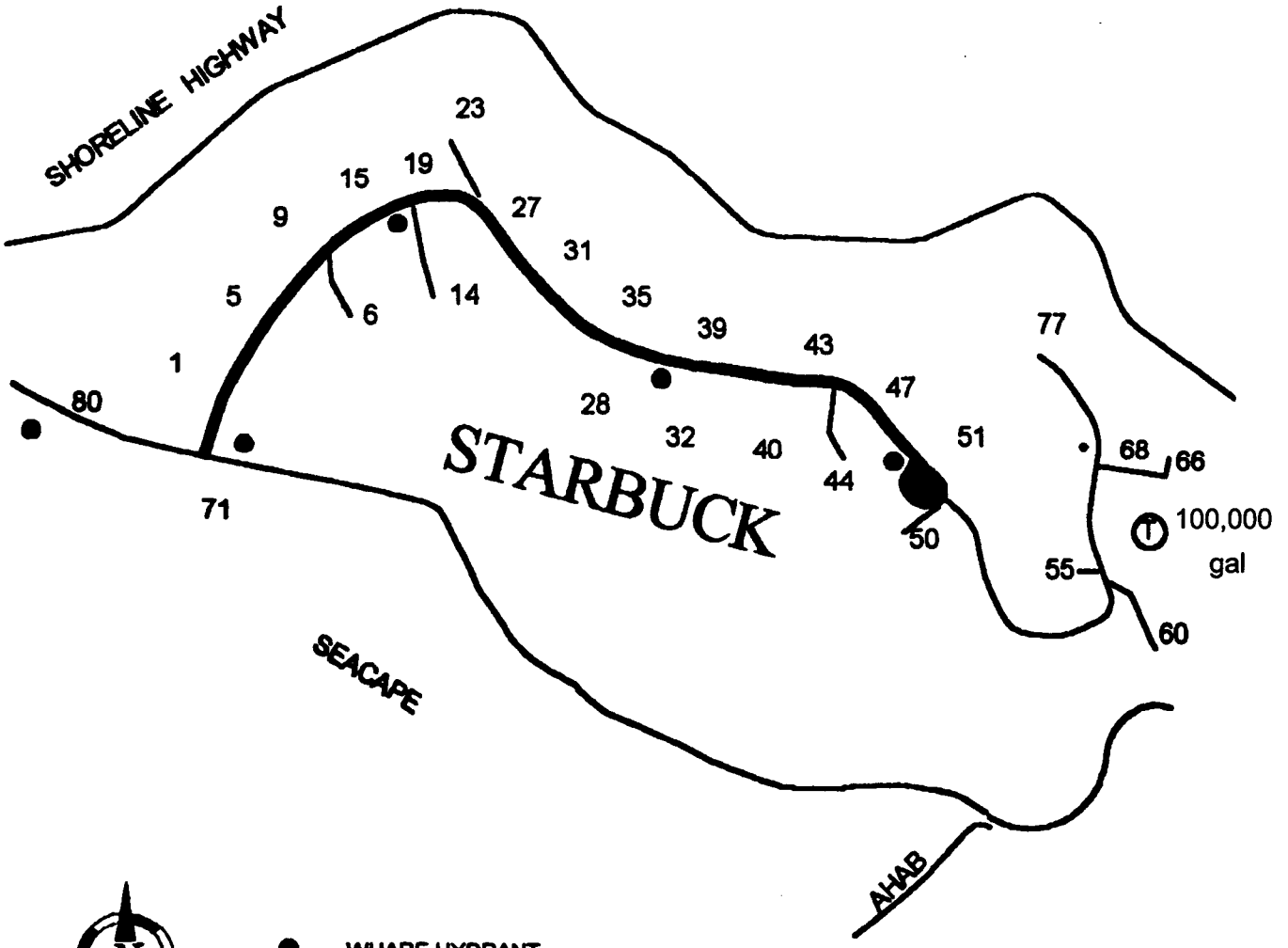


MARIN COUNTY FIRE DEPARTMENT
1994 L. BRYSON

PAGE 229 GREEN GULCH ZEN CENTER



STARBUCK



MUIR BEACH 1994

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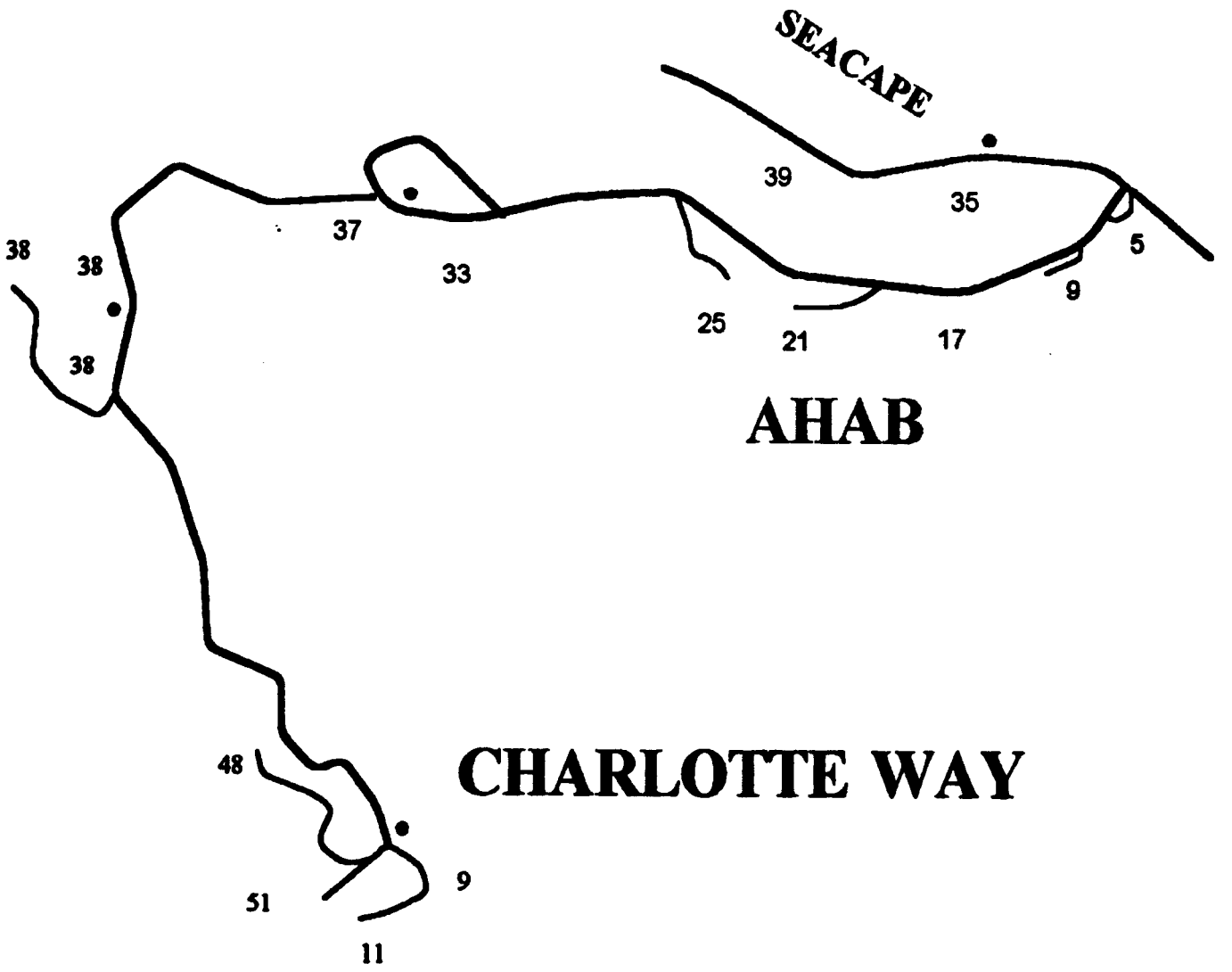
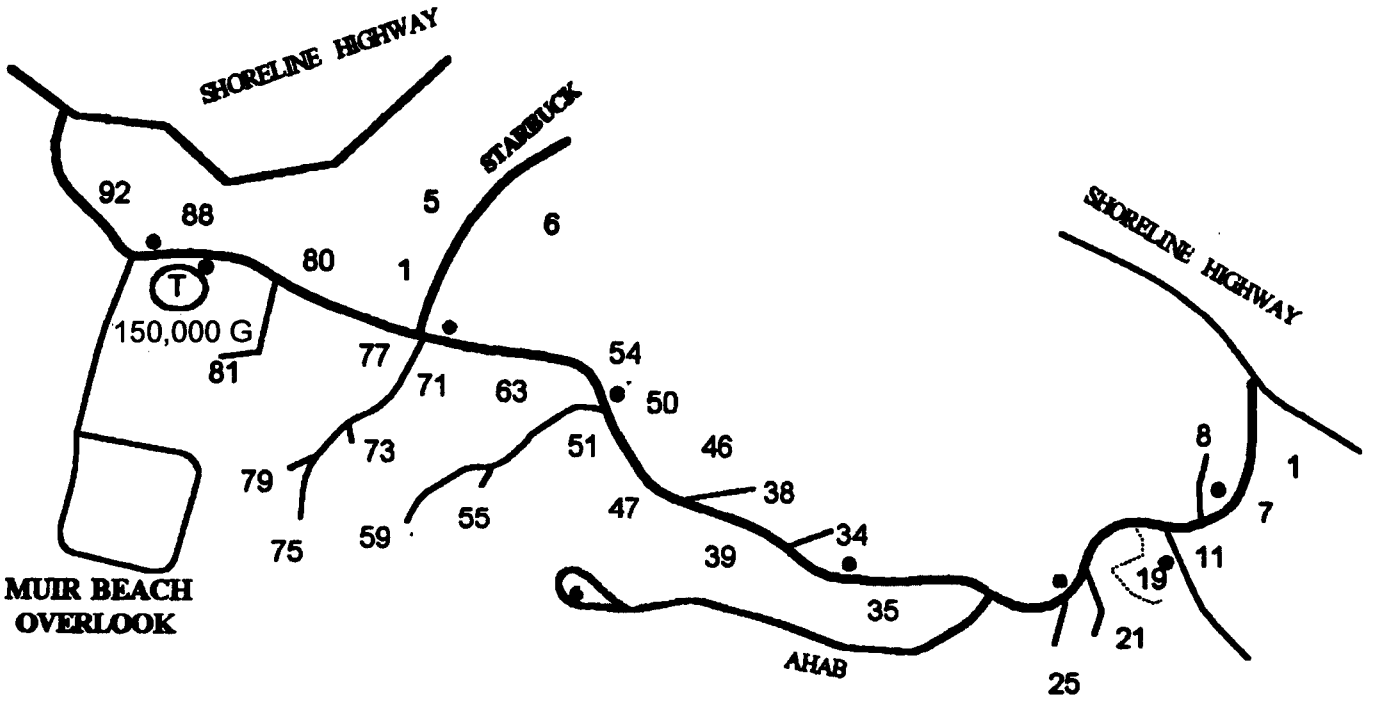
6/3/94



MARIN COUNTY FIRE DEPARTMENT
1994 L. BRYSON



SEACAPE DRIVE

● HYDRANT

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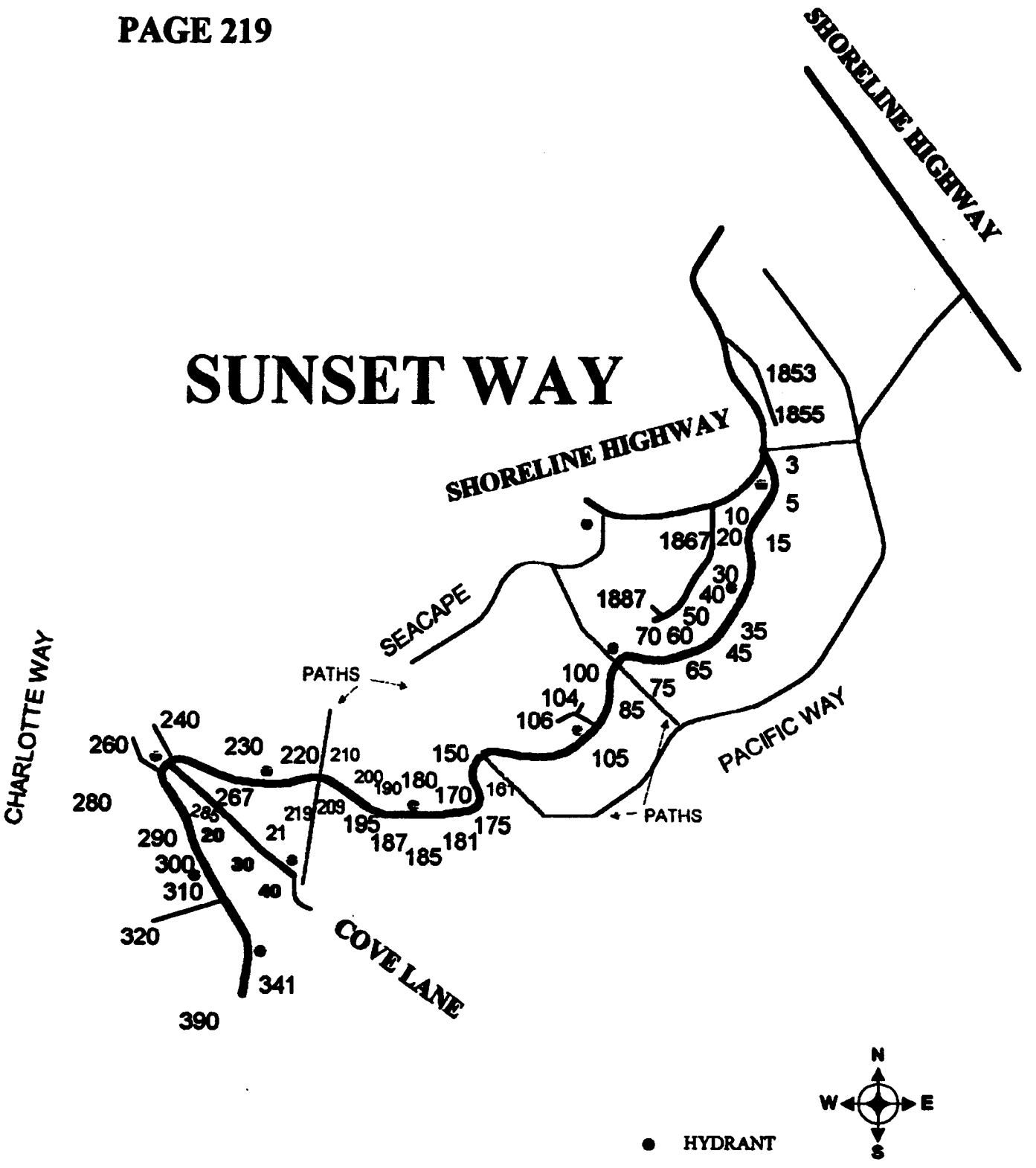
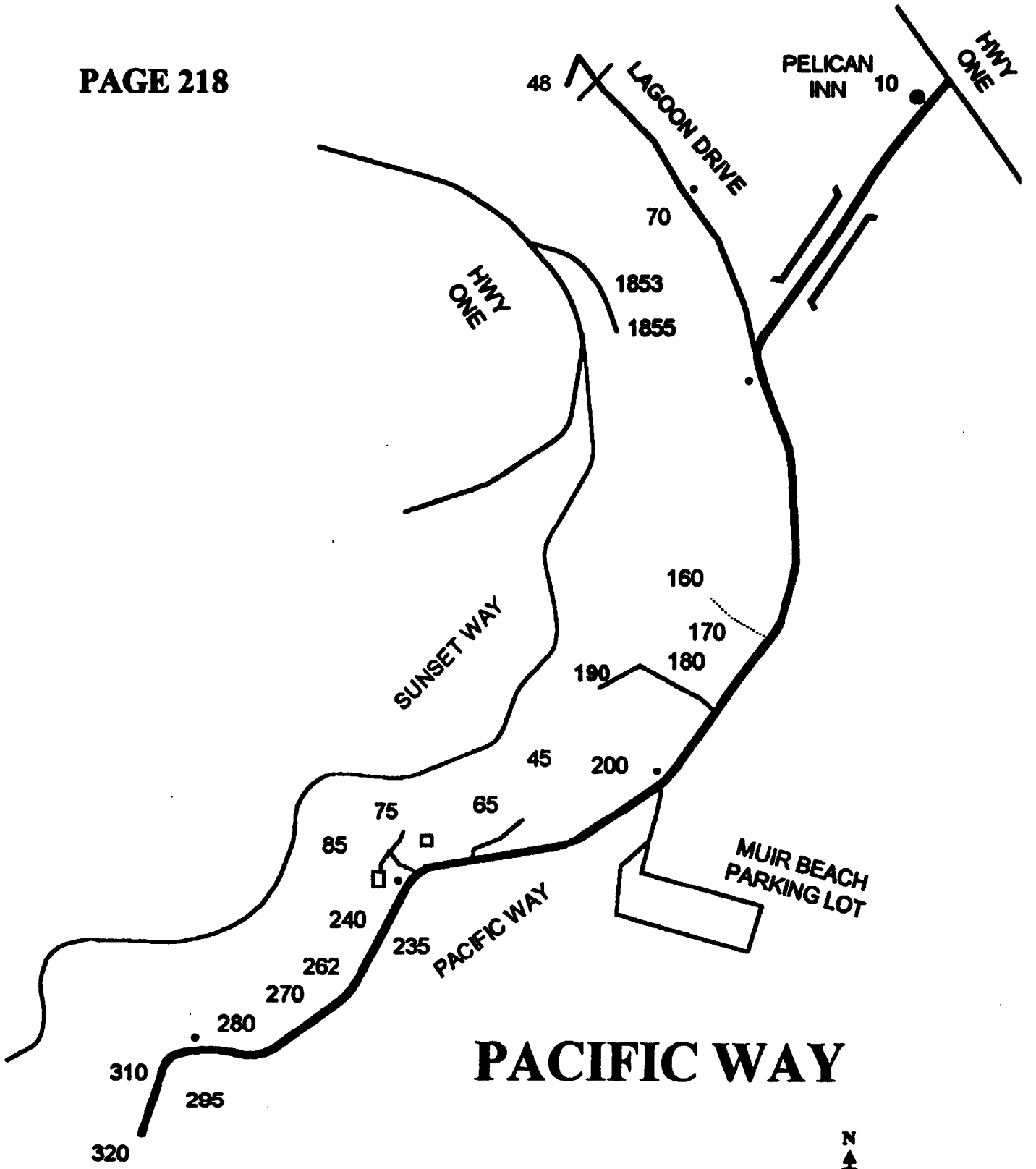
MARIN COUNTY FIRE DEPARTMENT
1994 L. BRYSON



MUIR BEACH, CALIFORNIA

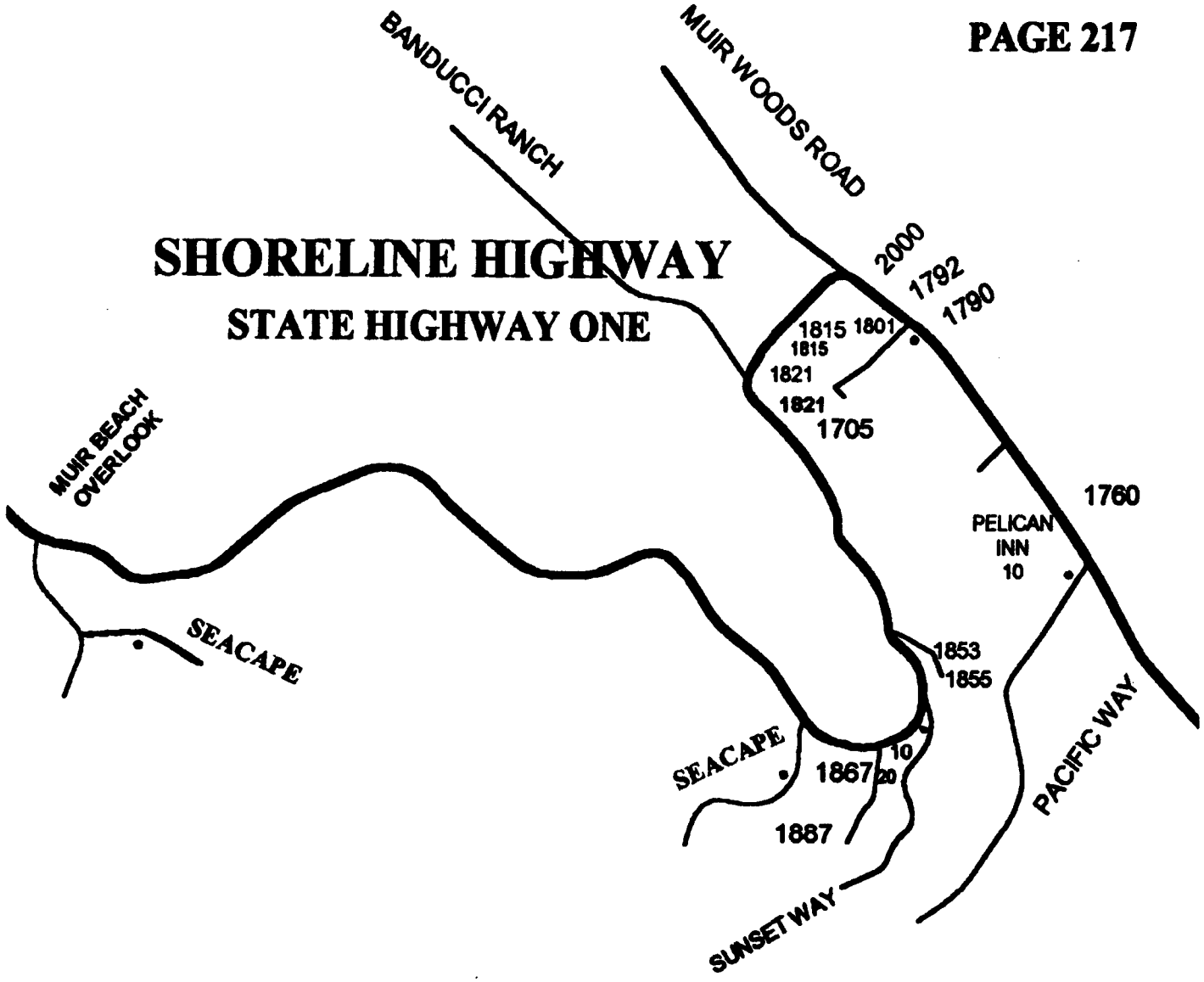
MARIN COUNTY FIRE DEPARTMENT 1994
LARRY BRYSON



PACIFIC WAY

MUIR BEACH CALIFORNIA

MARIN COUNTY FIRE DEPARTMENT 1994
LARRY BRYSON



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MARIN COUNTY FIRE DEPARTMENT
1994 L. BRYSON

CHAPTER IV

EXISTING WATER FACILITIES

Description of the System

The Muir Beach water system is comprised of the following major components:

1. Three shallow wells located in the alluvium of Redwood Creek adjacent to Frank Valley Road.

2. Chlorination, booster pumping and metering facilities. These are located in a small building adjacent to the wells that also serves as a District office.

3. A four inch transmission main running from the wells to the service area.

4. A 150,000 gallon redwood storage tank serving the high zone of the system. The high zone tank is located on Seacape Drive adjacent to the Golden Gate National Recreation Area overlook.

5. A 50,000 gallon redwood storage tank serving the low zone of the system. The low zone tank is located adjacent to a private road extending from the cul-de-sac at the end of Starbuck Drive. The recently-failed low zone tank is located on the same site.

6. Distribution system piping, including fire hydrants.

Figure 4-1 shows the location of principal components of the existing system and also shows the District boundary.

Supply

There are three wells located on property owned by the District on Frank Valley Road. Figure 4-2 is a schematic site plan of the various facilities at this location. Well No. 3, located in the small service building, is now used only as a standby booster pump. The well itself failed several years ago.

Well No. 1 is now used on a full time basis. It is the only well that can be chlorinated at the wellhead using the existing chlorine feed arrangement. The 15 horsepower submersible pump in Well No. 1 provides the pumping head needed to deliver water directly to the high zone tank. Weeks Drilling and Pump Company drilled the well in 1982 and has serviced it from time-to-time since. Well (i.e., pump) production is 75 to 80 gallons per minute (gpm) - adequate to meet the peak daily demands of the system. The well is 37 feet deep. The casing is perforated from a depth of 15 feet to 35 feet. Weeks Drilling bailed, swabbed and pumped the well in 1986 to clean it and restore capacity.

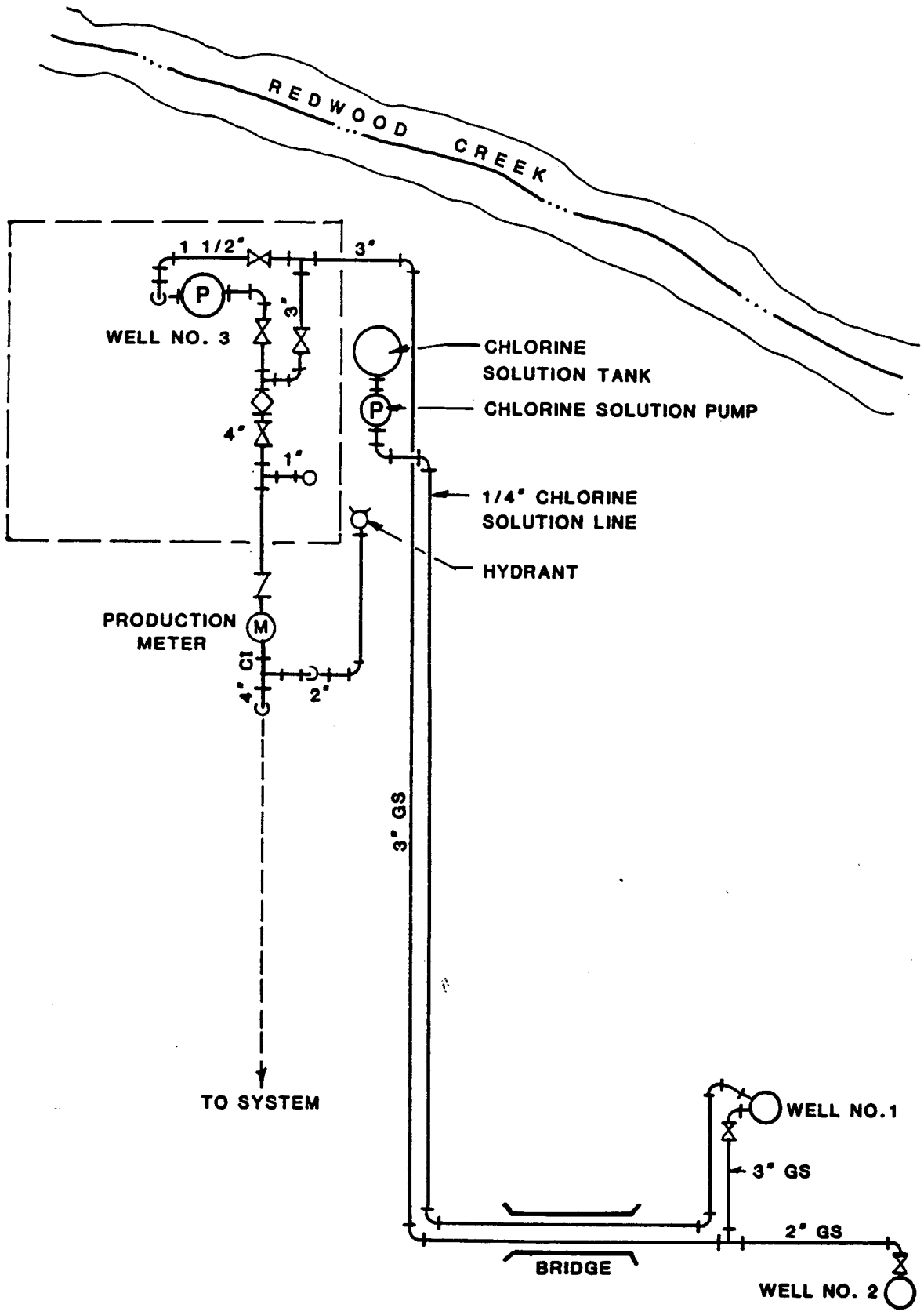


FIGURE 4-2

EXISTING SUPPLY FACILITIES

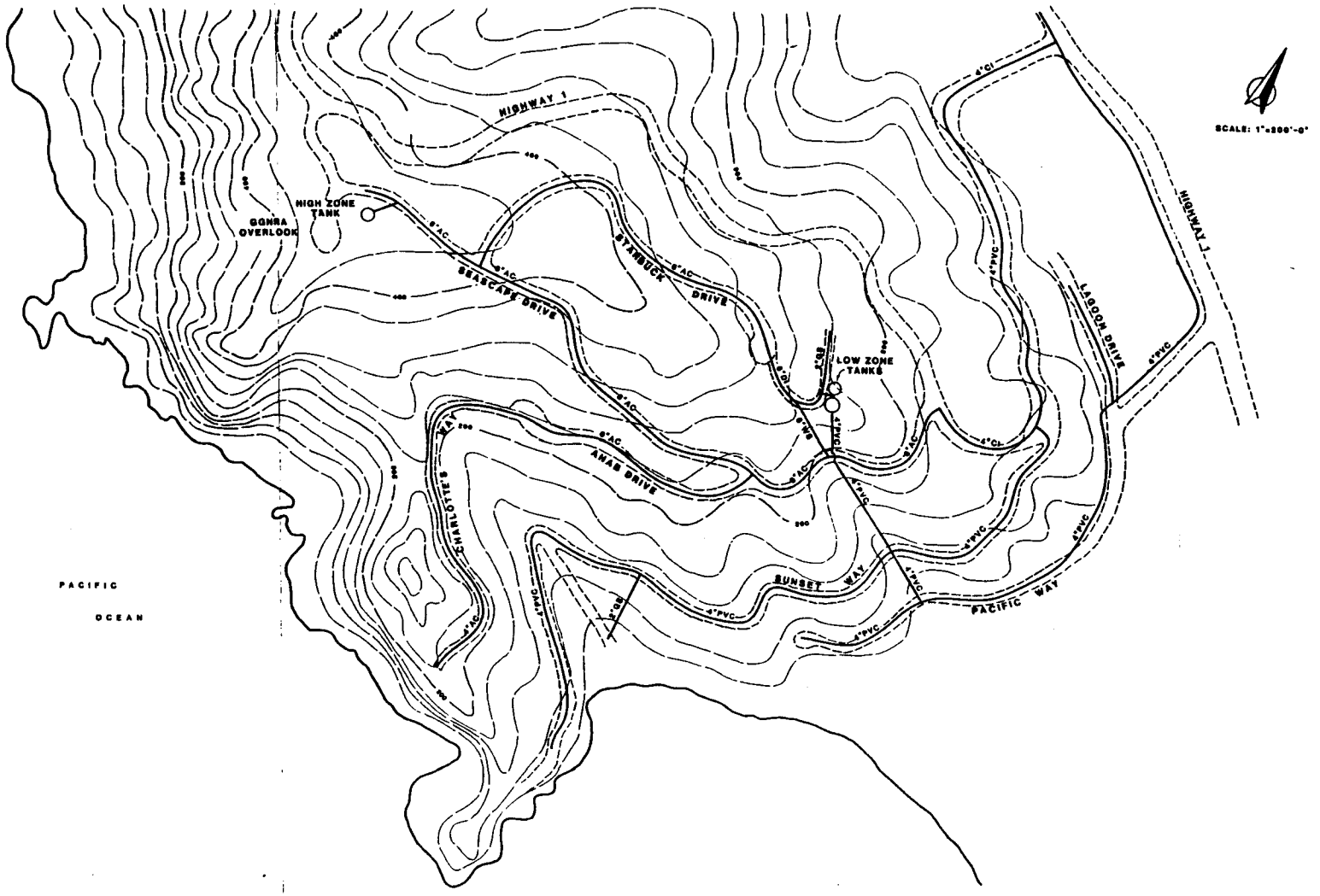


FIGURE 4-1
EXISTING WATER SYSTEM

The well log, pump curve and service history for Well No. 1, obtained from Weeks, are included in Appendix A.

Well No. 2, drilled in 1970, is located about 100 feet east of Well No. 1. It is of the same depth and of similar construction as Well No. 1. The pump installed in Well No. 2 is a 2 horsepower submersible type that pumps directly to Well No. 3 from which it is booster-pumped into the system. Well No. 2 lacks a feed line for applying chlorine down the well - a method the District has found effective in minimizing iron and manganese problems. As a result, the well is not used on a regular basis. Weeks' records show that Well No. 2 was acid-treated, bailed and swabbed in 1982 to restore capacity.

Sodium hypochlorite is fed to oxidize iron and manganese and for disinfection using a Wallace and Tiernan Model A747 diaphragm metering pump. Backup chlorination equipment is not available. Total water production is read daily from a propeller meter installed in the discharge piping. The number of hours the well pump operates each day is indicated by a clock that runs only when the "pump run" signal is received from the high zone tank.

Figure 4-3 shows photographs of the wells and supporting facilities.

Transmission Main

Water is piped to the system via a four inch cast iron (CI) main about 5,500 feet long. This main runs along Frank Valley Road to its intersection with State Highway No. 1 and then follows the highway to Seacape Drive. It was installed in the mid-sixties as part of the Seacape subdivision. The condition of the main is unknown. Normally the service life of cast iron pipe, in a favorable environment, is 50 years or more. Corrosive soils can, however, reduce service life. Nevertheless, this pipe is only 20 years old. It has not, to date, shown visible signs of leakage or deteroriation. It is recommended that the main be dug up in several locations and checked to determine its condition. The District plans to install a gate valve in this piping near the chlorine building. The condition of the section of pipe removed when the valve is installed will be checked at that time.

High Zone Distribution System

The mains in the upper zone are, with one exception, six inch asbestos cement (AC) pipe. These mains were also installed during the mid-sixties. Although this pipe is no longer being actively marketed due to a forthcoming EPA ban on its manufacture, it does not ordinarily present a health hazard to water users unless the water is highly corrosive (i.e., not the case at Muir Beach). The reason for its prohibition by EPA is the exposure of workers during the manufacturing process to airborne asbestos fibers. This pipe is not subject to normal soil-related corrosion. When properly installed, asbestos-cement pipe will provide

a 50 year, or greater, service life. The upper zone of the system includes about 6,500 feet of this pipe.

Other piping materials were used in the upper system near the lower tanks. A 340 foot section of six inch ductile iron (DI) pipe was installed from the end of the Starbuck Drive cul-de-sac south along a private road. A section of six inch welded steel pipe connects the ductile iron pipe to a six inch asbestos cement pipe on Seacape Drive below the tanks. A 370 foot length of two inch galvanized steel (GS) piping feeds those residences located along the private road north of the tanks. This pipe is the only size-deficient section of piping in the high zone.

High Zone Tank

The high zone tank, located at the westerly end of Seacape Drive, serves as the hydraulic control for the system. Level in this tank controls the well pumps. The tank is of redwood construction. It is 37 feet in diameter and 20 feet high providing a capacity of about 150,000 gallons when full. The pad elevation of this tank is about 475 feet, which provides a working water surface elevation in the tank in the 490 to 495 foot range. This tank was constructed when the Seacape system was built - in the mid-to-late-sixties. The condition of the wood in the tank appears satisfactory. The original bands are extensively corroded. Rebanding the tank has corrected this problem. It is estimated that the District can expect another 10 years of service from this tank before replacement. Figure 4-4 shows photographs of the tank and tank site.

Separate inlet and outlet tank piping promotes circulation. The outlet piping includes a check valve so that incoming water is diverted to the upper pipe. The tank is also equipped with a bottom drain and overflow. The site is not fenced. The tank is, however, partially screened by berms and vegetation. Figure 4-5 is a site plan of the existing high zone tank.

Low Zone Tank(s)

The remaining low zone tank and the recently failed low zone tank are both located on the same site. This site is adjacent to the private roadway, southeast of the Starbuck Drive cul-de-sac. The pad elevation of these tanks is about 260 feet, sufficient to provide adequate service pressures to the low zone of the system. This zone includes properties located along Sunset Way, Lagoon Drive and Pacific Way. Figure 4-6 is a site plan showing the low zone tanks. Figure 4-7 shows photographs of both tanks and the tank site.

Both tanks are of redwood construction. Band nut and thread failure was the direct cause of failure of the northerly tank. The District has taken the precaution of tack-welding the bolts to the bands on the remaining tank to prevent such a failure from occurring to the remaining tank. When the top bands broke on the failed tank, several staves broke at the approximate midpoint of

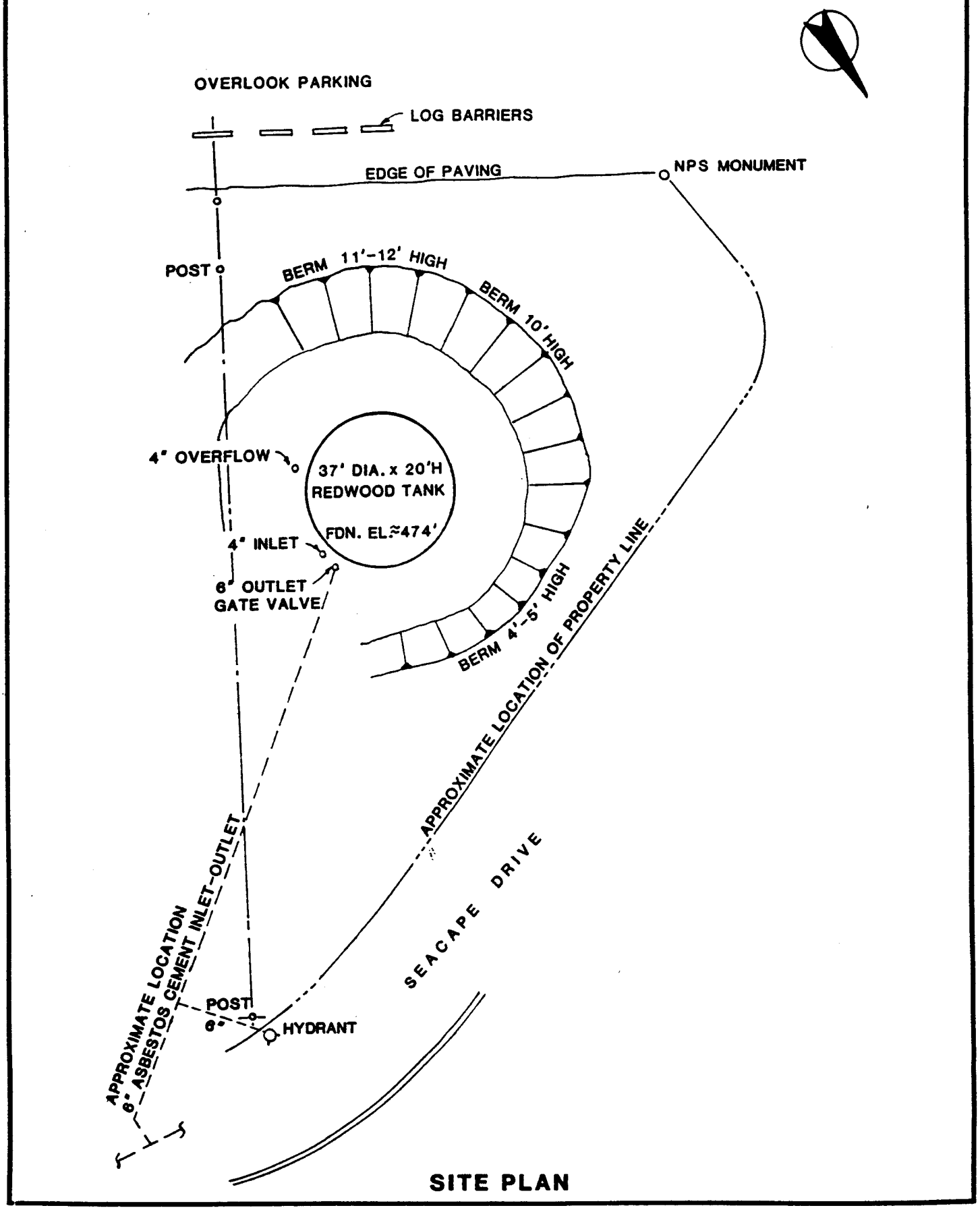
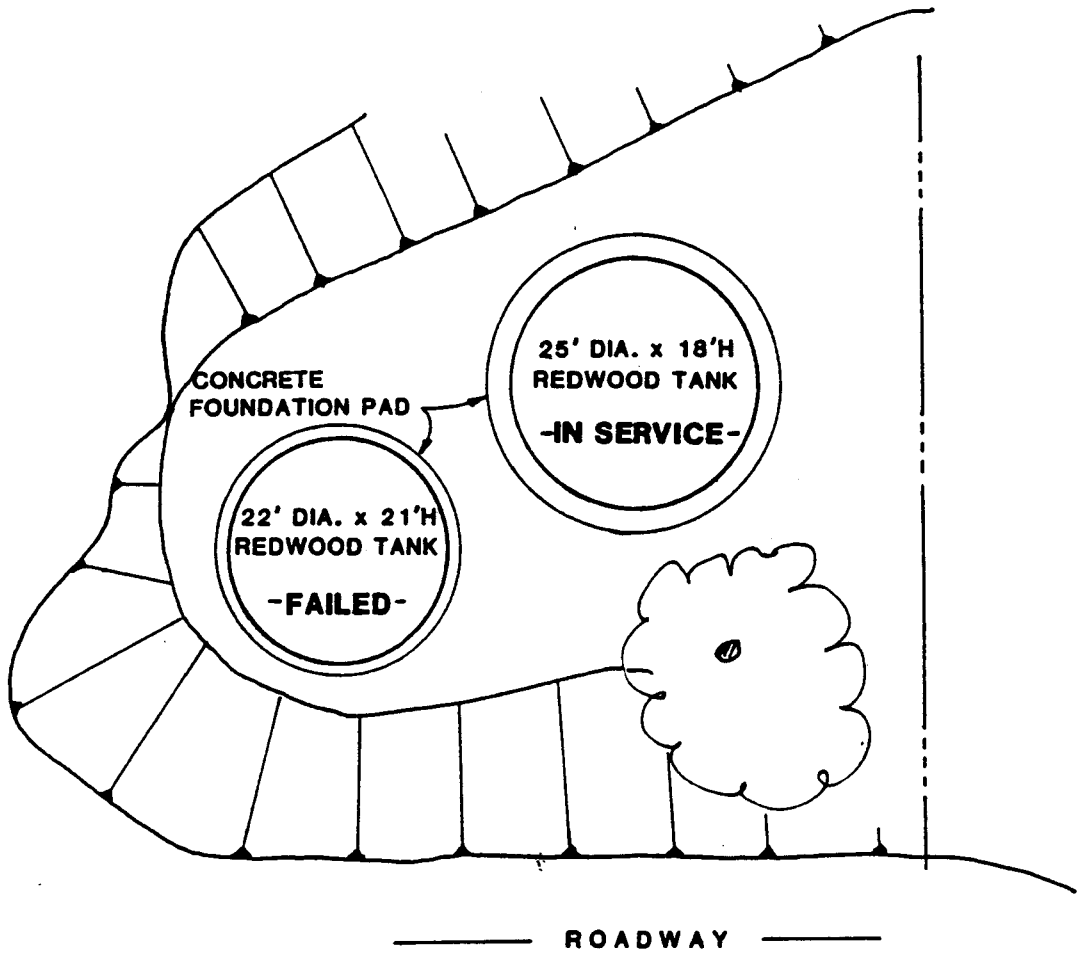


FIGURE 4-5

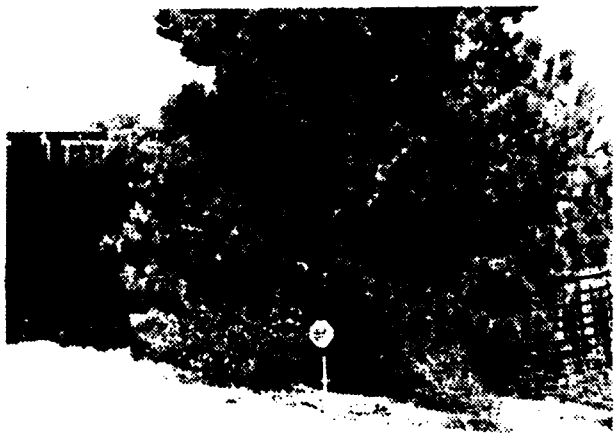
EXISTING HIGH ZONE TANK



SITE PLAN

FIGURE 4-6

EXISTING LOW ZONE TANK(S)



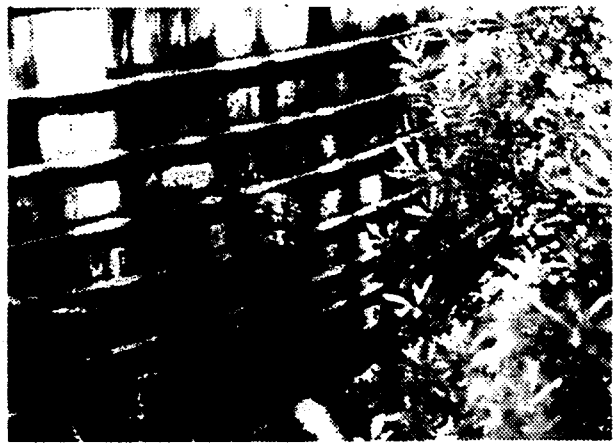


FIGURE 4-7

EXISTING LOW ZONE TANKS

the tank. Examination of the broken staves showed that they were in poor condition. These tanks were reportedly purchased used and have likely exceeded the normal life expectancy of 30 to 35 years for redwood tanks. The tank that is still in service is leaking. Wood shingles have been used to plug holes in the tank in an attempt to minimize leakage. The condition of the wood staves in this tank is poor.

The combined capacity of the two low zone tanks was about 100,000 gallons. The remaining tank has a diameter of 25 feet and is 18 feet high. Full to a normal working level, the capacity of this tank is about 50,000 gallons. The concrete foundation under the tank is 30 feet in diameter which may permit the erection of a larger diameter tank on the existing pad.

Low Zone Distribution System

The original low zone distribution system was installed in the 1920's. It consisted of small diameter galvanized steel pipe. All of this pipe was replaced with four inch polyvinyl chloride (PVC) pipe in the early seventies except for a section of 2 inch galvanized steel (GS) pipe on Cove Lane. A total of about 7,400 feet of PVC pipe was installed. The PVC pipe used was Schedule 40 which, considering the lack of an American Water Works Association (AWWA) standard for such pipe at that time, was a prudent choice. This pipe has a sufficiently thick wall to withstand pressures greater than 100 pounds per square inch (psi) over an extended period of time. Had a thinner-walled PVC pipe been used, the pipe may have failed prematurely. The installed depth of this pipe, however, is less than the normally-recommended 30 to 36 inches. The District manager has repaired sections of this pipe located in ditches that were damaged by vehicles because of shallow cover in ditches.

The low zone tank feeds the low zone system. There are no other interconnections between the high zone and the low zone. The District is now constructing a pressure regulator station on Seacape near the community center. This facility will improve the reliability of the low zone system and will allow service to be maintained in the low zone if the remaining low zone tank fails.

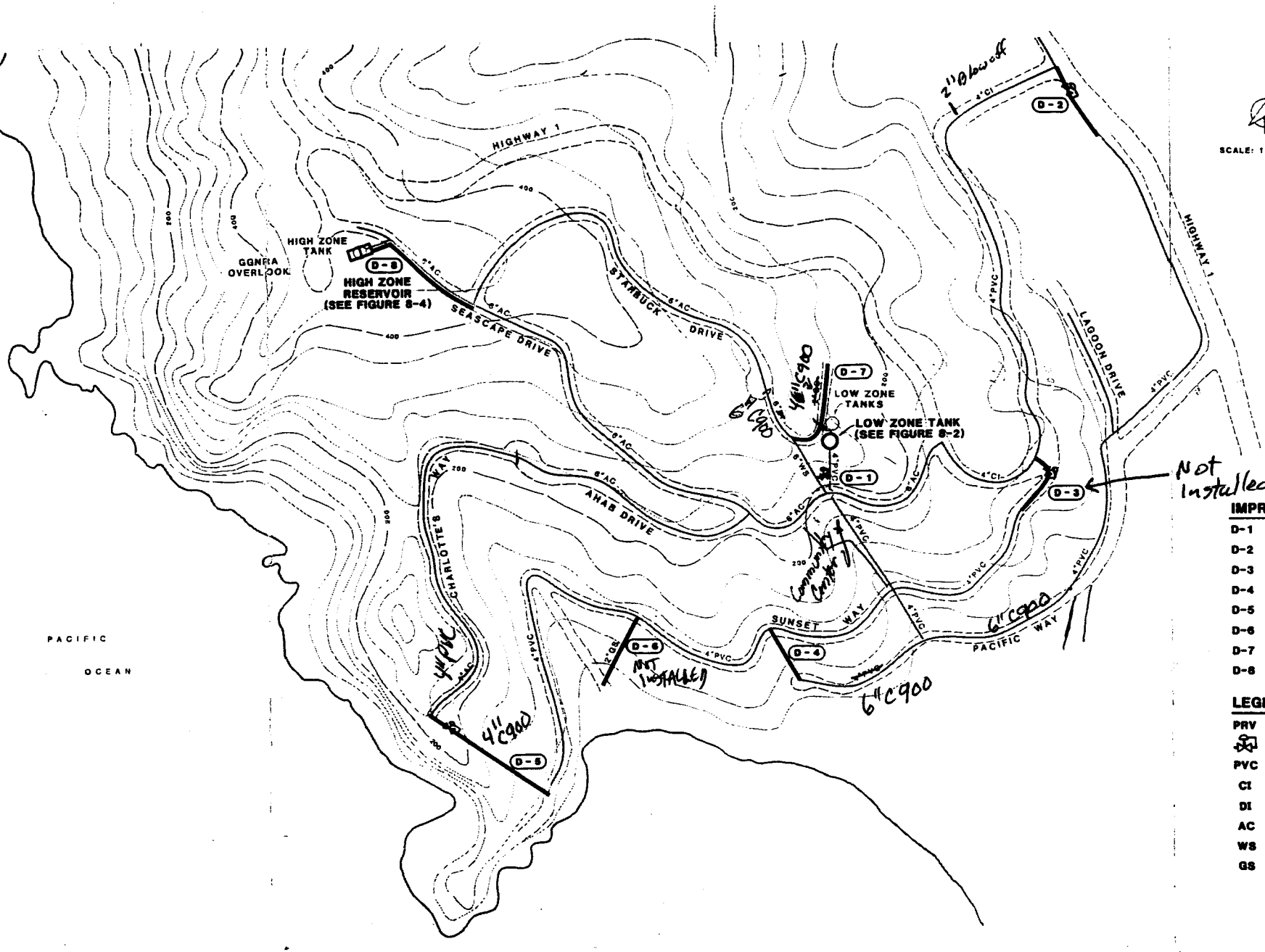
Fire Flow Capability

A computerized hydraulic model of the existing system was developed to test its adequacy under various assumed fire flow conditions. Appendix B lists the data used in preparing the model and includes printouts of typical computer "runs". The fire flow conditions modeled were chosen to simulate "worst case" fire flow situations. These included high fire flow locations or locations

The intersection of Seacape and Starbuck Drives is a critical location because of its relatively high elevation compared to the water surface elevation of the high zone tank. The water level in the tank is only 75 feet higher than the elevation of the intersection, providing a maximum of 32 psi pressure under "no flow" or "low flow" conditions. Forty (40) psi is usually the minimum acceptable pressure for residential service. Pressures are lower at times of heavy demand.

The sustainable fire flow at this intersection, maintaining the desired 20 psi residual, is about 800 gpm, adequate for residential purposes. Although the main sizes in this area are 6 inch, pressure problems will occur at this location from high flows elsewhere in the system.

The pressure problem worsens west of this intersection as Seacape rises to the elevation of the tank. Residents adjacent to the tank use individual pressure tank systems to boost pressures to acceptable levels.



SCALE: 1"=200'-0"

IMPROVEMENTS

D-1	100'-4"PVC W/PRV
D-2	330'-6"PVC W/PRV
D-3	190'-6"PVC W/PRV
D-4	250'-4"PVC
D-5	500'-4"PVC W/PRV
D-6	300'-4"PVC
D-7	370'-4"PVC
D-8	470'-8"PVC

LEGEND

PRV	PRESSURE REGULATOR VALVE STATION
	PRESSURE REGULATOR VALVE
PVC	POLYVINYL CHLORIDE PIPE
CI	CAST IRON PIPE
DI	DUCTILE IRON PIPE
AC	ASBESTOS CEMENT PIPE
WS	WELDED STEEL PIPE
GS	GALVANIZED STEEL PIPE

FIGURE 9-1

PROPOSED DISTRIBUTION SYSTEM IMPROVEME

TABLE 9-1

FIRE FLOWS - IMPROVED DISTRIBUTION SYSTEM

	Location	Fire Flows (gpm) Existing System	Improved System	Increase	Requirement
1.	Pelican Inn (low zone)	300	800	500	1,500 (1)
2.	Community Center (high zone)	1,000	1,500	500	1,500 (1)
3.	SW End of Charlotte's Way (high zone)	400	425	25	500 (2)
4.	SW End of Sunset Way (low zone)	250	600	350	500 (2)
5.	NE End of Private Drive near Starbuck Drive (high zone)	125	850	725	500 (2)
6.	Intersection of Seacape and Starbuck Drive (high zone)	800	1,500	700	1,500 (3)

(1) Minimum commercial or institutional fire flow - range 1,500 to 2,000 gpm.

(2) Minimum residential fire flow - range 500 to 1,000 gpm.

(3) Based on a 1,500 gpm fire flow at the community center (i.e., Location No. 2).

WATER SYSTEM DEMAND

		Upper Zone (40%)	Low Zone (60%)	Total System (100%)
Average Day,	gpm	10	15	25
	gpd	14,400	21,600	36,000
Maximum Day,	gpm	20	30	50
	gpd	28,800	43,200	72,000
Maximum Hour,	gpm	50	75	125

WATER SYSTEM CAPACITY

Well Pump No. 1: 70 gpm
Well Pump No. 2: 50 gpm

Either well pump able to meet total system max. day demand. Only one pump can operate at one time. NEVER OPERATE BOTH PUMPS AT SAME TIME.

Upper Zone Booster Pump: 25 gpm

(Equivalent to Upper Zone max. day demand). Well pump or storage and booster pump can meet maximum hour demand.

Upper Zone Storage Tank
- Rated capacity @ 20 ft. depth = 150,000 gal.
- Actual capacity @ 18 ft. depth = 135,000 gal.

Lower Zone Storage Tank
- Rated capacity @ 20 ft. depth = 100,000 gal.
- Actual capacity @ 18 ft. depth = 90,000 gal.

Total actual storage capacity = 225,000 gal.
- Less fire supply storage = 120,000 gal. (1,000 gpm for 2 hrs.)
- Available demand/emergency storage = 105,000 gal. (max. hr. demand for 14 hrs.)

Emergency Storage Availability (no well pump operation)
- @ Average Day Demand = 3 days
- using fire flow storage = 6 days
- @ Maximum Day Demand = 1.5 days
- using fire flow storage = 3 days

UPPER ZONE STORAGE TANK
OPERATION

1. The water level should fluctuate between ~~13~~ 14 and 18 feet (full). One foot depth in the tank is equivalent to 8,000 gallons. Therefore, for the average daily water use of 36,000 to 40,000 gallons, the tank level should fluctuate 4.5 to 5 feet.

2. The water level should never be allowed to fall below ~~13~~ 14 feet except as planned for tank cleaning, inspection, repair, etc. The water volume below ~~13~~ 14 feet (104,000 gallons) is fire storage. 51

3. A schematic diagram of the tank, piping and valves is shown below.

Normal Operation

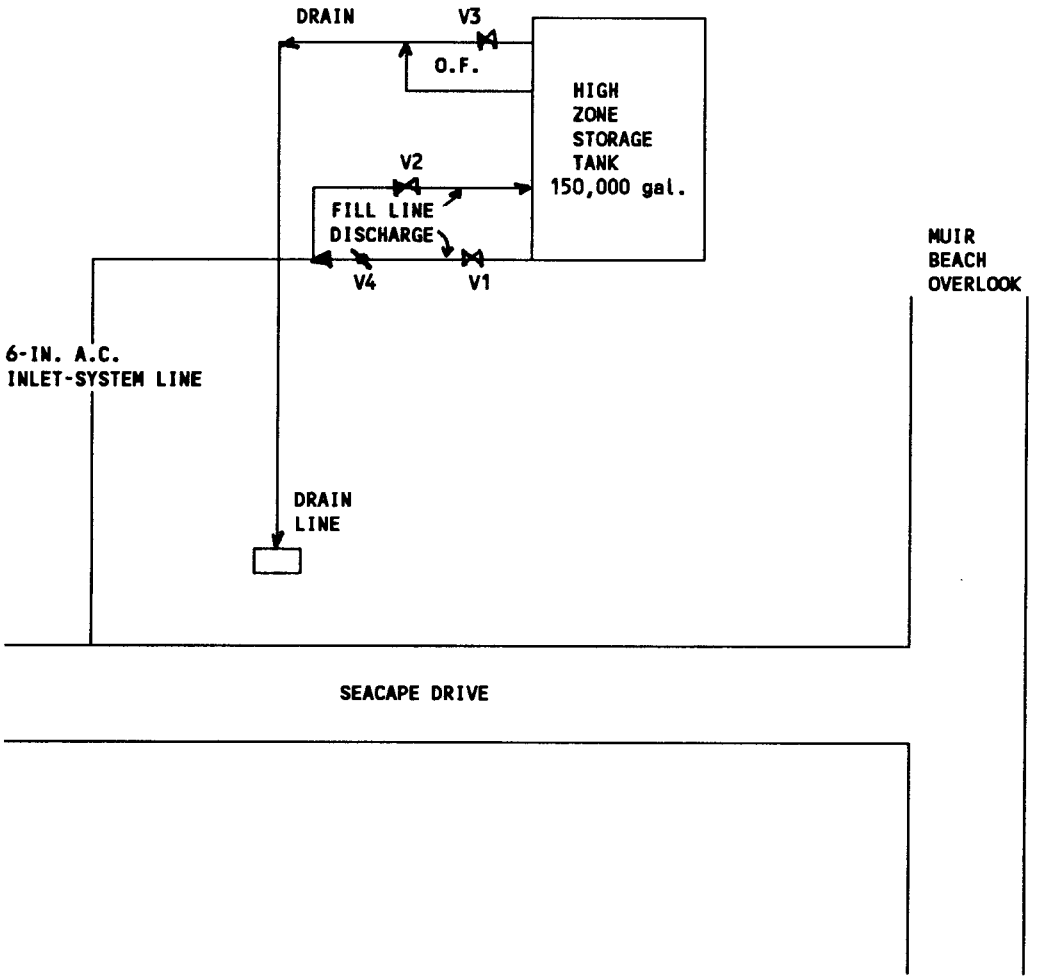
1. Gate valves V1 (outlet to system) and V2 (tank fill line) are open. Valve V3 (tank drain line) is closed.

2. Water enters the tank by operating either well pump and/or the lower tank booster pump through the 6-inch diameter pipeline in Seacape Drive. When water is being pumped (50 to 70 gpm) and the system demand is less than the pumping rate, check valve V4 will close and the excess water will be diverted through the tank fill line (4-inch steel pipe on outside of tank, V2), that discharges inside the top of the tank.

3. When the pumps are not operating or the system demand is greater than the pumping rate, check valve V4 will open and water will flow out of the tank into the system through the 6-inch pipeline (V1).

Maintenance Operation

1. To drain the tank for maintenance, allow the water level to drop by feeding water into the system with all pumps off for 3 to 4 days. Complete the draining of the tank by opening the drain valve (V3)


DRAIN
V3
O.F.
HIGH
ZONE
STORAGE
TANK
150,000 gal.
V2
FILL LINE
DISCHARGE
V4
V1
MUIR
BEACH
OVERLOOK
6-IN. A.C.
INLET-SYSTEM LINE
DRAIN
LINE
SEACAPE DRIVE

LOW ZONE STORAGE TANK

OPERATION

The low zone 100,000 gallon water storage tank is directly connected to the upper zone tank through the 6-inch diameter Starbuck Drive main and 2-in. diameter Starbuck Drive extension line. The low zone tank is ~~the~~ one of four hydraulic control points for the low zone. ~~and is the only source of water for the low zone under normal operating conditions~~ The other three control points are the three pressure regulating stations. The tank water level is normally maintained at 18 ft. Each one (1) foot mark is equivalent to 5,000 gallons. In the event of an emergency problem with the tank, there is a ~~second~~ intertie between the low zone and upper zone located on Seacape Drive across from the Community Center. The intertie is between the 6-in. diameter steel pipeline extension from Starbuck Drive and the 4-in. diameter PVC tank discharge line. The intertie consists of shutoff valves and a pressure regulating valve to control the low system water pressure. SEE HIGH TO LOW ZONE INTERCONNECTION OPERATING INSTRUCTIONS ON A FOLLOWING PAGE. This intertie is normally shut off and is only used in an emergency situation.

The low zone tank also is equipped with a 25 gpm booster pump that can be operated to supply water back up into the upper zone in the event of an upper zone emergency (e.g. upper storage tank problem, need to transfer water to upper storage tank, need to increase pressure in the upper zone, etc.). The tank drain line also has a fire hydrant connection to connect a booster pump to the nearby high zone hydrant. This is the HIGH ZONE EMERGENCY FIRE CONNECTION.
The low zone tank schematic diagram is shown below and the normal operation is as follows:

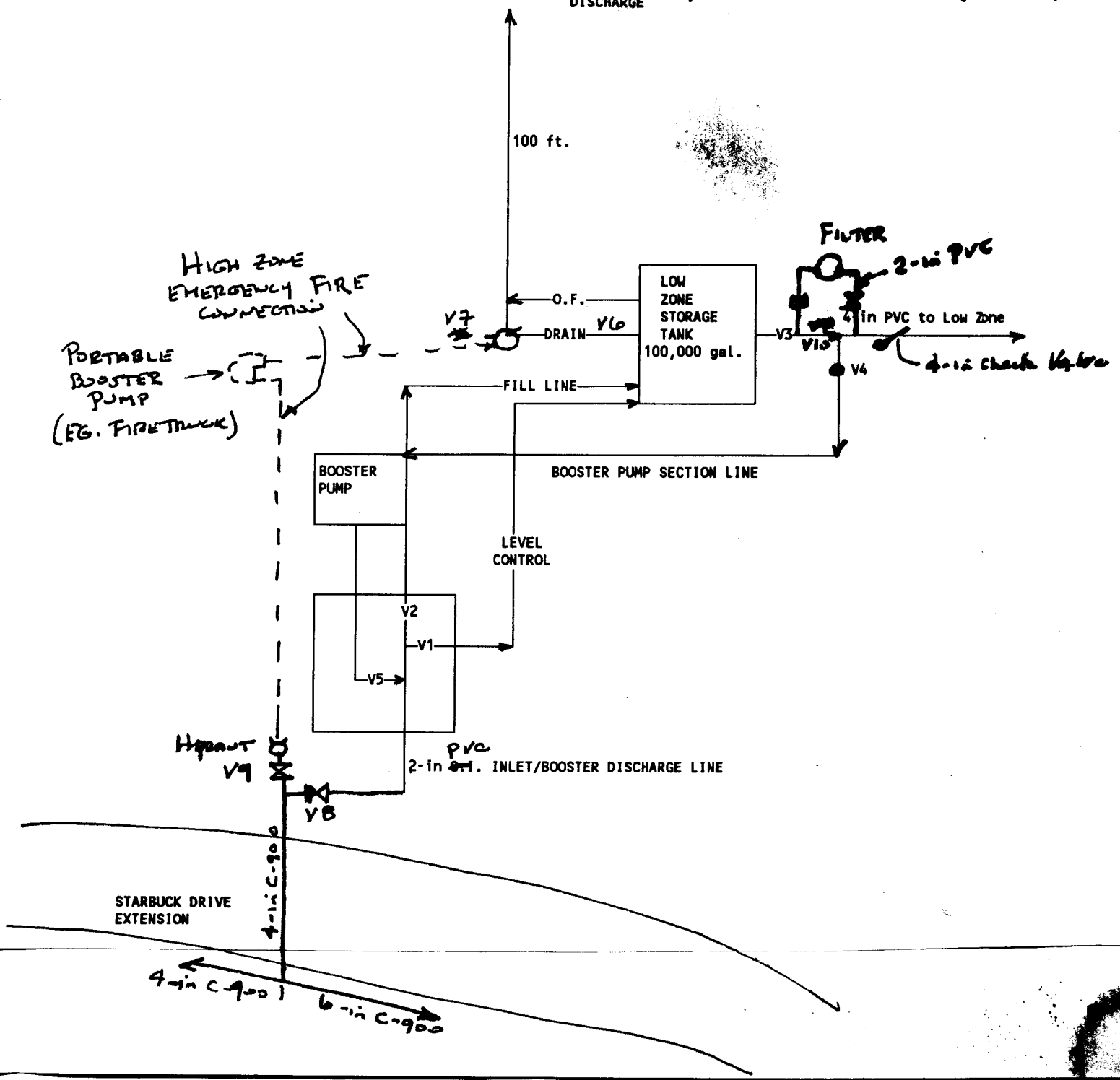
1. Control Valve V1 and gate valve V2 ~~or~~ are open to allow water to fill the tank. The level in the tank is normally set at 18 feet and is hydraulically controlled by the control valve through a ¾ inch line that extends to the 18 ft. level near the top of the tank. A ball float in the end of this line closes when the tank is full and automatically closes the control valve that shuts off the incoming water. When the tank level drops, the ball float opens signalling the control valve to open to fill the tank. Normally, the water level indicator on the side of the tank will read 18 ft. or slightly less. If the level is significantly less than 18 ft., this indicates a problem.

2. Discharge from the tank to the low zone system is through the 6-in. diameter steel pipe that transitions to a 4-in. diameter PVC pipe. Gate valve V3 is a shutoff valve to be used only when it is necessary to shut off the low zone water supply or to isolate the tank for some reason. A sand filter is installed on the tank discharge line. Gate valve V10 is closed and the two - 2-in gate valves on the filter lines are open with the filter in operation.
3. The tank has an overflow (O.F.) line and drain line that discharge into a common 4-in. diameter PVC pipe that discharges 100 feet downhill from the tank northwest of the home at No. 8 Seacape Drive. The drain valve V6 is normally closed unless it is necessary to open the drain line. A second valve, V7 is used for the HIGH ZONE EMERGENCY FIRE CONNECTION. In this case, V6 is open and V7 is closed to allow for operation of the hydrant.

*** IMPORTANT NOTE: IN A FIRE EMERGENCY IN THE LOW ZONE, GATE VALVE V10 SHOULD BE OPENED AND THE FILTER VALVES CLOSED.

4. The upper zone Booster Pump is operated to transfer water back up into the upper zone under abnormal conditions. To operate this pump, ball valve V4 and V5 are opened and gate valve V2 is closed. When the electrical power switch located on the side of the tank is turned on, the booster pump will operate and backfeed water into the upper zone. Water will still service the lower zone since valve V3 remains open. SEE BOOSTER PUMP OPERATING INSTRUCTIONS ON A PREVIOUS PAGE.

NOTE: EMERGENCY OPERATION. WATER CAN BE PUMPED FROM THE WELLS THROUGH THE LOW ZONE TO THE LOW ZONE TANK TO BYPASS THE NORMAL HIGH ZONE TRANSMISSION LINE IN THE EVENT OF AN EMERGENCY. IN THIS CASE, THE CHECK VALVE IN THE TANK DISCHARGE LINE MUST BE MANUALLY OPENED TO ALLOW WATER FLOW INTO THE TANK. WATER CAN THEN BE FED TO THE HIGH ZONE WITH THE BOOSTER PUMP.



MUIR BEACH
BOOSTER PUMP OPERATING INSTRUCTIONS

1. OPEN 2" BUTTERBALL VALVE NEXT TO MAIN 6" SUPPLY VALVE ON SOUTH SIDE OF TANK.

2. OPEN 1-1/4" BUTTERBALL VALVE ON PUMP DISCHARGE LINE IN VALVE PIT.

3. CLOSE 2" GATE VALVE DOWNSTREAM OF ALTITUDE VALVE IN VALVE PIT.

4. SET PUMP CONTROL SWITCH TO AUTOMATIC POSITION.

5. POSITION MAIN DISCONNECT SWITCH TO ON POSITION.

6. WHEN PUMPING OPERATION IS COMPLETE, REVERSE ALL VALVES AFTER DISCONNECTING ELECTRICAL SWITCH FOR PUMP.

MUIR BEACH

WELL PUMP OPERATING INSTRUCTIONS

*IMPORTANT NOTE!!- NEVER OPERATE BOTH PUMPS AT ONCE!!

1. MAIN WELL PUMP OPERATION:
   A. BE SURE 3" GATE VALVE AT WELL HEAD IS OPEN.
   B. SET HAND/OFF/AUTO SWITCH ON AUTO POSITION.
   C. START AND STOP PUMP BY OPERATING MAIN PUMP TIMER SWITCH.
   D. BE SURE STAND-BY WELL PUMP DISCONNECT SWITCH IS IN THE OFF POSITION.

2. STAND-BY WELL PUMP OPERATION:
   A. OPEN 3" GATE VALVE UNDER THE BRIDGE ACROSS THE CREEK BELOW THE BRIDGE STEPS.
   B. SET HAND/OFF/AUTO SWITCH ON AUTO POSITION.
   C. START AND STOP PUMP BY OPERATING STAND-BY PUMP TIMER SWITCH.
   D. BE SURE THE MAIN WELL PUMP DISCONNECT SWITCH IS IN THE OFF POSITION.

NOTE: WHEN RETURNING TO MAIN WELL PUMP OPERATION, CLOSE 3" GATE VALVE UNDER BRIDGE STEPS ACROSS THE CREEK.

PROCEDURES — VALVES

1. Conduct visual inspection around top of valve with flashlight. Observe any evidence of leakage or other unsual conditions. NOTE: Some cities install operating nut extension stems consisting of a socket over the valve operating nut at the lower end, and a nut with a wide flange at upper end. The flange serves to center the upper operating nut near the surface, so that a relatively short Tee Wrench can be used and conveniently carried in a service truck. This extension piece must be lifted out in order to inspect the top of the valve itself.

2. Close the valve all the way and count the number of turns.

3. Open the valve all the way and count the number of turns.

   Information on the correct number of turns is readily available from manufacturers.

NUMBER OF TURNS TO OPEN OR CLOSE CLOW VALVES

VALVE SIZE	TURNS TO OPEN
3"	7
4"	15
6"	21
8"	27
10"	33
12"	39
14	45
16"	52
18"	58
20"	64
24"	76

Turns to open are for valves without gearing.
For 14",16" and 18" geared valves take above turns to open multiplied by 2.

This test will reveal the presence of foreign material or a malfunction within the valve which prevents complete closing or opening.

4. Repeat visual inspection of top of valve. Observe any change in condition around the top of valve that may have occurred during operation.

   Occasionally a small amount of leakage will take place during the operation of a valve stem, this is not particularily serious. However, if leakage continues after completion of the closing and opening test, it means, in the case of compression type packing the packing material has crystallized and become hard or the gland follower bolts need tightened. Most valve operating nuts are shaped so that the gland nuts can be reached with a long socket wrench Care should be taken to see that the gland bolts are tightened

envenly so as not to cock the gland, and bind the stem. In the case of "0" ring seals continues leakage after the closing and opening tests are completed, means that the "0" rings have been damaged and should be replaces.

5. Record dates and observations for each valve and compare with record of previous observation. Any changes of conditions will readily be apparent and will give warning of possible trouble before is reaches emergency proportions.

6. IMPORTANT EFFECTS OF PROGRAM

   a. Dislodge sediment.
   b. Dislodge products of corrosion and maintain clearances. Because of dissimilar metals used in valve construction corrosion, or ion exchange, can be expected in the presence of water having very high, or low pH values. This can be especially troublesome if moving parts are not disturbed periodically.

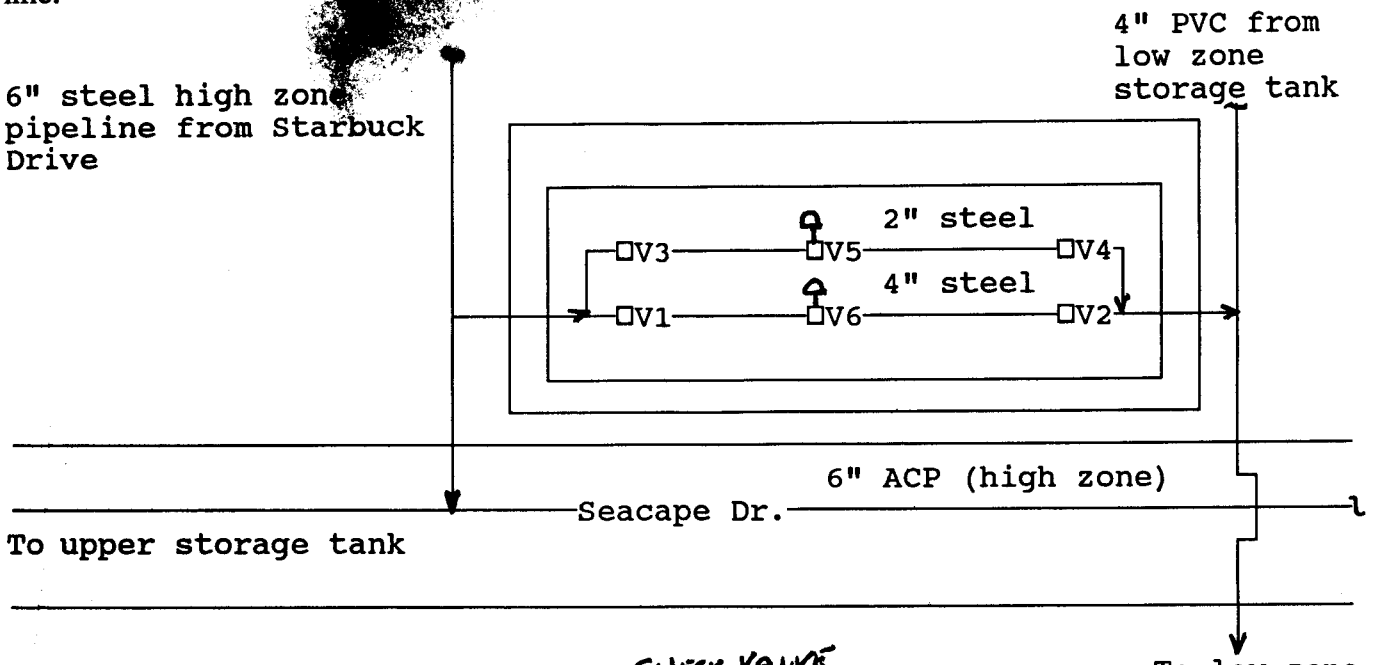
   c. Disturb water that sometimes lies dormant in the bonnet and other cavities in the valve.

NOTE: An effective procedure for clearing the inside of a valve, prior to closing and opening as in 2 and 3 above, is to close a valve downstream. Then open a hydrant downstream and adjacent to the valve being tested. This causes water to rush through the valve at high velocity while it is being closed and reopened. It creates maximum disturbance of unwanted sediment and etc.

HIGH TO LOW ZONE INTERCONNECTION
PRESSURE REGULATING STATION
(Across From Community Center)

A high to low pressure zone interconnection is located across from the Community Center on Seacape Drive. The purpose of the interconnection is to provide an emergency water supply to the low zone in the event of a problem with the low zone storage tank (the source of water for the low zone under normal operations).

A schematic diagram of the interconnection - pressure regulating station is shown below. A pressure regulator is required to provide about ~~100~~ 25 psi feed pressure to the low zone at this point. (This is the same pressure or head being provided by the low zone storage tank.). The pressure in the upper zone system at this point is about 130 to 140 psi. Under normal operation, water will flow through the 2 in. line and PRV until it can no longer meet demand. Then the 4-in. line will automatically open to provide service. When demand drops, the 4-in. line will close and service will resume through the 2-in. line.



EMERGENCY OPERATION * CLOSE 4" CHECK VALVE on Low Zone Tank Discharge Line

1. Slowly open all gate valves (V1, V2, V3, V4)
2. Open ball valve (with handle) on 4" PRV (V6)
3. Adjust 4" PRV pilot valve with allen wrench to desired operating pressure of ~~100~~ 25 psi (check gage)
4. Check adjustment of 2" PRV (screw on top) to ~~100~~ 25 psi (check gage)

RETURN TO NORMAL OPERATION

1. Shut ball valve on 4" PRV (V6)
2. Shut all gate valves (V1, V2, V3, V4)
3. Open 4" Check Valve on Low Zone Tank Discharge Line.

NOTE: ADD HIGHWAY 1 AND SUNSET WAY PRESSURE REGULATING STATIONS TO THIS PROCEDURE.

EMERGENCY POWER OPERATION
PROCEDURES

The Pump House is equipped with an emergency power safety switch that can provide electrical power to the main well pump in the event of a prolonged electrical power outage. The 15 Hp, 240V well pump motor requires a 30 KW source to start the motor.

A portable engine-generator of at least 30 KW capacity can be connected to the electrical system and safety switch by means of an electrical cable provided with the switch. A plug that is compatible with the generator needs to be provided or the cable can be wired directly to the generator.

When the safety switch is operated for emergency power, it automatically shuts off the normal PG&E main power source. However, the PG&E main power switch in the Pump House should be shut off prior to activating the emergency power generator.

Possible sources to rent a portable 30 kW generator are:

1. Piston Power Systems
   Napa (707) 257-3058

2. Mobile Energy, Inc.
   Fremont 770-9045

3. Peterson Power Systems, Inc.
   San Leandro 895-8400

K. O'Brien

Benicia 707 745-9544

CHLORINE DOSE
PROCEDURE

Chlorine Demand
Iron and Manganese = 0.83 mg/l Cl_2
Water System & Residual (0.1 mg/l) = 0.5 mg/l Cl_2
Total Demand = 1.33 mg/l Cl_2

Chlorine Dose
3-1/4 quarts (110 ounces) of Cl_2 solution to 10,000 gal. of water = 10 mg/l
or 11 oz./10,000 gal. = 1 mg/l Cl_2
or 40 oz./36,000 gpd = 1 mg/l Cl_2 (average day water demand)
or 53.4 oz./36,000 gpd = 1.33 mg/l Cl_2 (average water demand)

or $\frac{53.4 \text{ oz.}}{133.4 \text{ oz./gal.}}$ = 0.4 gal./day Cl_2 solution feed to 36,000 gal./day = 1.33 mg/l Cl_2 dose.

Chlorine Solution Feed Storage Tank = 100 gallons
therefore $\frac{1 \text{ gallon of } Cl_2 \text{ solution}}{100 \text{ gallons water}}$ = 0.01 dilution

therefore for $\frac{0.4 \text{ gal./day } Cl_2 \text{ feed}}{0.01 \text{ dilution}}$ = 40 gal./day of diluted feed solution to 36,000 gpd water = 1.33 mg/l Cl_2 dose.

OR 2 gallons of Cl_2 solution = 20 gal./day of diluted feed solution to 36,000 gpd water = 1.33 mg/l Cl_2 dose.

THEREFORE Add 2 gallons of Cl_2 solution to 100 gallons of dilution water in storage feed tank every 5 days. Set feed pump to deliver 20 gal./day from storage tank to 36,000 gal./day of pumped water.

PROCEDURES

1. If necessary, notify Telephone Tree & Fire Department (See Next Page)

2. Isolate the Problem
   - Leak - Use nearest shutoff valve(s).
   - Well Pump Malfunction - shut off electrical service.
     NOTE: Activate backup pump if possible.
   - Storage Tank - Shut off inlet-outlet valves.
     - Drain tank if necessary.

3. Depending Upon the Problem:
   - Distribution System Leak - Repair Self or call Contractor
   - Well Pump Malfunction - Call Forester Pump & Engineering
   - Storage Tank Problem - Call Bellagio Wood Tank Co.
   - Electrical Service - Call PG&E
     NOTE: May need to rent 30 KW-240 V portable generator to operate one well pump.
     SEE EMERGENCY POWER OPERATION PROCEDURES

4. Upper Zone Storage Tank Problem
   Maintain Water Service in Upper Zone by the operation of the booster pump located at the low zone storage tank - SEE BOOSTER PUMP OPERATION PROCEDURES.

5. Low Zone Storage Tank Problem
   Maintain Water Service to the Low Zone by operation of the interconnection - pressure regulating station located on Seacape Drive across from the Community Center and/or the interconnection on Hwy 1 and Sunset Way.
   SEE INTERCONNECTION - PRESSURE REGULATING STATION PROCEDURES.

JOB DESCRIPTION

Simply stated the job of the water technician is to keep the system operating in order to deliver safe and pleasant water.

Duties:

1. Operate and maintain well pump controls/settings.
2. Collect and transport water samples to appropriate labs -- take appropriate steps if results exceed requirements.
3. Clean chlorine tank
4. Protect water pipes and facilities from corrosion effects. Inspect pipes for leaks, problems and vandalism
5. Observe pump meters to detect unusual noises or excessive heat.
6. Fill chlorine tank. Always chlorinate water.
7. Keep records in daily log book
    a. hours of operation
    b. water production
    c. weather
    d. chlorine dose
    e. problems
8. Start up or shut down pump as necessary to regulate flow and pressure.
9. Troubleshoot minor electrical and mechanical equipment problems and correct.
10. Troubleshoot to locate the causes of water complaints.
11. Respond to customer complaints as soon as possible.
12. Discuss with the customers their concerns regarding water and system.
13. Flush sand filter and change filters at Green Way and pressure regulating stations.
14. Check upper and lower storage tank levels, determine if there are leaks, and assess general operating condition of tanks. Upper tank should be between 14 and 18 feet. Low zone tank level should be at 18 feet.
15. Check chlorine residuals.
16. Flush hydrants.
17. Exercise back up well pump when we get one.
18. Exercise upper zone booster pump 8hrs per month .
19. Read water meters.
20. Repair and replace meters, shut off valves, meter boxes when necessary.

21. Open drain lines on upper and lower tanks to flush accumulated material. Flush approximately 3000 gallons from each tank.

22. Exercise all system valves.

23. Report to the CSD when required.

24. Report to General Manager when required. When in doubt report to General Manager.

25. Help schedule replacement of key equipment, (well pumps, electrical equipment, valves) and help schedule maintenance items (storage tanks, cleaning lines, rehabilitation or replacement of maintenance equipment, meters etc.)

26. Service pressure regulating stations.

27. Continue education classes and seminars.

28. Order supplies (chlorine, pipe fittings, filters, test chemicals)

This job requires two certifications:

a. Distribution operator
b. Water treatment operator

HYDRANT FLUSHING SCHEDULE / EXERCISE VALVES

MONTHLY

1. ~~West End of Pacific Way & Flush Valve~~
2. End of Lagoon Drive
3. End of Sunset Way ~~(Both Ends)~~ Hwy. 1.
4. End of Charlott's Way
5. End of Starbuck Drive Extension
6. ~~Hwy. 1 (Near Franks Valley Road)~~ 2" Blow off at Highway 1 Bridge
7. ~~Seacape Drive near No. 88 (across from upper storage tank)~~
8. Pump House

SEMI-ANNUALLY

1. Pacific Way and Highway 1
2. Sunset Way
3. AHAB Drive & Charlott's Way
4. Seacape Drive
5. Starbuck Drive including extension

ACTION REQUIRED

1. Notify affected residents prior to flushing
2. Observe and note water quality (e.g. color, grit, etc.)
3. Place notes in file

DAILY SERVICES

1. Check well pump operation/electrical controls/settings.

2. Check chlorine tank/feed pump operation. Add chlorine as necessary in accordance with approved procedures. (See next page)

3. ~~Flush sand separator.~~ (Daily or as needed)

4. Inspect piping and facilities for leaks, problems, vandalism.

5. Check upper and lower storage tanks levels, leakage, general operating condition. The upper zone storage tank level should operate between ~~13~~ 14 and 18 feet. The low zone storage tank level should always be 18 feet.

6. Check chlorine residual at pump house and remote locations.

7. Maintain daily log of operations to include:

   a. Hours of pump operation
   b. Water production (gal./day)
   c. Cl_2 do[redacted]and residual
   d. Identified problems - action taken
   e. Customer/service calls - action taken

WEEKLY SERVICES

1. CLEAN PRS FILTERS, GREEN LAKE FILTER AND LOW ZONE TANK SAND FILTER.

MONTHLY SERVICES

1. Monthly Report to CSD Board of Directors

2. Coliform Samples Brelje & Race Laboratories.
   Collect one upper and one lower zone sample in bottles provided by ~~North Marin Water District~~ and deliver to the ~~District~~ laboratory the same day (no later than 3 p.m.). Collect the two samples near the middle of the month if possible.

   REPORT RESULTS TO THE COUNTY HEALTH DEPARTMENT. SEE COUNTY EMERGENCY NOTIFICATION PLAN IF RESULTS EXCEED REQUIREMENTS (<2.2 MPN/100 ml.)

3. Flush selected fire hydrants (see Hydrant Flushing Schedule).

4. Exercise Backup Well Pump for 6 days/month (20 percent of time).

5. Exercise Upper Zone Booster Pump 8 hrs./month (1 percent of time).

6. Exercise portable electrical generator unit.

7. Water Meter Reading (performed by District Secretary).

8. Compare metered monthly water production and water use quantities to determine the amount of unaccounted for water use or loss (e.g. leaks).

9. Service meter maintenance, calibration, repair or replacement.

10. Leak detection and repair.

11. Maintain maintenance equipment and supplies.

12. Maintain water system files, records and drawings.

13. Maintain and update standard operating procedures.

SEMI-ANNUAL SERVICES

Routine services to be provided on a semi-annual (twice per year) basis include:

1. Hydrant Flushing (See Hydrant Flushing Schedule).

2. Open drain lines on upper and lower zone storage tanks to flush accumulated material. Drain about 3,000 gallons of water from each tank (0.4 to 0.6 feet). Check the drain outlets for proper operation, color of the water or other indications of dirty/clean water.

3. Exercise all system shutoff valves

ANNUAL SERVICES

Routine services to be performed on an annual (once per year) basis include:

1. Chemical and mineral analysis of the water supply and report to customers and County Health Department.

2. Assist the District in the preparation of the annual budget to provide adequate funding for routine operation and maintenance services and capital improvements.

   Schedule replacement of key equipment (e.g. well pumps, electrical equipment, control valves) and schedule maintenance items (e.g. storage tank cleaning, line rehabilitation or replacement, maintenance equipment, meters, etc.).

3. Service Fill Line Control Valve at Lower Storage Tank
4. Service Pressure Regulating Stations

SECTION 2
EVALUATION OF EXISTING FACILITIES

INVENTORY OF EXISTING FACILITIES

Table 2-1 provides an inventory of existing water system facilities, and the year they were installed or replaced. The inventory is divided into major system components to include:

- Well Supply and Pumping System located on District property adjacent to Redwood Creek and Muir Woods Road.
- Transmission Main to the High Zone (Seacape Subdivision).
- A 150,000 gallon High Zone redwood storage tank with a maximum effective storage capacity of 135,000 gallons.
- A 100,000 gallon Low Zone redwood storage tank with a maximum effective storage capacity of 80,000 gallons.
- The High Zone and Low Zone distribution piping system, valves, and hydrants.
- Customer service meters.
- High Zone to Low Zone interconnection pressure regulation stations (3)

TABLE 2-1
WATER SYSTEM INVENTORY

Facilities	Year Installed
WATER SUPPLY	
Well No. 1 (including piping)	1982
Well No. 2	1970
Pump for Well No. 1 (15HP)	1991
Pump for Well No. 2 (15HP and piping)	1989
Pump House	1965
Chlorinator	1993
Well Pump Electrical Controls (2 ea.)	1990
Sand Separator	1990
Control Valves/Piping	1990
Emergency Generator Switch	1990
High Zone Storage Tank Telephonic Level Transmitter	1991

TABLE 2 - 1, Continued

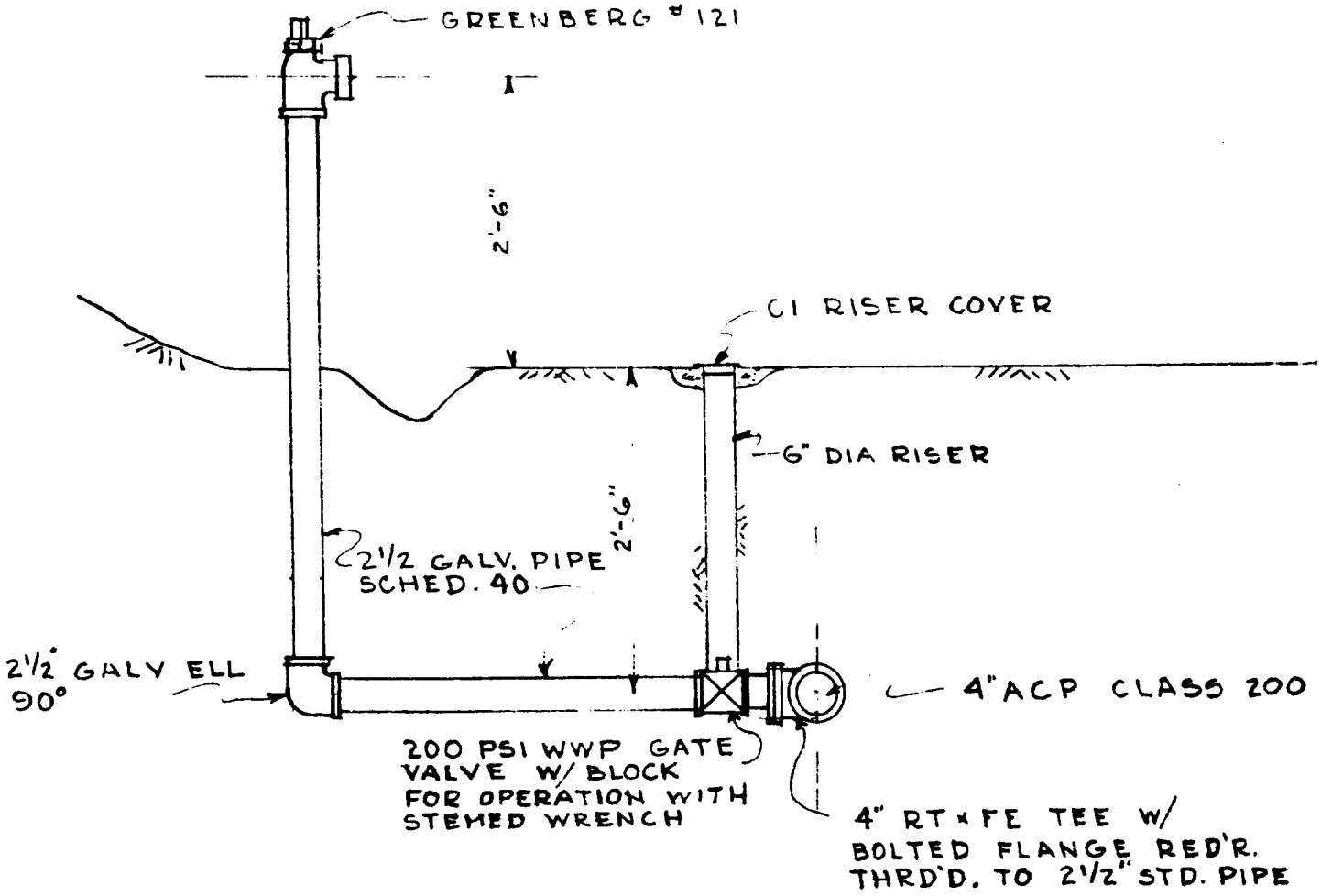
Facilities	Quantity	Year Installed
TRANSMISSION MAIN		
4 inch C.I.C.L. pipe	5,500 ft	1965
4 - in D.I.C.L. pipe for Highway 1 Connection & Pressure Regulating Station ("PRS")	325 ft.	1991
DISTRIBUTION MAINS		
High Zone (Seacape Subdivision)		
6 inch A.C. pipe	6,500 ft.	1965
6 inch D.I.C.L. pipe	260 ft.	1965
6 inch W.S.C.L. pipe	200 ft.	1965
6 inch C-900 pipe (Starbuck Extension)	230 ft.	1993
4 inch PVC pipe (Charlotte's Way)	1,300 ft.	1970
4 inch C-900 pipe (Starbuck Ext.)	270 ft.	1993
Low Zone (Bello Beach Subdivision)		
4 inch PVC pipe	7,400 ft.	1971-72
4 inch C-900 pipe (western Sunset to Pacific Way Intertie)	323 ft.	1992
2 inch G.I. pipe (Cove Lane)	300 ft.	Original
4 inch C-900 pipe & PRS (Charlotte's Way to Sunset Way Intertie)	500 ft.	1993
LINE VALVES		
4 inch Gate (Low Zone)	5 ea.	1971-72
4 inch Gate (Low Zone)	4 ea.	1991-92
6 inch Gate (High Zone)	4 ea.	1965
6 inch Gate (High Zone)	6 ea.	1992-93
4 inch Gate (High Zone)	5 ea.	1992-93
2 inch Gate (High Zone)	1 ea.	1993
HYDRANTS		
2-1/2 to 3 inch. (High Zone)	8 ea	.1965
6 inch (High Zone)	1 ea.	1965
2-1/2 inch (Charlotte's Way)	2 ea.	1970
2-1/2 inch (Low Zone)	12 ea.	1971-72

TABLE 2-1 continued

Facilities	Quantity	Year Installed
HYDRANTS, Continued		
2-1/2 inch (High Zone)	1 ea.	1990
4 - inch (Low Zone)	6 ea.	1991-93
4 - inch (High Zone)	4 ea.	1992-93
CUSTOMER SERVICE METERS		
3/4 inch	45 meters (High Zone)	1965
	10 meters (High Zone)	1991-93
	90 meters (Low Zone)	1990-93
1 inch	1 meter (Collier property)	1990
1-1/2 inch	1 meter (Pelican Inn)	1986
4 inch	1 meter (Well House Production)	1990
STORAGE TANKS		
150,000 gal. redwood (Upper Tank).		1965
New Retention Bands		1986
Ladder/Cleaning & Repairs		1990
New Roof and Staff Water Level Gage		1991
Exterior Linseed Oil Preservative Treatment		1993
100,000 gal. redwood (Lower Tank).		1988
25 g.p.m. Booster Pump and Electrical Service		1990
Sand Filter System		1993
Fire Hose Connection		1993
PRESSURE REGULATING STATIONS		
4 inch by 2 inch (Community Center)	1 each.	1988
4 inch by 1-1/4 inch (Highway 1)	1 each.	1991
4 inch by 1-1/4 inch (Sunset Way)	1 each.	1993

ABBREVIATIONS APPLICABLE TO TABLE 2-1:

C.I.C.L.	Cast Iron-Cement Lined pipe
D.I.C.L.	Ductile Iron-Cement Lined pipe
W.S.C.L.	Welded Steel-Cement Lined pipe
A.C.	Asbestos Cement pipe
C-900	Plastic pipe
PVC	Plastic pipe
G.I.	Galvanized Iron pipe



FIRE HYDRANT DETAIL

3/4" = 1'-0"

SPECIFICAT

1. 4" Pipe: Jo
2. Steel Pipe
3. Ser

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MAILING ADDRESS
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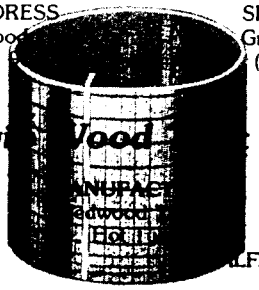
Healdsburg, Ca.

SHOP LOCATION
Grant School Road
(707) 433-4605

A. Bellagi Wood Co., Inc.



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