

This booklet is prepared to familiarize you with The Evergreen State College. We will be working with and around all the people on this 990 acre campus. Our primary purpose is to support academicians and their programs by providing utilities, sewers, fire protection and watchman service, environmental health and safety, building and grounds maintenance, waste disposal and custodial services.

We provide you an opportunity to participate in the maintenance training program because we must have technically oriented people to operate and staff our maintenance facility. This manual will help familiarize you with the principles, methods, and the basic systems of The Evergreen State College.

In many respects, The Evergreen State College is a small city, in that we have:

1. Storm water drainage systems
2. Sanitary sewer systems
3. Utility tunnel systems
4. Sanitary water distribution system
5. Central heating plant and distribution system
6. Parking facilities
7. A large growing population.

The 990 acre campus site is located in a wooded area of rolling hills on Cooper Point Peninsula approximately five miles northwest of Olympia. The site was selected after thorough study by the Board of Trustees and the Stanford Research Institute. The site includes 3300 feet of waterfront on Eld Inlet of Puget Sound. Present buildings and systems represent an investment of over \$38 million.

Let's look at each of the above systems and learn what it is composed of, where it is located, how to use it advantageously, and how to operate it under emergency conditions.

#### Storm Drainage Systems

The purpose of this system is to collect surface water from rain, snow and hail and dispose of it so that there will be no damage to the campus or surrounding area. To do this we have a system of catch basins which collect the surface water from the parking areas, walkways, and fields. Each building also has footing drains connected to this system. It is interesting to know that the greatest burial depth of storm drain lines is 26 feet. The greatest diameter pipe used in this system is 42 inches. Most of the pipe used is made of concrete, although in some places it is cast iron or steel. There are three general areas where disposal of surface water is accomplished. One is across Driftwood Road into the small ravine and drainage creek which flows into Eld Inlet. The second is south of parking lot "B" in the forest

area. The third is along "A" Road to Kaiser Road.

This system is shown on Page i in relation to the existing buildings. For specific details on this system reference must be made to Quinton-Budlong drawings C-54 and C-63. These drawings must be referred to before any work is done on the system. You should spend time studying these drawings so that you will gain specific knowledge of the system.

There can be some maintenance problems, many of which will be eliminated by not allowing foreign objects to get into the system. The system should not be used as a means of disposal of litter, leaves, dust, etc. It is for disposal of water and nothing else. Solids and liquids other than water must not be allowed to enter the system.

When it appears that the system is plugged, you should first attempt to clear the catch basins where the water first enters. These catch basins generally are constructed so that they will catch dirt and rocks. In most cases, they have an easily accessible clean out. If the stoppage is further down the pipe, it will be necessary to use some mechanical means to break up the stoppage. Large quantities of water must be provided to flush the broken up debris down the system and avoid further stoppage.

Under unusual conditions the pipe may be broken and would necessitate digging down to the line and replacing a section of it.

In most cases, the footing drains may be reached from the perimeter of the buildings. Some structures have clean outs accessible from their basements. This makes it possible to keep footing drains operating as intended.

Now a word of caution. The storm drainage system has numerous manholes large enough for individual entry into some of the pipes. Under no circumstances is entry allowed unless the system to continuously force fresh air into the area is operating. Two individuals must be standing by on the outside to secure help if problems are encountered. It is entirely possible that vapors detrimental to humans will be present in the system. These conditions could very easily kill a person.

#### Sanitary Sewer System

The purpose of this system is to collect drainage from sinks, toilets, showers, and floor drains, and any waters that are of unsanitary nature. Page ii shows the general arrangement of this system. The College system is connected to a pipeline which runs to the City of Olympia treatment plant. Sewerage goes through a meter, the purpose of which is to allow the City to charge Evergreen for the amount of sewerage entering their system. The system is quite elaborate, the pipe diameters up to 15 inches. Some are located 14 feet below ground level. The College system is connected to Olympia's across A road near Kaiser Road. These pipes are

buildings are plugged, contracted help may be required. If it is necessary to enter this system through one of the manholes, it is mandatory that mechanical ventilation of the system be instituted. Under no circumstances is anyone to enter the system unless a method to continuously force fresh air into it is operating, and unless there are two individuals standing by on the outside to secure help if problems are encountered. There are gases in the system that can very swiftly kill a person.

### Water System

This system is a source of all College drinking water, irrigation water, water used for fire fighting, fire sprinkler systems, water used for the power plant, and for the air conditioning systems. Water is provided by the City of Olympia. Evergreen is connected to the Olympia Water System in the vicinity of A road and Kaiser Road where a 12 inch underground water meter records College usage. On Page iii a diagram of our system from this point shows distribution throughout the campus. Water is at a pressure of about 25 pounds per square inch at the point of connection with the Olympia Water System, and at a maximum of 250 gallons per minute available. When water arrives in the storage tank, pressure is about 6 pounds per square inch. This pressure is not sufficient to adequately serve all campus needs, necessitating a storage tank system and water plant near the intersection of A Road and Overhulse Road.

The primary reason for the two one-million gallon storage tanks is the need for supplying large quantities of water for fire protection at all times. Water is stored in these large tanks and then routed to the pumping station, where the pressure is increased to about 125 pounds PSI for distribution throughout the campus.

The pumping station contains several pumps which are both electric and diesel powered. The diesel powered pumps are for use in case of fire and/or electrical power failures. There is also a small diesel-powered generator which provides electrical power to the electric, domestic, water pump, but only in case of an emergency.

The diagram on Page shows the plumbing and the pumping station layout. You can see that it is possible to isolate the campus water system from the

source of water and still have domestic water and fire protection for a short period of time.

Let us now refer back to the diagram on Page iv. There are 25 fire hydrants distributed throughout the campus for use in case of fire. Each has a separate shutoff valve which will isolate the individual fire hydrant in case it is damaged or if routine maintenance is required. These valves must always be open except under the conditions noted above. In case they are turned off, the fire department and building maintenance department must be notified. Many of the buildings have sprinkler systems. Each sprinkler system is connected separately to the main water system. A post indicator valve outside each building is shut off from the sprinkler system in that building. These PIV valves are located on Page iii. They must be on or open at all times to provide fire protection. Each is monitored at the control panel by the Delta 2000 Control System.

Valves which can be operated to isolate sections of the water system for routine maintenance or in case of broken lines are located throughout the water system. If you carefully study the diagram on Page iii you will see that there are several loop systems which provide alternate means of providing a continuation of water to all areas, even if some of the pipelines are broken or inoperative.

Under normal conditions, very little maintenance of the water system is necessary. Over a period of time dirt and debris will accumulate in the lines. Special blow-off valves and outlets have been provided to remove this accumulation. They should be operated by qualified personnel only.

#### Heating and Cooling of Buildings

All campus buildings with the exception of the shop and garage buildings and the temporary offices are provided with heat from the Central Power Plant. Steam at 225° F and 125 PSIG is supplied to each building. The mechanical room of each building contains equipment that throttles steam and distributes it as required to heat the air that is circulating. This steam is also used to heat water in the domestic water system (hot water at sinks, basins, showers, etc.). Eventually steam is reduced to hot water which is returned to the Central Power Plant to be converted back to steam and reused.

Some of the campus buildings are air conditioned: Library, College Activities, Lecture Halls, Laboratory Buildings. Here again the Central Power Plant is the source of cooling. Ordinary water is cooled (chilled) to a temperature of about 40°F by two 1200 ton electrically powered chillers. Chilled water is then distributed to each building by 24" and 8" pipes. The mechanical room of each building contains equipment which uses water to cool air that is used to ventilate the offices, classrooms, and public areas. Incidentally, this is the same system that heats the air when these areas need to be warmed. The system actually reuses some of the heated or cooled air in each room and adds some outside clean air. The cold water is not wasted. After the water has been used to cool the air, it is returned to the Central Power Plant to be chilled and reused.

The control systems and equipment used to heat, cool or ventilate buildings are not too complicated. Servicing and maintaining this equipment must be done only by personnel familiar with all the individual systems.

### Utility Tunnels

The campus includes almost half a mile of utility tunnels which originate at the Central Utilities Plant and extend to each of the major buildings. The standard tunnel section is 14 feet wide and 9 feet high, although widths vary from 20 feet to 8 feet. The tunnel contains steam lines, chilled water lines, and electric power lines, communication lines. There is a 12-inch steam line and a 6-inch pressurized return steam line, plus condensate return lines and 24-inch diameter chilled water supply and 24-inch chilled water return lines. Tunnels are lighted and ventilated with access at each of the buildings and several points between buildings. The tunnel is large enough to allow workmen to work and maintain lines, and even use small three-wheel motorized carts to move equipment and personnel through them. Page v shows the general layout. Residence halls are not served by the tunnel system, but their steam lines and return lines are completely buried and take off from one point of the tunnel.

Each of the pipes in the tunnel is painted a distinctive color to identify its use, such as chilled water, steam, etc.

The tunnel also includes communication lines from the telephone company and other forms of communication equipment.

### Central Utilities Plant

This complex is actually made up of three separate structures--the Central Power Plant, associated cooling towers, and electrical substation. The electrical substation is the receiving point for all campus electrical power purchased from Puget Sound Power and Light Company. The voltage from the power lines to the substation is 12,470 volts. The first of many safety devices designed to protect the campus from electrical problems is located here. It is possible to disconnect all electrical power, but, needless to say, you just don't turn off the campus with a single switch.

### Substation

Puget Power brings electrical energy to the campus by overhead wires to a pole about 70 feet east of the substation. Wires move underground from this pole into the substation. The substation consists of what looks like two parallel small buildings. The technical description for these little buildings is "an assembly of outdoor, metal clad, compartmented switchgear units with a common service aisle". These two buildings contain sufficient switching gear fuses, buses, breakers and meters to service an eventual building program for a student population of 12,000.

At the present time, only the south half of the system is being used. It services the Library, College Activities, Lecture Halls, Central Utilities

Plant, temporary offices, recreation center and student residences. The north half will be used as more buildings are added to the College complex, but it is not now connected into the electrical supply lines. Don't assume that there is no electricity here--you may be shocked. Page xxi contains a one-line diagram of the substation. By looking carefully at the diagram you can see there really are two separate systems in the substation: one on the left, southside, and one on the right, northside. Puget Power has meters that will record the amount of electricity the College is using. Another series of meters will indicate the quality and quantity of electricity being received and used. Below this on the sketch on Page xxii is a transfer switch with a separate panel. This is a system for the substation only. It provides electrical power for operating lights, heating, and ventilating, and operating any electrical hand tools that would be used around the substation. This system can be switched to operate from either side and provides power even if the electrical supply to the rest of the campus buildings is disconnected.

Below each of the main ACG-2000-A-500MVA breakers, the bus continues with the distribution of power to the individual buildings. These are F9-1, F8-1, F7-1, etc.

It is important to realize that voltage is not reduced by transformers at the substation before it is sent to the individual buildings. The substation serves only as a measuring, safety, and distribution point. Full voltage is delivered to the transformer vaults at each of the buildings, except for the electrical lighting system in the Utilities Tunnel. Half of the Utility Tunnel electrical system is supplied from the Library transformer vault, the rest from the transformer vault in the Central Power Plant. This avoids the necessity of a separate transformer vault to serve the Utility Tunnel.

#### Central Utility Plant

The Central Utility Plant is the source of all steam used on the campus and all chilled water provided to the buildings for use in the air conditioning system. The Central Utility Plant includes two packaged "Delta 68" steam generating units manufactured by Cleaver Brooks Company of Milwaukee, Wisconsin. Each unit is a boiler capable of producing 35,000 pounds per hour of saturated steam at a pressure of 125 PSI. (In everyday language this means that each of the steam-generating units has an equivalent capacity to brew 70,000 cups of coffee each hour.) Steam is generated by boilers fired by natural gas supplied to the campus by a four-inch pipeline from Olympia. Under certain conditions it will be necessary to use other means to fire the boilers. A supply of diesel grade fuel oil is stored in two large 25,000 gallon underground storage tanks adjacent to the building. Without any great difficulty this fuel can be used to fire the burners to produce steam. Also taken under consideration in providing this dual system is the fact that we get a better rate under interruptable gas supply program.

The Central Utility Plant has a large steam operated whistle which can be heard all over the campus. It was incorporated into the design as an emergency alarm system for the campus community.

A small amount of steam generated by either unit is diverted to power a steam-turbine driven electric generator. The electrical power from this unit does not provide electrical energy to the campus proper. It is used only to provide electrical power to drive the components directly related to the steam generating units. These include the combustion controllers, flame failure controllers, one forced draft fan, fuel oil pumps, condensate pumps and the emergency lighting system of the Central Utility Plant. This insures that even in case of failure in the electrical power supply system to the campus heat will be provided.

You may notice that we have a salt storage facility in conjunction with the Central Utility Plant. This is not used to melt ice on the paths in the wintertime; rather it is used to soften water used in the steam generating units. Through a fairly simple system, salt is used to remove any undesirable chemicals from water that is being converted into steam.

The Central Utility Plant contains two 4160 volt electric motor-driven centrifugal-type water chillers, carrier type 19C, that provide cold water to air conditioned buildings. This is the chilled water that leaves the Central Utility Plant in the 24" diameter pipes. This system operates something like an ordinary home refrigerator except that the function is merely to lower the water temperature. These units must be kept cool for proper operation. The two large cooling towers adjacent to the Central Utility Plant accomplish this purpose.

Warm water that comes from cooling the chillers is exposed to the atmosphere. The temperature of the water is reduced by spreading over a large area and forcing a large amount of outside air over the water. Through evaporation and temperature differential, the same water is reused to cool the chillers. Without the cooling towers, new water from our domestic supply lines would have to be used to cool the chillers. The water flow would be dumped down the sewer--a very expensive process because of the volume of water that is required.

#### Pumping Station

Operation of the pumping plant on the south corner of the intersection of Overhulse Road and A Road is twofold. It increases the pressure of all the water furnished to the campus and in case of electric power failure it insures adequate pressure and supply of water for domestic and fire fighting purposes for a short period of time, depending on the requirements. Page viii contains a diagram of the basic plumbing in the building. Under normal conditions the supply of water always comes from the two-million gallon storage tanks into the pump house through the 18" supply line that runs in the floor through the center of the building. All of the pumps in the building discharge into the two 16" diameter pipes that lead to the campus distribution system. When there is a minimum requirement for water on the campus such as at night or over the weekend, the #1 pump maintains the pressure and volume required. This 15 HP electrically powered pump has a capacity of 100 gallons per minute. When the system requires a greater volume of water, the #2 pump then

automatically cuts into the service. This 40 HP unit has a capacity of 450 gallons per minute. As the requirement for more water increases, the #3 pump automatically cuts into the line. If more volume is needed, the #4 pump cuts into the system. The other two are electrically powered 40 HP 450 GPM units. This condition will probably only occur when the flow is increased by the operation of part of the sprinkler systems, or when the fire hydrants are being used.

Pump #5 is a 15 HP electrically powered 100 GPM unit, and is used as a standby. Normally it operates only when the #1 pump is idle for maintenance or because of mechanical failures.

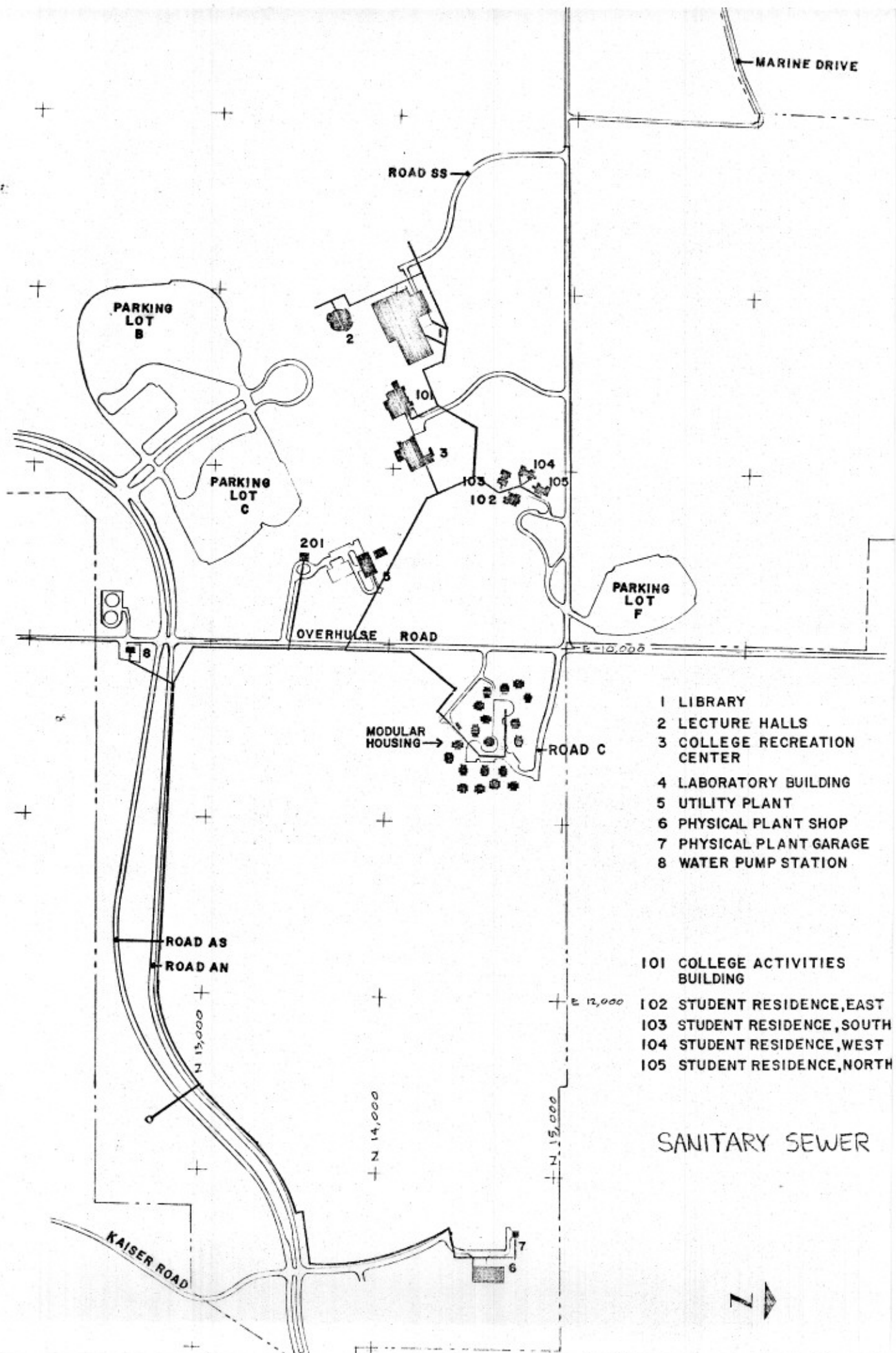
The system still has water pressure and volume when there is an electrical power failure to the pump station. This is the way it works: when power failure occurs the diesel powered auxiliary power unit automatically activates, providing a minimum amount of electrical energy to the pump station only. This electricity is used to operate the 40 HP 450 GPM pump #3. This will provide adequate water volume and pressure for reduced campus needs until normal electrical power is restored. The electrical diagram on Page ix shows how this works, and it also shows how the other pumps are wired into the system.

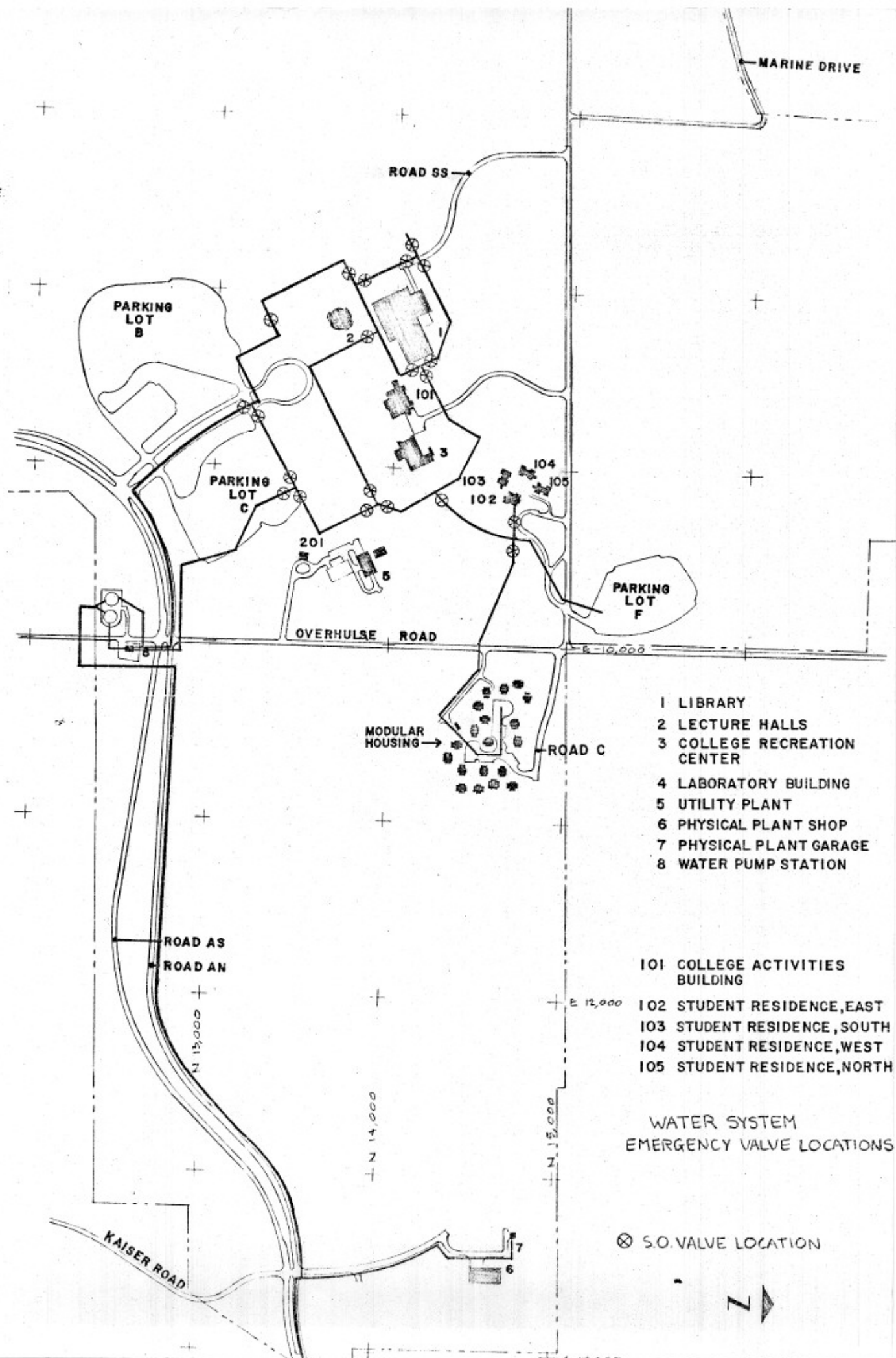
The two 225 HP diesel powered pumps have a capacity of 2500 GPM each, and they automatically start up when needed. Fire pump #1 starts when the pressure drops to 95 pounds PSI. Fire pump #3 starts when the pressure drops to 90 pounds PSI, when fire pump #1 is operating.

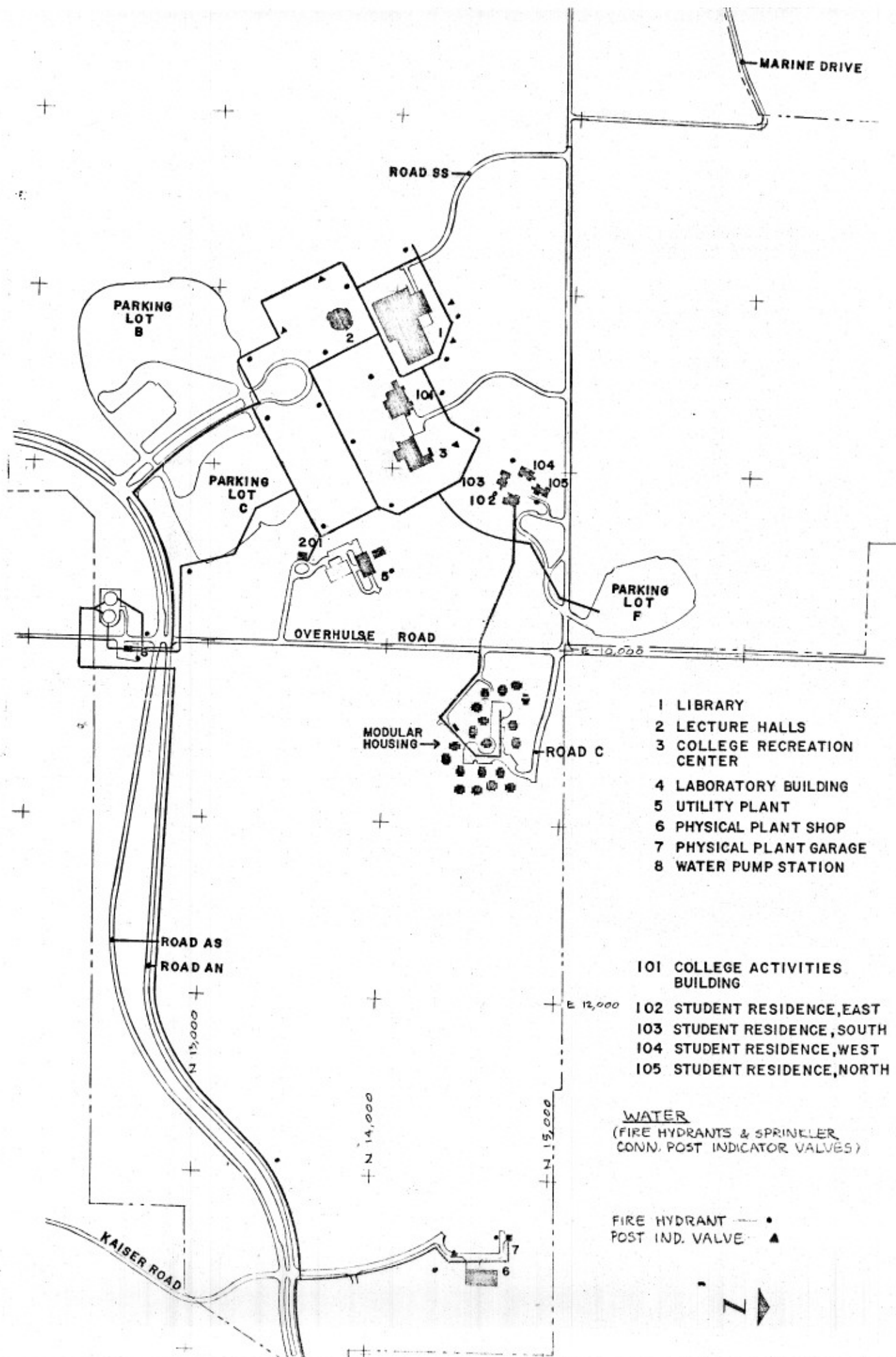
Now for details about the variable speed aspect of the pump motors which results in constant water pressure control. This is controlled more or less by the auto-sensory system and the programmer equipment. Normally one of the 100 GPM constant-speed pumps always will be running on the line to meet the demand of minimum water flow requirements. When the system pressure drops below 92 pounds PSI, but the volume required does not necessitate the starting of the fire pumps, the #2 electric 40 HP pump starts at a slow speed and the 100 GPM pump shuts down. The speed of the electric motor driving pump #2 will increase in order to maintain the constant discharge pressure of 94 PSI until maximum flow is reached by this unit. If the pressure continues to drop, the motor of pump #2 will lock at maximum speed, and the motor which drives pump #3 will start up at minimum speed, increasing to maintain the minimum pressure until it reaches maximum speed. Then it will be locked at maximum speed and pump #3 will start up at minimum speed and continue to maximum speed. These actions are determined by the flow and pressure requirements of the system.

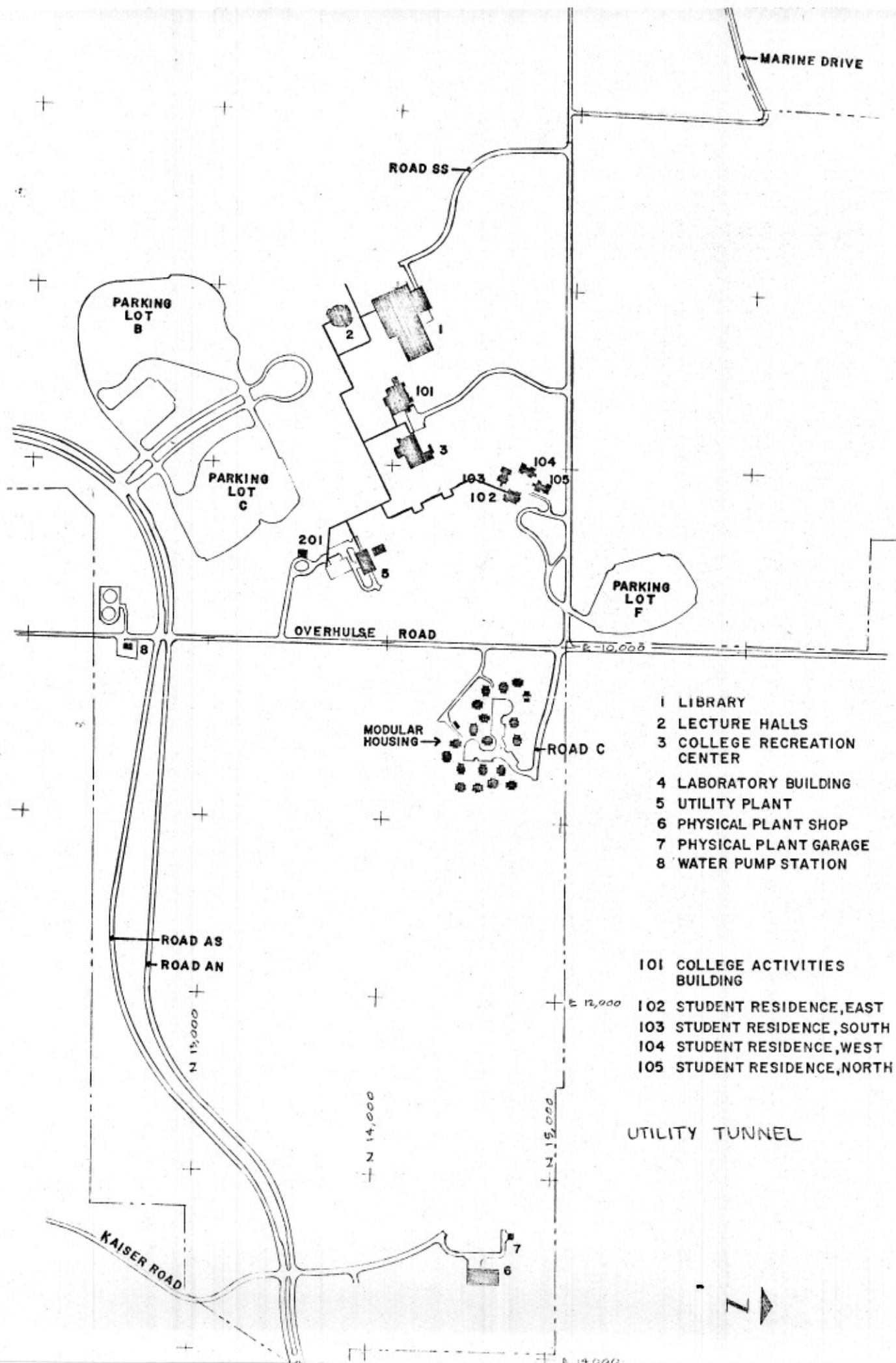
When the flow in the domestic water header reaches a pre-selected GPM, somewhere between 300 and 1400 minimum, the domestic pump programmer will initiate the signal to start fire pump #1, which is one of the 225 HP 2500 GPM diesel powered units. When this pump is operating and has raised the pressure to 100 PSI, action is automatically instituted to shut down all the domestic pumps on a delayed sequence basis. This allows the pump to

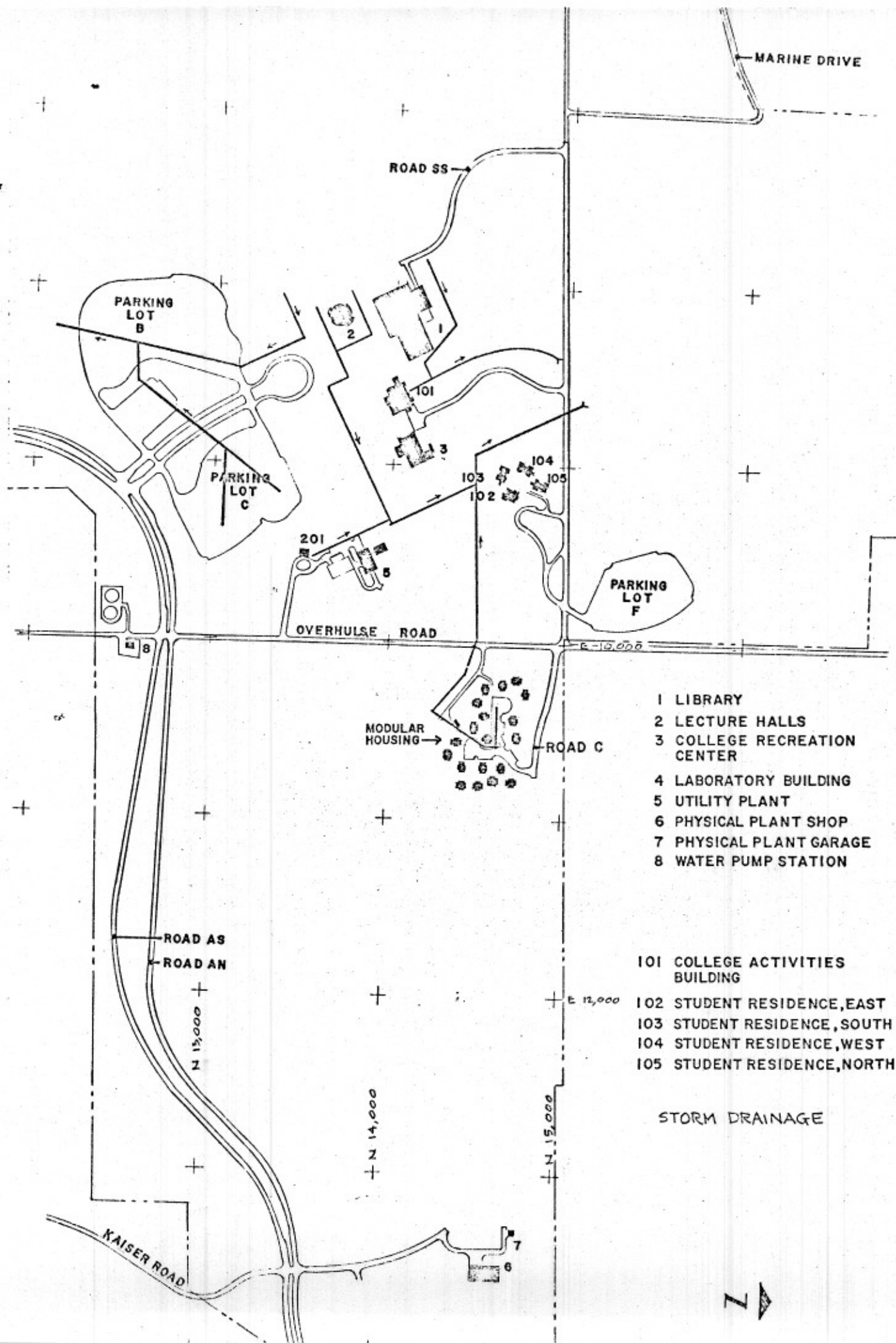
keep up with the volume required. If additional capacity is needed, pump #3, the second 225 HP 2500 GPM diesel powered pump, is activated and integrated into the system. The electric powered 200 HP 2500 GPM unit will be programmed to start only if pump #1 or #3 fails. As the needs of the system decrease--due to the shutting off of fire hydrants or the closing down of the sprinkler systems--a sequence almost opposite to that described above occurs. This returns the water system to normal operation.







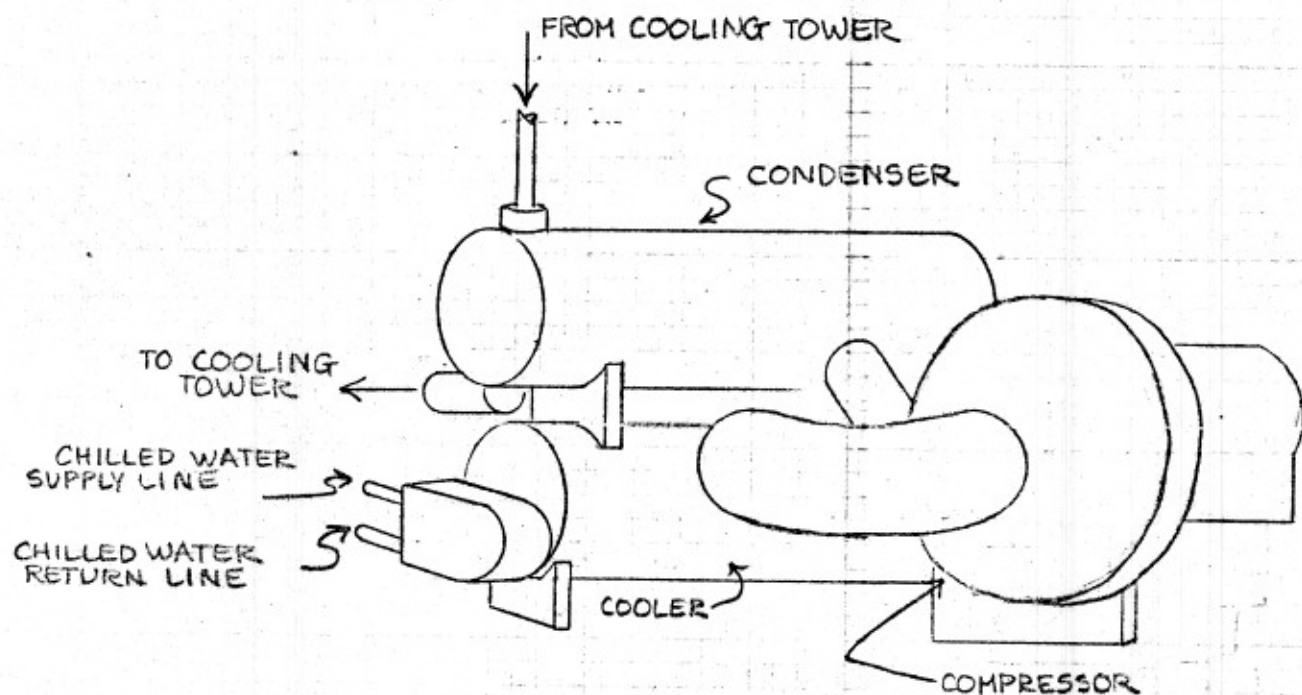




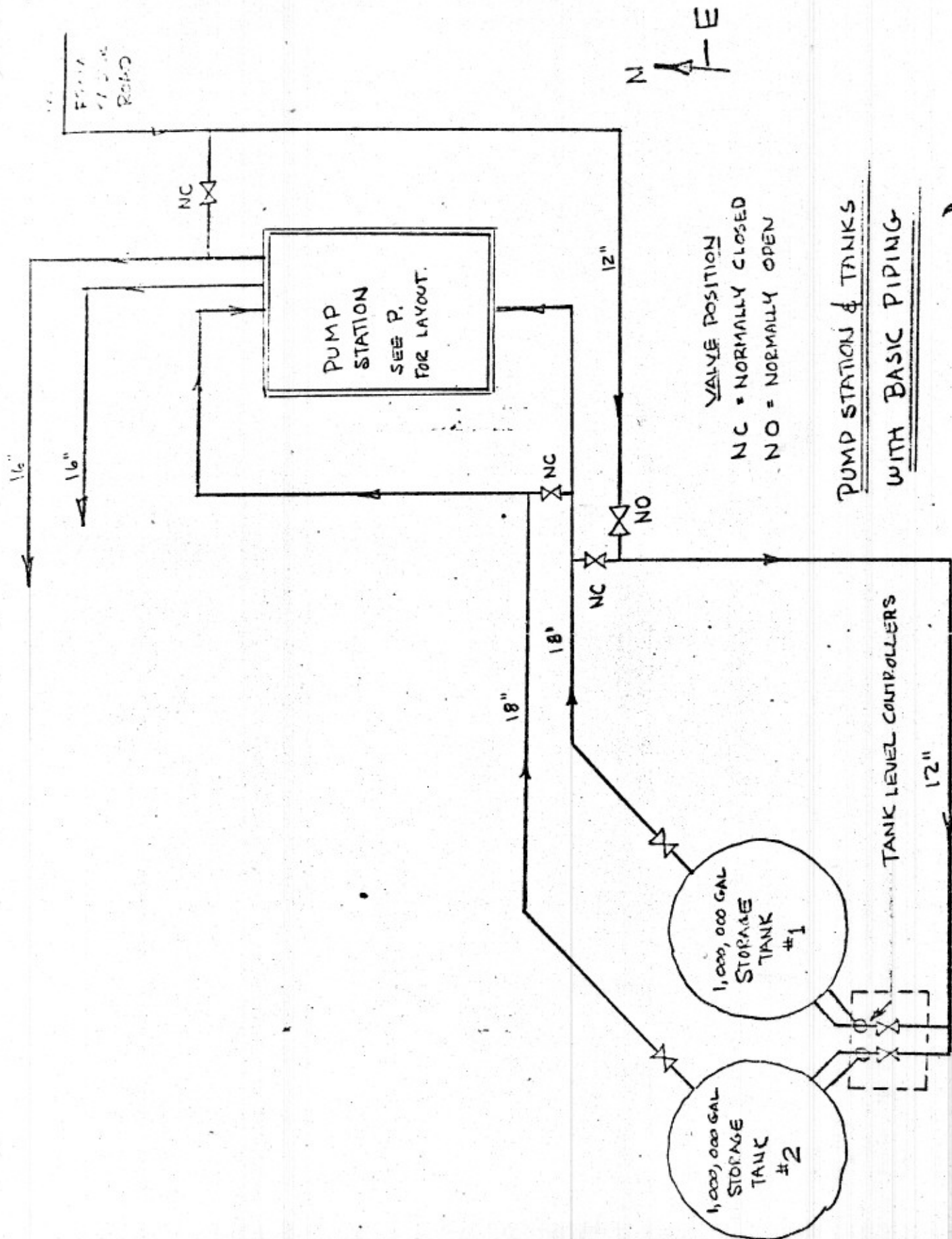
- 1 LIBRARY
- 2 LECTURE HALLS
- 3 COLLEGE RECREATION CENTER
- 4 LABORATORY BUILDING
- 5 UTILITY PLANT
- 6 PHYSICAL PLANT SHOP
- 7 PHYSICAL PLANT GARAGE
- 8 WATER PUMP STATION

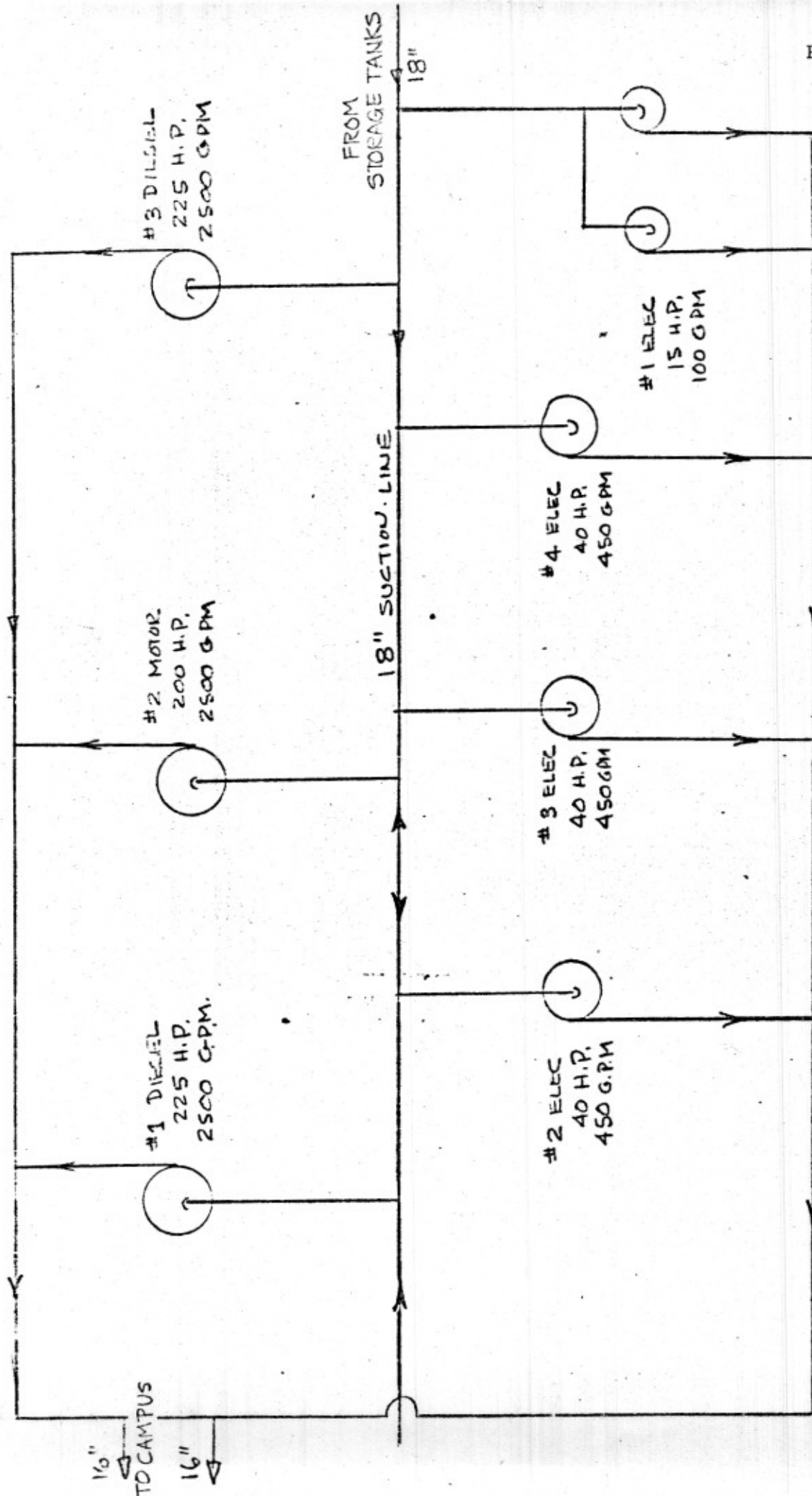
- 101 COLLEGE ACTIVITIES BUILDING
- 102 STUDENT RESIDENCE, EAST
- 103 STUDENT RESIDENCE, SOUTH
- 104 STUDENT RESIDENCE, WEST
- 105 STUDENT RESIDENCE, NORTH

STORM DRAINAGE



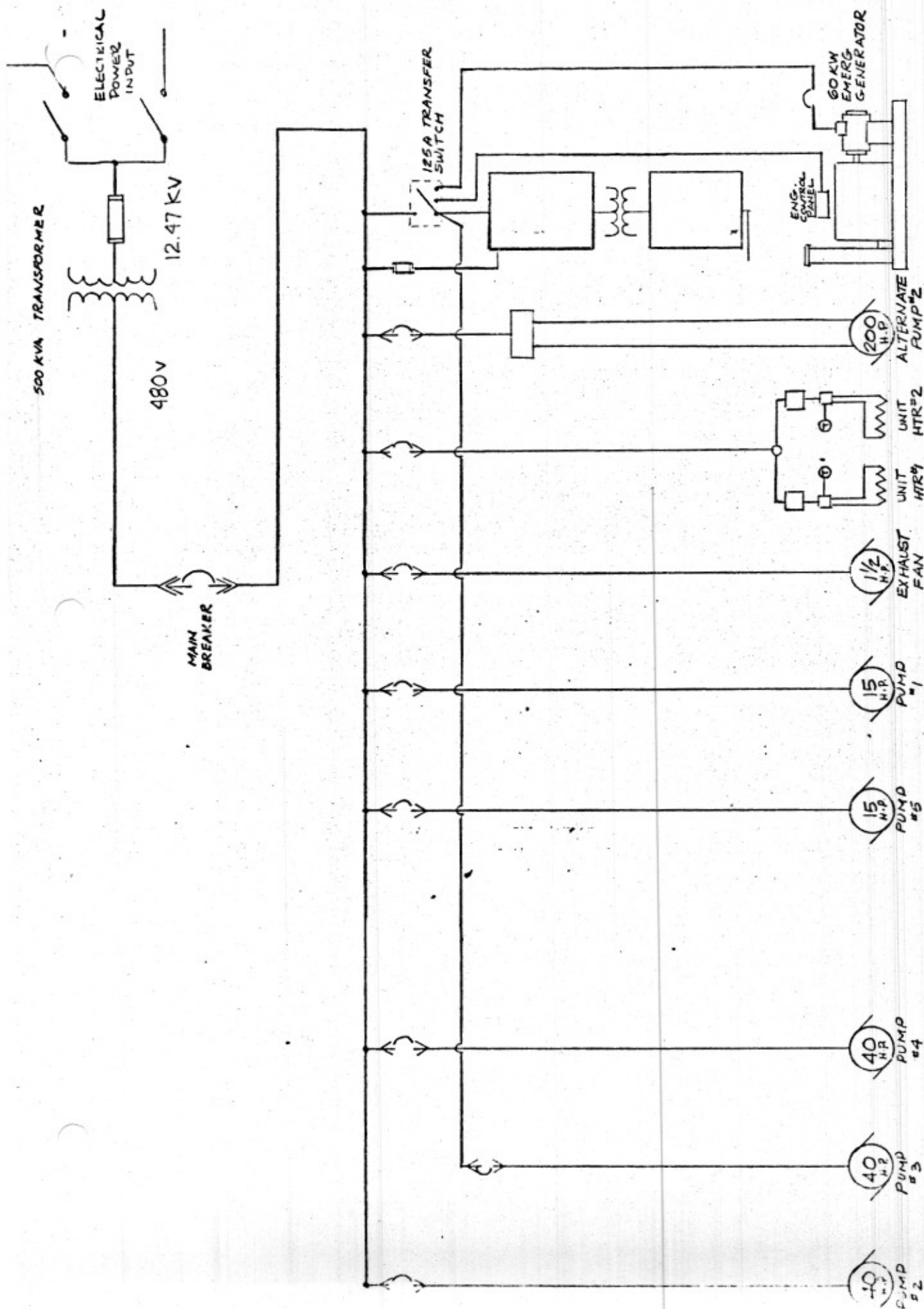
WATER CHILLER UNIT



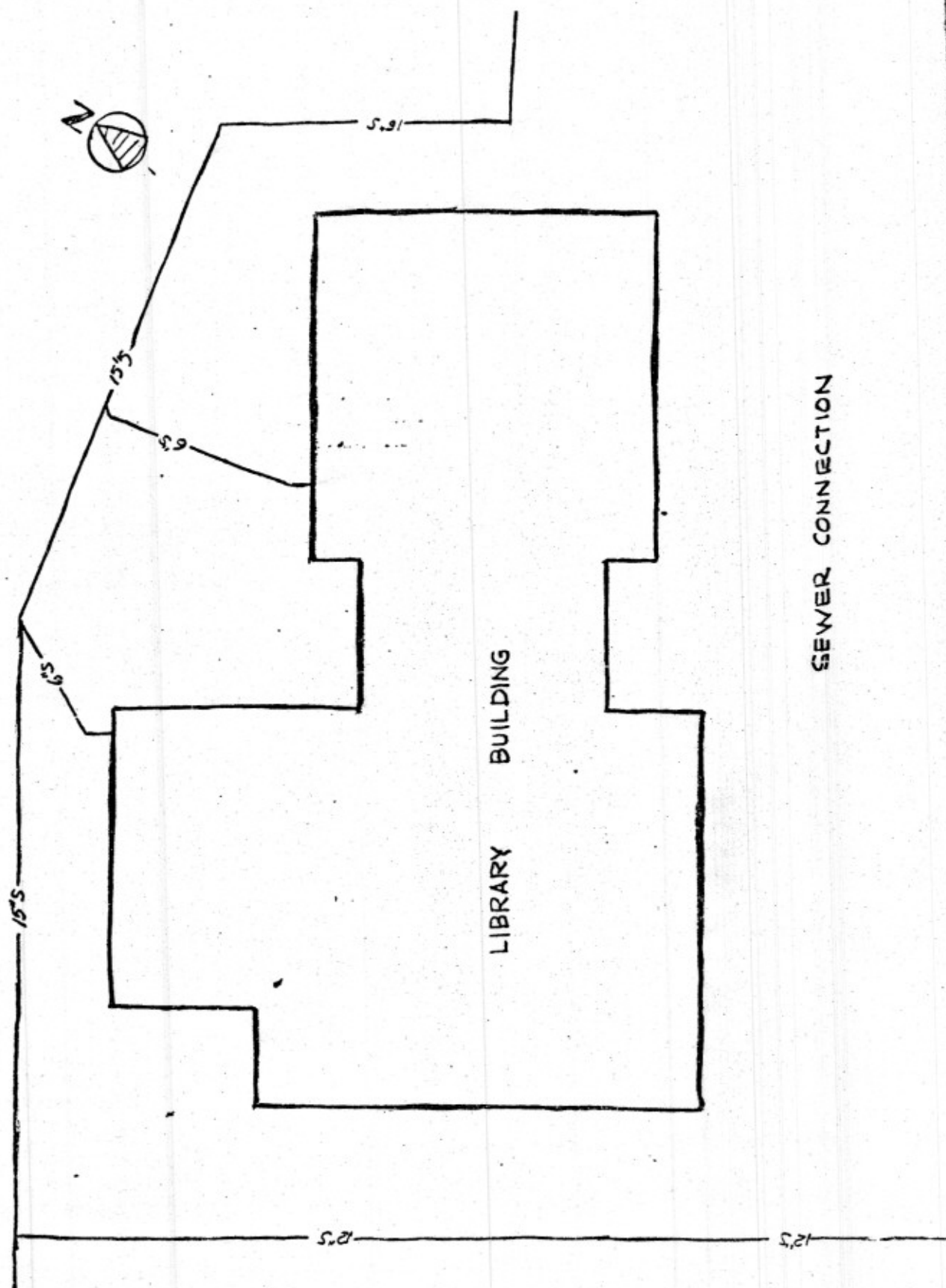


#5 ELEC  
15 H.P.,  
100 GPM.

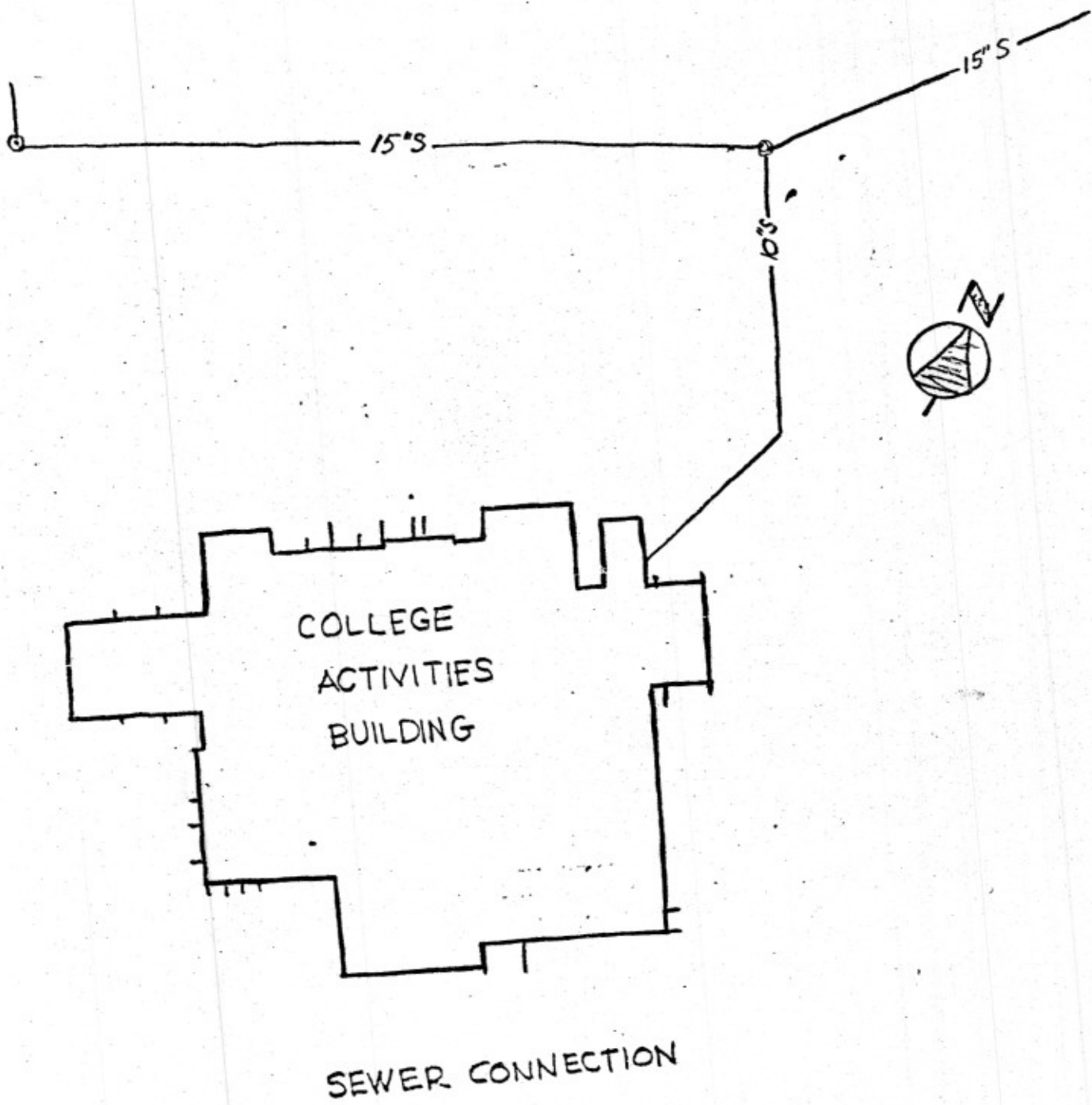
# PUMP STATION

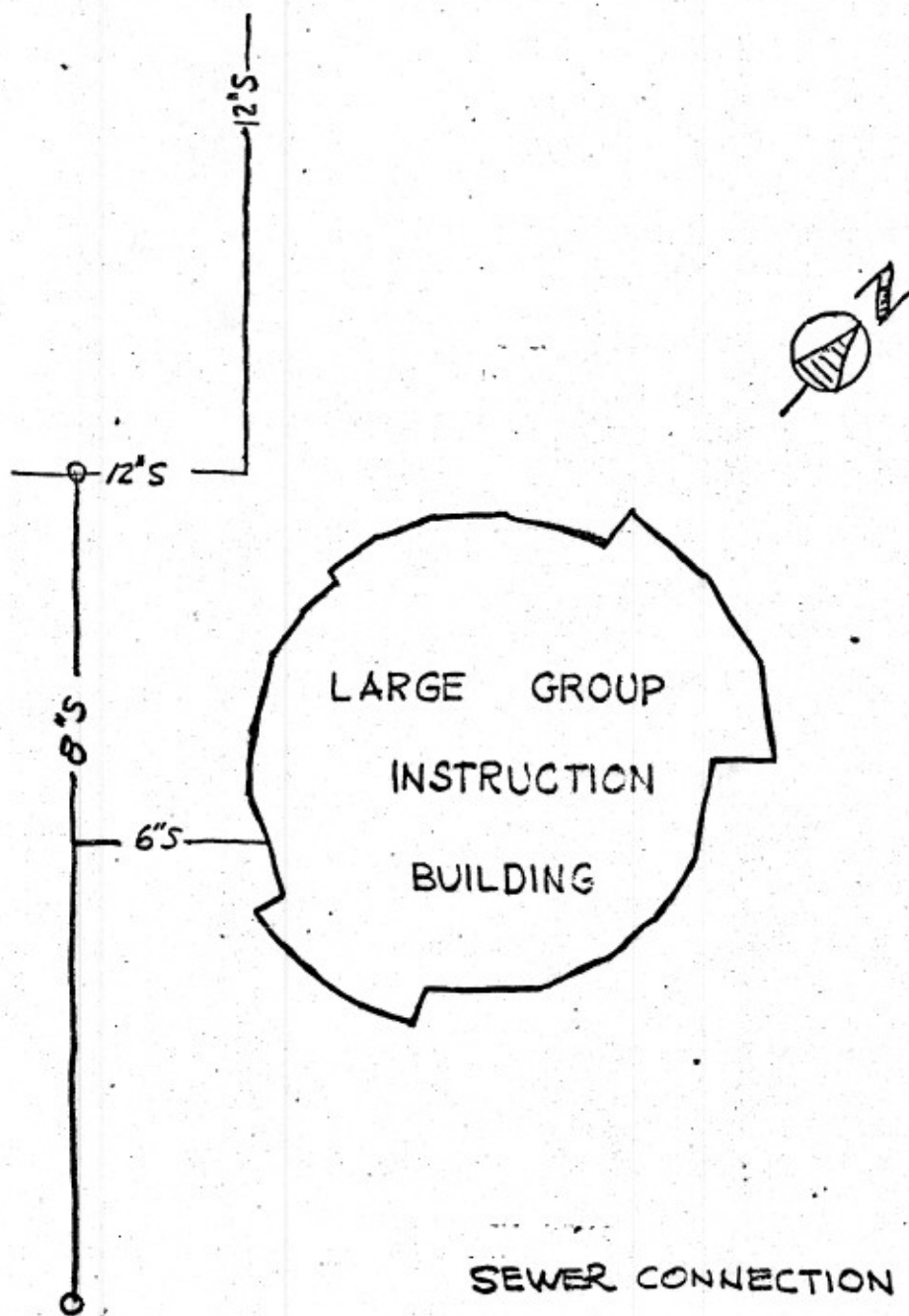


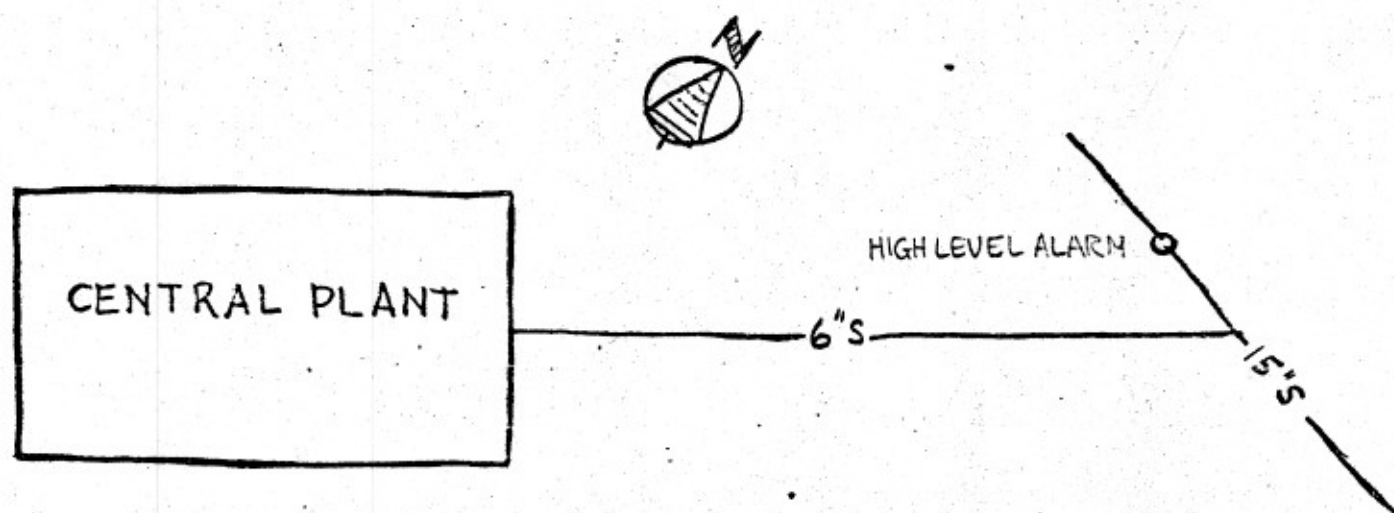
BASIC ELECTRICAL- PUMP STATION



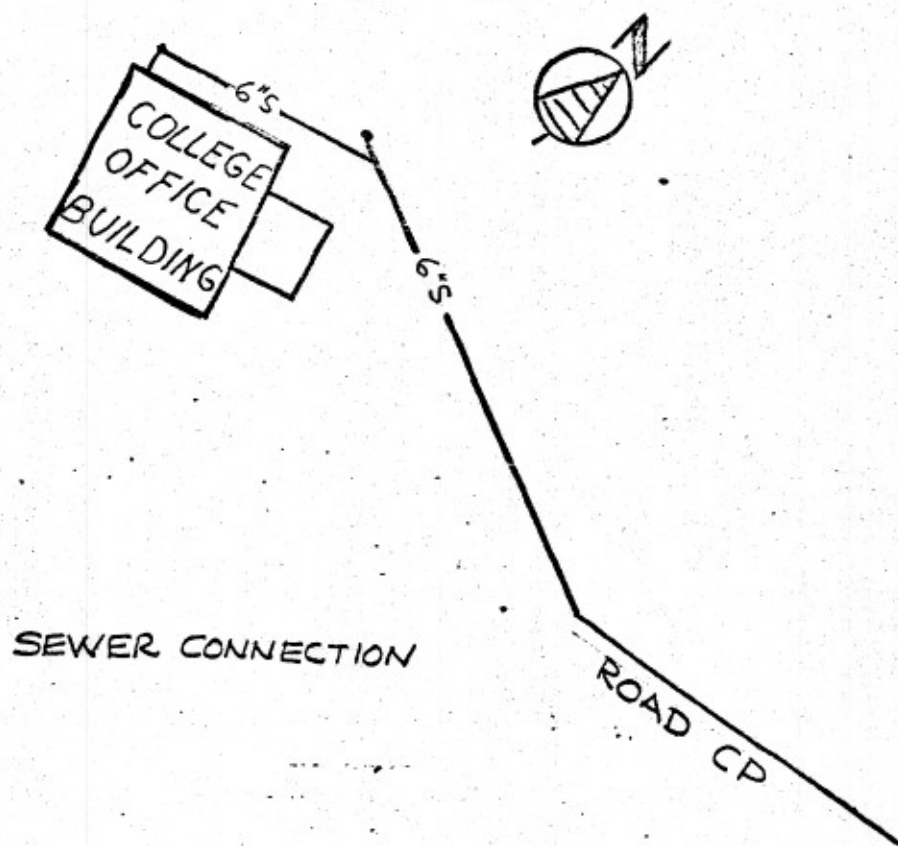
SEWER CONNECTION

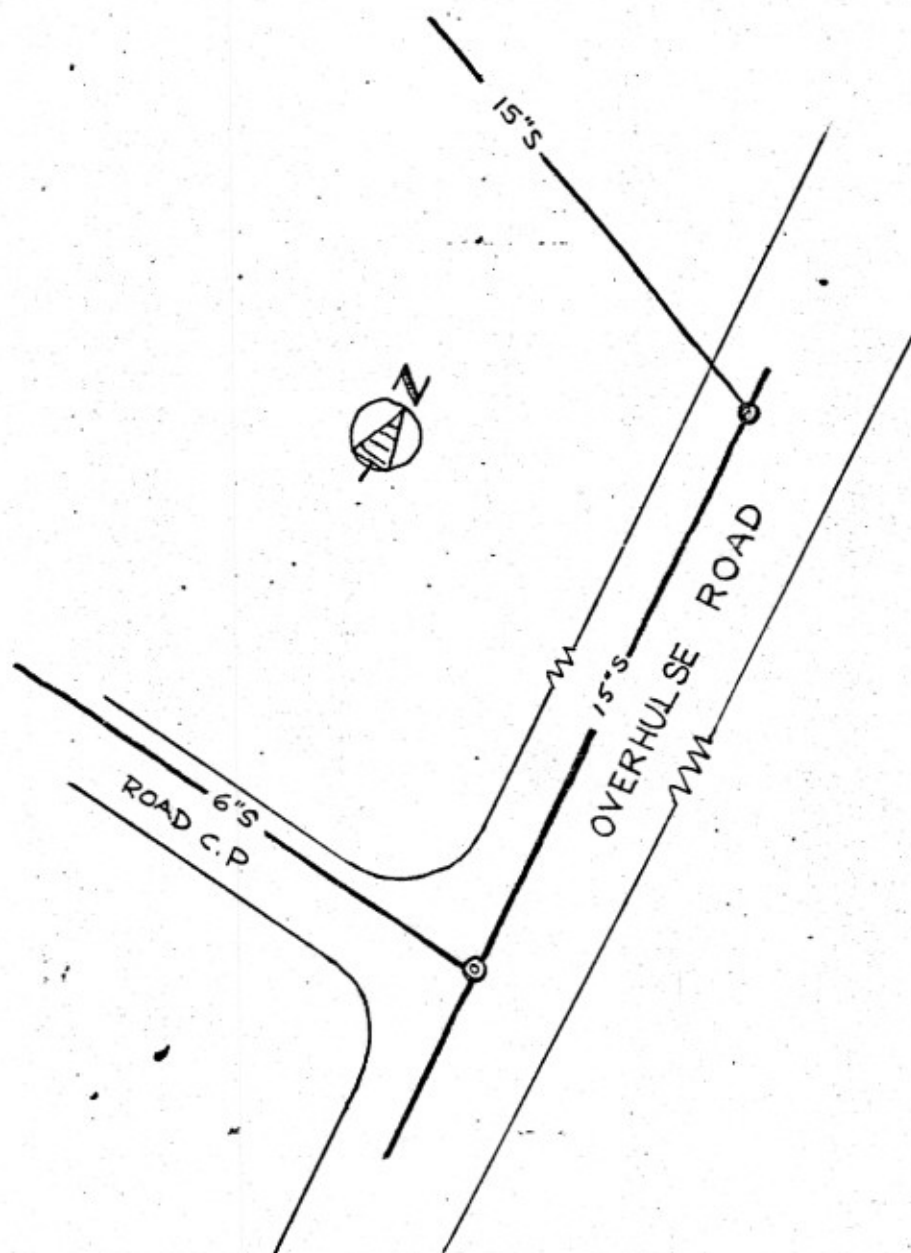


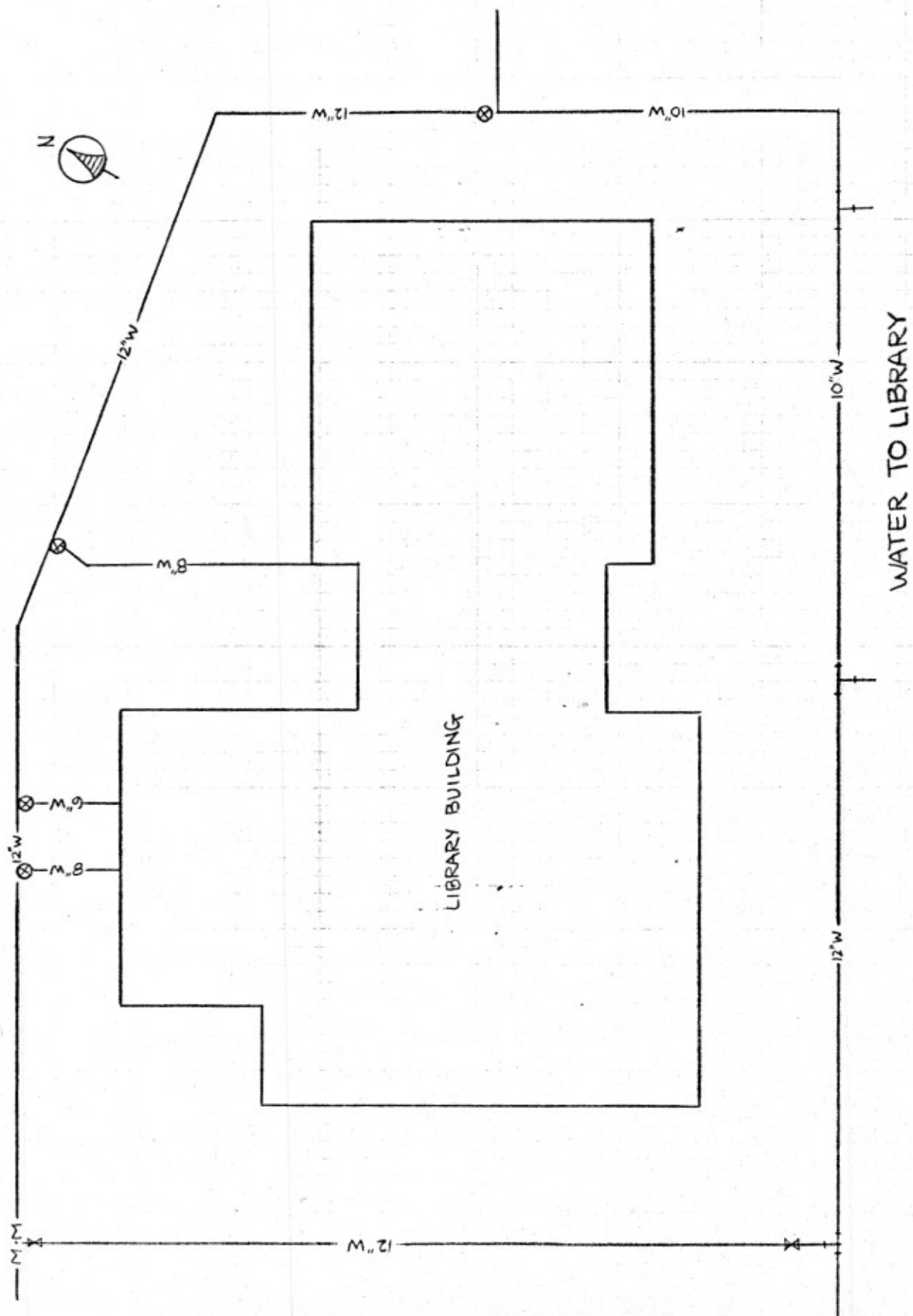


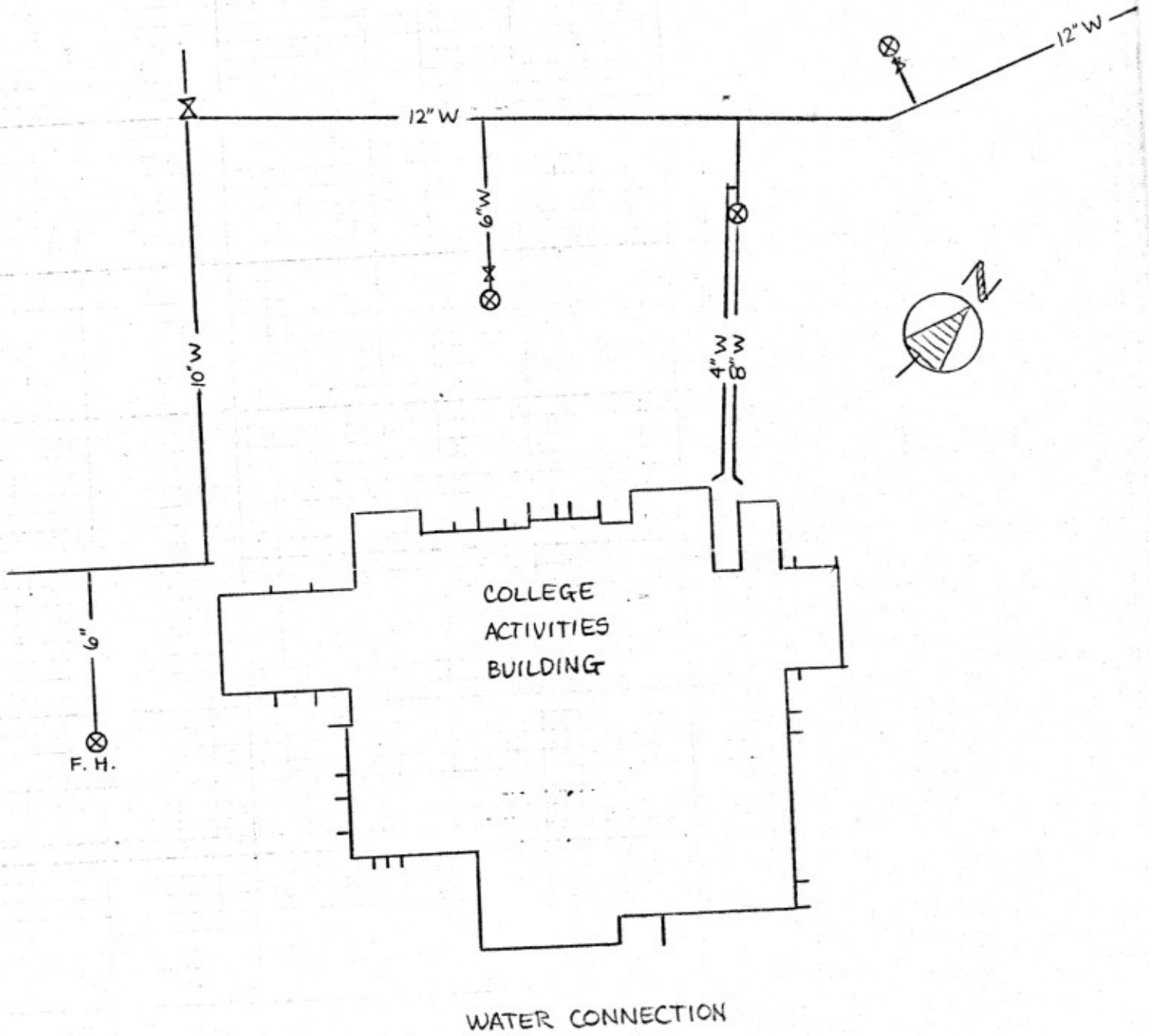


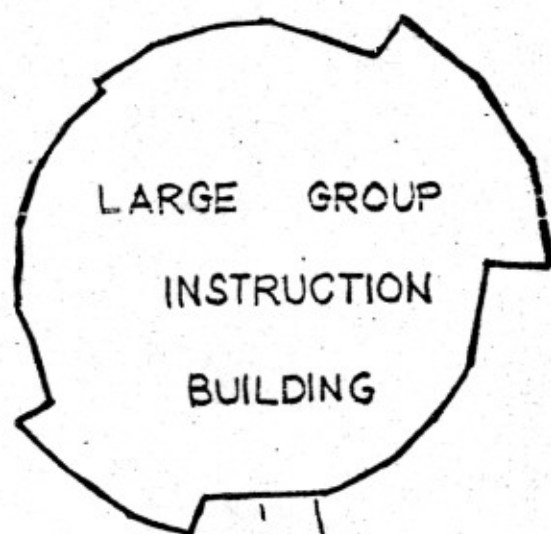
SEWER CONNECTION











WATER CONNECTION

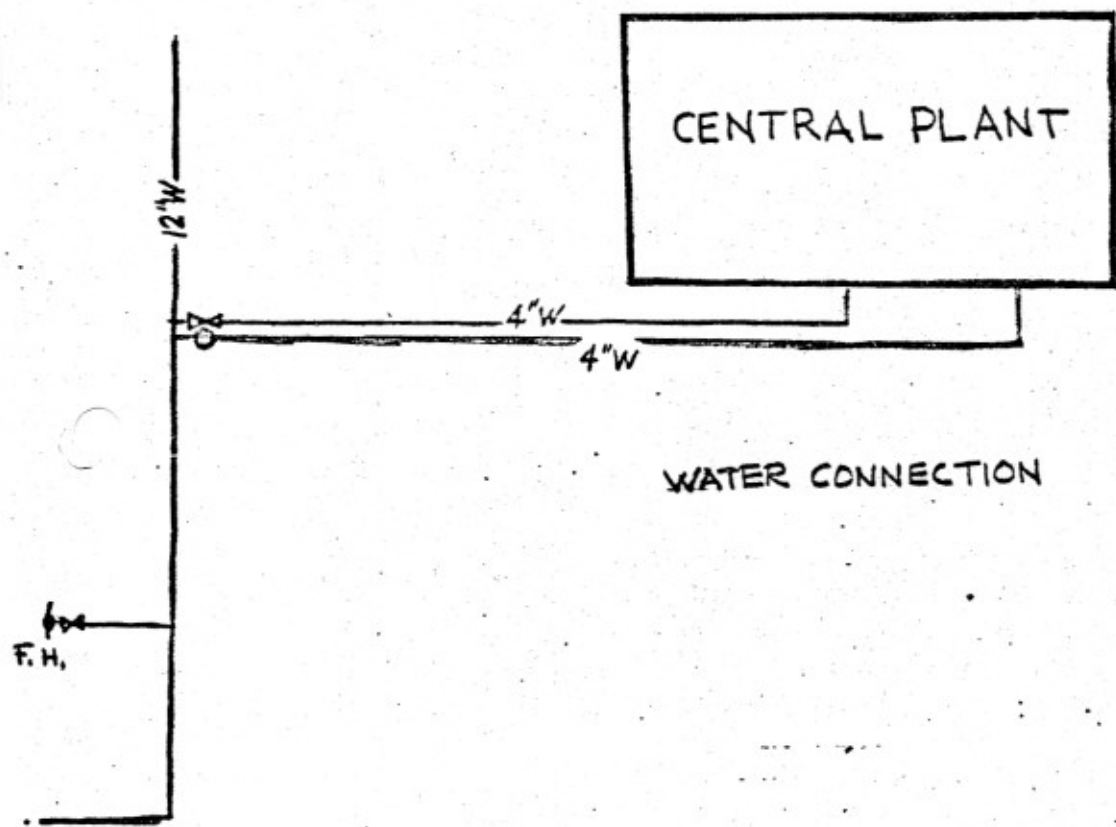
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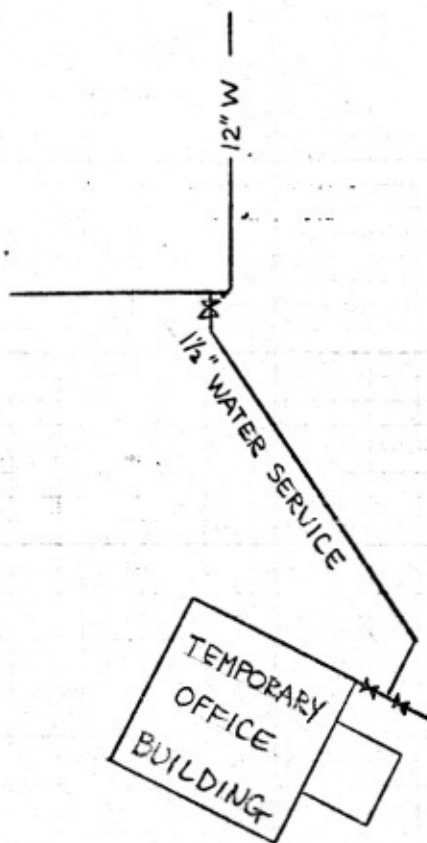
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WATER CONNECTION