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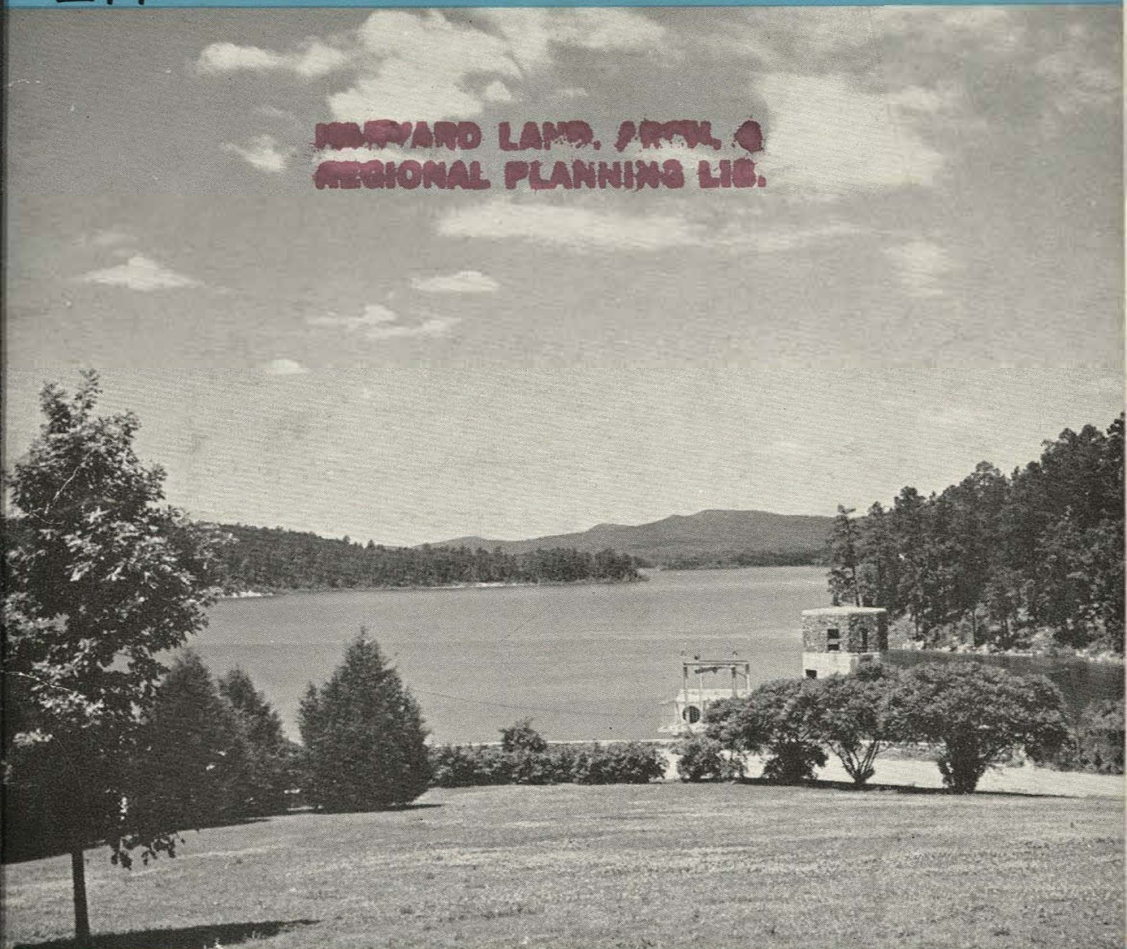
The Municipal Water System

of Greater Little Rock, Ark.

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Little Rock Municipal Water Works

"Publicly Owned for Public Welfare"

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Gift of The Water Works

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An abundant supply of pure and wholesome water is essential to the health and growth of the community of Greater Little Rock. The collection, transmission, purification and delivery of this vital commodity to the homes of water consumers makes an interesting story as related in this booklet.

The story begins with the rain falling over the highlands of the Ouachita National Forest in north-western Saline County 35 miles west of Little Rock. The story ends at more than a million taps located in the homes of water consumers, where approximately 13,000,000 gallons of sparkling, pure, soft water is consumed daily. It is a story of engineering and scientific accomplishments developed through many years by the water supply industry.

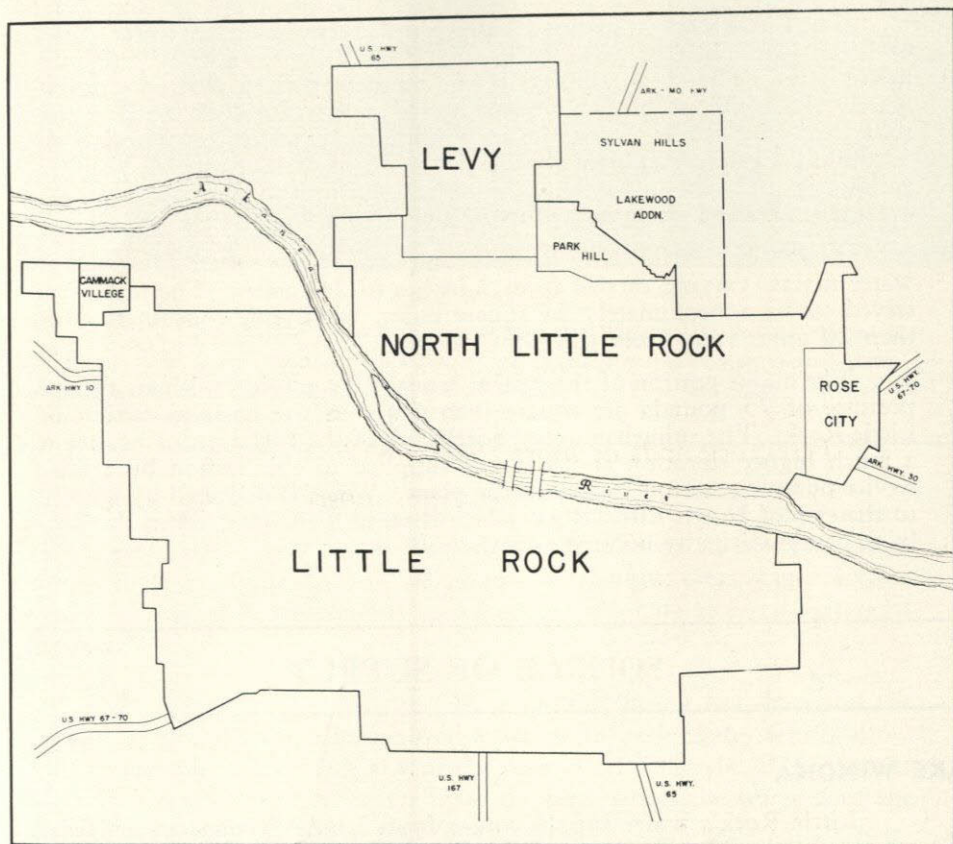
The following pages relate briefly of the work carried on by the Little Rock Municipal Water Works in the collection, processing and delivering of a soft and potable water to the citizens of Greater Little Rock.

Little Rock Municipal Water Works

"Publicly Owned For Public Welfare"

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Water supply - US Little Rock



TOTAL AREA USING WATER FROM THE LITTLE ROCK SUPPLY

The area north of the Arkansas River is served by the North Little Rock Water Company and the Park Hill-Sylvan Hills Water District. The combined distribution system covers an area of approximately 57 square miles and serves 160,000 people. In addition, the Little Rock Municipal Water Works serves rural areas along State Highway No. 10 and U. S. Highway No. 70.

STATISTICAL

LITTLE ROCK SUPPLY

The Little Rock Municipal Water Works furnishes water to the Cities of Little Rock, North Little Rock, Cammack Village, and outlying suburban areas. The total population of this metropolitan area is approximately 160,000 people. Domestic water usage, together with water sold to the industries, results in an average daily water consumption of 13,000,000 gallons. This daily water usage rate varies from 10,000,000 gallons in the winter to 20,000,000 gallons in the summer, and the average amount of water used per person per day is 85 gallons.

The water distribution system is composed of more than 350 miles of water mains, varying in size from 2 inches to 24 inches. The total area served covers approximately 57 square miles, with some consumers more than 20 miles away from the filtration plant.

The major portion of the system is served by gravity, with an average pressure of 75 pounds per square inch gauge in the business section of Little Rock. The suburban areas, northwest of the filtration plant, are at a much higher elevation and water is supplied to this section by a high service pumping station located at the plant. Water is delivered by gravity to the city of North Little Rock where it is, in turn, pumped to the outlying communities by booster pumps.

SOURCE OF SUPPLY

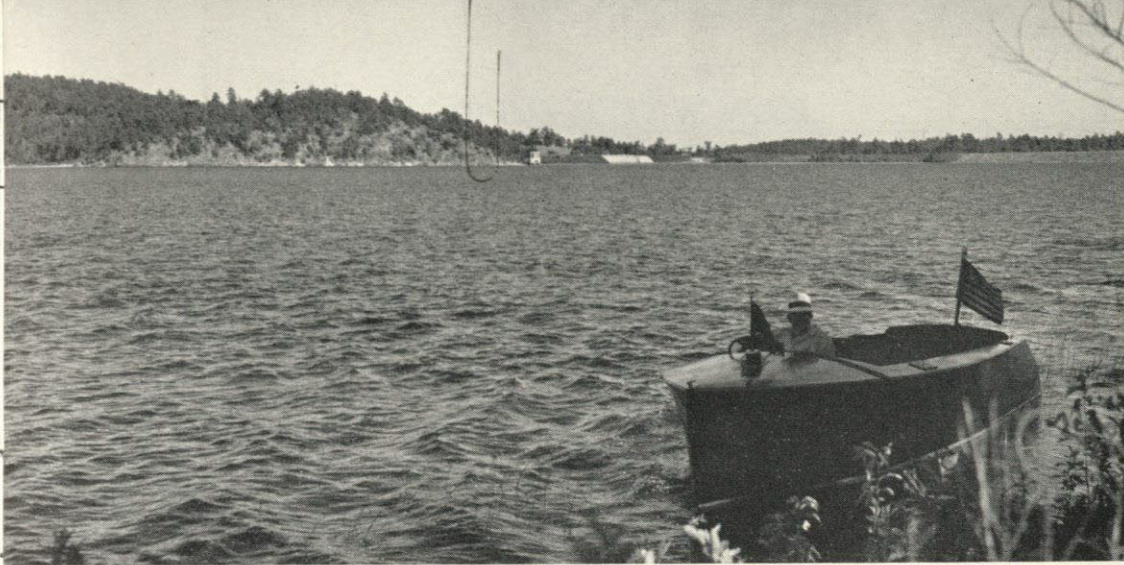
LAKE WINONA

Little Rock's water supply comes from Lake Winona, an artificial mountain lake 33 miles west of the City. This huge lake, when full to overflow level, holds fourteen billion gallons of water, which is enough water to supply Greater Little Rock for three successive years with each year having less rainfall than the driest year on record.

The average water level in Lake Winona is 225 feet higher than the water level in the settling basins at the filtration plant in Little Rock. Water from the lake, therefore, flows to the filtration plant by gravity.

Alum Fork Dam, which forms Lake Winona, is an earth dam 2,800 feet long and 115 feet high. It is 20 feet wide at the top and 650 feet wide at the base, and contains 1,500,000 cubic yards of earth.

The water shed tributary to Lake Winona consists of 43 square miles of timbered mountains in which there are no permanent habitations, a major part of which is Government owned land within the Ouachita National Forest.



LAKE WINONA

All water used in Greater Little Rock comes from this huge mountain lake. In the background, from left to right, is the Intake Tower, the Spillway and a portion of the Alum Fork Dam. The motor boat in the foreground is used to patrol the lake and collect water samples.

The water impounded in this lake, is extremely low in mineral matter and turbidity. Due to the clearness of the lake water, many different types of microscopic plant life grow in the shallow areas, but these are easily controlled by the careful use of copper sulphate at certain times of the year.

The major portion of the lake is more than 70 feet deep and the Intake Tower is located in 60 foot water, with outlet gates which allow the water to be taken from any of the four different levels. This permits the lake operators to take water from the level where the water is of the best quality at any particular time of the year.

All fishing and boating on the lake is prohibited by a ruling of the Arkansas State Board of Health. Regardless of the fact that all water from the lake is treated at the filtration plant in the City, before use, no chances are taken which might allow pollution to enter the water supply at the source. All of the water entering the supply line, on its way to the City, is chlorinated. Semi-automatic chlorination equipment, together with an ample supply of chlorine in 1 ton cylinders, is housed in a small building located over the supply line near the lake. This pre-chlorination treatment of the raw water prevents any form of slime growth on the inner walls of the pipeline and, at the same time, completely sterilizes the raw water. The amount of chlorine required for this purpose is determined daily by chemists at the filtration plant in the City.

RAW WATER SUPPLY LINE

TRANSMISSION LINE

As the water leaves Lake Winona it enters a 39-inch heavily reinforced concrete pipe line. The pipe consists of a steel cylinder surrounded by a cage of steel bars both entirely encased in concrete. Each section of pipe is 16-feet long, and on the average weighs 4½ tons.

The pipe line traverses a rugged and mountainous wooded country for the major portion of its 35 mile route from Lake Winona to the Filtration Plant in Little Rock.

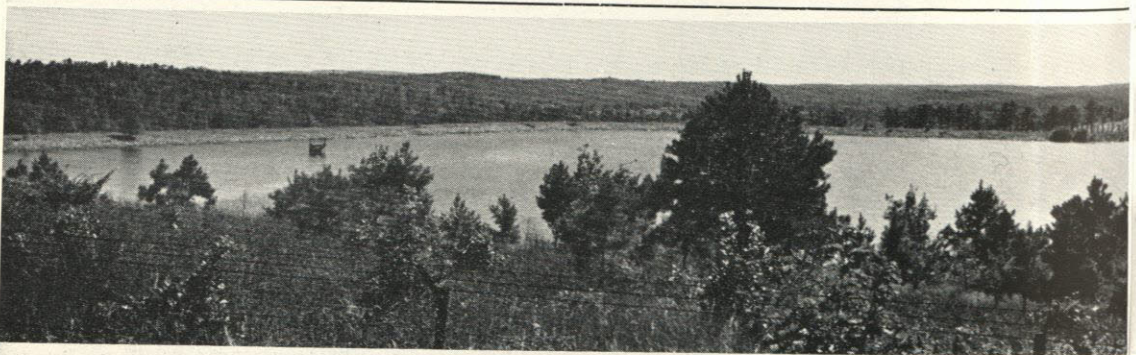
At each high point in the pipeline there is installed an air valve, housed in a concrete man-hole. This air valve permits air to enter or escape from the line with each variation of flow, and prevents any chance of an "air lock" which would stop the flow of water. At each low point in the line, there is a blow-off valve, which allows the line to be drained for inspection, when necessary.

The supply line has a maximum carrying capacity of 25 million gallons of water per day, which is sufficient to take care of the water requirements of Greater Little Rock for many years in the future. Twice each year, a flow capacity test is made on this line by water department engineers to make sure that the carrying capacity remains unchanged.

AUXILIARY RESERVOIR

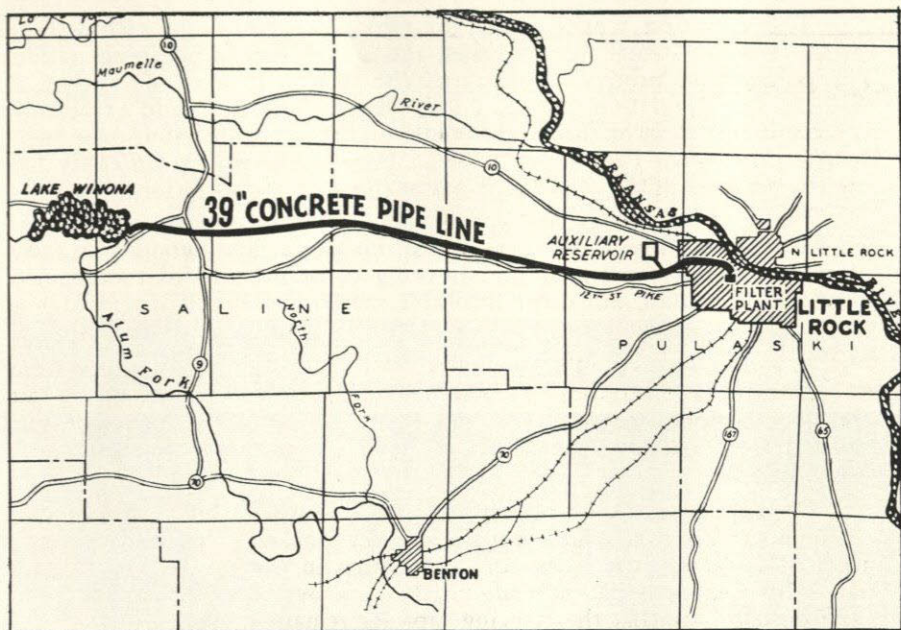
At the western edge of the City on Highway 10, the Water Department maintains an emergency reservoir which holds enough water to supply Greater Little Rock for five days of maximum consumption. In the event of a break in the 39 inch supply line from Lake Winona, this reservoir will serve as the supply until the break is repaired.

Under normal operation, the reservoir is kept full to the over-flow level so as to obtain maximum protection. A schematic diagram showing Lake Winona, 39 inch supply line, the filtration plant and the auxiliary reservoir is shown on page 5.



THE AUXILIARY RESERVOIR

This 92,000,000 gallon emergency reservoir is located three miles west of the City and has sufficient capacity to supply Greater Little Rock with water for five days, in event of a break in the 39-inch supply line from Lake Winona.



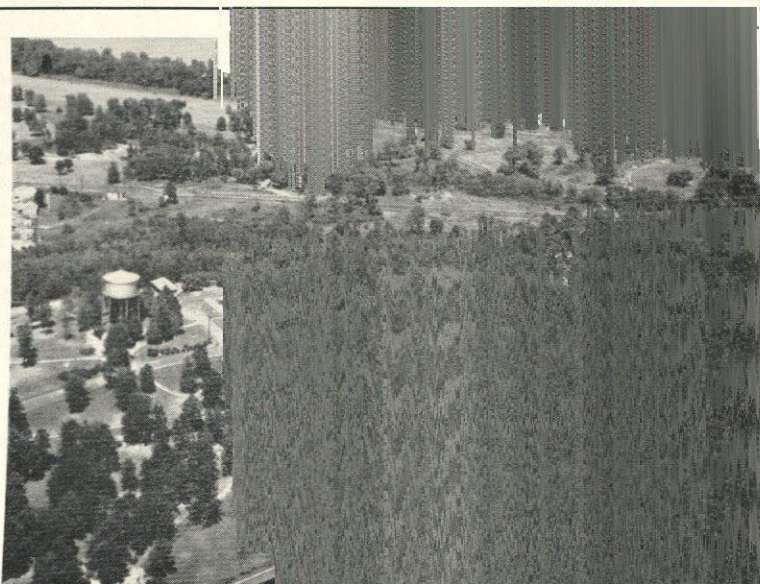
WATER SUPPLY, LITTLE ROCK, ARKANSAS

FILTRATION PLANT

The city terminus of the 39 inch raw water supply line is the filtration plant, which is located on Ozark Avenue in Little Rock. This plant is built on a high ridge just west of the city's business section and is more than 200 feet higher, in elevation, than the down-town area. Due to this fact, the major portion of Greater Little Rock is served by gravity pressure from the clear water storage basins on Reservoir Hill.

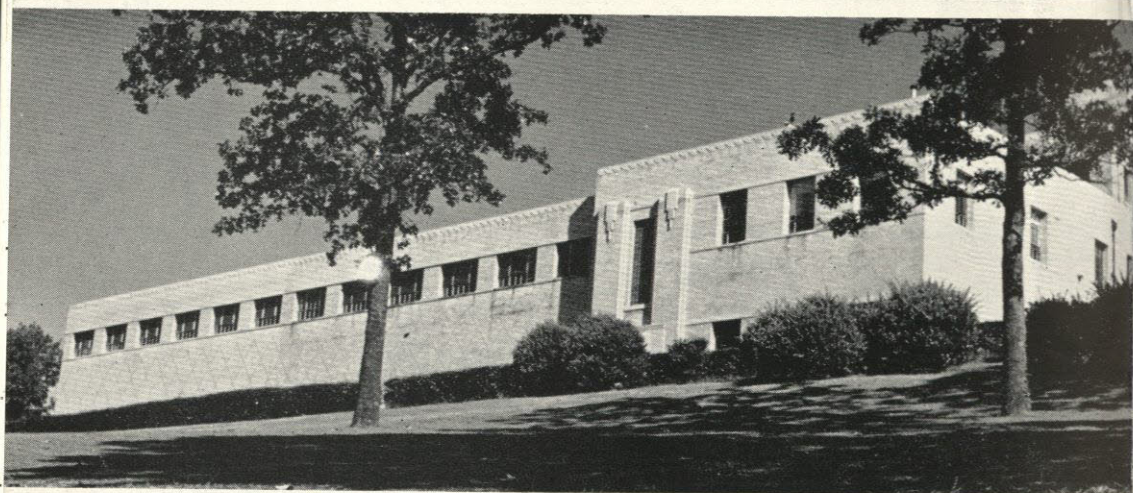
AERIAL VIEW OF THE FILTRATION WORKS

All water used in Greater Little Rock is treated at this plant. The white areas to the right of the settling basins, are the Clear Water Storage Reservoirs. The Arkansas River can be seen in the background.



The filtration works consist of two filter buildings, two settling basins, two clear water storage basins and a high service pumping station. The purification processes consists of the treatment methods known as sterilization, coagulation, taste and odor removal, filtration and a treatment to prevent corrosion of the pipelines and mains in the distribution system. By referring to the FLOW DIAGRAM on Page 9, the reader can easily follow the progress of the water as it passes through the filtration plant.

The raw lake water first enters two raw water mixing basins (M1 and M2 on the Flow Diagram), where the correct amount of aluminum sulfate (commonly called alum), is being constantly added to coagulate all of the silt, color and other insoluble matter present in the in-coming water. At the same time, another chemical feeding machine is adding activated carbon to the water. This chemical, which is a very pure form



THE FILTRATION BUILDING

The filters and chemical feeding machines are housed in the upper floors of this building and the high-service pumping station and filter pipe gallery are in the basement.

The office and laboratories are located in the upper right end of the building.

of powdered charcoal, has the ability to remove tastes and odors from water. Other special type chemical feeders add a secondary dosage of chlorine gas and a small amount of ammonia to the water at this point. This additional chlorine is necessary since the major portion of the chlorine added at Lake Winona is destroyed by oxidation processes in the 39 inch supply line, and more must be added to make sure that the correct amount of free chlorine is present and that the water will remain sterile. The ammonia is added to prevent "chlorinous" tastes or odors in the finished water.

The correct amount of all chemicals used in purifying the water, is determined hourly in the plant laboratory, to insure that the treatment is correct at all times.

After a mixing period of approximately ten minutes, the treated water flows through a concrete flume and enters the settling basins, designated as S1 and S2 on the FLOW DIAGRAM. On entering these basins the

water and added chemicals are again mixed, this time very slowly, for a period of approximately one hour. This very slow mixing promotes a chemical reaction between the alum and natural alkaline salts in the water to form a substance known chemically as aluminum hydroxide, but usually called "floc" by water plant operators. This "floc" is a very finely divided, sticky substance which, on being brought into contact with the silt and color in the water, causes them to clump together in heavy masses which settle out. This slow mixing process is accomplished by large, motor-driven paddle wheels known as "flocculators".



CHEMICAL APPLICATION ROOM

Alum, Lime and Activated Carbon are fed into the water by these machines, whose operation is very accurate and automatic. Operation of these feeders is checked every hour, day and night, by trained operators.

At the end of this slow-mixing period, the chemical reaction between alum and water is completed and the water flows out into the settling basins where it moves very slowly toward the basin outlet gates, located at the opposite end of each basin. Under normal operation rates, it requires between three and four hours for the water to cross these basins. During this long settling period, practically all of the silt and color are settled out by the alum, together with most of the activated carbon particles and some of the bacteria. This settled sludge is periodically removed by draining the basins and washing them out with fire hose streams.

Upon reaching the basin outlet gates, the treated and settled water enters a 30 inch pipeline, through which it flows back into the filter building and on to the rapid sand filters, which are marked F1 to F8 on the FLOW DIAGRAM. These sand filters are, in simple terms, large beds of a special type round grain sand known as filter sand. This sand bed, which

is 30 inches in depth, is supported by an 18 inch layer of graded gravel. The gravel, in turn, is supported by a perforated under-drain system, which collects the water passing through the filter. The filtering action is accomplished by the filter sand alone, the gravel being used merely to prevent the sand from entering the under-drain system.

The water enters the filters above the sand, passes slowly down through the sand and gravel layers, and is collected by the under-drain system, which conveys it out of the filter. As the water passes down through the sand, all undissolved matter which did not settle out in the basins, is retained on the sand and the water leaving the filters is crystal clear. This layer of silt and undissolved matter, which accumulates on the sand surface, is periodically removed by a process known as "back-washing" with clean water.



THE FILTER GALLERY

This large room contains eight filter units which are operated hydraulically from the operating tables shown above.

On leaving the filters, all of the clear filtered water enters a filtered water mixing basin, ("W.C." on the FLOW DIAGRAM), where it is treated with very carefully controlled amounts of lime and a chemical known as Calgon, followed by rapid mixing by means of a motor-driven mixer. These two chemicals are added to prevent the finished city water from corroding the water mains in the distribution system and thus eliminate roiled or discolored water complaints from the water consumers.

The water leaves this mixing chamber and enters a 36 inch pipeline, which conveys it to the two filtered water storage reservoirs shown on the FLOW DIAGRAM. From these two basins, the water flows out into the distribution system through two 16 inch and two 24 inch water mains. These mains branch off into a network of smaller water mains which cover the entire city and bring a safe, clear, sparkling water to the homes and industries of Greater Little Rock.

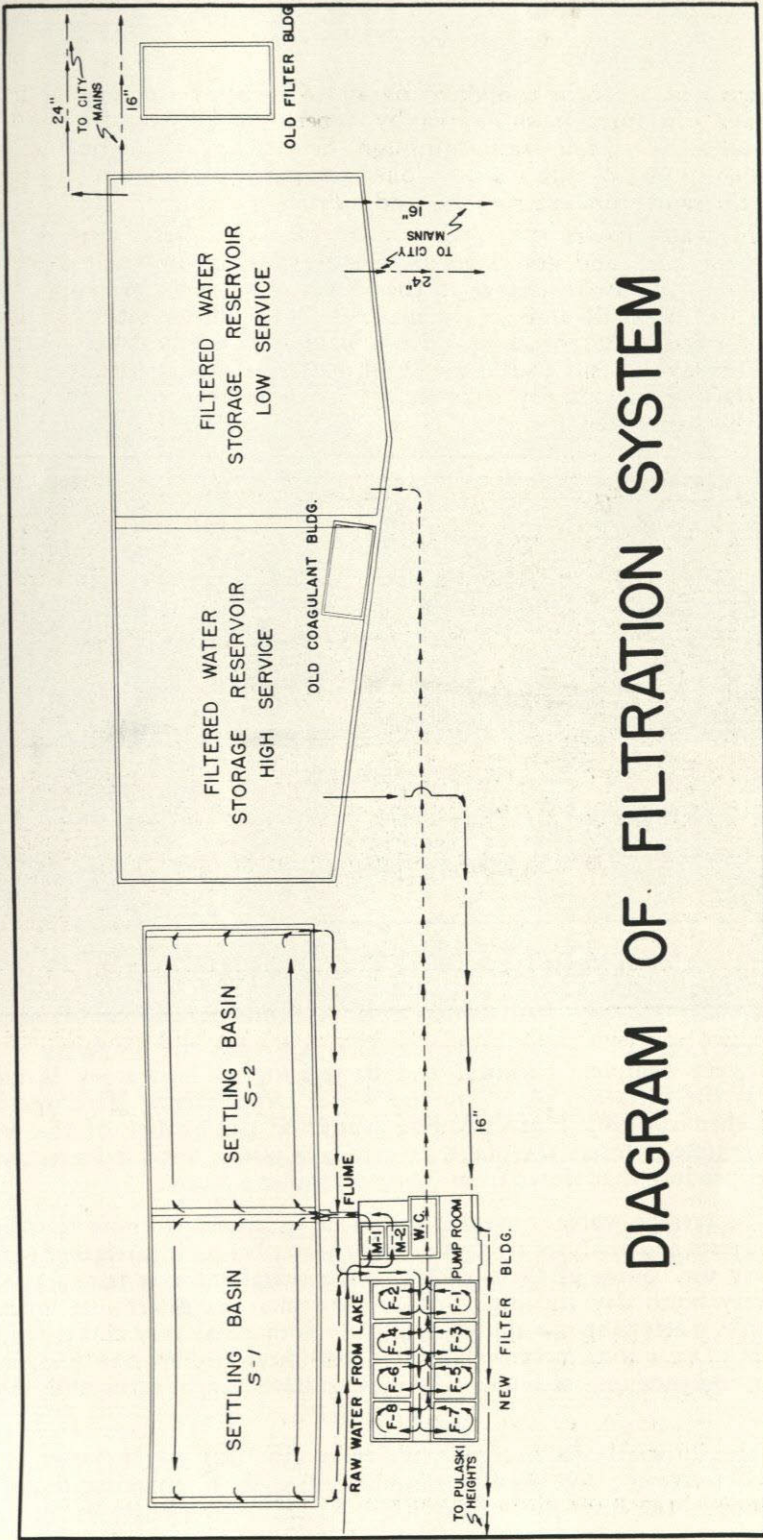
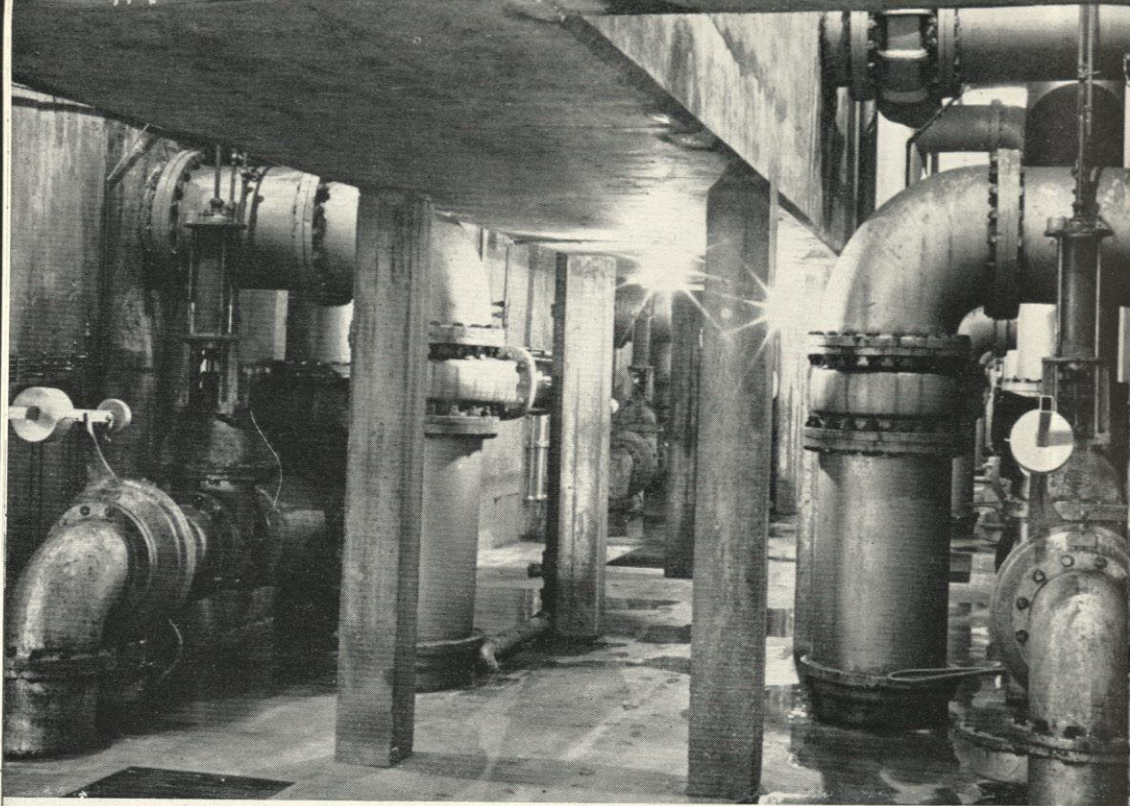


DIAGRAM OF FILTRATION SYSTEM

FLOW DIAGRAM



FILTER PIPE GALLERY

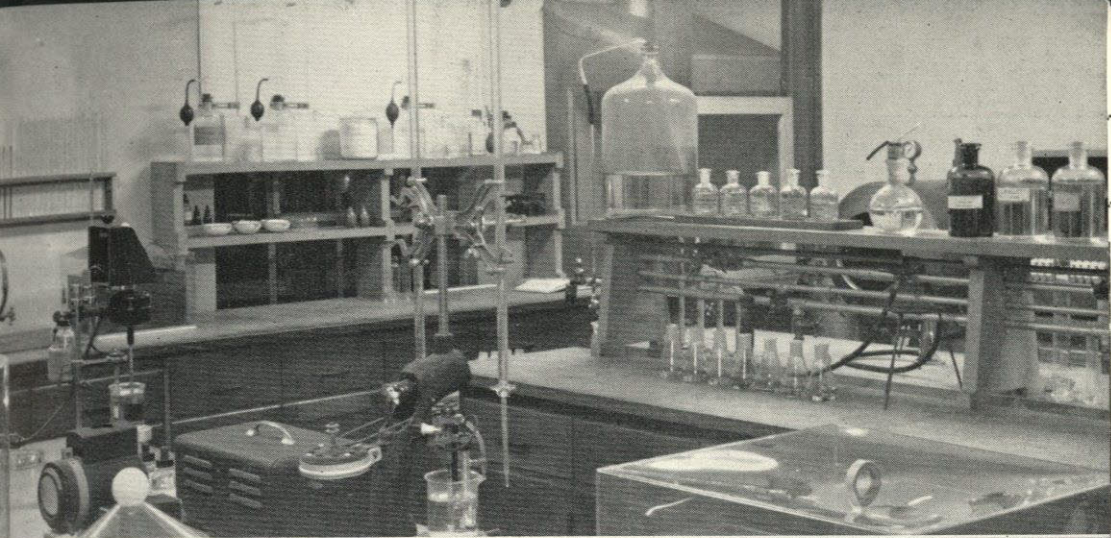
This maze of piping is necessary for the operation of the filter units.
All water passing through each filter is
automatically controlled.

LABORATORY CONTROL

A very complete chemical and bacteriological laboratory is maintained at the filtration plant, by the Water Department. Here, specially trained chemists keep a never-ending watch on the quality of the water from the time it enters the plant, as raw lake water, until it leaves as the finished product that flows from every consumer's faucet.

The average water consumer would be surprised to know that hundreds of tests and analyses are made on the water before it is released for his every-day use. Some of these, such as the residual chlorine test, are made once every hour, day and night. This particular test determines whether or not the water is sterile and consequently is made at very short, regular intervals. Other tests include those for alkalinity, acidity, hardness, iron, calcium, magnesium, sodium, chlorides, sulfates, carbonates and many others.

Bacteriological analyses are made twice each day on the water at all stages of treatment and also on samples collected at numerous sampling points out in the city. More than 5,000 bacteriological analyses are made



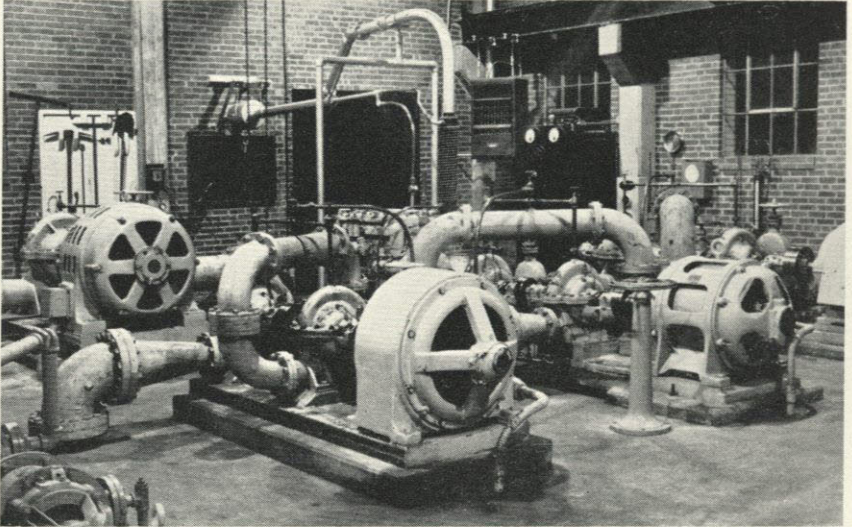
VIEWS OF THE CHEMICAL AND BACTERIOLOGICAL LABORATORY

More than 100 tests are made each day in this laboratory to insure the purity of the water furnished Greater Little Rock.

each year in the plant laboratory just to make sure that the water is safe to drink, not only when it leaves the filtration plant, but also when it is delivered to each individual water consumer at his meter.

Other duties of the water chemists include control tests to determine the proper amounts of all chemicals used in purifying the water. As the character of the raw lake water changes, the amount of treatment will vary and these changes must be determined by the laboratory. No change in chemical treatment of the water is ever made, until it has been very carefully checked by the laboratory staff. Constant vigilance and a rigid schedule of tests and analyses is very necessary to make sure that all water delivered to the consumers is always of satisfactory quality.

THE HIGH SERVICE PUMPING STATION



HIGH-SERVICE PUMPING STATION

These four centrifugal pumps pump water to the Pulaski Heights system under a pressure of 125 pounds per square inch.

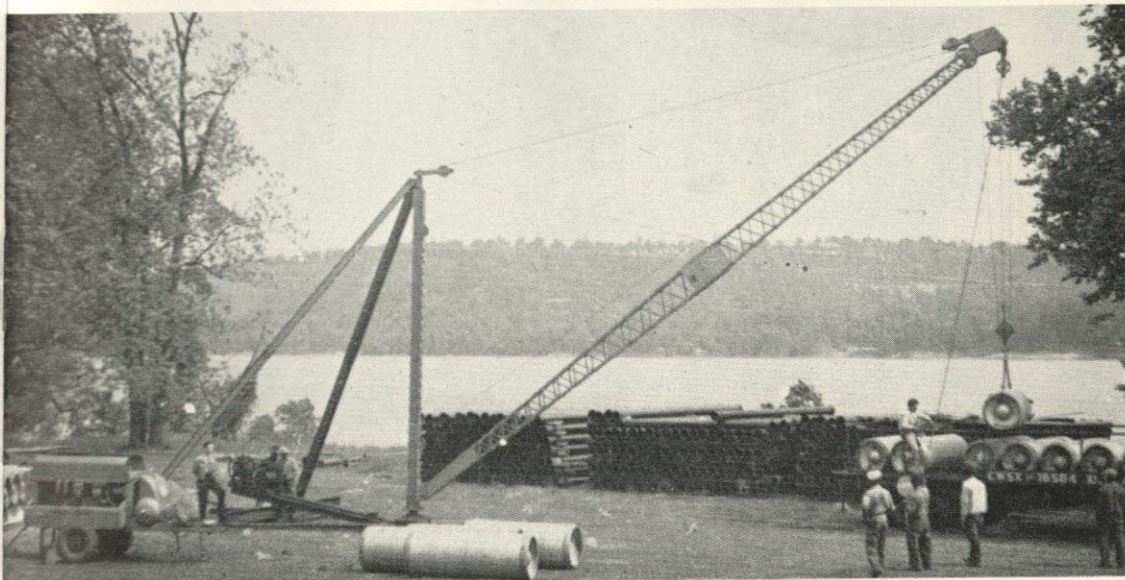
As previously mentioned, the major portion of Greater Little Rock is served by gravity pressure from the filtered water storage reservoirs on Reservoir Hill. The area west and northwest of the filtration plant is higher in elevation than the filtered water storage reservoirs and booster pumps are required to furnish water service to this area, which is known as the Pulaski Heights section of Little Rock.

The high service pumping station is located at the east end of the ground floor of the filtration building. This station contains four (4) motor-driven centrifugal pumps with capacities varying from two to six million gallons per day. These pumps take water from the west filtered water storage reservoir and pump it into the Pulaski Heights system at a pumping pressure of 125 pounds per square inch.

These high pressures are required, since elevations in the Pulaski Heights area reach a maximum of 630 feet above mean sea level and the pumping station is located at an elevation of 492 feet. Due to the hilly nature of this section, pressures in this area vary from 60 to 220 pounds per square inch.

An 80 foot standpipe, holding 188,000 gallons of water, is connected to the system near Forest Heights, but this storage is maintained for emergency purposes only and the pumps are in operation 24 hours each day.

DISTRIBUTION SYSTEM



PIPE STORAGE YARD

All pipe, pipe fittings and ton cylinders of chlorine gas are unloaded and stored on this yard until needed. The above picture shows a car of ton cylinders of chlorine gas being unloaded by use of a steel crane. These cylinders will later be hauled, by truck, to the filtration plant and to Lake Winona.

The distribution system is comprised of 350 miles of pipelines, the pipe varying in size from 2 inch to 24 inch diameter. Connected to these street mains are more than 100 miles of service lines, varying in size from $\frac{1}{2}$ inch to 6 inch diameter, and serving more than 27,000 customers. Each service is metered and these 27,000 meters vary in size from $\frac{5}{8}$ inch to 8 inch.

Fire service is supplied by more than 1,500 fire hydrants to provide adequate fire protection in the area.

The maintenance of the pipe system requires the services of a large number of employees, skilled in general pipe repair and maintenance work. The Water Department regularly operates seven repair and maintenance crews, complete with trucks and equipment. These crews are available for emergency work, day and night, and are largely responsible for the fine record of continuous and un-interrupted water service enjoyed by the water consumers in Little Rock.

The pipe storage and material yard is located at the site of the old pumping station on the south side of the Arkansas River near Highway 10, where a large supply of all size pipe and fittings is kept on hand for new construction and emergencies.

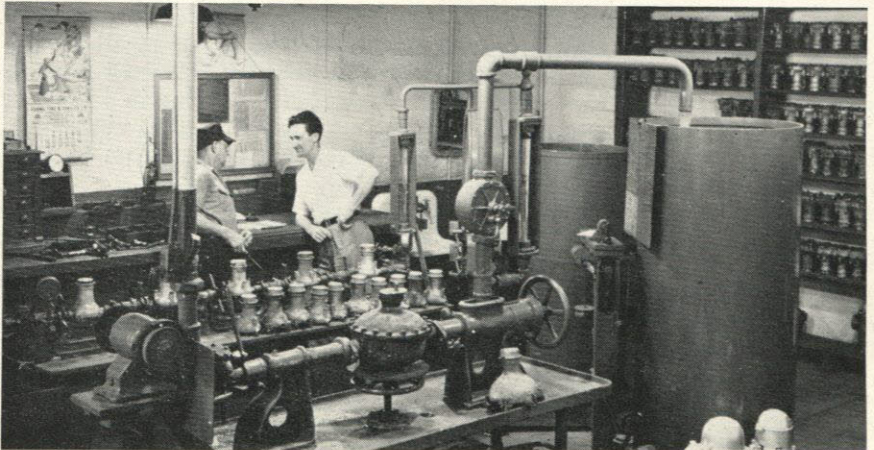


EMERGENCY CHLORINATION EQUIPMENT

All new water mains in Little Rock are sterilized before turning into service. This unit can apply 400 lbs. of chlorine per day against main pressures as high as 50 lbs. per square inch.

METER SHOP

A very complete meter testing and repair shop is located in the Municipal Auditorium, on the floor below the business office. This shop is equipped with the latest type of meter testing equipment and competent meter repair men carry on the daily work of installing, testing and repairing more than 3,000 water meters each year.



THE METER REPAIR SHOP

Modern meter repair and testing equipment, operated by experienced meter repair men, insures accurate measurement of all water used by water consumers in Little Rock.

GENERAL

The Water Department maintains a modern business office in the Municipal Auditorium and a pipe yard at the site of the old river pumping station on Highway 10.

In order to give better service and to expedite repair work in emergencies, the Department operates a short-wave radio-telephone system. Central radio stations are installed at the business office, at the filtration plant and at Lake Winona. Twelve department cars and trucks are equipped with twoway radio-telephone sets. All of these units operate on the same wave length and consequently expedite repair work and provide instant service in case of emergency.



THE BUSINESS OFFICE

This modern business office handles all of the many details involved in the operation of a large water system.

STATISTICAL DATA

YEAR 1950

Watershed Area Tributary
to Lake Winona 43 square miles

LAKE WINONA

Area 1,240 acres
 Length 4½ miles
 Maximum Depth 100 feet
 Capacity 14 billion gallons

ALUM FORK DAM

Length 2,800 feet
 Height 115 feet
 Volume 1.5 million cubic yards
 Spillway Capacity 30,000 cu. feet per sec.

39 INCH SUPPLY LINE

Length 33 miles
 Internal Diameter 39 inches
 Daily Capacity 25 million gallons

EMERGENCY RESERVOIR

Area 20 acres
 Capacity 92 million gallons

FILTRATION PLANT

Total Daily Rated Capacity 23 million gallons
 Capacity of Settling Basins 4 million gallons
 Depth of Settling Basins 14 feet
 Rated Daily Capacity
 Each Filter (New Plant) 2 million gallons
 Rated Daily Capacity
 Each Filter (Old Plant) ½ million gallons
 Raw Water Storage Capacity 5½ million gallons
 Clear Water Storage Capacity 10 million gallons

DISTRIBUTION SYSTEM

Length of Mains 350 miles
 Number of Fire Hydrants 1,500
 Number of Metered Services 27,000

The operation of the Municipal Water System is under the administration of a Board of three Water Commissioners. The system is operated by a trained personnel, a technical staff with a long record of service and experience in the water purification field. The Commission, Management and Operating Staff realize their responsibility of furnishing water service to the citizens of Greater Little Rock, with the knowledge that a safe, uninterrupted and wholesome water supply contributes largely in the building of better homes, better health, and a better community.

*“Truly, Water Is the Life Blood
of the Community.”*

Little Rock Municipal Water Works

“Publicly Owned For Public Welfare”