more of the city was covered, twenty temporary inspectors were engaged.

One of the assistant engineers made the district measurements and two were constantly engaged on sub-division. One assistant engineer tested the meters and fire lines. During the winter months two men worked in the office.

The inspection for house waste is of great value, and a large percentage of the total waste eliminated is directly due to inspection. However, proper control must be exercised or the results will be indifferent. From 1906 until 1915, the department employed men to stop house waste, but had no control over same by means of district measurements. During this period the per capita consumption was practically stationary, although the annual consumption increased.

Three Inspections, then Shut-Off

As the sub-divisions showed waste in practically every block, a system of inspection records was developed. Inspectors worked in pairs and report on every house and service made. Where leaks were discovered, a repair notice was left. Two weeks later a second inspection was made of all places where notice to repair was served. If repairs had not been made at that time a second repair notice was left and a reinspection made three days later, at which time water was turned off unless all plumbing was in good shape. The years of unlimited use and waste of water had rendered most people indifferent to the condition of the plumbing in their houses and at first considerable complaints were made at the so-called arbitrary ruling of the bureau. However, these soon ceased as the results of the survey became apparent and in the majority of cases splendid co-operation was secured.

The inspectors tested, first the house fixtures and then if these were O.K., tested with the aquaphone at the curb box for service leaks. If house waste was found, the stop cock at the house was closed before testing for service leaks. On their inspection report blanks, leaks were listed as service, faucet, toilet, etc., and a notice showing the nature of the leak served. A record of the number of people on each service was also reported. After the house inspection in a district was completed, the pitometer was again used to record the flow in different blocks in the sub-division. Where the night rate was still excessive, investigation for underground leaks was started. The determination of underground leaks is largely a matter of skill, judgment and experience. By sub-dividing by blocks the leak can be located as to block, but then the operator must find same by skill and judgment. If service pipes and boxes have been installed the aquaphone can give one the approximate location, and by driving a steel rod to the main the leak can be closely located. In only a few cases was it necessary to excavate more than one hole to find the leak.

Water Discharging into Sewer

Probably the most difficult work in this line was on Northland Ave., in section 3, where a night rate of 755,000 gallons was shown on one block. As there were practically no houses, and only one factory, which was metered and did not account for but a fraction of the flow, all indications pointed to a large joint leak, or cracked pipe. In this street the pipe is laid in the sewer trench, which was excavated through rock. When the street was paved in 1893, house services had been placed every sixty feet. No large main leak was encountered, but seven service leaks were discovered and shut off at the main, which accounted for 700,000 gallons, or practically the entire waste. The corporation cocks had in nearly every instance been destroyed and water was discharging directly into the sewer. No indications of these leaks appeared on the street surface.

As work was completed in each division a permanent map was filed in the office, showing gauging points for instrument and valves on boundary points. On this map is recorded date of first measurment, 24 hour consumption and minimum night rate, and same record of second measurement. It is the intent of the Bureau of Water to continue the pitometer work as a special department and regular measurements will be taken at varied intervals, and these maps will facilitate the work greatly. All inspectors reports are filed by streets and can be instantly referred to. As soon as a section was completed a full report on same was submitted by the enineer-in-charge. This report gave a general summary of the work with certain specific recommendations to meet the conditions for the sections. These reports are filed so as to be available for future reference.

The report for section 4 showed as follows:—

Total flow before inspection, per 24 hours	17,936,000 gallons
Minimum night rate	14,912,000 gallons
Per cent. of night rate to total flow	86.2%

Inspection of all buildings on this section showed: 3,444 leaky fixtures, divided as follows: Faucets, 1,064; toilets, 2,380.

It also disclosed 280 leaky services, which were repaired by the owners; 8 unfinished supplies which were discharging into the sewer were dug up and plugged. Also, one broken 6-inch main was uncovered and repaired.

After the house inspection and underground work was completed a remeasurement was taken with the following results: Reduction in daily consumption 3,780,000 gallons; reduction in night rate 3,910,000 gallons.

Work Done Hastily

On account of the desire to reduce the pumpage as quickly as possible, so as to conserve coal, as a war measure, no intensive work was attempted and the city surveyed as rapidly as consistent with good work. It is highly probable that the results in this section could have been bettered had more time been devoted to it. However, by extending the work rapidly large leaks in other districts were detected and stopped in the time which might have been devoted to more intensive work in this section. It is expected that the work to be done in this section this summer will materially better the above result.

Starting in July, 1917, which was coincident with the start of the survey, each month shows a decrease in pumpage when compared with the same month in the preceding year except for the extremely cold months of December, 1917, and January and February, 1918.

Our first section was surveyed in 1917, and this year remeasurements have been taken. These show that there is a more or less gradual return of the waste first eliminated, depending wholly on the character of dwellings. In all sections the consumption was less than it was two years ago at the time of the first measurement. In one case the result showed only 10% increase over the first remeasurement. I estimate that effects of the result of the survey will be from one to three years as far as house waste is concerned. All underground leaks stopped are a permanent saving.

In the sections completed, the house waste stopped is estimated at 18,000,000 gallons, while the underground waste stopped was 12,000,000 gallons by actual measurements.

It is our intention to measure and sub-divide the entire city once in two years, and to completely inspect as often. Of course, measurements and inspections will be made oftener in the sections where waste is greatest. To more fully control waste in these sections meters will be placed gradually.

Results of Survey

However, to quickly reduce our pumpage was imperative. I know of no other way which would have given results so quickly. To install meters would have taken from three to five years and the reduction would not have been felt for some time, at least not for the first six months, when the size of the bill would have brought the waste of water home very forcibly to the householder.

Nine tenths of the city has now been covered by the survey with the following results:—

33,278 leaky fixtures reported and repaired; 1,860 leaky services reported and repaired; 52 unfinished supplies found wasting 3,587,000 gals. per day; broken mains and leaky joints wasting 4,376,000 gals. per day, found and repaired.