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URBANIZED AREAS SERVED BY SEWERS AND SEPTIC TANKS IN THE SEATTLE-TACOMA URBAN COMPLEX AND ADJACENT AREAS, WASHINGTON

BY
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INTRODUCTION

This report is the fourth in a series of basic-data contributions which graphically depict various hydrologic aspects of the urbanization of the eastern part of the Puget Sound lowland. The report was prepared to present a generalized illustrative summary of the areal distribution of the sewered and nonsewered areas. It does not attempt to give finite detail but is intended to be used as a planning and teaching tool. The preceding reports in this series discuss low flows and temperatures of streams (Hidaka, 1972), emergency ground-water supplies (Foxworthy, 1972), and public water supplies (Parker, 1974).

As defined in this study, the Seattle-Tacoma urban complex and adjacent areas include southwestern Snohomish County, western King County, west-central Pierce County, and northeastern Thurston County, a total area of about 3,330 square miles (8,620 square kilometers). The population of the study area in 1972 was about 1,840,000--54 percent of the State's population--of which approximately 1,760,000 people live in the area herein described as the Seattle-Tacoma urban complex. This urban complex covers approximately 800 square miles (2,070 square kilometers) and is outlined by the shaded areas on the map. An average of 2,200 people per square mile (850 people per square kilometer) live in this urbanized area which is only slightly more than 1 percent of the State's area.

WASTE-WATER DISPOSAL

Urbanization can cause many changes in the hydrology of an area, and sewerage, or the lack thereof, can be of critical importance in the population centers. Traditionally, as homes are built in an area, several methods of sewage disposal are utilized--by burial in pits, by discharge into cesspools and septic tanks, and in some places by discharge into water bodies. In rural areas of low population density, some of these methods are still used and in some cases are utilitarian. However, ofttimes the ground is not suitable for proper operation of closely spaced septic tanks, and in urbanized areas health hazards can result.

In areas where the transmissivity is low--where the soil and earth materials do not permit ready percolation of water--septic tanks will not operate properly and septic effluent can form pools on the surface during wet periods. This can occur in the study area where the surface material is clay or glacial till ("hardpan"), typically an unsorted mixture of coarse pebbles and boulders in a matrix of clay and silt. In other areas, where the soil is more permeable, and thus more suitable to septic-tank operation, contamination of the ground water and nearby streams and lakes may occur as the effluent percolates through the soil. Even in terrain where septic systems will work properly, high densities of these systems can cause pollution of the ground water.

The standard solution to these problems in urban areas has been construction of miles of sanitary sewer lines and sewage-treatment facilities, which eliminate the need for individual sewage-disposal systems for each home or building. However, such community sewerage systems can also alter the local hydrology. Where the sewer lines are in good repair all the sewage is transported to a single point which is then subject to stress. For example, a sewerage outfall can increase the flow in a stream and drastically alter the quality of its water. In areas where the sewer lines are improperly installed or in poor condition they leak and, if the ground-water level is below the level of the sewer lines, raw sewage may eventually percolate to the ground-water body. Conversely, if leaky sewer lines are below the ground-water level the lines will receive ground-water inflow and increase the volume of sewage reaching the treatment plant.

SEWERAGE SYSTEMS IN THE SEATTLE-TACOMA URBAN COMPLEX

Based on data for 1969-72, the map shows those areas served by sanitary sewerage systems, and also the approximate suburban areas where buildings are individually served by septic tanks. Not all of the latter areas are densely populated; however, the general character of most of this area is such that it is considered more urban than rural. The remaining (nonpatterned) area of the map is considered nonurbanized and rural, where houses and other buildings are generally widely separated and use septic tanks or other private means of sewage disposal. No political or jurisdictional boundaries are shown--the only delineation is between community-sewerage service, suburban individual septic-tank service, and rural areas.

In the Seattle-Tacoma urban complex the largest single sewage-treatment system is that of Metro (Municipality of Metropolitan Seattle), which in 1971 processed almost 57 billion gallons (216 million cubic meters) of waste water from an estimated population of about 900,000. Another large sewage-treatment system is operated by the city of Tacoma which in 1971 processed about 18 billion gallons (68 million cubic meters) of waste water from an estimated population of about 200,000.

About 90 or 100 billion gallons (340 or 380 million cubic meters) of waste water is processed annually by the sewage-treatment systems in the study area. This is about 200 gallons (0.758 cubic meter) per person per day for those persons utilizing the sewerage systems. Most of this sewage receives "primary" treatment, which consists of removal of most of the solid material in the raw sewage by screening and sedimentation and then disinfecting the effluent, usually by chlorination. A smaller percentage of the sewage receives "secondary" treatment, which is the biological treatment of the effluent after primary treatment. Secondary treatment removes about 80 percent of the remaining suspended material by allowing bacteria to break down the organic content of the effluent.

More than half the treated waste water in the study area is discharged directly into Puget Sound through submarine outfalls. Most of the remainder is discharged into streams--such as the Puyallup, Duwamish, and Snohomish Rivers--and it then enters the Sound in a more dilute form. Occasionally, some untreated sewage enters the Sound or a stream due to treatment-plant overloading or sewer overflow. A very small percentage of the waste water does not reenter the drainage system by direct flow, but is discharged to lagoons or elaborate drainfields.

CONCLUSIONS

In the past few years great progress has been made in improving sewage treatment and disposal in the Seattle-Tacoma urban complex. However, additional sanitary-sewerage systems and improvement of existing facilities may be expected in the coming years. Many areas, especially in the suburbs, still use individual-home septic tanks and eventually may have to convert to community sewerage systems.

If the rate of population growth in the study area during 1960-70 is applied to the 1972 figure, the urbanized population could be as much as 2.2 million in 1982. This projected population increase, coupled with projected economic activity and increased pollution awareness, indicates that greater volumes of waste water will be treated and thus there must be an expansion and upgrading of sewage-treatment facilities.

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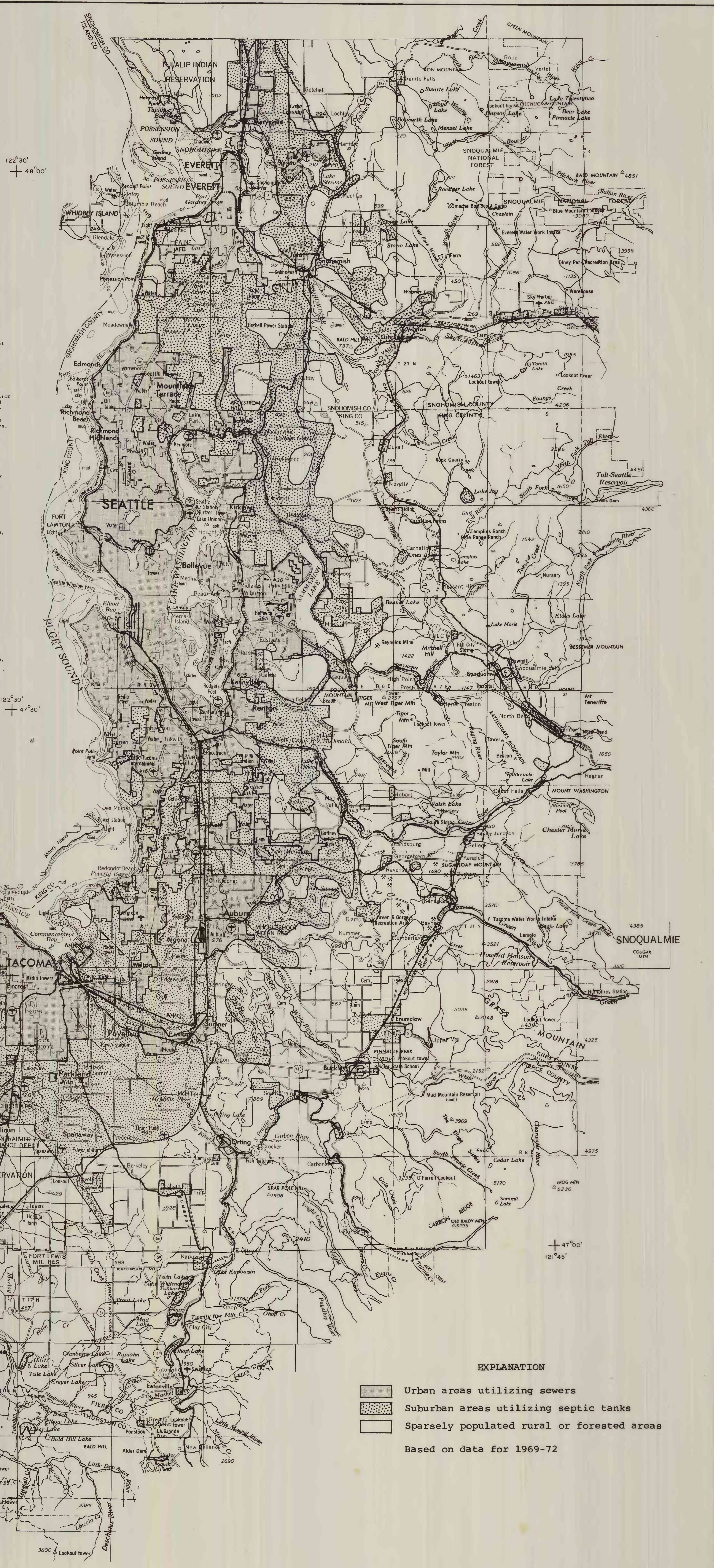

5 0 5 10 MILES
5 0 5 10 15 KILOMETERS

Base map from parts of Victoria-66, Concrete-62, Seattle-65, Wenatchee-63, Hoquiam-58, Yakima-63, at 1:250,000

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