WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

NATIONAL WATER-QUALITY ASSESSMENT PROGRAM—The Willamette Basin, Oregon

BACKGROUND

In 1991, the U. S. Geological Survey (USGS) began to implement a full-scale National Water-Quality Assessment (NAWQA) program. The long-term goals of the NAWQA program are to describe the status and trends in water quality of large, representative parts of the Nation's surface- and ground-water resources, and to provide a sound, scientific understanding of the primary natural and human factors affecting the quality of these resources. The program will produce water-quality information useful to national, State, and local policy makers and managers.

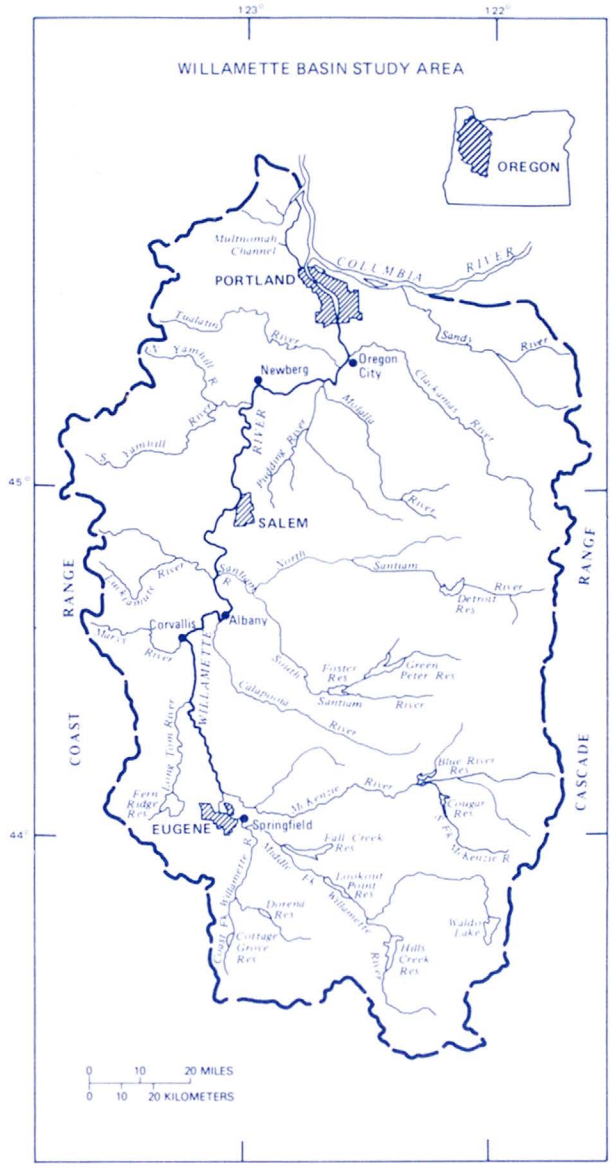
The NAWQA program will collate water-quality information at various areal scales. Sixty study-unit investigations comprise the principal building blocks of the program and provide the basis for national-level assessment activities. The study units are regional-scale hydrologic systems that range in size from 1,200 to more than 65,000 square miles and that incorporate about 60 to 70 percent of the Nation's water use and population served by public water supplies. They include parts of most major river basins and aquifer systems in the Nation. In 1991, the Willamette basin was among the first 20 NAWQA study units selected for investigation under the full-scale implementation plan.

STUDY UNIT DESCRIPTION

The Willamette basin NAWQA unit includes the Willamette and Sandy Rivers, which are tributary to the Columbia River. The Willamette basin drains an area of 12,000 square miles, contains Oregon's three largest cities (Portland, Eugene, and Salem), and is home to 68 percent of the State's population (about 1.9 million people). Approximately 60 percent of the basin is forested (largely in tributary basins), about 35 percent is farmed, and the remaining 5 percent is urbanized or in other uses.

The Willamette basin can be divided into three north-south physiographic provinces. The Cascade Range, consisting of volcanic rocks and exceeding elevations of 10,000 feet, forms the eastern boundary of the basin. The Coast Range, consisting of marine sedimentary and volcanic rocks at elevations over 4,000 feet, constitutes the western boundary. Between these mountain ranges lies the Willamette Valley, an elongated structural and erosional lowland filled with flows of Columbia River Basalt (in the northern half of the basin) and younger unconsolidated sediment. The unconsolidated material is a major source of ground water; wells commonly produce up to 300 gallons of water per minute. The Columbia River Basalt also is an important ground-water source, but wells completed in this material generally produce less than 100 gallons of water per minute.

The climate of the Willamette basin is a modified, maritime temperate regime that is characterized by cool, wet winters and warm, dry summers. Approximately 10 percent of the average annual precipitation of 63 inches occurs between May and



September. Precipitation varies markedly with altitude and ranges from about 40 inches at lower elevations to greater than 200 inches in the mountains. Most of the streamflow in the Willamette River typically occurs between November and March in response to the persistent winter rain and spring snowmelt; however, late spring snow in the high Cascade Range can prolong runoff into June or July. Summer and fall periods of low flow are significantly affected by reservoir operations.

The 11 major reservoirs in the Willamette River basin have a combined usable storage capacity of nearly 1.9 million acre-feet. The reservoirs are operated primarily to maintain a minimum navigable depth in the Willamette River upstream to about Newberg. They are also operated for power generation, recreation, flood protection, anadromous fish propagation, irrigation, and public-water supply. As a result of these operational considerations, river-water quality is enhanced by the augmentation of streamflow from reservoir releases. The Sandy River basin has three storage reservoirs on the Bull Run River, with a usable storage capacity of 37,000 acre-feet. The Bull Run River is the major source of drinking water for the Portland metropolitan area and serves about 700,000 customers.

Water use in the Willamette basin is estimated to be 800 million gallons per day, with 70 percent supplied by surface-water resources. Surface-water uses include commercial and industrial (40 percent), irrigation (25 percent), domestic (25 percent) and other (10 percent). About 65 percent of the basin population relies on surface-water resources for drinking water. Ground water (30 percent of total water use) is used for irrigation (60 percent), domestic supply (25 percent), commercial and industrial applications (10 percent), and other purposes (5 percent).

WATER-QUALITY ISSUES

Water-quality issues in the Willamette basin are difficult to categorize separately because they are, to a large extent, interrelated. On the basis of previous studies in the basin, however, and on discussions at the first meeting of the liaison committee (see section on Communication and Coordination), the following issues have been identified:

- Biological degradation, including effects of loss of riparian habitat on stream temperatures; effects of water temperature, sedimentation, and reservoir operation on resident fish populations, such as salmon and steelhead; loss of habitat for bottom-dwelling organisms; and deterioration of sanitary (bacterial) quality of surface and ground water.
- Erosion of soils due to changes in land use. Demands from increasing population growth and industrial development affect biological habitat and surface-water transport of trace contaminants by altering erosion and sedimentation rates within the basin.
- Evaluation of surface- and ground-water flow. This is not specifically a water-quality issue, but knowledge of flow rates and surface-water/ground-water interactions is prerequisite to understanding their effects on water quality. Management of surface- and ground-water resources has been and will remain a significant factor that contributes to current water-quality conditions within the basin. Considerations include operation of multiple-use reservoirs to optimize storage and streamflow augmentation, relations between river discharge and water quality, effects of well construction and pumpage on water quality, and effects of surface application of sewage sludge on ground-water quality.
- Eutrophication, the process by which surface waters increase in biological productivity in response to natural or man-induced nutrient enrichment. Possible effects on reservoirs and streams in the basin include excessive algal growth, high pH values (with potential for toxic ammonia concentrations), and low dissolved-oxygen concentrations from decay of organic matter. Considerable concern also exists with regard to increasing nutrient concentrations, especially nitrate, in ground water.
- Trace organic compounds and trace elements in surface and ground water and, perhaps, naturally occuring radon in ground water. Sources include pesticides from agricultural and urban runoff; industrial organic compounds, such as dioxin and furan, from point and nonpoint sources related to paper processing and wood preserving activities; and trace elements, including copper, lead, and zinc, from industrial (point) and nonpoint sources.

COMMUNICATION AND COORDINATION

Communication and coordination among USGS personnel and other interested scientists and representatives of water-management organizations are critical components of the NAWQA program. Each of the 60 study-unit investigations will have a local liaison committee consisting of members who represent Federal, state, and local agencies, universities, and the private sector and who have responsibilities with regard to water-resources issues. Specific activities of each liaison committee will include exchange of information about water-quality issues of regional and local interest; identification of sources of data and information; assistance in the design and scope of project products; and review of project planning documents and reports. The liaison committee for the Willamette basin study was formed in early 1991 and contributed significantly to the determination of the water-quality issues discussed previously.

Information on technical reports and hydrologic data related to the NAWQA program can be obtained from:

District Chief, Water Resources Division
U.S. Geological Survey
10615 SE Cherry Blossom Drive
Portland, Oregon 97216

Open-File Report 91–167

D.A. Wentz and
S.W. McKenzie, 1991

U.S. GOVERNMENT PRINTING OFFICE: 1991 0—866-560