

United States Geological Survey

Programs in Washington



The USGS provides maps, reports, and information to help others meet their needs to manage, develop, and protect America's water, energy, mineral, and land resources. We help find natural resources needed to build tomorrow, and supply scientific understanding needed to help minimize or mitigate the effects of natural hazards and environmental damage caused by human activities. The results of our efforts touch the daily lives of almost every American.

The U.S. Geological Survey (USGS) collects, compiles, and disseminates data on water, energy, and mineral resources in Washington. The USGS is known for its impartial data collection and research mission—gathering, interpreting, and presenting data that enable resource planners and others to make informed decisions on the basis of objective information. As the leading earth science agency, the USGS works cooperatively with State, local, and other Federal agencies to address issues related to Washington's earth resources. Today's issues are more pressing than ever—the continuing need for resource development, describing and evaluating natural hazards, and understanding the effects of man's activities on resources.

Earthquakes in the Pacific Northwest

The potential dangers to the Pacific Northwest posed by great earthquakes (magnitude 8 or larger) was first confirmed in 1987 by USGS scientists, who found geologic evidence that land along Washington's coast had abruptly dropped into tidal water in about 1700. Public and private groups, mostly at the local level, have responded by taking precautions, such as reinforcing bridges, dams, pipelines, and buildings. Engineers depend on the USGS for advanced seismology data that is used to design these reinforcements.

The Puget Sound region is underlain by several possibly active crustal faults that are covered by young sediments or dense vegetation or are submerged in the waterways of Puget Sound. The USGS is using marine geological and geophysical techniques to study these faults and related hazards commonly resulting from earthquakes along them, such as tsunamis and underwater landslides. The USGS is cooperating with State and university

researchers to examine the recent history of possibly active faults and landslides throughout Puget Sound and in Lake Washington and Elliott Bay in Seattle. Studies on land and, by acoustic images, of the deposits beneath the Sound show strong evidence of movement on at least some of these faults, such as the Seattle Fault and the Whidbey Island fault zone. Documentation of the extent, recent activity and possible recurrence intervals of fault activities can provide a better understanding of the most likely location and effects of future damaging earthquakes, tsunamis, and landslides.

Volcanic Hazards

Seven volcanoes in the Cascade Range have erupted during the past few hundred years, two of them during this century (fig. 1). Future eruptions pose serious hazards to communities, aviation, and interstate commerce in Washington, Oregon, and northern California. The USGS has demonstrated in recent studies that losses of lives and property from future eruptions can be reduced substantially through

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effective land-use planning and timely warnings of impending volcanic activity. Therefore, in cooperation with the U.S. Forest Service, the National Park Service, the Bureau of Land Management, the Federal Aviation Administration, the Washington Department of Natural Resources, and other Federal, State, and county agencies, USGS scientists are studying the far-reaching effects of past eruptions, monitoring for signs of renewed volcanic unrest, developing new monitoring and predictive tools, and exchanging information with concerned

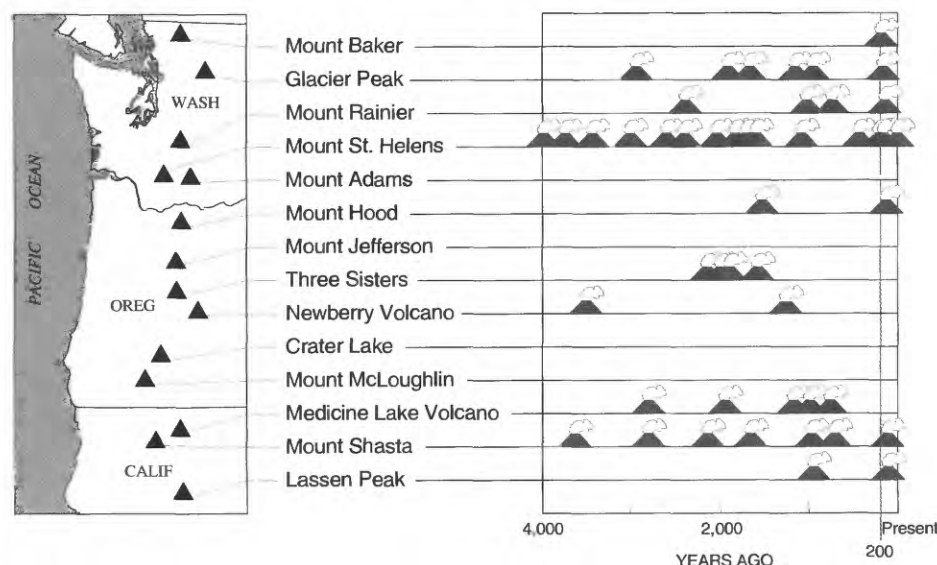


Figure 1. Cascade Range eruptions during the past 4,000 years

officials, agencies, and citizens to identify and mitigate hazards from future eruptions in the Northwestern United States.

Long-Term Water Supply

The continuing population increase in Washington has been paralleled by an increase in the competition among municipal, industrial, wildlife, fisheries, hydro-power, and agricultural interests for a limited water supply. Short-term droughts, such as those in 1976–77 and 1990–94, and long-term water-deficit periods, such as the latter part of the 1980's, have underscored the limitations of the available water supply.

Surface-water resources in many parts of the State have been fully developed for many years, and the attention of the public and local and State agencies has now shifted to assessment and development of the State's ground-water resources. The USGS has ongoing studies designed to understand and define ground- and surface-water relations but also has recognized the high priority placed on understanding the quantity and quality of ground water in the State. Studies of the quantity and quality of ground water in the Benton–Franklin County area; on the Yakima Indian Reservation; in Snohomish, King; and Thurston Counties; and at the Bangor Naval Base are some examples of the cooperative activities between the USGS and State and local agencies. As part of nationwide programs, the USGS has been conducting studies that provide information on a regional scale; for example the recently completed Columbia Plateau Regional Aquifer-System Analysis, (RASA), which describes and quantifies the major aquifer system in Washington, and the ongoing studies of the National Water-Quality Assessment Program (NAWQA) in the Yakima and the Puget Sound Basins and the Central Columbia Plateau (fig. 2).

Ground-Water/Surface-Water Interactions

The Washington Department of Ecology is the State agency responsible for issuing water-right permits. The State Supreme Court recently ruled that although that agency's authority to evaluate and make decisions about permit

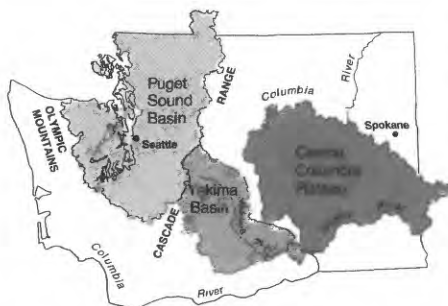


Figure 2. NAWQA study units in Washington.

applications still stands, its authority to enforce such decisions is curtailed. In effect, any decisions by the Department of Ecology that are not agreed to by property owners or third parties must be resolved in a court of law. This can delay the permit-issuing process for individual water-right cases for many years and, therefore, is not considered a long-term solution.

The significance of interactions between ground and surface water has only recently been recognized in the process of issuing water-right permits in the State. As a result, the permitted water rights in some basins may exceed the total water volume available for development. To assist the State in resolving this situation to the benefit of all water users, the USGS began an educational and training program to disseminate the concepts of ground-water/surface-water interaction to as wide an audience as possible, including technical and nontechnical parties. In cooperation with the Department of Ecology, the USGS has developed an effective training tool—a generic numerical model of ground-water/surface-water interaction in a typical Puget Lowlands glaciated area. USGS scientists are using model results in presentations to local water resource managers and are assessing how to best adapt the model for more direct use for water-resource management.

Long-Term Water-Quality Trends

Protection and enhancement of the quality of Washington's surface- and ground-water resources are a high priority. Effective management of these resources requires information on current and future water-quality conditions and trends and on the major factors that affect water quality. Management decisions

include establishing regulations and setting the levels of public spending for pollution control, monitoring, and research to understand better processes affecting water quality. An earth science perspective is essential for the informed management of water quality. Predicting the effects of proposed management actions on water quality relies heavily on knowledge of the interactions between water and earth materials. As part of its mission, the USGS provides information that will assist resource managers and policymakers at the State, local, and Federal levels. In Washington, this is being done partly through intensive, long-term assessments of the quantity and quality of the water resources in the Yakima Basin, the Central Columbia Plateau, and the Puget Sound Basin as part of the NAWQA Program (fig. 2).

The Yakima Basin study was a highly successful NAWQA Program pilot project that was useful for planning and developing subsequent studies nationwide. The Central Columbia Plateau study, started in 1991, focuses on a semi-arid area heavily dominated by irrigated and nonirrigated agriculture. The Puget Sound Basin study, just underway, focuses on the high-precipitation, densely populated areas surrounding Puget Sound. These studies are conducted with the full interaction and advice of local, State, and Federal agencies concerned with the environmental and water-resource issues of the study areas.

Eastside Ecosystem Management Project

The USGS is providing the earth science information needed for the Eastside Ecosystem Management Project. This project, led by the U.S. Forest Service and the Bureau of Land Management, will make a broad scientific assessment of and develop a land-management scheme for Federal land in a seven-State region in the Columbia River Basin. The effort takes into account all the ecological, economic, social, and managerial interests in the lands. USGS scientists are providing information about the geologic composition and processes to include in a numerical landscape model, predicting areas of possible soil erosion, assessing the potential for undiscovered energy and mineral

resources, providing information needed to assess the economic and social effects of major earthquakes or volcanic eruptions, determining the distribution of earth materials that affect ecosystem health, and helping to map potential habitats for various species. The USGS studies are contributing to the project goals of restoring ecosystem integrity and sustaining the widest possible range of interests.

Unconventional Gas Resources

Although Washington State has no commercial production of gas and oil, it is recognized as a petroleum frontier. For example, the subsurface of the vast Columbia River Plateau is a likely host to enormous unconventional gas resources that could become viable under the right economic conditions. USGS scientists are working on the National Petroleum Assessment in cooperation with the U.S. Department of Energy, the Washington Division of Geology and Earth Resources, to define potential petroleum occurrences in Washington. More than 10 conventional and unconventional (coal-bed methane, basin centered gas accumulations, deep gas) petroleum "plays" have been defined and documented. Five different petroleum companies contributed seismic reflection data to this effort, data bases that have proved crucial in defining the habitat of energy resources and assessing regional and local earthquake hazards. The USGS resource assessments provide key information to government and industry for economic and environmental planning and development and for leasing decisions on public lands.

Earth Observation Data

Through its Earth Resources Observation Systems (EROS) Data Center near Sioux Falls, South Dakota, the USGS distributes a variety of aerial photographs and satellite-image data products that cover Washington. Mapping photographs date back almost 40 years for some sites. Satellite images dating from 1972 can be used to study changes in regional landscapes.

Water-Data Collection

As part of its nationwide data-collection program, the USGS collects a large

amount of surface- and ground-water and water-quality data. In Washington, the USGS collects streamflow data on a continuous basis at about 250 sites, many of which are part of the National Flood Forecasting Network. The data are available to scientists, engineers, and planners to use in predicting the frequency and magnitude of floods, controlling flows for fisheries; designing hydroelectric powerplants; regulating streamflow for water supply, waste dilution, and recreation; and designing structures such as bridges, roads, dams, and culverts. About one half the stream flow gaging stations in Washington provide current information (mostly by satellite telemetry) to agencies, such as the U.S. Army Corps of Engineers; the National Oceanic and Atmospheric Administration, National Weather Service, and local flood-control agencies that operate water-resource systems and provide flood forecasts that allow people and property to be evacuated from areas that may be inundated.

The USGS also collects data on reservoir and lake elevation and contents, ground-water levels, well and spring discharge, and the quality of surface and ground water. The USGS data base has more than 10,000 sites in Washington where water-quality data on surface and ground water are available (fig. 3). The data are invaluable in defining the historic water quality at a wide variety of sites over more than the past 70 years and may

be used to monitor changes and trends in the quality of the water. These data constitute a long-term continuing record of the quantity and quality of the State's surface- and ground-water resource, and thus provide the hydrologic information needed by Federal, State, and local agencies and the private sector for the orderly development and management of Washington's water resources.

All data collected by the USGS in Washington and the Nation are stored in the National Water Information System (NWIS) and are published on an annual basis.

Assessment of Flood Frequencies

Flooding in low-lying areas adjacent to streams, particularly in western Washington, has been a recurring concern to citizens and water managers. State, local, and Federal agencies need to know how frequently floods of various sizes may be expected to occur to plan for and advise on various measures designed to prevent loss of life or mitigate destruction of property. Typically, the primary interest is for large floods that may occur rarely but with enough frequency to be of real concern in the scale of human lifetimes.

The last major analysis of flood frequencies in Washington was completed in 1975 by the USGS. It was based on data collected through 1972; thus, there are

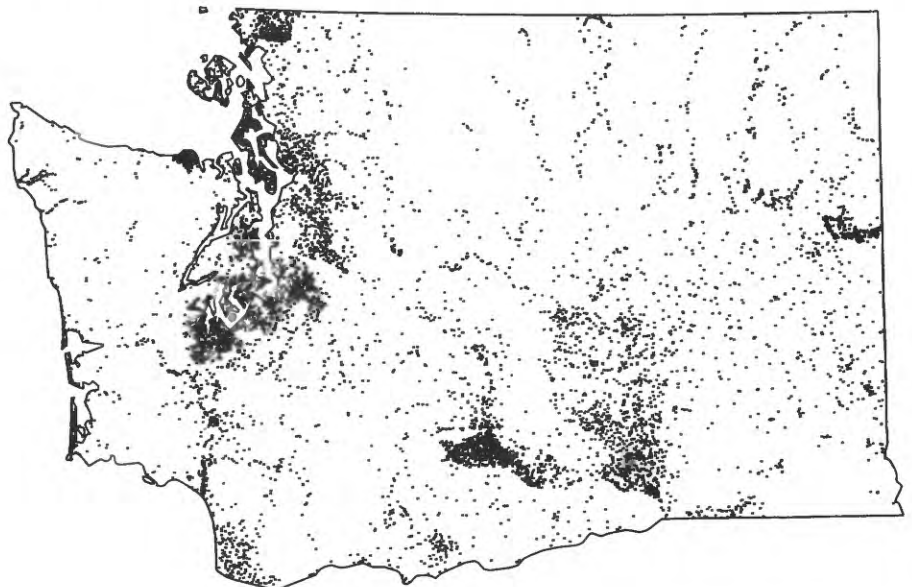


Figure 3. Water-quality data-collection sites in Washington

now more than 20 additional years of streamflow, climatic, and land-use data available to update and revise the previous analysis. The USGS in cooperation with the Washington Department of Transportation is performing the analysis. Available in the USGS data base are data from more than 500 streamflow sites statewide that have been operated over the past 80 years and supported by about 100 State and local cooperating agencies.

National Mapping Program

Among the most popular and versatile products of the USGS are its topographic maps at a scale of 1:24,000 (1 inch on the map represents 2,000 feet on the ground). Washington is covered by 1,456 quadrangles that depict basic natural and cultural features of the landscape, such as lakes and streams, highways and railroads, boundaries, and geographic names. Contour lines show the elevation and shape of terrain. These maps are a standard tool for civil engineering, land-use planning and management, natural-resource monitoring and evaluation, and many other technical applications. In addition, the maps have long been favorites with the general public for a wide variety of recreational uses.

The USGS is producing computerized (digital) cartographic and elevation data for Federal, State, and local government agencies in Washington as part of a region wide program that will fill gaps in hydrographic, transportation, boundary, Public Land Survey System, and elevation-data coverages. This program was developed

by cooperating State and Federal agencies to address current issues on sustainable economic development and natural-resource preservation in the Pacific Northwest coastal forests and the Columbia River Basin. In addition, the USGS, in cooperation with the National Park Service and U.S. Forest Service, is completing a digital mapping photography project that includes the Olympic National Park and much of the Olympic Peninsula. These activities in Washington exemplify how government agencies can work together to reduce duplication of effort and resources used while increasing efficiency in managing their respective responsibilities.

Geologic Mapping

The northern Cascade Range to the east of the Seattle-Bellingham urban corridor is a region in which countless critical, public and private land-use decisions will benefit from accurate geologic information and knowledge. The USGS, in cooperation with the Washington Department of Natural Resources, has completed the first geologic maps of the range with enough details to help make these important decisions. The geologic maps are an essential component of policy and development in many activities, such as evaluation of earthquake potential; recognition of landslide and flood hazard; evaluation of resources, including road material, gravel, and ground water; and evaluation of construction costs. In addition, the maps may be used in the management and protection of National Park

and National Forest lands and provide a valuable underpinning of earth science research by government, university, and private investigators.

Cooperative Programs

The USGS, in fulfilling its mission, cooperates with a wide network of local, State, and Federal agencies on such activities as water-resources-data collection, interpretive studies of water availability and quality, mineral-resource assessments, and mapping. Local and State agencies typically provide matching funds for cooperative studies, and many are mentioned in preceding sections. In addition, the USGS cooperates with local agencies, such as health, planning, and public-works departments in King, Pacific, Pierce, Snohomish, and Thurston Counties; irrigation districts in most of eastern Washington; the cities of Seattle and Tacoma; most of the 26 recognized Indian tribes; and State agencies, such as the Departments of Emergency Services and Health. Other Federal agencies that cooperate with the USGS on studies in Washington include the Bonneville Power Administration, the National Oceanic and Atmospheric Administration National Weather Service, the U.S. Fish and Wildlife Service, and the U.S. Navy.

The USGS also provides support to the State of Washington Water Resources Research Center, at Washington State University, which conducts a program of research, education, and information and technology transfer.

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Additional earth science information can be found by accessing the USGS "Home Page" on the World Wide Web at "<http://www.usgs.gov>".

For more information on all USGS reports and products (including maps, images, and computerized data), call 1-800-USA-MAPS.