

HYDROGEOLOGIC INVESTIGATIONS RELATED TO WATER RIGHTS DECISIONS IN WASHINGTON STATE

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Problem: By statute, the Washington State Department of Ecology must determine if water is available and if the new water use will impair an existing, senior water right before granting a new water right permit. Department hydrogeologists have to evaluate applications for hundreds of sites each year. To do this, they need to know the general geologic framework in the specific area under investigation.

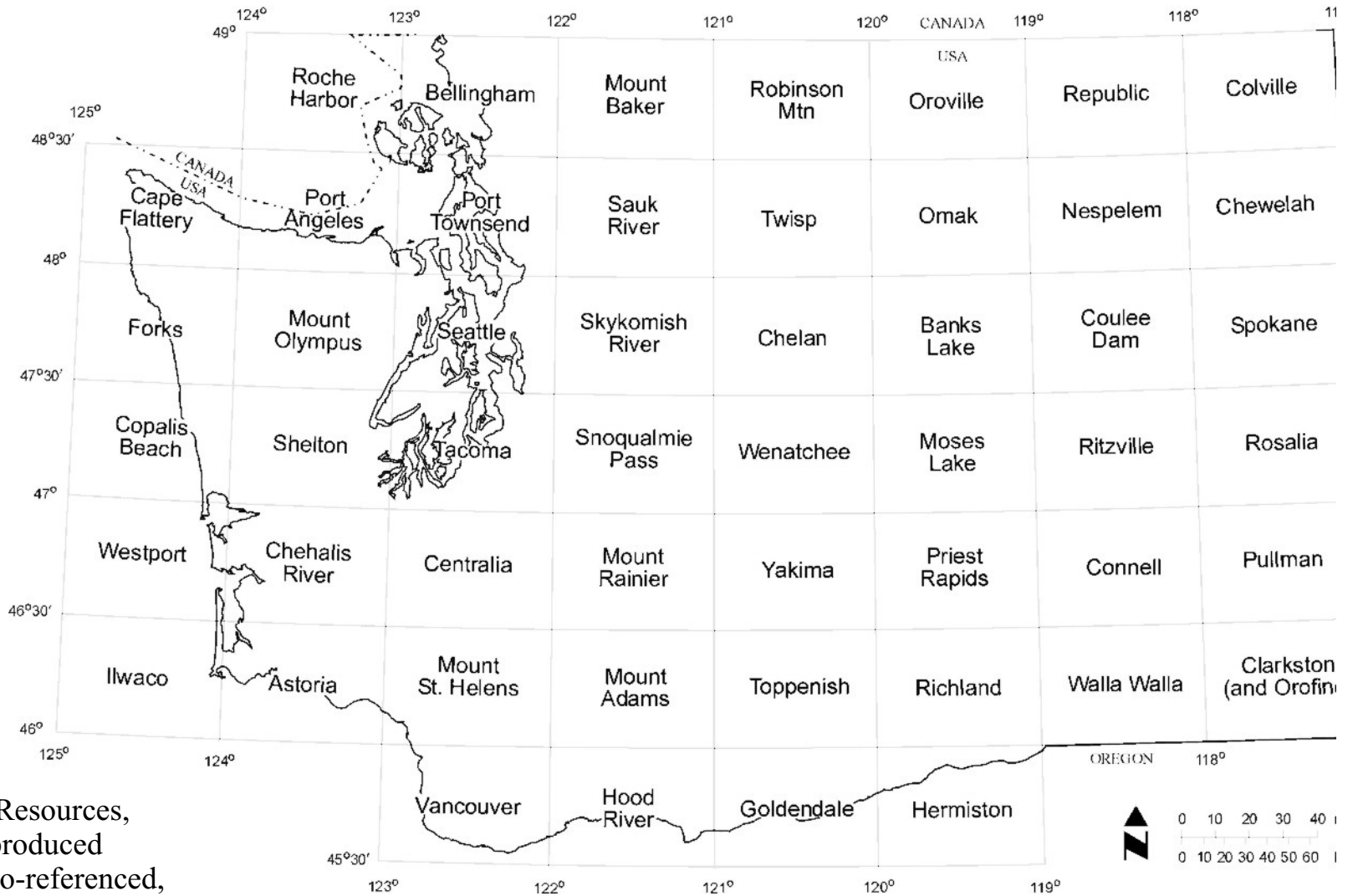


Figure 1: Map of Washington State showing the 1:100,000 quadrangles, which are available in a geo-referenced, digital format.

Geologic Map: The Washington Department of Natural Resources, Division of Geology and Earth Resources (DGER), has produced 1:100,000-scale geologic maps for the entire state in a geo-referenced, digital format (Fig. 1). Department of Ecology hydrogeologists retrieve the relevant geologic map and overlay it on a digital elevation model, adding land ownership, land use, watershed, and political boundaries to develop a conceptual model of the hydrogeologic regime for the site in question.

West Plains Area of Spokane County

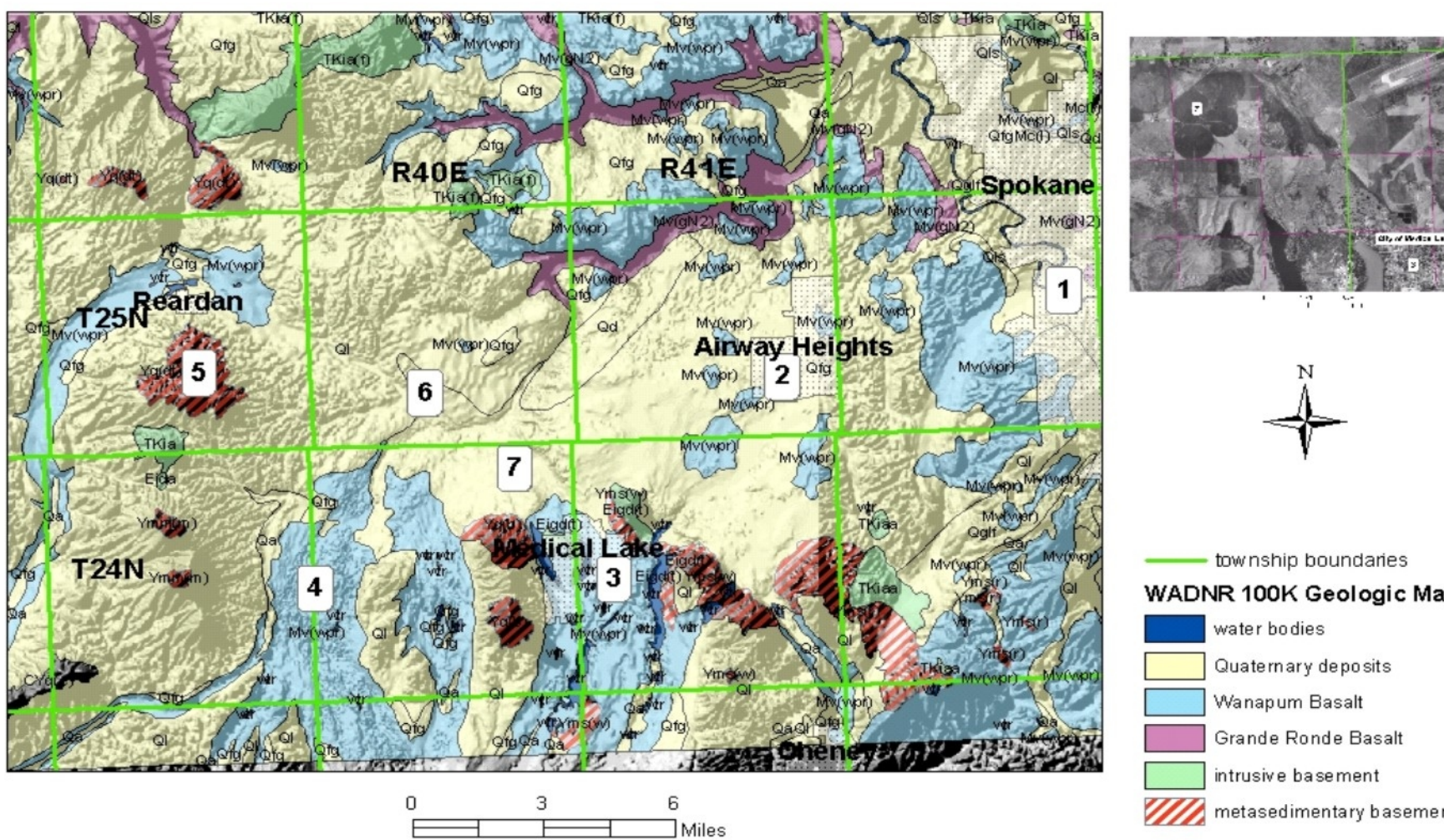


Figure 2: The attached map was created in ESRI's ArcMap 8.1. The digital version of the Geologic Map of the Spokane 1:100,000 Quadrangle was transparently overlain on top of a 10-meter resolution digital elevation model of the area. The insert, which shows the close proximity of irrigation circles to an urban area, comes from a digital orthoquad of the Medical Lake area.

Discussion and Applying the Geologic Map: An example is the West Plains area (Fig. 2), which is on the northeastern edge of the Columbia Plateau and also on the urban fringe of Washington's second largest city, Spokane (1). Several small municipalities (2,3) share the basalt aquifers of the Miocene Columbia River Basalt Group with rural, irrigated agricultural producers (7). The horizontally bedded basalt flows (4) and discontinuous sedimentary interbeds overlie Precambrian igneous and metamorphic basement rocks that occasionally breach the surface as steeples (5). Both units are capped by unconsolidated Quaternary glacial-flood deposits of sand and gravel (6). The principle aquifers produce water from the tops and bottoms of individual basalt flows. These flows have a limited recharge area where they thinned out against existing paleohighs in the basement rock. Aquifer tests performed on several of the municipal wells demonstrate boundary conditions. The continued reliance upon these aquifers for municipal and irrigation supplies has led to a gradual decline in the potentiometric surface of the aquifers. Water is being withdrawn at a rate that exceeds recharge. Pending applications for new water withdrawals and changes to existing certificates are awaiting a determination of the safe sustaining yield of the aquifer. The Geologic Map of the Spokane 1:100,000 Quadrangle is helping to unravel these problems.

Conclusion: Using the 1:100,000 digital geologic maps, we are able to determine whether a new well will tap into Precambrian metasediments, Miocene volcanics, or Quaternary glacial deposits. We are also able to determine whether existing wells and senior water rights in the general location are likely to withdraw water from the same lithologic units. Sometimes a simple visual inspection of the map is sufficient. More often, the geologic map is used in conjunction with drillers logs to help piece together the subsurface stratigraphy. In geologically complex or legally contentious areas, significant resources can be expended on costly legal entanglements if this work is not properly done before a water right decision is made.