Reconnaissance Investigation of Sand, Gravel, and Quarried Bedrock Resources in the Shelton 1:100,000 Quadrangle, Washington

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WASHINGTON
DIVISION OF GEOLOGY
AND EARTH RESOURCES

Information Circular 97
November 2002

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Doug Sutherland - Commissioner of Public Lands

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Printed on recycled paper.
Printed in the United States of America

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Figure 1. Index map of the Shelton quadrangle showing geographic features and the locations of some of the larger pits and quarries . . . 1

PLATE

Plate 1. Location of some sand, gravel, and quarried bedrock resources in the Shelton 1:100,000 quadrangle, Washington

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INTRODUCTION

Background

During its 1998 session, the Washington State Legislature, acting on a recommendation from the Governor's Land Use Study Commission, asked the Washington Department of Natural Resources (WADNR) to map sand and gravel and bedrock resources that are used for maintenance and construction of homes and infrastructure. The Study Commission sought information to assess the need to protect these resources from urban sprawl and other intensive land uses. These data would, in turn, result in better long-range planning and possible legislation to aid in designating mineral resource lands under the Growth Management Act (Revised Code of Washington [RCW] 36.70A; Lingley and Jazdzewski, 1994).

Although the data we present herein are in the traditional text and map format, this report is part of a project to prepare a geographic information system (GIS) database that delineates the locations of some of the significant construction aggregate resources (sand, gravel, and quarried bedrock) of Washington State. The digital version of this report, including ArcInfo coverages, is available through the Washington Division of Geology and Earth Resources. *(See back of title page for address.)*

The Shelton quadrangle (Fig. 1) is located in west-central Washington, on the southern end of the Olympic Peninsula. Prominent geographic features include the southern part of the Olympic Mountains, the southern part of Hood Canal, and the northern Black Hills. Most of the quadrangle (55%) is within Grays Harbor County. Mason County constitutes 40 percent of the quadrangle and Thurston County makes up about 5 percent. The total area of the quadrangle is about 1,620 square miles, and its population is about 50,000 persons (Washington Office of Fiscal Management, 2000), most of whom live in rural areas. The largest cities are Shelton (pop. 7,810), Elma (pop. 3,045), and McCleary (pop. 1,565). The quadrangle is located west of rapidly developing areas along the Interstate 5 corridor, which have population centers at Olympia (5 miles southeast of the quadrangle) and at Bremerton and Silverdale (about 25 miles east). Large markets at Seattle, Tacoma, and Everett are fairly short barging distances from the eastern part of the quadrangle.

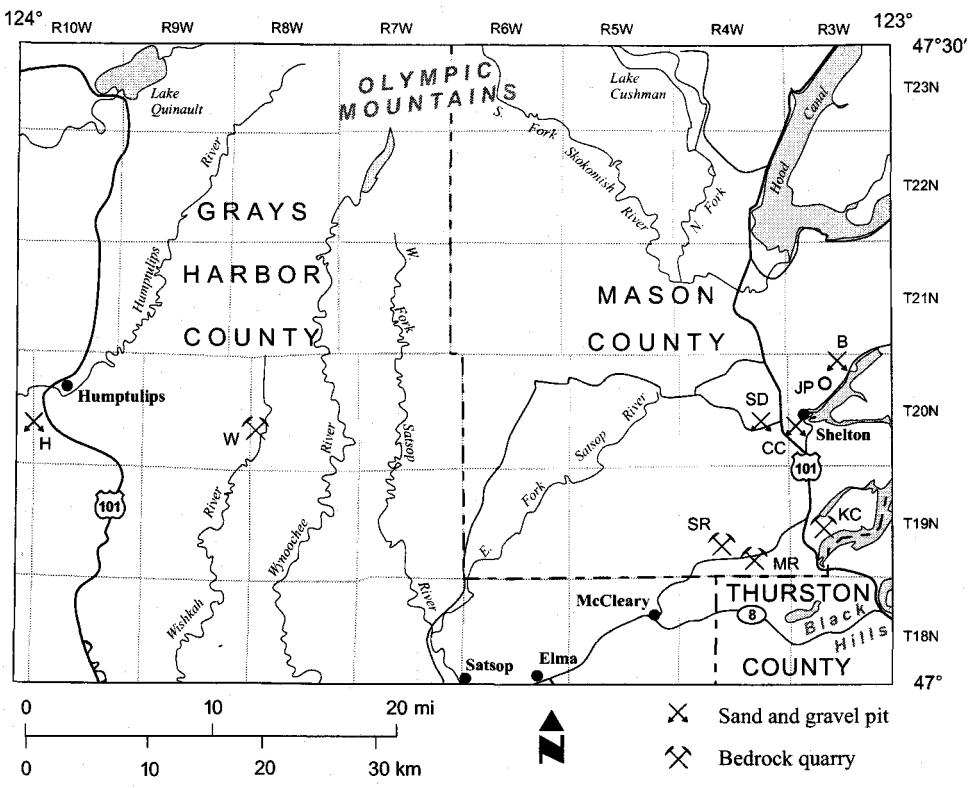

Figure 1. Index map of the Shelton quadrangle showing geographic features and the locations of some of the larger pits and quarries. H, Humptulips pit; W, Wishkah quarry; SR, Skookum rock quarry; MR, McDonald rock quarry; SD, Shelton delta pit; CC, Coffee Creek pit; B, Bayshore pit; KC, Kennedy Creek quarry. Also shown is the Johns Prairie delta proposed mine site (JP).

Intended Users

This inventory was created primarily to help local government planners refine comprehensive plans and other zoning determinations. It will also aid legislators and other policy makers to assess the importance of largely nonrenewable sand, gravel, and quarried bedrock resources. The study should also be of use to engineers, transportation departments, and industry.

Primary Products

This inventory consists of the following products:

- A map that delineates the probable extent of bedrock and sand and gravel resources (Plate 1). Thickness contours (isopachs) are shown for those sand and gravel deposits for which we have sufficient data. Plate 1 also shows the locations of active mines, borrow pits, some depleted mines, and large proposed mines.
- Text that describes the methodology of this report, as well as the geology and mining history of construction aggregates in the quadrangle.
- Databases containing information about the location, thickness, quality, and volume of some sand and gravel and bedrock resources, as well as about water wells and other boreholes (Appendices 2-4).
- Brief descriptions of some geologic units known to contain aggregate resources (Appendix 5).
- A glossary of terms used in this report (Appendix 1).

INVENTORY PHILOSOPHY AND METHODS

Two end-member philosophies for resource inventory have been employed in Washington for growth management studies of mineral resources: (1) strictly factual reporting, including only those sand, gravel, and bedrock deposits that have been proven to exist because they are part of active mines, or (2) reporting of all potential aggregate deposits that might exist as determined from surficial geologic or soils mapping. Both approaches have shortcomings. The first philosophy results in underestimation of available aggregate in any given area by ignoring high-quality deposits that have not been mined. The second philosophy results in overestimation of available resources because this method cannot adequately account for the heterogeneous nature of aggregate-bearing geologic units, especially their extent in the subsurface.

Geologists and mining engineers generally use a third method that uses geologic and engineering criteria to quantify the degree of assurance that a deposit actually exists. The method we use in this study characterizes minerals as either 'reserves', that is, that part of the reserve base (Table 1) that may be produced under current economic conditions, or as 'resources' that are concentrations of minerals from which extraction of economic amounts of a commodity is currently and (or) feasibly possible (Jackson, 1997). Reserves and resources are further subdivided based on the degree of certainty that any given deposit actually exists, mainly as determined from subsurface and other data as described in Table 1.

In this study, we mapped primarily 'hypothetical undiscovered resources', that is, resources with limited surficial and subsurface data that suggest that a mineral deposit could be present in any given area (Table 1). Generally, these data consist of a geologic polygon mapped at the surface, borehole data indicating at least some of the deposit extends to depth, and engineering data confirming that part of the deposit meets the threshold specifications described below. Hypothetical undiscovered sand and gravel resources of the Shelton quadrangle are shown on Plate 1 in shades of yellow with thickness contours (isopachs).

'Speculative undiscovered resources' (Table 1) are mapped only for bedrock units where several data sets each suggest the presence of a deposit meeting the threshold criteria. These speculative resources are shown in pink on Plate 1 as simple polygons depicting the extent of bedrock at the surface.

'Identified resources' (Table 1) are not mapped because the costly work required to confirm their existence, such as closely spaced exploratory drilling, is beyond the scope of this study. However, identified resources for most large mines are listed in Appendix 2.

Accuracy of Estimates

The accuracy of any assessment of undiscovered sand and gravel or bedrock resources, whether performed as a proprietary exploration project or as a governmental or academic research study, is largely controlled by the quantity and quality of subsurface data. The most widely available source of subsurface geological data for mapping resources is water-well logs archived by the Washington Department of Ecology, but the accuracy of the geology and locations recorded on these logs is generally poor. To reduce the inherent uncertainty introduced by use of these logs, we depict hypothetical undiscovered resources only where data from several water wells, together with other information such as landform analysis (geomorphology), geotechnical borehole data, outcrop descriptions, hydrologic data, and mine data allow reasonable extrapolation of surficial data into the subsurface.

We emphasize that this report almost certainly overestimates the volume of construction aggregate in the Shelton quadrangle that is available under current market conditions. Factors such as shallow bedrock under surficial gravels, diminishing rock quality with depth, unmapped areas of thick overburden, and lateral geologic variation affect the precision of the report. Furthermore, history indicates that when a deposit is mapped in detail using closely spaced drill or mining data, the reserve base is

Table 1. Classification of sand and gravel and bedrock resources, with examples relevant to this study *(modified from U.S. Bureau of Mines and U.S. Geological Survey, 1980)*

IDENTIFIED RESOURCES (RESERVE BASE)			UNDISCOVERED RESOURCES	
Demonstrated		Inferred	Hypothetical	Speculative
Measured	Indicated			
Deposit whose engineering properties, reserves in tons or cubic yards, and grain sizes are measured with a margin of error <20% (that is, a mine or a well-drilled prospect)	Deposit whose measurements, together with reasonable geologic projections, can be used to compute reserves in tons or cubic yards	Reasonable extension of indicated or measured deposit (generally <0.50 mile); thickness contours can be drawn with confidence	Undiscovered resources that may reasonably be expected to exist; applicable where landforms, water wells, proximal mines, or geophysical data justify such extension	Unexplored surficial deposit with no subsurface data
Active mine	Densely drilled deposit	Deposit with good subsurface control	Possible deposit defined only by limited subsurface control	Possible deposit; surficial data only

commonly less than the volume of resource as determined from reconnaissance mapping of the type shown on Plate 1. These factors must be balanced against the fact that rising prices will make some of today's sub-economic resources (such as clay-rich gravel deposits or rock buried under thick layers of overburden) commercially attractive in the future.

Definition of a Significant Resource

This study is limited to assessing mineral resources of long-term commercial significance. For the purposes of the Washington Growth Management Act, sand and gravel and quarried bedrock resources of long-term commercial significance are those aggregate deposits that are large enough and of sufficiently high quality to contribute to the long-term economic health of a region.

In this study, we define significant resources as those deposits that are likely to yield at least 10 million cubic yards of recoverable aggregate that meets threshold criteria described below. As calculated below, 10 million cubic yards is the approximate volume necessary to maintain (but not expand) existing infrastructure in a 100,000-person market during the 20-year period mandated by the Growth Management Act.

Lingley and Manson (1992) estimated that the annual per-capita demand for sand and gravel and crushed rock products in Washington is approximately 12 cubic yards. An informal rule of thumb used in industry and government is that about half of the demand for aggregate in any market will be used to repave roads, rebuild bridges, and remodel existing buildings, and half is used for new construction. Therefore, a hypothetical maintenance level of production for a 100,000-person market can be approximated as follows:

100,000 persons x 12 cubic yards/year x 20 years x 50% for maintenance = ~10 million cubic yards

This value can be converted to tons, which is the unit of weight used in most industry applications, by multiplying it by the density of the aggregate. For sand and gravel in outcrop, density is at least 1.85 tons per cubic yard, and for rock, at least 2.4 tons per cubic yard.

Local governments might want to designate at least double this volume for every 100,000 people in order to ensure adequate reserves to implement a 20-year comprehensive plan and to meet other goals of the Growth Management Act (Lingley and Jazdzewski, 1994).

Threshold Criteria Used in Preparing this Inventory

In addition to containing a large volume of aggregate, any given deposit must meet threshold criteria for strength, durability, and ease of extraction in order to be considered as a mineral resource of long-term commercial significance. Many geologic deposits are inherently unsuitable; common rock types such as claystone are weak, others are prone to chemical alteration and weathering that render much of any given deposit inadequate for use as construction aggregate, and some layered sedimentary and metamorphic rocks tend to break apart under the weight of heavy trucks or infrastructure. Furthermore, extraction or development costs for some deposits may exceed expected returns under foreseeable market conditions. In order to account for these issues in our inventory, we have developed the threshold criteria described below to determine which resources should be included. Although transportation cost is an important factor in determining whether a deposit is commercially significant, we do not use it as a threshold criterion in this study because we are not able to predict growth patterns within the quadrangle.

THICKNESS

Only those deposits that are known or likely to exceed 25 feet in their thickest parts are depicted. A thin gravel deposit requires a very large surface area to contain a significant reserve base. For example, a 20-foot-thick deposit covering 20 acres would yield only about 500,000 cubic yards of sand and gravel. Developing deposits with large surface areas may require installation of a conveyor belt system or trucking raw material within the mine to a central processing plant, either of which adds significantly to the capital required to operate a mine. Also, permitting costs per unit of resource generally increase as a function of decreasing thickness because developing thinner deposits requires greater surface disturbance (and results in greater damage to the ecosystem) per unit of aggregate produced. Because of these factors, the value of the gravel in thin deposits may not exceed proceeds from selling the land in its undisturbed state for its real-estate value.

SURFACE AREA AND DIMENSIONS

Most gravel deposits are less than 100 feet thick, and, consequently, must cover a fairly large area to contain a significant volume of construction aggregate. The smallest geologic polygons depicted on Plate 1 as significant sand and gravel deposits cover at least 0.25 square mile (160 acres, or a quarter-section). The volume of a typical 50-foot-thick sand and gravel unit this size would be about 10 million cubic yards. Additionally, we map only those sand and gravel deposits that have minimum widths of 1,500 feet; deposits that have long, narrow map patterns are generally inefficient to operate. Although environmental issues are not considered herein, long narrow sand and gravel deposits are generally associated with rivers or streams where mining cannot take place owing to environmental considerations.

Although surficial extent is less important for bedrock units, which can be very thick, we generally depict only those bedrock polygons that cover at least 160 acres, a size that can be clearly shown on a 1:100,000-scale map. We have included a few deposits smaller than 160 acres in surface area and (or) 1,500 feet wide where exceptionally thick deposits or resources of special local importance are present.

The surface area of each deposit was initially estimated using 1:100,000-scale geologic maps compiled by the Washington Division of Geology and Earth Resources (2001) and other geologic maps (Tabor and Cady, 1978; Walsh and others, 1987; Dragovich and others, 2002). The resulting polygons were modified to show only the parts of the deposit known to meet the other threshold criteria. This approach, taken to expedite the inventory process, probably results in omission of some significant resources.

OVERBURDEN

Economic considerations generally limit the volume of overburden that can be removed profitably. Only those deposits that have stripping ratios (ratios of overburden to sand and gravel or rock) of less than 1:3 are included in this inventory. However, supply restrictions, favorable topography, or other factors may make removal of thick overburden economically feasible in some mines. The largest stripping ratio reported for a profitable mine in Washington has been 1:2, and historically, few sand and

gravel deposits with more than 10 feet (3 m) of overburden have been mined. The practice of topsoil sales and (or) synthesis is one method of profitably disposing of thicker organic or clay-rich overburden, but as a general rule, most overburden must be saved for reclamation (Norman and others, 1998; Norman and Lingley, 1992).

STRENGTH AND DURABILITY

In order to perform adequately as construction aggregate, gravel or bedrock must have high compressive strength and resist degradation when wet. Without these characteristics, the aggregate cannot support the weight of roads or buildings. Much of the vertical compressive strength, or load-bearing capacity, in a concrete structure comes from grain-to-grain contact among individual pebbles that are effectively stacked and prevented from shifting by cement and fine aggregate. Stronger aggregate has many uses and commands a higher price, but weak rock has limited use. Minimum specifications for strength and durability of various rock products are published by the Washington State Department of Transportation (WSDOT) in *Standard Specifications for Road, Bridge and Municipal Construction, 2000* (Washington State Department of Transportation, 1999), a key reference book for the industry that is updated periodically. Specifications for gravel and bedrock are determined with laboratory tests including Los Angeles Abrasion, Degradation, Sand Equivalent, Specific Gravity, and Stabilometer tests. Table 2 identifies some of the specifications required for certain uses of aggregate.

For this study, we inventory gravel and bedrock that meet WSDOT specifications for asphalt-treated base. Asphalt-treated base is a compacted layer of aggregate coated with asphalt for stability and weatherproofing and placed directly on bulldozed earth or rock of the subgrade. Acceptable test results for asphalt-treated base are shown in Table 2. If most tests of any given deposit exceed these specifications, then we depict the entire deposit as meeting the strength and durability threshold criteria.

In some markets, a lack of high-quality gravel and bedrock has forced producers to mine deposits of lower quality. Homes and infrastructure constructed with weak gravel or bedrock generally have relatively short life cycles. We have not inventoried these lower-quality deposits because they do not meet the criteria of this study. However, Appendices 2 through 4 will serve as guides to the locations of some of the poorer-quality deposits, as well as resources buried under thick overburden layers that may become more attractive under future market conditions.

OTHER CONSIDERATIONS

Typically, sand and gravel deposits should have a sand-to-gravel ratio of about 40:60 and be free of weak or otherwise deleterious materials such as foliated metamorphic rock, poorly indurated clasts, clay, iron oxides, sulfides, glassy volcanic rock, and organic matter (Kroft, 1972; Washington State Department of Transportation, 1999).

Scope of Deposits Inventoried

In order to produce an objective analysis, we have inventoried all deposits meeting the threshold criteria defined above without consideration of environmental impacts or land-use conflicts that may be involved in permitting or extracting these resources. (However, we have not considered deposits that lie within the Quinault, Skokomish, and Squaxin Island Indian Reservations, Olympic National Park, and the Colonel Bob, Wonder Mountain, and Mount Skokomish Wilderness areas.) For example, all sand and gravel deposits on the lower flood plains of rivers that meet the threshold criteria are depicted in this report, even though most deposits on lower flood plains cannot be permitted owing to adverse impacts to aquatic and riparian habitat (Norman and others, 1998). Therefore, this inventory must be used in conjunction with maps of environmentally sensitive areas and land-use status in order to obtain a complete picture of available aggregate within the quadrangle.

Sources of Data

Published information on aggregate resources in the Shelton quadrangle has previously been limited to brief comments in regional assessments and to a few detailed studies of individual properties. Principal sand and gravel pits and rock quarries are listed in McKay and others (2001). Aspects of the aggregate market in the Puget Sound region were discussed by Huntting (1982) and White and others (1990). Detailed information pertaining to the Johns Prairie pit and barge facility are given in an environmental impact statement (Krautkramer, 1991; McLucas and Associates, Inc., 1991). The geologic setting of the Robertson pit was described by Lasmanis (1988).

Data for existing and terminated mines are archived in WADNR permit files, WSDOT pit-site files, and U.S. Forest Service mine files. The thicknesses of mined units, for example, are taken from the WADNR Form SM-2 *(Application for Surface Mining Reclamation Permit)* or from other permit-related documentation such as environmental impact statements. The surface extents of geologic units are depicted on Washington Division of Geology and Earth Resources geologic maps (Dragovich and others, 2002; Walsh and others, 1987; Washington Division of Geology and Earth Resources, 2001). Hydrologic studies have been particularly useful in assessing the stratigraphy of sand and gravel deposits (Hart-Crowser, 1994; Wills and Purdy, 1999). Such reports are included in various types of environmental documentation, wellhead protection studies, and water-resource reports. Logs of geotechnical boreholes (for example, boreholes for foundation engineering studies) have been useful. Water-well logs and some logs of geotechnical boreholes are archived by the Washington Department of Ecology and the WSDOT, respectively.

Table 2. Some specifications for construction aggregate products *(after Washington Department of Transportation, 1999)*. Los Angeles Abrasion and Percent Passing U.S. No. 200 Sieve measurements are in weight percent. Los Angeles Abrasion and Degradation specifications for coarse portland cement concrete aggregate are not rigorous because the gravel is rarely exposed on the outside of concrete structures such as foundations or sidewalks

	Product			
Laboratory test	**Asphalt-treated (road) base**	**Crushed (road) surfacing, top course**	**Coarse aggregate for portland cement concrete**	**Ballast (road subgrade)**
Los Angeles Abrasion	≤30%	≤35%	≤35%	≤40%
Degradation	≥15	≥25	not used	≥15
Sand Equivalent	≥30%	≥35%	not used	≥30%
Percent Passing U.S. No. 200 Sieve (<0.0025 in.)	2–9%	0–7.5%	0–0.5%	0–9%

GEOLOGY OF CONSTRUCTION AGGREGATES IN THE SHELTON QUADRANGLE

The following discussion of the geology of the Shelton quadrangle emphasizes only units that are significant aggregate resources. More detailed geologic descriptions of the units that are being mined or are considered a resource can be found in Appendix 5.

Sand and Gravel Geology

Most large sand and gravel deposits in the quadrangle were deposited by ice-age glaciers, which at their extremes covered much of the eastern half of the quadrangle (Bretz, 1913; Thorson, 1980; Washington Division of Geology and Earth Resources, 2001). Modern river deposits, known as alluvium, constitute the only other sand and gravel resource in the study area.

Ice-age glaciers are generally called 'continental ice sheets'. In Washington, several continental glaciations, known as the Cordilleran ice sheets, covered the entire Puget Lowland on at least four occasions during the past 1.6 million years. The latest advance was the Vashon Stade of the Fraser Glaciation. The Puget lobe of this glaciation terminated its advance a few miles south of the study area about 15,000 years ago, but older continental ice sheets extended somewhat farther south and west.

Sedimentary processes related to the Vashon ice sheet resulted in two layers of potential construction aggregate; these sandwich a non-commercial clay-rich layer. The lower layer, known as 'advance outwash' (unit Qga[1]), is commonly suitable for fine aggregate. In the Shelton quadrangle, it consists of sand with subordinate gravel and cobbles that were deposited by glacial streams at a distance of many miles from the snout of the ice.

A non-commercial layer called 'till' (unit Qgt) was deposited as the ice covered progressively more of the Puget Lowland and overrode the advance outwash. Till is deposited directly from glaciers and consists of a mixture of unsorted clasts of various rock types supported in a compact matrix of clay, silt, and sand. Till was deposited along the margins of and underneath glaciers, locally resulting in hummocky terrain. Most till in the Shelton quadrangle is compact till that was deposited at the base of the ice as an even layer or as streamlined hills called drumlins. Till is unsuitable for construction aggregate and commonly constitutes a thick overburden on top of advance outwash gravels that may otherwise be acceptable for construction aggregate. However, the weight of the ice compacted the advance outwash, making it relatively difficult to mine.

Near the end of the ice age, the glacier melted back, and streams from the shrinking ice flowed across the surface of the till. These streams deposited the third layer, 'recessional outwash' (unit Qgo), which is composed of sand, gravel, and boulders and constitutes the most important sand- and gravel-producing unit in Washington. In the Shelton quadrangle, recessional outwash is mostly composed of hard and durable clasts that are chiefly from granitic sources in British Columbia and can be used to make a variety of high-quality rock products. The only overburden on these deposits is a veneer of wind-blown silt and (or) modern alluvium.

Two types of recessional outwash have been identified in the study area: channel deposits and deltaic deposits. Each time an advancing Cordilleran ice sheet passed the present-day site of Port Townsend, ice blocked northern end of Puget Sound, isolating the area to the south from the Pacific Ocean. Rivers issuing from the Cordilleran ice sheet and from the Cascade and Olympic mountains were forced to flow southwestward to the Pacific Ocean at Grays Harbor (Bretz, 1913; Thorson, 1980). This huge drainage system carved the Chehalis River valley and other southwest-trending channels and laid down extensive deposits of high-quality boulder and gravel outwash.

At the same time, the outwash rivers poured sand and gravel into proglacial lakes (lakes that formed just in front of the glacial ice), forming deltas in the northeastern and western parts of the present-day Shelton town site. These deltas contain a large reserve base of high-quality construction aggregate, dominated by finer gravel and sand.

In addition to the continental ice, several major alpine glaciations are recorded by the deposits left by glaciers that originated high in the Olympic Mountains. The most recent alpine advance took place immediately before the Vashon continental glacier advanced into the Puget Lowland (Washington Division of Geology and Earth Resources, 2001; Thorson, 1980). Most clasts in the alpine outwash are derived from bedrock in the southern Olympic Mountains. The parent rock types are mainly weak basalt and volcaniclastic sandstone of the Crescent Formation and Olympic core rocks (Tabor and Cady, 1978); these are not suitable for construction aggregate.

Since the end of the last ice age, streams have eroded glacial sediments and bedrock, transporting and redepositing them as alluvium. As a result, alluvium deposits (unit Qa), like outwash deposits, consist chiefly of sand, gravel, and cobbles with some clay, silt, and boulders.

The quantity and quality of alluvial aggregate present on any given river's flood plain vary mainly as a function of drainage basin geology and geometry. More specifically, higher-quality aggregate results from longer transport distance and stronger parent material. In the Shelton quadrangle, the alluvium of several river systems consists mostly of fine aggregate because of: (1) physical and chemical disaggregation during long transport, (2) a predominance of weak rock types from the Olympic Mountains, and (3) relatively low topographic relief resulting in rivers in the southern half of the quadrangle having low gradients. For example, low current velocities in the lower Hoquiam and Wishkah Rivers in the southwestern part of the quadrangle cannot transport boulders and cobbles. As a result, alluvium in the Hoquiam and Wishkah river systems is dominated by sand and silt. (Silt has little value as aggregate or fill.) In the lower reaches of the Wynoochee and Humptulips Rivers, the alluvium contains somewhat better-quality aggregate because steep headwater gradients and long transport distances from the Olympic Mountains removed much of the weaker material through disaggregation processes. Alluvium of the East Fork Satsop River and its major tributary, Wildcat Creek, contains a large percentage of reworked granitic material from Vashon recessional outwash together with some weaker clasts from the southern Olympic Mountains, so the quality of aggregate varies. Many of these alluvial deposits grade laterally into high-quality recessional outwash.

Bedrock Geology

The bedrock geology of the Shelton quadrangle reflects a long history of marine sedimentation and volcanism, but only a limited volume of igneous rocks from the Eocene Crescent Formation is suitable for construction aggregate. The Crescent Formation (unit Ev_c) includes pillow basalts, volcaniclastic sandstones, basalt breccias, lava flows, and gabbroic dikes and sills. This formation and its subdivisions (units Ev_{cp}, Ev_{cf}, and Eigb)

[1] This and other unit symbols are discussed in Appendix 5.

cover much of the northern and western parts of the quadrangle. Marine sedimentary rocks of the Montesano, Astoria, Lincoln Creek, and Humptulips Formations and the Hoh lithic assemblage (Rau, 1973; Dragovich and others, 2002) comprise the remaining bedrock in the quadrangle; these rocks rarely meet our threshold specifications.

Crescent Formation basaltic rocks have highly varied engineering qualities and only rarely meet the asphalt-treated base specifications for strength and durability. These rocks are generally weak because initial contact of the parent lavas with seawater created soft mineral products and because the formation is dominated by fragmental volcaniclastic rock. However, columnar basalts of the Crescent Formation produce high-quality aggregate. The hexagonal columns generally formed in lava deposited on volcanic seamounts that built up to form islands, but some may have formed in lava deposited as sills. Columnar basalt is crushed at the Kennedy Creek (sec. 29, T19N R3W), Skookum (sec. 28, T19N R4W), and McDonald (sec. 34, T19N R4W) quarries.

Pillow basalts are volcanic rocks that contain 0.5- to 4-foot-diameter oblate structures called pillows that form where lava is erupted under water. Pillow basalts in the Shelton quadrangle typically are deeply weathered because glassy rinds on the pillows, which formed when the lava was rapidly quenched by cold seawater, eventually break down (devitrify), forming weak, clay-rich layers around the pillows. These layers form a convenient path for subsequent destructive alteration of the rock by hydrothermal fluids. Generally, the clay-rich material is removed during aggregate processing at considerable extra expense. Pillow basalt can be considered a resource only where there is little other material between the pillows and the pillows are very hard, as in the Robertson (sec. 26, T20N R5W) and Dinning (sec. 23, T20N R5W) quarries.

Gabbro (unit Eigb), the coarsely crystalline igneous intrusive equivalent of basalt, is a locally significant resource where it forms large sills within the upper part of the Crescent Formation (unit Ev_{cf}). Gabbro is mined at the Little Creek quarry (sec. 7, T19N R3W). However, gabbro exposed near Aberdeen Reservoir (sec. 33, T21N R8W) is intensely weathered to depths in excess of 20 feet and is not considered a significant resource.

AGGREGATE MINING AND SIGNIFICANT UNDEVELOPED DEPOSITS

Sand and gravel resource areas are shown on Plate 1 as yellow polygons; contours show approximate thickness in feet. Areas that may contain speculative undiscovered bedrock resources are indicated in pink on Plate 1. It is likely that these pink areas contain some areas of hard and durable rock, but current mapping is not sufficiently detailed to allow them to be delineated separately. Most of the pink areas consist of weak volcanic sandstone, breccia, or thoroughly altered basalt that are unsuitable for construction aggregate.

Aggregate mining has occurred at more than 235 sites in the Shelton quadrangle. Currently there are 12 permitted sand and gravel pits and 4 permitted bedrock quarries operating in study area (Appendix 2). Large mines have been proposed at Johns Prairie in northeast Shelton and at McEwen Prairie four miles northeast of Shelton. Many small borrow pits and quarries that are exempt from permit requirements under State law have been developed for forest road construction and repair by the U.S. Forest Service (24 mines), WADNR (29 mines), and private in-

Table 3. Larger active and proposed sand and gravel pits in the Shelton quadrangle. Data were obtained from mine operators, WADNR permit files, and environmental impact statements. Values in parentheses are projected rates if the proposed mine reaches full capacity. Values in brackets represent the authors' estimates. Data were collected during June 2000. The conversion factor from processed gravel volume to weight is 1.6 tons per cubic yard

Mine Name	Current operator	Location	Approximate reserve base (million tons)	Approximate annual production (million tons)
Mason County				
Manke Johns Prairie site *(proposed)*	Manke Lumber Company, Inc.	3 mi northeast of Shelton	63	0 (0.9)
Miles Shelton pit and J. D. Shotwell pit	Miles Sand & Gravel Company	1 mi west of Shelton	7	0.25
McEwen Prairie pit *(proposed)*	BB&R	4 mi northeast of Shelton	5.7	0 (0.26)
Bayshore pit	Bayshore Sand & Gravel, Inc.	3.5 mi northeast of Shelton	[3]	0.05
Coffee Creek pit *(mining not yet begun)*	Ronald G. Shipley	0.5 mi west of Shelton	1.95	0 (?)
Huson pit	Fred Hill Materials, Inc.	10 mi southwest of Belfair	0.9	0
Black Hills Project *(proposed)*	Peninsula Holding Company, LLC	1 mi northwest of Shelton	0.3	0 (?)
McReavy Road pit	Ace Paving Company, Inc.	4.5 mi north of Shelton	0.23	0.05
Ace Johns Prairie pit	Ace Paving Company, Inc.	3.4 mi northeast of Shelton	0.2	0.01
		Subtotal	82.3	0.36
Grays Harbor County				
Humptulips gravel pit	Quigg Bros. Construction	0.5 mi southwest of Humptulips	1.2	0.1
Evergreen pit	Northwest Rock, Inc.	14 mi northwest of Elma	[0.65]	*withheld*
Garden City pit	House Bros. Construction	2.5 mi southwest of McCleary	[0.4]	0.01
Mouncer pit	Northwest Rock, Inc.	6 mi northwest of Elma	[0.08]	[0.02]
		Subtotal	2.3	0.13
		Total	**84.6**	**0.49**
		Total currently permitted	15.6	0.49

dustry. Locations of mines are shown on Plate 1, and additional information on these mines is contained in Tables 3, 4, and 5 and Appendix 2.

Interviews with major pit and quarry operators indicate that about 850,000 tons of sand, gravel, and bedrock was produced from the Shelton quadrangle in 2000. Based on typical per capita demand (Lingley and Manson, 1992), approximately 600,000 tons of sand, gravel, and bedrock might be consumed annually in the study area. Statewide demand has been reduced considerably by the 2001 recession (Grant Newport, Weyerhaeuser Company, oral commun., 2002; Ron Summers, Glacier Northwest, Inc., oral commun., 2002). The difference between local consumption and production estimates (about 30% in 2000) probably represents the volume of aggregate exported to more populous regions to the south and east.

In the following discussion, the terms 'active' and 'terminated' refer to those mines with WADNR reclamation permits. Small pits and quarries that have not been permitted are referred to as borrow pits.

Sand and Gravel Resources

About 160 sand and gravel pits have been developed and cataloged in the Shelton quadrangle (Appendix 2), but of these, only seven are considered significant in terms of potential to impact the market (that is, have more than 0.5 million tons of reserve base listed in Table 3). These have a cumulative reserve base of approximately 15 million tons of sand and gravel.

In addition, several undeveloped sand and gravel deposits are present in the southeastern part of the quadrangle (Plate 1). Of these, the largest is the Johns Prairie deposit (sec. 9, T20N R3W). A proposed pit at Johns Prairie has estimated reserves of about 63 million tons of fine aggregate and is in the final stages of environmental review (McLucas and Associates, 1991).

ALLUVIAL DEPOSITS

Alluvium is mined near the village of Humptulips at the Humptulips gravel pit (sec. 18, T20N R10W), where 30 to 35 feet of sand and gravel are present. The Evergreen pit in the lower Wynoochee River valley (sec. 16, T18N R8W) also produces from alluvium. It has a similar geologic setting to that of the Humptulips River and contains approximately 40 feet of alluvial sand and gravel overlying compact noncommercial clay- and silt-rich gravel. Surficial expressions of this deposit terminate directly north of the pit (Plate 1), but exploration drilling farther upstream will probably delineate additional areas underlain by sand and gravel. Alluvium along the lower Skokomish River valley (sec. 16, T21N, R4W) may be of local commercial interest, but it is not depicted on Plate 1 because strength and durability data are lacking and overburden is locally thick (Appendices 2, 3, 4).

Alluvial deposits in the lower to middle reaches of the Satsop River valley include high-quality sand and gravel derived from reworked glacial outwash. Well logs suggest that sand and gravel deposits are as much as 81 feet thick near the center of the valley (sec. 31, T19N R6W; Appendix 4).

RECESSIONAL OUTWASH

Recessional glacial outwash (unit Qgo) covers much of the eastern half of the quadrangle. This is the most important aggregate-producing unit in the study area because it is typically unconsolidated and is overlain by little overburden (facilitating inexpensive excavation and processing) and at least half of the gravel is composed of durable granitic clasts from Canada. The best sand and gravel resources identified to date within the Shelton quadrangle are at Shelton (T20N R3W) and Elma (T18N R6W). Recessional outwash is the most intensely mined unit, containing eight active mines (WADNR permit nos. 10287, 10563, 10963, 12108, 12381, 12493, 12550, and 12890), ten depleted mines (WADNR permit nos. 11224, 11341, 11379, 11662, 11690, 11724, 11855, 12055, 12110, and 12760), three proposed mines, and at least 60 borrow pits. These mines and borrow pits together cover more than 921 acres.

Within the study area, outwash deposits have a variety of origins, including recessional deltas in proglacial lakes, outwash-channel deposits, terraces, and outwash plains. Recessional deltas are flat lying uplands that drop abruptly into adjacent valleys. Outwash channels are discrete valleys generally less than three miles in width and filled with coarse sediment. Outwash terraces are benches formed where a river cut down into outwash deposits after glacial ice retreated from adjacent areas. Outwash plains are broad, gently sloping areas where braided meltwater streams laid down sheets of sand, gravel, and coarser rock. All of these landforms are associated with both continental ice sheets and alpine glaciers.

In addition to these distinct landforms, the presence of prairies can indicate sand and gravel deposits. Most prairies in the Puget Sound region are located on porous and permeable recessional outwash gravels where the absence of clay in the sedi-

Table 4. Larger bedrock quarries in the Shelton quadrangle. Values in brackets are from WADNR files. The value in parentheses is the projected rates if the proposed mine reaches full capacity. The conversion factor from basaltic or gabbroic weight to volume is 2.4 tons per cubic yard

Mine Name	Current operator	Location	Approximate reserve base (million tons)	Approximate annual production (million tons)
Mason County				
Skookum rock quarry expansion *(proposed)*	Port Blakely Tree Farms, L. P.	5 mi northeast of McCleary	20	0 (0.1)
Kennedy Creek quarry	Thurman Enterprises, Inc.	7 mi south of Shelton	19	0.2
Little Creek quarry *(proposed)*	Arris Kollman Trucking, Inc.	4.5 mi south of Shelton	4.8	0.06
McDonald rock quarry	McDonald Land Company	5.5 mi northeast of McCleary	[4.5]	*minor*
Skookum rock quarry	Vessey & Sons	5 mi northeast of McCleary	1.7	0.05
Grays Harbor County				
Wishkah quarry	Wishkah Rock Products, Inc.	11 mi east of Humptulips	1.5	0.1
		Total	**51.5**	**0.41**
		Total currently permitted	26.7	0.35

ment and the well-drained nature of the gravel favors grassland vegetation.

Recessional Outwash Deltas

Recessional outwash deltas that built out into proglacial lakes contain the largest and highest-quality sand and gravel deposits in Washington (Lingley and Jazdzewski, 1994). In the Shelton quadrangle, four of these deposits have been mapped, the Shelton, Johns Prairie, Kamilche, and Isabella Lake deltas (Fig. 1). The Shelton and Johns Prairie deltas each are greater than 100 feet thick, contain unconsolidated sand and gravel, and have little overburden. All four deposits can be identified by their foreset beds, which are roughly planar gravel layers that are tilted at approximately 35 degrees. Foreset beds form as a result of gravel rolling down the face of a delta and settling at a slope known as the angle of repose where a stream empties into the still waters of a lake. Because these beds are close to the slope angle on which sliding will occur, excavation with front-end loaders, which require that gravel fall into a bucket, is feasible. Consequently, mining is relatively inexpensive because front-end loaders can move sand and gravel faster than other small-scale excavation methods. Proglacial deltas in the Shelton quadrangle have flat surfaces about 100 feet above the adjacent valleys, corresponding to the approximate elevation of the surface of the lake into which local streams flowed during the waning stages of the ice age.

Shelton delta — The Shelton delta is located directly west of Shelton (sec. 24, T20N R4W). It was formed by a major ice-age river that issued from the southwestern edge of the melting continental glacier and cut a prominent outwash channel that emptied into a proglacial lake. Goldsborough Creek later cut through the deltaic deposit, removed much sand and gravel, and isolated a small volume of sand and gravel on the south side of the creek (Plate 1). East of U.S. Highway 101 on the north side of Shelton Valley, the deposit is largely covered by a housing development. The deposit is in excess of 125 feet thick and contains alternating gravel-rich and sand-rich foreset beds. The foreset beds dip to the east-southeast. The Miles Shelton pit, the largest sand and gravel mine currently operating in the quadrangle, produces from the part of the deposit north of Goldsborough Creek (WADNR permit no. 10563). Adjacent to the Miles Shelton pit is the geologically similar J. D. Shotwell pit (WADNR permit no. 10287). The two mines together cover a total of 130 acres.

Johns Prairie delta — The Johns Prairie delta is located northeast of downtown Shelton and west of Oakland Bay (sec. 9, T20N R3W). This delta probably formed in the same proglacial lake as the Shelton delta but from a different outwash channel. The Johns Prairie deposit has little silt or clay, but is dominated by fine gravel and sand. (Aggregate producers prefer a great range of particle sizes including abundant cobbles, which can be used to manufacture crushed aggregate products.) Sand-rich foreset beds that dip southeastward can be seen in the eastern edge of the deposit (sec. 3, T20N R3W). This deltaic deposit supports parts of three active mines (WADNR permit nos. 10963, 12381, and 12493), one proposed mine (WADNR application no. 12931), and one borrow pit, together covering a total of more than 401 acres. The largest of these properties is the proposed 354-acre Johns Prairie mine. In this area, the delta thins northwestward from 175 feet near Oakland Bay to 25 feet at the western boundary of the proposed mine (McLucas and Associates, Inc., 1991). The mining plan includes shipping sand and gravel by barge to markets in more populous parts of the Puget Sound region.

Other deltas — The small Kamilche delta is exposed only in the northeastern road cut at the junction of U.S. Highway 101 and State Highway 108 at Kamilche (sec. 18, T19N R3W). This deposit is 110 feet thick and overlies basalt of the Crescent Formation. Another deposit is located at Isabella Lake (sec. 36, T20N R4W). The surface expression of the northwestern part of this deposit suggests it may be a recessional outwash delta with an upper surface at about 180 feet elevation. However, it contains a large fraction of silt and clay relative to the other deltas, and few large-scale deltaic features such as foreset beds are exposed. A terminated gravel mine (WADNR permit no. 11341) and a borrow pit, covering a total of about four acres, have been developed within the Isabella Lake deposit.

Recessional Outwash Channels

Recessional outwash channels are present where rivers issuing from a receding glacier carved discrete channels through older units and later deposited additional, younger outwash gravels in the resulting depressions. Generally, the channels are one to three miles wide and are cut in glacial till. These channels now contain under-fit streams, that is, streams that are too small and slow moving to have carved the valleys they currently occupy.

The southeast-directed Johns Creek and Winter Creek outwash channels, which fed the Shelton and Johns Prairie deltas, are preserved between the Skokomish River valley and Shelton. Two other ice-age channels, the Bingham Creek and Chehalis River channels, drained southwestward through the study area; the East Fork Satsop River and Wildcat Creek are extensions of these channels.

Johns Creek channel — The Johns Creek outwash channel has been mapped in detail using data from a large number of water-well logs and observations from gravel pits. The outwash is typically 25 to 50 feet thick and dominated by fine aggregate. Johns and McEwen Prairies are located along this channel, which stretches from the southern highland above the Skokomish Valley to the western edge of the Johns Prairie delta.

Winter Creek channel — The Winter Creek outwash channel (T21N R5W), which was mapped mainly on the basis of its geomorphic expression, appears similar to the Johns Creek outwash channel. It fed the Shelton delta and contains outwash

Table 5. Surficial and bedrock map units developed for mineral aggregate in the Shelton quadrangle. n, number of data points

Map unit	No. of mine sites	Los Angeles Abrasion (percent) Range	Los Angeles Abrasion (percent) Mean (n)	Washington Degradation Range	Washington Degradation Mean (n)
Large mines					
Qgo	14	12–27.8	16.9 (8)	48–75	59 (7)
Qa	3	13.7–15.2	14.6 (3)	34–50	44 (3)
Qga	2	—	—	—	—
Ev_{cf}	4	11–21	16 (3)	1–63	28 (3)
Small pits					
Qgo	60	10.4–21.8	14.8 (19)	19–77	51 (16)
Qa	11	—	—	—	—
Qga	7	9.5	9.5 (1)	43	43 (1)
Ev_{cf}	66	14.8–40	22 (35)	1–85	31 (31)
Ev_{cp}	5	11.7–20.5	16.3 (4)	17–75	48 (3)

generally 25 to 50 feet thick in its southeastern reaches. However, we are unable to estimate the thickness of sand and gravel in the northern part of the Winter Creek channel due to a lack of subsurface data, but we believe it is more than 25 feet thick within the channel.

Bingham Creek channel — The Bingham Creek outwash channel (in the eastern half of T20N R6W) contains abundant coarse sand and gravel that is locally more than 50 feet thick. This channel drained into the East Fork Satsop River and eventually to Grays Harbor. It is fairly wide and there is a possibility that the great volume of water escaping from the nearby ice scoured the channel deeply prior to deposition of the outwash. These reasons suggest that the Bingham Creek channel may contain significant resources. The deposit is probably similar in quality to the outwash terraces along the Satsop River (see below).

Chehalis River channel — A small part of the Chehalis River outwash channel extends into the southern part of the Shelton quadrangle between Elma and Satsop (T18N R6W). This outwash channel drained the entire Puget Sound region during the time the continental glacier blocked northward drainage through the Strait of Juan de Fuca. Due to a lack of data from deep water wells, the maximum thickness that can be contoured is 50 feet (Plate 1). Well logs indicate that sand and gravel deposits may be in excess of 100 feet thick, and extensive mining of this deposit occurs south and southeast of the quadrangle (Leslie Lingley, Leslie Geological Services, oral commun., 2001). However, a large wetland south of Hunters Prairie is covered with thick overburden of peat.

Satsop Outwash Terraces and Prairies

Thick sand and gravel sequences are contained in terraces along the Satsop River that formed from outwash deposits that were incised by rivers in response to post-glacial uplift. Elsewhere in the quadrangle, outwash plains and channels that have not been incised form prairies.

Outwash terraces along the Satsop River form important potential sources for sand and gravel. Well data suggest gravel thickness on these terraces increases northward, from about 40 feet at the Mouncer pit (sec. 14, T18N R7W) to greater than 60 feet south of Carstairs Prairie (center of T19N R6W). Carstairs Prairie appears to be an extension of the outwash plain along the Satsop River that has not been incised. Carstairs Prairie also is located directly adjacent to the maximum extent of the Vashon glacier (Washington Division of Geology and Earth Resources, 2001), which suggests that deposits there probably contain a significant percentage of cobbles and boulders. No contours are shown for the prairie due to a lack of subsurface data. However, the size of the prairie (~1,600 acres) and the thickness of adjacent terrace deposits suggest it could overlie important resources. Within the outwash terraces along the Satsop River, there are at least four borrow pits and one active pit (WADNR permit no. 12108), covering more than 7 acres total.

In addition to those previously discussed, other prairies that could contain sand and gravel deposits are Scott, Buck, and Goose Prairies (Plate 1). However, most prairies are not shown as sand and gravel resources on Plate 1 due to a lack of subsurface data.

Other Recessional Outwash Deposits

An extensive area that appears to contain vast sand and gravel resources is centered about 10 miles west of Shelton. However, well logs, field observations, and data from pits indicate that this is a recessional outwash plain where only 5 to 10 feet of gravel overlies non-commercial glacial till. Although two borrow pits (sec. 17, T20N R5W and sec. 26, T21N R5W) have been developed in this plain (Appendix 2), it does not meet the threshold of a significant resource used herein. Throughout the northeastern part of the Shelton quadrangle, veneers of outwash are sporadically present. In these areas, sand and gravel are preserved between elongate hills known as drumlins or fluted till. These areas are peppered with small borrow pits for forest road construction and maintenance, but because the deposits are thin, they are not mapped on Plate 1.

A large sand and gravel deposit is covered by residential housing at the Dayton Trails subdivision (sec. 8, T20N R4W), northeast of the town of Dayton. It is exposed in a large road cut and in a borrow pit in the southern part of the deposit and is defined in the subsurface by two water-well logs that show as much as 117 feet of sand and gravel. The deposit appears to thin toward the north; its western extent is unknown. The geomorphology of this deposit and lack of till above the sand and gravel suggest that it is recessional outwash.

ADVANCE OUTWASH

Advance outwash (unit Qga) is sediment deposited by rivers flowing from the continental ice sheet as it advanced. Generally, advance outwash is overlain by till. In the study area, the thickest deposits of advance outwash are along the margins of Hood Canal and the walls of the Skokomish Valley. Erosion exposes as much as 175 feet of sand and gravel in the Skokomish Valley. The thicknesses were determined using water-well logs (see Appendix 4) and measured stratigraphic sections in sec. 13, T21N R4W and sec. 5, T21N R4W (see Appendix 3 and Plate 1). Advance outwash is also documented from well logs on uplands north and south of the valley. In the study area, advance outwash typically is more consolidated than recessional outwash, contains more silt and clay, and has till as overburden. Although not depicted as a significant resource on Plate 1, its importance could increase in the future. Mines that are entirely or partially developed in advance outwash include three permitted mines (WADNR permit nos. 12366, 12381, and 12639) and seven borrow pits, covering more than 155 combined acres. However, of the three mines, only one is currently producing aggregate; the other two are inactive.

Bedrock Resources

There is a shortage of quality bedrock products in the Shelton quadrangle, especially the larger rock products used in applications such as rip rap, jetty stone, and retaining walls. The only bedrock of sufficient quality to map as speculative undiscovered resources are the Crescent Formation basalts and related intrusive igneous rocks. The outcrop pattern of these units is depicted on Plate 1 by pink polygons in the area southwest of Shelton. However, most of the Crescent Formation is weak volcaniclastic rock, and exposures of strong and durable bedrock are generally limited to thin igneous structures such as lava flows, sills, and dikes. Mapped hard and durable Crescent Formation resources are less than 160 feet thick. Folding, faulting, and deposition of thick overburden complicate development of these limited resources.

Bedrock has been quarried from at least 76 sites in the Shelton quadrangle (Appendix 2), although most of these are small borrow pits and are unimportant in terms of contribution to the market. The largest and most productive bedrock quarries in the Shelton quadrangle are located in Mason County, south of Shelton and northeast of McCleary (Plate 1, Table 4) and pro-

duce from the Crescent Formation. The largest permitted property is the Kennedy Creek quarry, which has an estimated remaining reserve base of about 19 million tons. The Wishkah quarry in the western half of the quadrangle (sec. 19, T20W R8W) has an estimated 1.5 million tons of reserve base. Other permitted properties in the quadrangle have a combined reserve base totaling about 6.2 million tons.

Significant Crescent Formation bedrock resources within the Shelton quadrangle can be grouped into three areas on the basis of volcanic rock type. These areas are located in the southeastern part of the study area, and each consists of several polygons. The first consists mostly of pillow basalts and is centered about 3.5 miles south of Nahwatzel Lake. The second area is chiefly composed of gabbroic sills and is centered about 1.5 miles south-southeast of Isabella Lake. The third area lies on either side of the Kamilche Valley and Skookum Creek and contains basaltic lava flows.

In the area near Nahwatzel Lake, resources consist of four pillow-basalt-dominated polygons (SE¼ T20N R5W), two of which contain the Robertson and Dinning quarries. Both of these quarries produce basalt that meets our criteria for strength and durability; there is little clay-rich material between pillows and no volcanic glass, and the pillows themselves are hard and durable.

The two polygons composed of gabbroic sills are present in the area south of Isabella Lake (NE¼ T19N R4W). The northeastern polygon contains the proposed Little Creek quarry (WADNR permit application no. 12882), which would cover a total of 35 acres. The plan of mining is to excavate the sill that is present in the mine and the adjacent basalt to a depth of 160 feet. The southwestern polygon in this area has not been developed.

The largest area of potential bedrock resource consists of a cluster of five polygons adjacent to Kamilche Valley (S½ T19N R4W). This area is somewhat of an anomaly within the Crescent Formation because three quarries produce from roughly horizontal basalt flows that are probably greater than 100 feet thick. The ellipsoidal pattern of the outer boundary of this cluster of polygons shown on Plate 1 is intentional to highlight the uncertainty in the distribution of the high-quality bedrock rather than to delineate its exact location. Future geologic mapping would be required to accurately delineate the extent of bedrock and to determine if the mines are producing from the same basalt flow. Three active mines (WADNR permit nos. 12460, 12642, and 12710), one proposed mine, and two borrow pits, covering a total of more than 295 acres, are in Crescent basalt in this area. The large active quarries are the Kennedy Creek, Skookum Rock, and McDonald Rock quarries. Basalt at the Kennedy Creek and Skookum Rock quarries forms near-vertical columns ranging from 12 to 18 inches in diameter. A proposed 110-acre expansion north of the current mine boundary could increase the Skookum Rock quarry's reserve base by approximately 20 million tons. Columns at the McDonald Rock quarry are 4 feet in diameter and vertical. WSDOT quality testing has not been performed on material from this quarry, but visual inspection using Universal Rock Classification System (URCS) tests (Williamson, 1984) suggests the rock is of high quality.

The Wishkah quarry (WADNR permit no. 12893; sec. 19, T20N R8W), located in Grays Harbor County east of Humptulips, is developed in a mixture of pillow basalt and massive basalt or volcaniclastic sandstone of the Crescent Formation (unit Ev_{cf}). The massive basalt is undesirable because it is weak, although the operator is able to selectively mine higher-quality pillow basalt. The quarried rock is used almost exclusively for construction and maintenance of forest roads. Tests conducted by Grays Harbor County indicate Los Angeles abrasion values of 21 percent and degradation factor of 1, although tests by an independent laboratory indicate Los Angeles abrasion values of 18 percent and degradation factor of 18 (Doug Schermer, Wishkah Rock Products, oral commun., 2000). In spite of the variable quality at this quarry, much crushed bedrock is hauled south to Aberdeen, north to Humptulips, and west to the coast because it is the only commercial quarry rock on the west side of the quadrangle, outside of Native American lands.

VOLUME OF AGGREGATE

The volume of aggregate currently available in major permitted mines was tabulated using data supplied by mine operators in June 2000 (Tables 3 and 4). Reserve bases for permitted properties are based on values listed on permit applications filed with the WADNR (Form SM-2) and augmented with information from field investigations and personal communication with operators. A reserve base in tons is obtained by multiplying cubic yards by conversion factors of 1.6 tons per cubic yard for processed sand and gravel and 2.4 tons per cubic yard for processed basalt and gabbro. Depletion is estimated by field observation or multiplying average annual production rates by the years of past production. For many sites, the operator confirmed our percent depletion estimates.

Permitted sand and gravel pits within the Shelton quadrangle contain about 15.6 million tons (9.75 million cubic yards) of aggregate in reserve. The production rate for these pits is about 0.49 million tons per year (0.3 million cubic yards per year). These data suggest existing sand and gravel pits in the Shelton quadrangle pits will be depleted in about 31 years. Permitted bedrock quarries have about 26.7 million tons (11 million cubic yards) of aggregate in reserve. The production rate for these quarries is 0.35 million tons per year (0.15 million cubic yards per year). These data suggest existing bedrock quarries in the Shelton quadrangle will be depleted in about 76 years. However, depletion calculations for sand and gravel and bedrock mines are merely a snapshot in time. A number of factors can cause these calculations to be misleading, including changing market conditions, inaccuracies in reserve-base estimates, and the shifting production to new mines.

MARKET CONSIDERATIONS

Historically, the principal market for sand and gravel and bedrock aggregate in the Shelton quadrangle has been small communities. Most bedrock quarries and several pits in the southeastern part of the study area have ready access to markets along U.S. Highway 101 or State Highway 108. (See Plate 1.) However, the geographical distribution of pits and quarries in other parts of the quadrangle with respect to end use has resulted in long haul distances and high prices. About 30 percent of the aggregate mined within the Shelton quadrangle is exported to the rapidly growing Puget Sound region. This percentage will likely increase in the future. For example, large volumes of sand and gravel from the proposed Manke Johns Prairie pit, if permitted, will be barged to markets in the eastern Puget Sound area outside of the Shelton quadrangle. Another consideration is that most of the large bedrock quarries are located in southeast corner of the quadrangle. Consequently, aggregate is abundant and transport costs are low in the vicinity of these quarries, but consumers in much of the western half of the Shelton quadrangle have few options for obtaining quarried bedrock at low cost. As a result, rock from the Wishkah quarry, some of which appears

to be of poor quality, has been hauled long distances throughout the western part of the quadrangle.

Increasingly, environmental considerations are affecting the sand and gravel market. For example, in the Humptulips area, as with much of the western part of the quadrangle, alluvium is the only source for high-quality aggregate. Flood-plain mining often has negative impacts on river ecosystems (Norman and others, 1998), but in the western half of the quadrangle, there are few other options. In the Shelton area, the availability of recessional outwash reduces the probability that alluvium from the Skokomish River valley will be mined commercially.

The quality of available aggregate is an important market consideration. Generally, the industry prefers sand and gravel deposits that contain a proportion of cobbles and small boulders suitable for crushing to manufacture feedstock for asphalt aggregate. The percentage of sand, silt, and clay must be low. In the Shelton quadrangle, sand and gravel deposits in the most intensively mined geologic unit, Vashon recessional outwash, typically have excessive amounts of fine gravel and sand and lack adequate volumes of cobbles and boulders. Although advance outwash deposits can be thick, they tend to contain large quantities of silt, clay, and detrimental mineral cements. One large pit is currently producing aggregate from advance outwash, and two more are permitted but have not commenced operations. In the future, industry might shift from relatively thin recessional outwash pits to thicker advance outwash pits. However, the washing process, removal of thick overburden, and ripping of these consolidated deposits could result in considerable extra cost and detrimental environmental impact.

SUMMARY

We have made a reconnaissance-level study of the aggregate resources in the Shelton 1:100,000 quadrangle to identify the existing and potential deposits that may be of interest, using the following criteria:

- Sand and gravel or bedrock deposits must appear to be in excess of 25 feet thick.
- The ratio of overburden to sand and gravel or overburden to rock must be less than 1 to 3.
- The rock must meet Washington State Department of Transportation minimum specifications for strength and durability of asphalt-treated base (a rock product used to construct some lower layers of asphalt roads).
- The area of the deposit exposed at the surface must exceed both 160 acres and 1,500 linear feet as measured along the minimum dimension of the deposit, or the reserve base must exceed 10 million cubic yards. A few exceptions are included where unusually thick deposits or resources of special local importance are present.

The Shelton quadrangle contains a moderate volume of sand and gravel (Tables 3 and 4; Plate 1) dominated by finer aggregate. The most significant sand and gravel deposits were originally laid down by ice-age rivers, but alluvium or modern river deposits are also mined. Currently, Vashon recessional outwash is the most widely used sand and gravel resource, and it will probably continue to be important well into the future. However, the large percentage of sand and fine gravel diminishes the value of this resource. Gravel pits in recessional outwash deltas contain the largest sand and gravel resources in the quadrangle, but two major recessional channels and several terrace deposits are also important. A number of operations are permitted to mine advance outwash, but their total production is relatively low. In the western half of the quadrangle, gravel is being mined only from alluvium on the flood plains of the Humptulips and Wynoochee Rivers.

The only significant bedrock unit mined in the quadrangle is the Crescent Formation, but most of this rock fails to meet the asphalt-treated base specification for strength and durability used in this study. Within the Crescent Formation, the highest-quality bedrock is located in the southeast quarter of the quadrangle where quarries produce from thick columnar basalt flows and lesser gabbros and pillow basalts.

Most of the permitted and proposed pits and quarries are located in the eastern half of the quadrangle. Currently permitted gravel pits in the Shelton quadrangle contain about 15.6 million tons (9.75 million cubic yards) of aggregate in reserve. The production rate for these pits is about 0.49 million tons (0.3 million cubic yards) per year. If permitted, proposed gravel pits will add approximately 69 million tons to the sand and gravel reserve base, 63 million tons of which would come from the Johns Prairie mine. Currently permitted bedrock quarries have about 26.7 million tons (11 million cubic yards) of aggregate in reserve. The production rate for these quarries is 0.35 million tons (0.15 million cubic yards) per year. If permitted, proposed bedrock quarries will add approximately 24.8 million tons to the reserve base; 20 million tons would come from expansion of the Skookum Rock quarry.

The larger pits and quarries could easily satisfy the need of the local consumers for many decades. However, based on production and population data, we expect that at least 30 percent of the permitted and proposed aggregate resources in the quadrangle will eventually be exported to more populous regions of Puget Sound.

ACKNOWLEDGMENTS

Thoughtful peer reviews of the draft manuscript were provided by George Bennett of SubTerra, Inc., Glennda McLucas of McLucas and Associates, Inc., and Bob Derkey of WADNR. However, any errors in this manuscript are the responsibility of the authors. The following people also helped to improve the quality of this study: Bill Shelmerdine (U.S. Forest Service) provided access to information on quarries and pits in the Olympic National Forest; Stephanie Abraham (Wash. Dept. of Ecology) assisted us in collecting copies of water well logs; Josh Logan (WADNR) and Leslie Lingley (Leslie Geologic Services) shared with us their knowledge of the geology of the Shelton quadrangle; Stephanie Zurenko (WADNR) provided information about aggregate mining in the Shelton quadrangle; the Washington State Department of Transportation gave us access to their geotechnical borehole logs and pit site data; and Dave Anderson and Russ Esses (Grays Harbor Co. Public Works Dept.) offered discussion on the aggregate industry in Grays Harbor County. Copies of wellhead protection plans were provided by Cindy Adams (Shelton) and Brian Shay (McCleary). Jim Starks discussed the geology around the city of Elma. Information on specific properties was shared by Roy Christopherson (Ace Paving Co., Inc.), Doug Archer (Bayshore pit), Tim Quigg and Tom LaForest (Humptulips gravel pit), Alex Hill (Huson pit), James Thurman (Kennedy Creek quarry), Jesse Kollman (Little Creek quarry), Mark Drain (McDonald rock quarry), Jeff Phipps and Brad Barton (Miles Sand and Gravel Co.), Chuck Hulet and Dan Meldrich (Northwest Rock, Inc.), Stan Vessey and Steve Schmitt (Skookum rock quarry), and Doug Schermer (Wishkah quarry).

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Appendix 1. Glossary of mining-related terms

The terms defined below are modified from Jackson (1997), American Geological Institute (1997), and Washington State Department of Transportation (1999).

Aggregate, construction aggregate – A mixture of sand and gravel or sand and crushed rock used in portland cement concrete, asphaltic concrete, mortar, plaster, or graded fill. Gravel and crushed stone that are in grain-to-grain contact in the aggregate are strong enough to support the weight of roads, buildings, or other infrastructure. The sand keeps the coarse aggregate in grain-to-grain contact by limiting the ability of the larger particles to shift laterally.

Alluvium – Unconsolidated boulders, cobbles, pebbles, sand, silt, and (or) clay deposited relatively recently from a stream or river and sorted by the current velocity.

Asphalt – Heavy oil (tar) produced from oil wells that is used to make asphalt roads.

Asphaltic concrete – Concrete made of asphalt and crushed aggregate.

Asphalt-treated base – A specific construction aggregate used to prepare the base of an asphaltic concrete road.

Basalt – A black volcanic rock that is finely crystalline. Basalt is the most common rock in the earth's crust and forms the floor of almost all of the oceans. In Washington, basalt covers the entire Columbia Basin and much of the Cascade Range and high Olympic Mountains. Basalt that erupted on land (for example, the Columbia River Basalt Group) is hard and makes excellent crushed aggregate, whereas basalt that erupted on the sea floor is commonly weak (for example, much of the Crescent Formation basalts).

Boulder – A rock fragment larger than 10 inches (256 mm) in diameter that has been somewhat rounded by abrasion in the course of transport.

Cement – (1) baked limestone dust and water that glues aggregate particles together to form concrete; (2) minerals, usually precipitated from hydrothermal fluids, that naturally glue the grains of a rock together creating a hard sediment or harder rock.

Clast – A rock fragment of any size, initially broken off bedrock by the force of water freezing in cracks or by impact from another rock. Clasts become smaller as they roll off a hillside and (or) down a stream.

Clay – Sediment composed of particles that are plastic, consolidated when dry, and are smaller than 0.000079 inch (0.002 mm) in diameter. Clay will not support weight (it behaves as a paste) because it is composed primarily of platy clay minerals. Clay is unsuitable for use in construction aggregates, and even small amounts must be washed off coarser aggregate.

Coarse aggregate – Gravel or crushed stone that is larger than ¼ inch (4.76 mm) in diameter. All clasts in coarse aggregate are larger than pea gravel (pebbles, cobbles, and boulders).

Cobble – A rock fragment larger than a pebble, but smaller than a boulder, having a diameter in the range of 2½ to 10 inches (64–256 mm) that has been somewhat rounded by abrasion in the course of transport.

Construction aggregate – *see Aggregate*

Cross-bed – A bed inclined at an angle to the main plane of stratification. Usually indicates deposition in a delta.

Crushed stone – Bedrock, cobbles, or boulders that have been crushed with a mechanical crusher to gravel-size rock fragments with at least three freshly broken faces. Crushed stone makes an excellent base course for road construction because the rock fragments tend to form an interlocking matrix. It is the only material suitable for asphaltic concrete because asphalt sticks only to freshly broken surfaces.

Degradation Test – A laboratory test designed to test the durability of rock under wet conditions. The degradation number indicates the percentage of rock remaining intact after tumbling in a wet chamber. Large numbers indicate favorable rock for construction aggregate.

Dike – A tabular intrusive rock that cuts across the bedding or foliation of the country rock.

Fine aggregate – Sand and gravel or crushed stone that will pass through a ¼-inch (4.76 mm) sieve, but will be trapped in a 200 mesh (ultrafine) sieve.

Granite – A light gray or pink, coarsely crystalline (typically ⅛-inch crystals) intrusive igneous rock composed of the hard minerals quartz and feldspar with minor amounts of black mica and black iron-magnesium-rich minerals. Granite and closely related rocks can make excellent construction aggregate.

Gravel – An unconsolidated natural accumulation of typically rounded rock fragments resulting from erosion and consisting predominantly of particles larger than sand, such as boulders, cobbles, and pebbles, in any combination.

Intrusive rock – Igneous rock that was emplaced below the earth's surface as a magma that cooled very slowly to form a coarsely crystalline rock.

Kame – A hummock, terrace, or short ridge composed of stratified sand and gravel deposited at the margin of a glacier as a delta or fan. In Washington, the term is generally applied to landforms created by deposition in the low area between the margin of a glacial ice sheet and the confining hills. After the ice has melted away, a high-quality sand and gravel deposit commonly remains.

Limestone – A rock composed of the mineral calcite. Normally, this rock type is deposited in the ocean from materials that are by-products or remnants of shells. Limestone is an important source of construction aggregate in much of the nation.

Loess – Silt and fine sand that is produced by the erosion of glacial outwash and transported by wind.

Los Angeles Abrasion Test – A laboratory test to assess the strength of aggregate under dry conditions. A 100-pound sample is placed in a tumbler resembling a washing machine with a tungsten carbide ball weighing about five pounds. The tumbler is revolved 500 times and then the sample is passed through a U.S. Standard No. 4 sieve. The larger the percent of the sample that passes through the sieve, the weaker the sample. The Los Angeles Abrasion value is the percent of the sample that has passed through the sieve. The lower the value, the more favorable the rock for construction aggregate.

Outwash – Sand, gravel, and coarser round rock deposited from streams and rivers issuing from alpine or continental (ice-age) glaciers. Proximal outwash was deposited relatively close to the snout of a glacier and is poorly sorted and has a large fraction of cobbles and boulders. Distal outwash was deposited miles from the edge of the glacier and is relatively well sorted and dominated by sand.

Overburden – The material that overlies an aggregate or mineral resource and must be removed before mining the underlying material.

Pebble – A stone, usually rounded by water transport, ⅛ to 2½ inches in diameter—the size of a small pea to that of a tennis ball.

Pit – This term is restricted herein to sand and gravel mines, regardless of size. A borrow pit is a small (<3 acre) mine that periodically produces unprocessed gravel and other sediment, generally for use as fill.

Pit run – Unprocessed material taken directly from the undisturbed geologic formation.

Plug – A vertical, pipe-like body of magma that represents the conduit to a former volcanic vent.

Portland cement – Cement made by heating limestone to about 2,700°F (calcining) to form lime. This lime is mixed with small amounts of water and dries to a hard adhesive that can glue aggregate together to form portland cement concrete. Portland cement by itself does not have great compressive strength, and it is costly because of the heat used in its manufacture. For these reasons, aggregate is added to form concrete. The gravel in portland cement concrete has great compressive strength and adds inexpensive filler to the mix.

Quarry – Used exclusively herein for mines that produce aggregate by blasting bedrock.

Sand Equivalent Test – A laboratory test that measures the cleanness of a sample in terms of the relative proportion of fine-grained dust or clay. High numbers indicate less dust and (or) clay, whereas low numbers indicate greater plasticity. Samples favorable for construction aggregate have values greater than 30.

Sill – A tabular intrusion that parallels the bedding or foliation of the sedimentary or metamorphic country rock and is substantially wider than it is thick. Sills form within a few miles of the Earth's surface.

Silt – Sediment composed of particles that are unconsolidated or poorly consolidated when dry and will pass a U.S. Standard No. 200 sieve (0.0025 in.) but are larger than clay (0.000079 in.). Silt has little or no cohesive strength because it contains a small proportion of clay minerals. Abundant silt can render a sand and gravel deposit unsuitable for use in construction aggregates.

Specific gravity – The specific gravity of a sample is the weight of the substance relative to the weight of an equal volume of water. The specific gravities of water, weak aggregate, granite, limestone, and basalt are 1.0, 1.95, 2.65, 2.72, and 3.2 grams per cubic centimeter, respectively.

Stabilometer R Value Test – A laboratory test that measures horizontal deformation when a vertical weight is applied. High numbers indicate stronger materials. Samples favorable for construction aggregate have values greater than 70.

Till – Very poorly sorted clay, silt, sand, gravel, cobbles, and boulders deposited directly from glacial ice in the form of a moraine or a compact blanket of sediment under the ice. Generally, till is unsuitable for construction aggregate.

Appendix 2. Mine database

This database contains information about most small active and terminated borrow pits or quarries and large active, terminated, and proposed mines in the Shelton 1:100,000 quadrangle. All of the borrow pits, quarries, and gravel pits in this database are shown on Plate 1. The information contained herein is available digitally as part of the geographic information system (GIS) files for the Shelton quadrangle. The columns that are not self-explanatory are defined as follows:

WADNR unique number – The Washington Department of Natural Resources (WADNR) unique number used by the geographic information system (GIS) to relate a feature on Plate 1 to a row in the database. The first four digits of the number identify the 7.5-minute quadrangle map in which the mine is located. The last four digits constitute a unique number in each 7.5-minute quadrangle.

WADNR data type code – The code number that indicates the type and size of the mine, as follows: 15, small borrow pit or quarry (point); 16, small terminated and (or) depleted borrow pit or quarry (point); 18, large active mine (polygon); 21, large terminated and (or) depleted mine (polygon); 22, large proposed mine (polygon).

WADNR permit number – The five-digit number on WADNR form SM-2, *Application for Surface Mining Reclamation Permit* (for a permitted mine), or, for small forest and borrow pits that do not have Surface Mine Reclamation Permits, a five-digit number that has been arbitrarily assigned by the authors.

WSDOT/USFS site number – A pit or quarry number assigned by the Washington State Department of Transportation (WSDOT) and (or) the U.S. Forest Service (USFS). These numbers link results of strength and durability testing or other data to a particular mine. The WSDOT numbers consist of a letter that identifies the county the site is in, followed by a sequentially assigned number.

¼¼ section, ¼ section, Section, Township, Range, Meridian – Legal description of the mine with reference to the Government Land Office grid. Values are relative to the Willamette principal meridian and base line. Townships, ranges, and sections are shown on Plate 1.

Product – The material being mined: rock, sand, or gravel.

Rock type – The type of rock that is being quarried at the site, if the mine is a quarry.

Geologic unit – The label that identifies a particular unit on a geologic map. This field indicates the unit in which the mine is located. See Appendix 5 for some geologic unit descriptions; descriptions of geologic units not in Appendix 5 can be found in Washington Division of Geology and Earth Resources (2001) and Dragovich and others (2002).

Qualifier – A symbol that indicates either that the thickness shown in the adjacent column is exact because the mine penetrates all the way through the resource (blank) or that the actual resource thickness is greater than the thickness reported because the bottom of the resource was not identified (>).

Resource thickness (feet) – The thickness, in feet, of the sand, gravel, or bedrock that is being mined.

Million cubic yards – The estimated volume (in millions of cubic yards) of aggregate resource present within the permitted boundary of a mine as of May 2000.

Million tons – Identified resource weight calculation based on volume estimates. Conversion factors are 1.6 ton/yd^3 for processed sand and gravel and 2.4 ton/yd^3 for processed basalt and gabbro.

Acres – Typically the number of acres permitted on the WADNR form SM-2, *Application for Surface Mining Reclamation Permit*. For unpermitted mines, indicates the estimated area of the mine. The value shown includes not only areas of aggregate extraction, but also all operations associated with the mine (stockpiling, crushing, screening, scales, etc.).

Percent depletion – The percentage by which the resource within the mine boundary has been depleted by mining, determined by communication with the mine operators or by field investigations.

Overburden thickness (feet) – The thickness, in feet, of soil, clay, or non-commercial aggregate that must be removed in order to reach the aggregate resource.

Stripping ratio – The overburden thickness divided by the resource thickness. A value of less than 0.33 (ratio of less than 1:3) is preferred.

Los Angeles Abrasion, Degradation, Specific Gravity, Sand Equivalent, and Stabilometer R Value tests – Results of laboratory tests, conducted mainly by the WSDOT, that reflect the quality of the deposit. See the glossary (Appendix 1) for explanation of tests.

Percent > 2½ inches, Percent ¼–2½ inches, Percent < ¼ inch, Percent < U.S. No. 200 sieve – Results of laboratory grain-size analysis of samples. Values are given in weight percent. The first three fields divide the whole sample, and the fourth field refers to the amount of silt and clay in the entire sample.

IDENTIFIER						LOCATION							IDENTIFIED RESOURCES									QUALITY									
WADNR unique number	WADNR data type code	WADNR permit number	WSDOT/USFS site number	Mine name	Operator	¼¼ section	¼ section	Section	Township N	Range	Meridian	County	Product	Rock type	Geologic unit	Qualifier	Resource thickness (feet)	Million cubic yards	Million tons	Acres	Percent depletion	Overburden thickness (feet)	Stripping ratio	Los Angeles abrasion	Degradation	Specific Gravity	Sand Equivalent	Stabilometer R value	Percent > 2½ inches	Percent ¼–2½ inches	Percent < ¼ inches	Percent < U.S. No. 200 sieve
16160019	15					SE	NW	2	18	3	W	Thurston	gravel	till	Qgt																
16160035	15			Schneider quarry	WADNR, Central Region	SW	SW	4	18	3	W	Thurston	rock	basalt	Ev_{cf}																
16160016	15					SE	NE	4	18	3	W	Thurston	gravel	recessional outwash	Qgo																
16160013	15		J-179	Fulmer Hill	WADNR, Central Region	SE	NE	10	18	3	W	Thurston	rock	basalt	Ev_{cf}							2		22.6	29						
16160011	16	11369	J-150		Gordon Willie	SE	NE	14	18	3	W	Thurston	gravel	till	Qgt		20			5		2	0.10				80	72	0	22	78	1
16160012	15		J-178	Maple Valley	WADNR, Central Region	NE	SE	14	18	3	W	Thurston	rock	basalt	Ev_{cf}							4		14.8	23						
16160051	15			Perry Creek quarry	WADNR, Central Region	SE	SW	15	18	3	W	Thurston	rock	basalt	Ev_{cf}							7									
16160010	15		J-208	State "8" pit	WADNR, Central Region	SE	NW	16	18	3	W	Thurston	rock	basalt	Ev_{cf}									16	75	2.98					
16160008	15			Jolly Roger pit	WADNR, Central Region	SW	SE	21	18	3	W	Thurston	rock	basalt	Ev_{cf}							3		23.4	9						
16160007	15			Bledsoe quarry	WADNR, Central Region	NE	NE	21	18	3	W	Thurston	rock	basalt	Ev_{cf}							1		20	7	2.83					
16160006	15			Deadwood	WADNR, Central Region	SW	SW	26	18	3	W	Thurston	rock	basalt	Ev_{cf}							4		21.9	59						
16160004	15			Rock Candy	WADNR, Central Region	SW	SW	30	18	3	W	Thurston	rock	basalt	Ev_{cf}							4		15.4	22						
16160005	15			Camp 2	WADNR, Central Region	NE	NW	30	18	3	W	Thurston	rock	basalt	Ev_{cf}																
16160001	15			Burma	WADNR, Central Region	SW	NW	31	18	3	W	Thurston	rock	basalt	Ev_{cf}									19.8	2						
16160002	15			C-2100	WADNR, Central Region	NE	NW	31	18	3	W	Thurston	rock	basalt	Ev_{cf}									21.9	56						
16150046	16	11416			Rex B. Valentine	SE	SW	8	18	4	W	Grays Harbor	rock	basalt	Ev_{cf}		150			10		5	0.03								
16150050	16	11738			Neil McDonald	SW	SW	8	18	4	W	Grays Harbor	rock	basalt	Ev_{cf}		25			3	5	10	0.40								
16150023	15			Cooper road (ORV) quarry	Port Blakely Tree Farms, L. P.	NW	NW	9	18	4	W	Thurston	rock	basalt	Ev_{cf}																
16150025	15		J-75		Simpson Timber Company	NE	SE	9	18	4	W	Thurston	gravel	recessional outwash	Qgo		20					1	0.05	15	72	2.73	37				
16150021	15					NW	NW	13	18	4	W	Thurston	rock	basalt	Ev_{cf}																
16150019	15			A-6000	WADNR, Central Region	NW	SW	15	18	4	W	Thurston	rock	basalt	Ev_{cf}									15.6	26						
16150017	15			County line pit	WADNR, Central Region	NW	SW	16	18	4	W	Thurston	rock	basalt	Ev_{cf}									16.8	4						
16150018	15			ORV pit	WADNR, Central Region	NW	SW	16	18	4	W	Thurston	rock	basalt	Ev_{cf}							6		20.9	59						

IDENTIFIER						LOCATION							IDENTIFIED RESOURCES									QUALITY										
WADNR unique number	WADNR data type code	WADNR permit number	WSDOT/USFS site number	Mine name	Operator	¼¼ section	¼ section	Section	Township N	Range	Meridian	County	Product	Rock type	Geologic unit	Qualifier	Resource thickness (feet)	Million cubic yards	Million tons	Acres	Percent depletion	Overburden thickness (feet)	Stripping ratio	Los Angeles abrasion	Degradation	Specific Gravity	Sand Equivalent	Stabilometer R value	Percent > 2½ inches	Percent ¼–2½ inches	Percent < ¼ inches	Percent < U.S. No. 200 sieve
16150016	15		H-157			NE	NE	17	18	4	W	Grays Harbor	gravel	recessional outwash	Qgo	>	21					2	0.10	12.2	62	2.87	71	75	1	53	46	3.7
16150048	16	11727			Boyd and William Zepp	SW	NE	17	18	4	W	Grays Harbor	rock	basalt	Ev_{cf}		100			40	10	3	0.03									
16150047	16	11436			Roger Landberg	SE	NW	18	18	4	W	Grays Harbor	rock	basalt	Ev_{cf}		25			15		10	0.40									
16150049	16	11736			Donald and Joe Pierce	SW	NE	18	18	4	W	Grays Harbor	rock	basalt	Ev_{cf}		40			30	10	15	0.38									
16150006	15			Red Head	WADNR, Central Region	SW	NW	19	18	4	W	Grays Harbor	rock	basalt	Ev_{cf}							8		19	17	2.86						
16150007	15			Bozy Creek	WADNR, Central Region	NW	NE	19	18	4	W	Grays Harbor	rock	basalt	Ev_{cf}							3		20.5	3	2.64						
16150008	15			Five forks quarry	WADNR, Central Region	SE	NE	22	18	4	W	Thurston	rock	basalt	Ev_{cf}							5		20.5	77							
16160003	15			Switchback	WADNR, Central Region	NE	NE	25	18	4	W	Thurston	rock	basalt	Ev_{cf}							3		16	32	2.9						
16150005	15			Spur pit	WADNR, Central Region	NE	NE	27	18	4	W	Thurston	rock	basalt	Ev_{cf}									26.1	1	2.89						
16150004	15			Snake pit	WADNR, Central Region	NW	NW	26	18	4	W	Thurston	rock	basalt	Ev_{cf}									21	71							
16150002	15			Totem	WADNR, Central Region	NE	SW	30	18	4	W	Grays Harbor	rock	basalt	Ev_{cf}							6		25.8	31							
16150003	15			North Rim pit	WADNR, Central Region	SE	NE	30	18	4	W	Grays Harbor	rock	basalt	Ev_{cf}									20.7	85							
16150001	15			Buck Ridge	WADNR, Central Region	NW	SE	33	18	4	W	Thurston	rock	basalt	Ev_{cf}							4		20.3	60							
16150031	15		H-131		Port Blakely Tree Farms, L. P.	SE	NE	1	18	5	W	Grays Harbor	gravel	recessional outwash	Qgo	>	12					2	0.17				81	75	4	53	43	0.9
16140054	15			Bush Creek pit	Port Blakely Tree Farms, L. P.	NW	NE	5	18	5	W	Grays Harbor	gravel	recessional outwash	Qgo																	
16140048	15					NE	NW	8	18	5	W	Grays Harbor	gravel	recessional outwash	Qgo																	
16140033	15					SE	SW	13	18	5	W	Grays Harbor	gravel	recessional outwash	Qgo	>	10															
16140044	15		H-166			SW	NE	15	18	5	W	Grays Harbor	gravel	recessional outwash	Qgo	>	10					1	0.10	14.3	19	2.75	49	77	0	42	58	1.7
16140037	18	12890		Garden City pit	House Bros. Construction	NE	SW	16	18	5	W	Grays Harbor	gravel	recessional outwash	Qgo		35	0.3	0.45	15		1	0.03									
16140017	21	11662		Landberg pit	Landberg Construction	SE	SW	19	18	5	W	Grays Harbor	gravel	recessional outwash	Qgo		20	0	0	7	100	1	0.05									
16140016	15		H-167		WSDOT	SE	SW	19	18	5	W	Grays Harbor	gravel	recessional outwash	Qgo	>	30					2	0.07	14.7	77	2.76	28	79	17	59	24	3.8

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16140015	15					SE	SW	19	18	5	W	Grays Harbor	gravel	recessional outwash	Qgo																	
16140022	21	11855	H-170	Wildcat Creek	William Breckenridge	NW	SE	20	18	5	W	Grays Harbor	Sand	recessional outwash	Qgo	>	30	0	0	6.4	100	2	0.07				67		0	0	100	6
16140021	21	11724	H-285		Taylor United	SE	SW	20	18	5	W	Grays Harbor	gravel	recessional outwash	Qgo												34	82	0	41	59	2.9
16140030	15					NE	NE	23	18	5	W	Grays Harbor	gravel	alluvium	Qa																	
16140091	16	11690			Bayview Lumber Company	SW	SE	30	18	5	W	Grays Harbor	gravel	recessional outwash	Qgo		15			10		1	0.07									
16140002	15		H-303		Gordon Berglund	NE	NE	36	18	6	W	Grays Harbor	gravel	recessional outwash	Qgo	>	25					1	0.04	16.8	52	2.79	26	72	0	67	33	3
16130062	16	12407		Vetter pit	Weyerhaeuser Company	SW	SE	12	18	7	W	Grays Harbor	gravel	alluvium	Qa		20	0	0	3	100	1	0.05									
16120051	16	11379		Borden's pit	Grays Harbor County	SW	SW	13	18	7	W	Grays Harbor	gravel	recessional outwash	Qgo		15			4		2	0.13									
16120008	18	12108	H-268	Mouncer pit	Northwest Rock, Inc.	SW	NE	14	18	7	W	Grays Harbor	gravel	recessional outwash	Qgo	>	23	0.05	0.08	7		1	0.04	14	58	2.87	68	76	0	54	46	3.5
16120050	16	11224		Seaman pit	Grays Harbor County	SW	NE	14	18	7	W	Grays Harbor	gravel	recessional outwash	Qgo		15			7		2	0.13									
16120006	15		H-269			SW	NE	15	18	7	W	Grays Harbor	gravel	conglomerate	Mm_{2mc}		40					2	0.05				37	73	2	57	41	6.1
16120049	16	11216			Grays Harbor County	SW	SW	25	18	7	W	Grays Harbor	gravel	alluvium	Qa		4			5		0	0.00									
16110008	18	11473	H-219	Evergreen pit	Northwest Rock, Inc./George Kron	NW	SW	16	18	8	W	Grays Harbor	gravel	alluvium	Qa		40	0.43	0.65	29		1	0.02	13.7	49	2.67	62	77				
16110005	15					NE	SW	20	18	8	W	Grays Harbor	rock	siltstone	Mm_{2mt}																	
16110006	15					SE	SE	20	18	8	W	Grays Harbor	rock	siltstone	Mm_{2mt}																	
16090004	15					SW	NE	8	18	10	W	Grays Harbor	gravel	alpine outwash	$Qapwo_1$																	
16090001	15					NE	SE	28	18	10	W	Grays Harbor	gravel	alpine outwash	$Qapwo_2$																	
15160019	22	12882	X-114	Little Creek quarry	Arris Kollman Trucking, Inc.	SW	NW	7	19	3	W	Mason	rock	gabbro, basalt	Ev_{cf}		160	2	4.8	35		10	0.06	40	23	2.82						
15160028	15					NW	NE	8	19	3	W	Mason	gravel	recessional outwash	Qgo	>	29					2	0.07									
15160014	15					SW	NE	15	19	3	W	Mason	gravel	till	Qgt																	
15160005	15		X-79		WSDOT	NE	SE	18	19	3	W	Mason	rock	basalt	Ev_{cf}							0										
15160010	15		X-67		WSDOT	NE	NE	18	19	3	W	Mason	gravel	recessional outwash	Qgo	>	24					0	0.00	13.1	66	2.76	74	75	0	10	90	3

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16160034	18	12460	X-113	Kennedy Creek quarry	Kennedy Creek Quarry, Inc.	SW	NW	29	19	3	W	Mason	rock	columnar basalt	Ev_{cf}	>	100	7.9	19	110		3	0.03	11	63	2.93						
16160022	15		X-71			NW	SE	32	19	3	W	Mason	gravel	recessional outwash	Qgo	>	24					1	0.04				75	76	0	32	68	3.4
16160025	15		J-92			SE	NE	34	19	3	W	Thurston	gravel	advance outwash	Qga	>	8							9.5	43	2.71	65	80	0	47	53	6
15160043	15					NE	SE	1	19	4	W	Mason	gravel	recessional outwash	Qgo		20															
15160041	16	11341	X-68	Lake Isabella pit	WADNR, South Puget Sound Region	NW	NE	1	19	4	W	Mason	gravel	recessional outwash	Qgo	>	44					1	0.02	12.7	57	2.74	79		0	58	42	1.7
15150007	15					NW	NW	8	19	4	W	Mason	gravel	till	Qgt																	
15150004	15					NW	SE	14	19	4	W	Mason	rock	pillow basalt	Ev_{cf}																	
15150001	15					NW	SW	18	19	4	W	Mason	gravel	till	Qgt																	
15150002	15					NE	SW	18	19	4	W	Mason	gravel	till	Qgt																	
15160001	15					SE	NE	24	19	4	W	Mason	rock	pillow basalt	Ev_{cf}																	
16150041	18	12642	X-103	Skookum rock quarry	Vessey & Sons/ Port Blakely Tree Farms	NW	SW	28	19	4	W	Mason	rock	columnar basalt	Ev_{cf}		150	0.7	1.7	40	25	12	0.08	16	20	2.8						
16150051	22	12642		Skookum rock expansion	Port Blakely Tree Farms L. P.	SW	NW	28	19	4	W	Mason	rock	columnar basalt	Ev_{cf}		300	8.3	20	110	0	12	0.04									
16150040	16	11768	X-72	CDC rock quarry	Capital Development Co.	NE	SE	30	19	4	W	Mason	rock	columnar basalt	Ev_{cf}		180			10	0	12	0.07									
16150035	15		X-18			NW	SE	31	19	4	W	Mason	gravel	recessional outwash	Qgo		10					2	0.20	21.8		2.84	40	74	7	47	46	3.7
16150034	15					SW	SE	31	19	4	W	Mason	gravel	recessional outwash	Qgo																	
16150038	18	12710		McDonald rock quarry	McDonald Land Company	SW	NW	34	19	4	W	Mason	rock	columnar basalt	Ev_{cf}		225	1.9	4.5	35		10	0.04									
15140021	15					NE	NE	3	19	5	W	Mason	gravel	till	Qgt																	
15140019	15					NW	NE	4	19	5	W	Mason	gravel	till	Qgt																	
15140017	15					NW	NE	5	19	5	W	Mason	gravel	till	Qgt																	
15140012	15					SE	SE	8	19	5	W	Mason	gravel	till	Qgt																	
15140016	15					SE	SE	11	19	5	W	Mason	rock	basalt	Ev_{cf}																	
15140015	15			Buck Prairie quarry	Port Blakely Tree Farms, L. P.	SW	SW	11	19	5	W	Grays Harbor	rock	pillow basalt	Ev_{cf}																	
15140009	15					NE	SE	15	19	5	W	Mason	gravel	till	Qgt	>	15															
15147004	21	12466	X-110	Cloquallum pit	Northwest Rock, Inc.	SE	NE	20	19	5	W	Mason	gravel	alluvium	Qa		11	0	0	10	100	2	0.18	15.2	50	2.82	50	77	0	52	48	2

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16147004	21	12466	X-110	Cloquallum pit	Northwest Rock, Inc.	NE	NE	20	19	5	W	Mason	gravel	alluvium	Qa		11	0	0	10	100	2	0.18	15.2	50	2.82	50	77	0	52	48	2
15130007	15					SW	SW	8	19	6	W	Mason	gravel	recessional outwash	Qgo	>	20															
15130016	15					SE	NW	11	19	6	W	Mason	gravel	recessional outwash	Qgo																	
15130014	15					NW	NW	11	19	6	W	Mason	gravel	recessional outwash	Qgo	>	35					2	0.06									
15130031	15					NW	NW	12	19	6	W	Mason	gravel	recessional outwash	Qgo																	
15130003	15					SE	NW	18	19	6	W	Mason	gravel	recessional outwash	Qgo	>	15															
16130091	15					SE	SW	28	19	6	W	Mason	gravel	recessional outwash	Qgo																	
16130098	15					NW	NE	28	19	6	W	Mason	gravel	recessional outwash	Qgo	>	35															
16130082	15		X-118			NE	SE	30	19	6	W	Mason	gravel	recessional outwash	Qgo	>	38					3	0.08	16	44	2.74	74	73				
15120001	15					NW	NE	17	19	7	W	Grays Harbor	gravel	alluvium	Qa																	
16120015	15					NW	SE	20	19	7	W	Grays Harbor	gravel	alluvium	Qa																	
16120016	15					NE	SE	23	19	7	W	Grays Harbor	gravel	alluvium	Qa																	
16130070	15					SE	NE	36	19	7	W	Grays Harbor	gravel	recessional outwash	Qgo																	
16110015	15					NE	SW	29	19	8	W	Grays Harbor	gravel	alpine outwash	$Qapwo_1$																	
15100004	15					NW	NW	8	19	9	W	Grays Harbor	gravel	alpine outwash	$Qapwo_2$																	
16100002	15					SE	NE	31	19	9	W	Grays Harbor	gravel	outwash	$Qapwo_1$																	
16100004	15					NW	SW	33	19	9	W	Grays Harbor	gravel	alluvium	Qa																	
15090004	15					NE	SE	8	19	10	W	Grays Harbor	rock	basalt	Ev_{cf}																	
15090002	15					NE	SE	17	19	10	W	Grays Harbor	rock	basalt	Ev_{cf}																	
15090003	15					SE	NE	17	19	10	W	Grays Harbor	rock	basalt	Ev_{cf}																	
15090001	15					NE	SW	17	19	10	W	Grays Harbor	rock	basalt	Ev_{cf}																	
16090012	16	12397	H-259	Failor Lake (Deep Creek)	Grays Harbor County	NW	NE	30	19	10	W	Grays Harbor	rock	basalt	Ev_{cf}		100			11		15	0.15	31.1	3	2.66						

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16090014	15					SE	SW	24	19	11	W	Grays Harbor	rock	basalt	Ev_{cf}																	
16090015	15					SW	SE	24	19	11	W	Grays Harbor	rock	basalt	Ev_{cf}																	
16090011	15		H-244		Anderson and Middleton	SW	NE	25	19	11	W	Grays Harbor	rock	basalt	Ev_{cf}	>	5					5	1.00	30.3	3	2.55	43	76				
16090008	15					NE	NW	25	19	11	W	Grays Harbor	rock	basalt	Ev_{cf}																	
16090009	15					SW	NE	25	19	11	W	Grays Harbor	rock	basalt	Ev_{cf}																	
15167003	18	12381	X-48	Bayshore pit	Bayshore Sand and Gravel, Inc.	NW	SW	3	20	3	W	Mason	gravel	recessional outwash	Qgo		80	2	3	33		4	0.05	13	63	2.76	77	76	0	36	64	3.6
15160136	15		X-69		Mason County	SW	SW	3	20	3	W	Mason	gravel	recessional outwash	Qgo	>	40					3	0.08	13.7	75	2.72	82		1	56	43	0.4
14167003	18	12381	X-48	Bayshore pit	Bayshore Sand and Gravel, Inc.	NW	SW	3	20	3	W	Mason	gravel	recessional outwash	Qgo		80	2	3	33		4	0.05	13	63	2.76	77	76	0	36	64	3.6
14160020	16	10254	X-91	Douglas fir tree farm pit	Interstate Asphalt Company	NW	SW	4	20	3	W	Mason	gravel	recessional outwash	Qgo		29			1		2	0.07	19.2	24	2.8	68	80	0	70	30	1
15160133	18	10963	X-41		WSDOT	SE	SE	4	20	3	W	Mason	gravel	recessional outwash	Qgo	>	14					1	0.07	15.4	48	2.77	60	76	0	62	38	5
15160132	18	12493	X-124	Ace Johns Prairie pit	Ace Paving Company, Inc.	SE	SE	4	20	3	W	Mason	gravel	recessional outwash	Qgo		40	0.13	0.2	10		1	0.02	17.6	60	2.75	79	72	15	54	31	0.7
15160121	15					NW	SW	5	20	3	W	Mason	gravel	recessional outwash	Qgo	>	27					3	0.11									
15160130	22	12931	X-125	Manke Johns Prairie site	Manke Lumber Company	SW	SE	9	20	3	W	Mason	gravel	recessional outwash	Qgo		165	42	63	354	0	5	0.03	12	75	2.76						
15160054	15					SW	SW	33	20	3	W	Mason	gravel	recessional outwash	Qgo																	
14157000	21	12760		Burnett pit	Quigg Bros. - McDonald, Inc.	NE	SE	1	20	4	W	Mason	gravel	recessional outwash	Qgo		28	0.9	1.4	20	0	3	0.11									
15167000	21	12760		Burnett pit	Quigg Bros. - McDonald, Inc.	NE	SE	1	20	4	W	Mason	gravel	recessional outwash	Qgo		28	0.9	1.4	20	0	3	0.11									
15157000	21	12760		Burnett pit	Quigg Bros. - McDonald, Inc.	NE	SE	1	20	4	W	Mason	gravel	recessional outwash	Qgo		28	0.9	1.4	20	0	3	0.11									
14167000	21	12760		Burnett pit	Quigg Bros. - McDonald, Inc.	NE	SE	1	20	4	W	Mason	gravel	recessional outwash	Qgo		28	0.9	1.4	20	0	3	0.11									
15150093	16	12055			Evergreen Materials, Inc.	NW	NE	2	20	4	W	Mason	gravel	recessional outwash	Qgt		30			10	0	2	0.07									
14150003	15					NW	NW	3	20	4	W	Mason	gravel	recessional outwash	Qgt		20					3	0.15									
15150092	16	12110		County dump	Mason Co. Dept. of Pub. Works	NW	SE	4	20	4	W	Mason	gravel	recessional outwash	Qgo	>	5			10		1	0.20									

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15150061	15			Pit run gravel		SW	NE	8	20	4	W	Mason	gravel	recessional outwash	Qgo		117					5	0.04									
15150070	15		X-82		Simpson Timber Company	NW	NW	9	20	4	W	Mason	gravel	recessional outwash	Qgo	>	10					2	0.20	14.6	35	2.83	39		10	65	25	2.5
15150084	15		X-96		Pacific Sand and Gravel	SE	SW	12	20	4	W	Mason	gravel	recessional outwash	Qgo	>	30					2	0.07	16.2	56	2.82	70		0	55	45	4
15150094	22			Black Hills project	Peninsula Holding Company, LLC	NE	NW	13	20	4	W	Mason	gravel	recessional outwash	Qgo			0.3	0.45	45.5	0											
15157001	18	10287	X-87	J. D. Shotwell pit	Miles Sand and Gravel Co.	NW	NE	24	20	4	W	Mason	gravel	recessional outwash	Qgo	>	100	1.5	2.25	30	0	2	0.02	27.8		2.74	93		6	49	45	1
15160148	18	12366		Coffee Creek	Ronald G. Shipley	NW	SE	24	20	4	W	Mason	gravel	recessional outwash	Qga		50	1.3	1.95	25	0	4	0.08									
15167001	18	10287	X-87	J. D. Shotwell pit	Miles Sand and Gravel Co.	NW	NE	24	20	4	W	Mason	gravel	recessional outwash	Qgo	>	100	1.5	2.25	30	0	2	0.02	27.8		2.74	93		6	49	45	1
15150041	18	10563	X-49	Miles Shelton pit	Miles Sand and Gravel Co.	SE	NW	24	20	4	W	Mason	gravel	recessional outwash	Qgo	>	100	3.2	4.75	100	50	5	0.05	21	50	2.78	90	74	0	43	57	0.5
15150027	15					SW	NE	29	20	4	W	Mason	rock	basalt	Ev_{cf}																	
15150022	15					NE	NE	33	20	4	W	Mason	gravel	till	Qgt																	
15160047	15					SE	SE	36	20	4	W	Mason	gravel	recessional outwash	Qgo	>	23					3	0.13									
15140053	15					SW	SW	6	20	5	W	Mason	gravel	till	Qgt																	
15140051	15		X-88		Mason County	NE	SE	11	20	5	W	Mason	gravel	recessional outwash	Qgo		12					1	0.08	10.4	47	2.77	75	79	0	50	50	4
15140057	15					NW	NE	11	20	5	W	Mason	gravel	recessional outwash	Qgo																	
15140039	15					SW	NW	17	20	5	W	Mason	gravel	till	Qgt		10					2	0.20									
15140031	15					SW	SW	20	20	5	W	Mason	gravel	till	Qgt	>	38					2	0.05									
15140034	15					SW	SW	22	20	5	W	Mason	gravel	till	Qgt		32					2	0.06									
15140035	15			Dinning quarry	Port Blakely Tree Farms, L. P.	SW	SW	23	20	5	W	Mason	rock	pillow basalt	Ev_{cf}									25	37	2.6						
15140036	15					SW	SE	23	20	5	W	Mason	rock	pillow basalt	Ev_{cf}																	
15140028	15			Robertson pit	Simpson Timber Company	SW	SW	26	20	5	W	Mason	rock	pillow basalt	Ev_{cf}		82					10	0.12									
15140026	15					NE	SW	33	20	5	W	Mason	gravel	till	Qgt																	
15140027	15					SE	NW	35	20	5	W	Mason	gravel	till	Qgt																	
15130030	15					NW	SE	2	20	6	W	Mason	gravel	recessional outwash	Qgo																	
15130029	15					NW	SE	2	20	6	W	Mason	gravel	recessional outwash	Qgo																	
15130028	15					SE	SE	3	20	6	W	Mason	gravel	recessional outwash	Qgo																	

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15130025	15					NW	NW	8	20	6	W	Mason	gravel	recessional outwash	Qgo																	
15130026	15					NE	NW	9	20	6	W	Mason	gravel	recessional outwash	Qgo																	
15130055	15					NE	NE	9	20	6	W	Mason	gravel	recessional outwash	Qgo																	
15130032	15					SW	SE	12	20	6	W	Mason	gravel	till	Qgt																	
15130033	15					NE	NE	14	20	6	W	Mason	gravel	recessional outwash	Qgo	>	10					3	0.30									
15130023	15					SE	SW	14	20	6	W	Mason	gravel	recessional outwash	Qgo																	
15120008	15					NW	SW	1	20	7	W	Grays Harbor	gravel	alluvium	Qa																	
15120007	15					NE	SE	11	20	7	W	Grays Harbor	gravel	alluvium	Qa																	
15120006	15					SW	NE	21	20	7	W	Grays Harbor	gravel	alluvium	Qa																	
15120005	15					SW	SE	21	20	7	W	Grays Harbor	gravel	alluvium	Qa																	
15110007	15					NW	SW	19	20	8	W	Grays Harbor	rock	basalt	Ev_{cf}																	
15110008	18	12893	H-309	Wishkah quarry	Wishkah Rock Products, Inc.	NE	NE	19	20	8	W	Grays Harbor	rock	pillow basalt	Ev_{cf}			0.6	1.5	80	50			21	1	2.55						
15110010	15					SW	NW	20	20	8	W	Grays Harbor	gravel	alpine outwash	$Qapw_2$																	
15110011	15					SE	NW	22	20	8	W	Grays Harbor	gravel	alpine outwash	$Qapw_2$																	
15100005	15					NW	SW	15	20	9	W	Grays Harbor	rock	basalt	Ev_{cf}																	
15090059	15					NW	SW	2	20	10	W	Grays Harbor	gravel	alluvium	Qa																	
14090001	15					NE	NE	3	20	10	W	Grays Harbor	gravel	alpine outwash	$Qapw_1$																	
15090033	15					NE	SW	7	20	10	W	Grays Harbor	gravel	alpine outwash	Qapo																	
15090043	16				Apex Hip and Ridge	SE	NW	8	20	10	W	Grays Harbor	gravel	alpine outwash	Qapo		30			8		2	0.07									
15090023	16	12445	H-156		Darrell Potter	NE	NW	17	20	10	W	Grays Harbor	gravel	alluvium	Qa		30			5.25		1	0.03	19.5	11	2.9	85		8	54	38	1.1
15090024	16	11624	H-129		WSDOT	NW	NE	17	20	10	W	Grays Harbor	gravel	alluvium	Qa	>	6					0	0.00	17.8	47	2.9	75	73	4	64	32	0.7
15090060	16	11896			Oran Turner	SW	NE	17	20	10	W	Grays Harbor	gravel	alluvium	Qa		6			10		0	0.00									

IDENTIFIER						LOCATION							IDENTIFIED RESOURCES									QUALITY										
WADNR unique number	WADNR data type code	WADNR permit number	WSDOT/USFS site number	Mine name	Operator	¼¼ section	¼ section	Section	Township N	Range	Meridian	County	Product	Rock type	Geologic unit	Qualifier	Resource thickness (feet)	Million cubic yards	Million tons	Acres	Percent depletion	Overburden thickness (feet)	Stripping ratio	Los Angeles abrasion	Degradation	Specific Gravity	Sand Equivalent	Stabilometer R value	Percent > 2½ inches	Percent ¼–2½ inches	Percent < ¼ inches	Percent < U.S. No. 200 sieve
15090021	18	12857	H-291	Humptulips gravel pit	Quigg Bros. Const./Tom LaForest	NW	NE	18	20	10	W	Grays Harbor	gravel	alluvium	Qa		35	0.8	1.2	40		3	0.09	15	34	2.87	86	74	0	71	29	0.9
15090018	15		H-33		Polson Logging Company	NE	NW	18	20	10	W	Grays Harbor	gravel	alpine outwash	$Qapwo_2$														40	39	11	
15090016	15					NE	NW	13	20	11	W	Grays Harbor	gravel	alpine outwash	$Qapwo_2$																	
15090009	15					SW	SW	24	20	11	W	Grays Harbor	gravel	alpine outwash	$Qapwo_2$																	
14160061	15					SE	SW	6	21	3	W	Mason	gravel	advance outwash	Qga																	
14160062	15					NE	SW	6	21	3	W	Mason	gravel	advance outwash	Qga																	
14160060	15					SW	NE	9	21	3	W	Mason	gravel	till	Qgt																	
14160059	15					NW	NW	9	21	3	W	Mason	gravel	till	Qgt																	
14160056	15					SE	SW	12	21	3	W	Mason	gravel	till	Qgt																	
14160055	15					NE	SW	23	21	3	W	Mason	gravel	till	Qgt																	
14160054	15					SW	SE	27	21	3	W	Mason	gravel	till	Qgt																	
14160047	15					SE	SW	30	21	3	W	Mason	gravel	recessional outwash	Qgo																	
14160044	15					NW	NW	31	21	3	W	Mason	gravel	recessional outwash	Qgo																	
14160016	22			McEwen Prairie mine site	BB&R	SW	SW	33	21	3	W	Mason	gravel	recessional outwash	Qgo		40	3.8	5.7	165	0	0	0.00									
14160021	15		X-108			SE	SW	33	21	3	W	Mason	gravel	recessional outwash	Qgo												75	75	1	54	45	2.2
14160038	15					NW	SW	34	21	3	W	Mason	gravel	recessional outwash	Qgo																	
14150071	15					NE	SE	5	21	4	W	Mason	gravel	advance outwash	Qga	>	26					10	0.38									
14160057	15		X-21	Webb Hill		SE	NE	12	21	4	W	Mason	gravel	advance outwash	Qga														10	62	28	0.8
14150061	16	11261		FHWA 45-23-0006	Federal Highway Admin.	NE	NW	13	21	4	W	Mason	gravel	advance outwash	Qga		63			4.2		1	0.02									
14150053	15					NW	SE	18	21	4	W	Mason	gravel	recessional outwash	Qgo																	
14150039	15					NE	SW	22	21	4	W	Mason	gravel	recessional outwash	Qgo																	
14150037	15		X-8			SW	SE	22	21	4	W	Mason	gravel	recessional outwash	Qgo												51	73	0	37	63	1
14167002	18	12550	X-115	McReavy road pit	Ace Paving Company, Inc.	SE	SE	25	21	4	W	Mason	gravel	recessional outwash	Qgo	>	30	0.15	0.23	45		1	0.03	14	56	2.77	71	74	3	53	44	1.9
14160051	15					SE	NE	25	21	4	W	Mason	gravel	till	Qgt																	

IDENTIFIER						LOCATION							IDENTIFIED RESOURCES									QUALITY										
WADNR unique number	WADNR data type code	WADNR permit number	WSDOT/USFS site number	Mine name	Operator	¼¼ section	¼ section	Section	Township N	Range	Meridian	County	Product	Rock type	Geologic unit	Qualifier	Resource thickness (feet)	Million cubic yards	Million tons	Acres	Percent depletion	Overburden thickness (feet)	Stripping ratio	Los Angeles abrasion	Degradation	Specific Gravity	Sand Equivalent	Stabilometer R value	Percent > 2½ inches	Percent ¼–2½ inches	Percent < ¼ inches	Percent < U.S. No. 200 sieve
14157002	18	12550	X-115	McReavy road pit	Ace Paving Company, Inc.	SE	SE	25	21	4	W	Mason	gravel	recessional outwash	Qgo	>	30	0.15	0.23	45		1	0.03	14	56	2.77	71	74	3	53	44	1.9
14150025	16	11871	X-89		Bill Gott Jr.	SW	NE	26	21	4	W	Mason	gravel	recessional outwash	Qgo		40			10		1	0.02	12.8	34	2.8	69		12	64	24	7
14150018	16	11735	X-61		WA Dept. of Fisheries	SW	SE	26	21	4	W	Mason	gravel	recessional outwash	Qgo	>	20			1		1	0.05	11.4	49	2.77	88					0.6
14140007	15					NE	SE	19	21	5	W	Mason	rock	pillow basalt	Ev_{cf}																	
14140009	15					SE	NW	20	21	5	W	Mason	rock	basalt	Ev_{cf}																	
14140006	15					NE	SE	26	21	5	W	Mason	gravel	till	Qgt		6					2	0.33									
14140005	15					SE	NW	36	21	5	W	Mason	gravel	recessional outwash	Qgo	>	9					2	0.22									
14130006	15					NE	SW	25	21	6	W	Mason	gravel	till	Qgt																	
14130005	15					NE	NE	26	21	6	W	Mason	gravel	till	Qgt																	
14110004	15		2200000-9.5	Army quarry	USFS, Olympic National Forest	NW	SW	6	21	7	W	Grays Harbor	rock	basalt	Ev_{cf}									23.3	17							
14110001	16		2200000-3.6	East Fork Humptulips pit	USFS, Olympic National Forest	SE	NE	7	21	8	W	Grays Harbor	gravel	alpine drift	Qap		30							20.9	29	2.77	22		30	42		3.9
14110003	15		2210000-5.1	Cougar quarry	USFS, Olympic National Forest	NW	NW	17	21	8	W	Grays Harbor	rock	basalt	Ev_{cf}									25.4	8	2.68	27					
14100007	15		2205000-2.5	Strip pit	USFS, Olympic National Forest	NW	SE	1	21	9	W	Grays Harbor	rock	basalt	Ev_{cf}									30.8	1	2.53	49					
14100006	15		2207000-0.7	Donkey Creek quarry	USFS, Olympic National Forest	NE	NE	2	21	9	W	Grays Harbor	rock	basalt	Ev_{cf}		50					3	0.06	21.6		2.69	63					
14100005	16		2203000-0.1	Donkey Creek pit	USFS, Olympic National Forest	NE	NW	9	21	9	W	Grays Harbor	gravel	alpine drift	Qap		8							17.2	43	2.75	75					
14100003	15					SE	SE	23	21	9	W	Grays Harbor	gravel	alpine outwash	$Qapw_1$																	
14100002	15					NW	NW	28	21	9	W	Grays Harbor	gravel	alpine outwash	$Qapw_1$																	
14100001	15					NW	NE	33	21	9	W	Grays Harbor	gravel	alpine outwash	$Qapw_1$																	
14090010	15		2220000-0.1; H-199		Rayonier, Inc.	NW	SW	2	21	10	W	Grays Harbor	gravel	alpine outwash	$Qapw_2$	>	12					1	0.08	15.2	55	2.7	38		7	48	45	2.3
14090003	15					NE	SW	17	21	10	W	Grays Harbor	gravel	alpine outwash	$Qapwo_2$																	
14090004	15					SE	SE	17	21	10	W	Grays Harbor	gravel	alpine outwash	$Qapwo_2$																	
13160014	18	12639		Huson pit (Mason Co. pit)	Fred Hill Materials, Inc.	NW	SW	1	22	3	W	Mason	gravel	advance outwash	Qga		35	0.6	0.9	80	0	2	0.06									
13160003	15					SW	SE	22	22	3	W	Mason	gravel	alluvium	Qa																	

IDENTIFIER						LOCATION							IDENTIFIED RESOURCES									QUALITY										
WADNR unique number	WADNR data type code	WADNR permit number	WSDOT/USFS site number	Mine name	Operator	¼¼ section	¼ section	Section	Township N	Range	Meridian	County	Product	Rock type	Geologic unit	Qualifier	Resource thickness (feet)	Million cubic yards	Million tons	Acres	Percent depletion	Overburden thickness (feet)	Stripping ratio	Los Angeles abrasion	Degradation	Specific Gravity	Sand Equivalent	Stabilometer R value	Percent > 2½ inches	Percent ¼–2½ inches	Percent < ¼ inches	Percent < U.S. No. 200 sieve
14160067	15		X-23	Union City		SW	SE	33	22	3	W	Mason	gravel	advance outwash	Qga														16	56	28	1.7
13150012	15					SW	SW	4	22	4	W	Mason	gravel	recessional outwash	Qgo																	
13150014	15			Mainline	WADNR, South Puget Sound Region	SW	SE	4	22	4	W	Mason	gravel	till	Qgt																	
13150009	15					NE	SW	9	22	4	W	Mason	gravel	recessional outwash	Qgo																	
13150001	15		X-94		City of Tacoma	NE	NE	21	22	4	W	Mason	gravel	till	Qgt									19.2	24	2.8	68	80				
13150004	15		X-10		Mason County	SE	SW	23	22	4	W	Mason	gravel	recessional outwash	Qgo	>	12					1	0.08	13.5	49	2.81	71		0	53	47	2.6
14150073	15					SW	SW	26	22	4	W	Mason	gravel	recessional outwash	Qgo																	
13140003	15					SW	SE	1	22	5	W	Mason	rock	basalt	Ev_{cf}																	
13140002	15		2354000-1.8	Brown Creek quarry	USFS, Olympic National Forest	NE	NW	3	22	5	W	Mason	rock	basalt	Ev_{cf}									22.6	37	2.81	74					
13140001	15					NE	SE	18	22	5	W	Mason	rock	basalt	Ev_{cf}																	
13130001	15		2360100-0.3	V-1043 quarry	USFS, Olympic National Forest	NE	NW	1	22	6	W	Mason	rock	basalt	Ev_{cp}									17.3		2.71	30					
13120004	15		2294130-0.6		Simpson Timber Company	NE	NW	18	22	7	W	Grays Harbor	rock	basalt	Ev_{cp}									20.5	17	2.79	62					
13120003	15		2294131-0.1	Corps of Engineers quarry		NE	NW	18	22	7	W	Grays Harbor	rock	basalt	Ev_{cp}									15.7	51	2.87	79					
14110002	15					SE	SE	35	22	7	W	Grays Harbor	gravel	alpine outwash	$Qapw_2$																	
13100004	15		2208040-0.7	Joe Creek north pit	USFS, Olympic National Forest	NW	SW	6	22	8	W	Grays Harbor	gravel	alpine drift	Qap									15.8	10	2.76	34					
13110002	15		2207150-0.1	Damper quarry	USFS, Olympic National Forest	SE	NW	8	22	8	W	Grays Harbor	rock	basalt	Ev_{cf}		20					1	0.05	16.7	7	2.72	32					
14110007	15		2200340-0.4	Harris Creek quarry	USFS, Olympic National Forest	NW	NW	26	22	8	W	Grays Harbor	rock	basalt	Ev_{cf}									23.6		2.68	48					
14110006	15		2281000-2.1	Flatbottom quarry	USFS, Olympic National Forest	NW	SW	28	22	8	W	Grays Harbor	rock	basalt	Ev_{cf}									25.8	2	2.63	44					
14110005	15		2207000-3.1	Hump quarry	USFS, Olympic National Forest	SW	SW	30	22	8	W	Grays Harbor	rock	basalt	Ev_{cf}									20.2		2.68	79					
13100012	16		2208030.0.1	Joe Creek #1 pit	USFS, Olympic National Forest	SW	NW	12	22	9	W	Grays Harbor	gravel	alpine drift	Qap	>	10							18.7	54	2.8	37					
13100001	16		2204031-0.1	Elk Creek pit	USFS, Olympic National Forest	SW	SE	23	22	9	W	Grays Harbor	gravel	alpine drift	Qap																	
14100004	15		2259040-0.6	Grouse Ridge quarry	USFS, Olympic National Forest	SW	SW	29	22	9	W	Grays Harbor	rock	basalt	Ev_{cf}									29.6		2.22	52					
13090008	15		2273050-0.1; H-96	Boulder Creek pit	USFS, Olympic National Forest	NE	NW	1	22	10	W	Grays Harbor	gravel	alpine outwash	$Qapw_2$		49					4	0.08	17	33	2.73	63		29	44	27	0.4

IDENTIFIER						LOCATION							IDENTIFIED RESOURCES									QUALITY										
WADNR unique number	WADNR data type code	WADNR permit number	WSDOT/USFS site number	Mine name	Operator	¼¼ section	¼ section	Section	Township N	Range	Meridian	County	Product	Rock type	Geologic unit	Qualifier	Resource thickness (feet)	Million cubic yards	Million tons	Acres	Percent depletion	Overburden thickness (feet)	Stripping ratio	Los Angeles abrasion	Degradation	Specific Gravity	Sand Equivalent	Stabilometer R value	Percent > 2½ inches	Percent ¼–2½ inches	Percent < ¼ inches	Percent < U.S. No. 200 sieve
13090001	15					NW	NE	21	22	10	W	Grays Harbor	gravel	alpine outwash	$Qapw_2$																	
13090002	15		2257087-0.2; H-258	Cook Creek pit	USFS, Olympic National Forest	SW	NW	22	22	10	W	Grays Harbor	gravel	alpine outwash	$Qapw_2$							2		15.4	54	2.66	24		7	55	38	2.8
14090009	15					SE	SE	30	22	10	W	Grays Harbor	gravel	alpine outwash	$Qapw_2$																	
14090008	15					SE	NE	31	22	10	W	Grays Harbor	gravel	alpine outwash	$Qapw_2$																	
14090007	16		2258000-0.2; H-40	Quinault Ridge pit	USFS, Olympic National Forest	SE	SE	35	22	10	W	Grays Harbor	gravel	alpine outwash	$Qapwo_2$												47	83	12	50	38	1.5
13160016	15		X-11			SW	NW	31	23	3	W	Mason	gravel	alpine outwash	Qgo		25					0	0.00	12.9		2.79	72	69	2	42	56	0.6
13150019	15		2400025-0.2	Cushman pit	USFS, Olympic National Forest	NW	SW	9	23	4	W	Mason	gravel	alpine outwash	Qgo									16.9	32	2.77	52					
13150018	15			Saddle	WADNR, South Puget Sound Region	NW	SE	14	23	4	W	Mason	rock	basalt	Ev_{cf}																	
13150017	15			Madonna ?	WADNR, South Puget Sound Region	NW	SE	24	23	4	W	Mason	rock	basalt	Ev_{cf}																	
13150015	15			BPA	WADNR, South Puget Sound Region	SW	SE	35	23	4	W	Mason	rock	basalt	Ev_{cf}																	
13140005	16		2400000-12.8	Lake Cushman quarry	USFS, Olympic National Forest	SE	NW	10	23	5	W	Mason	rock	basalt	Ev_{cp}																	
13140006	15		2400000-12.3	Cushman riprap quarry	USFS, Olympic National Forest	NW	SW	11	23	5	W	Mason	rock	basalt	Ev_{cp}									11.7	75	2.99						
13130002	15					NW	SE	23	23	6	W	Mason	rock	basalt	Ev_{cp}																	
13110001	15		2204090-0.4	Wineglass pit	USFS, Olympic National Forest	NE	NE	31	23	8	W	Grays Harbor	gravel	alpine drift	Qap									15	16	2.8	26		88	61		0.7
13100014	15		3970000-5.0	North Shore		NE	SE	7	23	9	W	Grays Harbor	rock	basalt	Ev_b																	
13100013	15		2204072-0.2	Chester Creek quarry	USFS, Olympic National Forest	SW	SW	36	23	9	W	Grays Harbor	rock	basalt	Ev_{cf}							2		17.5	74	2.62						
13090014	15		HWY101-128.6; H-128		WSDOT	NE	SE	22	23	10	W	Grays Harbor	gravel	alpine drift	Qad									18.1	50	2.64	47		37	37	26	9.7
13090016	15		H-182		Rayonier, Inc.	NW	SW	23	23	10	W	Grays Harbor	gravel	alpine drift	Qad									18.8	37	2.65	26	84	13	53	34	3.8
13090017	15		H-41	North Shore pit	Polson Logging Company	SW	NW	23	23	10	W	Grays Harbor	gravel	alpine drift	Qad									19.8					5	57	38	1.5
13090011	15		H-90	Amanda Park pit		SE	NW	26	23	10	W	Grays Harbor	gravel	alpine drift	Qad	>	10					4	0.40	19					17	59	24	1.2

Appendix 3. Outcrop database

This database contains information about outcrops on which strength and durability testing was performed but mining did not take place, as well as other outcrops identified by the authors. The locations of the outcrops in this database are shown on Plate 1. The information contained herein is available digitally as part of the geographic information system (GIS) files for the Shelton 1:100,000-scale quadrangle. The columns that are not self-explanatory are defined as follows:

WADNR unique number – The Washington Department of Natural Resources (WADNR) unique number used by the geographic information system (GIS) to relate a feature on Plate 1 to a row in the database. The first four digits of the number identify the 7.5-minute quadrangle map in which the outcrop is located. The last four digits are a unique number in each 7.5-minute quadrangle.

WADNR data type code – The code number that indicates the type and size of the mine, as follows: 13, strength and durability outcrop test location (point); 14, field investigation site (point); 17, measured stratigraphic section (line).

WADNR permit number – The five-digit number on WADNR form SM-2, *Application for Surface Mining Reclamation Permit* (for a permitted mine).

WSDOT site number – A number assigned by the Washington State Department of Transportation (WSDOT) that links results of strength and durability testing or other data to a particular outcrop. The number consists of a letter that identifies the county the site is in, followed by a sequentially assigned number.

¼¼ section, ¼ section, Section, Township, Range, Meridian – Legal description of the mine with reference to the Government Land Office grid. Values are relative to the Willamette principal meridian and base line. Townships, ranges, and sections are shown on Plate 1.

Product – The material of interest at the outcrop location: rock, sand, or gravel.

Rock type – The type of rock at the outcrop location, if the outcrop is in a bedrock unit.

Geologic unit – The label that identifies a particular unit on a geologic map. This field indicates the unit in which the outcrop is located. See Appendix 5 for some geologic unit descriptions; descriptions of geologic units not in Appendix 5 can be found in Washington Division of Geology and Earth Resources (2001) and Dragovich and others (2002).

Qualifier – A symbol that applies only to the deepest resource thickness reported (see following columns) and indicates either that the thickness is exact because the whole section could be measured (blank) or that the actual resource thickness is greater than the thickness reported because the bottom of the resource was not identified (>).

1st resource thickness (feet), 1st interbed thickness (feet), 2nd resource thickness (feet) – These fields refer to the bedding identified in the outcrop by the authors, starting at the top. 'Resource thickness' refers to the thickness of a likely aggregate resource, whereas 'interbeds' are non-commercial materials such as silt and clay.

Dip, Strike – Angle and compass direction, respectively, that indicate orientation of sedimentary bedding in a bedrock resource; if horizontal or no data, fields are blank.

Induration – The relative quality of a rock as determined in the field with a one-pound ball peen hammer. Estimates range from rebound (highest quality) through fracture, pit, and dent (lowest quality). If there are no data, field is blank.

Overburden thickness (feet) – Thickness, in feet, of soil, clay, or non-commercial aggregate that must be removed in order to reach the aggregate resource.

Stripping ratio – The overburden thickness divided by the resource thickness. A value of less than 0.33 (ratio of less than 1:3) is preferred.

Los Angeles Abrasion, Degradation, Specific Gravity, Sand Equivalent, and Stabilometer R Value tests – Results of laboratory tests, conducted mainly by the WSDOT, that reflect the quality of the deposit. See the glossary (Appendix 1) for explanation of tests.

Lab (L) or visual (V) – This code indicates whether grain-size analysis is from a laboratory test (L) or estimated visually in the field (V).

Percent >2½ inches, Percent ¼–2½ inches, Percent <¼ inch, Percent <U.S. No. 200 sieve – Results of laboratory grain-size analysis of samples. Values are given in weight percent. The first three fields divide the whole sample, and the fourth field refers to the amount of silt and clay in the entire sample.

IDENTIFIER				LOCATION							MATERIAL									QUALITY											
WADNR unique number	WADNR data type code	WSDOT site number	Site name / description	¼¼ section	¼ section	section	Township N	Range	Meridian	County	Product	Rock type	Geologic unit	Qualifier	1st resource thickness (feet)	1st interbed thickness (feet)	2nd resource thickness (feet)	Dip	Strike	Induration	Overburden thickness (feet)	Stripping ratio	Los Angeles abrasion	Degradation	Specific gravity	Sand equivalent	Stabilometer R value	Lab (L) or visual (V)	Percent > 2½ inches	Percent ¼–2½ inches	Percent < ¼ inch	Percent < U.S. No. 200 sieve
16160017	13	J-52	Otis Mitchell	NW	NE	2	18	3	W	Thurston	gravel		Qga								1							L	0	78	22	1
16160061	13	J-89		NE	NE	2	18	3	W	Thurston	gravel		Qga	>	34						2	0.06	12.6		2.69		76					
16140043	13	J-213		S	NW	3	18	3	W	Thurston	gravel		Qgo													73	72					
16130101	13	J-146		NW	SE	11	18	3	W	Thurston	rock	basalt	Ev_{cf}	>	15						4	0.27	15.2	3	2.98							
16130015	13	J-114	City of Olympia	S	SW	12	18	3	W	Thurston	rock	basalt	Ev_{cf}																			
16130025	13	J-150		N	SE	14	18	3	W	Thurston	gravel		Qgt		15						2	0.13				80	72	L	0	22	78	1
16120013	13	J-99		SE	SW	16	18	3	W	Thurston	gravel		Qgo	>	5						2	0.40				62	70	L	0	48	52	9
15160008	13	J-103				19	18	3	W	Thurston	gravel		Qgo																			
15160137	13	J-8	Thurston County	SE	SW	10	18	4	W	Thurston	gravel		Qgo																			
15150064	13	J-77	Weyerhaeuser Timber Co		SE	11	18	4	W	Thurston	gravel		Qgo		20						2	0.10				59	81	L	0	55	45	3.6
15150038	13	J-101	State	W	SW	11	18	4	W	Thurston	gravel		Qgo	>	16						3	0.19	11.6		2.82	63	80	L	0	52	48	5
15150037	13	H-5	Grays Harbor County	SW	NW	17	18	4	W	Grays Harbor	gravel		Qgo																			
15160074	13	H-155		NE	NW	17	18	4	W	Grays Harbor	gravel		Qgo	>	24						0	0.00				32	82	L	7	56	37	5.9
15160075	13	H-162		SE	NW	18	18	4	W	Grays Harbor	gravel		Qgo	>	6						2	0.33				94	77	L	8	43	49	0.5
15090048	13	H-89	Grays Harbor County & WA State	NE	SE	2	18	5	W	Grays Harbor	gravel		Qgo	>	10						2	0.20	14.2					L	2	56	42	1.3
15090012	13	H-148		NE	NW	15	18	5	W	Grays Harbor	gravel		Qgo																			
15090030	13	H-8		SE	SW	20	18	5	W	Grays Harbor	gravel		Mm_{2m}	>	24						2	0.08				68		L	0	51	49	4
15090031	13	H-9			SW	20	18	5	W	Grays Harbor	gravel		Qgo															L	9	62	29	0.1
15090008	13	H-136	WSDOT	NW	NW	24	18	5	W	Grays Harbor	gravel		Qa	>	10						2	0.20	10.4		2.78	51		L	0	67	33	1
14150070	13	H-7		E	SW	30	18	5	W	Grays Harbor	gravel		Qa		15						0	0.00	10.9	70	2.8	96	76	L	0	62	38	0.3
14150063	13	H-212	Landberg Construction	NW	SW	25	18	6	W	Grays Harbor	sand		Qa	>	3						0	0.00				36		L	0	2	98	13
14150058	13	H-185		NW	SE	27	18	6	W	Grays Harbor	gravel		Qgp																			
13140004	13	H-163		NW	SE	27	18	6	W	Grays Harbor	sand		Qgp		20						1	0.05				40		L	0	0	100	22
14140019	13	H-173		NE	SW	32	18	6	W	Grays Harbor	gravel		Qgo																			
13120002	13	H-61		NW	SW	34	18	6	W	Grays Harbor	gravel		Qgo		12						1	0.08						L	1	62	37	
13100010	13	H-165		NW	NE	36	18	6	W	Grays Harbor	gravel		Qgo	>	24						0	0.00	14	73	2.77	58	74	L	4	58	38	1.1
13100011	13	H-54	Cooper & Holman	SW	NE	36	18	6	W	Grays Harbor	gravel		Qgo	>	15						0	0.00										
14100008	13	H-169		NW	NW	36	18	6	W	Grays Harbor	gravel		Qgo	>	24						0	0.00				30	78	L	2	58	40	4.4
13100008	13	H-4		SW	NW	36	18	6	W	Grays Harbor	gravel		Qa								0	0.00	13.8	61	2.95			L	2	74	24	0
13090013	13	H-296		NE	SE	1	18	7	W	Grays Harbor	gravel		Qgo										16.2	56	2.73	86	70	L	9	63	28	3.7
13090015	13	H-310	Studer pit, Northwest Rock Products		NW	12	18	7	W	Grays Harbor	gravel		Qgo										14	59	2.85		76					
16160021	13	H-267		SE	NW	14	18	7	W	Grays Harbor	gravel		Qgo	>	10						2	0.20				42	77	L	1	61	38	3.6
16160020	13	H-137		SE	SE	23	18	7	W	Grays Harbor	gravel		Qa	>	3						0	0.00	11.1		2.82	97		L	16	43	41	1.2
16160014	13	H-247	Grays Harbor County	SW	SW	24	18	7	W	Grays Harbor	gravel		Qgo										13.9	41	2.83	36	77	L	16	50	34	8
16160015	13	H-256	Charles Wincewicz	SW	NE	5	18	8	W	Grays Harbor	gravel		Qa													85	79	L	0	63	37	1.1
16160011	13	H-261		NE	NE	8	18	8	W	Grays Harbor	gravel		Qa	>	9						0	0.00	17	10	2.78	80	68	L	0	57	43	2
16160009	13	H-141		NW	NW	4	18	9	W	Grays Harbor	gravel		Qa	>	3						0	0.00				72	77	L	5	65	30	0.6
16150027	13	H-34	WSDOT	NW	SE	9	18	10	W	Grays Harbor	gravel		Qa	>	12						3	0.25					63	L	0	66	34	1.7

IDENTIFIER				LOCATION							MATERIAL									QUALITY												
WADNR unique number	WADNR data type code	WSDOT site number	Site name / description	¼¼ section	¼ section	section	Township N	Range	Meridian	County	Product	Rock type	Geologic unit	Qualifier	1st resource thickness (feet)	1st interbed thickness (feet)	2nd resource thickness (feet)	Dip	Strike	Induration	Overburden thickness (feet)	Stripping ratio	Los Angeles abrasion	Degradation	Specific gravity	Sand equivalent	Stabilometer R value	Lab (L) or visual (V)	Percent > 2½ inches	Percent ¼–2½ inches	Percent < ¼ inch	Percent < U.S. No. 200 sieve
16150029	13	X-66	WSDOT	SW	NW	17	19	3	W	Mason	gravel		Qgo	>	20						1	0.05	10.4		2.73	100		L	3	46	51	0.5
16150030	13	X-33		NW	SE	18	19	3	W	Mason	gravel		Qgo		10						1	0.10						L	0	30	70	1
16150013	13	X-75	WSDOT	SE	SE	18	19	3	W	Mason	gravel		Qgo	>	50						2	0.04	14.7	60	2.72	87	65	L	0	37	63	
16150014	17		Kamilche Delta, Highway 101 road cut	SE	SE	18	19	3	W	Mason	gravel		Qgo		110						2	0.02						V	2	63	35	
16150010	13	X-76	Simpson Timber Company	N	NW	19	19	3	W	Mason	rock	basalt	Ev_{cf}	>	15						3	0.20	70.5	18	2.71							
16140060	13	J-51	Reitdorf	N	SW	25	19	3	W	Mason	gravel		Qgo		15						3	0.20						L	2	46	52	1
16140023	13	X-81		SW	SE	1	19	4	W	Mason	rock	basalt	Ev_{cf}	>	40						5	0.12	12.1	24	2.92							
16140020	13	X-65	Simpson Timber Company	NW	SE	24	19	4	W	Mason	gravel		Qgo		30						2	0.07				82		L	0	39	61	1.2
16140032	13	X-17		SE	SE	27	19	4	W	Mason	gravel		Qgo	>	9						2	0.22						L	44	30	26	2.3
16140008	13	X-44		SE	SW	31	19	4	W	Mason	gravel		Qgo	>	12						2	0.17	10.8					L	12	52	36	1
16130056	13	H-111		N	SE	28	19	8	W	Grays Harbor	gravel		Qa													67	78	L	0	55	45	3.6
16130055	13	H-255		SW	SW	33	19	8	W	Grays Harbor	gravel		Qa								0	0.00				73	76	L	0	63	37	1
16130031	13	H-216		SW	SE	14	19	9	W	Grays Harbor	gravel		Qa	>	3						0	0.00				32	75	L	0	66	34	16
16130034	13	H-213		NE	NE	22	19	9	W	Grays Harbor	gravel		Qa	>	3						0	0.00	18.1	33	2.9	62	79	L	0	69	31	4
16130035	13	H-112		NE	NW	27	19	9	W	Grays Harbor	gravel		Qa	>	3						0	0.00				67	77	L	0	72	28	1.7
16130037	13	H-215		E	SE	27	19	9	W	Grays Harbor	gravel		Qa										19.8	34	2.87	40	77	L	0	74	26	8
16130065	13	H-138		SE	SE	32	19	9	W	Grays Harbor	gravel		Qa	>	20						3	0.15				14	10	L	1	69	30	1.8
16120007	14		Front of Manke Shelton delta	SW	SW	3	20	3	W	Mason	gravel		Qgo	>	160						2	0.01						V	0	35	65	
16120004	13	X-45	Mason County	SW	SW	3	20	3	W	Mason	gravel		Qgo		240						1	0.00	9.5		2.78	97		L	0	49	51	0.5
16120005	13	X-43	Guy Norris	SE	SW	4	20	3	W	Mason	gravel		Qgo	>	20						2	0.10	10.2					L	14	79	7	0.1
16110013	13	X-46		SW	SE	4	20	3	W	Mason	gravel		Qgo		15						1	0.07	13					L	0	80	20	1.2
16110012	13	X-90		SE	NW	5	20	3	W	Mason	gravel		Qgo		20						2	0.10	11.8	58	2.72	72		L	0	75	25	5
16100001	13	X-109	Manke Lumber Company	NE	NE	9	20	3	W	Mason	gravel		Qgo	>	15								17.8	47	2.77	35		L	6	62	32	3.5
16090006	13	X-84		NE	NW	26	20	3	W	Mason	gravel		Qgt													73	71	L	0	26	74	3
15160011	13	X-74		SE	SE	27	20	3	W	Mason	gravel		Qgo		10						2	0.20				72	75	L	0	36	64	6.4
15160004	13	X-117		NW	SE	28	20	3	W	Mason	gravel		Qgo	>	7						1	0.14				86	72	L	0	35	65	2.3
15160141	13	X-97		SE	NE	30	20	3	W	Mason	gravel		Qgo	>	15						2	0.13				40	78	L	0	37	63	6
15160002	13	X-39		SE	NW	2	20	4	W	Mason	gravel		Qgo	>	6						2	0.33	11.2					L	6	55	39	2
16160043	13	X-37		NE	SE	3	20	4	W	Mason	gravel		Qgo		6						1	0.17	11.5					L	7	54	39	1
15160020	13	X-83		SE	NW	3	20	4	W	Mason	sand		Qgo													69						
16160045	17		Dayton Trails	SE	NE	8	20	4	W	Mason	gravel		Qgo	>	64						3	0.05										
16150044	13	X-4		SW	SE	12	20	4	W	Mason	gravel		Qgo															L	0	41	59	
16150045	13	X-116	Simpson Timber Company		NW	17	20	4	W	Mason	gravel		Qgo								2		16.9	48	2.79	65	75	L	8	56	36	1.1
16110016	17		Delta south of Miles, lower surface height	NW	SW	24	20	4	W	Mason	gravel		Qgo		76						3	0.04										
16110014	17		Delta south of Miles, lower to upper surface height	SW	SW	24	20	4	W	Mason	gravel		Qgo		32						3	0.09										
15100003	17		J. D. Shotwell pit area	NE	NE	24	20	4	W	Mason	gravel		Qgo		140						3	0.02										

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16100008	17		J. D. Shotwell pit area	NE	NE	24	20	4	W	Mason	gravel		Qgo		131						3	0.02										
16100005	13	X-85		SW	SW	24	20	4	W	Mason	gravel		Qgo		9						1	0.11				82	76	L	5	48	47	3
16100006	13	X-99		NW	NW	24	20	4	W	Mason	gravel		Qgo										16.6	73	2.74	54		L	4	41	55	5
16100003	13	X-3	City of Shelton	NW	NE	24	20	4	W	Mason	gravel		Qgo		80						0	0.00				85	76	L	0	43	57	1.7
15160135	13	H-263		SE	SE	3	20	10	W	Grays Harbor	gravel		Qa								4					61		L	0	50	50	3.4
15160127	13	H-37		SW	SW	7	20	10	W	Grays Harbor	gravel		Qa															L	1	47	52	0.3
15160128	13	H-36			SE	7	20	10	W	Grays Harbor	gravel		Qa	>	6								23.7	23	2.84	64	77	L	16	60	24	1.2
14160012	13	H-289		NW	SE	7	20	10	W	Grays Harbor	gravel		Qapo		80						2	0.02	17.4	31	2.79	73	80	L	2	60	38	2.3
15160129	13	H-298		NE	NE	8	20	10	W	Grays Harbor	gravel		Qa	>	4						4	1.00				76	74	L	0	54	46	1.6
15160073	13	H-97		NW	SW	8	20	10	W	Grays Harbor	gravel		Qapo	>	12						5	0.42						L	2	58	40	2
15160066	13	H-38		SE	SE	8	20	10	W	Grays Harbor	gravel		Qa										15	40		67		L	7	45	48	1.4
15160069	13	H-299		SE	SW	8	20	10	W	Grays Harbor	gravel		Qapo		25						1	0.04				75		L	0	62	38	1.9
15160068	13	H-284	Darell Potter	S	SE	8	20	10	W	Grays Harbor	gravel		Qa													54	83					
14150007	13	H-286		NE	NE	9	20	10	W	Grays Harbor	gravel		Qa								0	0.00				55	78	L	0	67	33	3.2
14150004	13	H-72		SE	NE	9	20	10	W	Grays Harbor	gravel		Qa		15						3	0.20						L	29	38	33	
15150073	13	H-95		SW	NE	9	20	10	W	Grays Harbor	rock	basalt	Ev_{cf}	>	50						5	0.10										
15150085	13	H-35		SW	NE	9	20	10	W	Grays Harbor	gravel		Qa	>	12						3	0.25						L	9	53	38	
15150055	13	H-71		NW	NW	9	20	10	W	Grays Harbor	gravel		Qa	>	10						3	0.30						L	5	46	49	6.9
15150042	13	H-246		SW	NE	17	20	10	W	Grays Harbor	gravel		$Qapw_1$								5		18.9	8	2.75	68	77	L	8	57	35	2
15160076	13	H-264	Oren Turner	NE	NE	17	20	10	W	Grays Harbor	gravel		Qa													92	72	L	1	53	46	0.4
15150047	13	H-293		SE	NW	17	20	10	W	Grays Harbor	gravel		Qa	>	7						3	0.43	15.5	44	2.82	61	81	L	6	67	27	2.5
15090058	13	H-32	Polson Logging Company	SW	NW	28	20	10	W	Grays Harbor	gravel		$Qapwo_2$															L	9	60	31	
15090036	13	H-154		SE	SE	12	20	11	W	Grays Harbor	gravel		Qa	>	3						2	0.67				91	76	L	3	75	22	0.7
15090032	13	H-153		NE	SE	12	20	11	W	Grays Harbor	gravel		Qa	>	3						0	0.00				93	76	L	0	71	29	0.6
15090035	13	H-270		SW	SW	25	20	11	W	Grays Harbor	gravel		Qa								3					80		L	3	45	52	2
15090049	13	X-22		SE	SE	6	21	3	W	Mason	gravel		Qgt													58		L	0	59	41	1
15090045	13	X-93		SE	NE	34	21	3	W	Mason	sand		Qgt	>	8						2	0.25				69		L	0	0	100	15
15090042	13	X-92		NW	SE	36	21	3	W	Mason	gravel		Qa		30						2	0.07				93	73	L	0	28	72	1
15090041	17		Reichert Ranch road cut		SE	5	21	4	W	Mason	gravel		Qga	>	184						10	0.05										
15090056	13	X-58		SW	NW	13	21	4	W	Mason	gravel		Qga		30						3	0.10	12.3		2.79	27		L	5	53	42	4.2
15090054	17		Webb Hill road cut	NW	NE	13	21	4	W	Mason	gravel		Qgo		77						20	0.26						V	5	35	40	
15090052	13	X-40		NE	SW	15	21	4	W	Mason	gravel		Qa								0		14.2					L	5	55	40	0.2
15090053	13	X-5	Old Tom pit	NW	NW	15	21	4	W	Mason	gravel		Qa	>	30						1	0.03	15.7	38	2.81	60		L	0	53	47	2.5
15090050	13	X-95	Mason County	SW	NE	22	21	4	W	Mason	gravel		Qgo	>	100						2	0.02				63	78	L	0	49	51	5
15090025	13	X-9	Pritchard estate	NW	NW	22	21	4	W	Mason	gravel		$Qapwo_s$															L	29	60	26	
15090026	13	X-56		NE	SW	26	21	4	W	Mason	gravel		Qgo	>	15						2	0.13	11.3		2.74	76	80	L	2	51	47	1.4
15090027	13	X-107			NW	26	21	4	W	Mason	gravel		Qgo													87	77	L	6	60	34	1
14160065	13	X-59		NE	NE	27	21	4	W	Mason	gravel		Qgo	>	16						2	0.12	11.6		2.76	46	81	L	15	50	35	2.5
14160039	13	X-16		S	SE	35	21	4	W	Mason	gravel		Qgo															L	16	57	27	

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14160029	13	H-210	Rayonier, Inc.	NE	NW	2	21	10	W	Grays Harbor	gravel		$Qapw_2$										16.3	41	2.68	25		L	0	41	59	6
14150060	13	H-39		NE	NE	2	21	10	W	Grays Harbor	gravel		$Qapw_2$																			
14150057	13	H-55	Polson Logging Company	NE	SW	35	21	10	W	Grays Harbor	gravel		Qa		10						0	0.00						L	15	64	21	1.9
13090010	13	X-24			SE	35	22	3	W	Mason	gravel		Qgt															L	4	69	27	1.4
13100005	13	X-54			S	22	22	4	W	Mason	gravel		Qgt	>	5						0	0.00	8		2.68	74		L	1	49	50	1.5
14150036	13		Brown Creek Flat quarry: 2353000-1.4 USFS	SE	NW	4	22	5	W	Mason	rock	basalt	Ev_{cf}										17.5	17	2.75	58						
14150034	13	X-102	Simpson Timber Company			35	22	5	W	Mason	rock	basalt	Ev_{cf}																			
14150021	13		Wynoochee Fish Trap pit: 2200000-5.0 USFS	SE	SW	19	22	7	W	Grays Harbor	gravel		Qapo		17						3	0.18										
13090021	13	H-62		NW	NW	7	22	9	W	Grays Harbor	gravel		$Qapw_2$		7						4	0.57	17.1					L	25	34	41	5.7
14150017	13		Joe Creek #2 pit: 2208032-0.1 USFS	NW	SE	12	22	9	W	Grays Harbor	gravel		Qap																			
13090018	13	H-239	USFS	NW	SE	12	22	9	W	Grays Harbor	gravel		Qap										17.9	3		34		L	34	39	27	5
14150016	13		Ridgetop quarry (prospect): 2280000-2.8 USFS	NW	NW	15	22	9	W	Grays Harbor	rock	basalt	Ev_{cf}										30.2		2.27	57						
14150015	13		quarry (prospect): 2259043-0.0 USFS	SW	NE	31	22	9	W	Grays Harbor	rock	basalt	Ev_{cf}																			
13090019	13	H-60		NE	SE	12	22	10	W	Grays Harbor	gravel		$Qapw_2$		10						3	0.30						L	0	40	60	10.8
14090005	13	X-62	WSDOT	SW	SE	9	23	3	W	Mason	gravel		Qls		25						1	0.04				61	78	L	1	40	59	3.5
14090006	13	X-47		NW	SE	9	23	3	W	Mason	gravel		Qgo	>	100						1	0.01	12.6			68	79	L	7	45	48	2.4
14090002	13	X-20	Lilliwaup		SW	19	23	3	W	Mason	gravel		Qgo															L	11	83	6	0.1
13150002	13	X-52		SW	NE	30	23	3	W	Mason	gravel		Qgo	>	30						1	0.03						L	13	51	36	3
14160071	13	X-51		SW	SW	30	23	3	W	Mason	gravel		Qga	>	20						1	0.05						L	9	54	37	0.7
13090007	13	H-257		NE	SE	9	23	9	W	Grays Harbor	gravel		Qad														74					
13160025	13	H-58		SW	NE	31	23	9	W	Grays Harbor	rock	basalt	Ev_b		75						5	0.07										
13090004	13	H-56		SW	SW	31	23	9	W	Grays Harbor	gravel		Qad	>	15						4	0.27										
13100003	13	H-57		SE	SW	31	23	9	W	Grays Harbor	gravel		Qad		20						2	0.10						L	25	43	32	
13160027	13	H-42		SE	SE	15	23	10	W	Grays Harbor	gravel		Qad															L	32	43	25	
13160022	13	H-43	Herron & Ewart	NE	SE	17	23	10	W	Grays Harbor	gravel		$Qapw_2$																			
13160019	13	H-91	Milburn Creek pit	SE	SE	17	23	10	W	Grays Harbor	gravel		$Qapw_2$	>	15						4	0.27	16.9					L	2	62	36	3.6
13160017	13	H-175	(2191090-0.5 USFS) Bureau of Indian Affairs	NE	SE	20	23	10	W	Grays Harbor	rock	basalt	Ev_b	>	100						3	0.03										
13100006	13	H-305		SW	NE	22	23	10	W	Grays Harbor	gravel		Qad		20						2	0.10	18	37	2.64		73					

Appendix 4. Well database

This database contains information about all the water wells and geotechnical boreholes shown on Plate 1. The information contained herein is available digitally as part of the geographic information system (GIS) files for the Shelton 1:100,000 quadrangle. The columns that are not self-explanatory are defined as follows:

WADNR unique number – The Washington Department of Natural Resources (WADNR) unique number is used by the geographic information system (GIS) to relate a feature on Plate 1 to a row in the database. The first four digits of the number identify the 7.5-minute quadrangle map in which the well is located. The last four digits are a unique number for the site on each 7.5-minute quadrangle.

WADNR data type code – The code number that indicates the type of drill hole, as follows: 11, water well (point); 12, geotechnical or other borehole (point).

WADOE well number – One of a variety of numbers found on the Washington Department of Ecology (WADOE) water-well report forms. The possible types include start card, application, or permit numbers.

Data verified? – An indication of the quality of data. 'Y' indicates that the drill log is from a geotechnical borehole or has been verified by a consulting firm; otherwise, the field is blank.

Well location – The street address of the well or the nearest geographical feature. Washington State Department of Transportation boreholes are referenced to the bridge, intersection, or street location where the borehole was drilled.

¼¼ section, ¼ section, Section, Township, Range, Meridian – Legal description of the well location with reference to the Government Land Office grid. Values are relative to the Willamette principal meridian and base line. Townships, ranges, and sections are shown on Plate 1.

Geologic unit – The label that identifies a particular unit on a geologic map. This field indicates the unit in which the well is located on the surface. See Appendix 5 for some geologic unit descriptions; descriptions of geologic units not in Appendix 5 can be found in Washington Division of Geology and Earth Resources (2001) and Dragovich and others (2002).

Qualifier – A symbol that applies only to the deepest sand and gravel thickness reported (see following columns) and indicates that either the thickness is exact because the whole layer is penetrated by the well (blank) or that the actual sand and gravel thickness is greater than the thickness reported because the bottom of the deposit was not identified in the well log (>).

Overburden thickness (feet) – The thickness, in feet, of soil, clay, or non-commercial aggregate that must be removed in order to reach the aggregate resource.

1st gravel thickness (feet), 1st interbed thickness (feet), 2nd gravel thickness (feet), 2nd interbed thickness (feet), 3rd gravel thickness (feet) – These fields refer to the interpretation of the well log by the authors, starting at the ground surface. 'Gravel thickness' refers to the thickness of a likely aggregate resource, whereas 'interbeds' are non-commercial materials such as silt and clay.

Depth to water-bearing zone (feet) – Depth, in feet, to top of the first water-bearing unit encountered during drilling.

Bedrock penetrated? – Y (yes) or N (no), indicating whether the well was drilled to the depth of bedrock.

Reference – The source of data for the well log, if other than the Washington Department of Ecology water-well log archives. See the References Cited section for full citations.

IDENTIFIER						LOCATION									WELL LOG DATA										
WADNR unique number	WADNR data type code	WADOE well number	Data verified?	Well name	Original well owner	Well location	¼¼ section	¼ section	Section	Township (N)	Range	Meridian	County	Geologic unit	Qualifier	Overburden thickness (feet)	1st resource thickness (feet)	1st interbed thickness (feet)	2nd resource thickness (feet)	2nd interbed thickness (feet)	3rd resource thickness (feet)	Depth to top of water zone (feet)	Well total depth (feet)	Bedrock penetrated?	Reference
16160018	12		Y		WADOT	SR 101 Schneider Creek bridge	NE	NW	2	18	3	W	Thurston	Qa		0	0							N	WADOT files
16160058	11	63074	N		Buzz Tribble	6931 Munson Dr	SW	SW	23	18	3	W	Thurston	Qgo	>	6	21	33	2			60	62	N	
16160059	11		N		William Olsen	6629 Cedar Flats Rd SW	SW	SE	23	18	3	W	Thurston	Qgo	>	0	22	39	9	12	6	82	88	N	
16160060	11	W072799	N		Rick Swanson	7019 Cedar Flats Rd	NW	SW	23	18	3	W	Thurston	Qgo		0	13	63	28	1	5	105	110	N	
16160056	11	W075523	N		Moris Pain	552 Cedar Flat Rd	SW	SE	24	18	3	W	Thurston	Qgo	>	22	13	125	20			160	180	N	
16160057	11	W092276	N		Richard Brunner	Harmony Lane	SE	SW	24	18	3	W	Thurston	Qgt		32	30					32	62	N	
16160054	11		N		Ben Thomas	5601 40th Ave SW	NE	NW	36	18	3	W	Thurston	Qgo	>	78	1					78	79	N	
16160055	11	12865	N		Patty Fauver	5724 40th SW	NE	NW	36	18	3	W	Thurston	Qgo			0					32	39	N	
16150033	11		N		Bob Long	End of Pleasant Glade	SE	SE	4	18	4	W	Thurston	Ev_{cf}			0					95	107	Y	
16150024	11		N		William Willis		NE	SW	9	18	4	W	Thurston	Qgo		3	77					40	85	N	
16150028	12	16756	Y		Elma Plywood		SE	SE	10	18	4	W	Thurston	Qgo	>	1	25	3	8			29	37	N	
16150022	11	W072798	N		Steven Johnson	12236 Summit Lake Rd	SW	NW	13	18	4	W	Thurston	Qgo			0						39	N	
16150020	11	W069045	N		Bill Jones		NW	NE	14	18	4	W	Thurston	Qgo			0					170	177	N	
16150015	12		Y		WADOT	SR 8, mile post 7	NW	NE	17	18	4	W	Grays Harbor	Qgo	>	1	40						41	N	WADOT files
16150011	11		N		Tom Scouller		SE	NE	18	18	4	W	Grays Harbor	Qgo		35	1					35	39	Y	
16150012	11		N		Pete Karson		NE	NE	18	18	4	W	Thurston	Qgo		19	13					19	46	Y	
16140063	11	W067021	N		John Graham	14 E Elma-Hicklin Rd	SW	NW	1	18	5	W	Grays Harbor	Qgo		1	5	23	1			29	43	N	
16140055	11		N		Smith Construction	52 Larson Rd	SE	SW	2	18	5	W	Grays Harbor	Qgo	>	54	8					54	62	N	
16140056	11		N		John Cornell		SE	SW	2	18	5	W	Grays Harbor	Qgo		4	41						56	N	
16140057	11	201673	N		Dan Comer	47 Lynch Rd	SW	SE	2	18	5	W	Grays Harbor	Qgo	>	0	23	13	7			36	43	N	
16140058	11	203586	N		Troy Colley	46 Lynch Rd	SW	SE	2	18	5	W	Grays Harbor	Qgo	>	0	22	10	11			32	43	N	
16140061	11		N		Clarence York		SE	SE	2	18	5	W	Grays Harbor	Qgo		0	55	10	17			65	104	Y	
16140062	11		N		Nick Basler		SE	NE	2	18	5	W	Grays Harbor	Qgo	>	50	9					50	60	N	
16140067	11		N		Art Roberts		NE	NE	2	18	5	W	Grays Harbor	Qgo	>	4	46						50	N	
16140053	11	W57971	N		Steve Pool	Power Creek	NW	NE	5	18	5	W	Grays Harbor	Qgo			0					35	140	Y	
16140051	11		N			444 HWY 12	SE	NE	6	18	5	W	Grays Harbor	Qgo		35	16						62	Y	
16140052	11	W067211	N		York	Power Creek	NE	SE	6	18	5	W	Grays Harbor	Qgo			0						106	Y	
16140047	11		N		Rick Burwash	93 Cloquallum Rd	SW	SE	8	18	5	W	Grays Harbor	Qgo			0					44	105	Y	
16140049	11		N		John Cornwell	526 N Sylvia St	SE	SW	10	18	5	W	Grays Harbor	Qgo	>	19	27						46	N	
16140080	11		N		M. Fuller		SE	NW	10	18	5	W	Grays Harbor	Qgo	>	0	7	10	24			17	41	N	
16140081	11		N		V. Carpenter		NW	SE	10	18	5	W	Grays Harbor	Qgo	>	38	5						43	N	
16140082	11	W067211	N		Mike Smith	70 E Stillson Rd	SW	SW	10	18	5	W	Grays Harbor	Qgo	>	22	13						35	N	
16140083	11	W097840	N		Dennis Pierce	385 Elma Hicklin Rd	SW	SE	10	18	5	W	Grays Harbor	Qgo	>	36	5					36	41	N	
16140084	11		N		Rick Baum		NE	NW	10	18	5	W	Grays Harbor	Qgo	>	34	5					36	39	N	
16140059	11	58555	N		Wilson Construction	Larson Rd	NW	NE	11	18	5	W	Grays Harbor	Qgo	>	37	13					40	50	N	
16140077	11		N		Simpson Timber Co.		SW	NE	11	18	5	W	Grays Harbor	Qgo		14	9	2	43			43	72	N	
16140078	11		N		Town of McCleary		NE	NE	11	18	5	W	Grays Harbor	Qgo	>	24	12	3	28	3	12	39	82	N	
16140079	11		N		Port Blakely Tree Farm	Larson Rd	NE	NW	11	18	5	W	Grays Harbor	Qgo		45	40						162	Y	

IDENTIFIER						LOCATION									WELL LOG DATA										
WADNR unique number	WADNR data type code	WADOE well number	Data verified?	Well name	Original well owner	Well location	¼¼ section	¼ section	Section	Township (N)	Range	Meridian	County	Geologic unit	Qualifier	Overburden thickness (feet)	1st resource thickness (feet)	1st interbed thickness (feet)	2nd resource thickness (feet)	2nd interbed thickness (feet)	3rd resource thickness (feet)	Depth to top of water zone (feet)	Well total depth (feet)	Bedrock penetrated?	Reference
16140031	11		N		Ebber Webber		SW	SW	13	18	5	W	Grays Harbor	Qgp	>	20	38						58	N	
16140028	11	W097538	N		Jay McDonald	93 Old Sand Creek Rd	SE	SW	14	18	5	W	Grays Harbor	Qgo			0						360	Y	
16140045	12		Y		WADOT	SR 8, holes 18 & 17	NE	NW	14	18	5	W	Grays Harbor	Qgo		3	6	21	20				63	N	WADOT files
16140041	11	38891	N		Don Rhoden	448 W Elma Hicklin Rd	NW	NW	15	18	5	W	Grays Harbor	Qgo	>	1	11	26	3	5	1		47	N	
16140042	12		Y		WADOT	SR 8, holes 10 and 12	SW	NW	15	18	5	W	Grays Harbor	Qgo		0	51						52	N	WADOT files
16140025	12		Y		WADOT	SR 108 - W Fork Wildcat Creek bridge	SE	SW	16	18	5	W	Grays Harbor	Qa		3	14						28	N	WADOT files
16140026	12		Y		WADOT	SR 8 - Wildcat Creek bridge	SE	SW	16	18	5	W	Grays Harbor	Qa		0	4						36	N	WADOT files
16140040	11		N		Joe House	Hicklin Rd	NW	SE	16	18	5	W	Grays Harbor	Qgo	>	35	20						55	N	
16140090	11		N		Loyd Stocker		NE	NE	16	18	5	W	Grays Harbor	Qgo	>	38	2	10	5			38	55	N	
16140035	11	W19461	N		Bobby Comer	Cloquallum Rd	NE	SW	18	18	5	W	Grays Harbor	Qgo		13	33						46	Y	
16140036	11	W067756	N		Gene Austin	Cloquallum Rd	NE	NW	18	18	5	W	Grays Harbor	Qgo			0						60	Y	
16140018	11		N		Taylor Hoskins	Bush Creek Rd	SW	NE	19	18	5	W	Grays Harbor	Qgo		8	39						140	Y	
16140019	11	215699	N		Larry Smith	End of Alder Pl	NE	SE	19	18	5	W	Grays Harbor	Qgo			0						83	Y	
16140024	11	W071893	N		Eva Dotson	513 Elma McCleary Rd	NE	NE	20	18	5	W	Grays Harbor	Qgo	>	8	33	52	2			93	95	N	
16140027	11	W119341	N		Quail Inc	21 Overlake Ln Lot 1	SW	NW	23	18	5	W	Grays Harbor	Qgo			0					48	160	Y	
16140029	11		N		Earl Mann		SW	NE	23	18	5	W	Grays Harbor	Qgp		48	2	16	4				120	Y	
16140013	11	W57979	N		Louise Kirby	1271 Mox Chehalis Rd	SW	NW	25	18	5	W	Grays Harbor	Qgo			0						105	Y	
16140011	11	W095403	N		Lulen Corp		NE	NW	29	18	5	W	Grays Harbor	Qgo	>	0	50						50	N	
16140087	11		N		Bud Grandoff		SE	SW	29	18	5	W	Grays Harbor	Qgo		14	44						78	Y	
16140088	11		N		David Christopherson		NW	SW	29	18	5	W	Grays Harbor	Qgo	>	6	21	26	7			53	60	N	
16140089	11		N		Eddie William		NW	NW	29	18	5	W	Grays Harbor	Qgo		3	17	18	20				78	N	
16140007	12		Y		WADOT	SR 8 Cloquallum Cr bridge	SW	SW	30	18	5	W	Grays Harbor	Qgo	>	2	25	10	17				52	N	WADOT files
16140009	11	38895	N		Lee Applegarth	South Union Rd	SE	SW	30	18	5	W	Grays Harbor	Qgo		0	8						213	Y	
16140085	11		N		WADOT		NE	SE	30	18	5	W	Grays Harbor	Qgo	>	50	11						61	N	
16140086	11	W092047	N		W. Benham	3980 Union Rd	SW	SW	30	18	5	W	Grays Harbor	Qgo		1	8	24	2				66	Y	
16140003	11	44719	N		Steve Neal	300 South Union Rd	NE	NE	32	18	5	W	Grays Harbor	Mm			0						293	Y	
16140005	11		N		Estes	Mox Chehalis Rd	SW	NW	35	18	5	W	Grays Harbor	Qgo		2	39						70	Y	
16140006	11		N		Brooks		NE	NW	35	18	5	W	Grays Harbor	Qgo	>	0	40						40	N	
16140050	11		N		Chuck Catterlin		NE	NE	1	18	6	W	Grays Harbor	Qgo	>	0	52						52	N	
16130069	11		N		John Gierdrum	Middle Fork Satsop	NW	SW	5	18	6	W	Grays Harbor	Qa		5	21						57	Y	
16130066	11		N		Gene Lafteniere		NW	NW	6	18	6	W	Grays Harbor	Qgo	>	14	10					14	24	N	
16130067	11	W092211	N	Lillie Rd Well #1	Rex Valentine		SE	NW	6	18	6	W	Grays Harbor	Qa	>	0	87	2	12			89	101	N	
16130068	11		N		Richard Erickson		NW	NE	6	18	6	W	Grays Harbor	Qa	>	27	14						41	N	
16140046	11	38900	N		Ron Jones	530 Cloquallum Rd	SE	SE	12	18	6	W	Grays Harbor	Qgo		2	10						80	Y	
16130061	11		N		Peterson		SE	NW	13	18	6	W	Grays Harbor	Qa	>	8	24						32	N	
16130060	11	W062321	N		Gary Newell	Carol Lane	NW	SW	24	18	6	W	Grays Harbor	Mm			0						221	Y	

IDENTIFIER						LOCATION									WELL LOG DATA										
WADNR unique number	WADNR data type code	WADOE well number	Data verified?	Well name	Original well owner	Well location	¼¼ section	¼ section	Section	Township (N)	Range	Meridian	County	Geologic unit	Qualifier	Overburden thickness (feet)	1st resource thickness (feet)	1st interbed thickness (feet)	2nd resource thickness (feet)	2nd interbed thickness (feet)	3rd resource thickness (feet)	Depth to top of water zone (feet)	Well total depth (feet)	Bedrock penetrated?	Reference
16130058	11	W111722	N		Ralph Secrest	36 Stamper Rd	SW	SW	25	18	6	W	Grays Harbor	Qgo			0						100	Y	
16130059	11	W12874	N		Roger Landberg	60 Hotdog Ln	NE	SW	25	18	6	W	Grays Harbor	Qgo			0						240	Y	
16140010	11		N		Roger Landberg	Lot 3	NW	NE	25	18	6	W	Grays Harbor	Qgo	>	3	57						60	N	
16140075	11		N		Roger Landberg		SW	NE	25	18	6	W	Grays Harbor	Qgo	>	5	62						67	N	
16130057	11		N		Tom Parris	31 Stamper Rd	SE	SE	26	18	6	W	Grays Harbor	Qgo			0						130	Y	
16140076	11		N		Roger Landberg		SW	NE	26	18	6	W	Grays Harbor	Qgo		5	48						122	Y	
16130054	11		N	Well # SO3	City of Elma		SE	SW	27	18	6	W	Grays Harbor	Qgo	>	43	2	8	47				100	N	
16130051	11	205083	N		Norm Sutherby	35 McIntyre Rd	SW	SW	28	18	6	W	Grays Harbor	Qgo	>	33	7						40	N	
16130052	11		N		Lee Crum		SW	SW	28	18	6	W	Grays Harbor	Qgo	>	28	17					35	45	N	
16130053	11	58582	N		Ace Duvall	181 Calder	SW	SE	28	18	6	W	Grays Harbor	Qgo		3	37						121	Y	
16130045	11		N		John Rantala	O' Neil Rd	NW	SW	29	18	6	W	Grays Harbor	Qgo			0						105	Y	
16130046	11		N		George Gouroff		SW	SW	29	18	6	W	Grays Harbor	Qgo		29	5						187	Y	
16130047	11	38908	N		Jan Music	106 O'Neill Rd	NE	SW	29	18	6	W	Grays Harbor	Qgo	>	52	8						60	N	
16130048	11		N		Walter Spinharney		SE	NE	29	18	6	W	Grays Harbor	Qgo			0						227	Y	
16130049	11	W108410	N		Thomas Dillard	121 Neuman Creek Rd	NW	SE	29	18	6	W	Grays Harbor	Qgo		52	10						150	Y	
16130050	11		N		Bruce Hargrone	Newman Creek	SE	SE	29	18	6	W	Grays Harbor	Qgo	>	31	28						59	N	
16130041	11		N		Lee Stover		SW	SE	30	18	6	W	Grays Harbor	Qgo		43	15					43	70	N	
16130042	11		N		James Barton	12-148 Moore Rd	NW	SE	30	18	6	W	Grays Harbor	Qgo	>	35	5						40	N	
16130043	11	214670	N		Gregory Orili	76 Moore Rd	SE	SE	30	18	6	W	Grays Harbor	Qgo		28	19						60	Y	
16130044	11	W067004	N		Eldred Read	116 Moore Rd	NE	SE	30	18	6	W	Grays Harbor	Qgo	>	40	9						49	N	
16130002	11	38869	N		Steve Lamphiear	23 Newman Rd	NW	NW	31	18	6	W	Grays Harbor	Qgo			0						190	Y	
16130003	11		N		L. Eaton		NW	SE	31	18	6	W	Grays Harbor	Qgo	>	4	44						48	N	
16130004	11	38890	N		Lee Dotson		NW	SE	31	18	6	W	Grays Harbor	Qgo	>	1	53						54	N	
16130005	11		N		Leo Berry		NW	SE	31	18	6	W	Grays Harbor	Qgo	>	0	40						40	N	
16130006	11	W111717	N		Satsop Water	end of Ash Road	SW	NE	31	18	6	W	Grays Harbor	Qgo	>	0	121						121	N	
16130007	11		N		Jud Evans		SW	NE	31	18	6	W	Grays Harbor	Qgo	>	0	40						40	N	
16130008	11		N		Comfort & Ortquist		SW	NE	31	18	6	W	Grays Harbor	Qgo	>	0	48						48	N	
16130009	11		N		Don Doherty		NE	NE	31	18	6	W	Grays Harbor	Qgo	>	0	56						56	N	
16130010	11		N				SE	NE	31	18	6	W	Grays Harbor	Qgo		31	66						98	N	
16130012	11		N		John Martin		SW	NW	32	18	6	W	Grays Harbor	Qgo	>	14	86						100	N	
16130013	11		N		Ken Kerr	O'Neil Rd	NW	NW	32	18	6	W	Grays Harbor	Qgo	>	21	90						111	N	
16130016	11		N		William Turley		NW	NE	32	18	6	W	Grays Harbor	Qgo		20	42						123	Y	
16130017	11	W072868	N	Well #1	Doyle Brothers Construction	Old Olympic HWY	SW	NE	32	18	6	W	Grays Harbor	Qgo	>	15	7	4	21			15	47	N	
16130014	11		N	SO #4	City of Elma		NE	SW	33	18	6	W	Grays Harbor	Qa	>	34	68						102	N	
16130018	11		N		WPPSS		SW	NW	33	18	6	W	Grays Harbor	Qgo	>	16	51						67	N	
16130019	11	38841	N		Larry Badgley	Hurd Rd tract 6	SW	NW	33	18	6	W	Grays Harbor	Qgo	>	2	46						49	N	
16130020	11	58550	N		Melvin Simon	118 Hurd Rd	NE	SW	33	18	6	W	Grays Harbor	Qa	>	52	9					57	61	N	
16130021	11		N		Robert Knight	Heather Acres subdivision	NE	SW	33	18	6	W	Grays Harbor	Qgo	>	0	43						43	N	

IDENTIFIER						LOCATION									WELL LOG DATA										
WADNR unique number	WADNR data type code	WADOE well number	Data verified?	Well name	Original well owner	Well location	¼¼ section	¼ section	Section	Township (N)	Range	Meridian	County	Geologic unit	Qualifier	Overburden thickness (feet)	1st resource thickness (feet)	1st interbed thickness (feet)	2nd resource thickness (feet)	2nd interbed thickness (feet)	3rd resource thickness (feet)	Depth to top of water zone (feet)	Well total depth (feet)	Bedrock penetrated?	Reference
16130022	11		N		Roger Landberg		SW	NE	33	18	6	W	Grays Harbor	Qgo	>	8	47						55	N	
16130023	11	11734	N		David Dilley	1251 Monte Elma Rd	NE	SE	33	18	6	W	Grays Harbor	Qgo	>	12	29	2	6				49	N	
16130024	11		N		Jerry Haath		NW	NW	34	18	6	W	Grays Harbor	Qgo	>	25	45						70	N	
16130026	11		N		Elizabeth Haerlen		NW	SW	34	18	6	W	Grays Harbor	Qgo	>	0	55						55	N	
16130027	12		Y		WADOT	HWY 12 3rd St UP Elma	NE	SW	35	18	6	W	Grays Harbor	Qa	>	0	30						30	N	WADOT files
16130028	11	W062074	N		William Neal		NW	SE	35	18	6	W	Grays Harbor	Qa	>	16	3	6	11	8	56	16	100	N	
16130029	12		Y		WADOT	HWY 9 - NP Railroad overpass	NW	SE	35	18	6	W	Grays Harbor	Qa	>	5	47						52	N	WADOT files
16130030	11	201692	N		Jared Nelson	Oakhurst Dr	NW	NE	35	18	6	W	Grays Harbor	Qgo			0						160	Y	
16130033	12		Y		WADOT	HWY 9 - Elma Y overpass	SW	NW	36	18	6	W	Grays Harbor	Qa	>	0	37						37	N	WADOT files
16130036	11	12884	N		Fred Tomlin	70 Fairgrounds Rd	NW	NE	36	18	6	W	Grays Harbor	Qgo			0						110	Y	
16120014	11	W11553	N		Elbert Jennison	W Satsop Rd	SE	SW	3	18	7	W	Grays Harbor	Qa		0	14						200	Y	
16120047	11	W097812	N		Mike McMeekin	West Satsop Rd	SE	SW	3	18	7	W	Grays Harbor	Qa			0						80	Y	
16120048	11		N		Henry Robinson		NE	SW	3	18	7	W	Grays Harbor	Qgp		8	24						105	Y	
16120012	11		N		Jim Comton		SW	NW	10	18	7	W	Grays Harbor	Qa	>	0	62						62	N	
16120041	11	W096989	N		Bret Benzley	731 W Satsop	SW	SE	10	18	7	W	Grays Harbor	Qa		34	3	3	5				130	Y	
16120042	11		N		Jared France		SE	SE	10	18	7	W	Grays Harbor	Mm		18	2						165	Y	
16120043	11	W072871	N		Gilbert Hendrickson	735 West Satsop Rd	SW	SE	10	18	7	W	Grays Harbor	Mm	>	18	28	17	17			63	80	y	
16120044	11	11190	N		Earl Gann	1303 West Satsop Rd	SW	SE	10	18	7	W	Grays Harbor	Mm		19	1						93	Y	
16120045	11		N		Kerr		NW	SE	10	18	7	W	Grays Harbor	Qa		10	5						120	Y	
16120046	11		N		Ken Kissolavitch		SW	NE	10	18	7	W	Grays Harbor	Qa		12	11						58	Y	
16120037	11	W116878	N		Jennie Wingate	90 Schaefer Meadows Ln	SE	NE	11	18	7	W	Grays Harbor	Qgo			0						126	Y	
16120038	11	23980	N		Steve Bridge	243 Middle Satsop Rd	SE	NE	11	18	7	W	Grays Harbor	Qgo		59	4					59	218	Y	
16120039	11	W045649	N		Jerry Dotson	Schaffer Meadows	SW	NE	11	18	7	W	Grays Harbor	Qgo			0						343	Y	
16120040	11	84811	N		Donn Leiske	Shafer Game Farm	NE	SE	11	18	7	W	Grays Harbor	Qgo	>	42	5					42	47	N	
16120035	11	38907	N		Kevin Baack	Middle Satsop Rd	SW	NW	12	18	7	W	Grays Harbor	Qgo		2	32						110	Y	
16120036	11	W097759	N		Deleris Cavanah	Middle Satsop Rd	NW	SW	12	18	7	W	Grays Harbor	Qgo			0						130	Y	
16130063	11		N		Gretchen		SE	NE	12	18	7	W	Grays Harbor	Qa			0						125	N	
16130064	11		N		Dick Studer	West Satsop	NE	NE	12	18	7	W	Grays Harbor	Qa			0						43	N	
16120011	11		N		Earnest Oleachea	Lot 92 E Satsop Loop Rd	NW	SW	13	18	7	W	Grays Harbor	Qa	>	18	23						41	N	
16120032	11	38876	N		Don Walker	241 Satsop Rivera Lp	NW	SW	13	18	7	W	Grays Harbor	Qa	>	2	37						39	N	
16120033	11		N		Crossroad Reality	East Satsop Rd	SW	NW	13	18	7	W	Grays Harbor	Qa	>	1	39						40	N	
16120034	11		N		Evald Eliason		NW	SW	13	18	7	W	Grays Harbor	Qa	>	6	27						33	N	
16120010	11	214666	N		Charles Blackman	Satsop Ct Lot 3	NE	NE	14	18	7	W	Grays Harbor	Qgo		1	62						85	Y	
16120023	11	W124502	N		Laurel Zeman	682 Middle Satsop Rd	SW	NE	14	18	7	W	Grays Harbor	Qa		2	4						93	Y	
16120024	11		N		Mark Bowe		SW	NE	14	18	7	W	Grays Harbor	Qgo		0	45						62	Y	
16120025	11		N		D. Chandler	119 Satsop Loop Pl	SE	NE	14	18	7	W	Grays Harbor	Qa	>	10	30						40	N	
16120026	11	W097673	N		Stanley Fleming	14 Scenic Pl	SE	NE	14	18	7	W	Grays Harbor	Qa		2	10						60	Y	
16120027	11		N		Stormy Glick	E Satsop River Rd	SE	SE	14	18	7	W	Grays Harbor	Qa	>	48	2						50	N	
16120028	11		N		Roger Landberg		NE	NE	14	18	7	W	Grays Harbor	Qa		0	11						75	Y	

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16120029	11	38831	N		Dick Roorda	Middle Satsop Rd	NE	NE	14	18	7	W	Grays Harbor	Qa		1	36						90	Y	
16120030	11	W067023	N		Rex Valentine	Middle Satsop Rd	SE	NE	14	18	7	W	Grays Harbor	Qa		0	8						119	Y	
16120031	11	W067010	N		John Willey	Middle Satsop Rd	NW	SE	14	18	7	W	Grays Harbor	Qa		1	7						115	Y	
16120003	11	38885	N		Don Kolisis	Middle Satsop Rd	SW	SW	23	18	7	W	Grays Harbor	Qa		12	7	7	4				61	Y	
16120021	11	W092025	N		Juanita Bailey	470 East Satsop Rd	NW	NW	24	18	7	W	Grays Harbor	Qa			0						67	N	
16120022	11		N		Juli Sanchez	390 East Satsop Rd	NW	SW	24	18	7	W	Grays Harbor	Qgo			0						125	Y	
16130038	11		N		PJ Walker	Satsop River Lot 5	SW	NE	25	18	7	W	Grays Harbor	Qgo	>	10	31						41	N	
16130039	11		N		Dave Beerbower		NW	SE	25	18	7	W	Grays Harbor	Qgp			0						159	Y	
16130040	11	W19458	N		Carolyn Wascott	162 E Satsop Rd	SW	SE	25	18	7	W	Grays Harbor	Qgo		75	23						183	Y	
16120002	11	W073819	N		Larry Jennings	196 Middle Satsop Rd	SW	SE	26	18	7	W	Grays Harbor	Qa		16	9					18	52	Y	
16120018	11		N		Evelyn Gleeson		NE	NE	26	18	7	W	Grays Harbor	Qa	>	15	16						36	N	
16120020	11		N		Jim Gleason		SW	NE	26	18	7	W	Grays Harbor	Qa		5	25						40	Y	
16120001	11		N		Jim Smith	Winkleman Rd	SW	NW	35	18	7	W	Grays Harbor	Qgp		59	12						145	Y	
16120019	11		N		Einar Jaren		SE	NE	35	18	7	W	Grays Harbor	Qgo		1	22						270	Y	
16120017	11		N		Mack McGraw		NE	SW	36	18	7	W	Grays Harbor	Qa	>	15	15						30	N	
16130001	11		N		Mahlon McGraw		SW	NE	36	18	7	W	Grays Harbor	Qgo	>	12	27						39	N	
16110033	11		N		Roland Strote		SE	NW	9	18	8	W	Grays Harbor	Qapwo		99	6					99	121	N	
16110034	11	38901	N		Tim Bowers	Fern Lane	NW	SW	9	18	8	W	Grays Harbor	Qa			0						120	Y	
16110010	11	W060161	N		Lynn Moore	1051 Wynoochee Valley Rd	SE	NW	16	18	8	W	Grays Harbor	Qa	>	25	15					25	40	N	
16110032	11	W058021	N		Farron Wallace	896 Wynoochee Valley Rd	SE	NW	16	18	8	W	Grays Harbor	Qa		22	14					22	36	Y	
16110007	11		N		Robert Taylor		SE	SW	21	18	8	W	Grays Harbor	Qa	>	17	9					17	26	N	
16110035	11	W097795	N		Erick R / Michelle Olson	822 Wynoochee Valley Rd	SE	NW	21	18	8	W	Grays Harbor	Qa			0						80	N	
16110004	11		N		Greg Friend	Wynoochee Rd	SW	SE	27	18	8	W	Grays Harbor	Qa	>	23	31						54	N	
16110031	11		N		Dagnen Farms	627 Wynoochee Valley Rd	SE	SW	27	18	8	W	Grays Harbor	Qa	>	6	42						48	N	
16110026	11		N				NE	NW	28	18	8	W	Grays Harbor	Qa	>	4	39						43	N	
16110027	11		N		Edwin Tonn	West Wynoochee Rd	SE	SW	28	18	8	W	Grays Harbor	Qa	>	8	25						33	N	
16110028	11	W069514	N		Edwin Tonn	388 Geissler Rd	NE	SW	28	18	8	W	Grays Harbor	Qa			0						295	Y	
16110029	11	34822	N		City of Aberdeen	420 Geissler Rd	SE	NW	28	18	8	W	Grays Harbor	Qa			0						122	Y	
16110030	11	W067750	N		Cheryl Horsley	659 Wynoochee Valley Rd	SE	SE	28	18	8	W	Grays Harbor	Qa			0						182	Y	
16110023	11		N		Howard Hughes		NE	NE	33	18	8	W	Grays Harbor	Qa	>	15	1						16	N	
16110024	11	201674	N		Cobb / Trissel	246 Geissler Rd	SE	NE	33	18	8	W	Grays Harbor	Qa		0	18						22	Y	
16110025	11	W097826	N		Ted Bialkoski	306 Geissler Rd	SW	NE	33	18	8	W	Grays Harbor	Qa		40	1						42	Y	
16110001	11	W101338	N		Owen Shaffner	Gieser Rd	NW	NE	34	18	8	W	Grays Harbor	Qa		1	55						56	N	
16110002	11	W097474	N		Owen Shaffner	Gieser Rd	NW	NE	34	18	8	W	Grays Harbor	Qa	>	23	23					23	48	N	
16110003	11	W065288	N		Paul Pekole	97 Geissler Rd	SE	NE	34	18	8	W	Grays Harbor	Qa	>	26	2	9	2				39	N	
16110020	11		N		Don Schmidt	Wynoochee Valley	NW	SW	34	18	8	W	Grays Harbor	Qgo			0						220	Y	
16110021	11		N		Paul Pekola		SE	NW	34	18	8	W	Grays Harbor	Qa		16	7						34	Y	
16110022	11	W01588	N		Diane Pinger	43 Geissler Rd	NE	NE	34	18	8	W	Grays Harbor	Qa	>	22	10						32	N	

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16110019	12	202060	Y			Geissler Rd bridge	NW	NW	35	18	8	W	Grays Harbor	Qa		18	10						45	Y	
16090007	12		Y		WADOT	SR 101 W Fork Hoquaim R bridge	SW	SE	4	18	10	W	Grays Harbor	Qa		21	29						53	Y	WADOT files
16090005	11	205045	N		Norm Stoken	49 Dekay Rd	SE	SW	9	18	10	W	Grays Harbor	Qapwo			0					200	242	N	
16090003	12		Y		WADOT	SR 101 Hoquaim River bridge	NE	NE	16	18	10	W	Grays Harbor	Qa			0						25	Y	WADOT files
16090002	11	W069139	N		William Drake	Lot 3 Lynwood/Ocean Beach	NW	NE	21	18	10	W	Grays Harbor	Qapwo	>	48	5	19	9			72	81	N	
15160040	11	W069138	N		Townsend & Ingstad	Totten Shores TR 17	SE	SW	1	19	3	W	Mason	Qgp	>	116	24	112	10			252	262	N	
15160058	11	W062067	N		Daryl Bugge	Off Lynch Rd Lot 1 & 2	NW	NE	1	19	3	W	Mason	Qgt			0					255	276	N	
15160037	11	W067772	N		Herbert Howell	Phillips Rd	NE	SW	2	19	3	W	Mason	Qgt	>	0	15	20	11	2e+02	20	223	243	N	
15160038	11		N		Crump	Lynch Rd	SE	SW	2	19	3	W	Mason	Qgt	>	223	6					223	229	N	
15160057	11	58534	N		Wade Duffy	Phillips Rd	NE	NW	2	19	3	W	Mason	Qgt	>	4	36	22	14				76	N	
15160034	11	W100411	N		Ron Ragan	Lot 2 My Rd	SE	SW	3	19	3	W	Mason	Qgt		16	12						106	N	
15160035	11	W062350	N		Dawson & Graves	Phillips Rd	NW	SE	3	19	3	W	Mason	Qgt		2	23	25	19	9	19		162	N	
15160055	11	W106176	N		Steve Walker	Cole Rd	NE	NW	4	19	3	W	Mason	Qgt		21	46					21	69	N	
15160056	11	W40751	N		Curries Landing Inc.	Currie Way off Cole Rd	SW	NE	4	19	3	W	Mason	Qgt		9	16	9	38	48	10	34	141	N	
15160024	11	W097550	N		Washington Home Center	61 SE Ryan Rd	SW	SW	5	19	3	W	Mason	Qgo	>	0	129					111	129	N	
15160029	11	35035	N		Mike Nelson	SE 30 Grove Pl	SE	SW	5	19	3	W	Mason	Qgt	>	65	5						70	N	
15160145	11	W061346	N		Rodney Richards	Ryan Rd	SW	SW	5	19	3	W	Mason	Qgo	>	2	76					70	78	N	
15160021	11	W074284	N		Stephen Kamin	60 W Delight Park Rd	SW	SW	6	19	3	W	Mason	Qgt	>	57	3					57	61	N	
15160045	11	W101341	N		Kamin Construction	Delight Park Rd	SW	NW	6	19	3	W	Mason	Qgo		0	81					94	115	N	
15160048	11	W105904	N		Arnie Schreiber	741 Golden Pheasant Rd	NE	NW	6	19	3	W	Mason	Qgo		43	12	25	25	6	47	43	218	N	
15160049	11	61427	N		Marg Dodge		NW	SE	6	19	3	W	Mason	Qgt	>	87	6					87	93	N	
15160050	11	W045643	N		Chris Elmlund	W 191 Delight Park Rd	SW	NE	6	19	3	W	Mason	Qgo	>	2	78	3	9	7	8	68	107	N	
15160022	11	W075655	N		Jeannine Griggs	211 W Fredson Rd	NW	NE	7	19	3	W	Mason	Qgt		15	1	56	2			15	74	N	
15160023	11	W066412	N		Howard Pershall	W 90 Manor Rd	NE	NE	7	19	3	W	Mason	Qgt	>	3	5	37	15	8	32	68	100	N	
15160025	11		N		Ray Brown		SE	SE	7	19	3	W	Mason	Qgo		34	49						244	N	
15160026	11		N		Frank Haynes		NE	SW	8	19	3	W	Mason	Qgt	>	58	9					58	73	N	
15160027	11	W056031	N		Bill Moore	Brewer Rd	SE	NW	8	19	3	W	Mason	Qgo	>	5	66	33	26			125	130	N	
15160030	11	58538	N		Larry Forsman	Lynch Rd	NW	NE	9	19	3	W	Mason	Qgt	>	122	6					122	128	N	
15160031	11	W097468	N		Ted Booth	2570 Kamilche Point Rd	NE	SW	10	19	3	W	Mason	Qgt		0	8	92	13			105	113	N	
15160032	11	W092259	N		James Beegle	E 200 Arabian Rd	NW	SE	10	19	3	W	Mason	Qgt		0	99	76	10			196	205	N	
15160033	11	W12806	N		Donna Holliday	SE 3030 Kamilche Point Rd	SW	NE	10	19	3	W	Mason	Qgt	>	119	17					119	136	N	
15160036	11	45372	N		Larry Anderson	193 Arabian Rd	NW	SE	10	19	3	W	Mason	Qgt		25	41	11	9	25	7	155	173	N	
15160039	11		N		Robert Miller		NE	NE	11	19	3	W	Mason	Qapo	>	4	37	66	9			107	116	N	
15160017	11	18283	N		Stewart	Dahlman Rd	NE	NW	14	19	3	W	Mason	Qgt			0						105	N	
15160015	11	W092225	N		Peggy Bloomfield	3320 Bloomfield Rd	SE	NE	15	19	3	W	Mason	Qgt		0	5	5	55			36	65	N	

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15160016	11	W12891	N		John Folk	3131 Bloomfield Rd	NE	SE	15	19	3	W	Mason	Qgt	>	59	6					59	65	N	
15160003	11		N		Squaxin Indian Tribe	Squaxin Tribal Center	NW	SE	18	19	3	W	Mason	Qa		55	6						61	N	
15160006	12		Y		WADOT	SR 108 Little Skookum Cr bridge	SE	SE	18	19	3	W	Mason	Qgo		0	30						40	N	WADOT files
15160007	12		Y		WADOT	SR 101 SR 108 OC at Kamilche	SE	SE	18	19	3	W	Mason	Qgo		0	33						75	N	WADOT files
15160009	11		N		Kamilche Water Association		SE	SE	18	19	3	W	Mason	Qgo		1	22						85	N	
15160012	11	73643	N		Indian Health Services	Squaxin Island	NW	NW	20	19	3	W	Mason	Qa		46	4					46	200	Y	
16160046	11	45608	N		Mark Carlson		SW	NE	20	19	3	W	Mason	Qgt		17	2						63	N	
16160047	11		N		Squaxin Indian Tribe	On Old Olympic HWY	SW	NE	20	19	3	W	Mason	Qgt	>	3	46	3	19	3	9		83	N	
16160048	11	W12797	N		Mike Dermond	2122 Bloomfield Rd	SW	NE	22	19	3	W	Mason	Qgp	>	107	38					145	145	N	
16160049	11	63561	N		Olympia Oyster Company	SE 1042 Bloomfield Rd	SW	NW	23	19	3	W	Mason	Qgp	>	20	8	18	2			46	48	N	
16160053	11		N		Bob Ward		SE	SE	23	19	3	W	Thurston	Qgt	>	100	20					100	129	N	
16160050	11	13363	N		Kristen Matnison	5925 Miller Rd	SE	SW	24	19	3	W	Thurston	Qgt	>	69	11					69	80	N	
16160044	11	W38502	N		D & L Custom Homes	5045 Steamboat Island Rd	NE	SW	25	19	3	W	Thurston	Qgt	>	52	42	1	17			76	112	N	
16160052	11	W067181	N		Wallace Johnson		SE	SW	25	19	3	W	Thurston	Qgo	>	0	67	14	12	9	17	111	119	N	
16160041	11	W092251	N		Deborah Voight	Steamboat Island Rd	SW	NE	26	19	3	W	Thurston	Qgt	>	0	45	10	45			35	100	N	
16160042	11	W067212	N		Randy Joswick	48th Ct / Gravely Bch Rd	SE	NE	26	19	3	W	Thurston	Qgt	>	4	117					67	121	N	
16160040	11	84772	N		Linda Flener	5030 Grand Fir Ln	NW	SW	27	19	3	W	Thurston	Qgt	>	75	41	59	5			175	180	N	
16160038	11	67392	N		Barbra Meservey	4832 Shellridge Rd	NW	SE	28	19	3	W	Thurston	Qgt	>	0	70	19	79			150	168	N	
16160036	11	W38516	N		Wayne Koch	SE 61 Craddick Rd	SE	NW	29	19	3	W	Thurston	Qgt			0						260	Y	
16160033	11	18893	N		Dewey Elliott	Hurley Waldrip Rd	SE	NW	30	19	3	W	Thurston	Qgo			0						255	Y	
16160023	11		N		Russ Miller		SE	SE	32	19	3	W	Thurston	Qgo			0						164	Y	
16160024	11	61495	N		Curtis Beckham	4726 Shellridge Rd	NE	NE	33	19	3	W	Thurston	Qgt	>	171	8					171	179	N	
16160026	11		N		Hugh Ward	Oyster Bay Rd	NE	NE	34	19	3	W	Thurston	Qgt	>	30	18					30	48	N	
16160027	11		N		John Cook		SE	NE	34	19	3	W	Thurston	Qgt	>	34	3	62	4			34	103	N	
16160028	11	63600	N		Norman Clixby	6327 41st St	SE	NW	35	19	3	W	Thurston	Qgt	>	15	98					95	113	N	
16160029	11	23997	N		Michael Mobbs	6445 41st NW	NW	SE	35	19	3	W	Thurston	Qgt	>	52	8	44	10			96	114	N	
16160030	11	W062315	N		Julie Goodwin	3810 Steamboat Island Lp	SE	SE	35	19	3	W	Thurston	Qgt	>	0	101	26	7	27	12	161	173	N	
16160031	11		N		Kelly	4409 Gravelly Beach Rd	NW	NW	36	19	3	W	Thurston	Qga	>	0	72	18	2			90	92	N	
15150020	11	W056381	N		Mark Padgett	W 3326 Cloquallum Rd	NW	NW	1	19	4	W	Mason	Qgo	>	2	18	10	17			30	47	N	
15150021	11		N		Bill White	2061 Cloquallum Rd	NW	NE	1	19	4	W	Mason	Qgo		0	14						141	N	
15160046	11	46515	N		Tim Lovgren	W 2671 Cloquallum Rd	NE	NE	1	19	4	W	Mason	Qgo	>	0	11	29	6			40	46	N	
15150019	11	84832	N		Quaade	Cloquallum Rd	NW	NE	2	19	4	W	Mason	Qgo			0						402	Y	
15150018	11		N		Rolland Cuzick		NW	SW	3	19	4	W	Mason	Ev_{cf}			0						440	Y	
15150017	11	63511	N		Rich Stevens		SW	NW	4	19	4	W	Mason	Qgt			0						200	Y	
15150003	11		N	19/4-6C1	Ethel Galbraith		NE	NW	6	19	4	W	Mason	Qgt			0						60	Y	Molenaar and Noble (1970)
15150009	11		N		Phil Herbig	Lost Lake	SW	SW	6	19	4	W	Mason	Qgt		45	3	10	20				80	N	

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15150016	11	W56402	N		Cathy Castro	7900 Cloquallum Rd	SE	SE	6	19	4	W	Mason	Qgo			0						50	Y	
15150006	11	58563	N		Randy Norris	W 164 Lost Lake Rd	SW	NW	7	19	4	W	Mason	Qgo		9	13	17	14			9	86	N	
15150008	11	W18604	N		Vivian Stickley	W 291 Wivel Rd	NE	NW	10	19	4	W	Mason	Qa			0						97	N	
16160032	11	W120790	N		Bill Jernigan	50 W Elk Ridge Dr	SE	NE	25	19	4	W	Mason	Qga	>	56	14					56	70	N	
16150043	11		N		Rick Blake		SW	SE	28	19	4	W	Mason	Qgo	>	87	1						88	N	
16150036	11	37669	N		Scott Miller	5341 HWY 108	NW	NE	32	19	4	W	Mason	Qgo	>	50	9						59	N	
15140022	11		N	19/5-1L1	A. G. Carlson		NE	SW	1	19	5	W	Mason	Qgt	>	0	32	38	19				89	N	Molenaar and Noble (1970)
15150010	11	W38540	N		Mark Studer	Lost Lake Rd	SE	SE	1	19	5	W	Mason	Qgt		0	3	35	5			36	43	N	
15150012	11	W072791	N		Pentti Kosky	Frosty Lane	SE	NE	1	19	5	W	Mason	Qgt		8	22	28	28				136	Y	
15150013	11	W062073	N		Joe Stipic	W 91 Frosty Ln N	NE	SE	1	19	5	W	Mason	Qgt	>	43	12					43	55	N	
15140013	11	W097731	N		Rich Vannice	7980 W Highland Rd	NW	NE	10	19	5	W	Mason	Qgt	>	0	67						67	N	
15140014	11	210705	N		Donna Vannice	Highland Rd	NW	NE	10	19	5	W	Mason	Qgt	>	12	7	27	1				47	N	
15140010	11		N		Thomas Crawford	112 Bulb Farm Rd	NW	SW	13	19	5	W	Mason	Qgt			0						190	Y	
15140011	11	W056032	N		Alex Hoyos	W 916 Bulb Farm Rd	NE	SW	13	19	5	W	Mason	Qgt			0					18	60	N	
15140007	11	84820	N		Lee Roth	12309 Cloquallum Rd	SW	SE	15	19	5	W	Mason	Qgt	>	22	10					24	32	N	
15140004	11	W060156	N		Scott Rowland	W 14281 Cloquallum Rd	NW	SW	16	19	5	W	Mason	Qgo		13	40					16	53	N	
15140005	11	W069095	N		Jim Ammons	Cloquallum Rd	SW	NW	16	19	5	W	Mason	Qgo	>	2	33	7	10			2	52	N	
15140006	11	W092236	N		Mike Strehlow	1764-17 Cloquallum Rd	NW	SE	16	19	5	W	Mason	Qgo		0	23	8	8	9	4	52	56	N	
15140003	11	62813	N		Lake Arrowhead Comm Club	Lake Arrowhead	SW	NE	17	19	5	W	Mason	Qgt		54	20						79	N	
16140070	11	57973	N		Larry Mellema	Cloquallum Rd	SW	SW	20	19	5	W	Mason	Mm	>	42	18					42	60	Y	
16140071	11		N		Leonard Stigall	1485 Cloquallum Rd	NE	NW	20	19	5	W	Mason	Qgo	>	2	28						30	N	
16140074	11	44644	N		Edward Burt	12 mi out Cloquallum Rd	SW	NW	22	19	5	W	Mason	Qgo		31	7						205	Y	
16150037	12		Y		WADOT	SR 108 mp 7.07 Creek bridge	SE	SE	28	19	5	W	Mason	Qgo		0	6						44	N	WADOT files
16140069	11		N		John Matau		NE	SE	30	19	5	W	Mason	Qgo		7	15						93	Y	
16140066	11	W052420	N		Bill Muir		SW	SE	35	19	5	W	Mason	Qgo			0						144	Y	
16140068	11	W052446	N		Mike Fields	32 Oak Meadows	SW	SW	36	19	5	W	Mason	Qgo			0						142	Y	
15130021	11	63566	N		Bob Wingle	Ripplewood Estates	SE	NW	2	19	6	W	Mason	Qgo	>	18	14					28	32	N	
15130022	11	W071879	N		Carolyn Shickley	W 167 Blueberry Ln	NW	SE	2	19	6	W	Mason	Qgo	>	30	25					30	56	N	
15130020	11		N			W 2640 Fish Hatchery Rd	NE	SE	3	19	6	W	Mason	Qgo		16	64						85	N	
15130017	11	64589	N		Brad Gallien		NW	SW	5	19	6	W	Mason	Qgo	>	3	19	91	27	66	3	206	209	N	
15130018	11	W101328	N		Michael Beste	Ford Loop	SE	SE	5	19	6	W	Mason	Qgo	>	0	35	6	20			41	61	N	
15130009	11	W045650	N		Shelia Tausa	W 7201 Matlock-Brady Rd	SW	SW	8	19	6	W	Mason	Qgo	>	48	12					48	60	N	
15130010	11		N		William Oyen		NW	NE	8	19	6	W	Mason	Qgo	>	0	66						66	N	
15130011	11	219672	N		Simpson Salmon Hatchery		NE	SW	11	19	6	W	Mason	Qa		4	52	3	5				72	N	
15130012	11	W11799	N		Simpson Salmon Hatchery		SW	SW	11	19	6	W	Mason	Qa		7	6	6	97			20	116	Y	

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15130013	11	219694	N		Simpson Salmon Hatchery		NE	SW	11	19	6	W	Mason	Qa		8	73						82	N	
15140002	11	W058020	N		Owen Ticknor	W 260 Mealista Rd	NW	SE	13	19	6	W	Mason	Qgt	>	6	29					6	35	N	
15130005	11	5557	N		Sam Budevdeen	N 7821 Matlock-Brady Rd	NE	NW	17	19	6	W	Mason	Qgo	>	1	2	48	8			51	59	N	
15130002	11	W101362	N		Neal Graham	1181 W Boundary Rd	NW	SW	18	19	6	W	Mason	Qgo		0	8	24	13			32	45	Y	
16130099	11	11728	N		Bob Morten	Plug Mill Rd	NW	SE	22	19	6	W	Mason	Qgo		1	24	14	1	2	1		46	N	
16130093	11	64612	N		Owen Ticknor	W 260 Mealista Rd	NE	SW	28	19	6	W	Mason	Qgo		6	2	22	3	12	1		88	N	
16130094	11	38866	N		Phillip Cabe	W 6651 Satsop-Cloquallum Rd	SW	SE	28	19	6	W	Mason	Qa		1	25	48	1				126	Y	
16130095	11	45379	N		M. McKay	W 310 Mealista Rd	NE	SE	28	19	6	W	Mason	Qa		6	10						105	Y	
16130096	11		N		Ron Graham	Satsop-Cloquallum Rd	SW	SE	28	19	6	W	Mason	Qa		0	74					70	112	Y	
16130097	11	W01594	N		Robert Essenpreis	6451 Satsop-Cloquallum Rd	SE	SE	28	19	6	W	Mason	Qa			0					38	170	Y	
16130083	11		N		Gladys Tayler		NW	NW	29	19	6	W	Mason	Qgo	>	2	46					45	48	N	
16130084	11		N		Fred Weis		NW	NW	29	19	6	W	Mason	Qgo	>	2	32					31	34	N	
16130085	11	18911	N		Kathy Hakes	W 210 Beerbower Rd	NW	SW	29	19	6	W	Mason	Qgo	>	86	2					86	88	N	
16130087	11		N		State Parks Committee	Schafer State Park	SW	SW	29	19	6	W	Mason	Qa	>	0	30						30	N	
16130088	11		N		Don Baltzell		SE	SW	29	19	6	W	Mason	Qa	>	29	1					29	30	N	
16130089	11		N		Robert Blecker		SE	SW	29	19	6	W	Mason	Qa		4	22						42	N	
16130090	11		N		George Owlett		SE	NE	29	19	6	W	Mason	ΦEm			0						315	Y	
16130076	11	W01536	N		Robert Springer	W 61 Satsop Maple Glenn Rd	NW	NW	30	19	6	W	Mason	Qgo			0						39	N	
16130077	11	W18603	N		Lonnie Brumfield	Parcel #2 Benthien Rd	NE	SW	30	19	6	W	Mason	Qa		30	4						203	Y	
16130078	11	59196	N		Raymond Hert	9514 Maple Glenn Rt 1	NE	NW	30	19	6	W	Mason	Qa			0					14	39	N	
16130080	11	5729	N		Don Thomas		SW	NE	30	19	6	W	Mason	Qa			0					27	34	N	
16130081	11	W069517	N			W 719 Satsop Maple Glenn Rd	NW	NE	30	19	6	W	Mason	Qa			0						130	Y	
16130100	11		N		Mark Hendricks		NE	SW	30	19	6	W	Mason	Qa		2	22						35	Y	
16130071	11		N		John McAninch		SE	NW	31	19	6	W	Mason	Qgo	>	5	27						32	N	
16130072	11	W092242	N		Rodney Salsman	Satsop-Cloquallum Rd Lot 3	SW	SE	31	19	6	W	Mason	Qa	>	0	81					69	81	N	
16130073	11	W072811	N		Weld Enterprises	Satsop-Cloquallum Rd Lot 1	SE	SE	31	19	6	W	Mason	Qgo	>	0	23	15	23			38	61	N	
16130074	11	W101325	N		Steven Messman	Lillie Rd	SW	NW	32	19	6	W	Mason	Qa	>	35	65					94	100	N	
16130075	11	W067791	N		Mark Vetter	Lillie Rd	SW	SW	32	19	6	W	Mason	Qgo	>	4	66	12	17			70	99	N	
16140065	11		N		Melvin Roberts		NE	SE	36	19	6	W	Mason	Qgo	>	17	6					17	23	N	
15130006	11		N		Ted Arnold	Riverside Park	SW	NE	12	19	7	W	Grays Harbor	Qa		2	28						37	Y	
15130001	11		N		Frank Hollatz		SE	SE	13	19	7	W	Grays Harbor	Qa	>	40	30	6	6				82	N	
15110003	11		N		Dick Todd		NE	SW	2	19	8	W	Grays Harbor	Qa		3	21						38	Y	
15110004	11	W073761	N		Ken Fries	2573 Wynoochee Valley Rd	NE	NE	2	19	8	W	Grays Harbor	ΦEm		10	4						160	Y	

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15110001	11		N		John Holcombe		SW	NW	14	19	8	W	Grays Harbor	Qa	>	10	12						22	N	
15100002	11	218915	N		Clearance Presswood	3043 E Hoquaim Rd	SW	NW	16	19	9	W	Grays Harbor	Qapwo			0						61	N	
15100001	11		N		Carlos Taylor	East Hoquaim	NE	SE	17	19	9	W	Grays Harbor	Qapwo	>	25	30						55	N	
14160027	11	87521	N		Boyd Crosson	E 291 Julian Rd	NE	SW	1	20	3	W	Mason	Qga	>	130	3					130	133	N	
14160028	11	W18602	N		Marilyn Snodgrass	E 709 Grosser Rd	NW	NW	1	20	3	W	Mason	Qga	>	25	37						62	N	
15160140	11	W40764	N		John Christen	501 W. Bayview Rd	NW	NW	1	20	3	W	Mason	Qgt	>	62	13					59	75	N	
14160025	11	46504	N		Tom Moran	E 4651 HWY3	NW	NW	2	20	3	W	Mason	Qgt			0						134	N	
14160026	11	45629	N		Lori West	SE 260 Phillips Rd	NE	NW	2	20	3	W	Mason	Qgt	>	119	11	1					130	N	
14160023	11	W57991	N		Carolyn Pederson	E 321 Mason Lk Rd	NW	NE	3	20	3	W	Mason	Qgt		3	44	6	13	6	12	35	85	N	
14160024	11	58560	N		Clyde Armstrong	HWY 3 mile post 7	SW	NE	3	20	3	W	Mason	Qgt	>	150	4					91	154	N	
14160075	11	W069418	N		Carolyn Pederson	E330 Mason Lake Rd	NW	NE	3	20	3	W	Mason	Qgo		30	8	13	15	9	8	30	160	N	
15160134	11		N	20/3-3N3	WADOT		SW	SW	3	20	3	W	Mason	Qgo	>	2	79	89	1			170	171	N	Molenaar and Noble (1970)
15160138	11		N		Bayshore Golf Course		SE	SW	3	20	3	W	Mason	Qa	>	3	11	56	11			70	81	N	
15160139	11		N	20/3-3K1	Bayshore, Inc.		NW	SE	3	20	3	W	Mason	Qa			0						254	N	Molenaar and Noble (1970)
14160074	12		Y	P-3	BB&R	McEwen Prairie mine site	NW	NW	4	20	3	W	Mason	Qgo		0	34						38	N	
15160131	11	W056394	N		S & K Builders	3260 Johns Prairie Rd	SW	SE	4	20	3	W	Mason	Qgo	>	0	82	93	5			175	180	N	
14160010	11	W092269	N		Dawn Butcher	91 E Little Bear Ln	NE	NW	5	20	3	W	Mason	Qgo		3	41	49	2	37	9	93	141	N	
14160011	11		N	20/3-5F1	Rayonier, Inc.		SE	NW	5	20	3	W	Mason	Qgo		0	27	41	5				500	N	Molenaar and Noble (1970)
14160013	11	W075701	N		Rick Simpson	E 221 Little Bear Ln	NW	NE	5	20	3	W	Mason	Qgo		0	22	9	26				70	N	
14160014	11		N	20/3-5A1	Rayonier, Inc.		NE	NE	5	20	3	W	Mason	Qgo		0	43	307	14				383	N	Molenaar and Noble (1970)
14160015	11		N	20/3-5J2	O. E. Lee		NE	SE	5	20	3	W	Mason	Qgo		0	27	11	1	25	1		102	N	Molenaar and Noble (1970)
14160017	12		Y	P-6	BB&R	McEwen Prairie mine site	NE	NE	5	20	3	W	Mason	Qgo		0	37						46	N	
14160019	12		Y	P-5	BB&R	McEwen Prairie mine site	SE	NE	5	20	3	W	Mason	Qgo		0	38						41	N	
14160076	11	W067797	N		Kelly Neill	E 141 Prairiewood Pl	SE	NE	5	20	3	W	Mason	Qgo		0	16	3	13	39	32	96	148	N	
14160077	11		N		Robert Ramsey		NE	NW	5	20	3	W	Mason	Qgo	>	3	17	160	5			180	185	N	
15160122	11	87679	N		Frank Pascher	E 621 Eagle Ridge Dr	SW	SW	5	20	3	W	Mason	Qgo	>	75	41					75	116	N	
15160123	11	63617	N		Tom Bolling	1081 Johns Prairie Rd	SW	SW	5	20	3	W	Mason	Qgo		2	9	2	3	12	15	55	60	N	
15160124	11		N	20/3-5N2	Rayonier, Inc.		SW	SW	5	20	3	W	Mason	Qgo		43	42	8	19	23	31		460	N	Molenaar and Noble (1970)
15160125	11		N	20/3-5L2	S. R. Steehler		NE	SW	5	20	3	W	Mason	Qgo		0	3	22	7				32	N	Molenaar and Noble (1970)
15160126	11	13859	N		Port of Shelton		SE	SE	5	20	3	W	Mason	Qgo	>	0	15	135	5	55	17	150	227	N	
14160001	11		N	M&N 20/3-6E2	J. A. Tobler		SW	NW	6	20	3	W	Mason	Qgo	>	0	12	48	9			57	69	N	Molenaar and Noble (1970)
14160002	11	W060174	N		J. A. Tobler	E 1351 Island Lake Dr	SW	NW	6	20	3	W	Mason	Qgo	>	14	36	7	16				73	N	
14160003	11		N		Helbert	Island Lake Dr	SE	NW	6	20	3	W	Mason	Qgo	>	0	25	3	5	3	4		40	N	

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14160004	11		N	20/3-6B1	L. S. Rutherford		NW	NE	6	20	3	W	Mason	Qgo	>	0	18	11	3				32	N	Molenaar and Noble (1970)
14160005	11	64614	N		Ron Shipley	Oak Park	NW	NE	6	20	3	W	Mason	Qgo	>	1	69	51	60			157	181	N	
14160006	11		N		Richard Hopkins		NW	NE	6	20	3	W	Mason	Qgo	>	1	13	6	23				43	N	
14160009	11		N		Larry Warren		SE	NE	6	20	3	W	Mason	Qgo	>	3	18	106	1				127	N	
15160115	11		N	20/3-6N1	W. D. Fox		SW	SW	6	20	3	W	Mason	Qgo	>	8	12	40	12				72	N	Molenaar and Noble (1970)
15160117	11		N	20/3-6P1	R. H. Lamb		SE	SW	6	20	3	W	Mason	Qgo	>	58	7						65	N	Molenaar and Noble (1970)
15160118	11		N		Jamie Tiffany	E 1750 Island Lk Dr	NE	SW	6	20	3	W	Mason	Qgo	>	1	111					108	112	N	
15160119	11	W092217	N		Jess Morris	E 2436 Brockdale Rd	NE	SE	6	20	3	W	Mason	Qgo	>	23	19	24	15	3	6	84	90	N	
15160101	11		N	Well #1 20/3-7P1	City of Shelton		SE	SW	7	20	3	W	Mason	Qgo		0	60	25	15	3e+02	55		745	N	Molenaar and Noble (1970)
15160102	11		N	Well #2 20/3-7L1	City of Shelton		NE	SW	7	20	3	W	Mason	Qgo		0	60	43	12	90	37		708	N	Molenaar and Noble (1970)
15160103	11		N		City of Shelton		SE	SW	7	20	3	W	Mason	Qgo		0	32	206	1	3e+02	3		752	N	
15160104	11		N		City of Shelton		NE	SW	7	20	3	W	Mason	Qgo		2	6	9	24	16	9		298	N	
15160116	11		N		Rice & Quinn	2531 Island Lk Dr	NW	NW	7	20	3	W	Mason	Qgo	>	2	4	59	18			80	83	N	
15160120	11	W106198	N		David Strom	Bastone Cutoff	NE	NE	7	20	3	W	Mason	Qgo	>	0	31	14	21			45	66	N	
15160146	11		N		S & P Properties		SW	NW	7	20	3	W	Mason	Qgo	>	35	28					35	63	N	
15160147	11	W055962	N		Era Conklin & Co.	Johns Prairie	NE	NE	7	20	3	W	Mason	Qgo	>	24	37					37	61	N	
15160105	11	W41838	N		George Lombardie	Capitol Prairie Rd	SW	SE	8	20	3	W	Mason	Qgt	>	84	6						90	N	
15160106	11	44683	N		Carl Johnson	E 390 Hiawatha Blvd	SW	NW	8	20	3	W	Mason	Qgo		80	0					24	80	N	
15160107	11	34604	N		Carl Johnson	E 390 Hiawatha Blvd	SW	NW	8	20	3	W	Mason	Qgt	>	0	60					34	60	N	
15160108	11	W38528	N		Nicolas Cardona	Hiawatha Park	NE	NE	8	20	3	W	Mason	Qgo		2	21	12	30			44	67	N	
15160109	11		N	20/3-9D1	Port of Shelton		NW	NW	9	20	3	W	Mason	Qgo			0						155	N	Molenaar and Noble (1970)
15160110	12	26415	Y		Manke Lumber Co.	production well	SE	SW	9	20	3	W	Mason	Qgo		2	43	26	7	43	15		265	N	
15160142	12		Y	DH-3	Manke Lumber Company, Inc.	Manke Johns Prairie site	NE	NW	9	20	3	W	Mason	Qgo		1	17						28	N	McLucas and Associates, Inc. (1991)
15160143	12		Y	DH-4	Manke Lumber Company, Inc.	Manke Johns Prairie site	NW	NE	9	20	3	W	Mason	Qgo		0	54						56	N	McLucas and Associates, Inc. (1991)
15160144	12		Y	DH-2	Manke Lumber Company, Inc.	Manke Johns Prairie site	SE	NE	9	20	3	W	Mason	Qgo		1	170						185	N	McLucas and Associates, Inc. (1991)
15160097	11	W058018	N		Ken Little	E 90 Bayview Dr	SE	SE	11	20	3	W	Mason	Qgt	>	3	10	68	8				89	N	
15160098	11	W067178	N		Jim Wolf	2560 Agate Rd	SE	SE	11	20	3	W	Mason	Qgt	>	5	58	65	7	20	6		161	N	
15160100	11	84828	N		Jack Hilton	Bertleson Rd	SW	SW	12	20	3	W	Mason	Qgt	>	62	10	32	1			104	105	N	
15160086	11		N		Wallitner & Kenyon	E 3711 Agate Rd	SW	SW	13	20	3	W	Mason	Qgt	>	15	25	85	32	8	2	165	167	N	
15160085	11	W051658	N		Susan Christianson	E 200 Crestview	SE	SE	14	20	3	W	Mason	Qgt	>	28	24					28	52	N	

IDENTIFIER						LOCATION									WELL LOG DATA										
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15160096	11	W097522	N		Rainier General Development	Agate Loop	NE	NW	14	20	3	W	Mason	Qa		0	57					243	261	N	
15160099	11	W071696	N		Leonard Stolen	E 3030 Agate Rd	NE	NE	14	20	3	W	Mason	Qgt	>	2	18	40	20			60	80	N	
15160083	11	W055950	N		Dean Doyle	E 1252 Crestview Dr	SW	SE	15	20	3	W	Mason	Qgt	>	6	47	1	2	85	10	143	151	N	
15160084	11	18881	N		John Rogers	E 251 Sunset	NE	SE	15	20	3	W	Mason	Qgo	>	3	23	172	6			198	204	N	
15160082	11	213466	N		John Friend	Sunset Dr	SW	SE	16	20	3	W	Mason	Qgt		137	56						195	N	
15160094	11	46178	N		Larry Clausen	E 31 Beil Rd	NW	NW	16	20	3	W	Mason	Qgo		0	14	7	1	31	7	21	76	N	
15160095	11	W092207	N		Brad Owen	E 1933 HWY 3	SW	NW	16	20	3	W	Mason	Qgt	>	75	4					55	79	N	
15160111	12	R00851	Y		Manke Lumber Co		NE	NW	16	20	3	W	Mason	Qgt	>	22	73	38	2	20	5	49	160	N	
15160090	11		N	20/3-17K1	Rayonier, Inc.		NW	SE	17	20	3	W	Mason	Qgt		72	26	15	136	16	25		500	N	Molenaar and Noble (1970)
15160091	11		N		Monty Marshall		SE	SE	17	20	3	W	Mason	Qgt	>	80	5	1	12	1e+02	9	218	220	N	
15160092	11	W092223	N	Maple St Well #1	Fredson Homes		NE	SW	17	20	3	W	Mason	Qgt		0	10	85	20	75	16	95	270	N	
15160093	11		N	20/3-17A1	Rayonier, Inc.		NE	NE	17	20	3	W	Mason	Qgo		0	16	34	17	96	10		485	N	Molenaar and Noble (1970)
15160087	11		N	20/3-18G1	Jay Abel		SW	NE	18	20	3	W	Mason	Qgt	>	148	1					143	149	N	Molenaar and Noble (1970)
15160088	11		N	20/3-18K1	B. T. Winiecki		NW	SE	18	20	3	W	Mason	Qgt	>	160	4						164	N	Molenaar and Noble (1970)
15160089	11		N	20/3-18J3	L. J. Anderson		NE	SE	18	20	3	W	Mason	Qgt	>	77	2	18	6				103	N	Molenaar and Noble (1970)
15160077	11		N	20/3-19C1	Rayonier, Inc.		NE	NW	19	20	3	W	Mason	Qgo		0	60	76	15	51	61		735	Y	Molenaar and Noble (1970)
15160078	11		N	20/3-19H1	Rayonier, Inc.		SE	NE	19	20	3	W	Mason	Qgo		0	74	268	127				750	N	Molenaar and Noble (1970)
15160079	11	43246	N		Charlie Brown	E36 Radius Ct	NE	NE	19	20	3	W	Mason	Qgo	>	69	1					39	70	N	
15160080	11		N	20/3-19A1	Rayonier, Inc.		NE	NE	19	20	3	W	Mason	Qgo			0						883	N	Molenaar and Noble (1970)
15160081	11		N	20/3-20D1	Rayonier, Inc.		NW	NW	20	20	3	W	Mason	Qgo		4	.6	10	30	59	3		252	N	Molenaar and Noble (1970)
15160071	11	63602	N		Ted Higbee	1916 Walker Park Rd	NW	SW	21	20	3	W	Mason	Qapo	>	30	2	3	10				45	N	
15160072	11	87568	N		Joyce Frei	Walker Park Rd	SW	SE	21	20	3	W	Mason	Qapo	>	47	5	39	1			91	92	N	
15160062	12		Y		WADOT	SR 101 Mill Cr Br	SE	SW	30	20	3	W	Mason	Qgo		0	8	10	20				56	N	WADOT files
15160063	12		Y		WADOT	SR 101 Cloquallum Rd UC	NW	SW	30	20	3	W	Mason	Qgo		0	15						62	N	WADOT files
15160070	11	26174	N		Jack Bartz	2632 Arcadia Rd	NW	NW	30	20	3	W	Mason	Qgt	>	165	15						179	N	
15160051	11	5075	N		Brad Hittle	350 Golden Pheasant Rd	NE	SE	31	20	3	W	Mason	Qgo	>	40	20	20	50	7	2	137	139	N	
15160052	12		Y		WADOT	SR 101 Cole Rd OC	SE	NE	31	20	3	W	Mason	Qgo		0	32						43	N	WADOT files
15160061	11	52428	N		Guy Steward	Kingfisher Rd	SE	NW	31	20	3	W	Mason	Qa	>	119	3					119	126	N	
15160064	11	W060768	N		Jerry Webb	W 430 Insels Rd	NE	NE	31	20	3	W	Mason	Qgt	>	18	3	25	24	46	8	18	124	N	
15160053	11	21203	N		Dave Kamin	.75 mi up Cole Rd	NE	SW	32	20	3	W	Mason	Qgo		0	16						218	N	

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15160065	11		N		Carl Roberts	Carpenter Rd	NE	NW	32	20	3	W	Mason	Qgt	>	25	25	35	11	19	1	109	116	N	
15160067	11	W101340	N		Fred Slusser	Picadilly Ln	NE	NW	35	20	3	W	Mason	Qgt	>	4	34	43	32			113	114	N	
14150009	11	W072866	N		Dick Shrum	Blevins Rd	SW	NW	1	20	4	W	Mason	Qgo	>	31	14	28	27			31	100	N	
15150076	11		N		Edna Johnson		SW	SW	1	20	4	W	Mason	Qgo	>	2	18	37	5			57	62	N	
15150077	11		N	20/4-1N4	Jennings Miklethum		SW	SW	1	20	4	W	Mason	Qgo	>	13	13	39	18				83	N	Molenaar and Noble (1970)
15150078	11		N	20/4-1N3	Edna Johnson		SW	SW	1	20	4	W	Mason	Qgo	>	1	23	31	11				66	N	Molenaar and Noble (1970)
15150079	11		N	20/4-1N2	Edna Johnson		SW	SW	1	20	4	W	Mason	Qgo	>	2	18	37	5				62	N	Molenaar and Noble (1970)
15150080	11		N	20/4-1N1	Edna Johnson		SW	SW	1	20	4	W	Mason	Qgo	>	3	21	34	2				60	N	Molenaar and Noble (1970)
15150082	11		N		Al Brotche		SE	SW	1	20	4	W	Mason	Qgo	>	0	7	26	16	6	14		69	N	
15160113	11		N	20/4-1R3	Lawrerce Starr		SE	SE	1	20	4	W	Mason	Qgo	>	3	9	32	9				53	N	Molenaar and Noble (1970)
15160114	11	W055979	N		David Bayley	Island Lake	SE	SE	1	20	4	W	Mason	Qgo		9	100					17	109	N	
14150005	11		N	M&N 20/4-2E1	John Swanson		SW	NW	2	20	4	W	Mason	Qgo	>	25	35						60	N	Molenaar and Noble (1970)
14150006	11	84744	N		Washington State Patrol	W 631 Dayton Airport Rd	NW	SW	2	20	4	W	Mason	Qgo	>	3	84	69	10			54	166	N	
14150008	11		N	20/4-2F1	Port of Shelton (airport)		SE	NW	2	20	4	W	Mason	Qgo	>	2	134						136	N	Molenaar and Noble (1970)
15150074	11		N		Port of Shelton		SW	SE	2	20	4	W	Mason	Qgo		0	102	7	30			109	140	N	
15150072	11		N		Brian Cora	W 231 Wivel Rd	SW	SW	3	20	4	W	Mason	Qgo	>	1	4	78	8				90	N	
14150002	11	W101317	N		Mason Co. Dept Comm. Develop.	501 Eells Hill Rd	SW	NE	4	20	4	W	Mason	Qgo		0	45	67	4			84	107	N	
14150001	11	61835	N		Tom Boling	2 mi out Eells Hill Rd	NE	SW	5	20	4	W	Mason	Qgt	>	1	9	30	4	86	4		134	N	
15150059	11	84829	N		Bill Neal	Dayton Trails	NW	NE	8	20	4	W	Mason	Qgo	>	4	67	23	4	21	58	157	176	N	
15150060	11	W071886	N		William Neal	W 210 Dayton Trails Dr	SW	NE	8	20	4	W	Mason	Qgo	>	0	77	6	22	21	31	39	157	N	
15150062	11		N	20/4-8G1	R. E. Grossman		SW	NE	8	20	4	W	Mason	Qgo	>	2	28	20	10				60	N	Molenaar and Noble (1970)
15150063	11	91966	N		WA Dept. of Corrections	320 ft SW of well # 4	SW	NW	9	20	4	W	Mason	Qgo		2	20	1	8			23	60	N	
15150065	11		N	Well #3 20/4-9E1	WA Dept. of Corrections		SW	NW	9	20	4	W	Mason	Qgo		0	6	55	2	94	21		184	N	Molenaar and Noble (1970)
15150066	11		N	Well #4 20/4-9E2	WA Dept. of Corrections		SW	NW	9	20	4	W	Mason	Qgo		0	3	16	25	96	2		178	N	Molenaar and Noble (1970)
15150067	11		N	Well #1 20/4-9F1	WA Dept. of Corrections		SE	NW	9	20	4	W	Mason	Qgo		0	3	112	48	58	3		402	N	Molenaar and Noble (1970)
15150068	11		N		WA Dept. of Corrections		SE	NW	9	20	4	W	Mason	Qgo		0	23	4	18			27	56	N	
15150069	11		N	Well #2 20/4-9G1	WA. Dept of Corrections		SW	NE	9	20	4	W	Mason	Qgo		0	37	30	2	9	13		632	N	Molenaar and Noble (1970)

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15150075	12	R05703	Y	MW-3			NE	NE	11	20	4	W	Mason	Qgo	>	1	42						43	N	
15150083	11		N	20/4-11R2	Mason Co. Fair Association		SE	SE	11	20	4	W	Mason	Qgt	>	78	22	385	16				501	N	Molenaar and Noble (1970)
15150081	11		N			1221 Shelton Springs Rd	NE	NW	12	20	4	W	Mason	Qgo	>	48	21						69	N	
15150086	11	37677	N		Sam Tasi	HWY 101 N	SW	SE	12	20	4	W	Mason	Qgo	>	0	28	100	8				139	N	
15150087	12		Y		WADOT	SR 101 N Shelton interchange	SW	SE	12	20	4	W	Mason	Qgo	>	0	33						33	N	WADOT files
15150090	11	13796	N		Don Knudson		NE	NW	12	20	4	W	Mason	Qgo	>	0	32	33	15			42	80	N	
15150091	11		N		W. Russell		NW	NE	12	20	4	W	Mason	Qgo	>	0	12	40	34			52	86	N	
15150057	11		N	20/4-15L1	Rayonier, Inc.		NE	NW	15	20	4	W	Mason	Qapo		372	10						404	Y	Molenaar and Noble (1970)
15150058	11	13146	N		Dan Wells	W 8321 Shelton Matlock Rd	SE	NE	15	20	4	W	Mason	Qgt	>	3	7	13	17			30	40	N	
15150056	11	37666	N		Jack Davidson		SE	SW	16	20	4	W	Mason	Qgo	>	41	13	10	8				72	N	
15150052	11	26154	N			Shelton Matlock Rd	NW	SE	17	20	4	W	Mason	Qgt		28	5						33	N	
15150053	11	W060789	N		Don Dumontet	W 4471 Dayton Airport Rd	SW	NW	17	20	4	W	Mason	Qgo	>	4	71						75	N	
15150049	11	W06635	N		Don Cress	401 Hyland Rd	NW	SW	18	20	4	W	Mason	Qgo	>	6	44	4	6				60	N	
15150050	11	W056012	N		Paul Demiero	W 974 Little Egypt Rd	NW	SE	18	20	4	W	Mason	Qa	>	4	17	183	5	1	3		214	N	
15150051	11	W056012	N		Dale Drewry	Little Egypt Track 3	NE	SE	18	20	4	W	Mason	Qgt		39	3					39	53	N	
15150054	11		N	20/4-18B1	Lemke's Store		NW	NE	18	20	4	W	Mason	Qgo	>	155	8						163	N	Molenaar and Noble (1970)
15150031	11	84737	N		Todd Fennel	W 1841 Little Egypt Rd	SE	SE	19	20	4	W	Mason	Qgo			0						280	Y	
15150032	11	W052441	N		Jim Lewis	W 1041 Carmen Rd S	SW	SW	21	20	4	W	Mason	Qgt		46	28					46	74	N	
15150033	11	18906	N		Randy Churchill	W 3517 Shelton Matlock Rd	NW	SE	22	20	4	W	Mason	Qgt		90	15	29	26				190	N	
15150034	11	84757	N		Bill Fox	W 3786 Shelton Matlock Rd	SE	SE	22	20	4	W	Mason	Qgt		28	8	36	18	7	17	234	244	N	
15150035	11	W062346	N		India Bublitz	W 4251 Shelton Matlock Rd	NW	SE	23	20	4	W	Mason	Qgt	>	17	10	107	22			17	157	N	
15150036	11	W058025	N		Cheryl Coleman	W 4040 Shelton Matlock Rd	SE	SE	23	20	4	W	Mason	Qgo		0	42	9	13				64	N	
15150039	11	35019	N		Glady Kamp	W 151 Deegan Rd	SW	SE	24	20	4	W	Mason	Qa	>	190	6						196	N	
15150040	12		Y		WADOT	SR 101 Matlock Rd	NW	SE	24	20	4	W	Mason	Qa		2	11						103	N	WADOT files
15150044	12		Y		WADOT	SR 101 Simpson Railroad	SW	NE	24	20	4	W	Mason	Qgo		0	17						78	N	WADOT files
15150045	11		N	20/4-24G1	Rayonier, Inc.		SW	NE	24	20	4	W	Mason	Qgo			0						745	N	Molenaar and Noble (1970)
15150048	12		Y		WADOT	SR 101 C St UC	NW	NE	24	20	4	W	Mason	Qgo	>	0	69						69	N	WADOT files
15150088	11		N	20/4-24N1	Rayonier, Inc.		SW	SW	24	20	4	W	Mason	Qgo			0						436	N	Molenaar and Noble (1970)
15150030	11	W18706	N		Betty Giraldes	W 1590 Deegan Rd	SW	SW	25	20	4	W	Mason	Qa	>	74	10					25	84	N	
15150029	11		N		Andrew Shear	W 2020 Shelton Valley Rd	SE	NW	26	20	4	W	Mason	Qapo	>	2	5	46	6	1	7		67	N	

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15150028	11		N	20/4-27A2	E. M. Franklin		NE	NE	27	20	4	W	Mason	Qgt	>	50	40						90	N	Molenaar and Noble (1970)
15150014	11	W12563	N		Kim Mack	W 300 Grouse Rd	SE	SW	31	20	4	W	Mason	Qgt	>	27	5					27	32	N	
15150015	11	W060770	N		Leon Flemming	1612 Gallagher Rd	SW	SW	32	20	4	W	Mason	Qgt			0					16	48	Y	
15150023	11		N		Ann Olli	W 2230 Shelton Valley Rd	NW	NE	34	20	4	W	Mason	Qa	>	164	4					164	168	N	
15150024	11	13152	N		Simpson Credit Union	W 2511 Deegan Rd	SW	NW	35	20	4	W	Mason	Qa	>	45	7						52	N	
15160059	11	W051662	N		Tom Villines	W 2250 Cloquallum Rd	NE	SE	36	20	4	W	Mason	Qgt	>	28	37						65	N	
15160060	11	205046	N		Thomas Nut	W 2072 Cloquallum Rd	SE	NE	36	20	4	W	Mason	Qgt			0					89	119	N	
14140001	11	W072796	N		Marie Lazaris	Hanks Lake	NE	SW	1	20	5	W	Mason	Qgt		0	14	41	11			55	100	N	
14140002	11	W067209	N		Rob Weeks	2270 Hanks Lk Rd	NE	NW	1	20	5	W	Mason	Qgt	>	0	31	9	12	7	21	40	80	N	
14140003	11	W097706	N		Anthony Sykora	Hanks Lake Rd	NW	NE	1	20	5	W	Mason	Qgt	>	1	6	103	7			19	117	N	
14140018	11	W069447	N		Carolyn Kuyper	Hanks Lake	NE	SW	1	20	5	W	Mason	Qgt	>	0	33	15	3	34	7	85	92	N	
15140060	11	W099001	N		Michael Ames	W 878 Hanks Lk Rd	SW	SW	1	20	5	W	Mason	Qgo	>	0	50	30	8			80	88	N	
15140054	11	W060787	N		Don Vanderwal	W 461 Nahwatzel Beach Dr	NW	SW	4	20	5	W	Mason	Qgt		2	25					27	60	N	
15140055	11		N		Louie Baker		SW	SW	4	20	5	W	Mason	Qgt	>	0	44						44	N	
15140056	11		N		Jack Ruger	Lake Nahwatzel	SE	SW	4	20	5	W	Mason	Qgt	>	25	20						45	N	
15140059	11	W097715	N		Don Vanderwal	W 461 Nahwatzel Beach Dr	NW	SW	4	20	5	W	Mason	Qgt	>	0	19	22	39			41	80	N	
15140047	11		N		Jim Packer	W 1140 Boyer Rd	SW	NE	7	20	5	W	Mason	Qgt		2	6	17	55	30	15		269	N	
15140048	11	W097470	N		Rick Hickson	14240 Shelton-Matlock Rd	SE	NE	7	20	5	W	Mason	Qgt	>	26	41	42				96	109	N	
15140049	11		N		Clarence Olson		SW	NE	8	20	5	W	Mason	Qgt	>	204	2					201	206	N	
15140050	11	W055960	N		Island West Associates	Shelton-Matlock Rd	SW	NW	9	20	5	W	Mason	Qgt	>	53	28					75	81	N	
15140044	11		N		Judd Brooks		SW	NW	13	20	5	W	Mason	Qgt	>	3	8	14	18			41	43	N	
15140045	11	W097503	N		Raymond Nunes	Shelton-Matlock Rd	SE	NW	13	20	5	W	Mason	Qgo		24	2	19	3	37	10	85	107	N	
15140043	11		N		Gene Bresee		NW	SE	14	20	5	W	Mason	Qgt	>	26	10					26	36	N	
15140042	11		N		Allen Coleman		SW	NW	15	20	5	W	Mason	Qgt	>	3	17	34	6				60	N	
15140041	11	W100275	N		Mary Hansen	741 W Boyer Rd	NW	NE	17	20	5	W	Mason	Qgt	>	70	2					70	72	N	
15140037	11	W41246	N		Kirk Smith	W 2070 Highland Rd	SW	SW	24	20	5	W	Mason	Qgt	>	15	24	19	5			15	63	N	
15140030	11	W074279	N		Jim Harvey	3331 W Highland Rd	SE	SE	25	20	5	W	Mason	Qgt		50	10					50	62	Y	
15150026	11	W069442	N		Ronald Leadbetter	W 3021-630 Little Egypt	NW	SE	25	20	5	W	Mason	Qgt		8	3	2	1				17	Y	
15140024	11		N		John Gore	Satsop River	NE	NW	32	20	5	W	Mason	Qgt	>	0	54						54	N	
15130054	11	W062062	N		Patricia Halvorson	W 681 Maple Rock Rd	SE	NW	2	20	6	W	Mason	Qgt	>	23	17					27	40	N	
15130053	11	W097725	N		Nellie Cole	W 547 Beeville Rd	SE	SW	3	20	6	W	Mason	Qgt		27	10						65	Y	
15130051	11		N		Grant Long		SE	SE	7	20	6	W	Mason	Qgp	>	20	10					20	30	N	
15130052	11	W106152	N		Mike Brehmeyer	3540 W Deckerville Rd	SW	SW	7	20	6	W	Mason	Qapw			0						120	Y	
15130049	11		N		Greg Maddox		SE	SW	8	20	6	W	Mason	Qgo		3	32						242	Y	
15130047	11	45570	N		John Denton	Dry Creek Bed Rd	SE	NE	10	20	6	W	Mason	Qgt	>	45	15					45	60	N	
15130048	11	W38518	N		Mario Luengo	W 421 Maple Rock Rd	NE	SW	10	20	6	W	Mason	Qgt		14	7	5	6	4	16	14	65	N	
15130044	11	W067185	N		Sharon Blackston	W 29 Matlock Brady Rd	SE	NW	11	20	6	W	Mason	Qgt		16	6	5	12			16	45	Y	

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15130045	11	37663	N		Steve		NW	SE	11	20	6	W	Mason	Qgt	>	0	9	32	5				46	N	
15130046	11	52425	N			Matlock Grange	NW	NW	11	20	6	W	Mason	Qgt	>	214	6					214	220	N	
15130043	11	W056386	N		George Paul	W 15810 Matlock Dayton HWY	SE	NW	12	20	6	W	Mason	Qgo	>	14	73					14	87	N	
15130042	11	W071892	N		Herbert Brehmeyer	W 1926 Matlock Brady Rd	SE	SW	15	20	6	W	Mason	Qgt	>	34	26					34	60	N	
15130040	11	61434	N		Becky Swanson	Dog Gone Rd	NW	NW	17	20	6	W	Mason	Qgo	>	21	7					21	28	N	
15130039	11	5299	N		Steve Duncan	81 Lucas Ln	SE	NE	18	20	6	W	Mason	Qgo		0	4	16	1				47	Y	
15130036	11		N		Kingery		SE	SE	21	20	6	W	Mason	Qgo			0						42	Y	
15130037	11		N			Mary M Knight School	SW	SW	22	20	6	W	Mason	Qgo		2	52	10	21			64	85	N	
15130038	11	W106860	N		Thomas Shay	100 Bingham Cr	NW	NW	24	20	6	W	Mason	Qgo	>	24	6					24	30	N	
15130034	11	W099534	N		Randy Barcom	W Forest Green Ln Lot B	NE	NW	28	20	6	W	Mason	Qgo		0	8	2	9			11	50	Y	
15130035	11	13155	N		Steve Townsend	W 251 Mary M Knight Rd	NW	NE	28	20	6	W	Mason	Qgo	>	5	22	7	6	5	4		49	N	
15120003	11		N		Mary Jo Hopper		SE	SW	28	20	7	W	Grays Harbor	Qa		16	15						35	Y	
15120002	11		N		Mary Jo Hopper		NW	NE	33	20	7	W	Grays Harbor	Qa		14	13						35	Y	
15120004	11	1	N		Earl Kalles	474 Cougar Smith Rd	NE	NE	33	20	7	W	Grays Harbor	Qa	>	5	17						22	N	
15110006	11		N		Fish Hatchery		NW	SE	30	20	8	W	Grays Harbor	Qa		0	22						30	Y	
15110005	11		N		DeTretzen		SW	SE	36	20	9	W	Grays Harbor	Qa	>	20	38	10	32			30	100	N	
15090034	11		N		Elda Gossler		SE	NW	7	20	10	W	Grays Harbor	Qa	>	0	68						70	N	
15090037	11	W074757	N		Ed Retherford		NW	SW	8	20	10	W	Grays Harbor	Qapo		60	55						120	N	
15090039	11		N		Joyce Potter		SW	NW	8	20	10	W	Grays Harbor	Qapo		3	70						115	N	
15090040	11	W055167	N		Craig Cooper	Mcfee Rd	SW	NW	8	20	10	W	Grays Harbor	Qapo	>	40	41						81	N	
15090044	11	W097010	N		Dave Smith	56 Prairie Garden	SE	NW	8	20	10	W	Grays Harbor	Qapo	>	6	15	19	10	25	15	75	90	N	
15090047	11	W097011	N		William Schuette	51 Prairie Garden	SE	NW	8	20	10	W	Grays Harbor	Qapo	>	2	46	21	12			75	81	N	
15090051	11	W060160	N		Larry Bennett	Mcnutt Rd	SE	NW	9	20	10	W	Grays Harbor	Qapo	>	137	13					137	150	N	
15090055	11		N		Steve Tobin		NE	NE	9	20	10	W	Grays Harbor	Qa		10	10						79	N	
15090057	11		N		Albert Beck		SW	SE	11	20	10	W	Grays Harbor	Qapwo	>	0	10	9	17	14	5		55	N	
15090028	11		N		Charlie Dauron		SW	NW	16	20	10	W	Grays Harbor	Qa		10	10						28	Y	
15090029	11	35705	N		Gene Smith		SE	NW	16	20	10	W	Grays Harbor	Qa		6	19						30	Y	
15090014	11	203539	N		KB Forest Products	Badger Rd	NW	SE	19	20	10	W	Grays Harbor	Qapo		0	80						100	N	
15090010	11		N		Homer Taylor		NW	NW	30	20	10	W	Grays Harbor	Qapwo		2	6						90	N	
15090011	11		N		Robert Droz		NW	NW	30	20	10	W	Grays Harbor	Qapwo		2	6						75	N	
15090006	11		N		Joel Madtson		NE	SE	31	20	10	W	Grays Harbor	Qapwo	>	35	5						40	N	
14160063	11	64599	N		Curtus Preston		SE	NW	6	21	3	W	Mason	Qapo	>	102	13					102	115	N	
14160064	11	W054548	N		Rusty Anderson	4050 HWY 106	SW	NE	6	21	3	W	Mason	Qapo	>	0	20	55	38			75	113	N	
14160058	11		N		Eldon Bell	E 2780 HWY 106	SW	NW	7	21	3	W	Mason	Qapo	>	60	7					60	67	N	
14160053	11	W062313	N		Arthur Bushey	Sundowner	NE	SE	28	21	3	W	Mason	Qgt	>	16	7	3	53			26	79	N	
14160048	11	62864	N		Ray Notar	E 119 Capitol Peak Dr	NW	SE	30	21	3	W	Mason	Qgt	>	130	2	3	1			135	136	N	
14160031	11		N	21/3-31F1	Rayonier, Inc.		SE	NW	31	21	3	W	Mason	Qa		0	16	28	5	17	8		444	N	Molenaar and Noble (1970)

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14160045	11		N	21/3-31A1	Rayonier, Inc.		NE	NE	31	21	3	W	Mason	Qgo		36	39	59	53	25	77		452	N	Molenaar and Noble (1970)
14160046	11		N	21/3-31C1	Rayonier, Inc.		NE	NW	31	21	3	W	Mason	Qgo			0						258	N	Molenaar and Noble (1970)
14160007	11		N	21/3-32N1	Rayonier, Inc.		SW	SW	32	21	3	W	Mason	Qa		215	6	29	18	92	14		658	N	Molenaar and Noble (1970)
14160032	11	87683	N		Keith Fuller	Jenson Rd #2	SW	NW	32	21	3	W	Mason	Qgo	>	15	20	8	7	3	6	15	59	N	
14160033	11		N	21/3-32F1	Rayonier, Inc.		SE	NW	32	21	3	W	Mason	Qgo		150	8	33	9	37	23		264	N	Molenaar and Noble (1970)
14160037	11	W075742	N		John Glenn	E 31 Bramble Ln	NW	SW	32	21	3	W	Mason	Qgo	>	0	39					18	39	N	
14160034	12		Y	P-4	BB&R	McEwen Prairie mine site	SW	SW	33	21	3	W	Mason	Qgo		0	25						26	N	
14160035	12		Y	P-2	BB&R	McEwen Prairie mine site	NW	SW	33	21	3	W	Mason	Qgo		0	58						64	N	
14160036	12		Y	P-1	BB&R	McEwen Prairie mine site	NW	SW	33	21	3	W	Mason	Qgo		0	15						30	N	
14160040	11	W097478	N		David Deremer	Catfish Lake	NE	SE	34	21	3	W	Mason	Qgo	>	0	37	15	9			52	61	N	
14160041	11	W067771	N		Harold Hatfield	E 560 Catfish Lake	SE	NW	34	21	3	W	Mason	Qgt		0	12	25	12	3	14	51	161	N	
14160042	11	92923	N		Steve Shineman	120 E Eler	NW	SE	35	21	3	W	Mason	Qgt	>	0	16	55	5				76	N	
14150069	11		N		Bill McKasson	Tract 5	SE	SW	5	21	4	W	Mason	Qgt	>	103	10						113	N	
14150068	11		N		Johnson		SE	NE	6	21	4	W	Mason	Qgt	>	12	30					12	42	N	
14150065	11		N		Lewis Metcalf		NE	SE	7	21	4	W	Mason	Qa	>	20	22						42	N	
14150066	11	45385	N		Dave Smalley	N 2820 Sunnyside Rd	NE	SW	8	21	4	W	Mason	Qa	>	225	6					216	231	N	
14150064	11		N		Ed Long		NW	SE	12	21	4	W	Mason	Qa	>	18	25					18	43	N	
14150067	11		N		Kim Kenyon		SW	SW	12	21	4	W	Mason	Qa		36	8					36	44	N	
14150062	11	W38536	N		Bill Schumacher	Webb Hill Rd	SW	NE	13	21	4	W	Mason	Qgt		216	5	116	7	1e+02	9	216	482	N	
14150047	11	45386	N		Bill Fox	Enchantment Ridge	SW	SE	14	21	4	W	Mason	Qga		162	15	7	16	88	12	290	300	N	
14150059	12		Y		WADOT	SR 101 Skokomish R. Slough bridge	SE	NW	15	21	4	W	Mason	Qa	>	12	74						86	N	WADOT files
14150055	12		Y		Weaver Creek Fish Hatchery		NW	SW	16	21	4	W	Mason	Qa		6	37	12	20				92	N	
14150056	12		Y		Weaver Creek Fish Hatchery		NW	SW	16	21	4	W	Mason	Qa		6	77						140	N	
14150075	12		Y		Weaver Creek Fish Hatchery		NW	SW	16	21	4	W	Mason	Qa		5	40	12	16	5	15		100	N	
14150054	11		N		John Spencer		NE	NW	17	21	4	W	Mason	Qa	>	16	9	16	8				49	N	
14150051	11	18915	N		Blaze Gorny	W 3810 Skokomish Valley Rd	SE	NW	18	21	4	W	Mason	Qa	>	30	9					30	39	N	
14150052	11	W069120	N		Margaret Van Cleave	W 3490 Skokomish Valley Rd	NW	NE	18	21	4	W	Mason	Qa	>	0	41					23	41	N	
14150033	11		N		Dept of Fisheries	George Adams Hatchery	NW	NW	22	21	4	W	Mason	Qa	>	16	79					42	108	N	
14150035	11	86429	N		Eric Fairchild	Thunder Ridge	NE	NW	22	21	4	W	Mason	Qgo	>	19	132	78	10			237	239	N	
14150038	11	W101367	N		Micheal Bloomfield	E 1651 Eagle Pt Dr	NE	SW	22	21	4	W	Mason	Qgo		0	11	112	24	58	29	205	216	N	
14150040	11	W105917	N		Cook & Sheldon	E 340 Eagle Pt Rd	NE	SW	22	21	4	W	Mason	Qgo	>	0	47	17	22	6	20	96	112	N	

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14150041	11	W062327	N		Bobby Hanna	Lot 13d Eagle Pt Rd	NW	SE	22	21	4	W	Mason	Qgo		0	21	31	31	48	22	133	259	N	
14150042	11	W119311	N		James Sherman	Thunder Ridge	NE	SE	22	21	4	W	Mason	Qgt		86	103	29	61			254	279	N	
14150043	11	W069411	N		Richard Dempsey	Thunder Ridge	SW	NW	23	21	4	W	Mason	Qgt	>	26	211	3	21				261	N	
14150044	11	W07284	N		Robert Nyland	Thunder Ridge	NW	SW	23	21	4	W	Mason	Qgt	>	145	60	33	83			277	320	N	
14150045	11	W060774	N		Gene Biddinger	E 135 Mooreview Ln E	SE	SW	23	21	4	W	Mason	Qgt	>	165	104	13	12	10	10	304	314	N	
14150046	11		N		Pam Hillstrom		NE	NW	23	21	4	W	Mason	Qga		0	80	15	65	1e+02	25	338	339	N	
14150048	11	W105939	N		Sherry Speaks	E Falcon Ridge Ct	SW	SW	24	21	4	W	Mason	Qgt	>	95	25					95	120	N	
14150049	11	W067743	N		McReavy Homeowners Assoc.	E 91 Marisa Pl	NW	SE	24	21	4	W	Mason	Qgt		74	46					87	120	N	
14150050	11	W054532	N		Mark Biser	E 241 Webb Hill Rd	SW	SE	24	21	4	W	Mason	Qgt	>	5	52	3	50			60	100	N	
14150028	11	44497	N		Steve Bennett	E 446 Snowy Owl Dr	SW	NW	25	21	4	W	Mason	Qgo	>	3	92						95	N	
14150029	11	W111702	N		William Spears	Rolling Hills & Snowy Owl	SW	NW	25	21	4	W	Mason	Qgo	>	0	96					55	96	N	
14150030	11	W067217	N		Island West	Lexinton Place	SE	NW	25	21	4	W	Mason	Qgt		25	88					25	113	N	
14150031	11	W056005	N		Herman Drake	McReavy Rd subdivision	SE	NW	25	21	4	W	Mason	Qgt		0	54	3	7	8	5	135	155	N	
14160052	11	W043890	N		Herman Drake	Off McReavy Rd	SE	NE	25	21	4	W	Mason	Qgt		0	34	10	43			44	87	N	
14150019	12		Y		WADOT	SR 101 Brockdale Rd to SR 3	SE	NW	26	21	4	W	Mason	Qgo		0	12						22	N	WADOT files
14150022	11	W045575	N		B & M Investments	Brockdale Road	NW	SE	26	21	4	W	Mason	Qgo	>	3	6	15	15			26	41	N	
14150023	11	W045581	N		B & M Investments	Brockdale Road	NW	SE	26	21	4	W	Mason	Qgo	>	1	12	33	15			55	61	N	
14150024	11	W119333	N		Demetric Washington	Kristina Lane #31	NE	SE	26	21	4	W	Mason	Qgo	>	0	49	4	17			19	70	N	
14150012	11	W106186	N		Adonis Ceniza	Eels Hill Rd	SW	SW	32	21	4	W	Mason	Qgo		19	20					19	67	N	
14150013	11	W056021	N		James Strong	Eels Hill Rd	SE	SW	32	21	4	W	Mason	Qgo	>	195	6	16	4			195	221	N	
14160030	11	W12791	N		Robert Dethlefs	Brockdale Road	SE	NE	36	21	4	W	Mason	Qga	>	137	22					137	159	N	
14140015	11	86275	N		Bruce Albert	W 550-620 Skokomish Valley Rd	SW	SW	1	21	5	W	Mason	Qa	>	17	25					17	42	N	
14140010	11	W097535	N		Frank Ragan	6571 W Skokomish Valley Rd	NE	SE	10	21	5	W	Mason	Qa	>	31	3					31	34	N	
14140011	11	218339	N		Gary Sytsma	Skokomish Valley Rd	NW	SE	11	21	5	W	Mason	Qa	>	25	17					25	42	N	
14140012	11	86440	N		Pat McAllisteer	W 5291 Skokomish Valley Rd	NW	SE	11	21	5	W	Mason	Qa	>	33	3					50	57	N	
14140014	11		N		Ron Gold	Skokomish Valley Rd Tract 8	NE	NE	11	21	5	W	Mason	Qa	>	0	33					21	33	N	
14140013	11		N		John Prouse		NE	SW	12	21	5	W	Mason	Qa	>	20	22					20	42	N	
14140016	11	W099093	N		Mason Ward	W Bambi Farms Rd	NW	NW	12	21	5	W	Mason	Qa	>	2	35					20	37	N	
14130003	11	W062335	N		Chuck Drummond	W 1940 Beeville Lp Rd	SW	NE	26	21	6	W	Mason	Qgt		14	13	15	15				67	N	
14130004	11	205035	N		Robert Edwards	W 3971 Beeville Rd	NW	NE	26	21	6	W	Mason	Qgt	>	67	2						69	N	
14130002	11	W38519	N		Tom Hanes	W 1930 Beeville Lp Rd	NW	SW	27	21	6	W	Mason	Qgt		34	2						38	N	
14130001	11	45377	N		Victor Austin	Matlock Beville Lp Rd	SE	NW	28	21	6	W	Mason	Qgt	>	10	9	17	4				40	N	
13160013	11		N		Lincoln Construction		NW	NW	1	22	3	W	Mason	Qgt		0	140					130	190	N	

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13160012	11	26979	N		Chet Loudin		SW	NE	2	22	3	W	Mason	Qgt	>	136	5					35	141	N	
13160011	11		N		Mt. Rainier Boy Scout Council		SE	NE	5	22	3	W	Mason	Qgt	>	0	148	558	2			706	708	N	
13160009	11	207110	N		Mobile Home Specialists	NE 1101 Tahuya Rd	NE	SW	12	22	3	W	Mason	Qgo			0						99	N	
13160007	11		N		Armstrong		SW	NE	14	22	3	W	Mason	Qgt	>	37	6	118	38			37	199	N	
13160008	11	14208	N		Maggie Lake Water Dist.	Lot 1,2 Block 3	SW	NE	14	22	3	W	Mason	Qgt	>	0	185	10	184			335	379	N	
13160001	11		N		Herb Chaffey		SE	SW	20	22	3	W	Mason	Qgo			0						99	N	
13160002	11	16863	N		Herbert Chaffey		SW	SE	20	22	3	W	Mason	Qapo	>	0	30	42	9	49	13	72	143	N	
13160004	11	44421	N		Tommy Thombs	NE 43 Klahowya Rd	SE	NE	23	22	3	W	Mason	Qgt		74	45	3	72	17	85	392	418	N	
13160005	11	W061317	N		Steve Justiss	NE 11271 N Shore Rd	SE	SE	23	22	3	W	Mason	Qga	>	0	20	70	10			90	100	N	
13160006	11	W111835	N		Jim Jones	11181 N Shore Rd	NW	NW	24	22	3	W	Mason	Qgt	>	0	17	84	15				116	N	
14160073	11		N		Kellington		SW	NE	26	22	3	W	Mason	Qapo	>	0	12	19	4	10	2		47	N	
14160072	11	W075740	N		Barbra Frost	17940 N Shore Rd	NW	NE	30	22	3	W	Mason	Qapo	>	0	25	136	1			161	162	N	
14160066	11		N		Gordon Gerbing		SE	SE	32	22	3	W	Mason	Qapo	>	24	59	132	5			215	220	N	
14160068	11	16860	N		Myron Skubinna	Lot 9 Timber Tides	SW	SE	35	22	3	W	Mason	Qgt	>	217	24					217	241	N	
14160069	11	44445	N		Ron Tarry	Lot 5 Timber Tides	SE	SW	35	22	3	W	Mason	Qgt		0	222	17	16	80	7	240	523	N	
14160070	11	W092221	N		Rodney Crow	Timber Tides	SW	SE	35	22	3	W	Mason	Qgt		0	4	281	37			285	322	N	
13160010	12		Y		WADOT	SR 101 Miller Cr Br	NE	NE	1	22	4	W	Mason	Qa		0	30						51	N	WADOT files
13150013	11		N		Don Persson	Tract 2 of Lk Cushman W#2	NE	SW	4	22	4	W	Mason	Qgo	>	20	38					20	58	N	
13150010	11	28305	N		Lk. Cushman Maint. Co.	3740 Lk Cushman Rd	NE	NW	9	22	4	W	Mason	Qgo		2	7	47	5			56	160	Y	
13150011	11	W099028	N		Pauline Ferrier	N 531 Finch Creek Rd	NW	SE	11	22	4	W	Mason	Qa	>	0	39					8	39	N	
13150006	11	W105941	N	PUD #1	Hoodsport Water System		NE	NW	14	22	4	W	Mason	Qga		31	140	2	6	3	77	114	270	N	
13150007	11		N		Groves Property Partnership		SW	NE	14	22	4	W	Mason	Qga	>	0	340						340	N	
13150008	11	W29669	N		Bill Petty	N 302 Old Mills Rd	NE	NE	14	22	4	W	Mason	Qapo	>	12	81	8	82			170	184	N	
13150005	11	W093360	N		Lk. Cushman Maint. Co.	Lot 125 Lk Cushman Dist 9	SW	SE	16	22	4	W	Mason	Qgt			0						73	Y	
13150003	11		N		Simpson Properties Inc.		SW	NW	23	22	4	W	Mason	Qgt		0	72	35	18			107	127	N	
14150074	11	44495	N		Tim Avey	N 21181 HWY 101	NW	SW	26	22	4	W	Mason	Qgo	>	8	30						38	N	
14120001	11		N		Olympic National Forest		NW	NE	28	22	7	W	Grays Harbor	Qapw	>	22	23	4	46			22	95	N	
13100002	11	W055996	N		Olympic National Forest	Quinault Ranger District	SE	SW	13	22	9	W	Grays Harbor	Qap	>	240	74					240	315	N	
13090003	11	W119308	N		Stanton	Off Burn Rd	SW	SE	12	22	10	W	Grays Harbor	Qapw	>	0	32	123	46			173	201	N	
13090005	11	201759	N		Candy Theel	Nielton Church	SE	NE	12	22	10	W	Grays Harbor	Qapw	>	80	107						187	N	
13090006	11	68091	N		Candy Theel	Old Mill Lane	SE	NE	12	22	10	W	Grays Harbor	Qapw	>	22	158						181	N	

IDENTIFIER						LOCATION									WELL LOG DATA										
WADNR unique number	WADNR data type code	WADOE well number	Data verified?	Well name	Original well owner	Well location	¼¼ section	¼ section	Section	Township (N)	Range	Meridian	County	Geologic unit	Qualifier	Overburden thickness (feet)	1st resource thickness (feet)	1st interbed thickness (feet)	2nd resource thickness (feet)	2nd interbed thickness (feet)	3rd resource thickness (feet)	Depth to *top of water zone* (feet)	Well total depth (feet)	Bedrock penetrated?	Reference
13160026	11		N		Chesterfield-Hoss		NE	SW	9	23	3	W	Mason	Qgt		5	345	20	20				440	N	
13160024	11	W092290	N		Tamyra James	Eagle Cr Rd	SW	NE	17	23	3	W	Mason	Qls	>	8	18	27	7			55	60	N	
13160023	11	7042	N		Jim Taylor		NE	NE	22	23	3	W	Mason	Qgt	>	0	118					80	118	N	
13160020	11		N		John Steatman		NE	SW	25	23	3	W	Mason	Qgt		0	27						150	N	
13160018	11	46175	N		John Williams	Hood Canal	SE	SW	30	23	3	W	Mason	ΦEm		0	37						195	Y	
13160021	11		N		Brian Olsen	N 68 Cushman Rd	NW	NW	30	23	3	W	Mason	Qgo		15	25						310	Y	
13160015	12		Y		WADOT	SR 101 Sund Creek bridge	SW	NW	31	23	3	W	Mason	Qa		0	5	5	9				47	N	WADOT files
13150020	11	W101332	N		Karla Weber	504 N Cushman Cutoff	SW	SE	9	23	4	W	Mason	Qgt	>	0	50						50	N	
13150016	11		N		City of Tacoma		NW	SE	20	23	4	W	Mason	Qgo		3	109					8	113	N	
13120001	11		N		U.S. Forest Service	Wynoochee Falls campground	SW	NW	24	23	7	W	Grays Harbor	Qa	>	0	11	29	5			40	45	N	
13100009	11		N		Harold Hanson		NE	SW	10	23	9	W	Grays Harbor	Qad		30	70						130	Y	
13100007	11	W062592	N		Edward Sheary	South Shore Rd	NW	NW	21	23	9	W	Grays Harbor	Qad	>	0	35						35	N	
13090012	11	45538	N		Delmar Colegrove	Amanda Park	NW	NW	30	23	9	W	Grays Harbor	Qad	>	12	74					49	86	N	
13090020	11	W055156	N		Gary Betts	6469 HWY 101	SW	SE	15	23	10	W	Grays Harbor	Qad	>	40	33					50	73	N	
13090022	11		N		Walden		SE	NE	15	23	10	W	Grays Harbor	Qad	>	0	100						100	N	

Appendix 5. Geologic descriptions of significant mined units

This appendix provides descriptions for geologic units that have been mined in the Shelton 1:100,000 quadrangle for construction aggregates and (or) that have potential to produce sand and gravel or bedrock meeting the threshold criteria of this study. These definitions are intended for geologists and engineers and contain a number of terms that are not included in the glossary (Appendix 1). For complete descriptions and ages of all geologic units in the Shelton quadrangle, see Dragovich and others (2002) and Washington Division of Geology and Earth Resources (2001).

SAND AND GRAVEL UNITS

Qa **Alluvium (Holocene)**—Poorly graded sand, gravel, cobbles, and boulders deposited along or in modern rivers and streams. These deposits tend to have marked horizontal and vertical variations in grain size resulting in local areas of poor-quality aggregate within most deposits. Flood plains typically consist of these sediments together with overbank deposits of fine sand, silt, and organic matter. Maximum thickness is 80 feet with an average thickness of 35 feet. Although alluvium is generally an excellent resource, impacts to riparian and aquatic habitats and the potential for physical damage to infrastructure resulting from excavation on lower flood plains may preclude development of these resources (see Norman and others, 1998).

Qgo **Recessional outwash (late Pleistocene, ~14,500 to 11,300 years)**—Sand and fine gravel with lesser cobbles, laminated silt and clay, and rare boulders. The unit mainly consists of tan sandstone, lithofeldspathic sandstone, and basalt clasts derived from the Olympic Mountains, with some granitic (<10%) and metamorphic clasts probably derived from Canadian sources. Fluvial deposits consist of unconsolidated, horizontally bedded, stratified, and poorly sorted sand and gravel with lesser amounts of silt and clay. Delta deposits are on the order of 175 feet thick and well stratified and contain little to no silt or clay. Deposits are poorly to well sorted, with sorting improving where they have been deposited as deltas in proglacial lakes. Well-sorted deposits of pebbles and cobbles in abandoned channels within the flood plains of major ice-age rivers provide the highest-quality aggregate in the study area for portland cement concrete. Deposits contain ubiquitous festoon cross-bedding. Most of the larger sand and gravel pits in the quadrangle are developed in this unit.

Qga **Advance outwash, Fraser Glaciation (late Pleistocene, ~18,300 to 14,500 years)**—Poorly sorted deposits of sand, gravel, and cobbles, with lesser clay, silt, boulders, and mineral cements. This unit is horizontally bedded and commonly cross-bedded in coarsening-upward sequences. The unit has highly varied composition and thickness and is commonly hard and compact. Clasts are about 95 percent fresh, but the percentage of weaker clast types derived from the Olympic Mountains increases toward the base of the unit. Advance outwash is stratigraphically overlain by Vashon glacial till. Its known thickness is 187 feet (based on a measured section shown on Plate 1 in sec. 5, T21N, R4W) and its maximum thickness is more than 200 feet on both sides of the Skokomish River valley and Hood Canal (Molenaar and Noble, 1970). Thick overlying till generally prevents development of this unit; however, the Huson pit, part of the Bayshore pit, and several smaller gravel pits are developed in this unit.

BEDROCK UNITS

Ev_c, Ev_{cf}, Ev_{cp}, Eigb **Crescent Formation (early Eocene, 57.8 to 45.6 million years)**—Varied basaltic rocks (Babcock and others, 1994). Volcaniclastic conglomerate, breccia, and mudflow deposits that dominate this unit are typically weak and commonly contain numerous deleterious calcite and zeolite veins. A lower aggregate-producing interval in this thick formation is characterized by pillow basalt (unit Ev_{cp}), whereas the upper half of the unit (unit Ev_{cp}) has more lava flows with rare but commercially significant columnar basalt (Tabor and Cady, 1978). The Crescent Formation also includes volcaniclastic sandstone and minor gabbro (unit Eigb). The color of the unit is black, greenish black, or very dark gray where fresh, and light yellowish brown where weathered. Columnar basalts that formed as subaerial flows or as sills are the most important aggregate-producing rocks in the study area. Columns are typically 12 to 18 inches in diameter, but locally as much as 4 feet in diameter. A thickness of greater than 100 feet of hard and durable basaltic rock is exposed in a few quarry faces. Pillow basalts contain varied amounts of clay and volcanic glass between pillows. This unit contains the only high-quality bedrock mined in the quadrangle and hosts all commercial bedrock quarries.

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Doug Sutherland - Commissioner of Public Lands
Division of Geology and Earth Resources
Ron Teissere, State Geologist

Washington Division of Geology and Earth Resources
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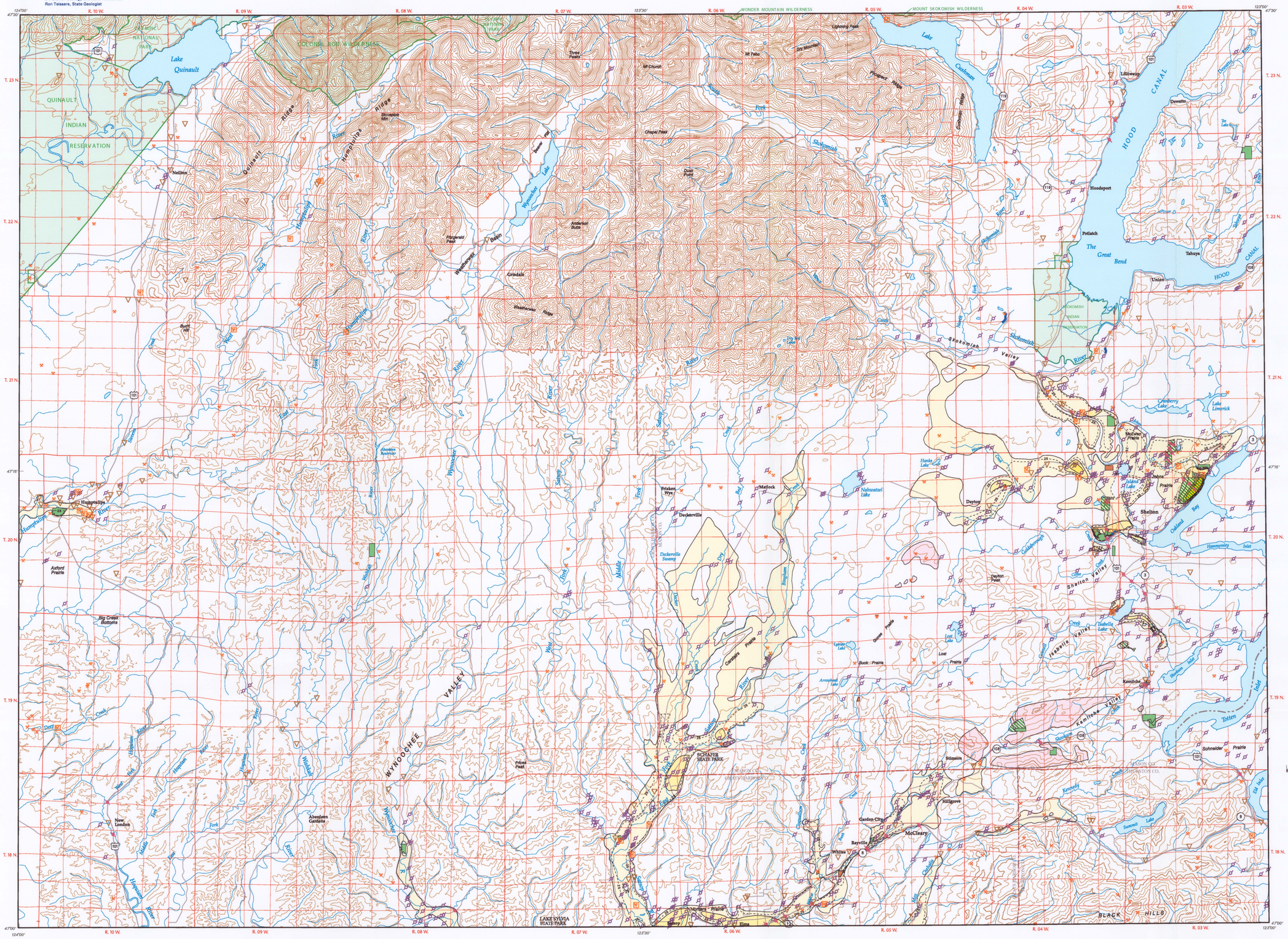

PLATE 1

LOCATION OF SOME SAND, GRAVEL, AND QUARRIED BEDROCK RESOURCES IN THE SHELTON 1:100,000 QUADRANGLE, WASHINGTON

EXPLANATION

- <50, 50-100, 100-150, 150-200: Potential extent of "hypothetical undiscovered" sand and gravel resources, most of which meet threshold criteria for strength, durability, thickness, areal extent, and clast-size distribution, and are not buried under thick layers of overburden. (See text for further explanation.) Yellow shades indicate approximate gravel thickness in feet.
- 60: Contour showing possible thickness of some hypothetical gravel deposits meeting the threshold criteria (50-ft interval)
- 25: Additional contour at 25 ft
- Potential extent of "speculative undiscovered" bedrock resources which locally meet the threshold criteria, but are composed mostly of weak rock types that are unsuitable for construction aggregate
- Large active mine. Includes intermittently operated sites and a few sites that may have been abandoned, but are not reported as such
- Large depleted or abandoned mine
- Large proposed mine
- Small gravel pit, borrow pit, or quarry. Most of these mines are used for forest road maintenance or construction and (or) do not significantly influence the market at this time
- Depleted or abandoned small gravel pit, borrow pit, or quarry. Includes mines with terminated state reclamation permits, reclaimed sites, and mines that cannot be operated owing to changes in land use (for example, the site has been flooded by a reservoir)
- Water well used in this study for subsurface information
- Geotechnical or other borehole used in this study
- Sampling site for laboratory test of strength and durability of gravel or rock. Does not include analyses from most mines (analyses from mines are described in Appendix 3)
- Geologic observation used in this study
- Stratigraphic section measured as part of this study

Section Grid

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Lambert Conformal Conic Projection
1927 North American Datum
Washington State Plane Coordinate System, South Zone
Other base map information from the Washington Department of Natural Resources, Geographic Information System Database—2002
Washington Division of Geology and Earth Resources

Map production by
Charles Caruthers, Anne Heinitz, and Phung Ho

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Plate 1