NATURAL RESOURCES

Deep-Seated Landslide Inventory of the West-Central Olympic Peninsula

by Wendy J. Gerstel

U.S. Forest Service contracts
UW 234153 and DNR FY96-165

WASHINGTON
DIVISION OF GEOLOGY
AND EARTH RESOURCES

Open File Report 99-2
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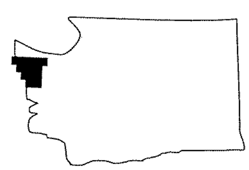

Location of map area

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Jennifer M. Belcher - Commissioner of Public Lands

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Deep-Seated Landslide Inventory of the West-Central Olympic Peninsula

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INTRODUCTION

This deep-seated landslide study was designed to serve the dual purposes of compiling an inventory of deep-seated landslides for a portion of the Olympic Peninsula and providing geologic information for the state geologic map (Schuster, 1996). The results of the study are intended to provide information for land managers, planners, and scientists making land-use decisions regarding natural resources and wildlife habitat.

The project area covers the west-central portion of the Olympic Peninsula, primarily the Forks 1:100,000 quadrangle. Mapping was compiled at a scale of 1:24,000 and encompasses 19 U.S. Geological Survey (USGS) 7½-minute quadrangles (Fig. 1). Landslide coverage was extended to Slide Peak, the northwesternmost 7½-minute quadrangle of the Mount Olympus 1:100,000 quadrangle, to include a large, active landslide area in that quadrangle.

The landslide inventory was funded by the U.S. Forest Service through the Olympic Natural Resources Center in Forks, Washington, under contracts UW 234153 and DNR FY96-165. The geology mapped and compiled in association with this inventory will be available separately as a digital file and hard-copy open-file report and contributes to the compilation of the state geologic map (Gerstel and Lingley, in preparation).

Deep-seated landslides are those that fail below the rooting depth of the vegetation and generally into the bedrock or sediments below the soil layer (see Fig. 2). They include both rotational and translational movement. This study of deep-seated slides is intended to complement a previous mapping and modeling study of shallow landslides (Shaw, 1995), already in use among forest planners. Deep-seated landslides occur in a wide range of geomorphic and geologic settings, are affected by a number of different geologic, hydrologic, and geomorphic variables, and are therefore not easily modeled or predicted by analytical slope-failure modeling tools. Individual deep-seated landslides are commonly more significant in their areal extent than shallow landslides. They can be reactivated by land management activities and, once reactivated, are costly and very difficult (often impossible) to mitigate. For this reason, the best mitigation is often avoidance, and landslide hazard maps are therefore an essential tool for land-use planners and land managers trying to identify landslide hazard areas.

PREVIOUS LANDSLIDE STUDIES

Western Olympic Peninsula

Landslides are a common feature of the Olympic Peninsula. This is due to the weak nature of the geologic materials, the

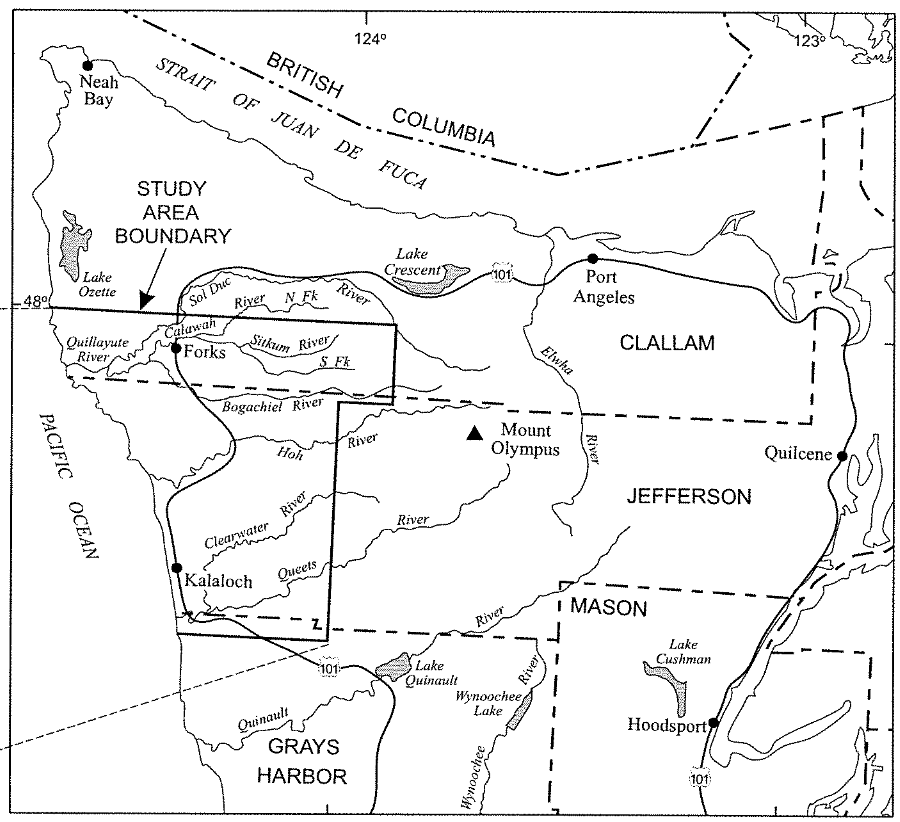
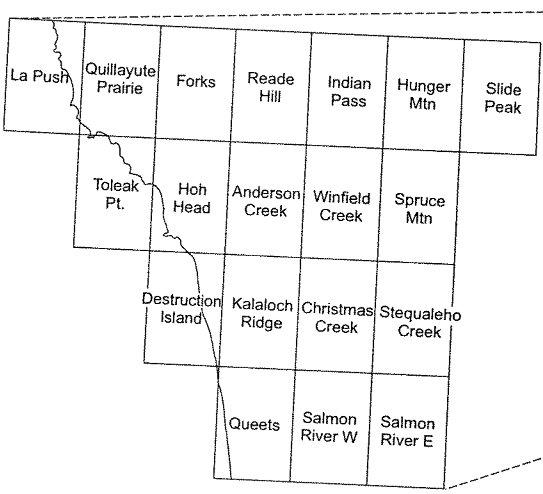


Figure 1. Map of the Olympic Peninsula, Washington, showing major drainage systems, study area boundary, and the USGS 7½-minute quadrangles *(below)* making up the study area.



steep topography, and the high average annual precipitation. Numerous site studies have been done over the years in response to specific landslide events. The reports on these studies, a majority of which likely deal with shallow landsliding, generally reside in the project files of local land owners such as the U.S. Forest Service, Washington State Department of Natural Resources (DNR), private timber companies, and private citizens. Recently, comprehensive basin-scale studies, regulated under a standardized state system called Watershed Analysis, have begun to provide a more comprehensive look at landslides within a particular drainage basin. Data from the Sitkum/South Fork Calawah River Watershed Analysis (Lingley, 1998) were compiled with this inventory by electronic data file transfer. Others have been incorporated into the mapping but were not available as digital data transfer files (Fiksdal and Brunengo, 1980; Logan and others, 1991; O'Connor and Cundy, 1993; Dieu and Shelmerdine, 1997). Many of these landslide studies have not been published.

Related Work in Other Areas

Dragovich and others (1993a, 1993b; Dragovich and Brunengo, 1995) published a landslide inventory and analysis of the Tilton River–Mineral Creek area in Lewis County, Washington. This study grew from the Timber/Fish/Wildlife Agreement of 1987, which spawned a collaborative interdisciplinary effort to study erosion and mass wasting on forest lands as a way to reduce adverse effects of forest practices on slope stability and downstream resources. About 65 percent of the landslides identified from air photos in the Tilton River–Mineral Creek project area were verified in the field. The study concluded that air photo analysis was a reliable method of identifying landslides. It also concluded that land management activities play a role in slope stability, and that sunlight, predominant storm track, soil moisture (that is, the various effects of aspect), and, of course, geologic conditions, contribute to differences in geomorphic processes.

MAP COMPILATION

As with earlier studies, this investigation found that the combination of air photo interpretation with field observations proved reliable in identifying deep-seated landslides. Since field visits to every location would have been impossible at this project area scale, air photo interpretation was the primary means of developing the inventory, particularly in the southern part of the area.

Air photos often proved more reliable than field visits in confirming landslide identification. Road closures and dense forest vegetation, particularly in 15- to 25-year-old stands, often restricted the observation of small-scale ground features, such as tension cracks, hummocky ground surface, and springs, that are indicative of slope movement. Consequently, large-scale landslide features such as head scarps, benched topography, and displaced drainages were easier to view remotely.

Two scales of photos were used for this study. DNR Project OL-75 color photos at a scale of 1:24,000 provided coverage of the entire study area. This scale made transfer of landslide features onto USGS 7½-minute (1:24,000-scale) quadrangle maps more accurate. DNR Photo Project OL-C-90 black and white photos (1:12,000 scale) were used in conjunction with field visits to confirm specific geomorphic features. This flight project did not provide coverage of the entire study area.

Landslides identified in the field and on air photos were compiled on field maps, then digitized using AutoCAD® and electronically transferred into a geographic information system (GIS) for final presentation and data tabulation. Some fields of the database (see Appendix) were calculated by the GIS. Others, such as direction of movement, underlying geology, and length of river exposure, were determined manually.

The final presentation of 1:24,000-scale maps to the Olympic Natural Resources Center was a product of ARC/INFO™, as are the enclosed 1:48,000-scale plates. The rotated orientation of the maps on paper is an artifact of the projection of the geographic coordinates and does not affect cartographic accuracy.

GENERAL GEOLOGY AND PREVIOUS GEOLOGIC MAPPING

The most current and widely used map describing the geology of the Olympic Peninsula is Tabor and Cady (1978) at a scale of 1:125,000. The Olympic Peninsula rocks have been grouped broadly into 'core rocks', a suite of folded and thrust-faulted sheets of marine turbidites, and 'peripheral rocks', incorporating units of folded and thrust-faulted marine and terrestrial sedimentary rocks and interbedded volcanic flows and sediments.

Tabor and Cady's mapping focuses on bedrock geology. Glacial deposits are subdivided into only two units differentiated on the basis of their clast lithologies, which suggest either a continental or alpine origin. Each unit combines several different ages of glacial deposits that are not depicted at this level of mapping detail. Therefore, there is no information given about weathering characteristics, such as soil thickness or relative clay content, that strongly influence ground-water hydrology and slope stability.

Rau (1975, 1979) used foraminifera to establish ages and depositional environments of Tertiary rocks along the westernmost margin of the Olympic Peninsula. This 1:62,500-scale mapping was done to locate major geologic structures and develop a better understanding of the tectonic framework of the Olympic Peninsula and was incorporated into Tabor and Cady's map. Rau's maps 'lumped' all Quaternary geologic units, including glacial deposits, into undivided or undifferentiated surficial deposits and surficial deposits, and thus provides little information about the distribution of Quaternary unit types.

Lingley and others (1996) mapped structures in the Matheny Ridge area and differentiated three units in previously undifferentiated Tertiary rocks. This map also highlights the bedrock geology and not the Quaternary deposits.

Until recently, the only mapping focusing on the Quaternary deposits of the entire Olympic Peninsula was unpublished text with maps by Long (1975, 1976). Long applied stratigraphic correlations developed in the Cascade Range to the deposits of the peninsula. This makes local age assignments difficult and unreliable since climatic events in these areas were probably not synchronous or even similar in intensity (Gillespie and Molnar, 1995; Thackray, 1997).

Since 1995, geologic mappers have focused on subdividing Quaternary deposits and improving surficial geologic mapping of the Olympic Peninsula. This mapping is being undertaken to correlate stratigraphic relationships and climatic implications with other parts of the Pacific Northwest and beyond and shed light on western Olympic Peninsula tectonic uplift and deformation rates over the past several hundred thousand years. To date, the most comprehensive Quaternary mapping is that of Thackray (1997) in the Hoh and Queets drainages and Pazzaglia and Brandon (1996) in the Snahapish and Clearwater drainages (tributaries to the Queets). Thackray's mapping (1997 and references within) developed a detailed chronology with correlations to known climatic fluctuations. He identified at least four major glacial advances, as well as several minor re-advances, occurring in the last 150,000 years.

Gerstel and Lingley (in preparation) are compiling Thackray's work with new mapping in the Bogachiel, Calawah, Quillayute, and lower Sol Duc drainages to extend age correlations to those drainages. Recent results suggest they experienced slightly less extensive alpine glaciations than the Hoh and Queets drainages. Mapping coverage will be at 1:100,000 scale and is being coordinated with similar-scale mapping to the north (Schasse, in preparation) and south (Logan, in preparation).

LANDSLIDE CLASSIFICATION

Deep-seated landslides are classified broadly by Varnes (1978) and Cruden and Varnes (1996) as topples, slumps, block slides, and slump-earthflows (Fig. 2). They are difficult to predict with analytical models because they can occur within a broad range of geologic and geomorphic conditions. Although several models are in use that adequately predict areas prone to shallow landsliding, large-scale basin studies, using air photo interpretation combined with field observations, are critical in characterizing terrain prone to deep-seated sliding. Existing landslides are the best indicators of the potential for future landslides.

Shallow landslides, defined by failure surfaces within the rooting zone, include debris flows, debris torrents, debris avalanches, and even soil creep (Cruden and Varnes, 1996). They can be transitional to deep-seated landslides and vice versa. Where landslide features appeared to extend well below the rooting depth of forest vegetation and were not confined to a drainage channel, they were included in this inventory. Although most types of shallow landslides were not included in this study, they are commonly superimposed on deep-seated slides (Cronin, 1992; Dragovich and others, 1993a,b; Dragovich and Brunengo, 1995). Shallow landslides occur where rotational blocks of the larger, deep-seated slide have resulted in over-steepening of segments of the slope, where drainages have been disrupted and redirected, and where material strengths have been reduced.

Colluvial hollows are buried bedrock swales that concentrate groundwater flow. These features are often not detectable at the surface because colluvial fill masks the underlying bedrock topography. Water commonly flows at

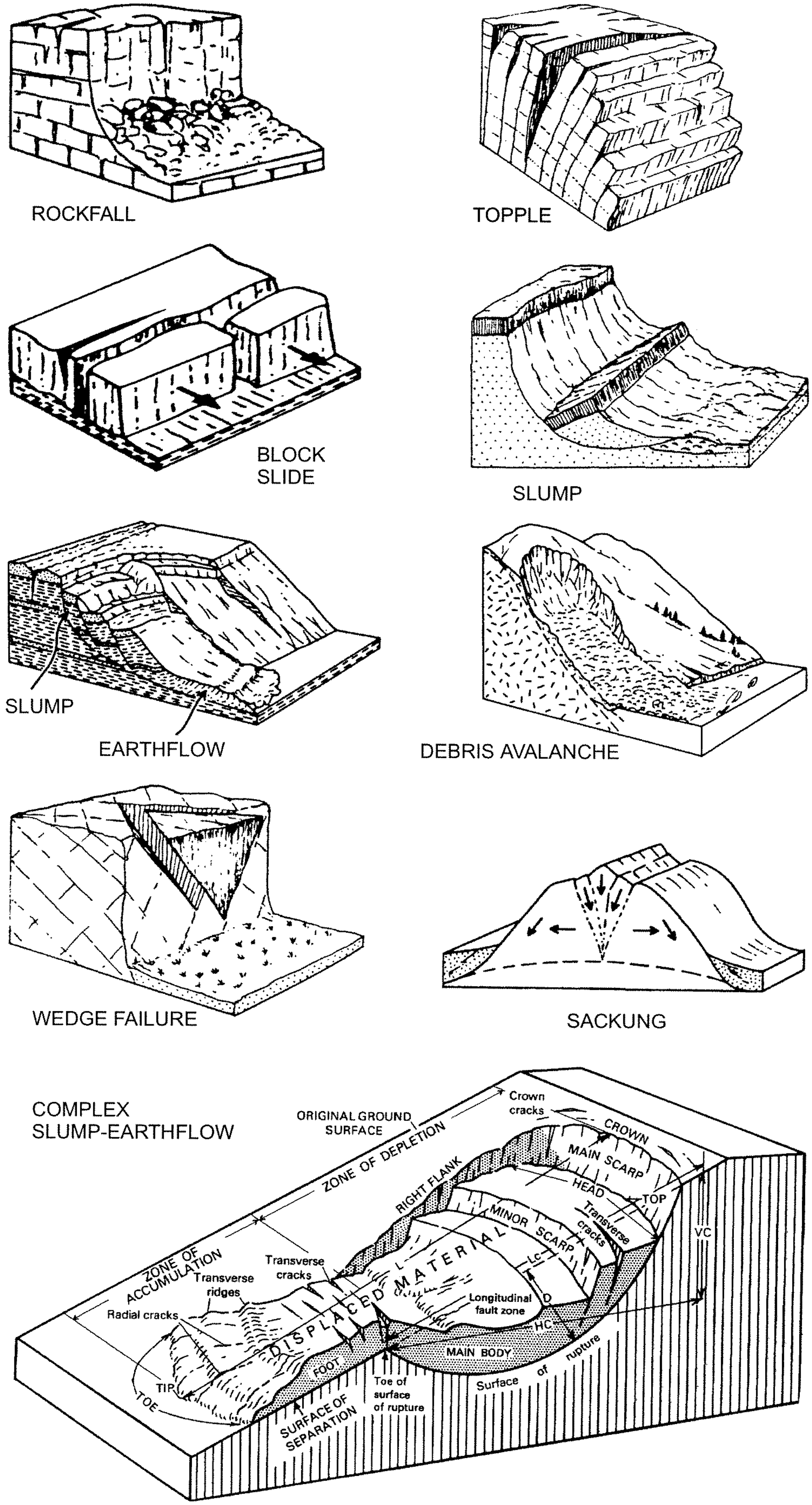


Figure 2. Classification of landslides and the anatomy of a complex slump-earthflow deep-seated landslide (bottom figure). Labeled components apply to most landslides. From Cruden and Varnes (1996).

the contact between the fill and the less permeable material (sometimes a dense sedimentary unit such as till) forming the hollow. Failures occur when the concentrated ground water saturates the fill to a depth sufficient to reduce its shear strength. Colluvial hollow failures can be classified as either shallow or deep-seated landslides, depending on the thickness of the fill. Generally failure occurs well below the rooting depth by translational movement and is often transitional to a debris flow, debris avalanche, or debris torrent, depending on the gradient and ratio of sediment to water. Colluvial hollow fills are particularly vulnerable to failure where road drainage adds additional water to the underlying surface. Since these features are difficult to identify on air photos, they were not categorically included in this study. Roadcuts provide the best 'windows' into this type of slope process.

Figure 3. This coastal landslide south of La Push exposes tectonic mélange clays with a thin covering of glacial outwash deposits. Activity has slowed during the summer since waves are not actively eroding the toe of the slope. (Photo was taken in August, 1997.) Note the water seeping from the base of the slide debris and the person, Carol Serdar, on the beach for scale.

THE LANDSLIDE INVENTORY

Scope of the Inventory

This inventory is intended to identify locations and geologic and geomorphic conditions prone to deep-seated landsliding. Although rigorous effort was made to review all the terrain within the study area, it is not a comprehensive catalog of every deep-seated landslide. It is meant to provide a framework for a database that will grow with the identification of additional landslides. Boundaries of landslides depicted on the maps represent the active slide area of a particular feature and will require adjustment as new information is collected. Head scarps and flanks of deep-seated landslides are generally retrogressive. That is, they are over-steepened by continued or renewed movement and prograde upslope or laterally. Therefore, the present mapped landslide boundaries will likely change with time.

Landslide inventories such as this will be particularly useful in the event of the increased precipitation suggested for the next several years (Mantua and others, 1997; Gershunov and others, 1999). If, as has been proposed, we are entering a period of long-term (10–20 yr) precipitation increase, we will likely see increased landslide activity and, thus, the reactivation of dormant deep-seated landslides.

Categories of Landslide Characteristics

Fifteen items (fields) were tabulated in the database for each landslide identified in the inventory (Appendix). Eleven of these fields were calculated or determined by the GIS. These include landslide identification number, legal description, State Plane South (location), USGS 7½-minute quadrangle name, Watershed Analysis Unit, head elevation (for this study averaged with crown elevation), toe elevation, total relief (difference in head and toe elevations), area, slope inclination, and other data sources. The remaining four fields, determined either in the field, during air photo interpretation, or by hand calculation from topographic maps, are level of certainty, length of river exposure, direction of movement, and geology (of failed soil or rock unit).

Level of certainty was assigned to each landslide on a scale of 1 to 5. A '1' represents the highest level of confidence that the feature is a landslide and a '5' the lowest level. Although the level of certainty is not the same as the level of activity, a level of certainty of 1 or 2 commonly indicates that evidence of recent movement was either observed in the field or clearly visible in the air photos.

Length of river exposure was included to give users an indicator for potential chronic sediment input (particularly fine sediment) from a particular landslide. For the most part, only those rivers at the toe of a landslide were used in the calculation, assuming that these, rather than lateral or internal streams, would be the most affected by sediment input. Furthermore, internal and lateral streams contribute much less to slope destabilization by undercutting. Within the study area, the lower elevation landslides will likely be the most chronic contributors of fine sediment. This is due to material type (the fine silts and clays of the glacial deposits) as well as their location for direct input into the channel. In headwall areas, deep-seated slides were not calculated for length of river exposure since most streams in those settings are intermittent and therefore sediment input would be episodic. Also, slide material in these areas is often coarse and not likely to be transported very far.

Coastal landslides were designated 'ocean' rather than assigned a length of river exposure. Sediment input and transport in the nearshore coastal environment require specific consideration. As with other landslides, seasonal effects are important in assessing potential sediment input. Coastal landslides are usually most active during the winter months when the ground-water table is highest and storm waves destabilize the slope by actively eroding the toe of the slide. During the summer, drained soil conditions, lower wave energy, and commonly a protecting remnant winter beach berm reduce landsliding activity.

Figure 4A. The Grouse Creek landslide failed along the shear plane (visible on the right) and through thin-bedded sandstone and shale turbidite sediments (visible on the left). This view is looking south into the headwall area from the area where the landslide transitioned from a slump-earthflow to a debris flow.

Direction of movement, indicated by arrows within the polygons on the accompanying maps, is a visual average of the direction the slope faces and the direction of movement of the slide mass. This element of landslide movement is influenced by storm patterns, soil moisture input, and moisture retention.

Geology of the material involved in the landsliding was determined using existing mapping (Tabor and Cady, 1978; Rau, 1975, 1979; Thackray, 1996; Lingley and others, 1996) and field observations. The term 'glaciofluvial terraces' was used to describe sequences of valley fill that include some or all of the following sedimentary units: sand, silt, clay, and varying percentages and sizes of gravels, cobbles, and occasionally boulders. These deposits have been dissected during postglacial incision, leaving the abandoned terrace surfaces. Glacial deposits fall generally into two categories: continental and alpine. Continental deposits are associated with the Vashon advance and contain granite clasts transported from British Columbia. Alpine glacial deposits are associated with at least three separate advances and are composed of local rock transported a short distance. Landslides in headwall areas were assigned to a bedrock geologic unit; however, a veneer of unmapped glacial till may also be involved in the initiation of slope movement.

DISCUSSION OF FAILURE TYPES

Failures in Bedrock

The landslides identified in this study fall into two broad geologically controlled groups. The first, those occurring in bedrock, are controlled by discrete zones of weakness within bedrock units (structural control) or low intact shear strength of the rock mass (nonstructural control) (Hoek and Bray, 1981). Structural controls include adversely oriented bedding planes, foliations, faults, shear zones, or joints. Nonstructural controls can include randomly oriented fractures or weathered, weakly consolidated rock masses.

A large number of the bedrock slides occur along shear zones. Shear zones are common in the Olympic Mountains, are dominated by a northeast–southwest orientation, and are related to oblique northeastward subduction of the Pacific plate under the North America plate (McCrory, 1997). In these zones, rocks have been altered to clay and their internal shear strengths have been reduced by the movement of one rock mass against another. The resulting lithologic material is called tectonic mélange (Orange, 1990). Numerous examples of the large landslides common in this material can be found along the coastline south of La Push (Fig. 3).

A large landslide in Grouse Creek (Fig. 4), a tributary to the Solleks and Clearwater Rivers, was triggered by the rain-on-snow event of March 1997. It illustrates the type of bedrock fail-

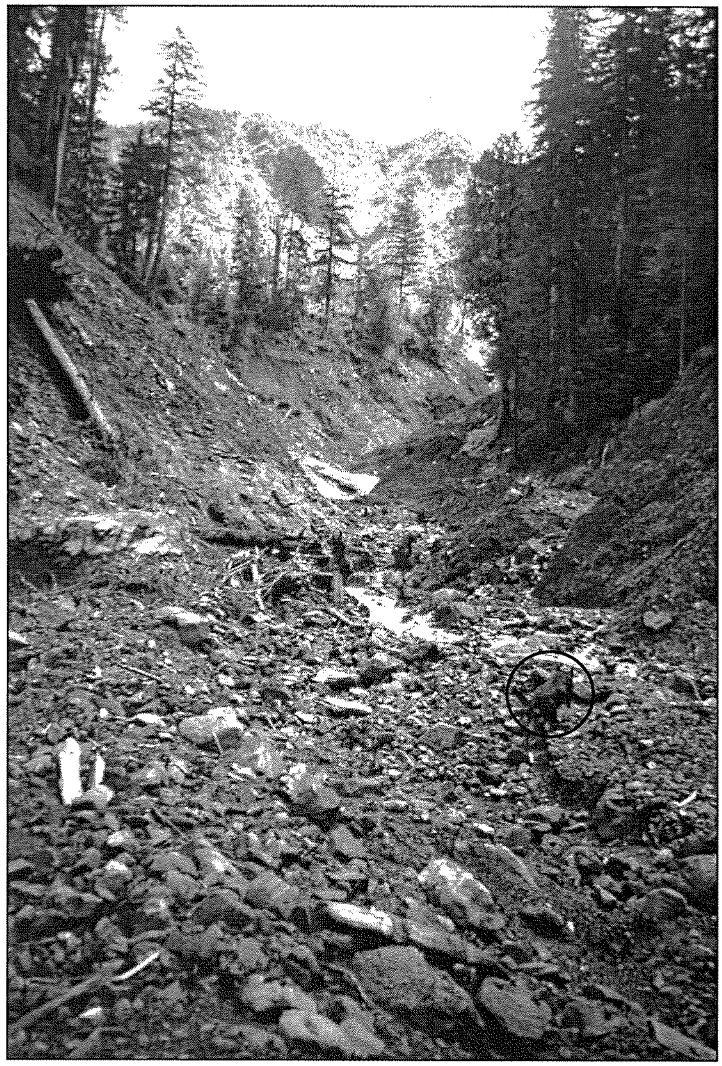


Figure 4B. This view looking north along Grouse Creek shows the path of the debris flow that traveled about 1.5 mi to the Solleks River. Note 'Alsea' the dog for scale.

ure that can occur in the weakened rocks along a shear zone (Serdar, 1997). Here the shear zone is narrower than some of those exposed along the coast and resulted in failure of adjacent rock material along possibly two discrete, intersecting planes of weakness. This particular type of bedrock failure is known as a wedge failure (Fig. 2).

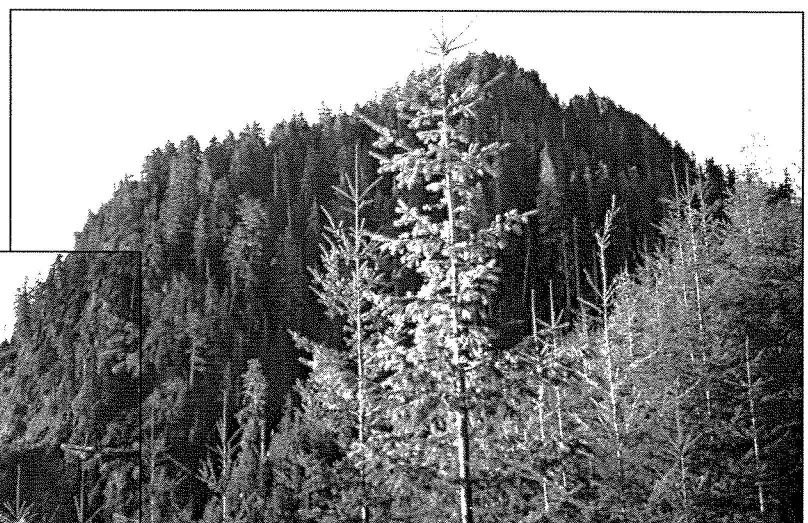
A pair of landslides in the headwaters of the Sitkum River (Fig. 5), triggered by the same March 1997 storm in combination with road-related sidecast failure, failed along a bedding plane surface. Shear strengths along bedding planes can be much lower than the internal, or across-bedding, shear strength of the rock mass (Hoek and Bray, 1981).

One type of bedrock failure that contributes to deep-seated landsliding is a product of settling or spreading of a mountain and its bedrock ridgetop (Thorsen, 1989, and references within). This phenomenon is called *sackung*, after a German word meaning 'to sag', and is often evidenced by a 'splitting mountaintop' or 'splitting ridgetop'. In such a case, rock topple (Cruden and Varnes, 1996), caused by the sackung and facilitated by bedrock jointing, loads the slopes below the bedrock outcrop and eventually, usually in combination with water perched on a subsurface layer of sediment or rock, causes the slope to start moving. This type of movement is usually very slow. The aptly named Slide Peak USGS 7½-minute quadrangle hosts one of these sackung features with several flanking deep-seated landslides. Figure 6 shows the peak called Sore Thumb in the upper Sol Duc drainage. The peak is separating along northwest–southeast fractures. During the summer of 1998, I observed evidence of slow-moving, deep-seated, bedrock landsliding of the slopes surrounding the base of the peak. Sackung features have been identified elsewhere within the Olympic National Park boundaries (Tabor, 1971), near Bellingham (Thorsen, 1989), and in areas of the Rocky Mountains (McCalpin and Irvine, 1995), among other places.

Figure 5. These two west-facing landslide tracks in the headwaters of the Sitkum River expose westward-dipping bedding-plane surfaces of a sandstone unit of the Olympic Peninsula core rocks. During a March 1997 rain-on-snow event, excessive runoff from the road traversing the ridge triggered the failure of colluvial material overlying the bedding plane surfaces (similar to colluvial hollow failure).

Failures in Sedimentary Deposits

The second broad group of failures recognized during this study occur in valley bottom sediments that were deposited in fluvial, glaciofluvial, and glaciolacustrine environments. These deposits make up the terrace morphology dominating the valleys of all the large rivers draining the Olympic Mountains (Fig. 7). Sequences of clay, silt, sand, and gravel, and sometimes organic



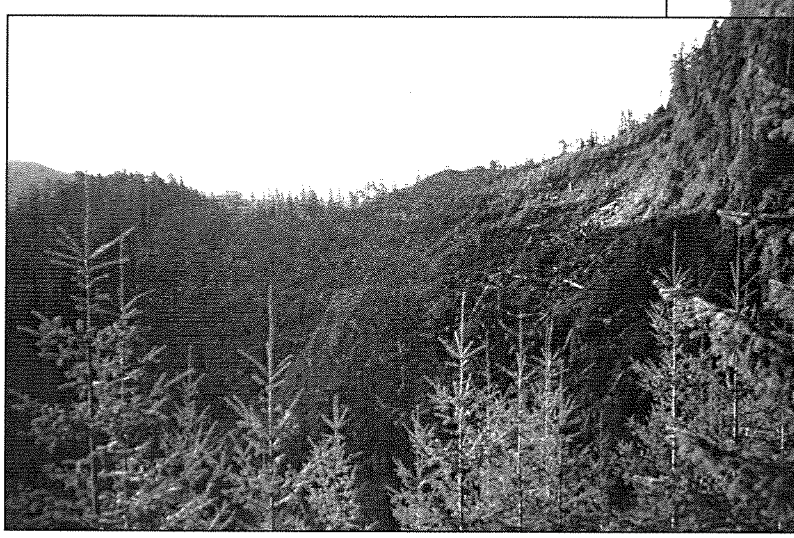


Figure 6. Looking south along the northwest–southeast trending sackung features in Sore Thumb. The spalled rock collecting at the east-facing base of the peak is loading the north-facing slope (left photo) and contributing to deep-seated landsliding.

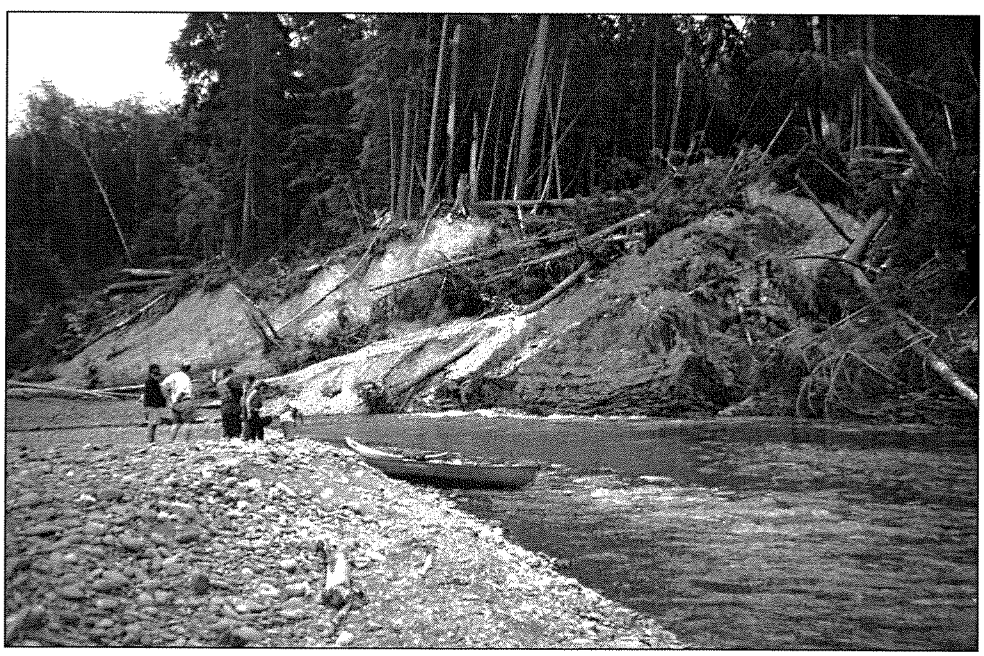


Figure 7. *(top)* View upstream (east) along the south bank of the Bogachiel River of a sequence of glaciofluvial terraces. The entire foreground and center of the photo below the prominent terrace surface is a complex of active deep-seated landslides in glacial deposits.

Figure 8. *(middle)* 'High Banks' along the Hoh River is the local name for this exposure of sediments representing several glacial and interglacial episodes of deposition. The dark-colored sediments are generally finer grained than the light-colored sediments and act as aquitards. Vegetation (not visible at the scale of this photo) at the upper contacts of the fine-grained sediments indicates the location of springs and seeps that occur at permeability changes in the sediment sequence.

Figure 9. *(bottom)* This very active deep-seated landslide on the Queets River incorporates outwash sands and gravels and underlying glacial lake clays. Movement will continue as long as the flow of the Queets River continues to undercut the toe of the slope. River flow is from left to right in the photo.

material, control ground-water flow and define aquifers and aquitards (Fig. 8). The saturated zone that forms in an aquifer above an underlying aquitard causes a loss of strength in the aquifer sediments and can result in the failure of those sediments. Frequently the underlying deposits are also involved in the failure. Figure 9 shows such a landslide on the Queets River that incorporates both the upper glacial outwash sands and gravels and the underlying glacial lake clays.

Terrace landslides form the largest and most laterally continuous of the deep-seated landslides in the project area. Landslides associated with the terraces are usually triggered by rivers undercutting and destabilizing the toe of the terrace slope as they meander back and forth across the valley. One such example along the Bogachiel River is described in a report by Ginn (1996). Excavation at the base of a terrace slope for home sites, roads, or other construction can also trigger landslide activity.

CONCLUSIONS

Deep-seated landslides on the west side of the Olympic Peninsula fall into two broad categories; those that occur in bedrock, and those that occur in valley-bottom glaciofluvial terrace deposits. Landslides in both categories are affected by climatic conditions and by land-use activities. Most deep-seated landslide features on the western Olympic Peninsula are probably several hundred to several thousand years old and may be dormant. However, the landslide events of 1996 to 1998 in many western Washington counties (for example, Gerstel and others, 1997) demonstrate that these 'ancient' landslides can be reactivated by wetter climatic conditions and human modification of natural slopes.

Because deep-seated landslides are difficult to model with existing analytical tools, landslide hazard maps are an essential tool for the land manager, land-use planner, and scientist. The most reliable method of mapping deep-seated landslides is by field observations in combination with air photo interpretation. Existing landslides are one of the best indicators of the potential for future landslide activity—areas near mapped deep-seated landslides warrant attention because they are likely to have similar geologic, hydrologic, and geomorphic conditions.

Mapped locations of the landslides included in this inventory are approximate. They represent the active portion of the observed landslide features as they appeared during the 1997 and 1998 summer field seasons and on 1975 and 1990 air photos. Basin-specific landslide studies are presently underway in several western Olympic Peninsula drainage basins and should eventually be added to this database: Hoh River (Parks, in preparation), Salmon River (Lingley, in preparation), and Queets River (Schaub, in preparation).

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Throughout the duration of this project, I received enthusiastic field assistance from Shannon Ginn and Carol Serdar, who willingly shared the results of their own landslide studies on the Bogachiel River and Grouse Creek, respectively. Karl Wegmann took time from his work on the Clearwater River to make a landslide/geology canoe trip down the Bogachiel possible. The evolution of my thoughts and ideas about the relationships of landslides to Olympic Peninsula geology has benefited from numerous discussions with Tom Badger, Matt Brunengo, Leslie and Bill Lingley, Josh Logan, Glenn Thackray, Karl Wegmann, and others. Reviews by Tim Walsh, Eric Schuster, and Joe Dragovich have greatly improved this manuscript. The presentation of this project as a GIS product would not have been possible without the technical wizardry of Anne Heinitz, Keith Ikerd, and Chuck Carruthers. Jari Roloff, as always, improved the text and figures with her editing and layout skills. Sadly, this was the last field season for Alsea, my most faithful field companion of the last 10 years.

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Appendix: Landslide Inventory Data

EXPLANATION OF INVENTORY CATEGORIES

Fifteen items (fields) are tabulated in the database for each landslide identified in the inventory. Eleven of these fields were calculated or determined by the Geographic Information System (GIS). These include landslide identification number, legal description, State Plane South (location), USGS 7½-minute quadrangle name, Watershed Analysis Unit, head elevation (for this study averaged with crown elevation), toe elevation, relief (difference in head and toe elevations), area, other data sources, and slope inclination. The remaining four fields, determined either in the field, during air photo interpretation, or by hand calculation from topographic maps, are level of certainty, length of river exposure, direction of movement, and geology.

Landslide ID No.

Numbers assigned consecutively by the GIS over the entire study area from west to east and top to bottom.

Legal Description

Township and range for a point location approximately at the geographic center of the landslide polygon.

State Plane South

The State Plane Coordinate System divides the U.S. into zones that define the projection parameters for a region. It is used for most federal, state and local large-scale mapping projects. Output is given in x,y coordinates for a point location approximately at the geographic center of the landslide polygon.

USGS 7½-minute Quadrangle

Name of the 1:24,000-scale U.S. Geological Survey topographic sheet that contains the landslide area. Digitized versions of these sheets were modified slightly on the GIS to provide a screened base for the mapped landslides.

Watershed Analysis Unit

State-designated name for the watershed basin subdivision containing the landslide.

Level of Certainty

Level of certainty is assigned to each landslide on a scale of 1 to 5. A '1' represents the highest level of confidence that the feature is a landslide and a '5' the lowest level. Although the level of certainty is not the same as the level of activity, a level of certainty of 1 or 2 usually indicates that evidence of recent movement was either observed in the field or clearly visible in the air photos.

Head Elevation

Maximum elevation of the area mapped as showing landslide activity. (Often identified as crown elevation.) Head and toe elevations were included to aid in monitoring the effects of rain-on-snow events on the activation or reactivation of deep-seated slides. Increased (higher than background) rates of landslide activity have been attributed to the topographically and elevationally defined rain-on-snow zone (Harr, 1981; Coffin and Harr, 1992).

Toe Elevation

Minimum elevation of the area mapped as showing landslide activity.

Total Relief

Difference between head and toe elevations. Total vertical extent of the landslide.

Area

Slope surface area of mapped landslide.

Slope Inclination

Average gradient of the slope of the landslide over its length.

Other Data Sources

Source of data obtained by digital transfer from other agencies.

Length of River Exposure

Length of river exposure was included in the inventory to give users an indicator for potential chronic sediment input (particularly fine sediment) from a particular landslide. For the most part, only those rivers at the toe of a landslide were used in the calculation, assuming that these, rather than lateral or internal streams, would be the most affected by sediment input. (See text for more detail.)

Coastal landslides were designated 'ocean' rather than assigned a length of river exposure. (See p. 4 for details.)

Direction of Movement

Direction of movement, indicated by arrows within the polygons on the accompanying maps, is a visual average of the direction the slope faces and the direction of movement of the slide.

Geology

Descriptions of the geology of the failed soil/rock unit based on mapping by Tabor and Cady (1978), Rau (1975, 1979), and Gerstel and Lingley (in preparation). The term 'glaciofluvial terrace deposits' is used to describe sequences of valley fill that include some or all of the following sedimentary units: sand, silt, clay, and varying percentages and sizes of gravel, cobbles, and occasionally boulders. 'Younger alpine' refers to sediments deposited during the last glacial maximum about 18,000 to 23,000 years ago, 'older alpine' to those deposited between 60,000 and 100,000 years ago, and 'very old alpine' to those deposited prior to the major interglacial period occurring about 125,000 to 190,000 years ago. Lack of relative age designation indicates age uncertainty. Continental glacial deposits are limited to the northern part of the study area and the late Pleistocene Vashon glaciation. Glaciofluvial terraces in this area could be a combination of alpine and continental.

Landslide ID no.	Legal description	State Plane South X Y	USGS 7½-minute quadrangle	Watershed Analysis Unit	Level of certainty	Head elevation (ft)	Toe elevation (ft)	Total relief (ft)	Area (acres)	Slope inclination (°)	Other data sources	Length of river exposure (ft)	Direction of movement	Geology
1	T29N R15W	977983.3 997701.9	La Push	Ozette Lake	3	233	6	227	15.5	18		ocean	W	Continental glacial outwash over sandstone and conglomerate with siltstone and argillite
2	T29N R15W	978285.3 996493.8	La Push	Ozette Lake	2	281	25	256	10.2	16		ocean	SW	Continental glacial outwash over sandstone and conglomerate with siltstone and argillite
3	T29M R13W	1038587.1 995351.2	Forks	Sol Duc Lowlands	3	805	495	310	21.1	14		0	NNW	Sheared turbidite sandstone, siltstone, and argillite
4	T29N R15W	979010.2 994621.3	La Push	Ozette Lake	3	384	24	360	18.2	18		ocean	WSW	Continental glacial outwash over sandstone and conglomerate with siltstone and argillite
5	T29N R13W	1038888.6 993542.5	Forks	Sol Duc Lowlands	4	724	402	322	37.6	13		0	SE	Sheared turbidite sandstone, siltstone, and argillite
6	T29N R11W	1102637.3 993246.7	Indian Pass	North Fork Calawah	4	1,827	1,604	223	10.3	19		0	N	Turbidite sandstone, siltstone, and argillite and some conglomerate
7	T29N R14W	1019361.1 992326.0	Quillayute Prairie	East Dickey	4	413	267	146	22.2	7		0	SW	Continental till over turbidite sandstone and conglomerate with minor siltstone and argillite
8	T29N R12W	1095138.6 991936.3	Indian Pass	Sitkum	5	1,785	1,335	450	16.9	23		0	SE	Turbidite sandstone, siltstone, and argillite and some conglomerate
9	T29N R11W	1105142.6 991807.0	Indian Pass	North Fork Calawah	3	1,535	1,305	230	4.0	23		300	N	Turbidite sandstone, siltstone, and argillite and some conglomerate
10	T29N R15W	979010.2 991238.7	La Push	Ozette Lake	3	303	12	291	16.8	19		ocean	W	Continental glacial outwash over sandstone and conglomerate with siltstone and argillite
11	T29N R14W	1005933.2 990507.7	Quillayute Prairie	Quillayute Bottom	4	450	39	411	87.1	12		3,000	E	Continental till over turbidite sandstone and conglomerate with minor siltstone and argillite
12	T29N R10W	1150805.9 990011.1	Slide Peak	Upper Sol Duc	3	3,476	2,671	805	64.4	19		0	NW	Thick-bedded conglomerate
13	T29N R10W	1135874.3 990673.8	Hunger Mountain	North Fork Calawah	1	3,325	2,877	448	6.7	20		0	NNW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
14	T29N R10W	1152178.5 991062.2	Slide Peak	Upper Sol Duc	1	3,520	3,260	260	2.9	17		0	WNW	Thick-bedded conglomerate
15	T29N R10W	1153635.3 990914.1	Slide Peak	Upper Sol Duc	2	3,452	2,970	482	12.6	25		0	NNE	Thick-bedded conglomerate
16	T29N R10W	1148699.0 990372.3	Slide Peak	Upper Sol Duc	1	3,198	2,800	398	11.3	19		0	NE	Thick-bedded conglomerate
17	T29N R11W	1103947.7 990553.0	Indian Pass	North Fork Calawah	4	2,257	1,753	504	7.1	23		0	ENE	Turbidite sandstone, siltstone, and argillite and some conglomerate
18	T29N R14W	1019321.5 989790.7	Quillayute Prairie	East Dickey	4	401	259	142	16.7	8		300	W	Continental till over turbidite sandstone and conglomerate with minor siltstone and argillite

Landslide ID no.	Legal description	State Plane South X Y	USGS 7½-minute quadrangle	Watershed Analysis Unit	Level of certainty	Head elevation (ft)	Toe elevation (ft)	Total relief (ft)	Area (acres)	Slope inclination (°)	Other data sources	Length of river exposure (ft)	Direction of movement	Geology
19	T29N R10W	1134204.2 989837.8	Hunger Mountain	North Fork Calawah	2	3,247	2,647	600	12.2	26		0	NNE	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
20	T29N R15W	995998.6 990170.6	Quillayute Prairie	Quillayute Bottom	4	401	247	154	26.6	7		0	ENE	Continental till over turbidite sandstone and conglomerate with minor siltstone and argillite
21	T29N R10W	1135463.8 990047.3	Hunger Mountain	Sitkum	1	3,326	2,736	590	7.3	26		0	NW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
22	T29N R14W	1020681.2 989442.8	Quillayute Prairie/ Forks	East Dickey	3	407	246	161	25.2	8		0	E	Continental till over turbidite sandstone and conglomerate with minor siltstone and argillite
23	T29N R10W	1148638.8 989108.1	Slide Peak	Upper Sol Duc	2	3,526	2,963	563	30.4	20		0	N	Turbidite sandstone and conglomerate with minor siltstone and argillite
24	T29N R14W	1034366.9 987513.6	Forks	Sol Duc Lowlands	1	509	162	347	70.4	9		3,000	SW	Continental till over turbidite sandstone, siltstone and argillite
25	T29N R13W	1047389.4 988538.5	Forks	Sol Duc Lowlands	4	283	218	65	15.8	4		0	N	Older alpine glaciofluvial terrace deposits
26	T29N R15W	995881.7 988446.6	Quillayute Prairie	Quillayute Bottom	4	393	259	134	13.3	7		0	SW	Continental till over turbidite sandstone and conglomerate with minor siltstone and argillite
27	T29N R09W	1171092.7 987121.6	Slide Peak	Upper Sol Duc	3	2,678	1,502	1,176	200.7	18		2,000	SW	Turbidite sandstone and conglomerate with minor siltstone and argillite
28	T29N R14W	1017261.6 987611.9	Quillayute Prairie	Quillayute Bottom	4	398	243	155	32.6	7		0	E	Continental till over turbidite sandstone and conglomerate with minor siltstone and argillite
29	T29N R14W	1032859.7 988176.7	Forks	Sol Duc Lowlands	3	544	320	224	15.7	9		600	NE	Sheared turbidite sandstone, siltstone, and argillite
30	T29N R14W	1007263.9 987725.3	Quillayute Prairie	Quillayute Bottom	3	220	39	181	29.3	6		1,700	ENE	Continental till over turbidite sandstone and conglomerate with minor siltstone and argillite
31	T28N R15W	978829.0 988278.9	La Push	Ozette Lake	2	328	27	301	9.7	15		ocean	W	Continental glacial outwash over sandstone and conglomerate with siltstone and argillite
32	T29N R11W	1130343.6 987778.8	Hunger Mountain	North Fork Calawah	1	2,916	2,169	747	33.7	21		200	ENE	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
33	T29N R10W	1135679.8 987843.7	Hunger Mountain	Sitkum	1	2,713	2,310	403	7.2	26		400	ENE	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
34	T28N R15W	979795.4 987493.7	La Push	Ozette Lake	2	332	30	302	30.4	14		ocean	SSW	Continental glacial outwash over sandstone and conglomerate with siltstone, argillite, and mélange
35	T29N R11W	1128613.4 987373.1	Hunger Mountain	North Fork Calawah	3	2,502	2,081	421	15.9	24		300	SW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
36	T28N R15W	992652.9 987380.1	Quillayute Prairie	Quillayute Bottom	4	377	255	122	18.4	7		0	S	Continental till over turbidite sandstone and conglomerate with minor siltstone and argillite

Landslide ID no.	Legal description	State Plane South X Y	USGS 7½-minute quadrangle	Watershed Analysis Unit	Level of certainty	Head elevation (ft)	Toe elevation (ft)	Total relief (ft)	Area (acres)	Slope inclination (°)	Other data sources	Length of river exposure (ft)	Direction of movement	Geology
37	T29N R12W	1068720.2 986208.5	Reade Hill	North Fork Calawah	2	1,299	357	942	89.6	15		1,600	S	Turbidite sandstone and conglomerate with siltstone and argillite
38	T29N R13W	1065539.0 987106.8	Reade Hill	North Fork Calawah	2	859	408	451	9.3	18		200	W	Turbidite sandstone and conglomerate with siltstone and argillite
39	T28N R15W	980822.3 985439.9	La Push	Ozette Lake	2	355	25	330	41.7	18		ocean	SW	Continental glacial outwash over sandstone and conglomerate with siltstone, argillite, and mélange
40	T29N R11W	1129154.4 986050.5	Hunger Mountain	North Fork Calawah	2	3,083	2,277	806	20.9	25		300	NW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
41	T29N R13W	1062999.3 985846.2	Reade Hill	North Fork Calawah	3	737	317	420	24.2	16		400	S	Turbidite sandstone and conglomerate with siltstone and argillite
42	T29N R12W	1089532.6 986270.9	Indian Pass	Sitkum	0	730	677	53	5.3	6	USFS	700	SSE	Turbidite sandstone, siltstone, and argillite and some conglomerate
43	T29N R11W	1114080.5 986033.7	Indian Pass	Sitkum	0	1,872	1,563	309	5.7	27	USFS	500	WNW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
44	T29N R10W	1134985.7 985509.5	Hunger Mountain	Sitkum	2	2,673	1,894	779	49.4	22		1,600	ENE	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
45	T29N R12W	1089202.3 985594.5	Indian Pass	Sitkum	0	803	710	93	0.9	12	USFS	300	WSW	Turbidite sandstone, siltstone, and argillite and some conglomerate
46	T29N R10W	1131739.4 985208.9	Hunger Mountain	Sitkum	2	3,293	2,464	829	21.6	19		900	ENE	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
47	T29N R12W	1087283.2 984650.6	Indian Pass	Sitkum	0	690	600	90	3.5	10	USFS	600	W	Turbidite sandstone, siltstone, and argillite and some conglomerate
48	T29N R12W	1071497.3 983431.3	Reade Hill	North Fork Calawah	2	657	413	244	5.4	18		0	NNE	Turbidite sandstone and conglomerate with siltstone and argillite
49	T29N R11W	1126208.7 982383.4	Hunger Mountain	Sitkum	3	2,845	1,966	879	33.5	30		1,300	SSW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
50	T28N R14W	1028338.0 981967.0	Forks	Sol Duc Lowlands	3	278	167	111	38.4	5		2,000	SE	Sheared turbidite sandstone, siltstone, and argillite
51	T29N R10W	1134745.2 982563.8	Hunger Mountain	Sitkum	2	2,367	1,995	372	11.5	22		0	NE	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
52	T28N R12W	1073368.8 982223.9	Reade Hill	Sitkum	4	764	378	386	51.2	19	USFS	800	SSW	Turbidite sandstone and conglomerate with siltstone and argillite
53	T29N R10W	1146230.9 981944.5	Slide Peak	Upper Sol Duc	3	3,461	2,854	607	33.8	22		0	NE	Turbidite sandstone and conglomerate with minor siltstone and argillite
54	T28N R12W	1070833.2 982103.1	Reade Hill	Sol Duc Valley	3	704	358	346	13.2	20		600	SSW	Turbidite sandstone and conglomerate with siltstone and argillite

Landslide ID no.	Legal description	State Plane South X Y	USGS 7½-minute quadrangle	Watershed Analysis Unit	Level of certainty	Head elevation (ft)	Toe elevation (ft)	Total relief (ft)	Area (acres)	Slope inclination (°)	Other data sources	Length of river exposure (ft)	Direction of movement	Geology
55	T28N R12W	1096449.1 981525.6	Indian Pass	Sitkum	4	1,890	1,236	654	36.8	24	USFS	0	NE	Turbidite sandstone, siltstone, and argillite and some conglomerate
56	T28N R12W	1075606.6 981682.7	Reade Hill	Sitkum	0	758	358	400	11.9	15		600	S	Turbidite sandstone and conglomerate with siltstone and argillite
57	T29N R10W	1131198.4 981421.6	Hunger Mountain	Sitkum	3	2,943	1,984	959	23.0	26		200	ESE	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
58	T28N R12W	1087858.4 981525.6	Indian Pass	Sitkum	5	1,516	1,295	221	14.2	11		0	NNW	Turbidite sandstone, siltstone, and argillite and some conglomerate
59	T29N R10W	1135634.4 981192.0	Hunger Mountain	Sitkum	2	2,153	1,549	604	36.1	21		2,200	E	Very old alpine glacial drift over turbidite sandstone and conglomerate with siltstone and argillite
60	T28N R13W	1039370.9 981002.3	Forks	Sol Duc Valley	1	329	155	174	11.6	11		1,000	S	Older alpine till and glaciofluvial terrace deposits
61	T28N R12W	1072380.1 980802.8	Reade Hill	Sitkum	0	993	362	631	35.3	21	USFS	1,500	N	Turbidite sandstone and conglomerate with siltstone and argillite
62	T28N R12W	1078979.8 980900.6	Reade Hill	Sitkum	0	582	380	202	17.0	11		1,700	NNE	Turbidite sandstone and conglomerate with siltstone and argillite
63	T28N R12W	1083194.9 981138.6	Indian Pass	Sitkum	2	1,237	850	387	7.1	21	USFS	0	NNW	Turbidite sandstone, siltstone, and argillite and some conglomerate
64	T28N R12W	1081961.5 980652.0	Reade Hill/ Indian Pass	Sitkum	3	1,061	396	665	78.4	14	USFS	2,000	W	Turbidite sandstone, siltstone, and argillite and some conglomerate
65	T28N R12W	1084137.1 981079.8	Indian Pass	Sitkum	0	1,105	860	245	2.4	19	USFS	0	WSW	Turbidite sandstone, siltstone, and argillite and some conglomerate
66	T28N R12W	1087928.1 980576.4	Indian Pass	Sitkum	0	1,496	1,053	443	11.0	26	USFS	0	S	Turbidite sandstone, siltstone, and argillite and some conglomerate
67	T29N R10W	1136007.6 979978.8	Hunger Mountain	Sitkum	3	1,878	1,477	401	14.4	15		400	SSE	Older alpine glaciofluvial deposits and glacial drift
68	T28N R15W	982151.2 980064.0	La Push	Ozette Lake	2	254	10	244	22.5	13		ocean	SW	Continental glacial outwash over sandstone and conglomerate with siltstone and argillite
69	T29N R10W	1140557.5 979674.7	Hunger Mountain	Sitkum	1	2,716	2,308	408	5.1	19		0	SSW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
70	T28N R12W	1068599.4 978963.8	Reade Hill	Sol Duc Valley	3	988	427	561	47.3	16		0	N	Turbidite sandstone and conglomerate with siltstone and argillite
71	T28N R12W	1084288.4 979742.1	Indian Pass	Sitkum	1	1,068	851	217	2.6	22		0	S	Turbidite sandstone, siltstone, and argillite and some conglomerate
72	T29N R10W	1129996.0 978235.4	Hunger Mountain	Sitkum	4	2,700	1,231	1,469	146.5	27		1,700	S	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite

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73	T28N R12W	1086583.6 979176.1	Indian Pass	Sitkum	0	2,700	1,231	1,469	0.3	27	USFS	0	SSE	Older alpine glaciofluvial terrace deposits over turbidites
74	T28N R12W	1091394.9 978780.9	Indian Pass	Sitkum	4	1,206	900	306	3.9	22		0	SE	Turbidite sandstone, siltstone, and argillite and some conglomerate
75	T28N R11W	1098341.9 978686.3	Indian Pass	Sitkum	4	1,332	1,027	05	10.3	23		0	S	Turbidite sandstone, siltstone, and argillite and some conglomerate
76	T28N R12W	1090592.6 978804.1	Indian Pass	Sitkum	4	1,075	751	324	4.1	20		300	W	Turbidite sandstone, siltstone, and argillite and some conglomerate
77	T29N R10W	1136668.9 977934.8	Hunger Mountain	Sitkum	2	2,436	1,463	973	52.0	30	USFS	1,700	NNE	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
78	T28N R11W	1123808.9 978505.1	Hunger Mountain	Sitkum	0	2,321	1,647	674	11.5	26	USFS	200	WNW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
79	T28N R13W	1066670.7 978429.0	Reade Hill	Sol Duc Valley	0	1,058	931	127	3.7	12	USFS	0	NNW	Turbidite sandstone and conglomerate with siltstone and argillite
80	T28N R12W	1070565.5 978090.3	Reade Hill	Sol Duc Valley	3	1,109	795	314	13.7	13		500	S	Turbidite sandstone and conglomerate with siltstone and argillite
81	T28N R12W	1085892.8 977812.7	Indian Pass	Sitkum	5	794	436	358	20.6	15		1,600	NNW	Older alpine glaciofluvial terrace deposits over turbidites
82	T28N R11W	1099323.3 977786.4	Indian Pass	Sitkum	1	1,103	816	287	9.6	15		500	SSE	Turbidite sandstone, siltstone, and argillite and some conglomerate
83	T28N R10W	1130856.4 976853.4	Hunger Mountain	Sitkum	2	1,408	1,261	147	4.3	12		1,100	NW	Older alpine glaciofluvial deposits and glacial drift
84	T28N R12W	1084072.7 977012.0	Indian Pass	Sitkum	4	507	429	78	11.2	8		1,200	SSW	Older alpine glaciofluvial terrace deposits over turbidites
85	T28N R15W	992444.5 975506.8	Quillayute Prairie	Quillayute Bottom	4	250	13	237	193.6	4		5,200	SE	Older glaciofluvial terrace deposits
86	T28N R11W	1123683.8 976311.7	Hunger Mountain	Sitkum	4	1,655	1,092	563	24.2	19	USFS	0	SSW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
87	T28N R11W	1125367.1 976311.7	Hunger Mountain	Sitkum	2	1,635	1,146	489	6.4	30		600	SSE	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
88	T28N R11W	1099729.4 976257.3	Indian Pass	Sitkum	1	1,221	916	305	10.0	17		0	NE	Turbidite sandstone, siltstone, and argillite and some conglomerate
89	T28N R11W	1106894.1 975791.9	Indian Pass	Sitkum	0	1,140	842	298	18.5	14	USFS	1,200	WNW	Older alpine glaciofluvial terrace deposits over turbidites
90	T28N R12W	1076926.5 975669.7	Reade Hill	Sitkum	0	1,431	1,060	371	29.2	15	USFS	0	SSE	Turbidite sandstone and conglomerate with siltstone and argillite

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91	T28N R12W	1089686.0 975645.2	Indian Pass	Sitkum	0	1,363	922	441	16.4	21	USFS	0	NNE	Turbidite sandstone, siltstone, and argillite and some conglomerate
92	T28N R10W	1150986.5 975262.6	Slide Peak	Upper Sol Duc	2	3,275	2,699	576	14.5	23		0	N	Turbidite sandstone and conglomerate with minor siltstone and argillite
93	T28N R15W	997223.0 974962.4	Quillayute Prairie	Quillayute Bottom	4	177	57	120	33.6	9		0	NNW	Older glaciofluvial terrace deposits
94	T28N R10W	1144123.9 974419.8	Slide Peak	Sitkum	4	3,485	2,472	1,013	61.8	29		0	NNW	Turbidite sandstone and conglomerate with minor siltstone and argillite
95	T28N R10W	1146351.3 974720.8	Slide Peak	Upper Sol Duc	2	3,593	2,723	870	22.6	25		0	NE	Turbidite sandstone and conglomerate with minor siltstone and argillite
96	T28N R10W	1148638.8 973215.8	Slide Peak	Upper Sol Duc	2	3,316	2,309	1,007	90.8	25		2,800	NNE (var.)	Turbidite sandstone and conglomerate with minor siltstone and argillite
97	T28N R11W	1111929.5 973714.2	Indian Pass/ Hunger Mountain	Sitkum	0	1,088	839	249	13.7	16	USFS	0	S	Older alpine glaciofluvial terrace deposits
98	T28N R13W	1047811.4 973405.9	Forks	Sol Duc Valley	4	483	300	183	33.7	9		1,800	NNW	Older alpine till and glaciofluvial terrace deposits
99	T28N R12W	1075264.4 973323.1	Reade Hill	Sitkum	0	1,592	1,441	151	23.9	10	USFS	0	E	Turbidite sandstone and conglomerate with siltstone and argillite
100	T28N R11W	1125607.6 973426.1	Hunger Mountain	Sitkum	3	2,179	1,466	713	17.0	30		400	W	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
101	T28N R12W	1074153.7 973047.3	Reade Hill	Sitkum	2	1,483	1,029	454	32.1	20		800	SW	Turbidite sandstone and conglomerate with siltstone and argillite
102	T28N R13W	1066124.2 972986.9	Reade Hill	Sol Duc Valley	3	1,023	556	467	34.6	19		1,600	ENE	Turbidite sandstone and conglomerate with siltstone and argillite
103	T28N R11W	1112173.9 972589.8	Indian Pass/ Hunger Mountain	Sitkum	0	2,267	826	1,441	92.3	27	USFS	2,200	NNW	Older alpine glaciofluvial deposits over turbidite sandstone, siltstone, argillite, and conglomerate
104	T28N R10W	1141538.3 972704.7	Hunger Mountain	Sitkum	3	2,655	2,233	422	16.3	24		0	NNW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
105	T28N R13W	1045520.4 972320.7	Forks	Sol Duc Valley	2	480	286	194	55.1	10		0	NNW	Older alpine till and glaciofluvial terrace deposits
106	T28N R10W	1131258.5 971442.3	Hunger Mountain	Sitkum	4	2,667	1,700	967	37.7	20		400	N	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
107	T28N R11W	1108507.4 972516.5	Indian Pass	Sitkum	0	936	760	176	6.9	16	USFS	1,200	NNE	Turbidite sandstone, siltstone, and argillite and some conglomerate
108	T28N R15W	989359.6 971696.1	La Push/ Quillayute Prairie	Quillayute Bottom	4	248	10	238	45.7	7		1,200	SE	Older glaciofluvial terrace deposits

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109	T28N R12W	1090174.9 971783.2	Indian Pass	South Fork Calawah	0	1,230	492	738	39.4	20	USFS	1,100	NE	Older alpine glaciofluvial deposits over turbidite sandstone, siltstone, argillite, and conglomerate
110	T28N R11W	1103716.5 971783.2	Indian Pass	Sitkum	0	1,105	662	443	46.0	16	USFS	2,100	N	Older alpine glaciofluvial deposits over turbidite sandstone, siltstone, argillite, and conglomerate
111	T28N R12W	1077366.5 971269.9	Reade Hill	South Fork Calawah	0	1,713	1,260	453	50.9	13	USFS	0	NNE	Turbidite sandstone and conglomerate with siltstone and argillite
112	T28N R12W	1075240.4 971296.5	Reade Hill	Sol Duc Valley	2	1,468	864	604	42.0	17		2,100	SW	Turbidite sandstone and conglomerate with siltstone and argillite
113	T28N R14W	1033884.6 970331.1	Forks	Bogachiel	2	450	109	341	85.9	5		800	NNW	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
114	T28N R12W	1090620.2 970711.4	Indian Pass	South Fork Calawah	2	884	502	382	10.4	19		600	NE	Turbidite sandstone, siltstone, and argillite and some conglomerate
115	T28N R13W	1059543.6 970632.4	Reade Hill	Sol Duc Valley	5	947	768	179	10.6	15		0	W	Turbidite sandstone and conglomerate with siltstone and argillite
116	T28N R12W	1093027.4 970532.5	Indian Pass	South Fork Calawah	3	892	508	384	10.7	16		500	SSW	Turbidite sandstone, siltstone, and argillite and some conglomerate
117	T28N R13W	1044676.3 970150.3	Forks	Sol Duc Valley	4	501	259	242	28.4	8		2,000	N	Older alpine glacial drift over turbidite sandstone, siltstone, and argillite
118	T28N R12W	1076568.6 970209.8	Reade Hill	Sol Duc Valley	2	1,628	1,171	457	20.0	16		1,600	NW	Turbidite sandstone and conglomerate with siltstone and argillite
119	T28N R13W	1037260.8 968944.5	Forks	Bogachiel	2	688	98	590	231.5	10		4,500	NNE	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
120	T28N R10W	1145368.0 969925.5	Slide Peak	South Fork Calawah	0	2,517	2,102	415	15.5	19	USFS	900	NW	Younger alpine glacial drift over turbidite sandstone and conglomerate with siltstone and argillite
121	T28N R10W	1143999.2 970023.3	Slide Peak	South Fork Calawah	0	2,292	2,007	285	21.9	16	USFS	2,200	SSE	Younger alpine glacial drift over turbidite sandstone and conglomerate with siltstone and argillite
122	T28N R12W	1074093.3 970089.1	Reade Hill	Sol Duc Valley	2	1,044	781	263	9.9	13		500	NE	Turbidite sandstone and conglomerate with siltstone and argillite
123	T28N R11W	1121038.7 969157.9	Hunger Mountain	Sitkum	4	2,864	1,812	1,052	62.6	27		0	NNE	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
124	T28N R10W	1143657.0 968801.1	Hunger Mountain/ Slide Peak	South Fork Calawah	0	2,725	1,896	829	55.1	24	USFS	2,700	NW	Younger alpine glacial drift over turbidite sandstone and conglomerate with siltstone and argillite
125	T28N R12W	1095021.3 969213.0	Indian Pass	South Fork Calawah	3	847	537	310	3.8	24		400	SSW	Turbidite sandstone, siltstone, and argillite and some conglomerate
126	T28N R14W	1028760.0 967859.3	Forks	Bogachiel	1	552	93	459	67.1	11		1,700	NE	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate

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127	T28N R14W	1026830.7 968522.5	Forks	Bogachiel	2	431	123	308	15.2	11		0	NNW	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
128	T28N R12W	1066305.3 968459.0	Reade Hill	Bogachiel	5	1,196	620	576	36.4	17		500	SW	Turbidite sandstone and conglomerate with siltstone and argillite
129	T28N R13W	1043651.4 967799.0	Forks	Bogachiel	3	590	131	459	133.9	9		900	W	Older alpine glacial drift over turbidite sandstone, siltstone, and argillite
130	T28N R13W	1045942.4 968401.9	Forks	Sol Duc Valley	4	528	415	113	25.2	5		0	NE	Older alpine glacial drift over turbidite sandstone, siltstone, and argillite
131	T28N R10W	1140430.4 967456.7	Hunger Mountain	South Fork Calawah	0	2,266	1,680	586	42.4	23	USFS	3,400	NW	Till(?) over undifferentiated turbidite sediments
132	T28N R12W	1075680.4 967716.5	Reade Hill	South Fork Calawah	0	1,081	900	181	10.3	12	USFS	1,600	E	Turbidite sandstone and conglomerate with siltstone and argillite
133	T28N R14W	1031955.3 967738.7	Forks	Bogachiel	3	357	206	151	10.3	7		900	ENE	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
134	T28N R13W	1061777.4 967613.8	Reade Hill	Bogachiel	4	949	644	305	11.4	15		800	NW	Turbidite sandstone and conglomerate with siltstone and argillite
135	T28N R12W	1078905.9 967192.7	Reade Hill	South Fork Calawah	0	936	893	43	0.7	3	USFS	0	ESE	Turbidite sandstone and conglomerate with siltstone and argillite
136	T28N R14W	1032678.8 966352.1	Forks	Bogachiel	2	531	245	286	16.2	10		500	NNW	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
137	T28N R12W	1095793.8 965582.0	Indian Pass	South Fork Calawah	3	1,155	578	577	76.6	18		3,800	ENE	Turbidite sandstone, siltstone, and argillite and some conglomerate
138	T28N R10W	1137210.9 966909.4	Hunger Mountain	South Fork Calawah	0	1,684	1,631	53	2.7	7	USFS	700	SSE	Till(?) over undifferentiated turbidite sediments
139	T28N R13W	1045761.5 964724.3	Forks	Bogachiel	1	775	128	647	304.9	10		3,000	W	Older alpine glacial drift over turbidite sandstone, siltstone, and argillite
140	T28N R14W	1032075.9 965025.7	Forks	Bogachiel	2	624	271	353	44.5	11		1,200	NNW	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
141	T28N R12W	1080173.9 965933.0	Reade Hill	South Fork Calawah	0	800	658	142	9.7	9	USFS	500	NE	Turbidite sandstone and conglomerate with siltstone and argillite
142	T28N R15W	991588.3 965416.4	Quillayute Prairie	Quillayute Bottom	3	178	32	146	10.3	11		0	NE	Older glaciofluvial terrace deposits
143	T28N R11W	1128853.8 964889.7	Hunger Mountain	South Fork Calawah	5	2,368	1,366	1,002	36.0	24	USFS	800	N	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
144	T28N R12W	1085601.6 965072.4	Indian Pass	South Fork Calawah	4	1,698	1,195	503	12.7	21		0	W	Turbidite sandstone, siltstone, and argillite and some conglomerate

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145	T28N R15W	994239.6 964427.2	Quillayute Prairie	Quillayute Bottom	3	249	38	211	55.6	9		0	NNW	Older glaciofluvial terrace deposits
146	T28N R11W	1113249.4 964327.9	Hunger Mountain	South Fork Calawah	0	1,491	902	589	42.6	20	USFS	1,500	SSW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
147	T28N R14W	1031292.1 963759.6	Forks	Bogachiel	3	660	374	286	22.4	11		800	NW	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
148	T28N R13W	1065641.2 964468.5	Reade Hill	Bogachiel	2	710	443	267	4.7	16		100	S	Turbidite sandstone and conglomerate with siltstone and argillite
149	T28N R09W	1161340.6 963885.1	Slide Peak	Upper Bogachiel	3	3,147	2,518	629	27.0	20		400	NNW	Till over turbidite sandstone and conglomerate with siltstone and argillite
150	T28N R14W	1033221.4 964061.1	Forks	Bogachiel	2	663	472	191	9.6	9		0	NE	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
151	T28N R13W	1041481.0 963217.0	Forks	Bogachiel	3	741	127	614	154.1	14		0	NE	Older alpine glaciofluvial deposits over undifferentiated glacial drift (till?)
152	T28N R11W	1114967.0 963266.5	Hunger Mountain	South Fork Calawah	4	1,598	921	677	69.1	17	USFS	1,600	SW	Older alpine glaciofluvial deposits and glacial drift
153	T28N R14W	1023514.8 963217.0	Forks	Bogachiel	1	469	79	390	28.5	11		0	NW	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
154	T28N R11W	1124345.1 962725.5	Hunger Mountain	South Fork Calawah	3	2,695	1,154	1,541	77.8	24	USFS	1,200	NW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
155	T28N R11W	1102054.8 962815.5	Indian Pass	South Fork Calawah	4	1,299	709	590	45.6	20		1,400	SE	Turbidite sandstone, siltstone, and argillite and some conglomerate
156	T28N R15W	1000368.3 962441.5	Quillayute Prairie	Quillayute Bottom	2	275	20	255	85.5	13		2,500	N	Older glaciofluvial terrace deposits
157	T28N R11W	1098778.9 962690.2	Indian Pass	South Fork Calawah	0	978	641	337	25.5	20	USFS	2,600	SSW	Older alpine glaciofluvial deposits over turbidite sandstone, siltstone, argillite, and conglomerate
158	T28N R14W	1003513.7 962139.1	Quillayute Prairie	Quillayute Bottom	2	237	22	215	30.1	9		0	NNE	Older glaciofluvial terrace deposits
159	T28N R14W	1019294.6 962071.5	Quillayute Prairie/ Forks	Bogachiel	2	322	93	229	35.3	8		0	N	Older alpine glacial drift over mélange
160	T28N R11W	1119776.3 962304.7	Hunger Mountain	South Fork Calawah	4	1,233	974	259	21.6	18		2,300	SSE	Older alpine glaciofluvial deposits and glacial drift
161	T28N R14W	1017365.3 961655.2	Quillayute Prairie	Bogachiel	2	374	61	313	76.7	9		400	N	Thrust contact of mélange with sandstone
162	T28N R11W	1121413.5 962225.8	Hunger Mountain	South Fork Calawah	0	1,331	1,058	273	9.0	18	USFS	1,700	NNW	Till(?) over undifferentiated turbidite sediments

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163	T28N R12W	1075481.9 961818.1	Reade Hill	Bogachiel	4	1,556	896	660	32.5	21		400	WNW	Turbidite sandstone and conglomerate with siltstone and argillite
164	T28N R14W	1012579.2 961524.8	Quillayute Prairie	Bogachiel	3	308	61	247	16.8	13		0	NW	Massive to thin-bedded sandstone
165	T28N R14W	1031593.6 960745.2	Forks	Bogachiel	1	587	302	285	42.7	11		1,800	NNW	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
166	T28N R12W	1088659.3 960631.5	Indian Pass	Upper Bogachiel	3	1,926	1,296	630	25.9	23		0	SSE	Turbidite sandstone, siltstone, and argillite and some conglomerate
167	T28N R14W	1026167.6 960142.3	Forks	Bogachiel	2	484	182	302	29.6	10		1,900	NNW	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
168	T28N R13W	1035150.7 960142.3	Forks	Bogachiel	2	636	347	289	46.2	12		2,900	SSW	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
169	T28N R14W	1033402.3 959840.8	Forks	Bogachiel	1	637	343	294	33.8	13		2,800	NNE	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
170	T28N R13W	1050891.6 959734.0	Reade Hill	Bogachiel	4	830	347	483	38.2	18		0	SSW	Turbidite sandstone and conglomerate with siltstone and argillite
171	T28N R11W	1105780.6 960126.3	Indian Pass	South Fork Calawah	3	1,998	1,416	582	8.1	31		600	SW	Turbidite sandstone, siltstone, and argillite and some conglomerate
172	T28N R13W	1045218.9 956826.4	Forks	Bogachiel	1	692	149	543	298.7	12		4,000	NE	Older alpine glaciofluvial deposits over undifferentiated glacial drift (till?)
173	T28N R13W	1036477.0 958514.5	Forks	Bogachiel	1	702	392	310	53.4	11		2,900	NNE	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
174	T28N R14W	1025082.4 959237.9	Forks	Bogachiel	3	442	195	247	22.8	12		700	SW	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
175	T28N R13W	1036778.5 959177.6	Forks	Bogachiel	2	676	412	264	30.0	12		2,200	SW	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
176	T28N R15W	989430.2 957911.0	Quillayute Prairie	Quillayute Bottom	1	196	7	189	31.3	15		ocean	SW	Mélange claystone and siltstone with blocks of sandstone
177	T28N R14W	1026469.0 957549.8	Forks	Bogachiel	2	565	228	337	35.0	11		1,300	SW	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
178	T28N R12W	1074395.2 957229.8	Reade Hill	Bogachiel	4	899	669	230	57.7	9		1,400	S	Turbidite sandstone and conglomerate with siltstone and argillite
179	T28N R13W	1038225.4 956886.7	Forks	Bogachiel	3	717	507	210	34.6	10		1,600	NE	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
180	T28N R11W	1123443.4 957254.9	Hunger Mountain	Upper Bogachiel	4	2,420	1,790	630	10.5	29		0	SSW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite

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181	T28N R10W	1136548.7 956653.8	Hunger Mountain	Upper Bogachiel	3	1,379	934	445	29.5	18		2,100	SE	Older alpine glaciofluvial deposits and glacial drift
182	T28N R12W	1075972.5 956769.5	Reade Hill	Bogachiel	3	971	701	270	18.4	17		1,400	NNW	Turbidite sandstone and conglomerate with siltstone and argillite
183	T28N R14W	1025383.8 956344.1	Forks	Bogachiel	2	555	233	322	59.7	9		800	NNE	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
184	T28N R12W	1080578.2 956045.0	Indian Pass	Bogachiel	4	885	616	269	16.7	20		1,800	E	Turbidite sandstone, siltstone, and argillite and some conglomerate
185	T28N R15W	991598.4 956311.8	Quillayute Prairie	Quillayute Bottom	1	254	5	249	32.8	18		ocean	SW	Mélange claystone and siltstone with blocks of sandstone
186	T28N R10W	1147735.8 955577.7	Slide Peak	Upper Bogachiel	3	3,287	2,286	1,001	46.1	27		0	NW	Turbidite sandstone and conglomerate with minor siltstone and argillite
187	T28N R12W	1084946.4 952477.7	Reade Hill/ Indian Pass	Upper Bogachiel	3	1,284	301	983	593.1	7		7,000	S	Older alpine glaciofluvial terrace deposits over turbidites
188	T28N R11W	1102582.6 956035.9	Indian Pass	Upper Bogachiel	3	1,296	1,080	216	8.3	14		1,300	W	Turbidite sandstone, siltstone, and argillite and some conglomerate
189	T28N R11W	1128132.4 954970.5	Hunger Mountain	Upper Bogachiel	4	2,163	1,153	1,010	41.5	24		0	SSE	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
190	T28N R13W	1042204.5 955319.1	Forks	Bogachiel	3	819	401	418	69.9	11		2,200	E	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
191	T28N R12W	1076085.6 955237.5	Reade Hill	Bogachiel	3	859	531	328	37.2	13		2,800	SW	Alpine glaciofluvial terrace deposits and glacial drift
192	T28N R10W	1145929.9 954975.8	Slide Peak	Upper Bogachiel	3	3,221	2,485	736	25.1	27		0	NNE	Turbidite sandstone and conglomerate with minor siltstone and argillite
193	T27N R15W	995905.1 954928.3	Quillayute Prairie	Quillayute Bottom	2	229	20	209	7.8	14		ocean	S	Mélange claystone and siltstone with blocks of sandstone
194	T27N R14W	1026227.9 954233.9	Forks	Bogachiel	1	495	330	165	12.7	7		0	NE	Older alpine glacial drift over turbidite sandstone, siltstone, and conglomerate
195	T28N R11W	1119054.9 953888.4	Hunger Mountain	Upper Bogachiel	3	2,126	1,263	863	12.6	29		200	WSW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
196	T27N R15W	998195.2 953892.8	Quillayute Prairie	Quillayute Bottom	3	158	33	125	6.5	13		ocean	SW	Mélange claystone and siltstone with blocks of sandstone
197	T28N R12W	1065943.0 951917.0	Reade Hill	Bogachiel	1	1,215	252	963	113.1	10		100	SW	Glaciofluvial terrace over turbidite sandstone and conglomerate with siltstone and argillite
198	T28N R10W	1132340.6 953046.8	Hunger Mountain	Upper Bogachiel	3	873	717	156	47.8	8		3,000	S	Older alpine glaciofluvial deposits and glacial drift

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199	T28N R11W	1098851.5 951822.4	Indian Pass	Upper Bogachiel	3	784	359	425	756.9	8		24,500	S	Older alpine glaciofluvial/glaciolacustrine terrace deposits
200	T27N R15W	999907.6 952500.6	Quillayute Prairie/ Toleak Point	Quillayute Bottom	1	188	13	175	19.0	11		ocean	SW	Tectonic mélange with blocks of siltstone, sandstone, and altered volcanic rocks
201	T28N R10W	1130657.3 951784.3	Hunger Mountain	Upper Bogachiel	3	1,091	669	422	287.0	12		14,500	N	Older alpine glaciofluvial deposits and glacial drift
202	T27N R13W	1062260.3 950951.1	Reade Hill/ Anderson Creek	Bogachiel	3	555	216	339	375.5	7		7,000	S	Older alpine glaciofluvial/glaciolacustrine terrace deposits
203	T28N R10W	1138773.0 950822.5	Hunger Mountain/ Slide Peak	Upper Bogachiel	3	1,292	842	450	161.3	9		7,000	SSW	Older alpine glaciofluvial deposits and glacial drift
204	T27N R13W	1056042.0 950468.1	Reade Hill/ Anderson Creek	Bogachiel	1	636	219	417	88.6	11		2,200	NE	Older alpine glaciofluvial deposits and glacial drift
205	T27N R14W	1020330.2 951372.7	Hoh Head	Bogachiel	3	377	234	143	9.2	7		300	SE	Thrust contact between siltstone and mélange
206	T27N R12W	1069152.9 950752.1	Reade Hill	Bogachiel	2	1,006	350	656	24.7	18		0	S	Turbidite sandstone and conglomerate with siltstone and argillite
207	T27N R12W	1078923.1 949441.9	Reade Hill/ Indian Pass/ Anderson Creek/ Winfield Creek	Bogachiel	2	769	289	480	884.0	8		18,500	N	Older alpine glaciofluvial/glaciolacustrine terrace deposits
208	T28N R10W	1149912.9 950548.4	Slide Peak	Upper Bogachiel	3	1,499	1,084	415	62.8	14		2,400	SSE	Younger alpine glaciofluvial deposits
209	T27N R11W	1107150.9 949638.4	Indian Pass	Upper Bogachiel	3	765	468	297	32.0	11		1,500	SSE	Older alpine glaciofluvial/glaciolacustrine terrace deposits
210	T27N R12W	1093828.2 949056.0	Indian Pass/ Winfield Creek	Upper Bogachiel	3	830	376	454	388.1	9		5,400	N	Older alpine glaciofluvial/glaciolacustrine terrace deposits
211	T27N R11W	1114906.9 949079.1	Hunger Mountain	Upper Bogachiel	5	713	547	166	104.2	4		3,000	N	Older alpine glaciofluvial deposits and glacial drift
212	T27N R11W	1120497.7 949019.0	Hunger Mountain	Upper Bogachiel	3	859	579	280	52.1	12		1,500	N	Older alpine glaciofluvial deposits and glacial drift
213	T27N R12W	1065666.1 947248.8	Anderson Creek	Bogachiel	1	659	236	423	281.5	8		5,400	N	Older alpine glaciofluvial/glaciolacustrine terrace deposits
214	T27N R11W	1117732.4 949079.1	Hunger Mountain	Upper Bogachiel	2	779	590	189	7.8	9		0	NNW	Older alpine glaciofluvial deposits and glacial drift
215	T27N R11W	1106005.1 946540.6	Winfield Creek	Upper Bogachiel	3	1,822	526	1,296	77.4	18		400	N	Turbidite sandstone, siltstone, and argillite with variable bedding thickness

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216	T27N R11W	1101602.2 946781.9	Winfield Creek	Upper Bogachiel	3	0	0	0	43.8	0		1,400	NW	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
217	T27N R14W	1004513.0 945829.1	Toleak Point	Bogachiel	1	145	8	137	11.5	11		ocean	W	Tectonic mélange with blocks of siltstone, sandstone, and altered volcanic rocks
218	T27N R11W	1107392.4 944309.0	Winfield Creek	Upper Bogachiel	3	1,908	1,026	882	31.1	24		0	N	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
219	T27N R14W	1010802.3 944311.0	Toleak Point	Bogachiel	4	175	114	61	44.6	3		ocean	SE	Massive to thick-bedded graywacke sandstone
220	T27N R14W	1005199.8 944564.0	Toleak Point	Bogachiel	1	175	0	175	37.8	14		ocean	SW	Tectonic mélange with blocks of siltstone, sandstone, and altered volcanic rocks
221	T27N R12W	1079218.3 944056.5	Anderson Creek/ Winfield Creek	Bogachiel	2	1,424	735	689	17.4	19		1,000	W	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
222	T27N R11W	1104979.8 943585.2	Winfield Creek	Upper Bogachiel	5	1,710	995	715	55.1	29		3,300	SSW	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
223	T27N R14W	1026435.7 943010.8	Hoh Head	Goodman–Mosquito	4	576	403	173	8.0	14		800	SW	Older glacial drift over massive to thick-bedded sandstone
224	T27N R10W	1129296.5 942402.7	Spruce Mountain	Upper Bogachiel	4	3,228	2,415	813	31.7	26		0	N	Turbidite sandstone and conglomerate with minor siltstone and argillite
225	T27N R14W	1007675.7 941780.8	Toleak Point	Bogachiel	2	146	0	146	44.6	10		ocean	SW	Tectonic mélange with blocks of siltstone, sandstone, and altered volcanic rocks
226	T27N R11W	1096415.1 941293.3	Winfield Creek	Upper Bogachiel	3	2,163	1,446	717	45.0	21		800	NW	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
227	T27N R11W	1121381.4 941081.7	Spruce Mountain	Upper Bogachiel	5	1,445	1,216	229	15.5	14		2,000	SW	Fluvial terrace deposits
228	T27N R11W	1098164.3 939966.3	Winfield Creek	Upper Bogachiel	3	2,205	1,793	412	10.2	16		600	S	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
229	T27N R12W	1083568.2 939966.3	Winfield Creek	Middle Hoh	2	1,226	681	545	42.1	15		1,400	NW	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
230	T27N R12W	1093037.5 939363.2	Winfield Creek	Middle Hoh	3	2,007	1,300	707	35.9	26		1,000	SSW	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
231	T27N R12W	1086620.4 939327.9	Winfield Creek	Middle Hoh	3	1,429	1,016	413	12.6	17		400	N	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
232	T27N R12W	1087200.8 939247.1	Winfield Creek	Middle Hoh	3	1,414	1,112	302	3.6	17		100	N	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
233	T27N R14W	1010983.0 938003.6	Toleak Point	Bogachiel	3	294	0	294	189.8	8		ocean	SW	Tectonic mélange with blocks of siltstone, sandstone, and altered volcanic rocks

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234	T27N R14W	1025653.3 937805.0	Hoh Head	Goodman–Mosquito	5	319	82	237	81.1	9		0	SSW	Older alpine undifferentiated glacial drift
235	T27N R11W	1103049.7 937433.1	Winfield Creek	Upper Bogachiel	3	2,462	1,824	638	45.6	16		1,600	NNE	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
236	T27N R12W	1090947.6 938159.8	Winfield Creek	Middle Hoh	3	1,707	1,370	337	5.7	20		200	S	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
237	T27N R14W	1015175.9 935889.1	Toleak Point/ Hoh Head	Goodman–Mosquito	3	352	16	336	227.9	8		7,000	S	Older alpine undifferentiated glacial drift
238	T27N R11W	1100878.4 937131.6	Winfield Creek	Middle Hoh	2	2,366	1,562	804	32.2	27		1,400	SW	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
239	T27N R11W	1114677.4 936584.2	Spruce Mountain	Upper Bogachiel	3	2,809	2,323	486	14.2	23		0	NW	Turbidite sandstone and conglomerate with minor siltstone and argillite
240	T27N R11W	1117150.3 935784.1	Spruce Mountain	Middle Hoh	4	2,831	2,491	340	18.4	17		0	NNE	Turbidite sandstone and conglomerate with minor siltstone and argillite
241	T27N R14W	1015519.2 934371.0	Toleak Point/ Hoh Head	Goodman–Mosquito	3	178	1	177	92.7	8		5,500	NNW	Older alpine glacial drift over tectonic mélange
242	T27N R11W	1104919.5 934779.3	Winfield Creek	Middle Hoh	2	2,488	1,631	857	66.7	25		1,500	SSW	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
243	T27N R10W	1129005.6 933820.4	Spruce Mountain	Upper Bogachiel	2	3,076	2,359	717	45.6	21		0	NNE	Turbidite sandstone and conglomerate with minor siltstone and argillite
244	T27N R11W	1096470.2 934160.4	Winfield Creek	Middle Hoh	3	1,041	771	270	3.8	20		0	WNW	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
245	T27N R14W	1022064.8 928573.5	Hoh Head	Goodman–Mosquito	1	494	0	494	1,000.7	11		ocean	WSW	Tectonic mélange with blocks of siltstone, sandstone, and altered volcanic rocks
246	T27N R11W	1099129.3 932487.4	Winfield Creek	Middle Hoh	4	1,417	804	613	19.9	23		0	SSW	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
247	T27N R11W	1101300.6 932427.0	Winfield Creek	Middle Hoh	3	1,970	1,228	742	23.3	26		2,000	SW	Turbidite sandstone, siltstone, and argillite with variable bedding thickness
248	T27N R13W	1055547.2 932552.2	Anderson Creek	Goodman–Mosquito	3	761	696	65	4.8	6		0	NE	Older alpine glacial drift (till?)
249	T27N R11W	1105763.9 927420.9	Winfield Creek	Middle Hoh	4	510	316	194	60.3	9		500	SSW	Younger alpine glaciofluvial terrace deposits and till(?)
250	T27N R11W	1124787.1 926329.0	Spruce Mountain	Middle Hoh	4	848	405	443	280.7	7		0	S	Younger alpine glaciofluvial/glaciolacustrine and till deposits
251	T27N R12W	1092916.9 925309.9	Winfield Creek	Middle Hoh	3	459	239	220	95.9	7		3,000	NNW	Younger alpine glaciofluvial terrace deposits

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252	T27N R12W	1090866.2 925490.9	Winfield Creek	Middle Hoh	4	400	264	136	16.3	8		1,400	NW	Younger alpine glaciofluvial terrace deposits
253	T27N R11W	1095389.8 925068.7	Winfield Creek	Middle Hoh	3	443	255	188	62.0	10		500	NNW	Younger alpine glaciofluvial terrace deposits
254	T27N R12W	1076266.9 923698.1	Anderson Creek	Hoh Lowlands	4	563	169	394	146.5	8		1,900	SE	Younger alpine glaciofluvial deposits
255	T27N R12W	1082603.1 923078.3	Winfield Creek	Middle Hoh	4	499	237	262	343.4	6		12,000	variab le	Younger alpine glaciofluvial terrace deposits and till(?)
256	T27N R12W	1079225.5 921389.5	Anderson Creek/ Winfield Creek	Hoh Lowlands	4	444	164	280	270.5	10		2,500	W	Younger alpine moraine and glaciofluvial terrace deposits
257	T27N R12W	1068015.2 921590.0	Anderson Creek	Hoh Lowlands	1	1,239	221	1,018	160.3	11		0	SE	Slate and phyllite with some sandstone
258	T27N R13W	1056872.3 922915.1	Anderson Creek	Goodman–Mosquito	3	1,163	685	478	54.6	13		0	WSW	Slate and phyllite with some sandstone
259	T27N R12W	1069942.6 922312.8	Anderson Creek	Hoh Lowlands	2	761	660	101	4.2	9		0	SSE	Slate and phyllite with some sandstone
260	T27N R13W	1063009.5 922082.8	Anderson Creek	Hoh Lowlands	3	1,020	711	309	23.2	13		800	WNW	Slate and phyllite with some sandstone
261	T27N R10W	1132569.4 921601.4	Spruce Mountain	Middle Hoh	3	606	436	170	57.1	8		0	N	Younger alpine glaciofluvial/glaciolacustrine and till deposits
262	T27N R10W	1139479.0 921019.5	Spruce Mountain	Rain Forest	3	636	478	158	45.0	6		3,800	NNE	Younger alpine glaciofluvial/glaciolacustrine and till deposits
263	T27N R13W	1054161.8 921590.0	Anderson Creek	Goodman–Mosquito	3	841	636	205	6.3	13		0	N	Slate and phyllite with some sandstone
264	T27N R11W	1112422.7 921237.7	Spruce Mountain	Middle Hoh	3	681	332	349	82.8	14		1,000	NNE	Younger alpine glaciofluvial/glaciolacustrine and till deposits
265	T27N R11W	1107663.8 921495.1	Winfield Creek	Middle Hoh	3	479	308	171	7.1	14		0	NNW	Younger alpine glaciofluvial terrace deposits and till(?)
266	T27N R13W	1063798.9 921108.2	Anderson Creek	Hoh Lowlands	2	1,143	780	363	25.5	13		1,000	SW	Slate and phyllite with some sandstone
267	T27N R10W	1128060.1 920801.3	Spruce Mountain	Middle Hoh	3	770	390	380	82.2	14		0	NNW	Younger alpine glaciofluvial/glaciolacustrine and till deposits
268	T27N R13W	1063738.3 920477.2	Anderson Creek	Hoh Lowlands	3	1,042	856	186	9.1	7		600	WSW	Slate and phyllite with some sandstone
269	T26N R12W	1067111.7 919963.8	Anderson Creek	Hoh Lowlands	4	843	334	509	21.3	18		0	SSE	Slate and phyllite with some sandstone

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270	T26N R12W	1066027.5 918879.6	Anderson Creek	Hoh Lowlands	2	977	386	591	37.6	11		0	SSE	Slate and phyllite with some sandstone
271	T27N R11W	1125078.1 919055.8	Spruce Mountain	Middle Hoh	3	1,536	516	1,020	59.9	23		0	NNW	Turbidite sandstone and conglomerate with minor siltstone and argillite
272	T26N R13W	1036369.6 919633.0	Hoh Head	Goodman–Mosquito	4	621	389	232	20.0	8		600	W	Thin- to medium-bedded siltstone and sandstone
273	T27N R10W	1129251.0 917603.7	Spruce Mountain	Middle Hoh	2	1,665	1,402	263	4.3	17		0	NE	Turbidite sandstone and conglomerate with minor siltstone and argillite
274	T27N R10W	1129704.1 917359.7	Spruce Mountain	Middle Hoh	2	1,570	1,224	346	4.8	20		500	NE	Turbidite sandstone and conglomerate with minor siltstone and argillite
275	T26N R12W	1075363.5 914362.2	Anderson Creek	Hoh Lowlands	3	295	136	159	64.9	7		1,300	N	Younger alpine glaciofluvial terrace deposits
276	T26N R12W	1086282.3 914272.4	Winfield Creek	Middle Hoh	4	996	473	523	86.5	15		0	N	Thick-bedded sandstone with minor thin-bedded siltstone and sandstone
277	T26N R12W	1071147.2 912374.5	Anderson Creek	Hoh Lowlands	3	481	132	349	183.1	9		0	WNW	Younger alpine glaciofluvial terrace deposits
278	T26N R10W	1139540.4 913222.2	Spruce Mountain	Rain Forest	4	2,216	1,998	218	5.6	12		0	NNE	Turbidite sandstone and conglomerate with minor siltstone and argillite
279	T26N R14W	1029643.5 911728.9	Hoh Head	Goodman–Mosquito	2	422	2	420	188.7	12		ocean	SW	Tectonic mélange with blocks of siltstone, sandstone, and altered volcanic rocks
280	T26N R13W	1060004.3 912374.5	Anderson Creek	Hoh Lowlands	5	334	127	207	18.3	10		800	E	Younger alpine glaciofluvial terrace deposits
281	T26N R11W	1104039.4 912313.2	Winfield Creek	Middle Hoh	3	1,575	1,493	82	6.0	8		0	NW	Older alpine glacial drift over slate and phyllite
282	T26N R12W	1071930.2 908519.7	Anderson Creek	Hoh Lowlands	4	360	211	149	134.0	4		3,500	variab le	Younger alpine glaciofluvial terrace deposits
283	T26N R12W	1066087.8 908820.8	Anderson Creek	Hoh Lowlands	3	343	178	165	87.0	9		0	NW	Younger alpine glaciofluvial terrace deposits
284	T26N R14W	1031137.7 907447.4	Hoh Head/ Destruction Island	Goodman–Mosquito	3	347	0	347	112.7	9		ocean/ 2,000	SSW	Older alpine glaciofluvial deposits over tectonic mélange
285	T26N R13W	1039680.9 907248.7	Hoh Head	Hoh Lowlands	5	555	138	417	56.4	9		1,200	SE	Older alpine glacial drift over coarse sandstone and conglomerate
286	T26N R13W	1055093.2 907148.3	Anderson Creek	Hoh Lowlands	4	247	95	152	11.6	12		0	NE	Younger alpine glaciofluvial terrace deposits
287	T26N R12W	1074643.6 907074.3	Anderson Creek	Hoh Lowlands	2	359	349	10	4.7	1		0	SSW	Younger alpine glaciofluvial terrace deposits

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288	T26N R10W	1138533.4 905236.7	Spruce Mountain	Middle Hoh	3	2,803	2,326	477	29.0	15		0	N	Turbidite sandstone and conglomerate with minor siltstone and argillite
289	T26N R13W	1043389.6 905526.8	Hoh Head	Hoh Lowlands	3	296	0	296	36.0	14		0	SSW	Older alpine glacial drift over coarse sandstone and conglomerate
290	T26N R10W	1133951.3 904145.7	Spruce Mountain	Middle Hoh	3	2,770	2,357	413	17.8	20		0	N	Turbidite sandstone and conglomerate with minor siltstone and argillite
291	T26N R10W	1132787.6 903273.0	Spruce Mountain	Middle Hoh	3	2,880	2,504	376	12.4	18		0	NW	Turbidite sandstone and conglomerate with minor siltstone and argillite
292	T26N R13W	1051303.0 898849.0	Destruction Island/ Kalaloch Ridge	Hoh Lowlands	3	225	59	166	912.4	2		3,800	NW	Younger alpine glaciofluvial/glaciolacustrine terrace deposits
293	T26N R12W	1072131.6 901928.1	Kalaloch Ridge	Hoh Lowlands	3	370	278	92	30.9	4		2,400	S	Younger alpine glaciofluvial/glaciolacustrine terrace deposits
294	T26N R12W	1088493.8 901349.4	Christmas Creek	Hoh Lowlands	4	972	845	127	17.7	8		1,000	W	Older alpine glacial drift over thick-bedded sandstone
295	T26N R12W	1072192.0 901263.9	Kalaloch Ridge	Hoh Lowlands	3	396	274	122	42.8	5		5,400	N	Younger alpine glaciofluvial/glaciolacustrine terrace deposits
296	T26N R10W	1134998.4 900272.5	Stequaleho Creek	Upper Clearwater	4	1,982	1,562	420	4.7	21		0	SSW	Slate and phyllite with sandstone lenses
297	T26N R10W	1133662.3 899374.4	Stequaleho Creek	Upper Clearwater	3	2,309	1,406	903	26.7	33		1,500	ENE	Slate and phyllite with sandstone lenses
298	T26N R11W	1112150.7 899193.6	Stequaleho Creek	Upper Clearwater	3	1,795	1,235	560	15.6	21		0	NW	Thick-bedded sandstone with thin-bedded siltstone
299	T26N R10W	1130107.2 898380.1	Stequaleho Creek	Upper Clearwater	4	2,030	1,260	770	28.4	22		0	SSE	Slate and phyllite with sandstone lenses
300	T26N R11W	1100013.9 897911.5	Christmas Creek	Upper Clearwater	5	1,228	646	582	92.9	15		0	SE	Siltstone, thin-bedded sandstone, and rhythmically bedded fine-grained sandstone
301	T26N R10W	1136373.9 897626.9	Stequaleho Creek	Upper Clearwater	3	2,011	1,098	913	29.6	25		1,100	SW	Slate and phyllite with sandstone lenses
302	T26N R13W	1055770.6 897641.5	Kalaloch Ridge	Hoh Lowlands	3	209	171	38	8.0	4		0	S	Younger alpine glaciofluvial/glaciolacustrine terrace deposits
303	T26N R12W	1073701.4 896796.3	Kalaloch Ridge	Hoh Lowlands	3	1,113	552	561	25.4	15		0	N	Massive to thick-bedded graywacke sandstone
304	T26N R13W	1036290.5 893569.2	Destruction Island	Hoh Lowlands	3	143	9	134	26.6	14		ocean	W	Tectonic claystone/siltstone mélange with blocks of sandstone
305	T26N R11W	1098868.0 895378.3	Christmas Creek	Upper Clearwater	5	1,226	671	555	54.1	11		700	ENE	Siltstone, thin-bedded sandstone, and rhythmically bedded fine-grained sandstone

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306	T26N R10W	1134574.8 894960.3	Stequaleho Creek	Upper Clearwater	2	1,233	771	462	33.1	14		1,400	S	Thick-bedded sandstone with thin-bedded siltstone
307	T26N R11W	1125226.4 894433.3	Stequaleho Creek	Upper Clearwater	3	1,317	760	557	17.8	20		1,100	SE	Thick-bedded sandstone with thin-bedded siltstone
308	T26N R10W	1135048.2 893409.1	Stequaleho Creek	Upper Clearwater	2	1,829	758	1,071	79.2	18		2,100	NNW	Thick-bedded sandstone with thin-bedded siltstone
309	T26N R12W	1089277.9 894051.3	Christmas Creek	Upper Clearwater	5	1,440	1,001	439	18.4	16		700	ENE	Siltstone, thin-bedded sandstone, and rhythmically bedded fine-grained sandstone
310	T26N R12W	1080208.1 892949.0	Christmas Creek	Lower Clearwater	3	1,224	800	424	10.9	16		0	S	Siltstone, thin-bedded sandstone, and rhythmically bedded fine-grained sandstone
311	T26N R10W	1127094.3 891661.5	Stequaleho Creek	Upper Clearwater	3	1,371	632	739	53.1	14		1,700	N	Siltstone and rhythmically bedded siltstone and sandstone
312	T26N R12W	1064283.2 892690.9	Kalaloch Ridge	Cedar	4	584	437	147	5.8	9		0	SSE	Very old alpine glacial drift
313	T26N R10W	1136916.2 892324.4	Stequaleho Creek	Upper Clearwater	3	2,333	1,394	939	38.5	29		0	NW	Thick-bedded sandstone with thin-bedded siltstone
314	T26N R11W	1124925.1 891450.6	Stequaleho Creek	Upper Clearwater	4	1,325	592	733	105.4	21		4,200	NW	Siltstone and rhythmically bedded siltstone and sandstone
315	T26N R10W	1134144.4 891721.9	Stequaleho Creek	Upper Clearwater	3	1,620	1,044	576	15.4	22		1,100	W	Thick-bedded sandstone with thin-bedded siltstone
316	T26N R12W	1077714.0 890874.5	Christmas Creek	Lower Clearwater	3	1,293	1,005	288	26.7	13		0	S	Rhythmically bedded siltstone and sandstone
317	T26N R10W	1138582.9 890977.2	Stequaleho Creek	Upper Clearwater	4	2,080	1,962	118	4.0	13		0	E	Thick-bedded sandstone with thin-bedded siltstone
318	T26N R12W	1090374.8 891015.6	Christmas Creek	Upper Clearwater	4	1,036	847	189	3.3	13		0	N	Siltstone, thin-bedded sandstone, and rhythmically bedded fine-grained sandstone
319	T26N R11W	1122575.1 890396.1	Stequaleho Creek	Upper Clearwater	2	942	576	366	29.8	12		1,100	NNW	Siltstone and rhythmically bedded siltstone and sandstone
320	T26N R10W	1125949.5 890094.9	Stequaleho Creek	Upper Clearwater	2	1,854	1,203	651	33.1	20		0	N	Siltstone and rhythmically bedded siltstone and sandstone
321	T26N R10W	1132276.4 890155.1	Stequaleho Creek	Upper Clearwater	3	1,916	1,318	598	18.4	22		400	NW	Siltstone and rhythmically bedded siltstone and sandstone
322	T26N R11W	1119622.5 889492.3	Stequaleho Creek	Upper Clearwater	3	809	522	287	32.2	10		500	SSE	Older alpine glaciofluvial terrace deposits
323	T26N R11W	1122153.3 888678.8	Stequaleho Creek	Upper Clearwater	2	1,185	547	638	59.3	21		3,000	W	Siltstone and rhythmically bedded siltstone and sandstone

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324	T25N R12W	1069113.0 888162.9	Kalaloch Ridge	Cedar	4	834	556	278	25.2	9		0	NW	Very old alpine glacial drift
325	T26N R10W	1125895.8 888232.1	Stequaleho Creek	Upper Clearwater	1	1,879	1,351	528	18.0	19		0	S	Siltstone and rhythmically bedded siltstone and sandstone
326	T26N R10W	1136072.6 887985.9	Stequaleho Creek	Upper Clearwater	3	2,570	1,644	926	33.4	23		0	NW	Thick-bedded sandstone with thin-bedded siltstone
327	T25N R12W	1068871.5 887197.0	Kalaloch Ridge	Cedar	5	813	556	257	37.0	8		0	NW	Very old alpine glacial drift
328	T26N R11W	1123165.1 887139.8	Stequaleho Creek	Upper Clearwater	2	1,289	643	646	53.5	20		1,900	SW	Siltstone and rhythmically bedded siltstone and sandstone
329	T25N R12W	1088192.2 886270.7	Christmas Creek	Lower Clearwater	3	899	484	415	59.2	15		2,000	SW	Siltstone, thin-bedded sandstone, and rhythmically bedded fine-grained sandstone
330	T26N R11W	1116549.4 886539.7	Stequaleho Creek	Upper Clearwater	2	804	480	324	44.4	10		1,200	SSE	Older alpine glaciofluvial and fluvial terrace deposits
331	T26N R11W	1124650.2 886814.8	Stequaleho Creek	Upper Clearwater	5	1,264	958	306	7.2	20		0	S	Siltstone and rhythmically bedded siltstone and sandstone
332	T25N R12W	1076637.3 886590.2	Kalaloch Ridge/ Christmas Creek	Lower Clearwater	4	972	634	338	16.1	16		0	W	Massive to thin-bedded siltstone
333	T26N R10W	1132396.9 886389.1	Stequaleho Creek	Upper Clearwater	4	2,599	2,148	451	14.1	22		0	NW	Siltstone and rhythmically bedded siltstone and sandstone
334	T26N R10W	1125431.7 886429.5	Stequaleho Creek	Upper Clearwater	2	1,204	958	246	5.9	17		300	S	Siltstone and rhythmically bedded siltstone and sandstone
335	T26N R10W	1130830.3 885425.0	Stequaleho Creek	Upper Clearwater	4	2,343	1,771	572	13.4	24		0	NW	Siltstone and rhythmically bedded siltstone and sandstone
336	T25N R11W	1114621.2 884912.8	Stequaleho Creek	Upper Clearwater	3	771	528	243	40.5	8		0	SSE	Older alpine glaciofluvial terrace deposits
337	T26N R10W	1136554.6 885364.7	Stequaleho Creek	Upper Clearwater	2	2,795	2,294	501	12.8	28		0	SW	Thick-bedded sandstone with thin-bedded siltstone
338	T25N R10W	1129866.1 884671.8	Stequaleho Creek	Upper Clearwater	3	2,338	1,807	531	22.6	20		0	NNW	Siltstone and rhythmically bedded siltstone and sandstone
339	T25N R11W	1119529.3 884489.9	Stequaleho Creek	Upper Clearwater	4	1,455	1,042	413	8.3	20		0	NNW	Siltstone and rhythmically bedded siltstone and sandstone
340	T25N R10W	1135409.8 884189.7	Stequaleho Creek	Upper Clearwater	3	2,011	1,456	555	20.6	20		300	SW	Thick-bedded sandstone with thin-bedded siltstone
341	T25N R11W	1124322.5 883798.0	Stequaleho Creek	Upper Clearwater	5	1,774	1,046	728	32.5	22		0	NNW	Siltstone and rhythmically bedded siltstone and sandstone

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342	T25N R11W	1113416.1 884310.2	Stequaleho Creek	Upper Clearwater	3	720	578	142	13.6	10		0	SSE	Older alpine glaciofluvial terrace deposits
343	T25N R10W	1134527.6 883834.1	Stequaleho Creek	Upper Clearwater	1	1,983	1,292	691	15.5	21		900	SSE	Thick-bedded sandstone with thin-bedded siltstone
344	T25N R12W	1087856.6 884031.2	Christmas Creek	Lower Clearwater	4	734	460	274	10.7	20		700	W	Siltstone, thin-bedded sandstone, and rhythmically bedded fine-grained sandstone
345	T25N R11W	1099290.2 883315.3	Christmas Creek	Upper Clearwater	4	883	535	348	32.5	13		0	S	Alpine glacial outwash over rhythmically bedded siltstone and fine grained sandstone
346	T25N R12W	1078541.8 883315.3	Christmas Creek	Lower Clearwater	3	968	582	386	16.5	20		1,000	SE	Siltstone, thin-bedded sandstone, and rhythmically bedded fine-grained sandstone
347	T25N R12W	1081759.0 882698.7	Christmas Creek	Lower Clearwater	2	957	548	409	18.8	16		1,700	S	Siltstone, thin-bedded sandstone, and rhythmically bedded fine-grained sandstone
348	T25N R10W	1134170.7 882892.0	Stequaleho Creek	Upper Clearwater	1	1,511	1,148	363	9.4	18		700	SE	Thick-bedded sandstone with thin-bedded siltstone
349	T25N R10W	1135020.9 883032.9	Stequaleho Creek	Upper Clearwater	2	1,700	1,266	434	9.1	21		700	WSW	Thick-bedded sandstone with thin-bedded siltstone
350	T25N R10W	1129564.9 882201.2	Stequaleho Creek	Upper Clearwater	3	2,404	1,504	900	47.5	21		0	S	Siltstone and rhythmically bedded siltstone and sandstone
351	T25N R11W	1124443.1 882351.9	Stequaleho Creek	Upper Clearwater	4	2,181	1,366	815	41.4	24		0	NW	Siltstone and rhythmically bedded siltstone and sandstone
352	T25N R11W	1108765.9 882904.9	Stequaleho Creek	Upper Clearwater	3	873	748	125	6.4	7		300	SE	Older alpine glaciofluvial terrace deposits
353	T25N R13W	1055710.2 882548.2	Kalaloch Ridge	Cedar	4	662	519	143	20.6	7		1,300	SSE	Older alpine drift over thin- to medium-bedded siltstone and sandstone
354	T25N R10W	1128946.3 881710.0	Stequaleho Creek	Upper Clearwater	4	2,108	1,654	454	9.7	21		0	SE	Siltstone and rhythmically bedded siltstone and sandstone
355	T25N R11W	1098928.3 879696.4	Christmas Creek	Upper Clearwater	2	965	485	480	46.3	9		900	NNW	Alpine glacial drift over rhythmically bedded siltstone and fine-grained sandstone
356	T25N R10W	1134491.2 880565.9	Stequaleho Creek	Upper Clearwater	3	1,031	868	163	11.7	11		1,000	SSW	Thick-bedded sandstone with thin-bedded siltstone
357	T25N R10W	1130348.2 878284.6	Stequaleho Creek	Upper Clearwater	3	1,331	768	563	31.8	24		1,400	NNW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
358	T25N R12W	1074606.9 878382.5	Kalaloch Ridge	Lower Clearwater	4	1,021	662	359	8.1	18		0	SSW	Massive to thin-bedded siltstone
359	T25N R13W	1047861.7 878141.0	Kalaloch Ridge	Cedar	3	887	603	284	10.7	13		0	NNW	Massive to thick-bedded graywacke sandstone

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360	T25N R10W	1134292.2 877863.5	Stequaleho Creek	Upper Clearwater	2	2,064	1,272	792	15.8	24		0	NE	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
361	T25N R10W	1135409.8 877621.7	Stequaleho Creek	Upper Clearwater	3	1,505	1,062	443	12.1	20		700	ENE	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
362	T25N R10W	1132095.6 876597.4	Stequaleho Creek	Upper Clearwater	3	2,390	1,802	588	43.1	21		0	NNE	Till over undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
363	T25N R13W	1056778.0 877162.5	Kalaloch Ridge	Kalaloch Ridge	4	1,008	825	183	5.7	8		0	NE	Massive to thick-bedded graywacke sandstone
364	T25N R12W	1062894.6 876269.4	Kalaloch Ridge	Kalaloch Ridge	4	662	407	255	12.0	12		0	SE	Older alpine drift over thin- to medium-bedded siltstone and sandstone
365	T25N R10W	1133106.5 876154.4	Stequaleho Creek	Upper Clearwater	3	2,230	1,953	277	18.2	14		0	NNE	Till over undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
366	T25N R10W	1134661.8 875933.7	Stequaleho Creek	Upper Clearwater	2	2,374	1,200	1,174	48.7	25		1,300	NE	Till over undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
367	T25N R10W	1131191.8 876085.2	Stequaleho Creek	Upper Clearwater	4	2,343	1,878	465	13.7	20		0	W	Till over undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
368	T25N R11W	1112211.0 875542.9	Stequaleho Creek	Upper Clearwater	3	918	407	511	39.7	17		1,400	S	Siltstone and rhythmically bedded siltstone and sandstone
369	T25N R11W	1116489.2 875060.8	Stequaleho Creek	Upper Clearwater	4	1,534	480	1,054	119.7	21		3,700	N	Siltstone and rhythmically bedded siltstone and sandstone
370	T25N R12W	1083886.2 875757.3	Christmas Creek	Lower Clearwater	2	793	476	317	6.8	21		0	NE	Siltstone, thin-bedded sandstone, and rhythmically bedded fine-grained sandstone
371	T25N R11W	1107518.3 875363.7	Kalaloch Ridge/ Christmas Creek	Upper Clearwater	3	628	501	127	14.5	7		0	SE	Older alpine glaciofluvial deposits over rhythmically bedded siltstone and sandstone
372	T25N R10W	1135891.8 874428.1	Stequaleho Creek	Upper Clearwater	2	2,040	1,215	825	28.9	26		1,100	NE	Till over undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
373	T25N R12W	1071467.5 874760.1	Kalaloch Ridge	Lower Clearwater	3	478	321	157	17.2	8		700	NE	Older alpine till over massive to thick-bedded graywacke sandstone
374	T25N R10W	1127757.2 874247.4	Stequaleho Creek	Upper Clearwater	1	1,775	991	784	44.8	23		1,400	S	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
375	T25N R11W	1124141.8 874639.0	Stequaleho Creek	Upper Clearwater	5	1,420	1,123	297	16.2	16		1,500	WNW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
376	T25N R12W	1066034.0 875001.6	Kalaloch Ridge	Kalaloch Ridge	3	1,214	998	216	6.2	12		0	WNW	Older alpine till over massive to thick-bedded graywacke sandstone
377	T25N R10W	1128995.5 874551.3	Stequaleho Creek	Upper Clearwater	2	1,686	1,239	447	10.2	19		500	S	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite

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378	T25N R10W	1131553.3 874247.4	Stequaleho Creek	Upper Clearwater	1	2,605	1,564	1,041	42.4	27		0	W	Till over undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
379	T25N R10W	1129926.2 874729.2	Stequaleho Creek	Upper Clearwater	2	1,774	1,470	304	6.1	20		400	SSW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
380	T25N R11W	1107251.1 873992.0	Kalaloch Ridge/ Christmas Creek	Upper Clearwater	3	464	350	114	12.2	6		700	SE	Older alpine glaciofluvial deposits over rhythmically bedded siltstone and sandstone
381	T25N R12W	1081028.1 874253.5	Christmas Creek	Lower Clearwater	3	974	714	260	10.3	17		0	SSW	Siltstone, thin-bedded sandstone, and rhythmically bedded fine-grained sandstone
382	T25N R11W	1110825.1 873735.2	Stequaleho Creek	Upper Clearwater	4	1,033	362	671	55.3	13		1,400	NW	Siltstone and rhythmically bedded siltstone and sandstone
383	T25N R13W	1059272.2 872043.3	Kalaloch Ridge	Kalaloch Ridge	4	611	270	341	40.9	13		200	NW	Massive to thin-bedded siltstone
384	T25N R11W	1096820.0 871634.5	Christmas Creek	Upper Clearwater	3	383	315	68	3.8	7		0	E	Alpine glaciofluvial deposits
385	T25N R12W	1083580.1 870645.7	Christmas Creek	Lower Clearwater	3	332	236	96	2.9	11		200	E	Very old alpine glaciofluvial deposits
386	T25N R11W	1104537.6 870287.2	Christmas Creek	Upper Clearwater	4	565	318	247	50.4	9		4,700	NNW	Old alpine glaciofluvial deposits and sheared thin-bedded sandstone and siltstone
387	T25N R13W	1041884.1 870379.0	Destruction Island	Cedar	4	111	11	100	7.9	8		ocean	W	Older alpine glaciofluvial terrace deposits and glacial drift
388	T25N R12W	1085875.1 869709.4	Christmas Creek	Lower Clearwater	3	360	229	131	4.3	15		0	SE	Older alpine glaciofluvial terrace deposits
389	T25N R10W	1130833.3 868291.4	Stequaleho Creek	Upper Clearwater	3	1,695	1,122	573	26.8	15		900	SSE	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
390	T25N R11W	1110282.7 868432.6	Stequaleho Creek	Upper Clearwater	4	1,471	703	768	25.8	20		700	NNW	Siltstone and rhythmically bedded siltstone and sandstone
391	T25N R12W	1084764.3 868635.3	Christmas Creek	Lower Clearwater	3	341	206	135	12.8	11		400	SSE	Older alpine glaciofluvial terrace deposits
392	T25N R11W	1105401.7 868005.0	Christmas Creek	Upper Clearwater	3	1,151	737	414	9.9	19		1,000	NE	Undifferentiated turbidite sandstone with siltstone and argillite
393	T25N R10W	1128600.8 867167.2	Stequaleho Creek	Upper Clearwater	4	1,928	1,034	894	80.1	17		1,200	N	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
394	T25N R10W	1131493.1 867016.6	Stequaleho Creek	Upper Clearwater	2	1,495	1,116	379	21.8	20		600	NW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
395	T25N R12W	1092025.9 865370.8	Christmas Creek	Lower Clearwater	4	636	282	354	12.5	17		1,200	NW	Undifferentiated turbidite sandstone with siltstone and argillite

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396	T25N R11W	1093017.4 865100.2	Christmas Creek	Lower Clearwater	3	727	304	423	9.4	20		500	N	Undifferentiated turbidite sandstone with siltstone and argillite
397	T25N R11W	1094284.0 864617.6	Christmas Creek	Lower Clearwater	3	786	367	419	12.8	24		900	N	Undifferentiated turbidite sandstone with siltstone and argillite
398	T25N R11W	1096937.9 864195.4	Christmas Creek	Lower Clearwater	3	1,028	409	619	26.5	21		1,200	NNE	Undifferentiated turbidite sandstone with siltstone and argillite
399	T25N R12W	1071648.7 863410.0	Kalaloch Ridge	Lower Clearwater	1	478	144	334	31.9	14		2,100	SE	Older alpine glacial drift over sheared claystone and siltstone
400	T25N R11W	1104356.6 863351.0	Christmas Creek	Upper Clearwater	3	1,178	845	333	8.7	15		0	NE	Undifferentiated turbidite sandstone with siltstone and argillite
401	T25N R12W	1079476.7 861732.6	Christmas Creek	Lower Clearwater	4	283	228	55	7.0	4		800	S	Very old alpine glaciofluvial deposits
402	T25N R12W	1088373.2 861722.5	Christmas Creek	Lower Clearwater	3	811	557	254	6.0	17		0	W	Undifferentiated turbidite sandstone with siltstone and argillite
403	T25N R12W	1082369.0 861581.1	Christmas Creek	Lower Clearwater	2	558	275	283	8.4	16		800	N	Rhythmically bedded siltstone with thin-bedded sandstone and siltstone
404	T25N R11W	1115127.8 861279.1	Stequaleho Creek	Upper Clearwater	3	1,561	853	708	56.3	22		2,300	NNW	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
405	T25N R12W	1078811.0 860951.6	Christmas Creek	Lower Clearwater	2	482	193	289	28.1	17		2,800	NNW	Rhythmically bedded siltstone with thin-bedded sandstone and siltstone
406	T25N R12W	1081617.9 860938.4	Christmas Creek	Lower Clearwater	2	634	329	305	13.7	14		0	N	Rhythmically bedded siltstone with thin-bedded sandstone and siltstone
407	T25N R11W	1117792.8 860588.7	Stequaleho Creek	Upper Clearwater	3	1,462	1,124	338	9.4	14		200	NNE	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
408	T25N R12W	1087993.5 860760.0	Christmas Creek	Lower Clearwater	3	690	374	316	9.2	17		200	W	Undifferentiated turbidite sandstone with siltstone and argillite
409	T25N R11W	1113710.5 859958.8	Stequaleho Creek	Upper Clearwater	3	1,560	1,040	520	25.0	18		0	N	Undifferentiated turbidite sandstone and conglomerate with siltstone and argillite
410	T25N R10W	1136795.7 859454.4	Stequaleho Creek	Queets Corridor N.	4	777	302	475	47.7	9		0	SSE	Older alpine glacial drift (moraine)
411	T25N R11W	1103832.3 859495.5	Christmas Creek	Lower Clearwater	4	1,130	834	296	8.4	15		0	SW	Older alpine glacial drift
412	T25N R11W	1099229.9 858948.0	Christmas Creek	Lower Clearwater	3	1,207	992	215	16.4	9		0	NE	Older alpine glacial drift
413	T25N R11W	1112090.4 858128.7	Stequaleho Creek	Queets Corridor N.	4	1,502	1,209	293	59.7	13		0	SSE	Older alpine glacial drift (moraine)

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414	T25N R12W	1080954.4 857922.7	Christmas Creek	Lower Clearwater	3	722	367	355	14.0	12		700	W	Rhythmically bedded siltstone with thin-bedded sandstone and siltstone
415	T24N R12W	1079004.2 854593.0	Salmon River West	Lower Clearwater	4	842	454	388	65.4	12		200	W	Siltstone and thin rhythmically bedded siltstone and sandstone
416	T25N R10W	1130191.5 854550.8	Salmon River East	Queets Corridor N.	4	456	260	196	33.2	6		1,300	SE	Younger alpine glaciofluvial/glaciolacustrine terrace deposits
417	T24N R13W	1049152.7 853984.1	Queets	Kalaloch Ridge	4	58	39	19	12.5	1		1,600	NW	Very old undifferentiated alpine glacial drift
418	T24N R10W5	1126223.8 852386.6	Salmon River East	Queets Corridor N.	4	486	227	259	201.2	6		6,400	SSE	Older alpine glaciofluvial and moraine deposits
419	T24N R12W	1076953.4 852120.1	Salmon River West	Lower Clearwater	5	839	435	404	90.5	11		200	NNE	Siltstone and thin rhythmically bedded siltstone and sandstone
420	T24N R10W5	1133678.3 852627.1	Salmon River East	Queets Corridor N.	4	399	311	88	13.3	7		0	NW	Younger alpine glaciofluvial terrace deposits
421	T24N R11W	1119490.7 850462.8	Salmon River East	Queets Corridor N.	2	470	196	274	175.4	8		5,200	SSE	Younger alpine glaciofluvial terrace deposits
422	T24N R11W	1115823.6 849140.3	Salmon River East	Queets Corridor N.	3	326	206	120	14.7	4		1,900	SSE	Younger alpine glaciofluvial terrace deposits
423	T24N R11W	1116484.9 849440.9	Salmon River East	Queets Corridor N.	3	329	212	117	10.3	6		800	SSE	Younger alpine glaciofluvial terrace deposits
424	T24N R11W	1103432.9 849293.8	Salmon River West	Queets Corridor N.	4	377	355	22	3.4	1		1,200	NNW	Older alpine glaciofluvial terrace deposits
425	T24N R11W	1096375.1 847596.4	Salmon River West	Queets Corridor N.	3	778	418	360	133.5	10		0	SSE	Older alpine glaciofluvial terrace deposits and till
426	T24N R11W	1110833.9 847457.0	Salmon River East	Queets Corridor N.	3	400	192	208	63.5	8		800	SE	Younger alpine glaciofluvial terrace deposits
427	T24N R12W	1090385.7 847635.2	Salmon River West	Queets Corridor N.	2	820	721	99	4.4	6		200	S	Older alpine glaciofluvial terrace deposits and till
428	T24N R11W	1121715.0 846916.0	Salmon River East	Queets Corridor N.	2	559	204	355	202.1	12		0	NNW	Younger alpine glaciofluvial terrace deposits
429	T24N R12W	1077797.9 847113.9	Salmon River West	Lower Clearwater	4	510	303	207	21.0	12		1,800	NNW	Very old alpine glacial outwash deposits
430	T24N R11W	1100610.3 846239.5	Salmon River West	Queets Corridor N.	4	326	289	37	6.0	4		1,300	NW	Older alpine glaciofluvial terrace deposits
431	T24N R11W	1107287.0 844992.2	Salmon River East	Queets Corridor N.	4	380	250	130	26.1	9		0	SSE	Younger alpine glaciofluvial terrace deposits

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432	T24N R11W	1116004.0 844691.6	Salmon River East	Queets Corridor N.	4	424	199	225	52.4	8		1,800	N	Younger alpine glaciofluvial terrace deposits
433	T24N R11W	1099574.4 844930.5	Salmon River West	Queets Corridor N.	3	320	244	76	7.2	6		700	SE	Older alpine glaciofluvial terrace deposits
434	T24N R11W	1113599.3 843369.1	Salmon River East	Queets Corridor N.	5	404	184	220	112.7	7		0	NW	Younger alpine glaciofluvial terrace deposits
435	T24N R13W	1060958.5 843322.8	Queets	Lower Clearwater	3	287	92	195	14.3	11		0	ENE	Younger alpine drift over massive to thin-bedded siltstone
436	T24N R11W	1100054.3 843154.8	Salmon River West	Queets Corridor N.	3	334	208	126	21.8	8		1,600	SW	Older alpine glaciofluvial terrace deposits
437	T24N R11W	1103701.3 843611.8	Salmon River West	Queets Corridor N.	3	382	234	148	26.1	10		0	SSW	Older alpine glaciofluvial terrace deposits
438	T24N R11W	1106385.3 842707.8	Salmon River East	Queets Corridor N.	3	280	190	90	34.9	5		0	SE	Younger alpine glaciofluvial terrace deposits
439	T24N R11W	1111435.1 838559.7	Salmon River East	Queets Corridor S.	2	389	154	235	189.1	5		8,000	WSW	Younger alpine glaciofluvial terrace deposits
440	T24N R12W	1071439.1 840311.2	Queets	Lower Clearwater	5	314	203	111	13.2	6		1,000	NE	Very old alpine glacial drift
441	T24N R13W	1052345.1 839889.5	Queets	Lower Clearwater	4	344	148	196	11.0	8		0	SW	Thin- to medium-bedded siltstone and sandstone
442	T24N R13W	1061018.7 840010.0	Queets	Lower Clearwater	4	215	124	91	4.7	7		400	WSW	Massive to thin-bedded siltstone
443	T24N R11W	1121715.0 837658.0	Salmon River East	Queets Corridor S.	4	475	371	104	40.9	7		2,500	ESE	Older alpine glaciofluvial deposits
444	T24N R11W	1107587.6 836756.2	Salmon River West/ Salmon River East	Queets Corridor S.	1	408	143	265	561.9	7		22,000	NNW	Younger alpine glaciofluvial terrace deposits
445	T24N R10W5	1133558.1 836034.8	Salmon River East	Queets Corridor S.	2	1,114	587	527	32.7	11		1,000	SSW	Intensely sheared claystone and siltstone (mélange)
446	T24N R12W	1062946.2 836998.3	Queets	Lower Clearwater	5	178	60	118	8.0	8		600	E	Thin- to medium-bedded siltstone and sandstone
447	T24N R11W	1097340.1 834869.8	Salmon River West	Queets Corridor S.	2	404	105	299	421.7	5		2,500	NW	Younger alpine glaciofluvial terrace deposits
448	T24N R12W	1082804.1 834146.0	Salmon River West	Queets Corridor N.	3	293	118	175	58.2	8		0	S (var.)	Younger alpine glaciofluvial terrace deposits
449	T24N R10W5	1125983.3 831706.4	Salmon River East	Queets Corridor S.	2	732	539	193	38.7	6		1,800	NW	Older alpine glacial drift and glaciofluvial deposits

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450	T24N R13W	1055597.7 830673.8	Queets	Queets Corridor N.	3	324	19	305	21.6	16		1,800	SE	Massive to thin-bedded siltstone
451	T24N R12W	1084915.1 829079.5	Salmon River West	Matheney-Salmon	5	346	129	217	44.3	12		2,500	NW	Older alpine glaciofluvial terrace deposits
452	T24N R11W	1121053.8 828760.7	Salmon River East	Matheney-Salmon	3	1,021	619	402	76.2	11		1,400	E	Siltstone and rhythmically bedded siltstone and sandstone
453	T24N R11W	1120512.7 827197.6	Salmon River East	Matheney-Salmon	3	931	782	149	13.7	11		0	ESE	Siltstone and rhythmically bedded siltstone and sandstone
454	T24N R11W	1119851.4 825634.6	Salmon River East	Matheney-Salmon	2	873	543	330	37.5	9		800	S	Older alpine glaciofluvial deposits over siltstone and rhythmically bedded siltstone and sandstone
455	T24N R12W	1086784.9 825159.0	Salmon River West	Matheney-Salmon	3	290	137	153	32.7	7		2,200	S	Older alpine glaciofluvial terrace deposits
456	T24N R11W	1114861.7 825093.6	Salmon River East	Matheney-Salmon	4	892	594	298	38.2	10		1,200	SSW	Siltstone and rhythmically bedded siltstone and sandstone
457	T24N R11W	1114921.9 822929.4	Salmon River East	Matheney-Salmon	2	594	420	174	9.6	11		400	SSE	Older alpine glaciofluvial deposits over siltstone and rhythmically bedded siltstone and sandstone
458	T24N R10W5	1126043.5 822628.8	Salmon River East	Matheney-Salmon	3	910	607	303	16.9	18		900	NW	Siltstone and rhythmically bedded siltstone and sandstone
459	T23N R11W	1113659.4 821967.53	Salmon River East	Matheney-Salmon	4	505	389	116	9.2	7		600	SSE	Older alpine glacial drift and glaciofluvial deposits
460	T23N R13W	1068285.1 819710.3	Queets	Raft River	4	350	292	58	3.9	8		0	NNE	Very old alpine glacial drift
461	T23N R13W	1067702.5 819057.1	Queets	Raft River	4	348	262	86	5.0	6		0	WNW	Very old alpine glacial drift
462	T23N R12W	1099571.8 818705.2	Salmon River West	Matheney-Salmon	3	314	259	55	22.1	3		1,600	SSW	Older alpine glaciofluvial terrace deposits
463	T23N R11W	1102949.5 817981.4	Salmon River West	Matheney-Salmon	3	527	293	234	52.0	11		1,500	NNW	Very old alpine moraine (till?) and glaciofluvial deposits
464	T23N R11W	1105663.9 818240.2	Salmon River East	Matheney-Salmon	3	507	300	207	14.9	13		1,300	N	Very old alpine glacial moraine deposits
465	T23N R12W	1098884.3 817563.3	Salmon River West	Matheney-Salmon	4	513	288	225	28.6	14		1,600	NNE	Very old alpine moraine (till?) and glaciofluvial deposits