U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the City of Seattle and the Pacific Northwest Center for Geologic Mapping Studies
at the Department of Earth and Space Sciences, University of Washington

OPEN-FILE REPORT 2005-1252

# About This Map

A new geologic map of the City of Seattle is nearing completion. This report was prepared for the 5th Washington Hydrogeology Symposium, April 2005, and it provides a progress report on the mapping. The new map is the result of field mapping and compilation of geologic subsurface data spanning the years 1999 to 2004 and was funded by the City of Seattle and the U.S. Geological Survey. Data from more than 36,000 exploration points (geotechnical borings, test pits, monitoring wells, excavations, and outcrops) were compiled in a spatial database (map in lower left corner) and used in developing this geologic map. These subsurface data are available on our web site listed below.

Changes from the previous USGS Preliminary Geologic Map of Seattle and Vicinity, Washington, by Waldron and others (1962) include the following:

- Modified land units are differentiated where possible, i.e. landfills, regrades, artificial fill
- Modified land and mass wastage units show as overprints to expose the underlying geologic units (9% more of the land area is now mapped)
- 33 new units are mapped
- 17% more area is mapped as sandy material
- 25% less area is mapped as Qvt
- Nearly 4 x the area is mapped as older glacial and nonglacial deposits
- Nearly 2 x the area is mapped as Qp and Qw, and Qvr
- Less than ½ the area originally mapped as Qvlc is now mapped as Qvlc

**Status of Mapping**

This poster is a composite of 4 individual maps in various stages of the publication and review process for 1:12,000-scale USGS SIM series maps:

- Geologic Map of Northwestern Seattle (part of the Seattle North 7.5' x 15 ' quadrangle) King County, Washington; in press
- Geologic Map of Northeastern Seattle (part of the Seattle North 7.5' x 15 ' quadrangle) King County, Washington; in review
- Geologic Map of Southwestern Seattle (part of the Seattle South 7.5' x 15 ' quadrangle) King County, Washington; in review
- Geologic Map of Southeastern Seattle (part of the Seattle South 7.5' x 15 ' quadrangle) King County, Washington; in review

We thank Ray Wells of the U. S. Geological Survey and Dave McCormack of Aspect Consulting for their careful and helpful reviews of this map and poster. The authors welcome comments; please send to ktroost@u.washington.edu.

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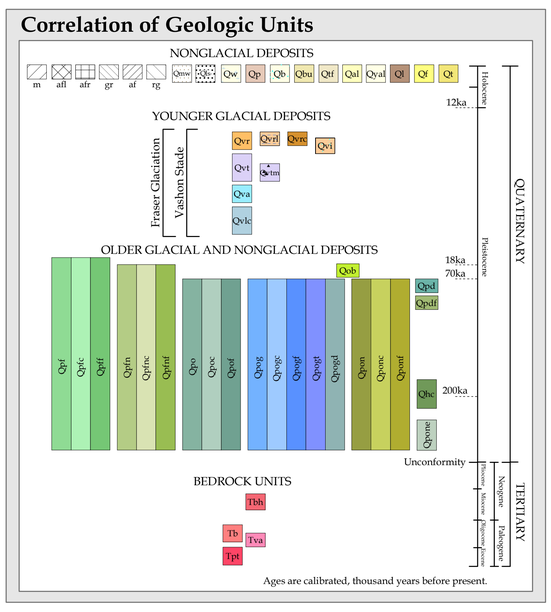
## Seattle Fault Zone

The **Seattle Fault Zone** represents the area where several parallel strands of the Seattle fault have either broken the ground surface or caused deformation of geologic materials. In Seattle, evidence for offset along the Seattle fault consists of uplifted beach deposits, down-dropped tidal marshes, offset strata, and deformation such as sheared and tightly folded strata near the leading (northern) edge of the fault. The Seattle fault is one of several active crustal faults in the Puget Lowland undergoing further research. The location of the Seattle fault zone was derived from this geologic mapping and from Blakely and others (2002), and Brocher and others (2004).

Blakely, R.J., Wells, R.E., Weaver, C.S., and Johnson, S.Y., 2002, Location, structure, and seismicity of the Seattle fault zone, Washington: Evidence from aeromagnetic anomalies, geologic mapping, and seismic-reflection data: Geological Society of America Bulletin, v. 114, p. 169-177.

Brocher, T.M., Blakely, R.J., and Wells, R.E., 2004, Interpretation of the Seattle uplift, Washington, as a passive-roof duplex, Bulletin of the Seismological Society of America, August 2004, vol. 94, no. 4, p 1379-1401.

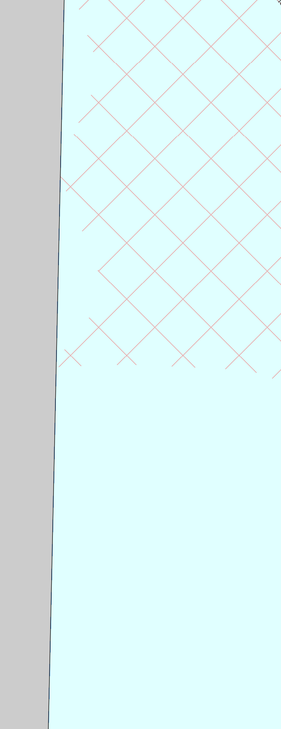
## Correlation of Geologic Units




## Description of Geologic Units

| Age & Geologic Unit | Name | Summary Description | Thickness | Density/ Hardness | Permeability Factors |
|---|---|---|---|---|---|
| Holocene | NONGLACIAL DEPOSITS | | | | |
| m | Modified land | Fill and/or graded natural deposits that obscure or alter the original deposit. Locally divided into: | | | |
| af | Artificial fill | Gravel, sand, silt, concrete, garbage, slag, and other materials, placed as a direct result of human activity, of substantial areal extent or thickness. Mapped where boring data provide sufficient information to delineate extent or where topography and overlying development suggests likelihood of fill, and where greater than ~ 2 m in thickness. Thin deposits of fill are commonly present elsewhere throughout the map area but not mapped due to lack of information. Locally divided into: | Mapped where >2 m; but 1m of fill common across most of the City; 3 m to > 15 m on slopes, in gullies, and capping peat beds | Very soft to stiff or very loose to dense | Voids common; variable and unpredictable grain size; angular and large particles common |
| afl | Landfill debris | Gravel, sand, silt, concrete, bricks, coal, wood, garbage, and other debris, placed in upland and low elevation peat bogs, gullies, ravines, river valleys, and other low-lying places | <1 m to 16 m; several locations across the City | Very soft to stiff or very loose to dense | Voids common; variable and unpredictable grain size; angular sand and gravel-sized fragments |
| afr | Artificial fill in historic river channels | Gravel, sand, silt, concrete, bricks, coal, wood, garbage, and other materials, placed in historic Duwamish river channel concurrent with straightening of the river by US Army Corps of Engineers in the 1930's. Former channel location digitized from georectified 1898 and 1908 USGS topographic maps | 7 m to 10 m; Duwamish Valley | Very soft to stiff or very loose to dense | Voids common; variable and unpredictable grain size; angular sand and gravel-sized fragments |
| gr | Graded land | Land substantially altered by excavation or grading, may include substantial thicknesses of fill too subtle to map or where boring data are insufficient to delineate extent. Gradational with units "af" and "rg" | Large areas for I-5 and other highways | Very soft to hard or very loose to very dense | Depends on thickness of material removed |
| rg | Regraded land | Land substantially altered by excavation or grading during the Seattle regrades of 1876-1928 (Morse, 1989), may include substantial thicknesses of fill that are too subtle to map or where boring data are insufficient to delineate extent. Locally more than 150 vertical feet removed | Variable but indistinct | Stiff to hard or loose to very dense | Depends on thickness of material removed |
| Qmw | Mass-wastage deposits | Colluvium, soil, and landslide debris with indistinct morphology. Mapped on steep slopes. Numerous unmapped areas of mass-wastage deposits occur elsewhere in quadrangle along ravines and the sidewalls of the Duwamish River valley. Deposits, both mapped and unmapped, include abundant discrete landslides up to 300 m (1000 ft) in lateral extent. Locally subdivided into: | Typically about 3 m, locally >10 m; along steep slopes | Loose to dense and soft to stiff | Intermixed fine and coarse-grained deposits |
| Qls | Landslide deposits | Diamict of broken to internally coherent surficial deposits transported down slope *en masse* by gravity. Blocks of native material are commonly fractured, have rotated or deformed bedding, and have abundant slickensided surfaces. Numerous unmapped areas of both landslide and related mass-wastage deposits occur along slopes and ravines draining east to the Duwamish River valley and Lake Washington and draining west into Puget Sound, particularly where coarse-grained deposits overlie fine-grained deposits. Vegetation, such as trees and roots, is commonly incorporated into the deposit | Variable, up to 20 m; along steep slopes | Very loose to very dense or soft to hard | Intermixed fine and coarse-grained deposits, voids common |
| Qw | Wetland deposits | Organic-rich sediment, peat, and fine-grained alluvium, poorly drained and intermittently wet. Areas identified from vegetation, maps, and topography; not all such deposits have been delineated | 1 to 7 m; typically 2 to 3 m | Very soft to medium stiff or very loose to medium dense | Commonly saturated |
| Qp | Peat | Predominantly organic matter consisting of plant material and woody debris, accumulated in bodies greater than about 1 m in thickness and of mappable extent. Accumulations are greatest in the floors of recessional-outwash channels and where lowering of Lake Washington has exposed extensive lake-floor deposits. Commonly interbedded with silt and clay. Gradational with units Qw, Ql, Qal, and Qvrl | >1 to 10 m | Very soft to medium stiff or very loose to medium dense | Commonly saturated |
| Qb | Beach deposits | Loose sand and gravel deposited or reworked by modern wave action. Shown in the map area along the Puget Sound shoreline, on the east side of Duwamish Head, west of Harbor Island, and along Lake Washington, where it is commonly overlain by fill | <3 to 10 m; some as thick as 17 m | Loose to dense | Uniformly to well graded |
| Qbu | Uplifted beach deposits | Loose sand and gravel deposited by wave action and subsequently uplifted above modern tide level by tectonic movement | <3 to 10 m | Loose to dense | Uniformly to well graded |
| Qtf | Tideflat deposits | Silt, sand, organic sediment and detritus, with some shells, historically exposed in broad coastal benches at low tide and now fill covered. Along Duwamish River valley thickens to north at mouth; initially deposited post-glacially when marine water extended up the Duwamish valley to Georgetown. Aggraded northward with rising sea level and alluvial filling of the Duwamish valley. Elsewhere, present along much of Puget Sound coastline and now fill covered | 50 m at the mouth of the Duwamish; 65 m at the N end of Harbor Island | Very loose to dense or and very soft to stiff | Micaceous, saturated, lenses of shell and wood debris |
| Qal | Alluvium | Sand, silt, gravel, and cobbles deposited by streams and running water. May include landslide debris and colluvium at margins. Locally contains very soft peat lenses. Locally subdivided into: | A few m to 30 m; in river and stream valleys | Loose to dense or soft to stiff | Predominantly sandy and horizontally bedded, fine- and coarser-grained lenses |
| Qyal | Younger alluvium | Sand, silt, gravel, and cobbles deposited by streams and running water. Locally contains soft peat lenses | Mapped in bottoms of filled Duwamish river channels | Loose to dense or soft to stiff | Predominantly sandy and horizontally bedded, fine- and coarser-grained lenses |
| Ql | Lake deposits | Silt and clay with local sand layers, peat, and other organic sediments, deposited in slow-flowing water. Most mapped areas are lake-bottom sediments exposed by the lowering of Lake Washington in 1916. Locally gradational with units Qvrl, Qal, and Qp | Typically 3 to 5 m on upland in recessional channels; 1 to 3 m adjacent to Lake WA | Very soft to medium stiff or very loose to medium dense | Predominantly fine grained and horizontally bedded |
| Qf | Fan deposits | Sand, silt, gravel, and cobbles deposited in lobate form where streams emerge from confining valleys and reduced gradients cause sediment loads to be deposited. Gradational with unit Qal | 3 to 5 m | Loose to dense or soft to stiff | Variable grain size |
| Qt | Terrace deposits | Sand, silt, gravel, and cobbles, deposited by streams and running water; elevated bench forms resulting from subsequent down cutting. May include slide debris and colluvium., locally gradational with unit Qal | 2 to 6 m, along modern river valleys | Loose to dense or soft to stiff | Predominantly sandy and horizontally bedded, fine- and coarser-grained lenses |
| Pleistocene | YOUNGER GLACIAL DEPOSITS | | | | |
| Qv | Deposits of Vashon stade of Fraser glaciation of Armstrong and others (1965) , not used as a map unit | | | | |
| Qvr | Recessional outwash deposits | Stratified sand and gravel, moderately sorted to well sorted, and less common silty sand and silt. Deposited in outwash channels that carried south-draining glacial meltwater during ice retreat away from the ice margin. Also includes deposits that accumulated in or adjacent to recessional lakes. Discontinuous. May include thin lag on glacial till uplands although deposits less than about 1 m (3 ft) thick not shown on map. Locally divided into: | ~1 to 6 m; typically in channels | Loose to dense | Horizontally bedded to cross bedded, uniformly to well graded, channelized, coarse lag deposits common |
| Qvrl | Recessional lacustrine deposits | Laminated silt and clay, low to high plasticity, with local sand layers, peat, and other organic sediments, deposited in slow-flowing water and ephemeral lakes. Locally includes high-plasticity clay with swell potential. Lenses and layers of ash and diatomite may be present. Gradational with units Qvr, Qp, and Ql | 5 m typically on uplands; up to 16 m at the heads of recessional channels, locally 18 m in Rainier valley | Very soft to stiff | Horizontally bedded; sandy channels may breach the lacustrine deposits |
| Qvrc | Recessional coarse-grained deposits | Predominantly sand and gravel, clean to silty, horizontally to cross bedded, deposited in outwash channels and in deltas | 4 to 10 m | Loose to dense | Interspersed silt and open-work gravel layers |
| Qvi | Ice-contact deposits | Intercalated till and outwash, irregularly shaped bodies of till and outwash. Outwash consists of sand and gravel, clean to silty, horizontally bedded to steeply dipping. The till consists of matrix supported gravelly sandy silt that may or may not have been glacially overridden. Deposits intermittently flank the west margin of the Duwamish River valley south to the edge of quadrangle and are common on the upland southwest of the Duwamish River. Gradational with units Qvr and Qvt | 3 to 15 m; in patches on the upland | Loose to very dense | Intermixed irregularly-shaped bodies of till and coarse-grained deposits |
| Qvt | Vashon till | Compact diamict of silt, sand and subrounded to well-rounded gravel, glacially transported and deposited under ice. Commonly fractured and has intercalated sand lenses. Generally forms undulating, elongated surfaces. Upper 1 meter of unit generally weathered and only medium dense to dense. Locally divided into: | Typically 1 to 10 m | Very dense | Vertical fractures, sand lenses, and crude sub-horizontal bedding common |
| Qvtm | Subglacial meltout till | Deposit consists of compact diamict (gravel and sand in a silt matrix) with large, often tabular, sand and gravel bodies, cobbles common. Coarse-grained layers may exceed 50% of the volume of the deposit. Locally identified as 'sandy till', locally gradational with units Qvt and Qva | Typically 1 to 10 m | Dense to very dense; sand is commonly less dense | Vertical fractures, sand bodies, and irregular bedding are common |
| Qva | Advance Outwash Deposits | Well-sorted sand and gravel deposited by streams issuing from advancing ice sheet. May grade upward into till. Silt lenses locally present in upper part and are common in lower part. Generally unoxidized to only slightly oxidized. May be overlain by Vashon till in areas too small to show at map scale. Includes Esperance Sand Member of the Vashon Drift of Mullineaux and others (1965). Grades downward into unit Qvlc with increasing silt content | Locally over 60 m thick; wide-spread | Dense to very dense | Predominantly medium grained sand, horizontally to cross bedded, hard silt beds common throughout |
| Qvlc | Lawton Clay<br>of Mullineaux and others (1965) | Laminated to massive silt, clayey silt, and silty clay with scattered dropstones deposited in lowland proglacial lakes. Marks transition from nonglacial to earliest glacial time, although unequivocal evidence for glacial or nonglacial origin may be absent. Deposits of correlative age and texture may be included in older fine-grained units where evidence of age and/or depositional environment is absent. Locally may include fine-grained sediment of unit Qob or distal deposits from the Cascade Mountains where indistinguishable from Qvlc | > 30 m; generally present in pre-Vashon valleys below 240 ft in elevation | Very stiff to hard | Vertical fractures, fine sand partings common near top and bottom of unit |
| Pleistocene | OLDER GLACIAL AND NONGLACIAL DEPOSITS | | | | |
| Qpf | Deposits of pre-Fraser glaciation age | Interbedded sand, gravel, silt, and diamicts of indeterminate age and origin. Locally divided into: | | Very dense and hard | Localized iron-oxide cemented layers, interbedded and intermixed fine- and coarse-grained layers |
| Qpfc | Coarse-grained deposits | Sand and gravel, clean to silty, with some silt layers, lightly to moderately oxidized | Up to 15 m | Very dense | Localized iron-oxide cemented layers and channels |
| Qpff | Fine-grained deposits | Silt and clay, may have sandy interbeds, laminated to massive | Up to 7 m | Hard | Localized iron-oxide cemented layers and sandy partings |
| Qpfn | Nonglacial deposits | Sand, gravel, silt, clay, and organic deposits of inferred nonglacial origin, based on the presence of peat, paleosol, and tephra layers; or a southern Cascade Range provenance for sedimentary clasts | 3 to 7 m | Very dense and hard | Localized iron-oxide cemented layers, interbedded and intermixed fine- and coarse-grained layers |
| Qpfnc | Coarse-grained nonglacial deposits | Sand and gravel, clean to silty, with some silt layers, with peat and tephra layers, lightly to moderately oxidized | 3 to 10 m | Very dense | Localized iron-oxide cemented layers |
| Qpfnf | Fine-grained nonglacial deposits | Silt and clay, with peat and tephra layers, with some sandy interbeds, laminated to massive | 15 to 25 m | Hard | Localized iron-oxide cemented layers and sandy partings |
| Qob<br>MIS 3<br>18-70 ka | Olympia beds<br>of Minard and Booth (1988) | Sand, silt (locally organic-rich), gravel, and peat, discontinuously and thinly interbedded; may contain tephra and/or diatomaceous layers. Sand and gravel clast lithology varies depending on source area, from volcanic to reworked northern lithologies. Assigned to the Olympia interglaciation of Mullineaux and others (1965) on the basis of stratigraphic position, correlation, and radiocarbon dates. Distinguished from Qvlc on the basis of coarser grain size and presence of organics. Locally identified previously as the "sandy phase of the Lawton" | Absent to 25 m | Very dense and hard | Localized iron-oxide cemented layers, interbedded and intermixed fine- and coarse-grained layers |
| Qpo | Deposits of pre-Olympia age | Interbedded sand, gravel, silt, and diamicts of indeterminate age and origin. Locally divided into: | 3 to >50m | Very dense and hard | Localized iron-oxide cemented layers, interbedded and intermixed fine- and coarse-grained layers |
| Qpof | Fine-grained deposits | Silt and clay, may have sandy interbeds, laminated to massive | 5 to 75 m | Hard | Localized iron-oxide cemented layers and sandy partings |
| Qpoc | Coarse-grained deposits | Sand and gravel, clean to silty, with some silt layers, lightly to moderately oxidized | 3 to 22 m | Very dense | Localized iron-oxide cemented layers and channels |
| Qpog | Glacial deposits | Silt, sand, gravel and till of glacial origin Weakly to strongly oxidized. Underlies Vashon-age deposits and thus must also be of pre-Olympia age. Sediment is of inferred glacial (northern) origin, based on presence of clasts or mineral grains requiring southward ice-sheet transport | 7 to >33 m | Very dense and hard | Localized iron-oxide cemented layers, interbedded and intermixed fine- and coarse-grained layers |
| Qpogc | Coarse-grained glacial deposits | Sand and gravel, clean to silty, with some silt layers, moderately to heavily oxidized | 1 to 15 m | Very dense | Localized iron-oxide cemented layers and channels |
| Qpogf | Fine-grained glacial deposits | Silt and clay, may have sandy interbeds, laminated to massive | 2 to 25 m | Hard | Localized iron-oxide cemented layers and sandy partings |
| Qpogt | Till deposits | Till thick enough to show at map scale. Most extensive on west slopes of Queen Anne Hill, and in the west wall of the Duwamish valley | Discontinuous, 1 to 10 m | Very dense and hard | Localized iron-oxide cemented layers, sandy partings, and lenses |
| Qpogd | Glacial diamict | Till-like material, but finer grained and with fewer gravel clasts than most Puget Lowland tills | Discontinuous, 3 to 7 m | Very dense and hard | Localized iron-oxide cemented layers, sandy partings and lenses |
| Qpon | Nonglacial deposits | Sand, gravel, silt, clay, and organic deposits of inferred nonglacial origin, based on the presence of paleosols, and tephra layers; or a southern Cascade Range provenance for sedimentary clasts | 3 to 23 m | Very dense and hard | Localized iron-oxide cemented layers, interbedded and intermixed fine- and coarse-grained layers |
| Qponc | Coarse-grained nonglacial deposits | Sand and gravel, clean to silt, with silt layers, with peat and tephra layers, moderately to heavily oxidized | 3 to 13 m | Very dense | Localized iron-oxide cemented layers, and channels |
| Qponf | Fine-grained nonglacial deposits | Silt and clay, may have sandy interbeds, with peat and tephra layers, laminated to massive | 3 to 23 m | Hard | Localized iron-oxide cemented layers and sandy partings |
| Qpone | Estuarine deposits | Sand, silt (locally organic-rich), gravel, and peat, discontinuously and thinly interbedded. Identified on the basis of obligate brackish-water fossils (Saltiniferous aquinus). Qpone, as seen in this map area, is likely older than Qhc | >10 m; outcrops in base of stream west of Poverty Hill | Very dense and hard | Localized iron-oxide cemented layers |
| Qpd<br>MIS 4, 70 ka | Possession Drift<br>of Easterbrook and others (1967) | Till, outwash, and glaciolacustrine deposits correlative with MIS 4. May include glaciomarine drift. Possession-age deposits are likely more extensive than mapped, but deposits without age control are included in units Qpf or Qpo. | Not a surficial geologic map unit | Very dense and hard | Interbedded and intermixed fine- and coarse-grained lenses |
| Qpdf | Possession glaciolacustrine deposits | Laminated silt and clay exposed along the west, north, and east faces of Beacon Hill; assigned to this unit based on a single IRSL date just southeast of the Interstate 5/Interstate 90 junction. Correlative with Marine Isotope Stage (MIS) 4, with an age range from 60 to 80 ka. Dated exposure displays strongly contorted and faulted beds, plausibly related to motion on the Seattle fault but also possibly a result of glaciotectonic shear or postglacial landsliding. Correlative diamict (unit Qpdf) is identifiable in subsurface borings and in outcrop to the south and is assigned to this unit based on spatial and stratigraphic proximity to dated exposure | >34 m | Hard | Localized iron-oxide cemented layers and sandy partings; locally deformed and jointed |
| Qhc<br>MIS 7, 200ka | Hamm Creek formation | Interbedded gravel, sand, silt, clay, peat, and tephra beds. Informally named interglacial deposits corresponding to MIS 7, on the basis of two Ar/Ar dates each on pumice and tephra from three sites in southwest Seattle above the west edge of Duwamish River valley. Deposits of this stage have also been identified near Redondo, 23 km south of the City of Seattle and in south Snohomish County, 29 km north of the City of Seattle (Troost and others, 2003) | 3 to 25 m; 2 m of tephra | Very dense and hard | Localized iron-oxide cemented layers, interbedded and intermixed fine- and coarse-grained layers |
| Tertiary | BEDROCK | | | | |
| Tbh<br>Miocene | Blakely Harbor Formation<br>of Fulmer (1975) (in the subsurface) | Interbedded terrestrial sandstone, siltstone, and shale, recognized only in subsurface data and assigned to this unit on the basis of lithology and stratigraphic position | In the subsurface | Weakly lithified | Clayey when weathered, poorly cemented, jointed, folded, locally steeply dipping, shear zones |
| Tb<br>Oligocene | Blakeley Formation<br>of Weaver (1916) | Medium-grained sandstone, coarse-grained sandstone, conglomerate, and minor siltstone, fresh to highly weathered, fossiliferous. Massive to well bedded. Deposited in a shallow marine near-shore sandy shelf environment. Distinguished from rocks of underlying Puget Group by presence of marine fossils and absence of volcanic flow rocks and breccias | >1000 m | Weakly to moderately lithified | Weathered zone is friable or soft and plastic, locally poorly cemented, jointed and folded, locally steeply dipping, shear zones |
| Tva<br>L. Eocene or younger | Andesite | Dark gray basaltic andesite forming sills or dikes, intruded younger Eocene rocks. Above-ground exposure mined from a hill in the Duwamish valley | >100 m | Well lithified | Jointed |
| Tp<br>Eocene | Puget Group<br>of White (1888) and Willis (1898a) | Micaceous feldspathic subquartzose sandstone, siltstone, claystone, and coal. Tabular beds of sandstone are massive to cross-bedded and occasionally exhibit channel cut-and-fill structures. Lights to dark siltstones form poor outcrops, are commonly thinly laminated, and contain organic matter. Coal beds are as thick as 5 m. Locally divided into: | >1000 m | Moderately lithified | Variable permeability, jointed, folded |
| Tpt | Tukwila Formation<br>of Vine (1962) | Andesitic sandstone, tuff, mudflow breccia, and minor lava flows or sills. Includes some marine and nonmarine sandstone, siltstone, and shale with scattered marine shells. Volcanic breccia, conglomerate, sandstone, and flows with intercalated feldspathic sandstone and impure coal beds. Tuff and breccia with clasts of porphyritic andesite and dacite and polymictic volcanic conglomerate appear to predominate, but flow rocks (in part sills or dikes) form resistant layers | >1000 m | Moderately to well lithified | Variable permeability, jointed, folded |




## Map Units

**Nonglacial Deposits (Holocene)**

- water
- Qw - Wetland deposits
- Qp - Peat
- Qb - Beach deposits
- Qbu - Uplifted beach deposits
- Qtf - Tideflat deposits
- Qal - Alluvium
- Qyal - Younger alluvium
- Ql - Lake deposits
- Qf - Fan deposits
- Qt - Terrace deposits

**Younger Glacial Deposits (Fraser Glaciation, Pleistocene)**

- Qvr - Vashon recessional outwash deposits
- Qvrl - Vashon recessional lacustrine deposits
- Qvrc - Vashon recessional coarse-grained deposits
- Qvi - Vashon ice-contact deposits
- Qvt - Vashon subglacial till
- Qvtm - Vashon subglacial meltout till
- Qva - Vashon advance outwash deposits
- Qvlc - Lawton Clay member of the Vashon Drift

**Older Glacial and Nonglacial Deposits (Pleistocene)**

- Qpf - Pre-Fraser glaciation age deposits
- Qpfc - Pre-Fraser coarse-grained deposits
- Qpff - Pre-Fraser fine-grained deposits
- Qpfn - Pre-Fraser nonglacial deposits
- Qpfnc - Pre-Fraser coarse-grained nonglacial deposits
- Qpfnf - Pre-Fraser fine-grained nonglacial deposits
- Qob - Olympia beds
- Qpo - Pre-Olympia deposits
- Qpoc - Pre-Olympia coarse-grained deposits
- Qpof - Pre-Olympia fine-grained deposits
- Qpog - Pre-Olympia glacial deposits
- Qpogc - Pre-Olympia coarse-grained glacial deposits
- Qpogf - Pre-Olympia fine-grained glacial deposits
- Qpogt - Pre-Olympia glacial till
- Qpogd - Pre-Olympia glacial diamict
- Qpon - Pre-Olympia nonglacial deposits
- Qponc - Pre-Olympia coarse-grained nonglacial deposits
- Qponf - Pre-Olympia fine-grained nonglacial deposits
- Qpdf - Possession drift fine-grained deposits
- Qhc - Hamm Creek formation
- Qpone - Pre-Olympia estuarine deposits

**Bedrock (Tertiary)**

- Tb - Blakeley Formation
- Tva - Andesite
- Tpt - Tukwila Formation

**Overprints**

- Mass wastage deposits
- Landslide deposits
- Modified land
- af - artificial fill
- afl - landfill debris
- afr - filled river channels
- graded land
- regraded land
- anticline, approx. located (McWilliams, 1971)
- fault, approx. located (Waldron and others, 1962; McWilliams, 1971)
- inclined bedding
- vertical bedding
- inclined jointing
- vertical joint

- Contact
- Scarps
- Peat bed
- Till bed
- Seattle Fault Zone
- Seattle City Limit

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