3.3 EARTH

Information in this section is condensed from the following reports: *Everett Growth Management Comprehensive Plan, DEIS; City of Everett Zoning Code; City of Everett Design and Construction Standards and Specifications*, 1993; and the *Snohomish County Solid Waste Management Plan Update October 1989, FEIS.*

3.3.1 EXISTING CONDITIONS

3.3.1.1 Geology

Everett lies on a plateau peninsula with the Snohomish River bordering to the north and east, Port Gardner Bay and Possession Sound to the west. The plateau is a glacial drift plain underlain by soils deposited by advancing and retreating glacial ice. Layers of glacial till soil were deposited by the successive ice ages between 11,000 and 14,000 years ago, which subjected underlying soil stratas to tremendous compacting forces and shearing. Subsequent runoff from streams eroded the drift plateau, forming ravines by removing the till and exposing the stratas beneath.

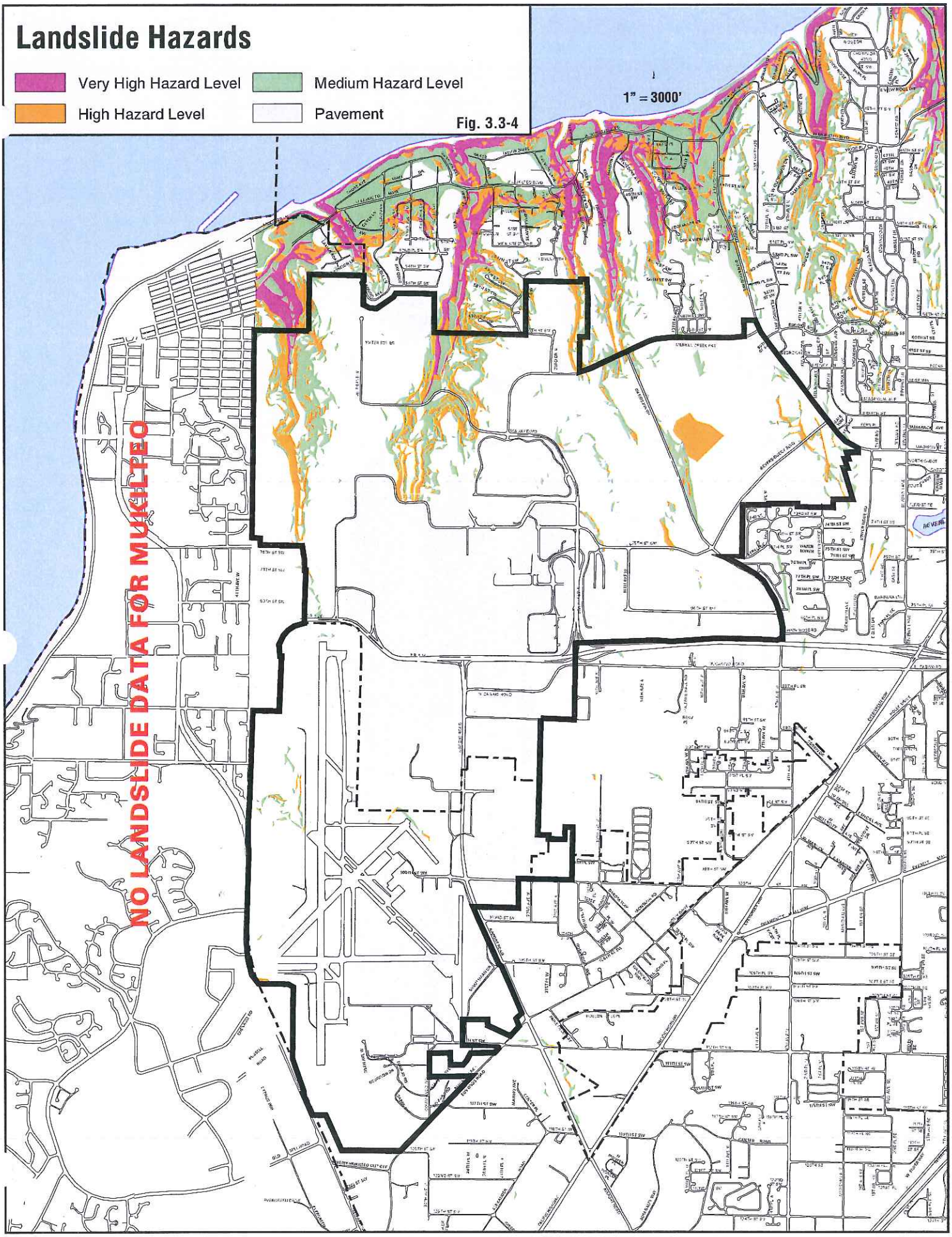
The northern portion of the Subarea is a combination of ridges, separated by ravines with associated steep slopes, streams and wetlands. The streams in the northern portion of the subarea flow north to Port Gardner Bay. The southern portion of the Subarea is relatively flat. Drainages in this area flow south towards Lake Washington and west towards Possession Sound. Much of the area is urbanized, and grading has modified the natural land forms in these areas.

3.3.1.2 Topography

The elevation of the Subarea varies from more than 600 feet to about 100 feet, with the major grade changes occurring along streams and the mined properties. Figure 3.3-1 shows a shaded topographic map of the area, and Figure 3.3-2 provides a perspective view of topography. Topography shown is based on 20 foot contours and does not accurately show slopes for areas that have been mined (Associated Sand and Gravel and Merrill Creek Associates). Photos 3.3-1 and 3.3-2 show existing mining slopes.

3.3.1.3 Soils

Figure 3.3.-3 identifies the soils found within the Subarea per Soil conservation Service (SCS) data formatted and distributed by the Department of Natural Resources (DNR). Data regarding the different soils were obtained from the *Soil Survey of Snohomish County*. Table 3.3-1 describes development limitations for the soils. The SCS classifications are general and must be verified for individual sites. Inclusions of other soil types may occur within the broader mapping units.


Landslide Hazards
Very High Hazard Level
Medium Hazard Level
High Hazard Level
Pavement
Fig. 3.3-4
1" = 3000'
NO LANDSLIDE DATA FOR MUCKLEO

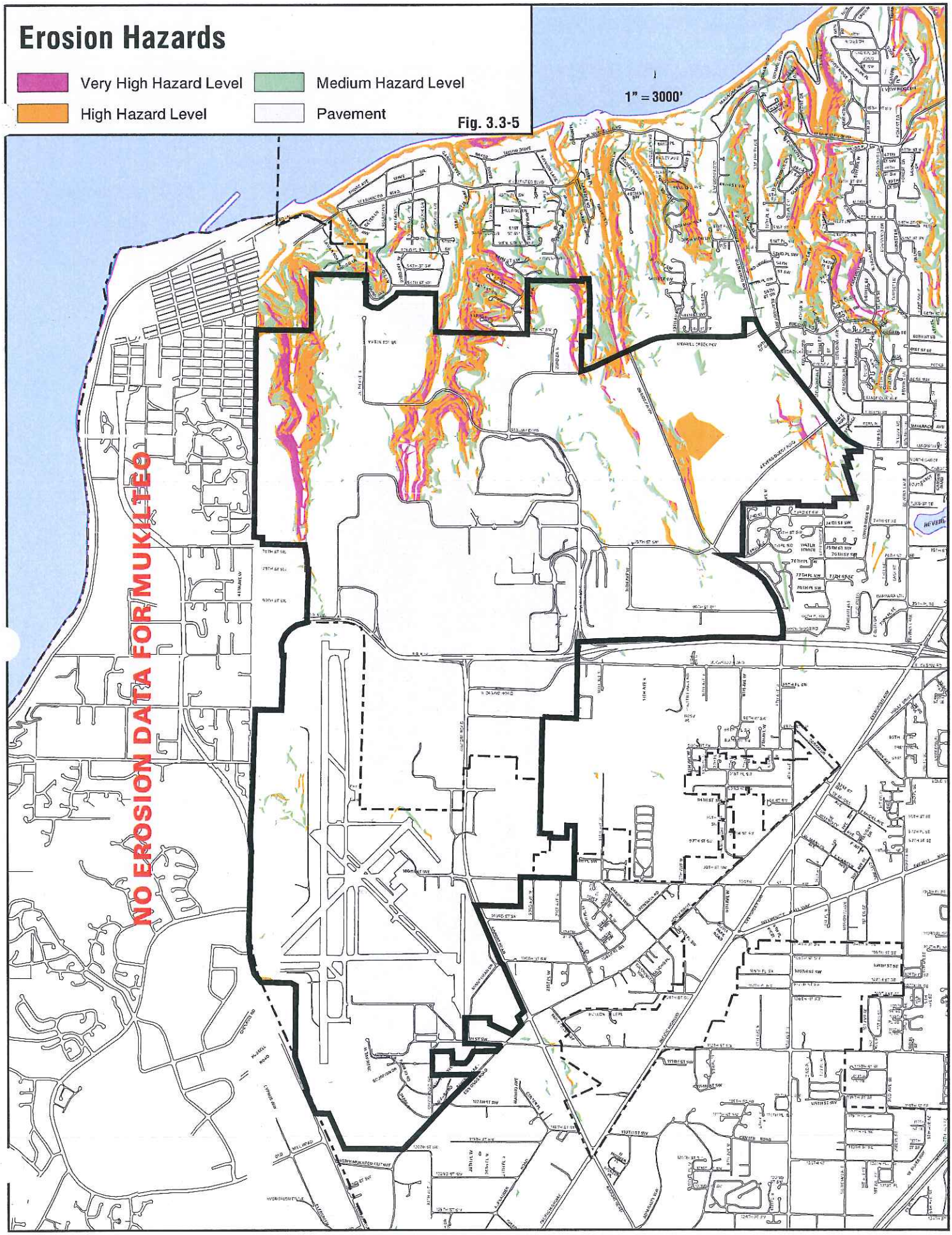
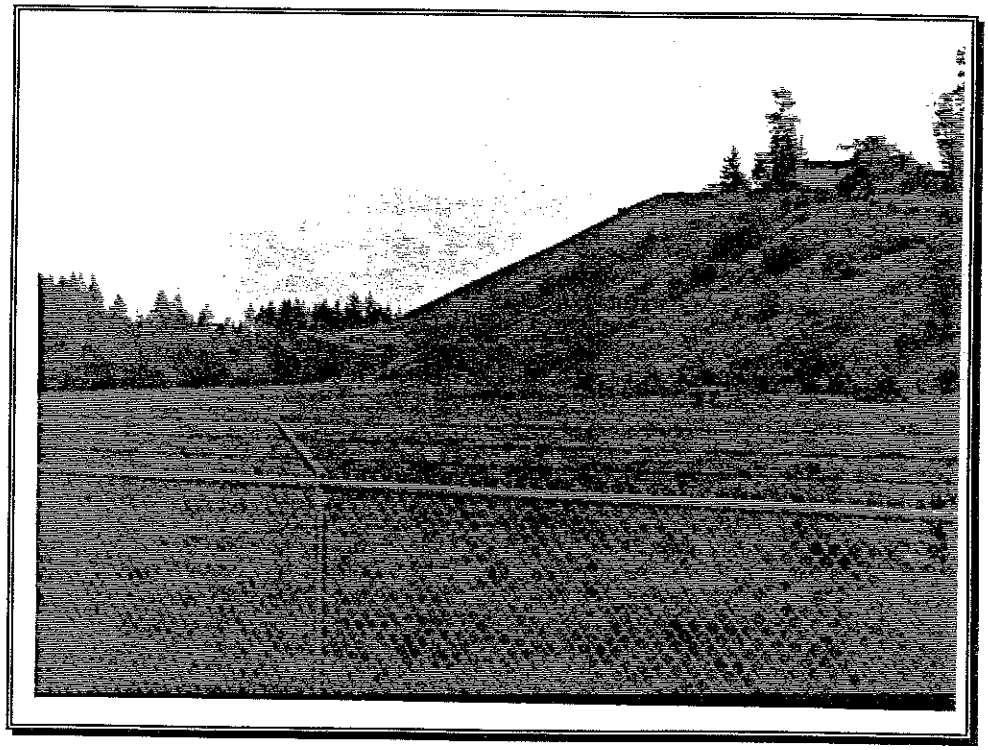

Erosion Hazards
Very High Hazard Level
High Hazard Level
Medium Hazard Level
Pavement
Fig. 3.3-5
1" = 3000'
NO EROSION DATA FOR MUKILTEO

Photo 3.3-1
Merrill Creek Associates Mining Slope

Photo 3.3-2
Associated Sand and Gravel Mining Slope



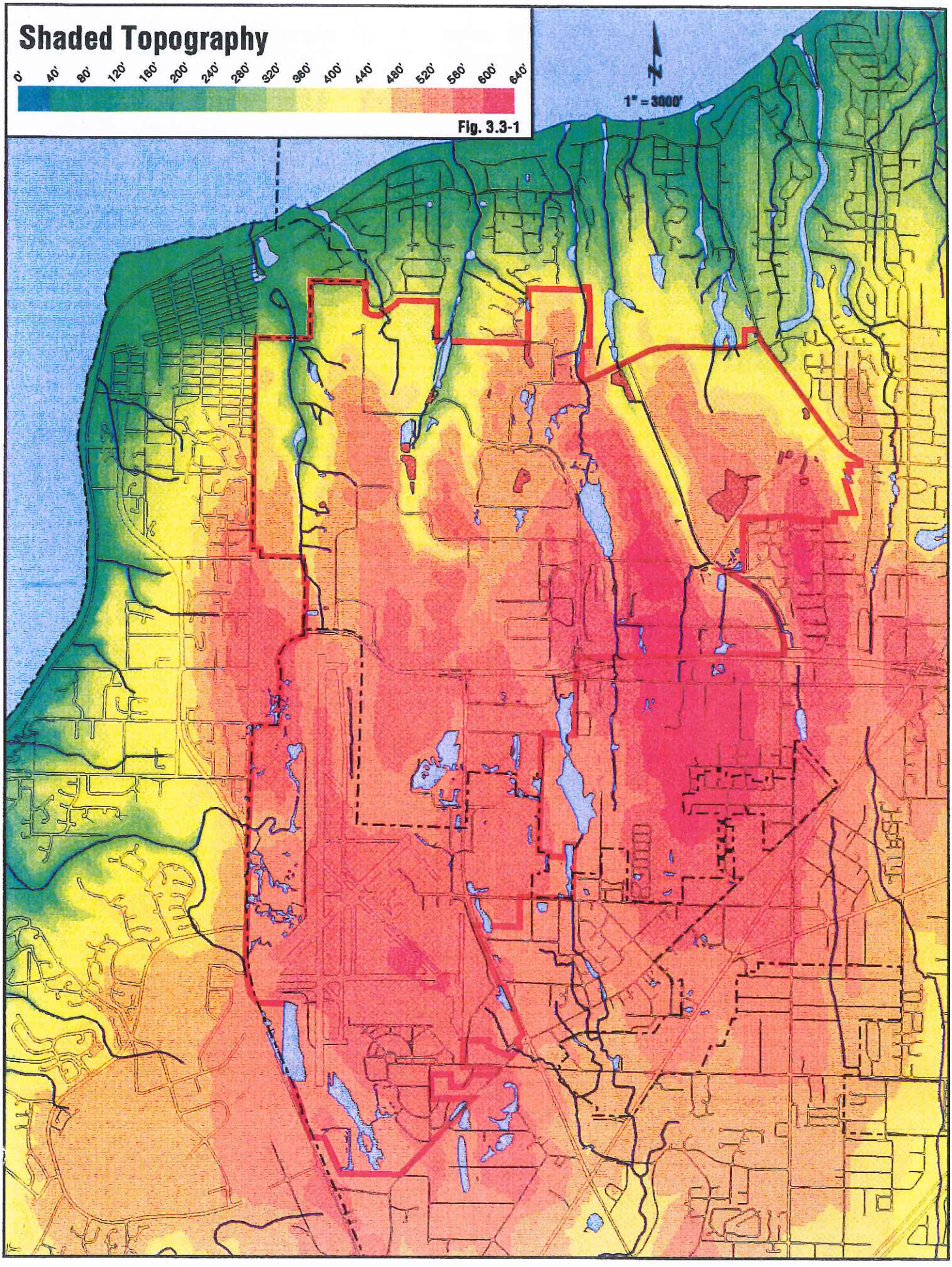

Shaded Topography
0'
40'
80'
120'
160'
200'
240'
280'
320'
360'
400'
440'
480'
520'
560'
600'
640'
N
1" = 3000'
Fig. 3.3-1

Table 3.3-1
Summary of Soil Characteristics of Soil Types Found in the Subarea

Soil Type	Slope	Development Limitations
Alderwood gravely sandy loam and Alderwood-Urban land complex*	2-15%	Drainage recommended for buildings with basements or crawl spaces. Topsoils should be stockpiled and subsequently used to cover the underlying material. Seasonal perched water table at a depth of 18 to 36 inches.
Alderwood gravely sandy loam	15-25%	Same as above, plus steepness of slopes increases erosion hazard. Sites disturbed during construction should be seeded and water runoff controlled to protect soils from erosion.
Alderwood-Everett gravely sandy loam	25-70%	Rapid runoff; high risk of water erosion. Steepness of slopes; seasonal perched water table; springs and seeps common, unstable soil when saturated. Road cuts tend to slough readily.
Everett gravely sandy loam	0-8%	No limitations to development.
Indianola loamy sand	15-25%	Steepness of slope. Cut banks are subject to caving in.
Tokul gravely loam	0-8%	Shallow depth to hardpan; wetness.
McKenna gravely silt loam	0-8%	Seasonal ponding and high water tables. Often indicate presence of wetlands.
Terric Medisaprists	nearly level	Seasonal ponding and high water tables. Often indicate presence of wetlands.
Mukilteo muck		Seasonal ponding and high water tables. Often indicate presence of wetlands. Not suitable for development due to ponding and low soil strength.
Urban land*		
Pits		(These are sites highly modified by mining activity that are suitable for development.)

Source: SCS Snohomish County Soil Survey, 1983, & Department of Natural Resources digital data.
*Soils designated Alderwood-Urban and Urban are partially or fully developed and obscured by streets, parking lots, paving, buildings, and other structures.

The central portion of the Subarea (Boeing and Paine Field) is primarily designated as ***Urban land.*** This SCS classification indicates that these nearly level or gently sloping areas are covered with streets, buildings, and other structures which obscure or alter the underlying soils so that identification is not possible.

Large portions of the Subarea are identified as ***Alderwood gravely sandy loam, Alderwood-Everett gravely sandy loam, or Alderwood-Urban land complex.*** Formed in glacial till,

Alderwood soil has a moderate depth of 20 to 40 inches over a hardpan. Permeability is moderately rapid above the hardpan and very slow through it. The soil is moderately well drained. Water erosion is slight on slopes of less than 15% and moderate on slopes of 15% and greater. A seasonal perched water table is at a depth of 18 to 36 inches from January to March.

These soils are suitable for urban development, and soils identified as Alderwood-Urban have been covered by development. Limitations to development on Alderwood gravely sandy loams with less than 25% slopes are minor. Alderwood gravely sandy loams on slopes of 2 to 8% have an inherent ability to support large loads. Drainage is needed if buildings with basements and crawl spaces are constructed. During site preparation, topsoil must be stockpiled and subsequently used to cover the exposed underlying material. On slopes of 15% and greater, developments may be limited by slope. Sites in these areas that are disturbed during construction should be seeded and water runoff controlled to protect soil from erosion.

More development limitations exist on Alderwood-Everett gravely sandy loams with slopes of 25% to 70%. Runoff on these soils is rapid, and the hazard of water erosion is high. The soil tends to slough readily, and springs and seep areas are common. Limitations for development are steepness of slope, a seasonal perched water table, and unstable soil when saturated. Road cuts tend to slough readily.

Most of the soils found on the Associated Sand & Gravel site and the Merrill Creek Associates/Heartland property west of Hardeson Road are classified as ***Pits***. These sites have been heavily modified from sand and gravel mining.

A large area of ***Tokul gravely loam,*** with 0-8% slopes occurs in the northeast corner of the Subarea, including portions of Associated Sand and Gravel, Merrill Creek Associates, Seaway Center Lot 8, and the John Dahl/Evergreen properties. This is a moderately deep, moderately well drained soil. Depth to hardpan ranges from 20 to 40 inches. Runoff is low and the hazard of water erosion is slight. Tokul gravely loam is suitable for urban development. Because the depth to hardpan restricts rooting depth, trees are occasionally subjected to windthrow, especially Western hemlock. The main limitation for development is wetness.

A small area of ***Indianola loamy sand,*** with 15-25% slopes is on Boeing property south of Seaway Blvd. This is a very deep, somewhat excessively drained soil that forms in sandy glacial outwash. Permeability is rapid, runoff is slow, and the hazard of water erosion is slight. This unit is suitable for urban development. The main limitation for urban development is steepness of slope. Cutbanks in this unit are subject to caving in.

Other soil units found in smaller areas within the Subarea include: ***McKenna gravely silt loam,*** with 0-8% slopes; ***Mukilteo muck***, and ***Terric Medisaprists***, with nearly levels slopes. These very poorly drained soils are found in depressional areas and have seasonal ponding or high water tables. These soils generally indicate the presence of wetlands. McKenna gravely silt loams and Terric Medisaprists are suitable for development only when drained. Mukilteo mucks are not suitable for urban development due to ponding and low soil strength.

3.3.1.4 Landslide Hazards

The near-surface geology in the Puget Sound area predominantly consists of glacial soils. The stability of slopes in the area is strongly influenced by the physical characteristics of the glacial formation underlying the vegetated surface. Studies by Atrim (1976), Miller (1973), Smith

(1976), and Tubbs (1974a,b and 1975) predicted relative permeability of the units to surface water. Permeable sand and gravel deposits are generally found to overlie less permeable glacially- consolidated clayey-silt to silt. The joint occurrence of these soils and exposure of this combination of soils on slopes constitute the majority of the existing landslide hazard areas in the region.

The relationship between geology, topography, and surface water to potential landslides was studied by Tubbs (1975). The studies focused on assessing the relationship between past landslide occurrences and slope angles in the Seattle area. Tubbs concluded that the ground water migrated downward through permeable sand and gravel, and to a lesser extent silt, until a less permeable stratum was encountered, i.e., clayey silt units. The water perches above the clayey silt, resulting in wetting of the clayey unit and saturation of the overlying units. This state of saturation greatly enhances the intergranular mobility of the soils by reducing the shear strength and friction of the soils at the interface. Earth movement or landsliding can occur as a result of gravitational forces. The angles of slopes necessary to initiate the landslides depend on the site specific soil and ground water conditions.

The above-mentioned studies have been established as guidelines for assessing potential landslide hazards in the Puget Sound area, and provide the general basis for various local and regional environmentally sensitive areas ordinances. Variations in the local geologic and soils conditions account for variations in guidelines adopted by various jurisdictions.

Previous geotechnical engineering analyses of sites located within the Subarea (Boeing) indicated that the slope angles greater than 25 percent should be used as one of the guidelines for assessing the presence of potential landslide hazard areas. Most landslides in the Everett area occur in unconsolidated or partially consolidated soil sediments combined with steep slopes. When these unstable soils become saturated with water during heavy rains, the force of gravity can create a landslide. Human activities such as diverting water from impervious surfaces, improperly placed and compacted fill, dumping of debris, cuts into hillsides, building site excavation, and failure of retaining walls can also contribute to landslide potential.

The City of Everett considers landslide hazards to exist in areas with:

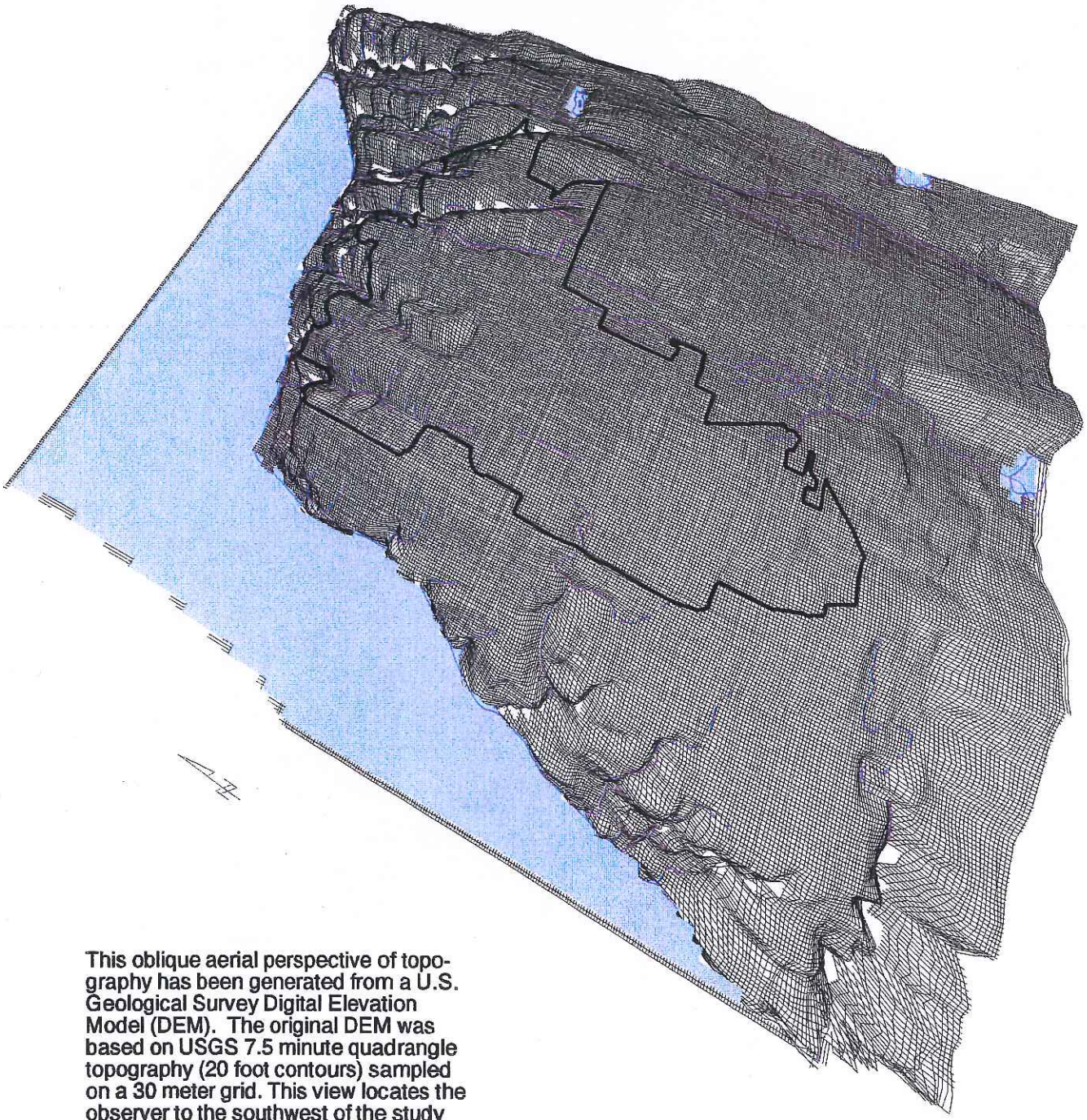
- slopes 15% or greater with "unstable soils",
- slopes 40% or greater with any soil type, or
- documented areas with previous landslide activity.

See **Figure 3.3-4** for the location of landslide hazard areas within the Subarea. Most of the areas identified as landslide hazards occur along the ravines associated with the streams draining the Subarea. Hazards shown on properties that have been mined may not be accurate.

3.3.1.5 Seismic Hazards

The Puget Sound region has a history of major earthquakes and is a seismically active region. Seismic activity may trigger landslides in areas of landslide hazard. Seismic hazards also occur in areas of non-cohesive soils where liquefaction may occur during earthquakes, such as in floodplains. There are no potential areas of liquefaction in the Subarea; therefore, seismic hazards are the same as landslide hazard areas. See Figure 3.3-4.

Perspective View of Topography



This oblique aerial perspective of topography has been generated from a U.S. Geological Survey Digital Elevation Model (DEM). The original DEM was based on USGS 7.5 minute quadrangle topography (20 foot contours) sampled on a 30 meter grid. This view locates the observer to the southwest of the study area at an angle of 30 degrees above the horizon. Vertical relief has been exaggerated by a factor of 7 to enhance subtle features. The study area boundary is outlined in black.

Fig. 3.3-2

3.3.1.6 Erosion Hazards

Erosion includes the breakdown of soils and bedrock by natural processes, including water, wind, and glaciation. Of these processes, water-related erosion has the most immediate impact in the Puget Sound area. The impacts of water erosion include the removal of the parent material, siltation of surface water, and deposition (or sedimentation) of the removed material at locations where the velocities of the transporting medium are reduced. The susceptibility of any material to erosion is dependent upon

- chemical and physical characteristics,
- topography,
- the amount and intensity of precipitation and surface water, and
- the type and density of vegetative ground cover, if present.

Erosion hazards within the Subarea are shown in Figure 3.3-5. These are soils which may experience severe to very severe erosion hazard and include Alderwood gravely sandy loams on slopes of 15% or greater. As with landslide hazard areas, most of the erosion hazard areas occur along the steep slopes associated with the streams draining the Subarea.

3.3.2 REGULATORY FRAMEWORK

3.3.2.1 City of Everett

Zoning Code

Section 37 of the Zoning Code (EMC 19.37.040) designates the following as "geologically hazardous" areas:

- slopes of 40% or greater;
- landslide hazard areas;
- seismic hazard areas;
- erosion hazard areas which are associated with another environmentally sensitive area (ESAs); and
- other areas which the City has reason to believe are geologically hazardous.

Geologically hazardous areas must be protected with 25-foot buffers measured from the top, toe, and sides of such areas. Modifications to this requirement are allowed only if a geotechnical report is submitted which shows that the development would not create a hazard to the subject property and surrounding properties.

Certain activities that are exempt from the requirements of the Environmentally Sensitive Areas Ordinance and may occur on slopes designated environmentally sensitive, include: emergencies; relocation of some utilities; and remodeling and maintenance of existing structures, roads, parks, and utilities.

Site regrading often results in the need for construction of retaining walls and rockeries. Section 39 of the Zoning Code (EMC19.39.140) regulates when retaining walls and rockeries can be located in required building setback areas. In general, rockeries and retaining walls greater than 36 inches high cannot be located in required setback areas.

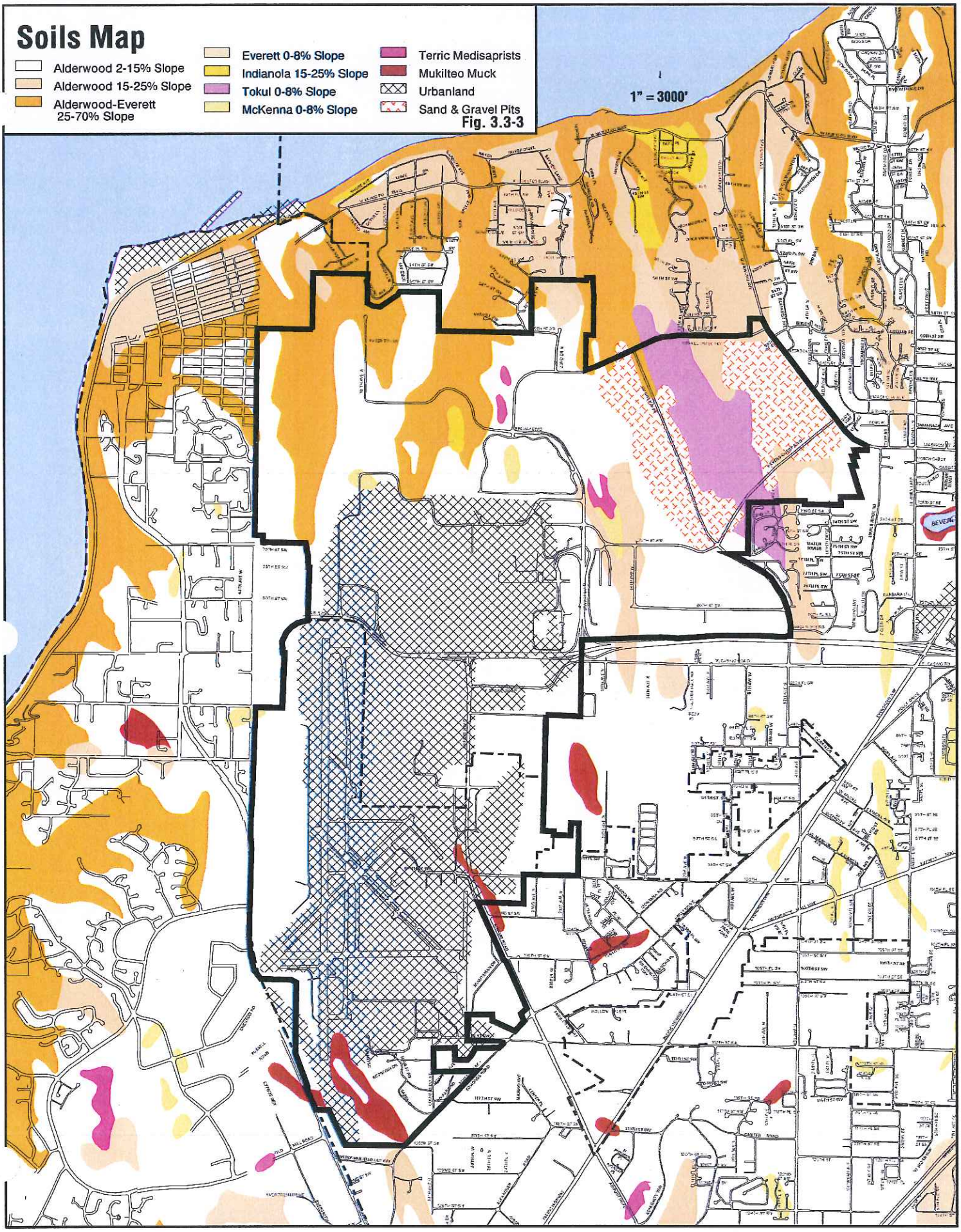

Soils Map
Alderwood 2-15% Slope
Alderwood 15-25% Slope
Alderwood-Everett 25-70% Slope
Everett 0-8% Slope
Indianola 15-25% Slope
Tokul 0-8% Slope
McKenna 0-8% Slope
Terric Medisaprists
Mukilteo Muck
Urbanland
Sand & Gravel Pits
1" = 3000'

Fig. 3.3-3

Uniform Building Code (UBC)

Structural design of buildings in landslide and seismic hazard areas is regulated by the Building Division through implementation of the Uniform Building Code standards for Seismic Risk Zone 3. This designation infers a seismic event with a magnitude of 7.5.

Design and Construction Standards and Specifications Manual

The City's Public Works Department permits and inspects land alteration activities through requirements of this Manual. The Manual contains many standards which mitigate the impacts to earth resources, including erosion/sedimentation control requirements for sites based upon the site size, location, and slopes; temporary construction entrances; seasonal limitations on land alteration activities; preservation and restoration of vegetation; and requirements for submittal of erosion control plans.

Draft Stormwater Management Manual

The manual includes the following seven basic principles of erosion and sedimentation control, modeled after the Department of Ecology's Stormwater Manual:

1. Plan the development to fit the particular topography, soils, drainage patterns, and natural vegetation of the site.
2. Minimize the extent of the area exposed at one time and the duration of exposure.
3. Stabilize and protect disturbed areas as soon as possible.
4. Keep runoff velocities low.
5. Protect disturbed areas from storm water runoff.
6. Retain sediment within the corridor or site area.
7. Implement a thorough maintenance and follow-up program.

Also included within the Stormwater Manual are definitions for seasonal limitations, a soil categorization for the rating system, and best management practices for erosion and sedimentation control.

Subdivision and Binding Site Plan Ordinances (EMC Title 18)

These regulations require subdivisions and other developments to design projects which conform to existing topography to the maximum extent possible. The intent of these requirements is to preserve natural landforms and reduce impacts on surrounding properties and environmentally sensitive areas.

Projects with Previous Approvals

Different standards may apply to projects with previous approvals. For example, the Seaway Center Master Plan approval requires that areas slopes of more than 25% be set aside as open space.

3.3.2.2 Snohomish County

Chapter 18.46 SCC

Snohomish County regulates development on steep slopes through Chapter 18.46 SCC. Chapter 18.46 controls development on steep slopes and landslide areas in order to protect the health, safety, and welfare of citizens and the environment. General regulations for development on steep slopes include:

- more stringent development standards;
- "respect" for natural processes rather than "overcoming" natural constraints;
- severe limitations or prohibition of development in landslide areas;
- no adverse impacts to drainage basins.

3.3.2.3 Department of Ecology

The Department of Ecology issues Baseline General Permits for storm water discharges on sites where clearing and grading of more than five acres will occur and where storm water from a construction activity can reach surface water or storm sewers. This permit is required in addition to any other local or state government permits for erosion and sedimentation control.

More detailed information of exact requirements for both Baseline General Permits and NPDES permits is available through the Washington State Department of Ecology.

3.3.3 PROPOSED THRESHOLDS

All slopes that are not designated environmentally sensitive may be modified. Major cuts and fills will likely occur to make sites suitable for development.

Sites that are designated environmentally sensitive may not be modified, except to construct necessary utilities. Disturbance to these areas will be limited to the minimum necessary for construction.

Sites designated as geologically hazardous areas may be modified if approved by the Planning Director based upon review of a geotechnical report that shows the proposal meets the criteria of Section 37 of the Zoning Code. The report must show that the modifications will not create a hazard to the subject property or surrounding properties.

This DEIS does not evaluate the impacts of earth removed from the Subarea and placed on sites outside of the Subarea. Additional SEPA analysis will be required for placement of fill outside the Subarea.

The Subarea Plan and DEIS do not evaluate the impacts of new mining activity. Additional SEPA review will be required for new mining activities.

3.3.4 IMPACTS OF DEVELOPMENT

All land within the Subarea that is not designated as environmentally sensitive has the potential to be modified. The main impacts to earth resources will be due to earth movement during construction in non-environmentally sensitive areas. Earth movement will occur to create building pads; install underground utilities; install underground storage tanks; construct detention and wet ponds; and construct roads, site access, parking and loading areas. Topsoils may be removed from sites or relocated on sites as earth movement occurs. Rockeries and retaining walls will be constructed on some sites to support cut or filled slopes.

This EIS assumes that all slopes greater than 25% located adjacent to streams and wetlands will not be modified; except some environmentally sensitive slopes will be modified in order to construct necessary utilities. For example, sewer and water crossings of steep slopes, wetlands, and streams may be necessary to create looped water systems or to connect into gravity lines. Stormwater outfall systems will also be installed through environmentally sensitive areas.

Additional geotechnical analysis will be required for development on any site with slopes of 40% and greater or slopes designated as landslide or erosion hazard areas. Geotechnical analysis will also be required for sites which contain substantial amounts of fill material or are known to contain hazardous waste. Analysis and approvals must be completed per Zoning Code requirements prior to any development on these slopes. All slope modifications must also be consistent with UBC requirements.

Impacts on earth resources due to development of the Subarea include changes to topography; removal of topsoil from sites; increased soil erosion and resulting sedimentation of streams, lakes, and wetlands; soil compaction; possible landslides or other slope failures; and modifications to drainage and stormwater flows. The degree of potential hazard depends on the soil type, slope, drainage characteristics of the site, the amount of rainfall during construction, the construction methods used, and the extent of grading proposed.

Erosion and sedimentation impacts are most likely to occur during site preparation and construction when soils are exposed. Soils can be eroded from the site by water and wind, or carried out on the wheels of construction vehicles. The eroded soil can impact air quality (See Section 3.5 Air Quality) and wetlands, streams and fisheries resources (see Section 3.4 Surface Water, Plants and Animals).

Impacts may also occur after construction is completed due to modifications to sites or lack of maintenance. For example, where drainage is routed down steep slopes through pipes, the pipes must be maintained over time. If the pipes break or leak and water is discharged on the slope, erosion and slope failure can occur.

More significant impacts may result for work on geologically hazardous areas than on less steep areas, including erosion and slope failures. Buildings and other man-made structures located in landslide hazard areas would be susceptible to the impacts of landslide/seismic hazards such as mudslides, erosion and falling debris. Landslides may disrupt sewer, water and gas lines; electrical facilities; hazardous waste or chemical storage; and detention ponds and other water quality features. Earth eroded from sites on steep slopes is more likely to be carried downhill into streams and wetlands.

Alteration of topography can also affect views and potentially cast shadows onto adjacent properties. For example, if a large amount of fill were to be placed near a property line, it could block views from adjacent properties and limit sunlight cast onto the adjacent property. Alternatively, the mining activity that has occurred in the Subarea has opened up views to some residential areas (Veralene Estates). The Zoning Code limits the height of rockeries and retaining walls in required setbacks to 36 inches, so in many cases substantial changes in grade cannot be made right at a property line. However, the Planning Director can grant modifications to the standard, and where setbacks are not required, substantial rockeries or walls could be located in setbacks. For further details on alteration of topography and visual impacts, see Section 3.1, Land Use.

3.3.5 POTENTIAL MEASURES TO REDUCE THE IMPACTS OF DEVELOPMENT

Control measures such as construction management practices, clearing limits, and revegetation; and maintaining developed sites are all vital factors for erosion and landslide control. Additional measures may be desired to reduce the visual impacts of changes in topography.

Potential measures to mitigate the impacts to erosion, soil stability, and topographic changes include:

1. All development must comply with Zoning Code requirements for geologically hazardous areas, including requirements for preservation of hazardous sites and/or submittal of geotechnical reports on sites that are potentially hazardous and compliance with the recommendations of the reports.

   All utility work in environmentally sensitive areas must be approved through the requirements of Chapter 37 of the Zoning Code, and must be completed per best management practices. (See Section 3.4.5.1 Surface Water, Plants and Animals for potential best management practices.)

2. All development must be in accordance with the standards in the City of Everett Public Works Design and Construction Standards and Specifications Manual and the Stormwater Management Manual (when adopted). Requirements include, but are not limited to:

   a. Erosion and sedimentation control plans must be reviewed and approved by the Public Works Department. At a minimum specific erosion control measures listed in the Manual must be provided. Additional measures may be required by Public Works.

   b. Erosion control measures must be constructed and operational prior to initiation of clearing, grubbing, or grading operations. Methods may include, but are not limited to the use of check dams and berms, cut-off trenches, filtering devices, gradient terraces, interceptor dikes, sediment traps, silt fences, and settlement and sedimentation ponds.

   c. Seasonal limitation on land alteration activities (restricts work during rainy seasons).

   d. Preservation and restoration of existing vegetation.

Public Works requirements for stormwater control will also mitigate the impacts to earth. For example, discharge of stormwater is not permitted on steep slopes where it can cause erosion and slope failures.

3. All development must be designed and constructed in accordance with the standards of Seismic Zone III per the Uniform Building Code.

4. All rockeries and retaining walls greater than 8 feet high must be designed by a structural engineer.

5. Development on Paine Field properties must be in conformance with Snohomish County Chapter 18.46 SCC.

6. The City could require that construction management plans be reviewed and approved prior to the issuance of permits allowing construction of any facilities located within 50 feet of an environmentally sensitive area (steep slope; stream; wetland; landslide hazard area; etc.) and associated buffer. The construction management plan should include the following minimum measures:

   a. Specific erosion controls to be implemented prior to authorizing any construction activities which will impact an environmentally sensitive area as defined by the City's environmentally sensitive area regulations.

   b. For any facilities on or adjacent to erosion or landslide hazard areas, the construction management plan must address all mitigation measures identified in the geotechnical report approved by the Planning Director.

   c. Implementation of best management practices to control erosion both during and after construction, including compliance with the City of Everett's design and construction standards (temporary sedimentation ponds, silt fences, hay bales, reseeding exposed earth where no construction within 30 days, etc.

   d. Construction schedule, status update reporting requirements, and contingency provisions to become effective if the schedule is not met.

7. All earthwork within an environmentally sensitive area or its required buffer should be performed under the direct observation of a professional civil or geotechnical engineer. The engineer should provide certification to the City that all work was done in compliance with requirements set forth in the City approved geotechnical report.

8. The City could require that all earthwork be performed under the direct supervision of a professional civil or geotechnical engineer.

9. A geotechnical report should be reviewed and approved by the City which identifies all facilities which are proposed to be located in areas which contain potentially moisture sensitive soils. The following minimum mitigation requirements should be met for all earthwork for facilities on moisture sensitive soils:
   - Limit site disturbance by using tracked equipment, where possible, within the excavation area.

- Remove standing water from the excavation area. Outfall water should be filtered or run through a sedimentation basin.
- Use surface erosion measures in areas in which surface water is anticipated to drain from the excavation area. Require control measures to be designed by a professional civil or geotechnical engineer, to prevent offsite surface drainage. Methods may include, but are not limited to use of silt fences and/or settlement ponds.
- A plan should be implemented to minimize the extent to which soils become disturbed. Soils which become disturbed, and which are above their optimum moisture content, should either be allowed to dry to within their optimum moisture content and be re-compacted, or be removed from the construction site.

10. Any water quality enhancement or detention facilities located near steep slopes will require detailed geotechnical analysis and design that documents and ensures their safety.

11. In order to minimize erosion during construction, any soil piles should be covered with plastic sheeting or other impervious covering staked to the ground or anchored with rocks or sandbags. Berms, earthen or otherwise, should be constructed at the perimeter of excavated areas to prevent adjacent site runoff from entering the excavations.

12. City streets must be kept clear of dirt and debris at all times during construction. Dust suppression and street cleaning must occur as directed by the Public Works Inspector. Measures should include
    - Cleaning the tires of construction vehicles before they leave the site.
    - Requiring that trucks carrying earth cover all loads.
    - Implementing watering programs on all unsurfaced construction sites and soil stockpile areas during dry weather to reduce dust emissions.
    - Minimizing open soill stockpiling. Hydroseeding or other soils stabilization methods approved by the City should be implemented for any soils storage or stockpiling.

13. Mining sites must comply with the Department of Natural Resources reclamation requirements. All vertical slopes on mining sites must be recontoured (reclaimed) to a slope no greater than 1-1/2 to 1 (horizontal to vertical) and revegetated. At a minimum, the recontoured slopes should be covered with top soil material that will support vegetation, jute matting or equivalent, and hydroseed mix. Shrubs and trees should also be planted to help stabilize the slope.

14. Temporary slopes within native glacial soils should be limited to a maximum angle of 1/2 foot horizontal (H) to 1 foot vertical (V). Temporary slopes within fill soils should be limited to a maximum angle of 1H:1V. Temporary slopes should be covered with an impermeable membrane, such as visqueen, or mulch in order to prevent precipitation from coming in contact with the soils.

    Permanent slopes steeper than 25% should be designed by a professional civil or geotechnical engineer. The design should present appropriate erosion control measures which may include: hydroseeding, erosion control blankets, rip-rap, jute matting, and visqueen.

15. During the detailed site-specific plan review, the City should ensure that grading/filling will not adversely affect hydrology of streams and existing or created wetlands.

16. During the detailed site-specific plan review, the City should ensure that grading/filling on-site will not adversely affect adjoining sites.

17. Clearing limits and required buffers should be staked, flagged in the field, and fenced off prior to initiation of any clearing or land alteration activities.

18. Clearing and grading should be limited to the minimum necessary for the development.

19. Removal of native vegetation within the building setback and buffer areas should be avoided when possible.

20. Excavation equipment should consist of track-mounted loaders and backhoes during periods of precipitation or on wet subgrades.

21. The City should consider establishing standards to mitigate the visual impacts of large retaining walls and rockeries, such as landscape screening of walls visible from adjacent properties and height limitations.

22. Prior to issuance of grading permits for removing earth from a site, the Applicant should provide the City with information showing the site for placement of earth has been permitted.

23. Project proponents should try to retain topsoil on sites to the maximum extent feasible.