

Shallow-Landslide Susceptibility Map of the City of Silverton, Marion County, Oregon

2012

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Regional Landslide Hazard Maps of the City of Silverton,
Marion County, Oregon

by William J. Burns and Katherine A. Mickelson

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PLATE 2

EXPLANATION

This map is a shallow-landslide susceptibility map of a portion of the quadrangle. The shallow-landslide susceptibility map identifies landslide prone areas within the region. This susceptibility map is not regulatory, and revisions can happen when new information regarding factors that affect landslide susceptibility is found or future (new) landslides occur. Therefore, it is possible these areas susceptible to shallow-landslide within the map were not identified or that the condition that lead to such susceptibility developed after the map was prepared.

On the basis of several factors and past studies (described in detail in Burns and Madin, 2009), a value (or depth) of 4.5 m (15 ft) is used to divide shallow from deep-landslides. This susceptibility map was prepared by combination of three factors: 1) calculated factor of safety (FOS), 2) landslide inventory data, and 3) buffers of the previous two factors. The factor of safety was calculated using conservative values such as a water table at the ground surface. The landslide inventory data were taken from the complimentary inventory map. The combination of these factors compares the relative susceptibility hazard zones: High, Moderate, and Low. The landslide data are displayed on top of a base map that consists of an aerial photograph (orthorectified) overlain on the lidar-derived digital elevation model. For additional detail on how this map was developed see Burns and others (2012).

This susceptibility map is intended to provide users with relative hazard information regarding shallow-seated landslide susceptibility within the quadrangle. The map is not intended to replace site-specific engineering geologic and geotechnical investigations. It is intended that this map will provide useful information to guide regional and site-specific investigations for future developments, assist in regional planning, and to reduce risk in areas where moderate and high hazards intersect vulnerable population.

SHALLOW-LANDSLIDE SUSCEPTIBILITY CLASSIFICATION

Each landslide susceptibility hazard zone shown on this map has been developed according to a number of specific factors. The classification scheme was developed by the Oregon Department of Geology and Mineral Industries (Burns and others, 2012). The symbology used to display these hazard zones is explained below.

Landslide Susceptibility Zones: This map uses color to show the relative degree of hazard. Each zone is a combination of several factors.

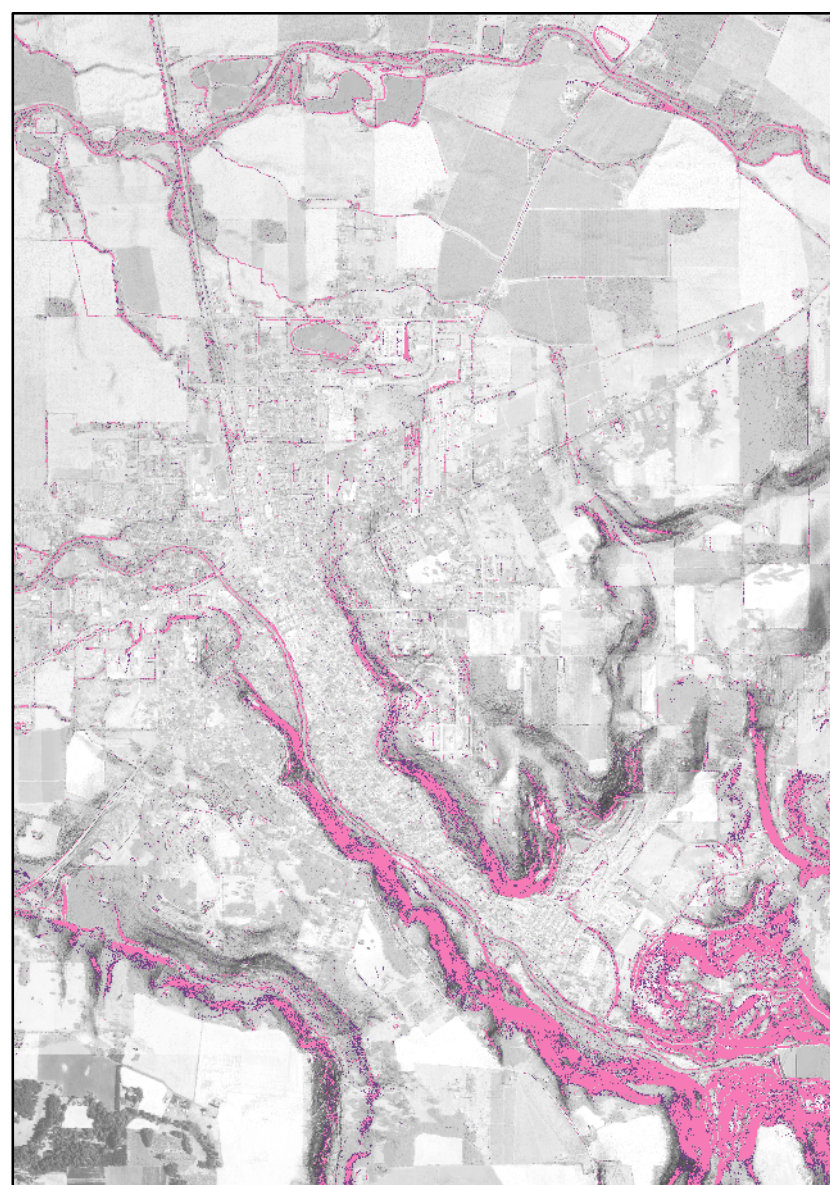
- HIGH:** High susceptibility to shallow landslides.
- MODERATE:** Moderate susceptibility to shallow landslides.
- LOW:** Low susceptibility to shallow landslides.

Hazard Zone Matrix Table

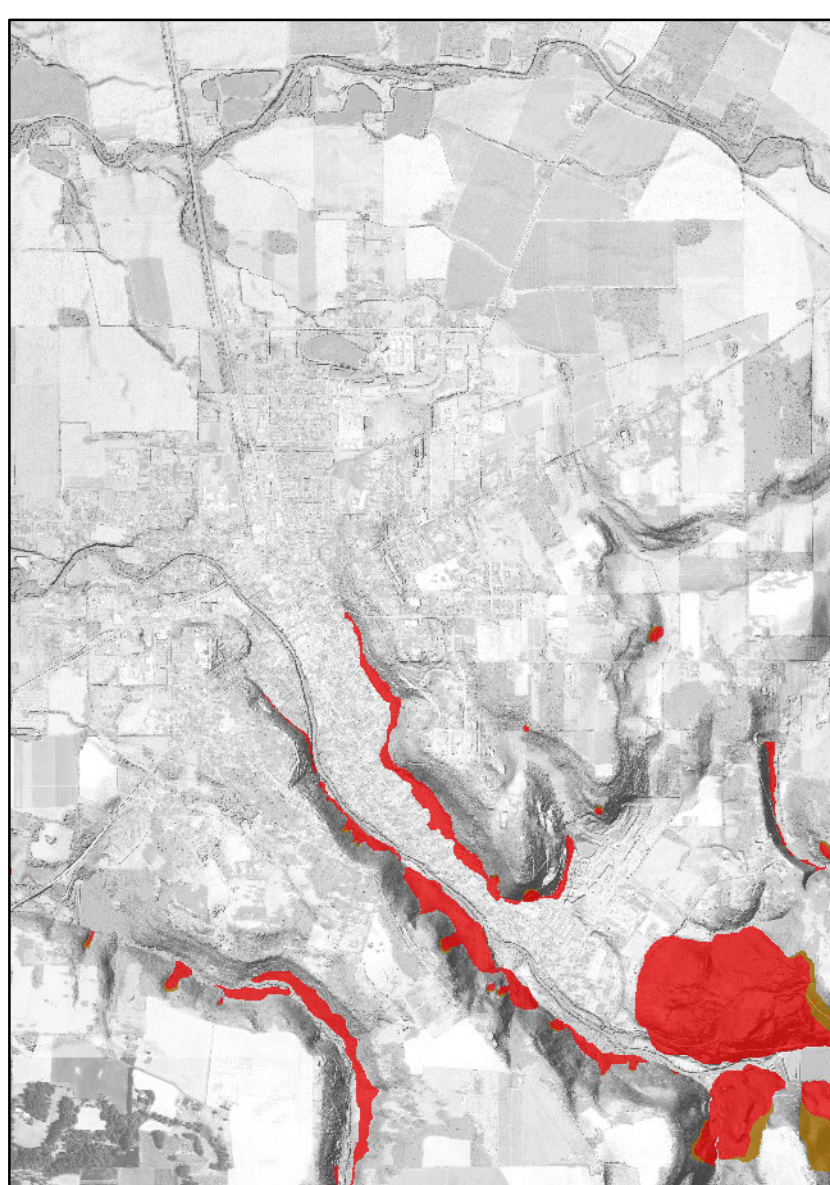
Contributing Factors*	Final Hazard Zone		
	High	Moderate	Low
1 Factor of Safety (FOS)	less than 1.25	1.25 - 1.5	greater than 1.5
2 Landslide Inventory	included	—	—
3 Buffers	2H-1V (head scarps)	2H-1V (FOS less than 1.5)	—

*See explanation of corresponding contributing factors below.

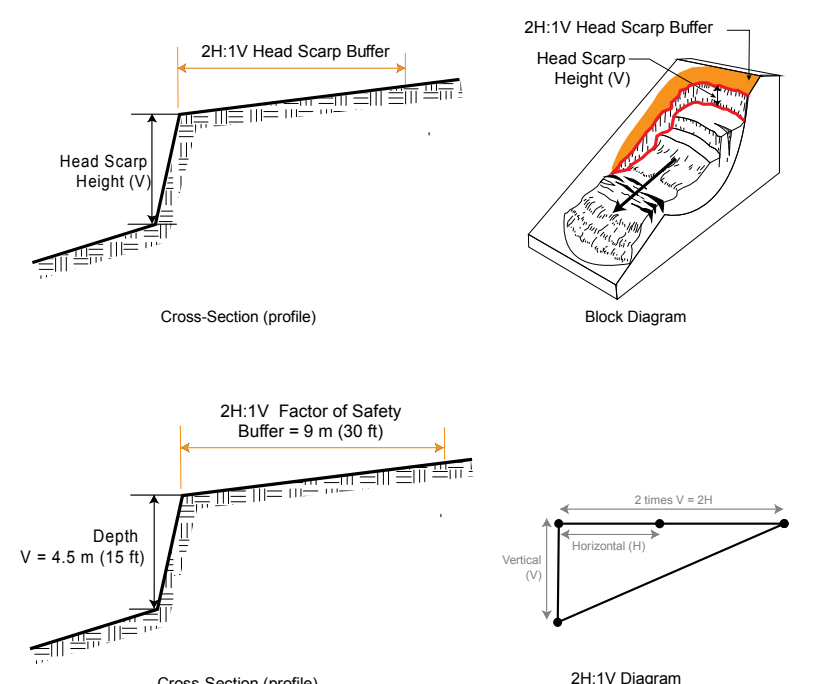
1 Factor of Safety Map



2 Landslide Inventory



3 Buffers for Head Scarps and Factor of Safety Less Than 1.5



LIMITATIONS

The shallow-landslide susceptibility protocol was developed with input from many sources, along with years of experience. Several limitations are worth noting and underscore that this hazard map is useful for regional applications but should not be used as an alternative to site-specific studies in critical areas.

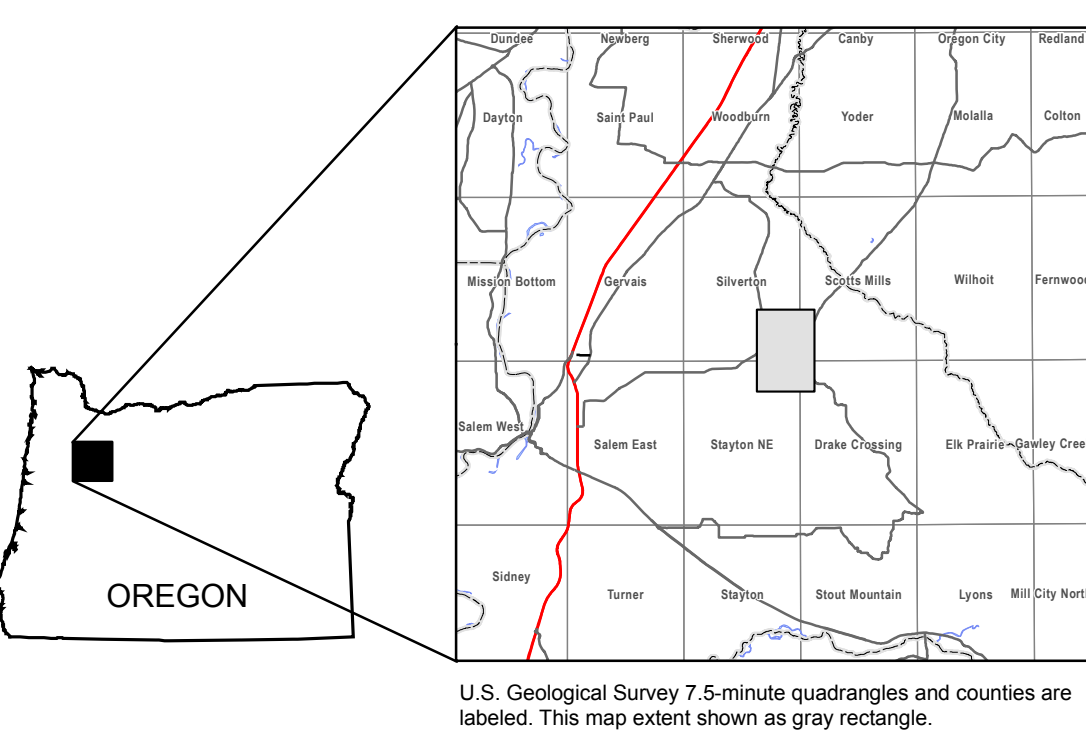
- Every effort has been made to ensure the accuracy of the GIS and tabular database, but it is not feasible to completely verify all of the original input data.
- The shallow-landslide susceptibility maps are based on three primary sources: a) landslide inventory, b) calculated factor of safety, c) buffers. Factors that can affect the level of detail and accuracy of the final susceptibility map include:
 - Limitations of the landslide inventory, which are discussed in the Special Paper 42 (Burns and Madin, 2009).
 - The infinite slope factor of safety calculations are done on one individual grid cell at a time without regard for the adjacent grid. The results sometimes underestimate or overestimate the level of stability for a certain area. We developed buffers for areas with low factors of safety to try to counter the tendency to underestimate susceptibility. We developed the focal pilot method to try to reduce the problem of overestimation of susceptibility due to steep slopes with low relief. However, the overestimation and underestimation of susceptible areas is still likely in some isolated areas.
 - The factor of safety calculations are strongly influenced by the accuracy and resolution of the input data for material properties, depth to failure surface, depth to groundwater, and slope angle. The first three of these inputs are usually estimates (material properties) or conservative limiting cases (depth to failure surface and groundwater), and local conditions may vary substantially from the values used to make these maps.
- The susceptibility maps are based on the topographic and landslide inventory data available as of the date of publication. Future changes in topography or the occurrence of new landslides may render this map locally inaccurate.
- The lidar-based digital elevation model does not distinguish elevation changes that may be due to the construction of structures like retaining walls. Because it would require extensive GIS and field work to locate all of these existing structures and remove them or adjust the material properties in the model, they have been included as a conservative approach and therefore must be examined on a site-specific basis.
- Some landslides in the inventory may have been mitigated, reducing their level of susceptibility. Because it is not feasible to collect detailed site-specific information on every landslide, potential mitigation has been ignored.

Because of these limitations this map is intended for regional purposes only and cannot replace site-specific investigations. However, the map can serve as a useful tool for estimating the regional landslide hazard and as a starting place for future detailed site-specific maps. Please contact DOGAMI if errors and/or omissions are found so that they can be corrected in future versions of this map.

REFERENCES

- Burns, W. J., and Madin, L. P., 2009, Protocol for inventory mapping of landslide deposits from light detection and ranging (lidar) imagery: Oregon Department of Geology and Mineral Industries Special Paper 42, 30 p., www.dogami.state.or.us/publications/.
- Burns, W. J., Madin, L. P., and Mickelson, K. A., 2012, Protocol for shallow-landslide susceptibility mapping: Oregon Department of Geology and Mineral Industries Special Paper 45, 12 p.
- Cornforth, D. H., 2005, Landslides in practice: Investigation, analysis, and remedial/preventative options in soils: Hoboken, N.J., John Wiley and Sons, Inc., 506 p.
- Turner, A. K., and Schuster, R. L., eds., 1996, Landslides: Investigation and mitigation: Transportation Research Board, National Research Council Special Report 247, 673 p.

LOCATION MAP

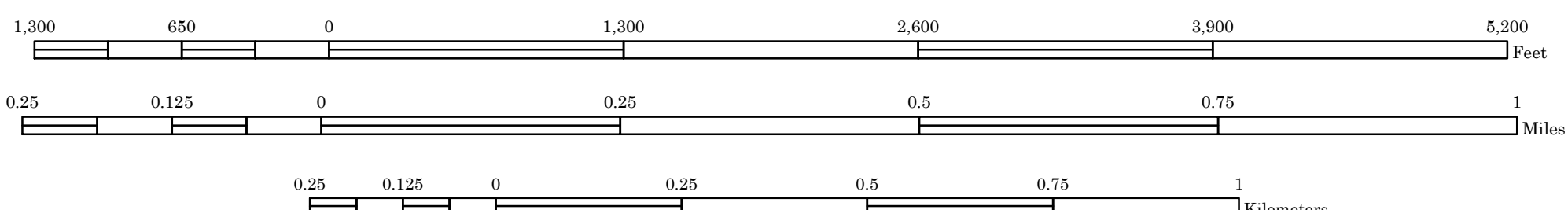


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Base Map:
Lidar-derived elevation data are from the Oregon Lidar Consortium, 2007. Digital elevation model (DEM) consists of a 3-foot square elevation grid that was converted into a hillshade image with sun angle at 31.5 degrees at a 45 degree angle from horizontal. The DEM is multiplied by 5 (vertical exaggeration) to enhance slope areas.
Orthophoto is from Oregon Geospatial Enterprise Office, 2005 and consists of 2005 orthophoto draped over DEM with transparency.
Projection: North American Datum 1983, UTM zone 10 north.
Software: MapInfo Professional 8.0, Esri ArcMap 9.2, Adobe Illustrator CS2.
Source File: Rocks\Publishations\Silverton.mxd.

16.5
Feet
1:8,000
APPROXIMATE MEAN
DECLINATION, 2008

SCALE 1:8,000



IMPORTANT NOTICE

This map depicts existing landslide susceptibility zones on the basis of limited data. The susceptibility zones were created following the methods in the accompanying report (Burns and others, 2012). This map cannot serve as a substitute for site-specific investigations by qualified practitioners. Site-specific data may give results that differ from those shown on this map.

Cartography by William J. Burns, Oregon Department of Geology and Mineral Industries
Outside agency review by Rick Baxstad, City of Silverton