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Landslide Inventory Map, U.S. Highway 30 (Oregon State Highway 92) Landslide Hazard and Risk Study, Clatsop and Columbia Counties, Oregon

2012

OPEN-FILE REPORT O-12-06

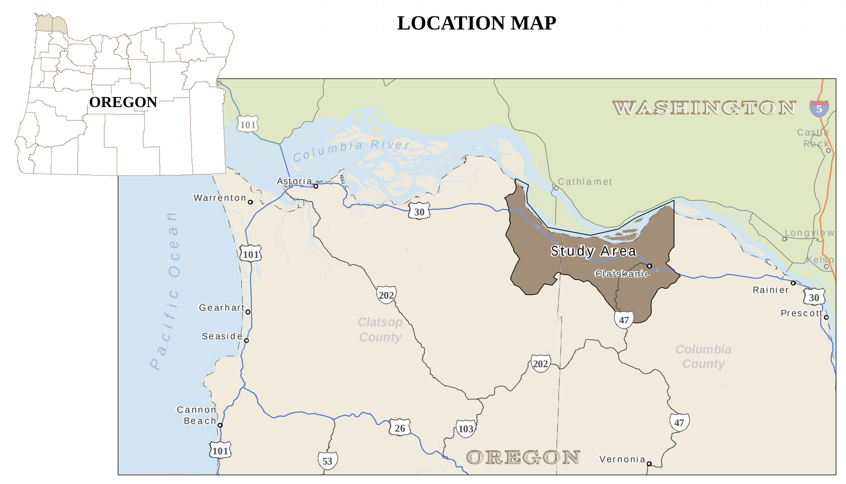
Landslide Hazard and Risk Study of the U.S. Highway 30 (Oregon State Highway 92) Corridor, Clatsop and Columbia Counties, Oregon

By Katherine A. Mickelson and William J. Burns

PLATE 2

The project described in this publication was funded in part by contract number HMGP-1733-14-F from Oregon Emergency Management, which was approved through the Hazard Mitigation Grant Program (HMGP) by FEMA for disaster DR-1733-OR.

LOCATION MAP



SCALE
1:24,000
0 1 2 Miles
0 1 2 Kilometers
APPROXIMATE MEAN DECLINATION, 2009

PROJECT BACKGROUND

In December 2007, a series of powerful storms produced heavy rainfall causing landslides and severe flooding in Oregon. Due to the severe damage caused by these storms, the President of the United States issued a disaster declaration that allowed FEMA Hazard Grant funding to become available under FEMA DR-1733-OR. In September, 2010, the Oregon Department of Geology and Mineral Industries (DOGAMI) entered an intergovernmental agreement with Oregon Emergency Management (contract no. DR-1733-OR-14-F) to perform regional landslide hazard evaluation along the U.S. Highway 30 (Oregon State Highway 92) corridor in Clatsop and Columbia Counties. The primary purpose of this project is to provide detailed information about landslide hazards and the assets at risk. Community assets included in this study are people, roads, railroads, bridges, high-voltage electric transmission lines, electric transmission towers and substations, buildings, and critical facilities. These asset datasets were created by combining existing published data with new data created specifically for this study.

Following the methodology of Burns and Madin (2009), a landslide inventory was created using lidar data within a geographic information system (GIS). After the inventory was completed, landslide susceptibility maps were produced. Different models were used to estimate landslide susceptibility from landslide failure depth. Shallow landslides are defined as having a failure depth equal to or less than 15 ft (4.6 m), and deep landslides as having a failure depth greater than 15 ft (4.6 m) (Burns and others, 2012). For this study, a deep and a shallow landslide susceptibility map were created following methods detailed by Burns and others (2012) and Burns (2008).

Both the landslide and asset datasets were used to conduct a landslide hazard risk assessment of the study area. Generally, the assessment involves the identification of the hazard, an inventory of the assets, and an estimation of damage and losses based on the exposure of each asset to the hazard. Currently, no standard of practice exists for performing landslide risk analysis; therefore two methods, a HAZUS-MH (FEMA, 2011) assessment and an exposure analysis, were used to estimate the potential damages and losses and the assets at risk within this study area.

The accompanying report provides a more detailed explanation of the methodologies used to create the datasets listed above and the results of the exposure and risk analyses. The four map plates provide thematic views of the landslide hazards and assets examined in this study.

MAP EXPLANATION

The general term landslide refers to the movement of earth materials down slope. This can include rockfalls, debris flows, earth slides, and other failure types. Three types of landslides are displayed on this map: shallow landslides, deep landslides, and debris flows.

Landslides are often classified by their depth of failure as deep or shallow. Shallow landslides commonly are defined as failing above the contact between the overlying soil and bedrock and are defined in this study as having a failure depth equal to or less than 15 ft (4.6 m). Deep landslides have fail¬ure surfaces that cut into the bedrock and can cover large areas, from acres to square miles. The large, deep landslides tend to move relatively slowly (less than an inch per year) but can lurch forward if shaken by an earthquake or disturbed by removing material from the toe, by adding material to the head scarp, or by adding of water into the slide mass. Deep landslides are defined in this study to have a failure depth greater than 15 ft (4.6 m) (Burns and Madin, 2009).

Channelized debris flows are one of the most potentially life-threatening types of slides due to their rapid movement down channel. Debris flows tend to initiate in the upper reaches of a channel and gather water and sediment as they pick up speed coming down the drainage. As a debris flow approaches the mouth of the channel, the material tends to fan out due to the lower slope gradient. Debris flows also are commonly mobilized by other types of landslides failing on slopes near channels or from accelerated erosion during heavy rainfall or snow melt.

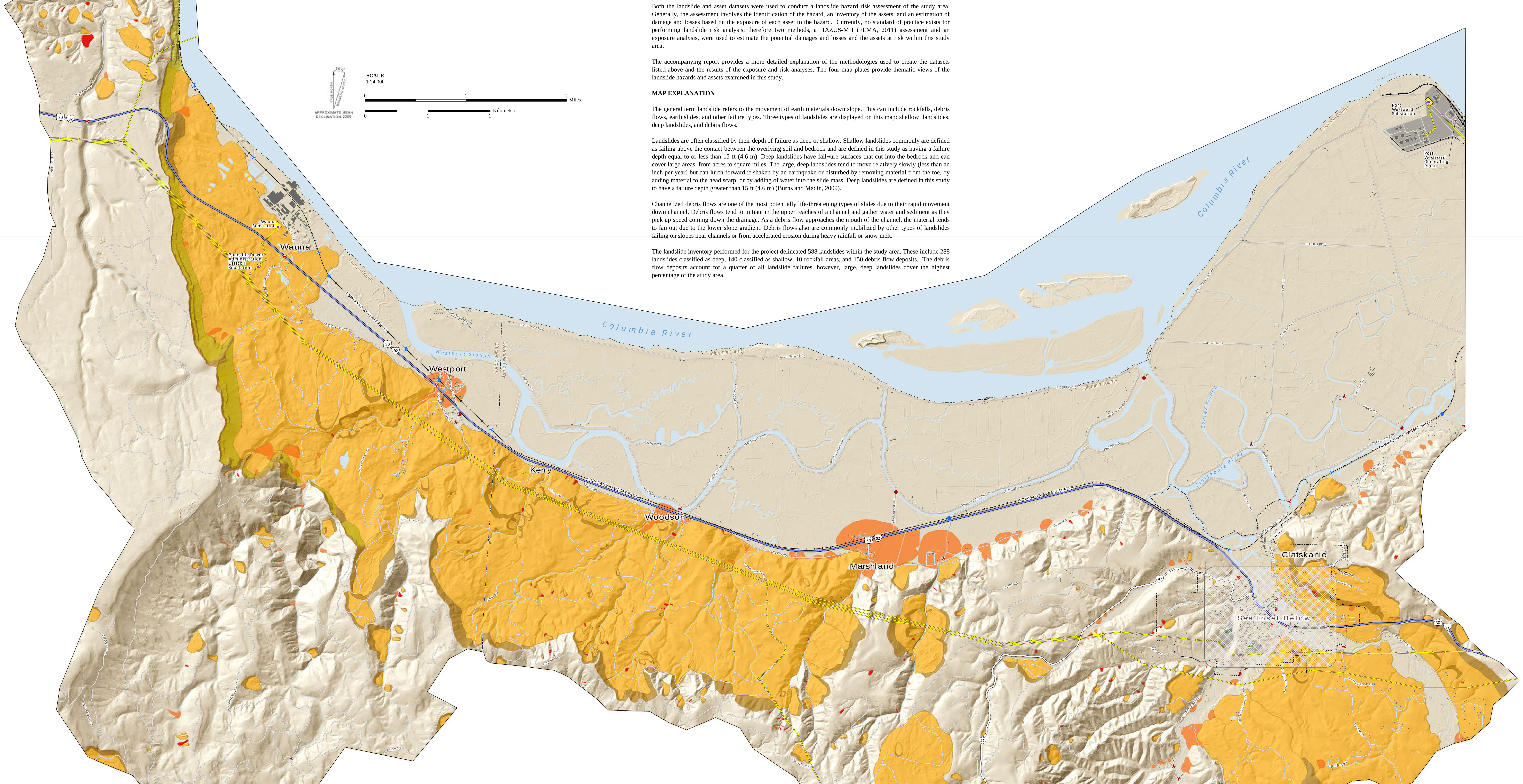
The landslide inventory performed for the project delineated 588 landslides within the study area. These include 288 landslides classified as deep, 140 classified as shallow, 10 rockfall areas, and 150 debris flow deposits. The debris flow deposits account for a quarter of all landslide failures, however, large, deep landslides cover the highest percentage of the study area.

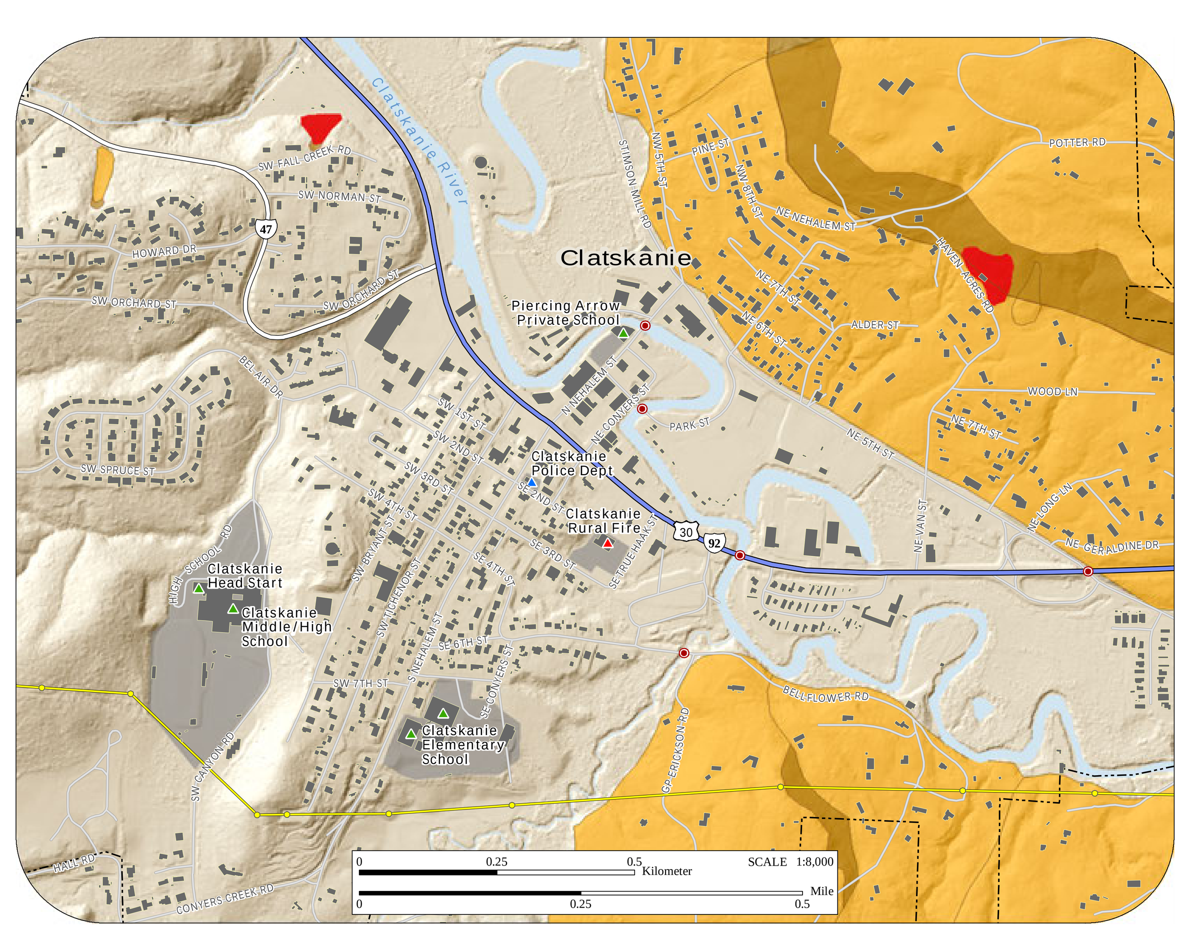
LEGEND

Road Bridge
Rail Bridge
Railroad
U.S. Highway
State Highway
Local Route
Watercourse
Waterbody
County Boundary
Urban Growth Boundary
Building Footprint
Fire
Police
School
Electric Facility
Critical Facility
Electric Substation
Electric Tower
High-Voltage Electric Transmission Line

LANDSLIDE INVENTORY

Landslide Head Scarp and Flanks
Rock Fall
Deep Landslide
Shallow Landslide
Debris Fan





DATA SOURCES FOR ALL PLATES IN THIS PUBLICATION

Bridge data (2010) were provided by the Oregon Department of Transportation (ODOT). Road and rail data (2010) were provided by the U.S. Census Bureau and were released as extracts from the Master Address File/Topologically Integrated Geographic Encoding and Referencing (MAF/TIGER) Database (MTDB). These datasets were also edited by DOGAMI to improve the spatial accuracy of the data or to add newly constructed features not present in the original data layer.

Critical facilities are a compilation of school, police, fire, and hospital facilities data from the Oregon Statewide Seismic Needs Assessment (Lewis, 2007). Electric transmission lines, towers, and substations are lidar-derived features created by DOGAMI for the Oregon Renewable Energy FIT. All critical facility locations were adjusted by DOGAMI to reflect their correct location based on lidar data.

Hydrology data (2005) were provided by the Pacific Northwest Hydrography Dataset and DOGAMI (2011).

Urban growth boundaries (2010) were provided by the Oregon Department of Land Conservation and Development (DLCD).

Lidar data are from DOGAMI Lidar Data Quadrangles LDQ-2009-46123-A2-Clatskanie, LDQ-2009-46123-A3-Marshland, LDQ-2009-46123-A4-NicolaiMountain, LDQ-2009-46123-B2-OakPoint, LDQ-2009-46123-B3-NassaPoint, and LDQ-2009-46123-B3-Cathlamet.

Coordinate System: Oregon Statewide Lambert Conformal Conic, Unit: International Feet, Horizonal Datum: NAD 1983 HARN.

Software: Esri ArcGIS® 10.0

Map Data Creation:
Lidar: William J. Burns and Katherine A. Mickelson
Landslide Inventory: Katherine A. Mickelson, William J. Burns, and Cullen B. Jones
Landslide Susceptibility Modeling: Katherine A. Mickelson and William J. Burns
Infrastructure Asset Data: Taylore E. Womble
Building Footprints: Kendra J. Williams, Cullen B. Jones, and Taylore E. Womble
Dasymetric Population Analysis: Taylore E. Womble

Map Production:
Cartography: Taylore E. Womble
Technical Review: Rachel R. Lyles Smith and Ian P. Madin

REFERENCES

Burns, W. J., 2008, Regional landslide hazard maps of the southwest quarter of the Beaverton quadrangle, West Bull Mountain Planning Area, Washington County, Oregon: Portland, Oreg., Oregon Department of Geology and Mineral Industries, Open-File Report O-08-09, 17 p., scale 1:8,000

Burns, W. J., and Madin, I. P., 2009, Protocol for inventory mapping of landslide deposits from light detection and ranging (lidar) imagery: Portland, Oreg., Oregon Department of Geology and Mineral Industries, Special Paper 42, 30 p.

Burns, W. J., Madin, I. P., and Mickelson, K.A., 2012, Protocol for shallow-landslide susceptibility mapping: Portland, Oreg., Oregon Department of Geology and Mineral Industries, Special Paper 45, 27 p.

FEMA (Federal Emergency Management Agency), 2011, HAZUS-MH, FEMA's tool for estimating potential losses from natural disasters: Available on CD-ROM from the Federal Emergency Management Agency (FEMA) or the National Institute of Building Sciences 1090 Vermont Avenue, NW, Suite 700 Washington, DC, 20005-4905, phone (202) 289-7800, fax (202) 289-1092, e-mail HAZUS@nibs.org or http://www.fema.gov/HAZUS/.

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