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Shallow-Landslide Susceptibility 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 3

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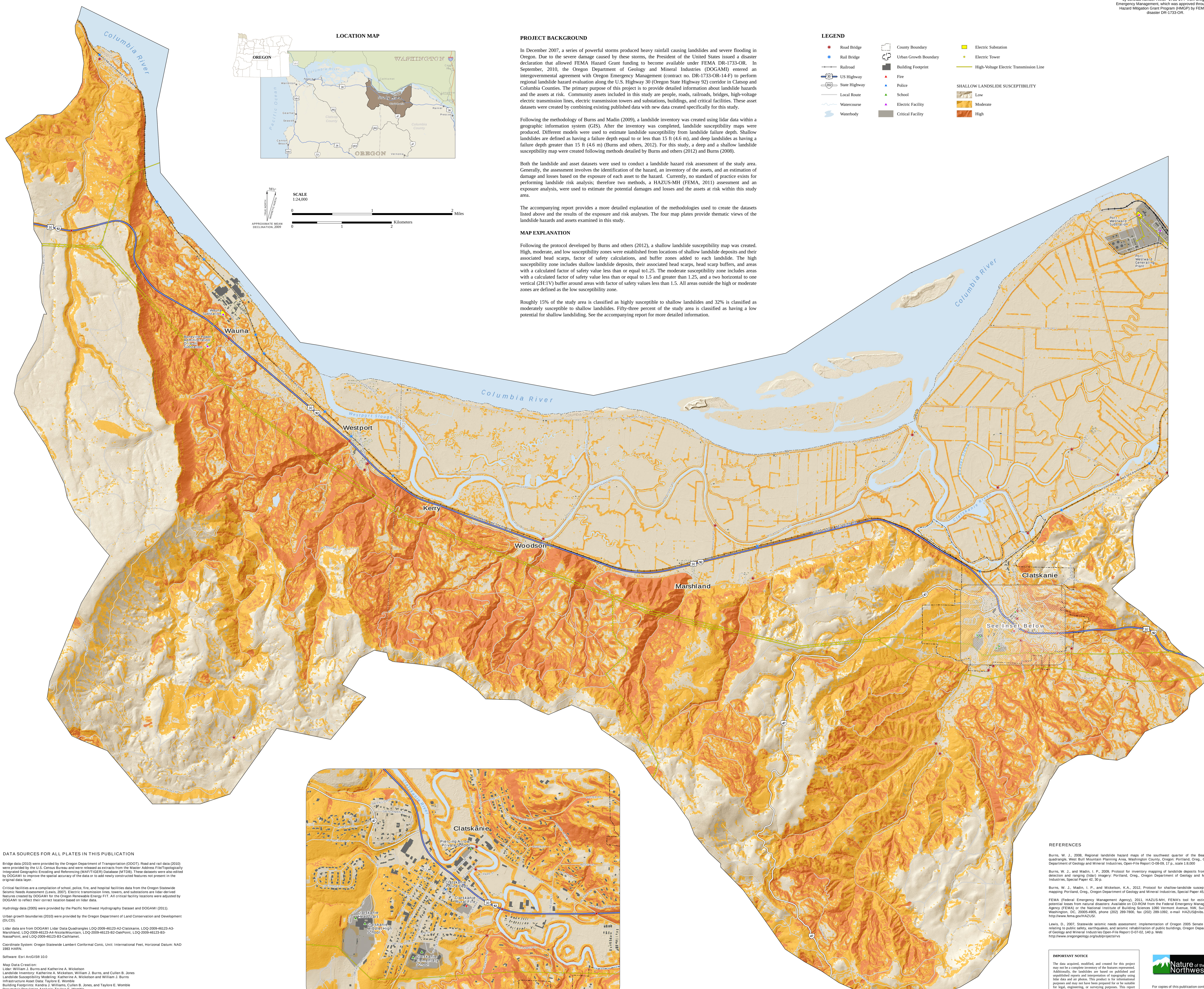

LOCATION MAP

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

Following the protocol developed by Burns and others (2012), a shallow landslide susceptibility map was created. High, moderate, and low susceptibility zones were established from locations of shallow landslide deposits and their associated head scarps, factor of safety calculations, and buffer zones added to each landslide. The high susceptibility zone includes shallow landslide deposits, their associated head scarps, head scarp buffers, and areas with a calculated factor of safety value less than or equal to1.25. The moderate susceptibility zone includes areas with a calculated factor of safety value less than or equal to 1.5 and greater than 1.25, and a two horizontal to one vertical (2H:1V) buffer around areas with factor of safety values less than 1.5. All areas outside the high or moderate zones are defined as the low susceptibility zone.

Roughly 15% of the study area is classified as highly susceptible to shallow landslides and 32% is classified as moderately susceptible to shallow landslides. Fifty-three percent of the study area is classified as having a low potential for shallow landsliding. See the accompanying report for more detailed information.

LEGEND

Road Bridge
Rail Bridge
Railroad
US 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

SHALLOW LANDSLIDE SUSCEPTIBILITY

Low
Moderate
High

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/.

Lewis, D., 2007, Statewide seismic needs assessment: implementation of Oregon 2005 Senate Bill 2 relating to public safety, earthquakes, and seismic rehabilitation of public buildings, Oregon Department of Geology and Mineral Industries Open-File Report O-07-02, 140 p. Web: http://www.oregongeology.org/sub/projects/rvs

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Nature of the Northwest Information Center
800 NE Oregon Street, #28, Ste. 965
Portland, Oregon 97232
telephone (971) 673-2331
http://www.NatureNW.org