



Woodson Debris Flow

December 2007

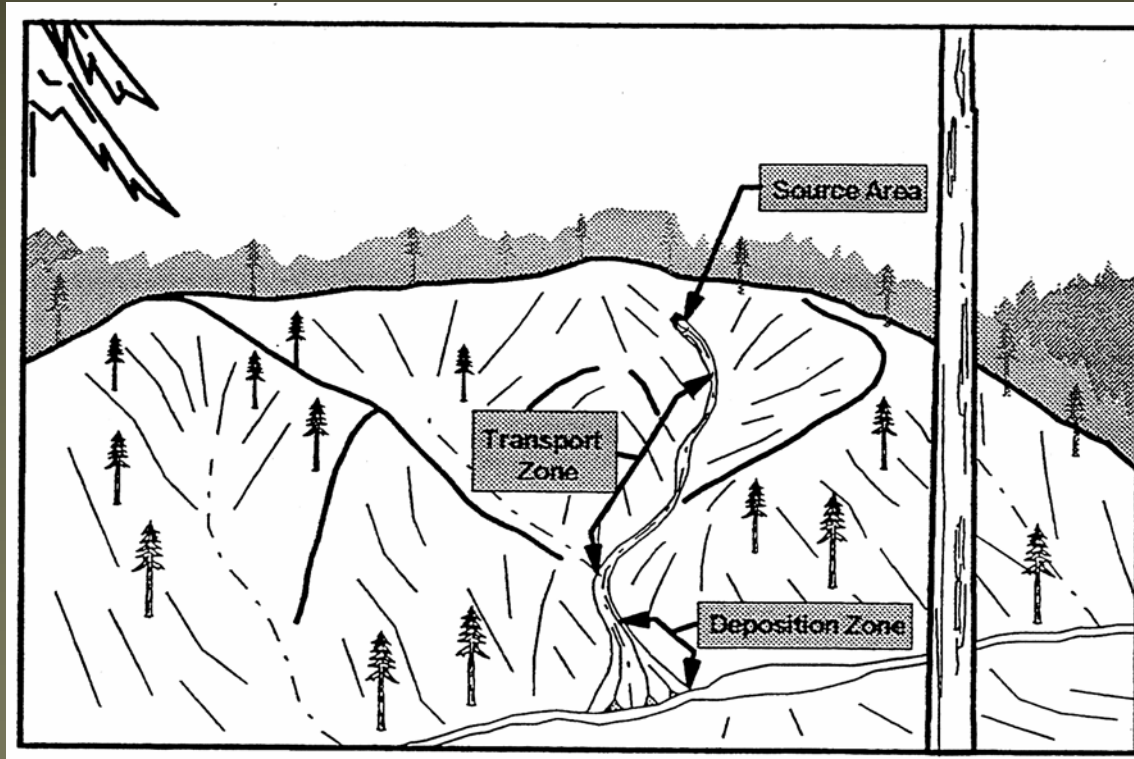
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What is a Debris Flow ?

A mixture of water and soil-rock-woody debris that have become a liquefied slurry in a channel and commonly move very rapidly down slope ($>10\text{m/s}$ ~25miles/hour).



Example: The Dodson Debris Flow, Columbia River Gorge, OR 1996



How do Debris Flows Start ?

Three common ways that debris flows initiate:

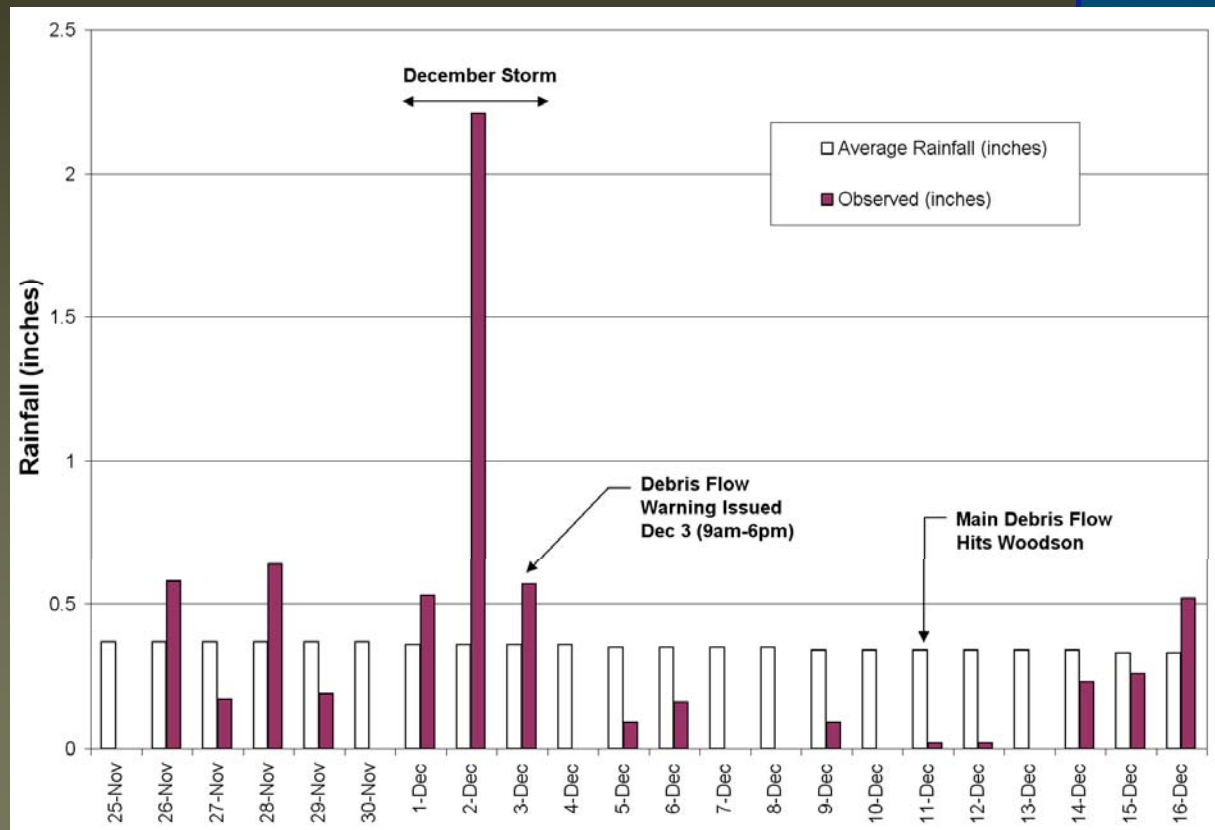
1. A small landslide fails into a channel & grows into a debris flow on the way down the channel
2. Erosion of material in a channel by severe runoff grows into a debris flow
3. A dam (usually from a separate landslide or an existing fill) in the channel fails & grows into a debris flow on the way down the channel

* Woodson debris flow was a combination of 1 & 3

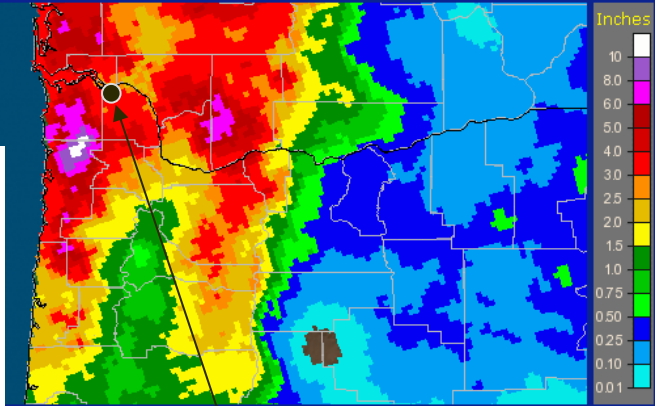


What Happened in Early December ?

Rainfall data from the Astoria
weather station - NWS



Portland, OR (PQR): 12/3/2007 1-Day Observed Precipitation
Valid at 12/3/2007 1200 UTC - Created 12/5/07 23:54 UTC

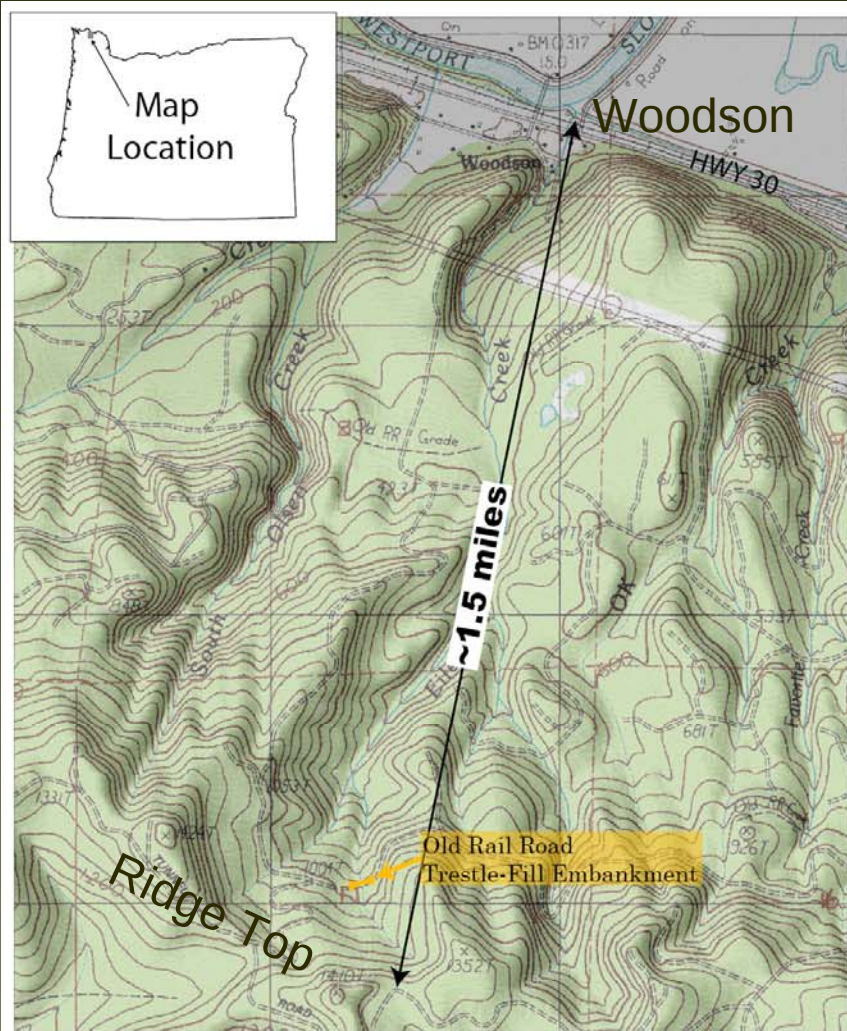


Woodson, OR

A large storm hit
NW Oregon
December 1-4,
2007



Where Did It Happen ?



USGS Topographic Quadrangle

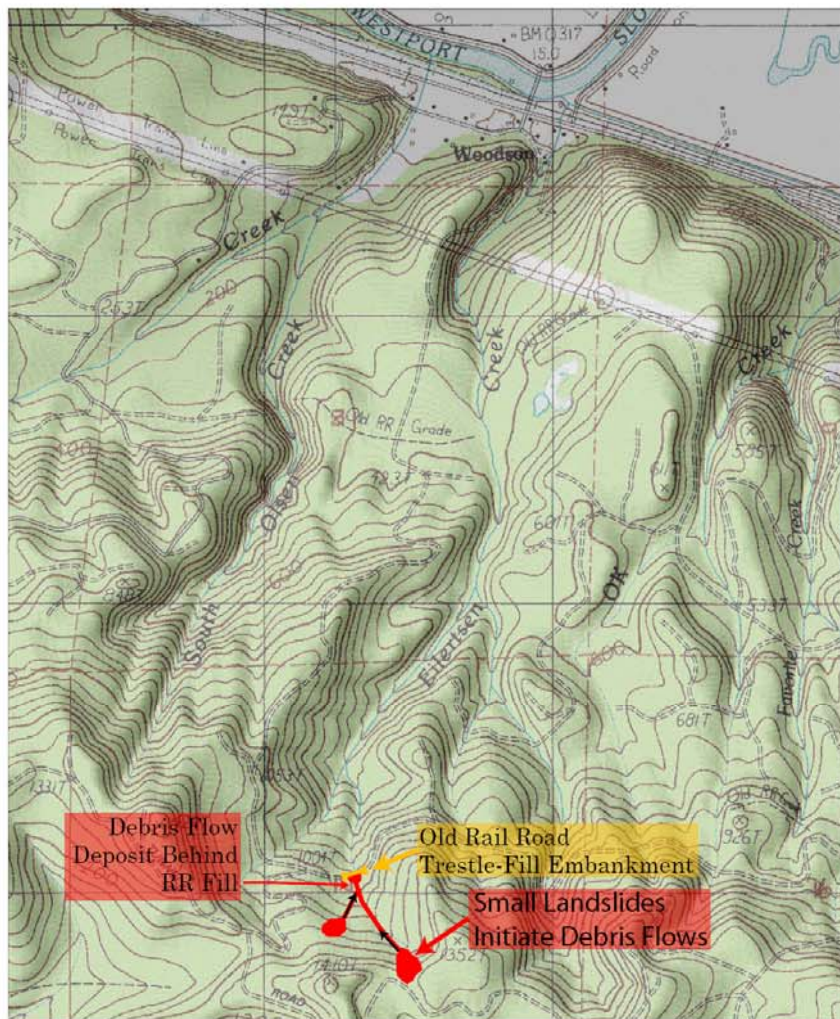


2005 Air Photo

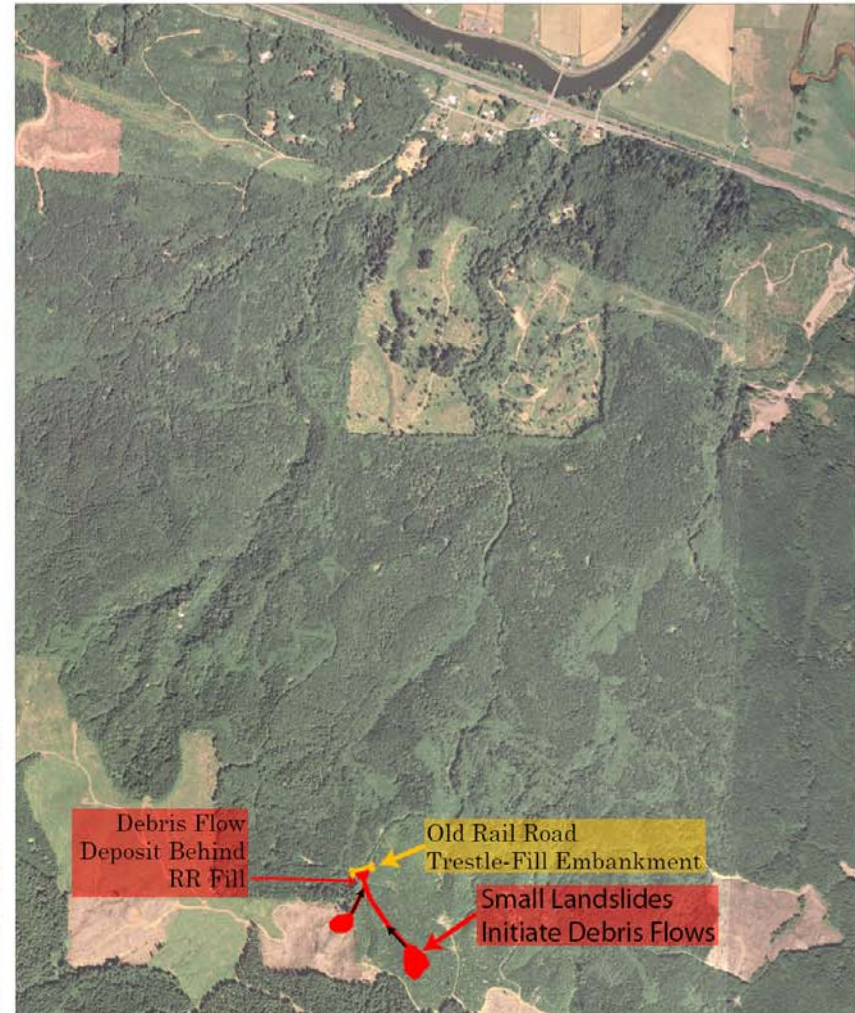
Pre-Event maps from Woodson/Highway 30 up to the ridge top
(roughly 1.5 miles)



December 2nd or 3rd Map



USGS Topographic Quadrangle



2005 Air Photo

It is likely that one or more small landslides triggered a debris flow that traveled ~1 mile to the old RR trestle-fill embankment and blocked the drainage.



December 2nd or 3rd Details

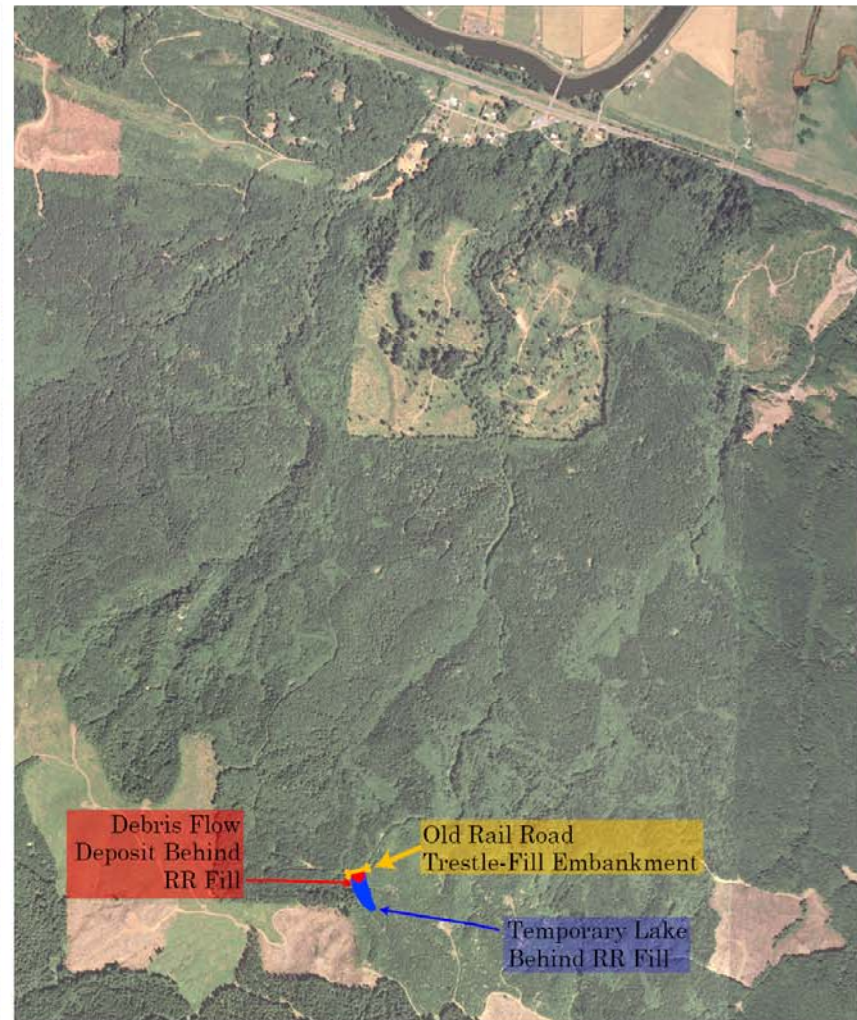
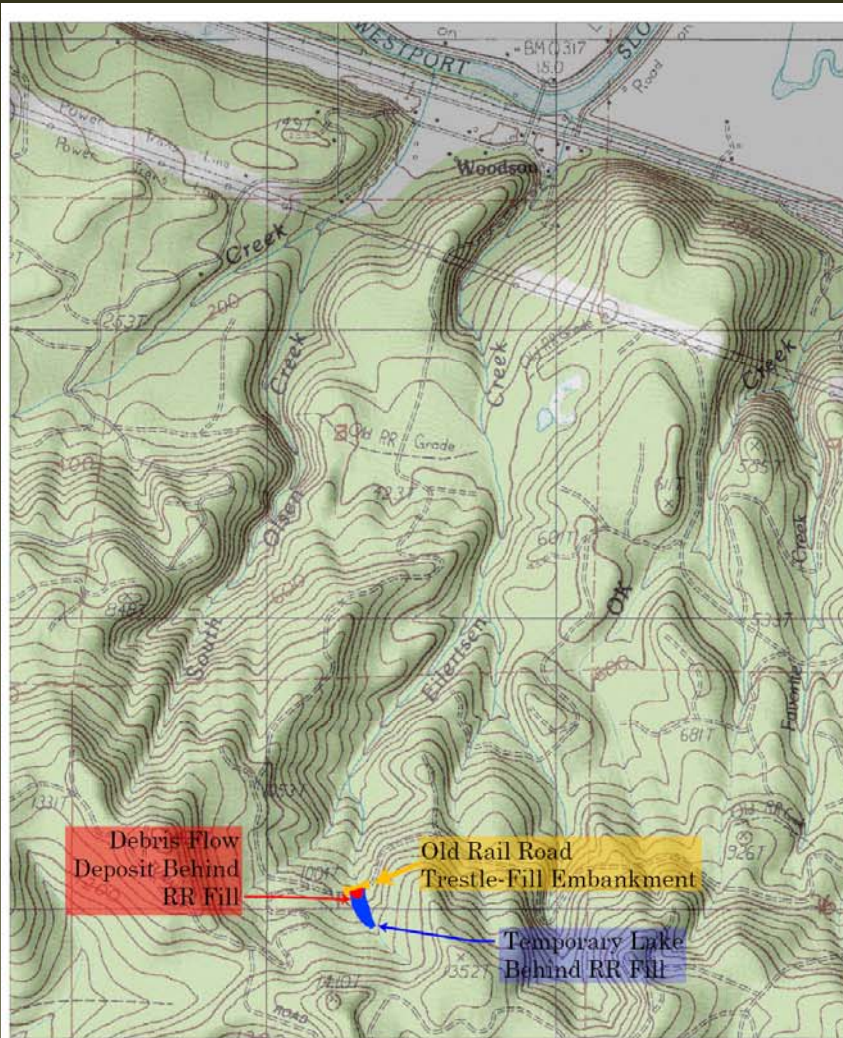
- ◆ Likely during the heavy rains on December 2nd or 3rd, one or two landslides roughly 1.5 miles up slope of Woodson and roughly 1/4 mile up slope of the RR trestle-fill embankment failed into Eilertsen Creek and formed debris flows that traveled down to the old RR trestle-fill embankment .
- ◆ These debris flows likely blocked the drainage under the RR crossing.



Photo of one of the two small landslides (eastern small landslide on previous map)



December 4th through 11th Map



With the drainage under the old RR trestle-fill embankment blocked, a temporary lake formed behind the embankment December 4-11.



December 4th through 11th Details

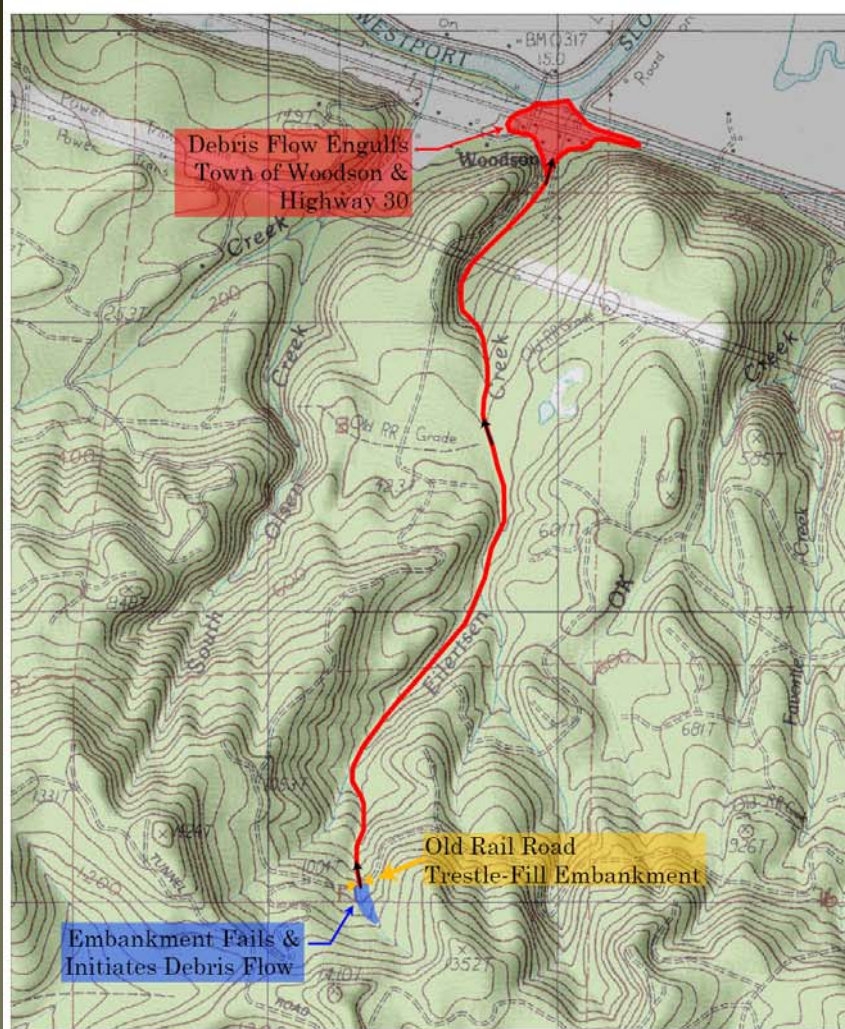
- ◆ After the drainage under the old RR trestle-fill embankment was blocked, a temporary lake roughly 30-40 feet deep and 200 feet long formed behind the embankment.
- ◆ The land owner noticed this lake and called the Oregon Department of Forestry (ODF).
- ◆ After study of the old RR trestle-fill embankment and lake, ODF notified the residents in Woodson and the Oregon Department of Transportation that a debris flow was eminent.
- ◆ The residents in Woodson were evacuated and Highway 30 closed during the morning of December 11th.



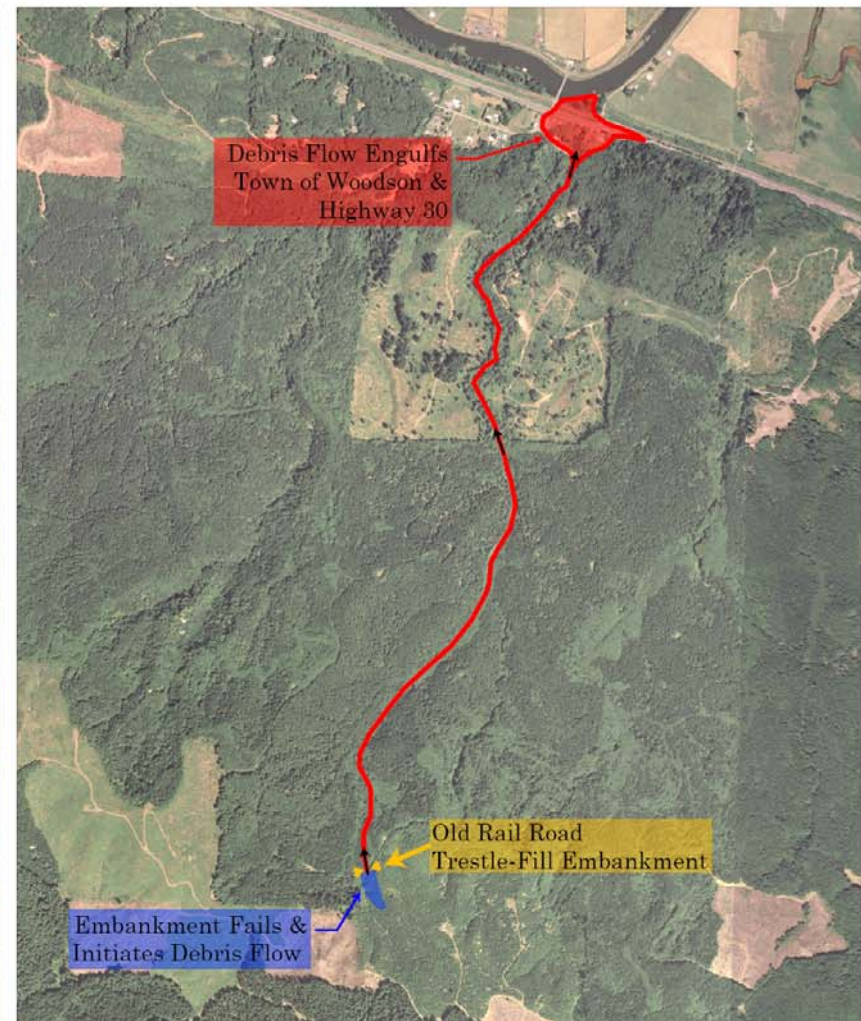
Portion of Old
RR trestle



December 11th Map



USGS Topographic Quadrangle



2005 Air Photo

The temporary lake was too deep for the old RR trestle-fill embankment to hold, and the embankment failed catastrophically, initiating a debris flow that engulfed the town of Woodson and Highway 30.



December 11th Details

- ◆ Around noon on December 11th the old RR trestle-fill embankment failed catastrophically and a debris flow engulfed the town of Woodson and Highway 30.
- ◆ There were no fatalities.



Geology

- ◆ The bedrock in the slopes above Woodson is relatively loose sandstone, which weathers to a sand.
- ◆ There are NO igneous rocks, which tend to weather to boulders.
- ◆ This is why the debris flow deposit at Woodson did not have big boulders like some other debris flow deposits in Oregon.
- ◆ The Woodson debris flow was composed of mostly water, sand, and woody debris.

Example of a Boulder Debris Flow
(Mt. Hood, 2006)



Woodson Debris Flow
with Only a Few Boulders



Prior to Intense Storm Events

- 1) Be familiar with the land around you
 - Learn if you are in a debris flow prone area
- 2) Support your local government to develop regulations or ordinances related to development in hazardous areas
- 3) Watch the weather
 - Heavy rainfall
 - Quick snowmelt
- 4) Contact local emergency-response authorities for evacuation plans in your area and develop emergency plans for your family or business



During Intense Storm Events

1) Stay awake and alert

- Listen for unusual sounds (cracking trees, boulders knocking together)
- Watch for sudden increase or decrease in water flow in a channel
- Watch for buildup of water in abnormal places

2) If you are in a debris flow prone area, consider leaving the area

3) If driving, be alert



Conclusions

- ◆ Excessive rainfall can trigger landslides
- ◆ The entire length of a drainage may be effected, especially in the drainage mouth area
- ◆ At Woodson, the hazard was increased by the water damming behind the old RR trestle-fill embankment
- ◆ Property owners and state agencies worked together to warn those at risk
- ◆ Systematic landslide hazard analysis in Oregon will lead to:
 - Effective mitigation strategies
 - Improved warning systems
 - Increased life safety and reduced property damage

