



The Groundwater Recharge Area Rule - Background and Research Strategy

Originally prepared for UPSAG for
2008 CMER Science Conference

Updated for Forest Practices Board Sept 2014

Upslope Processes Science Advisory Group

- SAG: CMER sub-group that designs and conducts research, updates Work Plan
- Topics: Slopes, roads and channels
- Expertise: Geology, Hydrology, Engineering, Forestry, Statistics
- Members: DNR, landowners, tribes, CMER staff

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- An aerial photograph of a river valley. The river flows from the top left towards the bottom right. In the foreground, a large, light-colored sandbar or gravel bar is visible, partially blocking the river's path. The surrounding landscape is a mix of green grass, brown shrubs, and patches of bare earth or rock. The background shows a dense forest of evergreen trees on a hillside.
1. Rule and Background
 2. 2007 Scoping Project
 3. Recommendations

The Groundwater Recharge Rule:

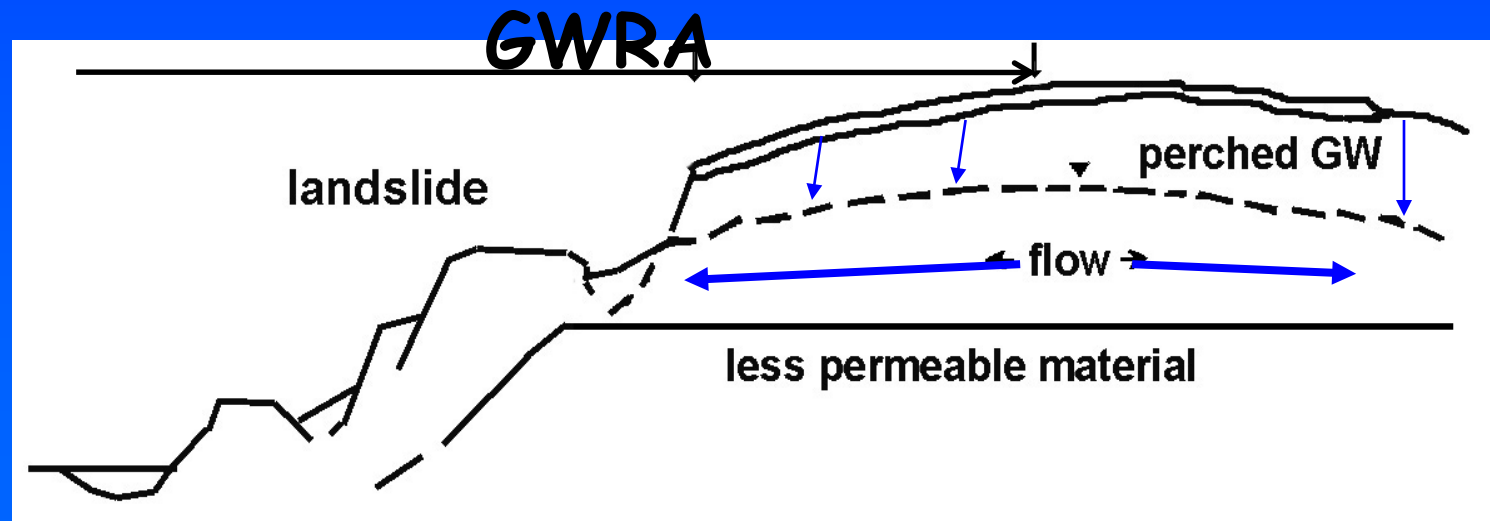
Class IV-Special and SEPA review of any forestry activities on unstable landforms with “...*the potential to deliver sediment or debris to public resource or that has the potential to threaten public safety...*”:

C. Ground water recharge areas for glacial deep-seated landslides”

WAC 222-16-050 (1)(d)(i)(C), as of 2001

Groundwater Recharge Areas

- Land up-gradient that contributes subsurface water to a deep-seated landslide in glacial sediments
- Indicated by topography but not always same



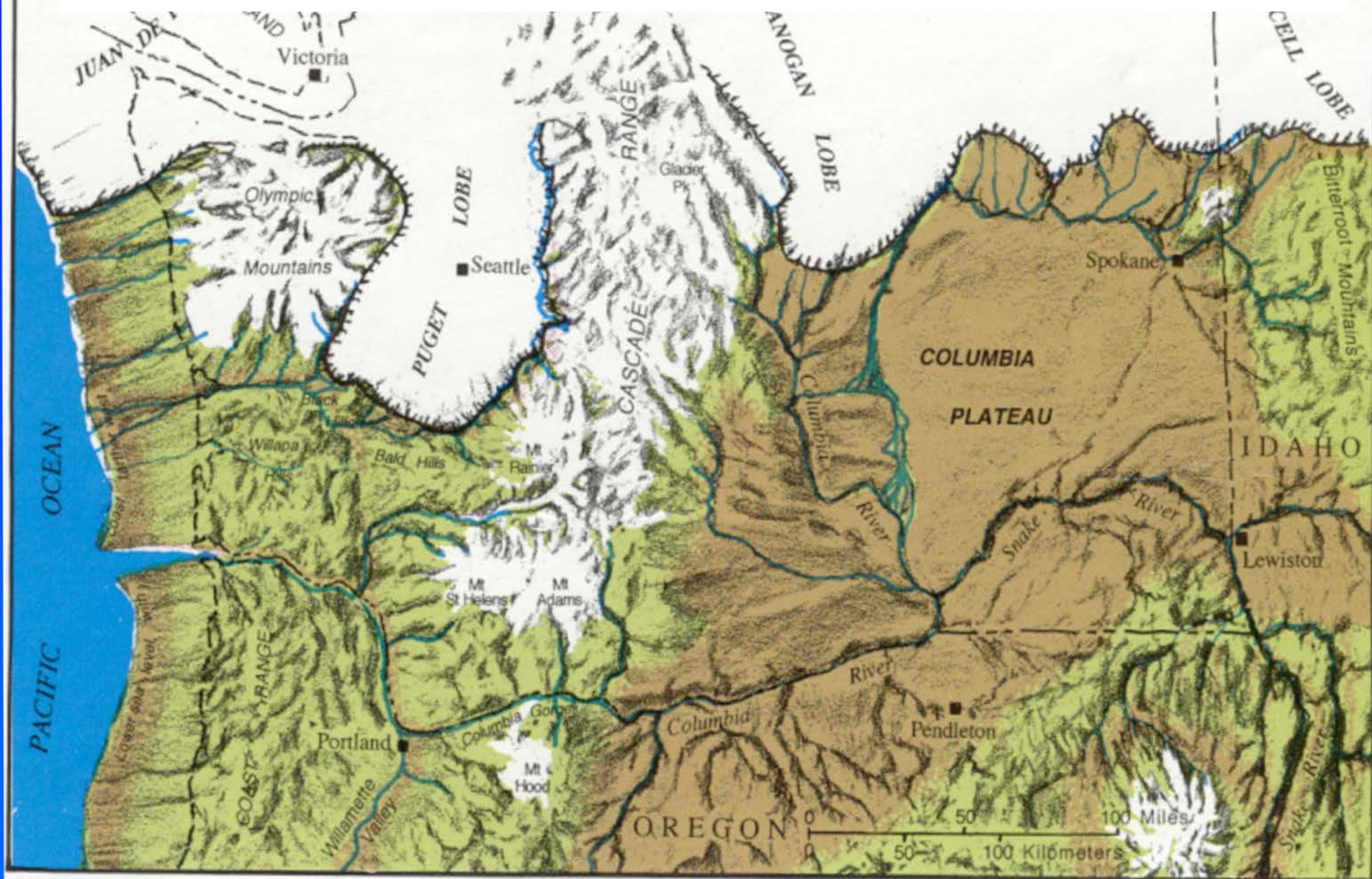
Why is there a GWRA rule?



Public Safety Impacts



Extent of glacial advance (white)



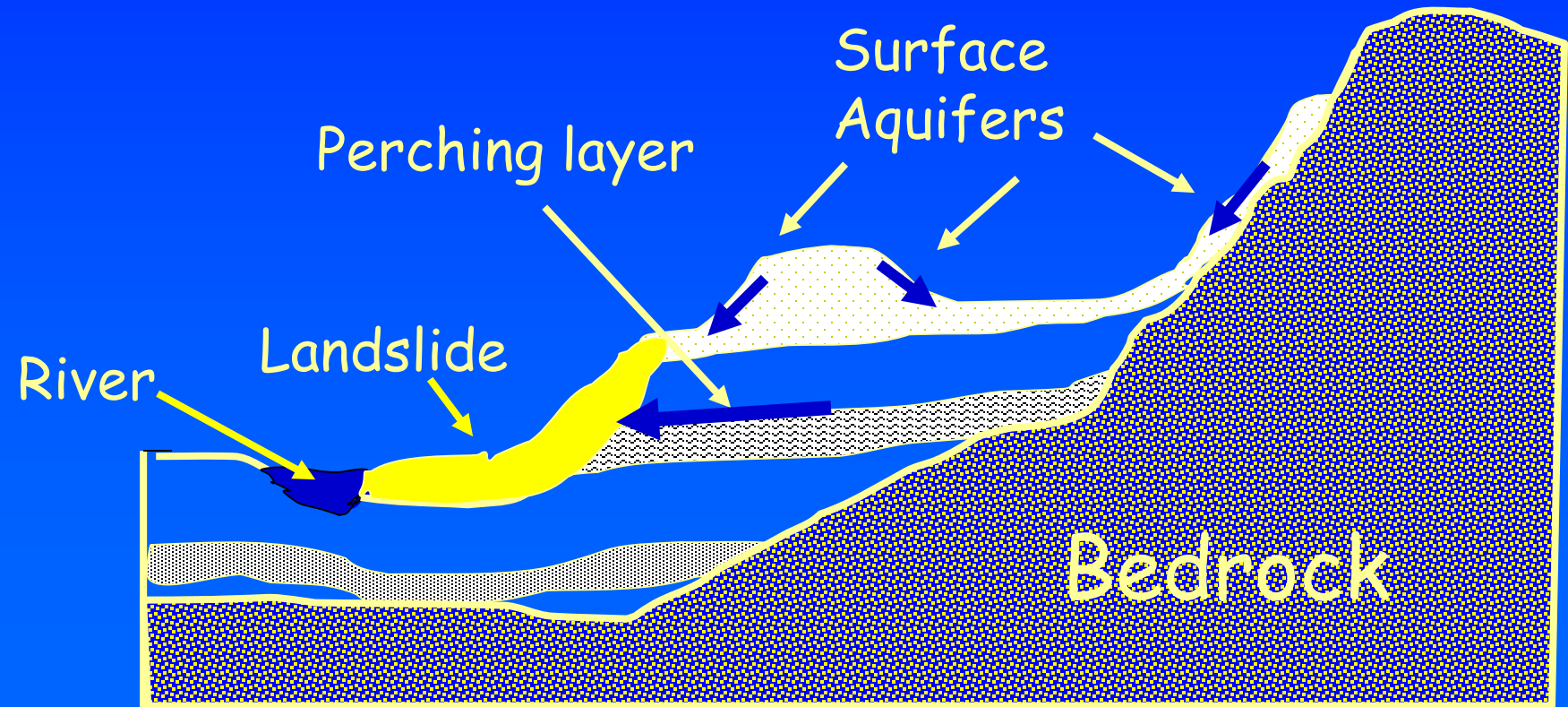
Glacial Outwash Plain



*Bedrock underlies
hillslope*

Thick unconsolidated sediments
River incision creates terraces

Deep-seated landslide in glacial sediments



Conceptual Linkages: Harvest to Deep-Seated Movement

1. Timber harvest reduces evapo-transpiration (ET), increasing moisture into soil
2. Added moisture flows into landslide, increasing saturation
3. Greater saturation increases weight and pore pressure along failure plane
4. Resulting in accelerated landslide movement
5. And greater resource impacts/risks

Scientific Difficulties

- a. Must evaluate and link three processes:
 - Evapo-transpiration
 - Groundwater movement
 - Hillslope movement
- b. Above processes all site-specific and hard to see
- c. Other uncertainties: river undercutting, runout, etc.
- d. Hard to separate potential harvest effect vs. others

Deep-seated landslide/GWRAs require evaluation on a case-by-case basis

Regulatory Difficulties

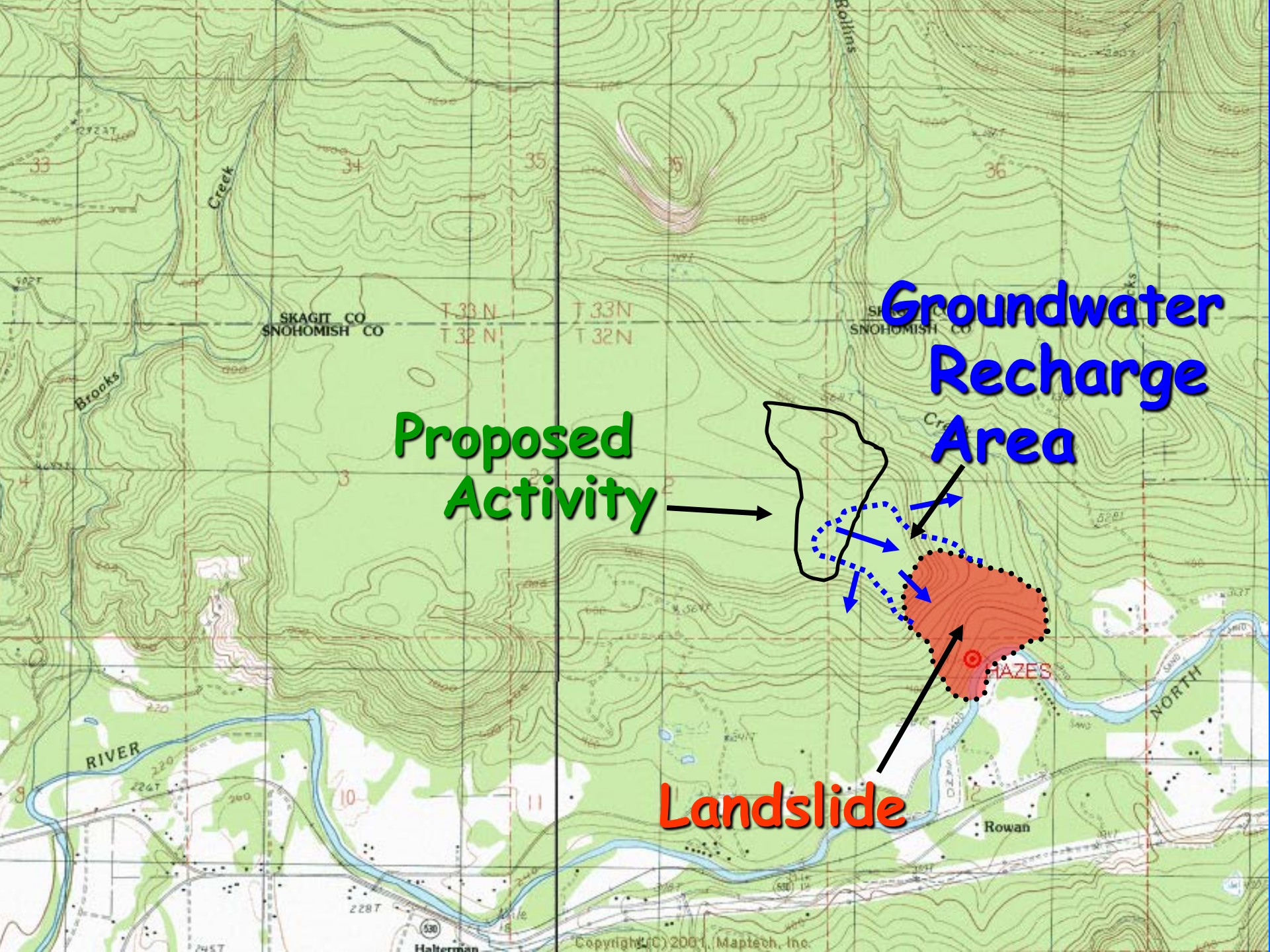
Where does IVS Rule apply?

- a. Active DS landslides only? How active?
- b. Landslides in any glacial material (till, outwash, etc) ?
- c. How deep/shallow, large/small or gradual/sudden are included?

Regulatory Difficulties -

Where is GWRA?

- a. Recharge Area has no evidence of instability
- b. GWRA can extend far upslope from the landslide
- c. Deep-seated landslides may not be mapped; GWRAAs are rarely mapped



Proposed Activity

Groundwater Recharge Area

Landslide

Regulatory Difficulties

How to Assess?

- a. What techniques are adequate for Geotech work – photos, field, modeling, drilling, monitoring..?
- b. Available modeling tools require many assumptions

Glacial Deep- seated Research Strategy



Past GWRA science

1998 - FFR Schedule L-1 Topic

2000 – UPSAG ET Project initiated

2006 – DNR/Policy Request

2007 – UPSAG Scoping Project

Further progress limited by competing priorities (prescription-scale effectiveness)

2007 Scoping Approach

1. UPSAG & geology contractors chose three possible projects
2. Contractors developed scoping papers
3. UPSAG evaluated projects
4. Results presented at 2008 CMER Science Conference

Scoped Projects

1. Evapo-Transpiration Modeling
2. Recharge Area Refinement
3. Landslide Classification

1. ET Modeling Project

- Extend previous modeling work
- Cost estimate:
~\$55k
- Doesn't address slide movement



2. Recharge Area Refinement Project

- Use ET Model to identify sensitive part of GWRA
- Cost estimate: ~\$55k per landslide category
- Requires accurate ET model
- Viability uncertain



3. Landslide Classification Project

- Create a landslide classification system based size, materials, etc.
- Cost Estimate: ~\$100 – 200k
- Project requires further scoping

2007 Recommendations

- *“No scoped project would substantially reduce scientific uncertainty”*
- *“Board Manual revision is attractive”*
- **Interest in further scoping Classification Project when more time available**
- **Scoped projects retained in CMER Work Plan as ‘placeholders’**

Board Manual Revision Approach

- Revise Board Manual (and possibly Rule) to provide guidance
- Could be done through science/policy 'stakeholder' process

Research Strategy Considerations 2014



- Technical sub-group: Sturhan, Dieu, Sarikhan
- Generated in past month
- No UPSAG/CMER or Policy review yet!

Critical Questions

- Original: *“Does harvesting of the recharge area of a glacial deep-seated landslide promote its instability?”*
- Additional: *“Can relative levels of response to forest practices be predicted by key characteristics of GDSLS and their recharge areas?”*
- Continuation of Classification Project

Possible Projects

1. Review/Synthesize Literature
2. Statewide Mapping of glacial DS slides
3. Develop 'classes' of deep-seated slides
4. Evaluate sensitivity among slide types using historical data

Further information below - very approximate!

1. Literature Review & Synthesis

Background: Expert panel recently collected large list of relevant literature

Goal: Review and synthesize literature to update research needs and questions

- Would require consultant
- 6 months, ~\$50K

2. Deep-seated Landslide Mapping

Goal: Complete statewide map of glacial deep-seated landslides

- Step 1: Compile existing info (DNR staff)
- Step 2: Fill gaps in original mapping (DNR, Consultant?)
- Total time: ~6 months, depending on gaps
- Total cost for Steps 1&2: \$100K or less

3. Classify Deep-seated Landslides

Goal: Identify categories of GDS landslides that respond differently to forest practices

- Possible criteria: size, depth, slope, glacial materials, etc.
- Requires a consultant
- 6 months, ~\$75K

4. Sensitivity of Landslide Classes

Goal: Identify historic response to management for landslide classes

- Correlate movement to harvest, weather and channel activity
- Would use air photos and field work
- Requires consultant
- 12 months, ~\$200K