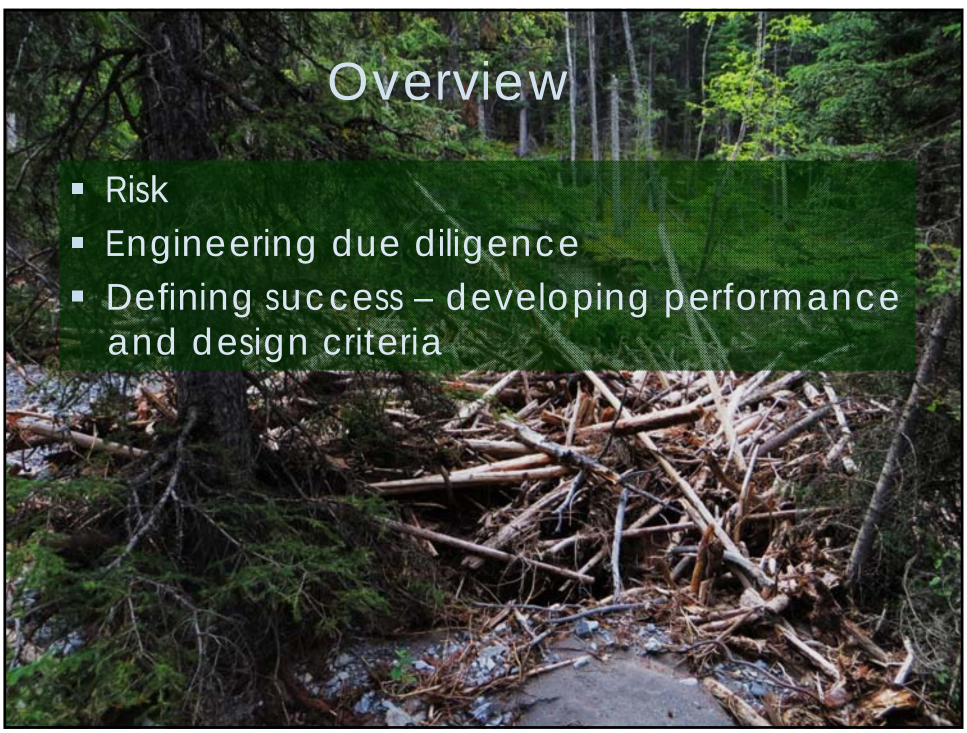

MANAGING RISK AND EXPECTATIONS IN LARGE WOOD PROJECTS
Dan Miller, PE


Overview
▪ Risk
▪ Engineering due diligence
▪ Defining success – developing performance and design criteria

## DEFINING RISK

## Defining Risk

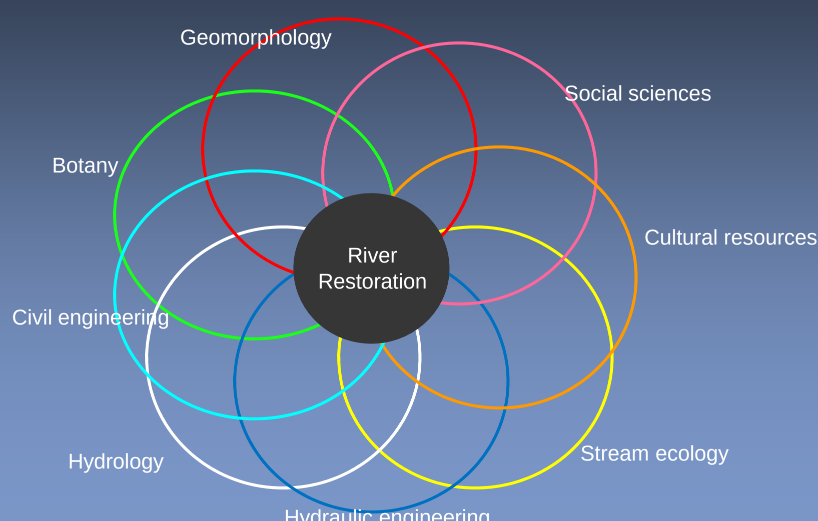
- Webster: *n. the possibility of danger, injury, loss etc.*
- Risk = Consequence x Probability of Occurrence
- Your job as a designer is to determine the consequences possible and calculate the probability of occurrence (as low, medium or high)
- Probability of occurrence helps the engineer choose a factor of safety

# Implications of ignoring risk

- In court, an attorney or administrative judge will ask you, “Did you assess the possible consequences?” and “Did you calculate the probability of occurrence?” You’d better have an answer.
- You could **lose a license** to practice, which in turn hurts your group’s reputation.
- Your business or group could be **sued for damages** or forced to do design and construction repair of damage.
- Some firms have gone bankrupt or sold liability to other larger firms capable of absorbing the liability for the price of institutional knowledge.

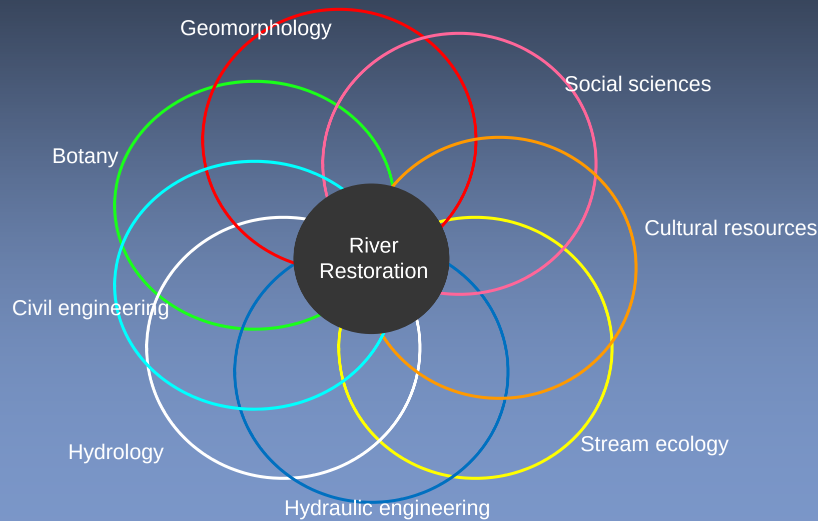
# THE MANY FACETS OF RIVER RESTORATION

- Current and hopefully future river restoration encompasses (or will encompass) many disciplines



# MODES OF FAILURE IN RIVER RESTORATION

- Look similar? You can have a failure in any one of these disciplines, so it pays to have a broad knowledge base




# NEWS FLASH: IF YOU ARE NOT WORKING WITH OTHERS, YOU ARE NOT PRACTICING DUE DILIGENCE

## Balancing risk and other goals

- We know what *good* things wood can do, but to manage risk, you need to understand consequences – Ask yourself what could go wrong?
- Infrastructure damage
  - Culvert blockage
  - Road failure
  - Dams


## Risks

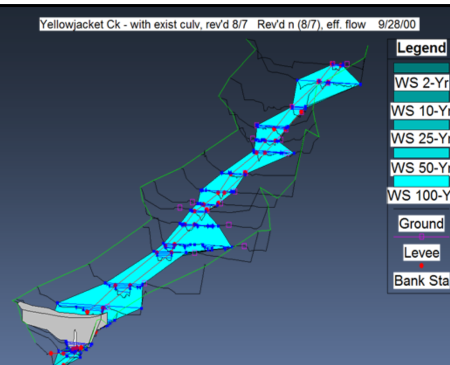
- Public safety
  - Occupational safety (builders/assessors)

# Risks

- Public safety
  - Paddlers
  - Floaters
  - Attractive nuisance

# Risks

- Public safety
  - Flood elevation
  - Flood path changes




## Risks

- Ecological
  - Access and construction disturbance
  - Invasive species introduction
    - Plants
    - Beetles
  - Check with your state DNR for wood transportation restrictions


## Balancing risk and other goals

- Money
  - Funders will want to know why their money has gone downstream
  - Who will pay for the repair/replacement?
  - Your (or your organization's) reputation is at risk
  - Public perception – Loss of $50K or $500K will raise public ire (NASA example)
  - Risk losing future funding


## Why have Criteria?

- Goals and objectives provide basis for design criteria
- Focus resources
- Prioritize activities
- Avoid being “everything to everybody”
- Establish monitoring parameters
- Provide a baseline for project evaluation

Define Success!

*So that others don’t define it for you

# Design Criteria

- Project performance criteria:
  - o Example: Stabilize the bank

- Project ***design criteria***:
  - o Design must be able to withstand the 25-yr flood
  - o Bank stability must be maintained for up to 2 months of inundation
  - o Wood must provide a minimum of 5 years of immobile toe protection, after which it is assumed that stabilizing vegetation will achieve long term toe protection

# Defining due diligence

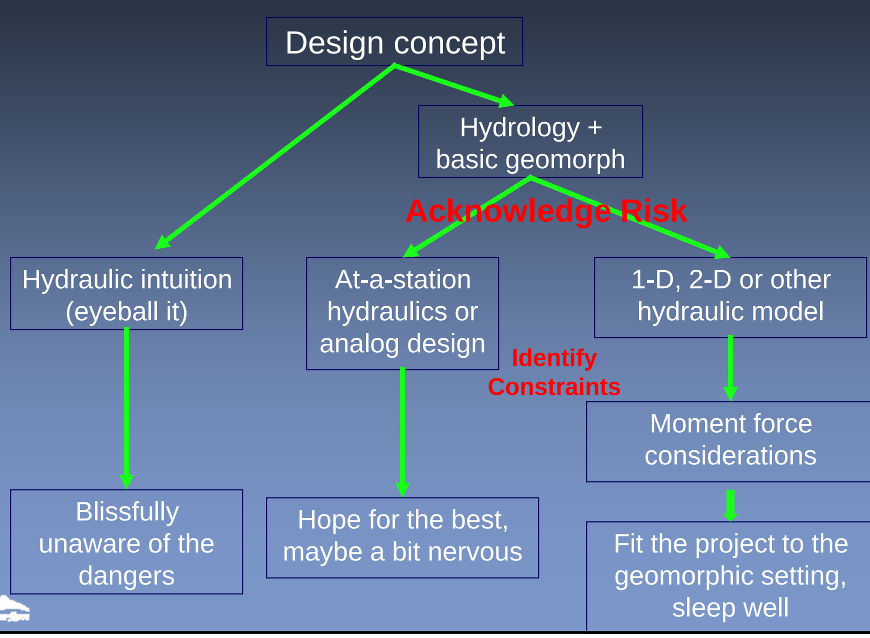
- Would you be able to defend your design and your organization’s actions if it came to it?

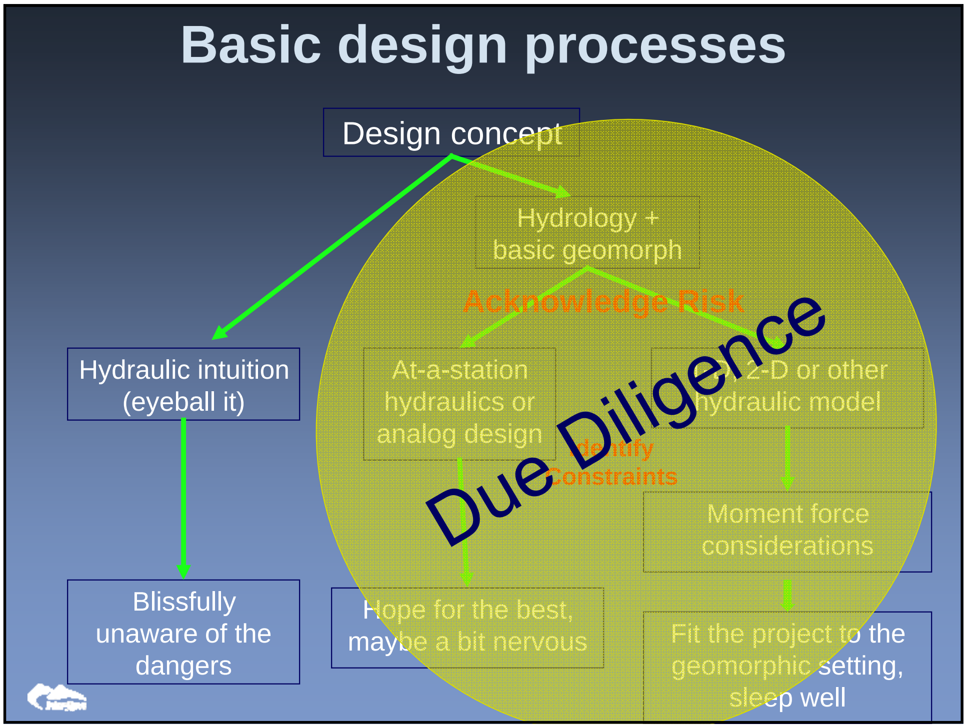
# Defining due diligence

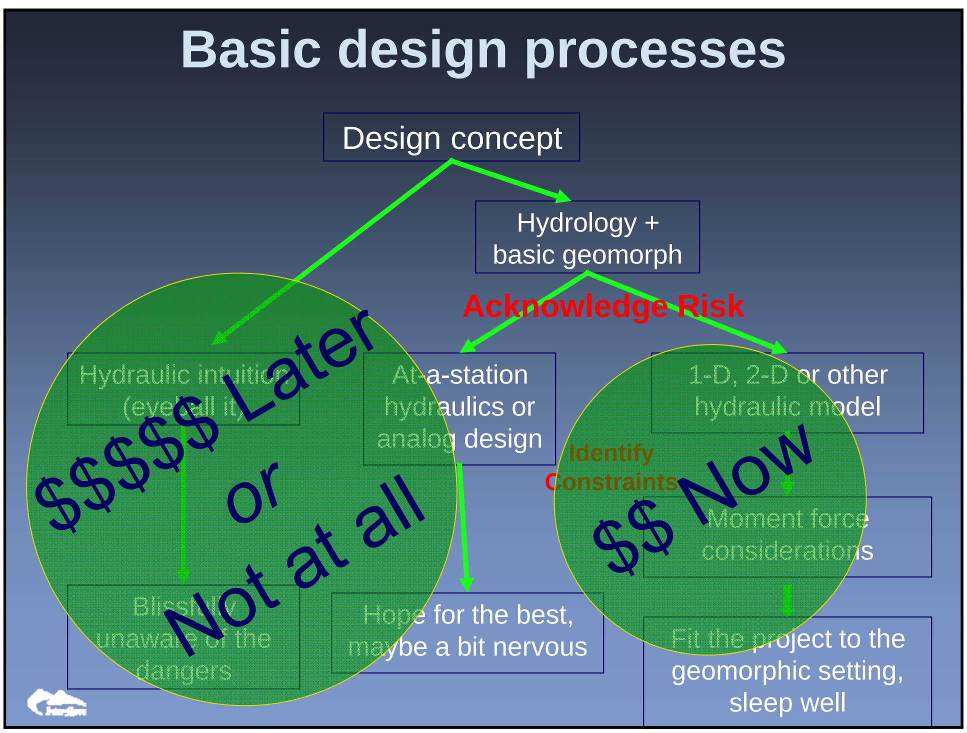
- Just the cost of defending yourself can put you out of business

Oso, WA landslide 2006

# Basic design processes




Basic design processes
Design concept
Hydrology +
basic geomorph
Acknowledge Risk
Hydraulic intuition
(eyeball it)
At-a-station
hydraulics or
analog design
1-D, 2-D or other
hydraulic model
Identify
Constraints
Moment force
considerations
Blissfully
unaware of the
dangers
Hope for the best,
maybe a bit nervous
Fit the project to the
geomorphic setting,
sleep well
Due Diligence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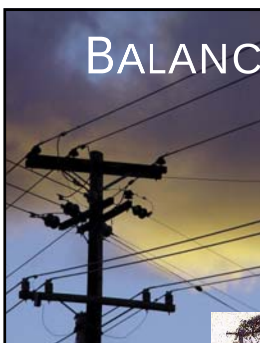
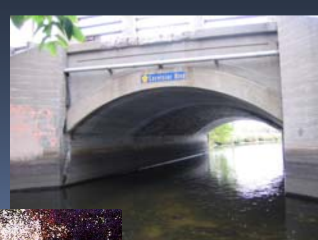
Fit the project to the
geomorphic setting,
sleep well
$$$$$ Later
or
Not at all
$$ Now

## NEWS FLASH:
## YOU MAY BE <u>PERSONALLY</u> LIABLE FOR DAMAGES CAUSED BY YOUR PROJECT


## BALANCING RISK AND DUE DILIGENCE





Manage risk <u>prior</u> to construction

- Utilities
- Soils
- Dewatering
- Future build-out conditions

# Balancing Risk and Due Diligence

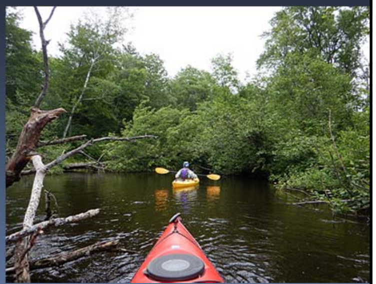
- Have a checklist that includes a breakdown of the following:
  - Performance criteria
  - Stakeholder ID
  - Public involvement
  - Background info (geomorph, F&W, cultural etc.)
  - Survey/Topographic info
  - H&H
  - Botanical
  - Feasibility
  - Design submittals
  - Permitting
  - Monitoring & maintenance


Low intensity due diligence


High intensity due diligence

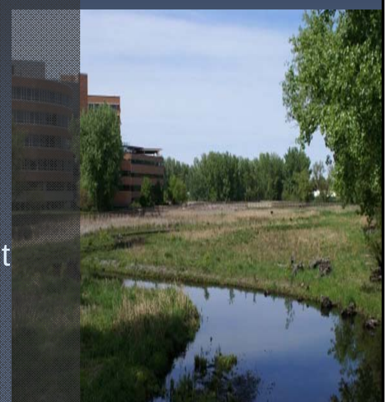
# Planning for Public Safety

- Involve stakeholders
  - Give them ownership in the process
  - Reiterate that they have a responsibility to be safe (i.e. wear floatation, avoid)
  - Don't wait until 90% design stage
- Incorporate user ideas into the performance criteria
- Design to minimize hazard to the extent possible
- **Opinion**: We need to be careful that we don't give the impression that designs are somehow "boater safe"



## DESIGNING FOR PUBLIC SAFETY – PADDLERS/FLOATERS

- Avoid strainers
- Adequate line of sight
- Deflecting structures
- Downstream facing piles
- Compact
- Submerged at time of use
- Consider behavior of structure at various flows
- Design portages
- Know where access is located



See SHRG Appendix F – Public Safety

## DESIGNING FOR PUBLIC SAFETY – PADDLERS/FLOATERS

# DESIGNING FOR PUBLIC SAFETY – PADDLERS/FLOATERS

# DUE DILIGENCE REVIEW

Q: How do you reduce risk and liability for yourself and the stakeholders?

A: Practice due diligence

Q: What's the best form of due diligence?

A: Use the industry **standard of care**, document work

## STANDARDS FOR RIVER RESTORATION

- **Standard of care** = The design professional, whether engineer or scientist, must perform with the level of skill and diligence that those engaged in the same profession would ordinarily exercise under the same or similar circumstances…

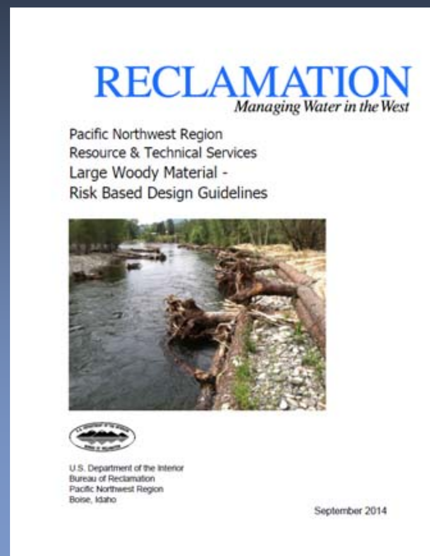
- Stamp does not guarantee success, but *"indicates that the engineer has used his or her best professional judgment in upholding the industry "standard of care" in the design process" (Slate et al. 2007)*

## STANDARDS OF PRACTICE

Q: What are the best engineering standards of practice for wood projects?

A: Those are still being developed, but SHRG, NRCS and BOR are all working on those. Some places have their own internal standards. Strength is found by referring to multiple sources.

# Defining Risk

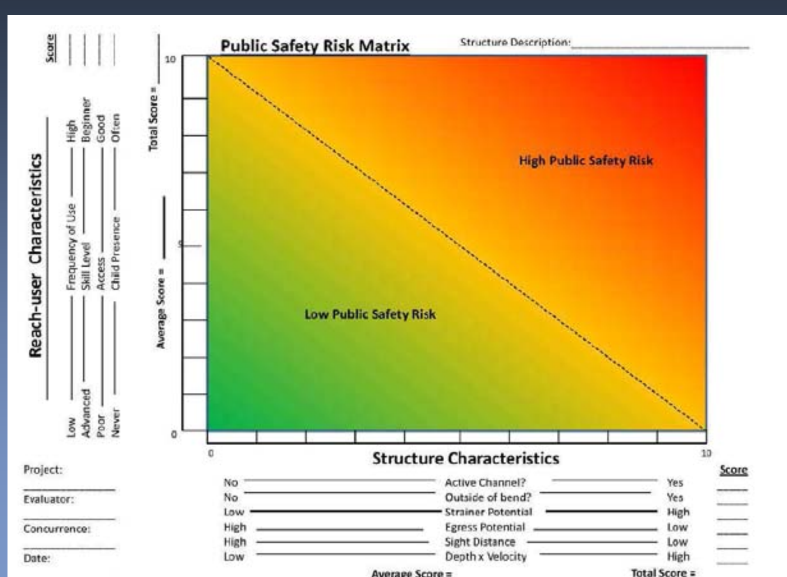

RECLAMATION
*Managing Water in the West*

Pacific Northwest Region
Resource & Technical Services
Large Woody Material -
Risk Based Design Guidelines

U.S. Department of the Interior
Bureau of Reclamation
Pacific Northwest Region
Boise, Idaho

September 2014

Mike Knutson, P.E.
and Jeff Fealko, P.E.



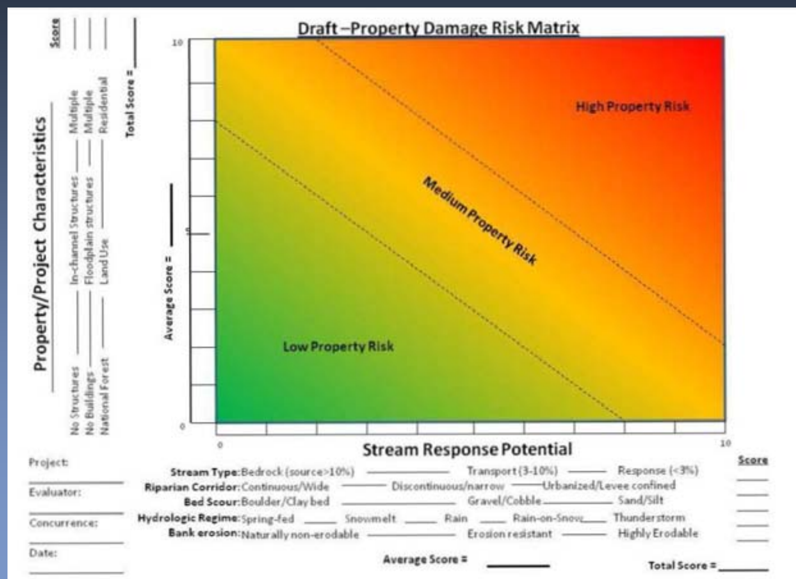



**Table 1. LWM Risk Rating Design Requirements for Reclamation Projects (see above for definitions).**

| Public Safety Risk | Property Damage Risk | Stability Design Flow Criteria | River Use Survey Needs | Geomorphic Assessment Needs | Design Team Needs | Hydraulic Model Requirements |
|---|---|---|---|---|---|---|
| High | **High** | 100-year | Public Interview | Reach Scale | PE, FG, FB, HE | 2 dimensional |
| High | **Moderate** | 50-year | Public Interview | Rapid | PE, FG, FB, HE | 2 dimensional |
| High | **Low** | 25-year | Public Interview | Rapid | PE, FG, FB | 2 dimensional |
| Low | **High** | 100-year | Literature Review | Reach Scale | PE,FG, FB, HE | 2 dimensional |
| Low | **Moderate** | 25-year | Literature Review | Rapid | PE, FG, FB | 1 dimensional |
| Low | **Low** | 10-year | Literature Review | Rapid | PE, FB | No requirement |

**Table 2–4** Potential range of qualified risks for selected instream treatment techniques*

| Technique | Risk to habitat | Risk of channel change | Risk to infra-structure, property, or public safety | Uncertainty of technique | Probability of success |
|---|---|---|---|---|---|
| Boulder clusters | Low | Low to moderate | Low | High | Moderate |
| Channel modification | High | High | Low to high | High | Low to high |
| Drop structures | Low to moderate | Moderate | Low to high | Low | Moderate to high |
| Fish passage restoration | Low to high | Low | Low to moderate | Low | High |
| Instream sediment detention basins | Moderate to high | Low to moderate | Moderate to high | High | Low to high |
| Large wood and logjams | Low | Moderate | Moderate to high | Moderate to high | Moderate |
| Side channel/off-channel habitat restoration | Low | Low to moderate | Low | Low | High |

* Derived from Stream Habitat Restoration Guidelines, September 2004; Washington Department of Fish and Wildlife, U.S. Fish and Wildlife Service, and Washington Department of Ecology: *http://wdfw.wa.gov/hab/ahg/shrg/*

NRCS – Stream Restoration Design, 2007

## NEWS FLASH:
## EXPERIENCE IS NOT DUE DILIGENCE

## DUE DILIGENCE AFTER DESIGN

- Qualified contractors
- Adequate construction observation
  - Tight controls on specs/details
  - Placement
  - Countermeasure installation details
  - Backfill and compaction
- Monitoring
  - As-built surveying
  - Label logs (metal or other tags)
  - Annual monitoring

## NEWS FLASH:

IF YOU DON'T DOCUMENT YOUR DUE DILIGENCE, IT'S THE SAME AS NOT DOING ANY

## DO YOU NEED ENGINEERING?

- There is no affirmative determination (yet) that projects involving wood placement require engineering expertise
- However, the statutory definition of engineering is broad enough whereby a judge could easily interpret Large Wood / ELJs as within that definition

AELS Sec. 08.48.341. Definitions:

(14) "practice of engineering" means professional service or creative work, the adequate performance of which requires the specialized knowledge of applied mathematics and sciences, dealing with the design of structures, machines, equipment, utilities systems, materials, processes, works, or projects, public or private; the teaching of advanced engineering courses in institutions of higher learning; the direction of or the performance of engineering surveys, consultation, investigation, evaluation, planning, and professional observation of construction of public and private structures, works, or projects and engineering review of drawings and specifications by regulatory agencies; "practice of engineering" may by regulation of the board include architectural building design of minor importance, but it does not include comprehensive architectural services;

## WAYS TO PROTECT YOURSELF

- Include occupational *hazard warning language* in the specs, point out the hazard
- Require project owner and/or post *warning signs* for river users
- Require the owner to indemnify you if warning signs are not posted or not maintained
- Design access and *portage* where it makes sense
- Include spec language recommending long-term *maintenance*
- Practice engineering *due diligence*
- Do not fund or stamp projects for which engineering due diligence was not practiced

## Take home message

- Properly assess *consequence*
- Properly assess *probability of occurrence*
- Conduct the *appropriate amount* of due diligence
- Be safe