Design process: Risk evaluation

Bruce Heiner

Design process: Risk & uncertainty evaluation

Ellen Wohl, Bric

(5) A landowner whose land is used for a habitat project that is included on a habitat project list, and who has received notice from the project sponsor that the conditions of this section have been met, may not be held civilly liable for any property damages resulting from the habitat project regardless of whether or not the project was funded by the salmon recovery funding board. This subsection is subject to the following conditions:

(a) The project was designed by a licensed professional engineer (PE) or a licensed geologist (LG, LEG, or LHG) with experience in riverine restoration;

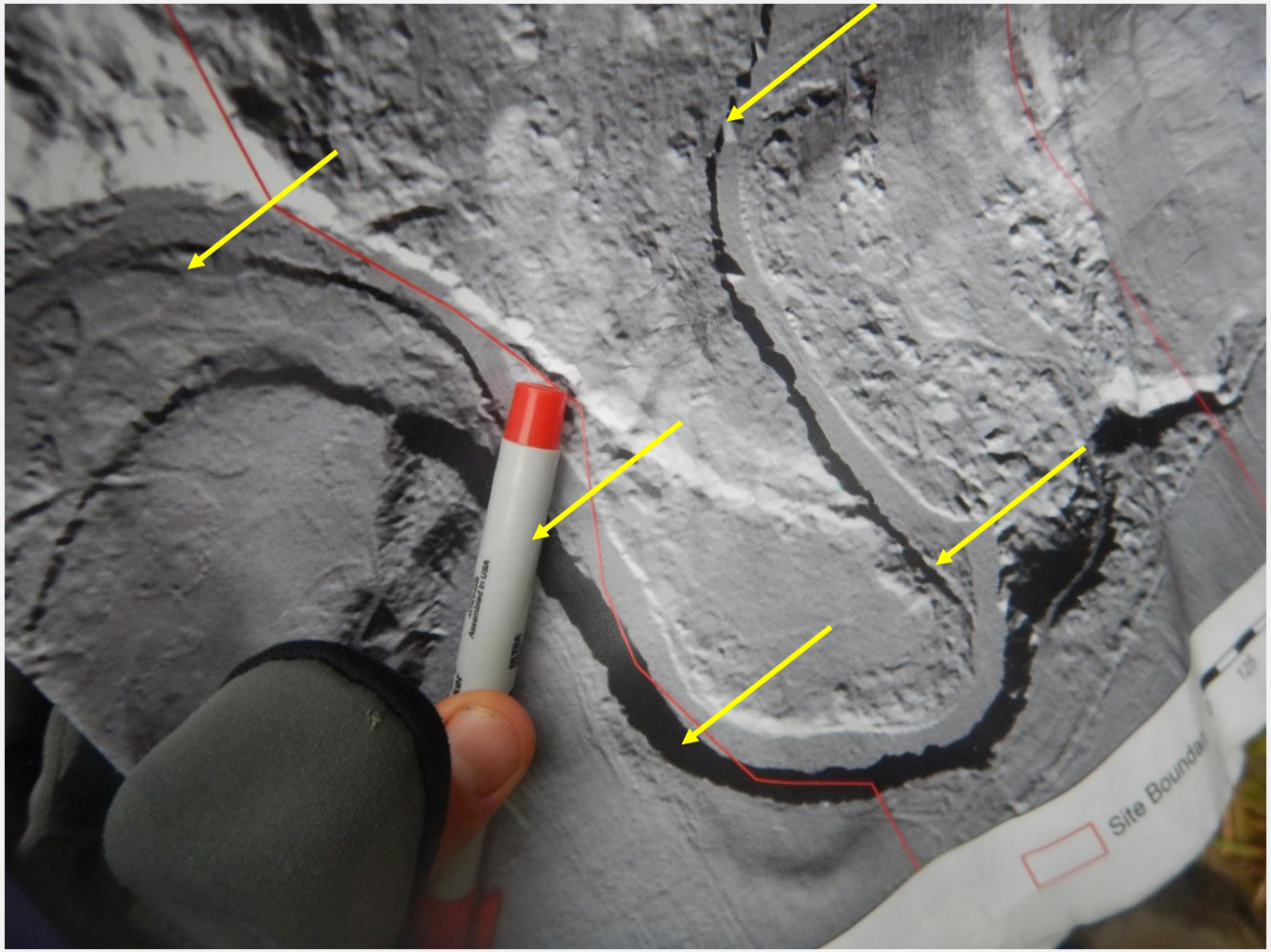
(b) The project is designed to withstand one hundred year floods;

(c) The project is not located within one-quarter mile of an established downstream boat launch;

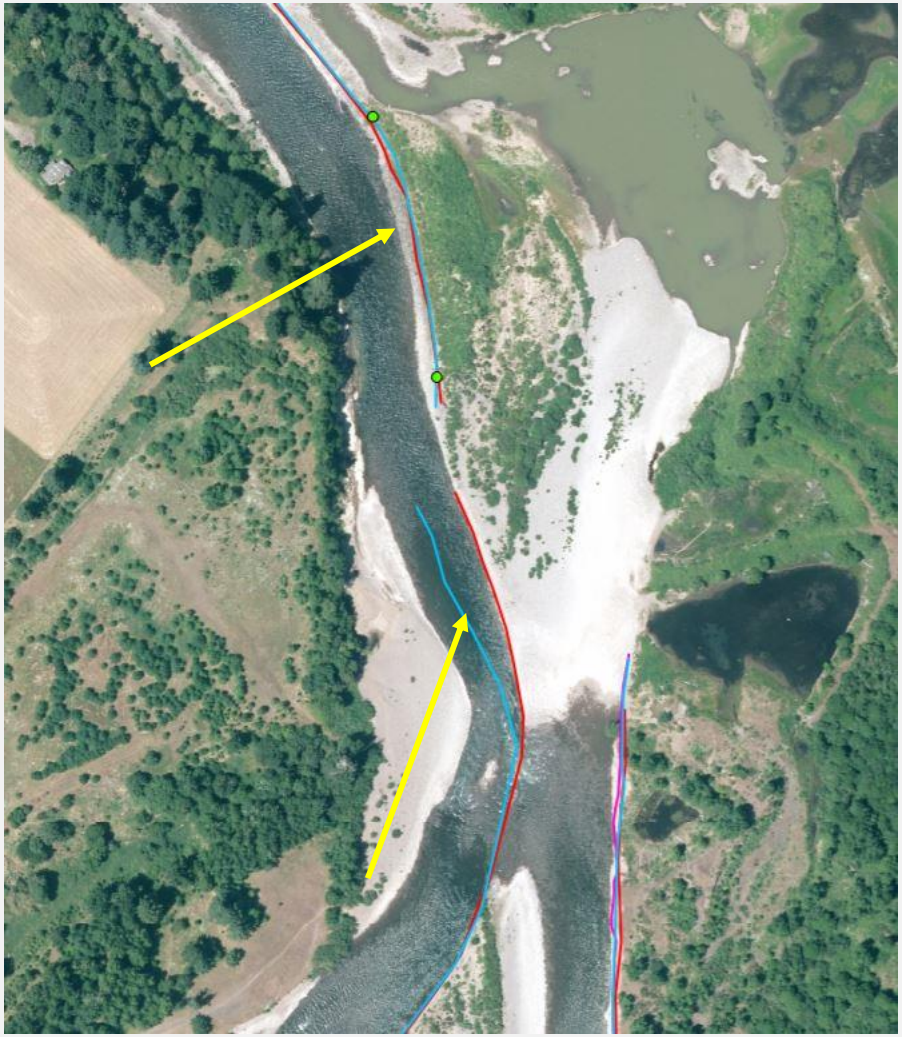
(d) The project is designed to allow adequate response time for in-river boaters to safely evade in-stream structures; and

(e) If the project includes large wood placement, each individual root wad and each log larger than ten feet long and one foot in diameter must be visibly tagged with a unique numerical identifier that will withstand typical river conditions for at least three years.

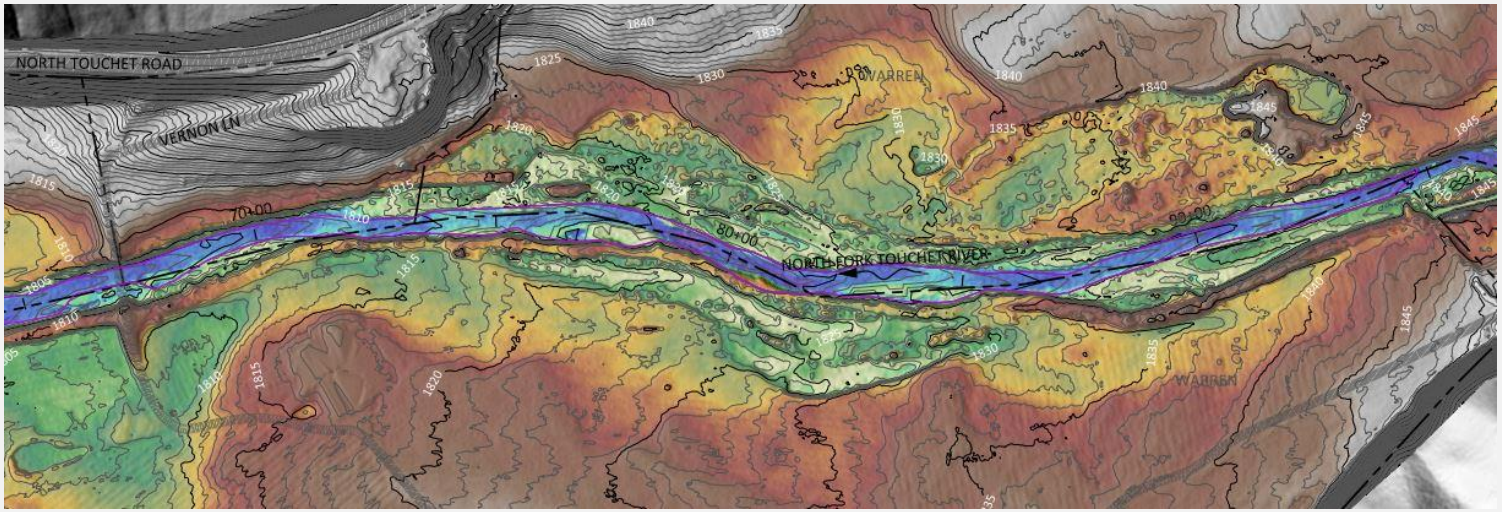
Design consideration: Site selection

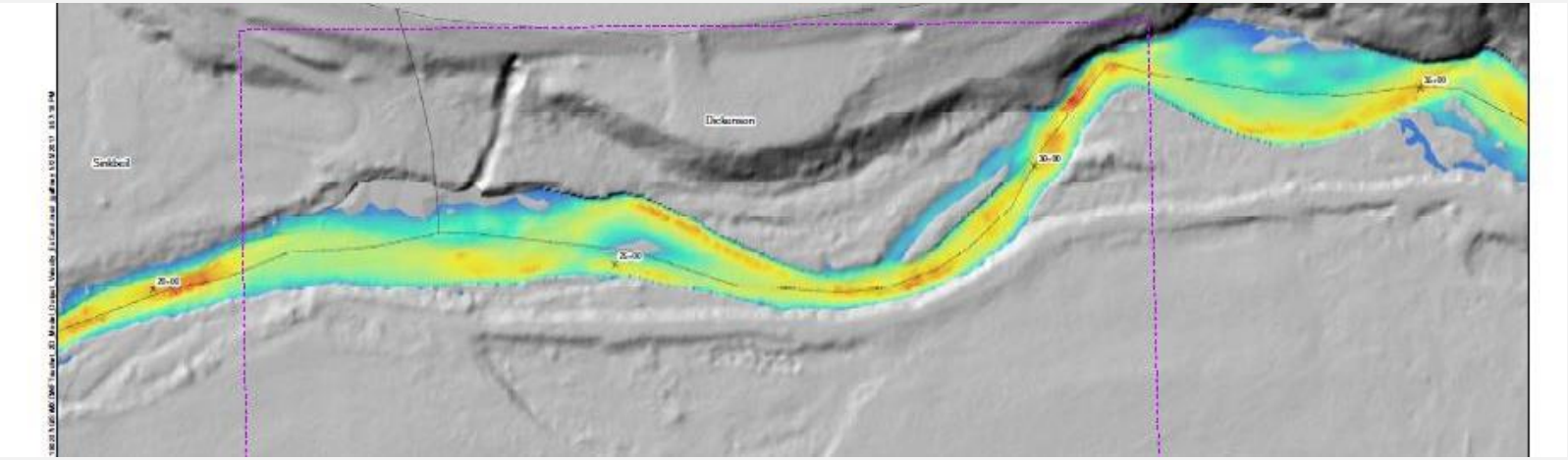


Design consideration: Site selection



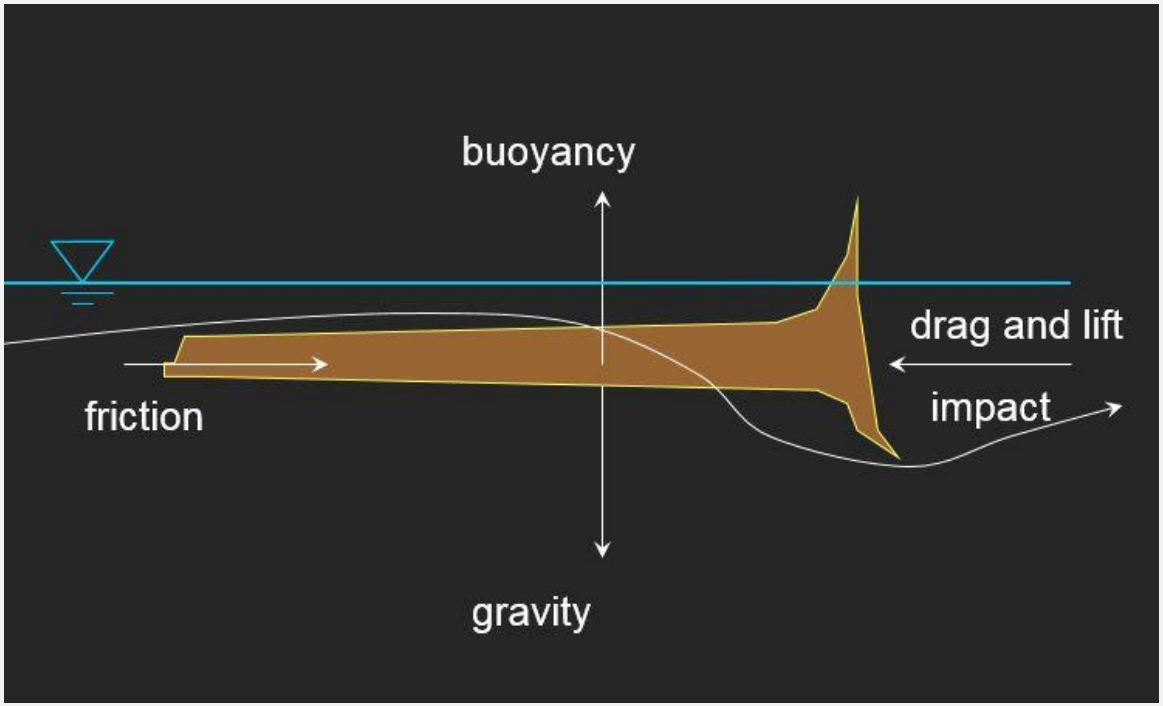
Design consideration: Site feasibility





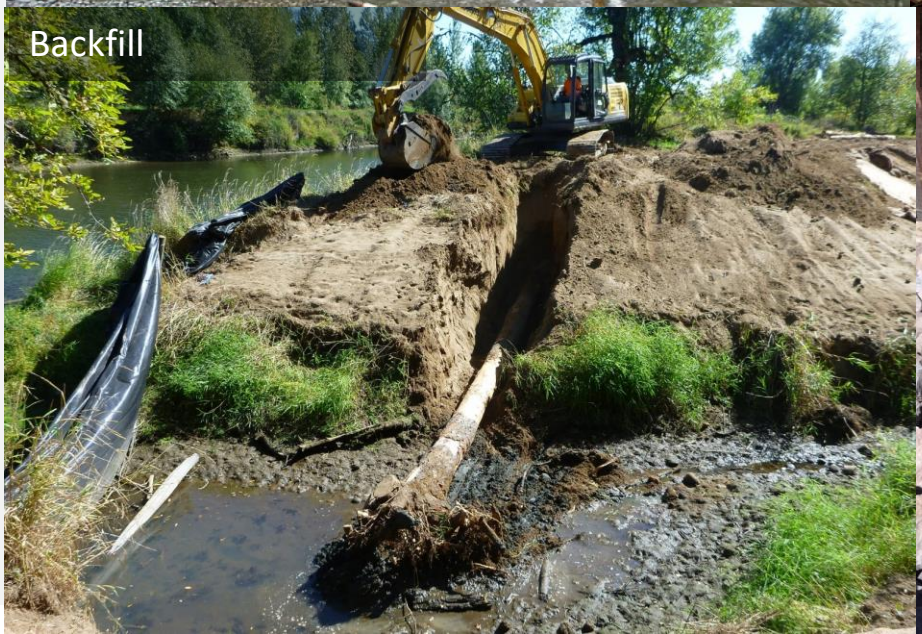
Design consideration: Stability

“Can’t nobody hold me down” Puff Daddy f. Mase, 1997



Design consideration: Stability…to ballast or not?

Design consideration: Anchoring



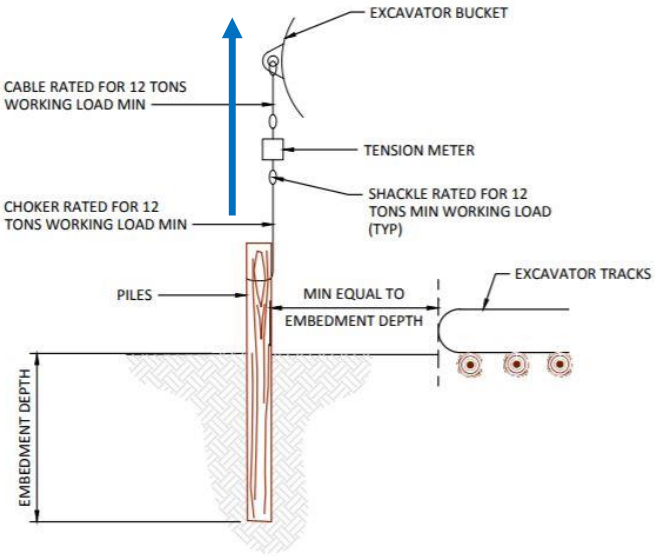
Design consideration: Vertical Pile Anchoring

“Good vibrations” – Marky Mark and the Funky Bunch, 1991

(Video)

Design consideration: Vertical Pile Anchoring

"Good vibrations" – Marky Mark and the Funky Bunch, 1991



2 / D8 PILE TESTING
NTS

PILES

ALL VERTICAL PILES SHALL BE INSTALLED USING VIBRASONIC PILE DRIVING EQUIPMENT. INSTALLATION BY EXCAVATION OR HAMMERING WILL NOT BE ALLOWED.

RIGGING

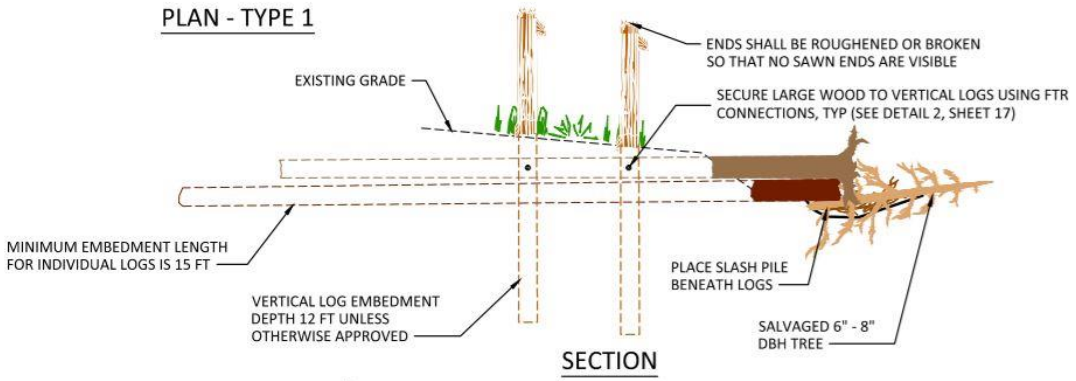
RIGGING FOR PILE TESTING SHALL CONFORM TO THE TENSION SCALE MANUFACTURER'S RECOMMENDATIONS.

CHOKERS, CABLES AND SHACKLES SHALL HAVE MINIMUM WORKING LOAD RATING OF 12 TONS. FITTINGS SHALL BE SIZED ACCORDINGLY

TESTING

TESTING OF PILES SHALL BE PERFORMED IN THE PRESENCE OF THE ENGINEER OR OTHER QUALIFIED PERSONNEL.

EACH PILE TEST SHALL HAVE UPWARD LOAD GRADUALLY INCREASED AND AS CLOSELY ALIGNED TO AXIS OF PILE AS POSSIBLE. RECORD THE PILE DIAMETER, EMBEDMENT DEPTH AND MAXIMUM FORCE REQUIRED TO MOVE THE PILE . UP TO



1 / 17 TYPICAL DETAIL - BANK MARGIN STRUCTURE
NOT TO SCALE

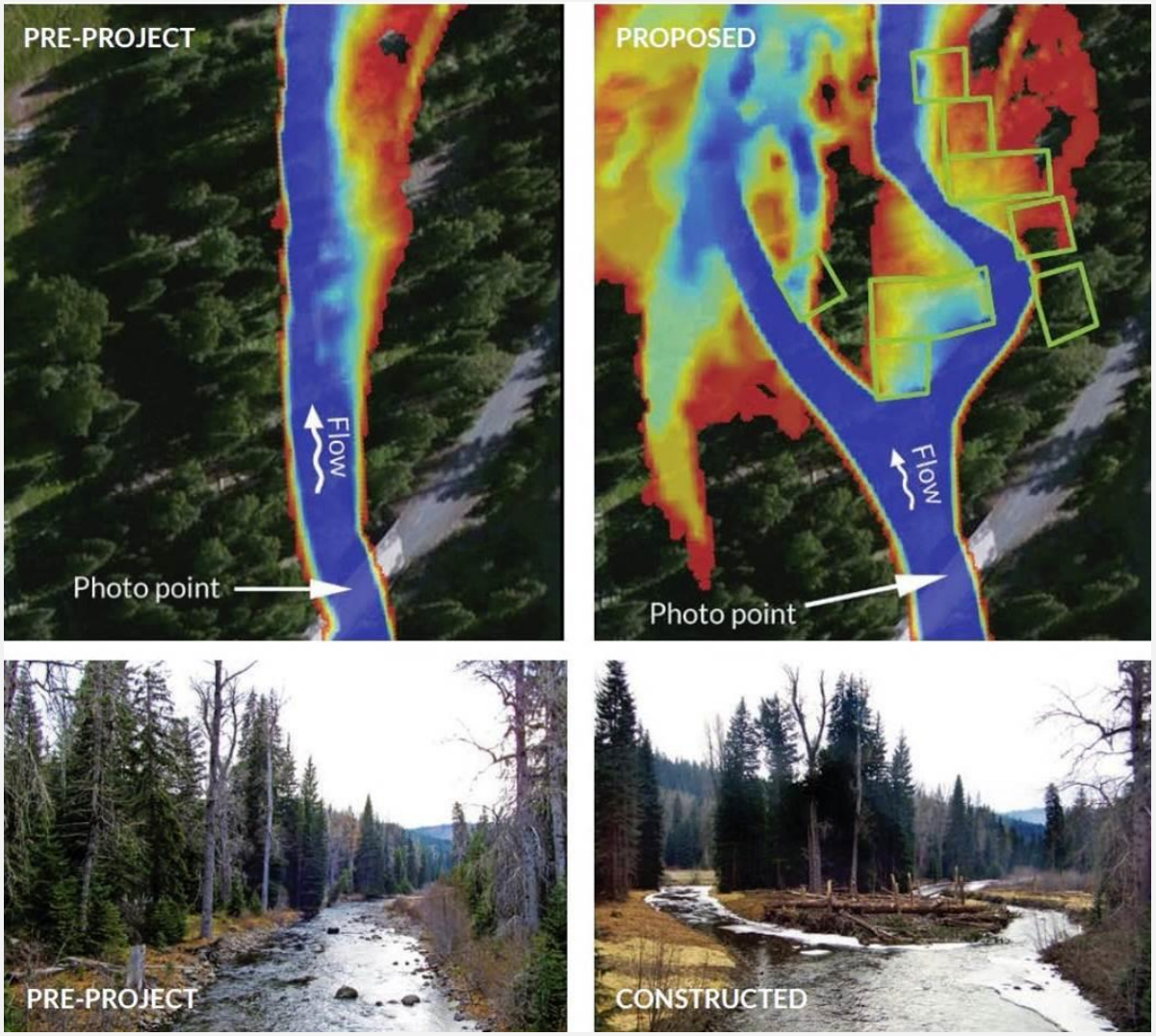
Design consideration: Size of structure

Design consideration: Size of structure

Design consideration: Size of structure

Design consideration: Placement and orientation

Design consideration: Process-promoting



Design consideration: Brush packing

Salmon Creek, WA

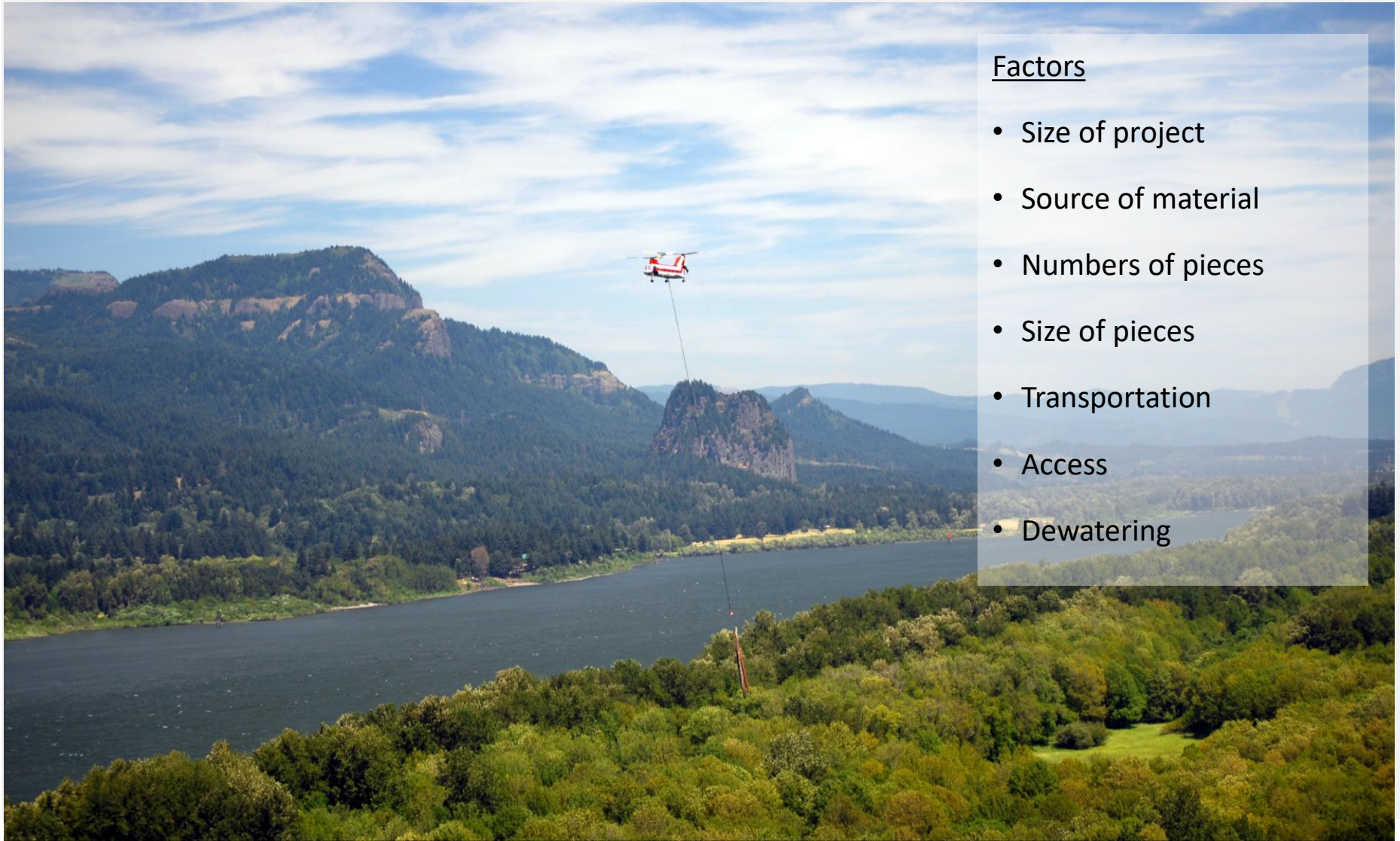
Design consideration: Materials

Wood removed from Swift Reservoir, Lewis River, WA

Project consideration: Permitting

- Streamline permit
- FEMA No-Rise policy
- Public safety (signage)

Project consideration: Cost estimation



Factors

- Size of project
- Source of material
- Numbers of pieces
- Size of pieces
- Transportation
- Access
- Dewatering

Construction considerations: Feasibility

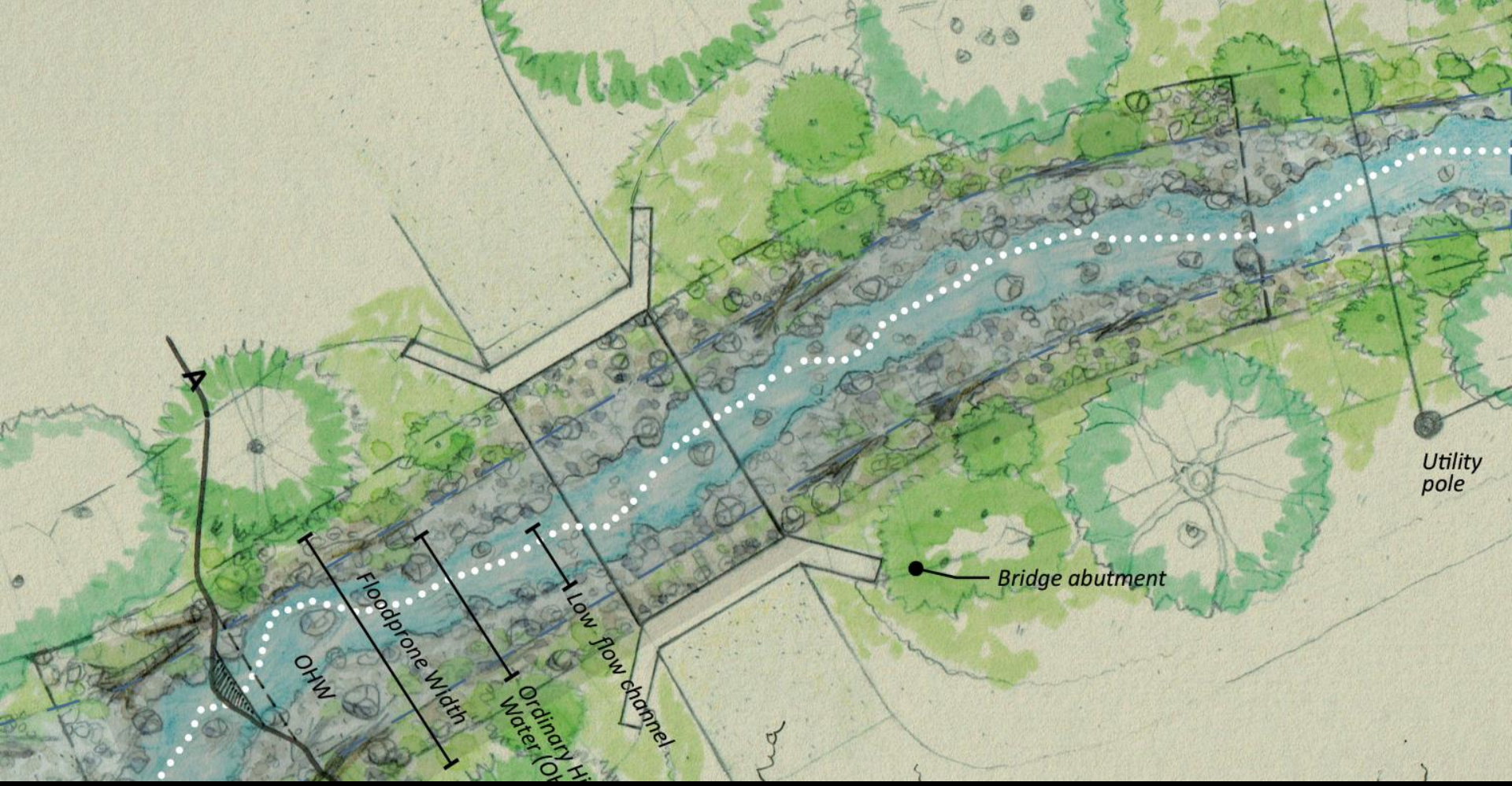
Clear Creek, OR

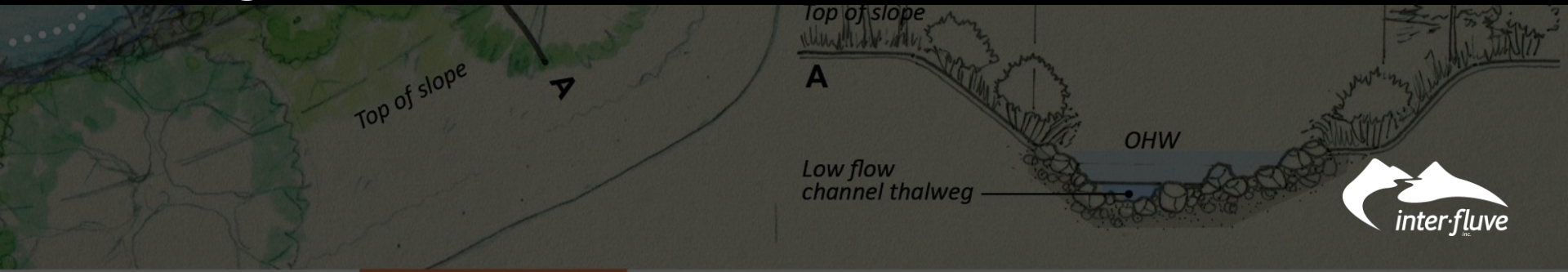
Project consideration: Monitoring and maintenance

- Based on goals and objectives
- Implementation effectiveness
  - Use by target species
  - Performance
- Movement not necessarily failure

Kelley Creek

2. Roughened Channels

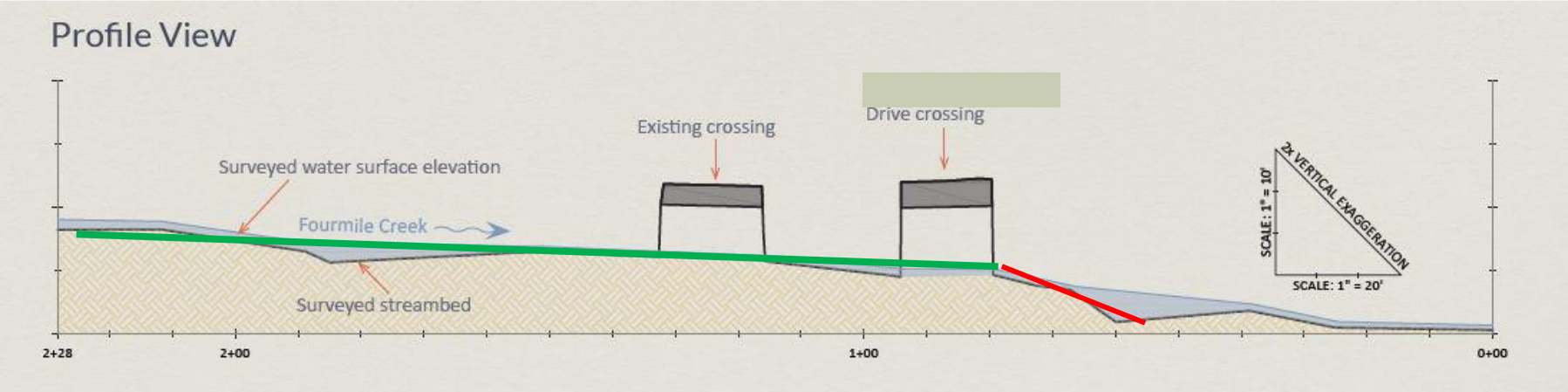




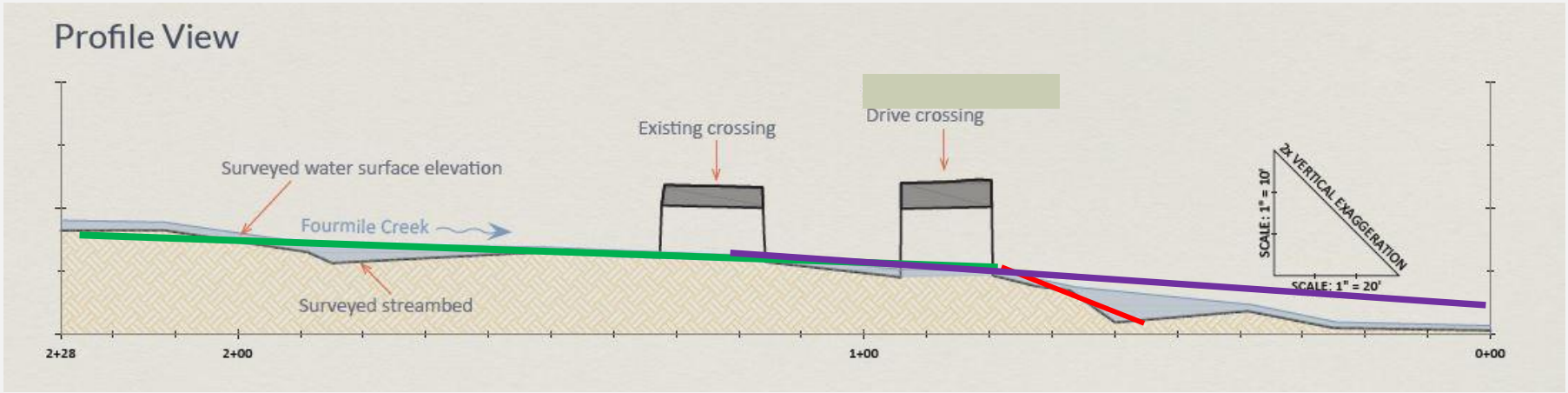

Go Rams!
By Dan Miller (in absentia)

The problem

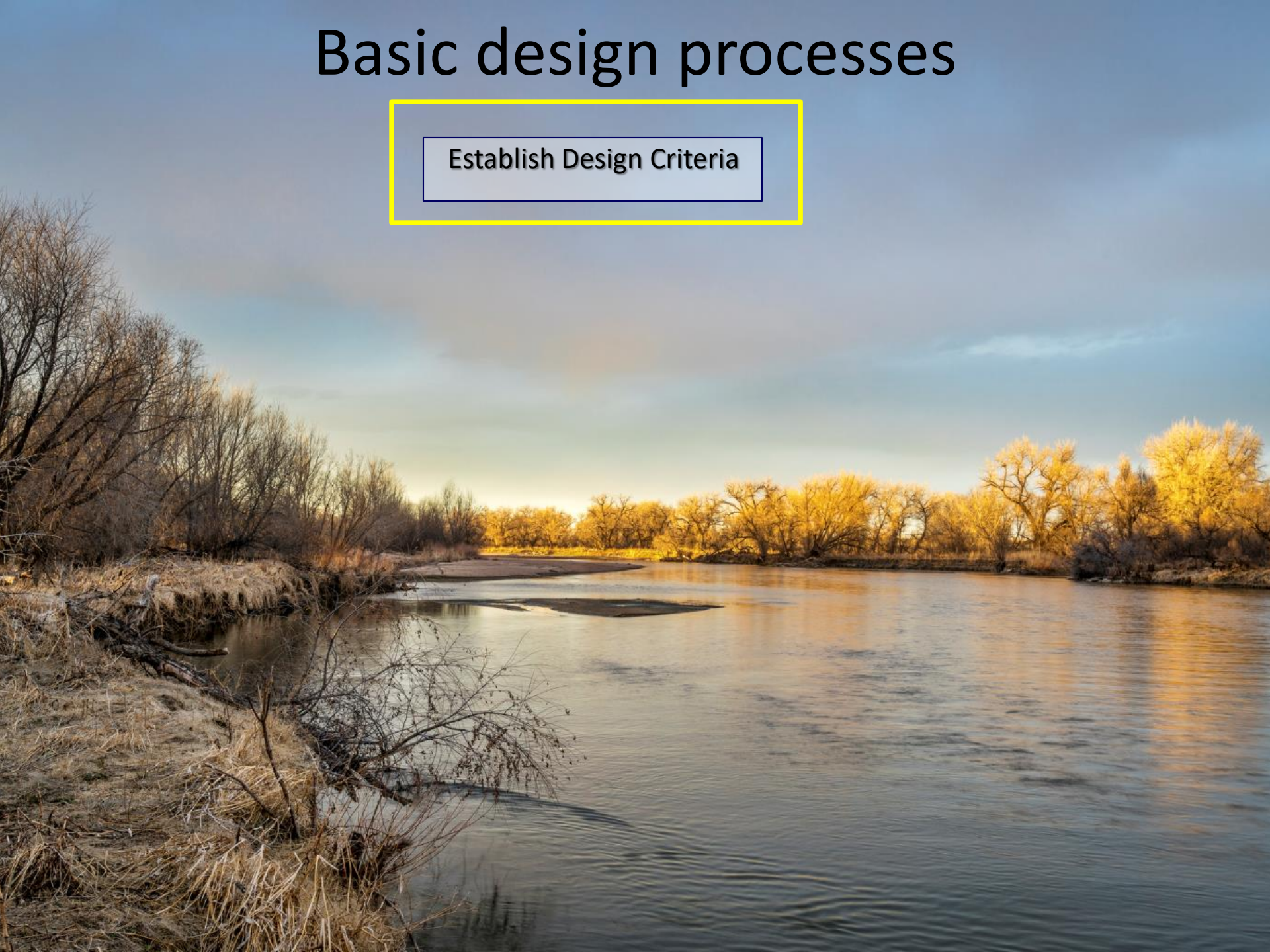
The problem


Profile View
Existing crossing
Drive crossing
Surveyed water surface elevation
Fourmile Creek
Surveyed streambed
2x VERTICAL EXAGGERATION
SCALE: 1" = 10'
SCALE: 1" = 20'
2+28
2+00
1+00
0+00

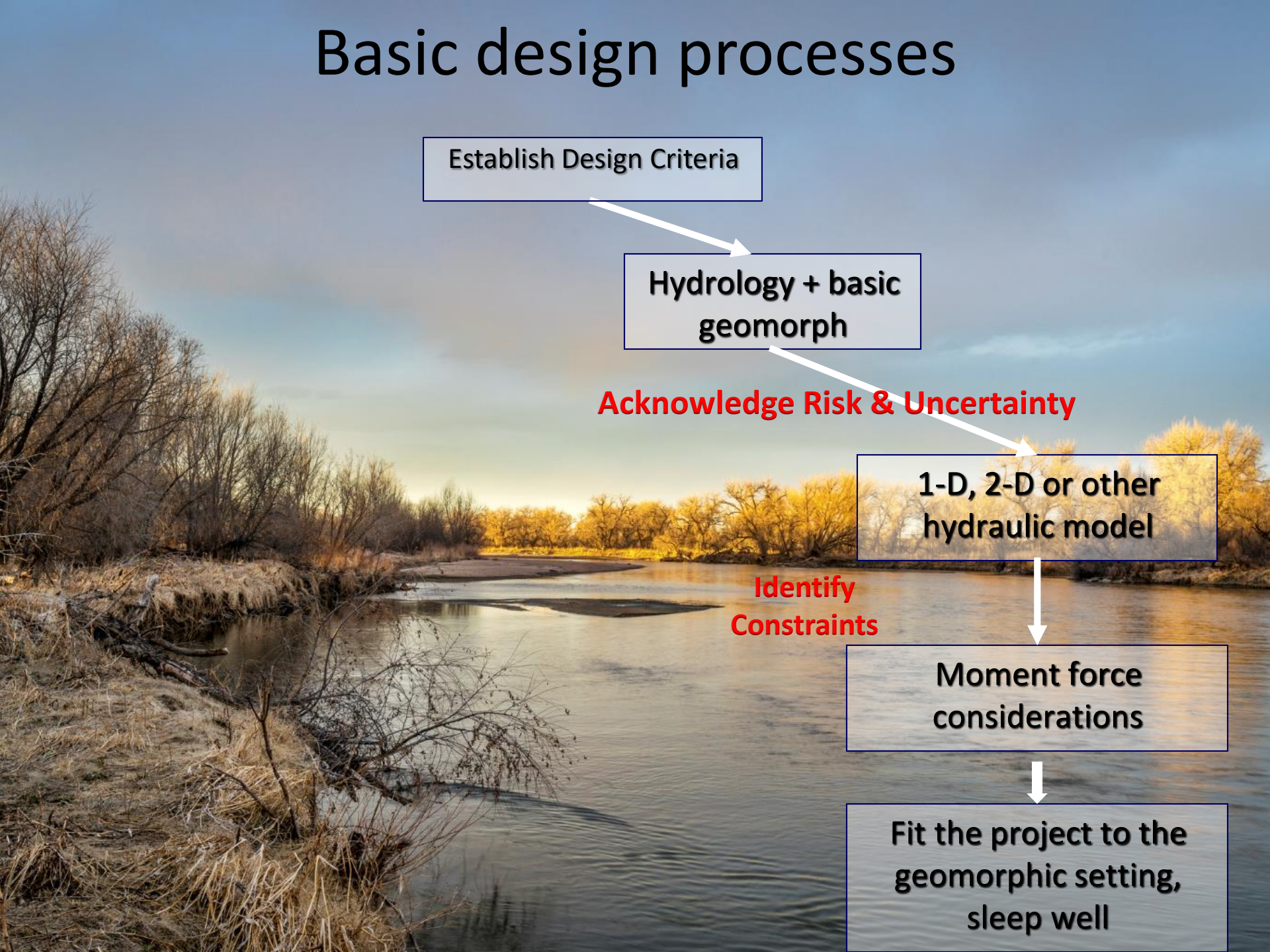
Solution: Roughened Channel



Basic design processes



Basic design processes



Design Consideration: Substrate

Moment-Stability Rock Sizing Procedure

Ref: Pierre Julien, 1995. *Erosion and Sedimentation* Cambridge University Press
pg 121 to 126

Equations:

$$\text{eta} = \frac{21 * \text{tau}}{(\text{gamma(s)} - \text{gamma}) * \text{Ds}}$$

$$\text{beta} = \arctan \frac{\cos(\text{lambda})}{\frac{(M + N)\sin(\text{theta})}{N * \text{eta} * \tan(\text{phi})} + \text{SIN(lambda)}}$$

$$\text{eta'} = \text{eta} * \frac{(M/N) + \sin(\text{lambda} + \text{beta})}{1 + (M/N)}$$

$$\text{s.f.} = \frac{\cos(\text{theta}) * \tan(\text{phi})}{\text{eta'} * \tan(\text{phi}) + \sin(\text{theta}) * \cos(\text{beta})}$$

FH

SUMMARY Legend: Entered values / Result

Moment-Stability Rock Sizing Calculations

Project XS	bed shear, tau	Particle Size, D84 =		Theta			Phi, angle of	
	psf	ft	in	H:1V	degrees	radians	degrees	ra
3.0-psf	3.00	1.00	12.0	3.00	18.43491	0.32175	41	0.7
4.0-psf	4.00	1.50	18.0	3.00	18.43491	0.32175	41	0.7
5.0-psf	5.00	1.75	21.0	3.00	18.43491	0.32175	41	0.7
6.0-psf	6.00	2.25	27.0	3.00	18.43491	0.32175	41	0.7
7.0-psf	7.00	2.75	33.0	3.00	18.43491	0.32175	41	0.7

USCOE Steep Slope Rock Design:

Ref: EM 1110-2-1601, Hydraulic Design of Flood Control Channels, June 30 1994, USCOE

Eqn 3-5, pg

D30 = $(1.95\, S^{0.555} (1.25 * q)^{2/3}) / (g^{1/3})$

D30 = 1.65 ft 19.7 in

D50 = $(2.26\, S^{0.555} q^{2/3}) / (g^{1/3})$

D50 = 1.91 ft 22.9 in

Bathurst D50 = $(3.56\, S^{0.75} (1.25\, q)^{2/3}) / (g^{1/3})$

D50 = 1.67 ft 20.1 in

Bathurst D8

(ref: Ken Bates
Fish-Friendly Culverts, 2004)

Where: q = 1.25 * Q/w

1.25 is flow concentration factor

s = 0.05 ft/ft

Q = 639 cfs

W = 15 ft

Roughened Channel Ingredients

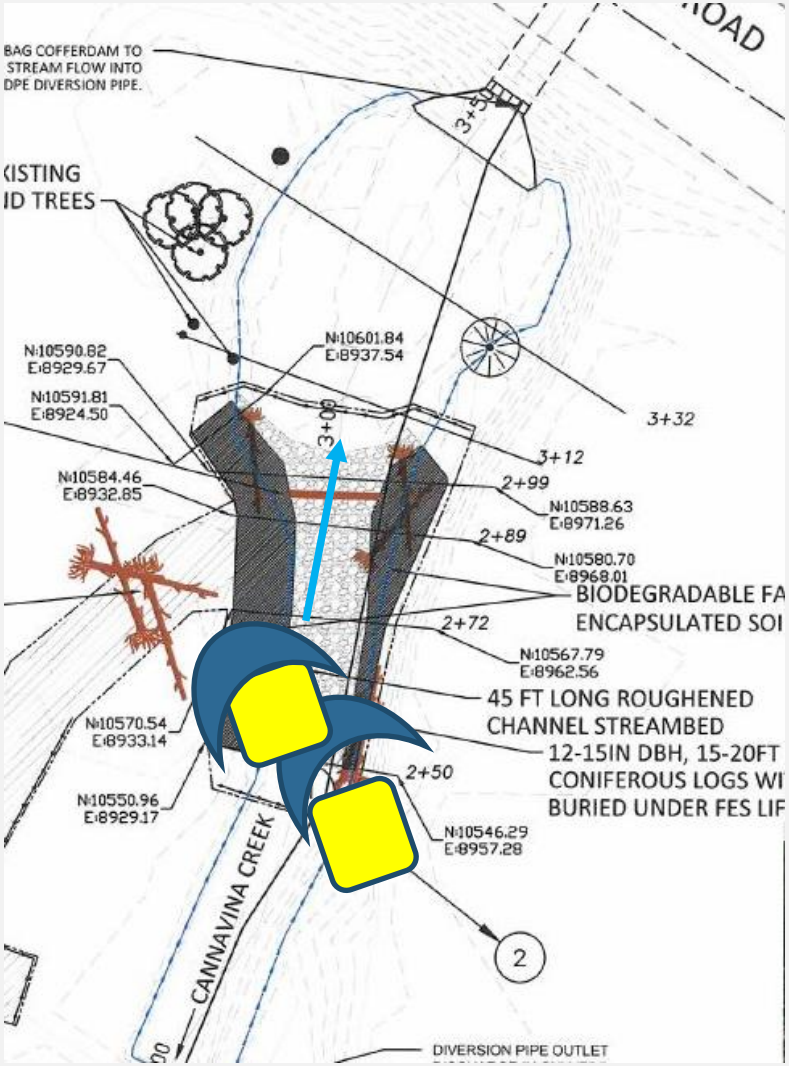
Roughened Channel Ingredients

Roughened Channel Ingredients

Placing Roughened Channel Ingredients

Placing Roughened Channel Ingredients

Placing Roughened Channel Ingredients



Placing Roughened Channel Ingredients

Placing Roughened Channel Ingredients

Final Washed Surface

Indian Creek culvert replacement - before

Indian Creek culvert replacement - after

Satus Creek – Before Construction

Satus Creek – During Construction

Satus Creek – After Construction

Thank you

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