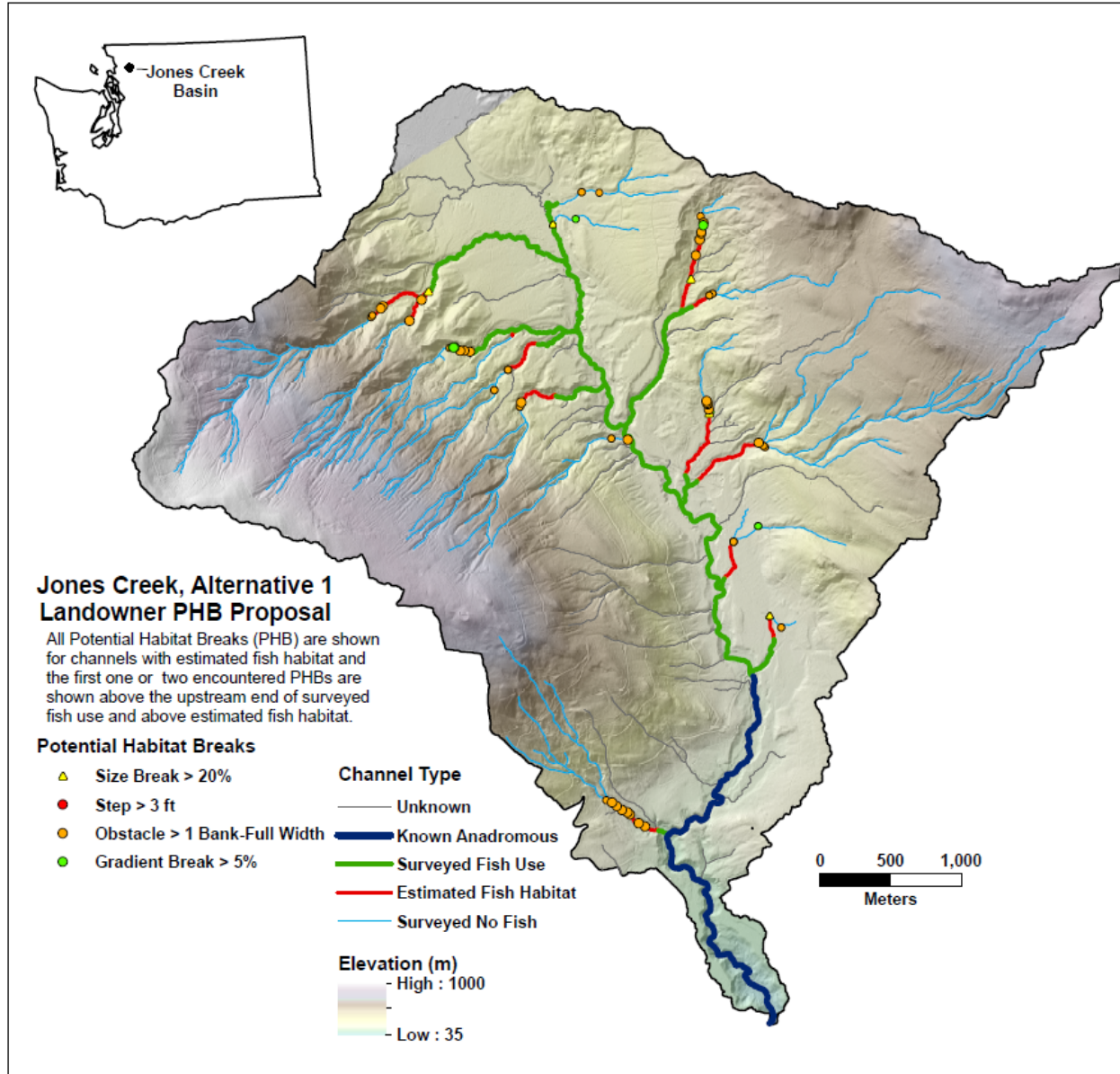


# Evaluation of Size-based PHB Criteria



## Fish Habitat Assessment Method (FHAM)

FHAM framework was presented to TFW Policy as a consensus product of the Fish Habitat Technical Group in January of 2017.

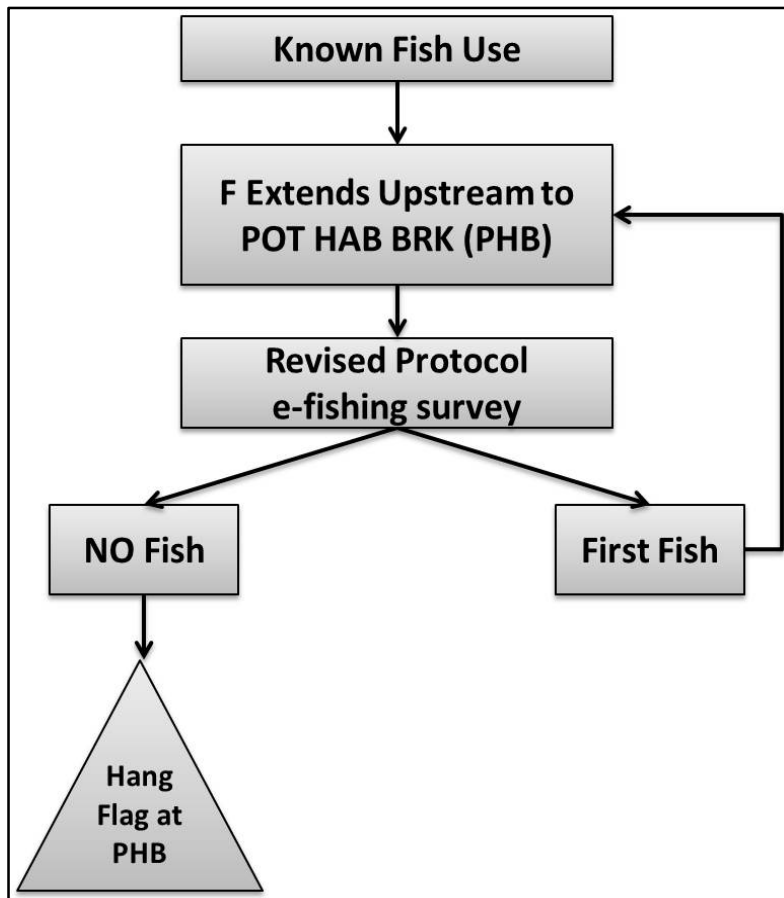


Figure 1. Conceptual framework for a joint alternative FHAM protocol.

- “PHBs are defined as permanent, distinct, and measurable changes to in-channel physical characteristics.
- “PHBs are typically associated with underlying geomorphic conditions and may consist of natural barriers that physically prevent fish access to upstream reaches (e.g. steep bedrock chute, vertical waterfall), or a distinct and measurable change in channel gradient, size, or a combination of the two.”

# Landowner PHB Proposal

“If the FPB selects multiple alternatives for further analysis, we simply ask that one or more alternative bolded in Table 1 be included in the pool of candidate PHB alternatives undergoing further evaluation.”

Gradient PHB	Size PHB	"Obstacle" PHB	Science Panel Alternative	Surveyor and PHB Agreement to Stop or Continue	Surveyor Stop Where PHB Would Indicate Extend Type F Water	Surveyor Extended F Water where PHB Would Indicate Stop	Percent of EOH Captured
5% Change	Stream Junct. Ratio .7	3 ft vert. OR >20% slope, Elev. > BFW	July Recom. w/New Obst. Def.	92%	4%	4%	83%
5% Change	Stream Junct. Ratio .7	>20% slope, Elevation > BFW	July Recommendation	91%	5%	4%	79%
5% Change	Stream Junct. Ratio .8	3 ft vert. OR >20% slope, Elev. > BFW	Jan. Test 15 Recommendation	90%	4%	5%	81%
15% Thresh.	3 ft Threshold	3 ft vert. OR >20% slope, Elev. > BFW	Jan. Test 5 Recommendation	86%	5%	9%	94%
10% Thresh.	3ft Threshold	3 ft vert. OR >20% slope, Elev. > BFW		83%	2%	14%	97%
10% Thresh.	3ft Threshold	>20% slope, Elevation > BFW		83%	3%	14%	96%
10% Thresh.	2 ft Threshold	3 ft vert. OR >20% slope, Elev. > BFW	Jan. Test 4 recommendation	80%	9%	11%	89%
10% Thresh.	3 ft Threshold	>20% slope, Elevation > BFW		80%	9%	11%	87%
15% Thresh.	2 ft Threshold	3 ft vert. OR >20% slope, Elev. > BFW	Jan. Test 2 Recommendation	80%	15%	5%	80%
15% Thresh.	3 ft Threshold	>20% slope, Elevation > BFW		79%	17%	5%	78%
	5 ft Threshold			75%	11%	15%	80%
15% Thresh.	2 ft Threshold			74%	21%	5%	70%
5% Change				74%	24%	2%	52%
	3 ft Threshold			68%	26%	6%	56%
20% Thresh.	2 ft Threshold			67%	30%	3%	56%
10% Thresh.				66%	24%	10%	71%
	2 ft Threshold			51%	48%	1%	28%
		3 ft vert. OR >20% slope, Elev. > BFW		38%	62%	0%	22%
		>20% slope, Elevation > BFW		36%	64%	0%	17%
20% Thresh. AND 2 ft Thresh. (Westside Defaults)			Westside Default Criteria	33%	67%	0%	9%

Table 1. Accuracy and error estimates for Science Panel recommendations and a range of potential PHB alternatives.

## Stream Junctions and Change-based Metrics as Size PHBs

The landowner's proposed size PHB is based on a change in stream size associated with a stream junction.

- The association of small stream tributary junctions with a decrease in the likelihood of fish use is well-established.
- Stream junctions can be reliably identified as reproducible/measurable points in the field, and remotely from high resolution LiDAR data.
- A determination whether a reduction in stream size above and below a stream junction point meets specified PHB criteria can be reliably made in the field and remotely from high resolution LiDAR data.
- Precise estimates of the specific location associated with a threshold of channel width is unnecessary to determine a relative reduction in stream size.

The proposed landowner size PHB can be reliably identified both in the field and within a GIS spatial platform. There is no technical basis for the decision not to include the landowner's size PHB in DNR's spatial analysis.

## Stream Width Thresholds as Size PHBs

### Field Implementation:

Threshold criteria are not always associated with locations having distinct and measurable changes in stream characteristics as described in the FHAM.

- Width may increase and decrease over long distances.
- Observer variability in application of methods to locate a width threshold point can be high, leading to lack of a consistent and reproducible result (example from DNR implementation assignment).

### Remote Spatial Evaluation:

Threshold points of channel width can be difficult to estimate remotely.

- Width can't be measured directly.
- Models may not provide necessary precision for use in determining distances along streams for a single point threshold estimate.

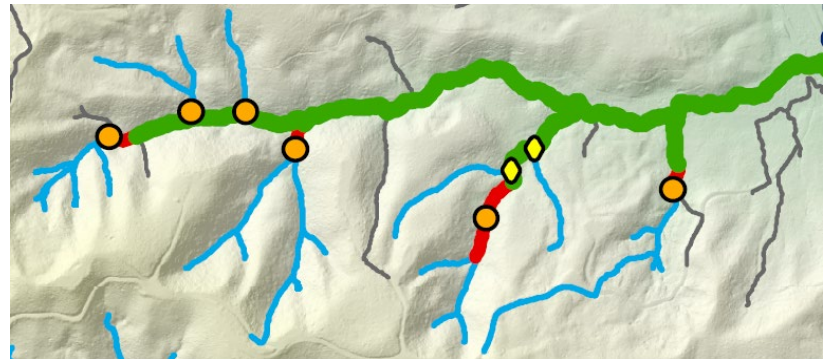
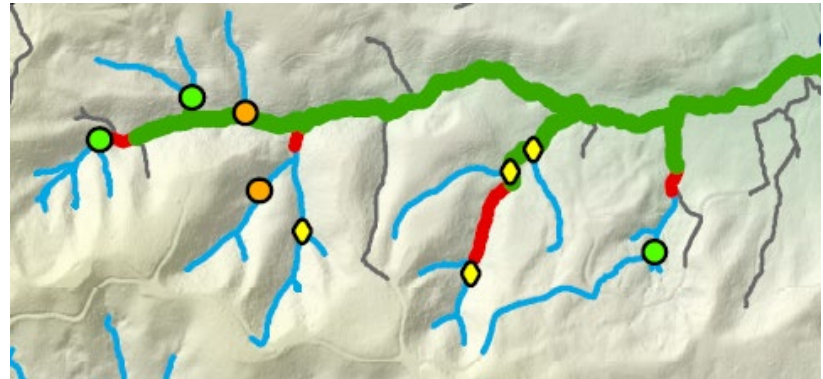
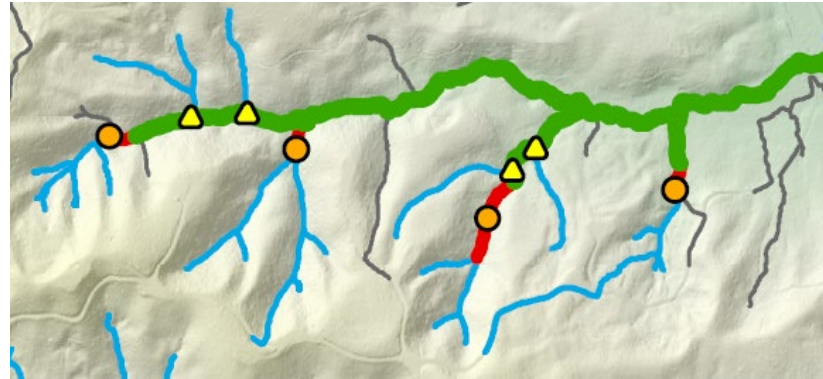
# Summary of Proposed Alternatives

- 
- ▲ Tributary Junction, 20% reduction
  - Step >3 ft
  - Obstacle >1 BFW
  - Gradient Break >5%

## W WA Tribe Alternative

- ◆ Width Threshold 2 ft
- Step > 3 ft
- Step > 1 BFW
- Obstacle > 2 BFW
- 

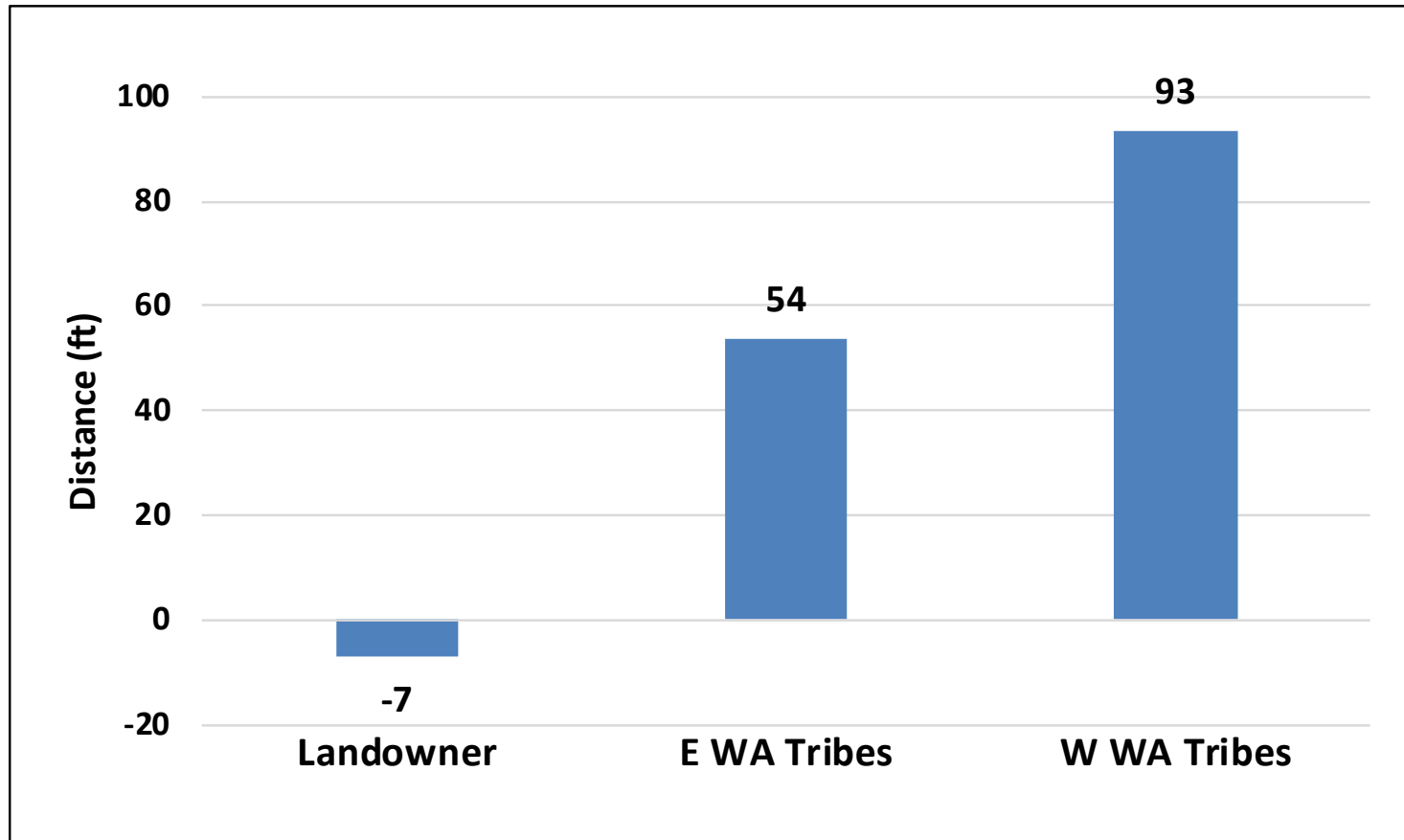
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## Can PHB Alternatives be Reliably Evaluated Remotely Using LiDAR DEMs?

- LiDAR technology has greatly improved the accuracy of topographic data available for use in characterizing stream networks.
- However, all remotely-derived estimates of the location and characteristics of stream size, gradient, barrier features include error.
- The frequency and magnitude of these errors in the context of identifying proposed PHB features has not yet been quantified.
- Some PHBs can more reliably be characterized than others.
- Estimates of the location and characteristics of all PHBs need to be interpreted with due consideration of the inherent errors and uncertainties associated with those estimates.
- Our preliminary comparison of field-based and remotely conducted evaluations of PHB alternatives yielded similar results.
- A field-based evaluation will be necessary to more fully understand performance of PHB alternatives.

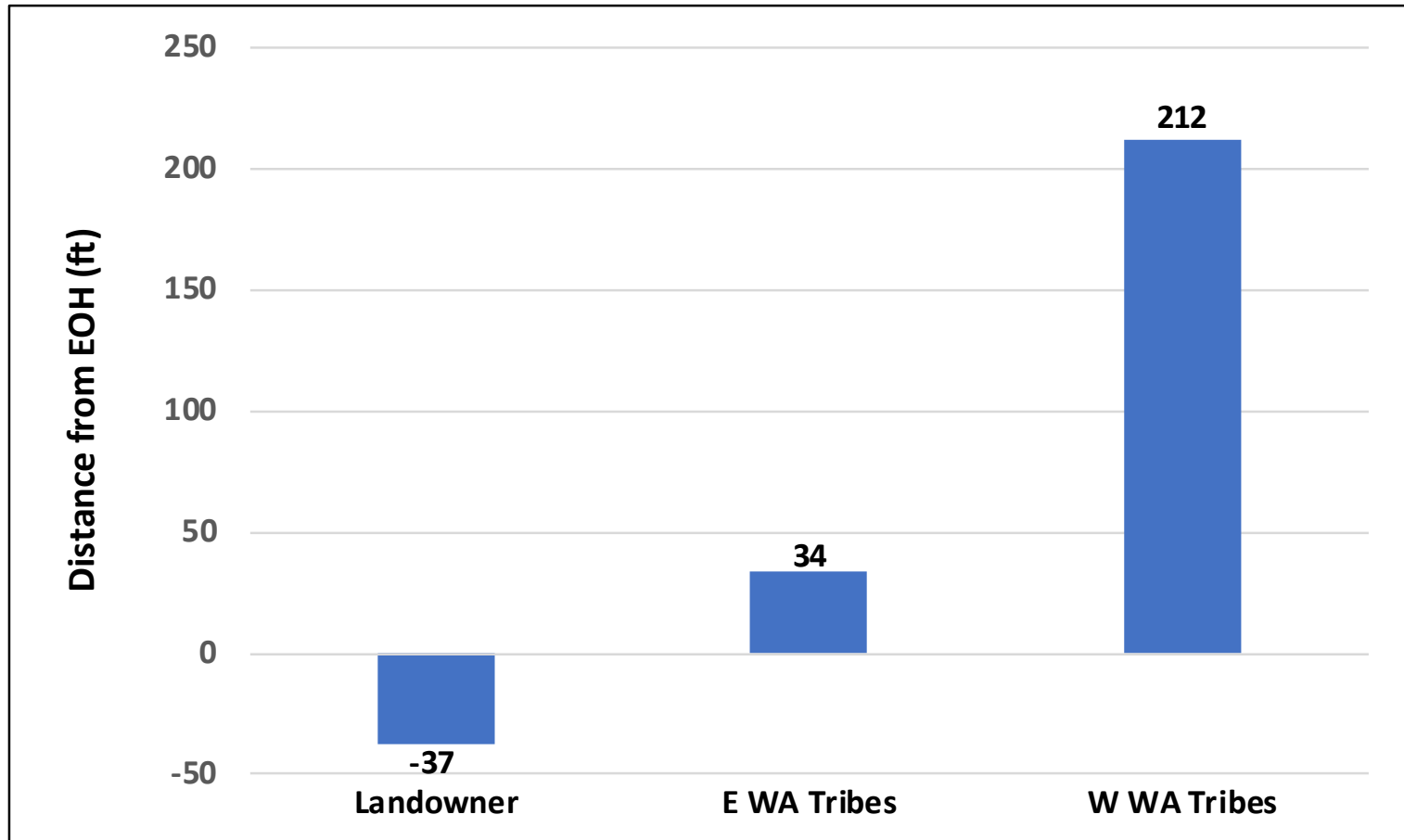
## Field Evaluation Results – W WA



Average field-measured distance from proposed EOH F/N Break for each PHB alternative (n= 145).



## Spatial Analysis Results – W WA



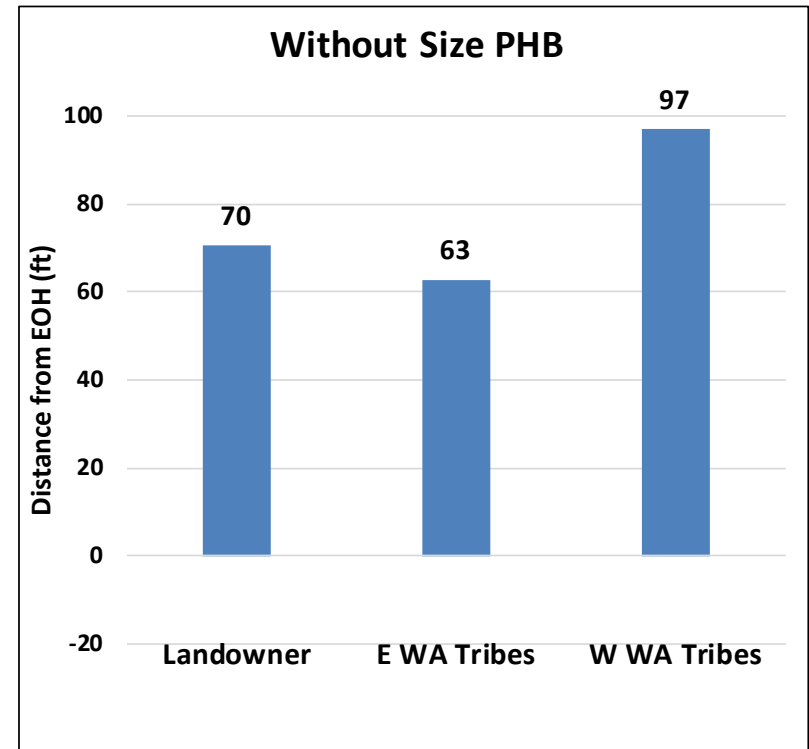
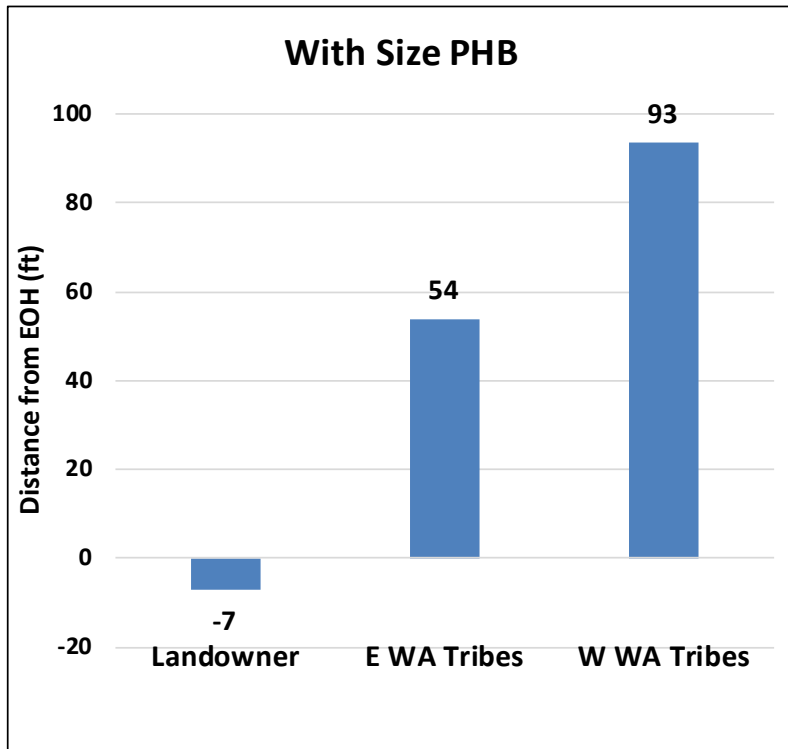
Average estimated distance from concurred F/N Break for Each PHB Alternative (n= 382).

## Can the Proposed PHB Alternatives be Reliably Evaluated Without the Size PHB?

- The performance of each PHB alternative is a result of the combined influence of the 3 specified size, gradient, and obstacle PHB criteria acting together.
- Removing any PHB of the 3 categories from a spatial analysis of proposed PHB alternatives has the potential to introduce additional error and uncertainty to the results.
- Ignoring any of the 3 PHB categories may not yield a reliable estimate of proposed PHB Alternative distances for use in subsequent analyses (e.g. CBA, Fish Benefit).
- We concluded that it is better to include the combined influence of all 3 PHBs in our spatial analysis, while recognizing the higher uncertainties in estimating threshold width points.
- Field evaluation conducted as a back-up, sensitivity analysis to follow...

## Potential Influence of Excluding a Size PHB from the Evaluation of Alternatives: Field-based Evaluation

Excluding a size-based PHB potentially influences both the magnitude and ranking of best performing alternatives.



Average field-measured distance from proposed EOH F/N break to the first PHB, with and without including a size-based PHB (n=145).

## Summary

- Size based PHBs are 1 of 3 PHB categories included in each proposed alternative approved for further evaluation by the Forest Practices Board.
- Failure to include all 3 PHB categories in the evaluation of PHB alternatives may result in inaccurate estimates of performance, leading to erroneous estimates of cost/public resource benefit in potential regulations.
- Consideration should be given to the sensitivity of each PHB alternative to concerns expressed about the precision of remotely conducted estimates of stream width.
- Decisions to further evaluate the performance of stream width PHB alternatives should also consider whether current threshold-based alternatives are viable in the context of the developing repeatable, enforceable, and implementable regulations.