# HABITAT HYDRAULICS:

## *SENSITIVITY ANALYSIS AND HABITAT SUITABILITY MODELING OF RIO GRANDE SILVERY MINNOW*

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BUREAU OF RECLAMATION

*"The views, opinions and findings contained in this report are those of the authors(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other official documentation."*

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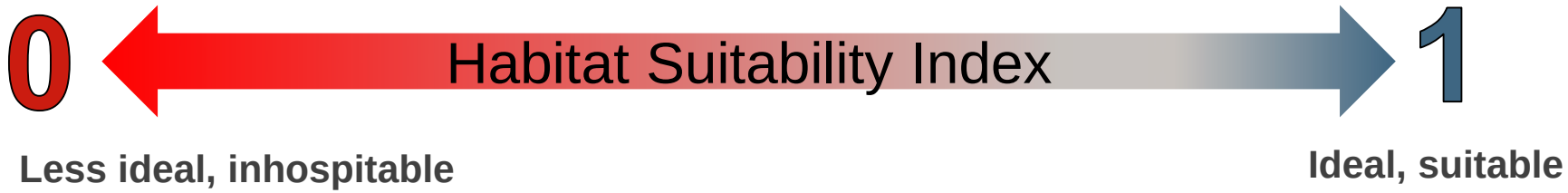
# HYDRAULIC HABITAT SUITABILITY

*THEORY: if we can correlate habitat criteria to environmental flows, to hydraulics, to spatial data, then we can use this information for design, implementation and monitoring.*

- Focus on spring runoff and the larval life stage.
- Uncertainty in adult criteria.




This year, we discussed:

- Reasonableness of binary criteria (totally suitable or totally not).
- Other spatial data may be used in mapping suitable habitat.

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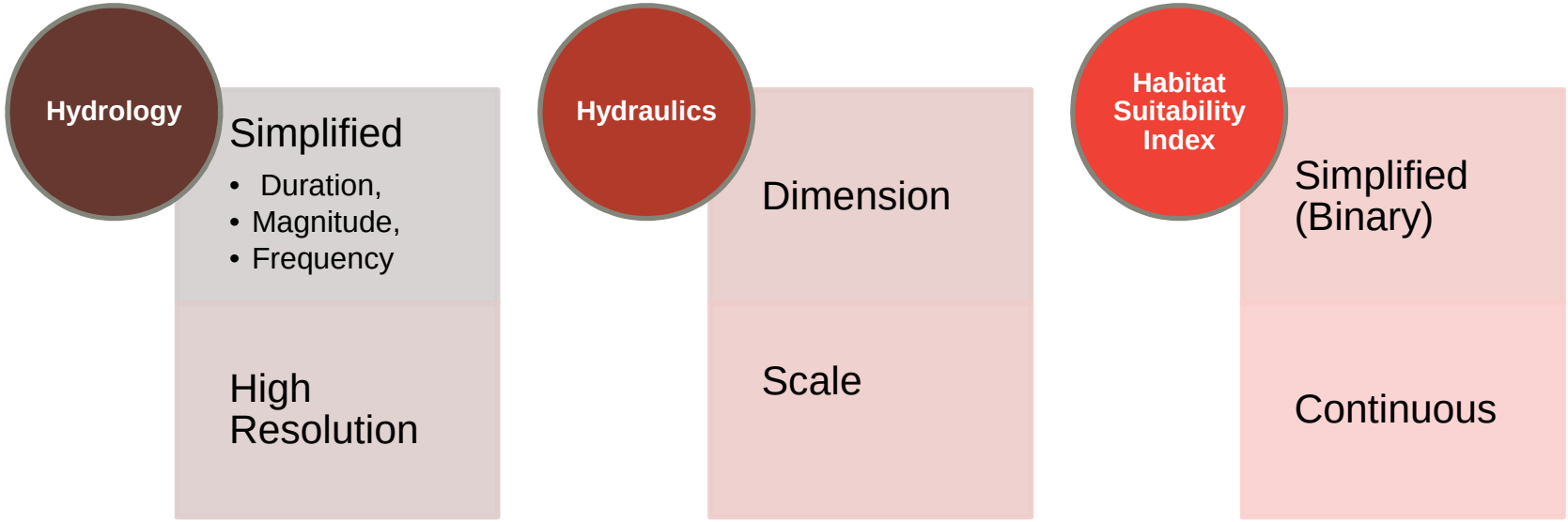
# OVERVIEW: (2) PROJECTS

## Sensitivity Analysis: USACE-ERDC

- Comparing hydrology and hydraulic parameters to 17 years of field-measured Minnow population metrics.




## Restoration Site Analysis: USACE-USBR

- Mapping (8) Restoration Sites suitable hydraulics

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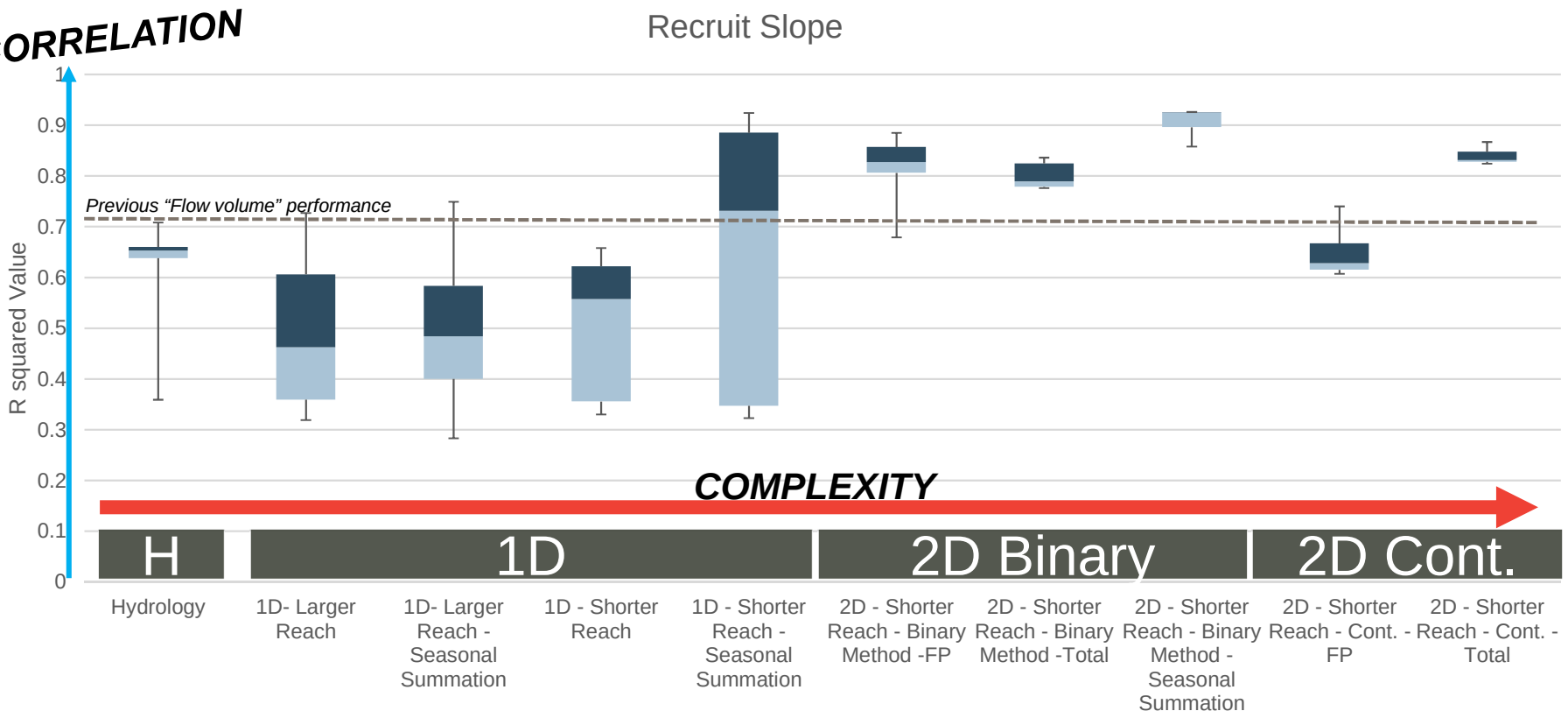


- Eco-value curves: Q ∝ suitable hydraulics area.
- Well-centered assumptions are better than comprehensive ones.
- YOY and Oct did not perform as well.

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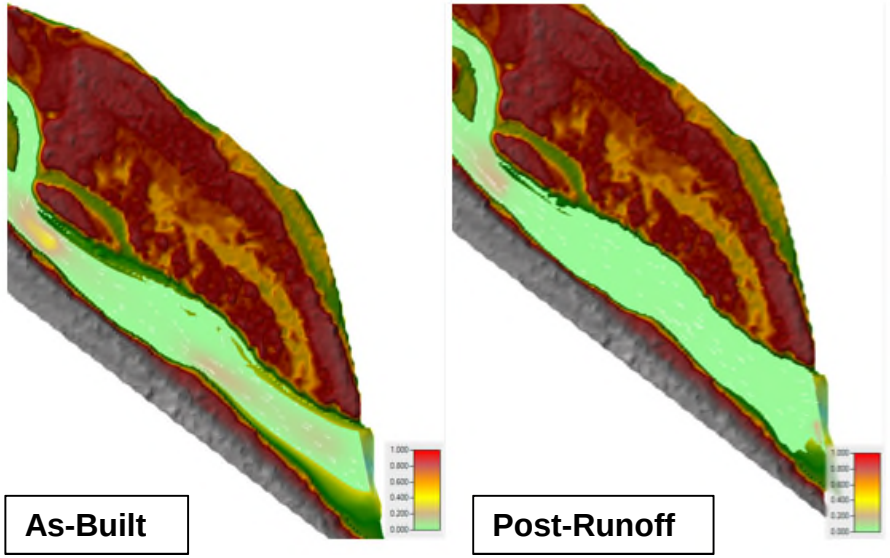
# MODELING LIMITATIONS

- 1D models should not be used for habitat mapping.**
- Calibration and validation (monitoring) data is PARAMOUNT.
  - Models may run without error and be inaccurate.
  - Reclamation's 2012 Agg-Deg is not calibrated to WSE's of interest.
  - We are lacking data at overbanking flows: >3000 cfs.
- Sediment analysis is needed.
  - Conveyance capacity of the Rio Grande CHANGES during high run-off events (Occam 2016).
  - Sedimentation/disconnection is point of failure for these restoration designs.



**As-Built** **Post-Runoff**

**Shear stresses at RM 112 indicate likelihood for sedimentation if As-Built design is repeated.**

**Modeler Application Guidance for Steady v. Unsteady, 1D vs 2D Hydraulic Modeling. https://www.hec.usace.army.mil/publications/TrainingDocuments/TD-41.pdf

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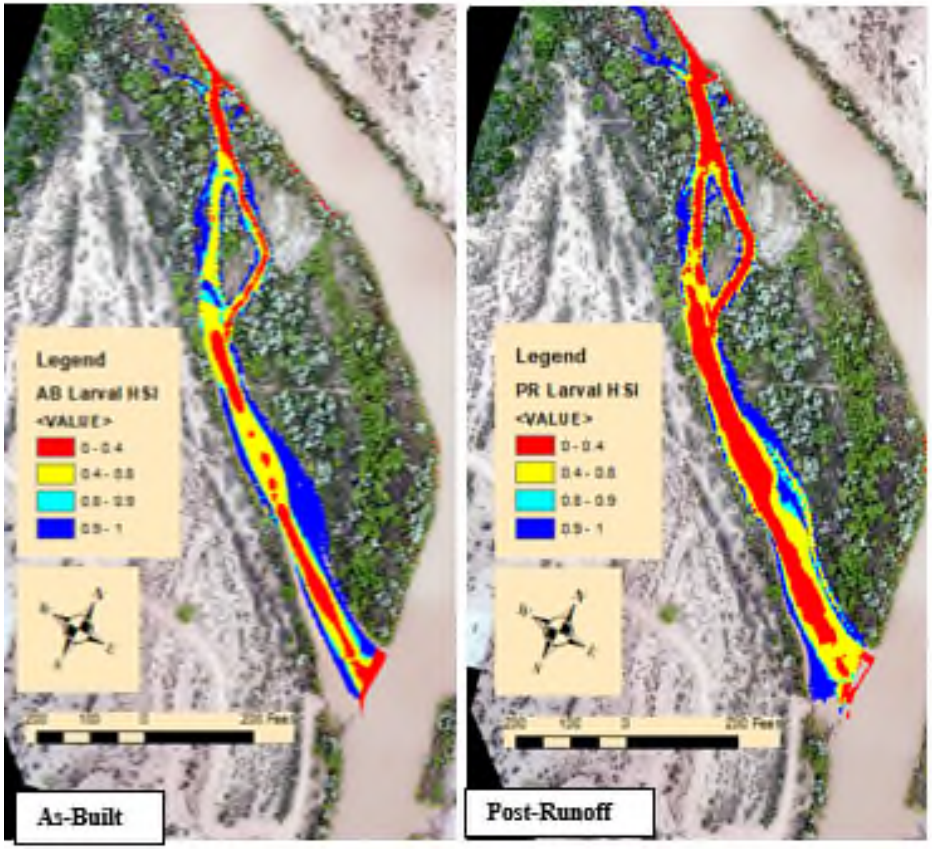
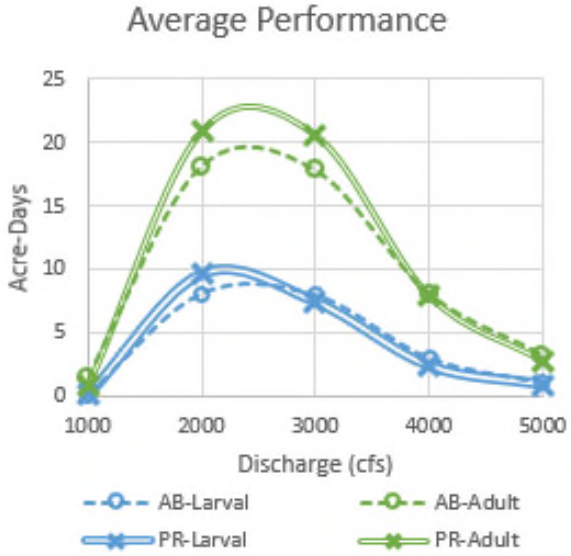
# CHANGES IN SITE PERFORMANCE

- The Reclamation Study is to quantify change from As-Built (AB) to Post-Runoff (PR) condition to justify site maintenance.
- Compares surrounding terrace/floodplain versus constructed site.

## **RM 112:** 1.5 acres




- 2019: 60 acre-days of suitable larval habitat
- Average:18 acre-days.

Performance ↑ by 40% from AB to PR

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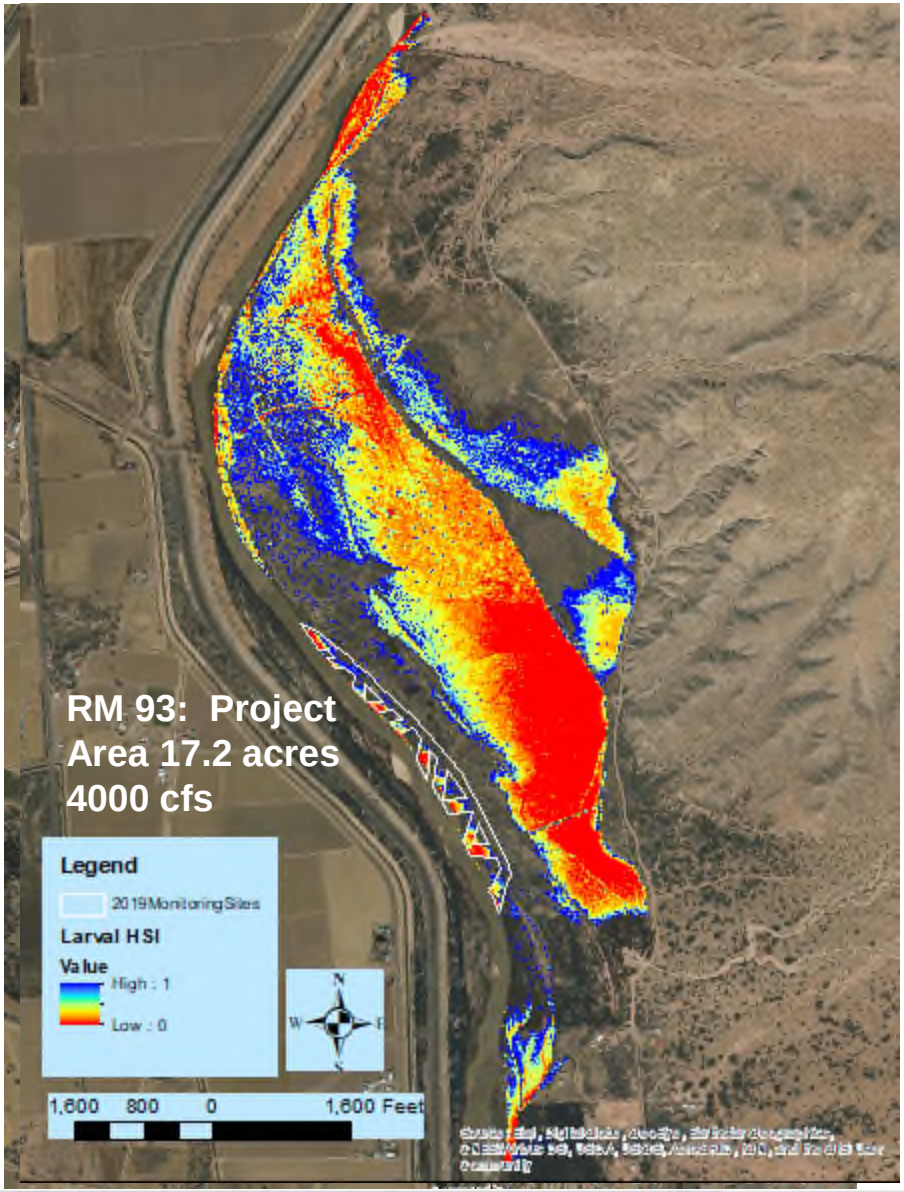
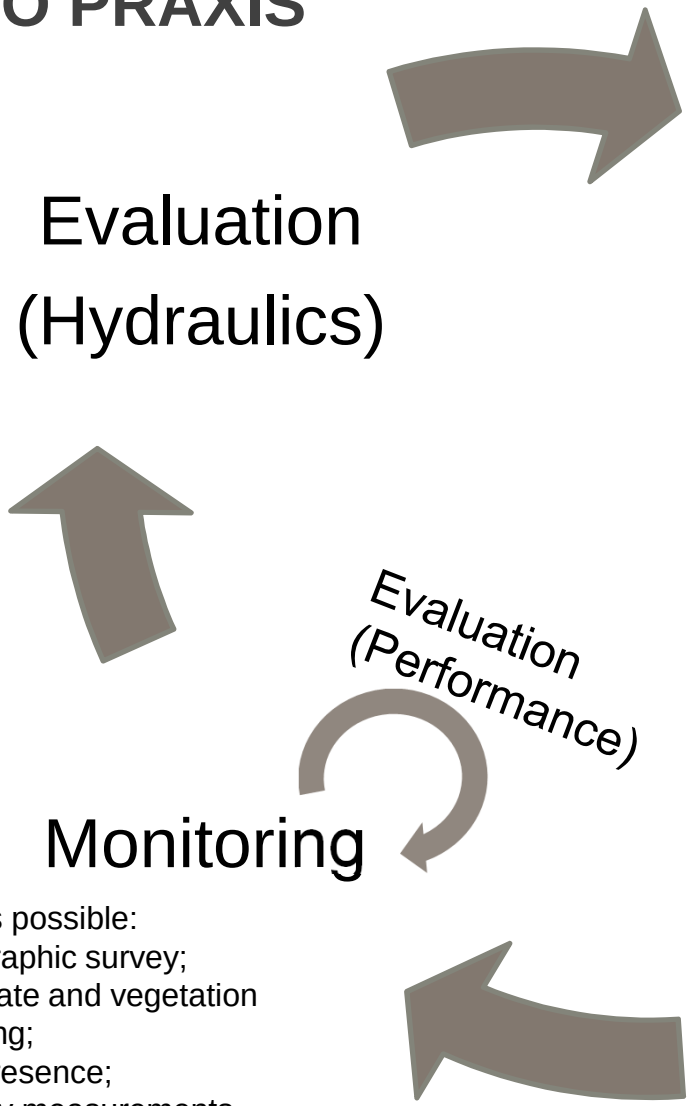
# RESTORATION SITE PERFORMANCE

- Different orientations: backwaters, lowered terraces, side channels;
  - ❑ Similar engineering approach:
    - ❖ Inundate at lower discharges than the surrounding floodplain.
    - ❖ Impact limited by excavation area.
  - ❑ Similar points of failure: natural levee development at downstream outlets.
- Different floodplain connectivity: terraces, disconnected floodplains, perched areas.
  - ❑ Greatly affects areas of suitable hydraulics.



# THEORY TO PRAXIS




5-10 yr frequency or triggered by poor performance evaluation:

- $$$.
- Data availability.

Before every construction effort

Best alternative carried forward

As often as possible:

- Topographic survey;
- Substrate and vegetation mapping;
- Fish presence;
- Velocity measurements.

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# LOOKING TO THE FUTURE

More diversity in engineering approaches to increase areas of suitable depth and velocity:

- Raising water surface elevations;
- Taking advantage of natural topography;
- Water management planning.

More coordination among agencies:

- Engaging Tribal Partners and landowners.
- Leveraging our diversity in signatories and authorities.
- Confronting conflicts in our missions statements.

Photo credit: Noel Mollinedo, UNM 2019

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- Save Our Bosque Task Force



Please contact me if you have questions:

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# KEY FOR SLIDE 4

| | |
|---|---|
| **Hydrology** | Duration hydrology (7-days to 21-days, mean of minimums or max of minimums) and Percent Exceedance to 3000 cfs |
| **1D Larger Reach** | 30 –mile 1D model + Duration hydrology + Binary method for habitat hydraulics |
| **1D Shorter Reach** | 10 – mile 1D model + Duration hydrology + Binary method for habitat hydraulics |
| **2D Shorter Reach** | 10 – mile 2D model + Duration hydrology |
| **Seasonal Summation** | Instead of duration hydrology: summation of the season for larval hydraulics and of the year for adult hydraulics. |
| **Binary Method** | Binary “ideal” or “not most ideal” for ideal habitat hydraulics |
| **Continuous (Cont.)** | Weighted Useable Area using a curve for ideal hydraulics. |
| **FP** | Habitat hydraulics applied only to inundated areas on the floodplain |
| **Total** | Habitat hydraulics applied to total river cross section |

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