FY21 RSM IPR: Iao Sediment Continuity

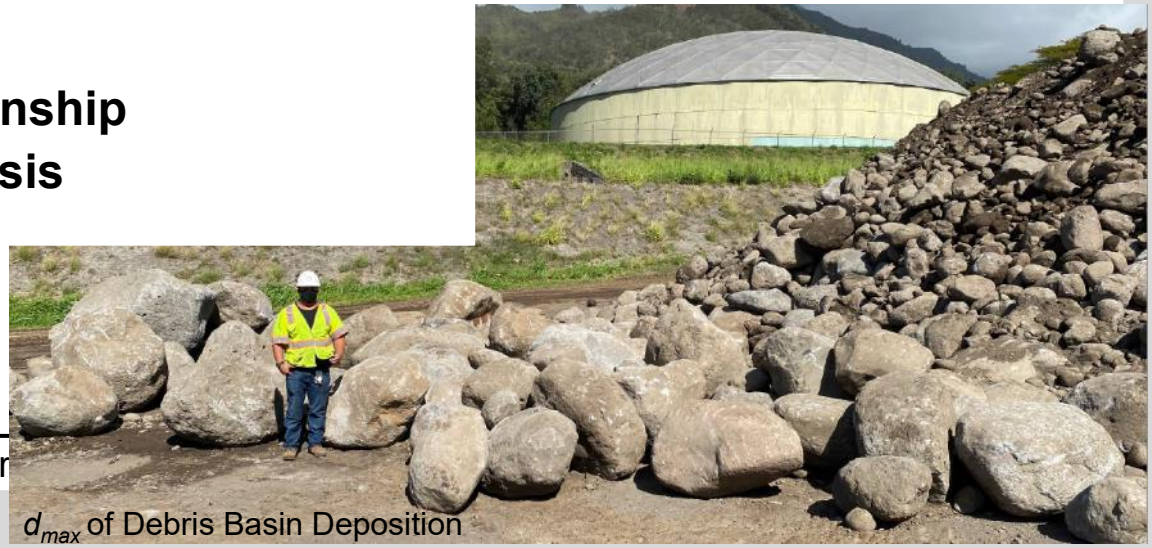
Stanford Gibson (HEC), Jessica Brunty (POH), Nani Shimabuku (POH),
Travis Dahl (CHL), Jake Helminiak (NAP), Autumn Murray (CHL)

BLUF: Can we reduce debris basin deposition and FRM channel erosion by keeping sediment in the system?

Objective: This examines the feasibility of alternate debris basin designs to restore sediment continuity, reduce maintenance costs in the debris basin and, potentially, reduce scour downstream…without introducing failure modes (more costly or controversial maintenance issues elsewhere).

Approach

1. Debris Basin Design Lit Review
2. Sediment Budget
3. Load-Frequency Relationship
4. Channel Capacity Analysis
   - -HEC-RAS 1D,2D
5. Debris Basin Model
   - -HEC-RAS 2D Sed



d_{max} of Debris Basin Deposition

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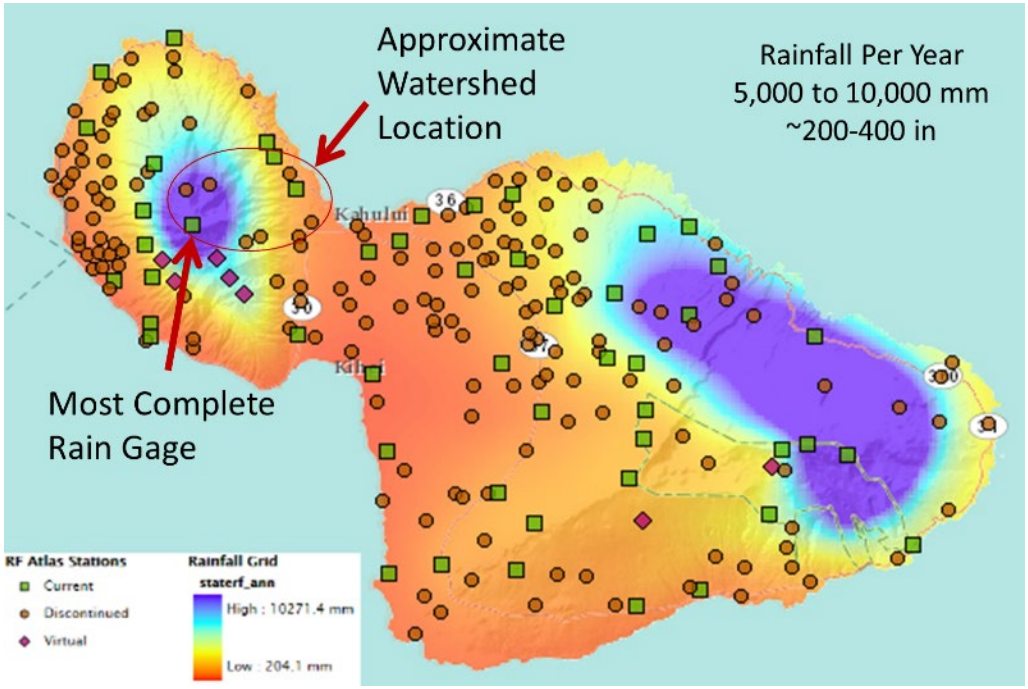
District/Other USACE PDT Members

Stanford Gibson (HEC)
Jessica Brunty (POH)
Nani Shimabuku (POH)
Travis Dahl (CHL)
Autumn Murray (CHL)
Jake Helminiak (NAP)

Stakeholders/Partners

Maui County Dep of Public Works
Wailuku Water Company



Leveraging/Collaborative Opportunities

- Alaska District DOTS Request
- RSM Video Work Unit
- 2D HEC-RAS Sediment Dev
- Post Wildfire Debris Yield Modeling

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Debris Basin

High Gradient Concrete Channel

Alluvial (Eroding, Leveed) Reach

Low Gradient Concrete Channel

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1. Debris Basin Design Lit Review

ERDC/CHL TR-XX-DRAFT

US Army Corps of Engineers®
Engineer Research and Development Center

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INNOVATIVE SOLUTIONS for a safer, better world

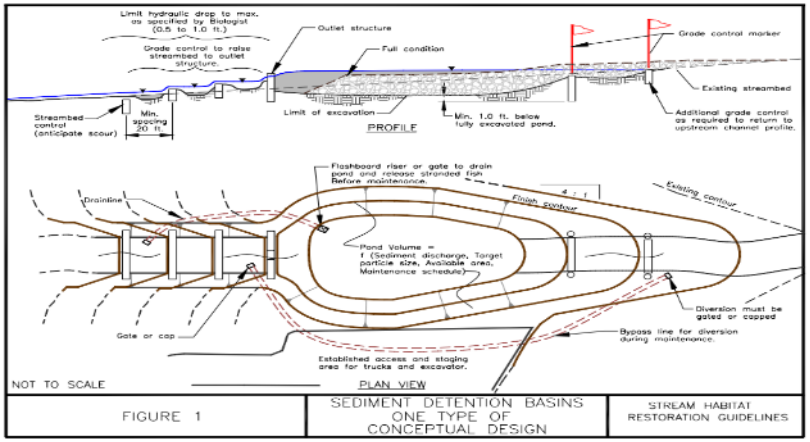
Program Title [[[if not applicable, delete this entire line]]]

Current State of Practice for Debris Basin Design: A Literature Review

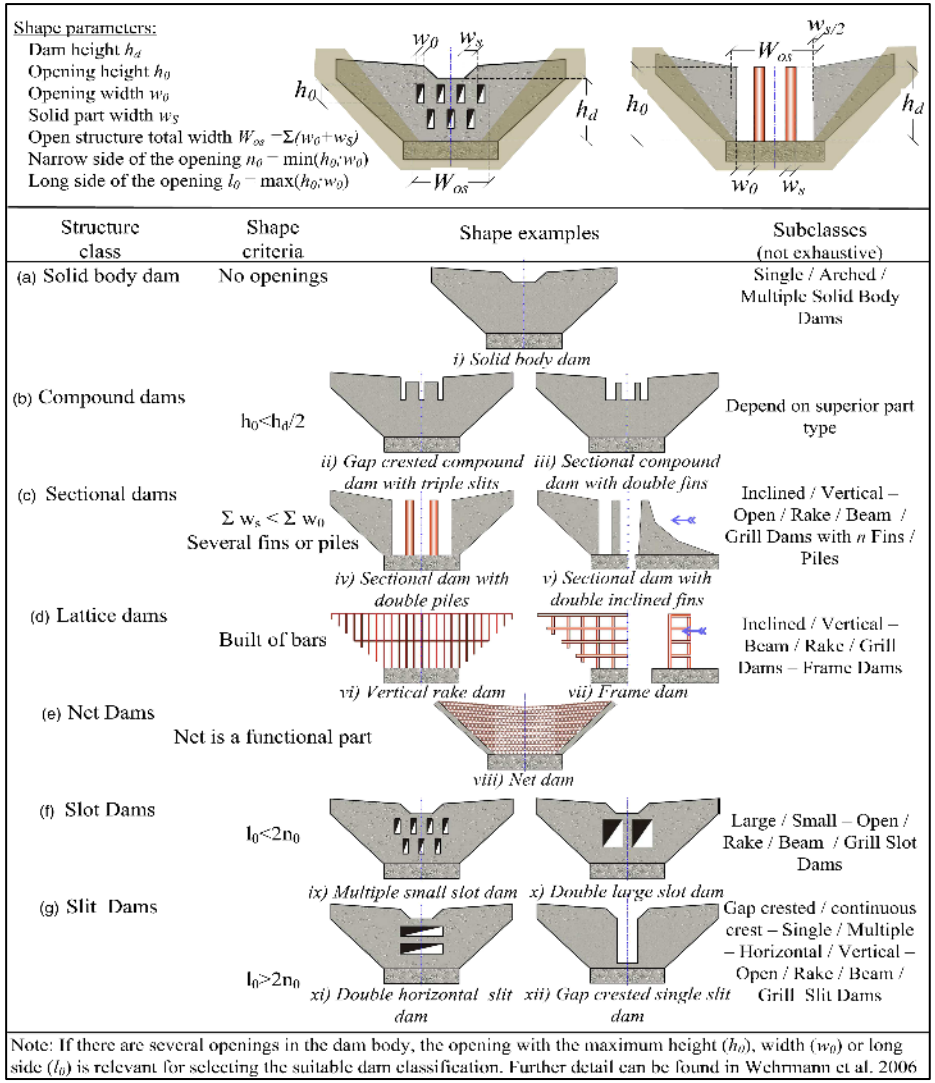
Report Subtitle [[[if not applicable, delete this entire line]]]

Autumn S. Murray, Travis A. Dahl, and Stanford A. Gibson

Month Year



-Current draft 64p.
-Informing EM 1601 Update
-Topic of Q2 RSM Webinar



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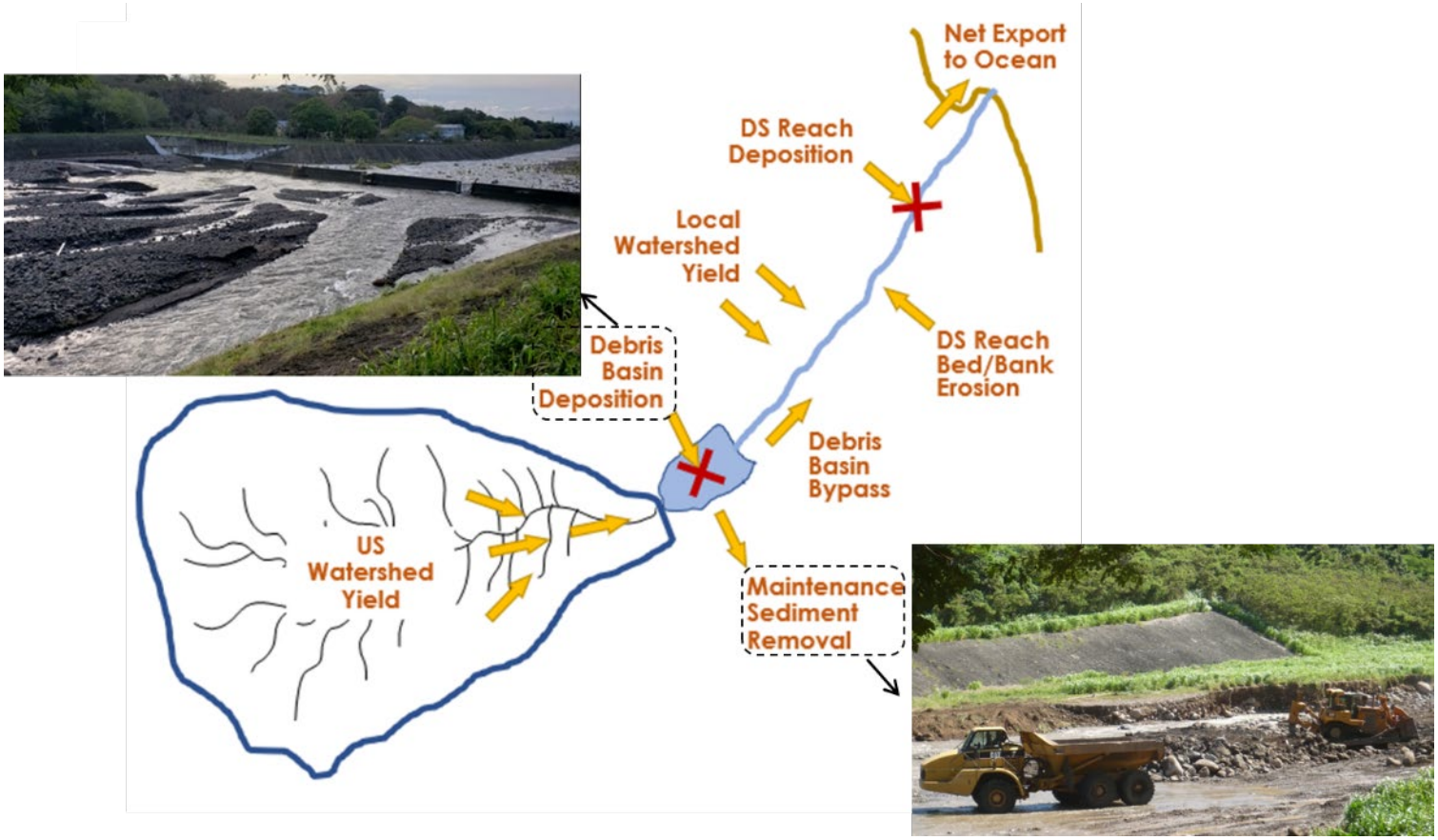
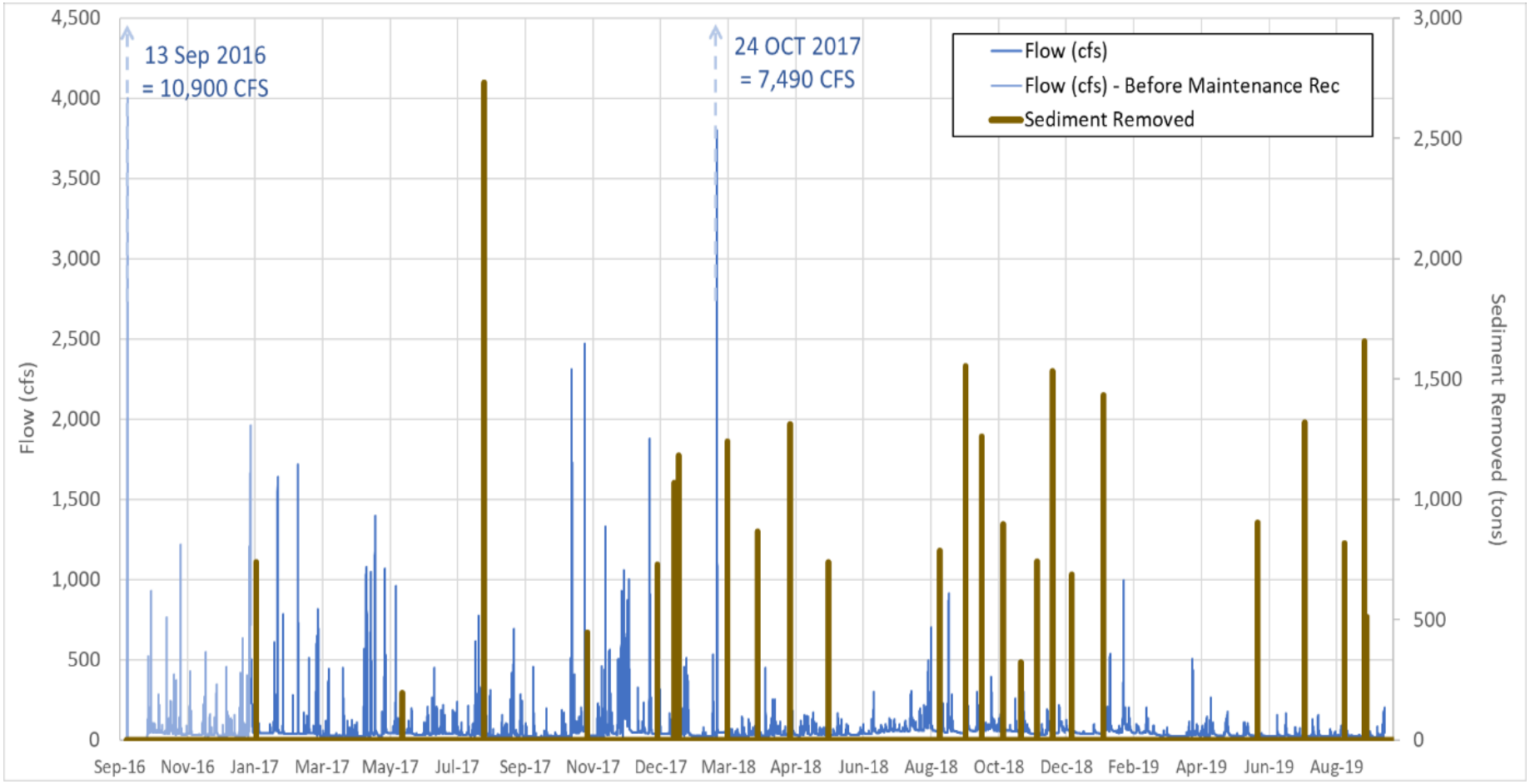
2. Sediment Budget

2. Sediment Budget

Yield: Mass and Gradation



2ai. Yield Mass: Watershed Delivery Analysis (from Maintenance Records)



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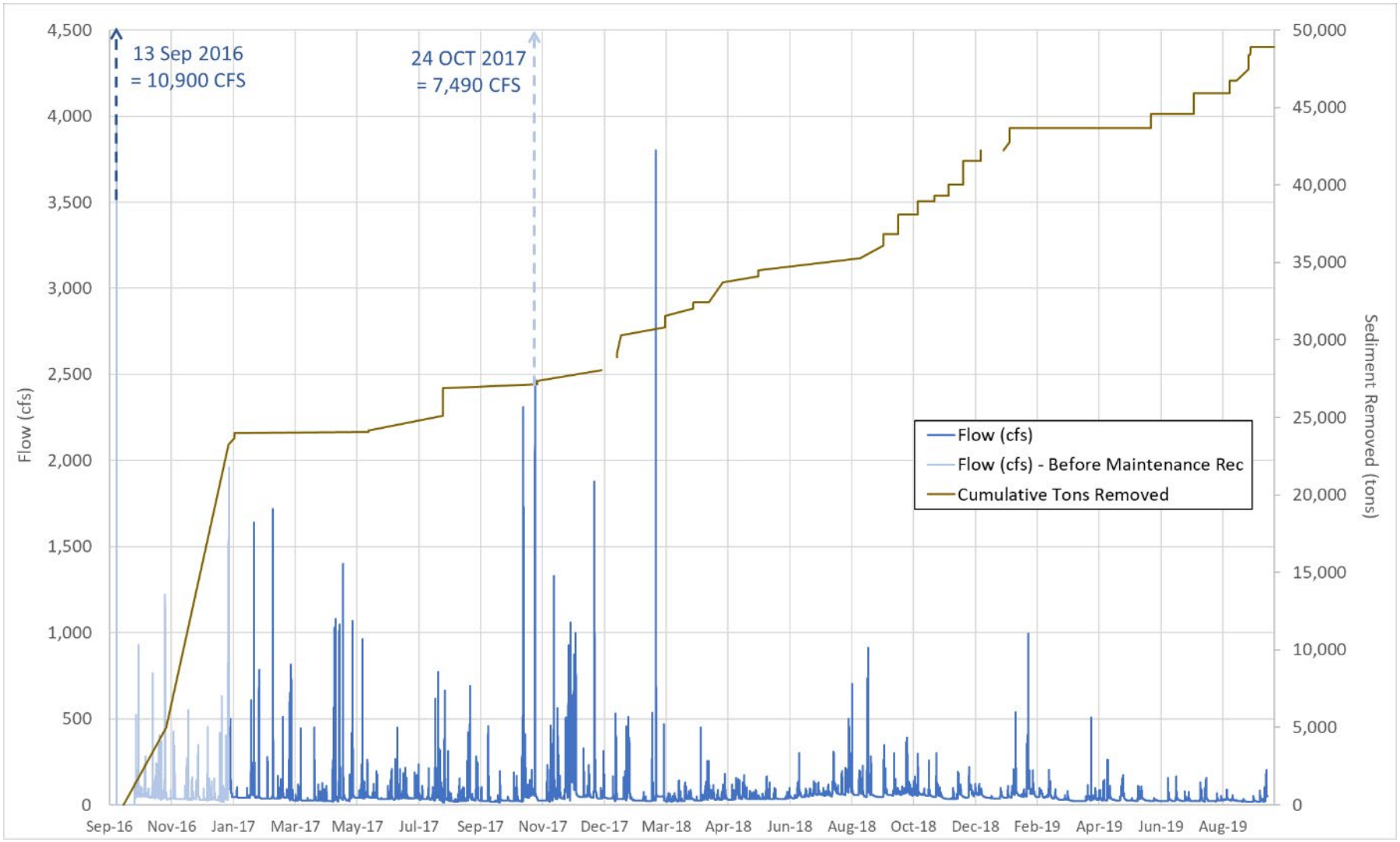
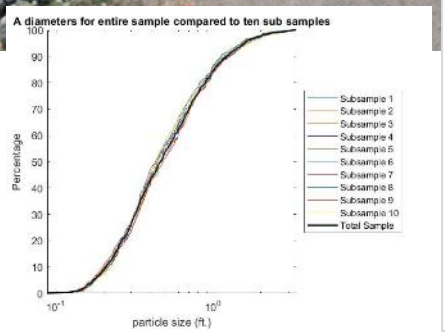
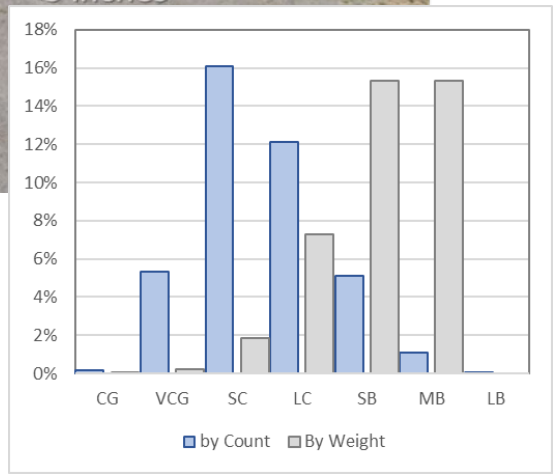


2aii. Yield Gradation: Photogrammetry





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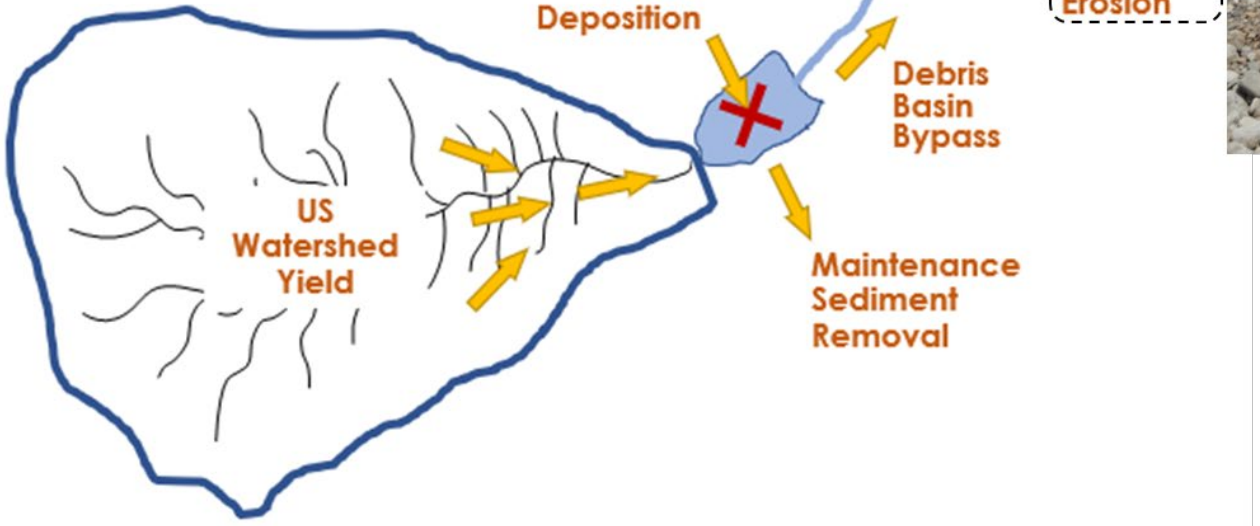
2b. Sediment Budget: Channel Erosion



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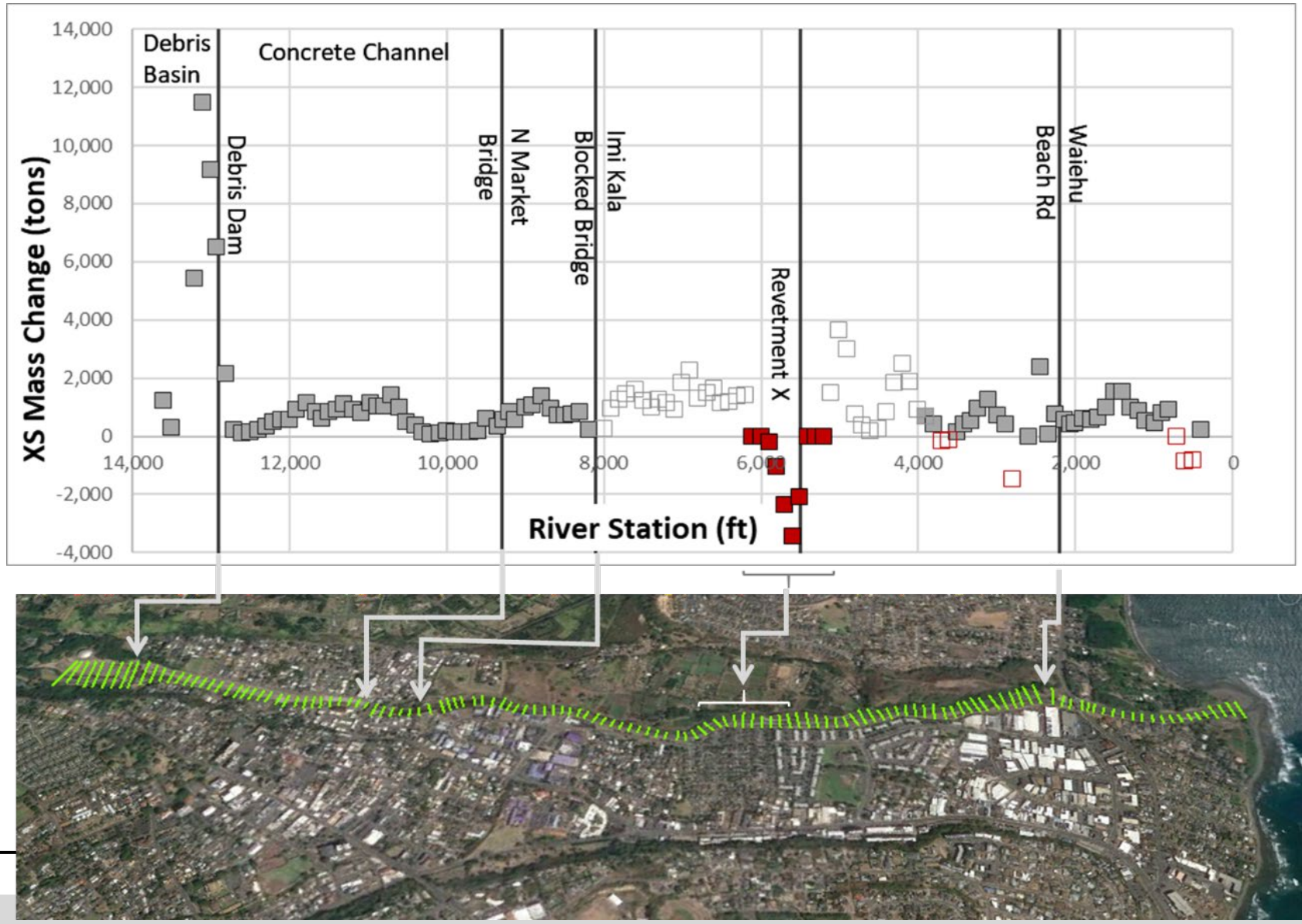
2b. Sediment Budget: Channel Erosion (2011-2013)



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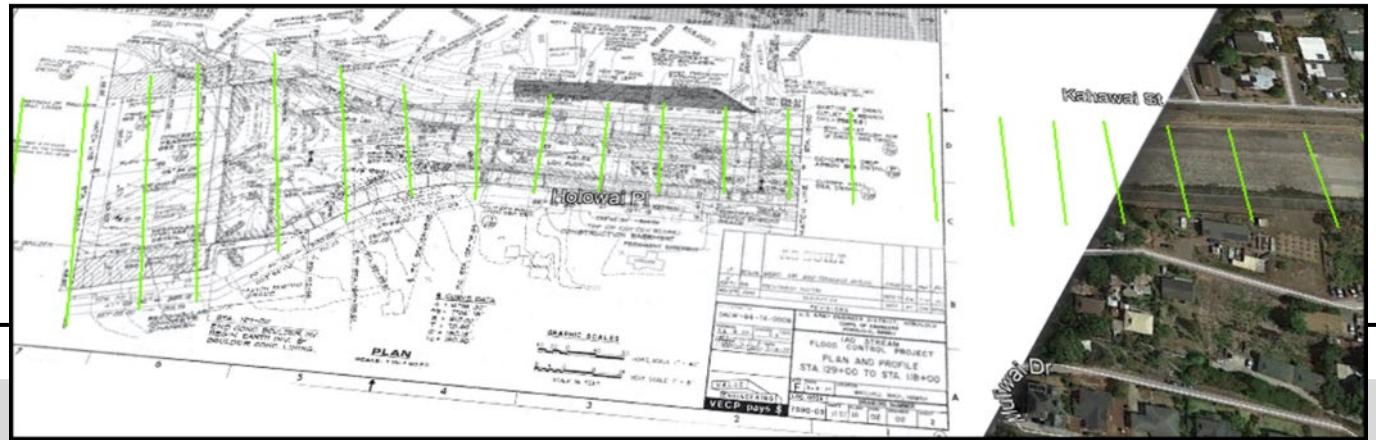
2b. Sediment Budget: Channel Erosion – Digitize 1984 As-Builts



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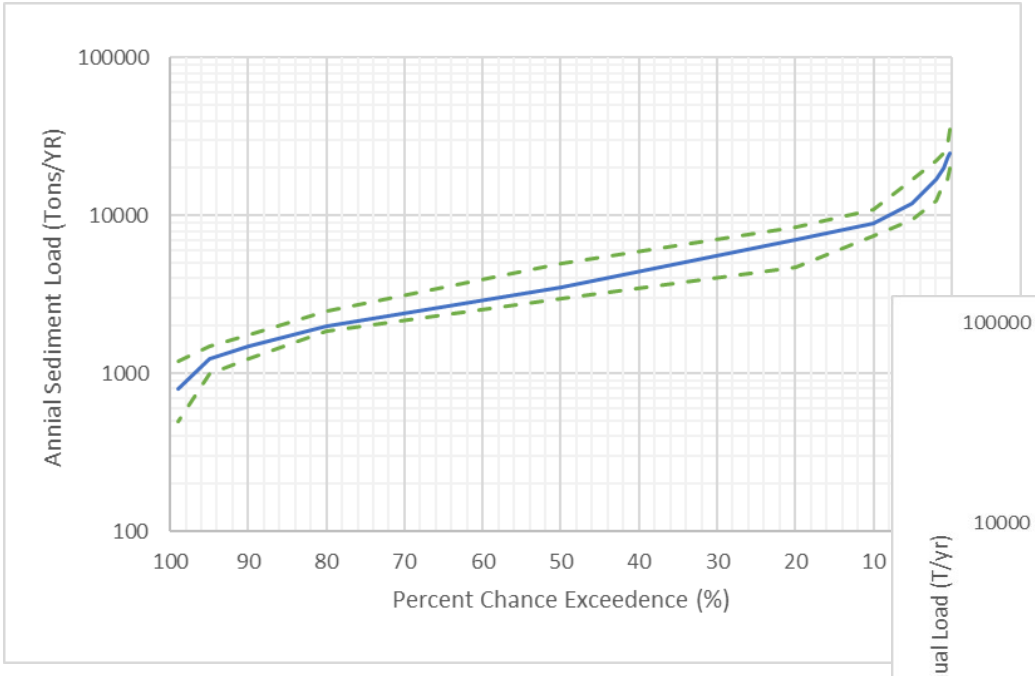
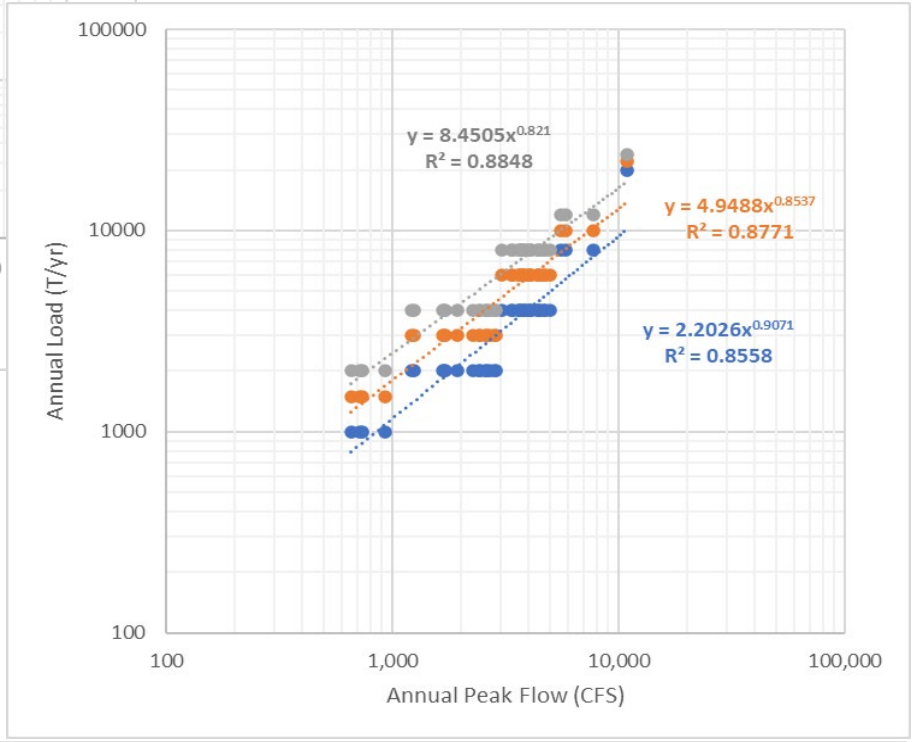
3. Deposition-Frequency Curve





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4. Channel Capacity Analysis

Big Question:

Can the DS Channel Move Material if we Pass it Through the Basin?

- How Much?
- What Size?

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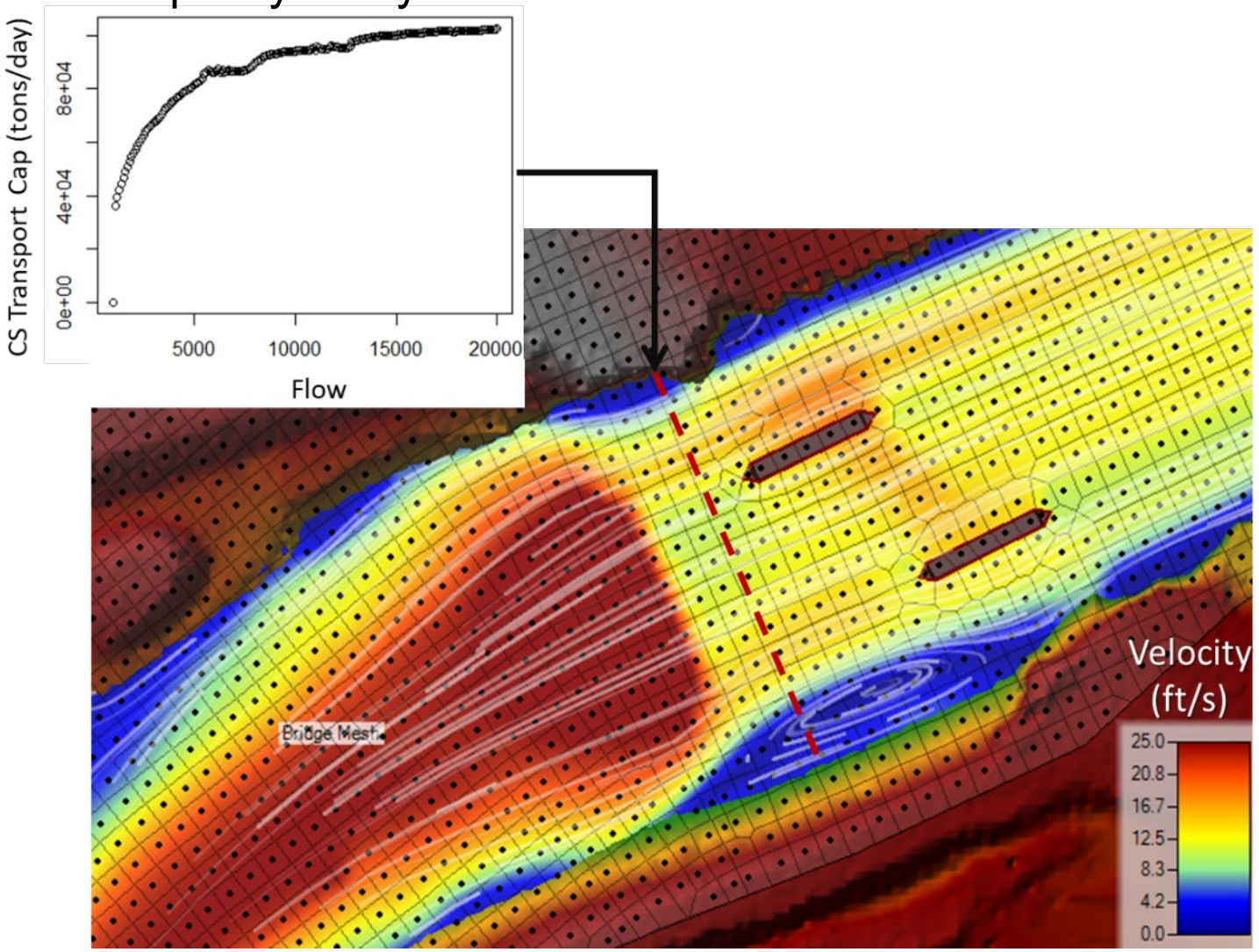
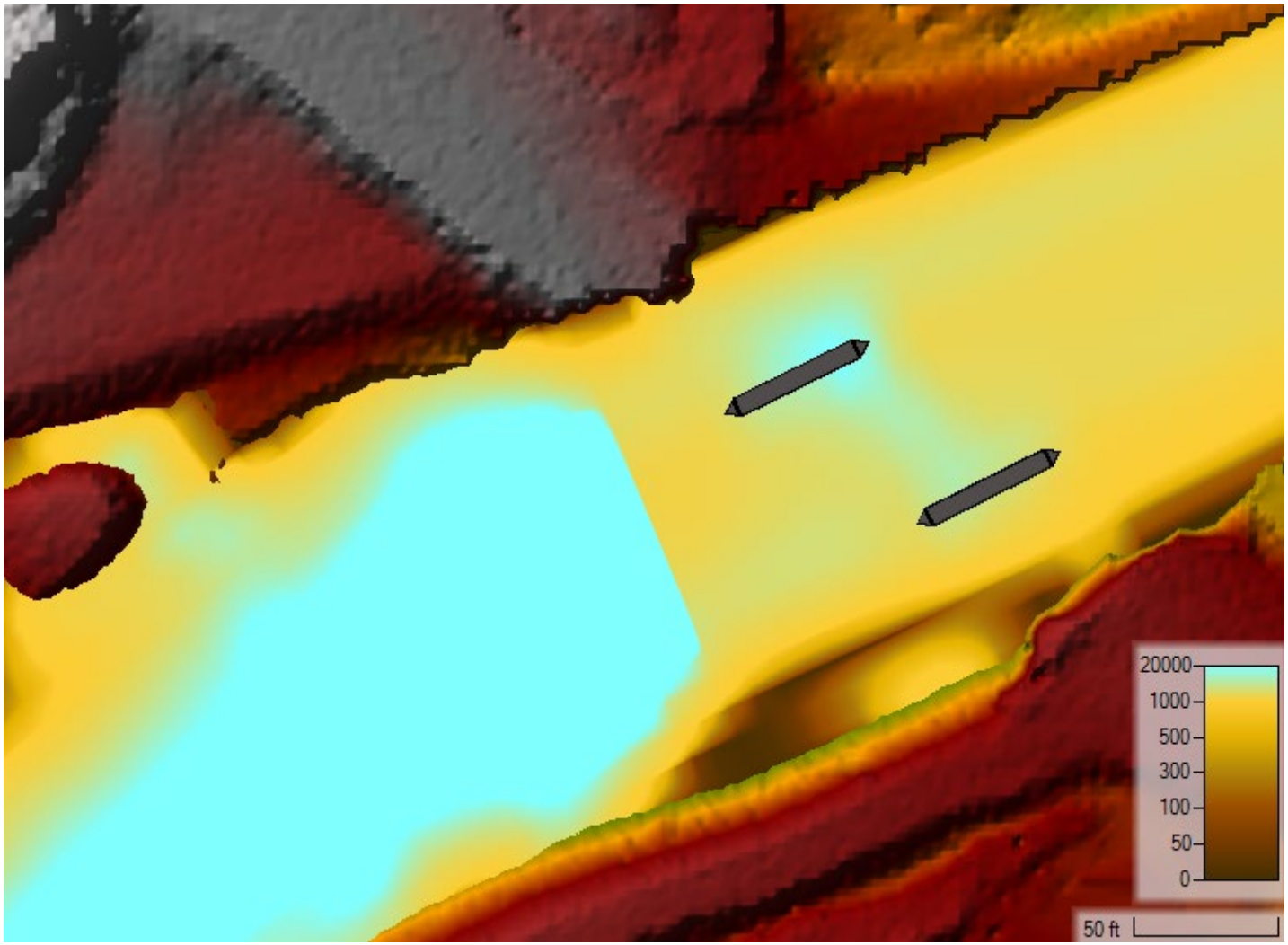
4. Channel Capacity Analysis



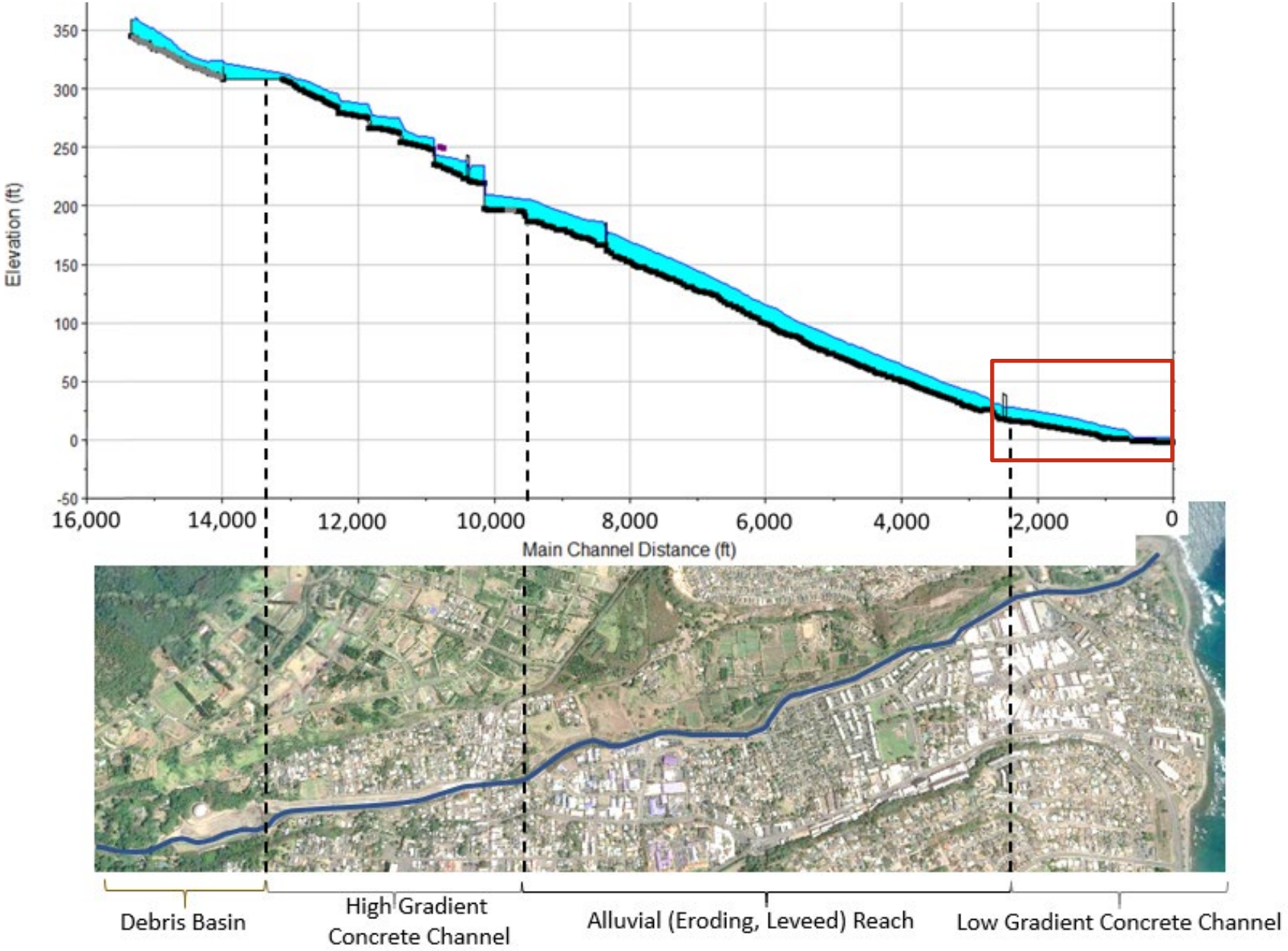
4. Channel Capacity Analysis



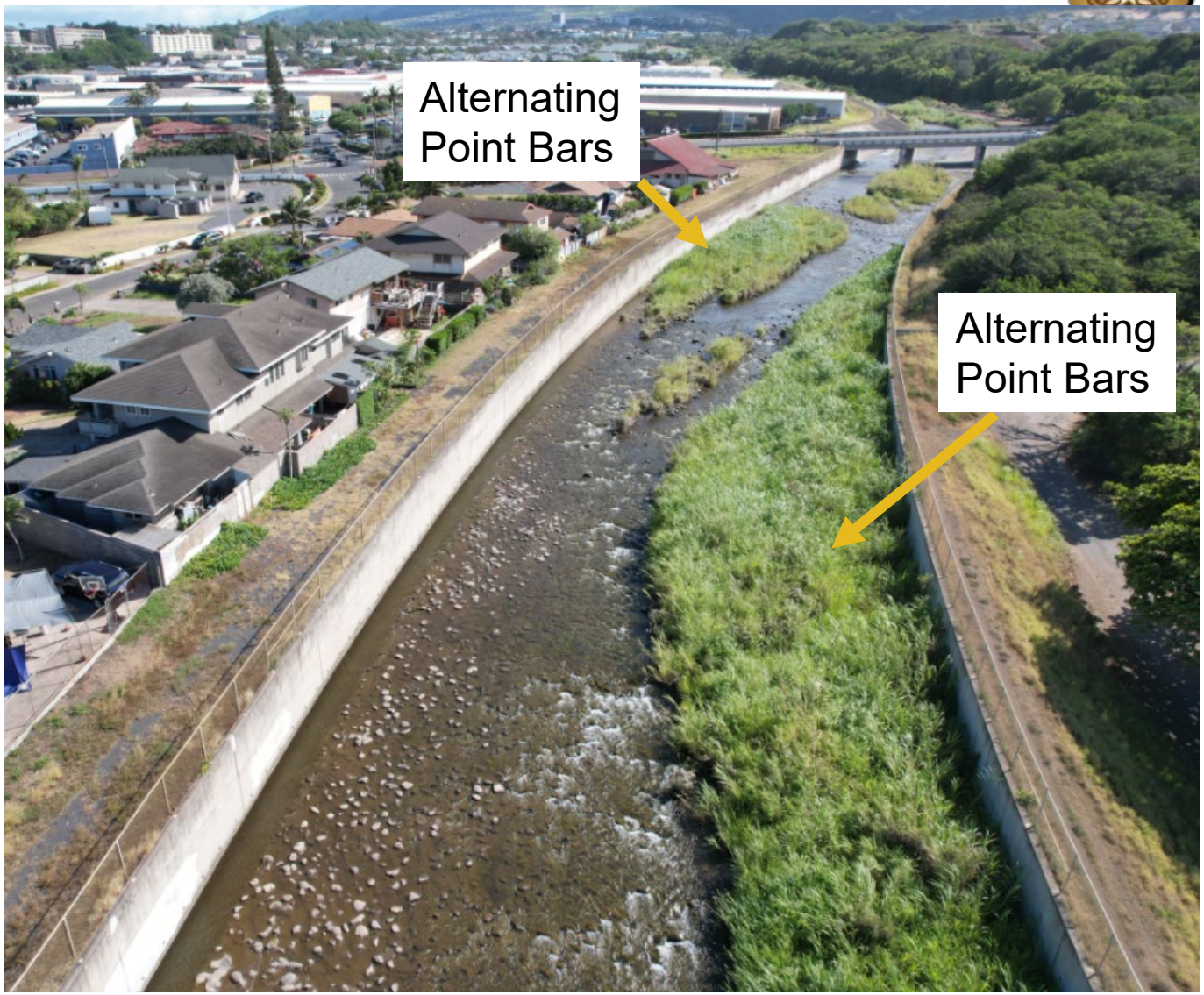
4. Channel Capacity Analysis

Big Question:
But…after the 2021 event.

4. Channel Capacity Analysis



4. Channel Capacity Analysis



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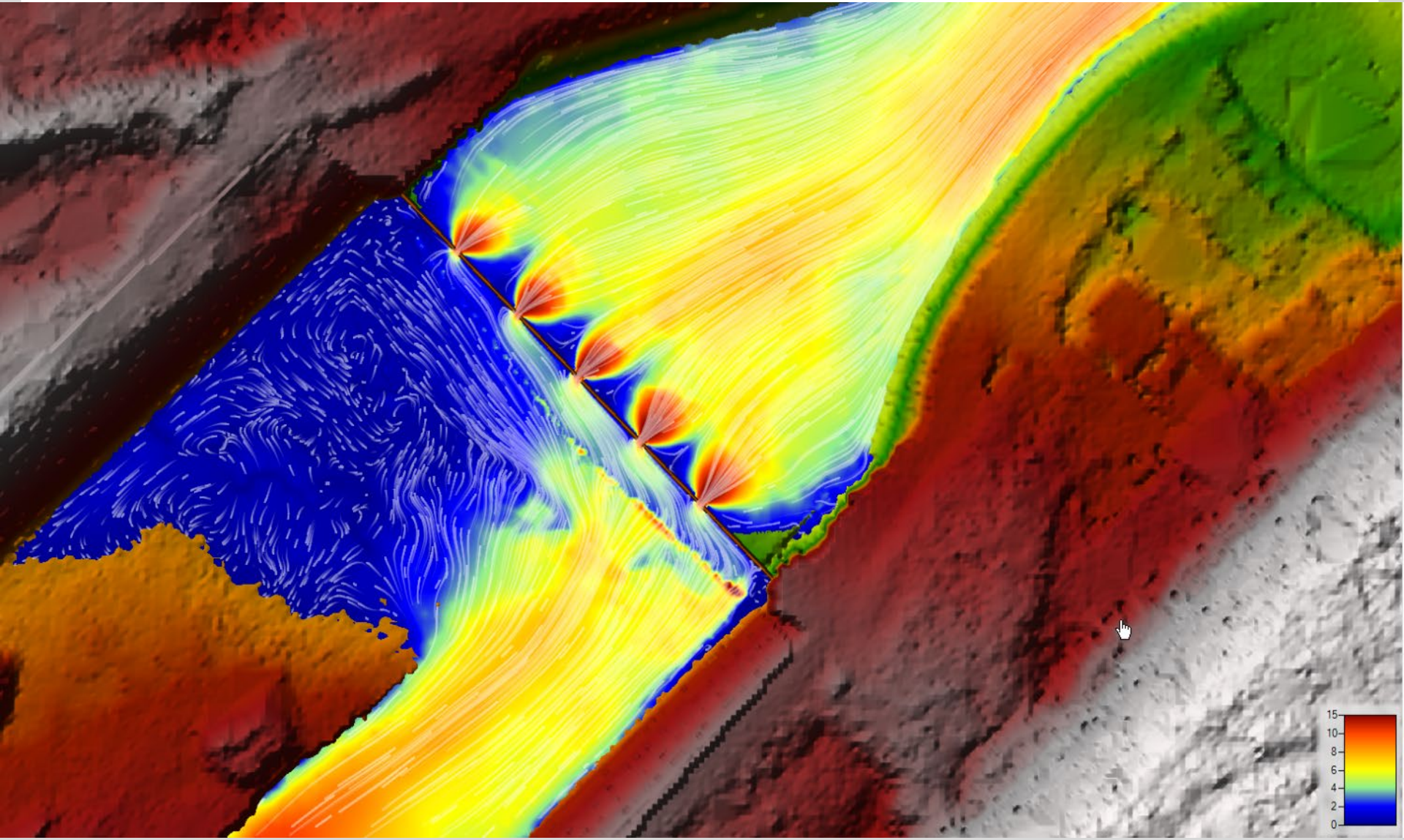
5. 2D Debris Basin Sediment Model



Setbacks

1. Water damage in the County Building destroyed all records more than 5-years old. Those data would have been very valuable.

2. Two of the three largest events were in 2016 and 2017, and it was difficult to parse the maintenance between those two events.

3. Flow/Stage divergence in record upstream and downstream of the basin complicated analysis.

4. COVID Travel restrictions precluded ideal field deployment (following January event).

Lessons Learned

A 5-10 year event in January filled the debris basin. POH has drone capacity and could have flown it to compute the volume and map the gradation. These data would have been incredibly valuable. But the window was short, because the County had to start excavating immediately. We missed the opportunity, but should go into a data-limited project like this with a contingency for opportunistic data collection.


Basin After Jan 2021 Event

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Maui County Department of Public Works is spending 75% of their transportation budget emptying this debris basin (>$1 million in 2016).

USACE is doing a project deficiency study of our FRM channel downstream.

A Regional Sediment Management solution could reduce the costs of one or both of these chronic issues.