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Portland District, Optimizing Fall Creek Reservoir Flush TMDL's,

Stanford Gibson, Chris Nygaard, Jim Crain, Jarod Norton

Fall Creek Reservoir

- Fall Creek Dam is at river mile 7.2 on Fall Creek, a tributary of the Willamette River, about 20 miles southeast of Eugene, OR.
- Dam works in coordination with Lookout Point and Hills Creek dams to provide FRM, water quality improvement, irrigation, recreation, and habitat for fish and wildlife.
- Completed in 1966 at a cost of $22 million. Estimated $2.5 billion in potential flood related damages.
- Provides 115,100 acre-feet of storage, controls runoff from 184 square mile drainage, and provides a 1,582 acre reservoir.

- **BLUF:** Fall Creek Reservoir is the first regular USACE reservoir flushing initiative. NWP will collaborate with USGS to monitor the flushing event and with HEC to model it, applying new features in HEC-RAS to evaluate TMDLs and automate operational alternatives. The initiative will inform future flushing events for this reservoir, larger reservoirs in the region, and will help develop the case for passive reservoir sediment management initiatives corps wide, and tools available to manage downstream effects.

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- **Background:**
  - NWP re-operated Fall Creek in 2012, drawing the reservoir down 18' to run-of-river conditions.
  - Motivation for the drawdown was to effectively force downstream migration of juvenile salmon holding in the pool and flush non-native predator species from the reservoir.
  - The drawdown dropped the reservoir to run-of-river flows and flushed 50,000 tons of sediment, depositing about a third of that in the downstream reach. Biological monitoring indicated that these operations improved fish passage and drawdowns were subsequently repeated in 2013, 2014, and are planned in 2016.
  - First recent, consistent, USACE reservoir flushing program.
  - USGS has sampled background sediment concentrations and elevated sediment load during the flushes, constructing rough sediment budgets.
  - Data gaps exist and need to be modeled to ensure that TMDL's for the system are not being exceeded.

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Problem Statement/Issue

- Reservoir flushes at Fall Creek have not been modeled.
- USGS has sampled background sediment concentrations and elevated sediment load during the flushes, constructing rough sediment budgets..
- Optimize flushing at Fall Creek and develop tool to inform other flushing events in the basin.

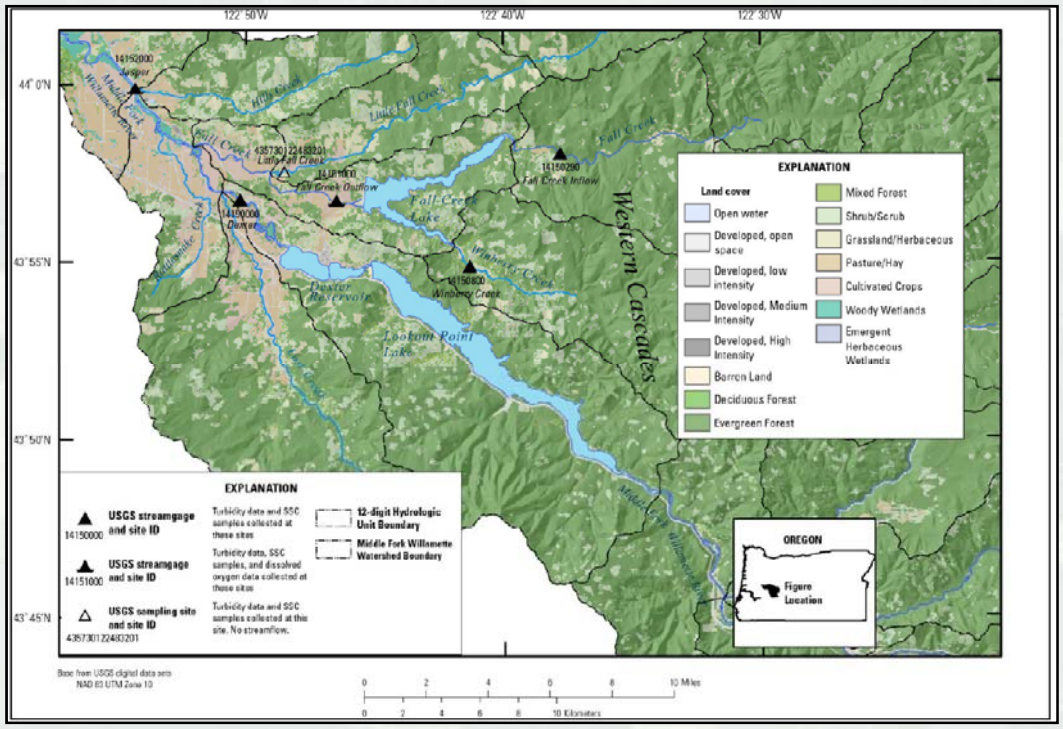

Figure 2: USGS Sampling Locations.

Approach to Address Problem

(non-technical)

- An operational model will help the NWP predict regional effects of these operations, managing for downstream concentration and deposition.
- Coordinate similar flushing events within a multi-reach, multi-reservoir system.
- NWP is considering returning Fall Creek and other systems to run-of-the-river conditions to improve fish passage and temperature control infrastructure.
- Provide a scale analog for operating regional basin reservoirs to optimize through-reservoir smolt survival and downstream turbidity.
- Build stakeholder confidence in our ability to predict downstream effects.

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What is working? Ups? Success?

- Application for use on other similar reservoir systems.
- Leveraging existing data collection by USGS.
- NWP ability to 'test' the run-of-river use of the system.
- Building a knowledge base through continued reservoir flushing.
- Ability to host other groups interested in similar flushing events.

What is not working? Downs? Issues?

- Personnel availability.
- Opportunities to modify the drawdown to do a 'better' job with TMDL's.

Deliverables

Stable HEC-RAS Unsteady Sediment Model	6/30/16
Calibrated HEC-RAS Unsteady Sediment Model	7/31/16
Alternative Recommendations	8/15/16
Technical Report	9/30/16
Conference or Journal Paper	FY17

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Approach to Address Problem
(Tools, Models, Technologies)

- Evaluation of existing data collected by USGS from previous flushing events.
- Develop an unsteady HEC-RAS sediment model based on 2012 LiDAR and calibrate it to the 2012 USGS sediment budget, potentially validating it with 2013 or 2014 data.
- Evaluate alternative operations, optimizing in-reservoir smolt survival with downstream turbidity and deposition.
- Develop Flushing Features in HEC-RAS: HEC added "concentration rules" to the unsteady sediment capabilities in HEC-RAS, precisely for applications like this, to automate operations constrained to downstream TMDLs
- Establish flushing precedent to demonstrate NWP's ability to model and predict downstream effects.

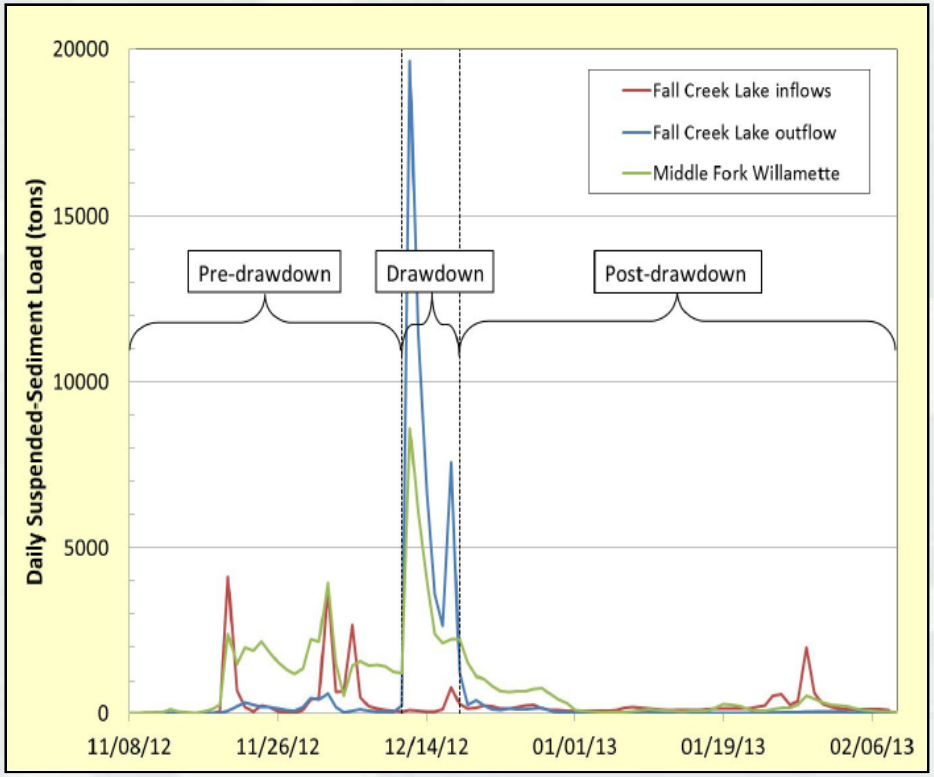

Figure 3: Sediment loads measured into (red), out of (blue), and 10 miles downstream (green) of Fall Creek reservoir before, during, and after the 2012 drawdown event (from Schenk and Bragg, 2015).

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USACE RSM PDT

- Stanford Gibson, Hydraulic Engineer
- Chris Nygaard, Hydraulic Engineer
- Jim Crain, Hydraulic Engineer
- Jarod Norton, RSM Project Manager

What key leveraging opportunity(s) did stakeholders/partners provide?

- USGS provided monitoring data, and leveraging of USGS resources ($350k)
- Use a successfully demonstrated project, that needs to capture and narrate what happened.
- Run-of-the-river conditions successfully improving salmonid passage and spawning opportunities.

Figure 4: 2012 Fall Creek Reservoir drawdown from 2012.

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Value to the Nation

- Value added
  - Run-of-river conditions increase spawning habitat for ESA-listed salmonids
  - Value of sediments previously trapped behind the reservoir flushing downstream.
- Leveraging resources
  - USGS monitoring stations have been in place and provide us with data on ambient and project conditions
- Environmental benefits
  - Spawning habitat
  - Increased salmonid populations
  - Benefits to other species that rely on salmonids
- Allowing for the most effective use of the reservoir flush to achieve desired benefits while limiting TMDL's.
- Permitting and compliance requirements improved (cost savings from reduction in requirements)
- Other