Trinity River Restoration Program Performance Measure:

Increase and Maintain Coarse Sediment Storage

Hypothesis: Increasing coarse sediment storage in the Trinity River will result in increased bar amplitude and channel complexity.

Importance: Since Trinity and Lewiston Dams trap sediment that would have been delivered from the watershed upstream, supplies of mobile coarse sediment are depleted downstream from Lewiston Dam. The lack of a coarse sediment supply results in armoring of the bed surface and a deficit of the sediments that build bars and other components of aquatic habitat. This performance measure tracks changes in the supply of coarse sediment in response to flow and sediment management activities.

Objective: Determine if coarse sediment storage is increasing in the reaches between Lewiston Dam and Indian Creek.

Related Program Objectives from the Integrated Assessment Plan or the Flow Study:
Increasing coarse sediment storage to pre-dam levels upstream from Indian Creek is an objective discussed in the Flow Study and in the Trinity River Record of Decision (ROD). The following objectives are specified in the Integrated Assessment Plan (IAP):

Objective 1: Create and maintain spatially complex channel morphology
- Sub-objective 1.1: Increase physical habitat diversity and availability
- Sub-objective 1.2: Increase coarse sediment transport and channel dynamics
- Sub-objective 1.3: Increase and maintain coarse sediment storage

Targets, Predicted or Desired Response: Increase to pre-dam levels as soon as possible.

Source of Target for Performance Measure: ROD and IAP.

Technical Approach: Coarse sediment transport will be directly assessed through the existing mainstem sediment monitoring program. Four mainstem sediment sampling locations have been established in the first 20 river miles below Lewiston Dam. Their positions with respect to Lewiston Dam and major tributaries are illustrated in Figure 1.

The Program intends to reestablish a balanced coarse sediment budget downstream of Lewiston Dam to Indian Creek. Downstream of Indian Creek the reduction in sediment attributable to Trinity Dam rapidly diminishes. Downstream of Indian Creek, the cumulative effects of Indian, Weaver, Reading, and Browns Creek greatly increase coarse sediment supply to the Trinity River (Flow Study). By adding coarse sediment to the river at a rate approximately equal to the long-term transport rates of the ROD flow regime we hope to restore the movement of sediment into and out of reaches similar to that found in the pre-dam Trinity River.

Coarse sediment storage in the reach from Lewiston Dam to Douglas City was computed based on measurements of coarse sediment transport rates and loads at four monitoring transects (Wilcock 2010, Gaeuman and Krause 2011). This section of river is subdivided into four mainstem sediment budget segments as shown in Figure 1; these segments are bounded at their downstream ends by mainstem

coarse sediment sampling locations and at their upstream ends either by an adjacent sediment sampling location or by Lewiston Dam. From upstream to downstream, the four monitoring locations are referred to as Trinity River at Lewiston (TRAL), Trinity River at Lowden Meadows (TRLM), Trinity River at Limekiln Gulch (TRLG), and Trinity River at Douglas City (TRDC) (Figure 1).

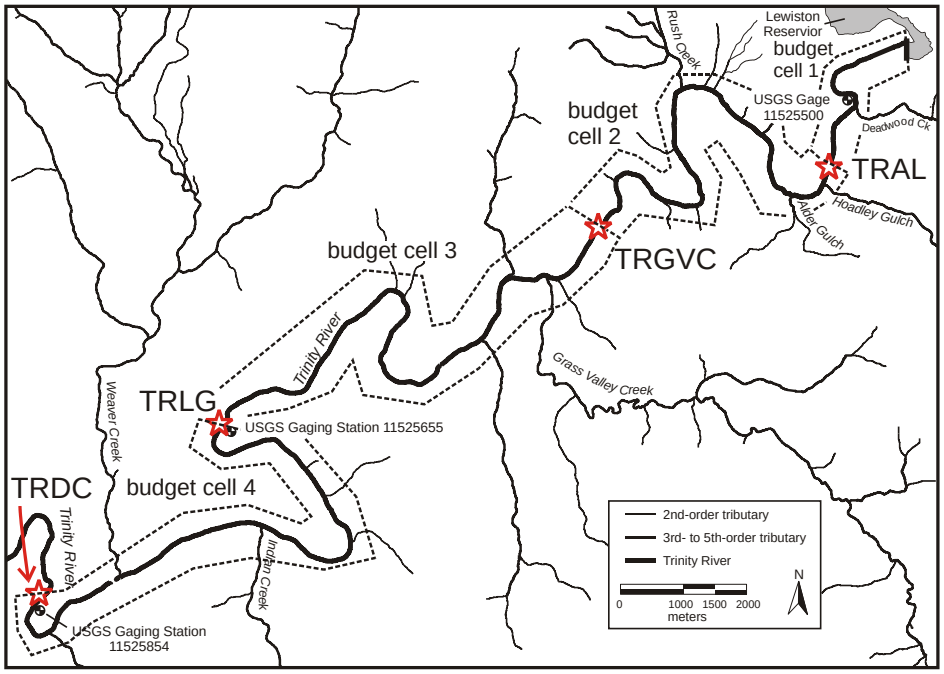


Figure 1: Map of the Trinity River basin downstream from Lewiston Dam showing the locations of sediment monitoring stations and sediment budget cells.

The sediment budget for each of these reaches incorporates measured mainstem bedload fluxes, coarse sediment augmentations, and estimated bedload inputs delivered to the mainstem from tributaries according to the general formula:

$$\Delta S = I_U + I_A + I_T - O$$

where I_U is the bedload input at the upstream boundary of the cell (zero in the case of Lewiston Dam), I_A is the quantity of coarse sediment augmentations in the cell, I_T is the bedload input from tributaries within the cell, O is the bedload output at the downstream boundary of the cell, and ΔS is the change in bedload storage in the cell.

Results: The coarse sediment budget suggests that the coarse sediment deficit in the 13 river miles downstream from Lewiston Dam has been greatly reduced over the past decade (Gaeuman and Krause 2011). In Figure 2, the dashed line indicates the point at which the accumulated deficit in these reaches since dam closure is eliminated (Gaeuman and Krause 2011). At present rates of input, the deficit should continue its decline toward 0 indicating a restoration of course sediment storage to pre-dam levels in the future.

The movement of sediment into and out of reaches should balance over time once the coarse sediment deficit has been eliminated (Figure 3). Cumulative changes in course sediment storage down river from Lewiston Dam to the Trinity River at Lewiston (TRAL), from TRAL to TRGVC, and from TRGVC to Trinity River at Limekiln Gulch increased, indicating increases in coarse sediment storage in the reaches.

This increased storage is necessary to reach the pre-dam conditions. From TRLG to Douglas City, no net increase in coarse sediment storage was observed (Gaeuman and Krause 2011).

Sediment budget calculations incorporate substantial uncertainties. Annual sediment transport monitoring and periodic bathymetric surveys are needed to continue tracking sediment storage changes into the future.

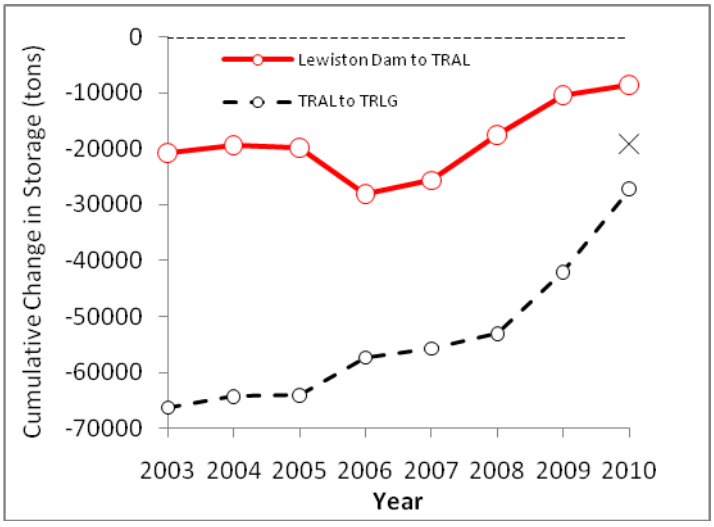
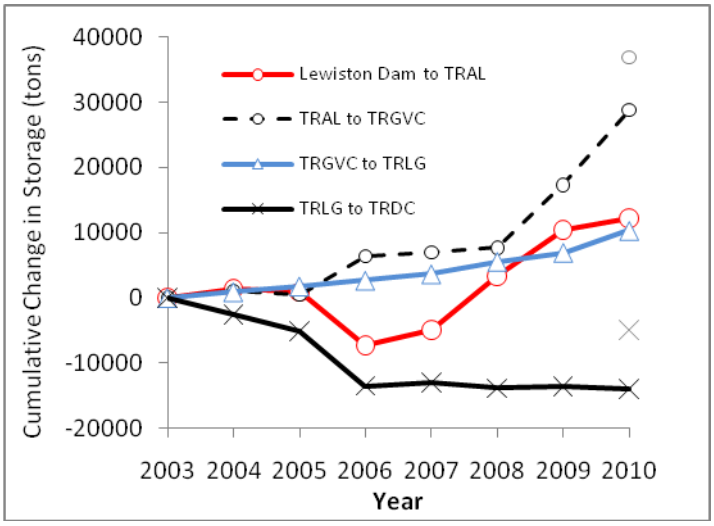


Figure 2: Cumulative changes in coarse sediment storage since dam closure in the budget cell 1 and the budget cells 2 and 3 combined as of the end of WY 2010. The X indicates the cumulative change in budget cells 2 and 3 as of January 2011, prior to the 2011 high flow release.

Figure 3: Cumulative changes in coarse sediment storage by budget cell for each water year between 2004-2010 (zero budget balance was assigned to WY 2003). Cumulative changes including fall 2010 construction placements (early WY 2011) in budget cells 2 and 4 are indicated with the solitary symbols.



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