Linking Sediment Supply, Substrate Conditions, and Management Actions in the Napa River Watershed

San Francisco Bay Regional Water Quality Control Board

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May 15, 2015

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Presentation Outline

- Mid-1990s through early-2000s, sediment supply was about 180% natural and more than half was human-caused
- At that time, salmon and steelhead habitat was adversely affected by high concentrations of sand in the streambed
- Channel incision identified as a major sediment source and primary agent of habitat simplification.
- This past decade, there has been a lot of river restoration and upland erosion control
- Therefore it's reasonable to hypothesize that human-caused erosion has decreased and that channel substrate conditions have improved
- How can determine how much progress has been made?

Sediment Budget Identifies Sources and Relative Contributions

The 1994-2004 sediment budget involved:

- Extensive field reconnaissance to define sub-areas that are similar with regard to natural process and land-use effects on sediment supply
- Identifying, mapping, and surveying sediment sources at representative sites
- Interpreting time-sequential aerial photos, and conducting field surveys to identify natural and man-made datums in order to define erosion timeframes.
- Calculated rates of sediment delivery to channels (tons/km^2/year)
- Verifying results by comparing to reservoir sedimentation rates

Sediment Supply
Terrain Types & Erosion potential

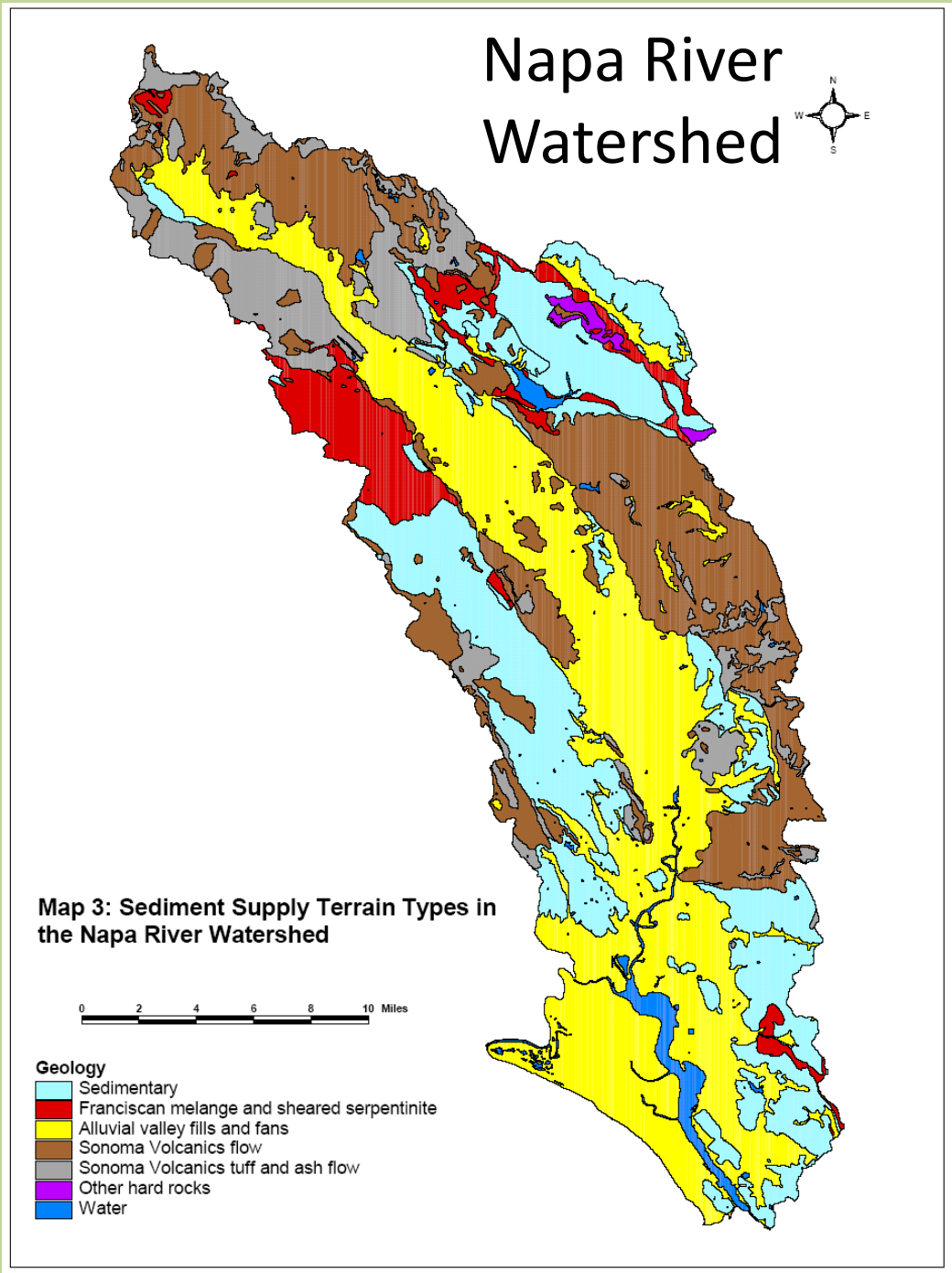
Hard Bedrock - low-moderate

Sedimentary – medium – high

Ash-flow Tuff – medium-high

Sheared Bedrock – high – extreme

Lowland/Valley Flat – High for incision



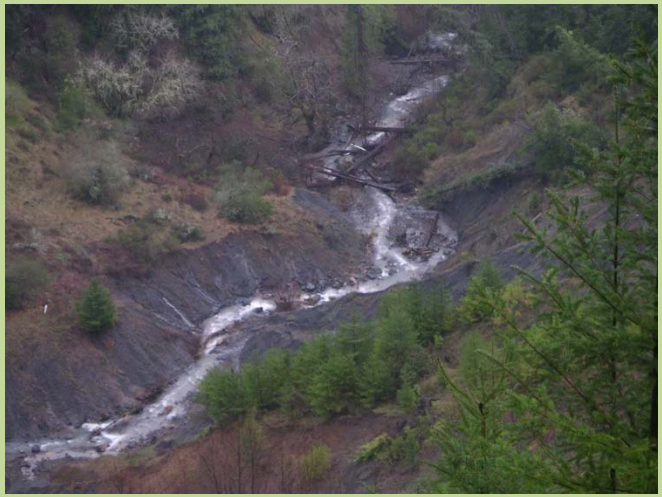
Hard Bedrock Type

Cobble-boulder substrate provides important rearing habitat, low natural erosion rates, but sensitive to small increase in fines.

Soft Sedimentary Type

Very low natural erosion rates, but potential for significant reaction to changes in runoff.

Upland Sediment Sources



Natural erosion

Road-related

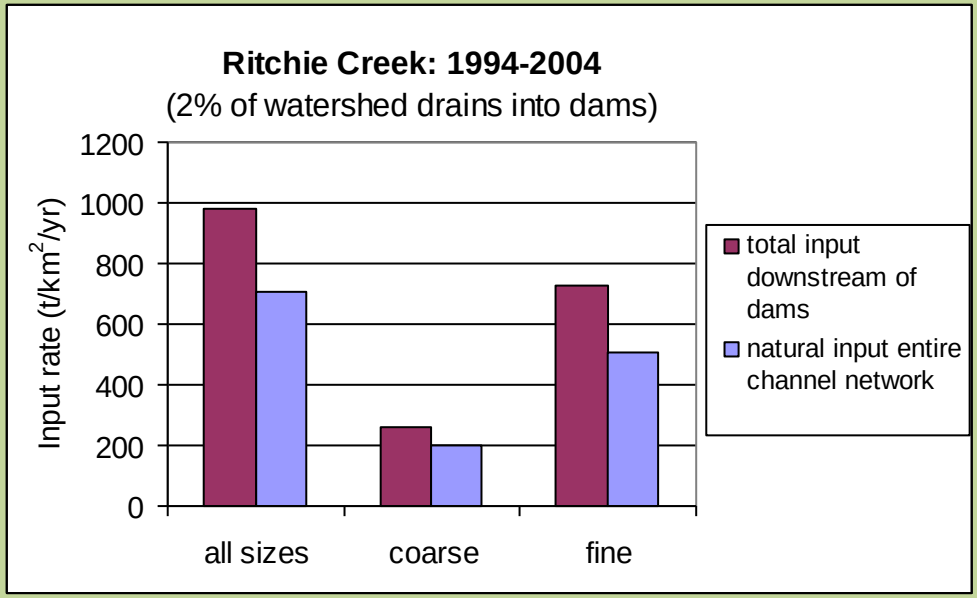
Vineyard-related

Grazing-related

Valley Floor Sediment Source

Human-caused Bed and Bank Erosion

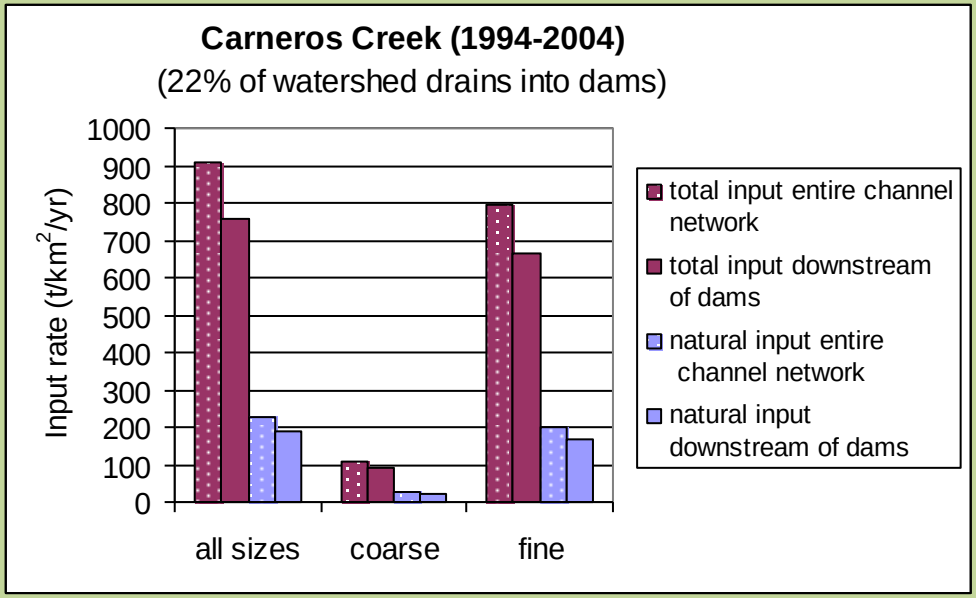
Sediment Budget Findings



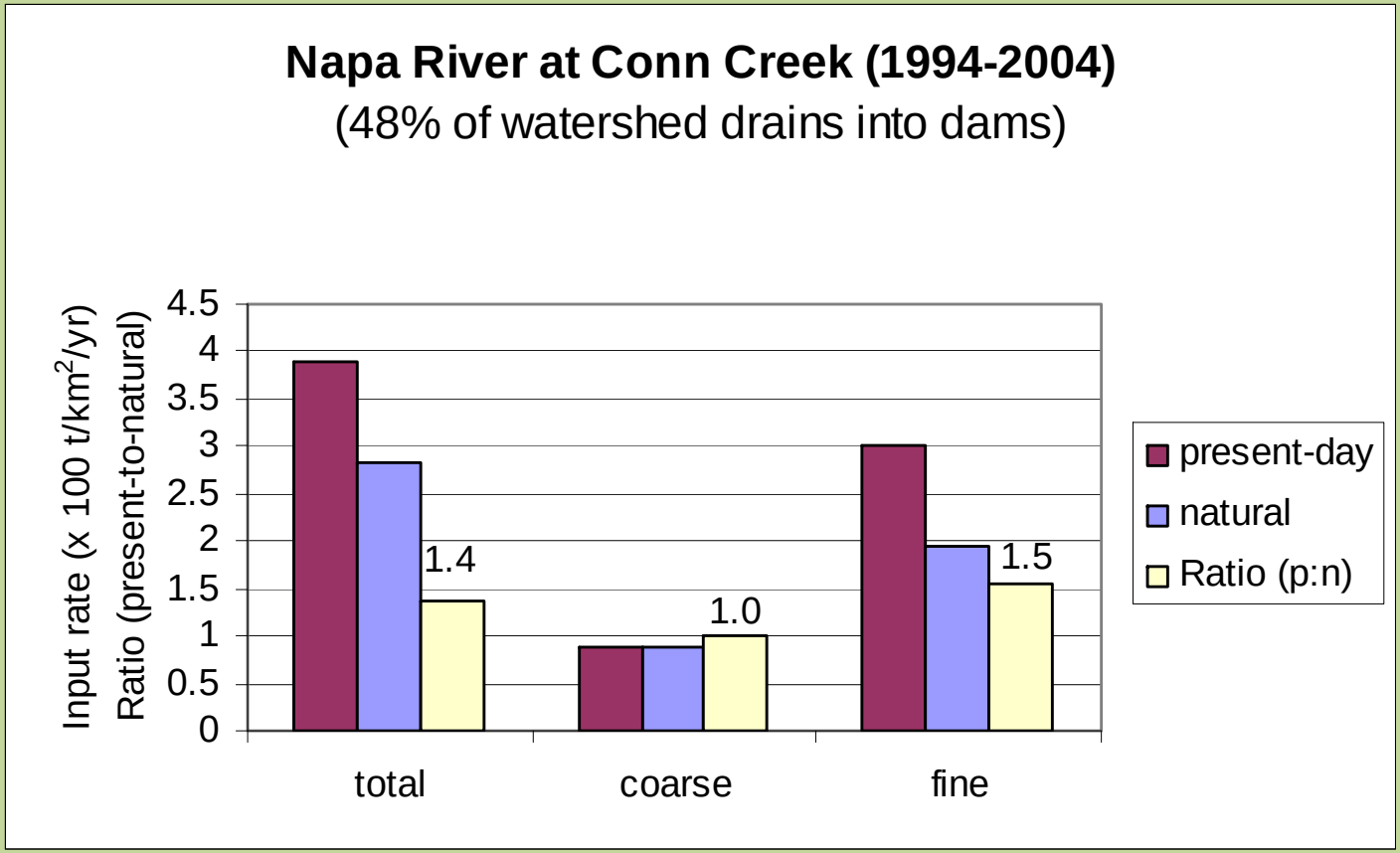
1/3 sediment delivery land use activities (mainly roads)

Naturally occurring landslides main source

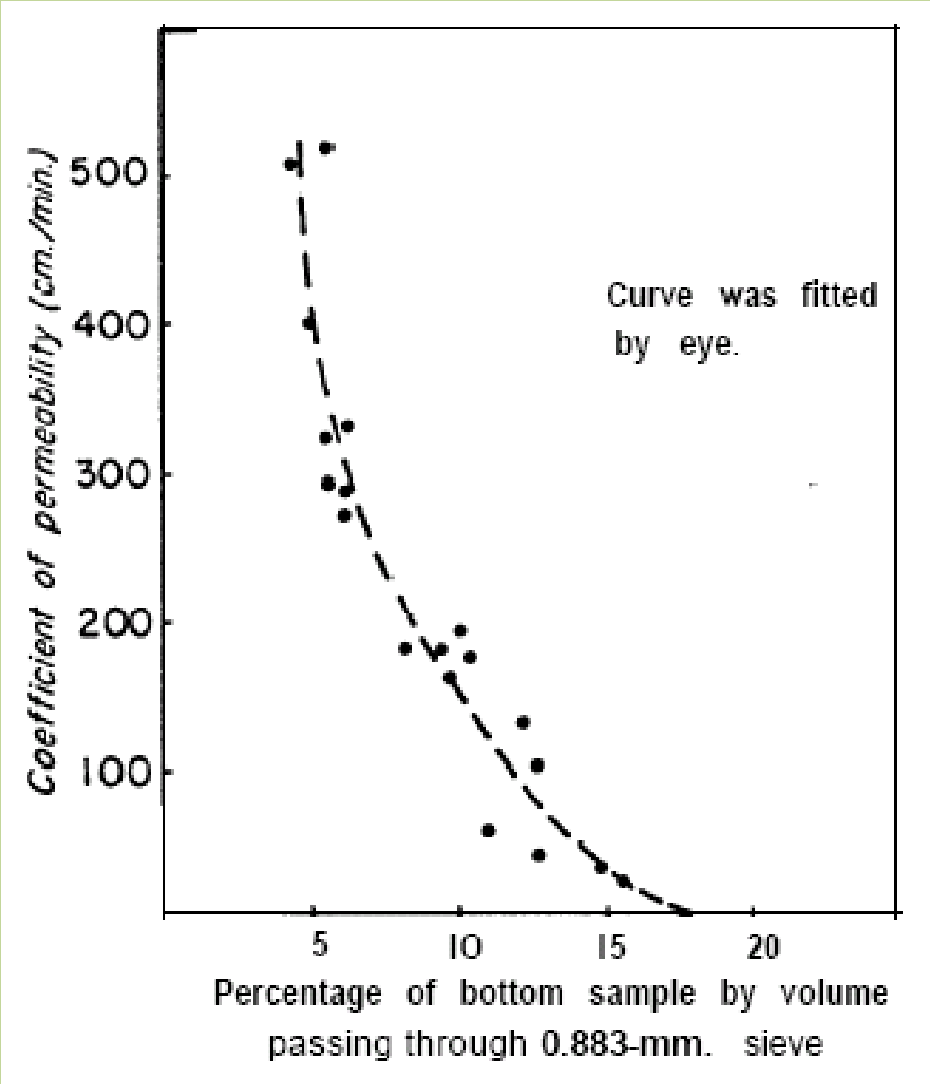
¾ sediment delivery from land use activities



Fine sediment load is about 150% of natural background in middle reaches (where influences of dams are greatest).

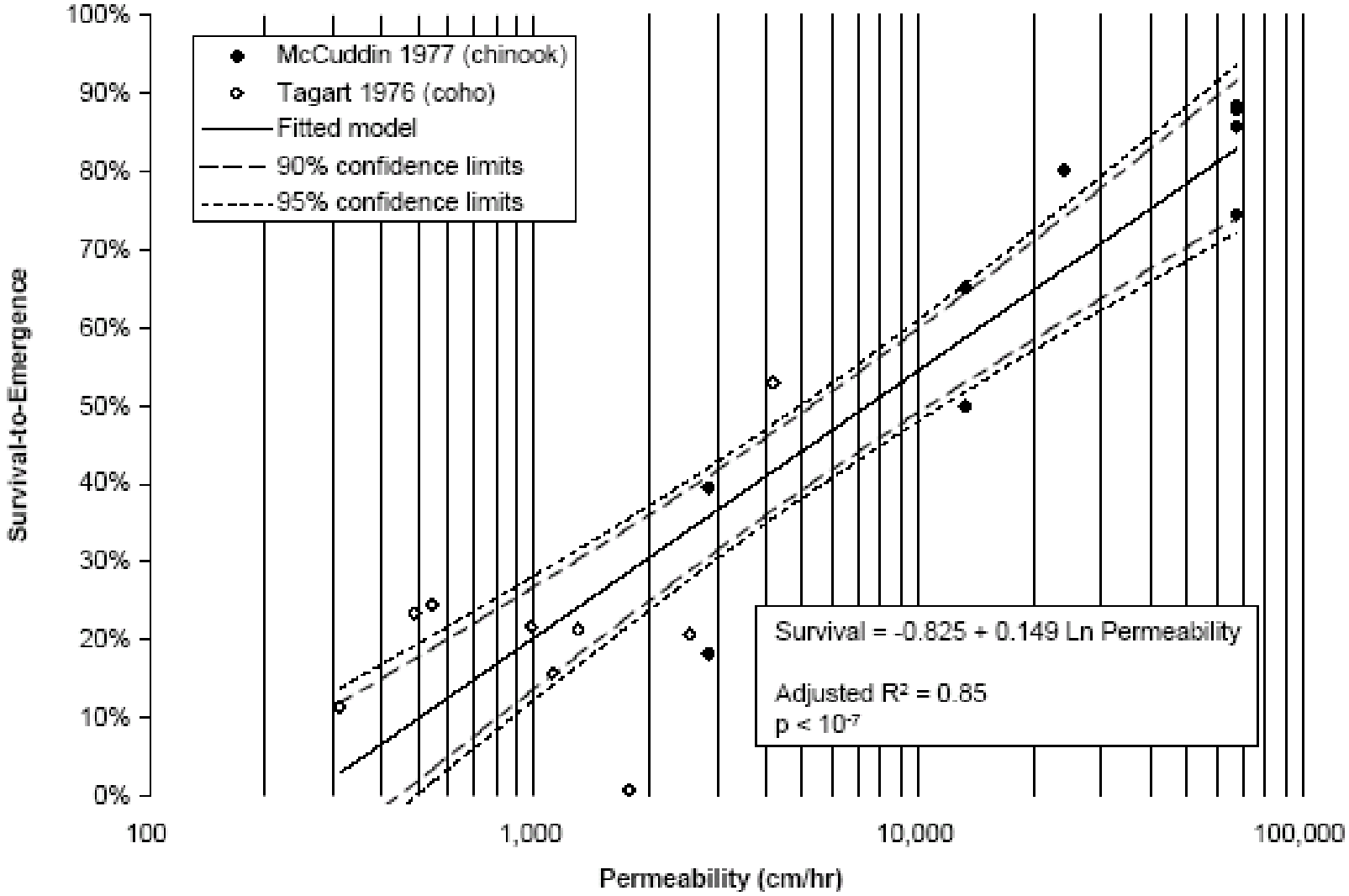


As sand deposition increases, flow rate through gravel (permeability) decreases



Source: McNeil and Ahnell (1964)

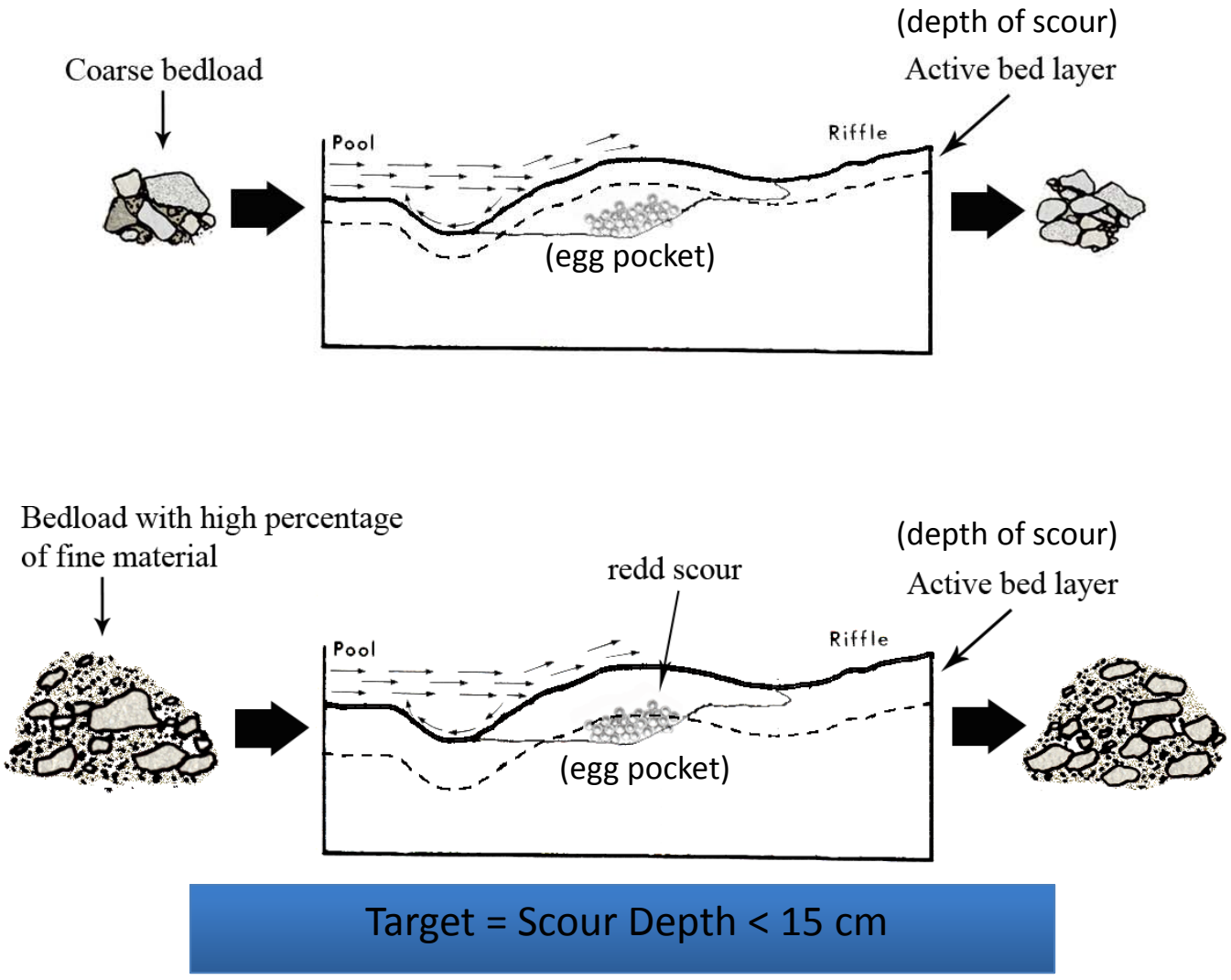
Permeable gravel supports salmon egg survival



Baseline period, median streambed permeability = 4800 cm/hr

Target = 7800 cm/hr or >50% survival

As total amount of sediment transported near bed increases or gets finer in texture, extent of streambed scour increases



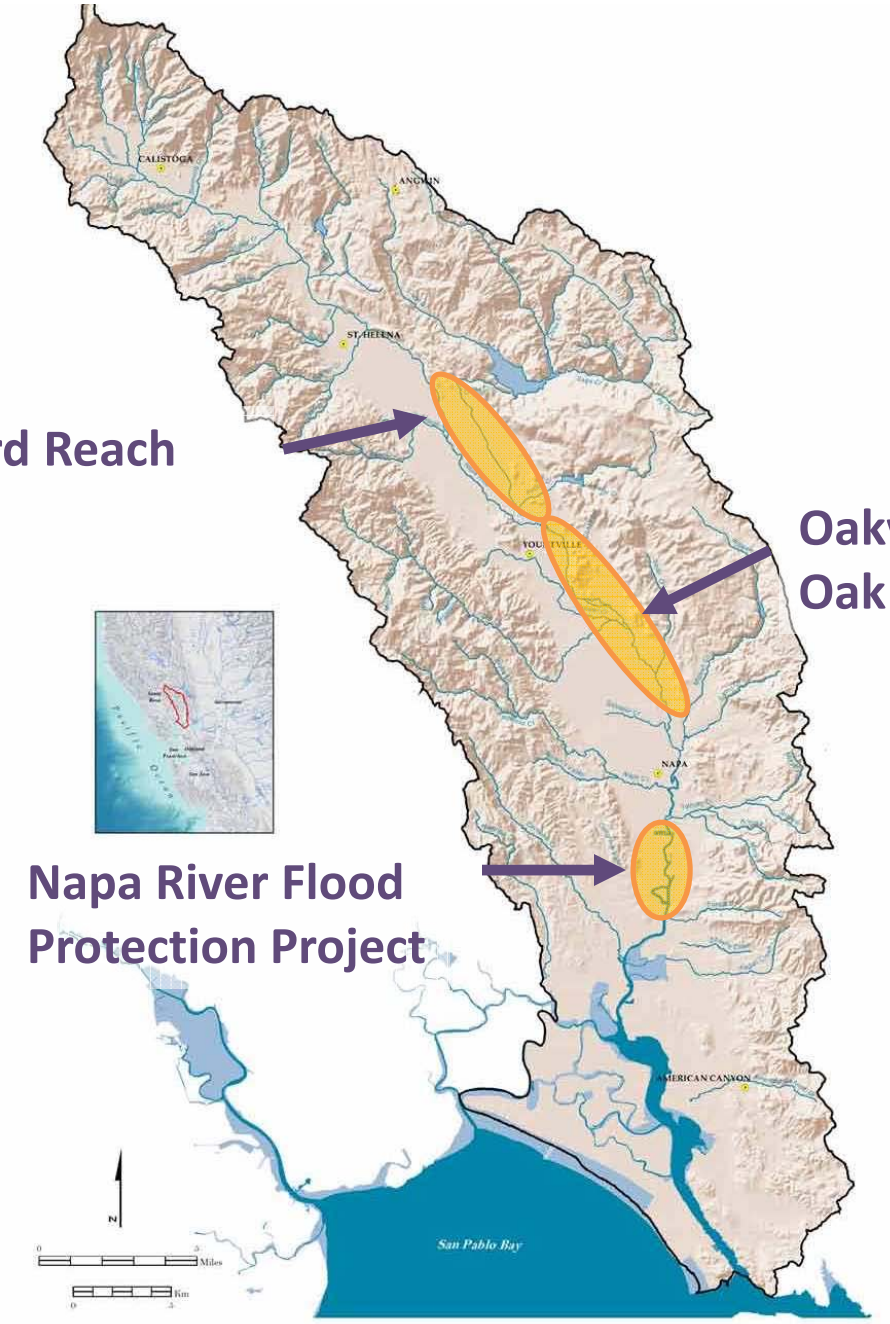
Target = Scour Depth < 15 cm

Restoring Habitat in the Napa River

Photo Credit: Phillip Williams & Associates

Napa River at Rutherford Cross Road (looking downstream)

Restoring habitat along the Napa River



Napa County Flood Control
& Water Conservation District

Addressing incision at Rutherford Reach at Sequoia Grove

Photo credits: ESA Associates and Tessera Sciences

Lots of Upland Erosion Control

Photo credits: Napa County Planning

52,500 Acres vineyard property (40% certified)

Erosion control looks good
Work underway to address concentrated runoff

Work underway to assess and control sediment delivery from roads

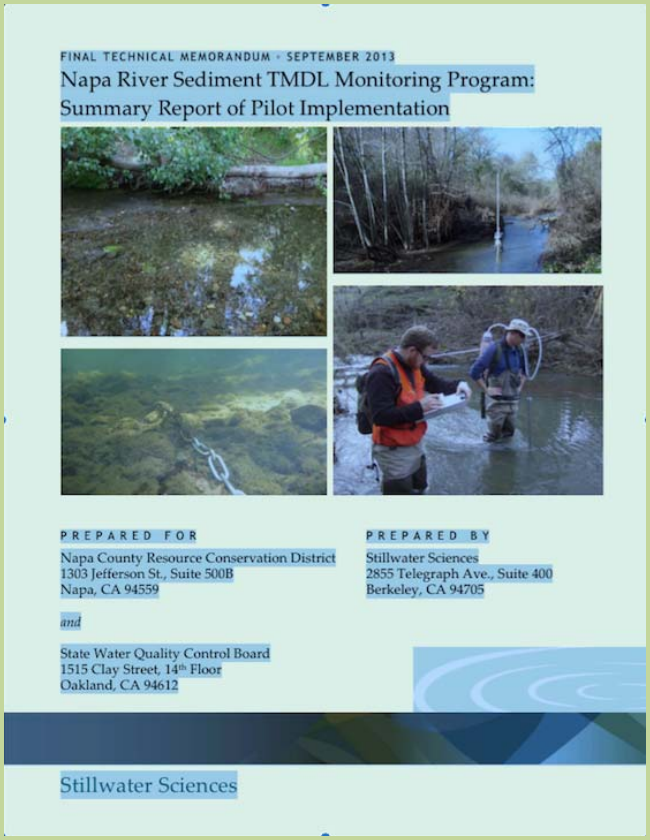
Building a Plan for Demonstrating Success

- Update the sediment budget
- Assess streambed permeability and redd scour
- Link actions to changes

Updating the Sediment Budget

- Quantify sediment sources at a greater number of sites
- Cosmogenic analyses to improve estimates of natural supply
- Reassess ground-cover to improve sheetwash estimate
- Road map and sediment traps to improve road delivery estimate
- Update channel incision estimate to reflect restoration projects
- Additional reservoir surveys to check sediment delivery estimates

Implement 2013 Recommendations for Permeability and Redd Scour Monitoring



FINAL TECHNICAL MEMORANDUM · SEPTEMBER 2013

Napa River Sediment TMDL Monitoring Program:
Summary Report of Pilot Implementation

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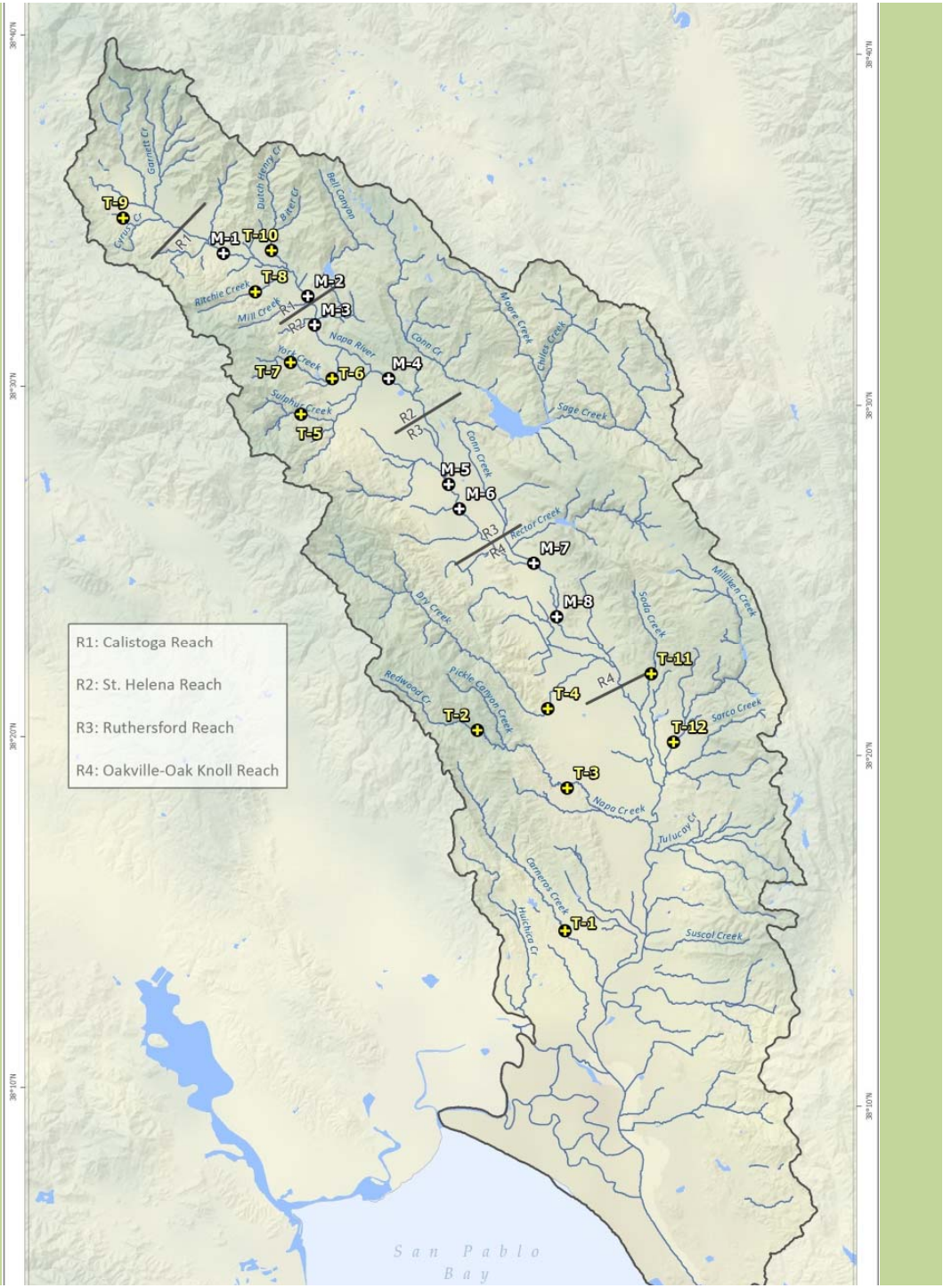

Why Invest in More Studies?

- Develop linkages between sediment supply and substrate conditions
- Update action plans as needed to optimize benefits and achieve sediment targets faster
- Predict future supply reductions from implementation of farm and ranch plans and planned restoration projects