Napa River Watershed Profile
Health and Resilience through Complexity

WICC Board Meeting

January 24, 2013

Meredith Williams

San Francisco Estuary Institute

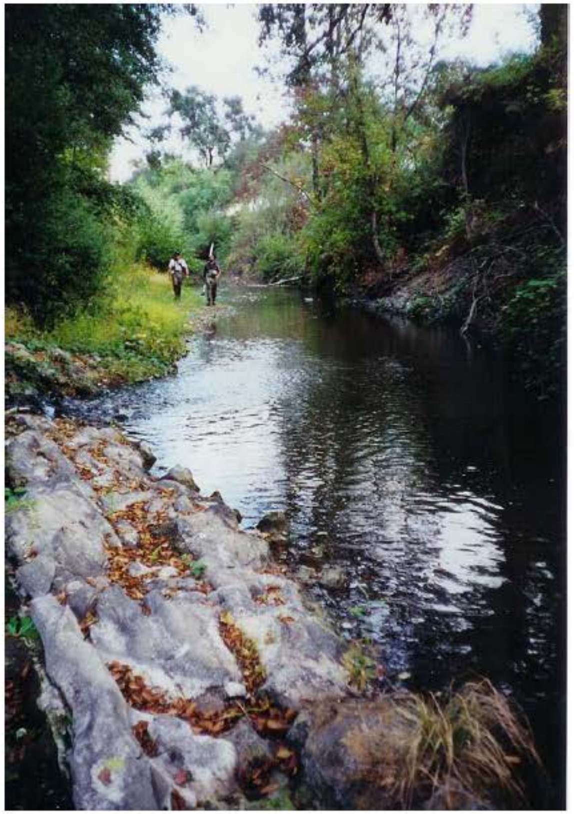
NAPA COUNTY
RCD
Resource Conservation District

NAPA COUNTY
FB
100
YEARS
1913 - 2013
FARM BUREAU

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

California Regional Water Quality Control Board
San Francisco Bay Region

Napa River Sediment TMDL and Habitat Enhancement Plan



Staff Report

Michael Napolitano
Sandia Potter
Dyan Whyte
September 2009

Attributes of an alluvial river and their relation to water policy and management

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Contributed by Luna B. Leopold, August 15, 2000

Rivers around the world are being regulated by dams to accommodate the needs of a rapidly growing global population. These regulatory efforts usually oppose the natural tendency of rivers to flood, move sediment, and migrate. Although an economic benefit, river regulation has come at unforeseen and unevaluated cumulative ecological costs. Historic and contemporary approaches to remedy environmental losses have largely ignored hydrologic, geomorphic, and biotic processes that form and maintain healthy alluvial river ecosystems. Several commonly known concepts that govern how alluvial channels work have been compiled into a set of "attributes" for alluvial river integrity. These attributes provide a minimum checklist of critical geomorphic and ecological processes derived from field observation and experimentation, a set of hypotheses to chart and evaluate strategies for restoring and preserving alluvial river ecosystems. They can guide how to (*i*) restore alluvial processes below an existing dam without necessarily resorting to extreme measures such as demolishing one, and (*ii*) preserve alluvial river integrity below proposed dams. Once altered by dam construction, a regulated alluvial river will never function as before. But a scaled-down morphology could retain much of a river's original integrity if key processes addressed in the attributes are explicitly provided. Although such a restoration strategy is an experiment, it may be the most practical solution for recovering regulated alluvial river ecosystems and the species that inhabit them. Preservation or restoration of the alluvial river attributes is a logical policy direction for river management in the future.

Since the 1990s, the physical and environmental consequences of river alteration and management have been openly questioned. Continued increases in flood losses, both financial and human, and the unanticipated and unwanted results of dams and channel straightening, invite reevaluation of river management. Reevaluation has even led to removing existing dams (e.g., Butte and Clear creeks in California, Elwha River in Washington), as well as implementing experimental releases of high flows (1, 2).

Historically, river policymakers and resource managers have

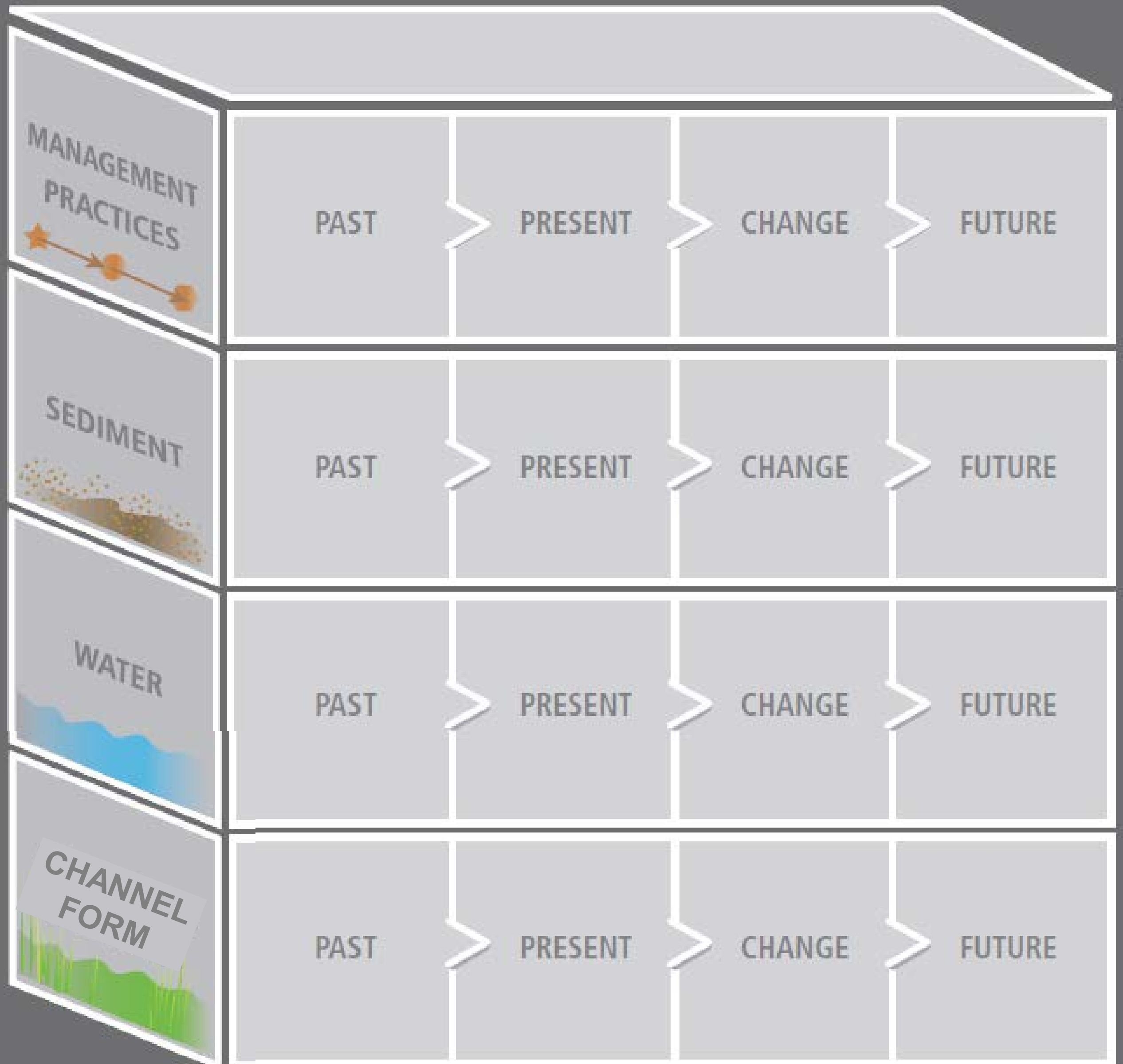
imposed on the river ecosystem (e.g., a recommended flow release), we should expect a response (e.g., scouring sand from a pool). The significance of an impetus will depend on an appropriate threshold beyond which a specific response is expected. A process, therefore, is comprised of an impetus and an expected response. To use the alluvial river attributes as guidelines for recovering or preserving critical processes, one must consider how the magnitude, duration, frequency, and timing of an impetus will exceed a threshold to produce a desired response. Rarely, however, is a single impetus imposed on a river ecosystem associated with a single response.

Floods are primary impetuses for all alluvial river morphology. An increase in discharge may initiate bed surface movement and bank erosion, once the force exerted by the flood event (the impetus) has passed some threshold for movement or erosion. This threshold may require a specific flow magnitude and duration before producing a significant morphological response. The timing and frequency of the flood also may have profound effects on a species or a population. Mobilizing sand from a pool in January may smother salmon eggs incubating in the downstream riffle. The impetus, therefore, cannot be prescribed as a simple measure of force, nor can the total reaction be as succinctly quantified or even fully anticipated. It is with this backdrop of uncertainty that the attributes were compiled.

The Alluvial River Attributes

The alluvial river attributes (3) can help river managers identify desired processes, then help prescribe necessary impetuses based on useful empirical relationships and thresholds developed by river geomorphologists and ecologists. All of the concepts deriving the alluvial attributes have been described among a wide range of professional journals, technical books, and agency reports (reviewed in ref. 2), but their compilation has not been previously published. They may not apply equally to all alluvial river ecosystems. Some rivers may not be capable of achieving certain attributes because of overriding constraints, e.g., a river

PROJECT FRAMEWORK

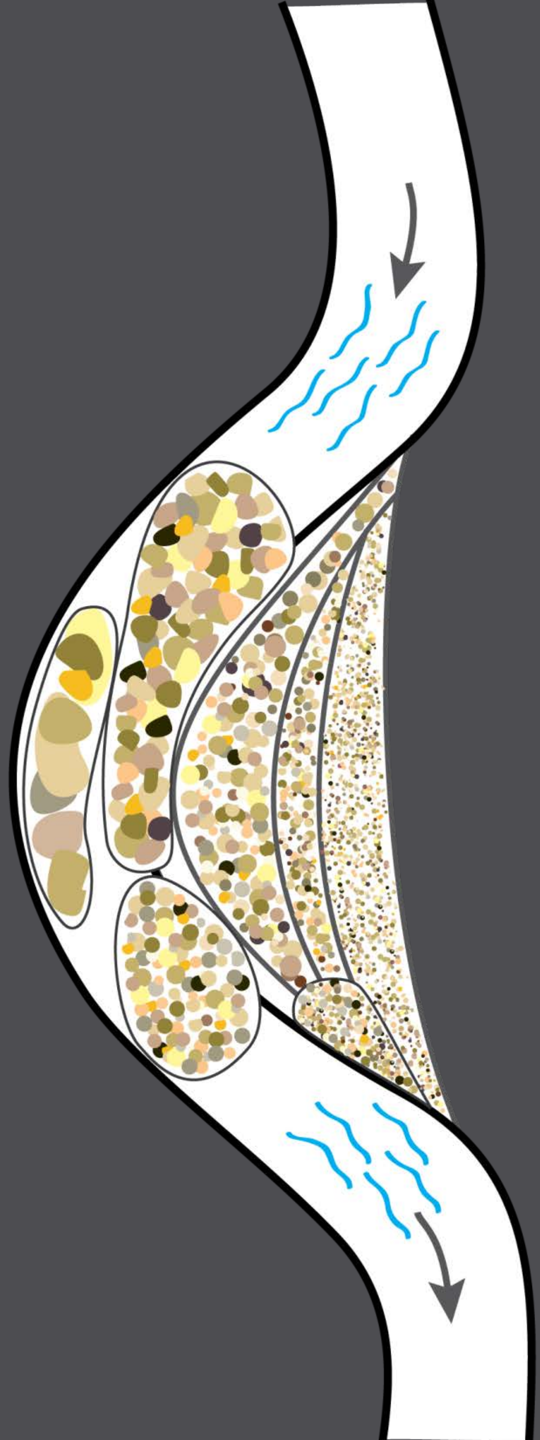


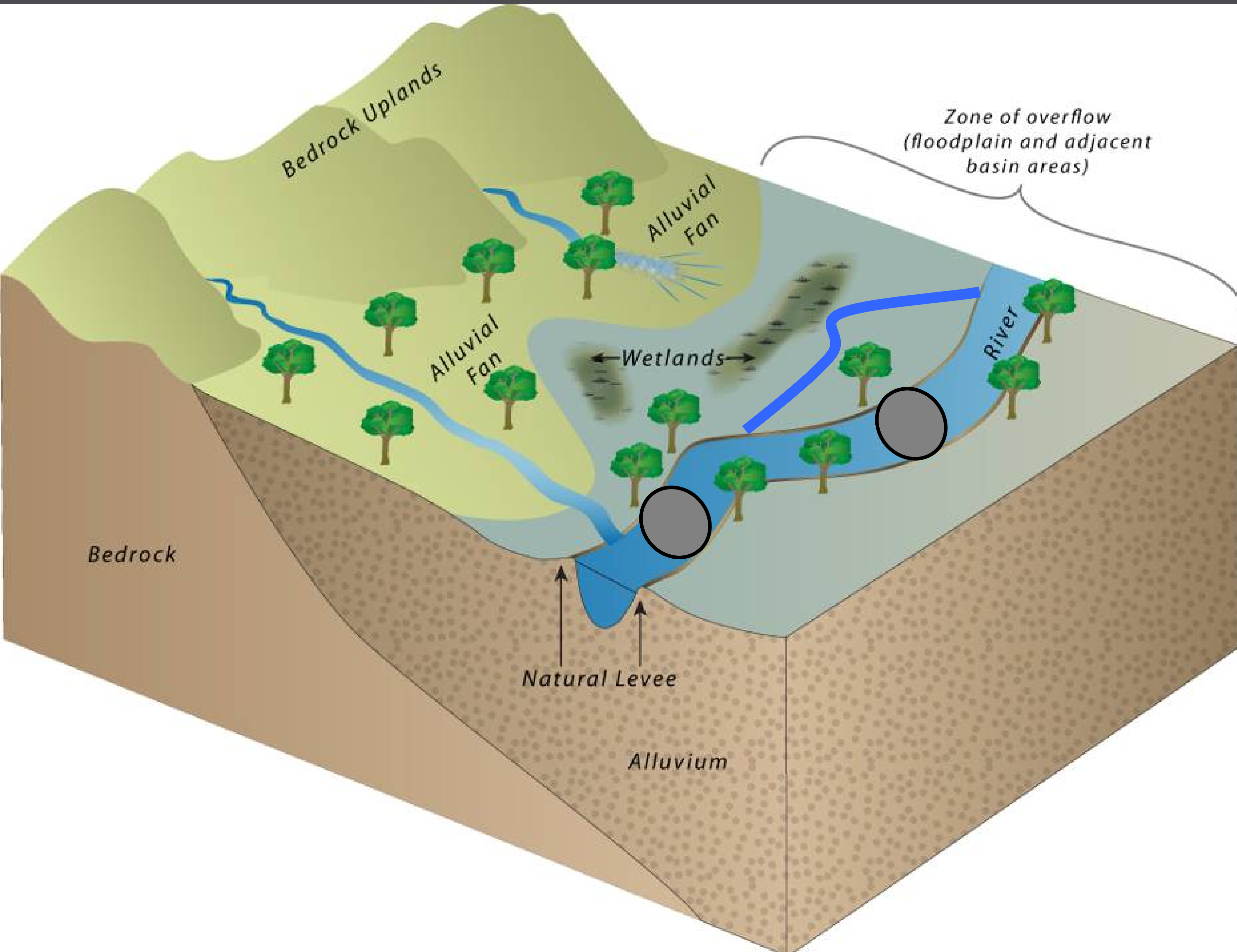
NAPA VALLEY
HISTORICAL ECOLOGY ATLAS

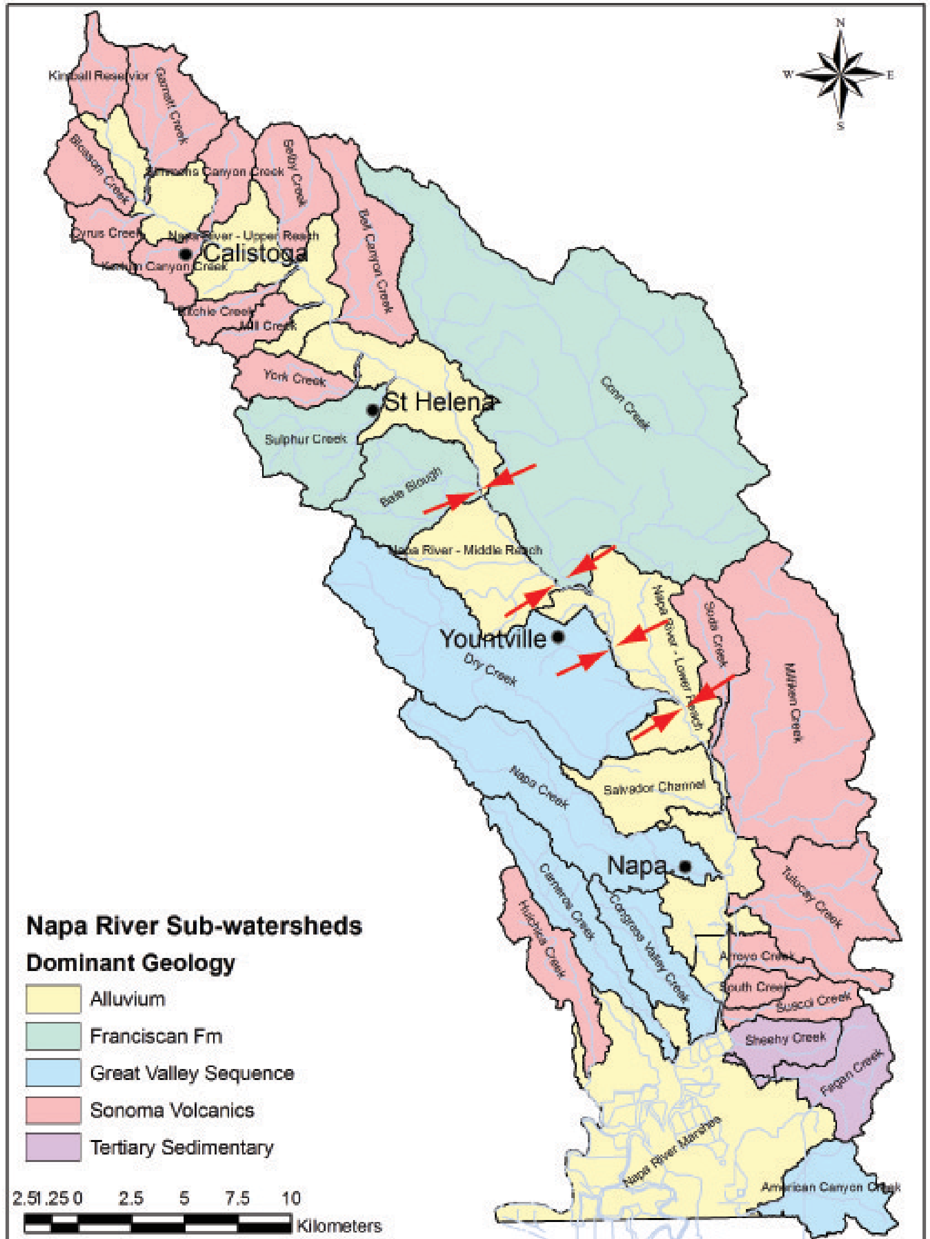
EXPLORING A HIDDEN LANDSCAPE OF TRANSFORMATION AND RESILIENCE

ROBIN GROSSINGER

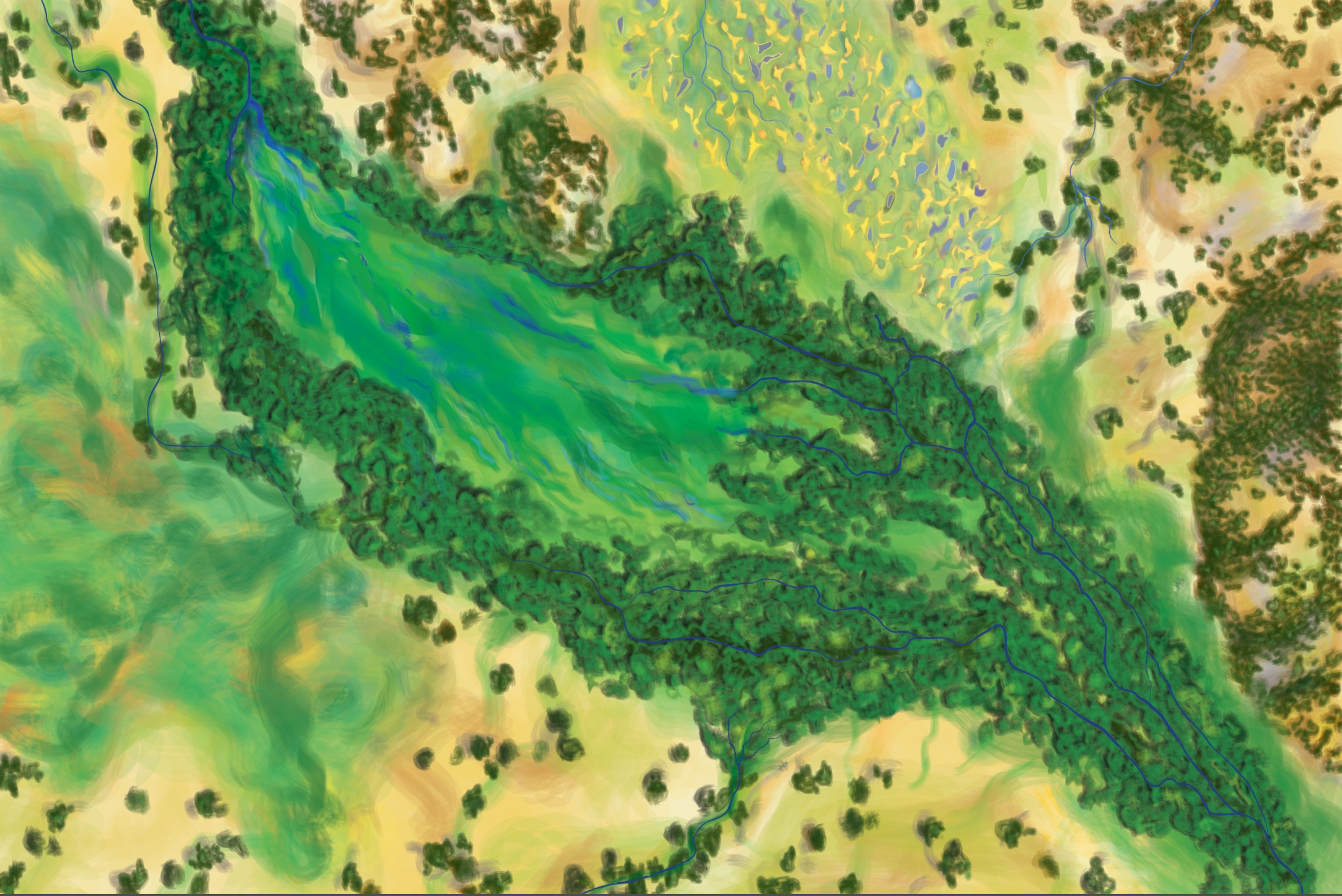
Design and Cartography by RUTH ASKEVOLD




Bedrock Uplands
Zone of overflow
(floodplain and adjacent
basin areas)
Alluvial
Fan
Alluvial
Fan
Wetlands
River
Bedrock
Natural Levee
Alluvium



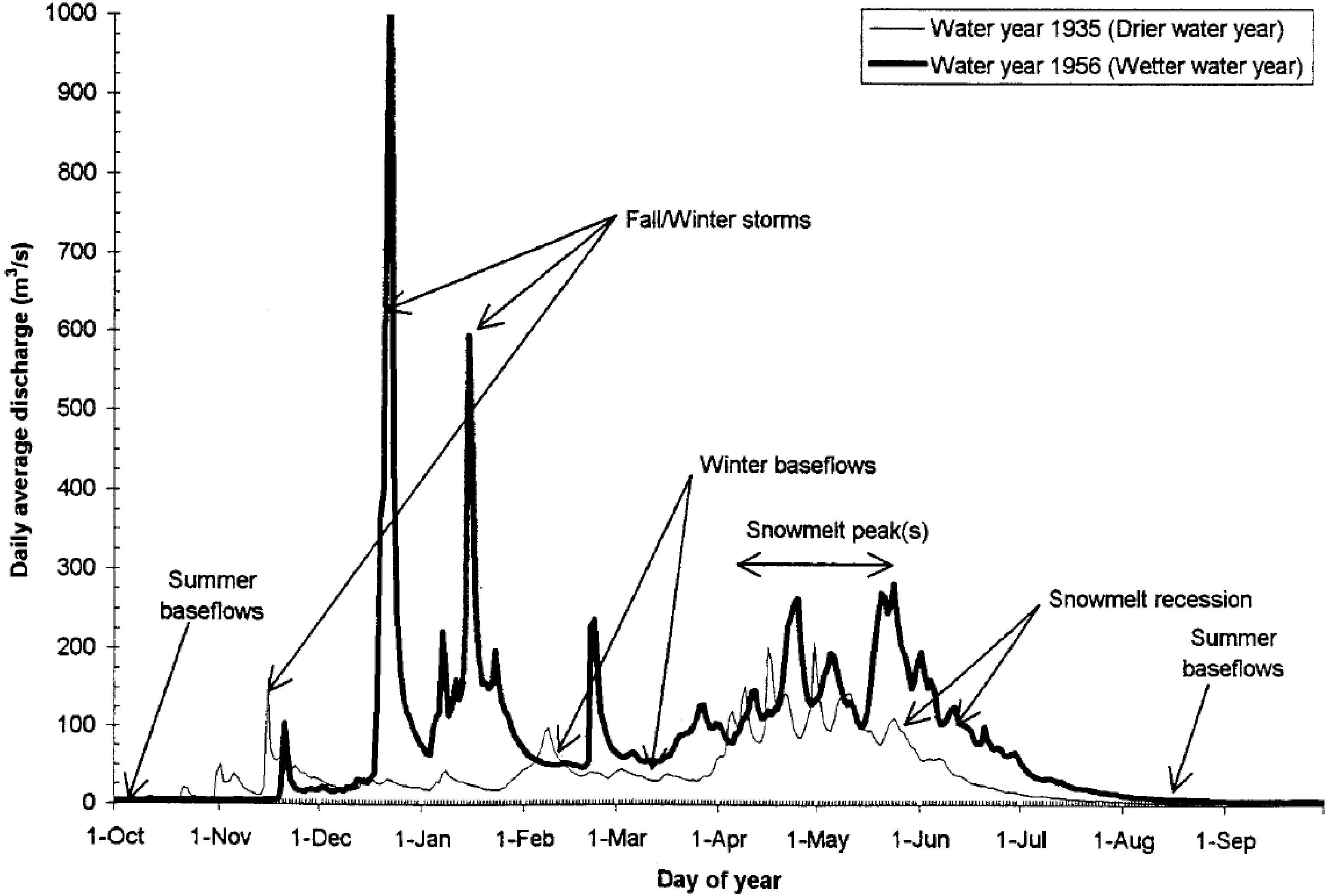
N
W
E
S
Kimball Reservoir
Garnett Creek
Blossom Creek
Selby Creek
Bell Canyon Creek
Cyrus Creek
Calistoga
Mill Creek
York Creek
St Helena
Sulphur Creek
Conn Creek
Bale Slough
Napa River - Middle Reach
Yountville
Dry Creek
Napa River - Lower Reach
Soda Creek
Milliken Creek
Salvador Channel
Napa Creek
Napa
Tulucay Creek
Carneros Creek
Congress Valley Creek
Huichica Creek
Arroyo Creek
South Creek
Suscol Creek
Sheehy Creek
Fagan Creek
Napa River Marshes
American Canyon Creek
Napa River Sub-watersheds
Dominant Geology
Alluvium
Franciscan Fm
Great Valley Sequence
Sonoma Volcanics
Tertiary Sedimentary
2.5 1.25 0 2.5 5 7.5 10
Kilometers



Drawing by Brian Maebius
from July 2012 *Bay Nature*

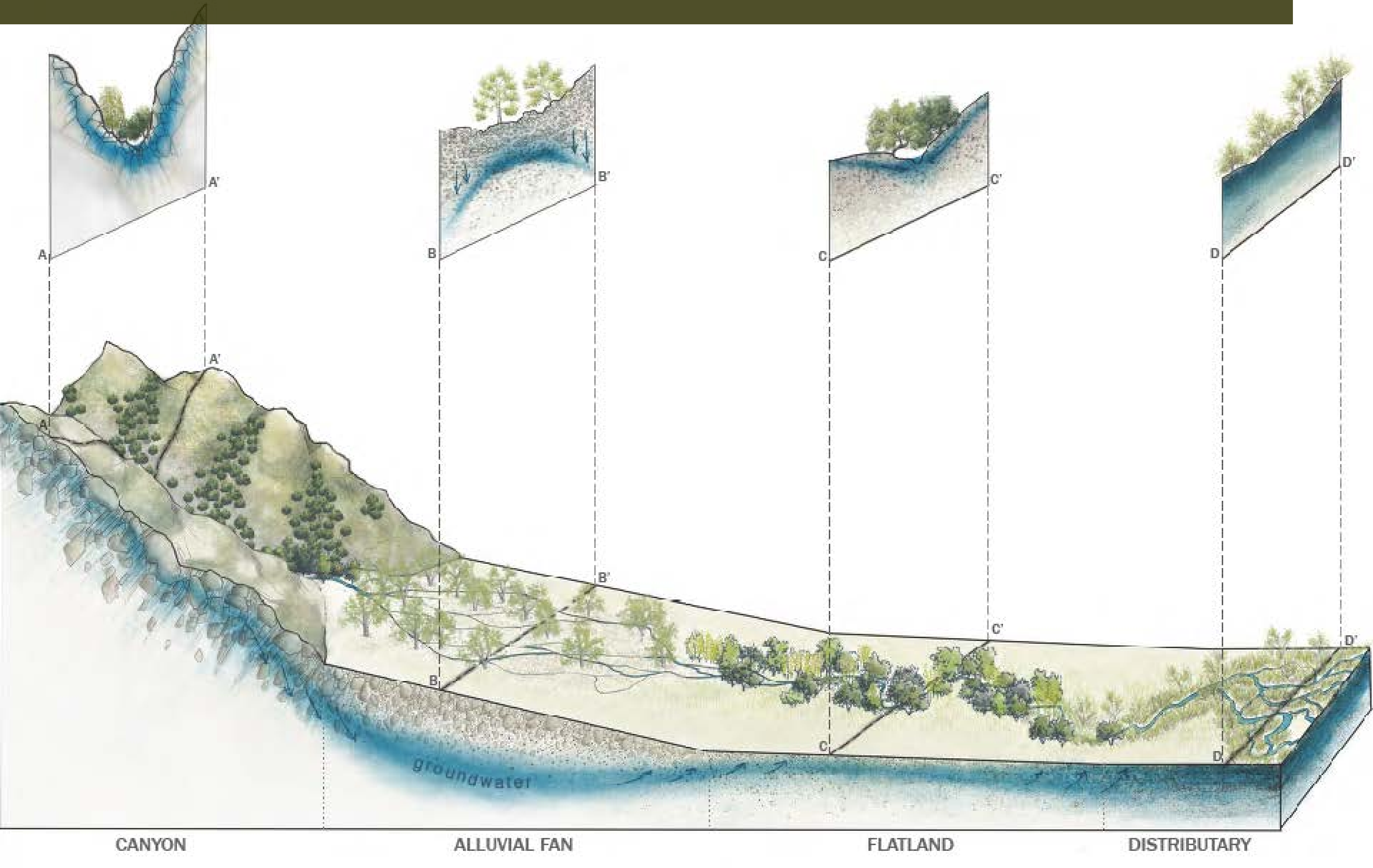

Roblas


NO.395 N. UPPER PORSTION NAPA RIVER.
TURRILL & MILLER, PHOTS, S.F.

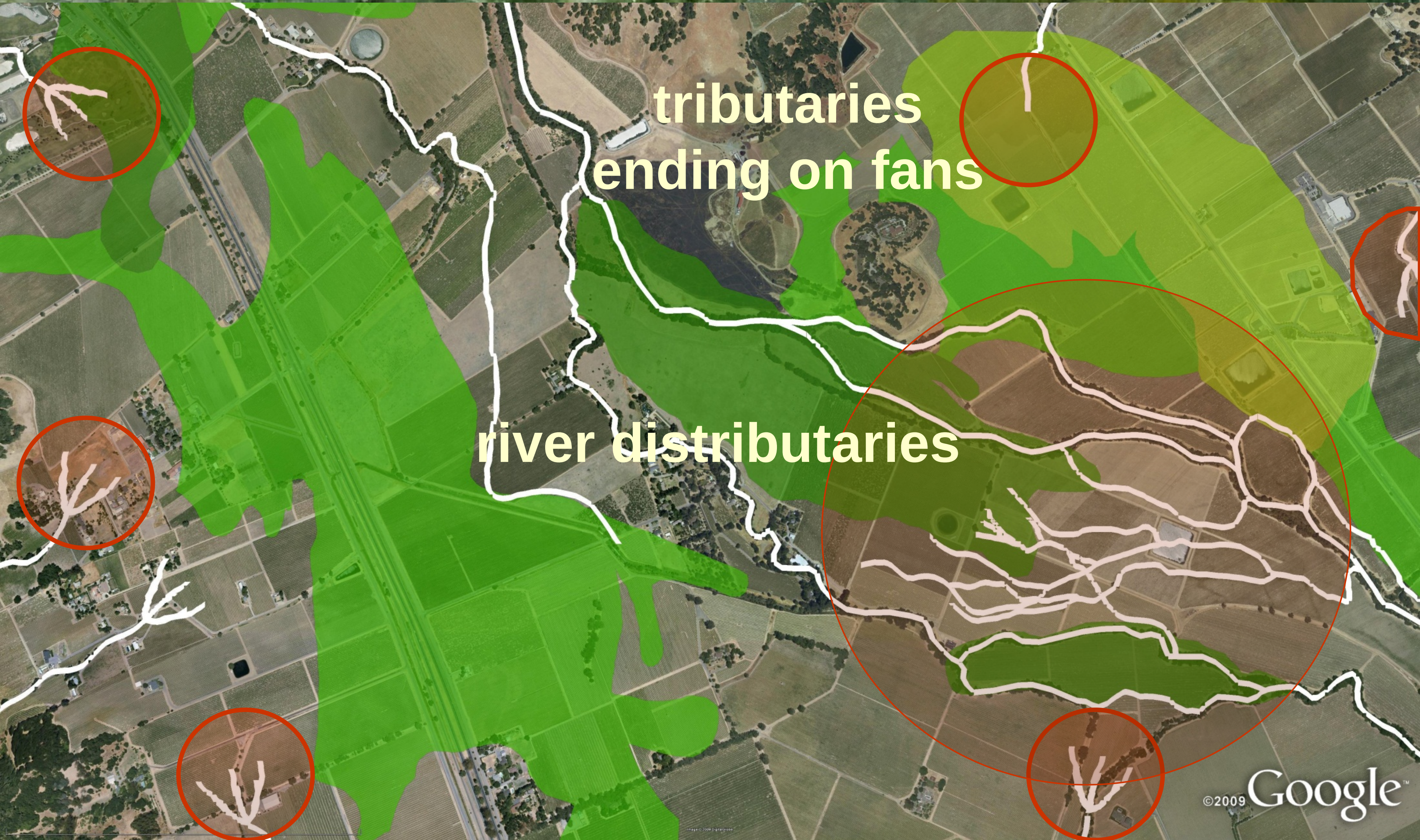

Water year 1935 (Drier water year)
Water year 1956 (Wetter water year)
Fall/Winter storms
Winter baseflows
Snowmelt peak(s)
Snowmelt recession
Summer baseflows
Summer baseflows
Daily average discharge (m³/s)
Day of year
0
100
200
300
400
500
600
700
800
900
1000
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep

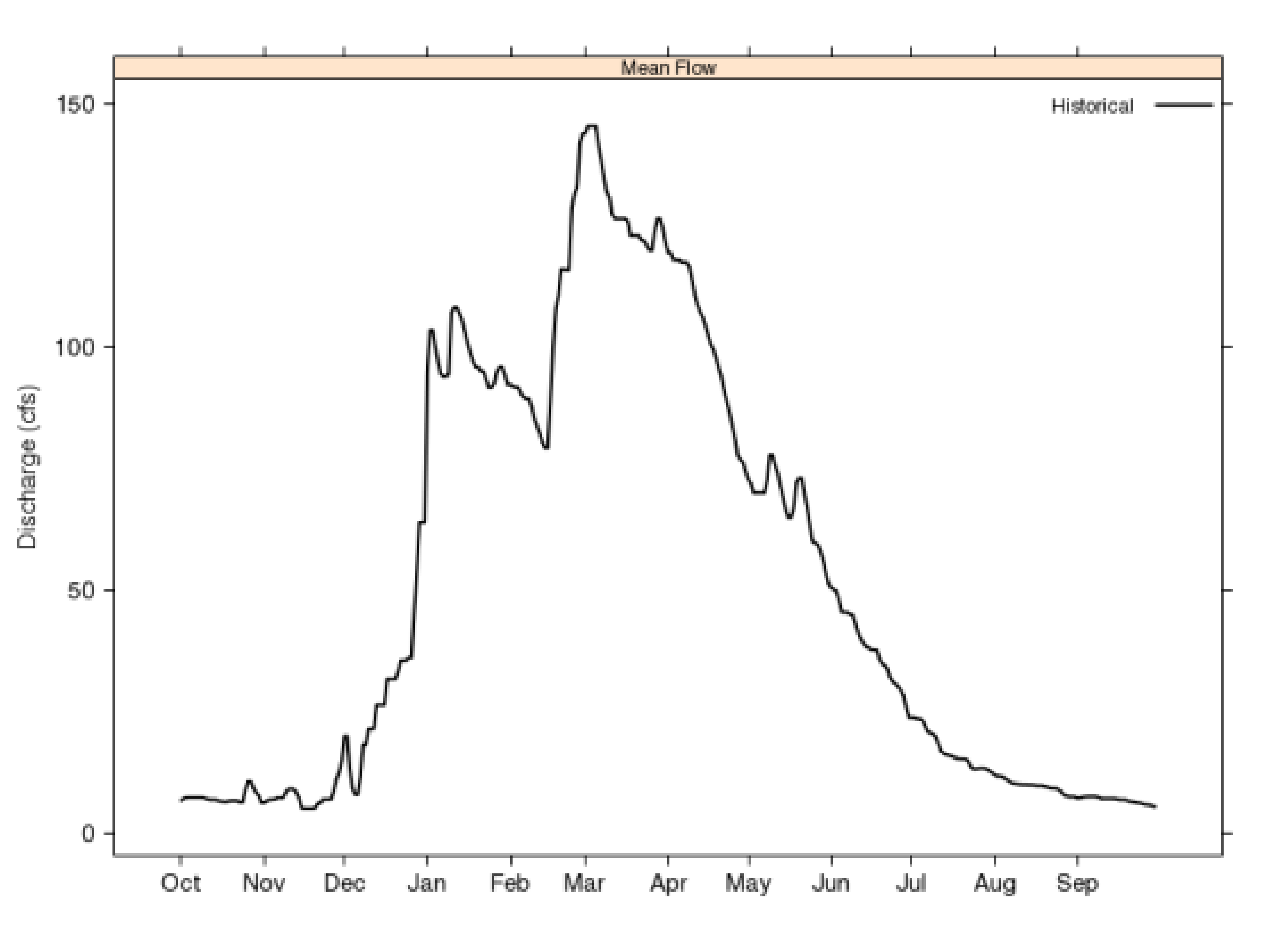
Hydrological diversity

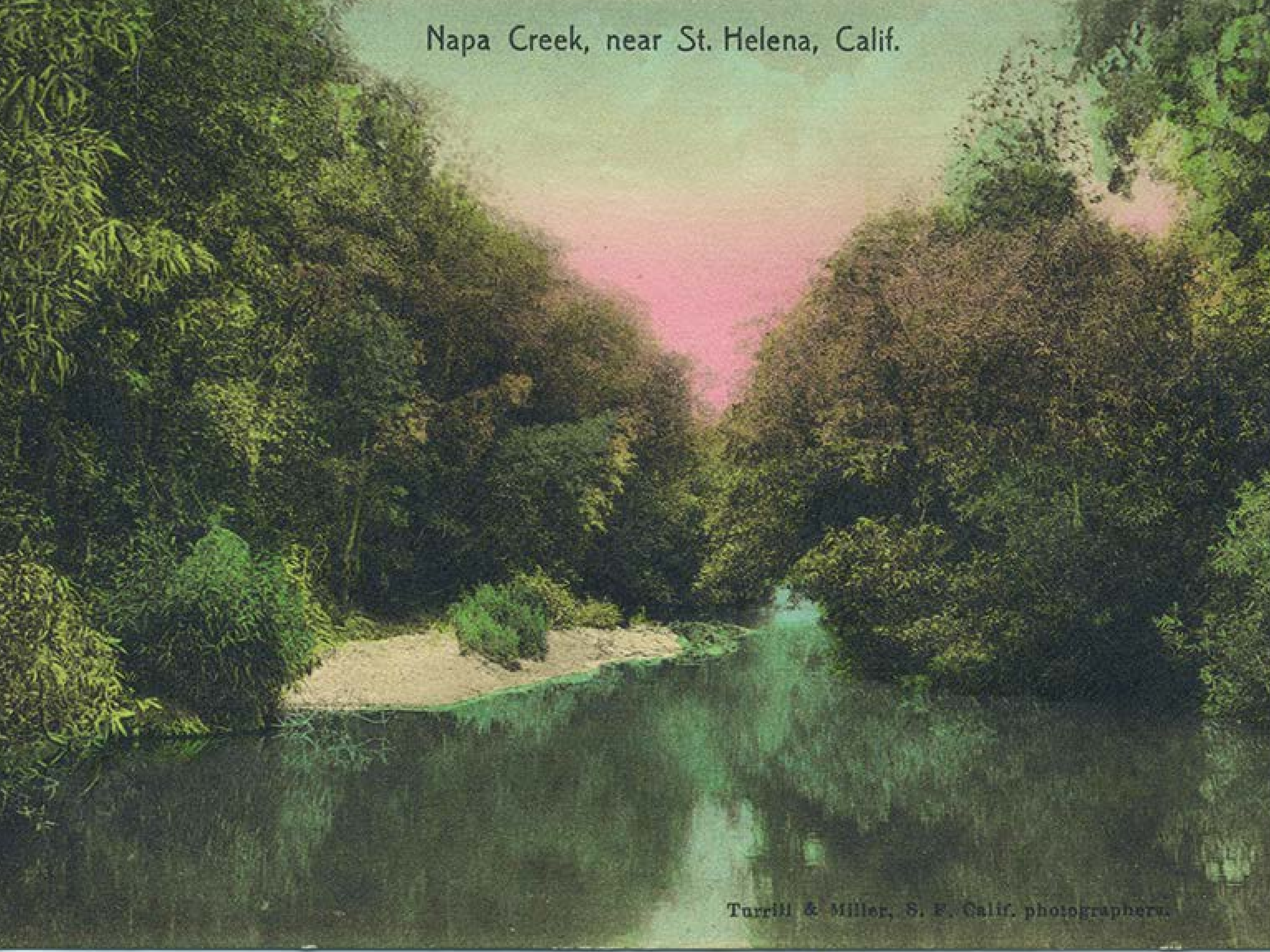
ALLUVIAL FAN TRANSECT
09.18.2011



Past close-up



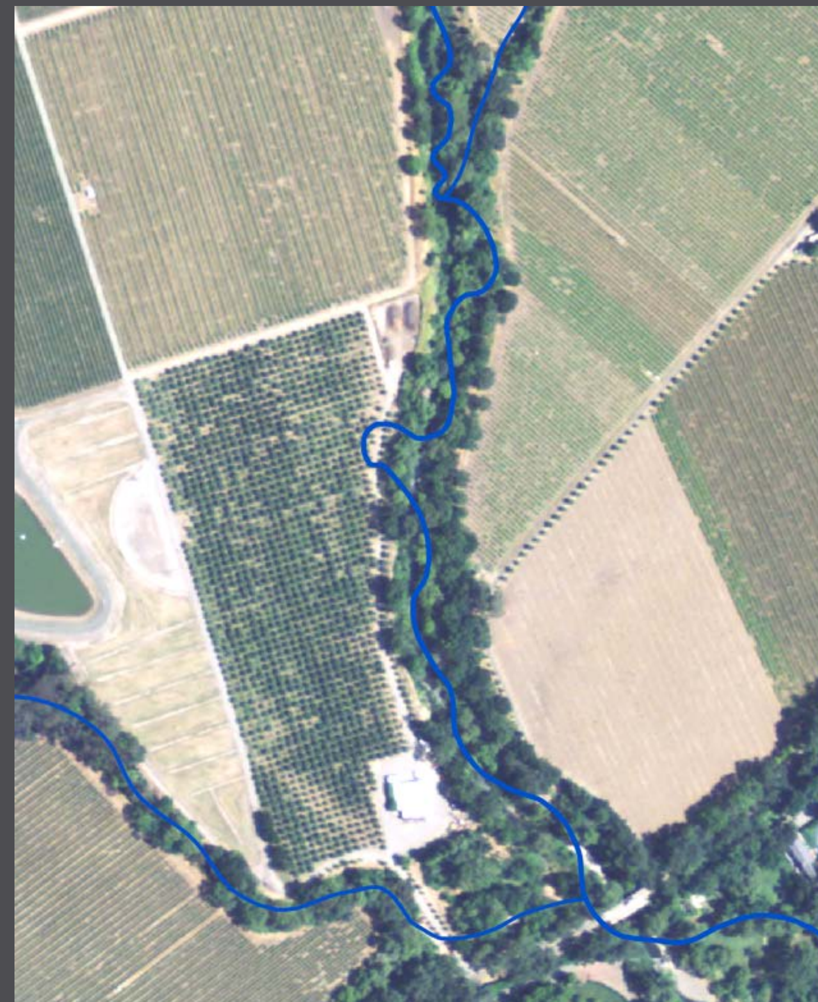

Mean Flow
Historical
Discharge (cfs)
150
100
50
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep

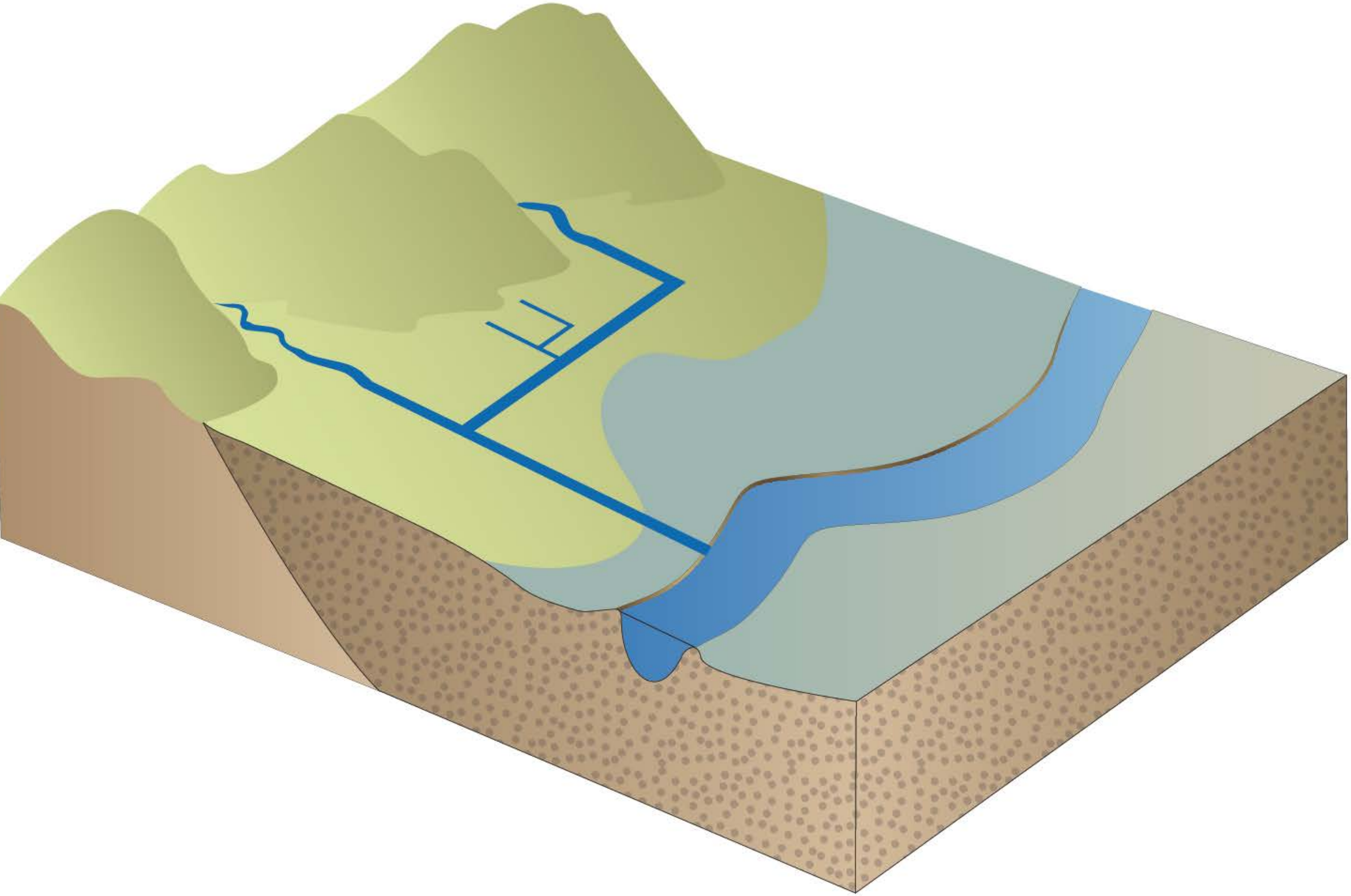

Napa Creek, near St. Helena, Calif.
Turrill & Miller, S. F. Calif. photographers.


© 2012 George Rose

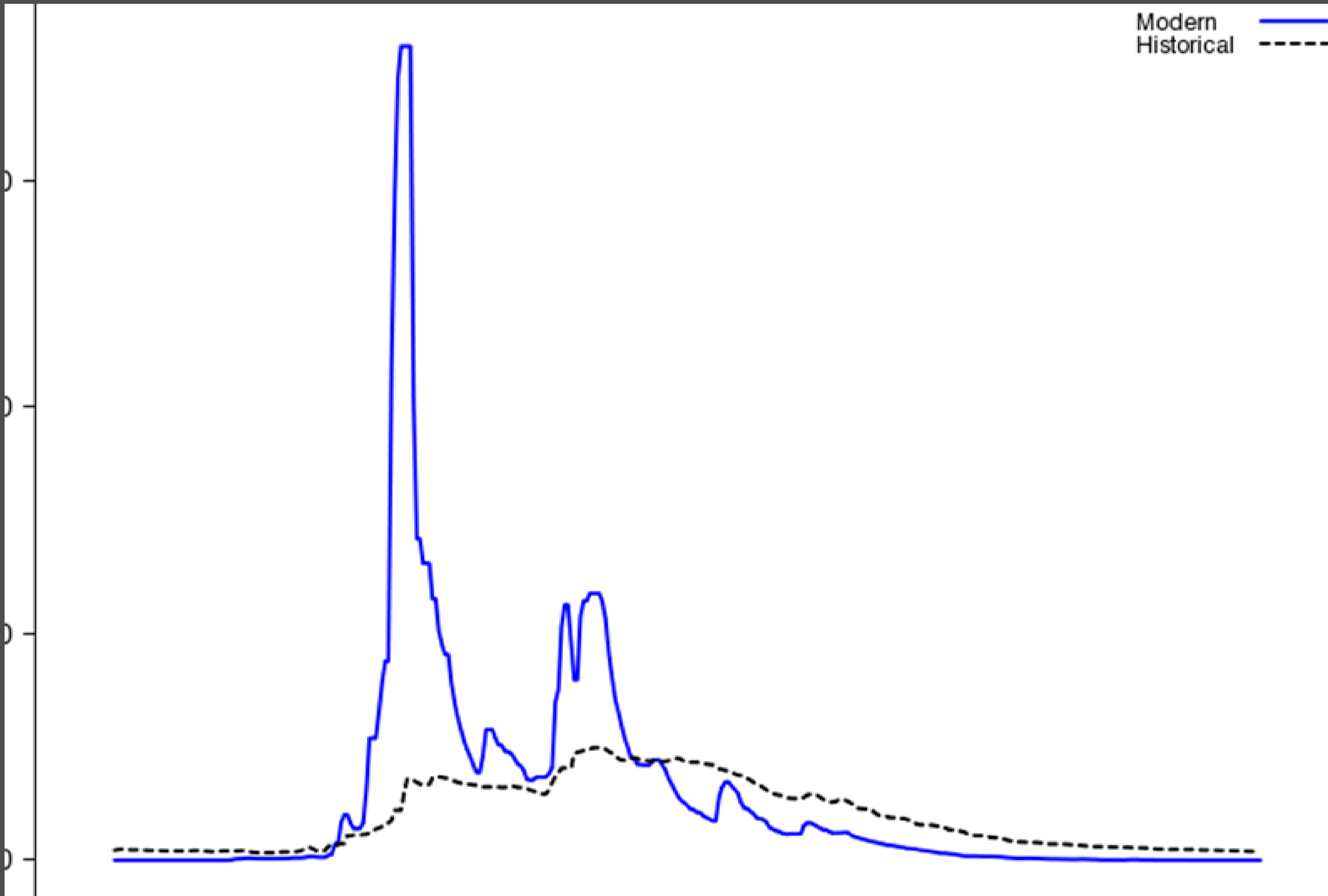
Jen Natali


JUN 1 2009

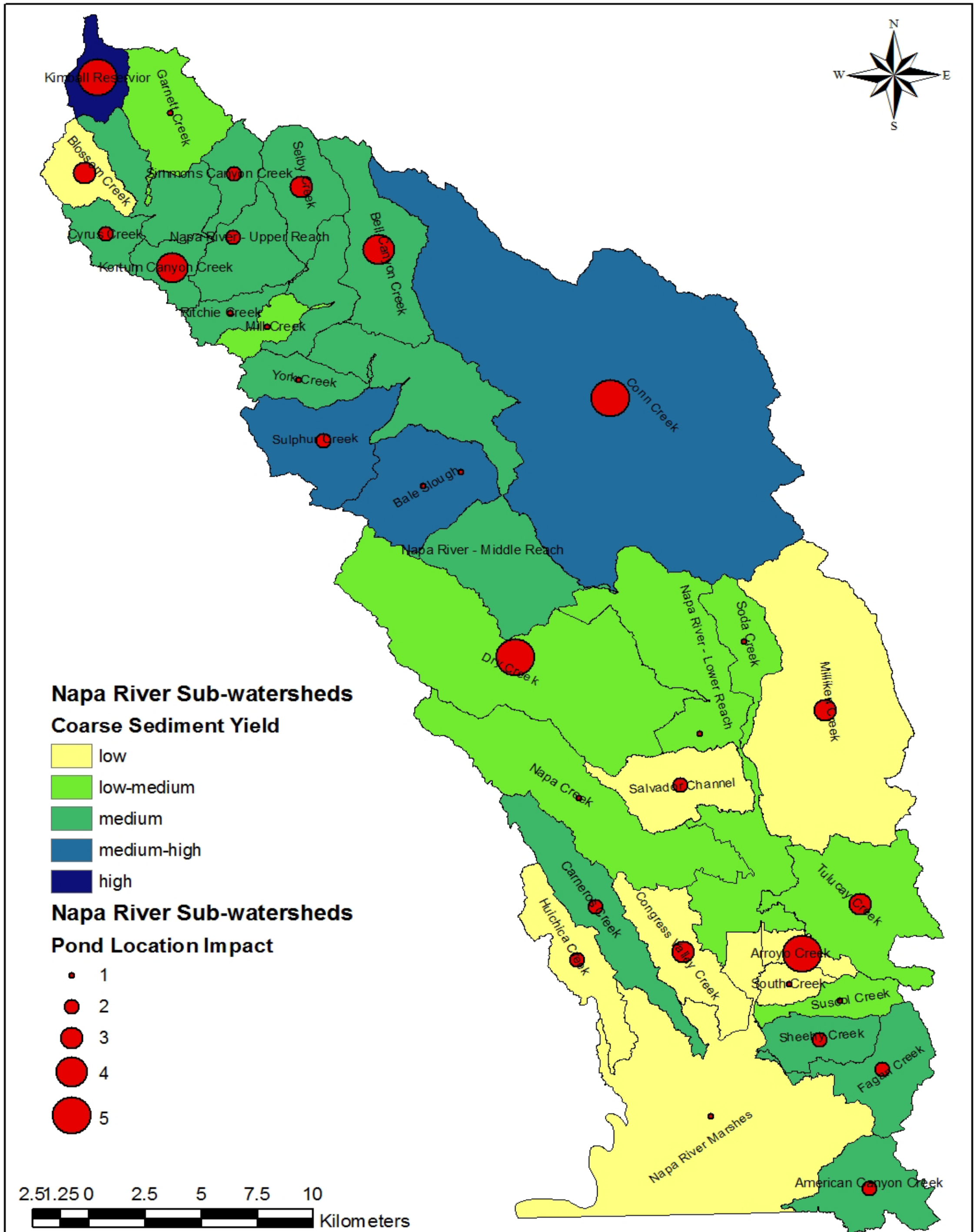



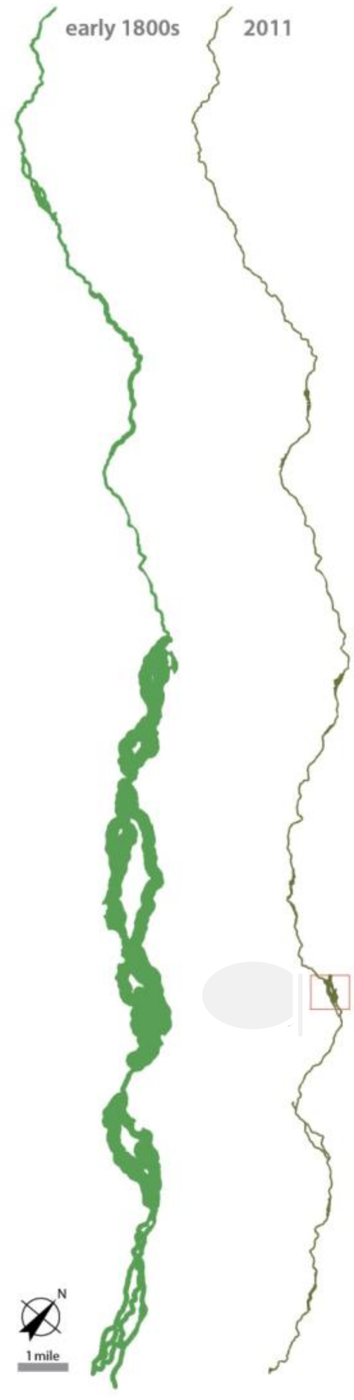


Present-day close-up



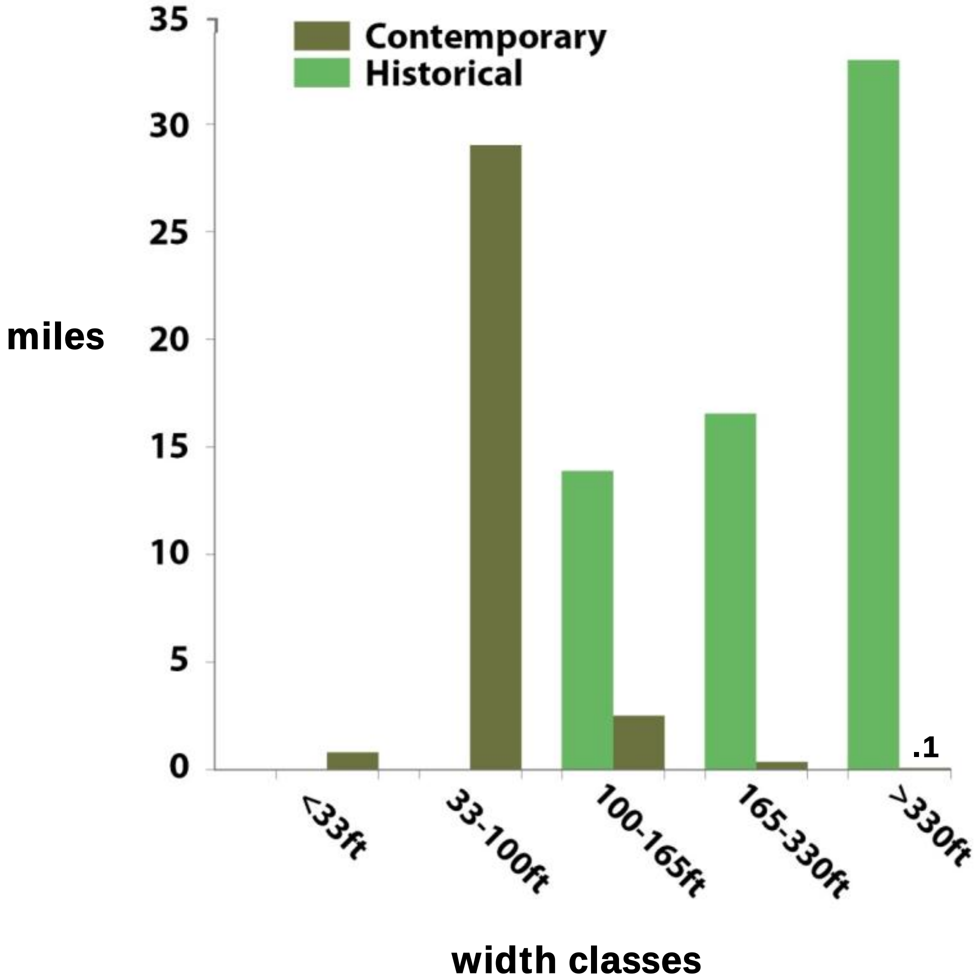
Historical and modern annual hydrographs


N
W
E
S
Kimball Resevior
Garnett Creek
Blossom Creek
Simmons Canyon Creek
Selby Creek
Cyrus Creek
Napa River - Upper Reach
Bell Canyon Creek
Kortum Canyon Creek
Ritchie Creek
Mill Creek
York Creek
Conn Creek
Sulphur Creek
Bale Slough
Napa River - Middle Reach
Napa River - Lower Reach
Soda Creek
Dry Creek
Milliken Creek
Salvador Channel
Napa Creek
Carneros Creek
Huichica Creek
Congress Valley Creek
Tulucay Creek
Arroyo Creek
South Creek
Suscol Creek
Sheehy Creek
Fagan Creek
Napa River Marshes
American Canyon Creek
Napa River Sub-watersheds
Coarse Sediment Yield
low
low-medium
medium
medium-high
high
Napa River Sub-watersheds
Pond Location Impact
1
2
3
4
5
2.5 1.25 0 2.5 5 7.5 10
Kilometers



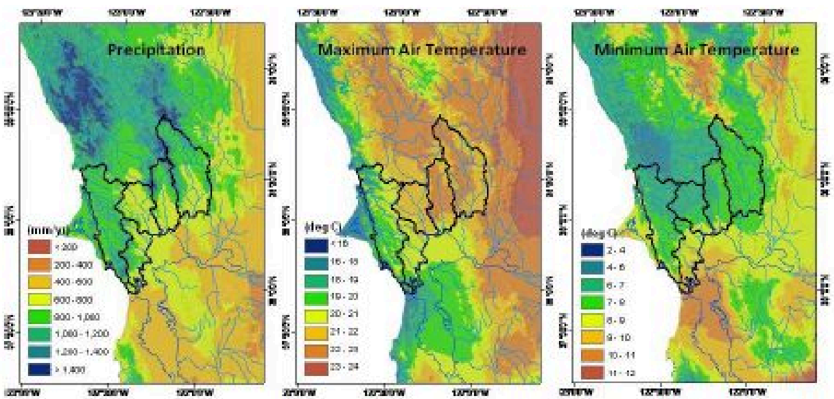
early 1800s
2011
N
1 mile

Napa River's Riparian Forest



Adapting to Climate Change
State of the Science for North Bay Watersheds
A Guide for Managers

December 2010

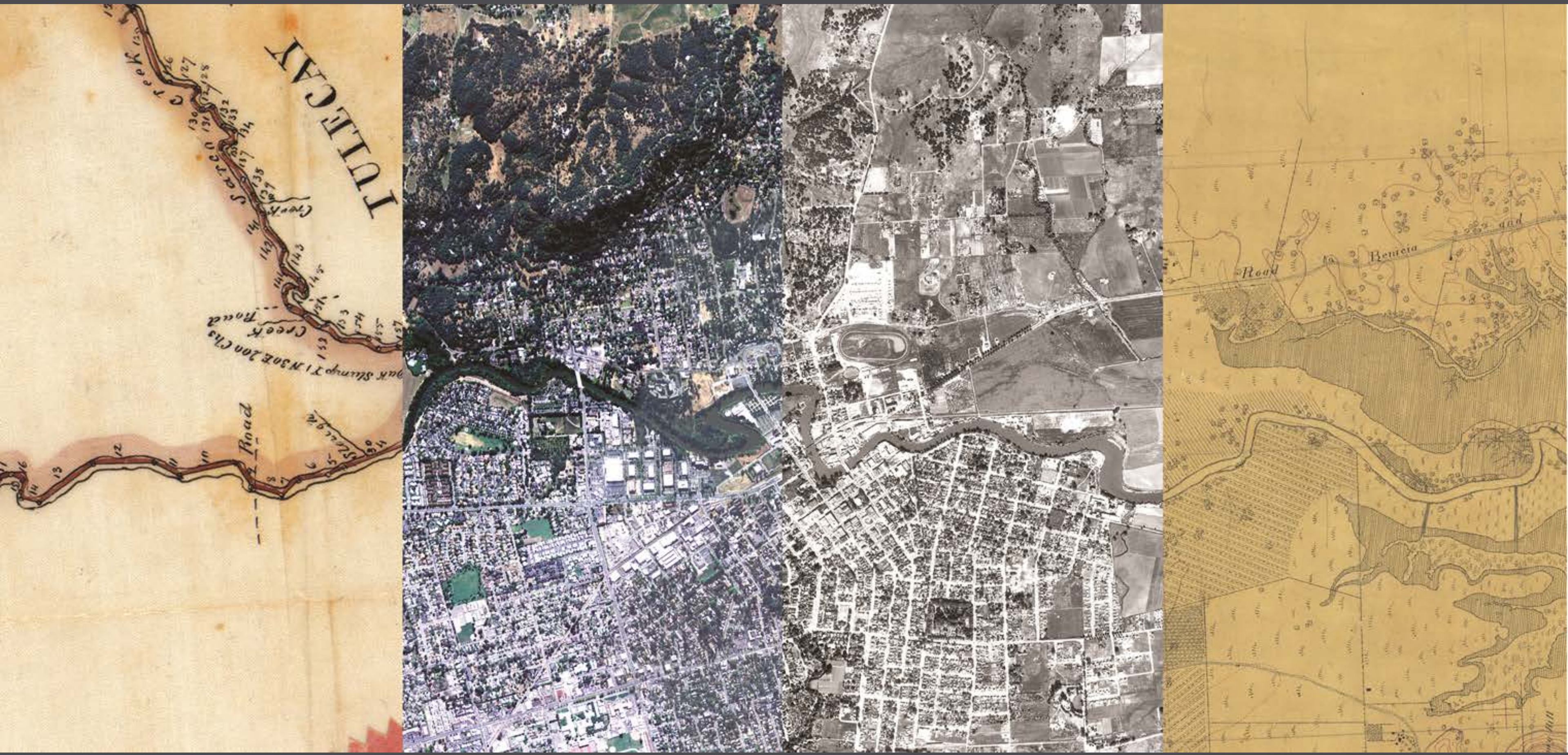


Average annual temperatures and precipitation, 1971-2000

A report prepared for the North Bay Watershed Association by the Dwight Center for Conservation Science at Pepperwood in partnership with the US Geological Survey and the Bay Area Open Space Council

Lisa Micheli, Pepperwood
Lorraine Flint, US Geological Survey
Alan Flint, US Geological Survey
Morgan Kennedy, Pepperwood
Stuart Weiss, Creekside Center for Earth Observations and
Ryan Branciforte, Bay Area Open Space Council

Pepperwood PRESERVE
Inspiring conservation through science

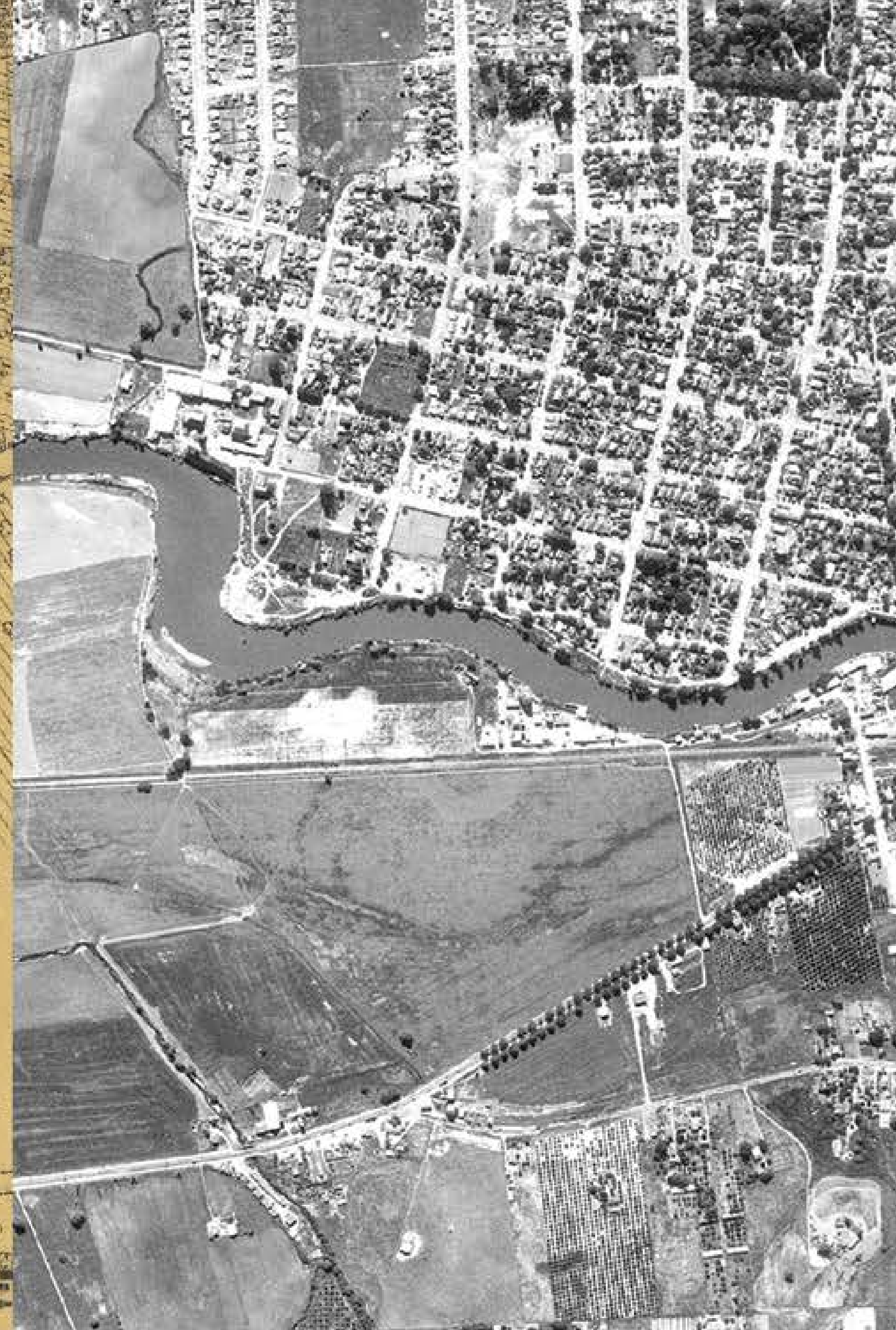


TULECAY
Creek Road
Road
Road to Benicia


DEERE
80C


Slough
Road
N30E 200 Chs
Creek
Road


Road




Ted Mull

Jen Natali

Widening and Restoration

Jen Natali


Thank you

Stag's Leap vineyard
Photo courtesy of Sandy Elles

Juvenile steelhead and chinook salmon
Photo courtesy of Jonathan Koehler

Monitoring at Redwood Creek
Photo Courtesy of Jonathan Koehler

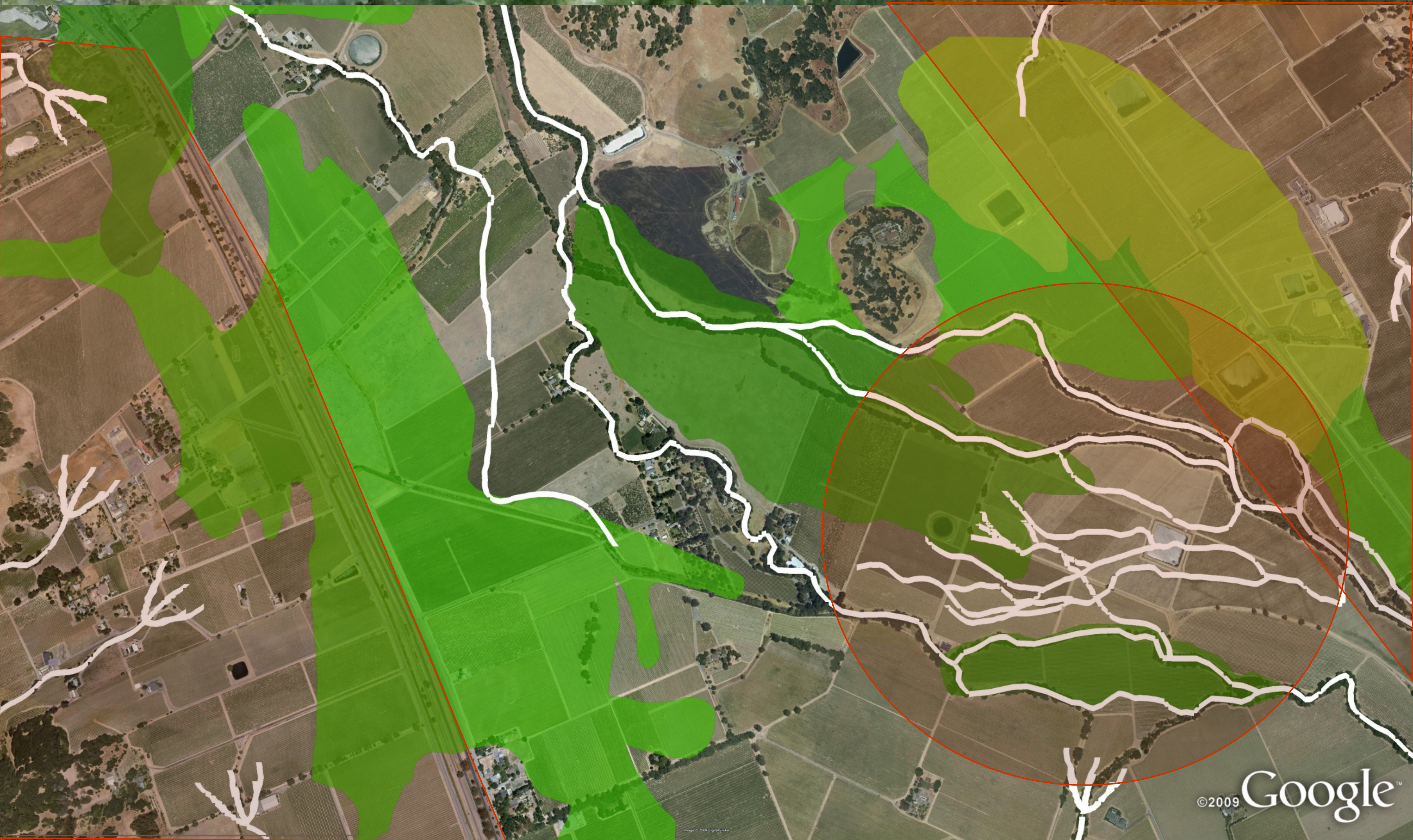
Channel Incision

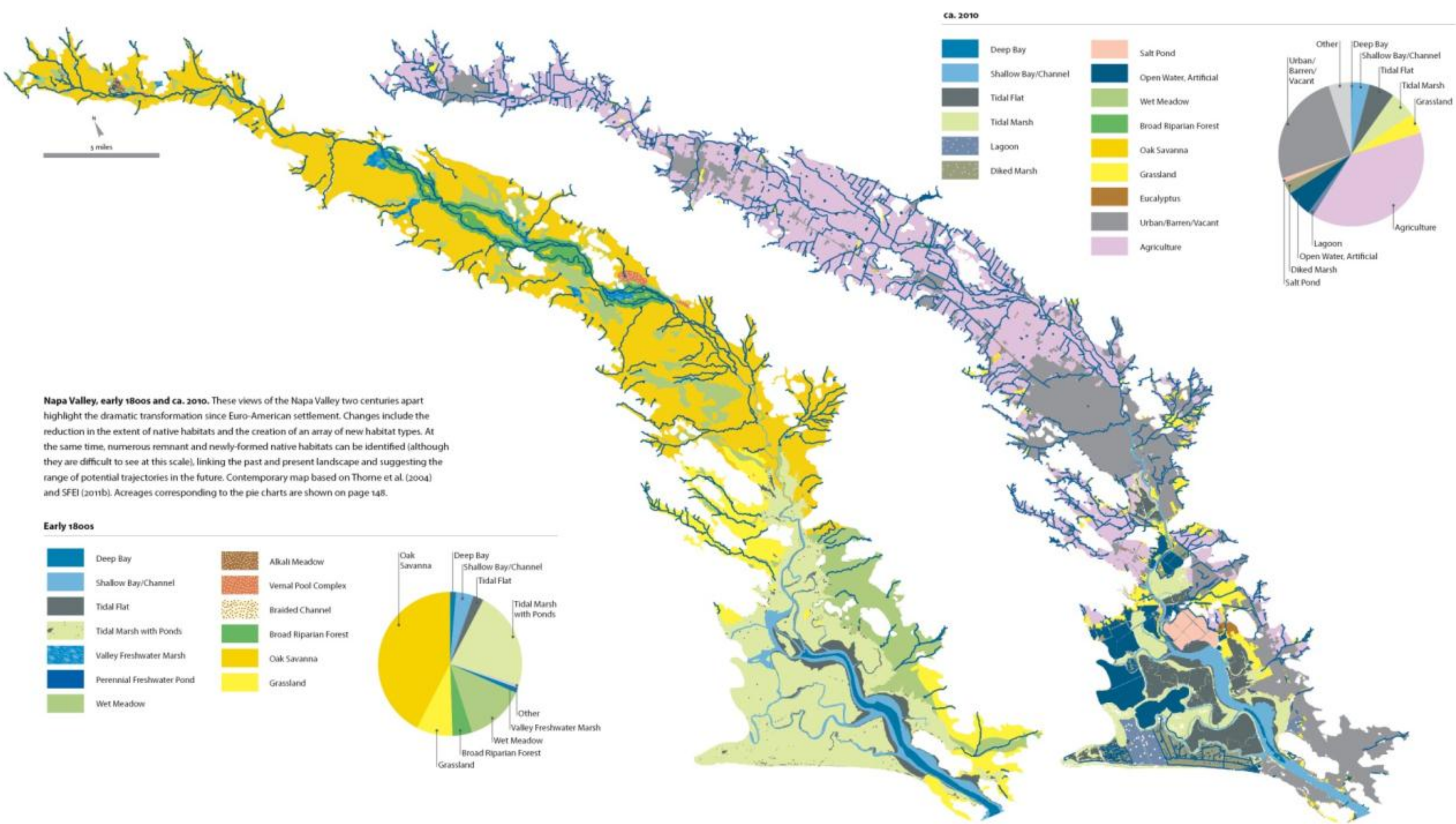
Jen Natali

Bank Erosion

Jen Natali

Past close-up / Present-day close-up





Napa Valley, early 1800s and ca. 2010. These views of the Napa Valley two centuries apart highlight the dramatic transformation since Euro-American settlement. Changes include the reduction in the extent of native habitats and the creation of an array of new habitat types. At the same time, numerous remnant and newly-formed native habitats can be identified (although they are difficult to see at this scale), linking the past and present landscape and suggesting the range of potential trajectories in the future. Contemporary map based on Thorne et al. (2004) and SFEI (2011b). Acreages corresponding to the pie charts are shown on page 148.