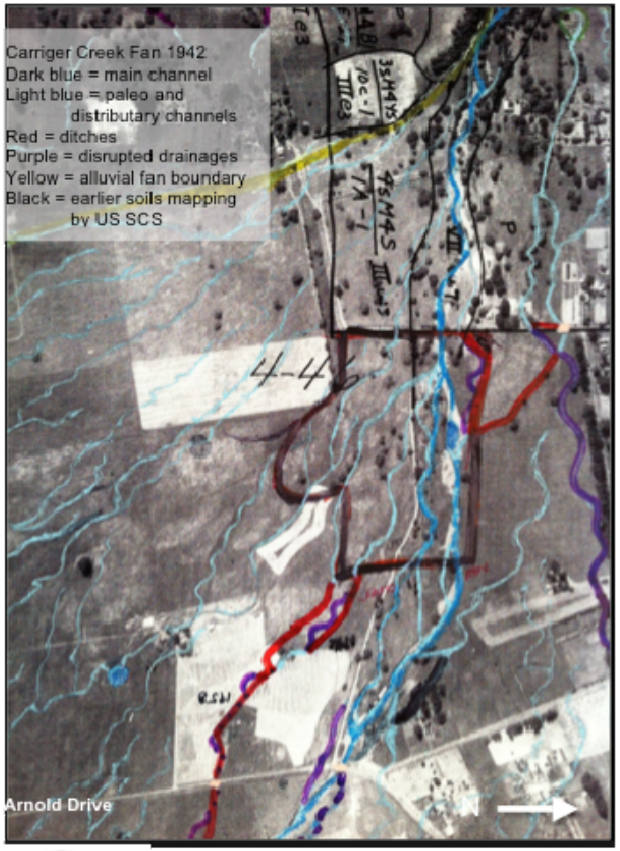
Sonoma and Carriger Creeks Alluvial Fan Assessment, Sonoma County, California

A Report for the Sonoma County Water Agency
and the
Southern Sonoma County Resource Conservation District



July 2012

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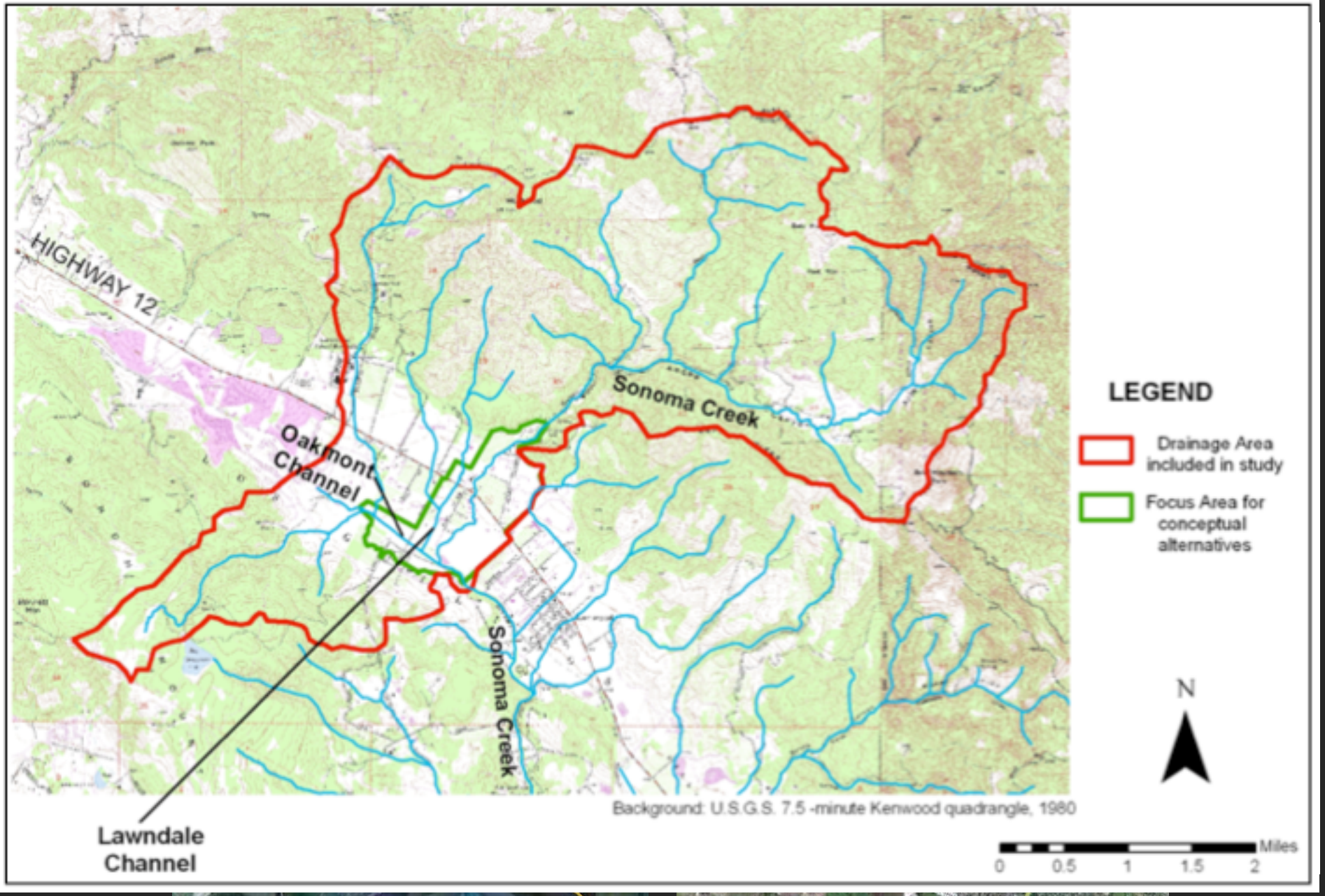
Objectives

The purpose of this project is to analyze the current channel conditions, causes of channel avulsion and instability, and identify potential sites of future concern along Carriger and Sonoma Creeks on their alluvial fans.


HIGHWAY 12
Oakmont Channel
Sonoma Creek
Sonoma Creek
Lawndale Channel
LEGEND
Drainage Area included in study
Focus Area for conceptual alternatives
N
Background: U.S.G.S. 7.5 -minute Kenwood quadrangle, 1980
Miles
0
0.5
1
1.5
2

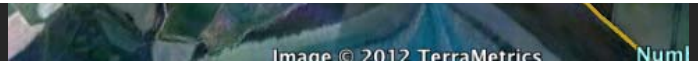
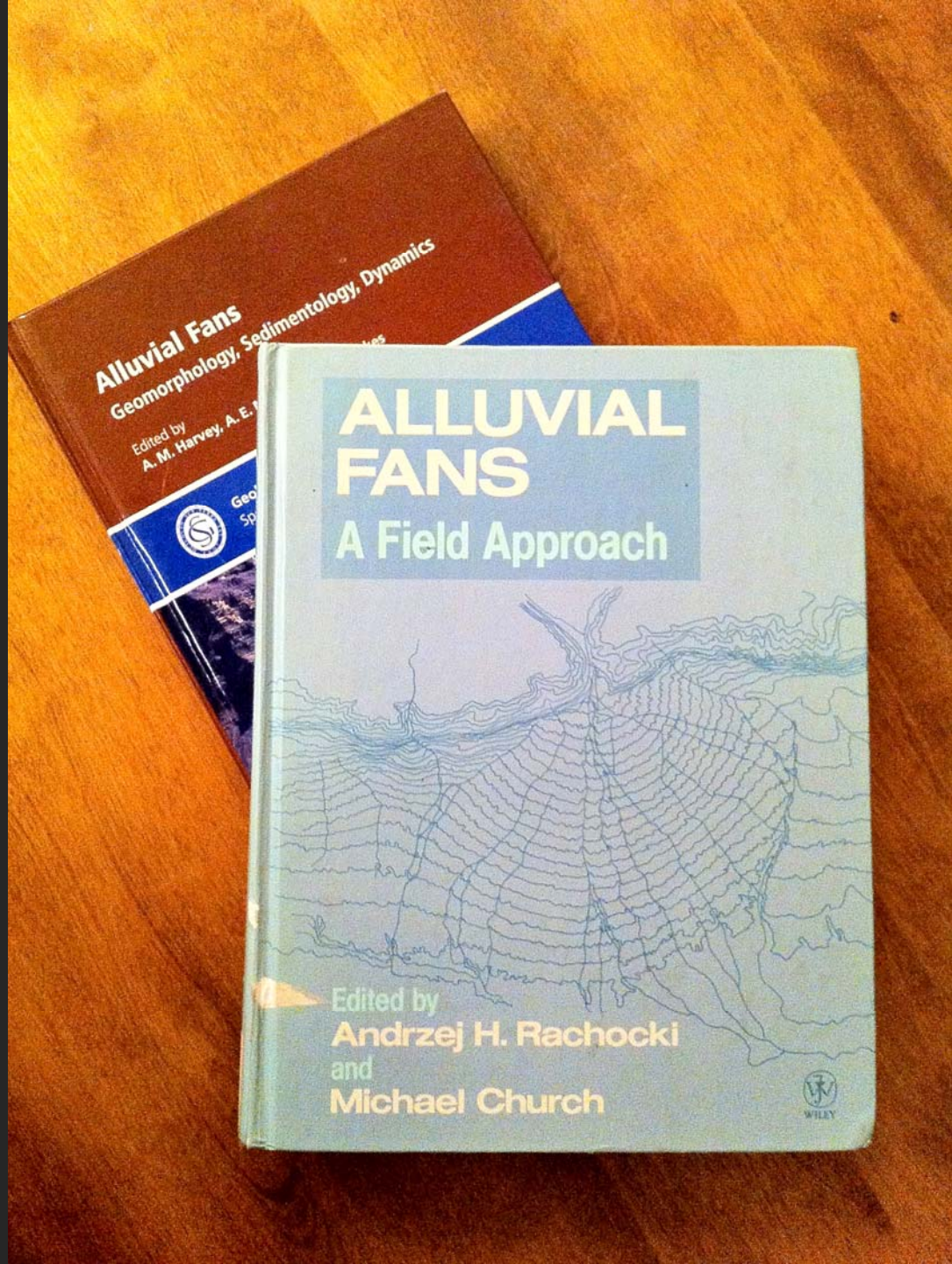


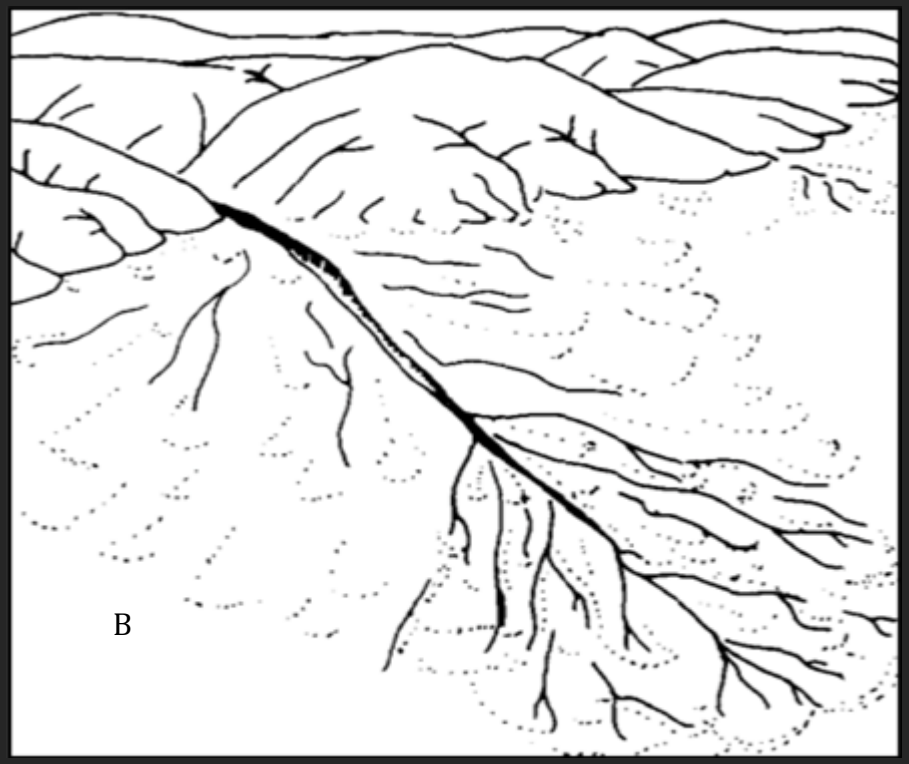
Image © 2012 TerraMetrics

What are alluvial fans?

- Fans form at the base of steep slopes
- Fans can be influenced by faults and tectonic uplift
- Fans can be influenced by catastrophic and/or punctuated inputs of very high sediment supply
- Channels on fans are inherently unstable

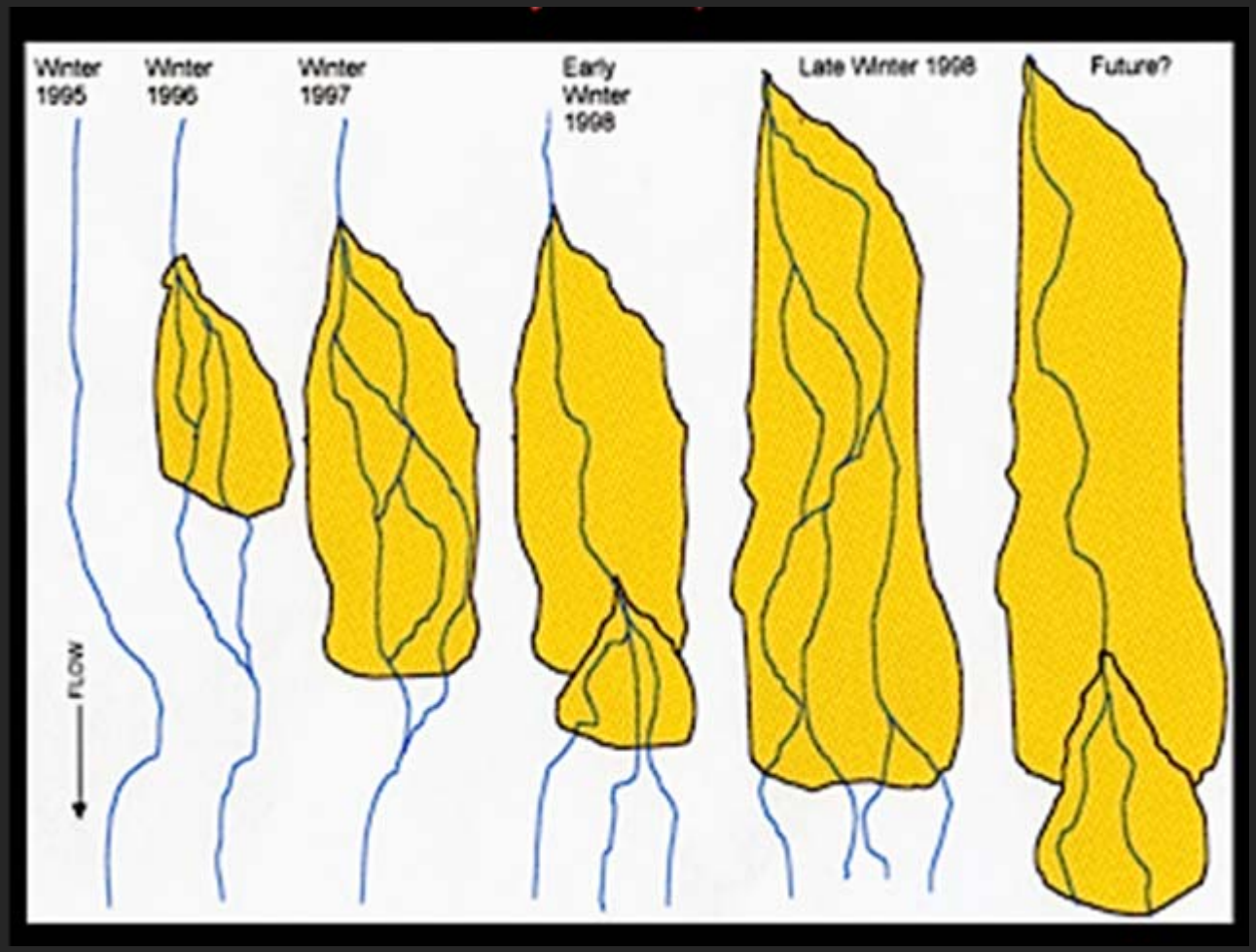


Confluence of Pine Creek and Lewis Creek , Mt. St. Helens, WA. Photo by L. Collins, 1982.



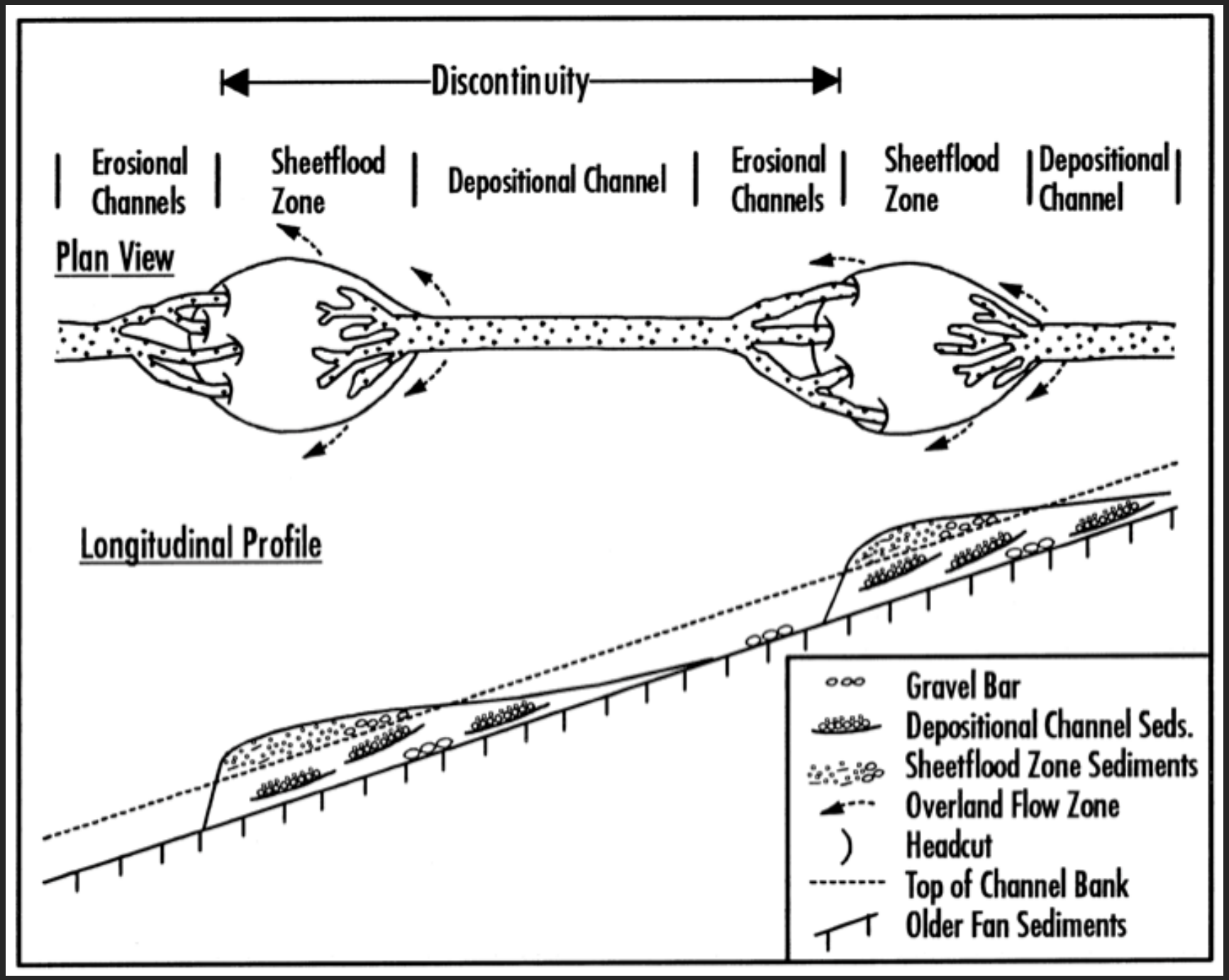
Phases of Fan Development

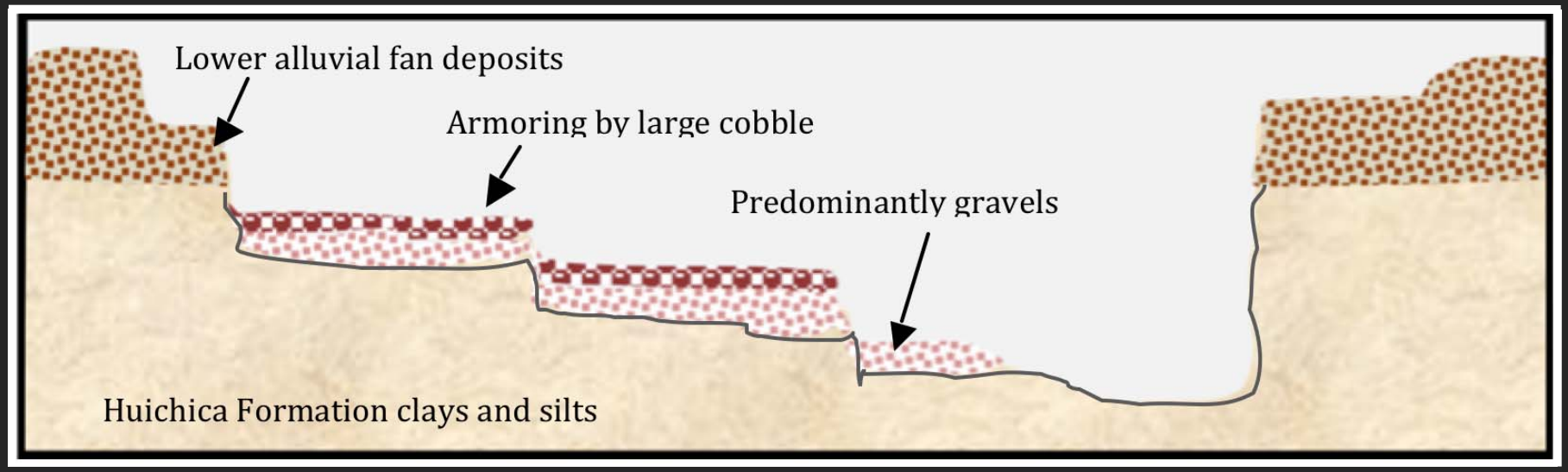
From Leece (1990) with permission to reproduce form Bull. 196R.

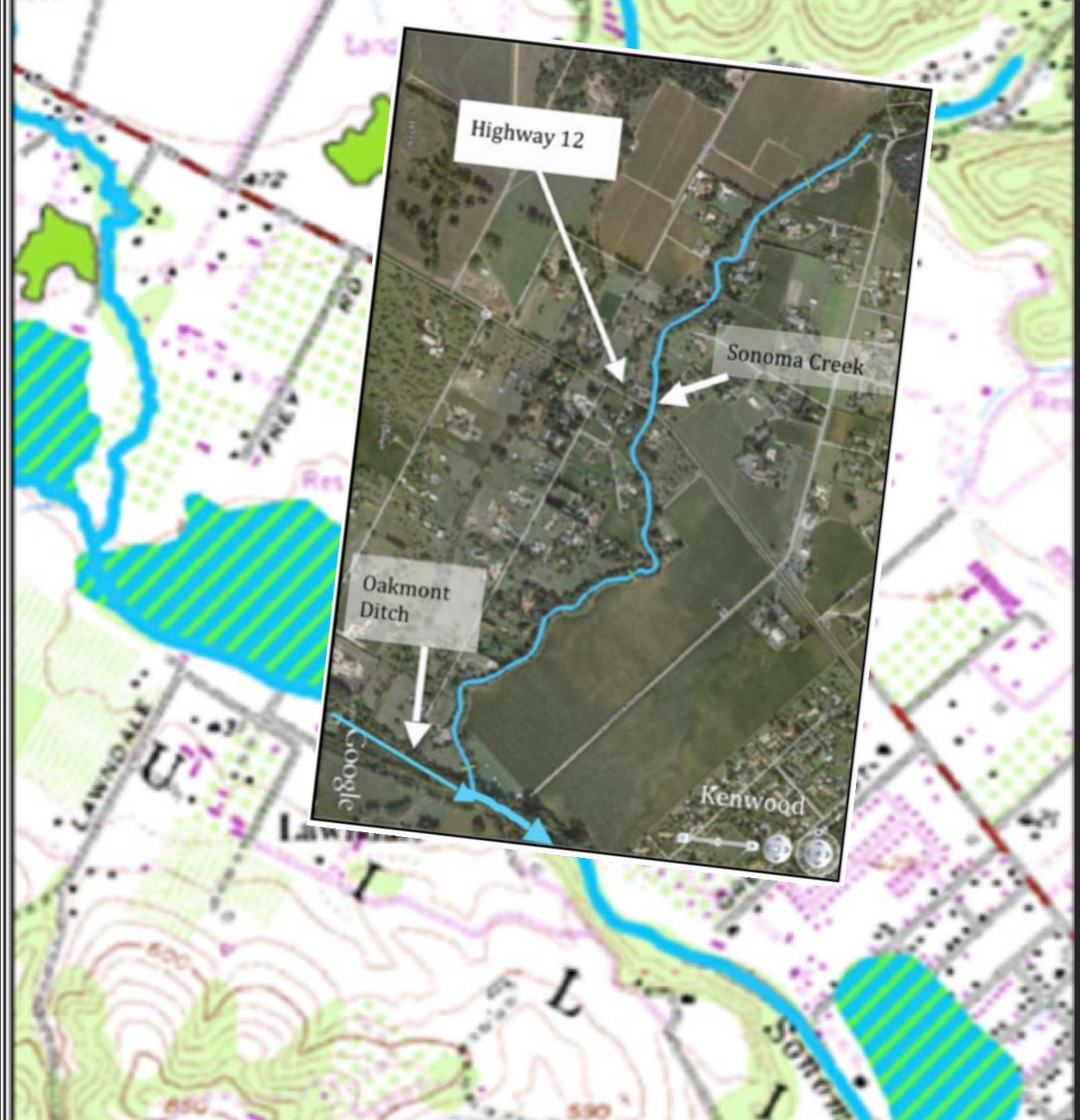


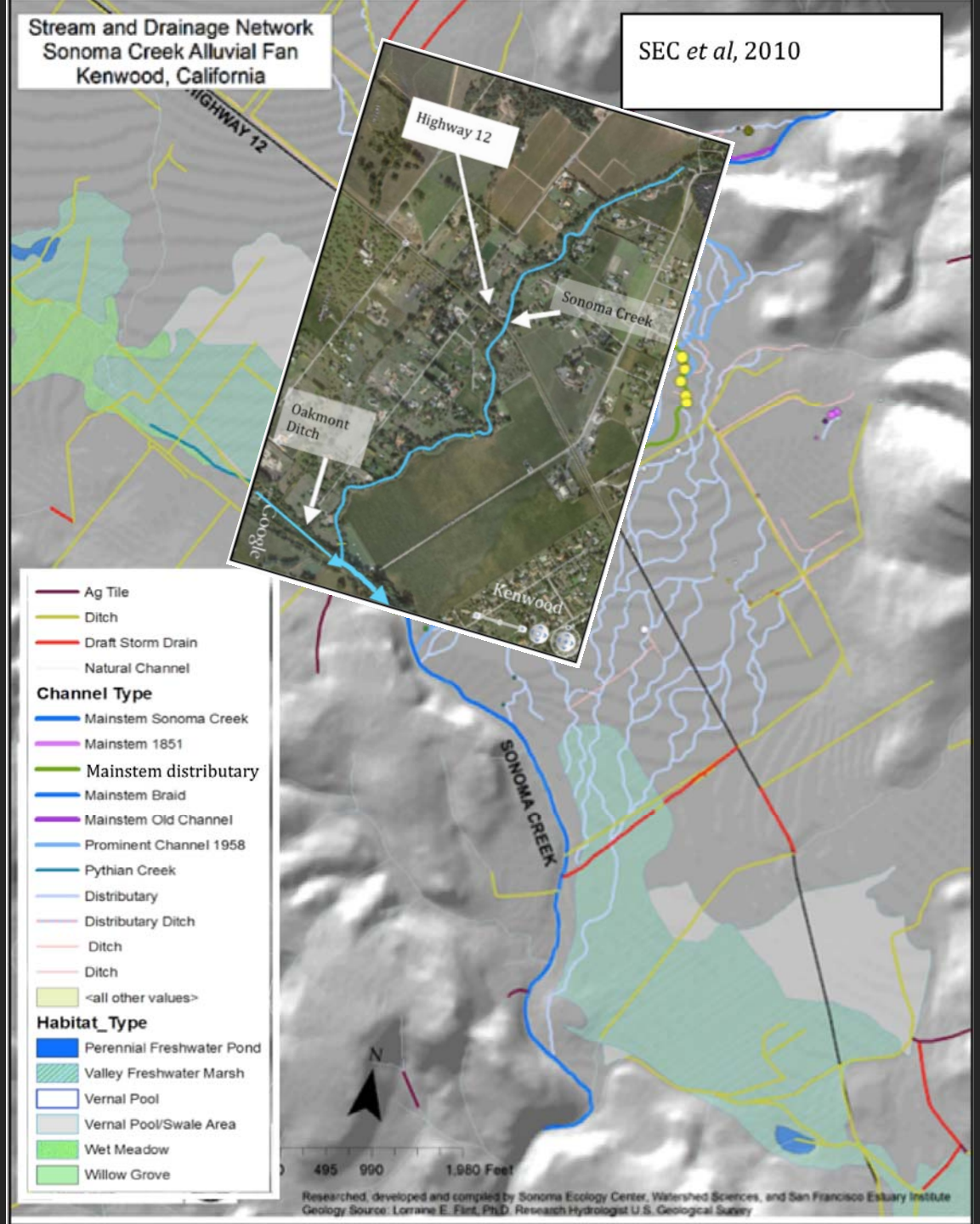
Activity can be shore-lived and episodic and be dependent upon sediment supply.

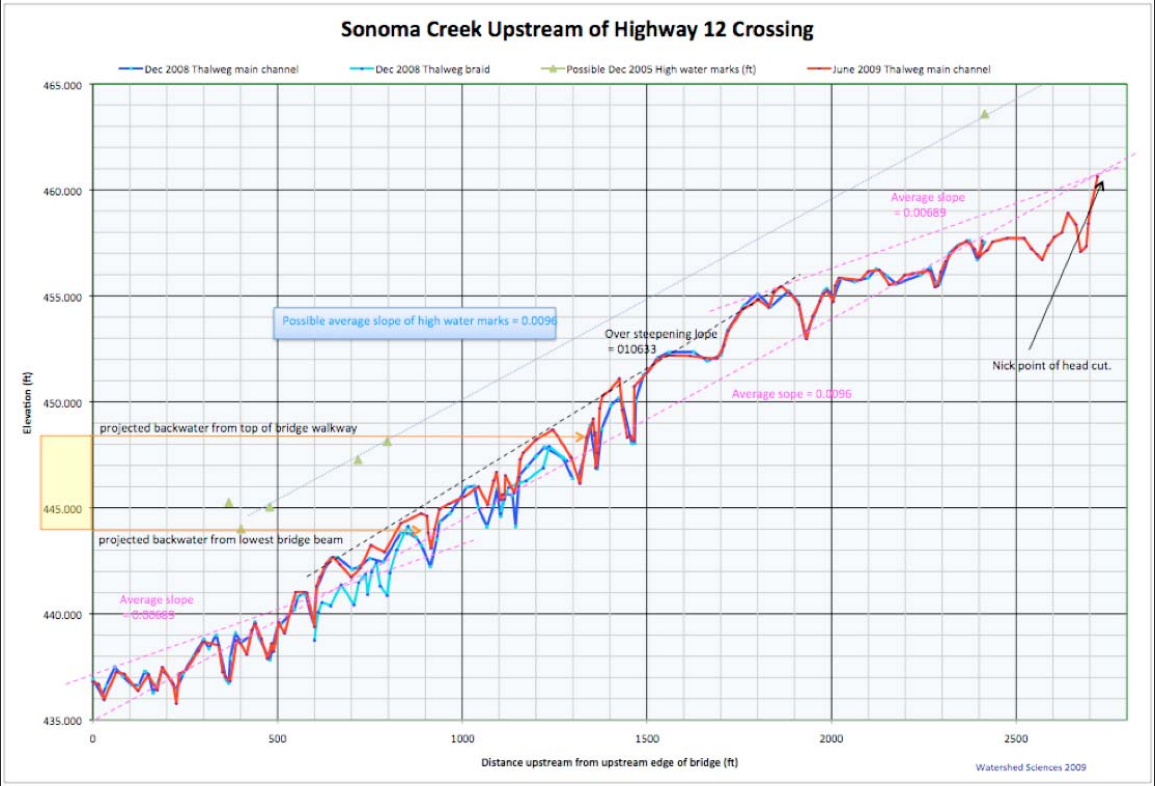
Muddy Hollow Creek, Post Vision Fire, Point Reyes National Seashore (Collins and Ketcham, 2001)

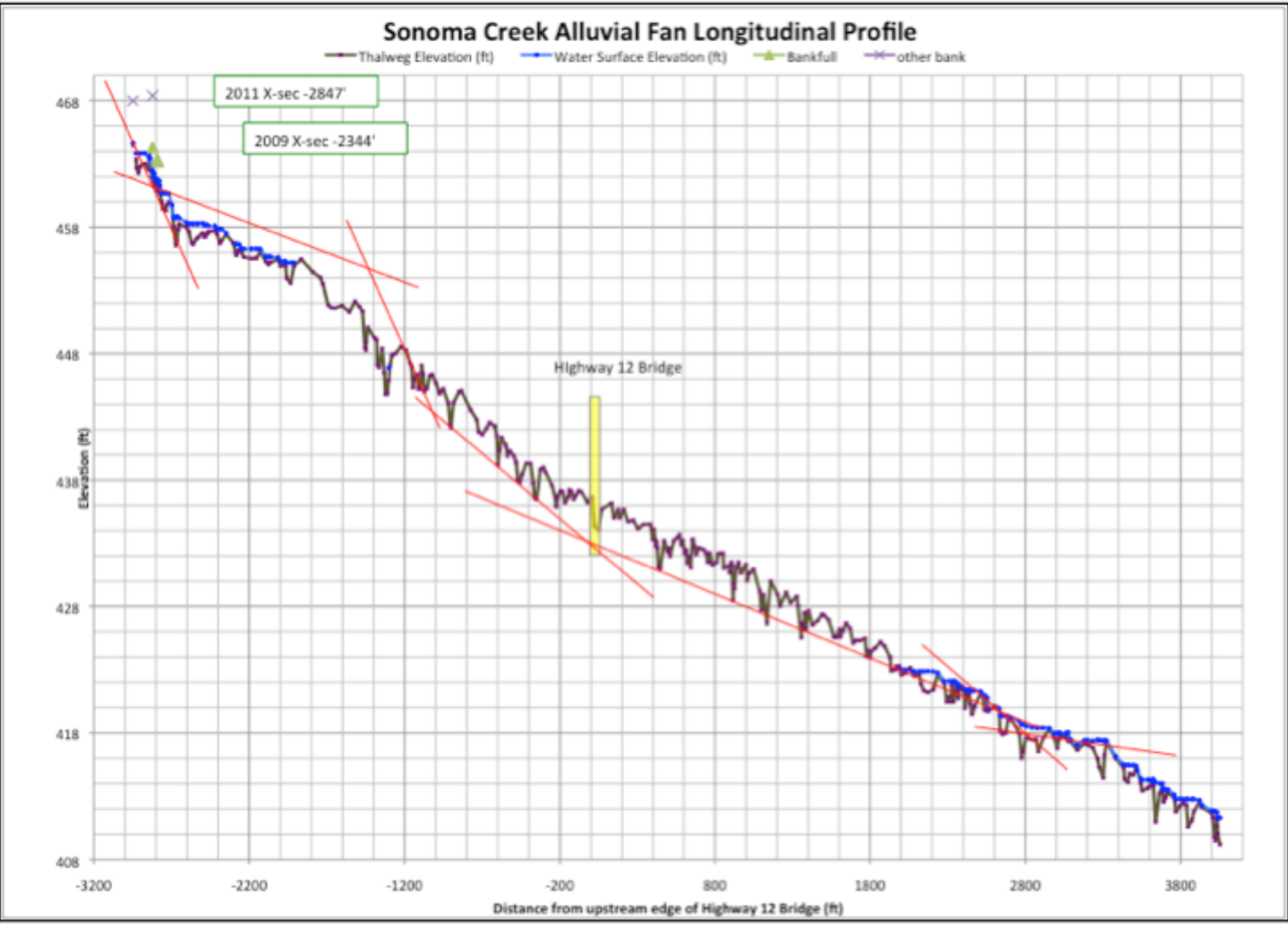

Discontinuity
Erosional Channels
Sheetflood Zone
Depositional Channel
Erosional Channels
Sheetflood Zone
Depositional Channel
Plan View
Longitudinal Profile
Gravel Bar
Depositional Channel Seds.
Sheetflood Zone Sediments
Overland Flow Zone
Headcut
Top of Channel Bank
Older Fan Sediments

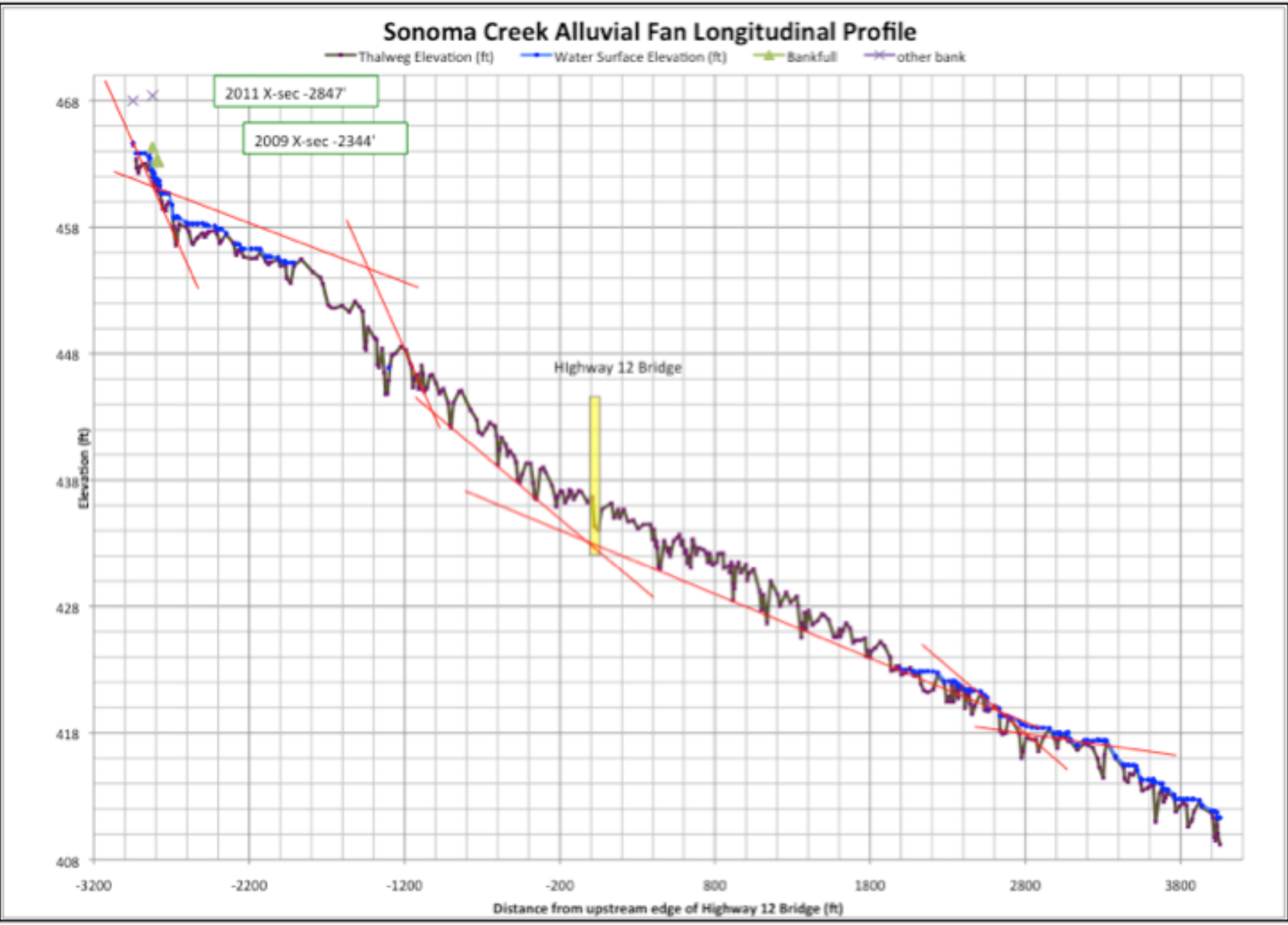

Lower alluvial fan deposits
Armoring by large cobble
Predominantly gravels
Huichica Formation clays and silts


Highway 12
Sonoma Creek
Oakmont Ditch
Google
Kenwood
LAWNDALE
Sonoma


Stream and Drainage Network
Sonoma Creek Alluvial Fan
Kenwood, California
SEC *et al*, 2010
HIGHWAY 12
Highway 12
Sonoma Creek
Oakmont Ditch
Kenwood
Google
SONOMA CREEK
Ag Tile
Ditch
Draft Storm Drain
Natural Channel
Channel Type
Mainstem Sonoma Creek
Mainstem 1851
Mainstem distributary
Mainstem Braid
Mainstem Old Channel
Prominent Channel 1958
Pythian Creek
Distributary
Distributary Ditch
Ditch
Ditch
<all other values>
Habitat_Type
Perennial Freshwater Pond
Valley Freshwater Marsh
Vernal Pool
Vernal Pool/Swale Area
Wet Meadow
Willow Grove
N
0 495 990 1,980 Feet
Researched, developed and compiled by Sonoma Ecology Center, Watershed Sciences, and San Francisco Estuary Institute
Geology Source: Lorraine E. Flint, Ph.D. Research Hydrologist U.S. Geological Survey


Sonoma Creek Upstream of Highway 12 Crossing
Dec 2008 Thalweg main channel
Dec 2008 Thalweg braid
Possible Dec 2005 High water marks (ft)
June 2009 Thalweg main channel
465.000
460.000
455.000
450.000
445.000
440.000
435.000
Elevation (ft)
0
500
1000
1500
2000
2500
Distance upstream from upstream edge of bridge (ft)
Possible average slope of high water marks = 0.0096
Over steepening lope
= 010633
Average slope
= 0.00689
Average sope = 0.0096
Nick point of head cut.
projected backwater from top of bridge walkway
projected backwater from lowest bridge beam
Average slope
= 0.00689
Watershed Sciences 2009


Sonoma Creek Alluvial Fan Longitudinal Profile
Thalweg Elevation (ft)
Water Surface Elevation (ft)
Bankfull
other bank
2011 X-sec -2847'
2009 X-sec -2344'
Highway 12 Bridge
Elevation (ft)
468
458
448
438
428
418
408
-3200
-2200
-1200
-200
800
1800
2800
3800
Distance from upstream edge of Highway 12 Bridge (ft)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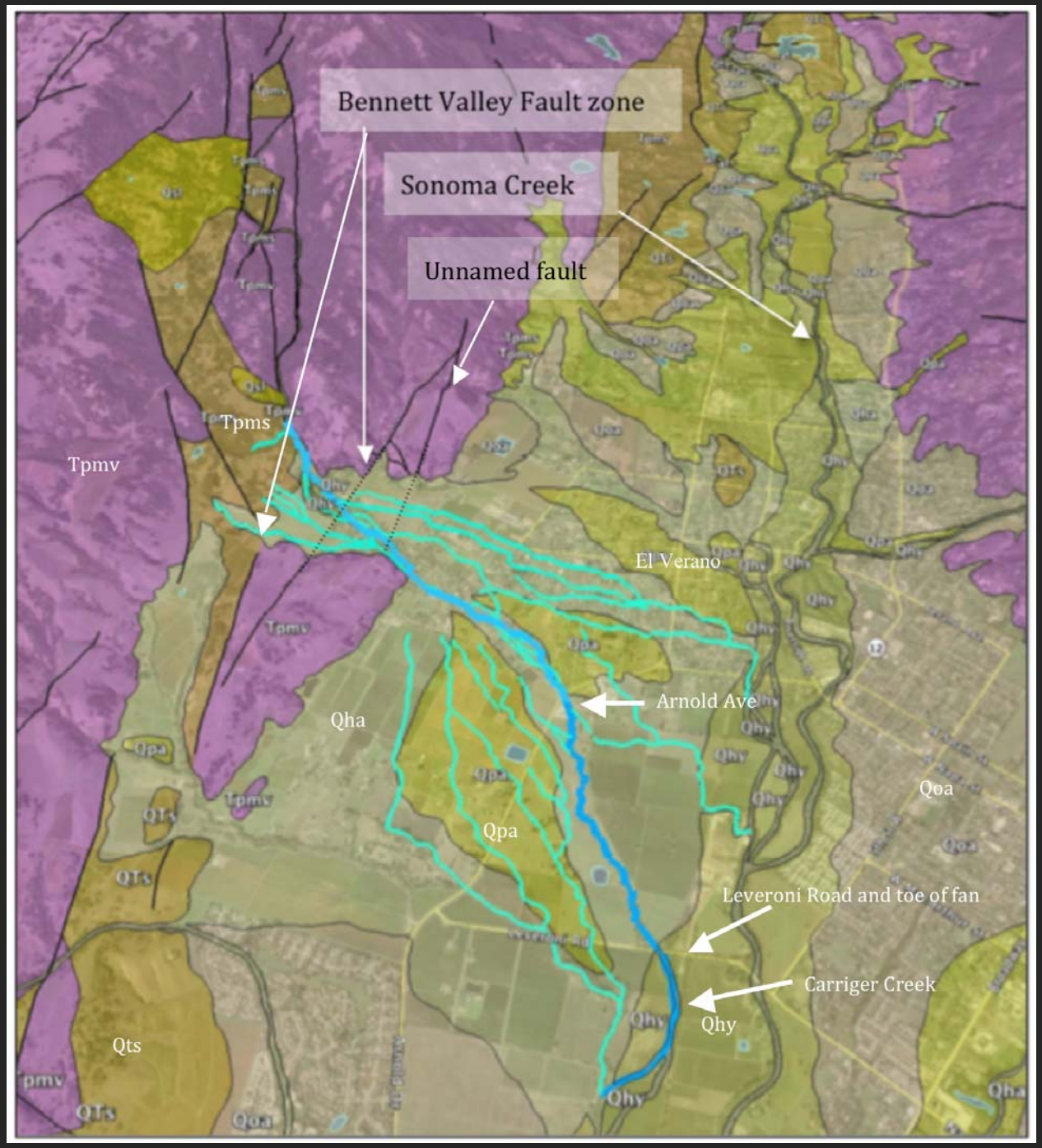
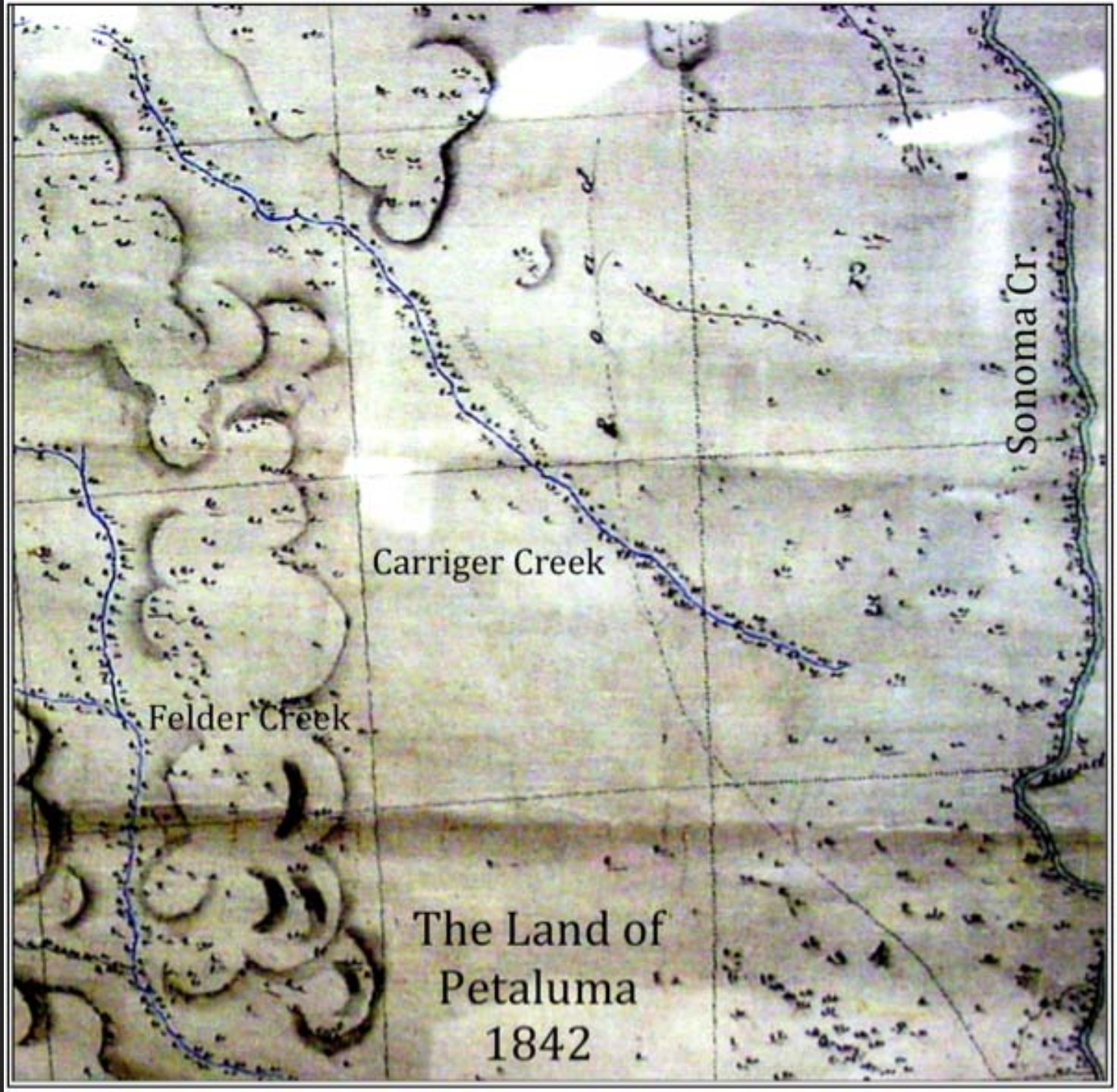
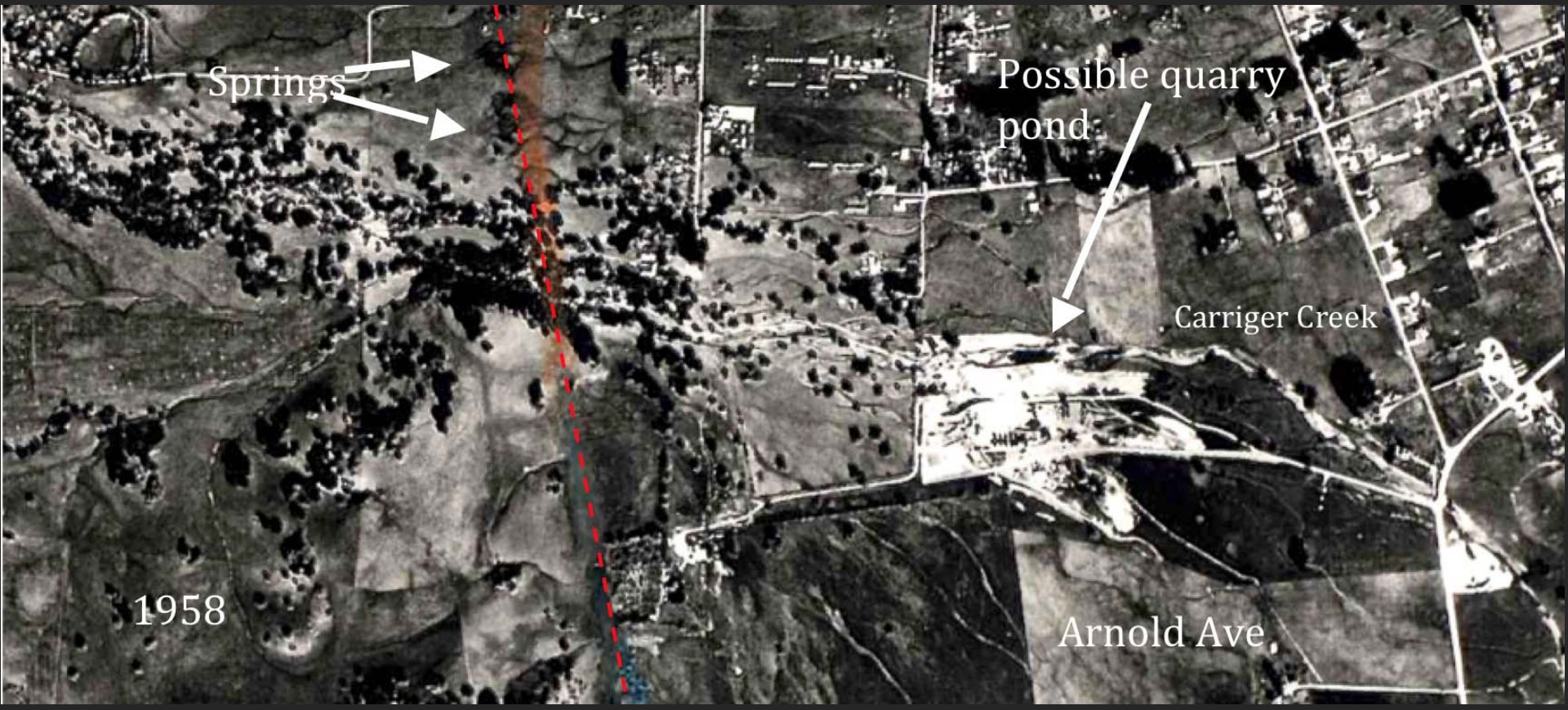
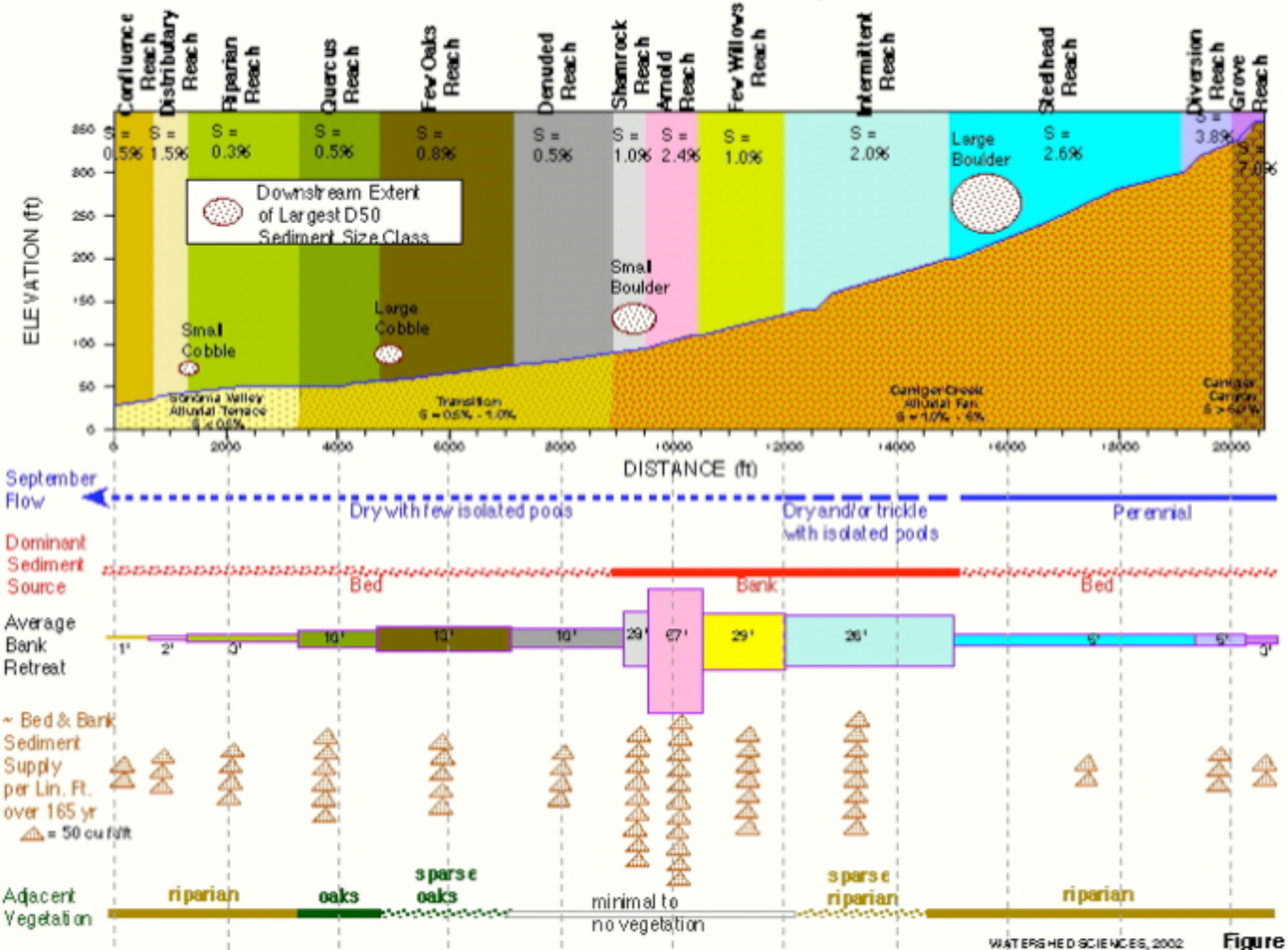

Bennett Valley Fault zone
Sonoma Creek
Unnamed fault
Tpms
Tpmv
El Verano
Arnold Ave
Qha
Qpa
Qoa
Leveroni Road and toe of fan
Carriger Creek
Qhy
Qts


Sonoma Cr.
Carriger Creek
Felder Creek
The Land of
Petaluma
1842


Springs
Possible quarry pond
Carriger Creek
1958
Arnold Ave

INTEGRATED PICTURE OF CARRIGER CREEK
3.9 MILE STUDY REACH, 2000



WATERSHED SCIENCES, 2002

Figure 29

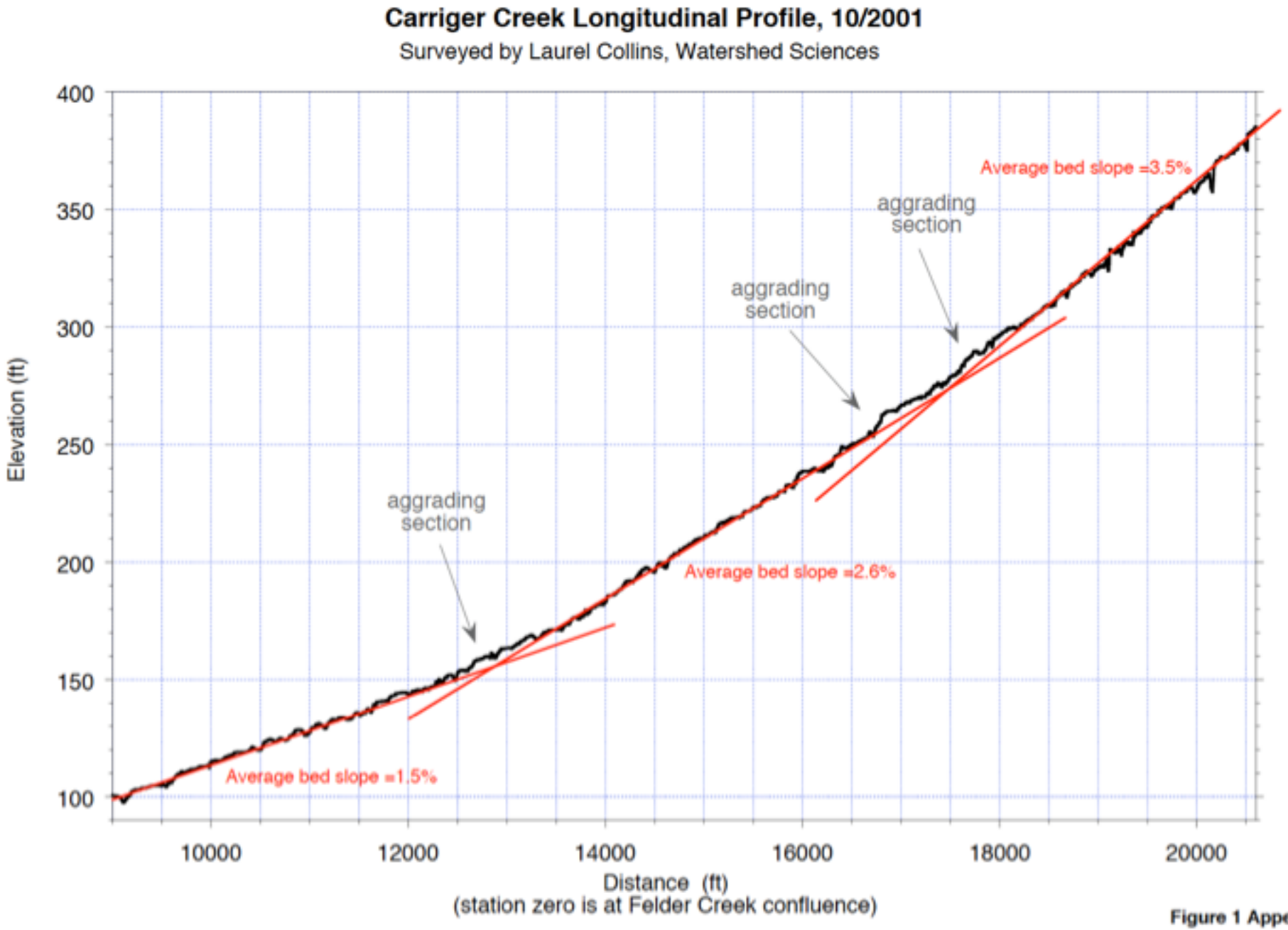
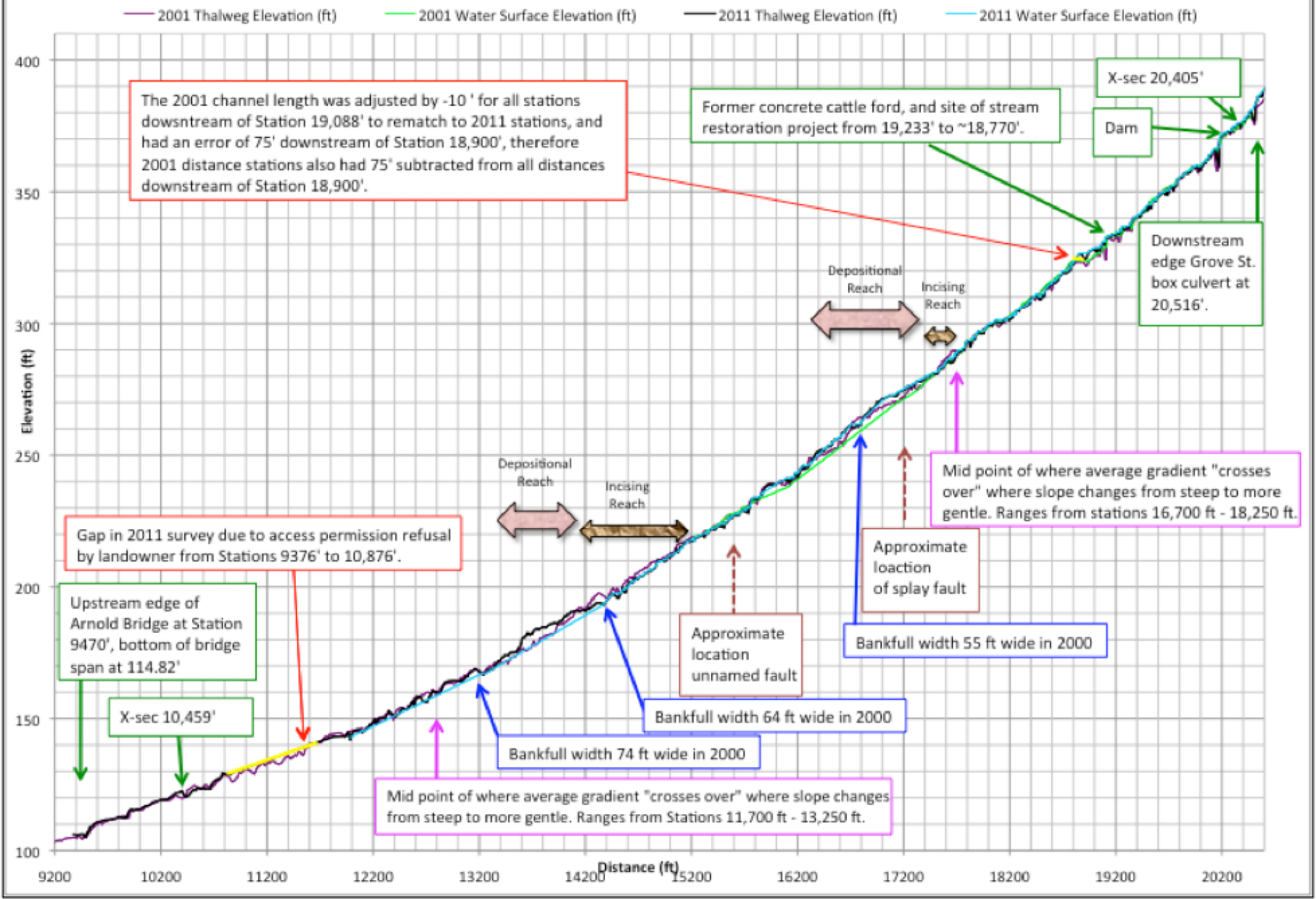


Figure 1 Append

2001 and 2011 Carriger Creek Longitudinal Profile Comparison
Surveyed during Autumn Low Flow



What are the potential signs of impending instability on an alluvial fan?

- Mid channel bars

What are the potential signs of impending instability on an alluvial fan?

- Mid channel bars
- Intersection points where stream bed = valley floor
- Aggradational and depositional areas
- Outside bends
- Cross over points where slope changes

What are the potential signs of impending instability on an alluvial fan?

- Losing reaches where surface flow converts to subsurface
- Over widened bankfull width
- former distributaries locations
- Under-sized bridge crossings

What are the potential signs of impending instability on an alluvial fan?

- Entrenched reaches where bank erosion is excessive, especially where there no large riparian species to add bank cohesion

- Areas of insufficient floodprone width (<2.5 times bankfull width)