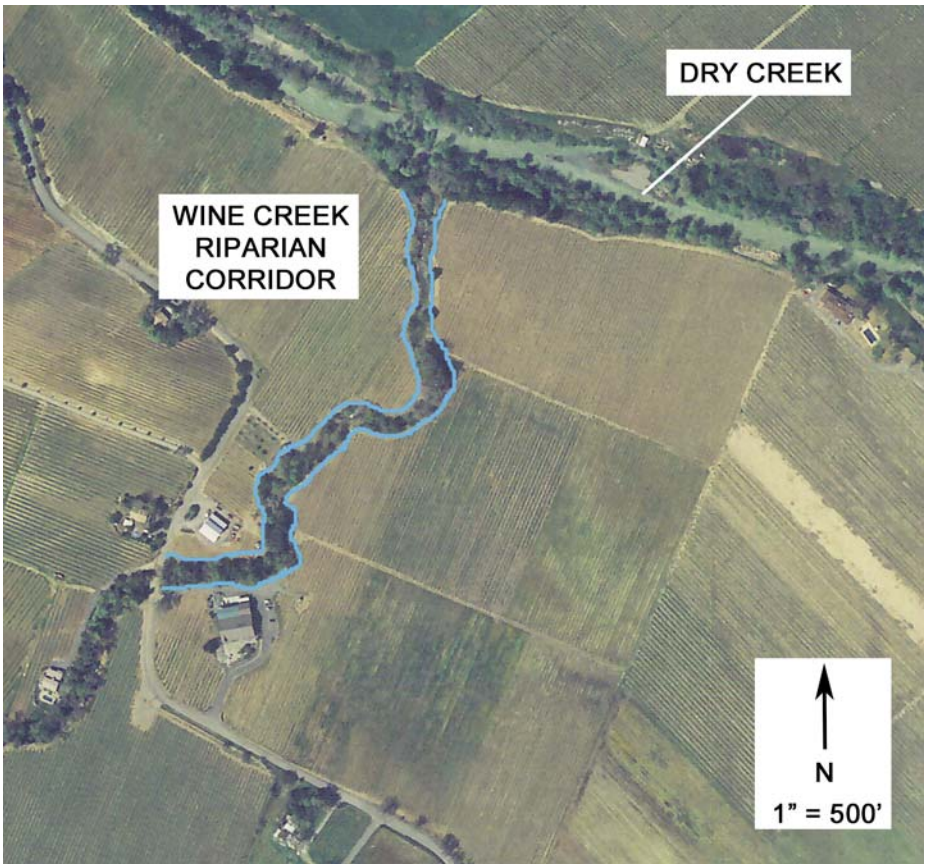
WINE CREEK RESTORATION AND REVEGATATION PROJECT



PREPARED BY:

FISH FRIENDLY FARMING PROGRAM
CALIFORNIA LAND STEWARDSHIP INSTITUTE
550 Gateway Drive #108
Napa, CA 94558

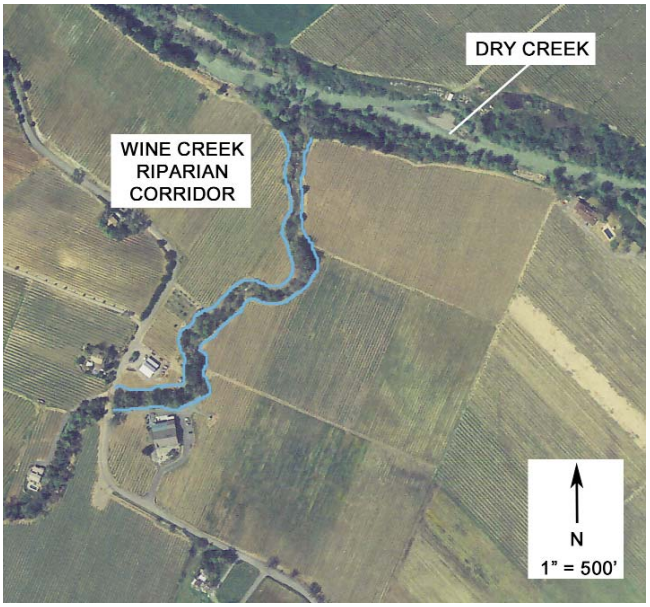
Channel Incision and Habitat Restoration: Wine Creek

Introduction

One of the greatest challenges for creek and riparian restoration in the Russian River watershed is the large number of creeks with significant incision of the stream channel. Restoration on these sites must address returning the relationship of the stream channel to its floodplain for any revegetation or habitat re-creation to be successful. This evaluation discusses a site with channel incision and the issues surrounding restoration activities. It should be noted that any restoration project of this type needs to be closely coordinated with the landowner and all attempts should be made to limit the impacts on agricultural lands and potential loss of income.

Background

Wine Creek is a tributary of Dry Creek that is in turn a tributary to the Middle Reach of the Russian River. The Middle Reach of the Russian River and Dry and Wine Creeks flow through broad floodplain valleys made up of deep deposits of sand and gravel. In alluvial creeks such as Dry and Wine Creeks, the channel is relatively small in comparison to its floodplain, or the flat valley lands next to the channel. Under unaltered natural conditions flood flows frequently spill out of the channel and inundate the floodplain. As flows leave the channel, water slows down and spreads out over the floodplain. Typically the floodplain is adjacent to and slightly elevated (+5 ft.)above the creek channel.



During flood events, meandering stream channels also erode, deposit sediment and change their location in their floodplain in a process of adjustments to conditions in the watershed as well as up and downstream channel conditions. The creek channel will vary in its width and depth as individual flood events provide various amounts of sediment or floodwater and the channel adjusts to these inputs.

In creeks such as Dry Creek and Wine Creek, the stream channel typically has gravel bars, pools, and riffles formed through these flood and adjustment processes. These riffles, bars, and pools are spawning and rearing habitat for salmon and steelhead trout. Riparian vegetation grows on the floodplain adjacent to the scour channel and provides shade to keep pools cold for salmon and steelhead trout.

Riparian trees require a floodplain that is slightly elevated above the channel and will be inundated frequently from small flood events. The relationship of the channel to its floodplain is a critical feature to consider when designing habitat restoration projects for riparian forest and fish habitat.

The Russian River and Dry Creek have been intensively mined for sand and gravel since the 1950's. As a result of these instream deep pit mines (>60 feet), the channel of the Russian River and Dry Creek underwent significant changes in the 1970's.

The pits remove deposits of sand and gravel in large amounts from the channel and floodplain. The natural replenishment of sediment from the watershed is much lower than the amounts of sand and gravel excavated. The result of the gravel mining was a large-scale deficit of sediment in the Middle Reach and Dry Creek causing the river and creek channel to undergo enormous adjustments. The river channels downcut, or incised, 10-20 feet into the floodplain. Dry Creek both deepened and widened eroding several hundred acres of land. These dramatic changes in the Russian River Middle Reach and Dry Creek are well documented in a number of studies (Collins and Dunne 1990, U.S. Army Corps of Engineers. 1985).

The incision of Dry Creek affected its tributaries including Wine Creek. As the elevation of the bottom of the Dry Creek channel downcut, it altered the base elevation controlling Wine Creek. The Wine Creek channel adjusted by incising from its downstream confluence with Dry Creek up the channel until reaching bedrock or an artificial structural control, such as a bridge. Wine Creek exhibits incision of 10-12 feet.

There are several features of incised channels that directly affect a creek's ability to create and sustain riparian forest and fish habitats. Incised channels have downcut into their floodplain, forcing the majority of flood flows to be confined within the channel. Unlike a channel with an adjacent floodplain, the incised channel has no area for floodwater to spread out and slow down. Instead, the floodwater confined in the channel flows at high velocity and scours the channel bottom, eroding the channel deeper. Spawning gravel is scoured out, along with salmon redds, from the incised channel.

The former floodplain, now 10 or more feet above the channel, no longer functions to spread out and slow floodwater and is isolated from the channel except in very large, infrequent flood flows. The plants along the abandoned floodplain, or terrace, may be able to withstand the incision of the channel if their roots can continue to reach groundwater as the summer water level recedes to the level of the lower incised channel. However, the abandoned floodplain is no longer able to support new riparian seedlings due to the lack of flood flows and natural processes. The high velocity incised channel is also unable to support new seedlings due to these altered processes. Eventually, as the channel gets deeper and the alluvial banks get steeper, the banks are undercut and collapse. As the banks collapse, the channel widens out and the bank material creates a new floodplain adjacent to the lower channel. Flood flows are able to spread out and slow down over the new floodplain and scour is greatly reduced. The channel adjustment re-establishes the natural relationship of the floodplain to its channel. This process of adjustment from a period of incision to the deepening and eventual widening of the channel with the reforming of a new floodplain is well documented in numerous creeks in the Russian River system.

Wine Creek is undergoing channel adjustments with the formation of a new floodplain through bank collapse and channel widening and riparian growth on the new slumped material. This process is very evident in the most downstream section of Wine Creek

Restoration programs must recognize the functions in the incised channel of high velocity and scour, lack of a floodplain and steep, vertical banks, as well as the ongoing process of bank collapse and new floodplain development. By recognizing that natural processes have the greatest influence in determining the channel form and habitats, designing the restoration project to work with nature creates the most successful project and a more stable channel. Riparian plants require a floodplain adjacent to the channel to grow and sustain shade over fish habitats. Typically, re-creating a new

floodplain from the abandoned floodplain is a first step in restoring habitat. Planting willows within the incised channel may create some growth, but without a channel form adjustment to create an adequate floodplain will not reduce velocities or the scour of gravel, nor will it advance the natural process of channel adjustment and floodplain formation, which will occur anyway.

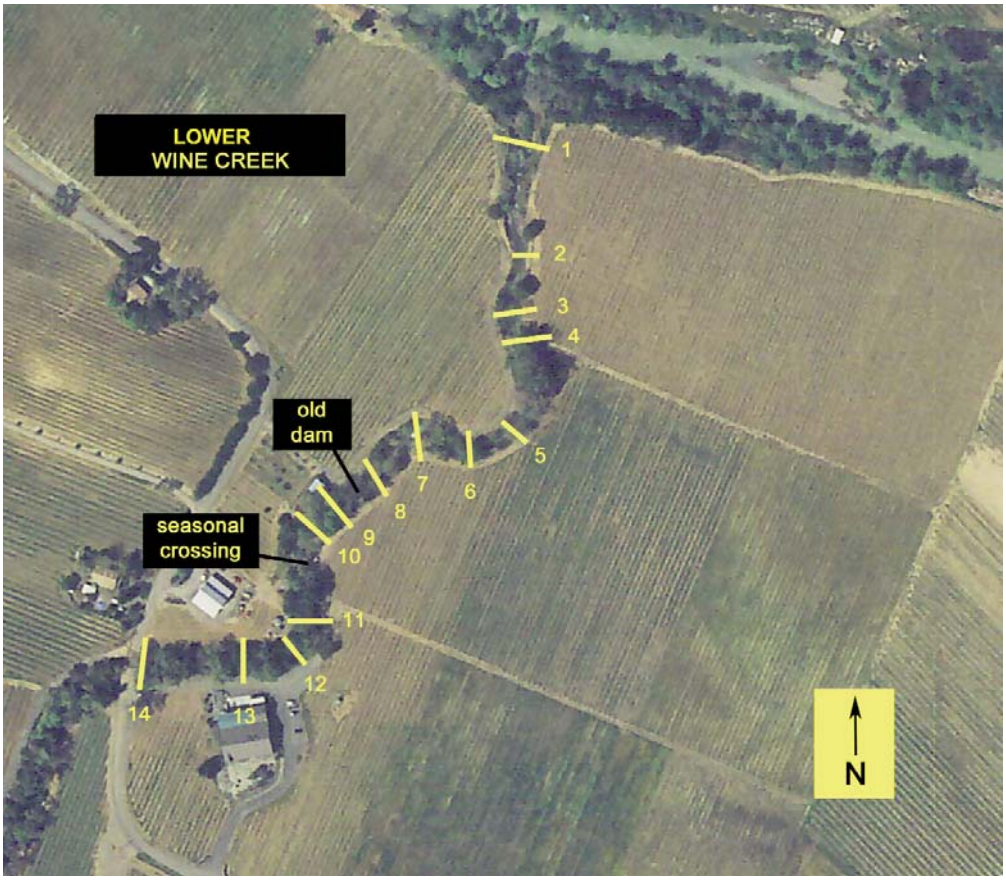
If willows are installed at the base of the bank, but the banks remain steep and vertical, bank collapse will likely occur under flood conditions and the location and amount of collapse may be unpredictable and great, affecting important facilities on the abandoned floodplain. Designing the project to incorporate this eventual collapse by setting back banks will increase the stability of the creek and allow for a controlled alteration to achieve the adjustment in the channel form.

Wine Creek Evaluation

We evaluated the condition of lower Wine Creek. We measured two cross sections and measured bank heights at fourteen locations. In particular, we evaluated the relationship of the channel, the new floodplain forming in the downstream section and the abandoned floodplain. Table 1 and Graphs 1 and 2 summarize the information we collected and the figure below illustrates the locations where the measurements were taken.

Several general conclusions can be drawn from our analysis:
Wine Creek has adjusted its form in its most downstream area to re-establish a floodplain along the channel and reduce flow velocities. Riparian vegetation has colonized and the channel has achieved a level of stability that is greater than the other areas of the creek.

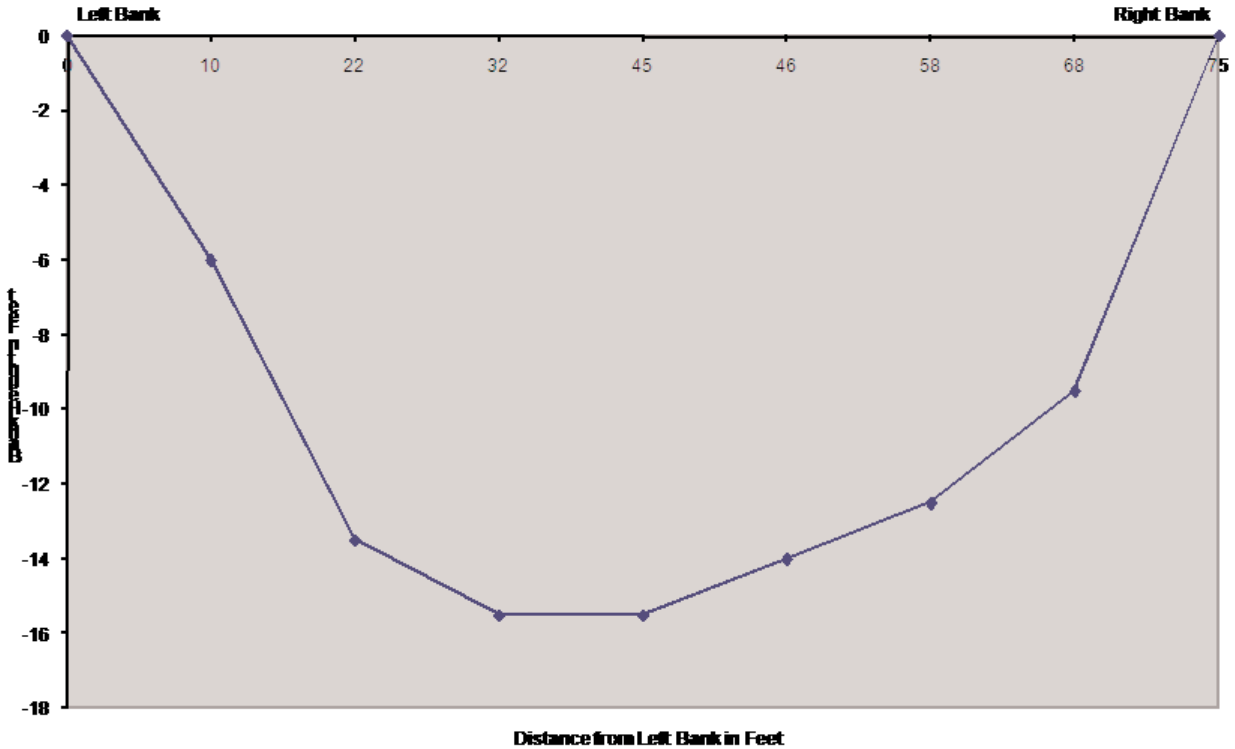
The remaining areas of lower Wine Creek are highly incised with little to no floodplain, vertical banks and high velocity flood flows and scour. In several locations the channel has incised to expose bedrock and will now likely begin to adjust its form by widening through bank collapse. There are a number of locations where this process is evident. Willow walls and other instream structures have

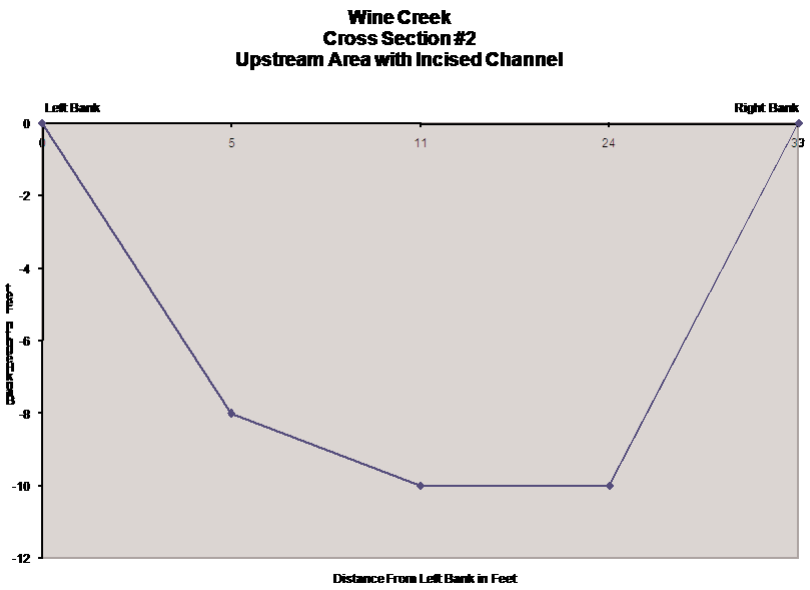


Wine Creek Summary of Observations and Measurements from April 4, 2003 Site Visit

Measure-ment Location	Bankfull Channel Width	Total Riparian Corridor Width	Bank Heights	Comments
1	23 ft.	125 ft.	15.5 ft.	Bank collapse has led to re-creation of natural, new, lower floodplain next to incised low flow channel. Riparian trees have colonized new floodplain. Detailed cross section #1 completed.
2	23	62	15	Bank collapse with new low floodplain formed on right bank; hard conglomerate outcrop on left bank.
3		94	10	Small floodplain on right bank; narrow channel
4	20	109	12	Bedrock channel; no floodplain; no riparian plants on steep banks
5		94	13	Point bar with outer eroding bank; no floodplain; oaks on bank undercut 6-8 feet.
6	17	63	13	Vortex weir holding gravel; undercut bank, no floodplain.
7		93	13	Some plants on terrace
8		63	13	Just downstream of at-grade road crossing with eroding bend.
9		94	11.5	Willow wall/rock installed at base; 1:1 bank above.
10		78	13	Rock weir upstream; 1 willow wall doing well; 1 undercut with baffle
11		94	12	Rock weir upstream; large riprap bank revetment
12		78	12	Bedrock control upstream/rock riprap revetment on both sides of channel
13	19	94	10	Flat bottom; highly incised channel; detailed cross section #2 completed.
14		125	10	16 feet from bridge deck to bottom of pool; cement apron under bridge to protect abutments.

Wine Creek
Cross Section #1
Downstream Area with New Floodplain





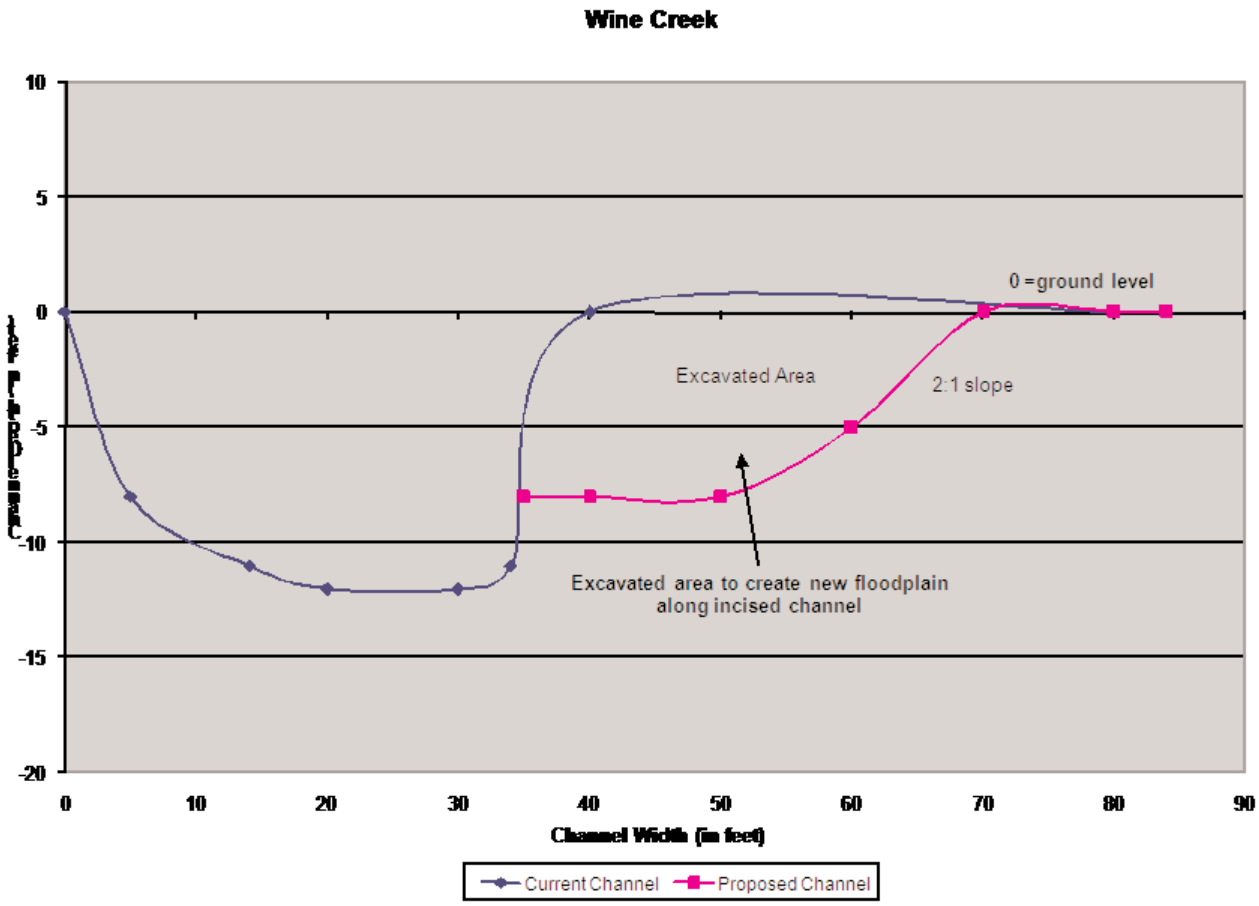
been placed in portions of the channel and these may act to create some sediment buildup in the stream bottom, but it is unlikely they will alter the natural progression of adjustment in the incised channel form. Additionally unless a part of the restoration project addresses the high velocity flood flows the ability of the structures to create viable spawning areas will be compromised by the ongoing high level of channel scour. We have attached a recently completed compilation of the physical factors in stream channels which steelhead trout can tolerate including the velocity for spawning . The velocity tolerance numbers range from 1.0 to 3.9 ft/second. It is highly unlikely that the current channel provides these flow conditions but instead has significantly higher velocities which cause the scour evident in the channel.

We recommend the following restoration steps:

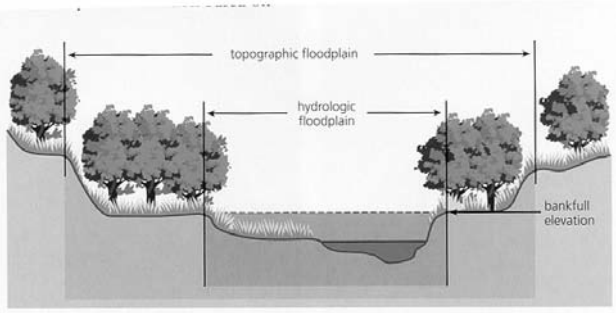
In the lower area of Wine Creek near Dry Creek no changes to the active channel or new floodplain should be carried out except to revegetate the floodplain with native riparian species and set back the collapsed banks where needed to a more stable angle and revegetate them with native plants such as oaks and upland species.

In the incised areas the instream structures and willow walls should be left in place and the banks set back to a 3:1 angle or the abandoned floodplain excavated to create a new floodplain adjacent to the channel with revegetation with native riparian plants. The bank setback or floodplain creation would require 40-50 feet of the abandoned floodplain and should be designed to reduce impacts on the vineyard operation while serving to restore natural functions in the channel and increase the spawning habitat and riparian cover adjacent to the channel. This approach will increase the stability of the channel and reduce the likelihood of bank collapse affecting the vineyard. All plans for changes to the creek will be closely coordinated with the landowner. Construction should be done from the land side not water side of the channel. Implementation will require a precise survey of the channel, engineered plan, phasing of implementation, a location on-site for excavated material and coordination with the farming operation at all times.

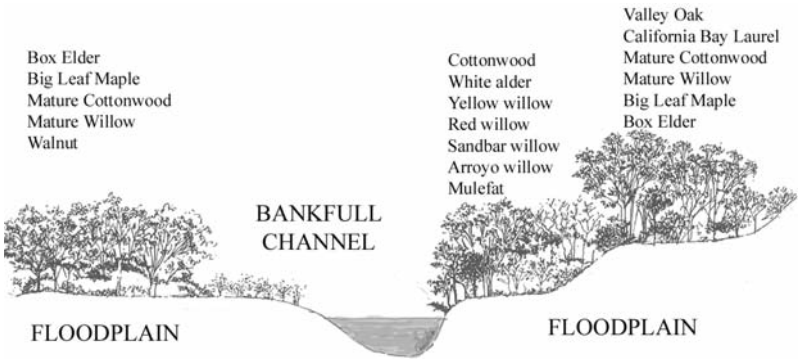
We believe that Wine Creek can be restored to a form which will support salmon and steelhead if the functions of the channel are taken into account and the need to re-establish the relationship between the channel and a new floodplain is the focus of the restoration effort.

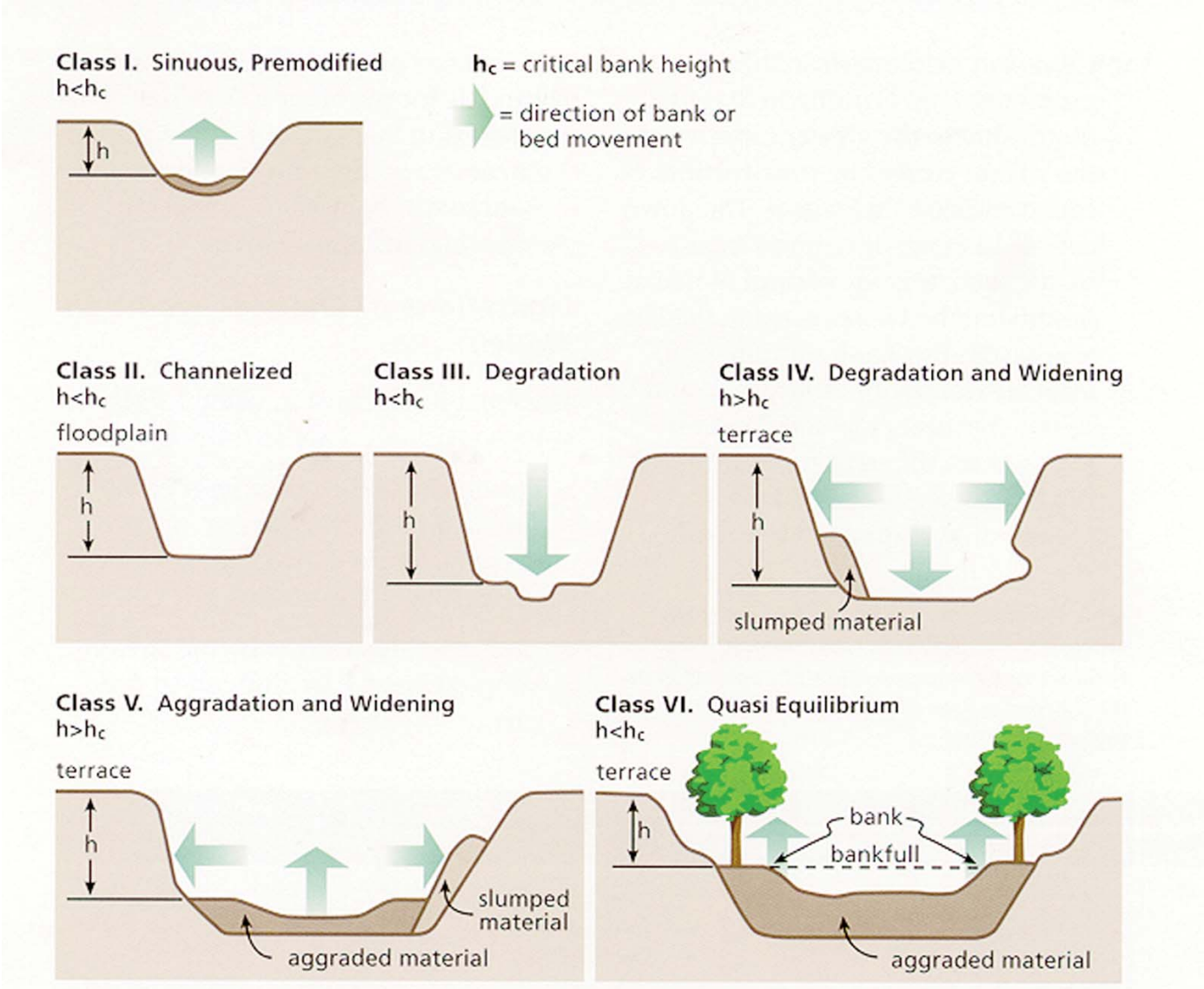


This graph represents a restoration concept for Wine Creek. Some features that can be adjusted include: the 3:1 slope which can be steeped to 2:1 reducing the overall excavation and change in agricultural land, the elevation of the new floodplain above the existing channel may be revised as the bankfull channel is surveyed in detail and the bankfull depth is better determined, and the overall width of the new floodplain may also be revised based on detailed site surveys. Additional cross sections for wine creek and the quantities of material to be excavated are attached.



Riparian vegetation grows on the floodplain next to the bankfull channel. Re-establishment of the floodplain is often needed in order to create a stable channel form and support a riparian corridor.





Most of lower Wine Creek is in the Class III and IV condition (see photo below) and is relatively unstable. The area of Wine Creek closest to Dry Creek is in the Class VI condition and is relatively stable.

PHOTOGRAPHS OF WINE CREEK

ABANDONED FLOODPLAIN OR TERRACE

INCISED OR ENTRENCHED CHANNEL

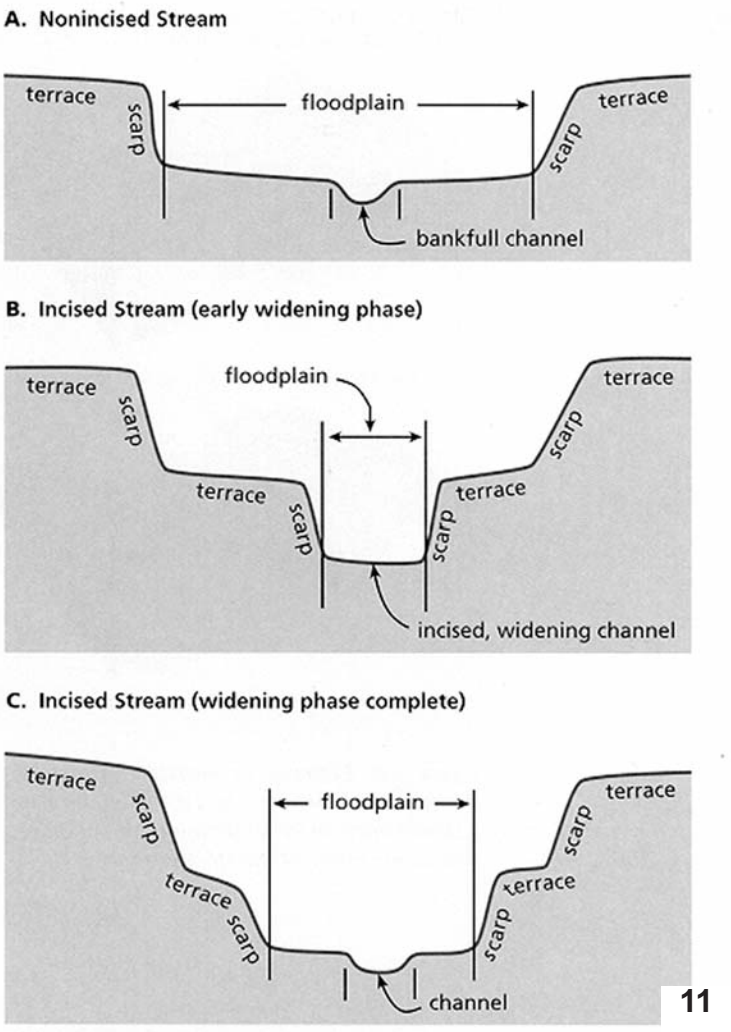
These photographs show the incision of the channel below its floodplain and the steep vertical nature of most of the stream banks along this section of Wine Creek. The entrenchment of the channel confines floodwater to the channel and increases velocities and scour of spawning areas.

Bedrock exposed in the channel

These photos show the undercutting and erosion around the willow walls indicating flow velocities continue to scour the channel due to the level of incision of the channel and the lack of a floodplain.

Incised channels undergo an adjustment involving the collapse of banks to re-create a new floodplain and reduce flow velocities. In these pictures the abandoned floodplain is collapsing due to the undercutting of banks. Revegetation efforts on the abandoned floodplain or terrace are unlikely to produce a sustainable system or reduce the bank collapse process

Downstream area of Wine Creek where bank collapse has created a new floodplain and riparian trees have colonized. The diagram depicts the process of adjustment this area of Wine Creek has undergone and upstream areas are also undergoing.



Wine Creek Revegetation/Restoration Project
Location of Areas Evaluated for Restoration