

# TECHNICAL NOTES

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U.S. Department of Agriculture

Natural Resources Conservation Service

TN-PLANT MATERIALS-70

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## **Review of paper “Napa River Flood Management Project – Willow and Cottonwood Revegetation”**

Attached is a paper titled “Napa River Flood Management Project – Willow and Cottonwood Revegetation”. This paper written by the USDA-NRCS Napa CA. field office staff to document the results of experimental plantings. During the project, the field office staff was assisted by field volunteers and Lockeford PMC staff.

This information paper provides a source of information and background for personnel who are working in tidal estuary areas which are being vegetated with willows and cottonwoods.

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CA-70-1

# Napa River Flood Management Project

## Experimental Plantings to Determine Minimum Planting Elevations In The Napa River Estuary

# Willow and Cottonwood Revegetation

USDA Natural Resources Conservation Service, Napa , CA

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## PURPOSE

The purpose of this project is to predict minimum viable planting elevations for willows and cottonwood planted as part of the bank revegetation along selected reaches of the Napa River Flood Management Project. Napa Field Office NRCS staff and field volunteers established experimental plantings to assess woody cutting viability. The reveg team also made observations of root crown elevations of existing trees along the Napa River, within the study reach.

## BACKGROUND

The Napa River Flood Management Project “Living River” channel widening and restoration project is within the tidal prism, influenced by brackish water tidal conditions. Because native willow and cottonwoods typically exhibit a relative intolerance for saline soils, the brackish tidal waters are expected to limit the minimum elevations at which these species can establish and survive.

Willow and cottonwood are excellent species for revegetating disturbed riparian areas. They typically establish and grow quickly, and develop strong root masses that help stabilize stream banks. They can tolerate inundation and are resilient to relatively strong tractive stream flow forces. Their trunks and branches help slow water velocity near the banks and thus reduce sediment scour and promote sediment deposition. They also provide excellent wildlife habitat and rapid development of shade for stream temperature moderation. Willows in particular are relatively simple to plant, and provide a low cost alternative to harsher mechanical stabilization methods.

## MATERIALS

Three tree species were tested: Arroyo willow (*Salix lasiolepis*), Red willow (*Salix laevigata*), and cottonwood (*Populus fremontii*).

Willow and cottonwood sprigs were harvested from riparian areas nearby to tidal influenced channels, to take advantage of any greater salt tolerance of the local ecotypes. Willow sprigs for Huichica and the river sites were harvested along Huichica Creek near the planting site. Willow for the Napa Sanitation Site was harvested along nearby Fagan Creek. Cottonwood sprigs were harvested from near the Copia and near the Craig sites.

## **PROCEDURE**

Arroyo willow, red willow, and cottonwood sprigs were planted in multiple accessible, tidally influenced locations chosen by NRCS District Conservationist Phill Blake, (see attached site location map). Four locations (Yacht Club, Copia, Craig, and Milliken Inn) are along the Napa River, one (Huichica) on Huichica Creek, and one (Napa Sanitation District) on Selby Creek. See the attached map for site locations. (The Napa Sanitation District site planting was not part of this experiment, but is included for its limited data.) Planting elevations were chosen to straddle the approximate high tide line. Sprigs were planted at three elevations, the lowest near the high tide mark, the middle about 2 vertical feet higher and the highest an additional 2 feet higher.

Sprig size was between 1" to 2" in diameter by approximately three feet long, with a sharpened bottom end. A steel tool bar was used to dig a pilot hole, ideally slightly smaller than the diameter of the sprig. Then the sprig was driven by sledge into the pilot hole, with approximately two feet of the sprig was buried. Effort was made to establish tight soil contact to the buried portion of the sprig. If space was left between the soil and the sprig, effort was made to tamp the soil tight to the sprig. After any necessary trimming to remove sledge damage, six to twelve inches of the sprig was left exposed above ground.

Tools used were bow saw, loppers, clippers, hatchet, sledge hammer, tool bar, soil probe, GPS receiver, digital camera, measuring tape, and sight level.

Soil salinity samples were taken at each planting location at varying depths (typically depths of 6", 12", 18", or 36") using a soil probe tool.

The planting location elevations were later surveyed relative to National Geodetic Vertical Datum (NGVD) monuments established by the City and County of Napa. Status of plantings were recorded in October 2002

## **SITE AND SOIL DESCRIPTIONS**

**Huichica Site:** The planting sites were on a moderately steep, partially vegetated cut bank. The soil was sandy loam, silt loam, and silty clay respectively downward from the top of the bank.

**Napa Sanitation District Site:** The planting sites were on shallow-sloped, thickly vegetated, floodplain/banks of Selby Creek, in salt influenced areas. Soil texture was not characterized.

Yacht Club Site: The planting sites were at two locations (north and south) at the base of and slope of a steep, partially vegetated cut bank. The lowest sprigs were in unvegetated tidal mud. The soil was a loam.

Copia Site: The planting sites were on a moderately steep, partially vegetated bank. The lowest sprigs were in unvegetated tidal mud. The soil was a soft fine sandy loam.

Craig Site: The planting sites were on a steep and eroding bank. The soil was slightly indurated alluvial silt to gravel sized sediments.

Milliken Inn Site: The planting sites were near the moderately steep base of a steep cut bank. The base soil was moderately indurated alluvial sediments; the bank soil contained recent loose sediment deposits.

## **SOIL SALINITY TESTING**

Soil salinity was measured at the planting locations using an electronic EC meter to take electro-conductivity readings in milli-Seimens (mS/cm) on a one-to-one soil/water paste. Soil salinity samples were taken at each planting location at depths of 6", 12", 18", and 36" using a soil probe tool. Soil salinity was measured at the Huichica, Yacht Club, Copia, and Craig sites.

## **RESULTS**

Planting elevations, measured salinity, and other data for Huichica, Yacht Club, Copia, Craig, and Milliken Inn sites are summarized on the table and chart pages for that planting site. Survival and vigor of the plantings were observed and recorded in October 2002, with the assistance of Dave Dyer, NRCS Lockford Plant Materials Center.

### **Huichica Site**

The location observed was willow sprigs planted at multiple elevations along an eroding bank to protect the bank were observed. Of 27 sprigs observed, all had good first growth, but suffered from drought or salt later in the dry season. In response to withering leaves, some irrigation was applied in August. Only 4 of the sprigs remained alive in October, with sprouts ranging from 12" to 18" in length. Although there was some apparent salt damage to the leaves, lack of soil moisture appeared to be the limit to viability.

### **Napa Sanitation District Site**

Willow sprigs were planted in February 2002 at multiple locations. Very few (less than 5%) grew or survived. It is not known whether the late planting date, salt toxicity, or rodent damage was the limiting factor. No planting elevations have been surveyed or soil salinity measured.

### **Yacht Club Site**

“North site” – no growth was seen on any of the 20 sprigs; the lower elevation row of sprigs was gone. “South site” – former growth was seen on two of the 9 sprigs found, with sprouts had reached 18” in length, although these were dead when observed. The lower sprigs may have been disturbed or removed by fishermen that frequently use the site.

There were no adjacent native trees to survey root crown elevations.

### **Copia Site**

The upper row had 8” of dead growth on the red willow, 24” of live growth on the arroyo willow, and no growth on the cottonwood. The middle row had 36” partly live growth on the red willow, 24” of dead growth on the arroyo willow, and no growth on the cottonwood. The lower row had no growth.

Adjacent willow root crowns were surveyed from an elevation of 4.2 to 5.3 feet, and cottonwoods were surveyed between elevations of 4.2 and 9.4 feet NGVD.

### **Craig Site**

This site has not yet been observed for sprig survival.

Adjacent cottonwood root crowns were surveyed from an elevation of 5.0 to 6.4 feet NGVD.

### **Milliken Inn Site**

This site has not yet been surveyed for sprig and root crown elevations or observed for sprig survival.

No clear relationship between measured soil salinity and sprig survival is apparent from the current data. Soil salinity was sampled during the winter rainy season when more soil water may be supplied from rainfall than from tidal wetting, as may be the case during the summer dry season. Soil salinity may thus be increased during the summer, during the sprig growth season.

## **RECOMMENDED FUTURE ACTIONS**

1. Survey the Milliken Inn Site elevations and measure soil salinities.
2. Monitor soil salinities at one or more planting locations over a year to document possible seasonal changes in soil salinity.
3. Continue to monitor second-year survival of existing plantings.
4. Measure elevations and soil salinities at Napa Sanitation District experimental willow planting sites.

5. Past plantings have been in locations with steep or constructed banks. Establish additional plantings in areas with more gently sloping banks that may better approximate the proposed Napa River Flood Control Project planting locations.
6. Based on the low first-year survivability of previous plantings, establish additional plantings at slightly higher elevations to better assess long-term survivability. (The 4-foot approximate minimum surveyed elevations of existing willow and cottonwood root crowns suggests that this elevation may be the minimum viable.
7. Correlate NGVD elevations with tidal elevations for the sites, if needed.
8. Collect coastal selections of native willows with greater potential tolerance for saline soils/ brackish water. Establish in existing plots and monitor for comparison on survival rates.

### Images of Study Plots:



Willow cutting being driven into streambank at Huichica Creek



Yacht Club willow plot. Cuttings on top of bank are ready to plant.