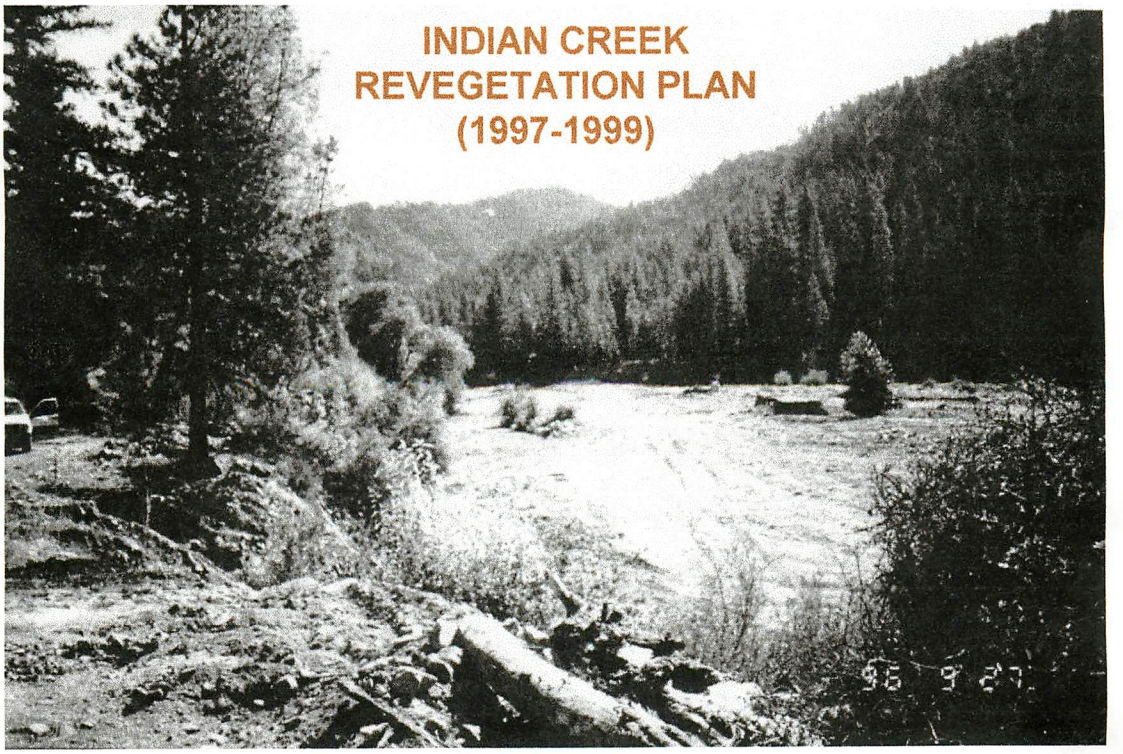

TRINITY COUNTY RESOURCE CONSERVATION DISTRICT

IN COOPERATION WITH

BUREAU OF LAND MANAGEMENT , REDDING RESOURCE AREA

Prepared by
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Plan Overview

Revegetation work as part of the Indian Creek restoration project will be divided into three years:

The revegetation work planned for the first year (1997) will focus on staking willows, alders, and cottonwoods and planting a small sample of plug stock (shrubs and conifers) with an experimental drip irrigation system.

During the second year in 1998, one half of the total stock will be planted and irrigation may be expanded to irrigate all plantings. Dri-Water a slow release water product, may also be used with selected plantings where irrigation is not feasible.

In the third year (1999) of the project the remaining half of the total stock will be planted, along with replanting (as necessary), and maintenance, which may include the thinning and trimming of willows.

Plan Objectives

- Stabilize banks with riparian vegetation in the form of willow, cottonwood, and alder stakes.
- Revegetate riparian area with plug stock and cuttings to create shaded, cool areas for spawning fish and fry.
- Revegetate upper banks and harsher areas, such as south facing sites with plug stock of shrubs, hardwoods, and conifers, to enhance these areas and create an overstory canopy which will eventually shade the creek.
- Irrigate designated area(s) to increase the survival of planted plug stock.
- Fertilize (if applicable) to enhance the growth of planted seedlings.
- Replant (as necessary)
- Maintain stake and plug stock plantings (as necessary) by expanding irrigation, weeding, thinning, and trimming.

Indian Creek Revegetation Plan

Planting Riparian Species

Hardwood Cuttings (staking)

When planting willow stock at Indian Creek remember that willows can adversely interact with other natural forces to cause increased damage to the riparian zone. Some major problems to watch for are: high velocities, sharp curves, high vertical to near vertical or undercut banks, entire reaches bare of vegetation to waterline, and evidence of mass soil slumping. Mature willows can partially block or deflect currents adversely. A continuous line of willows through the curve is important so that the water is not channeled behind the cuttings. Creeping type willows are found and should be planted on inside curves of a stream channel. Shrubby types would normally be planted on the outside curves of a stream channel as a continuous barrier. Plant tree type willows and cottonwoods up the bank from the shrubby type or right on top of the bank or the floodplain. (Information taken from Plant Materials Center, Aberdeen, Idaho: Riparian/Wetland Project Information series No. 4.)

STAKE SPECIFICATIONS:

- LENGTH: 3-5 FT., WITH AT 2/3 (60%) OF THE STAKE BELOW GROUND
- AT LEAST 1 INCH DIAMETER, PREFERABLY 3-4 INCHES
- USE GREEN WOOD, 1-2 YEARS OLD (not mature), NO SUCKERS
- CUT OFF APICAL BUD (tip of stake) PLUS 1-2 FT.
- COAT TOP OF STAKE WITH 50/50 MIX OF WATER AND LATEX PAINT (white)
- STORE IN COOLER
- SOAK 2-5 DAYS BEFORE PLANTING (lower 1/2)

Tree Planting

In order to maintain gradually sloping and rocky areas along Indian Creek (i.e., point bars), which provide flow diversity and cover for fish, no trees will be planted in these areas. Any vegetation planted in such areas will create backwater areas that tend to deposit sediment. Eventually, this sediment will accumulate and fill in the spaces created by the cobble. This sediment will also create additional areas for vegetation to establish, which creates additional backwater, then more sediment, and more vegetation. The eventual result of this process is a steep sided channel without any gradual slopes or much habitat diversity.

Tree planting along Indian Creek will be done high on the banks above the gradual slopes or closer to the water where the banks are already steep. Planting will also be done in fill areas, behind revetments, and on broad, flat areas. This planting will be done in the early spring (March) and in the late fall (November). Spacing of plantings will be at 10 ft. intervals. (It is expected that mortality will be no greater than 20% with the use of irrigation of Dri-Water.) (Information was obtained from Jay Glase, Fisheries Biologist, USFW.)

plot size only

Seeding with Native, Perennial Grasses

A mixture of native grass seed will be used to revegetate the broad, flat areas away from the creek, in order to help stabilize and enhance these areas. After seeding, these areas will be mulched with cereal grain straw such as barley or wheat. Due to the rocky composition of these flat areas, no mechanical tillage will be possible before seeding. (Hand raking may be utilized instead.) A small, 1/4 acre plot will be seeded and mulched during the fall of 1997 in order to test the effectiveness of this treatment before it is used on a larger scale.

Plant Prescriptions (By year and season):

No irrigation

Spring 1997- Feb./March

Install irrigation system on a test plot to irrigate approximately 1,000 plants to determine the effectiveness of irrigation. (See irrigation section for details). On another test plot (100 plants), Dri-Water (slow-release water in gel form) will be used to determine its effectiveness for increasing the survivability of plantings.

February: Stakes will be collected in mid-Feb. and installed the end of Feb.
Stakes: Alder-610, Willow-835 (creeping-410, shrubby-215, tree type- 210), Cottonwood- 192

March: Plant
Plug Stock: Alder- 377 (ordered 2-96)
Bigleaf Maple- 386 (ordered 2-96)
Greenleaf Manzanita- 100 (ordered 2-96)
Ponderosa Pine- 1,000 (ordered 12-96)- irrigate

Fall 1997 Oct./Nov.

October: Seed (10 lb.) and mulch (20 bales) test plot at Lower End of Project Site, Fill B. This areas may require some tilling or raking prior to sowing.

November: Plant
Plug Stock: Ponderosa Pine- 3250 (ordered 12-96)
Redbud- 250 (available, need to reserve)

Spring 1998-March

During this time irrigation may be expanded to irrigate all plantings or Dri-Water may be used.

Plug Stock: Birchleaf Mt. Mahogany- 50 (need to order)
Douglas Fir- 1250 (need to order)
Sugar Pine- 4000 (need to order)
Ponderosa Pine- 1625 (need to order)

Fall 1998- November

Plug Stock: White Oak- 750 (ordered 12-96)
Black Oak- 150 (need to order)
Gray Pine- 2500 (need to order)

Spring 1999- March

Replants and Maintenance: Approximately 20% of the plug stock and the stakes may require replanting (due to mortalities). Also, removal of some stakes may be required if they become invasive or if they divert the flow of water in the channel.

As willows age and start to develop their growth patterns, some will probably need to be trimmed or cut to stimulate smaller and denser growth. Subsequent trimming should be done in the dormant season. During the establishment period, leave standing dead branches in the clump plantings to reduce stream flow velocities, thus protecting the establishing clumps.

TOTAL PLANT STOCK NEEDED FOR INDIAN CREEK

Species	Amount
Stakes:	
Alder Stakes (ALST)	610
Willow Stakes (WIST)	835
Cottonwood Stakes (CWST)	192
Total:	**1,637**
Plug Stock:	
White Alder (ALRH2)	188
Big Leaf Maple (ACMA3)	193
Ponderosa Pine (PIPO)	5500
Sugar Pine (PILA)	4000
Gray Pine (PISA2)	2500
Douglas Fir (PSME)	1250
White Oak (QUGA4)	700
Black Oak (QUKE)	150
Birchleaf Mt. Mahogany (CEBE3)	50
Redbud (CECC3)	250
Greenleaf Manzanita (ARPA6)	50
Total:	**14,831**

TOTAL SEED/MULCH:

Native Grass Seed	Amount
Slender Hairgrass (DEEL)	25 lb.
Idaho Fescue (FEID)	25 lb.
Blue Wild Rye (ELGL)	25 lb.
Pine Bluegrass (POSC)	25 lb.
California Brome (BRCA5)	45 lb.
Total:	**145 lb.**

Straw Mulch

Cereal Barley	**580 bales**

PLANT STOCK NEEDED BY SITE (See project map for site locations)

INDIAN CREEK	REVEGETATION	PLAN
LOWER END	**BELOW (mesic)**	**ABOVE (mesic/xeric)**
A		PIPO-15, PILA-15
B	ALST-50, WIST-50	CWST-6, ALRH2-6, ACMA3-6
C	ALST-30, WIST-40	CWST-6, ALRH2-6
	Subtotal: 170	Subtotal: 60
	AREA I (10,000 ft. sq.)	**AREA II** (37,000 ft. sq.)
	PIPO-350, PILA-350, QUGA4-50, PISA2-250	PIPO-1500, PILA-1000, QUGA4-250, PISA2-1,000,WIST-40,CWST-15, CEBE3-50, ACMA3-15, CECC3-50
	Subtotal: 1,000	Subtotal: 3920
	FILL A (1,250 ft. sq.)	**FILL B** (10,000 ft. sq.)
	PIPO-50, PILA-50, QUGA4- 25	PIPO-462, PILA-462, QUKE-25, QUGA4- 25, CECC3- 25, SEED: 5 lb. AND MULCH: 20
	Subtotal: 125	Subtotal: 999
	AREA III (87,000 ft. sq.)	
	SEED/MULCH	
	SEED: Deschampsia elong./caes. Festuca idahoensis, Elymus glaucus, Poa secunda, Bromus carinatus- 40 lb.	MULCH: 160 BALES
	AREA IV (18,750 ft. sq.)	**ISLANDS** (1,750 ft. sq.)
	ALST-80, WIST-30, ACMA3-15, ALRH2-15, PSME-500, PIPO-500, PILA-750, CECC3-88	ALST-30, WIST-50, ALRH2-150, CWST-100
	Subtotal: 1978	Subtotal: 330
	AREA V (7,500 ft, sq.)	**AREA VI** (4,250 ft. sq.)
	WIST-50, ALST-40, CWST-40, ACMA3-75, PIPO-250, PISA2-150, PSME-250	WIST-20, ALST-15, ACMA3-100, ALRH2-100, CECC3-75, PIPO-50, PILA-50, PISA2-50
	Subtotal: 855	Subtotal: 460
	CHANNEL (length 904 ft.)	
	STAKES: WIST-400, ALST-250, CWST-150	
	Subtotal: 800	

UPPER END	AREA I (25,000 ft. sq.)	AREA II (216,250 ft. sq.)
	PIPO-1,000, QUGA4-250, PISA2-1,000, WIST-70, ALST-70	SEED/MULCH/PLANT
		SEED: 100 lb. (same mix as lower part)
		400 bales
		STAKES: WIST-30, ALST-30, CWST-75
	Subtotal: 2390	Subtotal: 135
REVETMENTS	**BELOW (mesic)**	**ABOVE (xeric)**
A (80 ft.)	ALST-10, WIST-10, CWST-10	PIPO-10, PILA-10
B (130 ft.)	WIST-25, ALST-20	PIPO-13, PILA-13
C (150 ft.)	WIST-20, ALST-15, CWST-15	PIPO-15, PILA-15
D (120 ft.)		PIPO-50, PILA-50, PISA2-25
E (175 ft.)		PIPO-50, PILA-50, PISA2-50
	Subtotal: 125	Subtotal: 351
	FILL SITE (45,000 ft. sq.)	
	PIPO-1250, PSME-500, PILA-1250, QUKE-125, QUGA4-125, ARPA6-50,	
	Subtotal: 3300	

Species Codes

ACMA3	California bigleaf maple
ALST	White alder stakes
ARPA6	Greenleaf manzanita
CEBE3	Birchleaf mountain mahogany
CECC3	Redbud
CWST	Black cottonwood stakes
PILA	Sugar pine
PSME	Douglas fir
PIPO	Ponderosa pine
QUGA	Oregon white oak
QUKE	Black oak
WIST	Willow stakes

Costs for Materials and Labor

- **Stakes:**
  Collection- ~ $130.00 (13 person crew (inmates) x 5 days)
  Installation- ~ $2,640.00 (5 person crew x 5 days)
- **Plants (plug stock):** ~ $2850.00
  Labor (planting all three years): 4.5 acres x $631.60 = $2,842.00
- **Native Seed:** ~ $1,958.00
  Labor- ~ $52.80
- **Straw Bales:** ~ $2,900.00
  Labor- ~ $1,893.00 (~ 3 acres)
- **Irrigation:** ~ $7,522.00 (materials, if entire area is irrigated)
  Labor- ~ $950.00 (3 persons x 3 days)
- **Fertilizer:** Healthy Start Micro Tablets (.05 ea.)- ~ $1,500.00
  Labor- included in planting cost
- **Dri-Water:** $1250 (for 1,000 trees)

Total Cost: ~ $26,488.00

Potential Problems:

- In order for equipment to access the other side of Indian Creek (during high flows), the installation of a temporary bridge or other crossing may be necessary.
- Transporting the water tank for irrigation may be difficult, and may require special equipment.
- There is potential for theft of irrigation equipment.
- Irrigation may require periodic repairs and maintenance. (Algae growth and rodent chewing are common problems.)
- Willow (or other) stakes may divert the flow of water in the channel.

Additional Information:

Fertilizer:
Plant Health Care, Healthy Start Micro Tablets (5-2-2) may be used as a soil amendment for some or all of the plantings. Place fertilizer tablets in hole (~ 8'' deep), 6''-1' upslope from plant. This will ensure that the roots of the plants will not get burned by the fertilizer. The fertilizer will be able to leach through the soil to the plant. A soil analysis from samples taken at the sight may help determine the need for fertilizer. NO

The addition of fertilizer can aid in transplant establishment, or provide additional growth to seedlings. Some species will benefit and some will not. Stimulation of fall growth of some species will result in winter kill. Fertilized plants are more palatable and may suffer increased animal damage. Care must be taken not to fertilize with greater amounts than the young plant can utilize or to allow contact of the fertilizer and transplant roots (Young et al 1981). According to Tom Jopson (per phone conversation 12-10-96), fertilizer should not be used when planting native species. Fertilizer tends to stress the plants and may facilitate mortalities. Also, fertilizer tends to produce "soft" growth in conifers.

Alders:
Alders are associated with both nitrogen fixation and nitrification, and so significant amounts of nitrogen are also contributed to the soil water by alder stands. The thousands of nodules that cling to their roots contain nitrogen-fixing bacteria able to convert atmospheric nitrogen into organic compounds which plants can use. These compounds travel up the alder stems to the leaves as amino acids, the building blocks for the synthesis of cell peptides and protein (Killham 1994). When leaves fall to the ground each autumn and decay, they add usable nitrogen to the soil. (References: *California Forests and Woodlands* by Verna Johnston and *Soil Ecology* by Ken Killham).

Stinger:
The Stinger is a tool used to plant hardwood cuttings of willow and cottonwood species through rock riprap into moist to wet soil underneath. The Stinger utilizes the power of a backhoe to plant larger diameter and longer cuttings. The Stinger can plant 3 to 6 inch diameter by 4 to 12 feet long cuttings. The Stinger fits on the end of a backhoe arm in place of the bucket. The bar for punching holes is 3.5 inches in diameter and the total length for punching holes is 7 feet. The entire attachment weighs about 900 to 1,000 pounds and can be transported either attached to the backhoe are or in a pickup truck. The estimated cost to build a Stinger attachment is approximately $1250.00. (See design specifications for details). (Reference: USDA Soil Conservation Service: Technical Notes Plant materials No. 6, The Stinger).

Cynthia Tarwater (12-12 96) has expressed the possibility of using existing equipment that may substitute for the Stinger. An equipment operator has an adaptation that fits onto a backhoe which is similar to the Stinger attachment. Research is being done to determine the feasibility of using this attachment to punch holes for the stakes.

Irrigation:
Designated areas for planting of conifers, oaks and shrubs may be drip irrigated. Plans for revegetating Indian Creek the first year call for the installation of an experimental drip system along a section of Indian Creek.

Sari Sommerstrum recommended drip irrigation (as per phone conversation 12-10-96). She explained that in Scott Valley, success with plantings was very tenuous when irrigation was not used. There was 60-90% survival when drip irrigation was used there. Although, she stated there may be problems with weed competition and browsing.

After researching irrigation systems, agronomist Scott Eberly (RC&D) recommended using a 1,300 gal.(minimum) water tank to store irrigation water. He also suggested irrigating using one inch of water per plant per week. Up to 4,285 plants can be irrigated using this amount of water, at a cost of approximately $2,000.00. Scott has offered his services in designing the irrigation system for Indian Creek

On 12-12-96 Scott Eberly provided the following information:

WATER PUMP LIFT OPTIONS

Pump: Hydraulic Ram

Pros:
- low cost
- automatic operation
- low maintenance
- simple mechanical
- operation-no complex parts
- potential high pump rates
- no energy costs
- good for remote or poor access locations,
- pump heads up to 30 feet or more.

Cons:
- feasible only on sites with both water and head
- requires installation
- may not be "tamper proof"

Cost: complete system possible for less than $400.00

Local Supplier: Fleming Hydro-Ram (1.5 inch)
Mountain Energy Center
Weaverville, CA 623-3586

Pump: Variable Volt DC Submersible with Solar Collectors

Pros:
- easy installation
- automated system
- any water source can be utilized
- good for remote and/or poor access sites,
- capable of pumping low volumes to high heads

Cons:
- high initial investment
- difficult to "theft proof"
- high technology systems and components

Costs: D.C. Submersible pump-$720.00
Solar panels, controls, and mounting tower-$1,190

Local Supplier: Mountain Energy Center

Weaverville, CA 623-3586

Pump: Portable- Gas Powered Centrifugal

Pros:
- relatively low cost
- proven and tested pump system
- good reliability, simple installation
- removable from site
- high capacity

Cons:
- labor required for pump installation and operation on every irrigation cycle
- more site visits required
- cannot be easily automated

Costs: $400 to $700 depending on make and capacity

Local Suppliers:

Berkeley Pumps
Salt Creek Growers
Hayfork, CA
628-5528

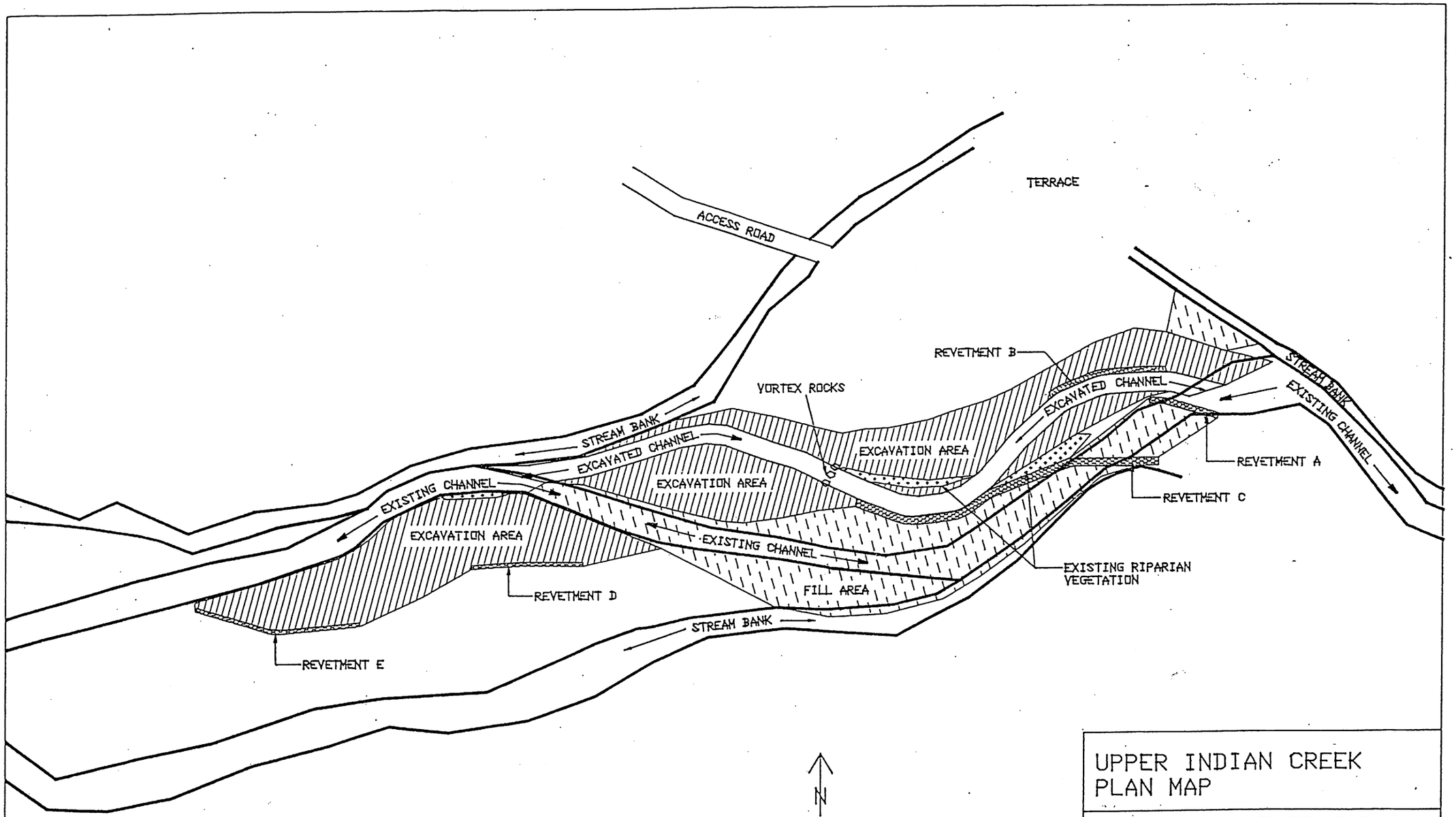
Honda Pumps
Morris hardware
Weaverville, CA
623-2952

PORTABLE IRRIGATION SYSTEM

Average Cost - Storage and Distribution (does not include any misc. fittings or plumbing supplies or labor)

Typical System - 1 Manifold - No Pump (retail $ from Salt Creek Growers- Hayfork, CA)

• 1,300 gal. Polyethylene Water Tank	**$500.00**
• 1.25 inch Gate Valve	**$35.00**
• #150 Stainless Mesh Filter and Housing	**$27.00**
• Battery Operated Controller - $30-$150 to use	**$70.00**
• 300 ft.x 3/4 inch Manifold - $90/1,000=.09/ft.x 300	**$27.00**
• 400 ft.x1/4 inch Supply Tubes @ 2 ft. each - $31.55/1,000=.32/ft x 800 ft.	**$26.00**
• 400 - E-2 Emitters @ .12 each	**$48.00**
Total:	**$733.00**



UPPER INDIAN CREEK PLAN MAP

TRINITY COUNTY RESOURCE CONSERVATION DISTRICT

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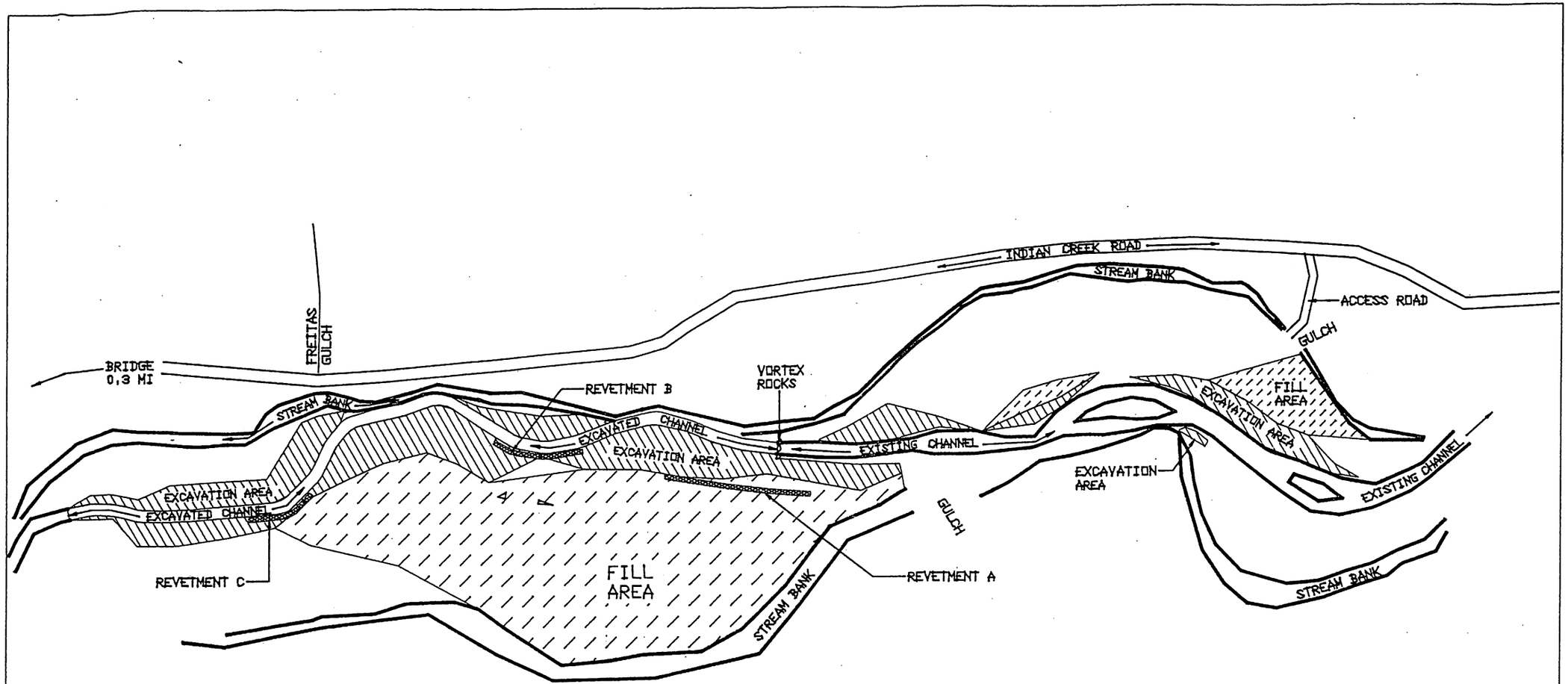

LOWER INDIAN CREEK PLAN MAP

TRINITY COUNTY RESOURCE CONSERVATION DISTRICT

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