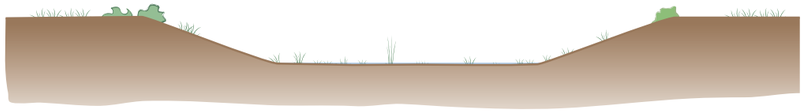


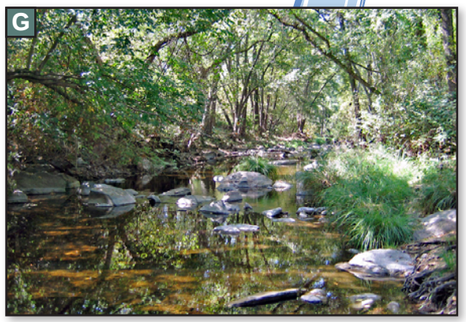
Cross-section of trapezoidal flood control channel with minimal in-channel complexity or riparian vegetation. Overall habitat function is low.

Straightened channel, minimal vegetation (Bellevue-Wilfred Channel)

Straightened channel, low in-channel complexity (small riffles and bars), low canopy closure (Lower Santa Rosa Creek)

Increased channel complexity (riffle-bar-pool sequence), riparian forest, high canopy closure (College Creek)

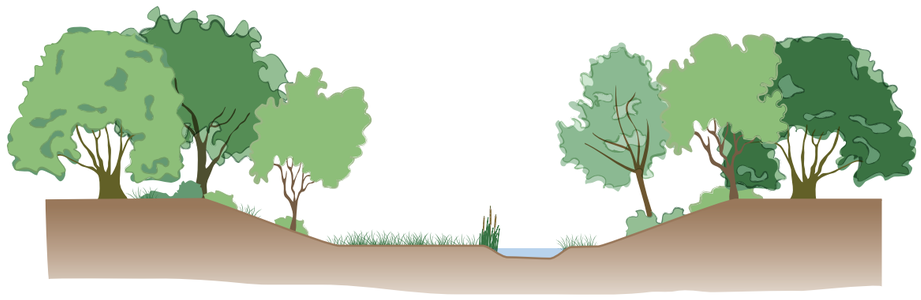
In-channel complexity (alternating bar features, low flow sinuosity, woody debris, pools), riparian forest with moderate canopy closure (Windsor Creek)



High in-channel complexity (pool-riffle sequence, cascades), mature riparian forest with closed canopy, few invasive/exotic species (Upper Santa Rosa Creek)

Straightened and incised channel, in-channel cattail/willow vegetation (Gossage Creek)

Increased channel sinuosity, in-channel complexity (point bars, shallow pools), riparian woodland with low canopy closure (Colgan Creek)



Cross-section of trapezoidal flood control channel managed for in-channel complexity (low-flow channel sinuosity, in-channel bars/benches, occasional in-channel woody debris, riffle-pool sequence) with mature riparian forest and closed canopy. Overall habitat function is improved.

Integrated Maintenance Approach at a Reach Scale

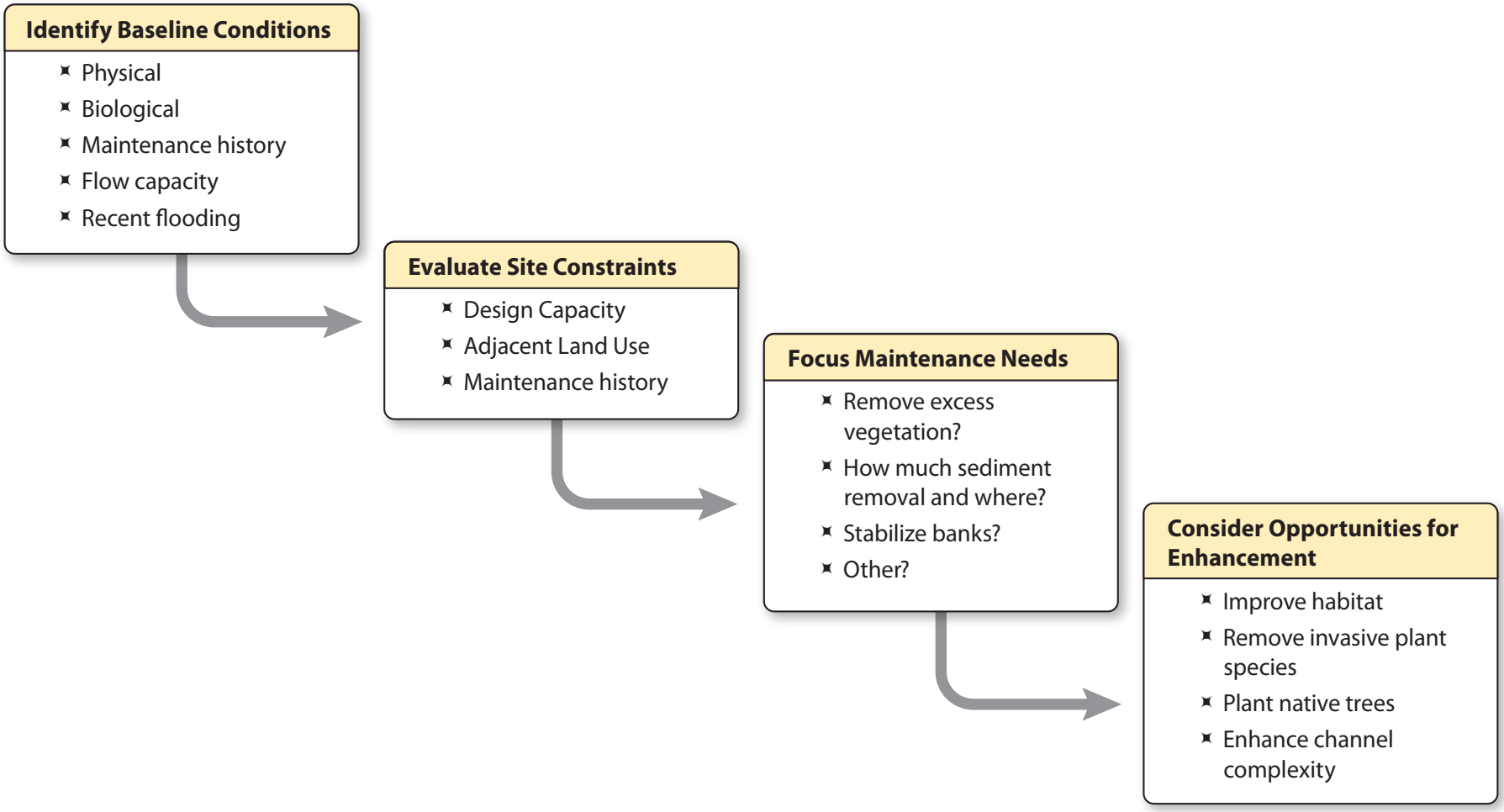


Figure 5-2
Integrated Maintenance Approach

Photo a. Copeland Creek (March 2007), channel bed is elevated and uniform with deposited sediment, emerging cattail growth is clogging channel, causing low flows to spread shallow and diffusely across stream bed. Cattails would grow 5 ft high within one year of this photo.

Photo b. Copeland Creek at Snyder Lane immediately following storm flows of early January 2008, 1-2 ft of sediment deposition occurs at the Snyder Lane crossing.

Photo c. Copeland Creek at Snyder Lane crossing, September 2008, following vegetation removal activities and prior to sediment removal activities.

Photo d. Copeland Creek at Snyder Lane crossing, October 2008, following sediment removal activities and construction of low-flow channel.

Figure 5-3
Maintenance Activities at Copeland Creek

Photo a. Santa Rosa Creek, 1997, looking downstream near Pierson Street Crossing.

Photo b. Santa Rosa Creek, 2007, looking downstream near Pierson Street Crossing.

Figure 5-4
Santa Rosa Creek in 1997 and 2007

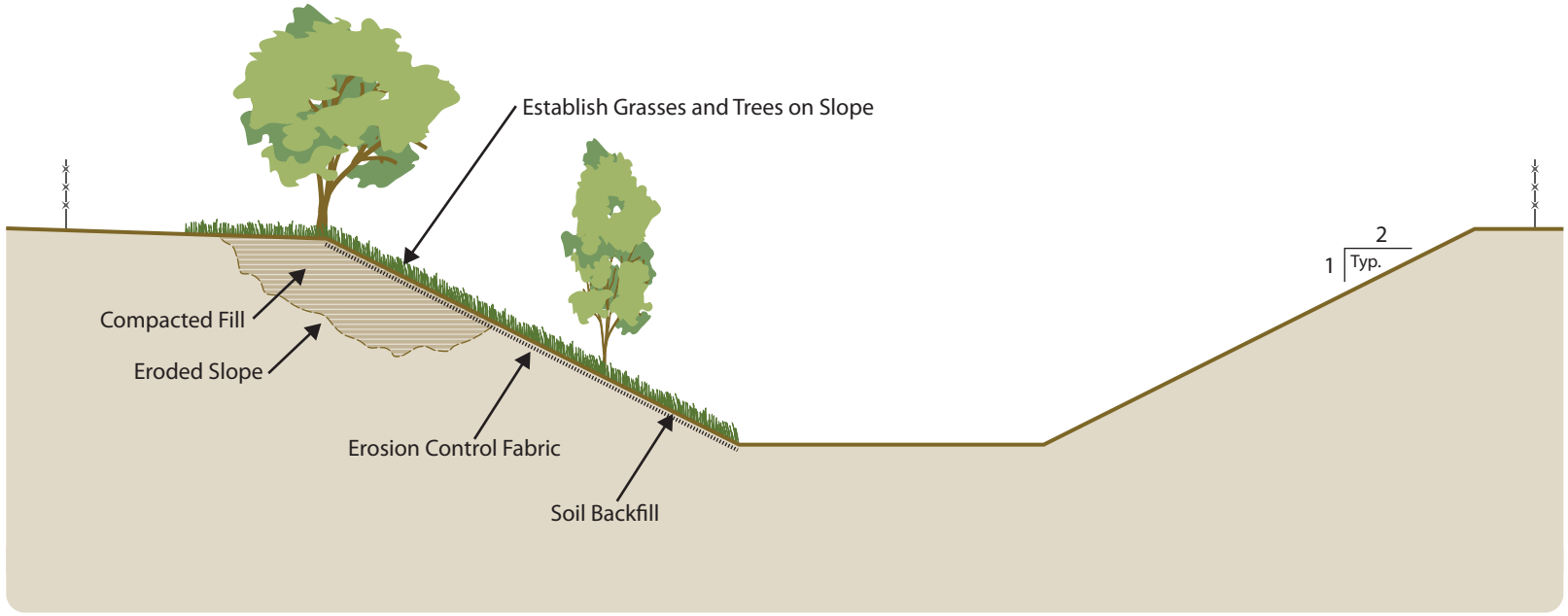


Photo a. Bank failure on Peterson Creek (Zone 1A).

Photo b. Same site as Photo (a) after bank repair using no rock-rip rap.

Figure 5-5
Bank Stabilization Treatment Design—Compacted Soil

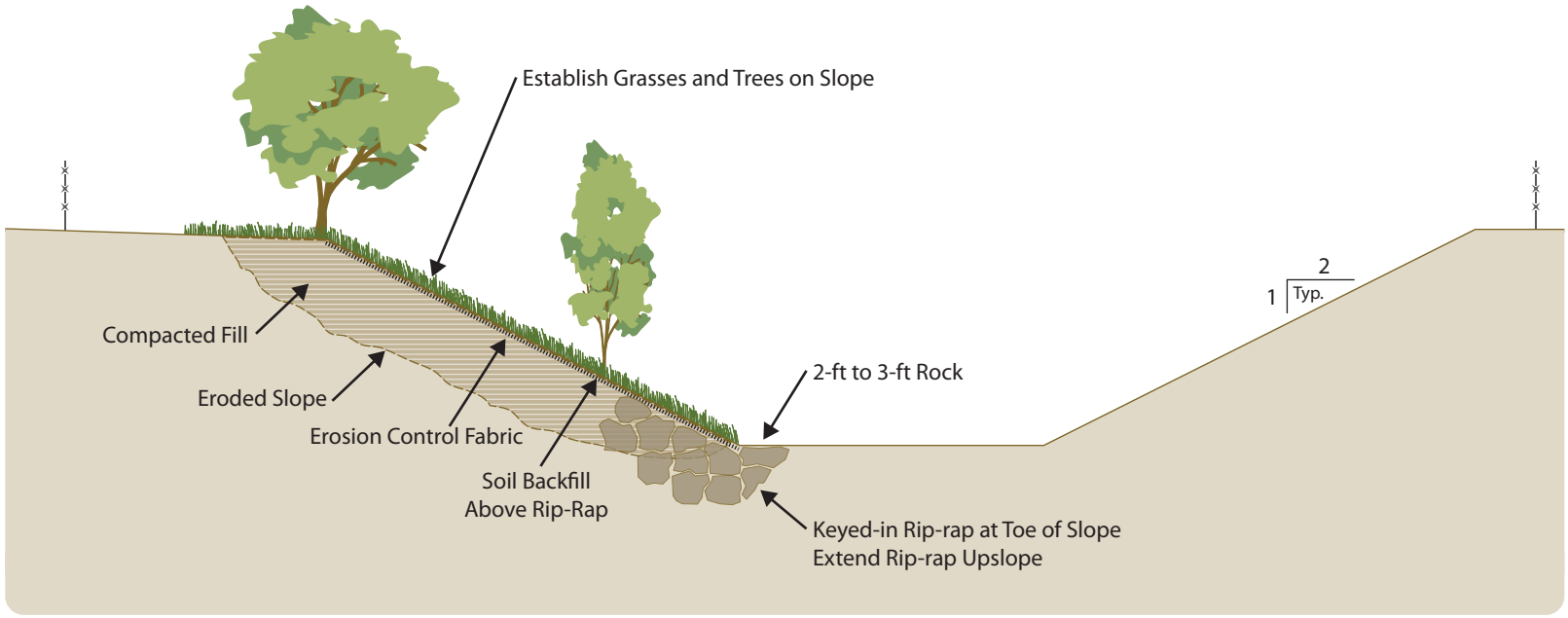


Photo a. Bank failure on Gossage Creek (Zone 1A).

Photo b. Same site as Photo (a) after bank repair, prior to revegetation.

Figure 5-6
Bank Stabilization Treatment Design—Rip-rap at Toe of Slope

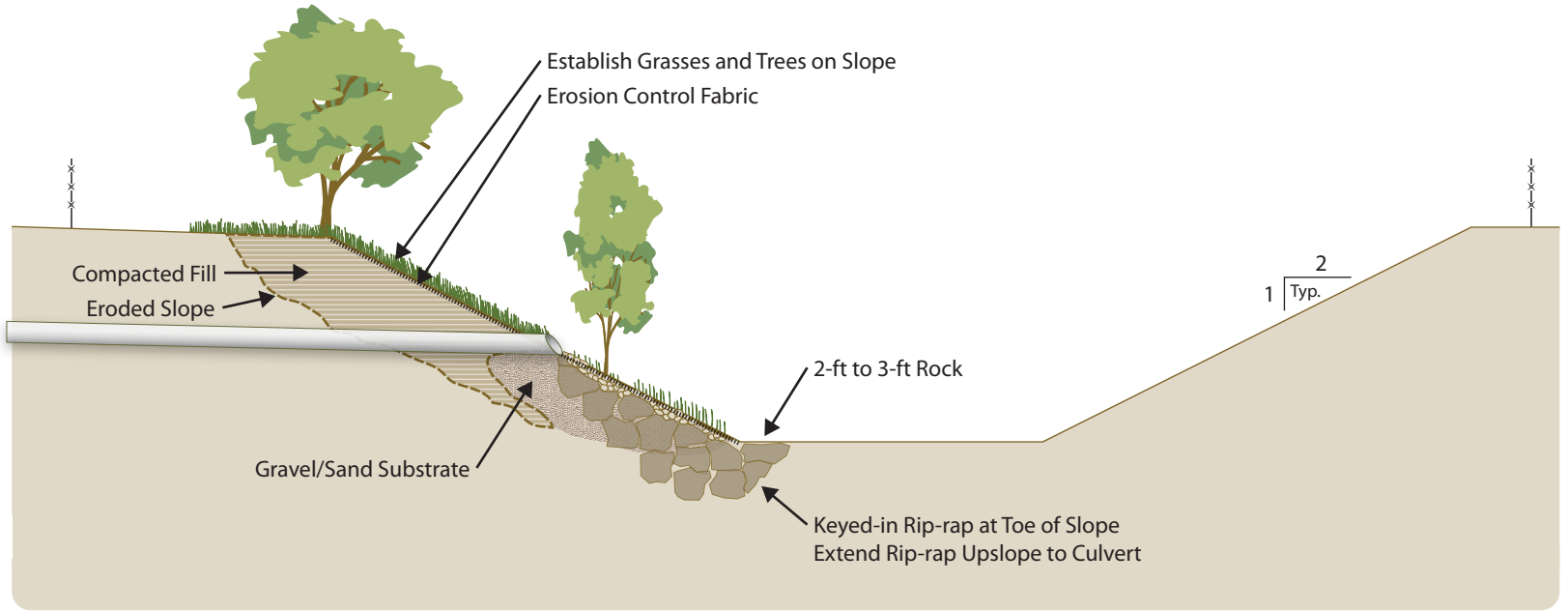


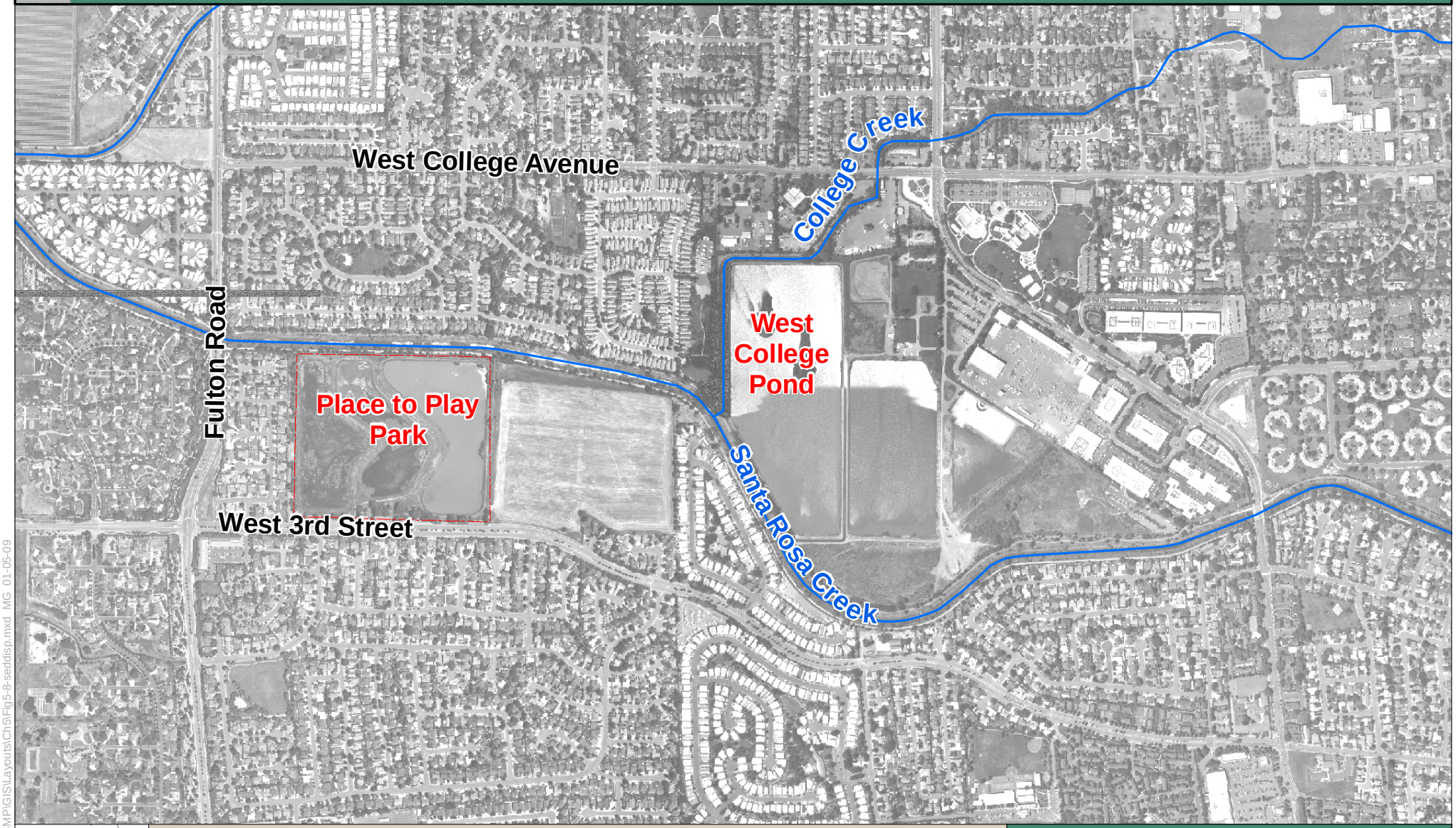
Photo a. Culvert failure on Piner Creek (Zone 1A).

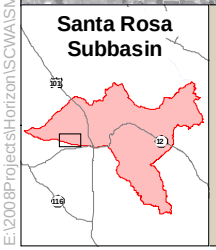
Photo b. Same site as Photo (a) after bank repair using minimum necessary rock rip-rap.

Figure 5-7
Bank Stabilization Treatment Design—Culvert Repair

Sonoma County Water Agency

Stream Maintenance Program





Sources:
Sonoma County Water Agency
County of Sonoma
AirPhotoUSA, 2005

FIGURE 5-8

City of Santa Rosa Potential Sediment Disposal Locations

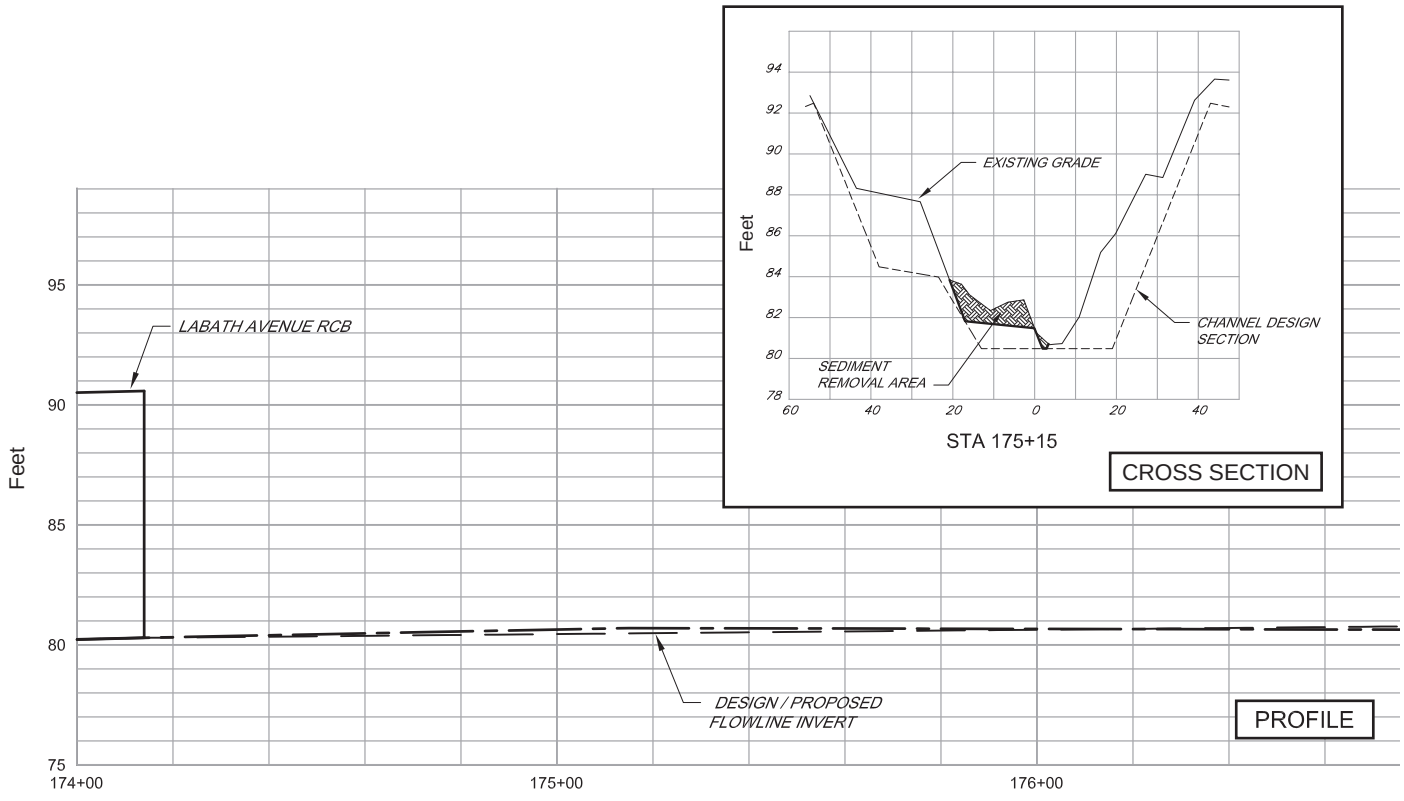
0 500 1,000 1,500 2,000

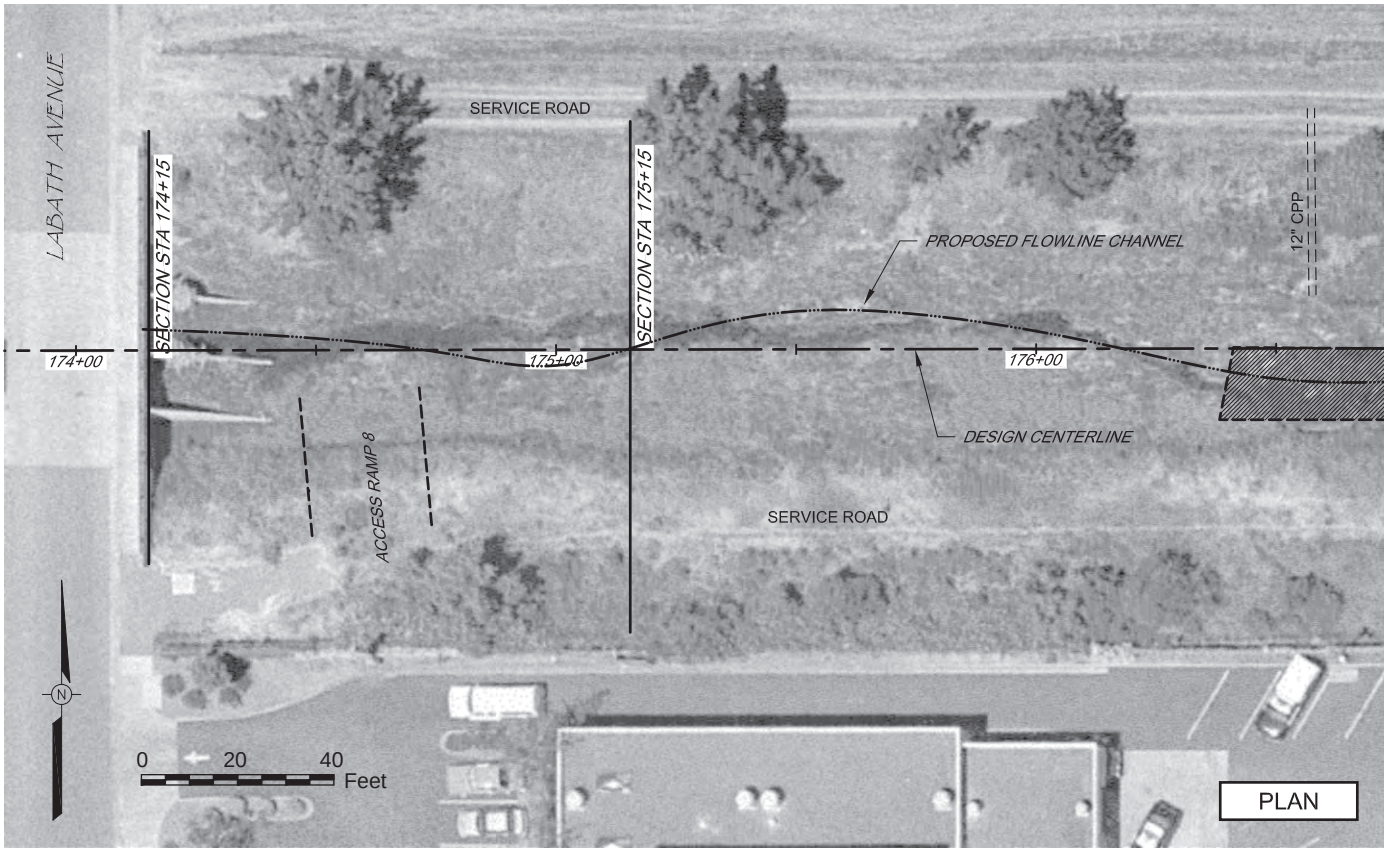
Feet

1 inch equals 1,000 feet

Horizon WATER and ENVIRONMENT

E:\2008Projects\Horizon\SCWA\SMP\GIS\Layouts\Ch5\Fig5-8-seddisp.mxd MG 01-05-09





Source: SCWA, 2007.

Figure 6-1
Cross Section, Profile, and Plan View for Typical Sediment Removal Work

Photo a. East Washington Creek, looking downstream from Garfield Drive, before sediment removal project (Zone 2A).

Photo b. Maintenance crew clearing vegetation by hand.

Photo c. Excavator positioned on access road on the top of the stream bank. Long-arm reaching into channel.

Photo d. Removed sediment placed into dump truck by excavator.

Photo e. Box culvert sediment removal staged from road crossing above.

Photo f. East Washington Creek, looking upstream at Garfield Drive, after sediment removal project.

Figure 6-2
Examples of Equipment, Access, and Staging for Sediment Removal Projects

Photo a. Looking upstream at Bloomfield Channel (Zone 8A) filled with sediment.

Photo b. Using a front loader to clear sediment in box culvert.

Photo c. Loading sediment onto an excavator.

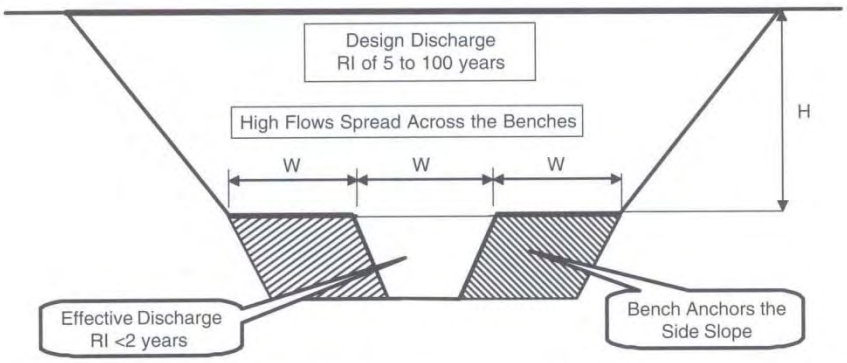
Photo d. Excavator staged on road above culvert.

Photo a. Wilfred Creek at Snyder Lane crossing (March 2007) - culvert severly blocked by chronic deposition, good site for targeted sediment removal.

Photo b. Copeland Creek at Snyder Lane crossing (March 2007) - similar to Photo (a), a chronic depositional area, see Figure 5-3 to view 2008 maintenance activities at this site.

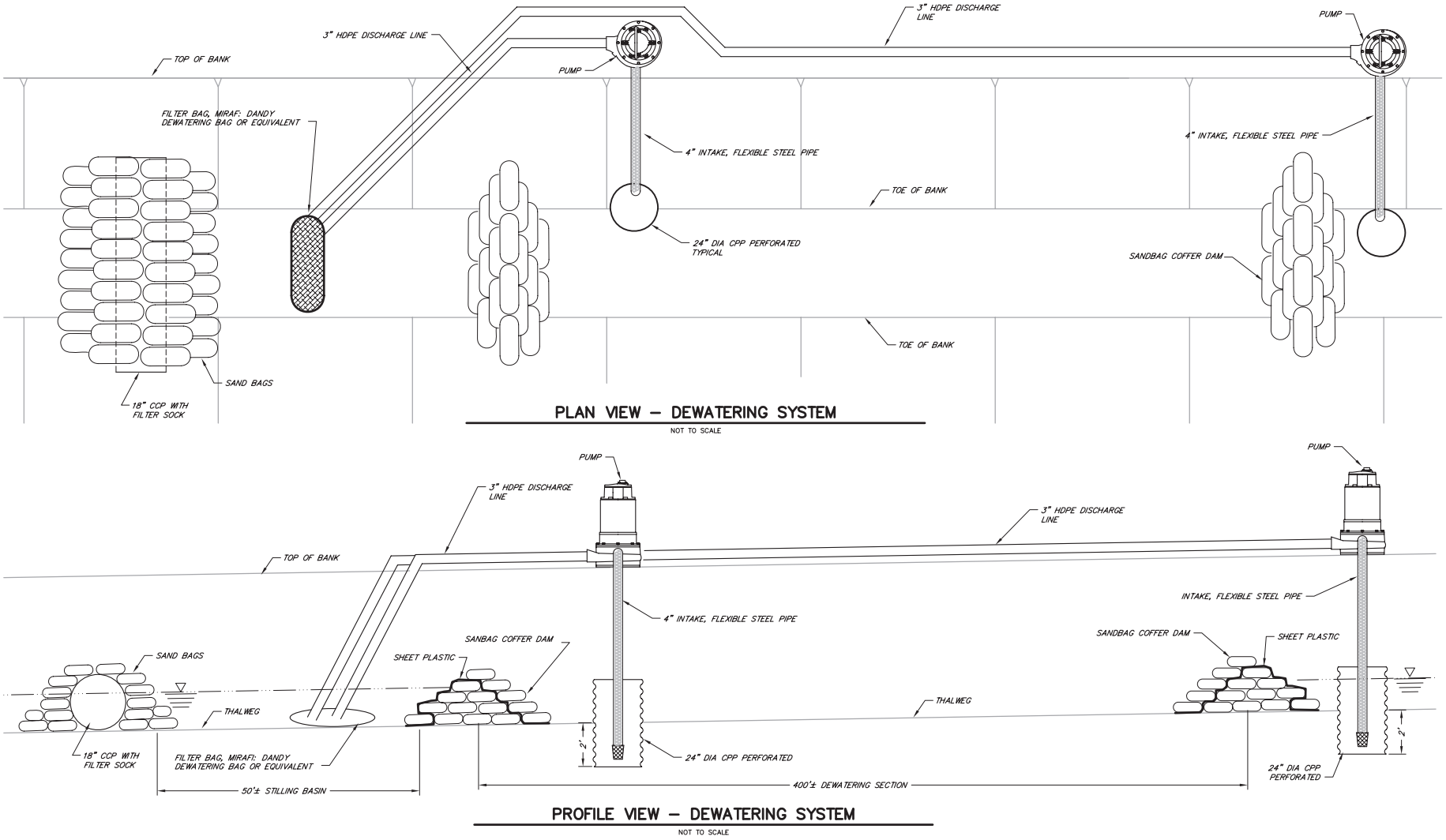
Photo c. Coleman Creek at Hillview Drive (March 2007) - chronic depositional area that is a good site for targeted sediment removal.

Meandering small main channel that has developed within the confines of an agricultural ditch in Ohio.



A two-stage ditch with a small main channel and recommended minimum width low grassed benches.

Source: Ward, A.D., and Trimble, A.S., 2004. Environmental Hydrology. Lewis Publishers, New York, pp. 475.



Source: Sonoma County Water Agency, 2007.

Photo a. Dewatering at Hinebaugh Creek sediment removal project (August 2008), intake screen and bypass hose seen in near ground, earthen berm damming flow seen just downstream of bypass hose, long-reach excavator shown in distance conducting sediment removal work from top-of-bank.

Photo b. Dewatering at Hinebaugh Creek sediment removal project (August 2008), upstream of dewatering reach shown in photo (a), intake screen, pump, and bypass hose shown in foreground.

Photo a. Bloomfield Channel (Zone 8A).

Photo b. Cotati Creek (Zone 1A).

Photo c. Colgan Creek (Zone 1A).

Photo d. Lorna Dell Creek (Zone 1A).

Photo e. Spring Lake Diversion (Zone 1A).

Photo a. Brush Creek Reservoir dam inlet structure with ponded water and some surrounding vegetation along creek above structure (Zone 1A).

Photo b. Piner Creek Reservoir dam inlet structure surrounded by water (Zone 1A).

Figure 6-9
Example of Reservoir Dam Inlet Conditions

Photo a. Cook Creek Sediment Basin (Zone 1A) before being cleared of sediment.

Photo b. Cook Creek Sediment Basin after being cleared of sediment.

Photo a. Santa Rosa Creek (Zone 1A), looking downstream. On the left side of the creek, arroyo willows were removed from between the alders, and the alders were pruned. No work has been conducted on the right side of the creek in this photo.

Photo b. Santa Rosa Creek (Zone 1A), looking downstream. Arroyo willows were removed along the right bank and the alders were pruned. No work has been conducted on the left side of the creek in this photo.

Photo c. Santa Rosa Creek (Zone 1A), looking upstream. Same reach as Photo (b), two weeks after Photo (b) was taken. Arroyo willows have been cleared from both banks and alders have been pruned.

Photo a. Corona Creek before willow removal (Zone 2A).

Photo b. Corona Creek after willow removal (Zone 2A).

Photo c. Starr Creek willows in channel before maintenance (Zone 1A).

Photo d. Starr Creek after maintenance (Zone 1A).

Photo e. Willows blocking culvert outlet on Windsor Creek before maintenance (Zone 1A).

Photo f. Willows cleared from culvert outlet on Windsor Creek after maintenance (Zone 1A).

Figure 6-12
Examples of Willow Removal

Photo a. Cutting willows with assistance from a maintenance team member.

Photo b. Cutting trees using a chainsaw.

Photo c. Pruning using a pole saw.

Photo d. Passing cut branches up the bank.

Photo e. Passing cut brush up the bank.

Photo a. Blackberry removal on Lawndale Creek (modified channel in Zone 3A).

Photo b. Blackberry removal on Ducker Creek (Zone 1A).

Photo c. After blackberry removal on Roseland Creek (Zone 1A).

Photo a. Coleman Creek, looking downstream from Snyder Lane, before cattail removal (Zone 1A).

Photo b. Coleman Creek, looking downstream from Snyder Lane, after cattail removal (compare to Photo a) (Zone 1A).

Photo c. East Washington Creek, looking downstream from Maria Drive, before cattail removal (Zone 2A).

Photo d. East Washington Creek, looking downstream from Maria Drive, after cattail removal (compare to Photo c) (Zone 2A).

Photo a. Ludwigia filling the channel. Hinebaugh Creek, looking upstream from Rohnert Park Expressway (Zone 1A).

Photo b. Ludwigia reestablishing along edge of channel after recent removal project. Laguna de Santa Rosa, looking downstream, immediately downstream of confluence with Hinebaugh Creek and approximately 200 feet downstream of Photo (a) (Zone 1A).

Photo a. Clearing cut brush with an excavator. Excavator is staged on adjacent access road.

Photo b. Clearing cut brush with a sling and excavator.

Photo c. Removing brush from creek with a sling and small tractor. Tractor remains outside of active channel.

Photo d. Chipping cut branches on adjacent paved road.

Photo a. Flail mower.

Photo b. Upper Laguna, looking downstream. Note wood stakes at top-of-bank and just up from toe-of-slope where recent planting was completed.

Photo a. Applying herbicide to gravel access road in early morning using a truck.

Photo b. Applying herbicide to gravel access road in early morning using a truck

Photo c. Hand-painting arroyo willow stumps with herbicide to discourage regrowth.

Photo a. Nathanson Creek (modified channel) before vegetation management (Zone 3A).

Photo b. Nathanson Creek (modified channel) after vegetation management (Zone 3A).

Photo a. Debris blockage in Laguna de Santa Rosa (Zone 1A).

Photo b. Removing debris from Laguna de Santa Rosa (Zone 1A).

Photo c. Graffiti on bulkhead on Copeland Creek (Zone 1A).

Photo d. Graffiti on bridge piling on Santa Rosa Creek at Willowside (Zone 1A).

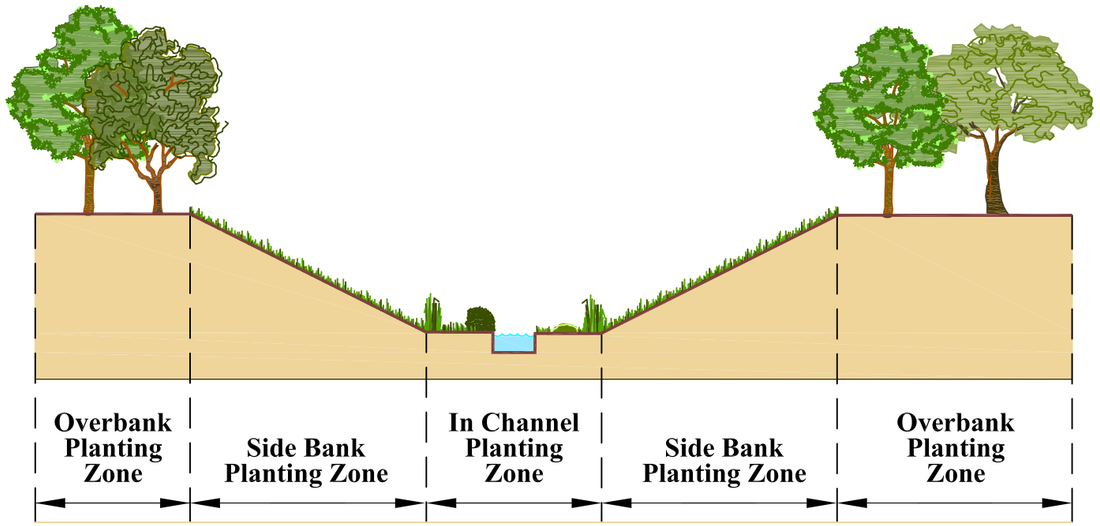
Figure 6-21
Examples of In-channel Debris Removal and Graffiti

Photo a. Coleman Creek upstream of Hillview Drive (March 2007).
No shade along channels due to lack of riparian canopy and taller bank vegetation, cattails flourish in sunny conditions without shading.

Photo b. Gossage Creek downstream of Stony Point Road (March 2007).

Figure 8-1
Examples of SMP Channels with Little Riparian Canopy or Shading

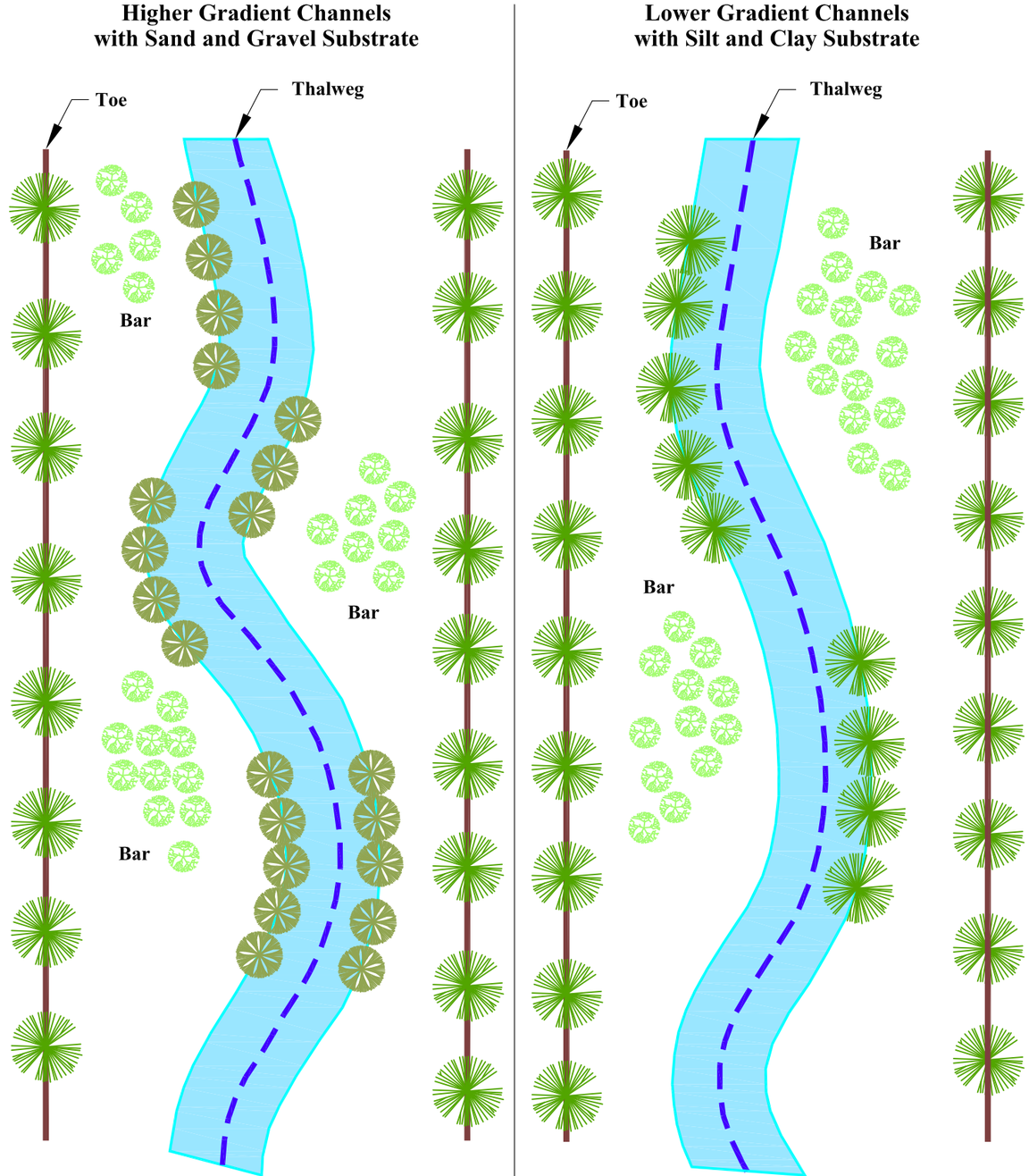
Cross Section View



Legend

- Carex barbarae (or equivalent)
- Carex nudata (or equivalent)
- Mix of Species in Table Below

In-Channel Planting Approach



Fresh Water Marsh and Transitional Habital Species for In-Channel Revegetation

Scientific Name	Common Name	Planting Location				Approximate Height	Notes:
		Bar	Edge of Thalweg	Toe	Side slope		
Agrostis exarata	spike bent	X				< 1 ft	Wetland grass, spreads via rhizomes, can form turf
Carex nudata	torrent sedge		X			1 - 3 ft	Use in higher gradient reaches to armor thalweg, sand and gravel substrate, cespitose growth habit
Carex barbarae	Santa Barbara sedge		X	X		1 - 3 ft	Use to armor tow in low gradient reaches, spreads via creeping rhizomes
Eleocharis acicularis	small spikerush	X				< 1 ft	Bar plantings, will form turf like mats
Eleocharis macrostachya	pale spikerush	X	X			1 - 1.5 ft	Bar plantings, spreads via creeping rhizomes
Eleocharis rostellata	creeping spikerush	X	X			1 - 2 ft	Bar plantings, spreads via creeping rhizomes
Equisetum arvensis	scouring rush	X	X	X	X	1 - 2 ft	Plant anywhere in channel, soil binder, spreads via creeping rhizomes
Hordeum brachyantherum	meadow barley	X		X	X	< 1 ft	Wetland transitional grass
Juncus balticus	baltic rush	X	X	X		1 - 1.5 ft	Plant anywhere in channel bottom, spreads via creeping rhizomes
Juncus phaeocephalus	brown–headed rush	X				< 1 ft	Bar plantings, spreads via creeping rhizomes
Juncus xiphioides	iris–leaved rush	X				< 1 ft	Bar plantings, spreads via creeping rhizomes
Leymus triticoides	wild blue ryegrass	X		X	X	1 - 2 ft	Wetland transitional and upland grass, spreads via creeping rhizomes, can form turf

FLOOD CONTROL\STREAM MAINT\CHANNEL MAINTENANCE PROGRAM\CONCEPTUAL PLANTING DIAGRAM.dwg JANUARY 6, 2009

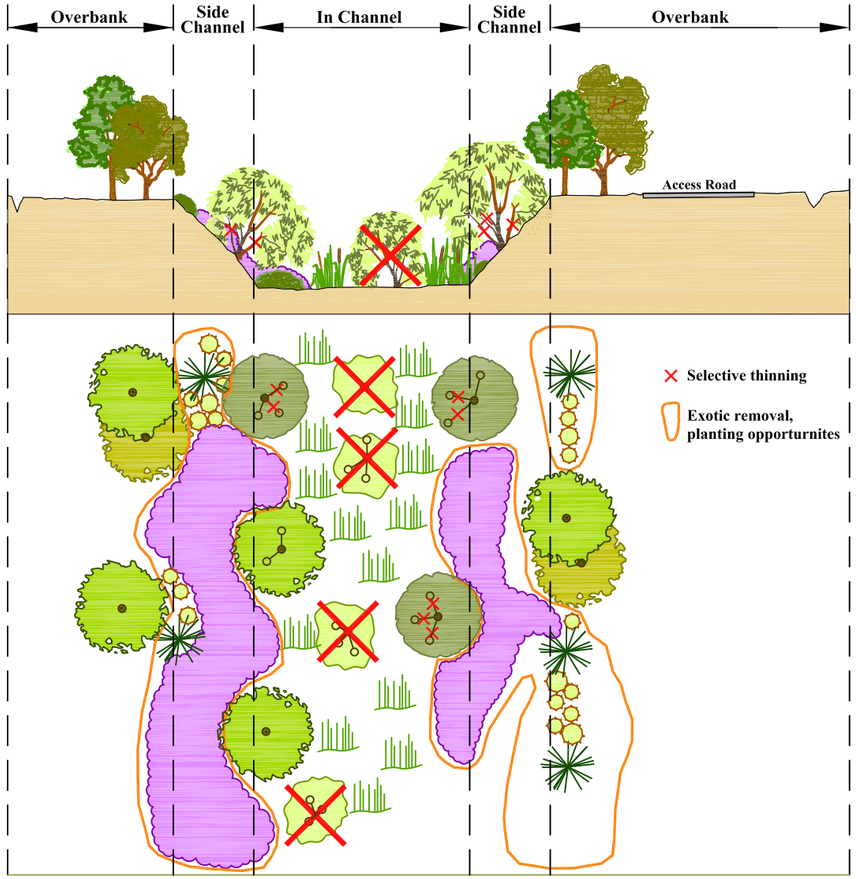
SONOMA COUNTY WATER AGENCY

Sonoma County Water Agency
Stream Maintenance Program

Conceptual In-Stream Planting Diagram

Figure 8-2

Typical Flood Control Channel Under Existing Conditions



Side Channel Dominants

Multi–trunked willow
Himalaya blackberry
Exotic shrubs
Non–native Grassland

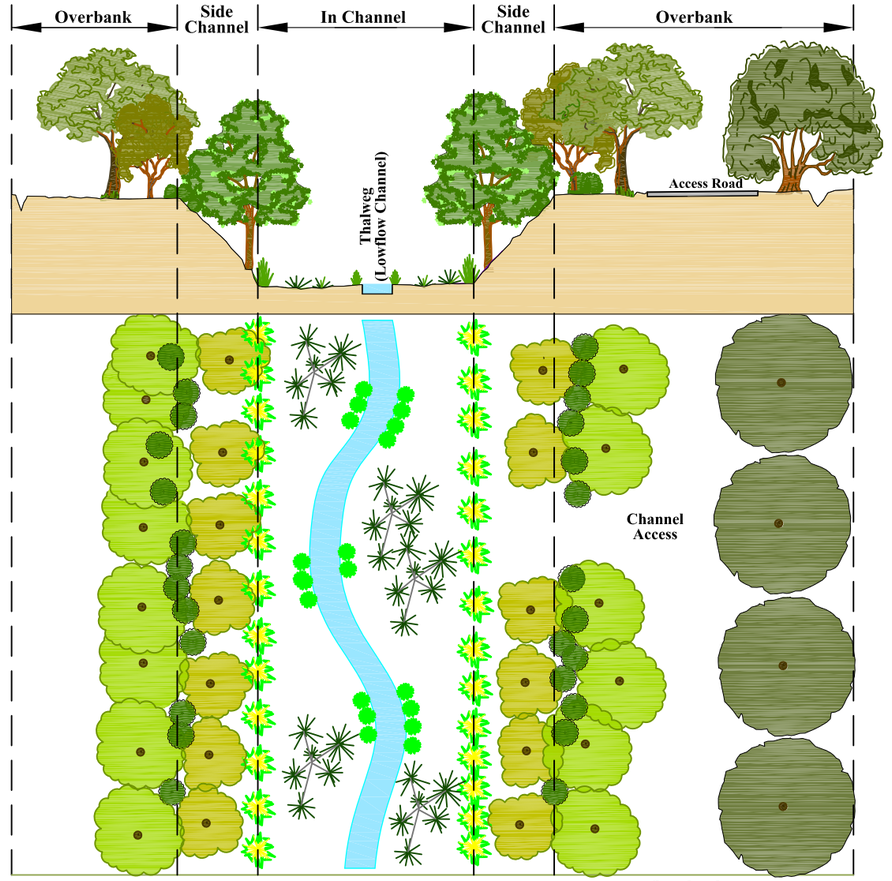
In Channel Dominants

Multi–trunked arroyo & other willow
Cattail
Cocklebar
Ludwigia
Various WIS grasses

Overbank Dominants

Exotic schrubs & trees, vines privet, plum, pyrocantha cotoneaster, Ivy, pampass grass

Enhanced SMP Channel Following Native Planting, Exotic Removal, and Canopy Development



Side Channel Dominants

Single–trunk riparian trees planted in a linear row or existing willows pruned to a single trunk

Preferred In Channel Dominants

Native Sedges and Rushes planted to help stabilize lowflow channel

Overbank Dominants

Redwoods or oaks

Stream Maintenance Program Plant Palette

Common Name	Scientific Name	Planting Area	Planting Source
Trees			
Big leaf maple	*Acer macrophyllum*	Mid to Upper Bank	Container
Box elder	*Acer negundo*	Mid to Upper Bank	Container
California buckeye	*Aesculus californica*	Upper Bank	Container
White alder	*Alnus rhombifolia*	Toe to Mid Bank	Container
Oregon ash	*Fraxinus latifolia*	Toe to Mid Bank	Container
N. California black walnut	*Juglans californica*	Mid to Upper Bank	Seed (fresh) or Container
Fremont cottonwood	*Populus fremontii fremontii*	Toe to Mid Bank	Cutting or Container
Coast live oak	*Quercus agrifolia*	Upper Bank	Container
Valley oak	*Quercus lobata*	Upper Bank	Container
Sandbar willow ***	*Salix exigua*	Toe	Container
Red willow	*Salix laevigata*	Toe to Mid Bank	Sprigs
Arroyo willow ***	*Salix lasiolepis*	Toe to Mid Bank	Cutting
Shining willow	*Salix lucida lasiandra*	Toe to Mid Bank	Cutting
Coast redwood	*Sequoia sempervirens*	Mid to Upper Bank	Container
California bay laurel	*Umbellularia californica*	Upper Bank	Container
Vines			
Clematis	*Clematis lasiantha, C. ligusticifolia*	Toe to Mid Bank	Seed or Container
Honeysuckle	*Lonciera hispidula vacillans*	Toe to Mid Bank	Seed or Container
California blackberry	*Rubus ursinus*	Toe to Mid Bank	Seed or Container

Common Name	Scientific Name	Planting Area	Planting Source
Herbs/Grasses			
Spike bent	*Agrostis exharta*	Toe to Mid Bank	Seed
Sloughgrass	*Beckmannia syzgachne*	Toe to Mid Bank	Seed
Santa Barbara sedge**	*Carex barbarae, C. obnupta, C. bolanderi*	Toe	Seed or Cutting
Dense sedge	*Carex densa*	Toe	Seed or Cutting
Torrent sedge	*Carex nudata*	Toe	Seed or Cutting
Pale spikerush	*Eleocharis macrostachya*	Toe	Seed or Cutting
Blue wild rye	*Elymus glaucus*	Mid to Upper Bank	Seed
California fescue	*Festuca californica*	Mid to Upper Bank	Seed or Container
Red fescue	*Festuca rubra*	Toe	Seed
Meadow barley	*Hordeum brachyantherum*	Toe to Mid Bank	Seed or Container
Wire rush	*Juncus balticus*	Toe	Cutting or Container
Pacific rush	*Juncus effusus*	Toe	Cutting or Container
Common rush	*Juncus patens*	Toe	Cutting or Container
Brown–headed rush	*Juncus phaeocephalus*	Toe	Seed, Cutting, or Container
Iris leaved rush	*Juncus xiphioides*	Toe to Mid Bank	Seed, Cutting, or Container
Creeping wild rye	*Leymus triticoides*	Toe	Seed
Knot grass	*Paspalum distichum*	Toe to Mid Bank	Seed or Container
Bulrush, Tule	*Scirpus acutus occidentalis, S. californicus*	Toe to Mid Bank	Cutting or Container
Small fruited bulrush	*Scirpus microcarpus*	Toe to Mid Bank	Cutting or Container

Common Name	Scientific Name	Planting Area	Planting Source
Schrubs			
Marsh baccharis	*Baccharis douglasii*	Toe to Mid Bank	Container
Mulefat	*Baccharis salicifolia*	Toe to Mid Bank	Container
Western spicebush	*Calycanthus occidentalis*	Toe to Upper Bank	Seed
Stream dogwood	*Cornus sericea*	Toe to Mid Bank	Container
California hazelnut	*Corylus cornuta californica*	Mid to Upper Bank	Container
Toyon	*Heteromeles arbutifolia*	Upper Bank	Container
Coffeeberry	*Rhamnus californica*	Upper Bank	Container
California wild rose	*Rosa californica*	Toe to Upper Bank	Seed or Container
Blue elderberry	*Sambucus mexicana*	Upper Bank	Container
Snowberry	*Symphoricarpos albus laevigatus*	Mid to Upper Bank	Container
Ferns/Other			
Horsetail	*Equisetum arvense, E. hyemale affinae, E. telmatieia braunii*	Toe	Cutting or Container
Sword fern	*Polystichum californicum*	Toe	Container
Western chain fern*	*Woodwardia fimbriata*	Toe	Container

* In forested locations.

** Or equivelent.

*** Not preferred but can be used on case by case basis.

Notes

1. Species for each project should be chosen based on native flora (current and historic) of project area.
2. Seeds, cuttings, seedlings and saplings used for revegetation should be obtained from local (Russian River Watershed or North Coast Floristic Province as defined in Jepson 1993) stock (local native plant nurseries should be used, or plants can be collected using appropriate collection techniques from adjacent sites – willow sprigs should be collected from adjacent sites and planted on the same day as collection).
3. Timing of planting should be appropriate for species and source (e.g. broadcast seeding of herbs and grasses in fall before first rains, cuttings planted when soil moist to at least 10 inches from rainfall, etc.).

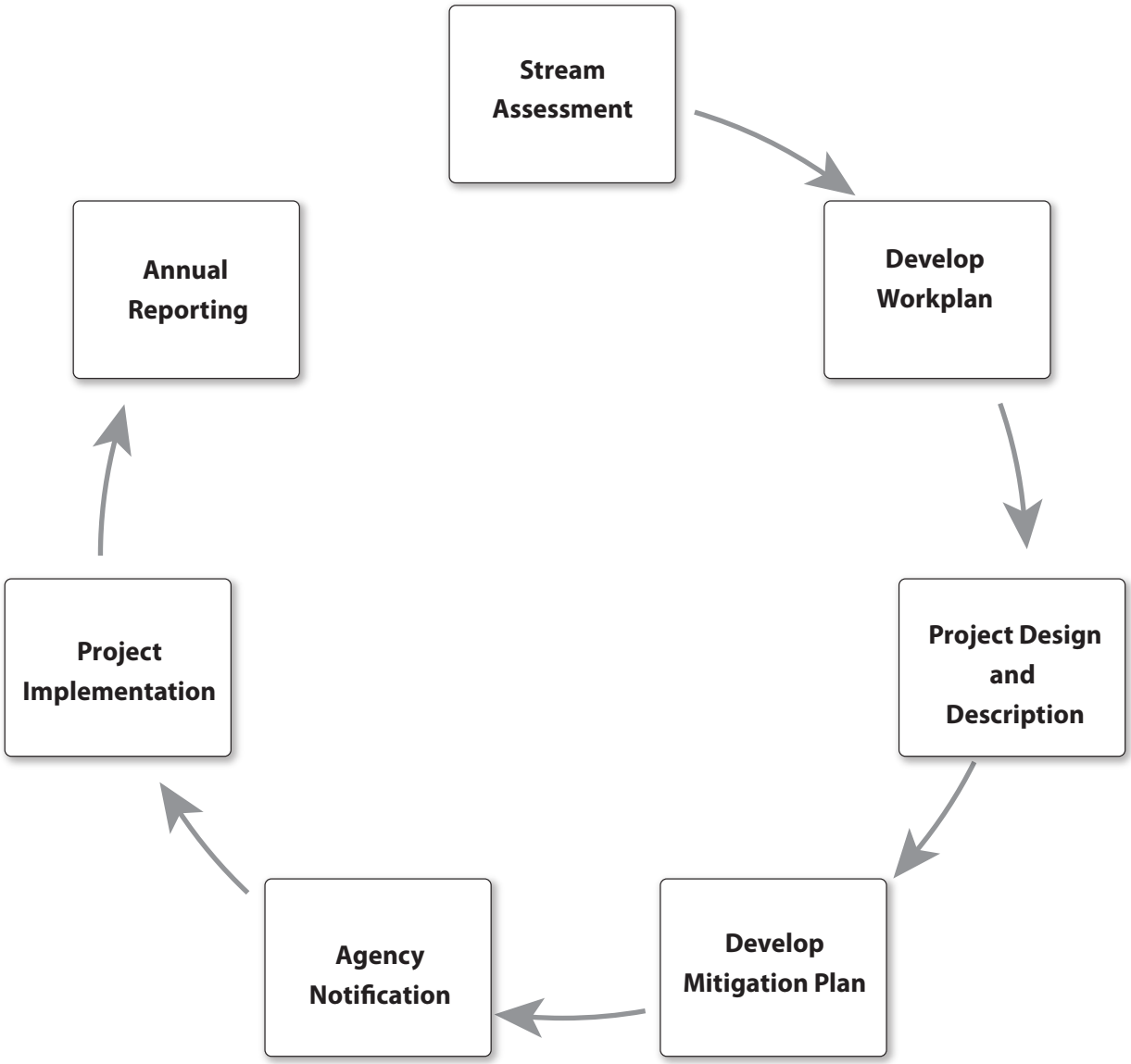
SONOMA COUNTY WATER AGENCY

Sonoma County Water Agency
Stream Maintenance Program
Conceptual Planting Diagram

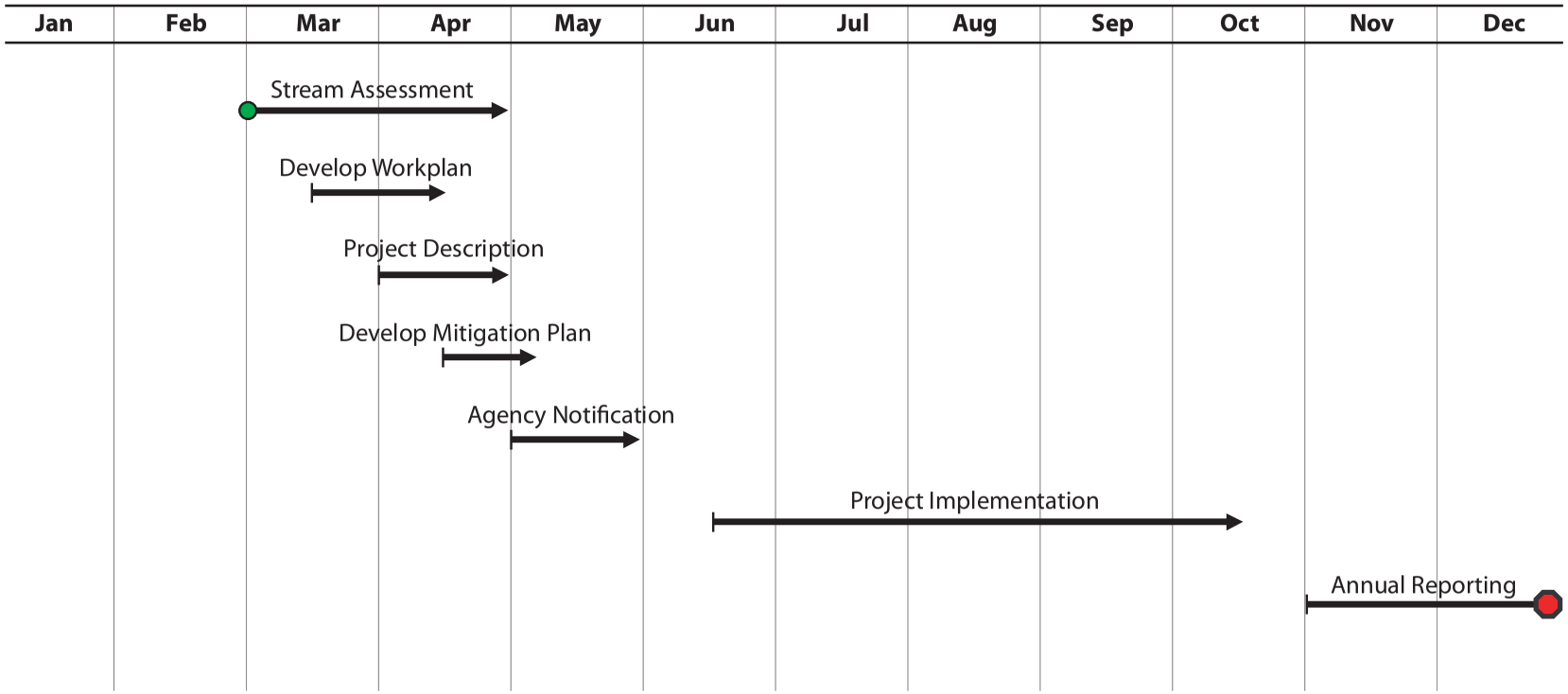
Figure 8-3

FLOOD CONTROL\STREAM MAINT\CHANNEL MAINTENANCE PROGRAM\CONCEPTUAL PLANTING DIAGRAM.dwg APRIL 28, 2008

SMP Work Cycle



SMP Work Cycle Calendar for Routine Projects



Creek Assessment Evaluation Form

Date: 5/9/2007 Town/Community Santa Rosa Zone 1A

Creek Name Russell Creek *Required field entry Maintenance Assesment Personal Add Employee

Creek Bank Side Traverse: SMP Reach Channel Type:

Cattails Present ☑ Maintenance Priority: 3
Cattail Density Low High / Med Hi / Med Low / Low
Approx. Days Maint. 1

Blackberries Present ☑ Bank / Channel: Bank & Chann
Blackberry Density: Med Hi Maintenance Priority: 2
Approx. Days of Maint. 2

Willows Present ☑ Bank / Channel: Bank & Chann
Willow Density: Med Low High / Med Hi / Med Low / Low Wilow Priority 3
Willow Type: Arroyo
Approx. Days Maint. 1

Exotics Misc. ☑ High / Med Hi / Med Low / Low
Exotic Misc. Density: Med Low Exotic-Misc. Priori 2
Exotic Comment Ludwig's
Approx. Days Maint. 0

Re-vegetation Priority 4 Sediment Removal ☐ Sediment Priority 4 Volume:

Bank Repair ☐ Maintenance Priority: 4 Channel Side:

Details:

N-Value 0.051 - 0.07 0.035 - 0.05 / 0.051 - 0.07 / 0.071 - 0.09 / > 0.09 Specific N-Value

Road Condition: Good Poor / Good / Excellent Road Type: Dirt Public Trail/ Access ☐

Maintenance Priority: 4 V-Ditch Priority 3 1 / 2 / 3 / 4 Winter Pruning Priority/Exotic Removal

Maintenance Recommendation

Comment Monitor ludwigia

Add Maintenance

SMP Workplan
Project Description Template

Name of Project:	
Type of project:	❑ Sediment removal ❑ Bank stabilization
Project city:	
Project location (address and/or location description):	
APN:	
Directions to project site:	
USGS map:	
Section, township, range:	
Latitude and longitude:	
Stream name:	
Tributary to:	
Description of activity (treatment and/or design; indicate if approach varies for this activity from that described in the SMP Manual):	

continued…

Reason for using treatment and/or design:	
Stream feet disturbed by activity:	
Total acres of project:	
Acres of waters of the United States:	
Acres of waters of the State:	
Quantity of sediment to be removed (if applicable):	
Quantity and type of fill to be placed (if applicable):	
Fill below OHWM (if applicable):	
Activity-specific BMPs that will be used for avoidance and minimization of impacts:	
Project cost:	
Attachments:	❑ Project site map ❑ Updated reach sheet ❑ Design details of proposed activity (cross-section and plan view as appropriate) ❑ Existing condition cross-section ❑ As-built cross-section ❑ Sediment disposal site information, as necessary