4 Supplemental Information on Recommended Actions

The information presented in this chapter is designed to supplement the recommendations within Chapter 2. This supplemental information is provided within the following sections and is organized in the same manner as Chapter 2, with the exception that Section 4.1 does not have a corresponding section in Chapter 2 as discussed in its introductory paragraph. Reference to the appropriate Chapter 2 recommendations (subsection and page number) are made for each set of information provided to help the reader understand how this supplemental information relates to the overall recommendations.

4.1 Public Outreach and Education

Within Chapter 2, several of the recommendations (Sections 2.2.2, 2.4.3, 2.5.1, and 2.6.4) include public outreach and education components. The following section discusses some basic guidelines that should be followed when developing these programs and materials.

Successful watershed management and improvement projects depend in part on focused public outreach and education that informs the public of the issue, its relationship to them, and how they can help. As such, many of the recommendations of this assessment include public outreach and education efforts. To avoid being redundant, an overview of key aspects of these efforts is included here, while the individual topics are discussed within the appropriate recommendation sections.

Getting the message out to target audiences can be a challenging task no matter what the topic is. Without appropriate research, planning, implementation, and evaluation even a well written and graphically clear information can miss its mark and potentially frustrate activists and supporters. Following a few simple rules and guidelines will help ensure the education and outreach topics described in the recommendations reach their target audience and accomplish the intended goal.

Research is a critical first step to a successful education or outreach campaign. Understanding the target audience is extremely important, whether it's an organization, a specific age group, or residents of a particular neighborhood. What issues are important to them? Where do they get their information? What media forms are most effective? Researching and understanding these topics before developing campaign materials will help focus the outreach efforts.

Planning various aspects of the campaign is also very important. What is the goal of the campaign? Is it to raise awareness? Or is it to change the target audience's attitude about some issue? Each of these goals will require a slightly different approach and may use different types of media to disseminate the message. Every campaign needs to have a clear goal and target audience to be successful.

Once the research and planning is done, the campaign is ready for implementation. This includes the development of appropriate materials for distribution: fliers, brochures, press releases, articles, etc. Once the materials are developed the message needs to be disseminated via the channels identified during your research as being the most effective for the targeted audience.

The final step in every campaign, and the one most often overlooked, is the evaluation of success. Without an evaluation of the campaign it is impossible to determine whether or not the desired goal was attained. Evaluation should include answers to questions such as: was one media form better received than another, and which dissemination routes were most effective? It is important during the planning phases of the campaign to determine how this evaluation is going to occur. Is some form of pre or post survey going to be used, or is some other form of evaluation appropriate?

Beyond these four basic steps, two other relevant guidelines have been published for developing effective public relations materials. First, a set of six criteria are often used by news desks to determine the news value of a particular issue. Second, the seven 'Cs' of Communication should be used to evaluate all messages.

Criteria of News Value

Impact – number of people affected, seriousness of consequences, directness of cause and effect, and immediacy of the effect.
Proximity – distance between the audience and the problem or issue of concern.
Timeliness – perishability of the information.
Prominence – extent to which problem or issue in recognizable and well known.
Novelty – unusual, bizarre, deviant, and offbeat.
Conflict – strikes, fights, disputes, wars, crime, politics, and sports.

Seven 'Cs' of Communication

Credibility – receivers must have confidence in the sender and high regard for the source's competence.
Context – communication messages must square with the realities of their environment.
Content – messages must have meaning and relevance to receivers, as well as be compatible with their value systems.
Clarity – messages must be in simple terms that mean the same to receivers as to the sender.
Continuity/Consistency – messages must be repeated and consistent.
Channels – selective channels that receivers use and respect are most likely to reach target audiences.
Capability of the audience – messages are effective when senders take into account the receivers' availability, ability, and prior knowledge.

4.2 Proactive Conservation

As discussed in Section 2.1 page 2-2 Proactive Conservation is at the heart of the recommendations within this Assessment. The use of a conservation bank (Light green outlined area in Figure 4-1) instead of a more traditional mitigation bank is discussed below.

Conventional Mitigation

Despite their purpose -- to offset environmental impacts -- mandated mitigation measures often have had insufficient net beneficial impact. Often they are undertaken at the same site as the development or project being mitigated for, result in piecemeal patches of conservation, require complex in-kind compensation (such as replacing wetlands with similar wetlands elsewhere), and/or do not address the broader conservation objectives of the project's region. While such a set-aside might satisfy the legal requirements, it may not substantially advance regional environmental objectives.

Though some mitigation banks began as early as the mid-1970s, it has been largely since the mid-1980s that the State and others have actively sought to prevent the inadequate, fragmented habitat conservation that too often results from project-specific mitigation such as currently carried out by numerous public and private entities including the City of San Diego.

While some City departments are currently considering creation of mitigation "banks" for their particular departmental purposes, this approach is still piece-meal, department by department; again without consideration of the overall conservation needs of the watershed. While this approach is a step above current practices; as a stand-alone effort, it is still conventional in as such it will not achieve a broader conservation objective of restoring and protecting our watersheds.

The Rose Creek Watershed includes a number of examples of previous piecemeal mitigation projects (Figure 3-11), most of which have been poorly maintained and sadly, some of which have been re-infested by invasive species, ameliorating the purpose for which they were created.

Conservation Banking is Proactive

As a habitat type, wetlands historically have not fared well under conventional mitigation policies. The type of project-by-project mitigation encouraged by current policies often results in smaller, fragmented wetlands rather than the larger, self-sustaining wetland ecosystems that will support fish and wildlife for the long-term. Initial banking efforts for wetlands have led often to costly and unsustainable mitigation banks because such efforts are often focused narrowly on a single species and do not recognize the importance of other species and potential impacts on associated species.

Figure 4-1: Proposed Rose Creek Conservation Bank

A conservation bank is like a biological bank account; instead of money, the bank owner has habitat or species credit to sell. Conservation banks are designed to address the protection of habitat types and dependent species at the same time. In addition, under conservation banking, mitigation credits may be allocated for the acquisition of land as well as its restoration. For example, with a conservation bank in the RCW, the City could gain credits for acquiring lands that will also help facilitate the regional trail system.

Conservation banking facilitates the development of anticipatory regional conservation strategies such as San Diego's Multiple Species Conservation Program (MSCP) or the watershed-wide improvements recommended in this Assessment. This allowance can effectively increase the value of the conservation bank lands (and associated credits) as they support and enhance other regional strategies.

The land in a proposed conservation bank must possess habitat value that is determined by an authorized wildlife agency (for instance, Department of Fish and Game or the U.S. Fish and Wildlife Service) to have substantial regional habitat value, be in need of protection and/or restoration, and be worthy of permanent protection. Rules are established as to what habitats can be mitigated at the bank, as well as the extent of the service area of the bank.

Terms for purchase of credits in conservation banks are determined by the regional market for mitigation. The price of each credit and financial arrangement surrounding the purchase of credits are determined strictly between the bank owner and credit purchaser. The number of credits likely to be purchased depends upon the level of development activity in the region, the uniqueness of the biological resources in the bank, and the amount of competition from other banks in the area. As over 97% our coastal wetlands have been destroyed and development pressures along the coast are most intensive, habitat created or restored in the RCW should be expected to be of the highest value. Conservation banks can also be designed to incorporate public uses compatible with protection of the natural resources like passive recreational (walking, cycling) and bird watching.

4.3 Biological Resources

4.3.1 Invasive Exotic Species Management Zones

The Invasive Exotic Species Management Zones presented in Section 2.2.2 page 2-8 and Figures 2-3 to 2-5 are shown in Figure 4-2 and described here in more detail to help the reader understand how the zones interrelate with each other and why each was formed.

Zone 1: Zone 1 areas include all of the residential and commercial properties not directly draining to one of the tributary drainages. These areas are targeted first for outreach as this activity does not require any permits and focuses on addressing the long-term solution for invasive plant species, which is source control and replacement. Outreach materials were described in Section 2.2.2.

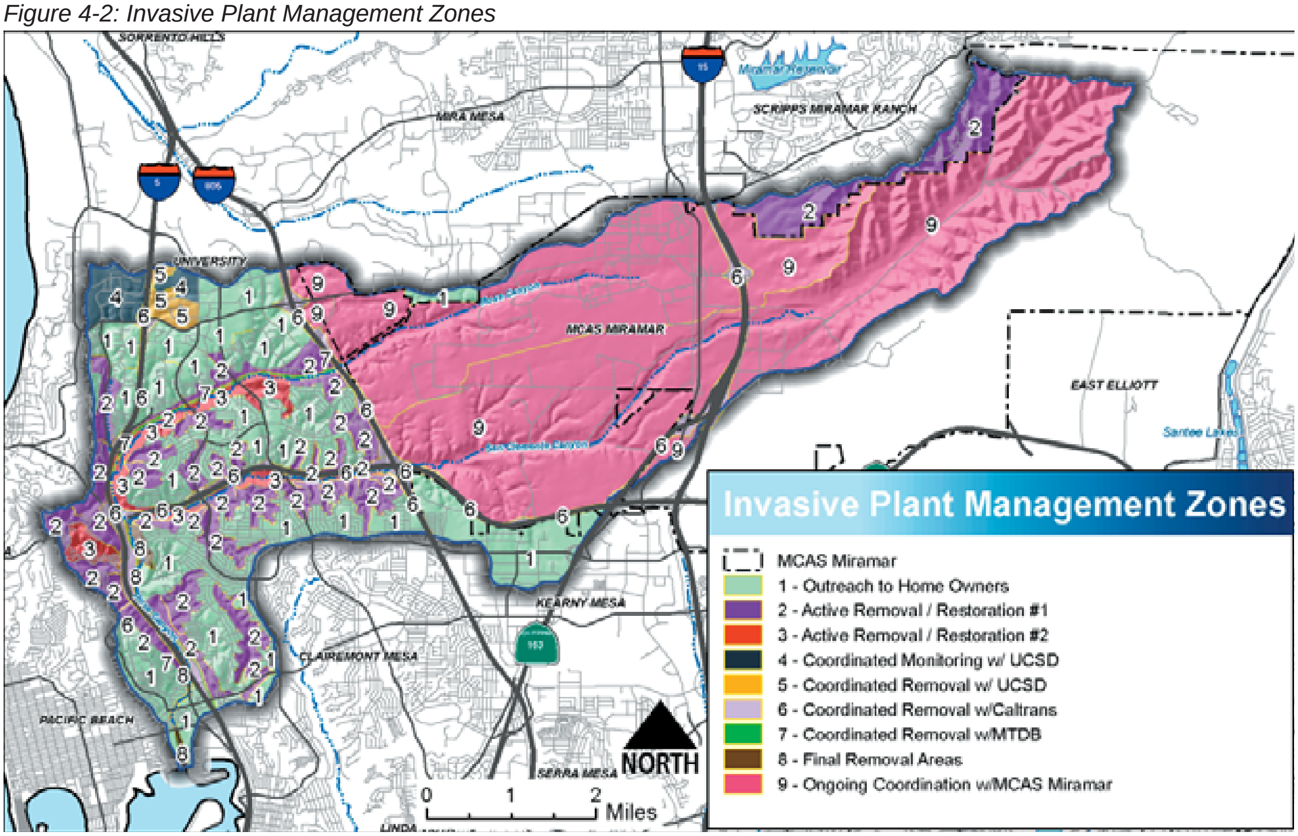
Zone 2: Zone 2 areas include all of the tributary drainages and any residential or commercial properties immediately adjacent to them. These areas should be the targeted first for active removal and restoration efforts as they are the primary sources of seeds and rhizomes to downstream areas. These areas should also be targeted for outreach efforts at the same time as the Zone 1 areas.

Zone 3: Zone 3 areas include all of the main canyon bottoms through Rose and San Clemente Canyon, as well as one other major tributary. These areas should not be targeted for active removal and restoration until all of the Zone 2 areas that drain into it have been completed. Most of the land areas within this Zone currently have limited infestations of many priority invasive species due to previous volunteer removal efforts.

Zone 4: Zone 4 areas are the developed portions of UCSD where monitoring and removal needs to be coordinated with UCSD maintenance staff for source control. These efforts can start with the Zone 1 areas or any time there after.

Zone 5: Zone 5 areas include the undeveloped portions of UCSD, many of which are currently infested with invasive species, such as giant reed, iceplant, and pampas grass. These areas can be targeted at the same time as the Zone 2 areas. Eradication and control efforts need to be coordinated with UCSD personnel.

Figure 4-2: Invasive Plant Management Zones



Zone 6: Zone 6 areas include all of the Caltrans right-of-ways along Interstate 5, Interstate 805, Interstate 15, and State Route 52. These areas can be targeted for coordinated monitoring and removal at the same time as the Zone 2 areas. It should be noted that Caltrans has already been undertaking removal efforts for pampas grass along Interstate 805.

Zone 7: Zone 7 areas include all of the MTS railroad rights-of-way. These areas can be targeted for coordinated monitoring and removal with the Zone 2 areas. Along with the Zone 2 areas, these areas are primary sources of seeds and rhizomes to downstream areas. Railroad maintenance crews do spray some of the exotics, such as pampas grass, but only within a specific distance of the tracks and not within their full rights-of-way.

Zone 8: Zone 8 areas include those portions of Rose Creek below the confluence with San Clemente Creek. These areas should only be targeted for removal and restoration once initial removal and restoration efforts have occurred in all of the Zone 2 - 7 areas. The purpose of this sequencing is to help minimize the opportunity for re-infestation, thereby maximizing the environmental benefit associated with every dollar spent of invasive plant removal and restoration. Again, as described within Section 2.2.2, situations can occur where volunteer efforts want to target management zones that are still being influenced by upstream sources to help maintain public visibility and interest. However, it is unrealistic to expect to be able to maintain these downstream management areas free of invasive exotic plant species if the upstream management areas have not first been completed.

Zone 9: Zone 9 areas include all of MCAS Miramar as they have been actively monitoring, removing, and restoring invasive plant infestations for several years. Ongoing coordinated monitoring is all that should be needed into the future as long as they continue their existing program.

4.3.2 Potential Wetland Restoration Sites

The Wetland Restoration/Creation recommendation presented in Section 2.2.3 page 2-13 and Figures 2-6 to 2-8 identified twenty sites. Each of these sites are shown in Figure 4-3 and described here in more detail to help the reader understand where the site is and what characteristics make it appropriate for restoration. In implementing proposed restoration sites, any potential impacts to pre-existing public facilities, such as sewer lines,

Figure 4-3: Wetland Restoration Opportunities

should be considered. This is not an exhaustive list of potential sites; new sites are expected to be considered as the watershed is subject to more detailed analysis.

Site 1: This is a low bench on the south side of Rose Creek across from the Lucera condominiums. The area could be graded down to provide better floodplain connectivity. There is a storm drain outfall near the toe of the slope that could be directed into the wetland area for preliminary treatment before discharging to Rose Creek.

Site 2: This is a low bench on the south side of Rose Creek below University High School. The area could be graded down to provide better floodplain connectivity.

Site 3: This low bench was historically more of a dynamic part of the floodplain along Rose Creek, but streambed degradation has disconnected it from flood flows except during larger storm events. The large storms in February 2005 barely topped the stream banks within this area. The site is located on the south side of Rose Creek and north of the Rose Canyon Sewer Trunk line about one-half mile west of Genesee Ave. The site is currently being designed for fall 2005 installation by the City of San Diego Metropolitan Waste Water Department (MWWD) as mitigation for wetland impacts associated with maintenance activities of their sewer lines. Full restoration of this site is limited by the sewer trunk line that dissects the site and prevents about one quarter of the site from being restored.

Site 4: This is an existing low-lying area formed by the main trail through the Rose Canyon Open Space Park (historic railroad bed). This area ponds with water after storm events and could be enhanced by providing for vegetation diversity, as the existing wetland species are very limited. Restoration of this site would be impacted by the construction of the Regent Road bridge that is being considered. As storm runoff along the main trail is diverted to correct current erosion issues, flows into this area will be reduced. Based on the extents of existing wetland species within this site, it appears that storm runoff from the main trail is a more recent introduction to the site. This site could be connected as a storm water detention area for the tributary that drains along the trail from Regents Road to the south.

Site 5: This low bench was historically more of a dynamic part of the floodplain along Rose Creek, but streambed degradation has disconnected it from flood flows except during larger storm events. The large storms in February 2005 barely topped the stream banks within this area. The site is located on the south side of Rose Creek and north of the Rose Canyon Sewer Trunk line about three-quarters of a mile west of Genesee Ave. The site is currently being designed for fall 2005 installation by the City of San Diego Metropolitan Waste Water Department (MWWD) as mitigation for wetland impacts associated with maintenance activities of their sewer lines. Full restoration of this site is limited by the sewer trunk line that dissects the site and prevents nearly one-half of the site from being restored.

Site 6: This low bench was historically more of a dynamic part of the floodplain along Rose Creek, but streambed degradation, the historic railroad alignment, and the Rose Canyon Trunk Sewer have all contributed to its disconnection from flood flows. The site is jest west of the Rose Creek Bridge along the historic railroad alignment and could be re-graded to provide some floodplain function today. Rose Creek is now at least six feet below this elevation.

Site 7: This is a low bench to the northwest of the confluence of the tributary draining Gilman Canyon and Rose Creek. The area may have been part of Rose Creek's historic floodplain and could be re-graded to provide some floodplain function today. Rose Creek is now at least six feet below this elevation.

Site 8: This is a low bench to the southeast of the confluence of the tributary draining Marcy and Governor Canyons and Rose Creek. The area appears to have been part of Rose Creek's historic floodplain and could be re-graded to provide some storm water detention for the tributary and floodplain function for Rose Creek. Rose Creek is now at least six feet below this elevation and the tributary is incised from four to eight feet. An SDG&E powerline runs through the site and access to the power poles would need to be maintained or the powerline re-routed.

Site 9: This is a low bench to the southwest of the confluence of the tributary draining Gilman Canyon and Rose Creek. The area currently functions as part of the floodplain for the tributary and shows signs of erosive flows cutting a secondary channel. The site could be re-graded to slow velocities and provide more floodplain functionality for the tributary and Rose Creek. There is a natural gas pipeline running through the site that needs to either be protected or re-routed. The pipeline has had loose rock placed over to reduce erosion that threatens to expose and damage it.

Site 10: This is a depressed area along the Rose Canyon Bike Path that drains portions of Interstate 5. The area currently ponds after storms due to sediment accumulation that has been deposited from another storm drain. The site is also infested with Pampas Grass, Iceplant, and Eucalyptus. The invasive exotic plant species could be removed and the site re-graded to promote the establishment of additional wetland species. Treatment of the storm water runoff from Interstate 5 should be a key aspect of the enhancements.

Site 11: This is a low bench that was historically part of the floodplain near the confluence of Rose and San Clemente Creeks, which was completely altered by the construction of State Route 52. By relocating the existing trail and SDG&E access road to the east along the toe of the slope, this area could be re-graded to provide some floodplain function today. Rose Creek is now at least six feet below this elevation.

Site 12: This is a low bench along both the north and south sides of San Clemente Creek about a quarter mile west of Genesee Ave. The area could be graded down to provide better floodplain connectivity. A sewer trunk line runs along the creek here and may constrain restoration activities.

Site 13: This is a low bench along both the north and south sides of San Clemente Creek about a quarter mile west of Genesee Ave. The area could be graded down to provide better floodplain connectivity. A sewer trunk line runs along the creek here and may constrain restoration activities.

Site 14: This is an elevated bench on the north side of San Clemente Creek to the east of the Standley Trail. The area could be graded down to provide additional riparian habitat.

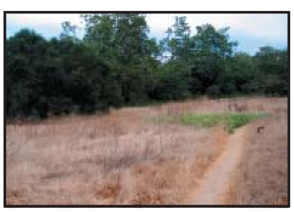
Site 15: This is an elevated bench on the south side of San Clemente Creek across from and to the south of the Standley Trail. This area appears to have been part of the historic floodplain for San Clemente Creek, but is currently disconnected due to streambed degradation. The area could be graded down to provide floodplain connectivity. The sewer trunk line prevents a larger area from being restored.

Site 16: This is an elevated bench on the south side of San Clemente Creek to the east of the Regents Road East parking lot. This area appears to have been part of the historic floodplain for San Clemente Creek, but is currently disconnected due to significant streambed degradation. The area could be graded down to provide floodplain connectivity. The restoration would displace a single-track trail that runs along the edge of the riparian vegetation. The loss of this trail would have insignificant impacts to the trail system within Marian Bear Memorial Natural Park. MWWD is planning for mitigation at this site in the fall of 2006.

Site 17: This is a gently sloping area vegetated with non-native grassland along the south side of the Regents Road East parking lot. The area could be re-graded to provide storm water detention and treatment of flows coming from two tributary canyons to the south. The wetland would drain to the west and connect via an enlarged vegetated detention basin to the drainage from Lakehurst Canyon.

Site 18: This is a low bench on the north side of San Clemente Creek less than a quarter mile west of the Regents Road West parking lot. The area could be graded down to provide floodplain connectivity. MWWD is planning for mitigation at this site in the fall of 2006.

Site 19: This is a low bench on the north side of San Clemente Creek just over a quarter mile west of the Regents Road West parking lot. The area could be graded down to provide floodplain connectivity.



Site 20: This is a low bench on the south side of San Clemente Creek just over a quarter mile west of the Regents Road West parking lot. The area could be graded down to provide floodplain connectivity. Access to site may be difficult and require temporary impacts to riparian habitat along San Clemente Creek.

Site 21: This is a low lying area along a tributary of Rose Creek below University Gardens Park that is infested with Pampas Grass. The Pampas Grass should be removed and the area could be re-graded to expand wetland habitat.

4.2.3 Enhancements for individual species

In addition to the general recommendations made in Section 2.2.6 page 2-25 regarding the management and enhancement of native plants and animals, some species-specific recommendations are included below:

1. Both the Western Spadefoot and Two-striped Gartersnake regularly use vernal pools. Within the watershed, the location of vernal pools outside MCAS Miramar needs to be established. A few vernal pools are known to exist near Nobel Drive and are already protected or within public ownership. These pools, as well as any others that are found, should have management and en-

hancement plans developed for them to ensure they do not become degraded.


2. Not draining a large watershed, Rose and San Clemente creeks offer only marginal habitat for the more restrictedly riparian birds, primarily the Yellow Warbler, Yellow-breasted Chat and Least Bell's Vireo. The general coverage of the area for the bird atlas revealed no Bell's Vireos or Yellow Warblers and Yellow-breasted Chats in only small numbers. A survey more focused on riparian birds is needed to say just where these species are and whether the sites are under any localized threat. If sites used consistently by riparian birds are identified, then the question of removal and management of threats can be addressed. The evolution of the creeks from ephemeral to perennial may support vegetative habitat usable by the Least Bell's Vireo, which would not have historically occurred within the watershed.

3. There may be some possibility for establishment of the endangered light-footed Clapper Rail along lower Rose Creek if stands of marsh vegetation (cattail, tule, or cordgrass) can be established. The species traditionally was restricted to tidal salt marshes with cordgrass but mainly within the last 20 years has colonized some freshwater sites near the coast, such as in the Sweetwater River channel in National City. Clapper Rails are known to exist within the Kendall Frost marsh to the west of the mouth of Rose Creek in Mission Bay. As plans move forward to establish a marsh at the mouth of Rose Creek that would connect the Kendall Frost marsh and the lower portions of Rose Creek, habitat enhancements for the light-footed Clapper Rail will become more important. Getting a head start on the modification of the stream channel environment and the establishment of appropriate habitat would only accelerate the potential colonization by the Rail.

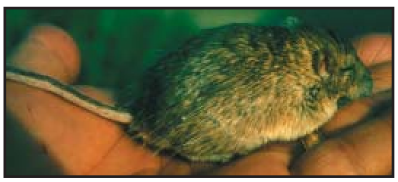

4. An unusual feature of the Rose Creek watershed is the groves of coast live oak trees in the canyon bottoms and on north-facing slopes. These support outlying but small populations of the Acorn Woodpecker and Hutton's Vireo, an interesting biological feature. Both species are common a short distance farther inland, but their maintenance in the Rose Creek Watershed maintains an element of biological diversity lacking in most of San Diego's other coastal canyons. Efforts to protect, maintain, and enhance these habitats should be considered.


5. The native vegetation of the south-facing slopes of the canyons within the watershed is a mosaic of sage scrub and grassland. Maintenance or restoration of these types of native vegetation on south-facing slopes would have a more substantial positive effect on native birds than the north-facing slopes. The California Gnatcatcher still occurs in this sage scrub, apparently in small numbers west of Interstate 805, but their distribution west of the Interstate 805 is poorly known. Surveys to determine the current population of California Gnatcatchers are recommended and restoration efforts incorporating Coastal sage scrub and native grasslands should occur where appropriate.

6. Maintenance of dispersal routes across roads and freeways are important for some birds. In particular, the numbers of the California Quail and Rufous-crowned Sparrow west of Interstate 805 appear to be very low.

Both of these species are sensitive to habitat fragmentation and isolation. The Rufous-crowned Sparrow prefers south-facing slopes and avoids north-facing slopes densely grown to chaparral or non-native weeds. Restoration efforts incorporating Coastal sage scrub and native grasslands should occur where appropriate to improve habitat conditions for these species.

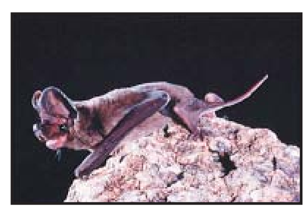
7. Miramar is a major center for the Grasshopper Sparrow in San Diego County. This species prefers grassland dominated by native bunchgrasses and is designated a bird of special concern by the California Department of Fish and Game. Individuals have been sighted near the Nobel Athletic Area suggesting that this species may occur more widely west of Interstate 805. If any areas can be restored to native bunchgrass, this species might benefit. Steep slopes are generally not suitable for the Grasshopper Sparrow; it occurs typically on gentle slopes and rolling hills. Restoration efforts incorporating native grasslands should occur where appropriate to improve habitat conditions for the Grasshopper Sparrow.



8. Friable soils are essential to the heteromyid rodents (kangaroo rats and pocket mice). These species do not persist where soils are coarse. It is reasonable to suspect that the soils in the watershed once consisted of areas with loose sand that have since been eroded by urban runoff. Returning suitable soils to the site will aid in re-colonization of these species. Restoration efforts should include efforts to improve soil conditions as well.

9. The use of riprap in the watershed has provided habitat for non-native mammals (e.g., black rats and opossum) and eliminated habitat for native rodents that prefer to burrow in natural stream banks. Removal of riprap and replacing it with banks covered in native vegetation with areas of bare earth would restore the habitat of preference for various native rodents.

10. Predators like the mountain lion and bobcat play a key role in perpetuating the diversity of plants and animals. As the Rose Creek Watershed is restored these animals should have access to as much of the watershed as possible. The variety of consumable plants in an area determines the numbers and varieties of plant eaters, and of their predators as well. In the absence of predators the numbers of plant-eating animals increases rapidly, thus reducing the relative abundance of native vegetation. Maintaining and improving habitat connections along key wildlife corridors is critical to the maintenance of these predators within the watershed.



11. Bats are key insect predators and pollinators in many ecosystems. Insectivorous bats can be important in controlling populations of insects that carry disease and attack crops. They may also help control invasive insects, which can degrade native vegetation. Nectar-feeding bats serve as a means of cross-pollination of many plants, increasing genetic out-crossing and facilitating dispersal. The Rose Creek Watershed currently provides habitat to three species of bat, the insectivorous pocketed free-tailed bat (N. femorosaccus) and western mastiff bat (E. perotis) and the nectarivorous, migratory Mexican long-tongued bat (C. mexicana). Little is known of the roosting preferences of the pocketed free-tailed bat. Western mastiff bats roost in cliff-face crevices and feed high above the ground. They are rarely seen and approach the ground only at a few select drinking sites. Mexican long-tongued bats roost in the cool mountain canyons where they can easily find flowers and insects to feed on. Because of the rather specialized roosting habits of the western mastiff and the Mexican long-tongued bat it is difficult to replicate a suitable man-made roost, as has been done for some other species of bats. Identifying and preserving migration corridors could benefit the Mexican long-tongued bat. Preserving or providing slow-flowing water sources could benefit the western mastiff bat.

4.3 Cultural Resources

4.3.1 Interpretive Panels

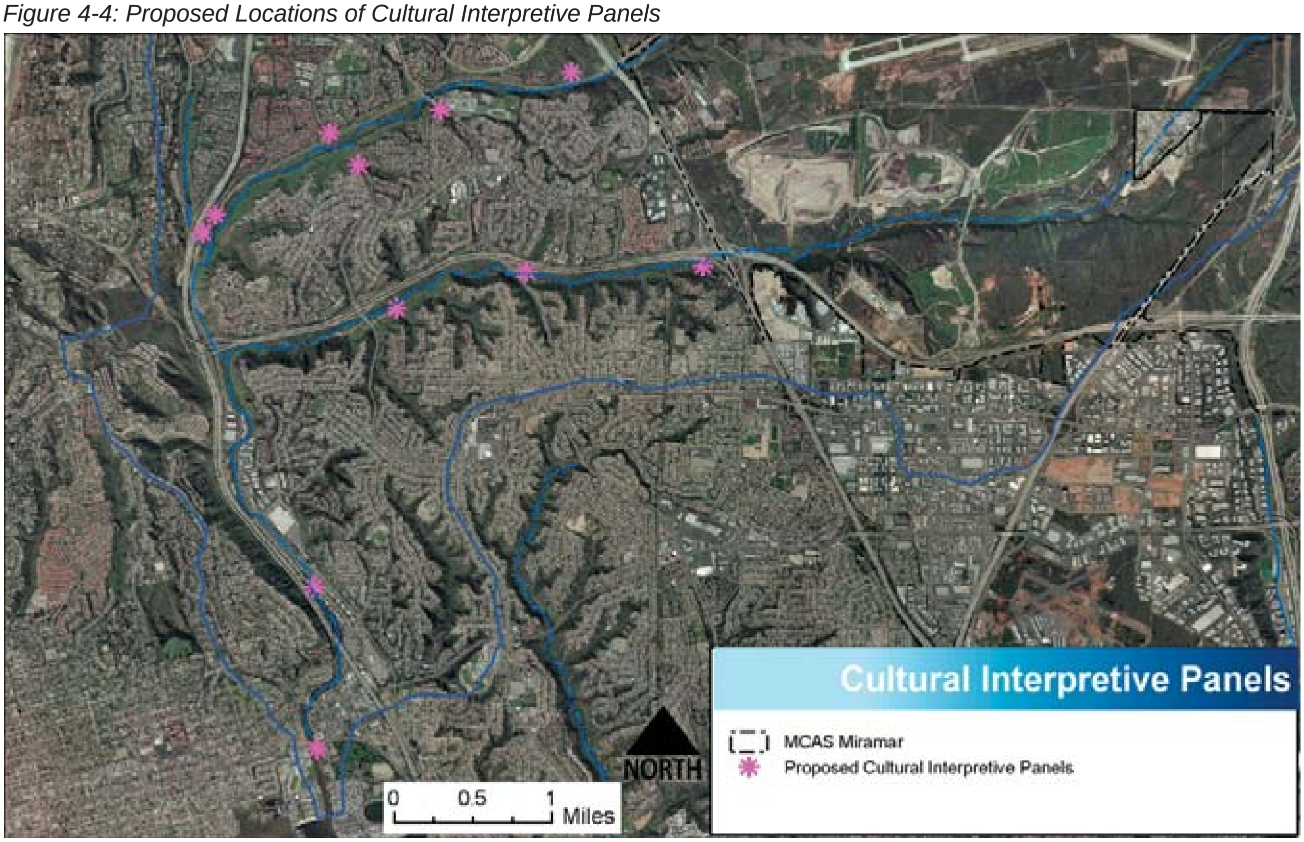
In the process of identifying the locations and topics for the cultural resources interpretive panels discussed in Section 2.3.3 page 2-30. The proposed locations of the panels are shown in Figure 4-3 and the additional ideas regarding the contents of the panels are discussed below.

Ancient Settlements—12,000 to 1,300 years ago: 1) there is evidence that people have lived in southern California for at least 15,000 years, 2) ancient hunters lived on the hills surrounding Rose and San Clemente canyons, 3) their tools are still here today, after many thousands of years, and 4) the people were adapted to living with the plants, animals, and geology of the watershed.

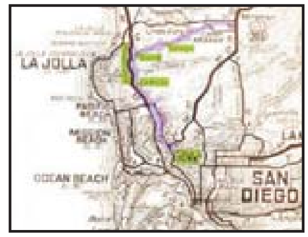
Late Prehistoric Travelers—1,300 to 200 years ago: 1) beginning 1000 years ago, San Diego's native people started using bows and arrows, and pottery, 2) large villages were established in the watershed, taking advantage of the rich environment, and 3) villages were surrounded by small seasonal camps, also located in the watershed, where acorns, grasses, stone materials, and other resource were available.

The Village of La Rinconada—200 years ago: 1) Native people lived near the bay over 250 years ago, 2) At the time the San Diego Mission was established, in 1769, there was a large village here called La Rinconada, and 3) people were taken from this village to the mission.

Figure 4-4: Proposed Locations of Cultural Interpretive Panels



Traditional Management and Use of the Watershed—12,000 to 200 years ago: 1) the California Indians managed their environment by controlled burning, 2) selective pruning, harvesting, and cutting of plants ensured their abundance for use in basketry, 3) the watershed contained many plants and animals of economic importance to the Indians, and 4) the complex culture of the Indians ensured the survival of a large native population.



Spanish Travelers—1769: 1) Juan Crespi traveled up Rose Canyon in 1769 after leaving the Mission in San Diego, 2) Pedro Fages, another Spaniard on the journey, noted that the canyon was full of grass, 3) groups of Indians greeted them in the canyon, and offered them food, and 4) many of the Indians who lived in the watershed were taken from their lands to the mission as laborers and converts.

Ranching in the Canyons—1800-1960s: 1) the Pueblo of San Diego used Rose and San Clemente canyons to graze cattle in the early days of the city, 2) sections of these lands were offered for sale in 1853, and 3) ranches had orchards, vineyards, and pasture for cattle and horses.

Louis Rose and the Dairies—1856-1900: 1) Louis Rose was a famous San Diego businessman, 2) he started his Rose Canyon Ranch in 1856, 3) his first business in the canyon was a tannery, and 4) dairy farms were located in Rose Canyon in the late 1800s.

Railroad Ties—1881 to present: 1) the California Southern Route was built through Rose Canyon in 1881, 2) the original route was south of the creek, but washed out many times, 3) there were three sidings in Rose Canyon, and 4) you may be able to see objects from the original route as you hike; please do not disturb these important artifacts.

The Brickyard—1912: 1) during San Diego's building boom, there were ten brick yards in the county , 2) the Union Brick Company established a brick kiln in Rose Canyon in 1912 , 3) the company made many different kinds of bricks, and 4) the Rose Canyon Historical Society preserves the heritage of the brick workers and their families, who lived on the grounds of the brick yard.

The Watershed Today: 1) east of Interstate 805, the watershed is contained within MCAS Miramar, 2) Camp Kearny, as it was called at the time, played a major role in World War II, 3) after the war, San Diego began to develop from a sleepy coastal town to a city, with housing and commercial development surrounding the watershed, and 4) the watershed is precious open space with opportunities to experience nature in the city.

4.3.2 Cultural Resource Management Measures

In addition to the recommendations presented in Section 2.3.1 and 2.3.2 on pages 2-28/29 regarding documentation, protection, and avoidance of cultural resources, a management matrix was also developed. The matrix (Table 4-1) lists the cultural resources recorded within the project area, proposed activities, and management recommendations. In all cases, projects should not be planned that will adversely impact cultural resources. Prior to implementation of any projects, including habitat restoration and non-native plant removal that may not require a discretionary action, a cultural resource study should be completed to identify cultural sites and avoid inadvertent adverse impacts.

Table 4-1: Matrix of Cultural Resources and Management Actions

Site Number	Proposed Activity	Management Recommendation
I-165	Not Applicable	No action needed; isolated artifact
Ladrillo Siding and Union Brick Company	The remains of this site are east of Morena Boulevard; paths and trails are west of the road	Completely document all features and artifacts in these areas, restrict public access to prevent vandalism and destruction, work with Rose Canyon Historical Society to develop interpretive programming
P-13710	Not Applicable	No action needed; isolated artifact
P-13711	Not Applicable	No action needed; isolated artifact
P-13712	Not Applicable	No action needed; isolated artifact
P-13713	Not Applicable	No action needed; isolated artifact
P-13714	Not Applicable	No action needed; isolated artifact
P-13715	Not Applicable	No action needed; isolated artifact
P-13716	Not Applicable	No action needed; isolated artifact
P-13717	Not Applicable	No action needed; isolated artifact
P-13718	Not Applicable	No action needed; isolated artifact
P-13719	Not Applicable	No action needed; isolated artifact
P-13720	Not Applicable	No action needed; isolated artifact
P-13721	Not Applicable	No action needed; isolated artifact
P-16179	Existing trails	Evaluate site condition, repair damage to this structure, stabilize the features, avoid impacts (do not plan or implement trails or habitat restoration projects near this cultural resource that would result in adverse impacts), protect the site from existing trail use after site condition is evaluated
P-24692	Not Applicable	No action needed; isolated artifact
SDI-5017	Multi-use trail	This site is likely buried beneath sediments; an archaeologist should monitor any construction activities that result in disturbance to the surface of the ground
SDI-5494	None	Site is west of Interstate 5
SDI-5495	None	Site is west of Interstate 5
SDI-10437	Existing ad hoc trails, habitat restoration project	Close the ad hoc trails and prevent future trail use; design the habitat restoration project so that the site is not disturbed and protect it with seeding
SDI-11783	Existing trail	Document the site boundaries and avoid the site; if re-routing the trail is not possible, monitor site condition to assess damage from trail use and take protective measures
SDI-12416	Existing ad hoc trail	Close the ad hoc trails and prevent future trail use
SDI-12417	Existing ad hoc trail	Close the ad hoc trails and prevent future trail use
SDI-12418	Existing ad hoc trail	Close the ad hoc trails and prevent future trail use
SDI-12419	Proposed Coastal Rail Trail	Document the site boundaries and avoid locating the trail in or near the site; protect the site by revegetation (non-disturbing methods like seeding)

Table 4-1: Matrix of Cultural Resources and Management Actions - Cont.

Site Number	Proposed Activity	Management Recommendation
SDI-12420	Existing ad hoc trail	Close the ad hoc trails and prevent future trail use
SDI-12421	Existing ad hoc trail	Close the ad hoc trails and prevent future trail use
SDI-12422	Proposed Coastal Rail Trail	Document the site boundaries and avoid locating the trail in or near the site; protect the site by revegetation (non-disturbing methods like seeding)
SDI-12423	Proposed Coastal Rail Trail	Document the site boundaries and avoid locating the trail in or near the site; protect the site by revegetation (non-disturbing methods like seeding)
SDI-12424	Existing ad hoc trail	Close the ad hoc trails and prevent future trail use
SDI-12425	Existing ad hoc trail	Close the ad hoc trails and prevent future trail use
SDI-12426	Existing ad hoc trail	Close the ad hoc trails and prevent future trail use
SDI-12427	Existing ad hoc trail	Close the ad hoc trails and prevent future trail use
SDI-12556	Existing trail, habitat restoration projects	Relocate the path so that it is not in or near the site; protect the site through non-disturbing revegetation (seeding), do not grade for habitat restoration
SDI-12557	Existing path, habitat restoration projects	Relocate the path so that it is not in or near the site; protect the site through non-disturbing revegetation (seeding), do not grade for habitat restoration
SDI-12558	Existing path	Relocate the path so that it is not in or near the site; protect the site through non-disturbing revegetation (seeding)
SDI-12559	Existing path	Relocate the path so that it is not in or near the site; protect the site through non-disturbing revegetation (seeding)

4.4 Public Safety

The lower Rose Creek corridor is included in two police beats by the San Diego Police Department. Beat 113 is largely the Bay Ho (Morena) community of Clairemont; Beat 122 is Pacific Beach. For this report, FBI Index crimes for a six month period between January and June of 2003-2005 were reviewed. The resulting data are shown in Table 4-2.

These data are provided as a snap shot of criminal activity in the area; more detailed analysis is required to ascertain long-term trends. Different observations can be made from these data. For example, proactive police department actions such as citations and arrests decrease during the period surveyed. Yet, this doesn't necessarily mean that crime has decreased, instead, it can be an indication that fewer officers were available to write citations or make arrests. In contrast, reactive (new crime cases) increase during the same period. This could be an indicator that officers' time is now spent more directly responding to dispatched calls.

Currently, police officers cite the nearest street on an arrest record making it difficult to track crime specifically within a natural area (that doesn't have a conventional address). For the Rose Creek Opportunities Assessment, individual cases at addresses adjacent to the creek were reviewed. This review showed that the one murder that took place during the review period occurred on Mission Bay Drive adjacent to Rose Creek. Three of the eight rapes occurring during the review period also took place in the vicinity of Rose Creek.

Commercial burglary decreased 47.1% over the review period. The analysis indicated that this could be directly attributable to arrests and convictions associated with the break up of a crime ring active in Clairemont during the same period.

Additional analysis of crime trends in the vicinity of Rose Creek is recommended.

Table 4-2: Summary of Crime Statistics within the lower Rose Creek Watershed 2003-2005

FBI INDEX CRIMES BEATS 113 AND 122

	Jan-June2003	Jan-June2004	Jan-June 2005	2003 - 2005 % Change
Murder	0	1	0	N/A
Rape	9	9	8	-11.1%
Robbery	27	25	34	25.9%
Aggravated Assault	101	98	95	-5.9%
Violent Crime Total	**137**	**133**	**137**	**0.0%**
Residential Burglary	157	190	181	15.3%
Commercial Burglary	85	51	45	-47.1%
Larceny	694	818	1,063	53.2%
Motor Vehicle Theft	267	301	309	15.7%
Property Crime Total	**1,203**	**1,360**	**1,598**	**32.8%**
Crime Index Total	**1,340**	**1,493**	**1,735**	**29.5%**
Car Prowls	304	483	764	151.3%

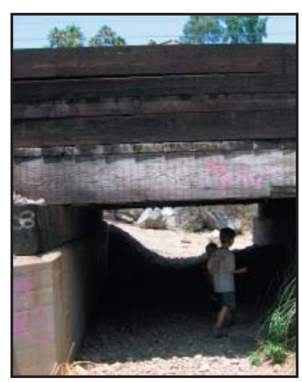
OVER ALL POLICE ACTIVITY BEATS 113 AND 122

	Jan-June2003	Jan-June2004	Jan-June 2005	2003 - 2005 % Change
ARRESTS	1,015	1,186	971	-4.3%
CITATIONS	5,887	6,529	5,205	-11.6%
CRIME CASES	2,381	2,382	2,603	9.3%
FIELD INTERVIEWS	1,409	1,775	1,473	4.5%

4.5 Recreational Trails

4.5.1 Descriptions of Proposed New Trails

The Proposed New Trails recommendation presented in Section 2.5.2 page 2-57 and Figures 2-31 to 2-33 identified ten new segments. Each of these segments are shown in Figure 4-4 and described here in more detail to help the reader understand where the segment is and its purpose.



Segment 1: This proposed trail segment is associated with Bridge 1 discussed in Section 4.4.3 and would provide a legal railroad crossing for recreational users accessing the Rose Canyon Open Space Park from the University Village Park entrance.

Segment 2: This proposed trail segment would provide access to a potential railroad under-crossing utilizing an existing railroad trestle structure. The under-crossing does not meet current design standards. If the under-crossing is determined to be infeasible, then there is no need to consider this trail segment.

Segment 3: This proposed trail segment is a loop trail that would be constructed as part of a restoration effort along the tributary drainages. The trail would provide permanent recreational access into a portion of the Rose Canyon Open Space Park that currently has no designated trail access. The trail loop would be accessed from the north via the SDG&E maintenance road that is infrequently maintained and currently overgrown with non-native species.

Segment 4: This proposed trail segment would improve an existing ad hoc trail that connects the residential area along Via Mallorca to Gilman Drive and then on to the Rose Canyon Bike Path. Improving this trail should be done in conjunction with the incorporation of this open space parcel into public management as parkland.

Segment 5: This proposed trail would connect the loop trail (segment 2) to the SDG&E access road and trail to the south. This connection would avoid two existing creek crossings that are impassable during higher stream flows. The trail would route across sections of relatively steep slopes with some native vegetation that is considered sensitive (*Artemisia palmerii*). A more detailed feasibility assessment is required to determine if trail impacts outweigh the recreational benefits.

Segment 6: This proposed trail re-routes the existing SDG&E access road and trail out of the historic floodplain of Rose Creek along the base of the slope and then re-connects to an existing ad hoc trail that routes over an area of historic fill. The trail would allow for two additional actions to occur: 1) the trail alignment would act as a slope stabilizer and allow for the gullies within this area to be re-contoured and vegetated, and 2) by removing the existing trail out of the historic floodplain, restoration of wetland communities within the floodplain could occur.

Figure 4-5: Proposed New Trail Segments

Segment 7: This proposed trail is associated with the Bicycle/Pedestrian Bridge recommended in Section 2.5.4 page 2-73 and would provide year-round trail access into Marian Bear Memorial Natural Park to the east, which is currently unavailable during periods of higher stream flow due to two existing creek crossings.

Segment 8: This proposed trail would provide connectivity from the existing ad hoc trail through Lakehurst Canyon down into Marian Bear Memorial Natural Park, thus providing another connection to the Clairemont community. The trail is intended to be implemented as part of a stream restoration effort to remove the concrete V-ditch along Regents Road and provide a more natural vegetated stream environment that the trail could be a component of.

Segment 9: This proposed trail would provide year-round trail access from Genesee Avenue west into Marian Bear Memorial Natural Park. Access to the west is currently unavailable during periods of higher stream flow due to two existing creek crossings.

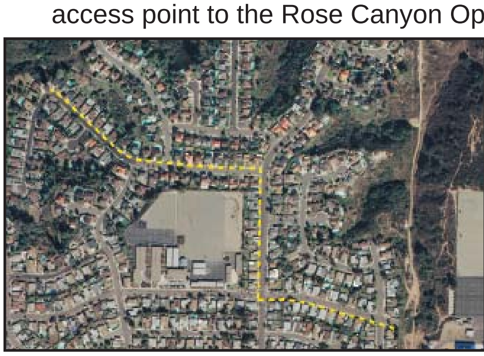
Segment 10: This proposed trail would act as a parallel route to the Class I path recommended in Section 2.5.2 page 2-62 and implemented as a component of the stream restoration recommended in Section 2.6.3 page 2-88. The trail would wind through the restored floodplain of Rose Creek providing an alternate route for walkers, runners, and birders during most of the year. Since it is routed within the floodplain, the trail needs to be designed to withstand period flooding and storm flows.

Segment 11: (Un-mapped) This proposed trail would enable the creation of a 9-mile loop trail through the two Open Space Parks by connecting them through the edge of MCAS Miramar along Interstate 805. Additional coordination needs to occur with MCAS Miramar staff to determine the feasibility of this connection and work out how the station's security concerns would be addressed.

4.5.2 Trail System Connectors

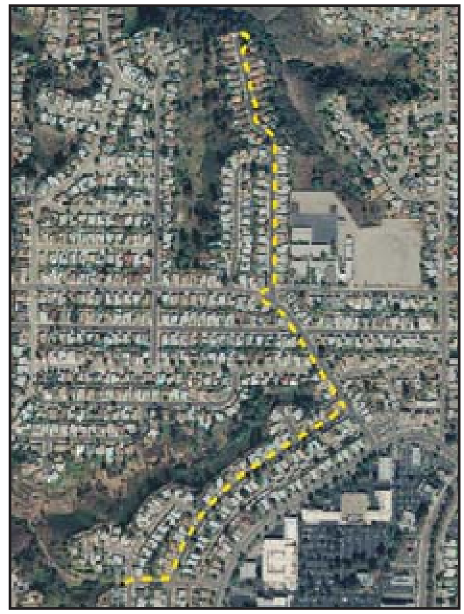
The Trail System Connectors recommendation presented in Section 2.5.2 page 2-57 and Figures 2-31 to 2-33 identified 7 connectors. Each of these routes are shown on Figure 4-6 and described here in more detail to help the reader understand where the segment is and its purpose.

Connector 1: This trail connector links the Regents Road south access point to the Rose Canyon Open Space Park to the Standley Community Park Trail. The route proceeds from the Regents Road Trailhead south along Regents Road to Millikin Avenue and travels east to Mercer Street and then south to the traffic light and across Governor Drive to Standley Community Park Trail.



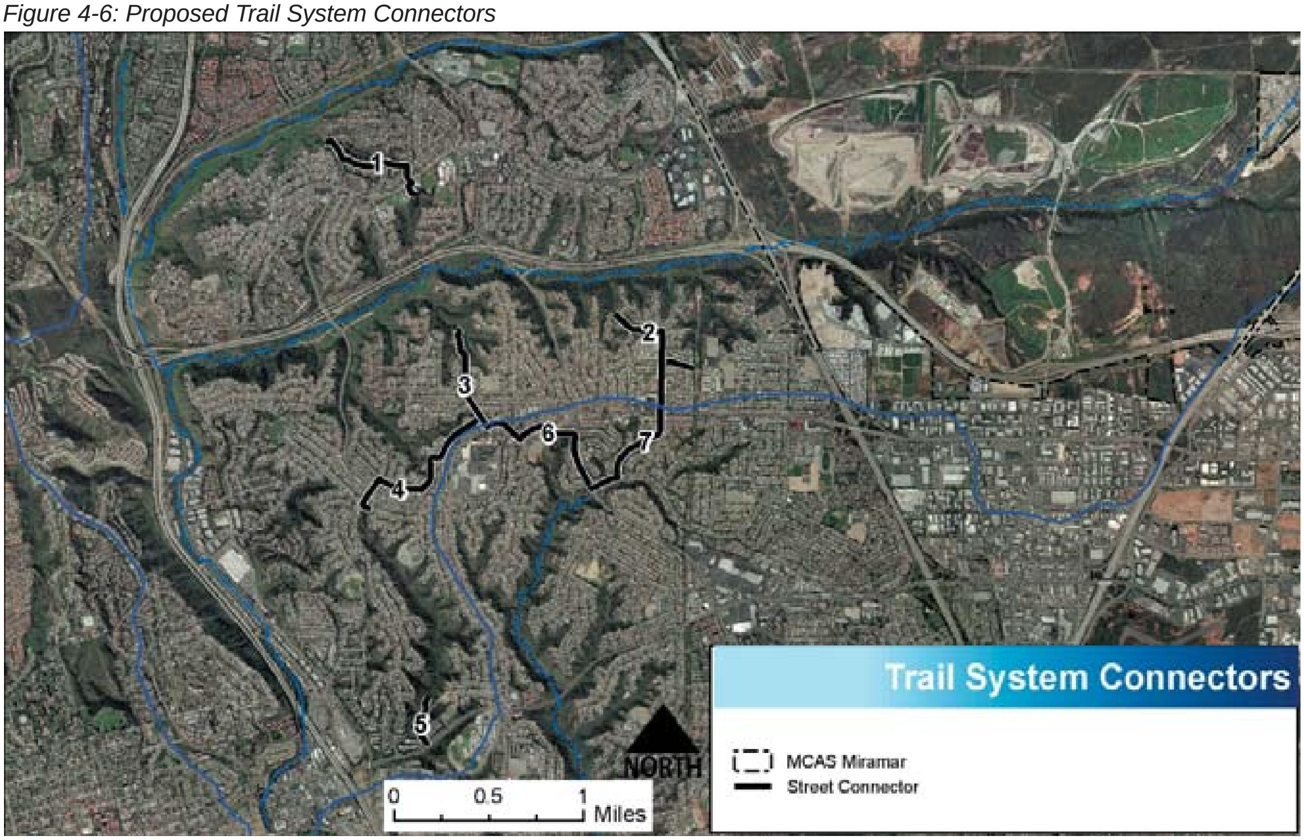
Connector 2: This trail connector links the proposed Lehrer Drive (SDG&E) Trailhead to Cobb Trail. The route proceeds from the Lehrer Drive Trailhead west along Lehrer Drive to Diane Avenue and then travels north to Cobb Drive and then west along Cobb Drive to the stairs that access the Cobb Trail.

Connector 3: This trail connector links the Biltmore Trailhead with the proposed Lakehurst Canyon Trailhead. The route proceeds south along Biltmore Street to Merrimac Avenue and then travels southeast along Merrimac Avenue to Coconino Way and then southwest to Lakehurst Avenue where it turns west and heads into Lakehurst Canyon.

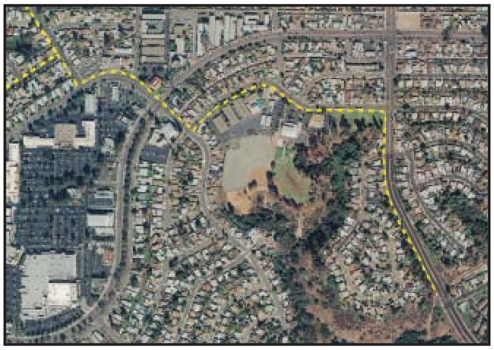


Connector 4: This connector links the proposed Lakehurst Canyon Trailhead with the proposed Stevenson Canyon Trailhead. The route proceeds east along Lakehurst Avenue to Pocahontas Avenue and then south along Pocahontas Avenue to Luna Avenue and then northwest along Luna Avenue to Moraga Avenue and then southwest along Moraga Avenue to Idlewild Way and then east to the Stevenson Canyon Trailhead.

Figure 4-6: Proposed Trail System Connectors



Connector 5: This connector links the southern end of the Stevenson Canyon trail to Balboa and Garnet Avenues. The route proceeds south through the Balboa Terrace Townhome development to Balboa Terrace and on south to Balboa Avenue where sidewalks and bike lanes are available for continued travel.



Connector 6: This connector links the proposed Lakehurst Canyon Trailhead and the Biltmore Trailhead to the Tecolote Canyon Trailhead across from Chateau Drive. The route proceeds from the intersection of Coconino Way and Merrimac Avenue and then goes southeast to Clairemont Drive. From Clairemont Drive it proceeds east to the intersection with Clairemont Mesa Boulevard where it turns into Kleefeld Avenue. The route then turns northeast on to Bannock Avenue and then along Bannock Avenue to Genesee Avenue and the south along Genesee Avenue to the trailhead across from Chateau Drive.

Connector 7: This connector links the Cobb Trailhead and the proposed Lehrer Drive Trailhead to the Tecolote Canyon Trailhead across form Chateau Drive. The route proceeds from the intersection of Lehrer Drive and Diane Avenue and then goes south along Diane Avenue across Clairemont Mesa Boulevard until it intersects with Chateau Drive where it proceeds to the west to Genesee Avenue and across to the trailhead.

4.5.3 Bicycle/Pedestrian Bridges

The Creek Crossings recommendation presented in Section 2.5.2 page 2-57 and Figures 2-31 to 2-33 identified 4 bridges. Each of these bridges are shown on Figure 4-6 and described here in more detail to help the reader understand where the segment is and its purpose. An additional bridge was discussed in Section 2.5.5 at the Interstate 5 and State Route 52 interchange and is not discussed again here.

Bridge 1: The Bridge over Rose Creek near the Interstate 805 bridge is intended to provide a railroad crossing at the east end of the Rose Canyon Open Space park. This bridge could be sited to take advantage of the slopes of the Interstate 805 bridge abutments to gain the elevation necessary to cross over the railroad (~23 feet from bottom of bridge). The bridge is needed to provide a legal railroad crossing to users accessing the trail system from the University Village Park entry point, as well as by trail users interested in using the proposed loop trail connecting Rose and San Clemente Canyon that is in the very preliminary stages of being coordinated with SDG&E and MCAS Miramar.

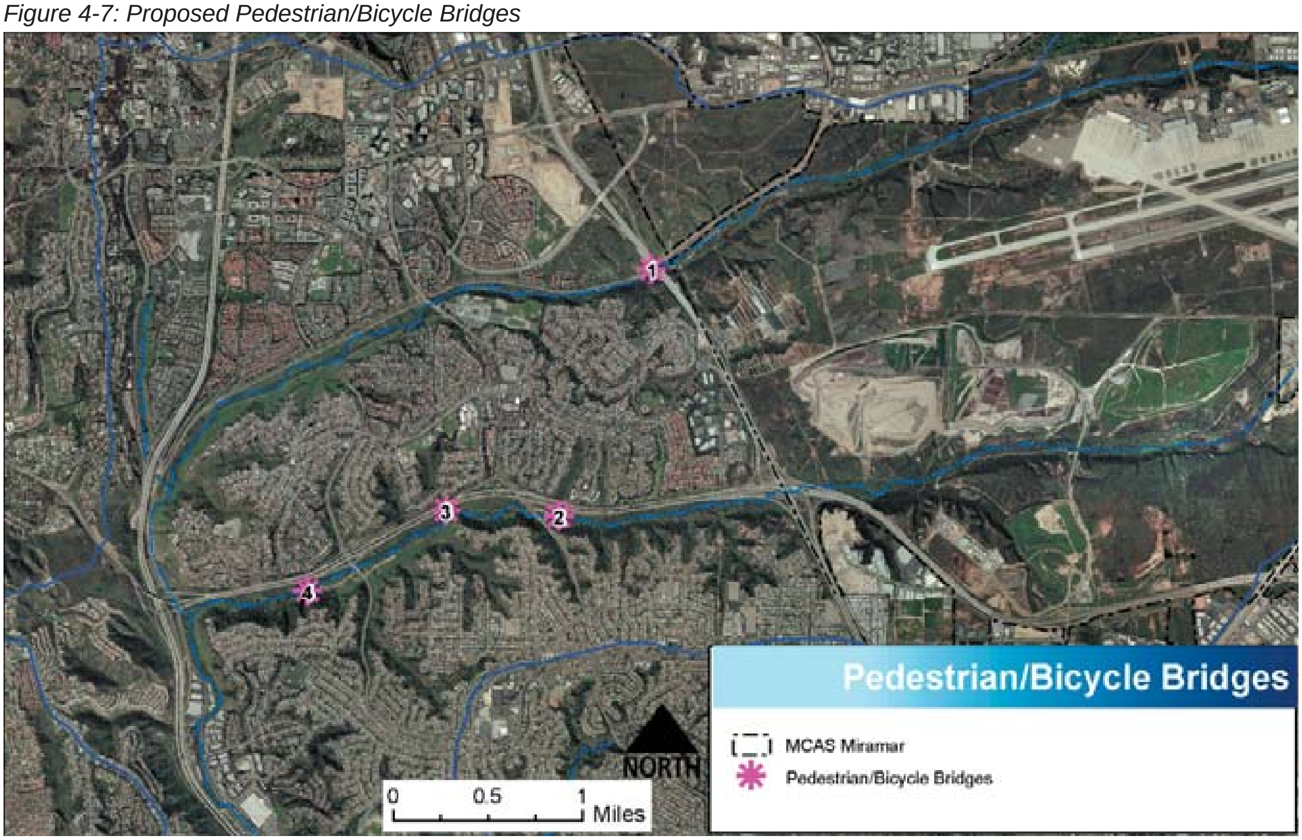
Bridge 2: The Bridge over San Clemente Creek above Genesee Avenue is recommended to provide bicycle/pedestrian access across the creek upstream of the existing maintenance road at-grade crossing. The at-grade crossing becomes deep and wide enough during spring stream

flows that it is difficult for many cyclist to cross and a barrier to pedestrians. The stream banks at this location are tall enough that a bridge could be easily sited with minimal abutment height to obtain any necessary elevation gain required based on the Hydrologic Assessment. Improvements to the at-grade crossing following the maintenance road recommendation described in Section 2.5.2 could modify the environment sufficiently to allow cyclists and pedestrian to utilize it in lieu of a separate bridge. As such, those improvements should be designed and implemented first to determine if a bridge is still needed.

Bridge 3: The Bridge over San Clemente Creek at the southern end of the Standley Trail is recommended to provide bicycle/pedestrian access across the creek down stream of the existing maintenance road at-grade crossing. The at-grade crossing becomes deep and wide enough during spring stream flows that it is difficult for many cyclist to cross and a barrier to pedestrians. The stream banks at this location are tall enough that a bridge could be easily sited with minimal abutment height on the north stream bank to obtain any necessary elevation gain required based on the Hydrologic Assessment. However, the south stream bank may require construction of a more significant bridge abutment structure due to its lower elevation. As with the previous bridge site, improvements to the at-grade crossing following the maintenance road recommendation described above could modify the environment sufficiently to allow cyclists and pedestrian to utilize it in lieu of a separate bridge. As such, those improvements should be designed and implemented first to determine if a bridge is still needed.

Bridge 4: The Bridge over San Clemente Creek down stream of the west Regents Road parking lot is recommended to provide bicycle/pedestrian access across the creek upstream of the existing maintenance road at-grade crossing. The at-grade crossing becomes deep and

Figure 4-7: Proposed Pedestrian/Bicycle Bridges



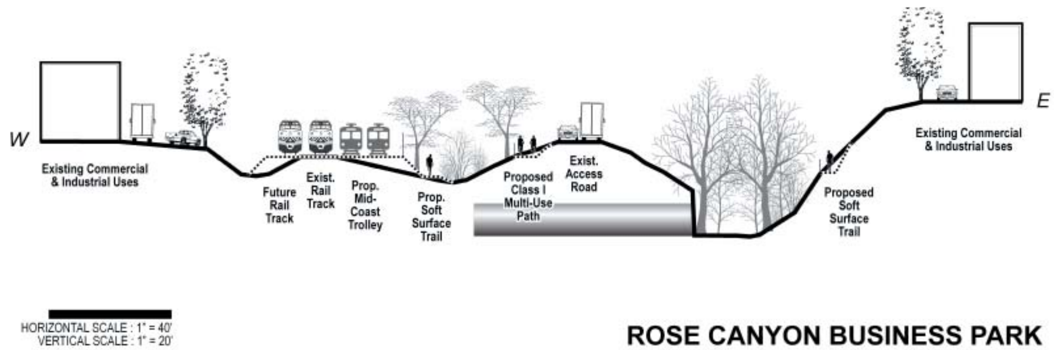
wide enough during spring stream flows that it is difficult for many cyclist to cross and a barrier to pedestrians. The surface substrate leading up to this site from the parking lot is also difficult to traverse as it consists of sands and fine sediments deposited during larger storm events (such as those of January and February 2005). Trail access could benefit from the construction of an elevated boardwalk designed to allow flows from larger storm events to pass underneath. The stream banks at this location are not as tall as at the other sites, so bridge abutments may need to be constructed with some height to obtain any necessary elevation gain required based on the Hydrologic Assessment. As with the previous bridge sites, improvements to the at-grade crossing following the maintenance road recommendation described above could modify the environment sufficiently to allow cyclists and pedestrian to utilize it in lieu of a separate bridge. As such, those improvements should be designed and implemented first to determine if a bridge is still needed. In the event that the bridge is not needed, the boardwalk should still be considered to facilitate trail usage and demarcate the trail alignment.

Figure 4-8: Cross-Sectional Studies of Proposed Class 1 Multi-Use Path

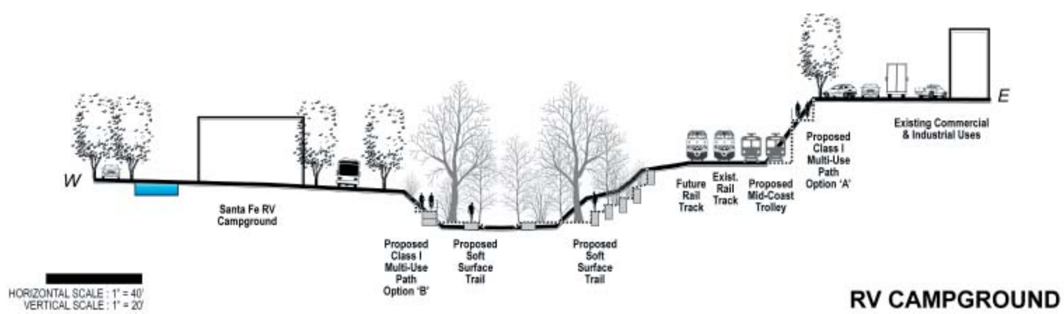
4.5.4 Regional Recreational Connections

The Regional Recreational Connections recommendation presented in Section 2.6.2 page 2-66 and Figures 2-37 to 2-38 identified 2 alternate alignments for a Class 1 Multi-Use path along the lower portions of Rose Creek and provided a sample cross-sectional study. All of the cross-sectional studies are shown on Figure 4-8 and described here in more detail to help the reader understand where the cross-section is and what issues or opportunities it presents.

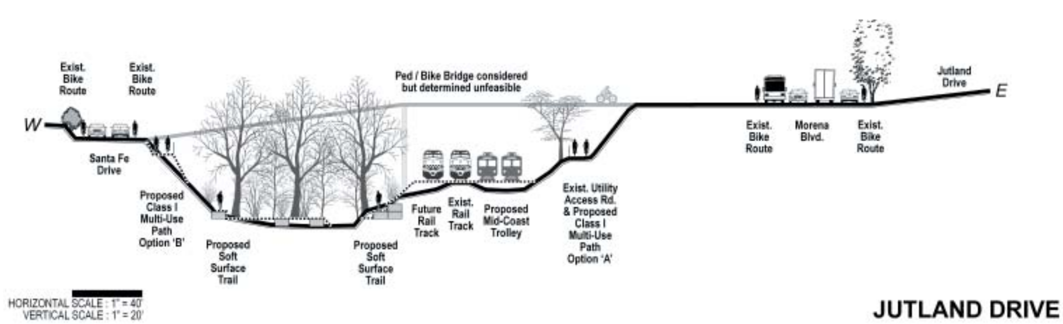
Cross-Section A: This cross-section depicts the use of the private Rose Canyon Business Park creek crossing for the proposed Class 1 Multi-Use path and the inclusion of two soft surface trails; one that runs to the south as part of the proposed lower Rose Creek restoration and the other (the eastern trail) runs north and connects with an existing single track trail into Marian Bear Memorial Natural Park. The future double tracking of the San Diego Northern Railroad tracks, the proposed Mid-Coast Trolley, and this proposed Class 1 Multi-Use Path make the corridor to the north of this section very tight and will require a collaborative planning effort if all three uses are to co-exists.



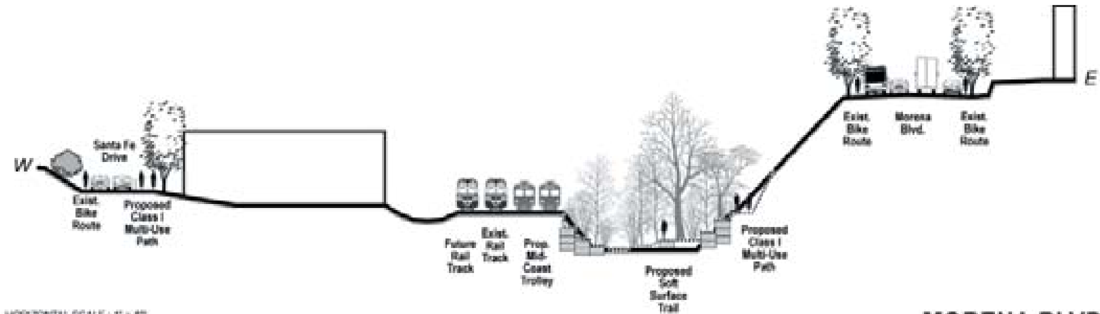
Cross-Section B: This cross-section depicts the different alignments of Alternative A and B for the proposed Class 1 Multi-Use Path. Alternative A runs on the east-side of the creek above the railroad tracks along the slope below the Rose Canyon Business Park. Alternative B runs on the west-side of the creek along the streambank at the edge of the Santa Fe RV Campground. The future double tracking and proposed Mid-Coast Trolley may make Alternative A impracticable within this area.



Cross-Section C: This cross-section depicts the different alignments of Alternative A and B for the proposed Class 1 Multi-Use Path. Alternative A runs on the east-side of the creek above the railroad tracks and ties into the existing maintenance access road for the flood control channel to the south. Alternative B runs on the west-side of the creek along the slope below the edge of Santa Fe Drive.

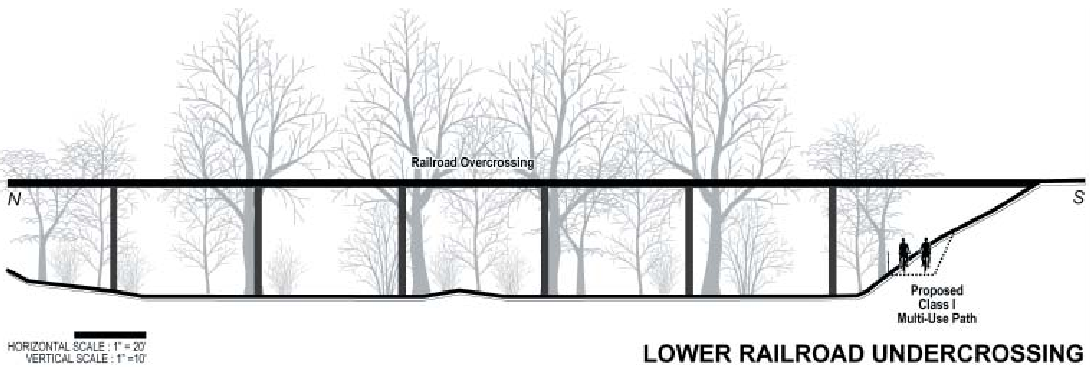


Cross-Section D: This cross-section depicts the different alignments of Alternative A and B for the proposed Class 1 Multi-Use Path. Alternative A runs on the east-side of the creek at the top edge of the existing flood control channel. Alternative B runs on the east-side of Santa Fe Drive within the landscaped area in front of the businesses. If it is determined that Alternative B is infeasible, then the use of the drainage ditch between the back of the businesses and the railroad tracks should be analyzed as well.



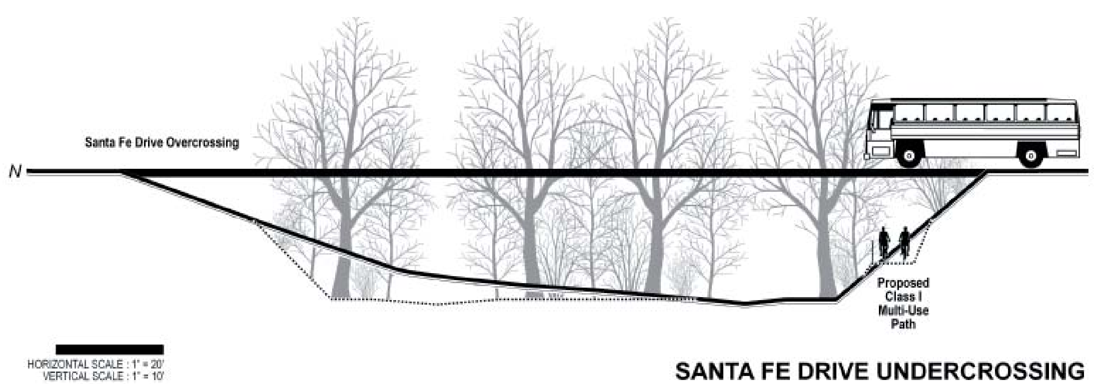
MORENA BLVD.

Cross-Section E: This cross-section depicts how Alternative A of the proposed Class 1 Multi-Use Path crosses under the existing railroad trestle along the streambank of the creek.



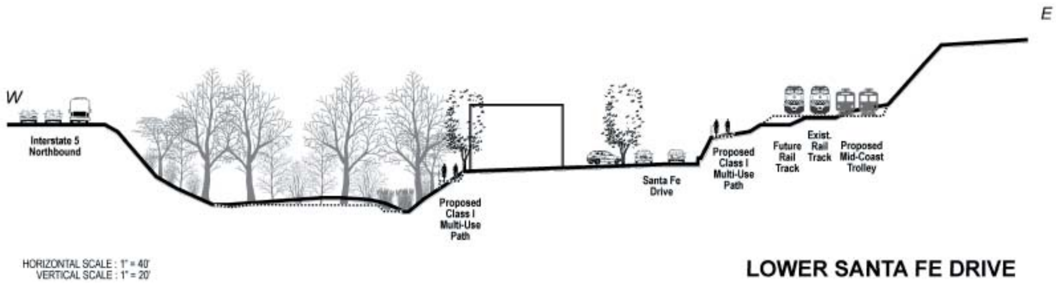
LOWER RAILROAD UNDERCROSSING

Cross-Section F: This cross-section depicts how Alternative A of the proposed Class 1 Multi-Use Path crosses under Santa Fe Drive. The existing clearance under the Santa Fe Drive bridge may not meet design standards and some re-grading my be necessary. Additionally, a sewer main crosses over the creek on the north side of the bridge and hangs slightly below the bottom of the bridge creating an additional vertical impediment. It may not be possible to re-grade this area to meet design standards. Alternative B is running along Santa Fe Drive and would require the construction of a bridge along side the Santa Fe Drive bridge over the sewer main. This style of bridge has been done in Mission Trails Regional Park below the old Mission Dam.

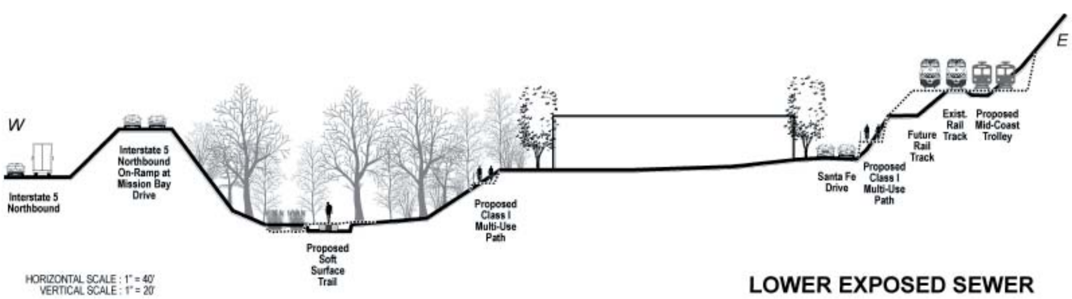


SANTA FE DRIVE UNDERCROSSING

Cross-Section G: This cross-section depicts the different alignments of Alternative A and B for the proposed Class 1 Multi-Use Path. Alternative A runs on the east-side of the creek along the top edge of the streambank below the existing businesses along Santa Fe Drive. Alternative B runs on the east-side of Santa Fe Drive along the slope below the existing railroad tracks.

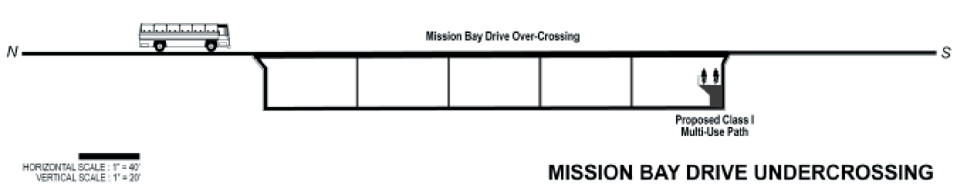


Cross-Section H: This cross-section depicts the different alignments of Alternative A and B for the proposed Class 1 Multi-Use Path. Alternative A runs on the east-side of the creek along the top edge of the streambank below the existing businesses along Santa Fe Drive. Alternative B runs on the east-side of Santa Fe Drive along the slope below the existing railroad tracks. The cross-section also shows the construction of a soft surface trail over an existing sewer main alignment. This particular sewer main was completely exposed during the spring of 2005 and will require some form of action to protect it from future storm events. By designing a trail over it as part of the proposed stream restoration effort long-term maintenance access to the sewer main can be maintained.



Cross-Section I: This cross-section depicts how Alternative A of the proposed Class 1 Multi-Use Path would cross under Interstate 5. It shows two options; the first utilizes the eastern most vent and re-grades the existing riprap slope to route the Path and the second utilizes the next vent to the west and would require some difficult transition curves to route back to the streambank.

Cross-Section J: This cross-section depicts how both Alternative alignments for the proposed Class 1 Multi-Use Path would route under North Mission Bay Drive before connecting to the existing section of the Rose Canyon Bike Path that continues south to Mission Bay Park. This under crossing would require the construction of an elevated surface to allow the use of the Path during periods of moderate stream flow.



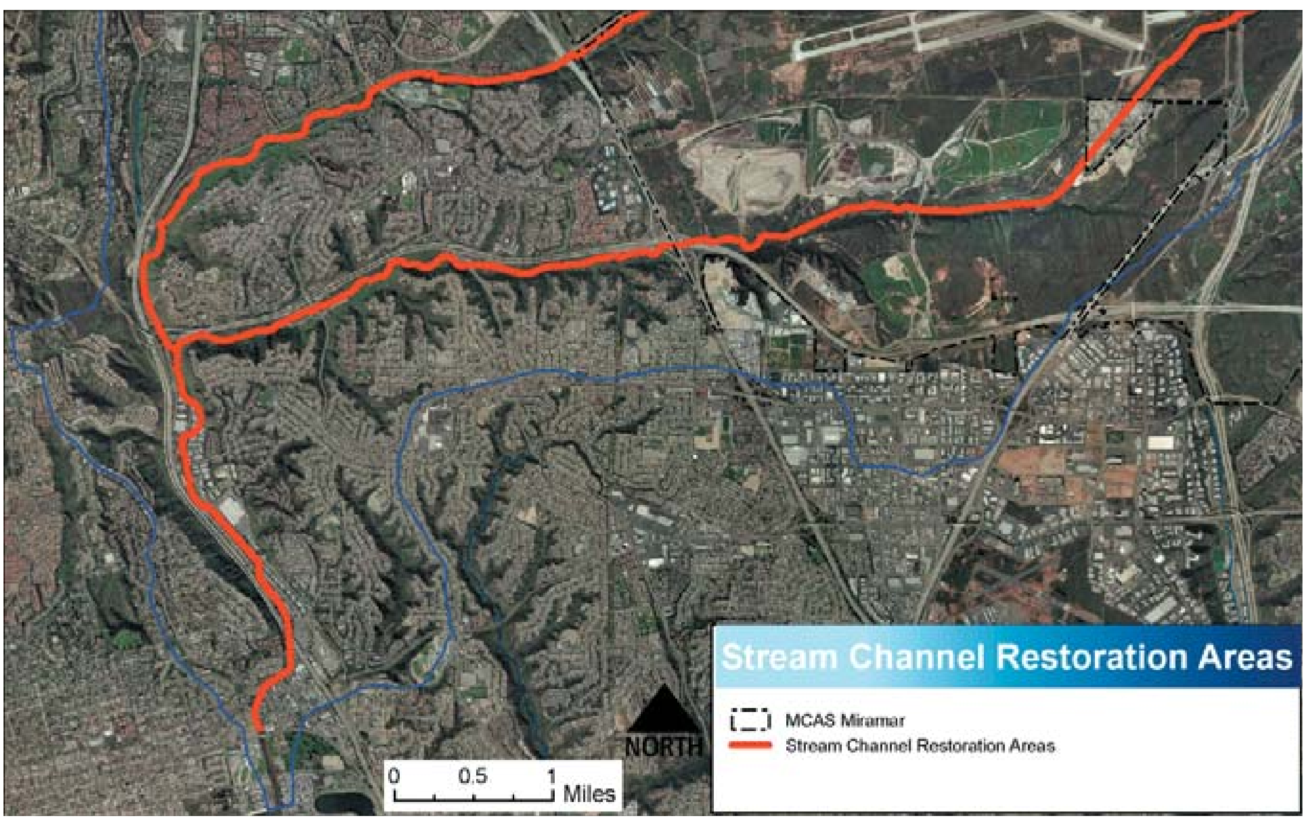
4.6 Water Resources

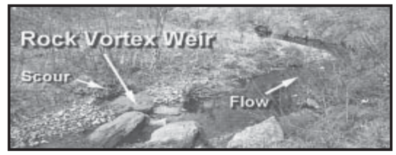
4.6.1 Streambed and Bank Restoration Techniques

The Streambed and Bank Restoration recommendation presented in Section 2.6.2 page 2-83 and Figures 2-51 to 2-53 identified a variety of locations where active streambed or bank erosion was apparent. In addition to these sites, the entire main stream channel of Rose and San Clemente creeks are recommended for potential streambed and bank restoration as shown in Figure 4-8. The application of any of the restoration techniques described below should be determined in part with the results of the recommended hydrology study in Section 2.6.1 page 2-80.

A variety of restoration techniques can be used to reduce the energy associated with the existing stream discharges and develop a more stable stream channel environment and are described briefly below. Many of the images shown came from two key sources: Restoring Streams in Cities, Riley 1998 and Urban Stream Restoration Practices, Center for Watershed Protection 2000. A key aspect of the approach within the RCW is to consider the problems on a watershed scale and not try to fix the issues at a given site without understanding how that site is affected by upstream activities and affects downstream activities. As such, the goal of the approach is to begin restoration efforts within the lower reaches of Rose Creek and work upstream using an adaptive management strategy to adjust the techniques being utilized to those that are being most effective and continuously re-evaluate the long-term goal of re-creating a functional stream channel and floodplain environment that is dynamic yet stable. Theoretically, by starting in the lower reaches the stream channel can be re-designed to cause incremental sedimentation to create reaches of flatter channel slopes terminated on either end by controlled steps in the streambed that gradually bring the streambed closer to its natural elevation, which in turn will re-connect the historic floodplain. The re-connection of the historic floodplain is important as it provides floodwater detention that contributes to lower stream discharge velocities, which in turn lessens the erosive forces within the stream channel and creates a more stable environment. Actions using these techniques within the main channels of Rose or San Clemente creeks are not recommended until the results of the Hydrologic Assessment are available as they will help guide the choice and design of appropriate techniques.

Figure 4-9: Potential locations for streambed and bank restoration

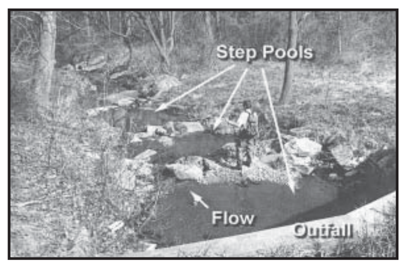




Rock Vortex Weir: A rock vortex weir is a structure designed to serve as grade control and create a diversity of flow velocities, while still maintaining the bed load sediment transport regime of the stream. The weir points upstream with the legs angling downstream at anywhere from a 15 to 30 degree angle relative to the stream bank. The legs are carried up the streambank to just above the bankfull elevation. The key component of the rock vortex weir is that the weir stones do not touch each other.

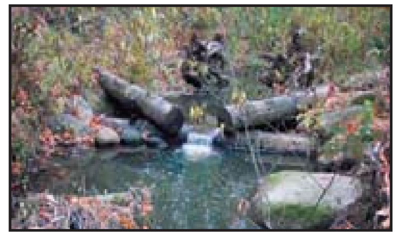
During baseflow conditions water is forced to flow around and between the stones creating a greater diversity of flow velocities and depths. During high flows the water rises over the weir stones creating a scour pool below the structure but allowing bed load sediments to move through. Built in this way, the weir will not cause significant sedimentation upstream or reduce the channel cross section to the point of causing the channel to widen or erode around the structure, as is sometimes the case with structures that span the stream above the invert (e.g., log drop structures). This device also works best as a grade control structure. Although, this must be judged against the amount of channel degradation expected. If a large nick point is migrating upstream toward the structure, measures must be taken to insure that the migrating nick point does not undermine the structure. In such cases a different type of structure such as a step pool should be utilized to halt the advance of the nick point. Rock vortex weir structures are more effective at preventing grade adjustments than halting them.

The rock vortex weir is constructed first by placing a foundation of boulders two to three feet in size in a trench excavated along the stream bottom. Large stones are then placed in the trench behind and against the footer stones so that they extend up to the desired elevation. A distance of 1/3 to ½ the stone width should be maintained between each stone. The rocks should extend up no more than 10 to 15% of the bankfull channel depth.



Step Pool: Step pools consist of a series of structures designed to dissipate energy in steep gradient sections of a stream. They are often used where a large nick point has formed and is migrating headward or where a channel has degraded below a culvert or outfall. They are made of large rock in alternating short steep drops and longer low or reverse grade sections. The number of steps is determined by the extent of the drop in invert of the stream. There are various configurations and arrangements of rock that can be utilized. The requirement is that whatever the design configuration chosen it must be stable at all flows, the rock must be large enough to be essentially immobile, and the drops should be low enough to allow aquatic life to migrate upstream.

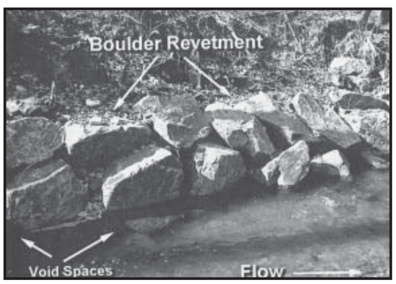
Log Drop: A log drop is a simple pool forming and grade control structure. Log drops mimic the influence of large woody debris (trees) that fall into the stream. Most log drops are formed of two 16" or greater diameter logs. The first log is laid in a trench perpendicular to the flow so that the top of the log is at or slightly below the stream invert and the ends of the log extend several feet into the streambank. A second log is placed atop the first until the logs rise in height to just above the baseflow level of the stream. Once the desired elevation is achieved, a weir notch is cut in the top log. The notch serves to concentrate the baseflow. Higher flows will form a scour pool below the log drop. It is important that the logs be keyed into the stream banks far enough to prevent them from being scoured out at high flows. The log/streambank interface must also be sufficiently stabilized with riprap or boulders to prevent washout around the sides.



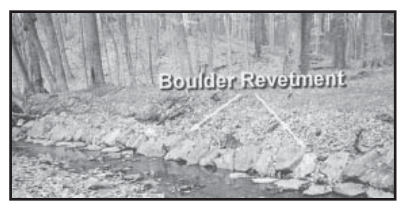
A variation of the standard log drop structure is the **V-log Structure**. Rather than having a single log that extends straight across the channel, two logs are used that form a V pointing upstream. The logs are lowest (at or below the stream invert) at the apex and rise into the stream banks. This structure has the advantage of not potentially creating a fish barrier and is more effective at concentrating flows and creating scour pools below the structure. Since it concentrates larger flows toward the middle of the channel, it is not likely to cause channel widening and bank erosion or deposition upstream.

Imbricated Riprap: Riprap is composed of various size large stones placed on the soil surface where the water contacts the soil. Live cuttings can be inter-planted in riprap to provide additional slope stability. Root growth below the riprap will improve soil strength and live vegetation will hide the rocks, presenting a more natural look. The stones are placed individually to ensure a tight fit with surrounding stones and good contact with the underlying soil, which distinguishes this method to standard riprap that is often dumped and can become habitat for invasive species such as the black rat.

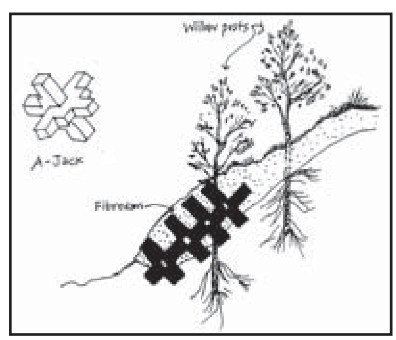
Boulder Revetments: Along streams, the most erosion prone area is the toe of the streambank. Generally, the lowest third of the stream bank experiences the highest erosive forces. Failure at the toe of the streambank can result in failure of the entire bank and lead to large influxes of sediment to the stream. Boulder revetments serve to protect the most vulnerable portion of the stream bank. Boulder revetments are often combined with bank stabilization for the streambank area above the revetment. On smaller streams, where bank heights may not exceed a few feet, boulder revetments (single, double, and large) can provide both lower and upper bank protection.



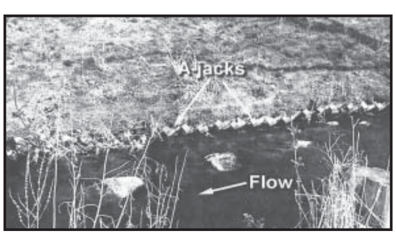
A boulder revetment consists of a series of boulders placed along a streambank to prevent erosion of the toe of the bank and in some cases to protect the entire bank. A single boulder revetment is created by first excavating a trench below the invert of the stream along the toe of the stream bank. In this trench, a series of generally large flat or rectangular boulders is placed as a foundation for the revetment stones. Once the foundation stones have been installed, the revetment stones are placed on top the foundation. If protection is needed higher on the bank, a second set of stone may be placed on top of the first (e.g., double stone revetment).

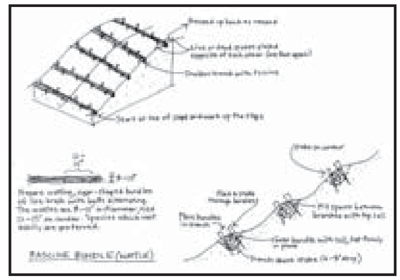


A-Jacks: A-jacks are three two-foot long cement stakes joined at the middle (six one-foot legs). They are a commercially made concrete product, originally made much larger (10-foot legs) to serve as breakwaters along shorefronts. They have been in use in the Midwest for several years. They serve to add structural stability to the lower stream bank.



A-jacks are manufactured in two pieces each weighing 45 lbs and are assembled onsite. The first step in the installation is to excavate a shallow trench along the toe of the stream bank. The A-jacks are assembled and placed in a row(s) along the trench so that each a-jack is interconnected with its neighbor. Rock, geotextile material or coir fiber is placed in the voids between the legs, and the a-jacks are backfilled. The upper bank is then stabilized using other bank stabilization techniques.





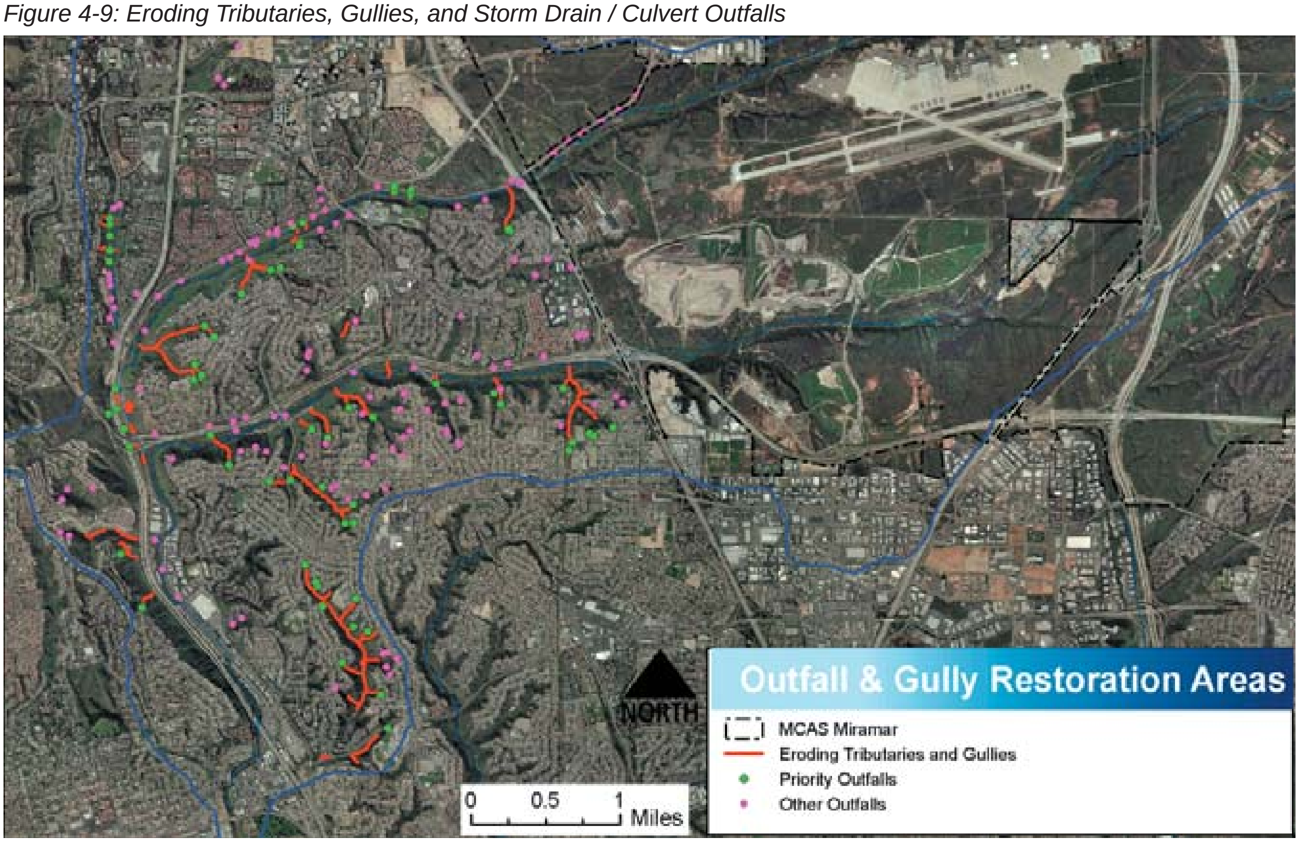
Fascines: Coir fascines are wattles made from the fibrous outer husk of coconuts. Coir is denser than water so it won't float and is very slow to decay. Coir fascines are readily available and are popular for streambank and wetland restoration. Live plants can be placed into coir fascines to create a natural look.

4.6.2 Gully Restoration Techniques

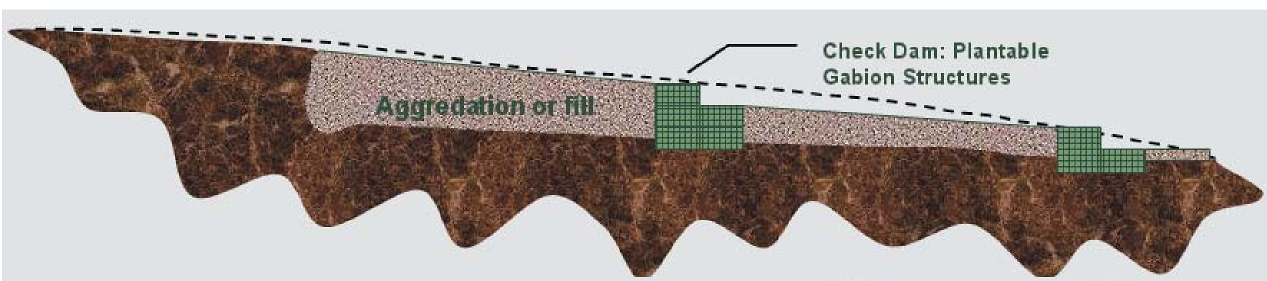
The Tributary and Gully Erosion recommendation presented in Section 2.6.2 page 2-83 and Figures 2-51 to 2-53 identified a variety of locations where active gully and tributary erosion was apparent as shown in Figure 4-9. The application of any of the restoration techniques described below should be determined in part with the results of the recommended hydrology study in Section 2.6.1 page 2-80.

Before restoring a gully, the original cause of the gully must first be determined - was it caused by a lowered drainage or change in slope gradient (e.g. streambed erosion); or was it caused by increases in downhill runoff. Both situations occur within the RCW, however most of the gullies and eroding tributaries identified in Figure 4-9 appear to be caused by increases in downhill runoff due to the contribution of storm drain runoff into the natural tributary canyons. The priority outfalls are all directly related to storm drain and culvert outfalls. The areas affected by lowered drainages and changes in slope gradient primarily occur within the main stream channels of Rose and San Clemente creeks and are addressed by the previously described restoration techniques in Section 4.5.1. A component of restoring the identified gullies and eroded tributaries will also include the restoration techniques described in Section 4.5.3 and the storm water runoff reduction techniques described in Section 4.5.4. Without the addition of these other techniques, the initial causes of the gully will not have been addressed and the chances for failure of the restoration will be elevated.

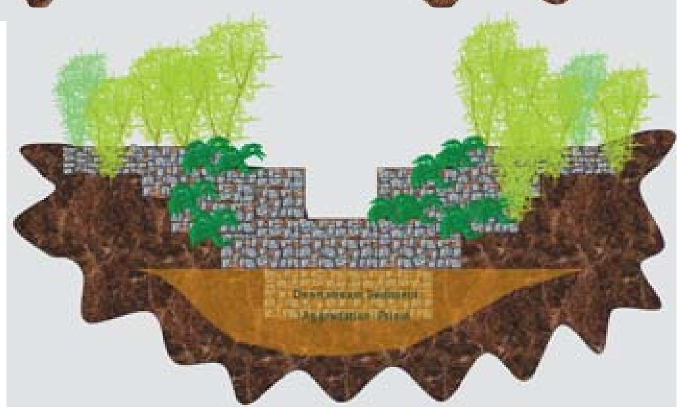
Figure 4-9: Eroding Tributaries, Gullies, and Storm Drain / Culvert Outfalls

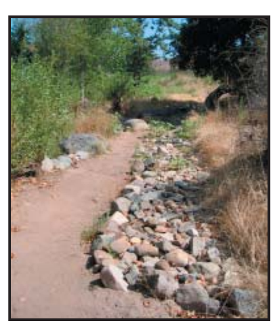


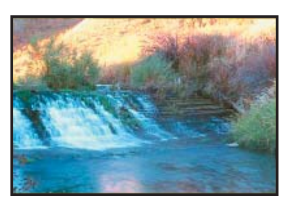
To restore the vast majority of the gullies and eroded tributaries the design and installation of check dams in combination with revegetation of the stream banks will be required. A sample profile of a series of check dams is shown below to illustrate how they can be used to rebuild the streambed to a more stable slope gradient. Also shown below is a sample section of a check dam to illustrate how it fits into the gully and provides a low flow opening and can be re-vegetated. In both illustrations, gabions (wire baskets filled with rocks and soil) are shown, however, other materials such as metal posts and wire with branches or willow posts and stakes with brush can also be used. The determining factor in selecting which materials to use will likely be the size of the gully being repaired. The largest gullies will likely require the use of gabions to provide the necessary structural stability to re-grade the streambed and banks and minimize the amount of upslope re-grading required along the stream banks to create more stable and plantable slopes. Several of the gullies identified were field measured at nearly 40 feet across and over 20 feet deep with nearly vertical walls for stream banks. If the streambed was left at the current elevation and the stream banks were re-graded to a more stable slope (even to a 1:1 slope) the top of the gully bank would need to be moved 20 feet, which in many situations is impossible. As such, the use of check dams to re-build and raise the streambed, potentially as much as 8 to 10 feet may be necessary before there is sufficient room to regrade the stream banks to more stable slopes (hopefully 2:1 or even 3:1). As with many of the other recommendations, the restoration of gullies is intended to be adaptive. Meaning start at the bottom; determine the amount of water that flows through the channel after different size storm events; design an appropriate channel dimension based on the predicted flows; plan and implement the first series of check dams; wait at least one full rainy season to determine how well the check dams are performing (may need to wait two or more to see significant sediment accumulation behind the check dams); plan the next series of check dams based on the results of the first making any necessary design modifications (e.g. are gabions stills needed or can other materials be used as the gully becomes smaller); as so on until the gully is fully restored.



As mentioned previously, a variety of materials can be used to construct check dams and repair gullies of various sizes. The photographs below depict a few examples.

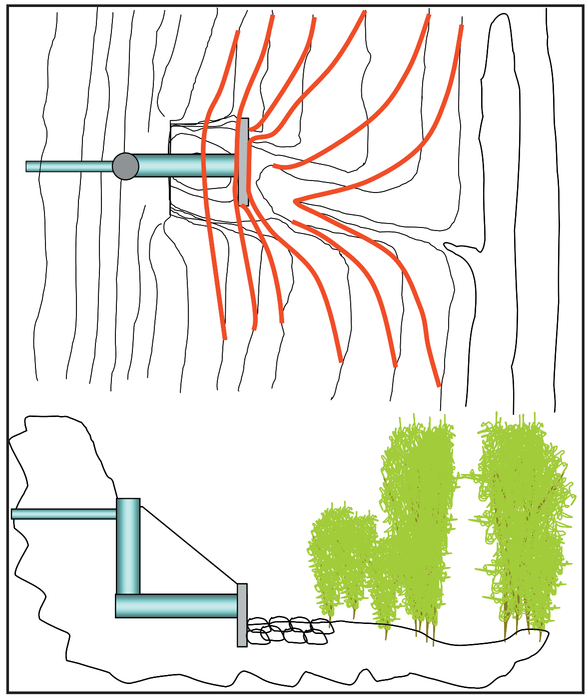






4.6.3 Outfall Restoration Techniques

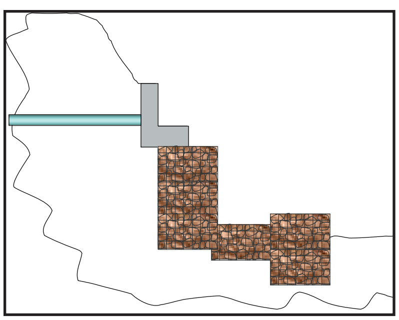
The Storm Drain and Culvert Erosion recommendation presented in Section 2.6.2 page 2-84 and Figures 2-51 to 2-53 identified a variety of locations where active storm drain and culvert outfall erosion was apparent as shown in Figure 4-9. The application of any of the restoration techniques described below should be determined in part with the results of the recommended hydrology study in Section 2.6.1 page 2-80.

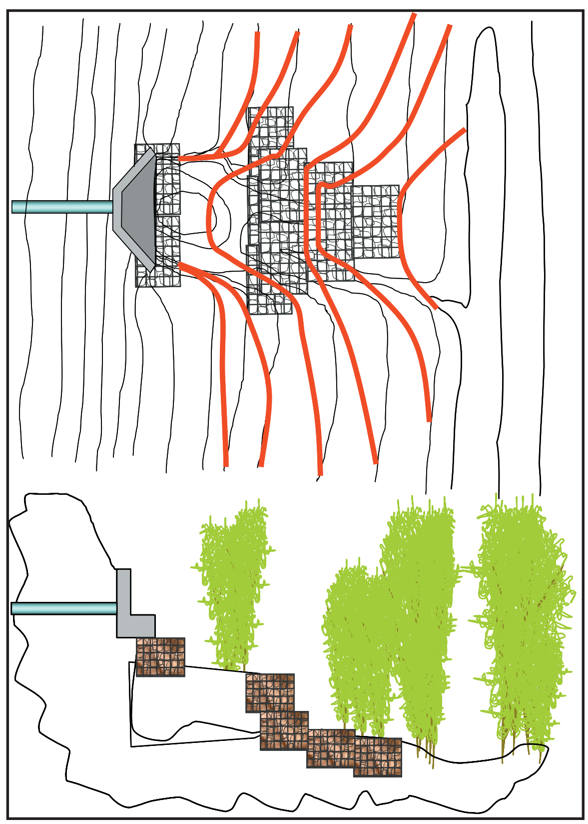


To correct the physical characteristics of each eroded outfall will require a final design that is customized for the location that balances environmental impacts and costs with the resultant benefit gained. It is intended that these typical solutions be used as guidance when designing the actual improvement project for each site.

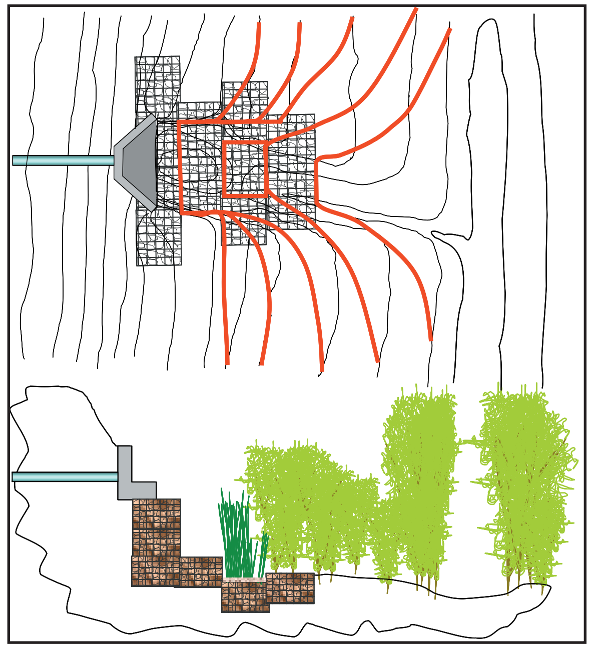
Outfall extension: Outfall extensions may be an appropriate solution where space is unavailable to undertake one of the other solutions that include more environmental restoration components as well. The goal of the outfall extension is to remedy the erosion by reducing the erosive forces of the discharge from an elevated outfall location. By extending the drain or culvert pipe down to the existing drainage bottom and providing energy dissipation the erosive forces of the discharges can be minimized.

Outfall energy dissipater only: The use of an energy dissipater alone to address issues related to an outfall that has not undergone significant erosion and scouring, but the velocity of the discharge is causing downstream erosion. Within these situations, the use of an energy dissipater to reduce the velocity of the discharge may be sufficient to remedy the issue and create a stable environment into the future.



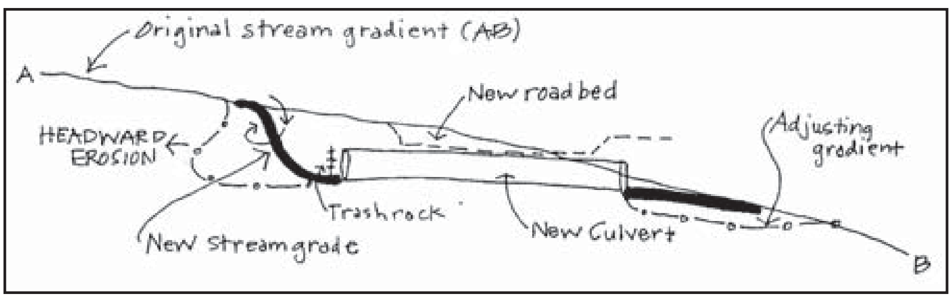


Outfall energy dissipater and partial restoration: The addition of some partial native plant restoration to the energy dissipater can provide several added benefits wherever space allows. The native vegetation can be used as a filtration device for trash, sediments, nutrients, and other pollutants. When used for this purpose, the native vegetation may need to be managed and periodically pruned or replaced to prevent the bound pollutants from being re-released into the environment. Whether used specifically for this purpose or not the native vegetation can provide habitat and protective cover for wildlife, help moderate water temperature, reduce the need for hard structures (e.g. riprap), and aesthetically soften the visual landscape within these impacted areas.



Outfall energy dissipater and full restoration: When space allows and impacts to existing resources would be minimal or non-existent a full native plant restoration should be considered in addition to an energy dissipater. As in the partial native plant restoration option the native vegetation can provide habitat and protective cover for wildlife, help moderate water temperature, and aesthetically soften the visual landscape within these impacted areas. Additionally, the full restoration will minimize the need for hard structures (e.g. rip-rap) further as the goal is to re-create an environment suitable for native vegetation to establish and maintain itself without maintenance. A portion of the restoration area can be designed and managed as a filtration device for trash, sediments, nutrients, and other pollutants. Again, when used for this purpose, the native vegetation may need to be managed and periodically pruned or replaced to prevent the bound pollutants from being re-released into the environment.

Culvert Re-design and Installation: At times it may be necessary to consider removing, re-designing, or installing a new culvert that properly maintains the existing channel slope to avoid upstream sedimentation or downstream erosion and scour holes. Even with a re-design of the culvert, one of the preceding solutions may also need to be implemented in order to remedy the causes and existing impacts of the erosion.



4.6.4 Concrete Flood Control Channel Restoration Techniques

The Modify Flood Control Channels recommendation presented in Section 2.6.3 page 2-88 and Figure 2-54 identified the four major sections of concrete flood control channels. The application of any of the restoration techniques described below should be determined in part with the results of the recommended hydrology study in Section 2.6.1 page 2-80.

The restoration of the concrete flood control channels is one of the key recommendations and goals of this Assessment. The existing concrete flood control channels provide no vegetative habitat; provides inhospitable aquatic habitat; are a barrier to wildlife movement; contribute to higher water temperatures; and are aesthetically displeasing.

The types of concrete channel modifications anticipated are depicted in Figures 4-10 and 4-11. Figure 4-10 shows how gabion structures could be used to replace the existing concrete channels to create benches to support various vegetation communities while maintaining the same cross-sectional volume as the existing channel. This would be appropriate if the results of the hydrologic and hydraulic assessment show that the current flood volumes and flow rates are still contained within the existing channel configuration. The goals of this approach are to provide varied physical conditions to promote the establishment of diverse vegetation communities and associated wildlife species while maintaining the necessary channel volume for flood conveyance.

Figure 4-10: Cross-section of restored creek channel within existing channel

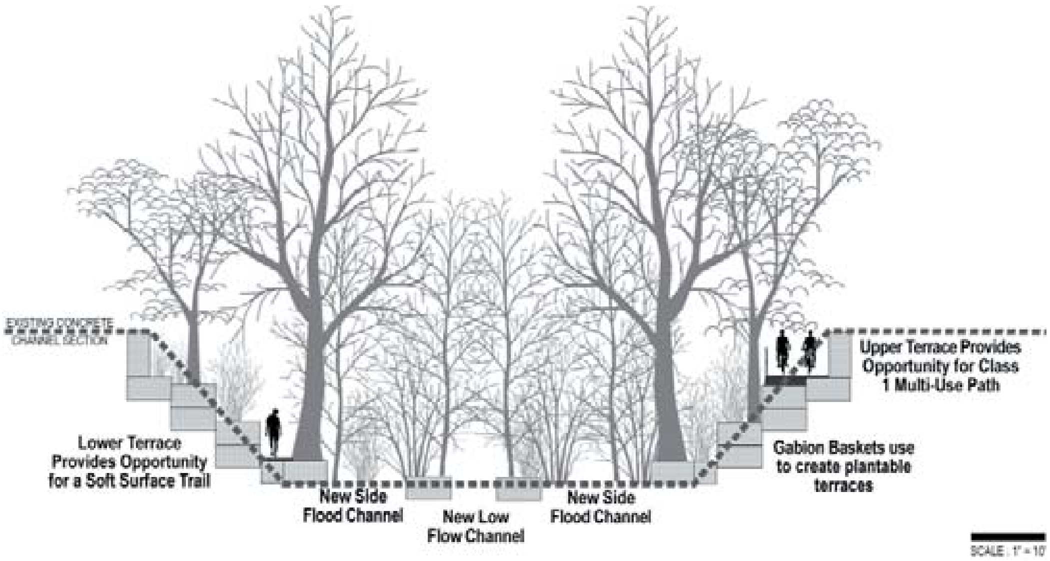


Figure 4-11 shows how near-vertical sidewalls can be introduced to increase the cross-sectional volume of the channel to accommodate increased flood flows that may currently exceed the capacity of the existing channel. This would be appropriate if the results of the hydrologic and hydraulic assessment show that the current flood volumes and flow rates are no longer contained within the existing channel configuration, thereby creating a need for an increase in the cross-sectional volume of the channel to minimize flood risks. The goals of this approach are the same as in the previous version with the addition of the need to increase channel capacity to convey the 100-yr flood. As part of this approach, maximum expansion of the channel width should be considered to accommodate additional runoff from future development during large storm events.

Figure 4-11: Cross-section of restored creek channel with expanded channel

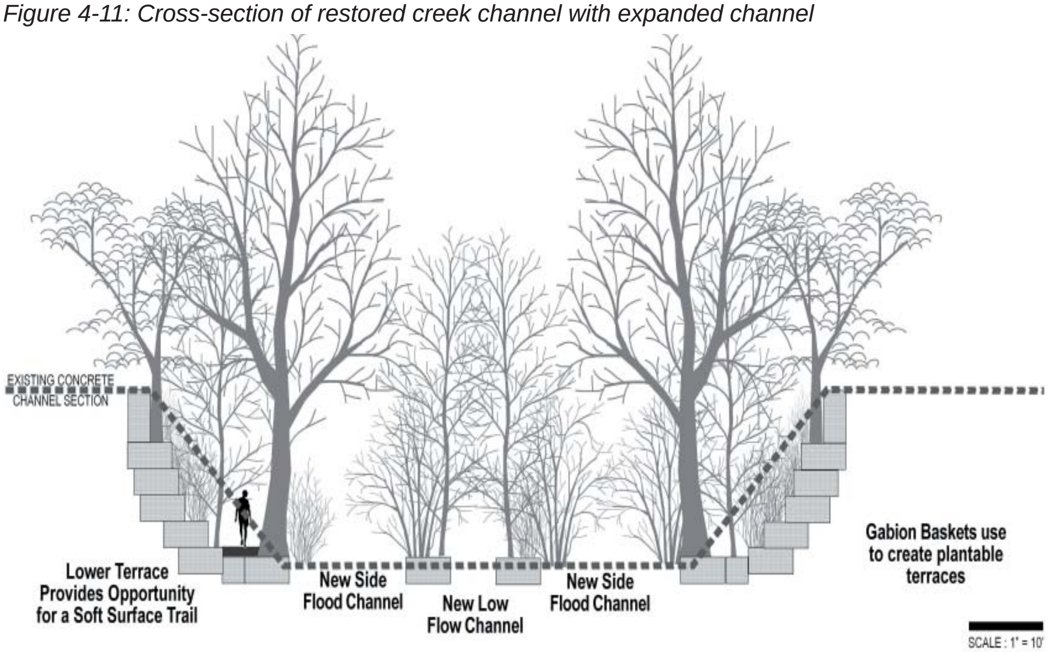
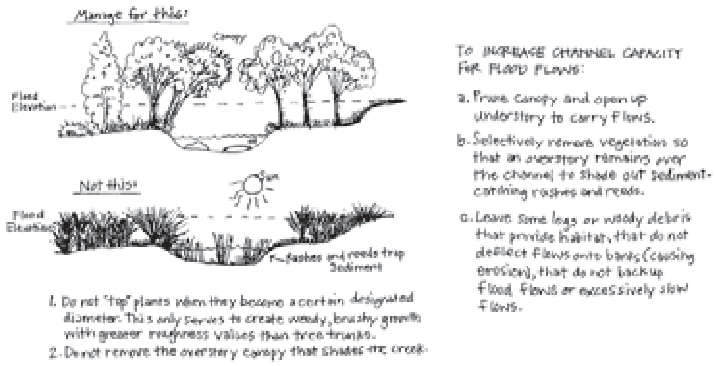


Figure 4-12: Vegetation Management within the



The combination of these two goals will likely require regular maintenance of the channel environment to ensure flood capacity is not jeopardized by the growth of a thick understory of brush as shown in Figure 4-12. Environmentally this approach is similar to brush management policies related to Defensible Space requirements to reduce risks from wildland fire where experts have concluded that the thinning of 50 percent of vegetative cover does not result in significant environmental harm. In fact, in this instance since the canopy trees are only having their lower branches pruned up and not being removed the harm related to thinning the understory is significantly reduced.

4.6.5 Techniques to Reduce Trail Erosion

The Trail Erosion recommendation presented in Section 2.6.2 page 2-84 and Figures 2-51 to 2-53 identified the locations of trail erosion identified as part of the field work for this Assessment, which are shown in Figure 4-13 as well. Most trail related erosion can be readily corrected using nothing more than hand tools to re-grade the trail section as shown in the figures that follow. However, some of the areas of trail erosion are bad enough that material may need to be brought near the site with equipment and then hauled to the site by wheel barrow or other manual means to fill gullies before trail re-grading can occur. Two of the trails should be addressed as soon as possible to prevent additional erosion during the upcoming wet season. The first is the main trail within the Rose Canyon Open Space Park (marked in red in Figure 4-13) that needs to have rolling grade dips installed to direct storm runoff off of the path. This is currently prevented by a small berm along the path that resulted from previous maintenance grading of the path for utility access purposes. The second site is the trail entering Marian Bear Memorial Natural Park from the SDG&E access road off Lehrer Drive (marked in red in Figure 4-13) that needs to have a gully filled in and the trail re-graded before it is lost completely to erosion.

Figure 4-13: Locations of Trail Erosion

Knick: A knick is a semi-circular, shaved down section of trail, about 10 feet in diameter that is canted to the outside. A knick is smooth and subtle; its presence can go virtually unnoticed.

Rolling Grade Dip: A rolling grade dip builds on the knick device. It features a similar out-sloped depression in the tread, followed by a long, gentle ramp made of soil.

Figure 4-14: Diagram of Knick

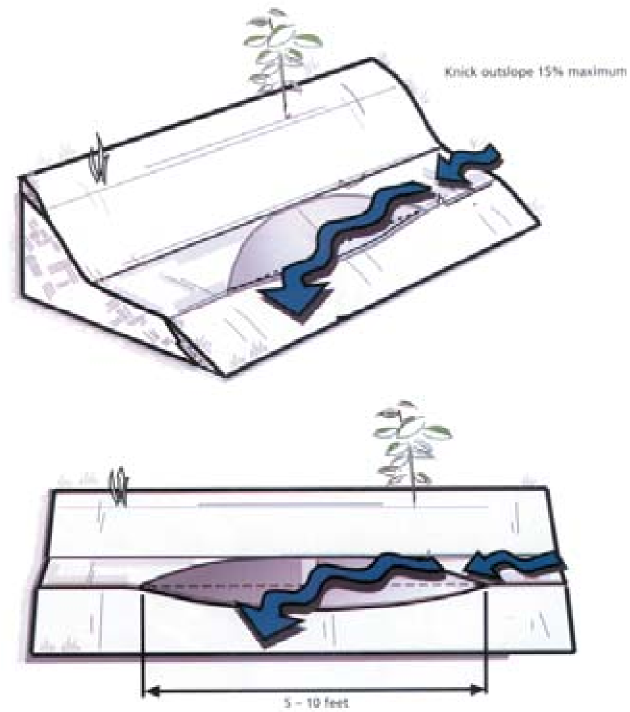
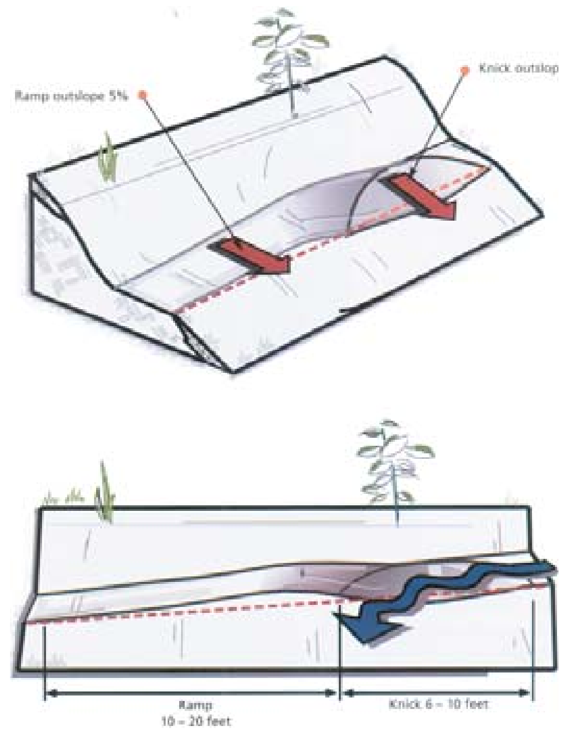


Figure 4-15: Diagram of Rolling Grade Dip

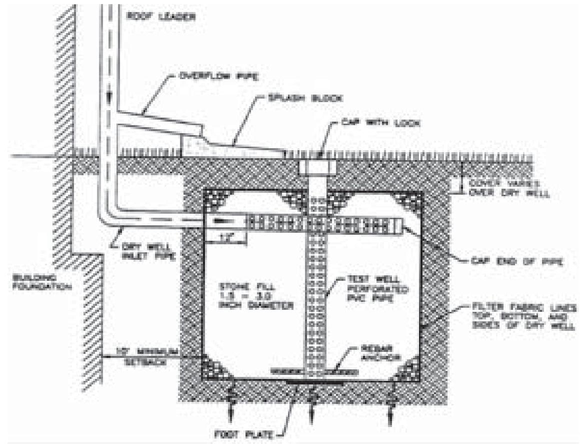


4.6.6 Storm Water Runoff Reduction Techniques

The Storm Water Runoff Reduction recommendation presented in Section 2.6.4 page 2-92 identified a variety of techniques for reducing storm water runoff and are described below in more detail.

Rain Barrels: A rain barrel is a system that collects and stores rainwater from your roof that would otherwise be lost to runoff and diverted to storm drains and streams. Usually a rain barrel is composed of a 55 gallon drum, a vinyl hose, PVC couplings, a screen grate to keep debris and insects out, and other off the-shelf items, a rain barrel is relatively simple and inexpensive to construct and can sit conveniently under any residential gutter down spout. Ready-made rain barrels can be purchased from numerous companies.

Lawn and garden watering make up nearly 40% of total household water use during the summer. A rain barrel collects water and stores it for when you need it most – during periods of drought - to water plants, wash your car, or to top off a swimming pool. It provides a supply of free “water” to homeowners, containing no chlorine, lime or calcium making it ideal for gardens, flowerpots, and car and window washing. Saving water not only helps protect the environment, it saves you money and energy (decreased demand for treated tap water). Rain barrels reduce water pollution by reducing stormwater runoff, which can contain pollutants like sediment, oil, grease, bacteria, and nutrients. Diverting water from storm drains also decreases the impact of runoff to streams.

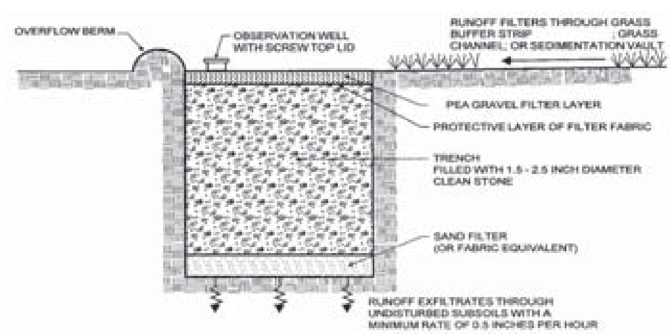


Dry Wells: A Dry Well, sometimes called a French Drain, is a subsurface storage facility that temporarily stores and infiltrates stormwater runoff typically from the roofs of structures. Roof leaders connect directly into the Dry Well, which may be either an excavated pit filled with uniformly graded aggregate wrapped in geotextile or a pre-fabricated storage chamber. Dry Wells discharge the stored runoff via infiltration into the surrounding soils. In the event that the Dry Well is overwhelmed in an intense storm event, an overflow mechanism (surcharge pipe, connection to larger infiltration area, etc.) will ensure that additional runoff is safely and efficiently conveyed downstream.

Dry wells should only be used with soils having suitable infiltration capacity (as confirmed through field testing). The minimum acceptable field-measured soil infiltration rate is 0.3 inches per hour. Field-measured soil infiltration rates should not exceed 5.0 inches per hour. This generally restricts application to soils of NRCS Hydrologic Soil Group A. Some Group B soils may be suitable if field-measured infiltration rates exceed 0.3 inches per hour. One infiltration test and test pit or soil boring is recommended at the proposed location of the dry well. An observation well consisting of a well-anchored, vertical perforated PVC pipe with lockable above ground cap should be installed to monitor system performance.

A variety of design considerations have also been developed for the use and placement of Dry Wells:

1. Dry Wells should be designed to accommodate runoff volumes for up to the 2-year storm.
2. Dry Wells should drain-down within 48 hours. Longer drain-down times reduce Dry Well efficiency and can lead to anaerobic conditions, odor, and water quality problems.
3. In general, 10 feet of separation is recommended between Dry Wells and building foundations. However, this distance may be shortened at the discretion of a geotechnical or structural engineer. Shorter separation distances may warrant an impermeable liner to be installed on the building side of the Dry Well.
4. As the water level in a Dry Well is the primary means of measuring infiltration rates and drain-down times, adequate inspection and maintenance access to the well should be provided. Observation wells not only provide the necessary access to the well, but they also provide a conduit through which pumping of stored runoff can be accomplished in a failed system.
5. Though roofs are generally not a significant source of runoff pollution, they can still be a source of particulates and organic matter, as well as sediment and debris during construction. Measures such as roof gutter guards, roof leader clean-out with sump, or an intermediate sump box can provide pretreatment for Dry Wells by minimizing the amount of sediment and other particulates that may enter it.



Infiltration Trenches: An infiltration trench is a shallow excavated trench backfilled with stone to create an underground reservoir. Because they are wider at their largest surface dimension than they are deep, infiltration trenches are not classified as dry wells, even though they operate under the same guidelines. Storm water drains into the trench and then seeps into the surrounding soil. To help prevent clogging of the trench, storm water runoff is often pretreated through some sort of filtering device to remove large particles of soil including associated pollutants, sand, and oil.

Rain Gardens: A rain garden uses native landscaping to soak up rain water mainly from your roof, but also from your driveway and lawn. The middle part of the garden holds several inches of water, allowing it to slowly infiltrate into the ground instead of being delivered to the storm drain all at once. A rain garden allows 30% more water to infiltrate into the ground than a conventional lawn. This helps replenish the groundwater supply, and reduces the amount of pollution that reaches our streams through stormwater runoff, such as fertilizers and pesticides. Since studies show that the first inch of rainfall is responsible for the bulk of the pollutants in stormwater, a rain garden is designed to temporarily hold water from a one-inch rainstorm, and slowly filter out many common pollutants like sediment, oil, grease and nutrients. By reducing the volume of water that drains into the storm drain system, rain gardens can also reduce the chances for local flooding, as well as localized erosion near the outfall of the storm drain. Rain gardens require less watering, fertilizers, and pesticides than conventional lawns, and provide habitat for birds and butterflies.

Each of these practices can reduce the volume of runoff from a given property by varying amounts when installed alone. However, if installed in combination, they have the potential to all but eliminate runoff from a given property during most storm events. An example of installing them in combination would be to utilize one or more rain barrels that overflow to a trench drain, that flows into a rain garden, that overflows into a drywell, that finally drains into the public storm drain system. In this manner, runoff is captured within the rain barrels for use later, infiltrates into the ground while flowing through the trench drain, continues to infiltrate into the ground in the rain garden while also being absorbed by the roots of the plants, and finally infiltrating out of the dry well.

The potential reduction of runoff volume can be calculated by adding each practice together:

Rain Barrels (x3) at 50 gallons each = 150 gallons
Infiltration Trench (20-ft long, 1-ft wide, 2-ft deep, drain pipe 8 in. from bottom, 50% capacity = 50 gallons
Rain Garden (20-feet long, 8-feet wide, ave 1-foot deep, 25% capacity = 300 gallons
Dry Well (4-ft diameter, 6-ft deep, overflow 1-ft from top, 50% capacity = 235 gallons
Total for all practices = 735 gallons

The example (Section 2.6.4 on page 2-90) 0.5 inch storm from a 2,000 sq.ft. home produced 623 gallons of runoff. This volume of runoff would be completely captured by the series of practices just described.