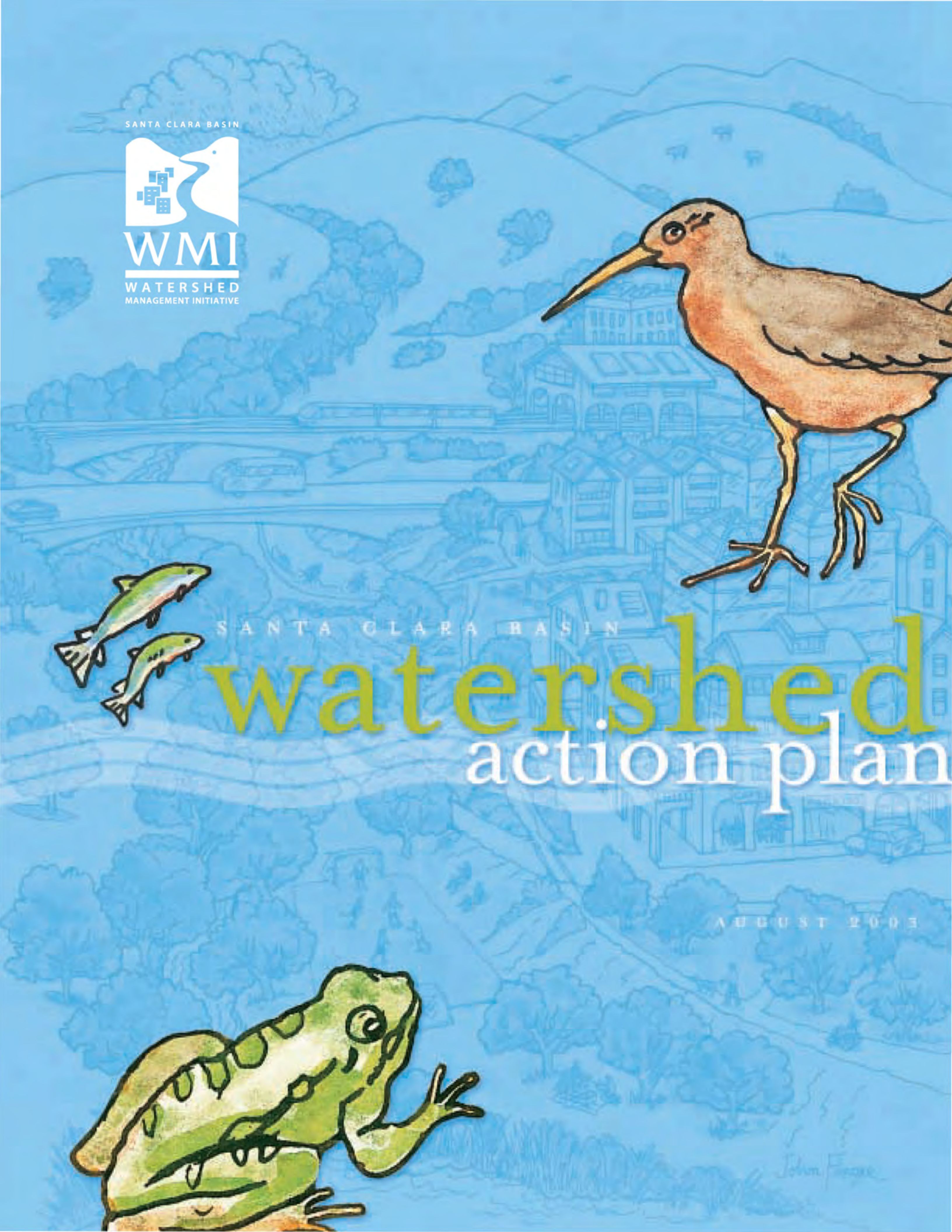
SANTA CLARA BASIN
WMI
WATERSHED
MANAGEMENT INITIATIVE

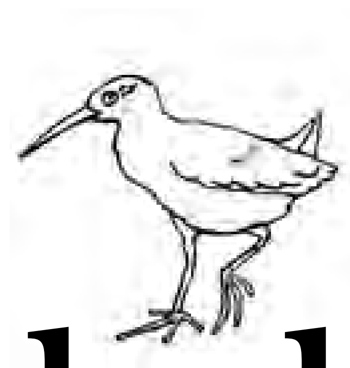


SANTA CLARA BASIN

watershed action plan

AUGUST 2003

WMI



watershed action plan

WMI

funded by
SANTA CLARA VALLEY WATER DISTRICT
and the cities of SAN JOSE, PALO ALTO, and SUNNYVALE

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ACWD	Alameda County Water District	6-2
BASMAA	Bay Area Stormwater Management Agencies Association	4-4
BMP	Best Management Practice	4-4
BOD	Biochemical Oxygen Demand	9-2
Cal-EPA	California Environmental Protection Agency	6-6
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CHCs	Chlorinated Hydrocarbons	9-8
CHCWG	RMP Chlorinated Hydrocarbon Workgroup	9-8
CRMP	Coordinated Resource Management Planning	9-10
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ACRONYMS AND ABBREVIATIONS

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EIR	Environmental Impact Report	3-7
ESA	Federal Endangered Species Act	7-2
FAHCE	Fisheries and Aquatic Habitat Collaborative Effort	6-3
FDA	US Food and Drug Administration	9-6
FEMA	Federal Emergency Management Agency	5-3
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GCMS	Gas Chromatograph/Mass Spectroscopy	9-11
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HCP	Habitat Conservation Plan	3-9
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IWRP	Integrated Water Resources Planning	6-4
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LTMAP	Long Term Monitoring and Assessment Plan	9-10
MCMP	Metals Control Measures Plan	9-5
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NFIP	National Flood Insurance Program	5-3
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PBDEs	Polybrominated diphenyl ethers	9-11
PCBs	Polychlorinated Biphenyls	2-8
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SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program	1-1
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SFEI	San Francisco Estuary Institute	9-11
SMP	Stream Maintenance Program	8-7
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SOILS	Sediment Observations in Lotic Systems	9-10
SPLWG	RMP Sources, Pathways, and Loadings Work Group	9-8
SWRCB	State Water Resources Control Board	1-1
TIE	Toxicity Identity Evaluation	9-9
TMDL	Total Maximum Daily Load	9-4
TWG	TMDL Work Group	9-5
USEPA	United States Environmental Protection Agency	1-1
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VTA	Valley Transportation Authority	5-9
WAP	Watershed Action Plan	1-3
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EXECUTIVE SUMMARY

ES-1 | The WMI and the Watershed Action Plan

The Santa Clara Basin Watershed Management Initiative (WMI) is a collaborative, stakeholder-driven effort among representatives from regional and local public agencies; civic, environmental, resource conservation and agricultural groups; professional and trade organizations; business and industrial sectors, and the public.

The WMI's watershed, the Santa Clara Basin, encompasses southern South San Francisco Bay (south of the Dumbarton Bridge) and the 840-square-mile area that drains to it.

The WMI's mission is to protect and enhance the watershed, creating a sustainable future for the community and the environment.

The WMI's goals are:

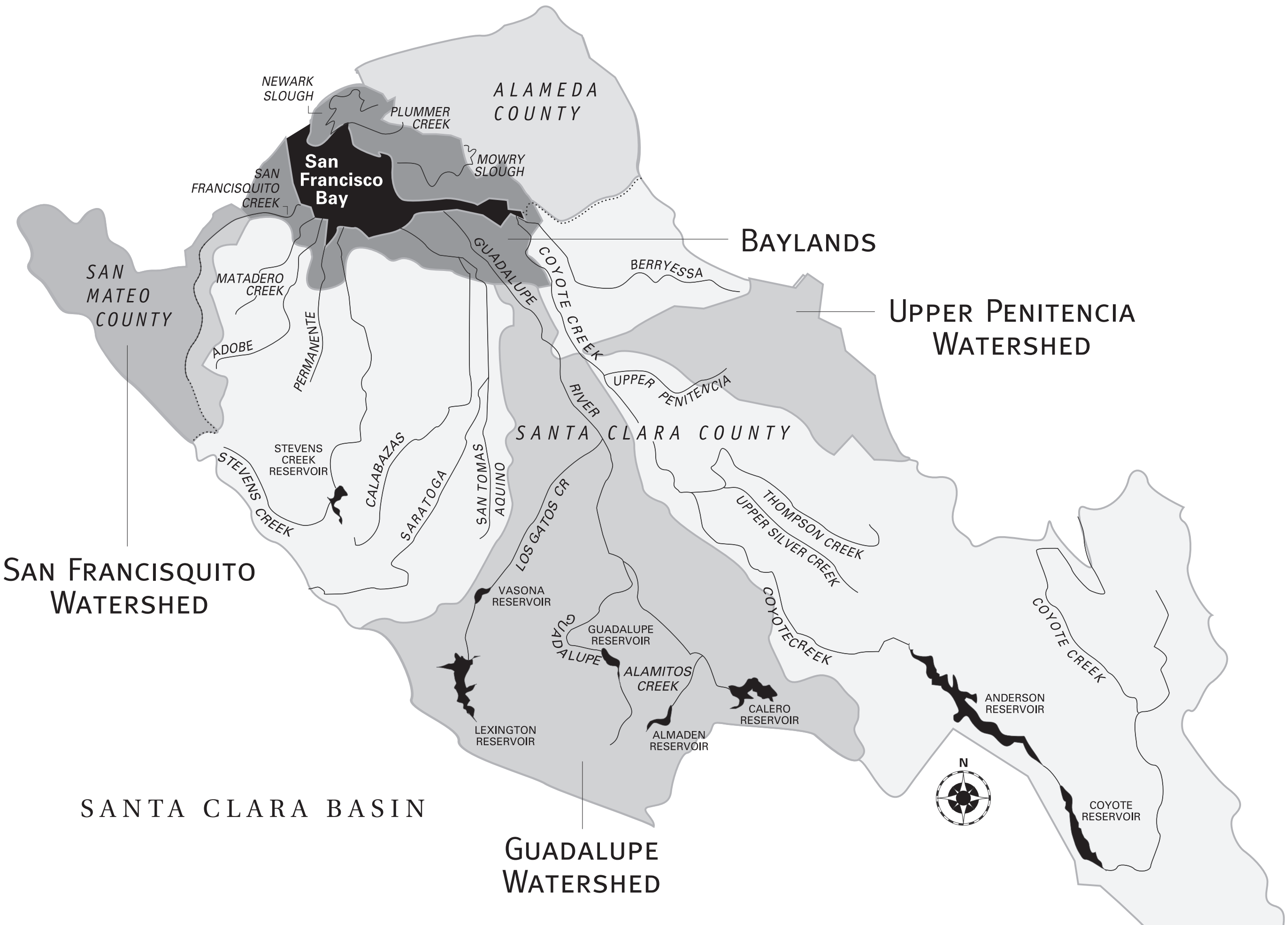
- Ensure that the WMI is a broad, consensus-based process.
- Ensure that necessary resources are provided for WMI implementation.
- Simplify compliance with regulatory requirements without compromising environmental protection.
- Balance the objectives of water supply management, habitat protection, flood management, and land use to protect and enhance water quality.
- Protect and/or restore streams, reservoirs, wetlands, and the Bay for the benefit of fish, wildlife, and human uses.
- Develop an implementable Watershed Management Plan that incorporates science and will be continuously improved.

The WMI's *Watershed Management Plan* consists of three volumes:

1. A *Watershed Characteristics Report,* produced in 2000–2001.
2. A *Watershed Assessment Report,* completed in February 2003, which presents the results of pilot assessments conducted in the Guadalupe River, San Francisquito Creek, and Upper Penitencia Creek watersheds.
3. This *Watershed Action Plan.*

To create the *Watershed Action Plan,* subgroups of stakeholders first developed about 112 "Action Worksheets." The Action Worksheets defined the WMI stakeholders' universe of common concerns and repre-

The WMI's mission is to protect and enhance the watershed, creating a sustainable future for the community and the environment.



Source: Santa Clara Valley Water District

sented preliminary consensus on what is to be done to protect and enhance Santa Clara Basin watersheds.

A Watershed Action Plan Technical Advisory Group, composed of stakeholder technical staff, helped prepare the Action Plan.

ES-2 | The WMI's Vision for Santa Clara Basin Watersheds

Mining, forestry, agriculture, and urbanization have radically altered the Santa Clara Basin's natural resources. However, the streams, rivers, wetlands, and Bay, and the watersheds that drain to them, still support rare species and native ecological communities.

In the coming decades, urban development and redevelopment, upgrades to the transportation system, and flood protection projects will continue to alter and transform Basin watersheds. WMI stakeholders believe this continued change could be managed to sustain economic growth, improve quality of habitat, promote social equity, and enhance natural habitats. Business, society, and government must work together to find ways to balance the needs of water supply, flood management, and habitat protection with needs for housing, recreation, and economic activity.

The WMI envisions a future Santa Clara Basin where:

- Habitat areas stretch contiguously from salt marsh to hilltop, comprising large, connected patches of tidal marsh, continuous riparian forests alongside streams, and buffer areas upland from tidal and riverine wetlands.
- These green corridors separate intensely developed neighborhoods where new and retrofitted buildings, streets, and drainage systems retain or treat runoff.
- Streamside areas are protected from development so that floods can naturally replenish groundwater and sediments without damaging homes and businesses.
- Water is used and reused efficiently, so that there is enough for homes and gardens and industries and also enough to support the natural seasonal cycles of stream and wetland habitats.
- The Basin's diversity of habitats and species is preserved, riparian and woodland areas are protected and/or restored, invasive plants and animals are controlled, and recreational uses are designed to be compatible with habitat protection.
- Streams flow freely, stream habitats are restored, barriers to fish migration are removed, and native fish species rebound.
- Pollutants do not impair aquatic life, and waters are fishable and swimmable.

A myriad of existing regulations and local government programs are already contributing to each aspect of this vision. However, the regulations and programs grew up one at a time as individual environmental issues emerged. Political systems, like ecosystems, are integrated and interdependent, and many of these programs now overlap. They sometimes even conflict with one another.

Aligning, coordinating, and integrating the funding, staffing, and authority vested in existing environmental-protection programs can accelerate environmental improvements. However, the bureaucratic barriers are daunting. The WMI will focus on finding ways to overcome these barriers.

ES-3 | Strategic Objectives and Next Steps for the WMI

The *Watershed Action Plan* outlines existing environmental-protection programs in each of seven areas and proposes "strategic objectives" for aligning, coordinating, and integrating the programs in each area. The plan also lists "next steps" that the WMI may undertake to promote each strategic objective.

The strategic objectives and next steps follow:

Incorporate the WMI Vision into General Plans and Specific Area Plans (Chapter 3). The WMI advocates that General Plans should incorporate detailed maps and plans to protect and enhance

watersheds. Cities, towns, and the County should study obstacles to implementing detailed maps of habitat corridors in General Plans and should consider how to make these maps part of future General Plan updates. Agencies that acquire and manage open space in the Santa Clara Basin should coordinate their individual strategies and link their efforts with General Plans, Habitat Conservation Plans/Natural Community Conservation Plans (HCPs/NCCPs), and floodplain management.

To further this objective, the WMI will:

- Convene and facilitate groups of stakeholders to participate in adaptive management for in-stream projects and programs.
- Convene a dialogue with Planning Commissioners and Directors regarding the use of General Plans and Specific Area Plans to implement, over the long term, the WMI's vision of continuous habitat corridors and intensely developed neighborhoods.
- Consider, in this dialogue, how to include more detailed watershed analyses in Environmental Impact Reports and balance cumulative impacts with mitigations across jurisdictional lines.
- Join or convene discussions among agencies that acquire and manage open space and work toward strategies for assembling continuous habitat corridors.
- Cultivate alliances with, and bring the WMI's vision to, "Smart Growth" advocates.
- Research examples where municipalities have used their authority under California's planning and zoning law to implement watershed-based land-use planning.
- Coordinate and integrate municipal land use planning with other WMI objectives, including riparian and floodplain planning and habitat conservation planning.
- Develop indicators of progress for land-use planning.

Drainage Systems that Detain or Retain Runoff (Chapter 4). The WMI advocates site development designs and drainage system designs that detain or retain runoff where needed to protect streams from flash runoff, erosion and pollutants, and to protect from downstream flooding, while preventing groundwater pollution. Cities, towns, and the County's standards for site development and drainage systems should encourage practices to minimize runoff entering the storm drain system or waterways. In areas where increased runoff could cause increased erosion of creek beds and banks, siltation, or other effects on streams, new and rebuilt sites and drainage systems should (where feasible) incorporate features to detain or retain runoff.

To further this objective, the WMI will:

- Work with the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) to facilitate implementation of the new NPDES requirements for new development (also known as the "C.3. Provisions") in the Regional Water Quality Control Board for the San Francisco Bay Region (RWQCB) stormwater discharge permit.

- Review the results of SCVURPPP's Development Policies Comparison and identify policies that limit detention and infiltration of runoff and potential improvements to policies controlling erosion and sedimentation from construction sites.
- In cooperation with SCVURPPP, develop model public works policies, specifications, and details to encourage detention and infiltration of runoff and to control erosion and sedimentation from construction activities.
- Coordinate and integrate implementation of the guidance manual and other outcomes of SCVURPPP's hydrographic modification management plans with stream stewardship plans (Chapter 8) and with General Plans and Specific Area Plans (Chapter 3).
- In cooperation with SCVURPPP, distribute model public works specifications and details to municipalities in presentations to managers and public works departments and in workshops for public works staff, developers, and engineering consultants.
- Provide a neutral place where contentious issues relating to drainage design methods and effectiveness can be referred.
- Develop indicators of progress for buildings, streets, and drainage.

Integrated Planning of Floodplains and Riparian Corridors (Chapter 5). The WMI advocates an integrated planning process to chart the future landscape of the Basin's floodplains and riparian corridors. The process should incorporate the cities' riparian corridor policies, the policies and procedures being developed by the Watershed Resources Protection Collaborative, applicable provisions in the cities' and County's General Plans, existing and planned recreational uses within floodplains and riparian areas, the Countywide Trails Master Plan and Uniform Interjurisdictional Trail Design, Use, and Management Guidelines, the National Flood Insurance Program, and benefits attainable under the Federal Emergency Management Agency's (FEMA's) Community Rating System. The plans should also consider potential habitat for the red-legged frog and other riparian species.

To further this objective, the WMI will:

- Work with the County, municipalities, SCVWD, and other agencies, provide a forum and develop a process for integrated planning of floodplains and riparian corridors.
- Provide a neutral place where potentially contentious floodplain management issues (e.g., protection from flooding vs. floodproofing for specific areas; e.g., location of recreational facilities) can be referred.

Standards for site development and drainage systems should encourage practices to minimize runoff entering the storm drain system or waterways.

- Promote and popularize natural flood protection and floodplain management as a component of the WMI's vision.
- Develop an outreach strategy that focuses on the multiple uses of stream corridors.
- Coordinate and integrate floodplain and riparian corridor planning with other WMI objectives, including watershed stewardship planning (Chapter 8), habitat conservation planning (Chapter 7), and General Plans (Chapter 3).
- Develop indicators of implementation and effectiveness of multi-use planning for floodplains and riparian corridors.

Integrated Water Resources Planning (Chapter 6). SCVWD, San Jose, and the Basin's other cities and towns should use Integrated Water Resources Planning (IWRP) to focus and coordinate their water conservation and recycling policies and programs. The process should document the many environmental and social benefits of water conservation and recycling—more water to support stream ecosystems in the Santa Clara Basin and statewide, more reliable water supply, and reduced effects of freshwater discharges—and should link these benefits to the overall water supply strategy. Conservation and recycling should be built into projections of future demand that are used for planning potable water supply.

To further this objective, the WMI will:

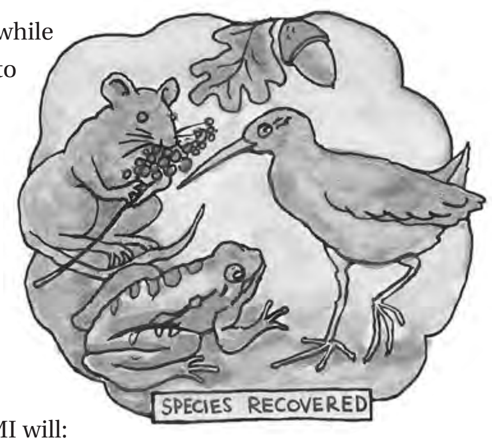
- Develop broad representation and facilitate efficient decision-making in SCVWD's IWRP stakeholder process.
- Communicate SCVWD's IWRP participants' consensus to agency decision-makers.
- Organize and facilitate outside expertise and technical resources.
- Gauge and build public support for water conservation and recycling.
- Promote water conservation as a component of the WMI's strategy to protect and enhance Basin watersheds.
- Coordinate and integrate SCVWD's IWRP with other WMI objectives including watershed stewardship planning (Chapter 8) and habitat conservation planning (Chapter 7).
- Develop indicators of progress toward water supply sustainability.

Habitat Conservation Plans/Natural Community Conservation Plans (Chapter 7). The WMI advocates that efforts to protect and enhance habitats for endangered, threatened, and special status species should be focused on creating and maintaining habitat-protected areas. Though Habitat Conservation Plans/ Natural Community Conservation Plans (HCPs/NCCPs) have been available as tools for over a decade to help strategically target areas for preservation, they have not been widely used. Some of the early HCP processes had significant shortcomings, such as the lack of "ground-truthed" habitat data, which has led to the improvements the WMI would incorporate in participating in any future HCP/NCCP effort. The plans should begin with updated, improved surveys of species habitats and should incorporate (where appropriate) existing reserves, refuges, parks, and public lands.

To further this objective, the WMI will:

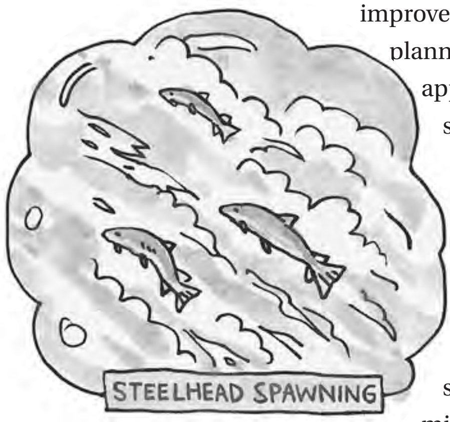
- Convene and facilitate a stakeholder group or groups to participate in scoping HCPs/NCCPs and to participate in adaptive management as plans get underway.
- Join or convene discussions among agencies that acquire or manage open space in the Santa Clara Basin.
- Support efforts to obtain state and Federal funding for the creation of upland habitat preserves identified through the HCP/NCCP process.
- Identify and pursue local sources of funding, including local agencies and foundations, for purchasing and managing critical habitat areas.
- Successfully implement mandated provisions for public outreach and participation in the NCCP process.
- Develop programmatic indicators of progress in implementing habitat conservation plans and a schedule for periodic reporting. Publicize the periodic reports.
- Coordinate the HCP/NCCP with implementation of other WMI objectives/planning processes including planning of floodplains and riparian areas and incorporation of watershed objectives into General Plans and Specific Area Plans.

Expanding the Don Edwards San Francisco Bay National Wildlife Refuge (DESFBNWR) (Chapter 7). The WMI advocates a comprehensive, integrated, stakeholder-based planning process for expanding the refuge. Permits should be issued timely and allow for flexibility and adaptive management to successfully convert salt ponds while allowing reasonable protection to South Bay water quality. The need to selectively maintain levees to manage potential flooding of urban areas should be addressed in a way that balances the objectives of habitat restoration and flood protection.



To further this objective, the WMI will:

- Convene a stakeholder group to track, discuss, and resolve obstacles to enhancing habitat while protecting water quality and protecting urban areas against flooding.
- Seek and endorse broader agency involvement, support, or appropriations necessary to successful habitat restoration.
- Develop indicators of implementation and effectiveness of the refuge expansion and habitat restoration.
- Coordinate and integrate refuge planning with other WMI strategic objectives, including multi-objective stream restoration projects (Chapter 8), habitat/natural community conservation (Chapter 7) and incorporating watershed objectives into General Plans and Specific Area Plans (Chapter 3).
- Encourage support for public education and interpretive facilities at the DESFBNWR and other public lands and wildlife refuges.
- Support efforts to obtain state and Federal funding (through CalFed and other programs) to support expansion of the DESFBNWR.



Integrated multi-objective planning and adaptive management for in-stream projects and programs (Chapter 8). The WMI advocates that SCVWD should continue to develop and improve the Watershed stewardship planning process that was recently applied to Coyote Creek. SCVWD should extend this process to other Basin watersheds. The plans should integrate and balance flood protection with habitat restoration and should also integrate floodplain management. The adaptive management process should seek alternatives that minimize expensive and failure-prone areas in-stream structures and, where possible, restore stream-floodplain connections and expand the overall area that is flooded. Floodplain management strategies, such as controlling development and raising and floodproofing structures, should be used to minimize potential damage.

To further this objective, the WMI will:

- Convene and facilitate groups of stakeholders to participate in adaptive management for watersheds.
- Communicate adaptive management participants' recommendations to decision-makers in SCVWD and other agencies.
- Organize and facilitate outside expertise and technical resources to supplement SCVWD staff expertise.
- Determine the potential for using stakeholder involvement in watershed stewardship planning and multi-objective project planning as a springboard for more permanent local stakeholder involvement.
- Sponsor and support applications to fund the stream stewardship process.
- Refine and detail the WMI's watershed vision and communicate to decision-makers and the public. In WMI outreach publications, promote an understanding of geomorphic and habitat functions and how they are affected by urbanization.
- Coordinate watershed stewardship planning with other WMI objectives, including floodplain & riparian corridor planning, habitat conservation planning, and TMDLs in streams.

Better Assessments, TMDLs, and Discharge Permits (Chapter 9). The WMI advocates that water-quality assessments, TMDLs, and discharge permit requirements should be coordinated through stakeholder processes that support long-term planning and regulatory stability. The RWQCB, SCVURPPP, SCVWD, United States Geological Survey, the municipalities, the Clean Estuary Partnership, and other agencies should coordinate and (where it makes sense to do so) integrate their monitoring and assessment activities. The agencies should envision monitoring and assessment as one component of an iterative process that includes planning, doing, checking, and adapting.

To further this objective, the WMI will:

- Continue and build on the WMI's successful collaborative processes that led to the 1998 adoption of uncontested discharge permits for the three wastewater treatment plants that discharge to southern South San Francisco Bay and to the 2002 adoption of site-specific objectives for copper and nickel.

- Continue to develop assessment methodologies based on "lessons learned" from the assessments of the San Francisquito, Guadalupe, and Upper Penitencia watersheds and from the forthcoming SCVURPPP assessment of the Coyote watershed.
- Coordinate assessment results and data from TMDLs and other mandated studies with other WMI objectives, including watershed stewardship planning, expansion of the national wildlife refuge, and habitat conservation.
- Prepare annual reports updating key indicators of watershed health and describing recent progress in preserving and enhancing Basin watersheds, new findings and study results, and WMI achievements and successes. (Consider the annual "Pulse of the Estuary" report as a model.)

ES-4 | WMI's Role in Managing Santa Clara Basin Watersheds

The WMI foresees that the process of aligning, coordinating, and integrating environmental-protection programs will take a long time and will be achieved through education, communication, negotiation, and trust-building.

WMI participants acknowledge each other's legitimate perspectives and interests and share consensus on a balanced approach to environmental protection that streamlines regulations and benefits the regional economy.

WMI participants continuously improve their common, interdisciplinary understanding of watershed science, including geomorphology, ecology, pollutant fate and transport, land-use policy, tax policy, land-development economics, and urban design. As the WMI continues, it is able to apply that expanded knowledge to help develop solutions to emerging environmental issues.

This process of investigating, educating, sharing information, and opening up discussion is what the WMI does best.

In summary, the WMI is laying the groundwork for adaptive management of Santa Clara Basin watersheds. Adaptive management is the process of implementing policy decisions as scientifically driven management experiments that test predictions and assumptions in management plans, and using the resulting information to improve the plans.

The WMI will focus on three general tasks:

1. Facilitating stakeholder processes
2. Bringing recommendations to decision-makers
3. Educating and involving the public

The WMI will continue to advance long-term stakeholder collaboration and information sharing and, at the same time, will support stakeholder work groups dedicated to TMDLs or other specific and current regulatory and environmental issues. The WMI will be an ongoing stakeholder forum to which contentious issues can be referred. The WMI will continue to emphasize the interconnectedness of watershed issues and will look for ways to align, coordinate, and integrate programs, policies, and actions.

The WMI will continue to develop consensus recommendations on what agencies, organizations, and individuals can do to help protect and enhance Basin watersheds. These recommendations will include grant applications and requests to fund watershed projects. The WMI will communicate these recommendations to commissions and advisory committees as well as to the Councils and Boards of public agencies.

The WMI will encourage its stakeholders to align and coordinate their messages in a way that promotes the WMI vision. The WMI will help stakeholders promote the WMI vision by:

- Developing, updating, and refining a message to popularize the WMI's approach to preserving and enhancing Basin watersheds.
- Bringing this message to advisory boards, environmental commissions, planning commissions, and other venues for public input to agency decision-making.
- Assessing the need for, and feasibility of, watershed councils in each watershed.
- Linking watershed issues and outreach to community organizations such as homeowners associations and groups that are established or supported in connection with municipal improvement efforts (e.g. San Jose's Strong Neighborhoods Initiative).
- Helping to coordinate input to, and distribution of, outreach newsletters published by agencies and community groups.
- Bringing the WMI's perspective on watershed management to K–12 environmental education curricula.
- Encouraging and assisting agencies to incorporate interpretive and educational features as part of recreational facilities and other public works projects (particularly those in the floodplain or that otherwise relate to streams or wetlands).
- Developing, in cooperation with stakeholders, an annual report updating key indicators of watershed health and describing recent progress in preserving and enhancing Basin watersheds, new findings and study results, and WMI achievements and successes.

ES-5 | Conclusion

Ecosystems are integrated and complex; social, legal, and political systems are also integrated and complex. These systems are in constant change, and change each other. Successful intervention follows from a common understanding of how our social, political, and natural environments interact.

This Action Plan is one step in the journey toward that common understanding.

1 ABOUT THE WMI AND THE WATERSHED ACTION PLAN

The Santa Clara Basin Watershed Management Initiative's (WMI's) mission is to protect and enhance the watershed, creating a sustainable future for the community and the environment.

A watershed is the area draining to a stream or water body. Because streams have tributaries, a watershed can be big or small, and there can be watersheds within watersheds.

The WMI's watershed, the Santa Clara Basin, encompasses southern South San Francisco Bay (south of the Dumbarton Bridge) and the 840-square-mile area that drains to it. For planning purposes, the WMI has identified 13 watersheds within this area, corresponding to the major streams that flow into southern South San Francisco Bay. The WMI has also identified subwatersheds (areas that drain to tributary streams) within these 13 watersheds. The Basin also includes the Baylands—lands that are inundated by tides, or that would be tidal were it not for levees and seawalls.

The United States Environmental Protection Agency (USEPA), the California State Water Resources Control Board (SWRCB), and the San Francisco Bay Regional Water Quality Control Board (RWQCB) started the WMI in 1996.

The WMI is a collaborative, stakeholder-driven effort among representatives from regional and local public agencies; civic, environmental, resource conservation and agricultural groups; professional and trade organizations; business and industrial sectors, and the public.

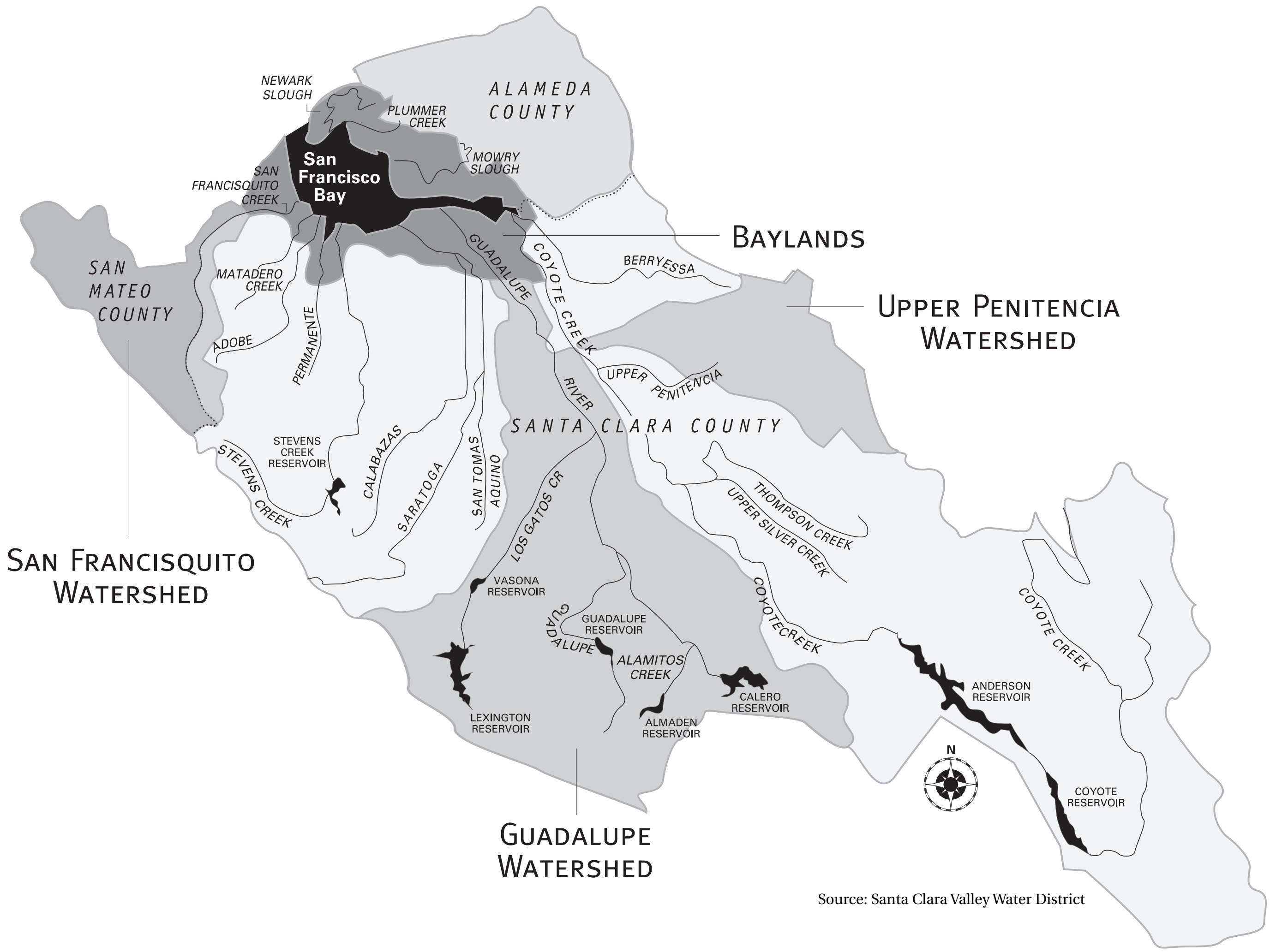
A WMI Core Group meets monthly. Subgroups (such as the Bay Monitoring and Modeling/Regulatory, Communications, Flood Management, Land Use, Watershed Assessment Subgroups, and the Wetlands Advisory Group, were formed as needed to perform functions and provide advice on specific or technical issues. Ad-hoc working groups are formed for task-specific functions.

A signatory document, prepared in 1998, outlines the structure of the WMI and the commitments of the stakeholder organizations during the WMI's planning phase. The document and a current list of signatories can be viewed at **www.scbwmi.org**

The WMI and SCVURPPP

Thirteen cities and towns, Santa Clara County, and the Santa Clara Valley Water District (SCVWD) share a common permit to discharge urban runoff to South San Francisco Bay.

These 15 agencies participate in the WMI both individually and as part of the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP). More information is at **www.scvurppp.org**



Source: Santa Clara Valley Water District

1.1 The Santa Clara Basin

1a | WMI Goals

The WMI's goals are:

- Ensure that the WMI is a broad, consensus-based process.
- Ensure that necessary resources are provided for WMI implementation.
- Simplify compliance with regulatory requirements without compromising environmental protection.
- Balance the objectives of water supply management, habitat protection, flood management and land use to protect and enhance water quality.
- Protect and/or restore streams, reservoirs, wetlands and the Bay for the benefit of fish, wildlife and human uses.
- Develop an implementable Watershed Management Plan that incorporates science and will be continuously improved.

1b | The Watershed Management Plan

The WMI's *Watershed Management Plan* consists of three volumes.

1. The *Watershed Characteristics Report* describes the cultural and natural history of the Basin, its current patterns of land use, management of its water supply and wastewater disposal, and the state and Federal regulations intended to govern the use of water and land and to protect water and habitat quality. A condensed version of the Watershed Characteristics Report was produced in May 2000; the "unabridged" version of the Watershed Characteristics Report became available in February 2001. Both can be accessed via WMI's website: **www.scbwmi.org**

2. The *Watershed Assessment Report,* completed in March 2003, used existing data to evaluate the condition of the Guadalupe River watershed, the San Francisquito Creek watershed, and the subwatershed of Upper Penitencia Creek (a tributary to Coyote Creek).

3. This *Watershed Action Plan* (WAP) sketches a comprehensive strategy for adaptive management of Basin watersheds and sets the stage for more detailed planning and adaptive management at the watershed scale.

1c | How the Watershed Action Plan Was Created

1c1 Action Worksheets and Objectives

In 2000, WMI stakeholders created a vision of a future Santa Clara Basin. The vision is illustrated in Figure 2.1.

During 2001, WMI subgroups prepared approximately 112 "Action Worksheets." The WMI Core Group reviewed each Action Worksheet and refined or revised it with help from the subgroups. The Action Worksheets defined the WMI stakeholders' universe of common concerns and represented preliminary consensus on what is to be done to protect and enhance Santa Clara Basin watersheds. Each of the Action Worksheets named a specific, measurable, achievable, result-oriented, and time-bound Action that would help the WMI achieve its goals and objectives. The Worksheets included information when available on specifics such as tasks, linkages, costs, benefits, and measures of success. These Action Worksheets are now stored in a database of Actions that will be accessible through the WMI's website at **www.scbwmi.org**

In January 2002, stakeholders agreed on objectives for this *Watershed Action Plan:*

- Outline a comprehensive approach to preserving and enhancing the watershed and communicate this to WMI stakeholders, decision-makers, potential funders, and the public.
- Provide guidance to the WMI by coordinating and phasing actions the WMI is doing or can do to protect and enhance the watershed.
- Identify specific actions that agencies, organizations, and individuals are doing and can do to protect and enhance the watershed, and describe these in the context of the comprehensive approach.
- Describe a process and criteria for phasing implementation of actions.

FAST FORWARD > > >

The WMI's pilot assessments are discussed in Section 8f2.

What if the funding, staffing, and authority vested in existing environmental-protection programs could be coordinated and directed toward achieving the WMI's vision?

The stakeholders also wanted the Watershed Action Plan to:

- Make an exciting and compelling case for the social, economic, and environmental benefits of watershed management in the Santa Clara Basin.
- Show that the WMI process is cost-effective, has economic benefits, and is responsive to the public and agency needs.
- Enhance coordination among stake-holders and identify opportunities for collaboration.
- Broaden and deepen participation in the WMI.
- Educate the public about watershed stewardship.

The WMI Core Group assigned a Watershed Action Plan Technical Advisory Group (WAPTAG), comprised of stakeholder technical staff, to assist in preparing the Action Plan.

1c2 A Fresh Perspective on Environmental Protection Programs

The WAPTAG organized the 112 Action Worksheets by subject. Chapter 2 summarizes the main issues in the Action Worksheets, expands on the WMI's vision, and describes the WMI's comprehensive approach to preserving and enhancing the watershed.

Chapters Three through Nine focus on a specific watershed issues. Each begins with an aspect of the WMI's vision, summarizes the natural and social history of the issue, describes current science, and evaluates related environmental-protection policies and programs.

This evaluation led to the following perspective:

New environmental-protection programs typically follow the emergence of major environmental problems. Often, new policies are developed only after resources have been depleted or ecosystems have been damaged.

Environmental-protection regulations have expanded rapidly since the first Earth Day in 1970. By the mid-1990s, local agencies were struggling to keep up with the pace of new environmental requirements. The local programs, like the regulations they implement, have grown up one at a time in response to specific environmental issues. Because ecosystems and political systems are integrated and interdependent, many of these programs overlap and can even conflict with one another. Program overlaps and conflicts occur within agencies (both regulatory and local agencies) and between agencies.

In response to local environmental advocacy, local agencies have adopted stronger local environmental-protection mandates. For example, the Santa Clara Valley Water District's (SCVWD's) recently expanded mission incorporates watershed stewardship, and the City of San Jose has adopted a Riparian Corridor Protection Policy. This has created even more potential for overlaps and conflicts.

The WMI's Action Worksheets identified actions and implementing tasks to achieve the improved stream conditions that are the desired outcomes of existing regulatory mandates and existing local programs for stream stewardship. The Action Sheets were seen as a useful and necessary step in developing an Action Plan because no previous analysis placed the myriad of existing programs in the context of a comprehensive vision for the watershed.

In some instances, local agencies implement their regulatory compliance program in a compartmentalized fashion. Regulators and permittees alike focus on individual permit provisions. When this approach is taken, implementation tends to be reactive and piecemeal, rather than embracing broad ecosystem objectives. This approach is not conducive to new, more scientific analyses of problems, or to new, more creative solutions.

The stakeholders' Action Worksheets suggested a fresh perspective: What if the funding, staffing, and authority vested in existing environmental-protection programs could be coordinated and directed toward achieving the WMI's vision?

This coordination could accelerate environmental improvements; however, the bureaucratic barriers are daunting. Each agency and interest has its own agenda and drivers. Interagency coordination costs time, staff hours, and money. If the coordination is unsuccessful, agencies and interests feel they have wasted hard-to-come-by resources, and may face regulatory consequences. What's more, agencies typically account for and track their regulatory compliance projects individually. Project managers may resist delaying or complicating "their" project so that it can be coordinated with a larger plan.

The WMI's next steps will be to focus on finding ways to overcome these barriers.

1d Strategic Objectives and Adaptive Management

Chapters 3 through 9 propose strategic objectives. The strategic objectives specify desired outcomes to be achieved by aligning, coordinating, and integrating existing policies and programs. This ongoing, comprehensive coordination must be based on stakeholder consensus, must include implementation of regulatory mandates, and must also accommodate local agencies' needs to streamline regulatory compliance and to plan their expenditures with some certainty.

The WMI has identified actions that agencies and organizations can do, and that the WMI will do, to implement each of the strategic objectives. These are summarized at the end of each of Chapters Three through Nine and in the summary sheets at the end of those chapters. These actions were developed in part by summarizing and organizing the information in the Action Worksheets developed by the WMI Subgroups.

The WMI's plan for Basin-wide coordination among the strategic objectives is described in Chapter Ten.

The WMI's strategic objectives specify desired outcomes to be achieved by aligning, coordinating, and integrating existing policies and programs.

2 A COMPREHENSIVE APPROACH TO PROTECT AND ENHANCE THE SANTA CLARA BASIN AND ITS WATERSHEDS

Since the 1770s, when the Spanish began to displace the native people, the Santa Clara Basin's landscape has been radically transformed. European and other exotic grasses, weeds, and other plants have replaced much of the native vegetation. Streams were diverted to irrigate the earliest farms; later, the drawdown of groundwater caused the land to sink as much as 13 feet. As the forests were cut, the hillsides eroded. Mining of cinnabar and other ores left a legacy of metal-tainted spoils. Hundreds of acres of wetlands were diked and converted to salt evaporators or filled for farmland.

These changes, although still evident today, began before a huge influx of residents—and the availability of the automobile—spread urban development across the valley floor. To make flood-prone land suitable for development, streams were buried, channelized, or confined within levees. Buildings, streets, and pavement now cover much of the valley floor, and storm drains pipe runoff from urban neighborhoods directly into the streams.

To provide water to the burgeoning population—and to recharge groundwater—dams and diversions were constructed across the streams, interfering with fish migration and spawning. Fresh water discharge and freshwater flows have affected nearby wetlands, contributing to conversion of tidal salt marsh to brackish marsh; however, recently new salt marsh has formed.

Despite centuries of continuous, disruptive change, the Basin's landscape contains rich and diverse natural habitats. Harbor seals and sea lions feed in South San Francisco Bay. More than a hundred species of birds forage in the surrounding wetlands. Shorebirds stalk the mudflats and feed on brine shrimp in the salt evaporators. Hawks and owls soar over the grasslands. Frogs hunker down in cattle ponds and in the remaining streamside puddles. Bobcats and mountain lions prowl the chaparral. Against the odds, steelhead and salmon still swim up the channelized lower reaches of some streams, past the houses and factories, under the streets and highways, to spawn.

Nearly two million people now live in the Basin. The quality of their lives and their water supply depend on preservation of the Basin's natural habitats.

2.1 A Vision for Our Watershed

Given our history—and with more than 200,000 new arrivals anticipated in the next two decades—how can we reverse the declining quality of our watershed?

The now-urbanized landscape will continue to be remade in the coming decades, as Basin communities struggle to meet demands for new housing, to accommodate potential growth, to upgrade an inadequate transportation system, and to reduce damages from flooding. With good planning, creative design, political will, and enough money, continued change can be managed in ways that enable economic growth, improve the quality of life, promote social equity, and enhance natural habitats.

These questions should be asked: Who will organize the remaking of the landscape? Who will pay to set aside land for habitat and to enhance what remains? Who will remove the barriers to fish migration? Who will reduce the flow of pollutants?

We must bring together business, society, and government—all those who have a stake in the area's future—and find ways to balance the needs of water supply, flood management, and habitat protection with needs for housing, recreation, and economic activity.

2a | Begin With a Vision

WMI stakeholders share a vision of a future Santa Clara Basin where:

- Habitat areas stretch contiguously from salt marsh to hilltop, comprising large, connected patches of tidal marsh, continuous riparian forests alongside streams, and buffer areas upland from tidal and riverine wetlands.
- These green corridors separate intensely developed neighborhoods where new and retrofitted buildings, streets, and drainage systems retain or treat runoff.
- Streamside areas are protected from development so that floods can naturally replenish groundwater and sediments without damaging homes and businesses.
- Water is used and reused efficiently, so that there is enough for homes and gardens and industries and also enough to support the natural seasonal cycles of stream and wetland habitats.
- The Basin's diversity of habitats and species is preserved, riparian and woodland areas are protected and/or restored, invasive plants and animals are controlled, and recreational uses are designed to be compatible with habitat protection.
- Streams flow freely, stream habitats are restored, barriers to fish migration are removed, and native fish species rebound.
- Pollutants do not impair aquatic life, and waters are fishable and swimmable.

2b | Actions to Protect and Enhance the Watershed

Chapters Three through Nine outline strategies that agencies, organizations, and individuals can use to help to achieve this vision. These strategies present actions in an effort to meet the WMI's goals and objectives, including the protection and enhancement of beneficial uses (for the benefit of fish, wildlife, and human uses).

A Question of Scale

What is the right scale for a watershed plan? Understanding relationships between structure and scale is a first step toward preserving and enhancing ecosystems. Landscape ecologists describe spatial structures as composed of matrix, patch, corridor, and mosaic elements. These structural elements are repeated at different spatial scales. Looking at the movement of materials, energy, and organisms between and within these structural elements helps us understand how an ecosystem functions. Political jurisdictions, such as city and county boundaries, have their own shape and scale, which may encompass or divide the natural scale of landscapes, stream corridors, or connected habitat. The Action Plan focuses on policies and activities that are (mostly) organized Basin-wide. These policies and activities set the stage for more detailed plans—at the scale of watersheds or stream reaches—to preserve and enhance habitat and stream functions and to understand the fate and transport of pollutants.

Chapter Ten focuses on what the WMI will do to facilitate and coordinate those strategies.

Chapter 3, Moving Beyond "Smart Growth," describes ways to incorporate the WMI's vision of a future urban watershed into present-day land-use plans and policies.

During the Basin's most rapid urban growth (roughly from WWII through the 1970s) land-use controls were governed by modernist principles—segregation of uses, circulation systems focused on the car, and a loss of public orientation for buildings and gathering places. Economic and tax policies encouraged and subsidized suburban development. Economic polarization became reflected in urban geography, resulting in disempowered, high-poverty urban neighborhoods and high-cost, environmentally unsound development in outlying sensitive areas.[1]

In the 1990s, national concern over sprawl—often expressed as a loss of community, lack of a sense of place and immersion in an ugly, environmentally degraded landscape—spurred a movement to "Smart Growth," which emphasizes government accountability, livable communities, better housing and transportation, and conserving green space and the natural environment.

The adoption and success of "Smart Growth" is a prerequisite for achieving the WMI's vision. However, preserving and enhancing the watershed will also require changes to the spatial structure of land use in the Basin, from one continuous swath of urbanized land to a more fine-grained pattern characterized by more intensely urbanized areas that are interstitial to broad, continuous stream corridors.

Over time, cities and towns will increasingly use General Plan policies and sub-elements, Specific Area Plans, and zoning overlays to map and designate some areas for more intense, "smart-growth" transit-accessible types of development, while identifying other, sensitive habitat areas to be preserved or restored. Cities and towns are also using their review authority under the California Environmental Quality Act (CEQA) to require that specific projects preserve habitat and limit effects on water quality. There may also be ways that cities and towns can use tax and financial incentives that encourage developers to pursue these same goals voluntarily.

Chapter Four, Better Designs for Buildings, Streets, and Drainage, foresees changes in the way cities are built (and changes in the policies that mandate the way cities are built). These changes must be made to stabilize the effects that the urbanized landscape has on streams, wetlands, and San Francisco Bay.

Today, most design standards for buildings, streets, and parking lots encourage rapid and efficient drainage. Runoff is routed via underground pipes to stream or wetland outfalls.

This rapid, efficient drainage increases the frequency and magnitude of stream flooding. Because the size and timing of floods helps determine the physical characteristics of streams—their width, depth, and sinuosity—the direct piping of runoff tends to destabilize streambeds and banks. The resulting movement of sediment can reduce pool depths, undermine streamside vegetation, and affect stream habitat in other ways.

Pollutants that wash off rooftops and streets become suspended or dissolved in runoff and flow directly into streams. These pollutants may include fine sediments from construction projects or unpaved roads.

Cities and towns are adopting new policies and standards that reduce the amount of runoff going into pipes. Runoff can be retained by limiting the amount of paved or impervious surface and by directing runoff to vegetated swales and basins. There, pollutants settle out or are absorbed by soil before the water drains off slowly or percolates down to replenish groundwater.

Chapter Five, Planning Floodplain and Riparian Stewardship, discusses how better land-use policies can protect streamside areas and wetlands and also reduce flood damage.

Flood control works (such as concrete-lined channels, floodwalls, and levees) are expensive to maintain and are prone to failure. In addition, they damage or eliminate sensitive in-stream and riparian habitat. SCVWD has shifted its policies and practices to emphasize natural flood protection and stewardship of natural resources. In most cases, this means preserving or expanding the area that is allowed to flood. This sometimes conflicts with plans to place new homes and businesses in flood-prone areas. Conflicts may also occur when streamside homeowners wish to add to their houses, or construct outbuildings, in riparian areas.

SCVWD's flood management program entitles homeowners within specifically mapped areas to take advantage of lower flood insurance rates. But this mapping is not yet coordinated with municipal land-use maps and policies.

Cities and towns can work with SCVWD to create and implement policies that protect floodplains from development, to map sensitive habitat areas where additional protections apply, to plan for acquisition of properties or easements within floodplains and riparian areas, and to integrate flood insurance programs into municipal planning. Individual streamside property owners can do their part to steward riparian habitat.

Chapter Six, Conserving and Reusing Water, is about conserving and managing water to serve the Basin's growing population and economy, while maintaining natural seasonal flow in creeks.

About half the Santa Clara Basin's water supply is imported from other parts of the state. The other half is pumped from groundwater. Beginning in the 1860s, as farmers began growing water-intensive crops, drawdown of groundwater caused rapid land subsidence, altering the slope and elevation of streams, destabilizing streambanks, and increasing tidewater incursion and the frequency of flooding.

Since the South Bay Aqueduct was completed in the 1960s, the SCVWD has used imported water, as well as local water, to recharge aquifers. SCVWD artificially increases groundwater recharge by releasing water from eight large reservoirs and from pipelines into streams during the dry season. Some water percolates through the streambed, but SCVWD also diverts stream flow into percolation ponds.

SCVWD's permanent and temporary dams, and the alteration of stream flows, can affect the survival and reproduction of fish and other aquatic life.

Once water is used by homes and businesses, it is collected in sewers and piped to three wastewater treatment plants. It is then discharged to South San Francisco Bay. Discharges from the three wastewater plants meet criteria intended to insure that wastewater pollutants don't affect the Bay. However, in the past the volume of fresh water flows may have caused some tidal wetlands to convert to brackish marsh, reducing scarce salt marsh habitat (though more recently, new salt marsh habitat is forming).

How effective are water conservation programs? Water and wastewater agencies may be able to reduce their projected needs for new sources and new facilities. We need to find more ways to help industries and residents reduce water use, so that more water is available for environmental needs. By using water recycled from treatment plant effluent, industries can also help reduce the quantity of wastewater discharged to the Bay.

Chapter Seven, Preserving and Enhancing Biodiversity, describes how we can sustain the many ecosystems within the Santa Clara Basin by re-establishing and managing large, contiguous natural areas and controlling invasive species.

Because the Basin features complex and varied soils and climate, many of its plant and animal species are adapted to specific conditions that occur only in small areas. As these specialized habitats are altered, and as non-native competitors and predators are introduced, many of these specialized and rare (special-status) species are threatened with extinction.

The arrival of European settlers dramatically changed the distribution and species composition of the Basin's plant communities. Non-native annual grasses displaced native perennial grasslands. The Douglas fir and redwood forests in the foothills were chopped down. As settlement continued, natural stands of vegetation were converted to grazing, vineyards, and orchards. As agricultural land gave way to urban development, much of the valley oak woodland in the lower foothills was also lost. Land subsidence and diking claimed large amounts of tidal salt marsh.

In many remaining natural areas, problematic, invasive plants have become established. Red brome, yellow star thistle, field mustard, and bull thistle are found in grasslands. Giant reed, periwinkle, and German (Cape) ivy occupy riparian forests. Smooth cordgrass has invaded some low tidal marsh and open mudflats, and perennial pepperweed infests brackish marshes.

Exotic animal species have also been introduced, some of which prey on native species. In marshes, for example, red foxes and feral cats severely reduce the population of nesting birds.

A plan to protect and (where possible) restore endangered species and ecosystem functions in the Santa Clara Basin's grasslands and forests should integrate the principles of conservation biology and effective and comprehensive habitat conservation planning.

In particular, there is a need to map and protect areas where the interrelation of environments is critical to the survival of species or to ecosystem function. For example, the transition zone between marsh and upland areas is critical to animals that must take refuge during high tides.

Surveys should identify the optimum areas to restore grasslands and riparian forests, and the locations of invasive and exotic species (and special status species) should be mapped. Next steps would include selecting target species, creating a restoration plan, and securing titles and easements to lands. Many remaining natural areas are within public parks and open space; designs should integrate recreation while minimizing effects on habitat.

The tidal wetlands that once surrounded southern South San Francisco Bay have been radically altered. Some were diked, filled, and converted to farmland, airfields or industrial parks; others have been diked and the flows controlled to evaporate Bay water and produce salt.

Some of these changes are irreversible; others should not be reversed, because the altered flow regime has created forage and resting habitat for various bird species. More surveys and maps are needed to identify opportunities where habitats can be expanded and made contiguous and where changes in tidal circulation could enhance habitat quality.

Chapter Eight, Preserving and Enhancing Stream Functions, focuses on the direct physical interventions in the stream channel that are required to protect and restore the Santa Clara Basin's streams and wetlands.

The natural forms of creeks—their width, depth, sinuousity, and the vegetation on their banks—are created, and change, in response to the size and frequency of floods. The banks of a typical stream can hold the size flood that recurs, on average, every one-and-a-half to two years. Less frequent floods cause overbanking and extension on to the floodplain. Over time, as the creek adjusts to large and small floods, the creek bed moves within the floodplain, cutting new channels and leaving benches and terraces alongside.

This geomorphic process creates and maintains characteristically alternating riffles and pools, shallows and deeper areas, eddies and undercut banks. A characteristic mix of streamside vegetation stabilizes the banks and also provides nutrients, shade, and refuge for fish and other organisms.

The species that live in creeks—fish, insects, worms, amphibians, etc.—have evolved together within this mosaic of damp and wet habitat. They are poorly suited to survive where creek banks consist of riprap and concrete, in straightened, trapezoidal channels, or in concrete culverts. In particular, steelhead and salmon, which migrate between the Bay and upstream spawning areas during higher flows, can be stymied by dams, drop structures, low flow, or poor water quality.

Conserving the ecology of creeks requires restoring (at least in part) geomorphic processes and habitat characteristics and removing barriers to fish migration.

Restoration begins with systematic, phased assessments of the specific conditions in each creek reach, mapping of their characteristics and resources, and evaluation of the factors that affect the creek and constrict the options for restoring it. This up-and-down-the-stream-corridor perspective sets the stage for projects in specific stream reaches. Many of these restoration projects will incorporate multiple objectives; for example, enhancing flood protection, restoring fish passage, and providing space for recreation.

Regulatory Corner: Urbanization and Water Quality

Federal and state water-quality standards have two parts:

(1) *beneficial uses* of water, and (2) physical, chemical, and biological *criteria* designed to protect those uses.

The RWQCB establishes beneficial uses and criteria for each water body. Santa Clara Basin streams, reservoirs, and wetlands are used for water supply, recreation, and to support aquatic life.

Even when the established water-quality criteria are met, the beneficial uses are still affected by disruptive changes due to urbanization, damming of streams for water supply, and channelization of streams and sloughs for flood control.

Chapter Nine, Understanding and Controlling Pollutants, describes which pollutants may be affecting organisms in streams, wetlands and the southern South Bay, and what is being done (or should be done) to reduce or eliminate those effects.

All of the Santa Clara Basin's municipal and industrial wastewater is collected in municipal sewers and is thoroughly treated before being discharged to southern South San Francisco Bay. However, a separate system of storm drains pipes runoff from rooftops, parking lots, and streets directly to hundreds of stream outfalls. This urban runoff carries suspended and dissolved metals, hydrocarbons, pesticides, and other pollutants, including trash and detritus.

Upstream of the urban area, grazing, agriculture, and other rural activities can contribute pesticides, fertilizers, and sediment to the creeks. Some of the most serious pollutant problems are a legacy of the Basin's history and of a time when the consequences of pollution were less understood. Now-banned pesticides (DDT, chlordane, and dieldrin) linger in aquatic sediments, as do PCBs, which were once widely used in electrical equipment and in industrial paints. Tailings from mercury mining and processing (particularly in the Guadalupe watershed), dumped in the creeks over a hundred years ago, continue to wash downstream. However, the presence of newly created chemicals, such as popular garden pesticides and fire retardants, shows that urban activities continue to generate pollutants that find their way into streams and the Bay.

The effects of these pollutants depend on how they interact with sediments, how they are transported, and how they are distributed in the food chain. Storms flush pollutant-laden water and sediment into the creeks, where they flow downstream. By contrast, pollutants tend to accumulate in the sediments of shallow southern South San Francisco Bay. During the dry summers, as the pollutants leach from the sediments, evaporation and lack of circulation cause them to concentrate in the overlying water. In wetlands, the natural decomposition of rooted aquatic plants creates conditions where relatively harmless inorganic mercury is transformed to methylmercury.

Methylmercury—like PCBs and DDT—tends to become concentrated in animal tissues. Animals near the top of the food chain, such as fish-eating birds and people, may be the most vulnerable.

The sources, fate, transport, and effects of each pollutant must be understood to determine the acceptable amounts found in water, sediment, and/or animal tissue, and to develop reasonable, effective plans for source reduction and clean-up. The WMI's approach is to foster collaboration among regulatory agencies, dischargers, and the community to oversee scientific investigations, decide on control plans, and monitor the results.

2c | An Integrated, Comprehensive Plan

The WMI seeks to establish ongoing adaptive management of Santa Clara Basin watersheds.

The work to achieve the WMI's vision will be a shared experience of collective discovery, learning, and problem solving. Together, stakeholders will engage in an ongoing deep and detailed examination of the science, policy, and politics of each environmental issue and will develop a common understanding of how these issues are linked.

Chapter Ten, Realizing the WMI Vision, proposes how the WMI can get this process started. The WMI will focus on three general tasks:

- Facilitating stakeholder processes,
- Bringing recommendations to decision-makers, and
- Educating and involving the public.

WMI stakeholders have prioritized some initial steps, including:

- Coordinating implementation of watershed stewardship plans (See Chapter 8), floodplain/riparian corridor planning (Chapter 5), SCVURPPP's hydrographic modification management plans (Chapter 4), and habitat conservation planning (Chapter 7).
- Convening a dialog with Planning Commissioners and Directors regarding the use of General Plans and Specific Area Plans to implement the WMI's vision of continuous habitat corridors and intensely developed neighborhoods (See Chapter 3).
- Improving and expanding pilot watershed assessments (See Chapter 8).
- Building on the WMI's successful collaborative processes that led to the 1998 adoption of uncontested discharge permits for three Publicly Owned Treatment Works (POTWs) and to the 2002 adoption of site-specific objectives for copper and nickel in southern South San Francisco Bay (See Chapter 9).
- Preparing annual reports updating key indicators of watershed health and describing recent progress in preserving and enhancing Basin watersheds, new findings and study results, and WMI achievements and successes.
- Bringing the WMI's message to advisory boards, environmental commissions, planning commissions, and other venues for public input to agency decision-making.

Each of these steps will be an incremental contribution to achieving the WMI's comprehensive, long-term vision. The WMI will help stakeholders keep that vision in mind as they coordinate a myriad of policies, programs, and actions that benefit the watershed.

3 MOVING BEYOND "SMART GROWTH"

3a | The WMI's Vision for a Future Santa Clara Basin

The WMI envisions a future Santa Clara Basin where planned land uses support society and nature alike.

In this future landscape, protected habitat areas will stretch contiguously from salt marsh to hilltop. Between these green corridors will be intensely developed neighborhoods with homes, stores, and industries. Workers and residents will be able to choose whether to walk, bike, drive, or ride efficient public transportation.

This vision seems far removed from today's Santa Clara Basin, with its urban sprawl, traffic congestion, housing shortage, and threatened habitats.

To achieve the WMI's vision, we need to understand how we got to where we are now. And we need practical strategies, using existing regulatory and economic tools, that can help us map and guide future land-use decisions.

3b | How We Got to Where We Are Now

3b1 The Causes of Sprawl

California has required its cities and counties to have development master plans (now called General Plans) since 1937. However, it wasn't until 1970—the year of the first "Earth Day"—that General Plans had to address conservation and open

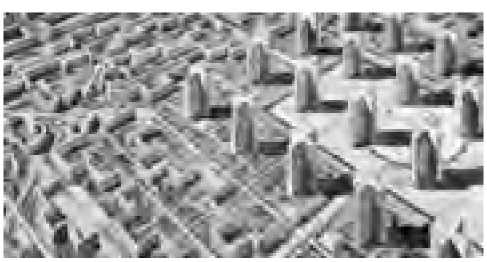
3.1 The WMI's Vision for "Smart Growth"

space.[1] Gov. Ronald Reagan signed the California Environmental Quality Act that same year.[2]

By that time, low-density sprawl had spread across much of the Santa Clara Valley floor. Industrial sites were concentrated in the northern part of the Basin, with housing spreading south. The segregated land uses were linked by an ever-expanding maze of highways. Channels and levees had transformed most of the Basin's floodplains into valuable real estate.[3]

Planners and economists continue to debate the root causes of sprawl (and some argue in favor of sprawl).[4] Here are three factors that have probably contributed to sprawl:

First, it's cheaper and easier to build housing (and therefore to buy houses) in outlying areas. Agricultural land is less expensive than urban land, and (with some exceptions) it gets cheaper with increasing distance from urban centers.[5] Homebuyers are willing to commute long distances to save on housing costs.[6] Further, lenders give easier credit to buyers of single-family homes, because the market for detached houses is more predictable than the market for attached homes and condominiums.



3.2 Le Corbusier's Radiant City (1920)

Second, government creates economic and tax incentives that tend to encourage sprawl. Municipal governments have an incentive to encourage highly taxed commercial, industrial, and high-end residential development over lower-tax affordable housing (and open space may be viewed as a loss of tax revenue all together). Seeking sales-tax revenues, municipal governments have an incentive to approve high-volume "big-box" retail in outlying areas, even when it worsens traffic congestion and paves over open space.[7] Urban dwellers pay part of the cost to extend electric service to lower-density outlying areas.[8] In the past, Federal and state transportation funding subsidized suburban freeways at the expense of urban transit; however, since 1991, when the Federal Intermodal Surface Transit Efficiency Act (ISTEA, 1991) first required that transportation funding "address the overall social, economic and environmental effects of transportation decisions," Bay area transportation funding has become more balanced between urban and suburban needs.[9]

Third, utopian ideas about how to eliminate urban crowding and poverty influenced the municipal codes and planning policies that were in effect during the postwar boom years. [10] The urbanist Peter Calthorpe states that, with the exception of a few urban centers, "Every piece of land in the USA is controlled by codes and planning documents that evolved after WWII. These controls have been largely founded on modernist principles—segregation of uses, circulation systems focused on the car, and a loss of public orientation for buildings and gathering places."[11]

3b2 Building in the Floodplain

Much of the Santa Clara Valley is prone to flooding. Long before urbanization spread across the valley, the Guadalupe River would, from time to time, overtop its banks and flood the City of San Jose. Floods occurred in 1779, 1862, 1867, 1869, and 1911.[12]

Alteration of streams to reduce flooding began in 1866, when a channel was dug to relieve flooding and to provide water to expanding orchards.[13] In the ensuing expansion of agriculture, much of the riparian forest was removed; in many cases, the land was farmed up to the edge of the now-shadeless streams.

Flood-control efforts were organized locally until the creation of the Santa Clara County Flood Control and Water Conservation District in 1951.[14] As the postwar boom brought jobs and people to the Santa Clara Valley, developers subdivided the farms in the broad floodplains. The consequences became apparent during a storm in December 1955, as the new neighborhoods were inundated. Only the retention of runoff behind new upstream dams saved the valley from even more severe flooding. (The next flood, in 1958, came when reservoirs were already full.)

In the 1960s and into the 1970s, development continued to spread across the floodplains. Channels and levees were built to allow development up to the edge of now-confined streams. Many smaller tributaries were placed in culverts and buried entirely. Despite these interventions—or perhaps because some of them were not yet complete—large areas of the valley suffered flood damage in 1983, 1985, 1995, and 1997.[15]

3b3 The Consequences Become Apparent

In the 1970s, after nearly three decades of rapid, uncontrolled urban development, the consequences—traffic congestion, long commutes, air pollution, exposure to flooding, and the destruction of stream and

Timeline of Land Use and Floodplain Policy

1700s	First European settlement in Santa Clara Valley.
1866	First alteration of the Guadalupe River for flood control and irrigation.
1928	Lower Mississippi Flood Control Act authorizes Corps of Engineers to build flood-control dams and levees; beginning of "structural era" of flood control.
1933	Le Corbusier's book *Urbanisme* proposes his design for a "Radiant City" with separated land uses served by automobiles.
1934	Valley's first water conservation bond measure authorizes construction of six reservoirs.
1942	Gilbert White's "Human Adjustment to Floods: A Geographic Approach to the Flood Problem in the United States," states that "floods are an act of God, flood damages result from the acts of men" and advocates comprehensive floodplain management.
1945	WWII ends.
1950	Anderson Dam constructed, completing Santa Clara Basin reservoir system.
1950–1970	Period of Santa Clara Valley's most rapid growth in jobs and population. San Jose grows from 95,000 to 445,000 people and from 17 to 137 square miles.
1950s–1960s	Countywide plans are created for chains of parks and recreational trails along many of the Basin's creeks.
1951	Santa Clara Countywide Flood Control District formed.
1962	In her book, *The Death and Life of Great American Cities,* Jane Jacobs decries the results of modernist city planning.
1968	National Flood Insurance Act encourages communities to adopt minimum floodplain regulations; beginning of "regulatory era" of flood control.
1975	Santa Clara Valley municipalities adopt land use policies limiting Urban Service Areas to within incorporated cities and towns.
1978	President Carter's Water Policy Initiative places equal emphasis on structural and "nonstructural" flood management.
1991	Intermodal Surface Transit Efficiency Act.
1993	Great Midwest Floods on the Mississippi usher in the "watershed era" of comprehensive floodplain management.
1994	Santa Clara County General Plan adopted.
1994	San Jose 2020 General Plan adopted.
1996	WMI started.
1999	California adopts "Smart Growth" as state policy.
2001	Santa Clara Valley Water District Act updated.

Consensus Points

The WMI's Land Use Subgroup includes representatives of the Home Builders Association; Chamber of Commerce; Audubon Society; League of Women Voters; Greenbelt Alliance; Planning Departments of the County, San Jose, and Cupertino, the RWQCB, and many others.

While discussing land development and environmental protection, the participants found many areas where they agreed. These were recorded as "consensus points." Later, the group decided on actions to begin implementing the "consensus points."

Those "consensus points" and actions were incorporated into the WMI's vision and strategy for creating a future Santa Clara Basin where planned land uses support society and nature alike.

riparian environments, to name a few—became all too apparent. The early 1970s saw a resurgence of interest in preserving rural lands and in building compact, livable cities. Santa Clara Valley municipalities adopted policies limiting urban growth to within existing incorporated areas. Also during the 1970s, the era of "structural" flood management, during which the Federal government subsidized flood-control dams and channelization, began to yield to a new emphasis on regulating development in floodplains. By the late 1970s, concern over the preservation of wetlands and other natural areas began to balance calls for more flood protection.[16]

In the 1990s, the "new urbanism," and the new environmental consciousness, began to mature. Santa Clara County's General Plan, adopted in 1994, emphasizes social and economic well-being; managed, balanced growth; livable communities, and responsible resource conservation.[17] Also in 1994, the City of San Jose adopted its *General Plan 2020*, which emphasizes high-density infill along transit corridors and includes a Sustainable City Major Strategy.[18] San Jose also completed its *Riparian Corridor Policy Study* that year.[19]

The 1993 historic flood on the Mississippi River ushered in the "watershed era" of comprehensive floodplain management, which takes into account the human values and local resource decisions related to flood hazards and the floodplain. Throughout the 1990s, the SCVWD was under public and legal pressure to update its approach to flood management. SCVWD responded by adopting policies to balance structural and non-structural flood protection with stewardship of creek, riparian, and wetland habitats. In 2001, SCVWD asked the California legislature to expand its authorization[20] to "provide comprehensive water management for all beneficial uses and protection from flooding."

3c | Strategies for Moving Beyond "Smart Growth"

Preserving and enhancing Santa Clara Basin watersheds begins from this legacy: Santa Clara Basin streams are mostly disconnected from their floodplains by channels and levees. Most wetland and riparian areas are gone; much of the remainder is intruded upon (or hemmed in) by urban development.

But the Basin's municipalities and its flood management agency have learned the lessons of uncontrolled development and structural flood management. They have adopted some of the most progressive and enlightened planning policies that exist in any urban watershed—although there is plenty of controversy over where, how, and to what extent these policies are or should be applied.

3c1 Smart Growth and Watershed Planning

Santa Clara Basin cities' new "Smart Growth" policies and SCVWD's emphasis on natural flood protection can help accommodate growth while protecting and enhancing existing habitat areas.

Many "Smart Growth" advocates are successfully advocating progressive policies for urban development and redevelopment, greenbelt protection, transportation, and the protection of agricultural lands.

TABLE 3.1 "SMART GROWTH" RESOURCES FOR THE BAY AREA

Smart Infill: Creating More Livable Communities in the Bay Area Greenbelt Alliance, Spring 2002 **www.greenbelt.org**	A guide for local government officials, planners, and citizens concerned about how development within existing towns and cities—especially infill housing and mixed-use development—can help revitalize communities and accommodate the future growth of the Bay Area.
Elements of a Smart Watershed Program Center for Watershed Protection **www.cwp.org**	17 public sector programs that treat stormwater runoff, restore urban stream corridors and reduce pollution discharges in highly urban watersheds. The best means to integrate these programs is the small watershed plan, which analyzes the unique characteristics of each subwatershed, evaluates its restoration potential, and ranks and selects priority restoration practices for long term implementation.
Smart Growth Strategy/Regional Livability Footprint Project Association of Bay Area Governments **www.abag.ca.gov**	Visioning effort by elected officials, local and regional government staff, community representatives, and business, equity, and environmental coalitions. Seeks to determine and lay out strategies for how the 9-county Bay area can become more sustainable over the next 20 years.
Draft Compact for a Sustainable Bay Area Bay Area Alliance for Sustainable Communities **www.bayareaalliance.org**	A multi-stakeholder forum emphasizing the 3 E's (prosperous economy, quality environment, and social equity).

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Chapter 7, Preserving and Enhancing Riparian and Upland Habitat, looks more closely at the science needed to plan contiguous habitat areas.

But these policies cannot, by themselves, achieve the WMI's vision of protected, contiguous habitat corridors stretching from bay to hilltop, with economically vital, high-density urban development in-between.

Similar to the way that freeways and urban redevelopment have been planned in the past, contiguous habitat areas will have to be assembled by examining the existing patchwork of parcels—public and private, derelict and used, developed and open.

A flexible, long-term plan will be needed to combine parcels and to convert and restore the resulting contiguous areas. The plan to transform the Basin's landscape will feature detailed maps that illustrate which existing habitat areas will be protected and which currently developed areas may be reclaimed (over many years to come) to support nature. To achieve the WMI's goal of balancing water supply management, habitat protection, flood management, and land use, the habitat corridors should be shown within a comprehensive plan that also shows how traffic will be accommodated and how housing will be balanced with jobs.

3c2 General Plans

In other words, the WMI's vision of creating continuous habitat corridors should become integrated into the County's General Plan. The General Plans for each of the Basin's cities and towns should include the appropriate portions of the overall plan for the Basin.

General Plans are a "constitution for all future developments" of a city, town, or county.[21] A municipality's General Plan must include text and diagrams address at least the following elements:

TABLE 3.2 EXAMPLES OF "SMART GROWTH" PROJECTS IN THE SANTA CLARA BASIN

PROJECT	CITY	KEY CHARACTERISTICS
Ryland Mews	San Jose	131 unit condominium, 57 units/acre, underground parking
Ohlohne-Chynoweth Commons	San Jose	192 affordable townhouse apartments, 27 units/acre, 4400 square feet retail, childcare center, adjacent to park-and-ride and rail stations. Developed in partnership with VTA.
City Center Plaza	Mountain View	81 units affordable housing over shops, community college extension.
The Crossings	Mountain View	359 units on a former shopping center.
Downtown Precise Plan	Mountain View	A "coherent framework for downtown development and preservation…" Includes reduced parking requirements and density incentives.
Gateway Senior Project	Santa Clara	42 units on 0.423 acres in downtown.
Los Gatos Gateway	Los Gatos	21 affordable and 84 market rate apartments and two commercial buildings with 164,000 square feet each.
Milpitas Midtown Specific Plan	Milpitas	20-60 units/acre, pedestrian-oriented district, mixture of affordable and market-rate housing.

Sources: Greenbelt Alliance, Transportation and Land Use Coalition, City of Mountain View

- Land Use (the general location and extent of uses of land).
- Circulation (routes, thoroughfares, terminals, utilities, etc.).
- Housing.
- Conservation (including explicitly, watershed protection and flood control).
- Open Space (intended to discourage "premature and unnecessary" conversion of open space land to urban uses).
- Noise.
- Safety, seismic, geologic, and fire.

Each of these elements must be consistent with the others.[22]

The significance of the General Plan lies in the requirement that subsequent zoning actions, development approvals, building permits, public works projects, and other municipal actions must be consistent with the plan.[23] Therefore the influence of the plan depends on its level of detail. A plan that only states broad principles can set the tone for more detailed actions via zoning ordinances or project plans, but a detailed General Plan map that shows areas and describes specific uses has a greater and more direct influence on the future landscape.

Santa Clara Basin municipalities' General Plans already include many policies intended to protect and enhance local watersheds. However, municipal planning departments will need to amend General Plans to incorporate more detailed diagrams showing objectives for the long-term preservation and possible restoration of stream corridors.

3c3 Specific Area Plans

Watershed planning should start at the Basin-wide or landscape scale, but more detailed plans must be created at the scale of a subwatershed, stream corridor, or habitat. Typically, this scale is roughly the same as an urban neighborhood (one to several square miles). For this reason, Specific Area Plans may be the most effective planning tool for preserving and enhancing urban watersheds.

Specific Area Plans detail at least:

- Location and extent of land use and open space.
- Major public facilities and transportation areas.
- Standards and criteria for development and for natural resources.
- An implementation program, including programs, projects, and financing.[24]

Specific Area Plans may be particularly necessary and appropriate in areas that are rapidly developing, where the opportunity exists to influence the course of near-term development. In these areas, it may be possible to map and protect valuable watershed resources while directing development to less-sensitive areas. Because Specific Area Plans also include standards and criteria for development, this also offers an opportunity to "design-in" drainage systems that minimize downstream effects.

3c4 California Environmental Quality Act (CEQA)

Development projects that are subject to CEQA—including some commercial and industrial development and residential subdivisions with more than three new houses—must first undergo a detailed review of the project's potential to affect riparian habitat or other sensitive natural communities, protected wetlands, and migratory wildlife corridors. Project proponents must also analyze whether the project could substantially alter site drainage or contribute to a violation of water-quality standards.

CEQA requires that project proponents assess potential cumulative effects. According to CEQA, the impact of a project is "significant" if "incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects."[25]

It's an important concept, but it's difficult to weigh cumulative effects fairly. It's hard to know when the threat to a particular resource is about to reach a threshold—and even harder to know if a particular project might push it over the edge.

It's better when a specific project can be put in the context of an overall plan that governs nearby development. That way, cumulative effects can be studied, and mitigations can be planned, at the appropriate scale. Later, when a project is proposed for a particular site, the relevant

Regulatory Corner: The CEQA Process

Unless a project is found to be exempt from CEQA review, all projects that require a state or local agency to make a discretionary decision (including funding) are subject to CEQA.

Initial Studies, Negative Declarations (i.e. statements that a project could not have a significant effect on the environment) and Environmental Impact Reports (EIR) receive public review and comment. CEQA requires that all comments be evaluated and addressed.

Minor projects may receive cursory documentation and review. Major projects, such as a flood control project or a General Plan amendment, generate attention and comment from regulatory and resource agencies, environmental advocates, and the public.

For these major decisions, it is best to create an informal forum where stakeholders can improve their understanding, air their concerns, and build consensus regarding appropriate mitigations for the project impacts. A successful stakeholder process can avoid public showdowns and lawsuits.

cumulative effects will be known, and the appropriate mitigations will have already been decided.

Having an overall plan means that the cumulative effects of future development can be traded-off against protection or mitigation elsewhere in the same plan area. This trading-off is necessary to achieve the WMI's vision of a patchwork of intensely developed urban areas that are interstitial to protected habitat corridors.

A Specific Area Plan for a watershed helps insure that the cumulative environmental effects of development are properly evaluated, because the projected increases in density and intensity of use are looked at as a single project. A CEQA review of the Specific Area Plan is completed before the plan is approved. Mitigations can be planned in advance and placed where they will be least expensive and most effective.

This streamlines the CEQA review of the individual projects that have been included in the Specific Area Plan. If traffic, water quality, and biological resources have already been studied in the Specific Area Plan EIR, the project proponents don't have to go over the same issues again. They only need to demonstrate that their project conforms to the overall plan for the watershed.

3c5 Public Investment and Private Initiative

Expressing the WMI's vision in detailed General Plans and Specific Area Plans would promote and streamline approvals for projects that are consistent with that vision (and would restrict development of floodplains and sensitive areas). However, plans are not enough—there must be the right combination of public investment and private initiative to actually implement these changes to the Santa Clara Basin's landscape.

3d | WMI Strategic Objective: Incorporate the WMI Vision into General Plans and Specific Area Plans

Cities, towns, and the County should study the obstacles to implementing detailed maps of habitat corridors in General Plans and consider how to make these maps part of future General Plan updates. This study should draw on the experience of public and private agencies that acquire and manage open space, or that might aid public agencies in making these acquisitions. Among the issues to be discussed: How to target properties for future acquisition or easements without financially harming property owners. Methods could include innovative financing methods to reduce acquisition costs, and seller lease-backs during project planning periods to minimize the abrupt displacement of residents.

State planning and zoning law requires General Plans to be coordinated with the General Plans of neighboring jurisdictions. This may provide opportunities to foster inter-jurisdictional agreements to trade-off future density and development for preservation of open space.

Agencies that acquire and manage open space in the Santa Clara Basin should coordinate their individual strategies to fund the purchase of land and easements and to transfer title to appropriate public or

TABLE 3.3 SOME AGENCIES AND ORGANIZATIONS INVOLVED IN SANTA CLARA BASIN OPEN SPACE ACQUISITION AND MANAGEMENT

AGENCY	ROLE
Santa Clara County Open Space Authority	Directors elected from each of seven Districts, which include Campbell, Milpitas, Morgan Hill, Santa Clara, San Jose, and much of the unincorporated areas of the County. Aims to acquire land on hillsides, valley floor, agricultural lands, trails, greenbelt, and urban open space. Has preserved over 9,000 acres so far. **www.openspaceauthority.org**
Santa Clara County Parks	For more than four decades, the County has focused on purchasing parkland and developing a network of regional parks and trails along the hillsides adjacent to the urban fringe and along the creeks that pass through the urban service area. Stakeholders are currently helping to prepare a Strategic Plan for County Parks. **www.parkhere.org**
The Nature Conservancy	Operates the world's largest private system of nature sanctuaries, including properties in the Santa Clara Basin. **www.tnc.org**
Committee for Green Foothills	Pursues grassroots activism, education, and advocacy to preserve and protect hills, forests, creeks, wetlands, and coastal lands of the San Francisco Peninsula. **www.greenfoothills.org**
Mid-Peninsula Open Space District	A nonprofit organization that works to acquire and preserve the regional greenbelt. Currently maintains over 42,000 acres of bay and foothill land preserves. **www.openspace.org**
Santa Clara Valley Water District	Manages streamside, watershed, and reservoir lands throughout the Basin. **www.valleywater.org**
Greenbelt Alliance	Protects open space and promotes livable communities in partnership with diverse coalitions on public policy development, advocacy and education. **www.greenbelt.org**
Calif. State Dept. of Parks	Manages Henry W. Coe State Park. **www.cal-parks.ca.gov**
U.S. Fish & Wildlife Service	Manages the Don Edwards San Francisco Bay National Wildlife Refuge. **http://desfbay.fws.gov/**
Peninsula Open Space Trust	Nonprofit land conservancy dedicated to preserving the beauty, character, and diversity of the San Francisco Peninsula. **www.openspacetrust.org**

Sources: Websites, as noted. In addition, each Santa Clara Valley city acquires, manages and preserves parks and open space within its boundaries. A comprehensive list of open space land holders and lands held is on the Bay Area Open Space Council's website at **www.openspacecouncil.org**.

nonprofit agencies. These strategies should be linked with General Plans, Habitat Conservation Plans/Natural Community Conservation Plans (HCPs/NCCPs) and floodplain management.

Creation of appropriate incentives to developers and builders can encourage high-density "smart growth" in planned areas, and discourage continued development of outlying agricultural lands.

Where possible, CEQA documentation should assess cumulative effects on watersheds, and should specify appropriate mitigations, at the scale of a Specific Area Plan rather than for a specific development site. This scale of planning can encourage desirable trade-offs between preserving and

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Habitat Conservation Plans and Natural Community Conservation Plans create natural reserves designed to protect critical habitat. **See Chapter 7.**

enhancing habitat in sensitive areas and increasing density in other areas that can be served by transit (i.e., "smart growth").

Consistent with detailed General Plans and Specific Area Plans, local government should consider using reduced development fees, fast track permit approvals, tax rebates, tax caps, or tax deferrals to encourage development in chosen areas. It may be possible to create "smart growth" enterprise zones or to designate redevelopment districts and use tax-increment financing to accelerate changes that are consistent with the WMI's vision.

Local government can work with "smart growth" advocates to promote changes to Federal and state tax policies to reverse current incentives toward sprawl and to encourage targeting Federal and state transportation monies toward a system that offers choice and supports the WMI's vision.

3e | Next Steps for the WMI

3e1 WMI Actions Needed to Implement the Strategic Objective

- Convene a dialogue with Planning Commissioners and Directors regarding the use of General Plans and Specific Area Plans to implement, over the long term, the WMI's vision of continuous habitat corridors and intensely developed neighborhoods.
- Consider, in this dialogue, how to include more detailed watershed analyses in EIRs and balance cumulative impacts with mitigations across jurisdictional lines.
- Join or convene discussions among agencies that acquire and manage open space and work toward strategies for assembling continuous habitat corridors.
- Cultivate alliances with, and bring the WMI's vision to, "Smart Growth" advocates.
- Research examples where municipalities have used their authority under California's planning and zoning law to implement watershed-based land-use planning.
- Coordinate and integrate municipal land use planning with other WMI objectives, including riparian and floodplain planning and habitat conservation planning
- Develop indicators of progress for land-use planning.

3e2 Other WMI Actions Needed to Support the Strategic Objective

- Consider how to include more detailed watershed analyses in EIRs and balance cumulative impacts with mitigations across jurisdictional lines.
- Complete the current study to compare and contrast Santa Clara Basin municipalities' land use development policies.
- Seek and support funding for municipal planning.
- Study how to target properties for future acquisitions or easements without financially harming property owners.
- Track and respond to proposed legislation on tax and economic incentives that affects local land-use decisions.

- Work with stakeholders and "Smart Growth" advocates on Federal and state transportation spending.
- Develop guidance to insure that CEQA reviews reference watershed plans.
- Bring the WMI's vision to the public by distributing fact sheets and other outreach materials.
- Distribute the results of the Santa Clara County Grazing Solutions (GRASS)[26] project and policies for agricultural conservation easements.
- Study and consider how to adapt and implement elements of the *Monterey Bay National Marine Sanctuary Water Quality Protection Program Action Plan for Agriculture and Rural Lands*.[27]

4 BETTER DESIGNS FOR BUILDINGS, STREETS, AND DRAINAGE

4a | A Vision of Better Urban Drainage

The WMI envisions rebuilt and reconfigured urban drainage systems that minimize effects on creeks and wetlands. Within cities, more areas are maintained as natural reserves, parks, and unpaved open space. As denser, livable neighborhoods are created, runoff from roofs, plazas, sidewalks, and streets is routed to landscaped areas where it is detained and filtered through soil, then allowed to drain slowly away or percolate into the ground. Because peak discharges and runoff volume are reduced, there is less need to harden stream banks or to build flood control structures downstream.

4b | Why Drainage Matters

The width, depth, and sinuosity of a natural creek depend, in large part, on the size and frequency of floods. In geologic time, the creek adjusts to large and small floods, changing its course and cutting new channels. The creek's structure of shallows and pools, its mosaic of wet and damp habitat, depend on this dynamic equilibrium between the creek and its watershed.

When watershed drainage is altered to make land drain more quickly, the flow of water and sediment to the creek also changes. The same rainstorm now produces more runoff, and it reaches the creek faster. Floods are bigger and more frequent, with higher peak flows. The creek's dynamic equilibrium with its watershed has been disturbed.

As the creek widens or deepens, its banks erode. Sediment from this erosion (or from fast-moving runoff) can become embedded in stream gravels or fill in channels downstream.

To stop the flooding and erosion, streamside landowners or flood control agencies may decide to reinforce the banks with riprap or concrete, build levees, or engineer a straighter, more uniform channel.[1]

What if this destructive chain of events could be stopped before it started? Can land be developed and used without increasing runoff?

Avoiding increases in runoff has an additional benefit: It also avoids increases in the amount of pollutants reaching streams.

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To comply with an RWQCB permit, the 15 SCVURPPP agencies implement a broad, complex program to reduce pollutants in urban runoff. See Chapter 9.

4c | Urbanization and Imperviousness

In the 1800s and early 1900s, farmers dug ditches in many areas of the Santa Clara Valley so that the clayey soils would drain.

But urbanization has an even greater effect on drainage. Because rooftops and streets are impervious to water, the amount of runoff is greatly increased. Pipes and channels carry the runoff to outfalls, where it spills directly into creek or wetland habitats. The runoff carries airborne pollutants that have settled on the roofs and pavement, as well as pollutants shed by automobiles or dumped in street gutters.

How can we measure urbanization and changes in a watershed's drainage?

One way is to estimate imperviousness—the percentage of a watershed's total area that has been paved or covered with impervious surfaces. In the Santa Clara Basin[2] and elsewhere,[3] studies have consistently associated watershed imperviousness with damage to stream habitat and to biological diversity.

There are other ways to measure the intensity of urbanization, for example, the number of residents, the total length of streets, or the length of drainage pipes and channels per unit area of watershed.[4]

Regardless of how we measure urbanization, urban drainage systems—the engineered pipes and channels that convey runoff to streams—are what links buildings, streets, and parking lots to stream habitat.

4d | Better Designs for Urban Drainage

Today, urban drainage systems are designed to efficiently remove runoff from streets and buildings and convey it downstream rapidly, to avoid local flooding. To protect urban streams and wetlands, however, we need drainage systems that retain runoff upstream, or detain it and release it slowly.

Conventional drainage is designed to collect runoff so it can be routed to pipes. The best way to detain and retain runoff is to disperse it to pervious, landscaped areas where it can infiltrate into the soil.

Simple designs that use natural materials can be reliable and relatively easy to maintain. Small paved areas, like driveways and walkways, can be sloped toward lawns or landscaping. Gravel, block pavers, or permeable asphalt can be used in place of impermeable paving.[5] Runoff from larger areas, such as rooftops or parking lots, can be routed to landscaped infiltration basins, which are designed to hold a few inches of water during and after storms. During rare, really big storms, these areas are allowed to overflow and drain offsite.

Development site architects, planners, and engineers can reduce the total amount of runoff from a site by limiting the widths of driveways and walkways, reducing parking (e.g., by sharing parking for facilities used at different times of the day) and by designing taller buildings with smaller footprints. "Neotraditional" designs for residential subdivisions can feature narrower streets (particularly streets with low traffic volume), parkway strips, and clustered housing with common open space.[6]

Designing sites to retain runoff is especially challenging in intensely developed areas, in areas where clayey soils slow infiltration, in areas with high groundwater tables, and on hillsides. Even on these sites, it may still be possible to retain runoff and let it drain slowly away. Where there is enough space, detention basins (which hold water long enough for many pollutants to settle out) can be used.[7,8] But it also may be possible to route runoff to lower-cost, more aesthetically pleasing rain gardens or bioretention basins.[9] Mulch, soil, and gravel; selected pest-resistant plants and trees, and underdrains help these landscape features effectively detain and filter runoff. All measures that detain or retain runoff must be operated and maintained correctly to avoid the creation of conditions that are conducive to mosquito habitat. It is important to ensure that runoff detention does not exceed 72 hours. The main goal is to avoid situations that create standing water.

Rooftops and parking lots create much of the imperviousness in urban watersheds, but streets and highways—the public right-of-way—are also major sources of runoff. In some of the Santa Clara Basin's urban subwatersheds, 50-60% of the total area is covered by impervious surfaces. Streets and highways account for about a third of this imperviousness.[10]

Most residential lots drain to streets, where gutters convey runoff into drain pipes. Streets receive vehicle fluids and brake dust, litter, and illegally dumped materials. Although the state has adopted stringent regulations for runoff from local development sites,[11] recent guidelines[12] make it optional to control runoff from state highways.

Screens or traps can be installed to stop trash from entering storm drains.[13] Swales and bioretention areas adjoin catch basins along some new or reconstructed streets.[14]

The design of roads, and road drainage, is particularly important in rural areas. Flows from road drainage can cause severe erosion, especially when outfalls drain onto unprotected hillsides. Erosion of unpaved road surfaces can contribute fine sediment to sensitive headwaters creeks.

The buildings, streets, and drainage of the fully urbanized Santa Clara Basin are nearly completely built. Some watersheds will see very little new land developed in the next 20 years; even the still-developing Coyote and Arroyo de la Laguna watersheds are 90% "built-out."[15] Site design strategies such as pervious pavements, landscape detention, and rain gardens can be incorporated into redeveloped sites, but this will only happen over the course of many decades. Detention and retention of runoff from streets and highways will likely take longer.

Detention of runoff near the pipe outfall, just before it reaches the creek, may be an alternative (or a complement) to having detention and infiltration features dispersed throughout the watershed. Detention of these large flows would require heavily engineered structures and large basins at the pipe outfall. Smaller structures might be able to detain and treat dry-weather flows

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To comply with a provision of the stormwater permit, SCVURPPP and Santa Clara County have developed a Performance Standard for rural public works, including road construction, maintenance, and repairs.

and high-temperature runoff from small summertime and early fall storms. These small structures might also buffer "flash discharges" and remove trash.

4e | Strategies to Improve Buildings, Streets and Drainage

In the last few years, watershed advocates, engineers, landscape architects, and others have developed a panoply of land-use policies, site designs, landscape features, and engineered devices that, with varying degrees of success, reduce or retain runoff while improving site aesthetics and utility.

What has been done and what needs to be done to encourage developers to use these designs?

For the last decade, Santa Clara Basin municipalities have been working with RWQCB staff to reduce the effects of new development on downstream water quality.

One of the first problems identified, and the first focus of action, was to control sediment and other pollutants in runoff from construction sites. Construction contractors are required to revegetate slopes before, and limit grading activities during the rainy season, create temporary detention basins where needed, and protect storm drain inlets. The municipalities have adopted, and the RWQCB has approved, details for these Best Management Practices (BMPs) as well as schedules for site inspections and procedures for enforcement.[16]

In 1994, Santa Clara Basin municipalities (along with city, town, and county governments from around the Bay area) assisted RWQCB staff to prepare a set of recommendations regarding municipal policies for new development. That same year, all the municipalities adopted those recommendations.[17] They created guidelines and plans to revise their General Plan policies, to change their procedures for reviewing new developments, and to require detention and retention of runoff from larger sites. These guidelines and plans were later revised and incorporated into performance standards[18] for each municipality, which the RWQCB approved in 1996.[19]

The performance standards are updated and expanded through a process of continuous improvement. In 2002, SCVURPPP developed a performance standard for rural public works, including roads.[20]

In 1997, with the participation of Santa Clara Basin municipalities, the Bay Area Stormwater Management Agencies Association (BASMAA) published *Start at the Source: Design Guidance Manual for Stormwater Quality Protection.* The manual, which received an award from the American Association of Landscape

Architects, emphasizes the use of site design and pervious materials to minimize runoff. BASMAA published a revised and expanded edition in 1999.

Santa Clara Basin municipalities distribute *Start at the Source* and related outreach materials to developers, planners, engineers, and landscape architects who plan new developments in their jurisdiction. The municipalities also hold workshops and training sessions for these professionals and for the municipal staff who review their plans.

Beginning in 1997, the WMI's Land Use Subgroup began to look for ways that municipalities might do more to reduce runoff from new and redeveloped sites. The LUS, in a series of studies sponsored by SCVURPPP, cataloged municipal policies that are relevant to land use, imperviousness, and drainage and compared and contrasted existing policies against an ideal or model, set of development principles.[21]

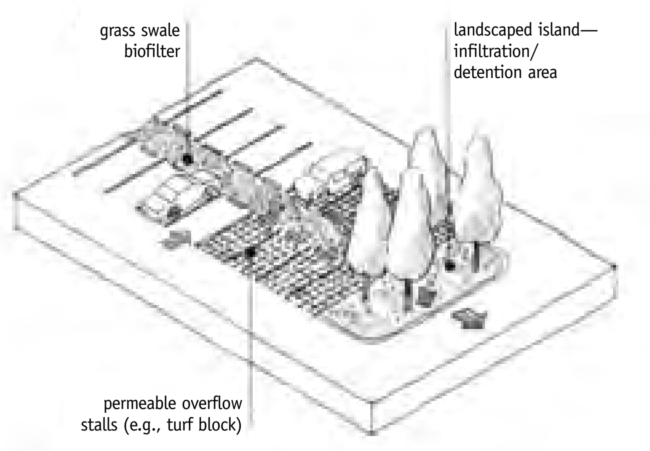
Some municipalities' current design standards, regulations, codes, and engineering details require collection of runoff and transport off-site; these practices may unnecessarily preclude retention and infiltration.

SCVWD can coordinate more closely with municipalities' efforts to reduce imperviousness by improving interagency communication at the Board/Council, management, and first-line staff levels.

4f | WMI Strategic Objective: Promote Drainage Systems that Detain or Retain Runoff

The WMI advocates site development designs and drainage system designs that detain or retain runoff to protect streams and habitats from flash runoff, erosion, and pollutants, and to protect from downstream flooding, while preventing groundwater pollution.

To meet these goals, cities, towns and the County should revise some of their standards for site development and drainage systems. In areas where increased runoff could cause increased erosion of creek beds and banks, siltation, or other effects on streams, new and rebuilt sites and drainage systems should (where feasible) incorporate features to detain or retain runoff.



4.1 Overflow parking design (from *Start at the Source*).

Regulatory Corner: Stormwater Permit Requirements For New Development

In October 2001, the RWQCB revised the SCVURPPP co-permittees' permit to discharge stormwater to local creeks and southern South San Francisco Bay.* Under the new provisions, cities, towns, and the County must require many proposed development projects to incorporate treatment controls to remove runoff pollutants.

The municipalities must also address increases in peak flow and runoff volume to avoid increased erosion of creek beds and banks, siltation of stream-beds, or other effects on streams. In some instances, this could require that future development projects be designed so that runoff is not increased above pre-development amounts. However, the cities and towns, county, and SCVWD have the option of showing that existing drainage facilities, or new facilities, can handle the increases without causing any damage to creeks, or propose alternative standards based on the condition of specific creeks.

The revisions also require the co-permittees to continue upgrading their programs to control erosion and sedimentation from construction projects and to insure that new commercial buildings include features to limit the flow of pollutants from dumpsters and outdoor wash areas. The provisions imposed extensive administrative and reporting requirements on the local government agencies.

*Order 01-119, issued October 17, 2001.
www.swrcb.ca.gov/rwqcb2/OrderNum/01-119final.doc

4g | Next Steps for the WMI

4g1 WMI Actions Needed to Implement the Strategic Objective

- Work with SCVURPPP to facilitate implementation of the RWQCB stormwater permit.
- Review the results of SCVURPPP's Development Policies Comparison and identify policies that limit detention and infiltration of runoff and potential improvements to policies controlling erosion and sedimentation from construction sites.
- In cooperation with SCVURPPP, develop model public works policies, specifications, and details to encourage detention and infiltration of runoff.
- Coordinate and integrate implementation of the guidance manual and other outcomes of SCVURPPP's Hydromodification Management Plans with Watershed Stewardship Plans (Chapter 8) and with General Plans and Specific Area Plans (Chapter 3).
- In cooperation with SCVURPPP, distribute model public works specifications and details to municipalities in presentations to managers and public works departments and in workshops for public works staff, developers, and engineering consultants.
- Provide a neutral place where contentious issues relating to drainage design methods and effectiveness can be referred.
- Develop indicators of progress for buildings, streets, and drainage.

4g2 Other WMI Actions that Support the Strategic Objective

- Track and participate in SCVWD research on the feasibility of regional detention, retention, or treatment facilities.

5 PLANNING FLOODPLAIN AND RIPARIAN STEWARDSHIP

5a | A Vision Along and Across the Stream Corridor

In the WMI's vision of a future Santa Clara Basin landscape, streams will flow through protected habitat corridors—from their headwaters down to the Bay.

In their upper, hillside reaches, the streams will cascade or meander through open space and less populated areas. On the urbanized valley floor, stream corridors will continue to serve many purposes: They will contain flows from major floods (while minimizing damage to property), protect streams and streamside habitat, and give city dwellers a place to enjoy nature, to play, and to walk or bike to work.

How can all these needs be accommodated on the same strip of land?

Think of separate zones nested within the corridor width. The riparian zone, which includes the stream, should be a contiguous natural preserve, disturbed only here and there by road overcrossings and places for people to walk or sit next to the creek. Outside the riparian zone, in addition to forested areas, the floodplain should feature ball fields, gardens, trails, and other uses that can be restored after the occasional inundation. Dense, livable urban neighborhoods should be located beyond the floodplain, built on higher land or protected by set-back levees.

Some elements of this vision exist; others are coming into being. Thanks to past generations of public leaders, park chains extend along many Santa Clara Basin streams. New flood protection projects minimize riprap and concrete. Rather than

5.1 A Vision for the Floodplain

< < < REWIND

The importance of imperviousness is discussed in Section 4b.

FAST FORWARD > > >

A stream's connection to its floodplain is necessary to maintain its "dynamic equilibrium" with its watershed. See the discussion of fluvial geomorphology in Section 8b3.

eliminate flooding, floodplain management policies seek to minimize property damage while accommodating natural and inevitable floods. Urban design guidelines and municipal development policies protect riparian corridors. Public agencies and volunteer associations get the public involved in cleaning up creeks and learning about their ecosystems.

Urban floodplains and riparian corridors should be planned and maintained in an integrated way to protect and enhance their value for habitat, park, and flood management. A first step is to create a shared sense of place and a consciousness of the many functions and values of stream corridors.

5b | Flooding and Flood Damages

5b1 Large and Small Floods

In undisturbed watersheds, creeks and rivers overtop their banks once every year or two (on average). These frequent, small floods refresh streamside vegetation, recharge local groundwater, and renew freshwater wetlands. They also move accumulated sediment and help maintain characteristic stream morphology. This classic pattern does not occur everywhere in Santa Clara streams. In some portions of many of Santa Clara County streams, the streambed is naturally incised and typically these small floods, and many larger ones, were retained within the deep banks.

Creeks and rivers must also carry or transport larger floods, the ones that recur every five or ten years, and the really big floods that may come only once in a century.

Reducing the amount of impervious surface—and incorporating swales, "rain gardens" and other runoff detention into the urban landscape—helps preserve the timing and peak discharges from small to moderate storms.

But during big storms, the ground has become saturated so that nearly all rainfall runs off. The amount of imperviousness in a watershed doesn't have much effect on flooding during big storms.[1]

During larger floods, a natural river spreads across its floodplain. Adjacent swamps become lakes, low-lying areas become swamps, and normally dry areas are briefly inundated. Fish and other aquatic animals enjoy a brief heyday of feeding, breeding, spawning, and migration. Then the floodwaters recede. In some portions of Santa Clara streams, this recession returns the water to the stream from which it came; but in many streams, the natural levees have changed the slope of adjacent land such that when flow escapes, water runs away from the creek or parallel to the creek and doesn't flow back. Mineralized nutrients wash back into the stream, and decaying vegetation is left behind on the floodplain. The biological productivity and diversity of both environments is enhanced.[2]

Big floods can benefit aquatic ecosystems, but they can be disastrous for people living or working within the floodplain. In addition to damaged or ruined property, floods block travel and disrupt the local economy.

5b2 Preventing Flood Damages

Many areas in the Santa Clara Basin are protected from flooding by reservoirs, levees, and stream channelization. But these “structural solutions” have at least two major flaws.

The first flaw is that they can radically reduce the quality of stream and riparian habitat. When streams are straightened and confined to earth channels, the connection between stream and floodplain is broken. In many reaches, streams are confined to relatively lifeless concrete or riprap channels, and riparian vegetation has been eliminated entirely.

A second flaw is that—because rainfall intensity is unpredictable, and because stream channels are naturally dynamic—structural solutions tend to fail unexpectedly. As the geographer Gilbert White documented in 1942, construction of flood-control structures can create a false sense of security, which, in turn, helps encourage development within floodplains. The result is a cycle of flooding, economic loss, disaster relief, flood-control projects, renewed floodplain development, more flooding, and more economic loss.[3]

Today, most public agencies—including SCVWD and the Basin’s cities and towns—manage floods more naturally. They use “biotechnical” methods to stabilize stream banks and floodplain management policies to limit damages from flooding. They encourage or require property owners to elevate structures or “pad up” the site; encourage site designs that maintain perviousness and slow runoff; maintain flood warning systems; mandate “floodproofing” of buildings, public works and utilities; relocate threatened structures; discourage development in flood-prone areas, and purchase and maintain floodplain property.

5b3 The National Flood Insurance Program

The National Flood Insurance Program (NFIP), which was started in 1968, is the centerpiece of Federal efforts to reduce flood damages. The Federal Emergency Management Agency (FEMA) administers the NFIP.

The NFIP defines the floodplain as areas having a one percent chance of being flooded in any given year. Federally backed mortgages require flood insurance for properties within these areas.

5.2 Measures to Reduce Flood Damages
From *Restoring Streams in Cities: A Guide for Planners, Policymakers, and Citizens,* by Ann L. Riley. Copyright © 1998 Ann L. Riley. Reproduced by permission of Island Press, Washington, D.C. and Covelo, California.

TABLE 5.1 FLOODPLAIN MANAGEMENT RESOURCES

National Flood Insurance Program & Community Rating System	**www.fema.gov**
California Dept. of Water Resources Floodplain Management	**www.fpm.water.ca.gov**
Santa Clara Valley Water District	**www.valleywater.org**
Floodplain Management Association	**www.floodplain.org**

Under the NFIP, Federally subsidized flood insurance is made available to property owners in communities that adopt minimum ordinances restricting development within floodplains. All Santa Clara Basin municipalities participate in the NFIP.

To regulate floodplain development, NFIP ordinances identify two zones within the floodplain: the "floodway" and the "floodway fringe."

The "floodway" is the area, including the stream channel, which must be kept unobstructed so that the "one percent flood" can be carried without backing up and increasing the height of floodwaters.

The "floodway fringe" is the area between the floodway and the boundary of the area inundated by a one percent flood. New or rebuilt residences must have their lowest floor raised above the predicted flood elevation. Commercial buildings must be elevated or have reinforced walls, watertight doors, and other features to protect them from flood damage. Mobile homes must be bolted to permanent foundations.[4]

The NFIP established, in effect, minimum national standards for floodplain management. Methods for determining floodplain boundaries have been standardized by FEMA and have withstood legal challenges.

However, the NFIP has an unintended consequence: rather than managing their floodplains, communities may seek to avoid the costs of flood insurance—and participation in the program—by opting for channelization and levees that will exclude their area from the 100-year floodplain.[5]

In 1990, a Community Rating System (CRS) was added to the NFIP. By adopting policies that go beyond the minimum NFIP standards, communities can reduce flood insurance premiums by 5% to 45%.

The CRS works on a point system. Points can be credited for activities and policies that relate directly to reducing flood hazards. For example, points can be credited for channel maintenance that preserves flood capacity and for requiring buildings to be raised to an additional "freeboard" height above the predicted flood elevation. Points can also be obtained for protecting water quality and sensitive habitats and for more general watershed-related programs. For example, points can be accumulated if a city requires that new development not increase runoff volume, or if it conducts education and outreach on watershed issues.[6]

Usually, FEMA works directly with individual cities and towns who want to participate in the CRS program. However, many SCVWD countywide activities, such as its creek maintenance program and its flood awareness program, meet the standards for CRS points. SCVWD created an unusual partnership under which the points for its activities are credited to cities and towns that participate in the CRS.[7]

5c | Protecting Riparian Areas

5c1 The Value of Riparian Ecosystems

Riparian zones are especially important in the semi-arid Santa Clara Basin. The linear shape of stream corridors creates a long boundary between the cooler, wetter, shaded riparian microclimate and the hot, dry, exposed hillside or plain. This edge provides a wider variety of food sources and places for animals to rest or hide and supports more complex assemblages of plant and animal species. Stream corridors with continuous riparian areas are most valuable. Next best are those that are not too fragmented.[8]

Riparian vegetation is essential to maintaining fish habitat. In a stream bounded by a healthy riparian forest, roots, shrubs, and vines bind the stream bank and resist erosion. Exposed, undercut roots and overhanging vegetation allow fish to rest and avoid predatory birds. The shade moderates water temperatures, and the overhanging trees contribute leaves, fruit, cones, insects, and other detritus to the aquatic food chain.

Woody debris slows flood velocities and forms pools and storage for sediment that might otherwise reach spawning areas. The organically rich soils store water along the corridor during the rainy winters and keep the zone damp during the dry summers.[9]

5c2 Riparian Areas in the Santa Clara Basin

Although Santa Clara Basin creeks have been extensively modified, riparian vegetation remains, or has re-grown, along much of their banks. One exception exists where there are reaches that have been lined with riprap or concrete—which are generally devoid of riparian cover—and many reaches confined by earthen levees.[10]

Because of continuous advocacy to protect creeks and riparian areas and a tradition of cooperative planning by Santa Clara County and its cities and towns, many creeks are bounded by parks.

Several types of riparian habitats abut Santa Clara Basin streams: Some forested areas feature cottonwoods and willows; in others, sycamores and valley oaks predominate. Some have herbaceous plants instead of trees. Streamside freshwater marshes and (closer to the Bay) brackish-water marshes each support special and distinct

5.3 Stream Vegetation. (From SCVWD, *Stream Care Guide)*.

ecosystems.[11,12] (Fifty percent of endangered species require wetland habitat at some point in their lifecycle.[13]) Where commercial and residential land uses impinge on streams, the riparian zone may have been reduced to weeds, or may feature a riparian "urban forest" of mostly non-native ornamentals.[14]

5c3 Policies to Protect Riparian Areas

Policies vary from one municipality to the next, but the Conservation and Open Space elements of many municipal General Plans recognize the value of riparian zones. These and other municipal policies call for development to be set back from riparian zones.

The policy stated in the City of Cupertino's 1993 *General Plan* may be typical: "Retain creek beds, riparian corridors, water courses and associated vegetation in their natural state to protect wildlife habitat and recreation potential and assist groundwater percolation."[15] The City's subdivision ordinance requires that "existing or potential riparian vegetation must be shown on all development plans… lots in major subdivisions must be clustered so that the water course and existing or potential riparian vegetation are retained [in designated open space]."[16]

The City of San Jose's 1999 *Riparian Corridor Policy Study*[17] recommends that buildings, paved surfaces, and ornamental landscaping be set back at least 100 feet from the edge of the riparian corridor. Exceptions are suggested in certain instances, such as the city's downtown areas and infill projects on small lots.[18]

5.4 Streamside Development. Frontage streets (bottom) are best; loop streets (upper right) are preferred over cul-de-sacs. (From *City of San Jose Riparian Corridor Policy Study,* p. 36)

5c4 Urban Design in Riparian Areas

In the 1970s, SCVWD began to study how different subdivision layouts affect the way streamside residents use their local waterways. SCVWD now recommends that subdivision developers avoid having private lots "back up" on to stream corridors, because this design reduces public access and creates security concerns for homeowners. Because the "back-up" lots are typically fenced off from the adjacent creek, residents may not regard the creek as their responsibility to steward. The creek may become a "no-man's land" where debris is dumped and clean-ups are infrequent.

Many owners of streamside residential lots are avid stream stewards; others may err by building or remodeling structures or play areas too close to sensitive habitat. Some Santa Clara Basin municipalities review designs for these changes before they may be built, but most do not.

SCVWD's streamside development guidelines recommend that streamside subdivisions be designed with frontage streets or loop streets. This design preference is echoed in the City of San Jose's *Riparian Corridor Policy Study* and the City's *Residential Design Guidelines*.

5.5 Countywide Trail Design Guidelines.
Santa Clara County's Uniform Interjursidictional Trail Design, Use and Management Guidelines specify setbacks and preferred locations of streamside trails.

5c5 Recreational Uses in Floodplains and Riparian Areas

Park chains and trail systems along the Basin's major creeks provide refuge for both people and wildlife. About three-fourths of riparian corridors are designated for public recreational trails, but only a small proportion of these actually have developed trails.[19]

In 1969, the San Jose City Council and the County Board of Supervisors adopted a joint policy statement outlining a framework for a linear regional park along Coyote Creek. The framework called for trails to be continuous the length of the park, for more intense uses to be located where there was sufficient park area away from the streamside, and to limit concessions and other commercial facilities only to essential services.

Over the years, contentious debate has taken place over how development occurred along Coyote Creek. In response to this debate, as well as many parks-related issues, the City of San Jose prepared the *1990 Long-Range Land Utilization Report* for the Coyote Creek Park Chain. That report left many issues unresolved, setting the stage for the City's 1994 *Riparian Corridor Policy Study*.

Santa Clara County's *General Plan* restates the County's long-held vision of linear streamside park chains along major creeks passing through the urban area. In 1995, the County adopted a *Countywide Trails Master Plan* and *Uniform Interjurisdictional Trail Design, Use, and Management Guidelines*.[20]

Those guidelines state that active play areas should be a minimum of 100 feet from the edge of riparian vegetation. Multi-use trails should be 10 feet from the edge, where feasible; hiking trails and picnic tables may be immediately adjacent.

The 1995 documents also guide trail designers: Trails should be on only one side of corridor in sensitive areas. Trail builders should minimize cut and fill and vegetation disturbance, direct drainage away from creek, and avoid sensitive wildlife areas. To allow users to experience creek environs while minimizing impacts, side trails with interpretive nodes are recommended. The guidelines consider the pros and cons of fences; they should discourage human access, but not block the movement of wildlife within the corridor, and should be no higher than 3-4 feet.

The County Parks Department is currently preparing a strategic plan for acquisition and development of parklands. A draft "system wide strategies" document envisions an inner ring of parks for group activities and an outer “emerald necklace” providing for “more solitary park experiences.” A trail system and streamside park chain would “become the web tying communities to parks and linking parks together.”[21]

5d | Encouraging Stewardship of Riparian Areas

Public agencies and volunteer associations work to get citizens involved in caring for creeks and riparian areas. Through its Adopt-a-Creek Program, SCVWD provides support, advice, and permits to groups who organize creek clean-ups.[22]

With support from SCVURPPP and the City of San Jose, the Environmental Education Center at the Don Edwards San Francisco Bay National Wildlife Refuge (DESFBNWR) in Alviso provides visitors with an engaging and educational experience of salt marshes and sloughs.

SCVURPPP, SCVWD, and local urban runoff pollution prevention programs support school programs where kids can learn about creek and riparian habitats.

FAST FORWARD > > >

Actions to protect stream banks can have unforeseen consequences downstream. See Chapter 8.

SCVWD’s *Stream Care Guide*[23] encourages streamside property owners to avoid building in the floodplain, to limit use of pesticides, herbicides, and fertilizers, to keep pets and livestock out of streams and riparian areas, and to use native plants in landscaping. The guide also tells property owners to work with the SCVWD’s permits section and obtain a permit before conducting any bank-protection work or removing any natural debris.

5e | Integrating Floodplain and Land Use Planning

The policies of SCVWD, Santa Clara Basin cities and towns, and the Santa Clara County Parks and Recreation Department set the stage for implementing the WMI’s vision of multi-use urban stream corridors. Credits for floodplain management, available under the National Flood Insurance Program’s Community Rating System, generally dovetail with the municipalities’ General Plans and other policies to protect streamside areas. With good design and maintenance, floodplains can accommodate playgrounds and trails for hiking, biking, and riding, while limiting effects on sensitive riparian habitat.

TABLE 5.2 RIPARIAN STEWARDSHIP RESOURCES

Stream Care Guide for Santa Clara County. Brochure, 12 pp. Available from the SCVWD Public Information Office.

“The Architecture of Urban Stream Buffers.” *Watershed Protection Techniques 1(4):* 155-163 **www.stormwatercenter.net**

“The Significance of Riparian Environments.” In: *Restoring Streams in Cities: A Guide For Planners, Policymakers, and Citizens,* by Ann L. Riley. Island Press, New York. pp. 95-104.

Federal Interagency Stream Restoration Work Group. *Stream Corridor Restoration: Principles, Processes, and Practices*. pp. 2-51 – 2-59. Available at **www.usda.gov/stream_restoration**

However, the implementation of current policies—for both floodplain management and riparian protection—tends to be reactive and focused on limiting impacts of new developments. Integrated planning is needed to serve the complex role of floodplains and riparian corridors as habitat, park space, and floodway. The County, municipalities, and SCVWD can build on their decades-long progressive tradition of working together to align their policies and efficiently serve the public interest.

Visits to streamside areas are an opportunity for the public to learn about the value and multiple functions of stream corridors and to develop a shared sense of place. By coordinating public outreach with specific information about streamside recreational sites, the WMI can help the County, municipalities and District to create a public awareness of the functions and value of stream corridors.

5f | WMI Strategic Objective: Integrated Multi-Use Planning of Floodplains and Riparian Corridors

The WMI advocates an integrated planning process to chart the future landscape of the Basin's floodplains and riparian corridors.

To the extent reasonably practicable, SCVWD, County Parks, Valley Transportation Authority (VTA), and Santa Clara Basin cities and towns should align their policies and integrate their planning of floodplains and riparian corridors. Integrated planning should incorporate the cities' riparian corridor policies, the policies and procedures being developed by the Watershed Resources Protection Collaborative, applicable provisions in the cities' and county's General Plans, existing and planned recreational uses within floodplains and riparian areas, the *Countywide Trails Master Plan and Uniform Interjurisdictional Trail Design, Use, and Management Guidelines*, the National Flood Insurance Program (FEMA maps) and benefits attainable under the FEMA's Community Rating System. In addition, the integrated plans should consider existing and potential habitat for the red-legged frog and other riparian species. Plans may also need to consider potential locations for facilities that detain runoff or strain trash from stormwater. New and rebuilt road and rail alignments and stream crossings should protect riparian corridors and accommodate flooding.

Integrated floodplain and riparian planning should also incorporate interpretive signs and other opportunities for the public to learn about the values and multiple functions of stream corridors and to develop a shared sense of place.

Integrated planning of floodplains and riparian corridors can begin with a pilot project in a specific watershed or in one or more reaches where this planning is especially needed.

5g | Next Steps for the WMI

5g1 WMI Actions Needed to Implement the Strategic Objective

- Working with the County, municipalities, District, and other agencies, provide a forum and develop a process for integrated planning of floodplains and riparian corridors.
- Provide a neutral place where potentially contentious floodplain management issues (e.g., protection from flooding vs. floodproofing for specific areas and location of recreational facilities) can be referred.
- Promote and popularize natural flood protection and floodplain management as a component of the WMI's vision.
- Develop an outreach strategy that focuses on the multiple uses of stream corridors.
- Coordinate and integrate floodplain and riparian corridor planning with other WMI objectives, including watershed stewardship planning (Chapter 8), habitat conservation planning (Chapter 7), and General Plans (Chapter 3).
- Develop indicators of implementation and effectiveness of multi-use planning for floodplains and riparian corridors.

5g2 Other WMI Actions that Support the Strategic Objective

- Encourage cities and towns to establish special review requirements for expansion or substantial remodeling on streamside residential properties.
- Develop and distribute information to creek side landowners and land users about protection and enhancement.
- Mobilize creek side residents to remove invasive or non-native species.
- Investigate, with SCVWD, allowing creek side property owners to remove fencing to restore a connection with the creek.

6

CONSERVING AND REUSING WATER

6a | A Vision for a Sustainable Water Supply

To the plants and animals that live there, the Santa Clara Basin's watersheds, creeks and wetlands are a rare and irreplaceable habitat. These special places are also part of a water-supply system that serves 2 million people. The WMI stakeholders believe that the Basin's water supply needs can be balanced with other needs—to protect Basin habitats, to keep people and property safe from floods, and to provide places for people to live, work, and play.

The WMI advocates a water supply system that relies primarily on local sources, optimizes water conservation, maximizes use of recycled and reused water, and enhances groundwater recharge to meet water demands.

6b | Where Our Water Comes From

In 1915, flowing (artesian) wells were common throughout much of the Santa Clara Valley. However, farmers had soon drilled so many wells that the groundwater began to be depleted. Citizens' groups looked for ways to make up the overdraft. Tibbetts and Kieffer's 1921 *Report to the Santa Clara Valley Water Conservation Committee on the Santa Clara Valley Water Conservation Project* showed this could be done by spreading water over gravelly areas so that it would seep into local aquifers. The report recommended 17 large reservoirs, plus low-check dams, pumping stations in the lowlands to divert the runoff, and a system of concrete conduits to distribute the water.

Voters authorized creation of the Santa Clara Valley Water Conservation District (predecessor to SCVWD) in 1929. The Calero, Almaden, Guadalupe, Vasona, and Stevens Creek dams were completed in 1935. Coyote Dam was topped off in 1936, Anderson Dam in 1950, and Lexington Dam in 1952.[1]

But the development of local water sources couldn't keep up with the expansion of farms and orchards. Water would have to be imported from outside the Basin.

In 1940, the San Francisco Public Utilities Commission first piped water from Yosemite National Park, via the southern Hetch Hetchy Aqueduct, to parts of the Santa Clara Basin. But the new water supply didn't slow the overpumping of groundwater. By the 1960s, groundwater elevations

TABLE 6.1 CALIFORNIA WATER USE PROJECTIONS

Water use information is based on average water year conditions. Maf = Million acre-feet/year

	1995	2020 Forecast
Population (million)	32.1	47.5
Irrigated crops (million acres)	9.5	9.2
Urban water use (maf)	8.8	12.0
Agricultural water use (maf)	33.8	31.5
Environmental water use (maf)	36.9	37.0

Source: California Department of Water Resources

in some parts of the valley had dropped 200 feet. Without the buoyant effect of the groundwater, the valley's clay soils compacted, and the land sank. Seawater seeped into groundwater as far as 10 miles inland.

Groundwater overdrafts began to be reversed in the mid-1960s, when the State Water Project's South Bay Aqueduct was completed. Pumping from wells decreased, and the groundwater was recharged with imported water.[2] During that same decade, factories and housing developments became the major users of water as they replaced farms and orchards. In 1987, a new series of pipes and tunnels connected the Santa Clara Valley with the San Felipe Division of the Federal Central Valley Project.

Today, SCVWD provides groundwater and Federal Central Valley Project and State Water Project water to public and private suppliers. Some suppliers also have their own wells or can buy Hetch Hetchy water.[3] Municipalities and industries use 90% of the total.[4]

SCVWD operates 10 reservoirs and 18 major recharge systems. Imported water and stored runoff is released from dams and pipelines to areas where it will seep into groundwater. These recharge areas include over 90 miles of stream channel in 30 local creeks, plus 71 off-stream recharge ponds with a combined surface area of more than 390 acres. An average of 157,200 acre-feet can be recharged each year.

From the 1920s into the 1990s, SCVWD built spreader dams across streams at more than 60 locations. These temporary or permanent dams impound water in streambeds to speed percolation through stream banks. SCVWD estimates that the spreader dams increase in-stream recharge capacity by about 15,000 acre-feet per year (about 10%).[5] The CWA 404 permit allowing many of the District's use of spreader dams expired in 1994. The instream recharge program is currently under review by SCVWD.[6]

The Alameda County Water District (ACWD) supplies the portion of the Basin that lies in Alameda County. ACWD also blends groundwater (recharged with water diverted from Alameda Creek) and State

Water Project water (from the South Bay Aqueduct) to serve its customers.

The Basin's reliance on imported water ties its economy, and its ecology, to California's statewide water system. The *California Water Plan* was first published in 1957; a 1991 amendment to the Water Code requires that it be updated every five years. The water plan appraises how actions planned by California water managers could reduce the gap between supplies and demands. California must reduce withdrawals from the Colorado River from the current 5.3 million acre-feet per year to 4.4 million acre-feet per year, as other states exercise their long-standing rights to the water. The Santa Clara Basin's ability to draw on statewide supplies will be affected by new listings of endangered species in habitats throughout the state and contention over water supplies to the Klamath River, Pyramid Lake, Mono Lake, and the Salton Sea.[7]

6c | Effects of Water Supply Operations on the Watershed

The damming, diversion, and control of Basin stream flows for water supply has radically changed the Basin's stream and riparian ecosystems.

First, there are the physical changes to streams and stream channels. Dams interrupt the stream continuum. Upstream of dams, reservoirs create a different (and less diverse) ecosystem. Dams block the transport of sediment, woody debris, and nutrients. As a result, downstream banks and beds erode, instream cover for fish is reduced, and downstream reaches are less biologically productive. In addition, dams (including low spreader dams) can block fish migration.

Reservoirs are allowed to fill during the winter, and water is released for recharge during dryer months. This changes (and usually flattens) the natural pattern of flows and floods. This change affects many native plants and animals, because their life cycles are timed to take advantage of high and low flows.

Some native riparian plants tolerate prolonged flooding. Some native invertebrates and fishes tolerate prolonged low flow. Other native fish have adapted to occasional high flows or exploit floodplain habitats during floods. These adaptations enable these native species to out-compete less tolerant exotic species. Flow stabilization can contribute to the invasion or establishment of exotic species and can threaten rare native species with local extinction.[8]

In 1997, in response to a water rights complaint brought by the Guadalupe-Coyote Resource Conservation District (GCRCD), SCVWD convened the Fisheries and Aquatic Habitat Collaborative Effort (FAHCE). The complaint alleged that SCVWD's water operations were harming cold water fisheries in Guadalupe, Coyote, and Stevens Creek watersheds.

FAHCE includes SCVWD, GCRCD, the US Fish and Wildlife Service (FWS), the National Marine Fisheries Service (NMFS), the California Department of Fish and Game (CDFG), the City of San Jose, Trout Unlimited and the Pacific Coast Federation of Fishermen's Associations. The FAHCE process has studied the effects of water supply operations on coldwater fisheries and developed plans to modify reservoir

The Central Valley Project Improvement Act of 1992

Competition for California's water led to passage of the Central Valley Project Improvement Act of 1992 (CVPIA). It makes the Bureau of Reclamation responsible for delivering water to wildlife refuges all year.

Refuges are granted the same priority as agriculture. Reductions during drought years may not exceed 25 percent of normal allocations. Wildlife biologists will determine how much water is needed to maintain optimum habitats, and 2002 allocations are to match this number.

The CVPIA established conditions under which Central Valley Project (CVP) water can be transferred. Allocations under a water district's water service contract can be transferred to any California water user for any purpose recognized as beneficial use under California law.

This change facilitated transfer of water entitlements from agriculture to municipal and industrial users.

releases and other water supply and operation to maximize the availability of suitable coldwater habitat.

6c1 Effects of Wastewater Discharges on a Salt Marsh

In 1990, the SWRCB reported that, between 1970 and 1985, the San Jose/Santa Clara Water Pollution Control Plant's increasing discharges of fresh water effluent had converted nearby salt marsh to brackish or fresh water marsh. The loss of salt marsh habitat affects two endangered species, the California clapper rail and the salt marsh harvest mouse. The SWRCB ordered the Plant to limit its dry-weather discharges to 120 million gallons per day (mgd) and to restore 380 acres of salt marsh or equivalent habitat.

In response to the 120 mgd flow limit, the City submitted a South Bay Action Plan, which in addition to salt marsh mitigation, included indoor water conservation and water recycling. The South Bay Action Plan was updated in 1997 in response to flows above 120 mgd average dry weather effluent flow to include additional programs. Since 1998, flows from the Plant have been below 120 mgd. No additional conversion has occurred since 1998 and significant additional salt marsh has formed.[9]

6d | Strategies for a Sustainable Water Supply

6d1 Integrated Water Resource Planning

SCVWD's 1975 water supply master plan identified importing more water from outside the Basin—through the Federal San Felipe Project—as the best solution to rising demand.[10] Two decades later, that view had evolved. In response to the 1987-1992 drought, and changes in water policy locally and statewide, SCVWD engaged stakeholders in an "Integrated Water Resources Planning" (IWRP) process to update the 1975 document and plan water supply through 2020.[11] IWRP is defined in many ways, but the term is used internationally to describe a strategic decision-making process that incorporates competing social and environmental goals.[12]

SCVWD's strategy aims to maximize its flexibility for meeting a projected shortfall of 100,000 acre-feet per year by 2020. The strategy includes water banking, possible transfers from other Basins, water conservation, and water recycling. SCVWD is currently developing a 2003 IWRP Update.[13]

6d2 Water Banking

SCVWD has reserved up to 350,000 acre-feet of storage in the Semitropic Groundwater Banking Program located near Wasco, California. Since 1996, SCVWD has stored about 160,000 acre-feet in the program. The only withdrawals so far were for the purpose of selling 30,000 acre-feet to the CALFED Environmental Water Account in 2001. SCVWD's rights to annual withdrawal capacity vary depending on the State Water Project allocation, ranging from a maximum of 65,000 acre-feet, to a minimum of 31,500 acre-feet.[14]

6d3 Water Transfers

SCVWD's preferred strategy calls for 25,000 acre-feet of "long-term transfers and/or water recycling" between 2005 and 2010. In recent years, SCVWD has entered into numerous one-year or short-term water transfers, including a 10-year agreement to share a Central Valley Project water service contract supply of 6,260 acre-feet with Pajaro Valley Water Management Agency and Westlands Water District. Although this activity has increased interim water supplies available to the Basin, provided experience with institutional and other processes governing transfers, and established important relationships in the water transfer market, none of these short-term agreements yet fulfill the IWRP preferred strategy. It is likely that long-term water transfers will be developed primarily as option agreements, in which SCVWD takes delivery of supplies only in certain dry and critically dry years, and that these water transfers will be developed through partnerships to provide regional benefits.[15]

6d4 Water Conservation

Conservation has succeeded in reducing water consumption (and water needs) significantly. After increasing steadily from 1950 to 1980, U.S. water use declined and has remained fairly constant since the mid-1980s, despite increases in population.[16] During the 1991 drought year, Santa Clara Basin businesses and residents cut their water consumption by 28%. Prompted by that drought, water agencies and environmental advocates joined together in a Memorandum of Understanding Regarding Urban Water Conservation in California to "…expedite implementation of reasonable water conservation measures in urban areas; and … to establish assumptions for use in calculating estimates of reliable future water conservation savings resulting from proven and reasonable conservation measures." The memorandum was updated in December 2002.

The California Urban Water Conservation Council oversees implementation of the memorandum and maintains and updates a list of Best Management Practices (BMPs) for water conservation. The Council adopted revised BMPs in 1997. [17]

As one component of the South Bay Action Plan, which was developed by the City of San Jose to reduce wastewater discharges from the San Jose/Santa Clara Water Pollution Control Plant, the City conducts a number of programs aimed at retrofitting older toilets with ultra-low flow (1.6 gallon-per flush), dual flush, and 1.0 gallon toilets.

TABLE 6.2 WATER CONSERVATION INFORMATION RESOURCES

Water Saver Website: This website was developed by the California Urban Water Conservation Council under a cooperative agreement with the U.S. Environmental Protection Agency. The Council is a consensus-based partnership of over 285 urban water suppliers, public advocacy organizations, and other interested parties concerned with water supply and conservation of natural resources in California. The Council was created to oversee the 1991 Memorandum of Understanding Regarding Urban Water Conservation in California, which sets forth Best Management Practices for the efficient use of water in urban areas in the state. **www.h2ouse.net/action/index.cfm**

City of San Jose's programs to reduce water use and effluent discharge: **www.slowtheflow.com/**

SCVWD's water use efficiency page: **www.valleywater.org**

SCVWD and other Cities also operate a toilet retrofitting program and other conservation programs.

The City of San Jose[18] and SCVWD[19] offer local industries rebates of up to $50,000 for water efficiency projects such as rinse water reuse systems, closed-loop cooling systems, and cooling tower upgrades.

6d5 Recycled Water

Recycled water is wastewater that has been treated and made into a valuable resource.[20] Depending on the level of treatment, recycled water can be used in California for irrigating landscape or crops (including crops eaten raw), for commercial laundries and industrial uses, and for recharging aquifers used as potable water supply. California's Water Code, Health Safety Code, and Code of Regulations specify requirements and conditions, including water quality, related to each use.

California's Water Recycling Act of 1991 mandated that recycled water be used for irrigation and other non-potable applications whenever it is economically feasible to do so.[21]

Californians used about 400,000 acre-feet of recycled water in 2000,[22] but this was far short of the Legislature's ambitious goal of 700,000 acre-feet by that year. The 1991 Water Recycling Act targeted 1,000,000 acre-feet of water recycling by 2010.[23] Water-recycling advocates are working to remove regulatory and financial barriers to water recycling. Implementing legislation signed by Gov. Davis in 2001,[24] the Department of Water Resources (DWR) has convened a task force[25] to investigate additional opportunities to use recycled water. Davis also signed legislation aimed at getting local governments to require separate recycled water systems whenever golf courses and parks are built in new subdivisions.

Public opposition is a bottleneck holding back the flow of recycled water. Many California recycling projects have been scuttled or delayed by public outcry after years of research, investigation, and planning. After receiving negative press and political pressure, San Diego's Council has, for now, abandoned its plan to pipe membrane-treated effluent to a water-supply reservoir. After local residents brought a toilet to a picket line outside their boardroom, the Zone 7 Water Agency now opposes injecting recycled water into the Livermore-Amador Valley groundwater basin.[26] Recycled water is being used to irrigate vegetables in the Salinas Valley, but only after decades of study and last-minute resolution of concerns about "emerging pathogens." [27] In the Santa Clara Basin, opponents of a power plant raised concerns over the use of recycled water in the cooling towers.

Proponents of recycled water use note that: (1) California's Environmental Protection Agency (Cal-EPA) and the state Department of Health Services (DHS) regulate the use of recycled water to protect public health and the environment; (2) California's laws are considerably more conservative and restrictive than those of any other state or country; (3) Decades of widespread potable and nonpotable use of recycled water—particularly in southern California—has not resulted in any documented illness; (4)

TABLE 6.3 INFORMATION RESOURCES FOR WATER RECYCLING

California Health Laws related to Recycled Water (Purple Book) June 2001. **www.dhs.cahwnet.gov/ps/ddwem/publications/waterrecycling/purplebookupdate6-01.PDF**
Water Reuse Association: **www.watereuse.org**
California Department of Water Resources Recycled Water Task Force: **www.owue.water.ca.gov/recycle/taskforce/taskforce.cfm**
South Bay Water Recycling Program: **www.ci.san-jose.ca.us/sbwr/**

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The WMI's Endocrine Disrupting Chemicals Workgroup has reviewed concerns about possible health or environmental effects of these compounds when recycled water is used in cooling towers or discharged to streams. See Chapter 9.

Exhaustive research,[28,29] has reviewed the use of recycled water both retrospectively[30] and prospectively and has generally found that the risks of using recycled water are comparable to the risks of using other water sources, although uncertainties remain.

More efficient and precise laboratory methods continue to reveal additional constituents in recycled water that may affect humans or other animals. Most of these constituents will also be found, in varying concentrations, in other water supply sources, including streams, reservoirs, and the Delta. Unknown constituents in water sources present risks; these risks are ubiquitous and deserve further research.

Water recycling in the South Bay began with the piping of effluent to parks and golf courses near treatment plants. For example, the Palo Alto Regional Water Quality Control Plant delivers up to a million gallons per day to the Palo Alto golf course, Emily Renzel Marsh, Greer Park, and water truck hydrants.

In the mid-1990s, as part of a strategy to reduce the quantity of pollutants discharged to San Francisco Bay, Sunnyvale constructed pipelines to Baylands Park, the Sunnyvale Municipal Golf course, and a number of commercial and industrial campuses.

San Jose's commitment to reducing fresh water effluent flows (p. 6-4) was demonstrated by the City's massive investment in pipelines to distribute recycled water to local parks, businesses, and industries. Phase I of the South Bay Water Recycling (SBWR) project began operation in October 1997 at an initial cost of $140 million. The system now serves over 350 customers, including San Jose State University, which uses over 100,000 gallons of recycled water per day in its cooling towers. Recycled water demand during summer 2001 ranged from eight to more than 10 million gallons per day.

New SBWR pipelines extend to Santa Clara and Milpitas. Nine additional miles of pipe, jointly funded by SBWR and SCVWD, will deliver 3.5 million gallons per day of cooling water (5 MGD peak demand) to the new Metcalf Energy Center. [31]

6d6 Graywater

If piping treated wastewater for irrigation and other purposes is a good idea, why not just reuse it on-site? That would save the cost of pumping and distribution pipelines.

Graywater is untreated household wastewater that has not come into contact with toilet waste.[32] On-site reuse of graywater was not legal in California until recently, although many homeowners operated systems anyway—notably in water-short Santa Barbara. The 1987-1992 drought prompted legislation to maximize the use of graywater, but it took until 1994 for California's Plumbing Code to be revised. At that time, legal use was limited to single-family dwellings. Systems that meet all the requirements can be complex and require regular maintenance; costs are estimated to be between $500 and $5000.[33]

California's standards were revised in 1997 to allow use of graywater in multi-family dwellings and commercial and industrial facilities. But graywater advocates see a need to clarify standards and remove bureaucratic barriers. The Santa Clara County Health Department discourages graywater use. [34]

6e | Strategic Objective: Integrated Water Resources Planning

Integrated Water Resource Planning provides a basis for implementing the WMI's vision for a sustainable water supply. No one water source or strategy can fulfill future needs or—by itself—protect Basin watersheds. Instead, agencies and advocates should emphasize conservation and water recycling to maximize water supplies. Local water yield and groundwater recharge operations should be balanced with the need to avoid in-stream effects and to restore natural seasonal flooding cycles. Local and out-of-basin groundwater storage (water banking) should be used to store water against drought. The amount of imported water used should be minimized while local agencies participate in programs to allocate statewide water supplies responsibly and fairly.

SCVWD, San Jose, and the Basin's other cities and towns should use SCVWD'S IWRP to focus and coordinate their water conservation and water recycling policies and programs. San Jose and SCVWD should continue its joint South Bay Water Resources collaborative process. The process should document the many environmental benefits of water conservation and recycling—more water to support stream ecosystems in the Santa Clara Basin and statewide, more reliable supply, and reduced effects of freshwater discharges—and should link these benefits to the overall water supply strategy. Conservation and recycling should be built into the projections of future demand that are used for planning potable water supply.

6f | Next Steps for the WMI

6f1 WMI Actions Needed to Implement the Strategic Objective

- Develop broad representation and facilitate efficient decision-making in SCVWD's IWRP stakeholder process.
- Communicate SCVWD's IWRP participants' consensus to agency decision-makers.
- Organize and facilitate outside expertise and technical resources.
- Gauge and expand public support for water conservation and recycling.
- Promote water conservation as a component of the WMI's strategy to protect and enhance Basin watersheds.
- Coordinate and integrate SCVWD's IWRP with other WMI objectives including watershed stewardship planning (Chapter 8) and Habitat Conservation Planning (Chapter 7).
- Develop indicators of progress toward water supply sustainability.

6f2 Other WMI Actions that Support the Strategic Objective

- Seek funding for and establish an Industrial Water Use Efficiency Partnership to promote closed-loop manufacturing systems.
- Estimate the effectiveness of water conservation on reducing water use and reducing treatment plant influent.
- Identify policies and obstacles that impede on-site water recycling and graywater use.
- Encourage municipalities that will be served by recycled water to adopt ordinances requiring that it be used when it is available.
- Set up educational programs and tours related to water conservation and recycling.

7 PRESERVING AND ENHANCING BIODIVERSITY

7a | A Vision for Preserving Biodiversity in the Santa Clara Basin

Within the Santa Clara Basin, there are many special places—places with just the right combination of soils, water, and climate to support distinctive, rarely found plants and animals. Some of these plants and animals have always been rare. Alterations to habitat have reduced the populations of others.

We need a plan, and positive actions, to protect the biodiversity of our watersheds. (By "biodiversity," we mean the variety of habitats within the basin, the variety and abundance of different organisms within those habitats, and the genetic variation within the population of each species.[1])

WMI stakeholders believe it is possible to provide housing and jobs for people while preserving and enhancing Basin ecosystems. With careful planning and resources (while recognizing resource limitations), we can protect critical habitats and help restore populations of threatened and endangered species.

7b | Preserving Open Space in the Santa Clara Basin

Even as housing tracts and shopping malls sprawled across the Basin floor, residents sought to protect some open space. The Basin's extraordinary mosaic of natural reserves within the urban area is a legacy of their far-sightedness. For example:

- The City of San Jose's Alum Rock Park, 720 acres in a canyon of Upper Penitencia Creek, was founded in 1890 and prides itself as California's first park.
- Henry W. Coe Park, at 87,000 acres, is the largest state park in northern California. It includes the headwaters of Coyote Creek and a 23,300-acre wilderness area.
- The Don Edwards San Francisco Bay National Wildlife Refuge (DESFBNWR), established in 1972, was the first wildlife refuge to be established in an urban area. It covers 18,000 acres around the edges of the South Bay from Redwood City to Fremont. Under a 2002 agreement among Federal and state agencies and Cargill Salt Company, over 15,000 acres will be added to the refuge.

- Founded in 1956, the Santa Clara County Parks and Recreation Department manages 27 parks totaling 45,000 acres. The County focuses on purchasing parkland and developing a network of regional parks and trails along the hillsides adjacent to the urban fringe and along the creeks that pass through the urban service area. This "necklace of parks" concept has guided park acquisition and development since the 1960s.
- The Midpeninsula Regional Open Space District, which overlaps the northwestern portion of the Basin, was created in 1972 and manages nearly 50,000 acres of land in 26 open space preserves.
- The Nature Conservancy recently purchased the 9,234-acre Lakeview Meadows Ranch and plans to annex 6,000 acres of it on to Henry Coe State Park.

Within the Santa Clara Basin, over 137,000 acres are protected by public agencies, property easements, or private land trusts. The proportion of protected lands within individual watersheds varies from over a third (Adobe) to less than 3% (Sunnyvale East).[2] Nearly two-thirds of the Basin's land area is undeveloped (this includes farms, urban parks, and vacant land).[3]

Today, a plethora of public and private agencies are involved in acquiring open space in the Santa Clara Basin. The Bay Area Open Space Council, "a collaborative program of public and non-profit agencies and organizations, providing regional leadership and expertise for the preservation and professional management of important open spaces," maintains a comprehensive list of open space lands and the agencies that manage them.[4]

Santa Clara County's Open Space Authority was created by the Legislature in 1993 and funds open space acquisition and management through a benefit assessment.[5] The Authority's boundaries include the County outside of the previously authorized Mid-Peninsula Regional Open Space District. Twenty percent of the benefit assessment is returned to municipalities to assist with their own open space programs. Voters approved an assessment increase in 2001, increasing the yield from about $4.2 million to approximately $12 million per year.

Within the Basin, large areas have been set aside for open space. Many organizations are interested in acquiring title or easements to remaining undeveloped lands. In the past few years—stimulated by increasing development, the scarcity of remaining un-urbanized land, and by some extraordinary opportunities—public and private funding for land acquisition has increased markedly.

7c | Strategies to Protect Species and Ecosystems

It isn't enough to set aside land to remain undeveloped. A plan to conserve species (and the ecosystems upon which they depend) must identify the specific habitats that are critical to their survival. Those habitats must be adequately protected from a host of threats. And in most cases, they must be actively managed to retain their distinctive qualities.

Section 9 of the 1973 Endangered Species Act (ESA) makes it unlawful for any person to "take" (i.e., "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect") any endangered or threatened species. Early in the Clinton Administration, Interior Secretary Bruce Babbitt promulgated a regulation defining "harm" to include "significant habitat modification or degradation where it actually kills or injures wildlife."

In 1995, the Supreme Court upheld the Secretary's interpretation of the ESA. That marked another step forward in an ongoing evolution of law and practice, from protecting plants and animals toward protecting the habitats and ecosystems on which they depend.

The 1995 decision also highlighted the uneasy interface between a stringent law and a science prone to ambiguity. Guidelines for preserving the habitat of threatened species require adherence to "principles of conservation biology," but in practice, biologists depend on their field experience to map "critical habitat."

7c1 What is Critical Habitat?

Once a species is listed as threatened or endangered, the US Fish and Wildlife Service must identify "critical habitat" for it. Section 7 of the ESA defines critical habitat as "specific areas within the geographical area occupied by the [designated] species at the time it is listed… on which are found those physical or biological features (constituent elements)… (a) essential to the conservation of the species and (b) which may require special management considerations of protection; and (2) specific areas outside the geographic area occupied by the species. [that] are essential for the conservation of the species."

What determines whether a species thrives or declines? At a landscape scale, conservation biologists try to create or retain:

- Large, intact patches of native vegetation, unfragmented by disturbance or development.
- Proximity of different habitats required for breeding and forage.
- Connection of habitats by barrier-free corridors to allow dispersal and migration between populations.
- Rare landscape elements, such as unusual soils, vegetation, rock outcroppings, or wet areas in a dry landscape.
- Undisturbed flows of water, food sources, and energy through protected areas.
- Control of exotic species that compete with, or prey upon, the species to be conserved.

The Watershed Characteristics Report identifies 93 "special status species" in the Santa Clara Basin. Twenty-four are listed as either threatened or endangered by the U.S., by California, or both.[6]

The following three examples—the red-legged frog, the Bay checkerspot butterfly, and the salt marsh harvest mouse—are among those listed. These three species represent a variety of habitats (riparian/freshwater wetland, grassland, and salt marsh). Because these "flagship" species have been the subject of regulatory actions, advocacy, research, and lawsuits, enough is known to summarize their life cycles, habitat requirements, and prospects for their survival. Their cases illustrate some of the challenges inherent in protecting

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Chapter 8 focuses on preserving and enhancing fish habitat and the dynamic environment within stream channels.

Listing the Red-Legged Frog

In 1996, the U.S. Fish and Wildlife listed the California red-legged frog as a Federally Endangered species, but did not identify critical habitat for the species. The Jumping Frog Institute, the Center for Biological Diversity, and the Center for Sierra Nevada Conservation won a 1999 lawsuit against USFWS.

In September 2000 USFWS proposed thirty-one "Critical Habitat Units" for the California red-legged frog, totaling 5,373,650 acres. Approximately 39% of these critical habitat areas are in public ownership. Final designation was in March 2001. (USFWS Press Release)

A July 2002 U.S. District Court ruling approved a settlement between the Interior Department and HBA that vacates most of the critical habitat designation. The agreement calls for an economic analysis and redrawing of the critical habitat boundaries by 2005.

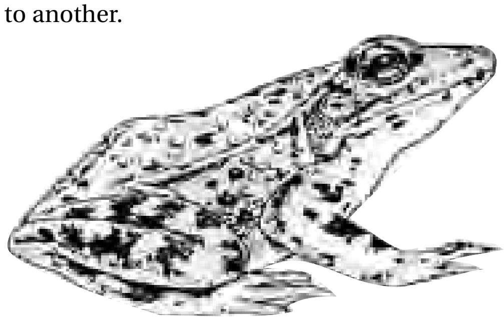
critical habitat and some of the successes that are being achieved.

7c2 Example: The Red-Legged Frog

In March 2001, FWS designated 4.1 million acres in 28 California counties, including Santa Clara County, as critical habitat for the threatened California red-legged frog.[7] The habitat has become fragmented and degraded, and is being colonized by nonnative species. Introduced bullfrogs eat the tadpoles of red-legged frogs, as well as juveniles and even large adults. Crayfish, catfish, sunfish, and mosquito fish all prey upon or compete with red-legged frogs at various life stages. The habitat may also be affected by changes to water flows and by pollutants.

Red-legged frogs breed in natural and man-made marshes, lagoons, and dune ponds, and in backwaters within streams and creeks. To rear tadpoles, they require water that is 8 inches deep continuously from March through July.

FWS found that red-legged frogs flourish where suitable breeding and non-breeding habitats are interspersed throughout the landscape and are interconnected by unfragmented dispersal habitat. This dispersal allows exchange of genetic material from one sub-population of frogs to another.



7.1 Red-Legged Frog

The frogs may move from breeding sites at any time of the year. They travel up and down stream channels and can hop hundreds of feet away from water—if it is abutted by dense riparian vegetation. During the rainy season, some individuals may travel two miles over upland terrain (even without vegetative cover) as long as they don't have to cross any roads or other barriers.

FWS defined critical habitat as follows: "an area must have two (or more) suitable breeding locations, one of which must be a permanent water source, associated uplands surrounding these water bodies (extending to 500 ft from the water's edge), all within 1.25 miles of one another and connected by barrier-free dispersal habitat (of at least 500 ft in width). When these three elements are all present, all other suitable aquatic habitat within 1.25 miles, and free of dispersal barriers, is also considered critical habitat."[8]

7c3 Example: The Bay Checkerspot Butterfly

FWS' 1998 *Recovery Plan for the Serpentine Soil Species of the San Francisco Bay Area*[9] lists 19 plants and nine animals that live in dry, nutrient-poor, serpentine-soil grass-lands. (Fourteen of the species are federally listed, but 14 additional "species of concern" are covered because FWS believes that a community-level strategy has the best likelihood of success.)

Serpentine soils occur in widely scattered sliver-shaped patches. The unusual geology provides plants with little calcium in ratio to magnesium. A lack of essential nutrients and high concentrations of chromium and nickel contribute to a harsh environment. The plant community is diverse but sparse, exposing individual plants to increased temperatures and wind. The plants that live here are rare and unusual. For example, the milkwort jewelflower concentrates nickel in amounts that would be toxic to other plants.

Before European settlement, these plants may have been more widely distributed. But on the richer, wetter soils they have long been out-competed by aggressive, introduced grasses and weeds. Even within the serpentine areas, the native plants struggle for a foothold against invaders.

The plant and animal communities that depend on the serpentine soil areas are highly fragmented. Many are marginal habitats, and some species may not persist in them during fires or drought.

Bay checkerspot butterfly *(Euphydryas editha editha)* larvae grow on an annual native plantain, *Plantago erecta,* which is abundant on Bay Area serpentine soils. The plantain dries up early in the year, and larvae may move to feed on purple owl's clover or exserted paintbrush. They then enter a diapause (stop feeding and reduce their metabolism), until the winter rains start. They feed again through the winter until they pupate in February. The adult butterflies emerge in the spring. Most stay within a few hundred yards, where they feed on nectar from Hog Fennel (*Lomatium*), Tidy Tips, Goldfields, and *Linanthus.*

The butterfly's historic range has been reduced to a few patches in San Mateo and Santa Clara Counties. The Bay checkerspot butterfly is a good example of a "metapopulation," a group of spatially distinct populations that occasionally exchange dispersing individuals. Populations may go extinct and later be recolonized from another population.

7.2 Bay Checkerspot Butterfly

The FWS first proposed critical habitat in 1984, when it identified five "core" areas. Four of these are along Coyote Ridge. Seventeen years later, when FWS finally designated the critical habitat under court order, [10] a fifth "core" area (in the Woodside area) had been covered by a housing development. But because additional studies were available, FWS was able to designate 11 additional habitat units.[11] Many of these are privately owned.

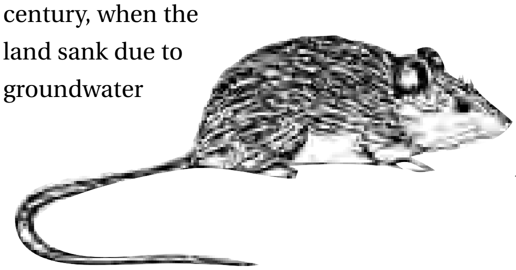
The recovery plan suggests that blocks of conservation lands should be situated as "stepping stones" for dispersal and recolonization. Active management of these areas is required, but management strategies have not yet been investigated. Research suggests that fallout of airborne nitrates, principally from automobile exhaust, can fertilize the serpentine soil areas and promote invasion of non-native grasses. It is generally accepted that grazing can be part of an effective strategy to manage the serpentine grasslands.

7c4 Example: The Salt Marsh Harvest Mouse

The northern subspecies of the salt marsh harvest mouse (*Reithrodontomys raviventris*) lives in the marshes of the San Pablo and Suisun bays. The southern subspecies is native to Corte Madera, Richmond and South San Francisco Bay. The average mouse is around 3 inches long and weighs less than half an ounce.

Salt marsh harvest mice live under the dense cover of pickleweed. During high tides, the mice escape to an upper zone of salt-tolerant plants. They may move into the adjoining grasslands during the highest winter tides.

From a mouse's perspective, South Bay marshes have been affected in three ways: First, much of the original pickleweed zone was inundated in the early twentieth century, when the land sank due to groundwater



7.3 Salt Marsh Harvest Mouse

overdrafts. Second, almost all of the upper edges of most marshes have been filled in, covered over, or converted to salt ponds, reducing the upper zone of salt-tolerant plants to a narrow strip along levee banks with no connections to adjacent grasslands (if any exist). Without refuge in the salt-tolerant plants, mice have no cover from predators when high tides push them out of the pickleweed. Third, the remaining marginalized habitats may be further impacted by local freshwater sources into the Bay (i.e., rivers and streams, wastewater treatment plants, rainfall and delta outflows); this impacts the tidal marsh vegetation by benefiting plant species that prefer fresh or brackish water (like cattail and bulrush) that are not used by the mouse. [12]

Most remaining marshes share an upper side with a leveed salt pond, business park, or subdivision. These provide easy access for predatory feral cats and red foxes.

The salt marsh harvest mouse has been on the Federal endangered species list since 1970. Critical habitat has never been formally designated. It is thought that the barriers that prevent the mice from dispersing from one remaining patch of marsh to another interfere with re-establishment of populations and reduce genetic diversity. Creation of the DESFBNWR in 1972 was a first step toward restoring sufficient contiguous marsh habitat to save the mice and the endangered clapper rail.

A 1984 recovery plan aimed to acquire larger marsh areas (to combine with existing small, isolated ones), to alter and plant upper edges of marshes to provide refuge for mice during floods, and to investigate the long-term succession of marsh vegetation. The 1999 *Baylands Ecosystem Habitat Goals* report[13] identifies and maps marsh restoration opportunities and benefits for segments around the Bay, including harvest mouse habitat in the South Bay. Marsh restoration should encompass a broad-based program to restore a variety of tidal marsh habitat, including salt marsh and brackish marsh.

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Effects of historic groundwater pumping, and recent wastewater discharges, are discussed in Chapter 6.

7d | Habitat Conservation Plans and Natural Community Conservation Plans

In 1975, Visitacion Associates, a major land holding company, proposed the construction of 8500 residential units and 2 million sq. ft. of office space on various portions of San Bruno Mountain in San Mateo County. One year later, FWS listed the mission blue butterfly, found only on San Bruno Mountain and on Twin Peaks in San Francisco, as an endangered species. Even after public agencies bought or received 1,952 acres of open space, controversy remained over development or preservation of the remaining area.

In 1982, representatives from the developers, environmentalists, regulatory agencies, and San Mateo County agreed there should be a plan to allow limited development in exchange for a developer-funded program to protect and enhance butterfly habitat on the remaining portions of the Mountain.[14] Congress amended the Endangered Species Act to allow this "incidental take" of endangered species on private property.

Permits for this "taking" require implementation of a Habitat Conservation Plan (HCP) including conservation and mitigation measures designed so that the "take" will not appreciably reduce the likelihood that the species will survive and recover. The landowner receives an assurance—called the "no surprises" guarantee—that the FWS will not increase the measures or other requirements without the landowner's consent, no matter how successful or unsuccessful the conservation and mitigation measures may prove to be.

Despite the flexibility offered by HCPs, only 10 were completed between 1982 and 1992. Beginning in 1993, they were aggressively promoted by the Clinton administration as a way to accommodate landowners while protecting imperiled species.

California's 1991 Natural Community Conservation Planning Act authorized regional, ecosystem-wide, multi-species programs that encourage landowners to voluntarily plan for habitat protection before species are listed. Plans may cover a mix of listed and unlisted (but declining) species and their shared habitats while still accommodating development outside areas set aside as preserves. Also, unlike HCPs prepared under the Federal ESA, Natural Community Conservation Plans (NCCPs) can protect habitat that is currently unoccupied by listed species but is important for their survival.

In the 1993 listing of the California gnatcatcher, Secretary Babbitt proposed a special rule expanding the "incidental take" exemption to all areas covered by the NCCP plan to protect coastal sage scrub habitats in Southern California. The rule provided a powerful incentive for developers, who would otherwise have to prepare individual HCPs for their own land, to participate in the region-wide NCCP.[15]

California Senate Bill 107[16], effective January 1, 2003, revamped the NCCP process. NCCP participants, who may include private individuals, corporations, and public entities, will enter into a binding planning agreement with CDFG. The planning agreement will specify a geographic area, a preliminary species list, preliminary conservation objectives, and design principles for habitat preserves. The planning agreement will provide for

Lessons From San Bruno Mountain

The first Habitat Conservation Plan was created in 1982 to allow development on 800 acres of San Bruno Mountain in San Mateo County. An additional 1700 acres was annexed to an existing park and managed to retain habitat for the Mission Blue Butterfly.

One ongoing concern is that the preserved habitat (at a higher elevation, and on the saddle of the mountain) was not equally suitable to the butterflies as the now-developed northwest slope. In the mid-1990s, the California Native Plant Society and others charged that plant restoration efforts were not succeeding. Habitat managers conceded that they had not adequately mapped the extent to which lupine (on which the butterflies depend) had been displaced by gorse, fennel, and other exotics.

Since then, preserve managers have focused their vegetation management have documented their success in restoring natives to specific sites.

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inclusion of independent scientific input, coordination with Federal agencies, and public outreach and participation.

CDFG must complete a list of findings, specified in the statute, before approving an NCCP. For example, CDFG must find that: "The plan provides for the protection of habitat, natural communities, and species diversity on a landscape or ecosystem level through the creation and long-term management of habitat reserves or other measures that provide equivalent conservation of covered species appropriate for land, aquatic, and marine habitats within the plan area."

In June 2001, Santa Clara County, San Jose, VTA, and SCVWD agreed to prepare an HCP/NCCP to expedite CDFG and FWS permits for Measure B transportation projects and development of Coyote Valley. The agreement left undecided which species or natural communities, and which development projects, might be covered under the plan. The County commissioned a report outlining three options.[17] The first option would focus on transportation projects in the southeastern portion of the County. The second option would cover the watersheds of the Guadalupe River, Coyote Creek, and Stevens Creek, and would consider the growth-inducing impacts of SCVWD's contract renewals for CVP water.[18] The third option would cover ongoing infrastructure, development and agricultural activities, as well as conservation needs, throughout the entire County. The third option would require participation of all jurisdictions in the County where protected species might be affected.

7e | WMI Strategic Objective: Habitat Conservation Plans/Natural Community Conservation Plans

The concept of biodiversity provides a theme and focus for actions to restore habitats that support native species and ecosystems.

To be effective, actions should be organized around a plan with specific, measurable objectives. The plan should identify resources and commitments (including regulatory requirements where applicable) and should include provisions to monitor and report progress. The HCP/NCCP process provides a means to involve the appropriate jurisdictions in the process of planning for protection needed habitat areas, while insuring an appropriate balance with land uses, flood control, and water supply. Specific objectives for each habitat area can provide focus and impetus for specific restoration actions. For example, an area that a threatened species or group of species uses as secondary habitat might be "upgraded" to core habitat by controlling invasive exotic plants and animals and by replanting and reintroducing native species.

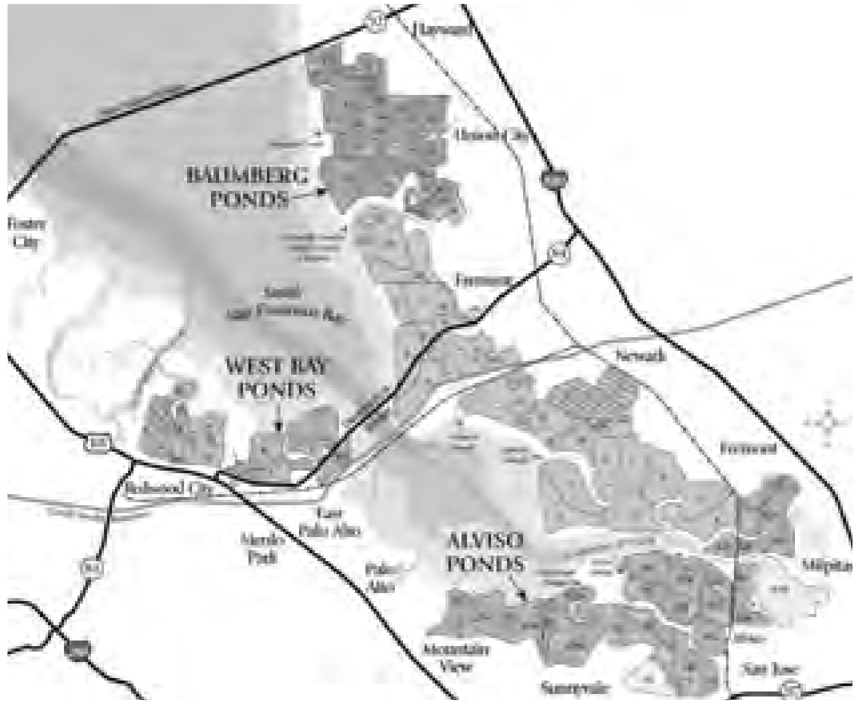
The WMI advocates that efforts to protect and enhance habitats for endangered, threatened, and special status species should provide for the protection of natural communities and species diversity on a landscape or ecosystem level through the creation and long-term management of habitat reserves or other measures that provide equivalent conservation of covered species.[19] The preserves should be developed through one or more HCPs/NCCPs. The HCPs/NCCPs should:

- Begin with updated, improved biological surveys of special status species and their habitats.
- Incorporate (as appropriate for the conservation of targeted species) existing reserves, refuges, parks, and public lands.
- Provide for acquisition of additional lands where needed to protect and enhance critical habitat.
- Incorporate restoration of native plants and animals in target areas.
- Be implemented using adaptive management, with specific, measurable objectives and provisions to monitor and report progress.
- Be coordinated with agencies' long-term and strategic planning (including General Plans).

7f | WMI Strategic Objective: Expanding the Don Edwards San Francisco Bay National Wildlife Refuge

Today, the Santa Clara Basin has a historic opportunity to restore tidal wetlands, salt ponds, and adjacent habitats. Cargill Salt Company has sold an additional 16,500 acres (15,100 acres in the South Bay) of former salt ponds in San Francisco Bay. This has nearly doubled the size of the wildlife refuge.

Currently the agencies are developing an interim management plan to begin reducing salinities in the ponds, and are initiating a stakeholder process to plan for long-term restoration.



7.4 Expansion of the DESFBNWR.

Some of the salt ponds will be managed to maintain their current functions as refuge and foraging grounds for shorebirds. Others can be restored to link currently isolated patches of salt marsh. Levees will need to be removed or altered to restore and maintain adjacent upland zones of salt-tolerant plants.

There are important lessons to be applied from the State of California's acquisition of Cargill Salt ponds along the Napa River in 1994. There, insufficient funds were allocated to interim maintenance of the ponds. Levees have failed, and ponds dried up leaving a salty crust of toxic bittern. Save the Bay estimates that restoration and interim management of the ponds would cost $148 million to $228 million over 20 years.[20]

The WMI advocates a comprehensive, integrated, stakeholder-based planning process for expanding the refuge.

With the planning process now beginning for public meetings, interim planning, and EIRs, the FWS, Army Corps of Engineers (ACOE), CDFG, RWQCB and other state and Federal agencies should work closely with SCVWD, the City of San Jose, other local agencies, and other WMI stakeholders to plan the restoration of newly acquired wetlands. Permits should be issued timely and allow for flexibility and adaptive management to successfully reconvert salt ponds to wetlands while allowing reasonable protection to South Bay water quality.

The potential for flooding of adjacent urban areas, and the need to selectively maintain levees, should be addressed in a way that balances the objectives of urban flood protection and habitat restoration.

Restoration plans should use the Bay Ecosystem Habitat Goals report as a guide to enhancing ecosystems and expanding contiguous critical habitat for the salt marsh harvest mouse and clapper rail. The plans should be coordinated with wetland protection and restoration in areas adjacent to the expanded refuge. The goal of the restoration effort will help accomplish one of the WMI's goals to lead to recovery of endangered species such as the salt marsh harvest mouse and the clapper rail and protection of all species using this habitat.

7g | Next Steps for the WMI

7g1 WMI Actions Needed to Implement Habitat Conservation Plans/Natural Community Conservation Plans

- Convene and facilitate a stakeholder group or groups to participate in scoping HCPs/NCCPs and to participate in adaptive management as plans get underway.
- Join or convene discussions among agencies that acquire or manage open space in the Santa Clara Basin.
- Support efforts to obtain state and Federal funding for the creation of upland habitat preserves identified through the HCP/NCCP process.
- Identify and pursue local sources of funding, including local agencies and foundations, for purchasing and managing critical habitat areas.
- Successfully implement mandated provisions for public outreach and participation in the NCCP process.
- Develop programmatic indicators of progress in implementing HCPs/NCCPs and a schedule for periodic reporting. Publicize the periodic reports.
- Coordinate the HCP/NCCP with implementation of other WMI objectives/planning processes including planning of floodplains and riparian areas and incorporation of watershed objectives into General Plans and Specific Area Plans.

- Share data and lessons learned and participate in the stakeholder process that is being convened by state/federal agencies.

7g2 Other WMI Actions that Support Habitat Conservation Plans/Natural Community Conservation Plans

- Refine the WMI vision to integrate key concepts of conservation biology and main issues that must be resolved to protect and enhance Santa Clara Basin habitats. Integrate these concepts and issues into WMI outreach.
- Mobilize streamside residents to remove invasive and non-native species.
- Encourage residents, workers, and businesspeople to participate in habitat conservation planning in their locale (perhaps through stakeholder groups and public participation for subregional plans) and use this participation for potential recruitment into watershed councils.
- Encourage a focus on more than one habitat type or species. Account for all priorities in the watershed related to habitat diversity.

7g3 WMI Actions Needed to Implement Expansion of the Don Edwards San Francisco Bay National Wildlife Refuge

- Participate in the stakeholder groups being convened by the state/regional salt pond restoration process to track, discuss, and resolve obstacles to enhancing habitat while protecting water quality and protecting urban areas against flooding.

- Seek and endorse broader agency involvement, support, or appropriations necessary to successful habitat restoration.
- Develop indicators of implementation and effectiveness of the refuge expansion and habitat restoration.
- Coordinate and integrate refuge planning with other WMI strategic objectives, including those in Chapter 8 (implement multi-objective stream restoration projects), Chapter 7 (habitat/natural community conservation) and Chapter 3 (incorporate watershed objectives into General Plans and Specific Area Plans).
- Encourage support for public education and interpretive facilities at the DESFBNWR and other public lands and wildlife refuges.
- Support efforts to obtain state and Federal funding (through California Bay-Delta Authority [CALFED] and other programs) to support expansion of the DESFBNWR.

8 PRESERVING AND ENHANCING STREAM FUNCTIONS

8a | The WMI's Vision for Protected and Enhanced Streams

In the WMI's vision, the Basin's streams flow freely through continuous riparian corridors. Seasonal high flows support migration of salmon and steelhead to and from their spawning redds. In the winter, floods sometimes overtop stream banks, but they spill across protected floodplains and cause little property damage. The floods leave behind a revived, intricate mosaic of riffles, pools, logjams, and eddies under the shade of willows and cottonwoods. Native fish swim in the deep, shaded pools, even in the heat of summer. The restored channels require minimal maintenance to remove accumulated sediment and to control vegetation.

8b | The River Continuum Concept

Stream and river habitats are made, and constantly remade, as flowing waters erode, transport and deposit sediment. Typically, most sediment is produced in steep-sloped headwaters and is transported downstream, where it forms alluvial fans, channels, floodplains, terraces, deltas, and other features of the stream corridor. This geomorphic process links the headwaters to the Bay and everything in between.

In upstream tributaries, overhanging trees and shrubs shade the water surface and drop insects, leaves and other detritus into the flow. These bits of organic material feed aquatic invertebrates. The current carries fine particles and dissolved organic matter to feed other organisms in the broader downstream reaches.

Stream and river habitats are best understood as a continuum. Physical and biological processes in the whole drainage network affect the biology of any particular reach.[1]

This understanding of the river continuum helps scientists and stakeholders plan restoration of streams and rivers damaged by logging, agriculture, urbanization, and flood control.

8c | The Decline of Santa Clara Basin Freshwater Fisheries

Santa Clara Valley streams have different characteristics, depending on their watershed's size, steepness, and proportion of developed area. The headwaters of some—such as San Francisquito Creek and Coyote Creek—are in large, protected preserves. Other watersheds, such as those of Matadero Creek, Barron Creek, and Adobe Creek, are smaller and mostly urbanized.

The streams have always been changeable, challenging habitats for fish. Flows fluctuate with the season and year-to-year. Reaches that flow reliably, even in dry years, are rare. In the middle and lower reaches, temperatures may rise, and dissolved oxygen may fall, during warm spells.

Fish populations in Santa Clara Basin streams began to decline in the 1940s as stream flows were diverted, dams blocked passage to upstream spawning areas, and reservoirs drowned the valleys. Increased erosion and sedimentation reduced the quality of riffle habitat. Channel straightening and armoring increased the velocity of high flows and began an ongoing process of stream bank erosion. As riparian vegetation was cut, there were no longer root wads and woody debris to create pools. The lack of shade caused higher stream temperatures and reduced the input of terrestrial insects and detritus.

Today, several species of rare native fish, such as resident rainbow trout and riffle sculpin, reproduce in cool, shaded headwater streams. Native species that tolerate higher temperatures and lower dissolved oxygen, such as the California roach and Sacramento sucker, are more widespread. Non-native fish tend to thrive in the altered habitat and now outnumber natives in most watersheds.[2]

Gravel mining and groundwater recharge basins create ponds within the stream floodplain. When floods rise, non-native fish that reside in off-stream ponds may enter the stream and prey upon stream fish.

Watersheds with extensive, relatively undisturbed headwaters provide summertime stream flows and the best habitats for native fish. These species may rebound rapidly if in-stream habitat is partially restored and barriers are removed.

8d | Stream Equilibrium

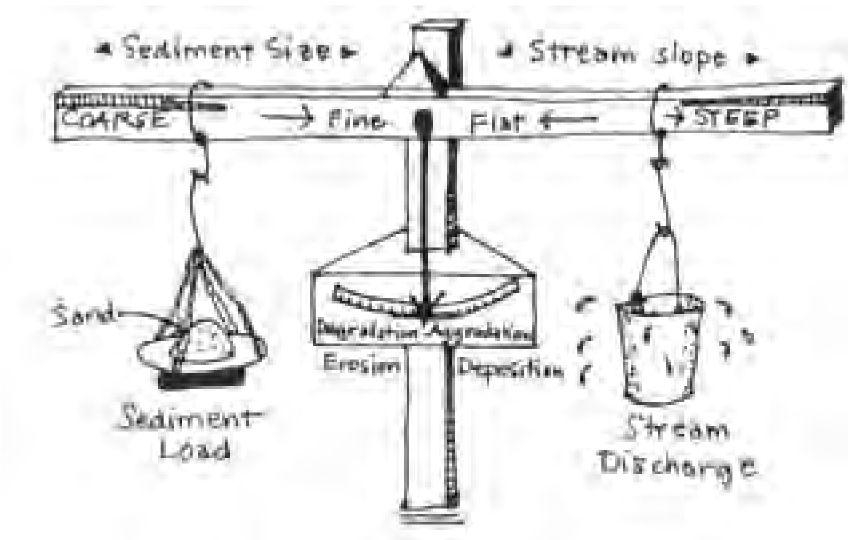
As stream and river channels were altered for flood control—and as many of these flood control structures failed—fluvial geomorphologists began to understand how watershed area, the amount and size of sediment transported in the river channel, stream discharge, and flood frequency influence the shape, size, slope, and roughness of stream channels.

Most natural streams are in a "dynamic equilibrium." This doesn't mean a stream is in a steady state or unchanging condition (because things change from reach to reach and over time). "Dynamic equilibrium" describes the average condition of a river or stream during its relatively recent history. In a stream in dynamic equilibrium, the amount of sediment entering a stream reach equals, over time, the amount that leaves it.

In 1955, E.W. Lane described the following equation:[3]

(Sediment load) x (sediment size) α (slope of the stream) x (stream discharge)

As the equation suggests, changing any of these four variables will promote a corresponding change in one or more of the



8.1 Factors Influencing Stream Erosion and Sedimentation.
From Restoring Streams in Cities: A Guide for Planners, Policymakers, and Citizens, by Ann L. Riley. Copyright © 1998 Ann L. Riley. Reproduced by permission of Island Press, Washington, D.C. and Covelo, California.

other variables. This can help watershed managers predict how streams will respond to disturbances or restoration efforts. [4]

As the mountains surrounding the Santa Clara Valley are uplifted, stream slopes increase. Landslides (some natural in origin, some hastened by deforestation, grazing, or development) contribute sediment to streams.

Alluvial fans form where mountain streams meet the flatter grades of the valley floor. Streams tend to cut new channels back and forth across the fans as they rapidly deposit sediment. This creates a natural hazard to neighborhoods built on alluvial fans.[5]

Where streams meet the Bay, they drop their remaining sediment in deltas and mudflats. Tides create a complex network of channels and sloughs. In historical time, this tidal influence has moved further upstream because of land subsidence.

As streams meander across the Santa Clara Valley floodplain, they deposit sediment in point bars and erode it from bends and pools. If stream discharges are reduced, or sediment loads are increased (e.g., diversions for water supply, landslides, urbanization) large amounts of debris may be dropped rapidly in the channel. The deposited material may deflect the current into different channels as the river searches for an easier course.

The concept of stream equilibrium can be used to predict how streams will respond to changes in their channel. For example:

- Eliminating meanders and straightening channels will shorten the length of the stream. This increases the slope of the channel, and is likely to cause erosion. The stream often responds by attacking banks and developing new meanders.
- Controlling the movement of a meander, say by placing a large rock, is likely to cause the stream to take out the bank in the next downstream bend and erode the opposite bank. In this way, a whole

stream system can be destabilized by successive placement of objects in the stream to protect backyards from a changing meander.

- Widening stream channels will decrease flow depths and velocities for frequent low and moderate flows. This usually results in increased channel sedimentation. As the channel aggrades, the gradient may increase at the downstream end of channel-widening project. There, the stream may attack its banks and cause erosion problems.

A stream's tendency toward equilibrium can also be used to naturally restore habitat diversity. For example, tree stumps, brush piles, or revetments can help narrow channels while restoring banks. Narrowing and deepening a channel can produce enough stream energy to transport sediment downstream and restore overly wide and laterally unstable channels to equilibrium.

A confined urban stream may adjust naturally by increasing its width and width/depth ratio. If left to continue this course, a stream may achieve a new "quasi equilibrium."

8e | Protecting Stream Habitats

8e1 Regulating Stream Alterations

Various agencies require permits for altering streams. However, their reviews tend to focus on the reach or resource that is immediately affected, without considering upstream and downstream effects on geomorphic stability or the overall effect on the stream ecosystems.

In the San Francisco Bay area, an in-stream project may require (depending on specifics) a Water Rights Permit from the SWRCB (for water withdrawals), a Streambed Alteration Agreement from CDFG, the RWQCB's Section 401 certification that the project will not cause a violation of state water quality standards, a FWS permit for a "take" of endangered species (via Section 7 process for Federal agencies, or a Section 10 process for private landowners), and an Army Corps of Engineers Section 404 permit for any fill.

The project will also likely require CEQA review, permits from the local flood control agency, and compliance with local ordinances. (For example, SCVWD's Ordinance 83-2 requires a permit for any construction activities within 50 feet of top of bank.)

Streamside property owners sometimes make alterations illegally, expecting that it may be easier to beg forgiveness than to ask for these permissions. To encourage property owners to get permits—and assistance with designing stream alterations—Bay area flood control agencies worked with the Association of Bay Area Governments (ABAG) to create a Joint Aquatic Resources Permit Application (JARPA).[6] JARPA consolidates preparation of submittals to Federal, state, and local agencies; however, the agencies conduct independent reviews.

This plethora of regulations has been inadequate to protect streams from poorly designed minor alterations—or to anticipate the consequences of major public projects. RWQCB staff say that Section 401 and Section 404 permit requirements are particularly unreliable for the protection of creeks and headwater streams: "Many hundreds of feet of riparian corridor may be filled under a nationwide permit without notification of the Army Corps because the limits for notification are determined by acres filled, rather than linear feet. Often, mitigation focuses only on replacing the riparian function of the stream, but there is no mitigation for the loss of stream functions such as flood retention, waters conveyance, or sediment transport. This contributes to cumulative impacts throughout the stream system.”[7] A contemplated Stream Protection Policy would expand RWQCB staff authority over stream alterations.

8e2 Flood Control Project Mitigations: The Guadalupe River Project

The story of the Guadalupe River Project in downtown San Jose illustrates how much, and how recently, environmental activism and regulation have changed the way that flood control projects are designed and built.

Congress authorized the Guadalupe River project in 1986. SCVWD and the Corps of Engineers started construction in 1992. A Mitigation and Monitoring Plan (MMP) specified protective and mitigation measures for riparian vegetation, fish spawning-gravel, fish passage, and thermal impacts.

In 1996, four environmental organizations stopped the project with a threatened lawsuit. They said that the third and final phase of the project—mainly concrete-lined channels—would harm runs of steelhead and Chinook salmon, which were then being considered for listing under the Endangered Species Act. They also said the 1992 MMP was inadequate.

In 1997, after Federal and state environmental agencies asked for a project redesign, the Guadalupe River Flood Control Project Collaborative was established. It includes all parties to the dispute: the City of San Jose and its Redevelopment Agency, the Corps, SCVWD, Federal and state environmental regulators, and the environmental groups.

A *Final General Re-Evaluation and Environmental Report for Proposed Project Modifications* [8] was approved in 2001. The modified project attempts to restore some of the river’s geomorphic and habitat functions. In reaches where the bottom and banks are armored, weirs, pools, check dams, and boulders concentrate low flows with the intent to enable fish passage. In other reaches, the natural bottom has been retained and enhanced, and high flows will be bypassed through box culverts. Further downstream, a 30-acre floodplain terrace, featuring an expanded riparian zone and recreational trails, was cut into the west bank.

The project will affect fish habitat, despite the improved design. Results of a Habitat Evaluation Procedure analysis were used to quantify mitigation requirements. Native plants will be added along 2,944 feet of streambank within the project area, and along another 7,848 feet of nearby streambank.

As additional mitigation for the Guadalupe River Project, for two adjacent projects (the Upper Guadalupe River Project and Lower Guadalupe River Project), and for other projects in the Basin, SCVWD is installing bank stabilization structures and riparian vegetation on 12,044 linear feet of Guadalupe Creek. Modification of a drop

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In 1995, SCVWD discontinued its annual construction of four instream gravel spreader dams in Guadalupe Creek. SCVWD continues to divert some creek waters to adjacent groundwater percolation ponds. Chapter 6 describes some effects of water supply diversions on habitat.

structure in 1999 opened fish passage to this upstream tributary.

Despite the efforts of the Guadalupe River Flood Control Project Collaborative to develop a design that balances flood protection with habitat protection and enhancement, there are some who remain highly critical of the project while continuing to work towards improvement of the integration of habitat protection and flood control project implementation.[9]

An updated MMP[10] commits SCVWD to mitigation and ongoing monitoring of these areas for the next 100 years. For example, the MMP requires SCVWD to confirm that riparian plantings are "sufficiently dense to provide shade along at least 85 percent of the planted bank length by year 40 following planting."

The MMP includes stakeholder participation in adaptive management (See Section *8f3*, below).

8e3 SCVWD's Flood Protection and Stream Stewardship Program

In November 2000, Santa Clara County voters approved SCVWD's 15-year Flood Protection and Stream Stewardship Program. The program includes five funds for capital improvements throughout the County (funded by ad valorem taxes and benefit assessment revenues), plus a new "Clean Safe Creeks and Natural Flood Protection Fund" (funded by a special parcel tax) and a "Watershed and Stream Stewardship Fund" (a portion of ad valorem taxes set aside for mitigation projects).

SCVWD's *Fiscal Years 2002-2003 15-year Capital Improvement Plan* includes brief descriptions of the funded projects. The $740 million to be spent in the Santa Clara Basin includes joint funding agreements with the Army Corps and the State of California. About $40 million of this is total is for restoration projects on Guadalupe Creek, Stevens Creek, and Calabazas Creek; an "outdoor classroom" on Coyote Creek, and restoration of 320 acres of tidal wetlands.

The primary objective of the other projects (approximately $700 million total) is to construct, or re-construct, flood control facilities. Most of these projects include mitigation of impacts and improvement of environmental habitat as additional objectives.

8e4 SCVWD's Stream Maintenance Program

SCVWD maintains about 240 miles of streams and 29 miles of canals in the Santa Clara Basin and in the Uvas and Llagas watersheds to the south. About 60 miles of these channels tend to aggrade from deposited sediments. Each year, SCVWD removes an estimated 80,000 cubic yards of sediment from about 16 miles of channel (on average). SCVWD also applies glyphosate (an herbicide marketed as Roundup® and Rodeo®) to vegetation in channels and sprays pendimethalin and chlorsulfuron (pre-emergent herbicides) on levees and access roads.

About one linear mile of streambank requires repair each year. The work is spread over 30 to 50 work sites and may include "hard" protection, such as rock, concrete, sack concrete, gabions, or "soft" structures, such as willow brush mattresses, log crib walls, or pole plantings. SCVWD's minor maintenance activities include removal of trash and obstructions, repairs to fences, gates, roads, levees, culverts, tide gates, and fish ladders, and trapping or poisoning ground squirrels.[11]

To alleviate difficulties in obtaining annual permits from multiple agencies, SCVWD convened a stakeholder workgroup of representatives from Federal and state regulatory agencies, environmental advocacy groups, and local cities. A Stream Maintenance Program (SMP) and EIR were produced in 2001 and 2002.

The SMP's policies, BMPs, and standard operating procedures are meant to minimize impacts to stream habitat. The SMP also includes "one-time" mitigation measures to compensate for temporary—but repetitive and unavoidable—effects on streams and wetlands.

As mitigation, SCVWD is restoring former Cargill Salt Company Pond A-4 as tidal salt marsh. It is also creating three acres of freshwater wetlands at Los Capitancillos (along Guadalupe Creek), adding seven acres of wetlands at Coyote Lakes Park, and mapping and removing 125 acres of invasive, non-native Giant Reed.

Under the SMP, SCVWD will balance habitat impacts from bank protection with habitat benefits from bank restoration. The plan links "impacts" and "benefits" to the quality of the existing habitat. For example, adding riprap or sacked concrete to an already "low-quality" reach requires no mitigation; the same activity in a "medium quality" reach may require 1:1 mitigation. (Riprap in a "high-quality" reach would require site-specific permits and is not covered by the SMP). Conversely, SCVWD may obtain mitigation credits by using large boulder revetments or crib walls to stabilize banks and improve habitat in medium or high-quality reaches.

Native plant species are used in bank restoration projects whenever possible.[12]

8f | Planning Projects to Protect and Enhance Streams

8f1 Stream Assessments and Monitoring

In 1987, USEPA began to emphasize the restructuring of monitoring programs to address toxics and non-point source pollutants. The agency funded development of Rapid Bioassessment Protocols[13] "designed to provide basic aquatic life data for water quality management purposes such as problem screening, site ranking, and trend monitoring." This methodology was meant to be used for broad geographical assessments, such as State and National 305(b) Water Quality Inventories.[14] Over the following decade, USEPA funded development of multimetric indices[15] to aid application of quantitative biological data to Federal and state water-quality assessments. Under a multimetric approach, each metric (e.g., ratio of native to non-native fish species, or number of macroinvertebrate taxa), is tested and calibrated to a scale and transformed into a unitless score before being aggregated into an index. This facilitates comparison between locations within a watershed or between similar watersheds.

Simultaneously, in a separate process, Federal and state resource agencies were beginning to use stream assessments as a guide to protect and restore streams and wetlands. Federal[16] and state[17] guidance for

TABLE 8.1 GUIDES TO STREAM RESTORATION

Restoring Streams in Cities, by Ann L. Riley, Island Press, Washington DC. 1998.

Stream Corridor Restoration: Principles, Processes, and Practices, by the Federal Interagency Stream Restoration Working Group. Updated 2001. **www.usda.gov/stream_restoration/**

Applied River Morphology, by Dave Rosgen. Wildland Hydrology, Pagosa Springs, CO. 1996.

this restoration approach emphasize visual assessment, analysis of hydrologic, geomorphic, and habitat functions, practical restoration design, and adaptive management (See Section *8f3*, below). The practice of restoration has been aided by development of practical, but sufficiently rigorous, methods to classify and assess streams according to their current function and potential for restoration.[18,19]

8f2 The WMI's Pilot Assessment of Three Watersheds

In 2000, the WMI selected the watersheds of San Francisquito Creek, the Guadalupe River, and Upper Penitencia Creek for pilot assessments using existing data. The WMI used a water-quality assessment approach. However, rather than using metrics or calibrating results against reference sites or reference conditions, the WMI compared available data to fixed quantitative parameters. The results were augmented by the judgment of local experts.[20] Decision-support logic diagrams were used to evaluate attainment of selected beneficial uses: water contact recreation, cold freshwater habitat, preservation of rare and endangered species, and municipal water supply. The WMI evaluated the same three watersheds for protection from flooding, based on a hydraulic model's prediction of response to a once-in-100-year event.

The WMI's Watershed Assessment Report[21] analyzed how the results could be applied to future WMI actions. The report states that the Assessment Framework is generally an excellent tool for assessing attainment of beneficial uses, but existing data are inadequate to apply it to most stream reaches in the Santa Clara Basin. The report suggests that, before similar assessments are attempted, the WMI should:

- Examine the beneficial uses that should be evaluated in each reach or reservoir (i.e. not all uses should be assessed in all reaches, as was done in the pilot assessments).
- Conduct a geomorphic characterization of streams. This would help determine which beneficial uses may apply to which reaches.
- Improve the methodology to better consider the reasons that uses are not attained. (When non-support for beneficial use was indicated, it was difficult to determine whether it was because of a lack of data, because the designated use was inappropriate, or because of actual conditions in the watershed.)
- Consider whether the criteria used are appropriate. For example, post-treatment drinking water standards may not be

appropriate criteria to be used to evaluate the municipal supply beneficial use.

- Reevaluate the 100-year flood as the criterion for protection from flooding. Consider using property damage occurrence as criterion.

Despite limitations in the methodology, the pilot assessment was able to determine that a major factor limiting aquatic habitat seemed to be the amount of flow. However, the assessment was unable to determine where lack of flow was due to water diversions or other anthropogenic changes to watershed. (Some cases are clear: headwater streams in the San Francisquito Creek watershed are ephemeral, while Los Gatos Creek and the Guadalupe River are affected by known diversions for water supply.)

8f3 SCVURPPP's Assessment of the Coyote Watershed

SCVURPPP developed and tested, on a pilot scale, an integrated watershed assessment approach in the Coyote Creek watershed. The approach links stream hydrogeomorphic functions (movement of water and sediment) to habitat functions and support of aquatic life beneficial uses. The project report[22] identifies the major issues affecting watershed health and includes a list of high-priority management actions.

The SCVURPPP assessment focused on the functional capacity of stream ecosystems—existing, future, and potential. Assessment of existing functional capacity was based on the following indicators: maintenance of characteristic hydrologic processes and channel dynamics (i.e., changes to hydrologic regime, channel condition, and accelerated sediment delivery), riparian and aquatic habitat condition, and landscape-level aquatic habitat connectivity, water quality, macroinvertebrate community and fish community.

The report projects the future functional capacity of each reach based on foreseeable effects of planned flood control and major development projects. The report evaluates potential functional capacity based on the availability of practical opportunities for stream restoration or enhancement.

Using this approach in earlier work,[23] investigators found that low stream flow in a reach of Upper Penitencia Creek may limit outmigration of steelhead smolts, especially during dry years. Releases from upstream Cherry Flat Reservoir could be timed to enhance stream flow during smolt outmigration. The distribution and abundance of steelhead could be monitored to determine whether this worked.

8f4 FAHCE Stream Monitoring

In contrast to the WMI and SCVURPPP assessments, which rely largely on data collected by others, the monitoring component of FAHCE included substantial fieldwork. Sampling and studies during 2001 may have included salmonid population dynamics, juvenile salmon rearing, salmonid spawning gravels, instream cover, passage barrier performance, summer cold water pool management, winter base flows and pulsed flows, water temperature monitoring and management, and assessment of the trapping and trucking of steelhead.

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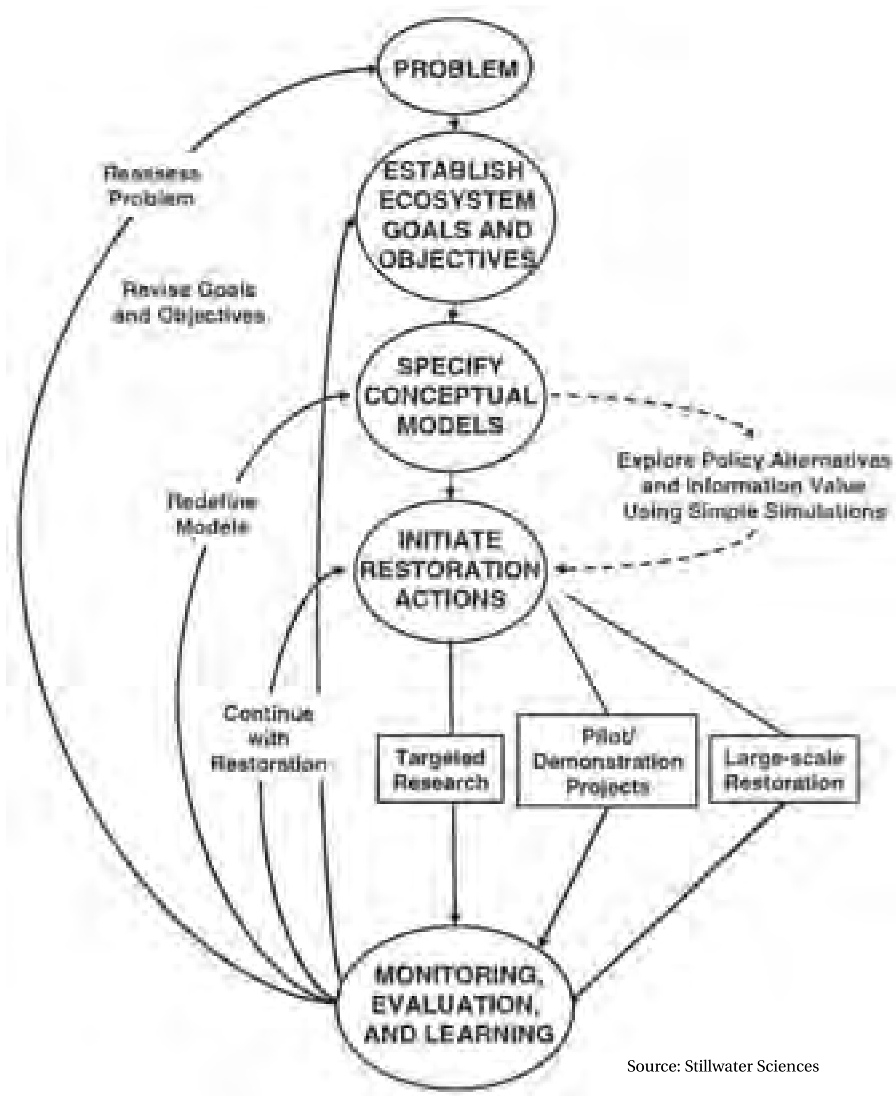
The objectives of the Fisheries and Aquatic Habitat Collaborative Effort (FAHCE) are discussed in Section 6c.



Source: Stillwater Sciences

8.2 Adaptive Management

Negotiation of specific studies and monitoring are part of a settlement agreement expected to be complete by December 2002. After this, the project will go through the CEQA process, which will further develop the schedule and level of effort for each monitoring activity. This is anticipated to be complete during winter 2004. Monitoring may begin in the 2004-2005 fiscal year.

8f5 Adaptive Management

Even with extensive monitoring and assessment, the WMI will probably still have a limited understanding of the processes (such as energy and nutrient cycles) that drive Santa Clara Basin ecosystems and how human actions affect these processes. It isn't possible to predict how dynamic, complex, ecosystems will respond to intervention. Even a basic understanding could require years or decades. A complete understanding may never be achieved.

Rather than postpone action indefinitely, watershed managers are using adaptive management. Adaptive management is the process of implementing policy decisions as scientifically driven management experiments that test predictions and assumptions in management plans, and using the resulting information to improve the plans.[24]

An adaptive management approach requires a carefully planned structure for monitoring, reviewing management actions, and refining management actions.[25] Adaptive management should begin with monitoring studies designed to test or validate the assumptions, hypotheses, and models that have been used to make management decisions.

Steps in adaptive management include: problem identification, establishment of goals and measurable objectives; development of conceptual models that articulate working hypotheses of cause-and-effect relationships in the system and anticipated responses to management actions; initiation of actions (including targeted research, pilot or demonstration projects, or large-scale restoration actions); monitoring, evaluation, and learning; and feedback (leading to revision of the problem statement, goals and objectives, models, and actions). (See Figure 8.2.)

8g | Strategies for Implementing Multi-Objective Stream Management

8g1 SCVWD's New Mission

On August 8, 2001, Governor Davis signed Senate Bill 449, amending the Santa Clara Valley Water District Act. Among other changes, the amendment allows SCVWD to use its powers to "enhance, protect, and restore streams, riparian corridors, and natural resources…". SCVWD's water supply and flood-control operations and facilities comprise the most significant influence on stream habitats. Amendment of SCVWD's purposes creates unprecedented new opportunities to integrate stream and riparian restoration into SCVWD's capital construction projects and its maintenance operations.

8g2 Watershed Stewardship Planning

Watershed stewardship planning incorporates improving beneficial uses while improving flood protection or reducing the potential for flood damage, and while promoting floodplain management. In the next 10-15 years, SCVWD will spend hundreds of millions of dollars to alter stream channels to contain floods. It will spend additional hundreds of millions to mitigate the environmental consequences of those alterations.

SCVWD's Waterways Management Model (WWMM) links SCVWD's flood-control projects within each watershed. The WWMM incorporates the flood conveyance capacity of stream reaches in successive project areas (e.g. for the Upper Guadalupe

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Section 5f discusses ways to integrate floodplain management and riparian stewardship.

WMI Accomplishment

To assist SCVWD with development of the Coyote Stream Stewardship Plan, the WMI created a Coyote Watershed Workgroup (CWW). The CWW also helped obtain CALFED funding for stewardship plans for the West Valley watersheds and the Guadalupe River watersheds. The CWW recommended that the WMI establish a Stewardship Planning Workgroup to assist with development of these plans.

River Project, Downtown Guadalupe River Project, and Lower Guadalupe River Project). It includes information on the physical condition of each reach and potential for damages from floods. The WWMM is used to prioritize flood-control expenditures.

In contrast, restoration and other mitigation measures are planned project-by-project. Most have been initiated in connection with environmental permits or in response to legal and regulatory challenges.

An integrated planning process is needed. This planning process for ecosystem renewal should be integrated with flood control planning to maximize both objectives and to allocate and prioritize the available budget.

This integrated planning process should also incorporate floodplain management as a strategy to reduce potential flood damages. (Changes in damage estimates could change priorities for flood-control projects.) From a watershed perspective, it makes sense to reduce damages from large, rare (i.e., 100-year) events by zoning, flood-proofing, and relocating and elevating structures. The resources saved can be applied to watershed management practices (such as retaining perviousness and increasing on-site detention) that will reduce more frequently recurring flooding problems.[26]

Perhaps most importantly, integrated planning should engage people from a variety of perspectives and technical backgrounds in creative and strategic design of better projects, large and small that promote multiple objectives for ecosystem restoration, flood protection, and recreation.

An integrated plan should also describe how current and foreseeable major projects by public and private agencies (e.g. Caltrans, major developers) might be influenced to benefit ecosystem restoration.

SCVWD's Watershep Stewardship plans may provide an opportunity to create the tools and process to plan the restoration of stream ecosystems. SCVWD recently completed a Watershed Stewardship Plan for the Coyote Watershed. The CALFED Watershed Program has awarded SCVWD $700,000 for the development of three additional stewardship plans, for West Valley watersheds, Lower Peninsula watersheds, and the Guadalupe watershed.

8h | Strategic Objective: Using Adaptive Management, implement multi-objective stream restoration projects.

The WMI advocates integrated multi-objective planning and adaptive management for in-stream projects and programs.

SCVWD should continue to improve the Stewardship Planning process that was recently applied to the Coyote watershed. A comprehensive, collaborative approach, using adaptive management, should be emphasized as the process is extended to other Basin watersheds.

Stewardship Plans will be effective in advancing the WMI's vision if they successfully integrate and balance flood protection with habitat restoration, including the removal and remediation of barriers to fish passage, restoring stream beds and banks using rock and wood structures, reconnecting streams to floodplains, eliminating stream/pond connections, and restoring shaded riparian aquatic habitat by planting native riparian vegetation.

This adaptive management of stream ecosystems might begin with clarifying/better defining management questions to be addressed before embarking on future assessments. Future assessments/monitoring efforts need to take into account lessons learned from the pilot watershed assessments of the San Francisquito, Guadalupe, Upper Penitencia, and Coyote watersheds and evaluation of assessment methodologies. Future assessments should include analysis of stream hydrology and geomorphology and identify the restoration potential and habitat objectives (including habitat for special status species) for different reaches.

Watershed stewardship should recognize the importance of enforcement of regulations that govern alterations and impacts to streams. In rural areas, this should include controlling or eliminating livestock access to streamside areas. Watershed stewardship should also include opportunities to restore natural flow regimes (in connection with the FAHCE project), and should provide clear linkage to stream maintenance activities.

The planning process should also seek ways to involve schools and community organizations in watershed protection and restoration projects.

8i | Next Steps for the WMI

8i1 WMI Actions Needed to Implement the Strategic Objective

- Convene and facilitate groups of stakeholders to participate in adaptive management for in-stream projects and programs.
- Convene and facilitate groups of stakeholders to participate in adaptive management for watersheds.
- Communicate adaptive management participants' recommendations to decision-makers in SCVWD and other agencies.
- Organize and facilitate outside expertise and technical resources to supplement SCVWD staff expertise.
- Determine the potential for using stakeholder involvement in watershed stewardship planning and multi-objective project planning as a springboard for more permanent local stakeholder involvement.
- Sponsor and support applications to fund the stream stewardship process.
- Refine and detail the WMI's watershed vision and communicate to decision-makers and the public. In WMI outreach publications, promote an understanding of geomorphic and habitat functions and how they are affected by urbanization.
- Coordinate watershed stewardship planning with other WMI objectives, including floodplain & riparian corridor planning, habitat conservation planning, and TMDLs in streams.

8i2 Additional WMI Actions that Support the Strategic Objective

- Improve and expand pilot watershed assessments.
- Facilitate a group to discuss a pilot project to time releases from Cherry Creek Reservoir to benefit smolt outmigration.
- Evaluate the results of the JARPA pilot.
- Prepare and publish periodic reports on the status of stream protection and restoration.

9 UNDERSTANDING AND CONTROLLING POLLUTANTS

9a | The WMI's Vision of Waters Unaffected by Pollutants

In the WMI's vision, southern South San Francisco Bay and the Santa Clara Basin's streams and reservoirs are fishable and swimmable. Fish and shellfish can be eaten without concern about the health effects of pollutants. Where people access the water, the sights and smells are natural, and there are few concerns about contracting water-borne diseases. No pollutants interfere with survival and reproduction of fish or other aquatic organisms, or with the birds and mammals that feed on them.

9b | A Brief History of Water Pollution in San Francisco Bay

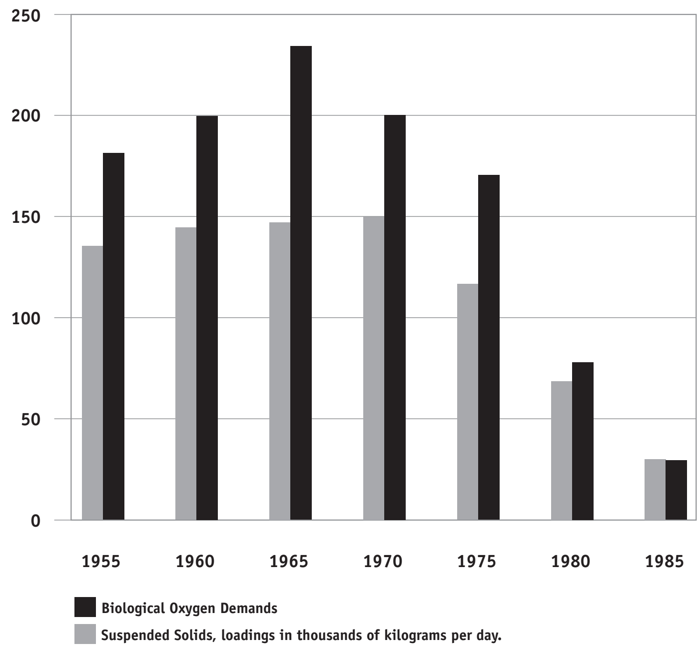
For 100 years following the Gold Rush, little was done to protect San Francisco Bay, even as 2.5 million people settled along its shores. Early sewage systems simply piped raw sewage into the Bay.

People gave up on harvesting shellfish sometime in the 1930s. By the late 1940s, the Bay produced, in summertime, an awful sulfide stench that blackened paint and tarnished household silver.

California's 1949 Dickey Act established nine Regional Water Quality Control Boards (RWQCBs) with watershed, rather than political, boundaries. The San Francisco Bay RWQCB worked with cities to begin some sewage treatment.[1] But partial treatment couldn't keep up with population growth, and the problem continued to worsen.

The 1969 Porter-Cologne Act expanded the RWQCB's powers to regulate waters "to attain the highest quality which is reasonable." But it took massive investment of public money—spurred by Federal grants—to tackle the sewage problem.

In 1972, Congress passed the Clean Water Act (CWA), establishing the National Pollutant Discharge Elimination System (NPDES) and requiring wastewater treatment facilities to implement secondary (biological) treatment. The Act also required industries to pretreat their discharges to municipal sewers. During the 1970s and 1980s, USEPA's construction grants program put more than $60 billion into public sewage treatment projects. The grants program required cities to establish fees to maintain, replace, and expand the facilities. Federal funding ended in 1990.



9.1 Loadings of Pollutants to SF Bay from Sewage Treatment Plants
BOD = Biochemical Oxygen Demand
SS = Suspended Solids, loadings in thousands of kilograms per day. Source: Bruhns, "50 years...".

With this massive public investment, Bay area cities built large plants that screen and settle sewage, then biologically treat it to remove over 90% of oxygen-depleting organics (biochemical oxygen demand, or BOD) and suspended solids. The effluent is disinfected before being discharged to the Bay. Despite increasing population and sewage flows, these plants ended the gross pollution of San Francisco Bay and restored the oxygen levels that fish need to survive (Figure 9.1).

Southern South San Francisco Bay is shallower, warmer, and has less circulation than other parts of the Bay. Occasional drops in oxygen concentrations persisted there. In 1979, the three plants discharging to southern South San Francisco Bay—in Palo Alto, Sunnyvale, and San Jose—added treatment steps to reduce ammonia, and the episodes of oxygen depletion immediately stopped.[2] These plants also filter their effluent.

As improved technology was removing BOD, solids, and ammonia from an ever-increasing flow of sewage, the Bay area's industries were booming—and they were discharging increasing amounts of heavy metals and other toxic chemicals into municipal sewers.[3] When Bay area treatment plants began permitting and inspecting industrial dischargers in the early 1980s,[4] the amount of heavy metals in Bay waters and in aquatic organisms dropped. This was demonstrated by long-term studies of native clams in the vicinity of Palo Alto's outfall.[5]

By the late 1980s, the effects of wastewater and industrial discharges to San Francisco Bay had been greatly reduced. Some shellfish harvesting resumed. But the Bay's problems hadn't been resolved.

Water diversions from the Sacramento/San Joaquin delta—mostly to serve the State Water Project and Central Valley Project—caused saline tidal waters to move far up the Sacramento River during dry years. The relocation of the freshwater/tidal interface affected the biological productivity North Bay wetlands.

An average of two new species have been introduced to the Bay every year since 1970. Introduced clams are capable of filtering the entire volume of the South Bay once a day. This has radically affected the stock of algae, altering the entire food web.[6] The Chinese mitten crab *(Eriocheir sinensis)*, which burrows in levees and banks in tidal areas, was first collected by shrimp trawlers in South San Francisco Bay in 1992 and has since spread throughout the San Francisco/ San Joaquin delta and into Sierra streams.[7]

Pollutants continue to threaten the Bay's aquatic life and the suitability of the Bay for fishing and swimming. But today's pollutant problems are different: they come from diffuse sources throughout the watershed, and most were produced and scattered over 100 years of settlement and industrial development. Some of these "non-point" legacy pollutants also affect Basin creeks, wetlands, and reservoirs.

9c | Sources, Fate, Transport, Effects

It required billions of dollars of public investment to clean up BOD, solids, and ammonia ("conventional" pollutants) from San Francisco Bay. But that task was relatively simple, compared to removing non-point and legacy pollutants.

The sources of the conventional pollutants were well defined: the sewage outfalls circling the Bay. Once the conventional pollutants were removed by treatment, the Bay naturally processed the residue left by years of pollution. Key indicators, like dissolved oxygen and the absence of fish kills, improved rapidly.

In contrast, each non-point and legacy pollutant has its own sources, fate, transport, and effects. Three examples illustrate the diverse history and characteristics of these pollutants:

1. Tetraethyl lead was added to gasoline from the 1920s through the 1970s. Lead bonds strongly to sediment, and roadside soils are laced with lead, which is also found in the sediment of streams flowing through cities. Lead is stable (won't biodegrade), but fortunately, aquatic life does not seem to be significantly affected.

2. PCBs were developed for commercial use in the late 1920's and widely used in many applications, including in electrical transformers and as a component of industrial lubricants and coatings. Manufacturing of PCBs was banned in the U.S. in 1979. Low concentrations of PCBs are ubiquitous in urban storm drain sediments, but there are also "hot spots" where concentrations may be 100 or 1,000 times higher. PCBs bioaccumulate, and higher levels of the food chain (birds, aquatic mammals, and humans that eat fish) may suffer increased cancers or reproductive harm.

3. Industrial pretreatment programs cut by 90% the quantity of copper and silver discharged from municipal sewage treatment plants. However, both metals adsorb to sediments, and Bay sediments are "enriched" with the legacy of pre-1985 concentrations. Now, nearly two decades later, the sediments are releasing copper and silver back into the overlying water. Permanent burial of these sediments, or their erosion and transport out through the Golden Gate, will take many decades. For copper, a study of its contaminant fate and transport found that copper is unlikely to impair South San Francisco Bay. A monitoring program will determine whether copper will be an issue for the Bay in the future.[8]

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SCVWD's Stream Maintenance Program is discussed in Section 8e4.

9d | Controlling Pollutants from Non-point Sources

9d1 The Stormwater NPDES Program

Congress amended the Clean Water Act in 1987 to bring discharges from municipal separate storm sewer systems[9] under the NPDES program. The new Section 402(p) required cities to (1) effectively prohibit non-stormwater discharges to municipal separate storm sewer systems and (2) implement controls to reduce pollutants in stormwater to the maximum extent practicable.

USEPA promulgated requirements for municipal stormwater NPDES permits in 1990. The RWQCB enforces the requirements in the Bay area. California municipalities worked with the state to define BMPs for local programs.

The RWQCB issued the 15 SCVURPPP co-permittees a first NPDES permit in 1990 and reissued the permit in 1995 and 2001. Working individually and collectively to implement an Urban Runoff Management Plan,[10] the co-permittees eliminate illicit connections and stop illegal dumping to storm drains, educate and involve the public in preventing stormwater pollution, reduce sources of pollutants from their own municipal activities, monitor and enforce erosion and sedimentation controls at construction sites, and inspect industrial sites.

SCVURPPP also monitors implementation and effectiveness of pollution-prevention measures and, in cooperation with the WMI, monitors and assesses the status of streams and water bodies in the Basin.

9d2 Adopt-a-Creek

SCVWD established the Adopt-A-Creek program in 1994. Adopt-a-Creek assists over 100 individuals, corporations, and community groups to organize twice-yearly trash cleanups. The program issues permits for creek access, publishes a newsletter twice a year, and encourages residents to report problems such as larger debris, erosion, or pollutant discharges. These problems may be addressed through SCVWD's Stream Maintenance Program.

9e | Water-quality-based Regulation of Pollutants

The CWA has "back-up" provisions to insure that water quality standards are met. Water quality standards include designated uses, narrative or numeric water quality objectives, and measures to insure that existing water quality is not degraded. If water quality standards are not attained, point-source dischargers must further reduce their pollutant discharges. California also requires urban runoff dischargers to address attainment of water quality standards in their management plans.[11]

9e1 Water-Quality Surveys, Impaired Water Bodies and TMDLs

USEPA requires states to submit a water quality survey (Section 305(b) water quality assessment) and a list of impaired water bodies (Section 303(d) list) every two years.

If a water body is impaired, the state must calculate the maximum pollutant load that a water body can assimilate and still meet water-quality objectives. Based on this Total Maximum Daily Load (TMDL) the state allocates loads to point and non-point pollutant sources and may require pollutant-loading reductions.

9e2 The Total Maximum Daily Load Process

Congress adopted TMDL requirements in 1972. USEPA issued regulations in 1985 and 1992 but the states implemented few TMDLs until environmental advocates brought successful lawsuits in the late 1990s.

TMDLs include a problem statement, a quantitative description of the desired condition, analyses of pollutant sources and the assimilative capacity of the water body, and allocations of loads to the various sources (with a margin of safety). They also include plans and schedules to fix the impairment (i.e., meet water quality standards) and monitoring to track the implementation and effectiveness of actions.

The RWQCB created the Regional Monitoring Program for Trace Substances (RMP) in 1991 to monitor contaminant concentrations in water, sediments, and fish and shellfish tissue in San Francisco Bay and Delta. Seventy-seven NPDES permittees share the RMP's $2.5 million annual cost. The RWQCB uses RMP data when it prepares 305(b) reports, 303(d) lists, and TMDLs.[12]

In addition to supporting the RMP, Bay area POTWs and stormwater pollution prevention programs share the cost (estimated at $7 to $10 million over five years) of a Clean Estuary Partnership[13] to assist RWQCB staff with TMDLs.

9e3 Current Listings and TMDLs in the Santa Clara Basin

The RWQCB and USEPA list a number of pollutants that impair beneficial uses of San Francisco Bay. Some streams are also impaired. Table 9.1 shows TMDLs currently scheduled in Basin water bodies. The RWQCB placed additional pollutants on a "monitoring list." Following are details about some of these ongoing and potential TMDLs and WMI stakeholders' contributions:

Copper and Nickel in South San Francisco Bay. The RWQCB first listed South San Francisco Bay as impaired by copper and nickel in 1989. A 1992 study of pollutant loads to San Francisco Bay led to a "Copper Dialogue" MOU, which was intended to achieve reductions in copper loads from various sources. A 1996 Metals Control Measures Plan (MCMP) identified copper-containing brake pads as a principal source of copper in runoff; the principal source of nickel is erosion of soils containing naturally high concentrations of nickel.[14] SCVURPPP's 1997 Urban Runoff Management Plan incorporates the MCMP actions.[15] In 1998, the City of San Jose funded extensive studies of copper and nickel, and the WMI formed a "Copper and Nickel TMDL Work Group" (TWG) to guide the studies. In June 2000, the TWG found that it is unlikely that concentrations of copper and nickel in southern South San Francisco Bay are impairing aquatic life.[16]

The TWG then developed "Action Plans" for copper[17] and nickel.[18] Under the Action Plans, the WMI will study remaining uncer-

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Copper/nickel actions include finding ways to reduce automobile use through changes in transportation and land use policy. See Chapter 3.

WMI Accomplishment

The achievement of stakeholder and scientific consensus regarding copper and nickel in South San Francisco Bay, developed through an SCBWMI stakeholder process, could provide a model for other TMDLs.

tainties about impairment. Ambient concentrations will be monitored; additional actions will be triggered if concentrations rise above set levels.

In December 2000, the RWQCB revised the Basin's three treatment plants' NPDES permits and formalized the plants' ongoing commitment to improve pretreatment programs, conduct scientific studies leading to final site-specific objectives, reduce discharges through water recycling, and continue participation in the WMI. The RWQCB concluded at that time that copper and nickel did not impair southern South San Francisco Bay.[19] In early 2001, actions specific to urban runoff were included in the SCVURPPP's reissued NPDES permit.[20]

In May 2002, the RWQCB adopted site-specific water-quality objectives[21] for copper and nickel. In doing so, the RWQCB commended the WMI and its participants "for their collaborative efforts and commitment of time and resources that contributed to the success of this project. Provision for stakeholder involvement, generation of high quality and reliable studies and data, and scientific peer review of findings are hallmarks of this project that serve as a model for successful resolution of complex technical and policy issues."[22]

Mercury in All San Francisco Bay Segments. Total mercury concentrations in San Francisco Bay waters exceed the RWQCB's Basin Plan objective (0.025 µg/L). Plant and animal tissues don't readily absorb inorganic mercury, but methylated mercury, produced in a complex cycle in certain natural environments (including wetlands) is more easily absorbed and can bioaccumulate.

Some fish caught in San Francisco Bay (e.g., leopard sharks) exceed the Federal Food and Drug Administration (FDA) limit for methylmercury in fish (1 µg/g). In December 2000, USEPA recommended that states adopt site-specific standards based on local consumption. The RMP recently completed a survey of fish consumption by anglers in San Francisco Bay and a third study of concentrations in fish tissue.

RWQCB staff is working with a stakeholder group (the Mercury Council) to develop a TMDL. A 2001 staff report[23] found that Central Valley watershed sources accounted for 58% to 74% of mercury entering the Bay, and remobilization of sediments accounted for 17% to 30%. Urban stormwater (about 4%), mining waste in the Guadalupe River watershed (1% to 4%) atmospheric deposition, natural minerals in soil, and atmospheric deposition on the Bay account for the remainder. Concentrations in most of the Bay are below the methylmercury target (0.5 ng/l in water[24]), but the highest concentrations are near the Guadalupe River.

The POTWs and SCVURPPP educate the public to properly recycle and dispose of fluorescent bulbs, thermometers, and other items that contain mercury.

Mercury in the Guadalupe Watershed. From the Gold Rush era until 1975, cinnabar was mined from the New Almaden Mining District on the eastern side of this watershed. Mine tailings were deposited in drainages, or have eroded into the drainages.

Studies of fish in reservoirs and the Guadalupe River in 1987 and 1988 led to fish consumption advisories. Mercury in fish may also be harmful to fish-eating

TABLE 9.1 SCHEDULE FOR SANTA CLARA BASIN TOTAL MAXIMUM DAILY LOADS

		COMPLETION DATE ON 1998 303(D) LIST	CURRENT PROJECTED COMPLETION DATE		
WATERBODY(S)	POLLUTANT(S)	(► = STARTED)	PRELIMINARY PROJECT REPORT	FINAL PROJECT REPORT	PLANNED BASIN PLAN AMENDMENT
All San Francisco Bay Segments	Mercury	2003►	June 2000	May 2003	August 2003
South SF Bay	Copper	2003►	Not Applicable	Not Applicable	Completed
South SF Bay	Nickel	2003►	Not Applicable	Not Applicable	Completed
All SF Bay Segments	PCBs	2008►	May 2003	October 2003	March 2004
SF Bay Urban Creeks (35 water bodies)	Diazinon	Listed by USEPA►	Completed	October 2003	March 2004
Guadalupe River Watershed **Calero Reservoir** **Guadalupe Reservoir** **Alamitos Creek** **Guadalupe Creek** **Guadalupe River**	Mercury	2003►	June 2005	February 2006	June 2006
San Francisquito Creek	Siltation	2005►	June 2004	May 2005	April 2006
All SF Bay Segments	Diazinon	2005	June 2005	June 2006	June 2007
All SF Bay Segments	Selenium	2010	June 2008	June 2009	June 2010
All SF Bay Segments	Chlordane, DDT, Dieldrin	Listed by USEPA	June 2005	December 2006	June 2007
All SF Bay Segments	Furans	Listed by USEPA	To be determined	To be determined	To be determined
All SF Bay Segments	Dioxins	Listed by USEPA	To be determined	To be determined	To be determined

Source: San Francisco Bay RWQCB TMDL Projects webpage, **www.swrcb.ca.gov/rwqcb2/tmdlprojects.htm**

birds, such as the common merganser, black-crowned night heron and belted kingfisher. Mercury concentrations in sediment exceed values that may increase mortality and teratogenesis in rainbow trout embryos. FWS recently completed a Natural Resource Damage Assessment in the Guadalupe watershed.

Since 1988, Santa Clara County and SCVWD have removed or immobilized much of the mercury-laden sediments in the mining area. In 2000, the state Department of Toxic Substances Control announced that remedial actions had been completed and that the mining area (now Almaden Quicksilver County Park) was no longer a threat to public health or the environment. However, additional investigation of these area, and of mercury-laden sediments that may have moved downstream, is required.[25]

The WMI's Guadalupe River Mercury TMDL Workgroup developed a Recommended Interim Sampling and Monitoring Plan. Implementation is beginning in 2003.

PCBs in San Francisco Bay. PCBs are a group of over 200 organic chemicals. Manufactured from 1929 to 1979, PCBs were used as hydraulic fluids, lubricants, plasticizers, insulators in electrical transformers, in industrial paints and coatings, and in carbonless copy paper.

PCBs bioaccumulate, and piscivorious fish, birds, and mammals (including humans) are most vulnerable. PCBs vary in toxicity; long-term exposures have been associated with developmental abnormalities, disruption of the endocrine system, impairment of immune function, and cancer. The U.S. banned sale and production of PCBs in 1979.

A 1994 RWQCB Fish Contamination Study[26, 27] found that PCB concentrations in fish throughout the Bay exceeded screening values; this led to health advisories for the consumption of sport fish. San Francisco Bay waters exceed the California Toxics Rule criterion (170 ng/L total PCBs) at all locations. (Exceedances of this low limit can also be found in samples from Arctic waters.)

The RMP's Sources, Pathways, and Loadings Work Group (SPLWG) and Chlorinated Hydrocarbon Work Group (CHCWG) concluded that there was no declining trend in PCB concentrations in water, sediment or mussel tissues since the early 1980s. However, recent data are being analyzed to determine whether PCBs are declining.

After creating a mass budget for PCBs in the Bay and estimating losses due to outflow, burial, and volatilization, the workgroups concluded that continuing inputs from the surrounding watersheds may contribute to the persistence of high PCB concentrations. Air deposition of PCBs may also be significant. An Estuary Interface Pilot Study, funded in part by SCVURPPP and conducted by the RMP, included sampling near Standish Dam on Coyote Creek and in Alviso Slough. The authors concluded that South Bay watersheds may be ongoing sources of PCBs (as well as chlordane, dieldrin and other pollutants).

In 2000, a City of San Jose/Silicon Valley Toxics Coalition project[28] identified the accumulation of PCBs in transplanted clams in the Guadalupe River, Coyote Creek, and Sunnyvale East Channel.

SCVURPPP led a multi-stormwater-agency study to characterize the concentration of PCBs and mercury in storm drain sediments. Follow up studies include characterization of sediment concentrations at tributary mouths, pilot work to investigate areas with elevated PCBs in storm drain sediments, and initial identification and evaluation of control measures.

Chlordanes, DDTs, and Dieldrin in San Francisco Bay. Like PCBs, these chlorinated hydrocarbon pesticides (CHCs) are no longer produced or used, but they persist in sediments and are biomagnified in the food chain. The 1994 Fish Contamination Study and follow-up work by the RMP published in 1999[29] found a significant percentage of samples were above screening values for some species. In general, higher concentrations were found in more industrial areas.

1997 fish tissue DDT concentrations are as little as 3-5% of the values in 1965, when DDT was partially banned. However, most of the decrease occurred soon after the halt in widespread use. Decreases in the concentrations of CHCs will be slow, due to resuspension of sediments and continuing input of polluted sediments from contributing watersheds.

USEPA listed these pollutants, but the RWQCB has not yet scheduled development of a TMDL. However, anticipating the need for data similar to that required for PCBs, SCVURPPP and other stormwater programs incorporated CHC analyses into the second year of their stormwater sediment characterization study.

Diazinon in urban creeks. This organophosphate pesticide is widely marketed for home and garden use. It is also used in commercial agriculture. Unlike organochlorine pesticides such as DDT, it is not bioaccumulative and usually persists for only 7-40 days in surface waters.

Studies in the Santa Clara Valley in 1992 suggested that some toxicity in urban runoff might be due to organic compounds. Subsequent toxicity identification evaluation (TIE) procedures associated observed toxicity with diazinon.[30] Grab samples from creeks throughout the Bay area in 1995 showed widely ranging concentrations of diazinon, with many in the range associated with laboratory toxicity to *Ceriodaphnia dubia*.

There is no water quality objective for diazinon. However, several creeks were observed to exhibit toxicity due to diazinon. EPA chose to list all urban creeks (37 are named) as impaired based on exceedance of the toxicity narrative objective.

Diazinon's chief manufacturer, Syngenta, will phase out all home and garden applications over the next four years. The voluntary phase-out responds to USEPA concerns about potential health impacts, particularly to children. RWQCB staff recommends continued listing until in-stream data show that concentrations are below those associated with aquatic toxicity. As use of organophosphate pesticides declines, regulatory attention is shifting to possible "third generation" successors, such as pyrethrins and pyrethroids, and whether these naturally derived pesticides might cause toxicity in urban creeks.

A Bay Area/Central Valley Urban Pesticide Committee seeks ways to limit use.[31] SCVURPPP promotes integrated pest management and other alternatives to pesticides.

Dioxins and Furans in San Francisco Bay. In 1999, USEPA added dioxins and furans to the 303(d) list. The RWQCB's TMDL schedule is "to be decided." Like PCBs, dioxins can be extremely toxic in low concentrations, tend to adhere to sediments, and degrade very slowly in the natural environment. Unlike PCBs, they have a plethora of continuing sources, including nearly all types of combustion—particularly the combustion of wood in stoves and fireplaces and diesel fuel. Garbage burning and medical waste incineration have been major sources of dioxin emissions in other parts of the U.S. While these activities are no longer practiced in the Bay area, they may have contributed to dioxin in Bay and watershed sediments.

In 2002, SCVURPPP reviewed data on methods used to characterize dioxins in stormwater runoff and surface waters and concentrations typically found in the Bay Area and other areas. SCVURPPP is currently collaborating with other Bay Area stormwater management agencies to develop a "synthesis" document that will summarize the current state of knowledge regarding dioxins in stormwater runoff.

Sediment and Siltation in San Francisquito Creek. Adult steelhead migrate up San

Francisquito Creek to spawning redds on Los Trancos Creek and Bear Creek. In the early 1990s, a group of local citizens began to plan a clean up and enhancement of the watershed. The Peninsula Conservation Center Foundation adopted a formal Coordinated Resource Management and Planning (CRMP) process in 1993. A watershed plan was prepared in 1995 and 1996. A February 1998 flood brought new urgency to flood management issues. That same year, the RWQCB added San Francisquito Creek (along with San Gregorio Creek and Pescadero Creek in San Mateo County) to the 303(d) list, stating that they were impaired by sediment and siltation.

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The concept of stream equilibrium is essential to understanding sediment in streams. **See Section 8d.**

Meanwhile, the CRMP (now the San Francisquito Watershed Council) has produced its own Long Term Monitoring and Assessment Plan (LTMAP) for the San Francisquito Creek watershed. The LTMAP includes metadata for existing studies and outlines future monitoring needs.

SCVURPPP, the San Mateo Countywide Stormwater Pollution Prevention Program (SMCSTOPPP) and other stakeholders are planning a sediment assessment to meet the different requirements of the RWQCB's TMDL work plan, SCVURPPP's NPDES permit, SMCSTOPPP's NPDES permit, additional requirements of RWQCB staff, and conditions of grant funding. They propose to use USGS and Stanford University sediment analyses that are currently underway. A draft scope suggests broad geomorphic studies, assessments of habitat, endangered species, and land use, and application of different approaches to assessing sources and impacts of sediment to the creek. The WMI's SOILS (Sediment Observations in Lotic Systems) Work Group is helping coordinate.

9e4 Potential new TMDLs in the Santa Clara Basin:

In 2001, the RWQCB created a "monitoring list" of pollutants and water bodies that need further investigation and possible listing in the next cycle. The "monitoring list" includes:

Sediment or Siltation in other creeks. SCVURPPP used the WMI's metadata database, supplemented by additional research, to prioritize investigation of possible impairment of stream reaches. The prioritization was based on beneficial use designation, type of fish community present, fish habitat survey data, and benthic macroinvertebrate community structure data. Evidence of bed and bank erosion, sediment accumulation areas, land use, and channel modifications were also considered. These factors were weighted for availability and relevance of data. SCVURPPP identified Stevens Creek and Coyote Creek as the highest priorities for conducting watershed analysis and assessing existing management practices for sediment and erosion control and prevention. SCVURPPP developed a work plan and schedule to conduct a watershed analysis and management practice assessment for these stream reaches, which will begin in July 2003.

Trash in urban creeks. Bay area cities commented at length on the RWQCB's consideration of a 303(d) listing and TMDL for all urban creeks. The RWQCB rejected the view that ongoing active municipal clean-up efforts are sufficient to avoid a listing, as programmatic measures of effort alone do not provide evidence of whether or not the water body is impaired.

The Los Angeles Basin RWQCB adopted a Trash TMDL for the Los Angeles River in September 2001. The target quantity is zero. The Los Angeles TMDL foresees installation of devices to catch trash in storm drains and requires that these be cleaned out within 72 hours after each rain event and every 3 months during dry weather.

Recent SCVURPPP efforts have addressed trash. One project expands on an earlier preliminary evaluation of storm drain inlet designs to prevent trash from entering drains. Another seeks to identify and map trash "hot spots;" this could lead to prioritizing cleanup and enforcement. SCVURPPP developed a work plan and schedule to address trash problems in urban creeks. Work will begin July 1, 2003 and continue for the next two years. Work plan tasks include documenting and evaluating existing trash management practices, identifying and prioritizing trash problem areas, conducting trash assessments, and implementing additional BMPs at high priority trash areas.

Polybrominated Diphenyl Ethers (PBDEs). In 1998, the RMP CHCWG found that "The RMP is underestimating contamination in the Bay by focusing on chemicals that are no longer in use…. CHCs have been replaced by other pesticides, insulators, and flame retardants that are required to be highly toxic and/or persistent in order to serve their purpose. Few of the chemicals that are currently in heavy use and are of potential concern in the Bay are currently monitored by the RMP."[32] Jay Davis at the San Francisco Estuary Institute (SFEI) subsequently noted that gas chromatograph (GCMS) traces from cormorant egg samples suggested concentrations of unknown contaminants, later identified as PBDEs. Later studies have found PBDEs in harbor seal blubber and human adipose tissue. PBDEs are similar in chemical structure to PCBs and are obviously bioaccumulative, but little is known of their effects.

RWQCB staff did not recommend a 303(d) listing for PBDEs because no applicable water quality criteria have been established; however, PBDEs are included on the monitoring list. The RMP 2002 Monitoring Plan includes special studies to sample Bay waters for pollutants on the 1977 USEPA priority list that have not been previously monitored and to review the toxic substances registry for possible substances that may persist in the environment or bioaccumulate.

Endocrine Disrupting Chemicals (EDCs). High concentrations of organochlorine pesticides, PCBs, dioxins, and some synthetic and plant-derived estrogens can disrupt animal endocrine systems. It is unknown if humans or wildlife are affected by lower concentrations of the same chemicals. Improved laboratory techniques allow scientists to measure concentrations in the part-per-trillion range in runoff and treated wastewater.

The endocrine system plays a critical role in normal growth, development, and reproduction. Even small disturbances in endocrine function may have profound and lasting effects, and multiple EDCs may have synergistic effects. A coordinated federal research effort has been underway since the late 1990s.

The WMI's Emerging Contaminants Workgroup includes scientists, engineers, regulatory personnel, environmental advocates, water retailers, health practi-

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SCVWD's "Adopt-a-Creek" program is discussed in Section 9d2.

tioners, and community members. The workgroup discusses and researches issues related to pollutants that has become recognized as new environmental concerns, such as EDCs and PBDEs.

Pathogens in Creeks. In 2001, the RWQCB listed ocean beaches and creeks in San Francisco and San Mateo County and added Redwood Creek in the South Bay to the “monitoring list.” Discerning whether a water body may be impaired by disease-causing microbes is complicated because:

- The relationship between the presence of indicator organisms (typically coliform bacteria) and the presence of pathogens is variable and complex.
- The presence of coliform or fecal coliform may be due to wildlife or domestic animals rather than pollution with human feces.
- Indicator-based water-quality criteria are complex and require calculation of a mean of samples taken within a specified period.
- Actual public health risk depends on opportunities for exposure. Evaluation of actual use for swimming and other contact recreation is required.
- Both use and water quality vary with season.
- Actual public health risk depends on the size and immune status of the population exposed.

Citizen monitoring of Saratoga Creek in the early 1990s found some samples with apparently high coliform levels; however, the data were insufficient for comparison with RWQCB Basin Plan objectives. (Further investigation eventually identified sewer leaks draining to the creek.)

SCVURPPP has created a computer-based tool that can evaluate coliform data and identify the boundaries of potential health risks based on that data. The screening tool uses a previously tested model of microbial risk.

In January 2001, USEPA published a Protocol for Developing Pathogen TMDLs. The protocol suggests an expanded set of microbial indicators; however, the approach is based on the broad application of criteria, rather than assessment of the actual risk in a specific location.

9f | Strategies for Understanding and Controlling Pollutants

9f1 Assessing Potential Impairments

Non-point source pollution is diffuse and variable. Sources, fate, transport, and effects vary from location to location within the Basin. Assessments need to be targeted and site specific.

Future watershed assessments will need to rapidly review (screen) stream reaches or wetland areas, identify which may be affected by pollutants, and prioritize these locations for further investigation. Prioritization criteria might include nearby land uses, proximity of known pollutant sources, or physical and visual evidence (disturbance, turbidity, oil sheen, trash) commonly associated with pollutants. The prioritization should also consider specific uses, habitat functions, and seasonality and how these may affect how long organisms are exposed and at what stage in their life cycle. The prioritization should lead to focused, well-designed studies to determine whether specific pollutants impair specific reaches or areas.

9f2 Impaired Water Bodies and TMDLs

The TMDL process provides a venue for stakeholders to participate in creating comprehensive, long-term plans to reduce specific pollutants. These pollutant-specific plans should build on previously planned and ongoing programs to reduce erosion, control urban runoff pollutants, restore habitat functions, and protect and enhance Basin watersheds. Regulatory actions should be pragmatic (results-oriented) and linked to achievable environmental benefits.[33]

When the RWQCB has placed a pollutant on the 303(d) list or "monitoring list," a structured, stakeholder-based process should be used to coordinate all further efforts to investigate or control that pollutant.

9g | Summary of Actions to Understand and Control Pollutants

The WMI has identified the following actions that agencies, organizations, and individuals can implement to understand and control pollutants:

- Improve implementation of TMDLs.
- Assess sources, fate, transport, and potential effects of pesticides, mercury, PCBs, dioxins, PBDEs, and endocrine-disrupting compounds.
- Review, prioritize, and implement actions to reduce potential effects of pollutants. Identify and remediate "hot spots" of PCBs.
- Identify and remediate "hot spots" of mercury. Assess actions that could reduce the methylation of mercury in wetlands.
- Assess the potential effects of pathogens on swimmers and other recreational users of streams, reservoirs, and southern South San Francisco Bay.
- Remove trash and larger debris from streams and wetlands and find ways to limit what gets dumped there.

9h | Next Steps for the WMI

9h1 WMI Actions Needed to Implement the Strategic Objective

- Continue to build on the WMI's successful collaborative processes that led to the 1998 adoption of uncontested discharge permits for the three POTWs and to the 2002 adoption of site-specific objectives for copper and nickel.
- Continue to develop assessment methodologies based on "lessons learned" from the assessments of the San Francisquito, Guadalupe, and Upper Penitencia watersheds and the SCVURPPP assessment of the Coyote watershed.
- Coordinate assessment results and data from TMDLs and other mandated studies with other WMI objectives, including watershed stewardship planning, expansion of the DESFBNWR, and habitat conservation.

- Prepare annual reports updating key indicators of watershed health and describing recent progress in preserving and enhancing Basin watersheds, new findings and study results, and WMI achievements and successes. (Consider the annual "Pulse of the Estuary" report as a model.)

9h1 Other WMI Actions that Support the Strategic Objective

- Reconvene the WMI Guadalupe Mercury TMDL Working Group.
- Continue the WMI's SOILS Working Group's efforts to coordinate the requirements of the RWQCB's San Franciscquito Sediment TMDL work plan, SCVURPPP's NPDES permit, SMCSTOPPP's NPDES permit, additional requirements of RWQCB staff, and conditions of grant funding.
- Convene additional work groups as needed to develop and implement TMDLs and pollutant-specific action plans.
- Conduct public outreach and education on the "virtual elimination" of mercury.
- Conduct public outreach programs encouraging integrated pest management and proper and limited use of pesticides.
- Research gaps and conflicts in regulations controlling air pollution and water pollution; initiate or influence legislation.
- Explore and encourage legislative actions and regulations that control the availability of products, including pesticides, that cause water pollution.
- Publish information, directed at policymakers, that links pollutants and land use/transportation decisions.

10 REALIZING THE WMI VISION

10a | A Vision and a Plan

WMI stakeholders began work on this Action Plan by identifying about 112 individual actions that would benefit the Basin's watersheds.

The stakeholders agreed that the actions should be part of a comprehensive plan to protect and enhance Basin watersheds. The plan should be guided by a common vision of a future Santa Clara Basin where the uses of land and water are planned and balanced to support society and nature alike.

As is shown in the previous chapters, nearly all of the needed actions are within the scope of existing environmental-protection mandates and programs.

The WMI must work to align, coordinate, and integrate these existing programs and mandates. Reducing overlaps and conflicts between programs will make it possible to accelerate stakeholder actions and, at the same time, achieve the economic benefits of more efficient regulation.

In this way, the WMI will promote purposeful progress toward the stakeholders' common vision.

10b | How the WMI Can Benefit the Basin

Alignment, coordination, and integration of environmental programs won't happen all at once. Improvement will come slowly, through education, communication, negotiation, and trust-building.

Public agency managers and staff, environmental advocates, business representatives, and citizens groups alike have learned that conflicts can be avoided or resolved through stakeholder processes. Many of these processes have been established, within and outside the WMI. Stakeholder processes are implementing TMDLs, resolving interagency disputes, planning projects, and allocating public funds.

In general, these stakeholder processes focus on one project or issue. The process ends when the project is complete or the issue is resolved. When a new project starts, or a new conflict arises, another process must be built from scratch. Participants in the process may overlook interconnections to other watershed issues.

As a permanent, ongoing institution, the WMI provides a context and resources for establishing successful stakeholder

Regulatory Corner: Streamlining and Certainty

Santa Clara Basin local agencies have two general concerns about the way that Federal and state environmental regulations are implemented.

The first concern is that "one-size-fits-all," "command and control" regulations contain cumbersome and unnecessary requirements. Regulations also overlap and sometimes conflict. Streamlining the regulations could achieve the same environmental benefits at lower cost and with less bureaucracy.

The second concern is that the regulations change frequently, making it difficult to plan and budget local programs. The local agencies seek regulatory certainty—a limit to the changes in requirements that may occur during the period of a discharge permit.

processes. WMI participants acknowledge each other's legitimate perspectives and interests and share consensus on a balanced approach to environmental protection that streamlines regulations and benefits the regional economy. Ongoing working relationships build communication and trust.

But the WMI does more: the WMI facilitates a shared understanding of how each project can be an incremental contribution to achieving the comprehensive long-term vision for the watershed. This comprehensive, long-term perspective yields insight into how projects and programs overlap, interconnect, or potentially conflict.

As WMI participants come to understand the complex, interconnected nature of environmental issues and the long-term process of watershed degradation and renewal, consensus-building becomes much more than simply negotiating or "trading off" one benefit against another. Instead of mere compromise, participants may find creative solutions that solve many problems at once. It is often possible, through consensus-based planning, to come up with a new solution that achieves higher economic values for land use, conserves public funds, and improves habitat quality.

However, the solution may not become apparent until stakeholders develop a common background in watershed science and policy. WMI participants share an interdisciplinary understanding that encompasses hydrogeomorphology, ecology, pollutant fate and transport, land-use policy, tax policy, land-development economics, and urban design. The WMI makes it possible for individual participants to build up this background over time. As the WMI continues, they can apply that expanded knowledge to help develop solutions to the next set of issues that arise.

This process of investigating, educating, sharing information, and opening up discussion is what the WMI does best.

10c | Adaptive Management of Santa Clara Basin Watersheds

In summary, the WMI is laying the groundwork for adaptive management of Santa Clara Basin watersheds. As described in Section 8f, adaptive management is the process of implementing policy decisions as scientifically driven management experiments that test predictions and assumptions in management plans, and using the resulting information to improve the plans.

Adaptive management requires that stakeholders make long-term commitments to a process of planning, doing, checking, and adapting their plans, and that they commit to doing this together.

There are two basic requirements to make this kind of iterative planning process work: A starting point, and a method to evaluate and improve with each iteration of the process.

10d | Initial Priorities

To suggest a starting point for the WMI's future work, the WMI's Core Group reviewed the strategic objectives and "Next Steps for the WMI" in Chapters 3–9 and conducted a prioritization exercise.

The results are a rough indication of what WMI participants believe will be the most important concerns of the WMI in the next 1-2 years.

The following strategic objectives scored highest:

- Better Assessments, TMDLs, and Discharge Permits
- Integrated Planning of Floodplains and Riparian Corridors
- Integrated multi-objective planning and adaptive management for in-stream projects and programs.
- Incorporating the WMI Vision into General Plans and Specific Area Plans

The highest-ranking "Next Steps for the WMI" included:

- Coordinate implementation of watershed stewardship plans, floodplain/riparian corridor planning, SCVURPPP's hydrographic modification management plans, and habitat conservation planning.
- Convene a dialogue with Planning Commissioners and Directors regarding the use of General Plans and Specific Area Plans to implement the WMI's vision of continuous habitat corridors and intensely developed neighborhoods.
- Improve and expand pilot watershed assessments.
- Continue and build on the WMI's successful collaborative processes that led the 1998 adoption of uncontested discharge permits for the three POTWs and to the 2002 adoption of site-specific objectives for copper and nickel.
- Prepare annual reports updating key indicators of watershed health and describing recent progress in preserving and enhancing Basin watersheds, new findings and study results, and WMI achievements and successes.
- Bring the WMI's message to advisory boards, environmental commissions, planning commissions, and other venues for public input to agency decision-making.

10e | Measures of Success

The WMI will develop and use programmatic indicators and environmental indicators to characterize progress toward the strategic objectives and to assess the effectiveness of the "next steps" identified in Chapters 3–9. These indicators will be reported annually.

Programmatic indicators will measure both outputs (efforts made) and outcomes (results achieved). Measured outputs will include stakeholder processes established, grants applied for, literature distributed, and presentations made. Measured outcomes will include permits adopted without contest, agreements reached, consensus documents published, and public response to watershed education efforts.

Environmental indicators should be scientifically driven and will be established by stakeholder groups working on specific issues. Environmental indicators may also measure both outputs and outcomes. Measured outputs may include acres of wetlands restored, linear feet of stream bank stabilized, or number of barriers to

Three Examples of How a Comprehensive Approach Can Lead to Better, More Cost-Effective Solutions

1. Instead of building channels to accommodate rare, large floods, protect buildings to minimize damage and create floodplain areas with trails, recreation, and protected riparian habitat. (See Chapter 5.)

2. Use water recycling to reduce potential impacts of summertime freshwater discharges to southern South San Francisco Bay, while supplementing the Basin's water supply. (See Chapter 6.)

3. Instead of requiring expensive enhancements to wastewater treatment, use the TMDL process to consider all pollutant sources and find the most efficient way to achieve water-quality objectives. (See Chapter 9.)

fish passage removed. Measured outcomes may include improved biotic indices, improved stream functions, and reduced numbers of pollutant "hot spots."

10f | The WMI's Role in Managing Santa Clara Basin Watersheds

This Watershed Action Plan is not merely a list of actions to be implemented by others; rather, it initiates an ongoing, iterative process of adaptive management for Santa Clara Basin watersheds.

The WMI will continue to pursue the goals that it adopted in 1999: a broad, consensus-based process, simplifying regulatory requirements without compromising environmental protection, balancing the objectives of water supply management, habitat protection, flood management and land use, and a commitment to an implementable plan that incorporates science and is continuously improved.

Each of the WMI's stakeholders has a unique role to play, and unique contributions to make, toward achieving those goals. Many of the things that agencies, organizations, and individuals can do are specified in Chapters 3-9.

The WMI itself will focus on three general tasks:

- **facilitating stakeholder processes.**
- **bringing recommendations to decision-makers.**
- **educating and involving the public.**

The WMI will continue to advance long-term stakeholder collaboration and information sharing and, at the same time, will support stakeholder work groups dedicated to TMDLs or other specific and current regulatory and environmental issues. The WMI will be an ongoing stakeholder forum to which contentious issues can be referred. The WMI will continue to emphasize the interconnectedness of watershed issues and will look for ways to align, coordinate, and integrate programs, policies, and actions.

The WMI will continue to develop consensus recommendations, such as those in Chapters 3–9, on what agencies, organizations, and individuals can do to help protect and enhance Basin watersheds. These recommendations will include grant applications and requests to fund watershed projects. The WMI will communicate these recommendations to commissions and advisory committees as well as to the Councils and Boards of public agencies.

10g | WMI Outreach

The WMI will also continue to educate the public on watershed issues and to encourage community participation and stewardship to protect and enhance watersheds.

In a large metropolitan area with a wide variety of communications media, it is difficult for any one message to cut through the "clutter" and reach all area residents unless it is disseminated widely and repeatedly.[1] SCVURPPP, the WMI, and the DESFBNWR are emphasizing the following messages in a multi-year public/private "Watershed Watch" campaign:[2]

- A watershed is a land area that drains water into a creek, river, lake, wetland, bay or groundwater aquifer.

- Because you live in the Santa Clara Basin watershed, your actions affect local creeks and the Bay.
- Be a watershed steward.
- By protecting the watershed, creeks, and the Bay, you are protecting the environment for you, your children, and future generations.

Through partnerships with media companies, the campaign is leveraging hundreds of thousands of dollars in media buys to promote both general watershed messages and seasonal messages focused on specific pollutants.

Through Watershed Watch, SCVURPPP, other public agencies, and private donors also fund outreach at schools and at fairs and other special events. A Creek Connections Action Group, which includes staff from SCVWD, San Jose, Santa Clara County Parks, and SCVURPPP, coordinates creek clean-ups. SCVURPPP and individual co-permittees conduct well-planned outreach targeted at employees, residents, businesses, and schools. These activities cover a broad range of watershed issues.[3]

Pollution prevention outreach typically aims to change individual behaviors; the WMI's outreach needs also to educate and inform the Basin community about the public policies and public investment needed to achieve the WMI's vision.

The WMI will encourage its stakeholders to align and coordinate their messages in a way that promotes the WMI vision. In particular, the stakeholders will promote broader understanding of stream functions, the effects of urbanization on streams, the multiple uses of floodplains in an urban area, the importance of imperviousness, how conservation and recycling can make more water available for stream habitat, the need for habitat reserves, and the advantages of smart growth, as well as pollution prevention.

The WMI will help stakeholders promote the WMI vision by:

- Developing, updating, and refining a message to popularize the WMI's approach to preserving and enhancing Basin watersheds.
- Bringing this message to advisory boards, environmental commissions, planning commissions, and other venues for public input to agency decision-making.
- Assessing the need for, and feasibility of, watershed councils in each watershed.
- Linking watershed issues and outreach to community organizations such as homeowners associations and groups that are established or supported in connection with municipal improvement efforts (e.g. San Jose's Strong Neighborhoods Initiative).
- Helping to coordinate input to, and distribution of, outreach newsletters published by agencies and community groups.
- Bringing the WMI's perspective on watershed management to K-12 environmental education curricula.
- Encouraging and assisting agencies to incorporate interpretive and educational features as part of recreational facilities and other public works projects (particu-

larly those in the floodplain or that otherwise relate to streams or wetlands).

- Developing, in cooperation with stakeholders, an annual report updating key indicators of watershed health and describing recent progress in preserving and enhancing Basin watersheds, new findings and study results, and WMI achievements and successes.

10h | Moving from Planning to Implementation

This Action Plan is intended to provide the basis for more detailed planning and adaptive management at the watershed scale through identification of the main areas of concern and action that were voiced by stakeholders through the Action Sheets.

The next steps for the WMI will include:

1. The Action Plan will be adopted by signatories during the fall of 2003. In addition, the WMI intends to prepare a factsheet to summarize the Action Plan and communicate it to the public.

2. The Core Group will finalize its workplan for the first year of the WMI and define a process to phase actions outlined in this plan. The workplan will then be implemented through aligning existing programs and/or obtaining grants and other resources to implement new actions. As part of its commitment to adaptive management, the Core Group will review all products and processes, accomplishments and successes in preparing workplans for subsequent years.

3. The Core Group will complete its review of options for the future structure of the WMI and determine the most appropriate structure.

10h1 First Year Workplan

As described earlier in this chapter, the WMI, in approaching implementation of the program of the Watershed Action Plan, initiated a process to establish consensual first year priorities. From the resulting list of priority Actions, a preliminary first year workplan was developed that emphasized the following five activities:

1. **Planning Dialogue:** Convene a dialogue with local county and municipal planning officials to encourage adoption/acceptance of the Watershed Action Plan and to move toward the integration of water resources protection interests or watershed stewardship into land use planning

2. **Wastewater Permit Adoption:** Secure adoption of appropriate permits for Wastewater Discharge.

3. **Baylands and Watershed Assessment:** Provide technical support and staff resources for Baylands Assessment and review watershed assessment methodology options for the next phase of watershed assessment in individual watersheds.

4. **Watershed Councils:** Assess the feasibility of establishing Watershed Councils to coordinate assessment and planning activities in individual watersheds.

5. **Watershed Stewardship Plans:** Provide input into the Santa Clara Valley Water District's development of Watershed Stewardship Plans for the Guadalupe River, West Valley and Lower Peninsula Watersheds.

The first year work plan also places high priority on restructuring the WMI organization to facilitate implementation of the Watershed Action Plan, developing performance indicators of Action Plan Success, and completing distribution of its *Watershed Characteristics Report, Watershed Assessment Report* and *Watershed Action Plan.*

The workplan also includes continuing to track and share information with other watershed related efforts, such as, San Francisco Estuary Project, Habitat Conservation Plan process, South Bay wetlands restoration, IWRP/South Bay Recycling program and the Community Outreach program of the Stormwater Program.

10h2 Leveraging Resources

A key element of the Action Plan's implementation strategy is to leverage resources—by securing grant assistance, by linking with existing programs and by efficiently using staff and resources of participating agencies and organizations.

For example, in the grant arena, the WMI is supporting grant applications for state grants to:

- stabilize eroding banks in Thompson creek, a tributary of Coyote Creek, develop design tools to aid in addressing urban development-related increases in peak flood flows, complete feasibility analyses of promising habitat improvements in Coyote Creek, and provide technical assistance to creek side landowners for bank stabilization and stream restoration,
- develop watershed health indicators and watershed planning indicators to measure success of the Action Plan implementation, support development of watershed councils to assist with watershed planning and project implementation,
- conduct feasibility analyses of habitat improvement projects on the Guadalupe River.

In the planning arena, the WMI intends to seek involvement and linkage with several initiatives, for example, planning for the restoration of South Bay wetlands, development of a county-wide Habitat Conservation Plan, and support, if requested, for the Watershed Resources Protection Collaborative.

The Watershed Resources Protection Collaborative is a forum among high-level planning officials, Water District executives and leaders of the business and environmental community in response to the Water District's efforts to update Ordinance 83-2 to address water resources protection interests. The Collaborative provides a unique opportunity for advancing the WMI's interests in convening a dialogue with planning officials on land use and water resources issues. The WMI's Land Use Subgroup, as well as members of the WMI, are either actively participating or seeking clarification on how it can develop linkages with such a forum as the Collaborative is evolving.

The WMI, through its Land Use Subgroup, has developed a comparison of local land use plans, policies, and ordinances with respect to watershed protection. The WMI therefore has expertise and information that could be of use to the Collaborative at the point where the Collaborative begins its fact finding process to develop guidelines and standards.

10h3 WMI Organizational Structure

The WMI Core Group is examining how it can adapt its current organizational structure to reflect the functions it will perform as it moves into implementation of the Action Plan. Some of the ideas include a structure to focus on the functions it performs best: information exchange, conflict resolution; a structure that would convene subgroups or workgroups only as needed; align the subgroups along the tasks of the WMI workplan.

10h4 Next Steps

The completion and adoption of this Action Plan is a major milestone for the WMI, because it concludes the Planning Phase and initiates the Implementation Phase of the WMI and accomplishes one of its goals.

In order to accomplish the WMI goals and realize the vision of restored habitat and healthy ecosystems balanced with needs for housing, recreation, and economic activities, the WMI will continue to play its unique role. The WMI's first year workplan is one step towards addressing the strategic objectives described in this action plan.

The initial work will include more efficiently using existing resources and aligning programs, continued use of facilitated stakeholder processes, and building relationships with other important efforts in the area, such as the Watershed Resources Protection Collaborative and the South Bay Saltponds restoration effort.

With the WMI's continued stakeholder support it can do what it does best—building a common understanding and integrating the various efforts to improve the Santa Clara Basin's environment.

10i | Conclusion

Ecosystems are integrated and complex; social, legal, and political systems are also integrated and complex. These systems are in constant change, and change each other. Successful intervention follows from a common understanding of how our social, political, and natural environments interact. This Action Plan is one step in the journey toward that common understanding.

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"The geomorphic functions were not returned to lower Guadalupe Creek. Very little channel modification was made to the creek, contrary to project consultant recommendations. Almost 8 million dollars was spent on about a 1.7 miles project, which installed structures where structures were not needed and did not install them where they were needed. Although numerous small sapling plants were installed they will take 10 to twenty years to grow enough to shade the creek, if they survive at all. The worst part is fish can't normally access the creek as the project does not go all of the way down to the river confluence. The 1.2 million dollar drop structure only leads salmonids to an inhospitable environment, Lake Almaden, a warm lake filled with predators. Dave Rosgen indicated he could restore the creek's proper form and fluvial geomorphic function from Camden Ave. to the river confluence, about 2.5 miles, including removal of the Masson Dam for well under 1 million dollars. Dave Derrick, ACOE, stated that 8 million dollars for the Guadalupe Creek project was absurd and the project was not achieving its goal. The Masson Dam replacement project was another 1.3 million dollar project that will cause more problems then it will solve."

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ACTION WORKSHEET LIST

The Watershed Action Plan was compiled from information in over 100 Action Worksheets developed by WMI subgroups during years 2001 and 2002. These Action Worksheets, which outlined the preliminary consensus actions aimed to protect and enhance Santa Clara Basin watersheds, are now stored in a database of Actions accessible through the WMI's website at **www.scbwmi.org**.

The following table lists the Action Worksheets and provides a general reference to where the actions have been incorporated in the Action Plan. This is not intended to be a complete index, but it may assist readers in finding sections where specific issues are discussed in the text. For a complete list and information contained in the Action Worksheets, please refer to the database of Actions.

ACTION #	ACTION TITLE	CHAPTER
COS 1A1	Identify and solicit involvement of community groups, homeowner associations, "Friends" groups, others.	10
COS 1A2	Mobilize Creek-side Residents to Remove Invasive or non-native Species.	5
COS 1A3	Expand the capacities of the Flood Control Zone Advisory Committees to include watershed stewardship.	10
COS 1A4	Establish and Operate Grass-root based Watershed Councils.	10
COS 1A5	Establish citizen monitoring clearinghouse to provide monitoring, guidance, supplies and resources.	10
COS 1A6	Support the establishment of a community-based watershed assessment center.	10
COS 1B1	Develop and distribute information to creekside landowners and land users.	5
COS 1B2	Restore connection to creeks by allowing residents to remove the fencing.	5
COS 1B3a	Public Visioning—Actively involve policy-makers and the public in the WMI.	10
COS 1B3b	Public Visioning—Communicate with City Councils, County Boards, Planning Commissions, etc.	10

ACTION WORKSHEET LIST

ACTION #	ACTION TITLE	CHAPTER
COS 2A1	Obtain funding for the Santa Clara Basin-wide Actions in the Action Plan	10
COS 2A2	Obtain funding for individual sub-basin actions in the Action Plan.	10
COS 6C1a	Establish an adaptive management framework for implementing the Action Plan.	10
FMS 4C1	Conduct an outreach program about need to integrate flood management, land use, habitat, and water protection.	10
FMS 4C2	Implement multi-objective projects.	8
FMS 4C3	Reduce adverse thermal impacts of channel/riparian corridor modifications.	8
FMS 4C4	Reduce impervious surfaces to maintain infiltration capacity in new development.	4
FMS 4C5	Identify and reduce erosion and sedimentation problems in the Basin.	8
FMS 4E1	Develop new approaches to the integration of flood protection, water quality, habitat, and development concerns.	4
LUS 4B5a	Identify areas and specific development pressures where expected near-term development presents significant threat.	3
LUS 4C4b	Minimize and/or reduce impervious surfaces and maintain infiltration capacity in new development and redevelopment.	4
LUS 4D2	Provide special policies for remodeling, expanding or redeveloping properties in or near sensitive locations.	5
LUS 4D3ab	Revise General Plans to reflect WMI objectives. Update General Plans to incorporate a long term vision of watershed.	3
LUS 4D3c	Promote re-use and recycling of land, make infill development more economically attractive.	3
LUS 4D4b	Establish and explore ways to implement trade-offs. Establish policies that respect property rights.	3
LUS 4D4c	Research appropriate mechanisms to address cumulative impacts of individual municipalities.	3
LUS 4D4d	Identify how floodplain management ordinances tie in to land use planning.	5
LUS 4D4e	Conduct analysis of how watershed planning can be implemented under General Plan and Zoning laws.	3 3
LUS 4D5a	Examine which WMI objectives conflict with existing public works policies.	4
LUS 4D6a	Explore avenues for inclusion of more detailed watershed analysis in EIRs.	3
LUS 4D7a	Explore and promote opportunities to create specific plans based on subwatershed planning.	3
LUS 4D7b	Develop guidance on how to ensure CEQA projects are consistent with watershed plans.	3
LUS 4D9a	Implement recommendations of the Tax and Economic Incentives project. Resolve issues in the existing tax structure.	3
LUS 4E1a	Seek illustrative examples of local watershed planning. Develop strategies using existing examples.	3
LUS 5A1a1	Each jurisdiction will establish and complete projects which will lead to creation of contiguous habitats.	3, 7

ACTION #	ACTION TITLE	CHAPTER
LUS 5A2a	Accomplish strategic acquisition of sensitive watershed lands in coordination with agencies.	3, 7
LUS 5A3a	Have different habitat goals based on biological resources within the watershed.	8
LUS 5D3x	Reduce and/or minimize impervious areas.	4
LUS 5D3y	Eliminate, stabilize, and/or prevent rural roads that produce and/or cause excessive sediment discharges.	4
REG 3A1	Elevate TMDLs as a process. [Issue #1 of Regulatory Gaps and Overlaps]	9
REG 3A2	Prepare a “Products Mitigation Mechanism.” [Issue #2]	9
REG 3A3	Identify missing regulatory elements, draft legislation. [Issue #3]	9
REG 3A4	Develop outreach materials for decision makers, others. [Issue #4]	3, 9
REG 3A5	Develop simple guidance document or source document. [Issue #5]	3, 9
REG 3A6	Evaluate results JARPA pilot study. [Issue #6]	8
SWSS 4A1	Implement Pilot stream augmentation program.	6
SWSS 4A2	Optimize operation of Cherry Creek Reservoir to enhance habitat.	8
SWSS 4B1	Determine what impact water conservation has had on water use and develop new integrated objectives.	6
SWSS 4B2	Conduct pilot WUE project in industrial closed-loop system.	6
SWSS 4B3	Develop appropriate residential gray water techniques and standards.	6
SWSS 4D1	Implement SB 2095 (2000) on a county-wide basis to forecast 10-year supply and use of recycled water.	6
SWSS 4D2	Enforce the state water code for mandatory use of recycled water.	6
SWSS 5A1	Remove or remediate fish passage barriers identified in FAHCE.	8
SWSS 5C3	Advertise educational programs and tours, provide transportation to activities, and link to WMI.	10
SWSS 5C4	Set up tours of reservoirs with water supply educational features.	6
WAG 5A61	Develop wetlands ecosystems assessment framework, and conduct wetlands/baylands assessment.	7
WAG 5Aa1	Restore tidal wetlands, salt ponds and adjacent habitats.	7
WAG 5Ad1	Identify occurrences of invasive plant species and implement removal and/or control.	7
WAG 5Ad2	Identify occurrences of invasive animal species and implement removal and/or control.	7
WAG 5C1	Establish guidelines, BMP’s and/or techniques for public recreation plans.	5
WAG 5D21	Eliminate pesticide-caused toxicity to aquatic life from urban runoff sources.	9
WAG 5D22	Reduce/eliminate bioaccumulation of mercury in aquatic life present in Baylands/Wetlands ecosystems.	9
WAG 5D23	Identify and control sources of PCBs and dioxins that have impacts on wetlands health.	9
WAG 5D24	Identify and control additional sources of pollutants (e.g. PBDE, EDC, etc.).	9

ACTION #	ACTION TITLE	CHAPTER
WAG 5E1	Enable better coordination of federal, state and local agencies regarding wetlands.	7
WAS 5A1a	Develop plan to revegetate contiguous riparian corridors with appropriate native plant species.	8
WAS 5A1b	Implement riparian corridor revegetation plan (5.A.1.a).	8
WAS 5A1c	Maximize the use of native riparian plant species in erosion repair.	5, 8
WAS 5A1d	Encourage enhancement and expansion of native species woodlands and grasslands that are contiguous.	7
WAS 5A1e	Implement riparian protection programs/policies.	3, 5, 8
WAS 5A1f	Conduct aquatic habitat assessments.	8
WAS 5A1g	Acquire high priority habitats and watershed lands.	3, 7
WAS 5A1h	Restore high priority aquatic and terrestrial habitats.	7, 8
WAS 5A2a	Identify occurrences of invasive, non-native plant species.	7
WAS 5A2b	Identify occurrences of invasive, non-native animal species.	7
WAS 5A3a	Separate stream channels from lakes and ponds.	8
WAS 5A4a	Restore fish passage to upstream spawning and rearing habitat.	8
WAS 5A5a	Modify water management operations to assure adequate water supply, allowing viable fish and aquatic populations.	6
WAS 5A6a	Conduct watershed assessments of Santa Clara Basin streams.	8
WAS 5A6b	Define hydrology and hydraulics of surface water systems.	8
WAS 5B1a	Conduct biological surveys of threatened and endangered species.	7
WAS 5B1b	Restore habitats in areas identified in the surveys.	7, 8
WAS 5B1c	Monitor success of restoration projects.	7, 8
WAS 5B2a	Limit water diversions and impoundment.	6
WAS 5B3a	Restrict/prohibit improper stream channel modification.	8
WAS 5B3b	Restore proper stream dimension, pattern and profile.	8
WAS 5B4a	Restrict/prohibit the improper alteration of stream hydrology.	4, 6, 8
WAS 5B4b	Restore proper stream hydrology.	8
WAS 5B5a	Curtail/prohibit actions which removes holding and hide cover, spawning areas, and food sources.	8

ACTION #	ACTION TITLE	CHAPTER
WAS 5B5b	Provide in stream rock and woody structures.	8
WAS 5C1a	Involve local schools in watershed restoration and protection.	8, 10
WAS 5C1b	Involve community volunteers in watershed protection and restoration.	8, 10
WAS 5C1c	Utilize streamside areas for open space incorporating environmentally sensitive design and mgt practices.	5
WAS 5C2a	Remove heavy debris and rubble from streams and riparian areas.	9
WAS 5C2b	Remove trash from streams and riparian areas.	9
WAS 5D1a	Control or eliminate livestock access to streamside areas.	5, 8
WAS 5D2a	Reduce improper use of pesticides and fertilizers to minimize impacts on watershed biodiversity.	9
WAS 5D2b	Implement comprehensive monitoring program.	7, 8
WAS 5D2c	Restore/assure adequate water quality.	9
WAS 5D2d	Control future and remove existing human-caused debris and trash from streams, nearby riparian areas and wetlands.	9
WAS 5D2e	Identify and remediate “hot spots” of mercury.	9
WAS 5D2f	Identify and remediate “hot spots” of PCBs.	9
WAS 5D2g	Identify and remediate sources of pathogens that adversely affect water contact recreational uses.	9
WAS 5D3a	Conduct sediment assessments and determine sediment criteria for waterbodies in Santa Clara Basin.	9
WAS 5D3b	Adopt local ordinance(s) to prevent erosion and sedimentation due to construction activities.	4
WAS 5D4a	Restore/enhance riparian cover and increase riparian setback area.	5, 8
WAS 5D4b	Restrict/control flash discharge.	4
WAS 5D4c	Restrict/control improper channel modification and bank armoring.	8
WAS 5D5a	Increase riparian and SRA cover along streams.	8
WAS 5D5b	Monitor/control high temperature water discharge.	8
WAS 5D5c	Reduce channel width/depth ratio.	8