

## Case Study: Solano County Water Agency

**Watershed:** Lower Putah Creek watershed

**Researcher:** Jeff Borchers

Year	Grant Program	Project Title	Watershed	Award Amount
2000-2001	CALFED Watershed Program	Lower Putah Creek Watershed Assessment and Stewardship Implementation Program	Lower Putah Creek, 18020162	\$600,000
2002-2003	CALFED Watershed Program	Putah Creek - Yolo Housing Authority Project	Lower Putah Creek, 18020162	\$279,655
2003-2004	CALFED Watershed Program	Community-Based Restoration of Lower Putah Creek Watershed	Lower Putah Creek, 18020162	\$992,236
2007	CALFED Watershed Program	Lower Putah Creek Winters Area Riparian Restoration Projects	Lower Putah Creek, 18020162	\$536,490
2008	CALFED Watershed Program	Lower Putah Creek Watershed Plan Priority Projects	Lower Putah Creek, 18020162	\$1,987,000

### Overview

This case study involved an assessment of five CALFED Watershed Program grants to Solano County Water Agency between 2000 and 2008. Findings of this research are based on interviews with stakeholders involved and a review of documents associated with the grants.

### Lower Putah Creek Watershed<sup>1</sup>

Located in west-central California, Putah Creek watershed encompasses 638 square miles and is a tributary of the Sacramento River. The creek originates in the Macaymas Mountains in Napa and Lake counties, and flows eastward 81 miles into Berryessa Reservoir behind Monticello Dam. Water released from the dam flows an additional 8 miles to a second dam, the Putah Diversion Dam (PDD), where most is diverted south to users in Solano County. The stream section below the PDD is the central focus of this case study, hereafter referred to as lower Putah Creek. This section of the creek flows 23 miles across Yolo and Solano Counties to the Yolo Bypass, a flood control channel that empties into Sacramento River. Approximately 72% of lower Putah Creek flows through private lands (“The Pied Piper guides creek restoration, restores peace,” 2014).

### Background

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<sup>1</sup> This section draws from several sources: Rubin (1988); Smith, 1991; Kiernan, Moyle, & Crain, 2012; and Moyle, Marchetti, Baldrige, & Taylor, 1998).

The Putah Creek watershed was once home to the Patwin people, whose livelihoods depended on resident and anadromous fish. Following Euro-American settlement of California, the region grew increasingly agricultural, particularly in the 19<sup>th</sup> century when the creek was used primarily as a ditch for flood control, drainage, gravel mining, and trash disposal. In 1957, the U.S. Bureau of Reclamation completed the Solano Project, which included Monticello Dam (forming Berryessa Reservoir) and the Putah Diversion Dam (PDD; forming Lake Solano). The project provides water for agricultural, municipal, and industrial uses, as well as flood control and recreational opportunities. Notwithstanding the degradation and dams of the 19<sup>th</sup> and 20<sup>th</sup> centuries, the creek—particularly between the two dams—continued to support remnant populations of native and nonnative fishes.

Putah Creek has a long history of conflict and litigation stretching back to the inception of the Solano Project by the Bureau of Reclamation. As early as the 1940s, when the project was under consideration by the Bureau, diverse parties

opposed the project because they anticipated that it would adversely affect Putah Creek below the proposed [Putah] Diversion Dam. Surface diverters on the lower creek anticipated that project diversions would interfere with the exercise of their rights to divert water naturally occurring in the lower creek. Groundwater users feared that reduced flows in the lower creek would interfere with the exercise of their rights to pump groundwater by percolation from the creek (Smith, 1991, p. 6)

Presaging more recent conflicts, California’s Department of Fish and Game (now Department of Fish and Wildlife) was also in opposition at the time, maintaining that appropriation of water by the Bureau would destroy fish in the creek.

Despite opposition, the project was finally completed in 1957. In the decades that followed, issues of fisheries, water rights, and groundwater recharge imbued conflicts around water *release schedules* from Monticello Dam. The State Water Rights Board (now the State Water Resources Control Board) exercised jurisdiction several times over the years, finally establishing a “fixed release schedule” in 1970. The intent was primarily to recharge groundwater and fulfill riparian rights, not address the health of fish populations. There were many challenges to this schedule over the years, but in the end the revised release schedule perpetuated the previous disregard of fish in lower Putah Creek.

In the summer of 1989, after three years of drought, some 20 miles of lower Putah Creek went dry. The resulting die-offs of fish and impact on riparian wildlife prompted a local non-profit organization, Putah Creek Council (PCC), to file a lawsuit against Solano County Water Agency and one of its member units, Solano Irrigation District. PCC’s mission includes “advocacy, education, and community-based stewardship” in protecting and enhancing Putah Creek (“Our Mission, Vision, Values, and Guiding Principles | Putah Creek Council,” n.d.). The lawsuit sought to increase flows in lower Putah Creek, and the non-profit eventually was joined in the suit by several municipalities and the Regents of the University of California.<sup>2</sup>

After years of legal maneuvering, the case finally went to trial in 1996. Five weeks later, and after lengthy scientific testimonies, the court ordered a 50% increase in the minimum release schedule to maintain surface water flow from the PDD to the Yolo Bypass (Moyle et al., 1998). This ruling in favor of plaintiffs—plus the threat of a precedent-setting appeals case—stimulated appetite for negotiations among all parties. By 2000, the Putah Creek Accord had been hammered out and signed, thereby establishing and implementing a final flow regime based in science, one mimicking ecologically significant components of the creek’s historic flow regime (California Superior Court, 2000; Grantham & Moyle, 2014). The

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<sup>2</sup> UC Davis and the City of Davis joined later as complainants.

Accord even went beyond the court’s mandates to include additional spring and winter “pulse flows” for anadromous fish, including fall-run chinook salmon (Ross, 2014).

### **Organizations and Grants**

Formed in 1951, the Solano County Water Agency (SCWA) is a wholesale water supply agency representing all local agencies involved in water and flood management in the county. Its Board of Directors includes members of the Solano County Board of Supervisors, mayors of Solano County cities, and directors from agricultural districts that provide retail water. The agency also engages in flood management and, congruent with the Putah Creek Accord, habitat conservation activities (“Solano County Water Agency : About Us,” n.d.).

The Putah Creek Accord committed SCWA to pay \$410,000 annually toward creek restoration projects through a new committee of representatives from both counties, the *Lower Putah Creek Coordinating Committee* (LPCCC)(“Saving Putah Creek: A dramatic victory in court,” n.d.). The committee was the political centerpiece of the Accord, which also enjoined SCWA to fund the permanent position of *Streamkeeper*, to be overseen by the LPCCC.<sup>3</sup> The Accord also directed SCWA to provide administrative support for the LPCCC, its committees, and the Streamkeeper.

The LPCCC provides a forum to support restoration projects, secure grant funds, advocate for specific projects, and disseminate information, but it has no regulatory or land use authority (Solano County Water Agency, 2018). Its many responsibilities under the Accord include grant seeking, maintaining an active public education and information program, and monitoring.

Duties of the Streamkeeper are diverse, and include preparing reports to the LPCCC on all aspects of lower Putah Creek, attending LPCCC meetings, weekly monitoring and recording stream flows and diversions, coordinating field trips and projects to enhance the natural values of lower Putah Creek, and reporting to the LPCCC activities harmful to the health of lower Putah Creek (California Superior Court, 2000). Informants in this study pointed out that the original vision of the Streamkeeper role was someone who “polices” for violators of the Accord, specifically, any illegal diversions of flow in lower Putah Creek.

### **CALFED Watershed Project grants.**

In all, the LPCCC received five CALFED grants that were aligned with the Accord’s mandates for “preservation and enhancement,” “public projects,” and monitoring (California Superior Court, 2000). The grants were thematically aligned to address infestations of invasive weeds, eroding banks, habitat loss and degradation, flood-related problems, and non-point source pollution.

#### ***2000-2001 Project Grant: Lower Putah Creek Watershed Assessment and Stewardship Implementation Program.***

The first of the five CALFED grants received by SCWA, *Lower Putah Creek Watershed Assessment and Stewardship Implementation Program*, defined and initiated an approach to “restore ecosystem processes and aquatic and terrestrial habitats in the lower Putah Creek watershed, including lower Putah Creek and

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<sup>3</sup> The Lower Putah Creek Coordinating Committee consists of: Cities of Davis, Fairfield, Suisun City, Vacaville, Vallejo and Winters; Counties of Solano and Yolo; Solano and Yolo Riparian Landowners; Maine Prairie Water District; Solano County Water Agency; Solano Irrigation District; Putah Creek Council and University of California, Davis (“LPCCC,” 2015).

its tributaries” (“Watershed Program Archive - CALFED,” n.d.). Described as a *Watershed Management Action Plan* (WMAP), this long-term, three-phased strategy consisted of:

- Phase I: Stewardship Process—Evaluate the opportunities and constraints for resource enhancement within the watershed, using the priorities determined by the community.
- Phase II: Resource Assessment—Document the history and present conditions of the creek and watershed and provides a comprehensive assessment of the biological, physical and cultural resources.
- Phase III: Implementation—Initiate technically defensible and sustainable restoration and enhancement projects, subject to funding, permits and regulatory approvals (Solano County Water Agency, 2006; The Flow, 2002).

A total of 36% of this CALFED grant focused on conducting a comprehensive physical and biological resource assessment in support of the larger WMAP (Solano County Water Agency, n.d.). Another 34% was allocated to implementation, primarily an *Adopt-A-Reach Community Stewardship*, a multifaceted, community-based stewardship program contracted to Putah Creek Council. The program involves community groups and volunteers as creek stewards, with work done on both public and private lands, the latter with full consent of landowners (“Putah Creek Council Volunteer Opportunities - VolunteerMatch,” n.d.).

Phase I activities continued a previously-funded process of seeking input and participation from diverse stakeholders to identify key ecosystem issues affecting lower Putah Creek and its tributaries.<sup>4</sup> This input was, and continued to be in subsequent CALFED grants, critical to the development of a stakeholder-based WMAP.

With just 6% allocated to fish habitat and wildlife enhancements, Phase III was more about future intent than applied work. It was generally agreed that as the project progresses, additional Phase III projects would be identified for funding by other sources (CALFED Bay-Delta Program, n.d.). The WMAP itself was designed to be a dynamic “conceptual and planning framework” that could be updated with new information and ideas for watershed enhancement “in a manner that is compatible with and respectful of landowner priorities, interests, and concerns” (Putah Creek Council, n.d.).

#### ***2002-2003 Project Grant: Putah Creek – Yolo Housing Authority Project.***

With the second of its five CALFED grants, the SCWA initiated a vigorous cleanup campaign along one of lower Putah Creek’s most degraded reaches near Yolo Housing Authority (YHA), a public housing development in Winters, CA. In addition to “nonnative vegetation,” the densely populated site was described as having “more submerged tires and other debris per square foot than at any other location in lower Putah Creek.” As such, the eight acres of riparian habitat was seen as a chokepoint along an important wildlife migration pathway from the north coast to the Bay–Delta (CALFED Bay-Delta Program, n.d.).

Restoration planning for this grant was informed by a vigorous outreach effort spearheaded by a succession of community liaisons. The first liaison, supported by the UC Davis Public Service Research Program, interviewed residents and ultimately drafted a “grass roots restoration plan” that encourages

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<sup>4</sup> According to the proposal for this grant, “[s]takeholder organizing and facilitation began with formation of the LPCCC and continues with implementation of a CALFED-funded Stewardship grant. The grant was originally awarded to the Solano County Department of Environmental Management (SCDEM) and is jointly implemented by SCDEM, the LPCCC, and the Putah Creek Streamkeeper.”

continued interest in Putah Creek after the restoration work is completed (Garzon, 2004; Putah Creek Council, 2004).

Using mechanical and chemical means of abatement, the project removed 60 (non-native) eucalyptus trees as well as 2.5 acres of Himalayan blackberry and other invasive species such as tree-of-heaven. The eucalyptus logs were used for bank stabilization, and chipped slash provided mulch for native vegetation. In the course of the work, 10 truckloads of trash were removed. Fish habitat was enhanced with two rock weirs designed to retain spawning gravels and narrow an over-widened channel to create higher, and more natural, flow velocities (EDAW, 2008).

At all stages of the project, residents of the YHA property were informed about creek restoration and invited to participate. The first community liaison was able to elicit participation from 24 households in the course of conducting a survey of community values, needs, attitudes and uses of the creek (Garzon, 2004). Principles of stewardship were fostered by having residents (especially children) participate in restoration activities such as planting native vegetation, removing weeds, disposing of trash, and attending an aquatic insect identification event.

### ***2003-2004 Project Grant: Community-Based Restoration of Lower Putah Creek Watershed.***

The overall goal of this project was to foster “an informed and engaged stakeholder community that is active in watershed planning, restoration and monitoring.” To that end, 1170 volunteers participated in 48 educational restoration and monitoring events that included restoration planting, benthic invertebrate monitoring, weed control, cleanup, and community seminars and educational events. The latter included a series of *Creek Speak!* seminars on all aspects of Putah Creek’s human and natural history. A guidebook, *Putah Creek: Flowing Through our Communities and our Lives*, also was published (Solano County Water Agency, 2010).

On a purely educational note, along the *Putah Creek Discovery Corridor*, a total of 1775 individuals attended 120 docent-led public outings.<sup>5</sup> Thirty of the docents were trained as part of this project. Thousands of students from scores of local schools (K-12, college) were involved in numerous events. As a result of the extensive outreach and educational activities, the list of existing partnerships (Putah Creek Council, U.C. Davis Riparian Reserve) grew to include members of Putah Creek Discovery Corridor (i.e., the cooperative), local schools, and government agencies.

The restoration work achieved in this grant was bolstered by a large amount of matching funds. The amount from this grant, \$992,236, was supplemented with an additional \$4.374 million from other sources, including the previously discussed *Putah Creek – Yolo Housing Authority Project*. The high profile afforded by these funds, as well as the expansion of public and agency participation, stimulated interest in the future of the creek. From a planning perspective, this CALFED grant was crucial in advancing stakeholder involvement in designating and prioritizing future projects along lower Putah Creek.

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<sup>5</sup> Putah Creek Discovery Corridor refers to the 6.5 mile inter-dam reach of Putah Creek that lies between Monticello Dam and Putah Diversion Dam. The area is known for its relatively healthy riparian zone and fish populations, and was the focus of an early (ca. 2004) outreach effort to forge a “cooperative” among diverse agencies, businesses, landowners, and other. The planning effort involved the LPCCC, Bureau of Reclamation, Bureau of Land Management, Solano County Parks, Yolo County Parks, U.C. Davis John Muir Center for the Environment, Blue Ridge Berryessa Natural Area, California Audubon, Solano Resource Conservation District, Yolo Resource Conservation District and City of Winters.

The logical context for such a vision was the pre-existing 2005 Watershed Management Action plan (WMAP), which represented extensive physical and biological assessments of lower Putah Creek. The start of this process was a series of “stewardship meetings” in 2006 in Winters, California involving approximately 100 landowners and other stakeholders. Over several weeks, a working group defined four main projects types for lower Putah Creek: *invasive species removal*, *bank stabilization*, *trash clean-up*, and *fish and wildlife habitat enhancement*. In addition, the group developed a set of eight selection criteria for prioritizing areas for restoration:

- High level of landowner cooperation
- Landowner commitment to long-term maintenance
- On-site availability of materials for restoration
- Project qualifies for available/multiple funding sources
- Project is on lands contiguous with other restoration or enhancement projects
- Project location allows for public education
- Project is located upstream
- Project includes multiple project types

Of the 63 potential projects identified, the area known as Winters Putah Creek Nature Park, in Winters, CA, emerged as top priority, along with the upstream Dry Creek confluence with Putah Creek (EDAW, 2008). Part of the motivation of private landowner stakeholders was to reduce trespass by increasing access to public lands (EDAW, 2008). The selection of Winters as top priority was not without scientific merit, however, as project types and selection criteria were guided by fluvial geomorphology theory. In practical terms, this translated to a selection of projects that would contribute to an overarching geomorphological restoration of a previously self-sustaining ecosystem.

#### ***2007 Project Grant: Lower Putah Creek Winters Area Riparian Restoration Projects.***

The fourth in the series of CALFED project grants represents a significantly expanded scope and vision for the watershed, one that emerged from the previously discussed stakeholder process and WMAP resources assessment.<sup>6</sup>

The City of Winters, CA has been described by one respondent as a “willing municipality” that was already engaged in downtown revitalization. Before its restoration, the Winters Putah Creek Nature Park area had been characterized by its “stagnant water, lack of shade, lack of continuous floodplains, and prevalence of foreign vegetation [which] has created a place with diminished abundance of wildlife” (“Selecting Priorities: Winters Putah Creek Park | Putah Creek Council,” n.d.). One resident of Winters noted that an Audubon bird count had shown a “dead zone” in the Putah Creek reaches around the city. Another stated that creek area was “one large blackberry bramble.”

In addition, since 1995 the City of Winters has had a Putah Creek Master Plan, which proposed improved recreational access, invasive weed control, and refurbishment of a 1907 railroad trestle bridge as a bike and pedestrian crossing. The bridge work was completed in 2005, linking the city-side north bank with the less developed south bank.

The grant proposal requested \$536,490 to achieve a number of objectives that dovetailed with other funding sources that amounted to \$739,534. This sum included cash and in-kind resources from the

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<sup>6</sup> Much of the information below is drawn from the original proposal to CALFED, *Lower Putah Creek Watershed Winters Area Riparian Restoration Projects*, specifically three documents: Exhibit B-Project Budget and Full Proposal Application (Sections 1 and 2).

California River Parkways Program (\$452,000), SCWA (\$170,000), and “volunteers” (\$97,374). The CALFED proposal had two main objectives: (1) establish a 15-foot-wide native vegetation hedgerow (to exclude traffic and dumping) along three miles of the south bank of lower Putah Creek across from the City of Winters, and (2) extend bank re-vegetation for 3600 linear feet along Dry Creek on the southwestern boundary of the city.<sup>7</sup> Activities included installing a water supply, providing for erosion control, trash cleanup, and monitoring wildlife.

Most of this work was supported by both CALFED funds and the other funding sources. However, the \$452,000 received by LPCCC from California River Parkways Program was designated for removal of a 1930s-era percolation dam that failed in 1952. The rationale for its removal is detailed in the Winters Putah Creek Nature Park Master Plan, including a determination from the Department of Fish and Game that the dam inhibited salmonid migration.

This CALFED grant engaged a number of groups, as “implementing partners” in pursuit of project goals. These entities, deploying scientists, students, community volunteers, and advocates, included the following:

UC Davis	Terrestrial biomonitoring	\$72,000
Audubon California	Establish native vegetation	\$116,625
Center for Land-Based Learning	Student learning events	\$60,225
Putah Creek Council	Volunteer coordination	\$112,950
Solano County RCD	Establish native vegetation	\$20,160
Yolo County RCD	Establish native vegetation	\$19,125

A public advisory group formed by the city, Winters Putah Creek Committee (WPCC), was instrumental in coordinating restoration work in the center third of the three mile reach of Putah Creek. This group also hosted community workshops to present information and solicit input to the development of the Putah Creek Nature Park Master Plan. Given the complexity of stream restoration, topics included stream geomorphology, historical and current stream conditions, percolation dam removal, vegetation management, and creek “realignment.”

***2008 Project Grant: Lower Putah Creek Watershed Plan Priority Projects.***

The final CALFED grant received by SCWA expanded significantly on previous restoration work initiated with the 2007 CALFED project grant and other funding. It continues to fulfill the vision of the WMAP, to restore the lower Putah Creek watershed to an ecologically self-sustaining condition (Solano County Water Agency, 2008). The 2008 CALFED grant focused on the highly disturbed channel form of the creek, with its past history of manipulation for water storage, flood conveyance, and gravel extraction. It also continued the work of stabilizing stream banks, enhancing habitat, and removing invasive plants.

The negative ecological impacts of a stream channel that is “out of natural form” are numerous, and described by the current condition of lower Putah Creek. The creek has “a much larger cross sectional area of wetted channel than the creek can restore on its own,” partly because native vegetation has been supplanted by invasive species such as arundo, Himalaya blackberry, and eucalyptus. These species—plus a history of gravel mining—have resulted in a creek with both excessive channel width and depth.

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<sup>7</sup> Previous restoration work had been completed at the Dry Creek confluence with Putah Creek, supported by a \$310,000 grant from the Urban Streams Restoration Program, California Department of Water Resources.

This translates to warmer waters, as well as a long-term disruption of spawning gravel replenishment for fish reproduction.

This grant amount, \$1,987,000, coupled with significant funds from the California River Parkways Program and local and federal match dollars, levied a total sum of \$4,710,513 for the overall project. The centerpiece of the larger, combined project was to restore natural channel dimensions by rebuilding floodplains, an engineering feat that effectively expands floodplains, narrows the channel, and restores the creek's "competency" to mobilize spawning gravels and create a host of other benefits. The ecological rationale—drawn from current theories in fluvial geomorphology—is that such manipulations will eventually restore the stream channel's capacity for self-renewal and create a "more naturally-functioning ecosystem appropriate to *current flows*," which is mainly a function of the Putah Creek Accord's release schedule (Solano County Water Agency, 2015; UC Davis Museum of Wildlife and Fish Biology, 2015).

Partners as contractors on the 2008 CALFED grant included most of the entities from the 2007 grant: Putah Creek Council, U.C. Davis Museum of Wildlife and Fish Biology, Audubon California, Solano RCD, Center for Land-Based Learning, and Yolo RCD. In addition, a consulting fluvial geomorphologist from Streamwise and engineering firm Wallace-Kuhl were retained for channel realignment work. Notably, the largest allocation from this grant (\$517,000) was to U.C. Davis for biological monitoring, primarily of birds reliant on the creek's habitat and insects.

## **Key Findings**

One prominent scientist-advocate interviewed for this study and who is knowledgeable about many such projects in California, stated, "the Lower Putah Creek is one of the better projects...top 15%." One prominent fisheries biologist who has worked closely in the recovery effort, characterized the success of the overall venture:

With the establishment of permanent flows, riparian plants, birds and other organisms began to flourish...as did restoration projects, such as removing large amounts of trash, planting native vegetation and undertaking large-scale improvements of the stream channel. These major changes were the result of a combination of factors: (1) enthusiastic citizenry, led by the Putah Creek Council; (2) a full-time stream keeper to manage the creek and restoration projects; (3) a cooperative water agency; (4) cooperative riparian landowners; and (5) annual monitoring of both aquatic and terrestrial organisms" (Moyle, 2014, p.1338).

In the sections that follow, the legal, scientific, and social factors that contributed to the success of the CALFED projects (and others) are discussed.

### **Lawsuit and accord.**

The first, and earliest step towards effective collaboration and restoration work in lower Putah Creek was, ironically, the initial 1989 lawsuit brought against SCWA by the PCC. This was new territory for what one respondent called a "science focused" organization that "refused to denigrate or demonize the opposition." But a three-year drought, coupled with large fish kills, motivated the PCC's legal action, which ultimately ended with a judgement in their favor.

This legal judgement offered creative "sideboards" for collaboration among the former legal adversaries, including (1) a revised flow schedule for the dry season (i.e., increased flows); (2) an annual financial allocation for restoration work from SCWA; (3) formation of the quasi-independent LPCCC; and (4) a



Streamkeeper position. The first product of this collaboration was the establishment of the Putah Creek Accord, a formal final settlement among PCC, SCWA, and other litigants.

Within the agency, the commonly-held view is that the Accord is a significant success. One individual lauded the fact that the LPCCC is “hitched” to the “stability of the water agency” (SCWA), which is committed to providing an annual baseline level of funding out of its budget for the Streamkeeper position and restoration work. Moreover, because the Accord has “genius” behind it, it is like “playing a winning hand.”

Although the outcome of such a “coerced collaboration” can never be guaranteed, it is likely that after 10 years of conflict, all parties were exhausted and ready to seek resolution. It is also possible that other factors were at play, including the appeal of applying a rigorous scientific perspective in managing water resources as an ecosystem service to be sustained.

### **Science and scientists.**

The lawsuit brought by the PCC against SCWA and other parties had an additional benefit: it brought science and scientists to the fore, first in testimony, then in giving the Putah Creek Accord a rigorous empirical framework, followed by extensive involvement in planning, monitoring, and direct participation. One agency employee ventured that because of the litigation (and proximity to U.C. Davis), Putah Creek is one of the most studied creeks for its size.

The scientific door opened by litigation and the resulting Accord set the stage for testing cutting-edge theories in geomorphology and ecology. The Accord mandated four types of releases and instream flows from the Putah Diversion Dam into lower Putah Creek: rearing, spawning, supplemental, and drought year. The goal was to define a release schedule that would resemble the historical *natural flow regime* in ways that would benefit key species of fish and riparian habitats, especially regarding the timing of releases (Poff et al., 1997).<sup>8</sup> Because of competing water demands, the Accord defined a less-than-natural release schedule, one designed to retain ecologically significant components of the hydrograph—functional flows—rather than mimic the full natural flow regime (Yarnell et al., 2015). This “pulse-flow” model had, almost from the outset, a positive impact, appearing as migrating fall-run Chinook salmon.

The natural flow regime concept suggested not only the judicious use of water for fish health, but it also provided a foundation for re-designing the morphology of the stream channel:

In rivers, the physical structure of the environment and, thus, of the habitat, is defined largely by physical processes, especially the movement of water and sediment within the channel and between the channel and floodplain. To understand the biodiversity, production, and sustainability of river ecosystems, it is necessary to appreciate the central organizing role played by a dynamically varying physical environment (Poff et al., 1997, p. 771).

Embedded in the natural flow regime concept is a scientific rationale for *geomorphological restoration* of lower Putah Creek, an approach that emerged as a high priority in the planning process. A previous study of lower Putah Creek had revealed an excess of pool habitat and elevated floodplains, a legacy of gravel mining and invasive plant species (Yates, 2003; Solano County Water Agency, 2010). Geomorphological restoration assumes as its target a stream channel morphology that would emerge over time as a product of the current “dynamically varying physical environment.” This environment, of course, now includes the Accord’s new flow regime. Rather than waiting for centuries, with good predictive models the new

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<sup>8</sup> Parameters of a natural flow regime include magnitude, frequency, duration, timing, and rate of change.

morphology could be engineered, as has been done in the Winters area projects using earth moving equipment, native vegetation, invasive species removal, and bank stabilization.

### **Outreach and collaboration.**

According to one landowner interviewed, along the banks of lower Putah Creek there are approximately 130 landowners, many of them growers of almonds and walnuts. A large proportion of these individuals eventually participated in the planning and execution of restoration projects on private and public lands. This level of engagement has been vital to the success of restoration process, but its beginnings have been described as a “slow start.” Not only had a major lawsuit just been settled after 10 years of conflict, but starting in 1989, SCWA had sued all the private landowners along lower Putah Creek (and UC Davis) over water diversions. In the words of one reporter, “[t]his...poisoned any relationship between landowners and the water agencies for the next decade...” (“Chapter Four,” n.d.; “Chapter Three,” n.d.). These factors, plus the vision of the Streamkeeper as a policeman for violators of the Accord (i.e., illegal diversions), made for an uphill battle to engage stakeholders.

Though slow to start, progress was nonetheless evident. One interviewee referred to a stakeholder outreach and facilitation around 2000 just after the formation of LPCCC. He characterized the meetings as having “lots of venting,” yet believes that it ultimately “stimulated restoration.” Other attempts to engage landowners followed, each including facilitations by Dennis Bowker and consulting group, MIG. By 2006, there were working agreements in place with 49 landowners (“Chapter Four,” n.d.). These agreements are substantial achievements, in that they represent private landowners who have entrusted a government agency (SCWA operating through LPCCC) to complete engineering projects along the creek.

Now, according to one of the earliest landowners to engage, there are roughly 150 landowners “on board,” with three fourths “cooperating” and two-thirds with signed agreements with SCWA/LPCCC. This individual, as well as most of the interviewees in the study, attribute this level of engagement to the unique skill set of the Streamkeeper who has remained in that position since 2000. Trained as a horticulturist, this SCWA employee gives much credit for his successes to CALFED’s “watershed program philosophy” and the training he received in community partnership building as part of consultant Dennis Bowker’s “watershed boot camp.” In his words, this was a philosophy that seeks “holistic solutions that do not vilify.” A final, but not insignificant factor in this successful engagement, is the decision by SCWA to contract with former legal adversary, PCC, to conduct outreach efforts among stakeholders.

While building support among landowners for some well-funded planning and restoration projects (e.g., the 2006 “stewardship meetings” in Winters), the Streamkeeper continued to “police” illegal water diversions. According to one respondent, in 2008, a drought year, there were five “flow violations” in one month that nearly led to another round of lawsuits against offending landowners. This time, however, the Streamkeeper and SCWA leadership brought in Dennis Bowker to facilitate a “self-policing” agreement among the parties. One interviewee lauds Bowker with having done “good therapy with hostile land owners.”

Finally, it must be noted that there has been vocal opposition from several individuals in the Winters community against “geomorphological engineering” and what they deem “an unproven and radical method of Creek channel narrowing and relocation using heavy equipment and imported fill...” (“What We Oppose,” n.d.). Although this type of engineering is not unproven, the scope and extent of proposed changes to the creek channel does suggest that project proponents carry the burden of proof. Conversely, advocates who view lower Putah Creek as “a natural ecosystem that should largely be left to its own devices” also bear the burden of proof regarding their hands-off approach. In short, there are the risks of

action to be weighed against the risks of inaction, a task that calls for the best available science conducted with extensive and intensive monitoring, the hallmark of adaptive management. To all appearances, this has been the approach taken in lower Putah Creek, where there has been in-depth participation by top scientists and subject matter experts in designing, planning, and executing restoration projects that will likely hold many lessons.

## **Lessons Learned**

The LPCCC and its fiscal sponsor, the SCWA, have applied a long-term disciplined and coherent strategy to achieve or exceed the original objectives of the CALFED watershed program. With copious matching funds from other granting agencies, the organization has leveraged a unique confluence of circumstances, events, and resources into notable accomplishments, namely the ecological restoration of a degraded stream ecosystem and the invigoration of the social landscape that surrounds it.

With the signing of the Putah Creek Accord, SCWA, through the LPCCC and its Streamkeeper “point person,” was well-positioned to capitalize on the 2000 implementation of the CALFED Watershed Program. In effect (and perhaps inadvertently), the Accord carved into legal stone a “community-based and locally led approach to achieving the goals of the CALFED Program.” (“Watershed Program Archive - CALFED,” n.d.). Indeed, most respondents in this study viewed the CALFED grants as “foundational,” and that they were instrumental in leveraging other funding sources.

That foundation, while fiscally generous, was also philosophically imbued with the spirit of the watershed approach as promulgated by individuals like Dennis Bowker. The approach, with its emphasis on collaboration and stakeholder involvement, became the *modus operandi* of the LPCCC and its Streamkeeper. One could assert that their willingness to adopt that approach was borne out of crisis—years of litigation, drought, and environmental degradation. However, there are indications that the legal mandate to collaborate was embraced—not just tolerated—by all parties as they forged a binding Putah Creek Accord.

The acceptance of the Accord and the LPCCC was apparently a gradual process for SCWA, a growing interest with each new grant received by LPCCC and with the prospect of working with landowners less litigiously. One respondent speculated (with fondness) that SCWA’s leader at the time of the Accord may have had a “green” side to him. Whether true or not, it is clear that SCWA’s leadership and organizational culture have exhibited agility and flexibility in the face of change. This was not preordained, however. When asked how to replicate the successes seen in lower Putah Creek, one respondent replied, “culture eats strategy for breakfast.” The implication is that one may encounter deep pockets of resistance to new ideas in an organization or a community. It also implies the converse, that an organizational “crisis” such as that faced by SCWA may bring an “adaptive response,” wherein a new culture is allowed to take root, and even encouraged (Gunderson & Holling, 2002). Almost always, though, it is leadership that must lead the way by example, and SCWA’s leadership has been successful in accommodating and supporting the culturally-distinct needs of LPCCC and its Streamkeeper (Cameron & Quinn, 2006).

## **Methods**

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