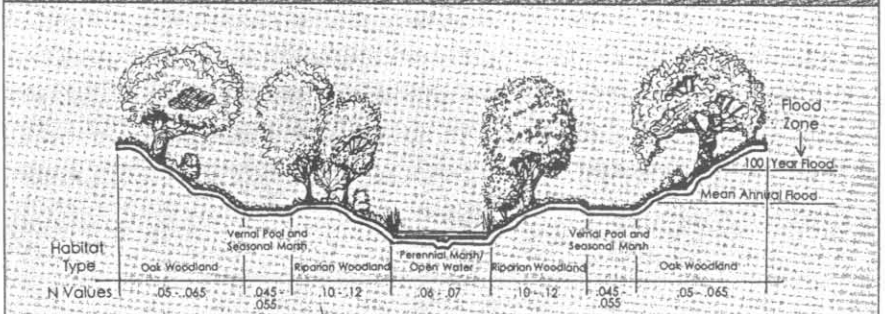
Meeting Flood Control and Wetland Needs

Evaluating Performance of the Laguna Creek Project



■ **FIGURE 1. Cross-section of the creek corridor showing habitat types and N values. Vertical scale is six times horizontal scale.**

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DESIGNING and building projects that meet both flood control and wetland permit requirements is a challenge. The Laguna Creek project, built by the city of Sacramento in 1988, was one of the first drainage projects in California to contend with the more stringent 1986 revisions to the Section 404 (Federal Clean Water Act) wetland regulations. Five years after construction, however, this project has met almost all environmental performance standards and still meets drainage objectives.

Laguna Creek flows for approximately 25 miles through Sacramento County. This part of the state has a Mediterranean climate with almost all of the 18 in. of average annual rainfall occurring between November and March. Runoff and flood volumes increase dramatically during storms and what appears to be a minor creek under normal conditions may become a major river during larger storms. These conditions are exacerbated in this region due to the relatively impermeable soils (primarily stiff clays, often with a hardpan only inches below the soil surface) and the flat landscape (total fall for Laguna Creek is about 1 ft per 400 linear ft of stream). Laguna Creek has also been significantly modified by farming practices over the past century. In many reaches, including that portion within the city, the creek is (or was before deepening) actually a narrow ditch, approximately 4 to 6 ft wide with a depth ranging from 3 to 4 ft. These features all make flooding inevitable but the extent difficult to predict.

Finally, the population of the region has grown significantly over the past three decades and land uses around Laguna Creek have shifted from farming and rural residential to suburban and commercial uses. While the land near the creek was dominated by grazing, there was little incentive to channelize or deepen the creek. When local development patterns began increasing population densities, though, it was clear that damage from floods would increase dramatically and pressure to modify the creek grew accordingly.

Project Planning

By the mid-1980s, the city was faced with development proposals from a number of landowners for approximately 700 acres in the southern portion of the city adjacent and tributary to Laguna Creek. A series of drainage plans completed for this reach by the Corps of Engineers and other entities proposed confining the creek within a concrete-lined flood channel. However, the City Council felt that Laguna Creek had the potential to become a parkway or greenbelt, like the award-winning parkway built along the Sacramento River in the previous decade.

At the same time, wetland preservation and permitting concerns were beginning to affect similar public works projects. By 1986, the Corps of Engineers had begun to extend its regulatory authority over isolated wetlands in the region, especially vernal pools. Vernal pools are seasonal

wetlands endemic to California that consist of shallow ponds during the winter, often no more than 400 to 500 sq ft in extent, which dry by early summer. This unique environment often supports a number of native plants, invertebrates, and amphibians, including federally-protected species. In 1987, a city study found about 98 acres of wetlands on the 700-acre site, including 71 acres of vernal pools, 25 acres of seasonal freshwater marsh, and 2 acres of riparian woodland.

Faced with the costs of piecemeal development if individual landowners proceeded on their own, the city decided to act as the agent for all environmental permitting. In retrospect, this was an important decision; it essentially provided for the creation of a wetland mitigation bank with the city as the agent for the landowners. With the city as the applicant, the alternatives analysis, required by both state and federal regulations, became relatively simple and limited in scope. Additionally, the wetland mitigation program was reviewed as mitigation for a flood control project, not for residential development, even though funding for the drainage improvements would be raised by selling bonds based on the value of the new homes.

These factors were important as a Corps permit of this magnitude was unprecedented. Additionally, wetland construction was a relatively new field, especially with regard to vernal pools. In final negotiations with the Corps of Engineers, the city agreed to preserve 33 acres of the wetlands and build almost 138 acres as compensation for the loss of 65 acres of wetlands. In essence, the city had committed to creating a complete native landscape including vernal pools, freshwater marshes, and oak woodland within a flood channel. Further, the performance of these habitats would be evaluated through specific standards with potentially expensive remedial actions required should the project fail to meet these standards.

Wetlands and flood channels are often incompatible, though. The dense plant growth characteristic of many wetlands greatly increases channel roughness and flood elevations. Research done by Zentner and Zentner and Bill Gill of Gill Water Resource Engineering found that the most problematic species, primarily willows and cottonwoods, were found only below the mean annual flood line in this region due to soil and seed viability factors. Accordingly, the creek corridor was designed to maximize the relatively open vernal pool and seasonal marsh zone (N value of 0.045 to 0.055), provide for a substantial amount of open oak woodlands (N value of 0.05 to 0.065), a lesser amount of perennial marsh (N value of 0.06 to 0.07) and to greatly limit the riparian woodland zone (N value of 0.10 to 0.12), where the N value relates to the channel roughness factor. Figure 1 provides a cross-sectional view of the proposed creek corridor.

Construction

Appropriate construction monitoring was of great concern to the city and Zentner and Zentner, one of the few firms in the region at that time with experience in wetland construction, was hired to supplement the city inspectors. The relationship between city inspector, ecological monitor, and contractor can be problematic. If the monitors provide direction to the contractor without adequate coordination with city staff, the project could be subject to delays and change orders. This issue did not arise, though, due to the effort made by the contractor (Granite Construction Company) and weekly meetings between the contractor and inspectors to ensure that all concerns were addressed promptly and within the contract.

Because of this cooperative effort and the innovative engineering design work completed by RVA Engineers of Sacramento, construction costs were relatively low compared to many wetland creation projects. Although projects vary significantly in their scope and character, relevant literature and our experience suggest that similar wetland construction projects in California range from about $10,000 to $30,000 per acre with an average over $20,000. Costs at Laguna Creek totaled $565,000, about $4,100 per acre.

Post-Construction Monitoring

The wetlands were monitored for five years after construction, including assessments of water depths, plant cover, and species richness in the vernal pools, health and height of the planted trees and shrubs, bird use, and other elements. At the fifth year performance review, 45 of the 62 built vernal pools (73 percent) met all performance standards (Figure 2). The unsuccessful pools were almost all in one portion of the project site that did not have suitable soils for vernal pools, illustrating the need for good soils data prior to construction. The constructed freshwater marsh and riparian woodlands completely met all performance standards. The extent and value of these habitats was significant; in addition to supporting more than 100 species of birds (compared to eight prior to construction) they created habitat for a wide variety of wildlife, including the federally-listed giant garter snake (*Thamnophis couchi gigas*).

Perhaps more importantly, pre-construction predictions with regard to flood heights and roughness values have also been verified. The riparian woodland has been successfully confined to a relatively narrow band near the center of the creek, not through yearly maintenance but through appropriate design. During the recent major storms (1 percent occurrence interval), the actual flood heights were within inches of the predicted heights. This portion of Laguna Creek was one of the few streams in this region that did not experience out-of-bank flooding. Unfortunately, even the Corps-constructed channel on Morrison Creek immediately to the north proved no match for this series of storms and homes near Laguna Creek were flooded by water moving south from the Morrison Creek overflow.

Prior to construction, the project site was characterized by degraded marshes and vernal pools; Laguna Creek was a channelized ditch that promoted flooding. The city has successfully created wetland and riparian woodland habitats that did not exist on-site prior to construction, and a large area of vernal pools. Wetland functions and values such as flood reduction, habitat diversity, fisheries habitat, nutrient production and export, wildlife habitat, shoreline protection, and erosion control have all been significantly increased by the project, while still providing flood protection for adjacent homes and businesses. □□□

■ **FIGURE 2. Fifth year performance review results expressed as percent of standard.**