

A Project report:

Las Virgenes Creek Restoration Project

Healing a Stream

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Along Las Virgenes Creek in Calabasas, California, passer bys now have a better chance of spotting a deer or turtle rather than trash or graffiti along its banks. The artery within the Malibu Watershed was recently liberated from its concrete shell--installed over three decades ago as a flood control measure--and will once again serve as a habitat-friendly haven for wildlife in the middle of a bustling urban pocket.



Before



After

Since the 1950s, the Los Angeles basin's natural waterways adjacent to developments have regularly been converted to cemented flood control channels to allow for rapid water removal (and the potential for fatal accidents when someone falls in during heavy rains). Urban planners are now realizing that this development practice greatly impacts a stream's natural duties.

In 1977, approximately 440 linear feet of Las Virgenes Creek between Highway 101 and the Agoura Road Bridge was lined with concrete, severely disrupting the wildlife corridor and removing all viable riparian habitats from this once thriving natural creek segment. Cemented-in flood channels have zero habitat value, no water cleansing and generate thermal pollution. The concrete channel removed vegetation and disturbed the creek's natural meander through the landscape.

The Malibu Creek Watershed provides habitats for the southern most documented continuous annual steelhead trout run of the West Coast. In addition to steelhead trout, the watershed provides habitat for arroyo chub, southwestern pond turtle, California slender salamander, California newt, Arroyo toad, Pacific tree frog, American goldfinches, black phoebes, warbling vireos, song sparrows, belted kingfishers, raccoons, ring tailed cats, wrentits, bushtits, California towhees, California thrashers, bobcats, western fence lizards, rattlesnakes, various raptors, coyotes and mountain lions.

This project was identified as a high priority project in the Calabasas Creeks Master Plan and Las Virgenes Gateway Master Plan. It had a regional impact on policy for urban stream restoration in the Santa Monica Mountains.



Concrete Channel built in 1977

The City of Calabasas was successful in securing \$1.3 million from the California Coastal Commission California Water Resource Control Board, California Department of Water Resources and Office of Los Angeles County Supervisor for the design and construction of the project. This is the first reach of concrete channel to be targeted for removal in this creek, leading the way toward the future vision of restoring and/or stabilizing the entire length of the Las Virgenes Creek.

Project Objectives

Historically, the Los Angeles basin had many streams that were buried instead of being ecologically engineered into neighborhood design. Natural streams can be brought back and future development should preserve present ones. In 1985, California established an Urban Streams Restoration Program to assist communities with restoring these waterways back to environmental function as well as flood control. While northern California has been taking advantage of the program since its inception, southern California has been slow to participate. The City of Calabasas (located just north of City of Los Angeles) was first in Southern California to accomplish a restoration, which was 10 years in the planning. Since it was a new concept for all the parties involved, the City had no guidelines to follow and spent several years studying the project from every angle--the bioengineering, the ecology, the public safety, and the aesthetics.

As a result of the Creeks Master Plan, the City of Calabasas commissioned a feasibility study to consider alternatives to the existing concrete trapezoidal channel that would facilitate wildlife movement and provide native riparian habitat. The *Feasibility Study for Removal of Concrete Lining in Las Virgenes Creek near Agoura Road* completed in February 2000, concluded that either a gabion structure or concrete block revetment liner would be feasible alternatives to the existing concrete. The City felt this concept was not appropriate and commissioned a second study to re-evaluate the restoration potential. In 2003, Questa Engineering Corp. an Oakland based environmental engineering firm, completed a detailed *Feasibility Study* that under went a public and stakeholder review process, culminating in a City Council approved conceptual design.

The main objective of the restoration was to restore a native creek side habitat, enhance the biological environment, plant native vegetation, and display the importance of environmental stewardship to the community's youth through the addition of an educational gazebo. In addition to providing more

native habitat in the region, this project was a high priority for watershed protection because it will help heal some habitat fragmentation in the area.

All objectives of this project are consistent with goals and direction of the Malibu Creek Watershed agencies, nonprofits, and environmentalist. If successful, other interested agencies will be encouraged to restore their own channelized creek segments. This shared vision and opportunity to work incrementally toward full stream restoration from ocean to headwaters will be realized throughout the watershed.

Extensive Feasibility Study

The potential design options were examined considering both technical and practical constraints. The technical analysis and discussion of the design considerations was presented in the report titled: *Preliminary Design and Feasibility Analysis for Restoration, Las Virgenes Creek, Calabasas, California* by Questa Engineering Corporation. This report examined existing geomorphic conditions, located existing utilities, identified right-of-constraints and thoroughly examined several potentially feasible options for concrete channel removal.

The *Feasibility Study* presented the results of Questa Engineering's investigation and analysis of the biologic, geomorphic, and hydraulic conditions within the Las Virgenes Creek Channel in the City of Calabasas, California. The purpose of this study was to gain an understanding of Las Virgenes Creek's channel processes and to determine what factors may lead to a successful restoration strategy.



The design process involved public workshops and design charrettes, City council presentations, and regulatory agency meetings to confirm project design direction and refine the project to achieve a balance between creating functional riparian habitat while still meeting the needs of the community, providing flood control, and ensuring the safety of public infrastructure. The Report provided valuable information and guidance as follows:

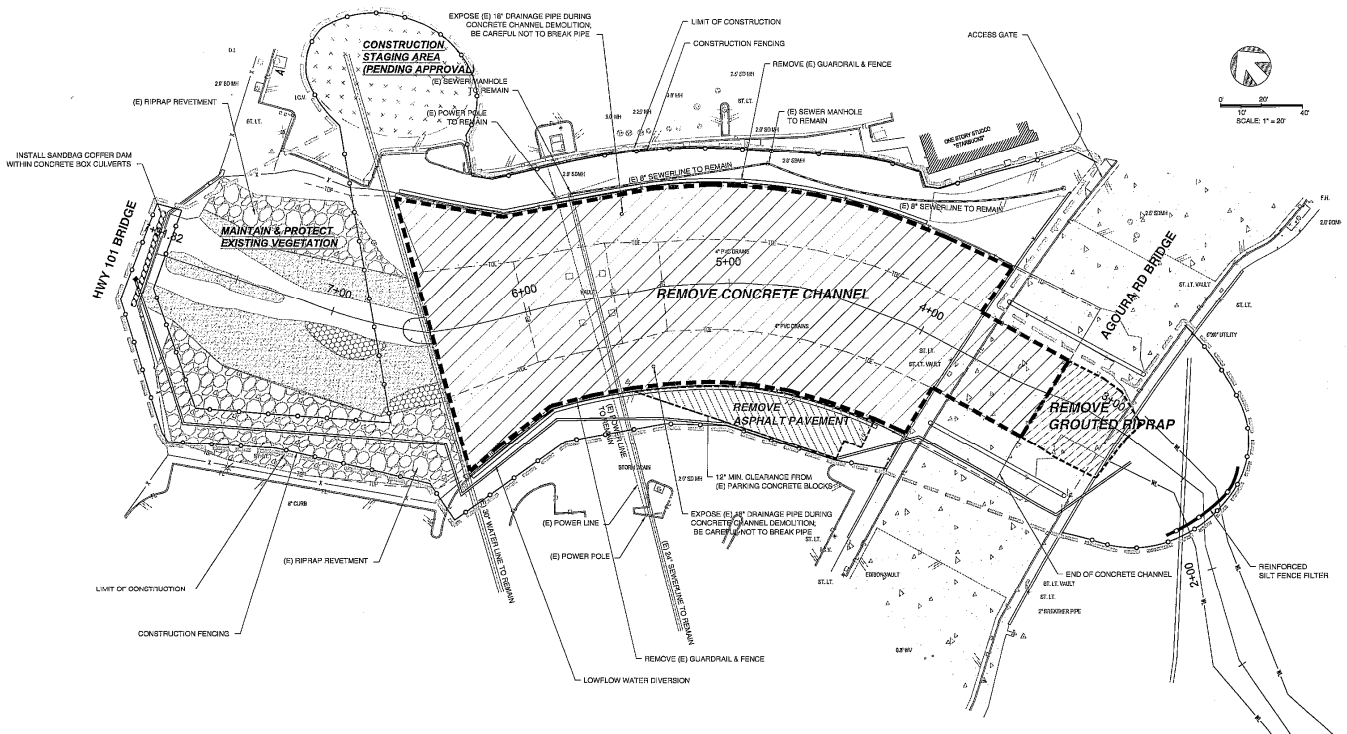
- It described the constraints and realities of urban stream restoration such as existing infrastructure and utility issues,
- A biological database search was conducted for any special status wildlife and plant species within the area,

- The geomorphic analysis examined the existing fluvial geomorphology and adjacent channel geometry parameters to determine appropriate restoration design strategies,
- A detailed topographic survey of the site was completed,
- Hydraulic computer models were developed to quantify existing flow conditions and test various project design alternatives,
- As built drawings of existing facilities, bridge abutments, and utility lines were attained and considered in the design,
- Fish passage conditions and design considerations were discussed and incorporated into analysis.

Additional follow up studies included geotechnical investigations to determine soil properties and detailed engineering design. Compiling all the baseline information and analysis, the report discussed the objectives of the restoration and the potential components of a restoration plan. Finally, the *Feasibility Study* outlined a preferred restoration strategy by combining individual project components to achieve project objectives.

Innovative and Harmonious Design

The final restoration design was based on the approved fencing concept and provided an integrated resources approach that would provide useful riparian habitat while still meeting the flood control requirements through this creek segment. It was chosen from alternatives developed through hydraulic computer models that quantified existing flow conditions. The design of the habitat element of the project was supported through a biological database search for any special status wildlife and plant species within the area. Some important design elements were as follows:



a) Wildlife Protection

The Las Virgenes Creek once provided refuge and a safe passage for wildlife to travel between the Ventura County Open Space and the Malibu Creek State Park. This restoration would re-establish direct connectivity between these two existing riparian communities to the north and south of the concreted segment. The restoration would afford better cover for local wildlife and promotes increased movement of animals and aquatic wildlife up and down the stream course.

b) Public Outreach and Education

The restoration would be used to educate the public regarding urban watershed issues. The project includes a gazebo overlook that would be a public interface with story boards educating visitors about water resource issues and to increase awareness of watershed protection issues and water conservation practices designed to reduce local residential and commercial use of potable water. Messages regarding the importance of water conservation, information on local water use reduction programs and litter prevention was included on the educational panels.



c) Footpath and Trail Connection

The restoration design included a footpath to encourage pedestrian and bike access to the future creek-side park. The establishment of the proposed footpath is part of a larger Trails Master Plan envisioned by the Region and incorporated in the City's General Plan. Easements for the proposed footpath had already been obtained and became part of the Las Virgenes Creek trail that will run northward from Malibu Creek State Park along Las Virgenes Creek, intersecting and following for a short distance the Calabasas/Cold Creek Trail, then continuing north into Las Virgenes Canyon to the upper limits of the Creek in Ventura County.

d) Water Quality Enhancement

This project will restore the biological ecosystem of the Creek by integrating habitat restoration with water quality and public education. It will enhance the water quality of the creek by constructing a vegetated habitat with canopy to deflect the sunlight to reduce dissolved oxygen in the daytime, thereby drastically reducing algal blooms for which this segment has been listed under the Clean Water Act Section 303(d). The planting of native vegetation will partially restore the riparian habitat and tree canopy required for native habitat and ecosystems for wildlife to flourish and travel.



e) Environmentally Harmonious Channel

There are numerous locations throughout this region where flood control agencies have channelized natural stream courses. However, more than 3,600 square yards of concrete was removed from this segment of the creek while recreating the flood control facility in an environmentally harmonious fashion that will undo the wildlife corridor fragmentation, provide essential riparian habitat, protect fish passage, and still provide adequate flood control protection within the confines of the engineered channel that existed there. The success of Las Virgenes Creek Restoration will encourage other interested agencies to restore their own channelized creek segments as well.



Economic Benefits

Investment in public goods like environmental quality can generate very valuable returns, even if they are difficult to measure. Quality of life benefits enjoyed by residents from creek restoration are commonly called non-market goods, because there is no purchase price for them, but they do hold value. The importance of natural amenities and stewardship on homebuyers' location decisions and on young professionals' location decisions should not be underestimated. In fact, many studies have shown that natural and cultural quality of life amenities are increasingly important factors in firm location decisions, particularly for the knowledge-based industries of the New Economy (*Salvesen and Renski, 2002*). The authors specifically address the unique

opportunity for cities in semi-rural regions to attract firms by offering cultural amenities while retaining natural amenities such as clean air, environmental quality, recreation opportunities, and community attitude. As Calabasas works to attract businesses and retain educated young professionals, demonstrating interest in protecting its natural amenities will distinguish it from other cities. Local economic benefits from Las Virgenes Creek restoration can be estimated in three main categories:

A. Local Economic Benefits

They are generated when restoration costs are paid by State restoration funds that circulate as local wages and purchases. Combined with spending planned for the next few years, this project will generate economic benefits to local businesses and residents. Typically, a dollar spent in creek restoration circulates in the local economy approximately 1.28 times—this is called the *multiplier*. The size of multiplier varies depending on location and nature of the economic activity in question. Benefits estimated based on expenditures should be compared with potential benefits forgone from alternative expenditure options.

B. Property Value Boom

Many studies have examined the relationship between environmental restoration and increased property values. Riparian property owners could conservatively expect an immediate increase in property values, generating increased local tax revenues as well. People like to be near water and are willing to pay more to be near water--as "riverfront" real estate often demonstrate. Parks that are improved with naturalization projects also draw more people, which can benefit near-by businesses. Studies can predict how property values would improve after restoration based on similar housing markets near pristine streams or lakes. Research can also follow changes in property values throughout the restoration process, tracking actual improvements. Given experiences of urban stream restoration in other cities, the restored creek could become a property value boom.



C. Sustainable Neighborhood

Benefits accrue to the local economy and to government budgets from future damages that are avoided by restoring the creek. These benefits can include reduced health care costs, reduced infrastructure expansion costs, and sustainable neighborhood development patterns. Some of these benefits will accrue to community residents experiencing an improved quality of life from increased opportunities for passive enjoyment of a restored creek.

To more fully analyze this and all categories of benefits, Las Virgenes creek restoration and naturalization should be considered within a comprehensive and integrated analysis of relevant county and municipal growth and development. Inter-agency development planning can reduce future costs and conflict, advance public private partnerships, and leverage complementary funding sources. This restoration project resolved flood control issues and provided recreational opportunities to the Community.

Achieving the Goal with Limited Budget

Several environmental agencies supported creek restoration efforts, believing it will improve water quality and provide vital resources particularly in the Southern California's arid climate. The State Water Resource Control Board, California Coastal Conservancy, the Department of Water Resources and Office the Los Angeles County Supervisor assisted City of Calabasas with the funding from public bonds through voter-approved propositions directed at the enhancement of the state's diminishing natural areas.

The project design process involved extensive regulatory agency review. This project had been reviewed and permitted by the California Department of Fish and Game, California State Regional Water Quality Control Board, the US Fish and Wildlife Service, the US Army Corps of Engineers and County of Los Angeles Public Works Department and Los Angeles County Flood Control District.

After the design was completed, the cost estimates to implement the project was much more than what initially was assumed. City staff spent thousands of hours to solicit funding from various local and state agencies. Each successful funding commitment was used as match for another funding opportunity, until 90% of the project cost was secured. The other 10% was matched by city either as staff time and construction management. The Project was short listed as one of the 14 priority projects within the County of Los Angeles, as part of the Integrated Regional Water Management Plan (IRWMP).



It was once thought that concrete protected creeks and streams by sending flood water quickly downstream and away from homes and businesses. Now we understand that without trees and shrubs on the banks and stones and rocks in the streambed to slow it down, water flows through these concrete channels so quickly it can cause erosion downstream. And when a stream bank washes away, it takes with it soil and vegetation, which can cause land along to the bank to destabilize and eventually be lost. With this and other restoration projects, communities are starting to realize that these natural waterways should not be turned into sewers. They have multi-objective

significance. The project achieved its primary goal: to heal and enhance this part of the natural landscape for ourselves and future generations to enjoy.



Mr. Chris Hooke, vice president of the Ventura Chapter of APWA presenting the Project of the Year Award to the Mayor of Calabasas during the grand opening/dedication ceremony.

Construction Phase

1. Construction Management

The project began on July 27th, 2007 and was completed on schedule by December 18th, 2007. The construction management was critical during this project. Due to the sensitive nature of the project, there needed to be clear and open lines of communication between the City, the design engineer, and the contractor to ensure timely completion of the project, and to resolve field issues before they became costly contract change orders.



The design engineer, Syd Temple of Questa Engineering, worked closely with the contractor, Robert Valdez of Olivas Valdez Inc., during the construction to literally make sure that every rock was in the right place. The exact placement of the rock was critical to the long term stability of the channel. The intent of the design was to replace the concrete channel with a rock lattice. This consisted of a parallel trench dug on both side of the channel, filled with larger boulders, and 5 rock weirs that cut across the channel connecting to the parallel trenches. The rock locks together in a box like structure to keep soil erosion to a minimum. It was vital that the rock in the weir be placed at exact angles so that the force of the falling water would be focused in the center of the channel creating scour ponds. The force of the falling water would churn up the loose soil and thereby keep the ponds from filling up with sediment.

In addition, it was imperative that the coordination between the City Project Manager and the contractor was expedited due to the project starting later in the season. Any issue that might delay construction could have pushed the timeline of the project back and caused the contractor to be working in the channel during the rainy season, which would have created substantial permit issues with Army Corp of Engineers and Department of Fish and Game. City staff worked hard to review and approve all submittals in a timely manner to help the contractor to stay on schedule.



At the same time, City staff worked closely with the design engineer to respond quickly to any design changes that were required in the field. An example of this was a cut off wall that was to be installed under the bridge. The original design called for a cast in place concrete wall to protect the center bridge footing. However, the contractor encountered unforeseen poor soil conditions which made the existing design extremely difficult to construct. The result was a field design change that was implemented within a day. The solution called for grouted riprap to be used instead of the concrete wall. This field change maintained the original design concept and expedited construction.



2. Safety

The project is located next to a busy shopping center with a food court and several commercial office buildings. Based on this, there is a fair amount of both automotive and pedestrian traffic. The main entrance to the site is located just 20 ft from a heavily used driveway entrance, and maintaining normal traffic flow was crucial to the adjacent businesses. Public safety was a primary concern in the pre-construction stages of this project. The contractor performed a careful review of the traffic control plan and devised a system that when truck traffic was leaving the site, a flagman would be used to stop traffic and all pedestrian traffic would be escorted past the site entrance.



In addition to the safety measures, the contractor installed security fencing along the perimeter of the project to secure the site and protect the existing vegetation.



The contractor was very safety conscious. He required his workers to wear safety vests, hard hats and protective gear at all times. However, despite the most vigilant approach to safety, accidents do still occur. In order to remove debris from the channel, a 2 step process was utilized. The lower excavator would place debris in a pile that the upper excavator would then place in the dump truck. In

an effort to access some debris, the veteran operator maneuvered too close the back of his platform, lost his stability and rolled the excavator. Fortunately, no one was injured except for some bruised pride.

3. Community Relations

Community relations were a very important element of this project. The project site was bracketed by a busy shopping center on one side, a densely packed office park, and several single family residences nearby, each with a unique concern about the project. City staff consulted with all the local businesses impacted by the project to gage their individual concerns and to create a direct line of communication with the City Project Manager.

On the shopping center side of the project the businesses were concerned that noise and dust from the demolition would create an unpleasant environment for customers. For example, a Starbuck's coffee shop is located just a few feet from the project, and has open terrace seating that overlooks one of the two project access points. The businesses at the other entrance to the job site had similar concerns as well as concerns regarding construction vehicles taking up space in an already crowded parking lot.



To mitigate this, the contractor approached the City with a proposal to do all the channel demolition work in the early morning hours. This was done to protect the workers due to the summer heat and to keep the disruption to the business to a minimum. However, due to the fact that several single family

residences were located nearby, this idea was not feasible. This resulted in the contractor working normal construction hours. The parking lane on the bridge was closed to allow for construction parking, and water was used extensively to keep the dust to a minimum. Since the demolition was being performed at a lower elevation than the surrounding populated areas, channel noise was directed upward and was not a nuisance to the surrounding businesses.

On the other side of the channel adjacent to the office park, there was concern, as well. Their employee parking was already tight and the contractor would need access to the parking lot to construct a flood wall. This would involve taking up to 20 parking spaces to create a staging area for equipment. The contractor, City staff, and the property management company for the office park worked together to come to an agreement that would allow the contractor a limited amount of time in which he could access the property and construct the wall.



Despite some initial hesitation by some of the businesses, the strong coordination efforts by the City and the contractor with the businesses paid off, and the City did not receive a single complaint from the adjacent businesses or citizens.

Additional community outreach was implemented through the use of the City's television public access channel which covered the construction extensively and broadcast routine reports on the progress. A local newspaper, The Acorn, published series of articles on the project. City staff received several phone calls from various students requesting information on the project for their own project reports about the creek. Other cities have contacted City staff to inquire how a similar project could be done in their city.

4. Environmental Protection and Awareness

The long term goal of this project is to help restore the creek and generate awareness of the importance of protecting natural open space. A large sign was posted on the bridge crossing the project site and another facing the shopping center informing the public of the project and its purpose. This project also required some protective measures of its own. Netting was placed on the bridge to prevent swallows from nesting and eliminating a problem with the machinery disrupting the birds. The contractor made every effort to minimize the trampling of vegetation by placing security fencing and using established trails when venturing into the wooded creek areas.



Sediment control in the creek and leaving the job site was a very important issue. A water shed of 12 square miles creates flows in the channel all year long. In order for the channel to be demolished and reconstructed, the stream water needed to be captured and then pumped downstream. To achieve this, a settling pond and silt fences were constructed to allow any suspended particles to be deposited so as to not affect water quality downstream. In addition, the contractor would sweep the street after each truck that left the site, and took pride in the fact that he left the job site cleaner than they found it.



5. Unusual and adverse conditions

There were a few noteworthy events that occurred within the project site. The first is that despite the project only being 440 feet long, there are three utility lines that run through the project site. At the upstream end of the project there is a water and wastewater main located under the creek, and a power line runs over it. The water main is located just above the limits of the concrete channel. However, the wastewater main ran under a concrete portion of the channel. The contractor took special care not to damage the sewer when removing the concrete channel lining over the top of it.



After the concrete removal the sewer line was inspected and it suffered no damage. Fortunately, the power pole was located on the bank and due to its elevation was not at risk of being hit by the excavators that were working in the channel. However, one of the power poles did hamper debris removal because it forced the dump trucks to have to use the downstream entrance, which exited directly onto a busy road.

An additional construction challenge was that the contractor was faced with the constant presence of water. Due to the upcoming rainy season the contractor was required to be out of the channel bottom by October 15th. However, Mother Nature doesn't always follow a tight schedule. On Saturday September 22nd the Calabasas area receive a surprise rainstorm. The water shed area upstream is approximately 12 square miles, and the rain water quickly overwhelmed the diversion dam and spilled out on to the bare dirt channel. This resulted in construction being halted for three days while the construction area dried out.

Another source of water is the two drain outlets that feed into the channel. The outlet on the east side of the channel was connected to the parking lot of the shopping center. The shopping center would irrigate extensively at night and all the excess water would run into the channel. The contractor would arrive at the job site every morning to find a muddy mess. A solution was conceived to make use of all the excess water. The contractor used it as temporary irrigation water.

The design called for a five foot trench to be dug on both sides on the channel parallel to the sides for the entire length of the channel. This trench would be filled with large two to four ton boulders that would keep the channel from wandering due to stream bed erosion. Once the boulders were placed, willow stakes were placed around the boulders, followed by smaller rock and finally dirt in a process

called “chinking”. In order for the willows to root they needed to be watered. The contractor blocked the outlet on the east side and placed a 4 inch diameter corrugated pipe in the outlet and channeled the water into the pipe. The contractor ran the pipe along the top of the slope above the willow stakes and then perforated the pipe at regular intervals which allowed the water too slowly leak into the trench and keep the willow stakes wet. Thus we managed to utilize all of the wasted water coming from the shopping center parking lot.



The water table was incredibly high on this project. In fact, the only thing keeping the water from surfacing was a two foot thick layer of gravel that was laid down during the initial construction of the channel. Any water that was not captured by the diversionary dam was using the gravel layer as a French drain to make its way downstream. Once the contractor had disturbed this gravel bed, the water surfaced, and created a serious problem at the downstream end of the construction site where it turned the soil conditions to mud. However, it created an opportunity to employ a little ingenuity and value engineering.

The design called for a concrete cut off wall to be constructed. Due the muddy conditions, this was proving to be very tough. As a result, City staff and the design engineer and came up with a quick and inexpensive design change. The cut off wall design was to be replaced with a grouted riprap. As it turned out the concrete apron under the bridge was not structural but rather ascetics. It was placed to continue the uniform look of the channel.



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