Introduction

CHAPTER 1

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This chapter introduces the Pajaro River Watershed Study Phase 3 and 4a Report. This phase of work incorporates two aspects of the State Water Resources Control Board (SWRCB) plan for the Pajaro River Watershed Study. In the Phase 3 aspect of the plan, the project is conceptually defined and documented according to California Environmental Quality Act (CEQA) regulations. The Phase 4a aspect of the plan addresses preliminary design requirements such as topography and aerial photography. This chapter also provides some background on the foundation of the Pajaro River Watershed Flood Prevention Authority and work that has already been completed in Phases 1 and 2.

Purpose of the Pajaro River Watershed Study: Phase 3 and 4a

Phase 2 identified and evaluated many alternatives throughout the Pajaro River Watershed to protect downstream properties and developments from flooding. A separate effort, the Lower Pajaro River Project led by the U.S. Army Corps of Engineers (Corps) and the counties of Monterey and Santa Cruz, identified a project that could provide 100-year protection and utilize federal funding at the same time. The focus of the Authority and Study therefore shifted to maintaining the predicted 100-year flows at current levels in the downstream reaches. This will ensure that the design capacity of the Corps Project is adequate to pass the design flood event safely to Monterey Bay.

One of the main conclusions from Phase 1 of the Study was the importance of Soap Lake in reducing the peak flood flows from the Upper Pajaro River. Phase 3 and 4a defines and documents the preferred method to maintain the Soap Lake attenuation and storage capacity, known as the Soap Lake Floodplain Preservation Project (Project). Soap Lake has been hydraulically modeled and the boundaries are defined, the impacts of flooding and land use preservation are examined, and the cost of the Project is estimated. This report summarizes and explains Phase 3 and 4a of the Pajaro River Watershed Study.

Study Background

LEGAL AUTHORITY

The Pajaro River Watershed Flood Prevention Authority (Authority) was established in July 2000 in order to "identify, evaluate, fund, and implement flood prevention and control strategies in the Pajaro River Watershed, on an intergovernmental basis."[1] As directed in the Assembly legislation, the Board of the Authority is comprised of one representative from each county and water district within the watershed. These include the following agencies:

- County of Monterey
- County of San Benito
- County of Santa Clara
- County of Santa Cruz
- Monterey County Water Resources Agency
- San Benito County Water District
- Santa Clara Valley Water District

[1] Keeley, "Assembly Bill 807: Pajaro River Watershed Flood Prevention Authority Act." October 10, 1999.

- Santa Cruz County Zone 7 Flood Control District

The Authority acts as a governing body through which each member organization can participate and contribute to developing a method to provide flood protection in the watershed and promote general watershed interests. In addition to flood protection, some identified benefits include:

- Municipal, agricultural, and industrial water supply
- Groundwater recharge
- Support of rare, threatened, or endangered species
- Migration and spawning of aquatic organisms
- Preservation of wildlife habitat[2]

Although efforts by individual agencies have been made in the past to protect against flooding, the ultimate solution may require coordination of structural and non-structural projects throughout the four counties that make up the watershed. Flooding throughout the lower Pajaro River reaches is a hazard to public and private property including residences, agriculture, highways, watercourses, and environmental resources. Recent floods have caused millions of dollars in damage.

As described in the enabling legislation State Assembly Bill 807, the goal of the Authority is to implement flood prevention and control strategies within the watershed. A further goal of the Authority is to identify strategies and projects that will provide multiple benefits, such as drinking water, ground water recharge, or environmental restoration and protection.

WATERSHED SETTING

The Pajaro River is the largest coastal stream between the San Francisco Bay and the Salinas Watershed in the County of Monterey.[3] The watershed is approximately 1,300 square miles and covers portions of Santa Cruz, Santa Clara, San Benito, and Monterey Counties. The large size contributes to the number of diverse environments, physical features, and land uses within the watershed. Tributaries to the Pajaro River, the largest of which is the San Benito River, serve as the major routes for flow and floods throughout the watershed. A relief map of the watershed showing major highways, cities, dams, and rivers is shown on Figure 1-1.

Prominent hydraulic features of the Pajaro River Watershed, in addition to the rivers and streams, include the storage locations. As will be described later in this chapter, the man-made reservoirs have played a significant role in reducing the peak flows in the Lower Pajaro River. The in-stream dams include Hernandez Dam, Pacheco Dam, Uvas Dam and Chesbro Dam. Soap Lake is an intermittent yet prominent storage feature of the watershed as well. It is the focus of Phase 3 of the Study as it significantly controls the magnitude and timing of the peak flows originating from the Upper Pajaro River Watershed. Soap Lake is described in greater detail in Chapter 2.

Development within the watershed, both urban and rural, is clustered around the major cities. The major urban centers are Watsonville, Gilroy, Morgan Hill, Hollister, and San Juan Bautista. Agriculture and grazing are the dominant land uses in these areas but represent a small portion of the total watershed land use. Other industries outside of the urban setting include mining and timber harvesting. The majority of the land cover is grassland, shrubland, and forest. Figure 1-2 shows the spatial distribution of the land uses.

[2] "Draft Water Quality Management Plan for the Pajaro River Watershed." Prepared for Association of Monterey Bay Area of Governments. March 1999.
[3] Ibid.

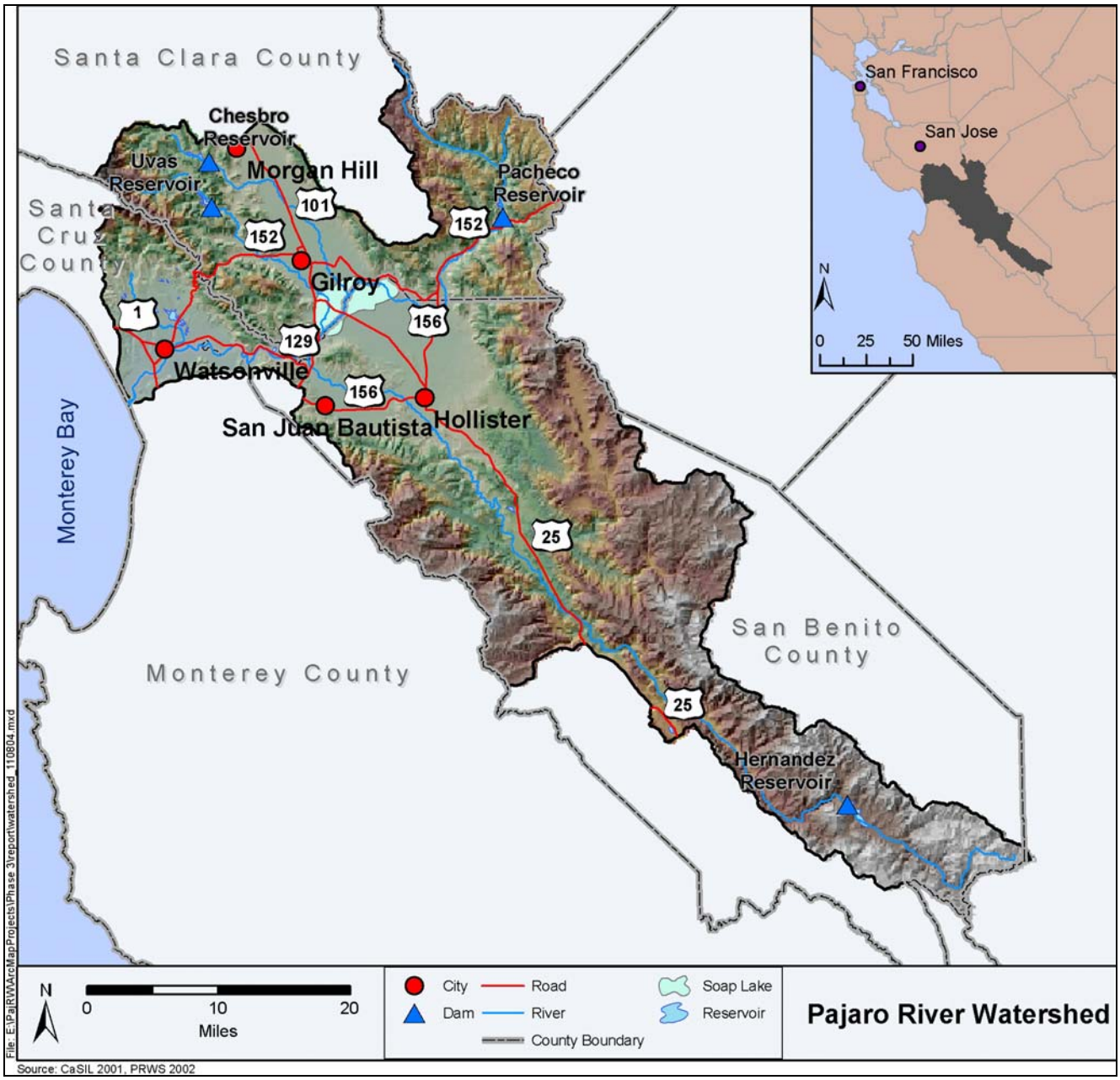

Figure 1-1: Relief map of the watershed showing major highways, cities, dams, and rivers.

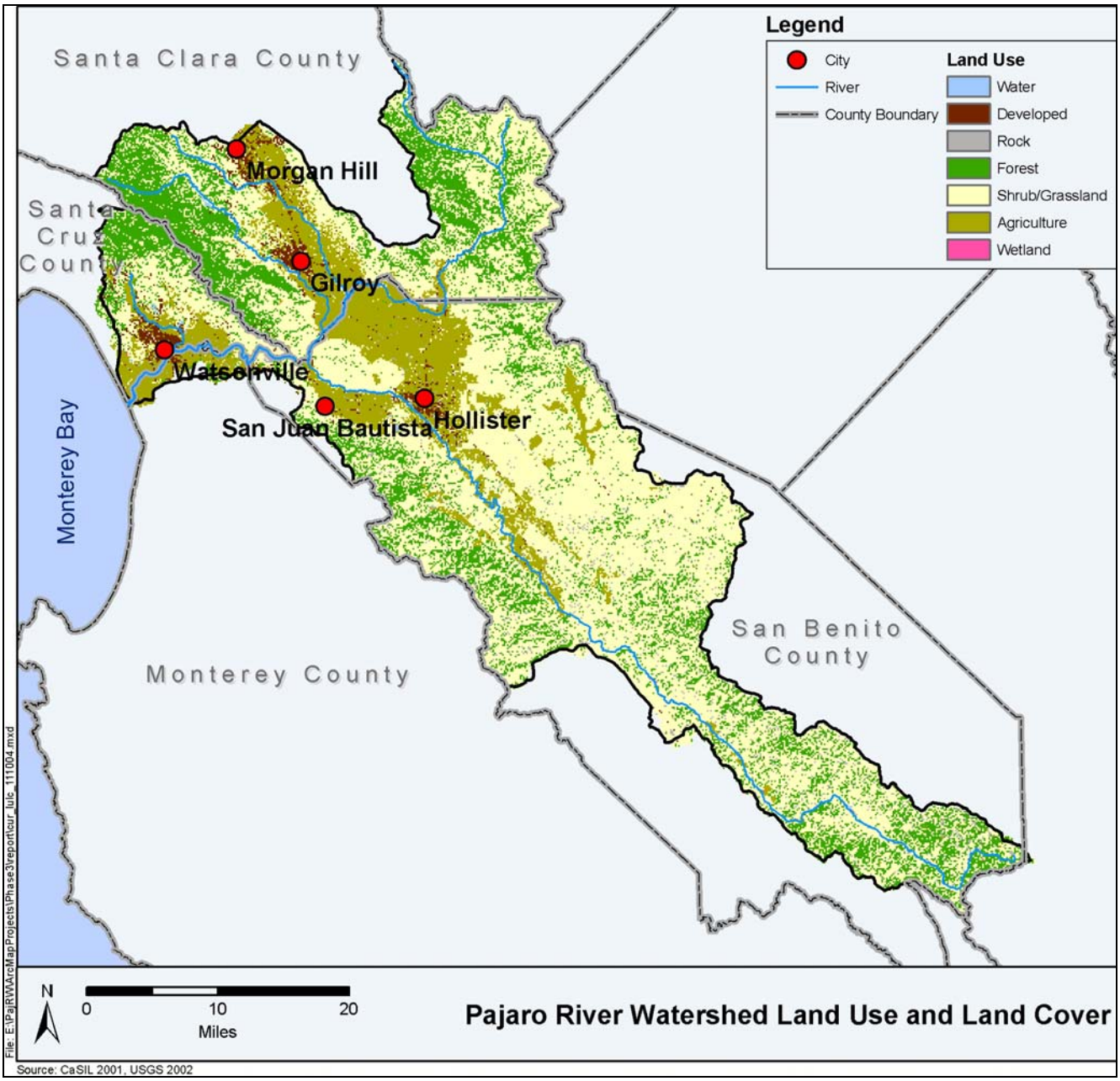

Figure 1-2: Major land use categories and locations within the watershed.

Over the recent years, rivers within the watershed have had significant water quality issues. They have been listed on the Clean Water Act 303d list for nutrients, sediments, fecal coliform, chloride, dissolved oxygen, sodium, and total dissolved solids. These pollutants limit the uses of the water and reduce the environmental benefits.

PHASE 1 SUMMARY

Objectives and Background

The scope of Phase 1 was designed to answer questions about the origins of flood waters and sediment. It was also important to the Authority to understand how sensitive the watershed is to changes in various types of land use, especially urban and agricultural areas.

In order to address these unknowns, the Authority created hydrologic models for the watershed and hydraulic and sediment generation and transport models for the Lower Pajaro River and Lower San Benito River. These models simulated peak and 3-day average flows for the 2-, 10-, 25-, 50-, 100-, and 200-year flood events. The models were calibrated at four points which characterized flows from the major subwatersheds. The locations and descriptions of these four points are:

- San Benito River Upstream of Pajaro River Confluence – Pour point for the entire San Benito River Watershed
- Soap Lake Outlet – Pour point for the Upper Pajaro River Watershed just upstream of Highway 101
- Chittenden Gage – Downstream of the Pajaro River and San Benito River confluence, this point captures flow from the entire upper watershed.
- Downstream of Salsipuedes – This calibrated node around Watsonville captures flow from the Pajaro River and all of its major tributaries.

Models simulating four other watershed conditions, based on the model calibrated for current conditions, were also created. Those watershed conditions are:

- **Historical Condition (1947)**: Provides insight into flooding conditions before the current Corps' levees, Hernandez Dam, Uvas Dam, or Chesbro Dam were in place.
- **General Plan Buildout Condition (2015-2020)**: Models the flood potential using the land use designations established by the individual city and county planning departments in their General Plans.
- **Ultimate Buildout (2050)**: This scenario is a worst case situation in terms of flooding. Urban growth is extrapolated to the year 2050 without regard to limits or regulations set forth in the General Plans.
- **Changes in Agriculture**: This scenario is intended to represent the worst case scenario, in terms of flooding, for agricultural changes. All agriculture present in the current condition is changed to row crops with a poor hydrologic condition. There is no timeframe associated with this scenario.

Results and Conclusions

Results from all four conditions can be found in Phase 1 documentation. However, the General Plan Buildout is particularly important to Phases 2 and 3 of the Study. The General Plan Buildout condition results are used in Phases 2 and 3 since it represents the best estimate of realistic, planned conditions, runoff, and flows within the watershed for a reasonable planning horizon. The results of this modeled condition can be found below in Table 1-1.

Table 1-1: Hydraulic Model Peak Flows Based on General Plan Buildout Conditions

Watershed Location	Peak Model Flow Rate (cfs)					
	2-Year Event	10-Year Event	25-Year Event	50-Year Event	100-Year Event	200-Year Event
San Benito River	1,280	10,800	18,800	26,200	31,600	44,700
Soap Lake Outlet on Pajaro River	4,020	15,300	21,600	27,400	30,700	35,600
Chittenden Gage on Pajaro River	3,610	17,300	29,300	38,400	44,400	58,200
Pajaro River downstream of Salsipuedes Creek	4,340	20,300	32,700	43,100	49,600	65,300

Figure 1-3 shows the four calibrated model points and the channel capacities in the lower reaches of the Pajaro River watershed. As listed in Table 1-1, the San Benito River 100-yr peak flow is 31,600 cfs and the Pajaro River 100-yr peak flow at the Soap Lake outlet is 30,700 cfs. However, due to the time difference between peak flows on each river, the cumulative peak discharge of these two rivers at Chittenden and the Murphy Road Crossing is a lower flow rate, about 44,400 cfs, than the two peaks added together. The channel capacity just downstream from Chittenden is about 19,000 cfs, based on the design channel size and levee conditions. However, the channel capacity certifiable by the Corps based on current channel and levee conditions could be much lower, at 9,000 cfs with 90% confidence. The design conditions of 19,000 cfs for channel capacity were used in this analysis. Flow from Salsipuedes Creek increases the peak discharge in the lower Pajaro River. The Pajaro River flow of 49,600 cfs just downstream from the Salsipuedes Creek confluence is the design flow for the 100-year flood event. The existing channel capacity in the lower reaches of Pajaro River is approximately 22,000 cfs, which is well below the expected 100-year flood event. Frequent flooding occurs in the region because of the lack of flood flow capacity in the river channel downstream of Chittenden.

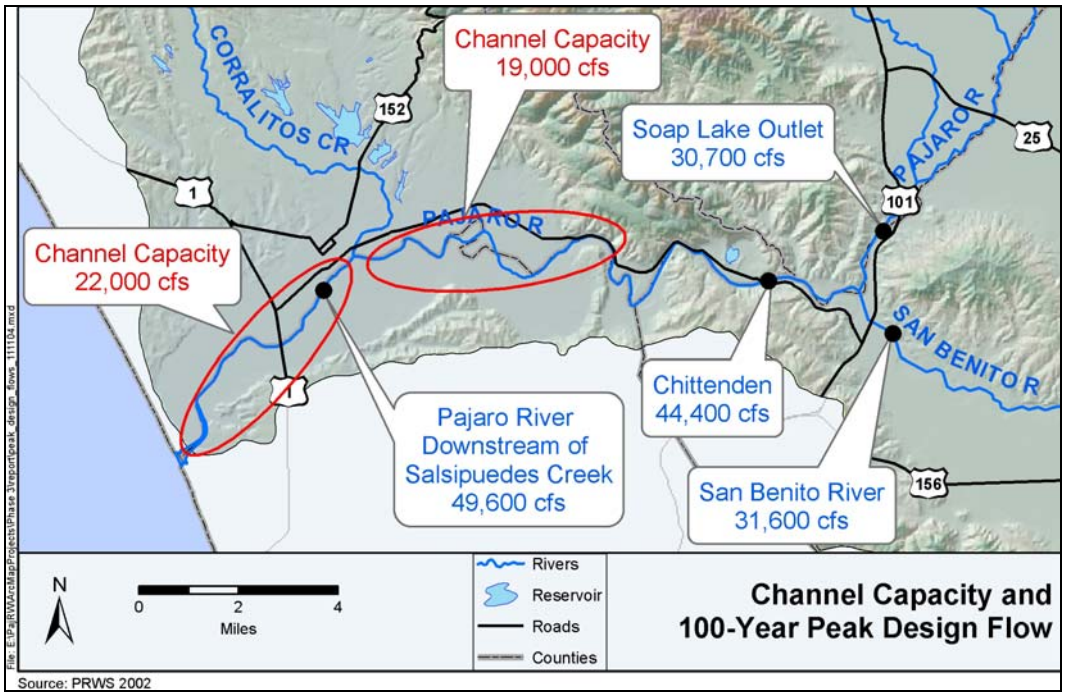

Figure 1-3: 100-Year Return Period Peak Design Flows on the Lower Pajaro River.

The following results and conclusions were based on the hydrologic modeling work:

- Since 1947, the construction of three reservoirs (Hernandez, Uvas, and Chesbro dams) reduced peak flood flows and the probability of flooding in the lower Pajaro River.
- Neither current agriculture conditions nor potential changes in agricultural conditions will cause significant changes in the design discharge or flood conditions.
- Urbanization will increase the runoff from smaller storm events with frequent return periods (2-year to 25-year), but causes little change in runoff from larger storms with longer return periods (50-year to 200-year).

- Flooding in the Soap Lake area provides peak flow attenuation of Pajaro River flows upstream of the San Benito River confluence, and this situation has been assumed to continue for the Corps peak flow design conditions.

The following results and conclusions were based on the sediment modeling work:

- Sediment conditions within the Pajaro River channel should not be significantly altered by the small, predicted changes in peak design discharges.
- Significant growth of shrubby vegetation could be expected to cause an increase in sediment deposition.
- Changes in sediment load may have localized impacts at the confluence of the San Benito and Pajaro Rivers, but do not affect the Lower Pajaro system as a whole.
- The flooding along Soap Lake limits sediment discharge from the Pajaro River upstream of the San Benito River confluence.

Since the results and conclusions of the sediment studies indicated that sediment conditions would not change significantly from existing conditions, the alternatives developed during Phase 2 were focused primarily on reduction of flooding risk within the lower Pajaro River. However, sediment management impacts were considered for alternatives with incidental effects on sediment conditions, such as reservoirs and detention basins.

PHASE 2 SUMMARY

The goal of Phase 2 was to identify flood control projects throughout the Pajaro River Watershed at a conceptual level that would provide protection to the general Watsonville area. Enough detail for each project was needed to generate quantification of potential flood reduction, other benefits and disadvantages, and cost. After evaluating all of the options, one or a few projects would be selected to carry on to Phase 3 of the Pajaro River Watershed Study. The Authority was able to utilize the models and conclusions of Phase 1 as well as significant coordination with the Corps' concurrent Lower Pajaro River flood control project to accomplish these goals.

A wide variety of flood protection projects throughout the watershed were considered. There are two general ways to protect against flooding: storage and conveyance. The purpose of storage is to detain or retain flood waters by either reducing the total amount of water included in the flood wave or attenuating the peak flows. The purpose of conveyance is to move the water out of an area as quickly as possible. Both types of projects were considered. Also, since upper and lower watershed agencies are involved in the Study, upper watershed projects are viable options to provide downstream flood protection. Figure 1-4 below shows a matrix of the projects considered based on the above two qualifications.

	Upper Watershed	Downstream
Conveyance	• None	• Open channel bypass • Flood channel • Underground bypass • Flood tunnel • Flood walls
Storage	• Land/Flood Easement at Soap Lake • Detention Basin in San Benito Watershed • Raise existing dams • New dam (various locations)	• Detention basin at College Lake

Figure 1-4: Matrix of flood control options considered in Phase 2.

Figure 1-5 highlights reasons why the pairings of downstream conveyance and upper watershed storage make more sense than the other pairings in Figure 1-4.

	Upper Watershed	Downstream
Conveyance	• Conveyance options would move the water to the downstream areas faster and allow less natural channel attenuation of peak flows.	• Proximity to river outlet (Monterey Bay) and limited available space make conveyance a good option • Uses less room than storage methods
Storage	• Rural and open space with varied topography lead to good storage opportunities. • Storage reduces the total volume of water or attenuates the peak flows.	• Lack of space and flat topography make storage difficult.

Figure 1-5: Matrix of conditions that create beneficial flood control pairings for the Pajaro River Watershed.

In addition to the projects in Figure 1-4, a concurrent flood protection process was reviewed and evaluated. Monterey and Santa Cruz counties are working with the U.S. Army Corps of Engineers to identify a 100-year flood protection project in the lower reaches of the Pajaro River. By identifying, permitting, and building a suitable project, the counties could save a significant portion of the cost through federal funding. At the time of the Phase 2 evaluation, the Corps was developing concepts that would provide 30- to 65-year protection through a combination of setback levees and floodwalls.

After analyzing all of the above projects, including the Study and Corps' projects, it was apparent that none of the more feasible projects would yield a complete flood protection solution, i.e. one that could provide 100-year protection. It was therefore necessary to group the individual projects to create packages. While the cost for the packages was higher than the individual projects, many additional benefits were realized in addition to providing the necessary flood protection. Depending on the package configuration, these benefits included additional water supplies, additional habitat, and additional recreational space.

At the time of the package evaluation, the Corps and downstream agencies had not yet arrived at their final proposed project. The Authority therefore took the position that the downstream project was considered to be the basis of the project packages and the additional projects identified in the Study would provide the additional flood protection up to a 100-year level. Figure 1-6 shows this concept graphically.

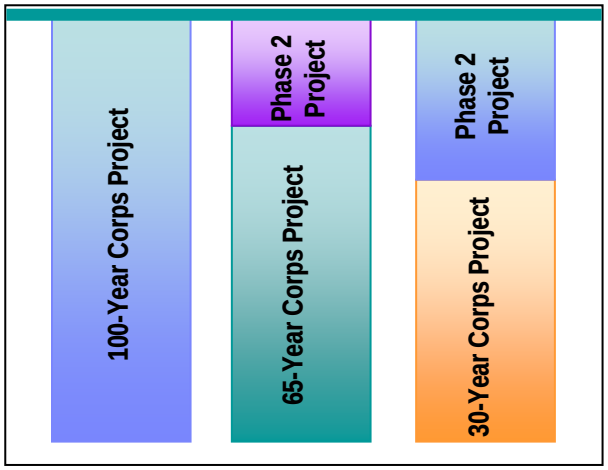

Figure 1-6: Combinations of projects yield 100-year protection.

The project packages that were preferred above all others were:

- Corps 65-year Project and New San Benito Dam
- Corps 65-year Project and Open Earthen Bypass Channel
- Corps 30-year Project and New San Benito Dam
- Corps 30-year Project and New Pacheco Dam and New San Benito Dam

All of the evaluated packages, including the four above, assumed that Soap Lake was functioning as it does currently.

After the conclusion of the analysis phase of work, the Corps selected a project capable of passing a 100-year flood event without any upstream projects. The focus of the Authority work shifted again to working to ensure that the flows passing through the Lower Pajaro River Project would not increase above the currently predicted levels. The most direct way to achieve this goal was to preserve Soap Lake and its attenuation capabilities. Therefore, the Soap Lake Floodplain Preservation Project became the focus of Phase 3 of the Authority's Study.

Should the Corps and downstream agencies choose a different project or if the protection level of the selected project is downgraded, it will be possible to reconsider the projects identified in Phase 2.

The Phase 3 work would still be applicable since Soap Lake would be an important part of any recommended project.