

# CHAPTER 5

## EVALUATION OF PRELIMINARY PLANS



Levee boils in 1983.

## **CHAPTER 5**

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#### **PRELIMINARY EVALUATION**

The five preliminary action plans were evaluated, and comparative quantity and costs estimates were developed. The preliminary action plans include (1) Channel Clearing, (2) Raising and Constructing New Levees, (3) Channelization and Constructing New Levees, (4) Constructing Setback Levees, and (5) Constructing a Flood Barrier.

Except for the first plan, the evaluation of preliminary plans was based on the peak flow estimated to be associated with a flood event having a 1 in 200 chance of occurring in any given year. This chapter presents the results of the preliminary assessment of each plan in terms of its benefits or accomplishments and the environmental effects associated with implementation.

Preliminary assessment provides information for selection of two plans for feasibility-level analysis. The actual level of protection, which would be afforded by the final plan, is determined after further refinement and evaluation.

#### **NO-ACTION PLAN**

The No-Action Plan is the same as the without-project condition, which is described in Chapter 2. This plan serves as the baseline against which the effects and benefits of the action plans are evaluated. The Federal Government would take no action to implement a specific plan to reduce flooding of the city of Woodland under the No-Action Plan; and the Cache Creek levee system, with continued maintenance and repairs/rehabilitation, would continue to provide for the reliable conveyance of the 1 in 10 chance flood event. Annual damages to real property from overflows from Cache Creek would be expected to continue to be about \$12 million. Other losses or adverse effects would continue to include the potential for flood-related loss of life, contamination from sanitary sewage and hazardous materials, and the extended closure of the section of I-5 east of the city of Woodland.

#### **CHANNEL CLEARING, PRELIMINARY PLAN**

##### **GENERAL DESCRIPTION**

This plan would include clearing the existing channel to improve conveyance of floodwater within the channel area by removing riparian trees, brush and associated root balls, and other obstructions in the watercourse. The cleared area would be reseeded with grass once the other obstructions are removed. Plate 4 shows the boundaries of this plan.

Clearing would take place from approximately 2 miles east of CR 94B to 1 mile east of CR 102 near the entrance of the settling basin, about 9.5 miles.

## **PLAN ACCOMPLISHMENTS**

To assess the primary benefit of this plan, the hydraulic computer models were adjusted to reduce the Manning's roughness coefficient in the channel from the existing value of 0.032-0.042 to 0.022-0.031. The model results indicate that this preliminary plan would increase channel capacity to accommodate approximately a 1 in 40 chance flood event.

Removing flow constrictions through clearing would significantly increase channel velocity; therefore, slope protection to stabilize the banks would be required through most of the affected reach.

## **POTENTIAL ENVIRONMENTAL EFFECTS**

Because trees, brush, and other obstructions would be removed during channel clearing, this plan would result in the significant loss of valuable riparian habitat. This plan could also disturb mercury-laden sediments that could remobilize and ultimately be deposited in the Yolo Bypass and Delta. Biomagnification of mercury could adversely affect organisms throughout the food chain. The plan would not affect agricultural land or Yolo County's goal for agricultural land preservation.

## **RAISING EXISTING LEVEES AND CONSTRUCTING NEW LEVEES, PRELIMINARY PLAN**

### **GENERAL DESCRIPTION**

This plan is similar to the levee-raising measure reviewed in the reconnaissance study. Existing project levees would be raised on approximately 8 miles of Cache Creek from CR 97A to the settling basin. Levees would be raised on both sides of this 8-mile reach. Four miles of new levees would be constructed upstream from the existing project levee on the south bank from CR 97A to CR 96. On the north bank of the levees, 1.5 miles of levee would be constructed from CR 96B to CR 95B. Plate 5 shows the locations of the raised levees and newly constructed levees for this plan.

Levees would be raised from 1 to 14 feet. This plan would require replacement of several bridges, including the I-5 bridges, CR 99W bridge, SH 113 bridge, CR 102 bridge, and a railroad bridge. In general, this plan would also require installation of slope protection for bank stabilization along the raised and newly constructed levees due to high velocities.

## **PLAN ACCOMPLISHMENTS**

Implementation of this plan would reliably pass a peak flow with a 1 in 200 chance of occurring in any given year. This plan includes factors to characterize and meet levee stability requirements at the PNP and PFP flows. A benefit of implementing this preliminary plan is that impacts on lands outside the existing levee system would be limited.

## **POTENTIAL ENVIRONMENTAL EFFECTS**

Hydraulic effects associated with this plan include the resulting high channel velocities and increased peak flow entering the settling basin. The requirement for slope protection would result in the significant loss of valuable riparian habitat. This plan could also result in the disturbance of mercury-laden sediments with potential ecological effects in the Yolo Bypass and Delta. Effects to agricultural lands would be minimal.

### **CHANNELIZATION AND CONSTRUCTING NEW LEVEES,** **PRELIMINARY PLAN**

## **GENERAL DESCRIPTION**

Under this plan, the channel would be benched, and new levees would be constructed along several sections of a 9.3-mile reach of Cache Creek from about 1 mile west of CR 97A to the settling basin, as shown on Plate 6. A bench would be constructed along one side of the existing channel. The existing levee would be removed and the overbank area adjacent to the channel is excavated. The levee would be reconstructed approximately 500 to 700 feet from its existing location. The bench or terrace would be located at the 1 in 2 chance flow water-surface elevation, which is the average high flow over a 2-year recurrence interval. Bench channelization is planned for the reach approximately 2 miles upstream from California Northern Railroad on Cache Creek. Bench channelization and levee raising are planned on the southern bank of Cache Creek over approximately a 3-mile area directly downstream. Channelization and levee raising are planned on the opposite bank of Cache Creek for approximately 2 miles beginning at SH 113 and extending to CR 102. At CR 102, channelization and levee raising are begun again on the southern bank and extend to the settling basin. Implementation of this plan would require replacement of a railroad bridge and installation of slope protection.

## **PLAN ACCOMPLISHMENTS**

Similar to the plan to raise the existing levees, the plan to improve the channel and construct new levees would reliably pass a flow with a 1 in 200 chance of occurring in any given year. An important feature of this plan is that in most of the 9.3-mile reach, the PFP of the remaining existing levee would not be exceeded; therefore, levee construction would be required on only one side of the channel, instead of both sides.

## **POTENTIAL ENVIRONMENTAL EFFECTS**

The environmental effects of this plan would be the removal of some riparian habitat. However, the bench area would likely provide an area for onsite mitigation. Also, high floodflow velocities will require rock slope protection at some locations. Although channelization and levee construction are required for the most part on only one side of the channel, the overall land requirements for this plan are still high given the requirement for 500-700 feet of terraced land adjacent to the channel. This land is currently cultivated. This plan could also result in the release of mercury-laden sediments with potential ecological effects in the Yolo Bypass and Delta. New levee construction would also result in minor agricultural land loss.

### **CONSTRUCTING SETBACK LEVEES AND RAISING EXISTING LEVEES, PRELIMINARY PLAN**

#### **GENERAL DESCRIPTION**

This plan involves installing about 6.5 miles of setback levees on one side of Cache Creek and raising existing levees on the opposing side. In addition, this plan would require construction of about 3 miles of new setback levees on both sides of Cache Creek upstream from the 6.5-mile reach. Levees would be set back 1,000 to 2,000 feet from the existing levees. The proposed setback areas, raised levee areas, and locations for newly constructed levees are illustrated on Plate 7.

Setback levees would range from 1 foot to 14 feet in height. Raised levees would range from 1 foot to 7 feet in additional height. The farther the levees are set back, the greater the increase in channel capacity, providing more conveyance capacity and reducing the overall channel velocity.

Setbacks were calculated at 1,000-, 1,500-, and 2,000-foot distances from the existing levee. Although the 1,000-foot setback would require less land acquisition, velocities would be higher, and more bank stabilization would be needed. Conversely, the 1,500- and 2,000-foot setbacks would increase the flood plain significantly and require more land acquisition and the relocation of some existing homes and other structures.

This plan would also involve the replacement of the railroad bridge and construction of slope protection along creek banks where setback levees, raised levees, and newly constructed levees would be installed.

#### **PLAN ACCOMPLISHMENTS**

This plan would reliably pass a flow with a 1 in 200 chance of occurring in any given year.

## **POTENTIAL ENVIRONMENTAL EFFECTS**

Effects to the creek channel would be minimal; channelization would only be required at the railway bridge. Land between the old levee and the new setback levee would remain undisturbed; however, this land would be isolated and potentially inaccessible for continued agricultural use. In addition, agricultural land would be lost due to the construction of the new setback levees. The loss of agricultural land would need to be addressed as related to Yolo County's General Plan and agricultural land preservation goals.

High water would flow over the bank for at least 1,000 feet before being retained. As a result, this plan more closely mimics the natural flooding process and reduces effects due to minimal velocities and associated scour.

## **CONSTRUCTING A FLOOD BARRIER, PRELIMINARY PLAN**

### **GENERAL DESCRIPTION**

This plan consists of the construction of about 6.8 miles of new levee. The new levee would be located 1 to 2 miles south of Cache Creek between CR 96B and the settling basin, just north of the city of Woodland, as indicated on Plate 8. The area between the new levee and Cache Creek, which is currently a portion of the existing flood plain, would remain in the flood plain with increased flood depth and duration in the vicinity of the settling basin. The chance of flooding in any given year would remain unchanged.

In the remaining flood plain, provisions would be made to flood proof the structures that would have significant, induced flood damages. Closure structures would be provided on the levee at road and railroad crossings. A flood warning system would also be incorporated to initiate evacuation of the flood plain and closure of crossings.

The new levee would vary from 4 to 17 feet in height. A 450-cfs canal on the flood side of the levee would be included for internal drainage of more frequent events.

Another major component of the preliminary plan would be the removal of a 4,000-foot section of the west levee of the settling basin. This feature will allow floodflows to drain by gravity from the flood plain.

### **PLAN ACCOMPLISHMENTS**

This plan has many benefits and meets all the planning objectives for the project. As shown on Plate 9, the plan would reduce the risk of flooding to Woodland to flooding associated with a flow having a 1 in 200 chance of occurring in any given year. Because

the existing levee system would remain the same, use of existing flood damage reduction facilities would be maximized. Larger flood events would be confined to agricultural land currently in the flood plain. Implementation of the Flood Barrier Plan would, however, increase flood depths and durations on lands east of CR 101.

Peak floodflows on the flood plain would also increase over their current levels. Plate 10 shows that the peak flows on the flood plain would also increase for most of the flood plain area north of the flood barrier as an effect of diverting flows that would have gone through industrial and residential portions of Woodland.

## **POTENTIAL ENVIRONMENTAL EFFECTS**

This plan would cause minimal environmental effects to the creek and its riparian habitat. Some loss of agricultural land along the boundary with the city of Woodland would be expected, but not to the extent of the land lost under the Setback Levee Plan. Depth and duration of ponded water would increase west of the west levee of the settling basin.

## **COMPARATIVE COST ESTIMATES**

Comparative cost estimates were developed for the five preliminary plans. These estimates are summarized in Table 5-1. The estimates are not intended for budgetary purposes. They were developed to assist in screening the plans and selecting the two preliminary plans for feasibility-level analysis.

The estimates only reflect the major cost elements of these plans. Fish and wildlife mitigation costs were estimated at 10 percent, utility relocations at 1 percent, and operation and maintenance at 0.2 percent of construction costs. Lands, Easements, Relocations, Rights-of-Way, and Disposal Area (LERRDS) costs are based on preliminary design and cost estimates of these items.

**Table 5-1. Comparative Cost Estimates of Preliminary Plans**

<b>Plan Description</b>	<b>First Cost (\$)</b>	<b>Investment Costs (\$)</b>	<b>Annual Costs (\$)</b>
Channel Clearing <sup>1</sup>	37,383,000	40,241,000	2,945,000
Raising Levees and Constructing New Levees	75,376,000	81,139,000	5,937,000
Channelization and Constructing New Levees	64,286,000	69,201,000	5,063,000
Constructing Setback Levees and Raising Existing Levees	42,375,000	45,615,000	3,339,000
1,000 Feet	41,053,000	44,192,000	3,234,000
1,500 Feet	33,868,000	36,457,000	2,668,000
2,000 Feet			
Constructing a Flood Barrier	25,739,000	27,707,000	2,028,000

<sup>1</sup>Does not meet minimum flood damage reduction objectives.

### **PRELIMINARY EVALUATION**

The criteria for the preliminary plans were evaluated in terms of the ability of each plan to meet the four general planning criteria presented in Chapter 4: (1) completeness, (2) effectiveness, (3) efficiency, and (4) acceptability. The results of this evaluation provided the basis for selecting two of the preliminary plans for a feasibility-level evaluation. The results of the criteria evaluation are presented in this section.

#### **COMPLETENESS**

Completeness is the extent to which a given plan provides and accounts for all necessary investments or other actions to ensure the realization of the planning objectives. The degree of completeness is measured with respect to the five primary factors. The ability of the plans to meet these factors is described below.

Yolo County is particularly interested in preserving agricultural lands. Of the plans that meet the primary flood damage reduction objective, the Flood Barrier Plan has the least impact on agricultural lands.

The Flood Barrier Plan has the highest degree of reliability because it would be least sensitive to flows exceeding the design capacity. Flows significantly higher than the design capacity could cause relatively small increases in water-surface elevations. This characteristic is attributable to the large flood plain area that would remain active under this plan. This characteristic also exists to a lesser extent with the Setback Levee Plan, depending on how far the levees are set back from the creek.

### **Further Actions**

To achieve completeness, no further actions should be needed to ensure fulfillment of the stated degree of flood damage reduction. None of the preliminary plans would require additional facilities to achieve the stated degree of protection. However, the Channel Clearing Plan cannot meet the primary flood damage reduction objective.

### **Environmental Effects**

Completeness also considers the ability to mitigate unavoidable adverse environmental effects. The types of potential effects and scope of mitigation varies significantly between the plans.

The Channel Clearing Plan and the Raising Existing Levees and Constructing New Levees Plan would involve the permanent removal of significant amounts of riparian vegetation in and along lower Cache Creek. Mitigation for the effects of these plans would be difficult onsite, and potentially offsite as well, due to the limited amount of suitable habitat in and near the area. Additionally, the mitigation would be very costly.

The Channelization and Constructing New Levees Plan and the Constructing Setback Levee and Raising Existing Levees Plan would also involve removal of riparian habitat (considerably more habitat would be removed for the former). However, both of these plans could provide an area for onsite mitigation.

The Flood Barrier Plan requires minimal construction activities in Cache Creek, although there is significant construction involving the settling basin levees. The channel and project levees would be maintained according to the current project requirements. The flood barrier levee and associated drain would traverse agricultural lands, so construction of these facilities would have little impact on riparian vegetation and wildlife habitat.

All plans involving construction activity within the creek raise the potential for release of mercury-laden sediment. Constructing a Flood Barrier Levee Plan minimizes this potential. All plans, except Channel Clearing, would involve the loss of prime agricultural land covered by the levee footprint. This effect would not be able to be mitigated. The Constructing Setback Levees and Raising Existing Levees Plan would potentially result in the greatest loss of prime agricultural land.

### **Hydraulic Effects to Other Areas**

Another measure of completeness is the ability to fully compensate or offset adverse hydraulic effects to other areas. The preliminary plans have been formulated to

reflect compensation for hydraulic effects and include costs for flood easements as deemed appropriate.

The hydraulic effects to the Yolo Bypass were assessed in the hydrology analysis and determined to be insignificant due to non-concurrent flood peaks.

Constructing a Flood Barrier Plan would adversely affect some farmhouses/structures in the remaining flood plain between the creek and the flood barrier. The comparative cost estimates reflect the cost of flood proofing/protecting these structures.

## **EFFECTIVENESS**

The primary objective for every plan is to protect the city of Woodland from a flood event on Cache Creek having a 1 in 100 chance of occurring in any given year. Effectiveness is the extent to which a plan alleviates identified problems and achieves the planning objectives. The objectives addressed by the preliminary plans are shown in Table 5-2. All plans except Channel Clearing can meet these objectives.

Another objective is to maximize the use of existing flood damage reduction facilities prior to constructing new facilities. The Channel Clearing Plan, the Raising Existing Levees Plan, and Flood Barrier Plan fully use the existing flood damage reduction facilities. The Channelization Plan and Constructing New Levees and the Setback Levee Plan require removing the existing levee and constructing a new levee on one side of the creek.

## **EFFICIENCY**

Efficiency is a measure of the extent to which a plan is cost effective in terms of alleviating flood problems while realizing the specified objectives. It is measured by comparing estimated monetary costs and benefits of plans. Table 5-2 provides a qualitative comparison of the estimated benefit and cost for the five preliminary plans. These comparison indicate that the Flood Barrier Plan and the Setback Levee Plan are the most cost effective.

## **ACCEPTABILITY**

Acceptability is the workability and viability of an alternative with the plans and projects of Federal, State and local agencies, and public entities in accordance with existing laws, regulations, and public policies. The relative acceptability of the five preliminary plans was judged on the basis of feedback and tentative support indicated by potential non-Federal sponsors.

**Table 5-2**

**Table 5-2. Comparison of Ability of Flood Damage Reduction Plans to Meet Planning Criteria Preliminary Screening**

Plan	Cost (\$ millions)	Plan Formulation Criteria			
	Investment Cost*	Completeness	Effectiveness	Efficiency	Acceptability
Channel Clearing	\$40	Does not meet 1 in 200 chance event flood damage reduction goal and has significant adverse environmental effects.	Meets 5 of 8 planning objectives; however, does not provide adequate flood damage reduction.	Does not provide 1 in 100 chance protection.	Judged to be unacceptable because flood damage reduction is only provided for 1 in 40 chance flood events.
Ranking		Unacceptable	Unacceptable	Poor	Unacceptable
Raising Existing Levees and Constructing New Levee	\$81	Meets flood damage reduction goal, maximizes use of existing facilities, and has significant adverse environmental effects.	Meets 5 of 8 planning objectives, provides adequate flood damage reduction.		High price is unacceptable to general public.
Ranking		Good	Moderate	Poor due to cost	Poor
Channelization and Constructing New Levees	\$69	Meets flood damage reduction goal, maximizes use of existing facilities, but requires significant changes to existing facilities and land acquisition.	Meets 4 of 8 planning objectives, requires large land acquisition.		High price and large land acquisition needs are unacceptable to general public.
Ranking		Moderate	Moderate	Poor due to cost	Poor
Constructing Setback Levees and Raising Existing Levees	\$36 to \$46	Meets flood damage reduction goal, maximizes use of existing facilities, but also requires large setback area and new levee.	Meets 4 of 8 planning objectives, but with significant environmental damage while meeting flood damage reduction goals. Has potential for ecosystem restoration component.		Public acceptance of cost; however, little public approval for using large sections of agricultural land for new levee construction.
Ranking		Good	Good	Good	Moderate
Constructing a Flood Barrier	\$27	Meets flood damage reduction goal; no further action required, but does include hydraulic impact to new area.	Meets 7 of 8 planning objectives, is easily physically implemented.		Public acceptance of cost; public approval for minimization of environmental damage and land acquisition.
Ranking		Good	Excellent	Good	Moderate

\*Investment cost includes interest that would accrue over a 2-year construction period (6.875 percent).

Federal, State, and other local agencies have participated in various steps of formulating and evaluating the preliminary plans. These entities include the Corps, U.S. Fish and Wildlife Service, California Department of Fish and Game, California Department of Water Resources, Yolo County, City of Woodland, and the City of Woodland Flood Task Force.

Non-Federal participation in the project is essential, since a non-Federal sponsor must share costs associated with project components. In addition, non-Federal input is critical to identify and establish plans that will be acceptable to the public and address the needs and concerns of local stakeholders.

The City of Woodland Floodplain Task Force includes members of the Woodland City Council, the Yolo County Board of Supervisors, an Association of General Construction member, a Cache Creek Conservancy member, the Farm Bureau, the Woodland Chamber of Commerce, the Woodland Economic Reconnaissance Corporation, and three citizens at large. The City of Woodland Floodplain Task Force helped identify measures for the initial screening process. On February 8, 2001, task force members were presented with the evaluation of the five preliminary plans described in this report. The City Council and Yolo County Supervisors unanimously endorsed those recommendations to the Corps.

## **SUMMARY AND SELECTED PRELIMINARY PLANS**

A comparison of estimated costs and the ability to meet the planning criteria of the preliminary plans is shown in Table 5-2. Careful review of the table shows that the setback levees and flood barrier should be selected for further study as final plans.