CHAPTER 1 Introduction

1.1 Mandate

In 1955, Congress passed legislation (Public Law (P.L.) 84-386) (1955 Act) authorizing the construction of the Trinity River Division (TRD) of the Central Valley Project (CVP) to divert surplus water from the Trinity River into the Sacramento River. The 1955 Act also specifically authorized and directed the Secretary of the Interior (Secretary) to " . . . adopt appropriate measures to insure the preservation and propagation of fish and wildlife . . . " The U.S. House of Representatives report on the 1955 Act (USHOR, 1955) states:

. . . there is available for importation from the Trinity River, water that is surplus to the present and future needs of the Trinity and Klamath River Basins, and that surplus water, in the amount proposed in the Trinity division plan (704,000 acre-feet), can be diverted to the Central Valley without detrimental effect to the fishery resources.

For the 10 years after the TRD became operational in 1964, an average of 88 percent (1,234 thousand acre-feet (TAF)) of the annual inflow was diverted into the Sacramento River Basin, with releases to the Trinity River ranging from 150 to 250 cubic feet per second (cfs) and a total annual instream volume of 120.5 TAF (TRBFWTF, 1977). These minimum releases were thought, at that time, to be adequate to sustain the fishery resources of the Trinity River. The releases identified as appropriate to protect the fishery resources below the TRD addressed primarily chinook spawning needs (Moffett and Smith, 1950). These minimum releases, however, did not address the fluvial geomorphic processes that maintain habitat, nor did these minimum releases provide habitat for other species or other life stages of salmonids. Following construction and

The 1955 Act authorized the TRD and directed the Secretary of the Interior to " . . . adopt appropriate measures to insure the preservation and propagation of fish and wildlife . . . " of the Trinity River.

operation of the TRD, rapid and unexpected changes in the river morphology caused the degradation of fish and wildlife habitat.

Following construction and operation of the TRD, rapid and unexpected changes in the river morphology caused the degradation of fish and wildlife habitat, and salmonid populations noticeably decreased.

Within a decade of completion of the TRD, salmonid populations had noticeably decreased (Hubbel, 1973). Increased flow releases and habitat rehabilitation projects were identified as necessary to restore the fishery resources (TRBFWTF, 1977). On January 14, 1981, Secretary Cecil Andrus issued a Secretarial Decision and supporting documents (1981 Secretarial Decision, Appendix A) that directed the U.S. Fish and Wildlife Service (Service) to conduct the Trinity River Flow Evaluation (TRFE) Study. The mandate of this study was to determine how to restore anadromous fish populations in the Trinity River Basin.

The 1981 Secretarial Decision directed the Service to submit a report summarizing the effects of minimum releases and other actions in restoring Trinity River salmon and steelhead populations. The report was to address habitat availability over a range of instream water volumes (140 TAF to 340 TAF), and the need to maintain, increase, or decrease these volumes. The report was also to recommend specifically what actions should be continued, eliminated, or implemented to mitigate fish population declines attributable to the TRD.

The 1981 Secretarial Decision directed the U.S. Fish and Wildlife Service to conduct the Trinity River Flow Evaluation Study to determine how to restore fish populations in the Trinity River Basin, and to recommend specifically what actions should be continued, eliminated, or implemented to mitigate fish population declines attributable to the TRD.

1.2 Purpose of the Trinity River Flow Evaluation Report

This report provides recommendations to the Secretary of the Interior designed to fulfill fish and wildlife protection mandates of the 1955 Act, the 1981 Secretarial Decision, 1984 Trinity River Basin Fish and Wildlife Management Act, 1991 Secretarial Decision, the 1992 Central Valley Project Improvement Act, and the federal trust responsibility to restore and maintain the Trinity River fishery resources.

This report:

- describes Congressional, Secretarial, and other actions taken to address the declines of the Trinity River fishery resources;
- presents the current scientific knowledge of the Trinity River, including changes in channel morphology and overall quality of fish habitat; and
- concludes that a new channel configuration, with accompanying adaptive management of releases, will provide water temperature control and sediment transport needed to create the dynamic habitat required to restore and maintain the fishery resources of the Trinity River Basin.

The science at the time of the 1981 Secretarial Decision focused on single species management. In response to an increasing awareness and understanding of river ecosystems and fishery habitats, additional studies that addressed channel morphology, sediment, water temperature, and

other ecosystem processes were initiated. This report makes management recommendations based on information provided in the following studies:

- Salmonid Microhabitat
- Channel Rehabilitation Microhabitat
- Fine Sediment Transport and Spawning Gravel Flushing
- Investigations of the Alluvial River Attributes
- Flow-Water Temperature Relations
- Chinook Salmon Potential Production

"This report provides recommendations to the Secretary of the Interior designed to fulfill fish and wildlife protection mandates . . . "

Integrating the results of these studies provides the scientific basis necessary to satisfy Secretarial and Congressional mandates. Fundamentally, this report acknowledges that native fish and wildlife species evolved and adapted to the fluvial processes and habitats characteristic of the pre-disturbance Trinity River, and restoring salmonid populations must be founded on rehabilitating and managing fluvial processes that create and maintain habitats vital to anadromous fish.

Subsequent chapters are summarized below:

Chapter 2: Background: Water Management and Fishery Restoration Activities chronicles events leading up to the 1981 Secretarial Decision and subsequent legislative and administrative actions addressing restoration efforts in the Trinity River Basin. The Trinity River Division of the Central Valley Project facilities also are described.

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Chapter 3: Fish and Wildlife Background presents detailed descriptions of the life histories and habitat requirements of Trinity River anadromous salmonids, as well as other fish and semi-aquatic species that live in the Trinity River.

Chapter 4: A Historical Perspective to Guide Future Restoration describes the general physical, hydrological, and biological setting of the Trinity River prior to and after construction of the TRD— specifically, the hydrology, fluvial geomorphology, and riparian communities of the Trinity River. Specific alluvial river attributes that link natural riverine processes necessary to rehabilitate salmonid habitat are presented.

Chapter 5: Study Approaches and Results describes individual studies, conducted as a part of the Flow Evaluation, and other studies, conducted under the Trinity River Restoration Program, that addressed restoration and maintenance of the habitat necessary to the fishery resources of the Trinity River.

Chapter 6: Evaluation of the 1981 Secretarial Decision Volumes evaluates annual instream volumes of 140, 220, 287, and 340 TAF, as identified in the 1981 Decision.

Chapter 7: Restoration Strategy presents the overall strategy necessary to rehabilitate the mainstem Trinity River and restore its fishery resources.

Chapter 8: Recommendations presents recommended flow regimes, sediment, and channel rehabilitation actions necessary to restore and maintain the Trinity River fishery resources. Management objectives and recommendations to achieve these objectives are

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presented. Also included is a recommendation to establish an Adaptive Environmental Assessment and Management program to guide future restoration activities and modify management recommendations.

CHAPTER 2 Background: Water Management and Fishery Restoration Actions

2.1 Authorization, Construction, and Facilities of the Trinity River Division

The Trinity River, located in northwest California, is the largest tributary to the Klamath River (Figure 2.1). Water export and energy generation from the Trinity River were envisioned as early as 1931, when plans for diverting Trinity River water to the Sacramento River were included as part of the California State Water Plan (TRBFWTF, 1977). Plans involving the Trinity River Division were removed from the California State Water Plan in 1945 (USBOR, 1952), but these plans were subsequently adopted and refined by the U.S. Bureau of Reclamation (Reclamation) and the U.S. Army Corps of Engineers.

In 1949, Reclamation released preliminary plans to develop the Trinity River as part of the CVP. In 1953, the Secretary transmitted to Congress the reports and findings of the Department's agencies regarding the proposed plan.

The TRD was authorized by an act of Congress on August 12, 1955, (P.L. 84-386). Section 1 of the 1955 Act provided for the construction, operation, and maintenance of the TRD. Section 2, however, specifically authorized and directed the Secretary to " . . . adopt appropriate measures to insure the preservation and propagation of fish and wildlife[.]" Congress stated that an average annual supply of 704 TAF of water, considered surplus to the present and future needs of the Trinity River Basin, could be exported from the Trinity River Basin to the Central Valley " . . . without detrimental effect on the fishery resources . . . " (H.R. Rep. No. 602, 84th Cong., 1st Sess. 4-5 (1955); S. Rep. No. 1154, 84th Cong., 1st Sess. 5 (1955)). Reclamation completed the Trinity River Division in 1964.

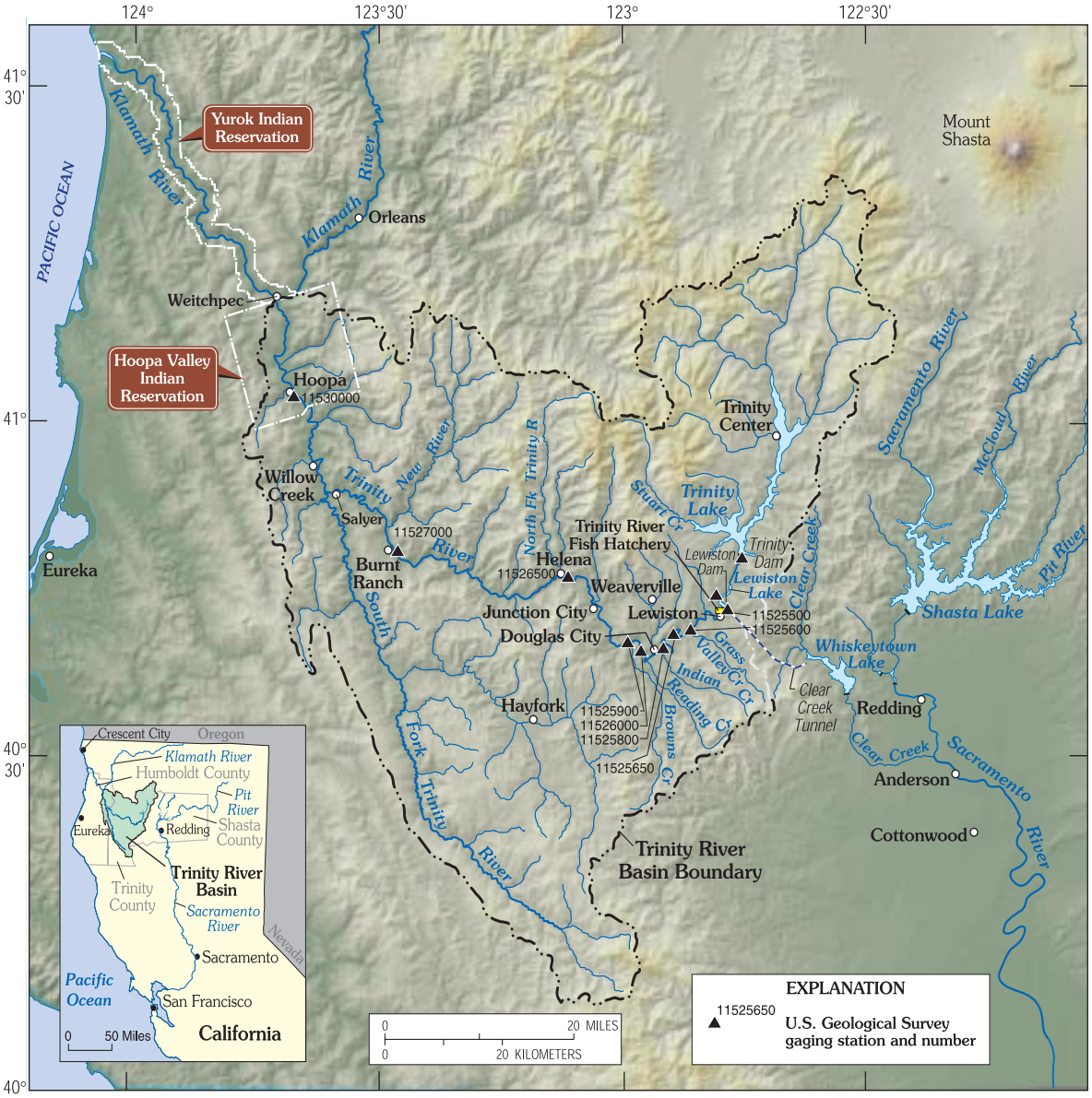

Figure 2.1. The Trinity River Basin and adjacent area in northwestern California.

The Shasta (authorized in 1935 and completed in 1945) and Trinity River Divisions of the Central Valley Project store and transfer water resources of the Trinity and northern Sacramento River basins to the Central Valley (Figure 2.2). Water from the Trinity River Basin is stored, regulated, and diverted through a system of dams, reservoirs, tunnels, and powerplants. The system diverts the water south into Clear Creek, the Sacramento River, and the Central Valley of California. A brief description of pertinent facilities is presented below.

Trinity Dam and Lake: Trinity Dam regulates flows and stores water for various uses. Completed in 1962, Trinity Dam is an earthfill structure 538 feet high with a crest length of 2,450 feet. The dam forms Trinity Lake, which

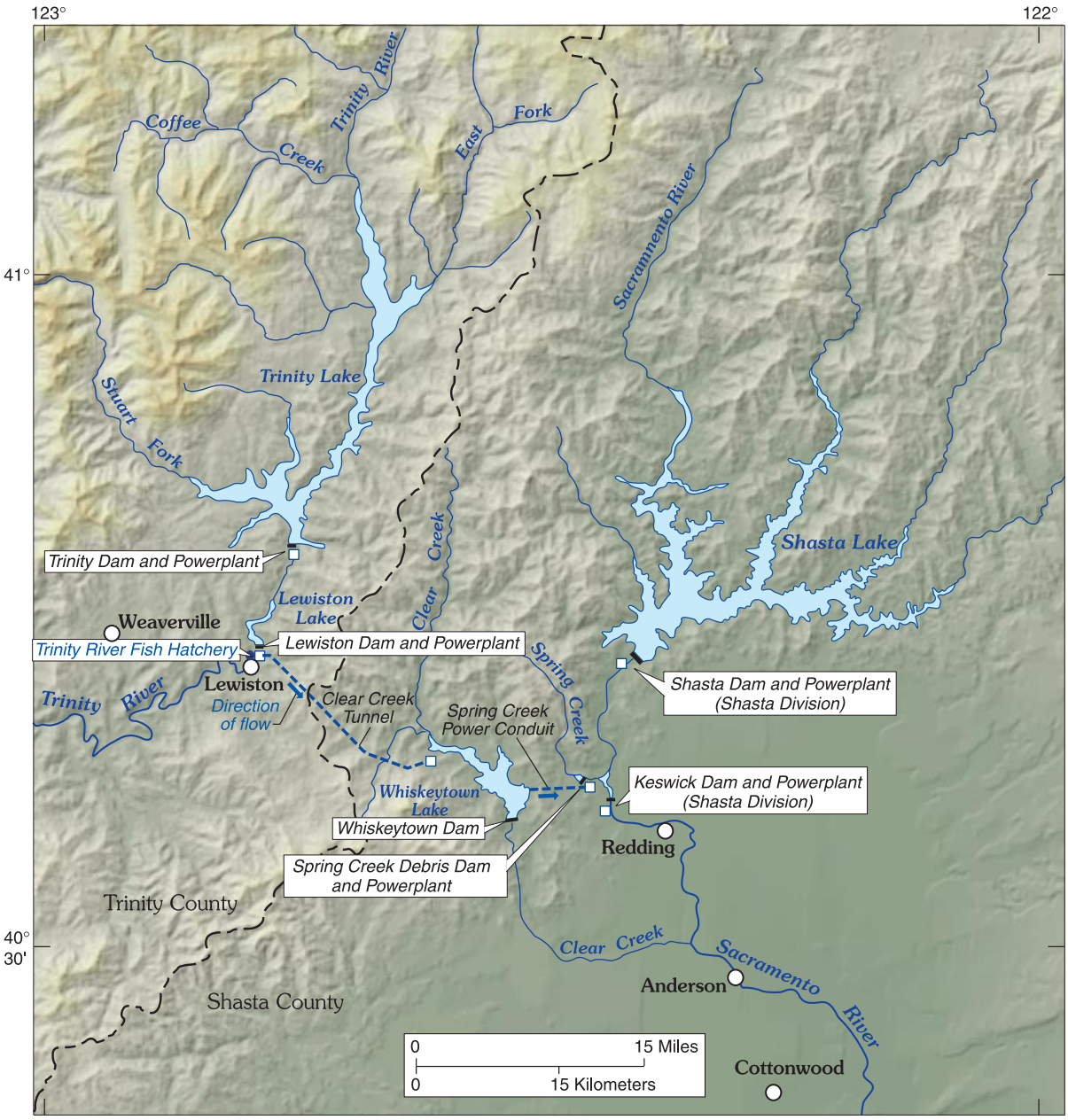

Figure 2.2. Trinity River and Shasta Division of the Central Valley Project.

has a storage capacity of 2,448,000 acre-feet. The lake offers recreation facilities for camping, boating, water skiing, swimming, fishing, and hunting.

Trinity Powerplant: Trinity Powerplant at Trinity Dam has two generators with a total capacity of 105,556 kilowatts (Figure 2.2).

Lewiston Dam and Lake: Lewiston Dam is about 8 miles downstream from Trinity Dam. The dam creates an afterbay to Trinity Powerplant and regulates releases into the Trinity River. Lewiston Dam is an earthfill structure 91 feet high and 754 feet long, forming a reservoir with a storage capacity of 14,660 acre-feet. The trans-basin diversion begins at Lewiston Lake via Clear Creek Tunnel to Whiskeytown Lake.

Lewiston Powerplant: Lewiston Powerplant at Lewiston Dam has one generator with a capacity of 350 kilowatts (Figure 2.2).

Trinity River Fish Hatchery: The Trinity River Fish Hatchery (TRFH), operated by the California Department of Fish and Game (CDFG), has a production capacity of roughly 40 million salmonid eggs. It is located immediately downstream from Lewiston Dam. The hatchery was constructed and operated to help mitigate for lost production from habitats upstream from the TRD.

Clear Creek Tunnel: Clear Creek Tunnel, 17.5 feet in diameter and 10.7 miles long, conveys up to 3,200 cfs from Lewiston Lake to Judge Francis Carr Powerhouse and Whiskeytown Lake. It is the conduit for the trans-basin diversion.

Judge Francis Carr Powerhouse: Judge Francis Carr Powerhouse, on Clear Creek, has two generators with a total capacity of 141,444 kilowatts.

Whiskeytown Dam and Lake: Located on Clear Creek, Whiskeytown Dam stores Clear Creek runoff and diverted Trinity River flows discharged from Judge Francis Carr Powerhouse. The dam is an earthfill structure 282 feet high with a crest length of 4,000 feet. Whiskeytown Lake has a capacity of 241,100 acre-feet and provides recreation facilities for picnicking, camping, swimming, boating, water skiing, fishing, and hunting. The Spring Creek Tunnel diverts water from Whiskeytown Lake to the Spring Creek Powerhouse and Keswick Dam on the Sacramento River.

2.2 Early Operation of TRD

Over the first 10 years of full TRD operations, water years (WY) 1964-1973, 88 percent of the inflow of the Trinity River (averaging annually 1,234 of 1,396 TAF) into Trinity Lake (formerly Clair Engle Reservoir) was diverted into the Sacramento River Basin. Until 1974, Reclamation operated the TRD to release a minimum flow into the Trinity River ranging from 150 to 250 cfs for fishery resource purposes, pursuant to provisions of the 1955 Act. Studies supporting the 1955 Act determined that an annual instream fishery volume of 120.5 TAF was necessary to maintain or improve the fish and wildlife resources (TRBFWTF, 1977). The original release schedule and annual instream volume focused primarily on providing fish habitat for spawning chinook (Moffett and Smith, 1950). Within a decade of the completion of the TRD, salmonid populations had noticeably decreased (Hubbel, 1973).

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2.3 Trinity River Basin Fish and Wildlife Task Force

The decline of the salmon and steelhead populations led to the formation in 1971 of the Trinity River Basin Fish and Wildlife Task Force (TRBFWTF). Members included Federal, State, Tribal, and local agencies. This Task Force developed the Trinity River Basin Comprehensive Action Program (TRBFWTF, 1977) to halt the degradation of fish and wildlife habitat in the Basin and formulate a long-term management program for the Trinity River.

2.4 Increased Flow Regimes in the 1970's

In 1973, the California Department of Fish and Game (CDFG) requested that Reclamation release an annual volume of 315 TAF into the Trinity River to " . . . reverse the steelhead and fall-run king [chinook] salmon declines." (TRBFWTF, 1977). In 1974, CDFG began a 3-year experiment to determine the effects of this increased streamflow on salmon and steelhead populations, but a combination of flood and drought

conditions resulted in the annual instream flows totaling 705 TAF in 1974, 275 TAF in 1975, and 126 TAF in 1976. Since the 3-year experiment could not be completed as designed, no formal evaluation of the flows was made.

In 1978, the Service conducted a microhabitat study investigating the relation between streamflows and anadromous fish habitats in the Trinity River (USFWS, 1980a). The study concluded that substantial gains in fish habitat for specific life stages would be achieved if the annual instream flow regime were raised to 287 TAF. Ultimately, the study concluded that an instream flow regime of 340 TAF would be necessary after a stream restoration program was implemented. The report noted that, in some cases, habitat gains for some life stages would occur at the expense of habitat reduction for other life stages.

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An Environmental Impact Statement (EIS), prepared in 1980, addressed the Department of the Interior's proposal to restore salmon and steelhead populations by increasing streamflows in the Trinity River (USFWS, 1980b). The EIS determined that an 80 percent decline in chinook salmon and a 60 percent decline in steelhead populations had occurred since the commencement of TRD operations. The EIS further estimated the total salmonid habitat loss in the Trinity River Basin to be 80 to 90 percent. The EIS concluded that the fundamental factors causing the decline in fishery resources were insufficient streamflow, streambed sedimentation, and inadequate regulation of fish harvest. While recognizing that full restoration of the fisheries must address each of those factors, the EIS concluded that insufficient streamflow was the most critical limiting factor, and that increased flows would result in immediate improvement in fish habitat and fish runs; thus, an increase in flows was deemed a necessary first step in restoring Trinity River fishery resources.

2.5 Secretarial Decision of 1981

Supported by the 1980 EIS, Secretary Cecil Andrus issued a Secretarial Decision on January 14, 1981, that directed the Service to conduct the Trinity River Flow Evaluation to evaluate the effects on fish habitat by increasing annual instream releases to 140 TAF in critically dry water years, 220 TAF in dry water years, and 340 TAF in normal or wetter water years, and to recommend long-term flow releases. On the same date, the Secretary affirmed an agreement (Appendix B) between the Service and Reclamation (then the Water and Power Resources Service) concerning the flow evaluation. The agreement stated that the Trinity River Flow Evaluation Report would: (1) summarize the effectiveness of flow restoration and other measures, including intensive stream and watershed management programs, in rebuilding Trinity River salmon and steelhead stocks; (2) address the adequacy of habitat at specific instream releases discussed above and the need to maintain, increase, or decrease the 340 TAF flow regime; (3) recommend measures to mitigate fishery habitat impacts attributable to the TRD; and (4) recommend appropriate flows and other measures necessary to better maintain favorable instream habitat conditions.

2.6 Congressional Responses in the 1980's to Declining Fish and Wildlife Resources

One of the first congressional responses to the decline of the Trinity River fishery resources was the enactment of the Trinity River Stream Rectification Act in 1980 (P. L. 96-335) to control sand deposition from the degraded watershed of Grass Valley Creek, a tributary to the Trinity River (Figure 2.1). However, by 1984, Congress had concluded that the reduction in streamflows below Lewiston Dam was a principal cause of the drastic reduction in fish populations.

In 1984, Congress passed the Trinity River Basin Fish and Wildlife Management Act, P. L. 98-541 (1984 Management Act). In this Act, Congress found that the TRD's operations substantially reduced instream flows in the Trinity River, resulting in degraded fish habitat (pools, spawning gravels, and rearing areas) and consequently a drastic reduction in anadromous fish populations. Congress further found that construction of the TRD reservoirs contributed to reductions in the terrestrial wildlife populations historically found in the Basin because habitat was inundated by the reservoirs. Congress also found that factors not related to the TRD, including watershed erosion and fishery harvest management practices, had significantly reduced the Basin's fish and wildlife populations. A similar Act, the Klamath River Basin Conservation Restoration Area Act 16 U.S.C § 460ss et seq.9(P.L. 99-552), was passed in 1986 for the entire Klamath River Basin. This companion Act provided additional authority to the Secretary " . . . to implement a restoration program in cooperation with State and local governments to restore anadromous fish populations to optimum levels in both the Klamath and Trinity River Basins." Id. § 460ss(9).

The 1984 Management Act directed the Secretary to develop a management program to restore fish and wildlife populations in the Basin to levels approximating those that existed immediately before TRD construction began. The Act statutorily established the Trinity River Fish and Wildlife Task Force as an advisory committee to the Secretary. The Act directed the Secretary to use the fish and wildlife management program prepared in 1983 by the prior-existing Task Force to develop a fish and wildlife restoration program (Program). The Act further directed that the Program include efforts aimed toward the rehabilitation of fish habitat in the Trinity River and its tributaries, modernization and increased effectiveness of the TRFH, monitoring of fish and wildlife populations and the effectiveness of rehabilitation work, advising the Pacific Fisheries Management Council (PFMC) on salmon harvest management plans, and "other activities as the Secretary determines to be necessary to achieve the long-term goal of the program."

Congress reauthorized the 1984 Act in 1996 (P.L. 104-143) and, among other things, amended its goal to clarify that the management program is intended to aid in the resumption of fishing activities (recreational, non-tribal commercial, and Tribal) and that restoration will be measured not only by returning salmon and steelhead spawners but also by the ability of dependent Tribal and non-tribal fishers to participate fully in the benefits of restoration through enhanced harvest opportunities. Additionally, the 1984 Management Act was amended to clarify that the TRFH should not impair efforts to restore and maintain naturally reproducing anadromous fish stocks within the Basin.

A major component of the Program has been a watershed rehabilitation program to reduce fine sediment input, primarily decomposed granite, from tributaries of the upper Trinity River below Lewiston Dam (TCRCD and NRCS, 1998). Construction of Buckhorn Debris Dam on Grass Valley Creek in 1990, pursuant to P. L. 96-335, and the purchase and rehabilitation of portions of the Grass Valley Creek watershed in 1993, have assisted in

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the reduction of sand input into the mainstem Trinity River. The Bureau of Land Management (BLM) and the United States Forest Service (USFS) also have undertaken substantial watershed rehabilitation activities to reduce erosion (BLM, 1995).

"Since the implementation of the Program, more restrictive management of commercial, sport, and Tribal fisheries has greatly reduced the harvest impacts on fall chinook from the Klamath Basin (which includes Trinity stock) from the levels that occurred in the late 1970's and early 1980's."

The Program has provided estimates of the annual run sizes of salmonids (spring and fall chinook salmon, coho salmon, and steelhead) in the Trinity River. This information has been used to manage the Klamath Basin fisheries. Since the implementation of the Program, more restrictive management of commercial, sport, and Tribal fisheries has greatly reduced the harvest impacts on fall chinook from the Klamath Basin (which includes Trinity stock) from the levels that occurred in the late 1970's and early 1980's (KRTAT, 1986; PFMC, 1988). These reductions also would have reduced harvest impacts on Trinity River spring chinook salmon stocks. The impacts that ocean fisheries have on Trinity River coho have been greatly reduced since 1994, when ocean fishery management was modified to protect Oregon coastal coho salmon stocks (PFMC, 1995).

2.7 Increased Flow Regimes in the 1990's

Four of the first six years of the Trinity River Flow Evaluation Study were designated as dry water years under criteria established in the 1981 Secretarial Decision, due to drought conditions in California from 1986 through 1990. As a result, the Hoopa Valley Tribe filed an administrative appeal seeking Secretarial intervention to resolve issues pertaining to dry-year flow reductions. In July 1990, the Secretary directed the Service to review Trinity River flows as originally described by the 1981 Secretarial Decision. In January 1991, the Service developed an environmental assessment (EA) tiered to the 1980 EIS that analyzed the environmental impacts of a proposal to provide " . . . at least 340 TAF for each dry or wetter water year and 340 TAF in each critically dry year, if at all possible." This 1991 EA was adopted by the Secretary, and a Finding of No Significant Impact (FONSI) was made (Secretarial Decision on Trinity River Flows, 1991; Appendix C).

2.8 Central Valley Project Improvement Act

In 1992, Congress enacted the Central Valley Project Improvement Act, Title XXXIV of P.L. 102-575 (CVPIA). Among other purposes described in section 3402 of the CVPIA, Congress intended the statute " . . . to protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River Basins . . . " and " . . . to address impacts of the Central Valley Project on fish, wildlife, and associated habitats." The CVPIA includes several provisions related to the TRD such as Section 3406(b)(19) addressing carry-over storage and Section 3406(e)(4) addressing studies evaluating the need for temperature control devices at Trinity Dam and Reservoir. In order to meet the Federal Government's trust responsibility to protect the fishery resources of the Hoopa Valley Tribe, as well as to meet the fishery restoration goals of the 1984 Act, section 3406(b)(23) of the CVPIA directed the Secretary to provide annual instream flow releases into the Trinity River of not less than 340 TAF for the purposes of fishery restoration, propagation, and maintenance pending the completion of the study directed by Secretary Andrus. This section further required that the Trinity River Flow Evaluation Study be completed " . . . in a manner which insures the development of recommendations, based on the best available scientific data, regarding permanent instream fishery flow requirements and Trinity River Division operating criteria and procedures for the restoration and maintenance of the Trinity River fishery."

"In order to meet the Federal Government's trust responsibility to protect the fishery resources of the Hoopa Valley Tribe, as well as to meet the fishery restoration goals of the 1984 Act, section 3406(b)(23) of the CVPIA directed the Secretary to provide annual instream flow releases into the Trinity River of not less than 340 TAF for the purposes of fishery restoration, propagation, and maintenance. . . ."

If both the Secretary and the Hoopa Valley Tribe concur in the recommendations, the Secretary shall implement them accordingly. If the Hoopa Valley Tribe and the Secretary do not concur, then the minimum releases of 340 TAF shall continue unless increased by Congress, by judicial decree, or by an agreement between the Secretary and the Hoopa Valley Tribe.

2.9 Tribal Trust Responsibility

The 1981 Secretarial Decision directed the Trinity River Flow Evaluation Study based on the conclusion that the Secretary's statutory responsibilities, as well as the Federal trust responsibility to the Hoopa Valley and Yurok tribes, " . . . compel restoration of the river's salmon and steelhead resources to pre-project levels." In 1993, the Department of the Interior's Solicitor elaborated on the Federal Government's trust responsibility to the Hoopa Valley and Yurok Tribes (DOI, 1993). The Solicitor stated that the Hoopa Valley and Yurok Tribes' reserved fishing rights include the right to harvest quantities of fish on their reservations sufficient to support a moderate standard of living, and that the Tribes' reserved fishing rights include the right to fish for ceremonial, subsistence, and commercial purposes. Because of the depressed condition of the fishery, the Tribes are entitled, under the Solicitor's Opinion, to 50 percent of the harvest. The Ninth Circuit Court of Appeals concluded that the Federal Government's trust responsibility includes the duty to preserve the Hoopa Valley and Yurok Tribes' fishing rights (Parravano v. Babbitt, 70 F.3d 539, 546-47 (9th Cir. 1995) cert. denied, 116 S.Ct. 2546 (1996)). One of the expected results of the restoration measures recommended in this Trinity River Flow Evaluation Report, including instream flows from the TRD, is to meet the Secretary's trust responsibility to restore and maintain the Tribal fisheries.

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