UPPER SAN JOAQUIN RIVER BASIN STORAGE INVESTIGATION

PRELIMINARY DESCRIPTION OF SURFACE STORAGE OPTIONS

The CALFED ROD recommended that the Upper San Joaquin River Basin Storage Investigation consider enlarging Friant Dam and Millerton Lake or development of an equivalent storage program that would increase available water supplies to support river restoration, improve river water quality, and increase water supply reliability. This paper presents preliminary descriptions of surface storage options being considered. A separate strategy is being developed to assess conjunctive use opportunities consistent with the CALFED Conjunctive Use Integrated Storage Investigation.

Many of the potential surface water storage sites described in this document were identified and evaluated by others over the past several years. Many of the preliminary descriptions were developed from information contained in previous reports and studies conducted for Reclamation, U.S. Army Corps of Engineers (USACOE), California Department of Water Resources, local water agencies, and for the Coalition of the Friant Water Users Association (FWUA) and Natural Resources Defense Council (NRDC) in support of their ongoing efforts to settle litigation. Potential sites for additional surface water storage are listed by major watershed, from north to south. For each potential site, the location, configuration, water sources, and water delivery assumptions are presented. Preliminary engineering studies are under way for these sites to identify the size, cost, and effectiveness of the facilities. Results of engineering studies will be presented in future documentation.

MERCED RIVER WATERSHED

Montgomery Dam and Reservoir (New Reservoir)

- **Location:** Montgomery Dam would be located about 3½ miles north of the town of Snelling on Dry Creek, a tributary that enters the Merced River downstream of Exchequer Dam from the north.

- **Configuration:** The dam would be a zoned earthfill embankment with a height of up to 101 feet above streambed level. At a pool elevation of 325 feet above mean sea level (MSL), the reservoir would store up to 241 thousand acre-feet (TAF) of water. In addition to the main dam, eight saddle dams of various lengths would be required for a reservoir elevation 300 ft MSL or higher.

- **Water Sources:** The reservoir would store natural runoff from Dry Creek and diversions from flood release of Lake McClure via the North Side Canal at Merced Falls Diversion Dam.

- **Water Delivery:** Stored water could be used to supplement existing water supply in the service areas of Merced Irrigation District (MID) and/or the Madera Canal.

    - MID Delivery – The stored water could be released to the modified North Side Canal, which would allow reverse flow to the Merced River, and transferred to the Main Canal of MID through a connecting pipeline beneath the riverbed.

    - Madera Canal Delivery – The delivery to the Main Canal could be further transferred to Medera Canal near Fresno River to supplement or to reduce the delivery from Millerton Lake.

SAN JOAQUIN RIVER WATERSHED

Friant Dam Raise (Millerton Lake Enlargement)

- **Location:** Friant Dam is located on the San Joaquin River, about 20-miles northeast of Fresno, close to the town of Friant. Millerton Lake is created by the impoundment. The existing structure, built in 1945, is a 319-ft high concrete gravity dam.

- **Configuration Changes:** Potential modifications to Friant Dam include a 20-, 60- or 140-foot raise to increase storage.

    - A 20-foot raise would increase the pool elevation to 598 feet and the storage capacity by approximately 105 TAF. This would involve raising the dam crest and modifying the spillway and spillway chute. It would also require construction of an approximately 3,000-foot long dike across a low ridge saddle at the southwest margin of the existing reservoir.

    - A 60-foot raise would entail raising the dam crest and modifying the spillway and spillway chute. Approximately 8,500 ft of new dike would be required for a 60 ft raise.

    - More extensive efforts would be required for a 140-foot raise, which would result in approximately 700 TAF of additional storage capacity.

- **Water Sources:** An enlarge Friant Dam and Millerton Lake would continue to capture flow on the San Joaquin River. Additional storage capacity would provide opportunities to store larger flood volumes than the current reservoir.

- **Water Delivery:** The stored water would continue to be diverted to the Friant-Kern Canal, the Madera Canal, and released to the San Joaquin River.

Fine Gold Dam and Reservoir (New Reservoir)

- **Location:** Fine Gold Creek enters the San Joaquin River in the northeast portion of Millerton Lake. The watershed is approximately 91 square miles.

- **Configuration:** Two storage sizes will be considered at this site.

    - *350-TAF Storage Option* – A 400-foot high roller-compacted concrete (RCC) dam would create a reservoir with a storage capacity of approximately 350 TAF at a maximum pool elevation of 1,000 ft MSL. Hydropower facilities could be included in this option.

    - *50- to 80-TAF Option* – A 220- to 260-foot high dam would result in a reservoir with a storage capacity of 50 to 80 TAF. No hydropower facilities would be included in this option.

- **Water Sources:** The potential sources of water vary by configuration option.
    - *350-TAF Option* – Natural runoff from Fine Gold Creek, diversions from the San Joaquin River near Kerckhoff Reservoir via a tunnel during flood periods, and pumping from Millerton Lake through pump-storage operation.
    - *50- to 80-TAF Option* – Natural runoff from Fine Gold Creek, and diversions from the San Joaquin River near Kerckhoff Reservoir via a tunnel during flood periods.
- **Water Delivery:** The stored water would be released to Millerton Lake and diverted to the Friant-Kern Canal, the Madera Canal, and released to the San Joaquin River. Storage in Fine Gold Creek Reservoir would provide an opportunity to increase available flood storage space in Millerton Lake, which would capture a larger portion of flood flows than the existing reservoir.

Temperance Flat Reservoir (New Reservoir)

- **Location:** Temperance Flat is a wide bowl-shaped area in the upper portion of Millerton Lake. Three potential locations for the dam are considered between Temperance Flat and the confluence with Fine Gold Creek.
    - The downstream site is located at approximately River Mile 274 on the USGS 7.5 minute quadrangle, about 1 mile upstream of the Fine Gold Creek confluence and about 7 miles downstream of Temperance Flat.
    - The middle site is located at approximately River Mile 279, a little under two miles downstream from Temperance Flat. The USGS 7.5 minute topographic quadrangle map shows an old mining prospect very close to this location.
    - The upstream site is located at approximately River Mile 280 on the USGS 7.5 minute quadrangle, a little less than a mile downstream from Temperance Flat.
- **Configuration:** Specific recommendations regarding dam type or associated facilities have not yet been made for these sites. The maximum pool elevation would be approximately 1,100 ft MSL for each of the three sites.
- **Water Source:** Temperance Flat Reservoir would capture the flow of the San Joaquin River before it enters Millerton Lake.
- **Water Delivery:** The operation of Temperance Flat Reservoir would be integrated with storage in Millerton Lake. Water would be released from Temperance Flat to Millerton Lake and diverted to the Friant-Kern Canal, the Madera Canal, and released to the San Joaquin River. Storage in Temperance Flat Reservoir would increase the opportunity to capture a larger portion of flood flows than the existing reservoir.

Kerckhoff Lake Enlargement with New Dam Construction

- **Location:** Kerckhoff Dam, Kerckhoff Lake and powerhouses are owned and operated by Pacific Gas and Electric (PG&E) as parts of the Kerckhoff Project. The project is located upstream of Millerton Lake downstream of the confluence of Willow Creek and the San

Joaquin River. The enlargement involves the construction of a new dam downstream of the existing Kerckhoff Dam, but upstream of Temperance Flat.

- **Configuration Change:** Specific recommendations regarding the potential dam have not yet been made.

- **Water Source:** The additional storage space would be filled by the San Joaquin River flows during flood periods. Because there is no other major water diversions and uses below Kerckhoff Dam, it is also possible to store regular San Joaquin River flows to consider the additional storage as part of the extended Millerton Lake storage.

- **Water Delivery:** The enlarged reservoir could provide additional water delivery in two ways:

- Water could be released from an enlarged Kerchoff Lake to Millerton Lake and diverted to the Friant-Kern Canal, the Madera Canal, and released to the San Joaquin River. Additional storage in Kerchoff Lake would provide an opportunity to increase available flood storage space on the San Joaquin River.

- The enlarged reservoir could also facilitate a diversion of San Joaquin River water to Fine Gold Creek Reservoir while avoiding impacts to power generation of the exiting Kerchoff Project.

Mammoth Pool Reservoir Enlargement with Flood Gate Installation

- **Location:** Mammoth Pool Reservoir is owned and operated by Southern California Edison (SCE) as part of the Big Creek Project. The dam and reservoir are located in the upper San Joaquin River watershed at the confluence of West Fork and San Joaquin River, upstream of Kerchoff Lake.

- **Configuration Change:** Storage expansion improvements include the installation of new gates on the existing spillway. Surcharging the spillway would increase the active storage of the reservoir by approximately 35 TAF.

- **Water Source:** San Joaquin River flows.

- **Water Delivery:** Water could be released from an enlarged Mammoth Pool to the San Joaquin River and re-captured in Millerton Lake. It could them be diverted to the Friant-Kern Canal, the Madera Canal, and released to the San Joaquin River. Additional storage in Mammoth Pool Lake would provide an opportunity to increase available flood storage space on the San Joaquin River.

DRY CREEK WATERSHED

Big Dry Creek Dam and Reservoir

- **Location:** Big Dry Creek Dam and Reservoir is an existing flood control structure operated by the Fresno Metropolitan Flood Control District. The dam is a zoned earthfill embankment that creates a reservoir with a storage capacity of 30 TAF.

- **Configuration Change:** No configuration change to the dam or reservoir would be needed for this option, although a turnout would be required to receive water from the Friant-Kern Canal.

- **Water Source:** The Big Dry Creek Reservoir would be operated as an off-stream storage facility to store water diverted from the Friant-Kern Canal, which passes along the northern shoreline of the reservoir.

- **Water Delivery:** The stored water would be used to supplement or offset the delivery to service areas along the Friant-Kern Canal. The Department of Safety of Dams has indicated that storage of 10 TAF would be allowable from April through September. Due to the flood control obligation of this reservoir, no carryover storage would be allowed.

KINGS RIVER WATERSHED

Pine Flat Dam Raise (Pine Flat Reservoir Enlargement)

- **Location:** Pine Flat Dam is a concrete gravity structure on the Kings River completed by the USACOE in 1954. The existing dam crest is 429 feet high. The gated spillway has a crest elevation of 916.5 ft. A 165 mW power plant operated by Kings River Conservation District (KRCD) is located at the downstream base of the dam on the right side. A PG&E power plant and penstock (Kings Power Plant) is located on the upper margin of Pine Flat Reservoir.

- **Configuration Changes:** Three potential storage increases have been considered at Pine Flat Reservoir.

    - Increase the gross pool elevation by 7 feet by the addition of a 7-foot parapet to the existing dam crest, with no other changes to increase existing gross pool elevation. This change would create 45 TAF of additional reservoir capacity.

    - Two other previously studied options assume that dam raises could be accompanied by other changes that allow gross pool elevation to be increased by eight feet. Under these options, a 7-foot dam raise would result in a 15-foot increase in gross pool elevation, creating 93 TAF of new storage capacity. A 12-foot dam raise would allow a 20-foot increase in gross pool elevation, resulting in 124 TAF of additional storage. The 12 foot dam raise would require extensive concrete on the downstream dam face, as well as flood protection for the upstream PG&E Kings Power Plant.

- **Water Source:** Kings River flow.

- **Water Delivery:** The additional water stored in the enlarged Pine Flat Reservoir could be released to the Friant-Kern Canal to supplement or offset water released from Millerton Lake.

Mill Creek Dam and Reservoir (New Reservoir)

- **Location:** The potential dam on Mill Creek would be located approximately 1.3 miles upstream of its confluence with the Kings River, which is downstream of Pine Flat Reservoir.

- **Configuration:** The dam would consist of a zoned earthfill embankment rising up to 500 feet above streambed level that would store up to 1,000 TAF of water, plus spillway and outlet works.

- **Water Source:** The reservoir would store Mill Creek flows and diversions from Pine Flat Reservoir through a 7,200-ft long, 10-ft diameter tunnel.

- **Water Delivery:** The water stored in Mill Creek Reservoir would be released to the Friant-Kern Canal to supplement or offset water released from Millerton Lake.

Rodgers Crossing Dam and Reservoir (New Reservoir)

- **Location:** The potential dam at Rodgers Crossing would be located on the main stem of the Kings River, approximately one half mile upstream of its confluence with the North Fork.

- **Configuration:** Two options have been studied:

    - One options includes a roller compacted concrete embankment dam up to 660 feet above streambed level, that would create a reservoir up to 950 TAF, plus spillway and outlet works.

    - A smaller dam at the same location would consist of a 400-ft high, 1,660-ft long, thick concrete arch dam with a central gated crest spillway. Normal full reservoir capacity would be about 295 TAF.

- **Water Source:** Kings River flows during flood periods, or regular Kings River flows if the Rogers Crossing Reservoir is jointly operated with the Pine Flat Reservoir.

- **Water Delivery:** The additional water stored in Rogers Crossing Reservoir would be released to the Friant-Kern Canal to supplement or offset water released from Millerton Lake.

Dinkey Creek Dam and Reservoir (New Reservoir)

- **Location:** The potential dam at Dinkey Creek would be located in Sierra National Forest at an elevation of approximately 5,425 ft MSL.

- **Configuration:** Two options have been studied:

    - One dam would be a concrete-faced rockfill embankment up to 395 feet above streambed level that would create a reservoir up to 200 TAF, plus spillway and outlet works.

    - A smaller dam at the same general location would be approximately 340-ft high and 1,600-ft long. It would be constructed as a zoned rockfill dam with the spillway located on the right abutment and associated hydropower facilities. Full reservoir capacity is estimated at 90 TAF. This option would include a 70-ft wide right abutment spillway with discharge bucket, two power plants, a second diversion dam, connecting tunnels, penstocks, and surge tanks. The diversion tunnels together would total 46,000 ft in length. The power plants would each consist of a single generating unit, 26,000kW and 63,000 kW, respectively.

- **Water Source:** Dinkey Creek flows during flood periods, or regular Dinkey Creek flows if the Dinkey Creek Reservoir is jointly operated with the Pine Flat Reservoir.

- **Water Delivery:** The additional water stored in Rogers Crossing Reservoir would be released to the Friant-Kern Canal to supplement or offset water released from Millerton Lake.

KAWEAH RIVER WATERSHED

Terminus Dam Raise (Lake Kaweah Expansion)

- **Location:** Terminus Dam, built in 1962, is a rolled earthfill main dam and auxiliary dam with a crest elevation of 750 ft MSL. The dam forms Lake Kaweah, which has a gross pool of 143 TAF for flood control and irrigation water supply. One 16 mW power plant, installed in 1990 and capable of expansion to 21 mW, is located at the base of the dam at the left toe.

- **Configuration Change:** Several configurations have been proposed and studied:

    - The USACOE evaluated and commenced installation of a fusegate structure within the existing spillway to raise the gross pool level of Lake Kaweah by 21 feet. This will increase storage in Lake Kaweah by 43 TAF. Berms will be constructed to protect some downstream structures.

    - FWUA/NRDC considered 106-, 206-, and 306-ft raise of Terminus Dam, assuming the current 56 feet of freeboard is maintained. The resulting storage increases are approximately 100, 450, and 1,000 TAF. A new dam would be needed for these levels of enlargement.

- **Water Source:** Kaweah River flows during flood periods or currently uncontrolled by the existing facilities.

- **Water Delivery:** The additional water stored in the expanded Lake Kaweah would be released to the Friant-Kern Canal to supplement or offset water released from Millerton Lake.

Dry Creek Dam and Reservoir (New Reservoir, north of Terminus Dam)

- **Location:** The Dry Creek dam would be located approximately 2 miles northwest of Terminus Dam on Dry Creek, a tributary to the Kaweah River downstream of Termnus Dam that enters from the north.

- **Configuration:** The Dry Creek dam would be a 200-foot roller-compacted concrete (RCC) dam with a crest length of approximately 3,210 feet. The resulting reservoir would have a storage capacity of approximately 70 TAF at a gross pool elevation of 684 ft MSL. Gated and ungated outlets works have been evaluated. The gated alternative would enable additional carryover storage of about 10 TAF.

- **Water Source:** Natural runoff of Dry Creek, diversions from Lake Kaweah during flood periods via an interconnecting, concrete-lined, 12-ft diameter, and 7,600-ft long tunnel, and diversions from Friant-Kern Canal for off-stream storage.

- **Water Delivery:** The additional water stored in Dry Creek Reservoir would be released to the Friant-Kern Canal to supplement or offset water released from Millerton Lake.

Dry Creek Dam and Reservoir (New Reservoir, south of Terminus Dam)

- **Location:** The Dry Creek Dam would be located approximately 7 miles southwest of Terminus Dam or approximately 6 miles south of Woodlake Township. The Dry Creek is a tributary to Kaweah River that enters downsteam of Terminus Dam from the south.

- **Configuration:** This potential facility would consist of a new earthfill dam extending to as high as 300 feet, spillway, outlet works, and a 6-mile long, 10-ft diameter diversion tunnel. The gross storage of the Dry Creek Reservoir would be about 444 TAF.

- **Water Source:** Natural runoff of Dry Creek, diversions from Lake Kaweah during flood periods via a 6-mile long, 10-ft diameter long tunnel, and diversions from Friant-Kern Canal for off-stream storage.

- **Water Delivery:** The additional water stored in Dry Creek Reservoir would be released to the Friant-Kern Canal to supplement or offset water released from Millerton Lake.

Yokhol Creek Dam and Reservoir (New Reservoir)

- **Location:** Yokohl Creek Dam would be located approximately 8 miles southwest of Terminus Dam or approximately 7 miles south of Woodlake Township.

- **Configuration Change:** Two options have been studied:

    - **970-TAF Option** – Yokhol Creek Dam would consist of a new zoned earthfill dam extending to a height of 320 feet creating a reservoir with storage capacity of approximately 970 TAF.

    - **450-TAF Option** – A 260-foot high, 12 million cubic yard earthfill dam that would create a 450 TAF reservoir covering a surface area of 4,400 acres. The crest elevation would be 805 ft MSL. Two small saddle dams in the hills west of the damsite would be required.

- **Water Source:** Sources of water vary by configuration option.

    - **970-TAF Option** – Natural runoff of Yokhol Creek, diversions from Lake Kaweah during flood periods via an 8-mile long, 10-ft diameter tunnel, and diversions from Friant-Kern Canal for off-stream storage.

    - **450-TAF Option** – Natural runoff of Yokhol Creek, diversions from Lake Kaweah during flood periods, and water from the Friant-Kern Canal. This option was described initially in a study of the Mid-Valley Canal by USBR.

- **Water Delivery:** Water stored in Yokhol Creek Reservoir would be released to the Friant-Kern Canal to supplement or offset water released from Millerton Lake.

TULE RIVER WATERSHED

Success Dam Raise (Lake Success Enlargement)

- **Location:** The Success Dam is located on the main stem of Tule River about 6 miles east of Porterville. The existing Success Dam is 145 feet high with crest elevation of 691.5 and a gross pool elevation of 652.5 ft MSL. The 8,500-foot long Frazier Dike extends along the northern perimeter of Success Lake has a crest elevation of 690 ft MSL, approximately 38 feet higher than the current maximum pool elevation.

- **Configuration Change:** A potenial enlargement of Lake Success involves raising the dam spillway 10 feet. This would be accomplished by lengthening the spillway by 165 feet and placing a 10-foot high concrete ogee crest weir in the spillway. These modifications would yield an additional 28 TAF of storage capacity.

- **Water Source:** Tule River flows during flood periods or currently unregulated by the existing facilities.

- **Water Delivery:** The additional water stored in the expanded Lake Success would be released to the Friant-Kern Canal to supplement or offset water released from Millerton Lake.

Hungry Hollow Dam and Reservoir (New Reservoir)

- **Location:** Hungry Hollow Dam would be located on Deer Creek, about 3 miles SSW of Success Dam and about 6 miles east of Porterville.

- **Configuration:** Previous study for a dam on Deer Creek at Hungry Hollow considered a zoned earthfill dam extending to a height of up to 267 feet. Storage capacity would be up to 850 TAF. Additional features would be likely to include a spillway, outlet works, and relief wells along the downstream toe of the dam.

- **Water Source:** Natural runoff of Deer Creek, diversions from Lake Success during flood periods via a 3-mile, 10-ft diameter tunnel, and diversions from the Friant-Kern Canal as off-stream storage.

- **Water Delivery:** The additional water stored in the Hungry Hollow Reservoir would be released to the Friant-Kern Canal to supplement or offset water released from Millerton Lake.

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