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May 31, 2019

Via Email and First Class Mail

State Water Resources Control Board
Division of Water Rights
Attn: Mitchell Moody
PO Box 2000
Sacramento, CA 95812-2000
Mitchell.Moody@waterboards.ca.gov

Re: Petitions to Revise Declaration of Fully Appropriated Stream Systems - Kings River System

Dear Mr. Moody:

This letter is sent on behalf of the Kings River Water Association (**KRWA**) and its member units[1], together with the three KRWA member units who filed one of the pending Fully Appropriated Stream (**FAS**) petitions and water rights applications: Alta, Consolidated, and Fresno Irrigation Districts (collectively, the "**Districts**"). The Districts filed their FAS petition solely as a prerequisite to filing their water rights application, which the Districts will pursue only if there is ultimately a determination that Kings River water is available for appropriation. However, there is no reasonable cause to hold a hearing on the two petitions to revise the Kings River FAS designation. The State Water Resources Control Board (**State Water Board**) should reject both pending petitions to revise the Kings River FAS status on the grounds that all Kings River flows are fully appropriated and already held under prior rights, and any flood flows that have historically left the Kings River watershed will be captured and used in the basin under those existing prior rights to comply with the Sustainable Groundwater Management Act (**SGMA**) and to support future growth demands in Fresno, Kings, and Tulare Counties, as the watershed and area of origin of the Kings River.

In addition, revising the FAS designation and processing Semitropic Water Storage District's (**Semitropic**) water rights complaint and water rights application is a waste of time and resources because Semitropic's water availability analysis is based on fundamental misunderstandings of Pine Flat Dam and Kings River operations. Semitropic's water

[1] KRWA is comprised of 28 member units, which are identified on the attached **Exhibit A**.

availability analysis, complaint, and project are all premised on the basic claim that Kings River waters are available for appropriation because flood flows periodically leave the watershed *via the North Fork* of the Kings River. The Semitropic project seeks to obtain a water right to divert these flood flows, however, exclusively *via the South Forth* of the Kings River. What Semitropic fails to consider or even mention is the United States Army Corps of Engineers (**Corps**) Pine Flat Reservoir Regulation Manual, Revised September 1979 (**Manual**), which details operations of Pine Flat Dam and the Kings River system. During extreme events, the Manual directs flood flows that are not absorbed within the North Fork or South Fork by demands of KRWA's member units under senior water rights *first* to the North Fork to avoid risk to life and property in the Tulare Lakebed. A copy of the Manual is attached to **Exhibit B.**

The Manual describes a complex system of determining how the Corps determines when and how flows must be released from Pine Flat Dam for purposes of flood control. In simple terms, the Manual looks at forecasted inflows for the season, forecasted local senior water rights usage (demands), and available vacant storage space within Pine Flat Reservoir and the up-stream reservoirs to determine flood control releases. From that, the Manual guides flood control operations of the Kings River system. That guidance balances the need for flood control while considering then existing channel constraints and the broader context of flood control in the San Joaquin Valley. Once demand has been satisfied, the Manual generally directs the initial flood releases out the North Fork until the capacity of the North Fork is reached, at which time the Corps can, as necessary, direct damaging flows to the South Fork with the stated goal of avoiding entirely or minimizing any flooding to the Tulare Lakebed. These flood protection protocols enacted under federal law are intended to protect life and property in the Kings River watershed, and will not be lessened or altered to accommodate the export of Kings River flows to Kern County. Semitropic ignores this complex process in making its seemingly simple request to the State Water Board for flood water from the South Fork of the Kings River, ironically under the guise of a "flood control project."

Semitropic also overlooks another relatively simple but critical flood control component of the Kings River System; the capacity of the South Fork. Semitropic has prematurely submitted a water availability analysis (**WAA**). The WAA significantly misstates the channel capacities on the South Fork. The South Fork currently has hundreds of cubic feet per second (cfs) less channel capacity than is assumed for the Semitropic's project – never mind the senior water rights holders that use the existing capacity. Semitropic claims flood waters are available for appropriation, but ignores the reality that the water Semitropic claims cannot physically be moved down the South Fork at times when those waters are allegedly available to appropriate. The WAA also erroneously fails to consider the storage rights held by KRWA in Courtright and Wishon Reservoirs (Licenses 11520 and 11522), and also omits the direct diversion right from License 11519. These issues are discussed in more detail below, and are the subject of **Exhibit B**, which is a critique of the WAA performed by a water resources engineering firm.

With these points in mind, State Water Board should deny both pending FAS petitions and Semitropic's pending water rights complaint.[2]

A. FAS Revocation Standard

Water Code section 1205(c) permits any interested person to petition the State Water Board "to revoke or revise the declaration that a stream system is fully appropriated." Regulations adopted by the State Water Board authorize the Chief of the Division of Water Rights to recommend a hearing to consider revision of the FAS Declaration upon a showing of reasonable cause: "The petition shall include hydrologic data, water usage data, or other relevant information based upon which the Chief . . . may determine that reasonable cause exists to conduct a hearing on the question whether the fully appropriated status of the stream system should be revoked or revised." (Cal. Code Regs., tit. 23, § 871(c)(1).)

In reviewing a petition seeking revocation or revision to the FAS Declaration, "the focus of [the Chief of the Division of Water Rights] inquiry . . . is only the relatively narrow task of determining if the evidentiary record supports revising the fully appropriated stream status." (*In Matter of Petitions to Revise Declaration (Santa Ana River)* WR 2000-12, p. 15.) The key issue is whether there exists "changed circumstances" from the conditions present at the time the original FAS Declaration was enacted, and this analysis consists of two elements: (1) the petitioner must show whether the water at issue is "new water," or water that would not have reached the stream at the time the orders were made that support the declaration that the stream is fully appropriated; and (2) the petitioner must show that, if the water is new water, circumstances have changed so that it would have been available for appropriation by new users during the relevant time period without interference, curtailment or injury to prior right holders. (*Draft Order Denying Petition to Revise the Declaration on Fully Appropriated Stream – American River* (2003), p. 16, 22, 28; see also Cal. Code Regs., tit. 23, § 871(b).) Therefore, the appropriate testimony for the hearing must include limitations on water rights holders that existed at the time the decisions were issued that support the FAS Declaration.

California law requires that the State Water Board recognize and protect existing rights before making an unappropriated water finding. (*United States v. State Water Resources Control Board* (*United States*) (1986) 182 Cal.App.3d 82,102-103; (*Meridian, Ltd. v. San Francisco* (*Meridian, Ltd.*) (1939) 13 Cal.2d 424; Wat. Code, § 1375(d).) Any appropriation approved by the State Water Board is subject to the requirement that vested rights and prior existing appropriative rights remain unaffected by such approval. (*United States*, 182 Cal.App.3d at 103; Wat. Code, § 1228.6(a)(1).) Water does not become "unappropriated" unless it "has ceased to be put to some useful or beneficial purpose." (Wat. Code, § 1202(b).)

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[2] The Districts request that the State Water Board maintain on file, and in first priority position, the Districts' pending water rights application. The purpose of this request is to maintain the priority of Kings River Water for use within the Kings River Watershed. (See Wat. Code, § 11460.)

Importantly, it has long been the rule in California that the party claiming there is excess water available for appropriation bears the burden of proving the claim. (*Peabody v. Vallejo (Peabody)* (1935) 2 Cal.2d 351, 381). As the California Supreme Court held in *Peabody*, ". . . when one enters a field of water supply and seeks by appropriation to take water from such supply on the claim that there is more than sufficient for all reasonable beneficial uses by those who have the prior and preferential right, it would seem to comport with the principles of fairness and justice that the appropriator, in whatever way the issue may arise, should have the burden of proving that such excess exists." (*Ibid.*) This rule comports with California Evidence Code section 500, which provides that, "a party has the burden of proof as to each fact the existence or nonexistence of which is essential to the claim for relief or defense that he is asserting." (See also *Barnes v. Hussa* (*Barnes)* (2006) 136 Cal.App.4th 1358, 1366.)

Following the hearing, the Chief may recommend, or decline to recommend, that the State Water Board adopt an order revoking or revising the FAS Declaration. The Chief's recommendation "may be based upon any relevant factor, including but not limited to a change in circumstances from those considered in a previous water right decision determining that no water remains available for appropriation, or upon reasonable cause derived from hydrologic data, water usage data, or other relevant information . . . ." (Cal. Code Regs., tit. 23, § 871(b).)

B. Procedural Posture

KRWA and the Districts take the position that the FAS designation for the Kings River should remain in place and the two petitions dismissed – i.e., status quo. Semitropic takes the position that its FAS petition should be granted. It is Semitropic that is claiming there are flows available for appropriation and, therefore, "changed circumstances" and "reasonable cause" to hold a FAS hearing. As such, Semitropic bears the burden of proving the facts supporting a finding of "changed circumstances" and "reasonable cause" to hold a FAS revocation hearing. (See *Peabody*, supra, at p. 381; Evidence Code section 500; *Barnes*, supra, at p. 1366.)

C. Physical Setting of the Kings River and Flood Flows

The Kings River originates high in the Sierra Nevada and, after flowing through Fresno, Kings and Tulare Counties, historically terminates in Tulare Lake (what is now referred to as the "Tulare Lakebed"). The North Fork, in high flow years, joins the San Joaquin River. The South Fork terminates in the Tulare Lakebed. As measured at the Pine Flat Dam, the Kings River has an average annual flow of approximately 1.7 million acre-feet ("**acre-feet**" or "**af**"), although its year-to-year flows are highly variable. The hydrology of the Kings River has produced flood years, on average, about once every three years. However, several flood years often occur in sequence, with significant below-average water years in between those high flow years.

Pine Flat Dam is a federally-regulated flood control facility authorized for construction by the 1944 Flood Control Act. The purpose of this act was to provide flood protection to the Tulare Lakebed. In conjunction with the construction of Pine Flat Dam the Manual was developed to provide guidance on the operations of Pine Flat and the Kings River. The Manual's guidance regarding the Kings River system balances water deliveries to senior rights holders with the needs for flood control while considering then existing channel constraints and the broader context of flood control in the San Joaquin Valley. Under certain conditions, if a flood release is necessary, the Manual directs initial flows out the North Fork of the Kings River, via the Army/Island Weir Complex and Fresno Slough. Those flows can reach the Delta Mendota Pool and, eventually, the San Joaquin River. In extreme conditions, as necessary, but only after the North Fork is at capacity, the Manual directs damaging flows to the Tulare Lakebed via the South Fork. A visual depiction of these flood control facilities is found in Chart 7 of the Manual. There is significant risk to life and property when flood conditions require flows reaching the Tulare Lakebed, and so it is the policy of the Corps, as set forth in the Manual, "to eliminate or minimize flood flows from Kings River into Tulare Lakebed, without causing flooding along the channels of Kings River North . . . ." (Manual, section 17, objective a.2.)

D. Kings River Water Rights and FAS Declaration

Appropriation of Kings River flows for irrigation and other uses dates back to before California was admitted as a state. (State Water Board Decision 1290, p. 10. [3]) KRWA's member units held riparian and pre-1914 appropriative rights to the historic flows of the Kings River. These entities formed the KRWA in 1927, and later filed applications to appropriate all Kings River flows. Some of these applications are dated as early as 1916. The predecessor agency to the State Water Board issued eight permits for the applications and, ultimately, six licenses were issued to cover all the applications.

Attached as **Exhibit C** is a one-page summary of the Kings River licenses held by the KRWA in trust for its 28 member units: license numbers 11517-11522 (collectively referred to as the "Licenses"). As shown on the summary, the Licenses allow storage of up to 2,169,700 acre-feet annually in Pine Flat and associated auxiliary reservoirs. In addition, the Licenses authorize maximum beneficial use of 3,134,600 acre-feet annually. The Licenses cap the total amount of water diverted from the source at 3,971,200 acre-feet annually. This volume of runoff from the Kings River natural flow has only been exceeded three times since 1895.

As described in Decision 1290, the average annual water supply from the Kings River during the period 1896-1966 was 1,626,526 acre-feet, while the maximum flow year came in 1906 and was 3,958,300 acre-feet. Thus, the Licenses' quantities exceeded the pre-Decision 1290 maximum flow year. This fact was confirmed in Decision 1290, which provides:

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[3] State Water Board Decisions will hereinafter be referred to as "Decision" followed by the number assigned to the decision

> [T]he amounts of water applied for . . . exceed the long-term mean annual runoff . . . and, in addition, include flood flows in order to utilize the entire flow of the Kings River. . . . [I]t must be concluded that the prior major applications which are to be approved will appropriate essentially all of the available unappropriated water of the Kings River." (Decision 1290, pg. 37-38.)

Decision 1290 further provides:

> It is the intention of KRWA to utilize all of the runoff of the river. While this is not possible in years of extreme flood, the association (KRWA) members have planned their overall project to take maximum advantage of all storage facilities available to them. This includes recharge of groundwater and underground storage as well as the storage of floodwaters in Tulare Lake Basin and maximum retention in Pine Flat Reservoir. (Decision 1290, pg. 35.)

Decision 1290 memorialized the understanding that KRWA and its member units may utilize all of the flows of the Kings River through, in part, groundwater recharge and storage projects. This is even more critical today as those member units comply with SGMA and seek to balance their groundwater subbasins over the next 20 years.

Subsequent to Decision 1290, there have been only three years when Kings River flows exceeded the maximum annual diversion/storage cap in the Licenses. Notwithstanding these outlier years (3 years out of a flow record spanning more than 120 years), the State Water Board underwent the Fully Appropriated Stream process, and through that process re-confirmed that the Kings River is fully appropriated. The Kings River is listed as Fully Appropriated year-round in Order WR 89-25, the original FAS Declaration, and the Kings River system remains listed on the most recent FAS Declaration, which was updated with the issuance of State Water Board Orders WR 91-07 and WR 98-08.

E. Federal Regulation for Flood Protection

Federal statutory law and regulations govern flood control regulation associated with the nation's dams and reservoirs constructed with federal funds for purposes including flood control. (See 33 U.S.C., § 700 et seq.; 33 C.F.R., § 208.11.) Pine Flat Dam and Reservoir were constructed pursuant to specific authorization in the Flood Control Act of 1944. (Pub.L. No. 78-534, (1944) 58 Stat. 901.) In pertinent part, the authorizing language provides, "The project for flood control and other purposes for the Kings River and Tulare Lake Basin, California, is hereby authorized substantially in accordance with plans contained in House Document No. 630, Seventy-sixth Congress, third session, with such modifications thereof as in the discretion of the Secretary of War and the Chief of Engineers may be advisable . . . ." (*Ibid.*) The Flood Control Act of 1944 further requires the Secretary of the Army to prescribe regulations for the use of storage allocated to flood control at all reservoirs constructed wholly

or in part with federal funds provided on the basis of that purpose, and also requires that the operation of any such project be in accordance with those regulations. (Flood Control Act of 1944, Pub.L. No. 78-534, (1944) 58 Stat. 887. Regulations subsidiary to the Flood Control Act further require the Secretary of the Army to develop a "water control plan" for the operation of such reservoirs. (33 C.F.R. § 208.11.)

The Manual is the "water control plan" for Pine Flat Dam and Reservoir, and the Kings River. The Corps originally developed the Manual in 1959, and revised it in 1979. Releases from Pine Flat Reservoir are further regulated by numerous downstream diversion structures for purposes of irrigation and flood control. (Manual, p. 16.) Pine Flat is operated for flood control and conservation purposes to achieve four primary objectives:

1. To restrict flows in downstream channels of the Kings River and its distributaries to non-damaging rates;
2. To eliminate or minimize flood flows from Kings River into Tulare Lakebed, without causing flooding along the channels of Kings River North or causing flood damage along San Joaquin River below Mendota Dam over that which would occur under preproject conditions;
3. To assist indirectly in providing flood protection along the San Joaquin River; and
4. To provide the maximum practicable amount of storage space for irrigation water without impairment of the flood-control functions.

(Manual, section 17, p. 15.)

KRWA has permission from the Corps to operate the Army Weir, which controls the bifurcation of flows between the North and South Forks of the Kings River, in accordance with agreements among water users. (Manual, p. 15.) The Army Weir is also the primary diversion structure on the Kings River for purposes of flood control operations. (Manual, p. 16.)

Flood control releases are subject to the Flood Control Diagram contained in the Manual (Chart A-8). Based on forecasted runoff, irrigation demand, and vacant storage space the diagram is used to determine the necessary release from Pine Flat Reservoir at any particular time of year. The diagram is designed to reserve flood control space during the winter season for rain floods and to prepare for spring snowmelt floods. (Manual, p. A-4.). During a flood release, water is first delivered to member units based upon demand. Once demand is satisfied, generally, flood released water is initially directed out the North Fork up to the capacity of the North Fork (set at 4,750 cfs pursuant to Note 2 of the "Use of Diagram" key on Chart A-8), . When the North Fork capacity is reached, damaging flood flows are then, as necessary, sent to the South Fork, which ends up in Tulare Lakebed. (Manual, p. 17.)

Prior to February 1, the Flood Control Manual imposes strict protocol mandating flood releases when Pine Flat storage encroaches on designated flood control space. During this period, when stored water is in the "Flood Control Space," the Manual provides that water is to be released "as rapidly as possible without exceeding 4,750 cfs below Crescent Weir [on

the North Fork] or causing flood flows to Kings River South." (Manual, Chart A-8.) After February 1, the Corps and KRWA have more discretion in when and how to make flood releases, but there is no change to the mandate that flows are routed to the North Fork of the Kings River to prevent flooding of the Tulare Lakebed.

When flood releases are not required—as determined by the diagram—outflows depend on irrigation demand and fishery requirements. KRWA and the then-named California Department of Fish and Game signed an agreement in 1964 establishing minimum releases and rates of change for releases from Pine Flat Reservoir and flows at Centerville Bottoms to benefit fish and wildlife on the Kings River. (Manual, p. 16.) The agreements provide for a minimum release of 25 cfs from Pine Flat Reservoir and for up to 100 cfs at Centerville Bottoms, depending on the time of year and the volume of runoff during the previous water year. (Flood Control Manual, Chart 17.) The minimum flow requirements noted in the Manual have been superseded by the 1999 Kings River Fisheries Program Framework Agreement executed between California Department of Fish and Game, Kings River Conservation District and the KRWA. That agreement: established a temperature control pool for Pine Flat Reservoir of 100,000 acre-feet; set year around minimum flow requirements of 100 cfs in all years; set minimum flow requirement of 250 cfs in the wettest quartile of years; established a number of downstream flow requirements; established a capital contribution to the program; and established a number of management objectives for the reservoir and various river reaches. The Manual further states that, with a few exceptions, "virtually all use of Kings River water [for irrigation] between Piedra [located just below Pine Flat Lake] and Mendota [located at the confluence of the North Fork of the Kings River and the San Joaquin River] is being administered by the Kings River Water Association." (Manual, p. 24.) Irrigation releases are based on day-to-day requests made to the Kings River Watermaster. (Manual, p. A-4.)

Any releases in excess of irrigation demands are restricted to channel capacities or as otherwise determined by the Corps. Releases of flood water to Tulare Lake are delayed as long as possible to permit harvesting of crops, and flows in the North Fork are restricted when they would cause San Joaquin River flows to exceed pre-project quantities. (Manual, p. A-2).

Once a flood release is deemed necessary, the Corps takes over control of Pine Flat Reservoir and the Kings River. The KRWA works closely with the Corps to aid in administering the river on its behalf. In summary, there are established requirements in the Manual that divest KRWA of discretion in making flood releases. The rate and direction of diversion of flood waters is explicitly detailed in the Manual diagram, and additional agreements among water users determine outflows for irrigation and fish and wildlife.

F. There Is No Reasonable Cause Justifying a Hearing on the Petitions

There is no reasonable cause to hold a hearing on the petitions, nor changed conditions on the Kings River demonstrating the presence of water available for appropriation.

1. The Proposed Semitropic Project Conflicts with the Manual Approved Under Federal Flood Control Law

Article VI, clause 2 of the U.S. Constitution is the Supremacy Clause, which provides that Congress has the power to preempt state law. (See *Crosby v. Nat'l Foreign Trade Council* (*Crosby*) (2000) 530, U.S. 363, 372.) For reservoir/dam projects built with federal funding and for flood control purposes, such as Pine Flat Dam and Reservoir, Congress has preempted state law with an extensive statutory/regulatory scheme. (See 35 U.S.C., § 700 et seq.; 33 C.F.R., §208.11.) Federal law specifically requires the Corps to develop flood control and navigation regulations for these federal projects. (35 U.S.C., § 709.) The Corps has published regulations addressing the subject and authorizing flood control pursuant to "water control plans." (33 C.F.R., §208.11.) The Manual governing Pine Flat and the Kings River is a "water control plan."

Semitropic's FAS petition, water rights application, water availability analysis and water rights complaint filed with the State Water Board are all in support of a water supply project called the "Tulare Lake Storage and Flood Control Project" (**Semitropic Project**). In addition to the aforementioned filings with the State Water Board, Semitropic has also submitted a detailed grant application to the California Water Commission in an attempt to secure $452,000,000 for the Semitropic Project. The California Water Commission denied Semitropic's grant application in its entirety, but project documentation remains available on the Water Commission's website: https://cwc.ca.gov/pages/WSIP.aspx. The State Water Board submitted a November 13, 2017 comment letter that raised concerns regarding the lack of underlying water rights for the Semitropic Project.

Semitropic is attempting to prove that water for its project is available to appropriate from the *South Fork* of the Kings River because federally directed flood flows occur on the *North Fork* of the river. To protect life and property, damaging flood flows that are not absorbed within the North Fork or South Fork by KRWA's member units are directed first to the North Fork as provided in the Manual. The Manual sets forth clear objectives to protect the South Fork and Tulare Lakebed from flooding conditions. **Thus, Semitropic is petitioning the State Water Board to revoke the FAS designation and issue a water right permit/license to force more floodwater flow down the South Fork, and less water flow to the North Fork without even considering the Manual's rules or how the Kings River is operated under the Manual.**

Simply put, the State Water Board cannot issue a water right permit/license that conflicts with the flood control procedures set forth in the Manual – or any other flood control actions authorized by the Corps. Any such permit/license would be null and void. Without the authority to re-route flood flows from the North Fork to the South Fork, there is no water source for the Semitropic Project. As such, there is no reasonable cause to revoke the Kings River FAS designation for the processing of Semitropic's pointless water right application.

2. Semitropic's Water Availability Analysis Contains Significant Errors and Fails to Address Both the Federally-Mandated Flood Control Operations and the South Fork Channel Capacity Limitations

Semitropic's WAA purports to compare the historic Kings River flows with existing rights, and erroneously concludes that water was available in 18 of the 63 years studied, with an average amount available in those years of 18,506 af. **Exhibit B** to this letter is an analysis of Semitropic's WAA performed by water resources engineers Nicholas Bonsignore and Vincent Maples at Wagner & Bonsignore. As set forth therein, the Semitropic WAA is factually inaccurate and wholly ignores the real-world limitations imposed by the Corps' flood control operations and South Fork channel capacity limitations. Following is a summary of the errors and omissions from the Semitropic WAA, and full details/analysis are found in **Exhibit B**.

The vast majority of the existing water rights on the Kings River are accounted for in the six licenses held in trust by KRWA. Semitropic's WAA *omitted large quantity water rights in three of the six licenses*. In this regard, Semitropic's WAA failed to consider:

License 11520, which is the storage right in Wishon reservoir (located upstream of Pine Flat Lake), and allows for an annual storage of 128,600 af;

License 11522, which is the storage right in Courtright reservoir (also located upstream of Pine Flat), and allows for an annual storage of 123,000 af; and

The Pine Flat direct diversion right from License 11519, which allows for use of 3,059 cfs during the period May 1 through July 31.

When correcting for these major errors and making other minor adjustments, and assuming the same WAA methodology used by Semitropic, the Wagner & Bonsignore analysis found that the Semitropic WAA should have found available water only in 5 of the 63 years, with an average amount available in those years of 5,393 acre-feet. Thus, when the Semitropic methodology is correctly applied, there is more than a 70% reduction in the years and quantities of water available. The Wagner & Bonsignore analysis points out that the Semitropic WAA totally ignores the federally mandated flood control operations that direct damaging flood water away from the South Fork points of diversion identified in Semitropic's water rights application. Amazingly, the Semitropic WAA *assumes* available South Fork channel capacity of 2,200 cfs. In fact, channel capacity on the South Fork is approximately 1,400 cfs[4], and most or all of this capacity is used by existing water rights holders during most conditions to meet actual demand of those senior water rights holders. It is not an exaggeration to say that a Semitropic diversion at 2,200 cfs is literally impossible on the South Fork of the Kings River. Ironically, Semitropic bills its project as a flood control

[4] See May 29, 2019 letter from Kings River Conservation District, p. 2, attached as **Exhibit F**.

project. Nothing could be further from the truth. The project's facilities rely on water being pumped into the project for conveyance and storage. One operational hiccup, such as a power system or pump failure, would divert water into Tulare Lakebed conveyance facilities, which would overwhelm them and result in flooding and major property damage.

In summary, and as explained in more detail in **Exhibit B** to this letter, the Semitropic WAA lacks credibility and fails to demonstrate "reasonable cause" upon which to hold a hearing on the FAS petition.

3. Subbasins Within the Kings River Service Area are Critically Overdrafted and Kings River Flood Flows Will Be Used to Meet SGMA Mandates in the Kings River Watershed – Fresno, Kings and Tulare Counties

The Kings River Service Area covers portions of Fresno, Kings and Tulare Counties; and also covers all or portions of three subbasins pursuant to Bulletin 118, Kings (5-22.08), Tulare Lake (5-22.12), and Delta-Mendota (5-22.07), all of which have been declared by the Department of Water Resources as critically overdrafted and have been ranked a "high" priority basin. Based on Bulletin 118 alone, the demand for all of the waters of the Kings River has been objectively proven. Indeed, ***Bulletin 118 demonstrates that not enough waters exist in the Kings and Tulare Lake subbasins to comply with SGMA***. Improvements to inflow forecasting techniques and optimization of senior water rights to meet changing demands and compliance with SGMA have significantly reduced recent flood flows leaving the Kings River watershed and will drastically reduce any future flood flows. It is therefore patently false to suggest there are unappropriated waters available on the Kings River. (See Decision 906, where the Board found despite no attempt being made to determine the quantity of Kings River water diverted to Tulare Lake Basin, none was necessary in view of the ground-water overdrafts as stated in Bulletin 2 and the importation of water to the area from the Friant-Kern Canal.)[5]

Decision 1290 was adopted in 1967 and explicitly acknowledged occasional flood events on the Kings River. (Decision 1290, p. 35.) Nevertheless, Decision 1290 determined the Kings River was fully appropriated. This decision has been considered by the State Water Board on two subsequent occasions, and both times upheld. (State Water Board Orders WR 91-07 and WR 98-08.)

Although there are no "changed circumstances" that support revoking the Kings River FAS designation, there are circumstances bolstering the FAS designation. Specifically, the mandates of SGMA in Fresno, Kings and Tulare Counties will require full utilization of the

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[5] "No attempt has been made here to determine the quantity of Kings River water divert to Tulare Lake Basin. However, in view of the ground-water overdrafts as stated in Bulletin 2 and the importation of water to the area from the Friant-Kern Canal, it may be assumed that all Kings River water diverted southward toward Tulare Lake Basin is beneficially used." (P. Decision 906, p. 6)

entire yield of the Kings River, including flood flows, which is held under license by KRWA. Fresno, Kings, and Tulare Counties overlie and rely on groundwater basins subject to SGMA: the Kings Subasin, Tulare Lake Subbasin, and portions of the Delta-Mendota Subbasin. Attached hereto as **Exhibit D** is a technical memorandum summarizing the SGMA agencies, issues and potential water recharge project locations within these subbasins.

Within the three-county Kings River watershed there are seven GSAs in the Kings Subbasin, six GSAs in the Tulare Lake Subbasin, and one GSA in the Delta-Mendota Subbasin. **Exhibit D** to this letter summarizes each of these GSAs, including participating agencies, acreage, and location. These GSAs have seen declared "critically overdrafted" and ranked "high" priority by the Department of Water Resources. Hydrologic engineering analysis indicates an annual regional groundwater overdraft of over 120,000 af in the Kings Subbasin and another 100,000 af in the Tulare Lake Subbasin.[6] Depriving the Kings River Watershed of access to all Kings River water will only exacerbate overdraft conditions and make it nearly impossible for GSAs to achieve sustainability goals and avoid undesirable results.

Again, the GSA planning process is new, but there are already many groundwater banking projects being planned. Some of these projects are identified in the Districts' water right application that was submitted along with the FAS petition, while others will emerge in future planning. (See **Exhibit E** to this letter, which is a list of groundwater banking/recharge projects identified in the Districts' water right application.) **Exhibit D** to this letter has a map showing the locations of future banking/recharge projects. (See Figure 2 to Exhibit D.) The Districts currently participate in the Kings Basin Water Authority (IRWP) process that has developed new water storage/banking facilities via successful grant applications under Propositions 13, 50, and 84. The Kings River water users have demonstrated their abilities to fund and develop groundwater storage/recharge projects, and intend to capture and store all Kings River flows in an effort to meet groundwater sustainability goals, and to help with water supply for regional growth.

Semitropic's Project seeks to capture and use the same Kings River waters that the KRWA's member units must rely on for SGMA compliance and regional growth. In support of its petition, Semitropic points to the fact that Kings River waters have left the system during major flood events. As explicitly stated in Decision 1290, historically, it has not been possible for KRWA's member units to capture all flood flows; however, the KRWA's member units and the regional GSAs must capture and use **all Kings River water, including flood flows** to comply with SGMA. Additionally, allowing Semitropic to export Kings River water would have direct negative impacts on the 16 Disadvantaged Communities and 24 Severely Disadvantaged Communities located within the Kings Subbasin and Tulare Lake Subbasin. (See Exhibit D, p. 8.)

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[6] See **Exhibit D**, Technical Memorandum authored by Provost & Pritchard engineer Kevin R. Johansen (Technical Memorandum), p. 2.

The State Water Board should recognize and protect the holders of water users having prior and paramount rights to all of the Kings River waters for use in compliance with statutorily mandated SGMA programming. In Decision 1290, the Board quotes *Meridian, Ltd. v. San Francisco*, which indicates that the State Water Board, like a court, has the obligation to protect those holders of prior water rights:

> It should be the first concern of the court in any case pending before it and of the [Board] in the exercise of its powers under the act to recognize and protect the interest of those who have prior and paramount rights to the use of the waters of the stream. (*Meridian, Ltd.* at p. 424.)

The State Water Board has applied similar logic to limit diversions of water where they would impact an overdrafted groundwater basin that is hydrologically connected with the relevant surface stream. In Order WR 2006-0001, the State Water Board issued a cease and desist order to, and imposed administrative civil liability on, Lake Arrowhead Community Services District for diverting water in excess of the district's pre-1914 appropriative right in Lake Arrowhead. The Board held that: (1) the original pre-1914 consumptive right was limited to 1,566 acre-feet per year; and (2) the district's water use above that amount could not be authorized as a change in a separate pre-1914 non-consumptive, recreational right, partly because the downstream Mojave groundwater basin had been in overdraft since the 1950s and the change in the non-consumptive right would have injured the groundwater users in that basin. (Order WR 2006-0001, pp. 10, 18.)

The logic of Order WR 2006-0001's reliance on injury to groundwater users in a hydrologically connected and overdrafted basin in rejecting a change to an *existing* appropriative right applies even more forcefully here. Semitropic seeks to establish that there is water available for a *new* appropriative right to export water to a basin that is not hydrologically connected to the proposed source stream. That water, however, is one of the sources of recharge on which groundwater users rely in overdrafted basins along the Kings River. Under the principle stated in Order WR 2006-0001, that water is not available for the sort of appropriation that Semitropic proposes.

By exporting water from critically overdrafted groundwater basins, Semitropic's project would severely impact already critically overdrafted basins ranked as high priority by the Department of Water Resources. If any floods flows are found to be available for appropriation and exported out of the Kings River watershed, then conditions of the subbasins will only be exacerbated to the detriment of disadvantaged communities, residents, and landowners. Without retaining already appropriated Kings River floodwaters in the Kings River watershed for surface water deliveries and groundwater recharge within the basin, agricultural lands will have to be fallowed, city growth will be curtailed or altogether suspended, water supplies will be rationed, and the quality of life in Fresno, Kings and Tulare Counties will be irreversibly and negatively impacted.

4. Semitropic's Claims That KRWA Is Underutilizing Storage and Use of Water in the Tulare Lakebed is Factually False and a Red Herring

Semitropic's assertion that waters have not been put to reasonable and beneficial use within the Kings River Service Area is without merit. In various filings Semitropic alleges that KRWA is not making full beneficial use of its water rights because water is only infrequently stored in the Tulare Lakebed. This argument is a complete red herring, and fails to account for flood control operations at Pine Flat and regionally, which operations *are mandated by the Corps*. The argument also ignores the beneficial use of floodwaters by non-KRWA water users who receive flood flows via Fresno Slough and downstream in and near the Delta Mendota Pool. While it is true that flood control operations on the Kings River have managed to avoid flooding of productive farmland in the Tulare Lakebed in all but the most extreme flood events, when occasional flood flows do occur in the Lakebed, they are either directly used or stored and then used for in-lieu recharge. To suggest these waters will suddenly be available for appropriation to a different watershed, different county and different subbasin, will only exacerbate the critically overdrafted subbasins underlying the Kings River Service Area. Finally, it is important to note that the quantities allowed for storage and direct diversion under the two Tulare lakebed licenses (11517 and 11521) were determined based on the actual amounts that reached the Lakebed in 1969.

5. Semitropic's Petition and Application Contravene Area of Origin Law and Policy

Revoking the FAS to allow for export of Kings River flows would violate Water Code sections 11460 and 11463 by utilizing State Water Project facilities to export water that is necessary to meet beneficial needs within the watershed of origin. Semitropic seeks to revoke the FAS designation in order to process an application for a flawed project to appropriate Kings River waters and transfer those waters via the California Aqueduct. Doing so would deprive water users within the watershed of origin of water "reasonably required to adequately supply the beneficial needs," and is, therefore, prohibited under Water Code section 11460.

The California Legislature has repeatedly articulated a clear statewide policy that regions in which water originates should have a priority to that water as against those who would export it for use elsewhere. Consistent with this longstanding State policy, Kings River water should be used in the Kings River watershed before it is exported to areas that provide no benefit to the counties served by the Kings River. Semitropic seeks to revise the Kings River FAS for a project that would take water from a State-declared critically overdrafted basin and use such waters on lands wholly outside the watershed of origin. The precedent set by allowing Semitropic to violate the principal of "local water for local needs" would have wide-ranging implications well beyond the Kings River service area. As discussed above, the fully appropriated water resources of the Kings River are vital and necessary for regional compliance with SGMA. Any benefits to Semitropic from its project will be at the expense of every person within the Kings River watershed of origin, which includes the Districts.

6. Tulare Lake Basin Water Storage District Opposes the Project

Semitropic asserts in its water rights application that, in regards to a right of access, it believes Tulare Lake Basin Water Storage District (**TLBWSD**) owns or administers points of diversion upstream of the lands to which Semitropic holds easements and licenses and is "confident it will obtain the necessary consent" needed from TLBWSD for the right of access necessary for the project. TLBWSD **opposes** the Semitropic project in its entirety and will not consent to any requests from Semitropic for the proposed project, including improvements to the Empire No. 2 structure.

G. Conclusion

There is no Kings River water available for appropriation. The Semitropic Project is predicated on the false premise that Semitropic can obtain a water right compelling the Corps to fundamentally alter its Manual and redirect tens/hundreds of thousands of af of flood flow to the South Fork for the benefit of Semitropic (and to the detriment of life and property in the three counties). Semitropic has not and will not receive the consent of local agencies to complete the project. Proceeding with a FAS hearing is a waste of time and money for all involved. KRWA and the Districts encourage the State Water Board not to promote the transfer of resources from critically overdrafted areas in an attempt to alleviate overdraft conditions in neighboring, non-hydraulically connected subbasins. The State Water Board should determine that no reasonable cause exists to conduct a hearing on the question of the whether to revoke the Kings River FAS Declaration.

Very truly yours,

SOMACH SIMMONS & DUNN

By: _____

Nicholas A. Jacobs
Attorneys for Alta Irrigation District,
Consolidated Irrigation District, and
Fresno Irrigation District

KINGS RIVER WATER ASSOCIATION

By: _____

Joseph Hughes, General Counsel

cc: Amanda Montgomery, Mitchell Moody, Matt McCarthy and Samantha Olson

EXHIBIT A

KRWA Member Units

Alta Irrigation District
Burrel Ditch Company
Clark's Fork Reclamation District #2069
Consolidated Irrigation District
Corcoran Irrigation Company
Crescent Canal Company
Empire West Side Irrigation District
Fresno Irrigation District
James Irrigation District
John Heinlen Mutual Water Company
Kings River Water District
Laguna Irrigation District
Last Chance Water Ditch Company
Lemoore Canal & Irrigation Company
Liberty Canal Company
Liberty Mill Race Company
Lovelace Water Corporation
Peoples Ditch Company
Reed Ditch Company
Riverdale Irrigation District
Southeast Lake Water Company
Stinson Canal & Irrigation Company
Stratford Irrigation District
Tranquillity Irrigation District
Tulare Lake Basin Water Storage District
Tulare Lake Canal Company
Tulare Lake Reclamation District #761
Upper San Jose Water Company

EXHIBIT B

Wagner Bonsignore
Consulting Civil Engineers, A Corporation

Nicholas F. Bonsignore, P.E.
Robert C. Wagner, P.E.
Paula J. Whealen
David H. Peterson, CEG, CHG
David P. Lounsbury, P.E.
Vincent Maples, P.E.
Patrick W. Ervin, P.E.
Martin Berber, P.E.
Ryan E. Stolfus

James C. Hanson, P.E.
Henry S. Matsunaga

TECHNICAL MEMORANDUM

To: Kings River Water Association, Consolidated Irrigation District, Fresno Irrigation District, and Alta Irrigation District

From: Nicholas F. Bonsignore, P.E. and Vincent Maples, P.E.

Date: May 29, 2019

Re: **Comments on Water Availability Analysis for Water Right Application 32815 of Semitropic Improvement District**

This Memorandum discusses our review of the water availability analysis (WAA) prepared by West Yost Associates for water right Application 32815 (A032815) of Semitropic Improvement District (SID)[1], as well as certain operational and physical constraints in the Kings River system related to management of flood flows that are relevant to determining whether any actual flows may be available for appropriation at SID's proposed points of diversion.

As used in this Memorandum, the term "water available for appropriation" means water that would be available to SID under Application 32815 after considering senior water rights on the Kings River system. It is noted that the SID WAA did not consider pending Application 32810, filed by Consolidated Irrigation District, Fresno Irrigation District, and Alta Irrigation District, to be a senior right.

The SID WAA evaluated flows for Water Years 1955 through 2017, and concluded that over the 63-year study period water would be available for appropriation in 18 years, with a 63-year average of 18,506 acre-feet. The SID WAA further concluded that the amount of water available for appropriation annually in those 18 years ranged from 353 acre-feet to 244,890 acre-feet.

The SID WAA did not include the calculations underlying the results. We therefore attempted to recreate those calculations based on the description of the methodology in the text of the WAA and review of Attachment A to the WAA, which provides a reckoning of water availability at several "points of analysis" within the Kings River system. We concluded that the

[1] Technical Memorandum to State Water Resources Control Board, Division of Water Rights Staff dated May 18, 2018, by West Yost Associates.

SID WAA is flawed, and this led to our preparation of an "Alternative Analysis". The Alternative Analysis is based on the methodology that was described in the SID WAA, but modified to address its shortcomings, including consideration of Kings River Water Association (KRWA) water right licenses that were inadvertently omitted from the SID WAA and exclusion of river losses from the analysis (to avoid double counting). In addition, we prepared a variation of the Alternative Analysis that considers channel capacity limitations in the South Fork Kings River that affect the actual occurrence of flow at SID's points of diversion.

SUMMARY OF SID WAA METHODOLOGY

The SID WAA describes the methodology used for determining water available based on computed historic daily natural flows for the Kings River at Piedra, downstream of Pine Flat Dam. Calculated pre-project flows (natural flow) at Piedra were obtained from annual reports of the Kings River Watermaster. The SID WAA states that daily unimpaired flows (natural flow) were compared to diversion limits for senior water rights, including six KRWA water right licenses and 41 Statements of Water Diversion and Use (Statements) held by other users for diversions under other claims of right. The SID WAA further states, "River losses were included, to estimate unimpaired flow at the points of analysis, using river loss data presented in the KRWA Water Master Reports for each year analyzed."

Attachment A to the SID WAA shows that for each year evaluated, water was deducted from daily Piedra flows in the following order: river losses; diversions by other users (Statements); License 11517 (A000353); Licenses 11518 (A000360) and 11519 (A005640); and License 11521 (A015231). Absent from Attachment A is any mention of diversions under KRWA License 11520 (A010979) for Wishon Reservoir and License 11522 (A016469) for Courtright Reservoir; this is a serious omission that significantly skewed the SID WAA. After deducting river losses and diversions under senior water rights, the portion of the remaining daily "Unimpaired Flow (Supply)" available to SID was calculated based on a diversion rate of 2,200 cfs (the rate requested in A032815).

The SID WAA 1) mischaracterizes "losses" reported in the Kings River Watermaster reports, 2) apparently fails to consider direct diversions under KRWA's License 11519 for Pine Flat, and 3) fails to consider effects on water supply resulting from diversions under License 11520 for Wishon Reservoir and License 11522 for Courtright Reservoir. These issues are discussed below.

River Losses

It is not clear how the monthly loss values set forth in the Watermaster reports were converted to a daily value and incorporated into the SID WAA. Additionally, the annual Watermaster reports indicate that river losses are computed by subtracting KRWA member unit diversions from flow at a given point and comparing to measured downstream flow, with the difference between upstream flow less member diversions and measured downstream flow being reckoned as "losses". As such, all diversions under the Statements are part of the "loss" calculated

in the Watermaster reports, and, therefore, the value of losses taken from the Watermaster reports should not be counted against the available flow as a separate additional reduction of available flow.

Omission of Direct Diversions under License 11519

License 11519 allows for the collection of up to 355,200 acre-feet by storage in Pine Flat Reservoir from September 1 of each year to July 31 of the succeeding year, and direct diversion of 3,059 cfs from May 1 to July 31. The maximum combined authorized diversion under Licenses 11518 and 11519, whether by storage or direct diversion, is 2,786,000 acre-feet per year.

In attempting to recreate the SID WAA calculations, we observed that the results of daily calculations we prepared came very close to matching those in Appendix A of the SID WAA when direct diversion under License 11519 was not counted. This suggests that the SID WAA calculations neglected to consider direct diversion under License 11519. This omission apparently contributed to significant overestimation of the occasional flows in excess of existing rights.

Omission of Diversions under KRWA's Licenses for Wishon and Courtright Reservoirs

The SID WAA relies on pre-project Piedra flows as reported by the Watermaster. Pre-project Piedra flows are defined in each annual Watermaster report, and, while there have been minor changes in wording over the years, the definition on page I-21 in the 2004-2005 Watermaster report succinctly defines it as follows:

> *"PRE-PROJECT PIEDRA: This is the total flow of the Kings River at Piedra as it would have occurred in a state of nature without interference by Pacific Gas and Electric power reservoirs and/or Pine Flat Reservoir. It is determined to be the sum of the inflow above Pine Flat Dam and the flows of Mill Creek and Hughes Creek."*

The 2004-2005 Watermaster Report, on page I-23, goes on to explain that the "net change in Pacific Gas and Electric Company's upstream storage (plus or minus)" is included in the calculation of Pre-Project Piedra.

Diversions under water rights associated with Wishon Reservoir (License 11520) and Courtright Reservoir (License 11522) are not included in Attachment A of the SID WAA, and the text offers no explanation for the omission of these rights from the analysis. Wishon and Courtright reservoirs are located upstream of Piedra, and the effects of these reservoirs have been accounted for by the Watermaster to derive pre-project Piedra flows, i.e. natural flows. Diversions at these reservoirs should have been considered in the SID WAA, similar to how diversions under KRWA Pine Flat Lake rights were included (though apparently only partially included). Based on the maximum allowed diversion to storage amounts under each right (128,000 acre-feet for Wishon and 102,500 acre-feet for Courtright), omission of these rights from the SID WAA results in undercounting senior diversions by up to 230,500 acre-feet annually and apparently contributed to overestimation of the occasional flows in excess of existing rights.

SUMMARY OF ALTERNATIVE ANALYSIS

The Alterative Analysis used the same basic methodology set forth in the SID WAA. Assumptions and modifications to the SID WAA methodology are explained below.

1. The SID WAA accounted for losses as described above. As discussed earlier herein, we disagree with how the SID WAA quantified losses. The fact that losses were somehow included in the analysis could account for some relatively minor discrepancies between the SID WAA results and our attempt to recreate the daily flow calculations.

   We did not attempt to account for losses in the Alternative Analysis because losses are a function of operations along the river and its various distributaries. The methodology used for the SID WAA is essentially a comparison of daily natural flow with diversion of face-value amounts for the applicable water rights. Appropriately, it does not include other operational elements, but accounting for losses, especially given the problems with the loss accounting approach used, is inappropriate and inconsistent with the overall methodology.

2. The Alternative Analysis assumed the same maximum rates and diversion seasons for the Statements as listed in Table 2 of the SID WAA, i.e. we did not independently review the State Water Board's eWRIMS database to vet the Table 2 values. Our resulting quantifications of annual diversions under the Statements are very close to the values shown in Attachment A of the SID WAA.

3. Because the SID WAA states that diversions to storage were deducted from available flows before direct diversions under each license, and because Attachment A groups Licenses 11518 and 11519 together (the Pine Flat licenses), we concluded that where the storage and direct diversion seasons overlap, the SID WAA deducted storage concurrently under both Pine Flat licenses before direct diversions were deducted under either. The Alternative Analysis makes this same assumption.

4. The Alternative Analysis includes direct diversions under KRWA's junior Pine Flat right, License 11519, which apparently was not included in the SID WAA.

5. The Alternative Analysis includes diversions to storage in Wishon and Courtright reservoirs as allowed by KRWA Licenses 11520 and 11522, respectively. In quantifying amounts available for diversion at these reservoirs we relied on the daily pre-project Piedra flows after accounting for diversions under senior rights. Because the methodology used in the SID WAA is not an operational analysis of the Kings River system, we did not attempt to extrapolate what the daily unimpaired flows would have been at Wishon and Courtright, and instead deducted daily diversions at these reservoirs under their respective entitlements based on the Piedra daily flows.

Because the Alternative Analysis included consideration of diversions under certain KRWA licenses that were omitted from the SID WAA, we expected that it would conclude that less water is available for appropriation than indicated in the SID WAA. This turned out to be correct for the 18 years that the SID WAA showed water being available. Based on this result, we did not run the Alternative Analysis for years that the SID WAA concluded that no water is available for appropriation, and assumed that no water would be available for A032815 in those years.

ALTERNATIVE ANALYSIS RESULTS

A comparison of the results of our Alternative Analysis with the SID WAA results, including years for which the SID WAA concluded that no water was available for appropriation, is provided as the attached **Table 1** and depicted graphically in **Figure 1**. In Figure 1 the results of the SID WAA are shown as blue bars, while the results of the Alternative Analysis are shown as green bars.[2] The SID WAA concludes, as summarized in its Attachment A, that water would be available for appropriation in 18 of the years evaluated, including 1956, 1958, 1963, 1967, 1969, 1978, 1980, 1982, 1983, 1986, 1993, 1995, 1998, 2005, 2006, 2010, 2011, and 2017. In contrast, the Alternative Analysis concludes that water would be available in only 5 of those years.

The Alternative Analysis concludes that the maximum-year amount of water available for appropriation would be 122,229 acre-feet, or about half the maximum-year value indicated in the SID WAA (244,890 acre-feet). The Alternative Analysis also concludes that the average annual amount of water available over the 63-year study period would be about 5,393 acre-feet, or about 29 percent of the average amount in the SID WAA (18,506 acre-feet). Based on the Alternative Analysis, the SID WAA significantly overstates the amount of water available to SID's A032815. As discussed in the following section, consideration of physical and operational constraints within the Kings River system would further limit water available for appropriation.

PHYSICAL AND OPERATIONAL CONSTRAINTS ON FLOWS AVAILABLE TO SID

Both the SID WAA and the Alternative Analysis rely on an accounting methodology that does not consider physical and operational constraints that affect the actual occurrence of flow at SID's proposed points of diversion during periods of high flows in the system (noting however that the SID WAA does make an attempt to account for "losses"). As described below, these real-world constraints involve federally-mandated flood control operations, as well as channel capacity limitations on the South Fork Kings River where SID seeks to divert water.

Under flood flow conditions, the Kings River system is controlled by the U.S. Army Corps of Engineers (ACOE) as described in the ACOE's Pine Flat Lake Reservoir Regulation Manual, Revised September 1979 (Manual). A copy of the Manual is attached as **Exhibit A** to this

[2] Table 1 and Figure 1 also show results for the Alternative Analysis based on a SID diversion rate of 1,400 cfs instead of 2,200 cfs. Use of the lower rate is discussed later in this memorandum.

memorandum.[3] The following sections describe certain operational elements in the Manual that are relevant to the occurrence of water available for appropriation at SID's requested points of diversion.

Kings River North/James Bypass Operations

Paragraph 17 (in Chapter V) of the Manual states the following objectives for the operation of Pine Flat Lake (among other objectives):

"(1) To restrict flows in downstream channels of Kings River and its distributaries to non-damaging rates.

(2) To eliminate or minimize flood flows from Kings River into Tulare Lakebed, without causing flooding along the channels of Kings River North or causing flood damage along San Joaquin River below Mendota Dam over that which would occur under preproject conditions."

Paragraph 23c of the Manual (also in Chapter V) states:

"c. Since the late 1800's Kings River flows have divided in the Delta between Kings River North and Kings River South. Flow from Kings River North enters the San Joaquin River and the flow going south ends up in Tulare Lakebed. Since Tulare Lakebed has no outlet to the ocean, flows in excess of irrigation and spreading demand are damaging, and over the years provisions have been made to divert flood water north. Normally, under present conditions, Kings River flood water is diverted north up to the capacity of the Kings River North channels. When Kings River North capacity is reached, flood water is then sent south. During large floods it may be necessary to consider the capacity of the San Joaquin River when determining the rate of flow to be sent north." [emphasis added]

Chart A-6 in the Manual indicates the capacity of the James Bypass to be 4,750 cfs, and Notes 2 and 3 in the Flood Control Diagram for Pine Flat Lake (Chart A-8) in the Manual state the following:

"2. Water stored in Flood Control Space shall be released as rapidly as possible without exceeding 4,750 c.f.s. below Crescent Weir or causing flood flows to Kings River South..."

"3. When water is stored in Rain Flood Space, releases shall be increased to maximum channel capacity to Kings River North and up to maximum channel capacity to Kings River South as necessary to evacuate the Rain Flood Space within 10 days..."

[3] We understand that Exhibit A is a redacted version of the Manual that the ACOE has made available to the general public.

The foregoing excerpts from the Manual indicate that the priority during flood flow conditions is to first direct high flows that cannot be absorbed by senior water rights, up to 4,750 cfs, out of the Kings River system by way of the Kings River North and James Bypass to avoid the occurrence of damaging flows in Kings River South. This is relevant for consideration because both the SID WAA and the Alternative Analysis compare high flow conditions to existing water right entitlements on the system as a whole. In reality, however, the SID project's points of diversion are on the South Fork Kings River, while the vast majority of flood flows are routed to the North Fork in accordance with the mandates of federal flood control law and direction from the ACOE, which render such flows unavailable for diversion at SID's proposed points of diversion.

Kings River South Operations

SID's proposed Points of Diversion 3 and 4, which are the locations where SID would take water out of the Kings River system for conveyance to the proposed Kettleman Reservoir and the California Aqueduct, are located on the South Fork Kings River (referred to as Kings River South in the Manual) downstream of Empire Weir No. 1. Chart A-6 in the Manual indicates the channel capacity in this reach of Kings River South to be 3,200 cfs, which would seem to be adequate to convey 2,200 cfs to SID's PODs 3 and 4, provided the capacity was not being used to meet KRWA demands. However, the actual channel capacity on the South Fork is much less than 3,200 cfs. The following is excerpted from a letter dated April 25, 2018 from the Kings River Conservation District (KRCD) to the California Water Commission in regard to SID's Water Storage Investment Program Funding Application for the proposed Tulare Lake Storage and Floodwater Protection Project:

> *"During the most recent 2017 flood release event, the South Fork channel section right bank levee breached in June 2017 at a flow rate of approximately 1,400 CFS which is 1800 CFS less than Semitropic's assumed capacity. The breach was approximately one mile below the confluence of the Crescent Bypass and Clarks Fork channel sections. This condition also limited the Crescent Bypass channel section capacity to less than 200 CFS which is 1300 CFS below Semitropic's assumed capacity. There was significant groundwater seepage and little to no levee freeboard in these channels. It is important to note that during 2017 flood releases the entire capacity of these channels was used to deliver water with no excess capacity remaining. Thus, there was no capacity remaining to deliver water to the Project if it had existed."*

Thus, SID's application seeks to appropriate approximately 800 cfs more flow than the current South Fork channel capacity at the location where the levee failed, and does not consider that available channel capacity may be needed to meet KRWA-member demand under existing rights.

For discussion purposes, and without considering whether channel capacity in excess of KRWA demands would actually be available in the South Fork, we evaluated the effect on water available for appropriation if the maximum rate of diversion for SID's A032815 in the Alternative

Analysis is limited to 1,400 cfs rather than 2,200 cfs. This is a generous assumption given that, per KRCD, there was little to no freeboard in the affected channel at the 1,400 cfs flow rate in 2017. While a little-to-no-freeboard condition may be necessary under emergency flood conditions, it would not be appropriate design criteria for a water supply project. And again, this analysis does not consider the fact that some or all of the limited South Fork capacity may be used to convey existing, senior water rights.

The results of this analysis are included in **Table 1** and **Figure 1** (in Figure 1 the results of the 1,400 cfs diversion scenario are shown as red bars). Relative to the 2,200 cfs diversion rate scenario, the analysis concludes that for a diversion rate of 1,400 cfs over the 63-year study period, water would still be available for appropriation in 5 years, but the average annual amount available for appropriation would drop by about 25 percent, from 5,393 acre-feet to 4,027 acre-feet. The amount available for appropriation in the maximum year would drop by about 23 percent, from 122,229 acre-feet to 94,100 acre-feet. To the extent that South Fork channel capacity would be needed to convey flows under senior KRWA water rights, the amounts available to SID would be less, possibly much less.

Conclusion

The SID WAA significantly overstates the Kings River flows available for appropriation because it fails to include the direct diversion portion of senior water right License 11519, and does not consider Licenses 11520 and 11522. Moreover, there are significant operational and channel capacity constraints to the actual occurrence of water available for appropriation at SID's proposed PODs 3 and 4. The SID WAA does not address these constraints. The operational prioritization for conveying high flows out of the Kings River system via James Bypass, and the limited channel capacity in Kings River South, which, per KRCD, may be fully utilized by KRWA to meet senior water right demands, renders the availability of any Kings River water for appropriation by SID highly doubtful.

* * * * *

Encl. √

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TABLE 1
Results of SID WAA and Alternative Analysis of Water Available for Appropriation*
Water Years 1955 - 2017

Water Year	Annual Amount in Acre-Feet**		
	SID WAA	Alternative Analysis (1,400 cfs)	Alternative Analysis (2,200 cfs)
1955	0	0	0
1956	353	0	0
1957	0	0	0
1958	4,367	0	0
1959	0	0	0
1960	0	0	0
1961	0	0	0
1962	0	0	0
1963	407	0	0
1964	0	0	0
1965	0	0	0
1966	0	0	0
1967	85,893	29,004	39,917
1968	0	0	0
1969	244,490	78,272	108,552
1970	0	0	0
1971	0	0	0
1972	0	0	0
1973	0	0	0
1974	0	0	0
1975	0	0	0
1976	0	0	0
1977	0	0	0
1978	97,295	0	0
1979	0	0	0
1980	55,020	0	0
1981	0	0	0
1982	34,361	0	0
1983	162,155	94,100	122,229
1984	0	0	0
1985	0	0	0
1986	6,621	0	0
1987	0	0	0
1988	0	0	0
1989	0	0	0
1990	0	0	0
1991	0	0	0
1992	0	0	0
1993	14,752	0	0
1994	0	0	0

TABLE 1
Results of SID WAA and Alternative Analysis of Water Available for Appropriation*
Water Years 1955 - 2017

Water Year	Annual Amount in Acre-Feet**		
	SID WAA	Alternative Analysis (1,400 cfs)	Alternative Analysis (2,200 cfs)
1995	107,547	24,686	34,207
1996	0	0	0
1997	0	0	0
1998	106,199	27,643	34,876
1999	0	0	0
2000	0	0	0
2001	0	0	0
2002	0	0	0
2003	0	0	0
2004	0	0	0
2005	18,003	0	0
2006	5,067	0	0
2007	0	0	0
2008	0	0	0
2009	0	0	0
2010	1,313	0	0
2011	54,858	0	0
2012	0	0	0
2013	0	0	0
2014	0	0	0
2015	0	0	0
2016	0	0	0
2017	167,171	0	0
Average	**18,506**	**4,027**	**5,393**
Maximum	**244,490**	**94,100**	**122,229**
Minimum	**0**	**0**	**0**

* "Water available for appropriation" means water that would be available to SID after considering senior water rights on the Kings River system, but excluding pending Application 32810 filed by Consolidated Irrigation District, Fresno Irrigation District, and Alta Irrigation District.

** Years in the SID WAA showing no water available for A032815 were not reevaluated in the Alternative Analysis. It was assumed that years having "0" availability in the SID WAA would similarly have "0" availability if evaluated using the Alternative Analysis methodology.

Figure 1
Results of SID WAA and Alternative Analysis of Water Available for Appropriation*
Water Years 1955 - 2017

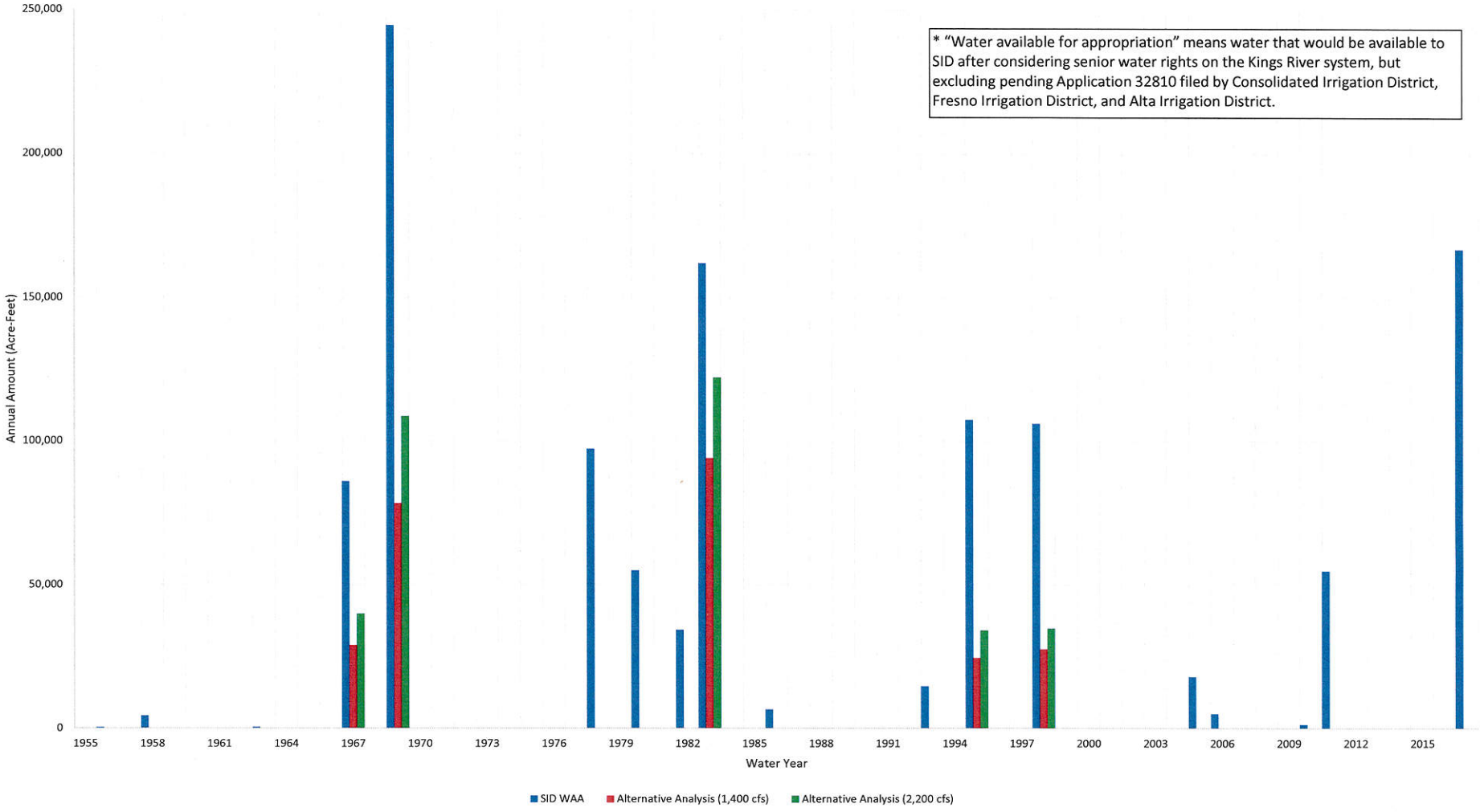

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EXHIBIT A

PINE FLAT LAKE

Kings River, California

RESERVOIR REGULATION MANUAL

November 1953
Revised September 1979

DEPARTMENT OF THE ARMY

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

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RESERVOIR REGULATION MANUAL

FOR

PINE FLAT LAKE

KINGS RIVER, CALIFORNIA

APPENDIX I

TO

MASTER MANUAL OF RESERVOIR REGULATION

TULARE LAKE BASIN, CALIFORNIA

November 1953
Revised September 1979

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

RESERVOIR REGULATION MANUAL
PINE FLAT LAKE
FRESNO, CALIFORNIA

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PART A

PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

CHAPTER I - GENERAL INFORMATION

1. AUTHORITY AND SCOPE

This reservoir regulation manual is an appendix to the "Master Manual of Reservoir Regulation, Tulare Lake Basin, California," and has been prepared in accordance with instructions contained in ER 1110-2-240 and EM 1110-2-3600.

2. PROJECT AUTHORIZATION

The Pine Flat Project was authorized by the Flood Control Act of 1944, approved 22 December 1944, the pertinent portion of which follows:

> "The project for flood control and other purposes for the Kings River and Tulare Lake Basin, California, is hereby authorized substantially in accordance with plans contained in House Document No. 630, Seventy-sixth Congress, third session, with such modifications thereof as in the discretion of the Secretary of War and the Chief of Engineers may be advisable ... Provided, that the conditions of local cooperation specified in said document shall not apply . . ."

In 1943 an act of Congress (Public Law 138, 78th Congress, Chapter 224, 1st Session, approved 12 July 1943) provided funds for emergency repair and restoration of levees and other flood control features damaged or destroyed by floods immediately prior to that time. Allocations were made from these funds for the construction of channel improvements to the lower Kings River.

CHAPTER II - BASIN DESCRIPTION

3. DESCRIPTION OF THE PROJECT AREA

a. The project area, shown on chart 1, is located in Tulare Lake Basin in the southern portion of the San Joaquin Valley. It is comprised of the Kings River watershed above the valley floor, the alluvial-fan area, the Kings River North and Kings River South areas on the valley floor, and the Tulare Lakebed.

b. The watershed area includes about 1,700 square miles above Piedra 1,545 of which lies above Pine Flat Dam. It lies along the westward face of the highest portion of the Sierra Nevada. Elevations range from a maximum of about 14,000 feet at the headwaters to about 400 feet at the edge of the valley floor. This basin is among the most rugged of the entire Sierra Nevada, and is characterized by sharp peaks and ridges, precipitous canyons, and granite domes. Kings River has its source in many small glacial lakes at elevations of 12,000 feet or more, near the crest of the Sierra Nevada. Nearly all of the tributaries flow in deep granite canyons, and the main canyon below the junction of the Middle and South Forks is more than 5,000 feet deep. The soil cover, except for granite outcroppings and precipitous canyons, ranges from moderate, in the lower area, to non-existent above 10,000 feet elevation. Vegetative cover is distributed approximately as follows:

Type of Vegetation	Range of Elevation (feet)	Percent of Basin Area
Grass land (with scattered timber)	400 - 2,000	4
Brush land (chaparral, etc.)	2,000 - 6,000	17
Deciduous forest	400 - 3,000	16
Light coniferous forest (20-50% cover)	5,000 - 9,000	25
Heavy coniferous forest (over 50% cover)	6,000 - 8,000	4
Sub-alpine timber (juniper, lodgepole, etc.)	9,000 - 10,000	13
Open ground (barren and lakes)	10,000 and above	21

c. The watershed area is suitable for grazing, lumbering, hydroelectric power generation, mining, and recreation. It is sparsely populated. There are presently two hydroelectric power projects: the Kings River Project and the Balch Project, in the Kings River Basin, both operated by Pacific Gas and Electric Company. The Kings River Project consists of Courtright and Wishon Reservoirs and the Haas and Kings River power houses. The Balch Project consists of Balch power houses number one and two, a small upstream diversion dam and an afterbay.

d. The alluvial-fan portion of the basin, an area of about 1,200,000 acres, decreases in elevation from about 400 feet at the foothill line to about 200 feet at the edge of Tulare Lakebed and about 180 feet along the Kings River North area. There are a few small towns in this area, but no large population centers except Fresno which is approximately thirty miles northwest of the river. Excellent soils, moderate climate, and availability of summer stream flow and ground water for irrigation have made this a predominantly agricultural area. Several oil and gas wells are producing in the area. Also, numerous agricultural processing plants and manufacturing plants are spread throughout the area. The main line of the Atchison, Topeka, and Santa Fe Railroad and the valley route of the Southern Pacific Railroad between San Francisco and Los Angeles pass through the Kings River area. Branch lines serve important agricultural centers within the area. U. S. Highway 99 crosses Kings River at Kingsburg. Numerous state highways and an extensive system of county roads also serve the area.

e. From the mouth of the canyon below Piedra, Kings River flows southwesterly in a single channel to near Centerville, where it divides into numerous channels, reuniting as a single channel below Centerville Bottoms. Small intermittent levees exist through this reach. Near Kingsburg, the river emerges on the crown of the alluvial cone and is provided with continuous levees through the lower reaches of the river. The channel has a sandy shifting bottom and is crossed at intervals by permanent weirs, which divert water into numerous large diversion canals. The principal division of flow between Kings River North and Kings River South is accomplished by the Army Weir at the head of Clarks Fork (which leads to Kings River South) and by Island Weir on Kings River below Clarks Fork. A secondary diversion to Kings River South via Cresent Bypass can be accomplished at the Crescent Bypass structure, operating in conjunction with Crescent Weir. Locations of these structures are shown on chart A-6. As a result of numerous diversions, the river flow is intensely modified and is usually depleted before reaching the lower reaches. The capacity of the river system decreases progressively downstream to 11,000 cfs at the head of Army Weir.

f. The Kings River North and Kings River South areas are of predominately heavy soils which formerly were traversed by many channels and sloughs. Most of the areas have been developed for agricultural use by leveling the land, restricting river flows to the principal channels, (or construction of a new channel, as in the case of the James Bypass) and by construction of levees along these channels. The use of pervious materials (sand and tules) in much of the levee system along Fresno Slough has created a seepage problem during periods of high flow. The principal crops in this area are cotton, small grains, and forage. Extensive oil and gas development exists in the Fresno Slough area. State Highways 41, 198, and 180, Interstate Highway 5, and numerous county roads serve the area. Rail service to the area is provided by the Southern Pacific and the Atchison, Topeka, and Santa Fe Railroads.

g. The Tulare Lakebed is a closed depression with a bottom elevation of about 175 feet. The only outlet is to the north (at elevation 207 feet) into the San Joaquin River. This lakebed area receives runoff from Kings River South and from the Kaweah, Tule and Kern Rivers. During large rainflood years, runoff from the Coast Range Mountains also reaches the lakebed. Agricultural

development in the lakebed has been facilitated by a cellular dike system designed to confine flood waters to the smallest possible area.

h. Agricultural development of the Kings River service area is dependent on an irrigation supply from surface runoff and ground-water pumping, since precipitation on the valley floor is not sufficient to support normal farm crops. At present, approximately 1,100,000 acres receive water, directly or indirectly, from Kings River. Extensive irrigation systems for the diversion and distribution of water have been developed by individuals, companies and irrigation districts. Some historic irrigation diversions for the Kings River service area are listed on chart A-6.

4. CLIMATE

a. Average annual precipitation varies greatly throughout the project area, ranging from about 6 inches on the valley floor to about 60 inches high in the mountains. About 90 percent of the runoff-producing precipitation occurs during the months of November through April as demonstrated by the following table:

Normal Precipitation

Month	Pine Flat 1/ (elev 610)		Balch P.H. (elev 1720)		Grant Grove (elev 6600)		Huntington L. (elev 7020)	
	Amount	%	Amount	%	Amount	%	Amount	%
Jul	.03	.00	.02	.00	.06	.00	.17	.01
Aug	.02	.00	T	.00	.08	.00	.07	.00
Sep	.24	.01	.56	.02	.52	.01	.68	.02
Oct	.67	.04	.87	.03	1.46	.03	1.57	.05
Nov	2.07	.11	3.45	.12	5.14	.12	2.91	.09
Dec	3.28	.18	5.70	.19	7.56	.17	6.26	.19
Jan	3.46	.19	5.45	.19	7.83	.18	5.23	.16
Feb	2.84	.16	4.45	.15	7.16	.17	5.99	.18
Mar	2.62	.15	3.73	.13	6.78	.16	4.37	.14
Apr	1.93	.11	3.27	.11	4.81	.11	3.00	.09
May	.64	.04	1.35	.05	1.55	.04	1.68	.05
Jun	.14	.01	.25	.01	.39	.01	.52	.02
Total	17.94	100	29.1	100	43.34	100	32.45	100

1/ 1953-1978 avg.

b. Normal annual precipitation for the Kings River Basin is shown on chart 2. Precipitation usually occurs as rain at elevations below 5,000 feet and as snow at higher elevations, although snow has occurred in the valley and rain at elevations above 12,000 feet. Generally the snow pack accumulates during the winter months until about 1 April, when increased temperatures cause the pack to begin melting. Snow pack data for 1969, 1975 and 1977, representing wet, normal and dry years, are presented in the following tabulation.

1 April Snow Survey Data
Kings River Basin

Index No.	Snow Course	Elev in feet	Depth in inches			Water Content Inches			Average 1/	% of Average		
			1969	1975	1977	1969	1975	1977	1931-75	1969	1975	1977
222	Bishop Pass	11,200	176.8	101.0	30.2	78.4	36.9	8.0	31.0	253	119	26
223	Blackcap Basin	10,300	156.2	108.8	26.6	66.4	37.1	7.6	34.0	195	109	22
225	Beard Meadow	9,800	168.4	95.8	24.2	72.2	34.4	7.5	32.0	226	108	23
233	Statum Meadow	8,300	162.3	103.6	17.1	83.3	40.6	8.1	31.0	269	131	26
240	Grant Grove	6,600	94.2	60.1	3.1	42.4	24.8	1.1	15.0	283	165	7

1/ Average values of 1 April water content in inches and averages for 45-year period (1931-1975) from Snow Survey Data, California Cooperative Snow Surveys, 1978.

c. The valley area is characterized by hot, dry summers and moderate winters. Temperatures in the mountains decrease generally with increasing elevation. At higher elevations the summers are cool and winters are severe. Observed temperature extremes are 114° and 18° at Fresno in the valley, 90° and -5° at Grant Grove and 89° and -18° at Huntington Lake. The monthly temperature distributions at representative stations follow:

Normal Temperature (°F)

Month	Fresno WSO AP (Elev. 328)	Pine Flat Dam 1/ (Elev. 610)	Balch Power House 2/ (Elev. 1,720)	Grant Grove (Elev. 6,600)	Huntington Lake (Elev. 7,020)
Jan	45.3	44.7	44.7	33.2	31.1
Feb	49.9	49.2	49.4	33.6	31.1
Mar	53.9	52.9	52.5	34.5	32.0
Apr	60.3	58.2	56.0	39.5	37.2
May	67.4	65.7	65.1	46.4	44.2
Jun	73.9	74.2	72.8	54.1	52.2
Jul	80.6	80.4	80.4	62.6	60.6
Aug	78.3	79.1	80.3	61.3	59.7
Sep	73.8	74.1	74.8	57.0	55.4
Oct	64.2	64.4	65.1	49.1	47.2
Nov	53.5	52.7	52.6	40.5	39.0
Dec	45.8	45.3	45.3	35.3	33.5
Normal Annual	62.2	61.7	61.6	45.6	43.6

1/ Average Temperatures from 1954 - 1977.
2/ Average Temperatures from 1962 - 1977.

5. RUNOFF

a. Stream flow records on the Kings River date back to 1896 at Piedra. However, a stream gage was not installed at the Pine Flat damsite until 1953. Pertinent data (adjusted for upstream storage and evaporation) for the Kings River flow into Pine Flat Lake is shown below. More gage data may be found on chart 3.

Unimpaired Kings River Flow Into Pine Flat Lake

Period of Record Included	1955-1978
Drainage Area, sq. mi.	1,545
Instantaneous Flows, cfs	
Maximum	112,000 (25 Jan 1956)
Minimum	0 (25 and 29 July 1977)
Instantaneous Flow, cfs/sq. mi.	
Maximum	72.5
Minimum	0.0
Mean Daily	2,240
Mean Daily Flow, cfs/sq. mi.	1.4
Annual Flow, ac-ft	
Maximum	4,207,000 (1969) 1/
Minimum	385,000 (1977) 2/
Mean	1,620,000
Annual Flow, inches	
Maximum	51.1
Minimum	4.7
Mean	19.7
Apr-July Flow, ac-ft	
Maximum	3,116,000 (1969) 1/
Minimum	274,000 (1977) 2/
Mean	1,179,000
Apr-Jul Flow, inches	
Maximum	37.8
Minimum	3.3
Mean	14.3

1/ 1969 had the largest volume of runoff for the period of record at Piedra (1896 to date).
2/ 1977 had the smallest volume of runnoff for the period of record at Piedra (1896 to date).

b. Approximately two-thirds of the annual runoff into Pine Flat Lake occurs April through July. The seasonal variation of runoff into Pine Flat Lake (1955-1978) is illustrated in the following table (adjusted for upstream storage and evaporation):

Average Monthly Unimpaired Runoff Into Pine Flat Lake

Month	Acre-feet	%
Oct	17,000	1
Nov	26,000	2
Dec	63,000	4
Jan	75,000	5
Feb	76,000	5
Mar	103,000	6
Apr	190,000	12
May	422,000	26
Jun	396,000	24
Jul	170,000	10
Aug	54,000	3
Sep	28,000	2
Totals	1,620,000	100

c. Mill Creek, the major source of local runoff below the dam, discharges about 26,000 acre-feet per year. Mill Creek has been gaged since 1938. A rough estimate of the total volume of local runoff between the dam and Reedly during major floods can be obtained by multiplying Mill Creek flows by 1.2. Local runoff into the Kings River below Reedley is negligible.

d. Historical inflow to Pine Flat Lake is shown on chart 4.

CHAPTER III - PROJECT DESCRIPTION

6. DESCRIPTION OF THE PROJECT

a. Pine Flat Lake is located about thirty miles northeast of Fresno. The Project consists of Pine Flat multiple-purpose reservoir on Kings River, improvements on certain downstream channels, and structures for controlling the division of flow between the channels of Kings River North and Kings River South. A brief description of the project and associated facilities follows:

(1) **Portions of this chapter are not available in this version of the Pine Flat water control manual. For additional information, contact the U.S. Army**
(2) **Corps of Engineers Sacramento District Public Affairs Office at 916-557-7236.**

(3)

(4) The reservoir is of narrow, winding shape and extends up Kings River for about 20 miles, see chart 6. The reservoir area (about 6,000 acres) was formerly in brush and grazing land. A store, a few houses, and a Forest Service Ranger Station were within the reservoir area. The former were abandoned, and the Ranger Station was relocated outside the reservoir area. County roads through the reservoir area were also relocated.

(5) The downstream channel improvements which have been constructed as a part of this project include: (1) Channel restoration and debris removal in Centerville Bottoms area; (2) new levee construction and levee repair from Cole Slough Weir to Stinson Weir; (3) excavation of a new channel from Kings River immediately upstream from Island Weir southward into Clarks Fork; (4) clearing, widening, straightening, and constructing confining levees on the South Fork below Army Weir; (5) South Fork diversion structure (Army Weir), (6) gated structures at Crooked Slough, Faull Slough and Sand Slough, and a dike across Heinlen Cut and (7) timber removal in the Kings River South channel. Chart 7 shows the locations of the downstream improvements.

(6) Associated facilities owned by local interests which assist in the division of flow between Kings River North and Kings River South are: (1) Island

Weir, a combination gate and flashboard structure constructed by local interests and modified by the Corps of Engineers; (2) the Crescent Bypass headgate control structure, at the head of Crescent Bypass, constructed by local interests; (3) Cresent Weir, a flashboard structure on Kings River immediately below the entrance to Crescent Bypass, constructed by local interests; and (4) Stinson Weir on Kings River North which was repaired by the Corps of Engineers in 1970.

7. RECREATION FACILITIES

a. Although recreation was not an authorized project purpose, recreation use of the Pine Flat Lake area is significant. There is no established minimum pool, but the water stored for irrigation purposes is generally ample for recreation.

b. There are presently eleven areas identified for recreation development. Existing and proposed activities in these areas include pinicking, camping, boat-launching, fishing, swimming, marina concessions, a visitor center, public access, cycling, hiking, equestrian and nature trails. These facilities have been provided and are administered by the Corps of Engineers, the Forest Service and Fresno County. Coordination is maintained with the Fish and Wildlife Service and the California Department of Fish and Game.

c. Pine Flat Lake became fully operational in 1954 and records for recreation use began in 1955. The annual visitation for the period of record at 5 year intervals and for the last 3 years is shown below.

Calendar Year	Recreation Days
1955	270,000
1960	345,400
1965	491,000
1970	609,000
1975	467,200
1976 *	694,190
1977 *	625,500

* Extreme drought years.

d. Recreation development is shown on chart 6 and is described in detail in the "Pine Flat Lake Master Plan".

8. CHANGES TO AUTHORIZED PLAN

The Pine Flat Project as constructed is essentially the same as authorized, with the exception that a first-class stream gaging station on Kings River below the North Fork has been substituted for the inflow weir pursuant to agreement with local interests.

9. CONSTRUCTION HISTORY

a. Excavation for Pine Flat Dam was initiated in July 1948. Concrete placement and reservoir clearing were initiated in 1950 and the dam and appurtenances were completed in 1954. Pine Flat Lake was first operated for flood control in May 1952 and for conservation in February 1954.

b. In 1943 and 1944 a portion of the downstream channel improvements was completed with emergency funds. The remainder of the downstream channel improvements were completed during the period 1968 through 1976.

CHAPTER IV - FLOOD POTENTIAL

10. FLOOD CHARACTERISTICS

a. Precipitation in the area is largely orographic in nature and usually results from air masses traveling inland from a westerly direction. Flood flows on Kings River are of two types, winter rain floods and spring snowmelt floods. Winter rain floods, which generally occur during the period of November through March, are caused by heavy rains and sometimes augmented by the melting of snow at intermediate elevations. These winter floods have sharp, high peaks and are usually of short duration and comparatively small volume. Generally, a major portion of winter precipitation occurs as snow and remains in the mountains above the 5,000 foot elevation until the spring. Snowmelt floods have comparatively moderate peak flows, but very large volumes extending over a two to four month period. Generally sixty-five percent of the annual runoff occurs between the first of April and the end of July.

b. The largest rainflood of record on Kings River occurred on 23 December 1955 and had an estimated peak inflow to Pine Flat Lake of 112,000 c.f.s. Maximum release from Pine Flat during the peak of the December 1955 rainflood was about 70 c.f.s. A comparison of large flows experienced in Kings River Basin follows:

	23 Dec 55	6 Dec 66	25 Jan 69	1 Feb 63
Inflow to Pine Flat Lake				
Peak (cfs)	112,000 1/	91,000 1/	70,600 1/	76,800 1/
5-day volume (acre-feet)	316,541	195,603	175,254	152,684
Kings River above N. Fork				
Peak (cfs)	59,100	41,000	35,000	29,000
5-day volume (acre-feet)	159,711	112,524	90,904	79,122
N. Fork Kings River below Dinky Creek 2/				
Peak (cfs)	N/A	22,100	15,000	27,400
5-day volume (acre-feet)	N/A	43,698	26,184	44,301
Mill Creek near Piedra				
Peak (cfs)	N/A	11,000	9,860	3,120
5-day volume (acre-feet)	20,618	16,747	31,704	4,151

1/ Estimated peak flow.
2/ Does not include upstream diversions for power.

c. Mill Creek contributes roughly eighty percent of the local flow below Pine Flat Lake. During periods of high flow, releases from the project are reduced to minimize damages in the lower channel and in Tulare Lake area.

d. The largest snowmelt flood of record occurred in 1969 when the unimpaired April through July runoff was 3,116,000 acre-feet at the dam and 3,141,000 acre-feet at Piedra. The 1906 April through July runoff at Piedra was 2,979,000 acre-feet.

11. RAINFLOOD POTENTIAL

The major rainflood threat to areas protected by Pine Flat Lake is from local runoff below the project. For rainfloods likely to occur more often than once in three hundred years on the average, the peak local flow below Pine Flat will most likely exceed the releases from the project. To date, no flood releases to Tulare Lake have been made during a rain flood. Rain flow frequency curves for the Kings River at Pine Flat and at Piedra, and for Mill Creek are shown on charts 8, 9, and 10 respectively.

12. SEASONAL VARIATION OF RAINFLOOD POTENTIAL

Large rainfloods in the Tulare Lake Basin occur most frequently in the months of November through March and are not known to occur in the months of June through August. The seasonal variation of storm potential is defined by criteria contained in office report, "Reservoir Operation Criteria for Flood Control," dated October 1959.

13. SNOWMELT FLOOD POTENTIAL

Snowmelt floods on Kings River result from large volumes of spring runoff created by the melting snow pack above Pine Flat Lake. If the snowmelt volume exceeds the available storage within the basin plus the irrigation and spreading demand, supplemental releases must be made. Normally the supplemental releases can be sent to Mendota Pool through Kings River North, and from there to the San Joaquin River. However, in large runoff years, excess Kings River snowmelt flood water goes to Tulare Lake. Snowmelt flow frequency curves are shown on charts 11 and 12.

14. STANDARD PROJECT FLOOD

The standard project flood presented in this manual was developed in 1970. The average precipitation on the contributing area is 18.98 inches and the excess is 5.09. The peak inflow is 186,000 c.f.s. and the total volume of the main wave is 418,000 acre-feet. A routing of the standard project flood is shown on chart 13.

15. RESERVOIR DESIGN FLOOD

a. The 1906 snowmelt flood, which was the largest known snowmelt flood prior to project authorization, was adopted as the design flood for Pine Flat Lake. The rainflood reservation was based on a hypothetical flood estimated to be as large as any prerecord flood known to have occurred.

b. In 1969, the snowmelt runoff slightly exceeded that of 1906. Routings of both floods are shown on chart 14. The frequency of occurrence of both floods is estimated to be about once in sixty years.

c. The flood used to size the rainflood reservation in Pine Flat Lake had a sixteen day volume of 400,000 acre-feet. The December 1955 rainflood, which is the largest of record, also had a sixteen day volume of about 400,000 acre-feet. A routing of the 1955 flood through the rainflood reservation portion of Pine Flat Lake is shown on chart 15. The frequency of occurrence of the December 1955 flood is estimated to be about once in 80 years.

16. SPILLWAY DESIGN FLOOD

a. The Pine Flat Lake spillway design flood is based on a storm having 28.5 inches of precipitation and 4.7 inches of snowmelt in 66 hours with an excess of 13.41 inches. The peak inflow is 437,000 c.f.s. and the volume 1,186,000 acre-feet, 84,000 acre-feet of which was base flow. A routing of the SDF is shown on chart 16.

CHAPTER V - GENERAL PROJECT OPERATION

17. OBJECTIVES

a. Pine Flat Lake will be operated for flood control and conservation in accordance with the regulations contained herein to achieve the following objectives:

(1) To restrict flows in downstream channels of Kings River and its distributaries to non-damaging rates.

(2) To eliminate or minimize flood flows from Kings River into Tulare Lakebed, without causing flooding along the channels of Kings River North or causing flood damage along San Joaquin River below Mendota Dam over that which would occur under preproject conditions.

(3) To assist indirectly in providing flood protection along the San Joaquin River.

(4) To provide the maximum practicable amount of storage space for irrigation water without impairment of the flood-control functions.

b. In achieving the above objectives, forecasting of snowmelt runoff is important. When it is anticipated that flood water might be discharged into the San Joaquin River through Kings River North or to Tulare Lake, the Watermaster will be alerted so that he may update irrigation and spreading capabilities to make all possible use of the water for irrigation and spreading. Since the rate at which water can be used for irrigation and spreading may be relatively small, releases for such purposes should be initiated as soon as possible.

18. RESPONSIBILITY FOR OPERATION

a. Pine Flat Lake is operated by the U.S. Army Corps of Engineers and is under the jurisdiction of the District Engineer, Sacramento, California.

b. Army Weir is also under the jurisdiction of the District Engineer. However, permission has been granted to the Kings River Water Association to operate the structure in accordance with agreements among the water users. Accordingly, the Kings River Water Association is the operating agency for the purpose of these regulations until such time as the Corps of Engineers, on its own initiative or at the request of the Kings River Water Association, again assumes direct responsibility for operation. However, the Corps of Engineers is still responsible for maintaining Army Weir.

19. UPSTREAM REGULATION

a. The river above Pine Flat Lake is used for hydroelectric power generation by four Pacific Gas and Electric Company power plants and appurtenent facilities. The only major storage facilities connected with the power development are Wishon and Courtright Reservoirs. They have storage capacities of 128,600 acre-feet and 123,300 acre-feet respectively. The power facilities are shown on chart 1.

b. Due to their high elevation, Wishon and Courtright Reservoirs have relatively little effect on rainfloods. However, they do store snowmelt runoff that might otherwise have to be stored in Pine Flat Lake. Therefore, space available in these reservoirs less 20,000 acre-feet may be credited to Pine Flat Lake for the control of snowmelt floods.

20. DOWNSTREAM REGULATION

There are no significant storage facilities below Pine Flat Lake. However, Pine Flat Lake releases are reregulated by numerous downstream diversion structures for purposes of irrigation and flood control. The diversion structures are shown on chart A-6.

21. RELEASE REQUIREMENTS

a. The Kings River Water Association and California Department of Fish and Game signed an agreement, dated 11 September 1964, establishing minimum releases and rates of change for releases to benefit fish and wildlife on the Kings River. Basically, the agreement provides for a minimum release of 25 c.f.s. from Pine Flat Lake and for the maintenance of slightly larger flows up to 100 c.f.s. at Centerville Bottoms depending on the time of year and the volume of runoff during the previous water year. A brief summary of the agreement is shown on chart 17.

b. Releases for fish and wildlife will be initiated by the watermaster. Such requests will normally be made directly to the reservoir operator.

22. DOWNSTREAM CHANNEL CAPACITIES

a. The channel capacities downstream from Pine Flat Lake are shown on chart A-6. To illustrate the historic performance of the channels, the maximum 30-day and 1-day flows during 1969 are shown for critical reaches. However, it should be noted that the passage of the 1969 flows required continuous surveillence and maintenance to prevent seepage, erosion and levee failure.

b. The critical channel reaches for determining permissible releases are those below Army Weir, Cresent Weir, and Cresent Bypass.

23. DOWNSTREAM DIVISION OF FLOWS

a. The numerous Kings River diversion structures are shown on Chart A-6.

b. The diversion structure of primary concern during flood operations is Army Weir, which was constructed by the Corps of Engineers in 1943 to control the bifurcation of flows between Kings River North and Kings River South. The Crescent Bypass structure, further downstream, is also capable of sending Kings River water south.

c. Since the late 1800's Kings River flows have divided in the Delta between Kings River North and Kings River South. Flow from Kings River North enters the San Joaquin River and the flow going south ends up in Tulare Lakebed. Since Tulare Lakebed has no outlet to the ocean, flows in excess of irrigation and spreading demand are damaging, and over the years provisions have been made to divert flood water north. Normally, under present conditions, Kings River flood water is diverted north up to the capacity of the Kings River North channels. When Kings River North capacity is reached, flood water is then sent south. During large floods it may be necessary to consider the capacity of the San Joaquin River when determining the rate of flow to be sent north.

d. Prior to construction at Pine Flat Dam, an agreement, dated 15 December 1947, was signed by three local entities (Tulare Lake Water Storage District, Kings River Water Association, and Lower Kings River Association) to establish the division of flow between Kings River North and Kings River South. The agreement provides that flood water may be sent north up to the Kings River North channel capacity but that the total flow at Mendota Pool should not be permitted to exceed flows that would occur naturally. The agreement also provides that flows at Lemoore Wier of 10,000 c.f.s. or more will be split, fifty percent going north and fifty percent going south. The Lower Kings River Association is now defunct, the Tulare Lake Water Storage District has joined the Kings River Water Association, and physical conditions have changed considerably. Should the Kings River flow above Army Wier exceed the combined north and south channel capacities, the operation of the diversion structures will be determined by the conditions prevailing at the time.

24. FLOOD DAMAGES UNDER PROJECT CONDITIONS

a. Since completion of Pine Flat Lake, the largest rainflood of record (1896-1978) occurred in December 1955 and the largest snowmelt flood of record occurred in 1969. Releases from Pine Flat Lake during the 1955 flood were nominal and caused no damage downstream. In 1969, about 185,000 acre-feet of water from Kings River reached Tulare Lake during April through July and flows in Kings River below Pine Flat Lake exceeded design channel capacity. However, channel improvements constructed under operation foresight and a well coordinated program for levee patrol and flood fighting enabled the releases to be continued through the critical period.

b. In December 1955, it is estimated that Pine Flat Lake prevented about $5,000,000 in flood damage to the Kings River area and Tulare Lake. The 1969 snowmelt flood was preceded by a rainflood and during the entire 1969 flood season Pine Flat Lake prevented approximately $7,600,000 in flood damage in the Kings River area and Tulare Lake.

25. FLOOD CONTROL OPERATION

The schedule for flood control operation of Pine Flat Lake under the multiple-purpose operation is given on chart A-8.

26. CONSERVATION OPERATION

Operation for conservation in accordance with the contract with local interests, dated 23 December 1963, is essentially as follows:

a. All inflow in excess of the release requested by the Kings River Watermaster will be stored to the extent that conservation space in the reservoir is available.

b. Water stored for irrigation will be released in accordance with the requests of the Kings River Watermaster.

c. Requests by the Kings River Watermaster for irrigation or fish and wildlife releases will normally be made directly to the reservoir operator and will be coordinated with downstream interests by the watermaster.

27. SEDIMENTATION AND WATER QUALITY MEASUREMENT

a. A system of 35 sedimentation ranges shown on chart 18 was established in 1951 before any significant water had been stored in the reservoir. Of these, two ranges cross the river channel below the dam, and one is above the gross pool elevation on the river above the reservoir. The remaining ranges are so spaced that no range will represent more than 10 percent of the potential sediment accumulation in the reservoir. Each range is straight and is marked by a permanent monument above gross pool level at each end. Each profile is recorded on a permanent drawing to a horizontal scale of 1 inch to 400 feet and a vertical scale of 1 inch to 20 feet with an attached table showing the coordinates of all survey points.

b. Surveys made in November 1956 and June 1973 indicate that the annual rate of sediment inflow is 243 acre-feet per year or about 216 tons per square mile per year. Future sediment surveys will probably not be made unless a major flood event has occurred. However, outflow sediment concentration is checked at frequent intervals.

c. Water quality at Pine Flat Lake is measured twice a year. Inflow and outflow samples are checked for dissolved oxygen and temperature and a chemical analysis of the samples is then made in a laboratory. In addition, a water quality profile of the lake is made for disolved oxygen, temperature, ph and electrical conductivity. The quality of water in Pine Flat Lake is generally excellent.

28. RELATION TO OTHER PROJECTS

a. Pine Flat Lake operates in conjunction with four other Federal storage projects (Millerton Lake, Lake Kaweah, Success Lake, and Isabella Lake) to minimize floodflows into Tulare Lakebed. The operation of these projects is coordinated for maximum realization of their common goal.

b. As a prerequisite for construction of Wishon and Courtright Reservoirs, Pacific Gas and Electric Company contracted with Kings River irrigation interests to store 251,800 acre-feet of Kings River water for power generation. They also contracted (Contract No. DA-04-167-eng-1328) with the United States to store all or a portion of that water in Pine Flat Lake when it was not stored in their projects. Under that contract they are permitted to store up to 230,000 acre-feet of water within space reserved for flood control provided: (1) no water is stored in space required to control rainfloods, (2) no water is stored in the uppermost 30,000 acre-feet of flood control reservation and (3) in time of emergency, the Government may place additional restrictions on the transfer of flood control space. The charge for storing water in Pine Flat is 13.75 cents per acre-foot per month based on the maximum storage space occupied during the month. In 1972, Pacific Gas and Electric Company and the Kings River irrigation interests ammended their contracts so that Pacific Gas and Electric is required to store no more than 60,000 acre-feet of water. Now, except for rare exceptions, this power water is stored in Wishon and Courtright and payments to the Government are not necessary.

29. GATE OPERATION

A detailed description of gate operation is given in Appendix A.

CHAPTER VI - FLOOD CONTROL DESIGN REQUIREMENTS

30. HYDROLOGIC BASIS FOR DESIGN

Selection of the capacity of Pine Flat Lake was based primarily on flood control. Snowmelt-season runoff governed the capacity, since the space required for the control of potential snowmelt floods is at all times greater than the space required to control rain floods.

31. FLOOD CONTROL SPACE REQUIREMENTS

Prior to authorization it was determined that 1,000,000 acre-feet of flood control reservation would be required to control the 1906 flood to objective flows with only minor damaging flows to Tulare Lake. It was also found that in evacuating the reservoir by the start of the snowmelt season, sufficient space (475,000 acre-feet) would normally be available to control all but extremely rare rainfloods. For operational purposes, a minimum rainflood reservation of 260,000 acre-feet was adopted based on a hypothetical flood developed at that time.

32. MULTIPLE USE OF RESERVOIR SPACE

a. The space in Pine Flat Lake required to control snowmelt floods may be adjusted for available space upstream in Wishon and Courtright Reservoirs less 20,000 acre-feet. There is a minor amount of storage capacity in Black Rock Reservoir and Balch afterbay but since they are usually full, they are not considered in flood operations.

b. From 1 December to 1 February, 475,000 acre-feet, minus the adjustments for upstream storage, must be available to control anticipated snowmelt. After 1 February, when snowmelt forecasts are available, the required flood control space is based on forecasted snowmelt-runoff and is also adjusted for upstream storage.

c. A contract between the Federal Government and the Pacific Gas and Electric Company that permits storage of power water in Pine Flat Lake is discussed in paragraph 28c. However, due to a 1972 agreement between the electric company and Kings River irrigation interests, except for rare situations, it is doubtful that water for the Kings River Project will be stored in Pine Flat Lake again.

33. FLOOD CONTROL DIAGRAM

The flood control diagram for Pine Flat Lake is shown on chart A-8. It is based on 83 years of hydrologic data for the basin, 25 years of operational experience with the project, and current irrigation demands. The diagram gives the required flood control release for a given storage at any particular time of year.

CHAPTER VII - OPERATIONAL CONTROLS

34. DIVISION OF RESPONSIBILITY FOR OPERATION

a. The primary responsibilities of operating Pine Flat Reservoir are delegated to units of the Engineering Division and Construction-Operations Division of the Sacramento District, Corps of Engineers as outlined herein. Names, addresses, and telephone numbers for those individuals whose responsibilities are outlined in the following paragraphs are given on the personnel chart at the front of this report.

b. The Reservoir Control Section (Engineering Division), will be responsible for:

(1) Analyzing current reservoir and hydrologic data, determining the condition under which the reservoir shall be operated, and issuing appropriate operation instructions to the reservoir operator.

(2) Preparing monthly operation and other special reports relative to operation of the reservoir as required by the Office, Chief of Engineers, and as needed for operational purposes.

(3) Advising the District Engineer whenever there has been an unavoidable departure from these regulations, or when there is a need for making a temporary modification of these regulations.

(4) Keeping advised at all times of downstream channel conditions by making periodic field inspections.

(5) Arranging with local interests for collection of current flow and diversion data.

(6) Obtaining from local interests each month a summary of recorded Kings River flows and diversions; maintaining a record of instructions issued, data transmitted to other agencies, and requests received from other agencies.

c. The responsibilities of the Reservoir Operator (Construction-Operations Division) are outlined in Appendix A.

d. The Hydrology Section (Engineering Division) will be responsible for:

(1) Obtaining current hydrometeorological data and weather forecast for the region as required for use by the Chief, Reservoir Control Section.

(2) Maintaining hydrologic equipment and supervising its operation.

(3) Supervising a program of water quality and sediment measurement.

35. HYDROLOGIC FACILITIES

Hydrologic facilities for operation of the project consist of:

a. A weather station at the dam consisting of:

(1) Recording precipitation gage.

(2) Non-recording precipitation gage.

(3) Weather Bureau class A land evaporation pan with anemometer and a maximum-minumum U tube thermometer.

(4) Cottonbelt type shelter containing hygrothermograph, maximum thermometer, minimum thermometer and fan aspirated psychrometer.

b. Recording and non-recording pool gages on the dam.

c. Wire reporting and recording outflow stream gaging stations on Kings River.

d. First-class stream gaging station on Kings River below North Fork.

e. Other recording stream gaging stations on downstream channels as shown on chart 3.

f. Snow courses shown on chart 2.

g. Snow pillows shown on chart 2.

h. Precipitation stations shown on chart 2.

i. Sedimentation ranges shown on chart 18.

36. FLOOD RUNOFF FORECASTS

a. Normally the reservation maintained in Pine Flat Lake through the winter is greater than that required to control major rainfloods. Therefore, the probability of spills from Pine Flat Lake due to a rainflood is small. However, local flows downstream may be substantial and releases should be curtailed at the onset of an impending flood. Rainflood forecast criteria for flows into Pine Flat Lake and an area elevation curve are shown on charts 19 and 20.

b. During the snowmelt season, the release schedule for Pine Flat Lake is based on runoff forecasts. Forecasts of snowmelt made by the Department of Water Resources of the State of California will be utilized in the operation of Pine Flat Lake. The department publishes forecasts of runoff through July into Pine Flat Lake as of 1 February, 1 March, 1 April, and 1 May of each year. Preliminary forecast values are furnished the District Office by the 10th of each of these months. The forecasts are published in "Water Conditions in California". A forecast summary is shown on chart 21.

37. COORDINATION WITH OTHER AGENCIES

In order to assure that the flood control operation of Pine Flat Lake is effective, it is essential the Corps of Engineers be aware at all times of possible flood hazards, weather conditions, inflow to Millerton and Pine Flat Lakes, and the flows in the San Joaquin and Kings River. This requires close liaison with other agencies including the National Weather Service, the State of California Department of Water Resources, the Bureau of Reclamation, the Kings River Water Association, the Kings River Conservation District, and other downstream interests.

CHAPTER VIII - WATER RIGHTS

38. WATER RIGHTS FOR IRRIGATION

With the exception of water used by a few riparian owners who pump water from the river, virtually all use of Kings River water between Piedra and Mendota is being administered by the Kings River Water Association.

39. WATER RIGHTS FOR POWER

Pacific Gas and Electric Company has no water rights in the Kings River Basin but has contracted with irrigation interests for use of Kings River water for power. The agreement is dated 20 December 1954 and was amended 18 January 1972.

CHAPTER IX - PROJECT ACCOMPLISHMENTS

40. EXAMPLES OF OPERATION

Hypothetical operation during the standard project and the December 1955 rainflood is illustrated on charts 13 and 15. Hypothetical operation of Pine Flat Lake during the spillway design flood is shown on chart 16. Hypothetical routings of historic snowmelt floods are shown on chart 14. Stage duration curves are presented on chart 22, a stage frequency curve on chart 23, and a seasonal variation of reservoir storage on chart 24.

41. OPERATION RECORD

The official operation record of Pine Flat Lake is included in a monthly report submitted to the Chief of Engineers. Daily storage and daily outflow are published annually in the U.S. Geological Survey Water Supply Papers. Historical operation of Pine Flat is shown graphically on chart 25.

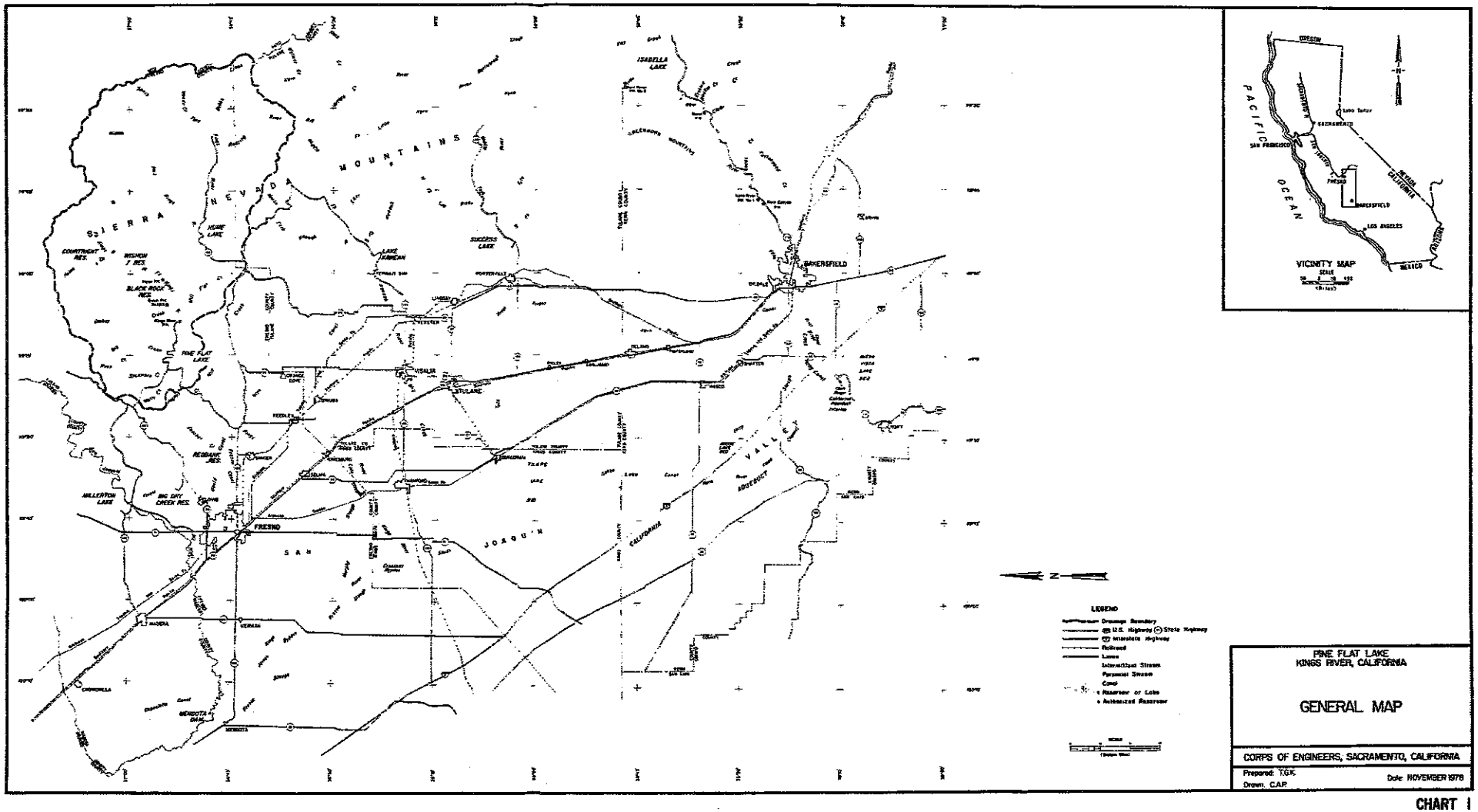
CHAPTER X - FUTURE DEVELOPMENT

42. PROJECTS UNDER CONSTRUCTION

Pacific Gas and Electric Company is presently constructing the Helms Pumped Storage Project between Courtright and Wishon Reserviors. The project is scheduled to be operational by 1981.

43. POTENTIAL DEVELOPMENT

In December 1974 the International Engineering Company, under contract to the Kings River Conservation District, completed a "Master Plan Study for Kings River Service Area". As a result of the study, the Kings River Conservation District applied to the Federal Power Commission for a preliminary permit covering hydroelectric sites at Pine Flat, Piedra, Mill Creek, Rodgers Crossing and Dinkey Creek. The permit was granted and the Kings River Conservation District is presently applying for licenses to construct the first two units of their proposed development: a hydroelectric power plant at Pine Flat Dam, and power development on Dinkey Creek.



PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

GENERAL MAP

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: T.G.K.
Drawn: C.A.P.

Date: NOVEMBER 1978

CHART I

Chart 2 is not available in this version of the Pine Flat water control manual.
For additional information, contact the U.S. Army Corps of Engineers
Sacramento District Public Affairs Office at (916) 557-7236

Chart 3 is not available in this version of the Pine Flat water control manual.
For additional information, contact the U.S. Army Corps of Engineers
Sacramento District Public Affairs Office at (916) 557-7236

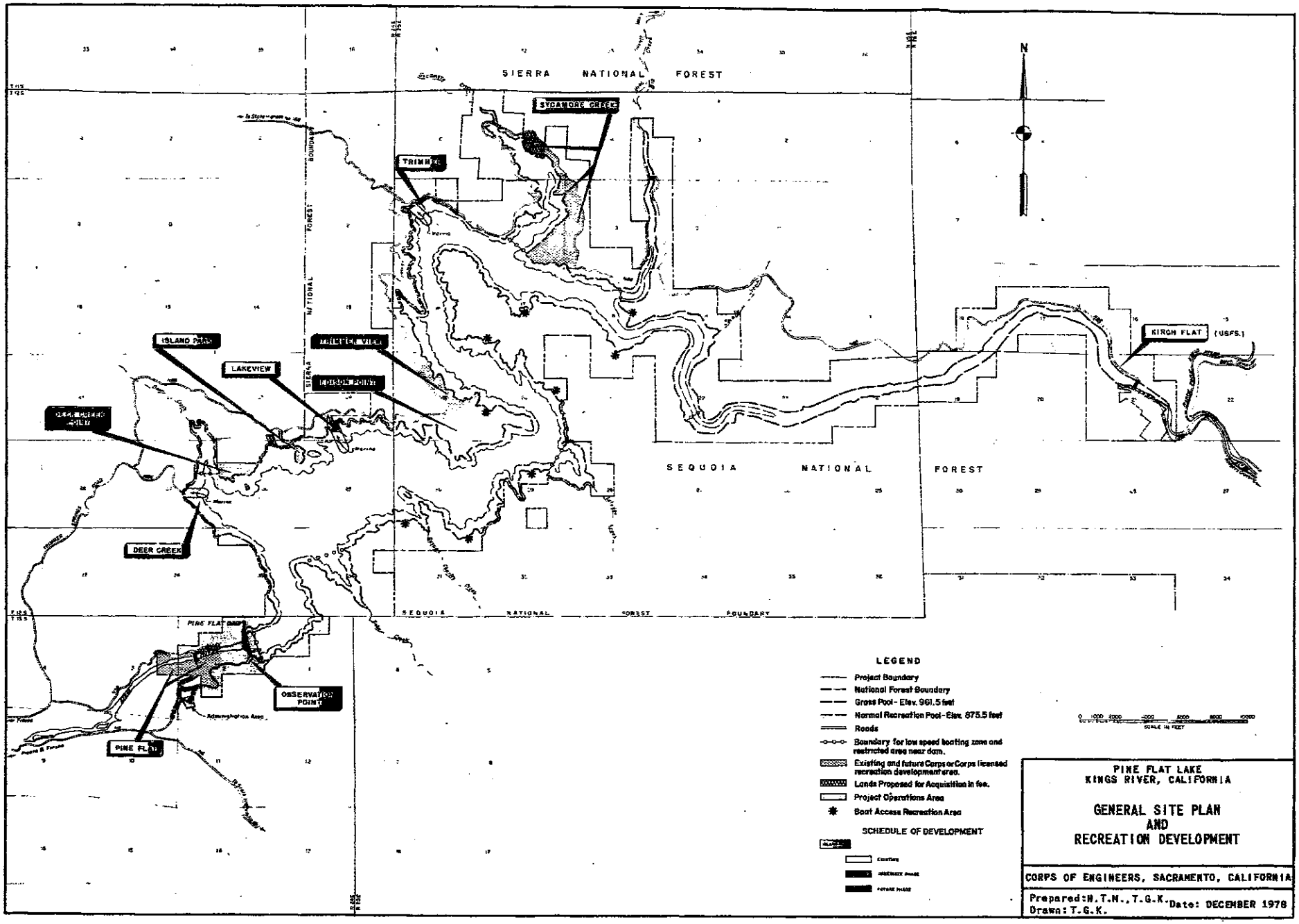
HISTORICAL UNIMPAIRED INFLOWS TO PINE FLAT LAKE

Runoff in 1,000 acre-feet

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL TOTAL
1955	8.7	18.0	26.9	39.1	50.3	62.0	122.3	329.4	330.8	77.7	31.0	11.2	1107.4
1956	8.7	13.2	379.7	204.5	98.6	127.5	239.6	519.2	565.9	266.8	67.8	26.8	2518.3
1957	24.2	18.2	16.6	21.5	50.0	66.7	122.4	318.2	467.1	100.7	28.6	11.2	1245.4
1958	16.2	24.7	44.0	39.3	87.5	154.9	321.4	751.2	647.3	271.0	92.2	31.4	2481.1
1959	16.7	14.2	13.7	26.9	70.0	92.3	182.8	191.9	122.7	30.3	15.0	25.4	801.9
1960	12.7	8.3	8.3	14.0	45.7	62.8	166.6	227.1	122.3	25.3	10.5	7.8	711.4
1961	10.3	20.4	24.1	14.6	20.9	37.9	116.7	161.9	104.6	20.2	25.5	10.6	567.7
1962	7.8	11.3	20.5	22.9	153.2	92.0	373.0	423.7	510.3	188.4	47.5	17.7	1868.3
1963	17.3	12.0	9.7	76.8	186.1	85.9	176.2	469.7	505.7	271.5	74.6	31.3	1916.8
1964	26.9	58.4	37.6	28.5	26.6	47.3	129.1	266.6	192.5	53.8	24.8	12.0	904.1
1965	9.6	33.8	148.2	149.3	82.0	94.9	222.1	411.3	458.7	291.0	110.8	29.8	1981.5
1966	17.1	68.7	59.7	53.3	43.4	101.2	274.2	368.8	143.5	46.4	23.5	9.7	1209.5
1967	8.5	28.3	295.3	99.1	99.7	208.0	217.4	607.0	847.6	649.2	161.2	66.7	3288.0
1968	25.4	24.8	36.0	33.4	53.2	70.2	140.0	246.1	137.1	41.4	18.6	7.0	833.2
1969	16.0	31.9	42.0	393.5	201.0	185.2	396.6	1117.1	1014.8	587.5	171.5	50.1	4207.2
1970	35.4	30.2	35.4	116.5	60.9	101.7	132.4	397.3	254.9	99.4	29.9	13.8	1307.8
1971	11.6	28.5	58.9	60.4	56.5	81.0	152.5	272.2	298.6	96.9	30.8	15.0	1162.9
1972	12.8	24.1	40.9	35.7	38.1	115.2	114.5	235.3	159.2	39.0	11.4	29.2	855.4
1973	17.5	28.6	39.2	76.8	87.5	112.0	211.6	748.3	550.7	154.7	50.0	15.4	2092.3
1974	21.3	56.1	59.9	109.1	53.8	161.3	233.9	619.6	515.3	154.6	56.8	14.9	2056.6
1975	15.1	18.5	26.4	30.6	53.1	101.4	97.9	522.2	512.1	125.5	32.1	15.0	1549.9
1976	38.0	26.0	21.0	14.9	24.9	45.7	73.7	160.0	47.3	21.9	16.7	42.6	532.7
1977	29.2	13.2	9.0	13.7	13.7	19.0	70.9	83.2	105.0	15.2	6.7	6.5	385.3
1978	8.2	10.1	68.8	131.2	174.8	254.9	275.1	687.6	899.9	519.1	167.1	166.8	3363.6
24-YEAR TOTAL	415.2	621.5	1521.8	1805.6	1831.5	2481.0	4562.9	10134.9	9513.9	4087.5	1304.6	667.9	38948.3
MEAN	17.3	25.9	63.4	75.2	76.3	103.4	190.1	422.3	396.4	170.3	54.4	27.8	1622.8

CHART 4

Chart 5 is not available in this version of the Pine Flat water control manual.
For additional information, contact the U.S. Army Corps of Engineers
Sacramento District Public Affairs Office at (916) 557-7236



PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

GENERAL SITE PLAN AND RECREATION DEVELOPMENT

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: N.T.M., T.G.K. Date: DECEMBER 1978
Drawn: T.G.K.

CHART 6

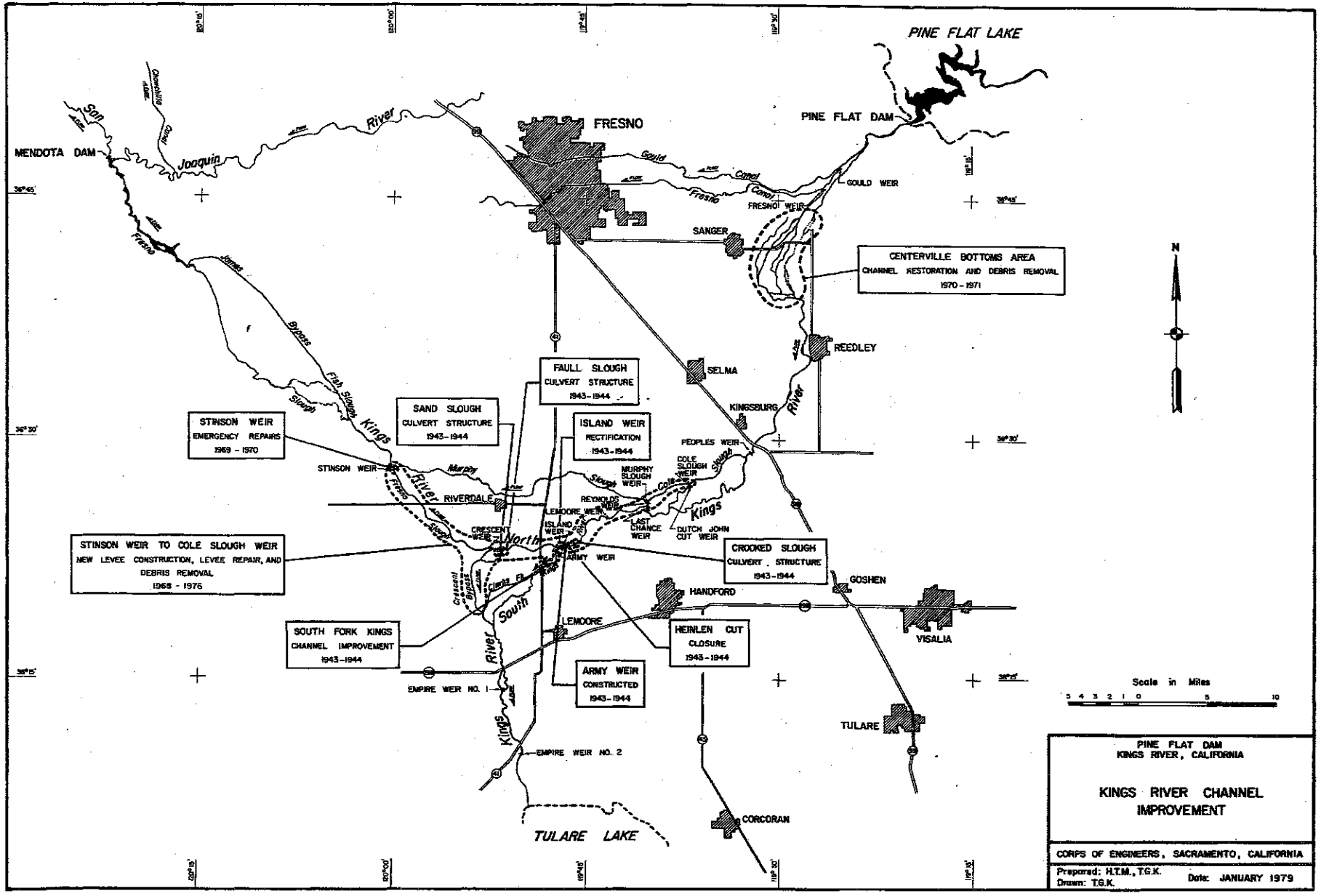
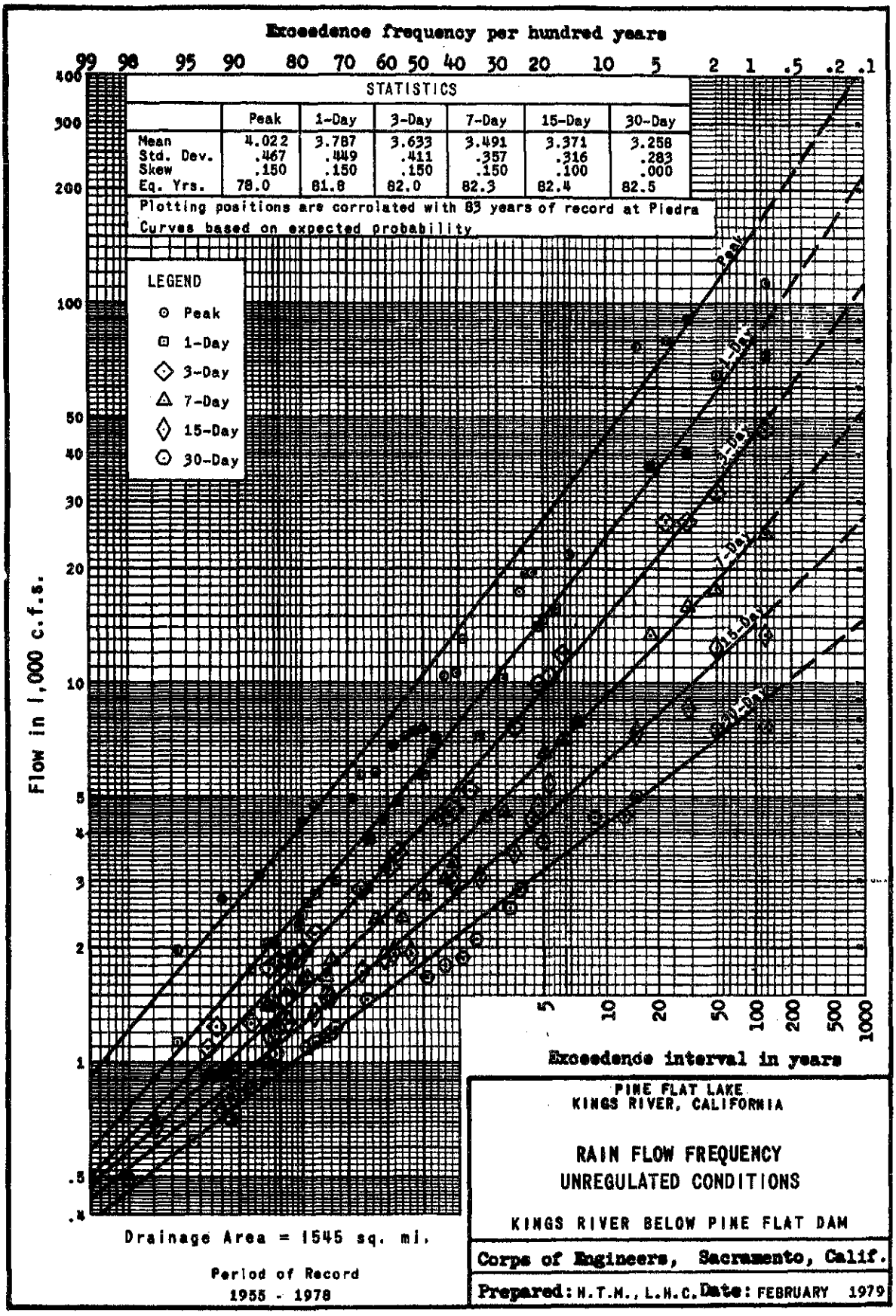
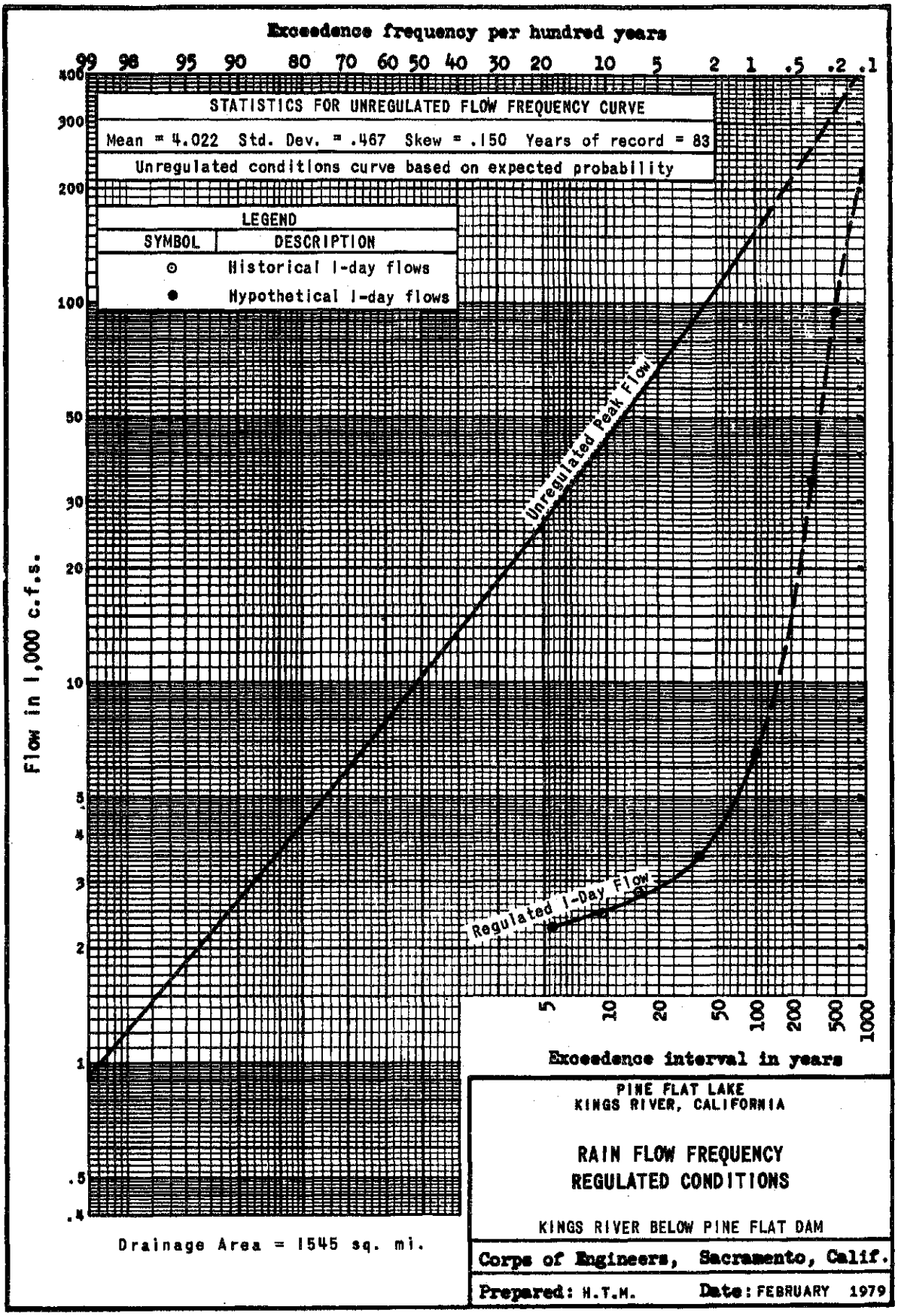

PINE FLAT LAKE
PINE FLAT DAM
FRESNO
MENDOTA DAM
San Joaquin River
Chowchilla Canal
Fresno River
James Bypass
Fish Slough
Gould Canal
Fresno Slough
GOULD WEIR
FRESNO WEIR
SANGER
CENTERVILLE BOTTOMS AREA
CHANNEL RESTORATION AND DEBRIS REMOVAL
1970 - 1971
REEDLEY
SELMA
KINGSBURG
PEOPLES WEIR
FAULL SLOUGH
CULVERT STRUCTURE
1943-1944
SAND SLOUGH
CULVERT STRUCTURE
1943-1944
ISLAND WEIR
RECTIFICATION
1943-1944
STINSON WEIR
EMERGENCY REPAIRS
1969 - 1970
STINSON WEIR
Murphy Slough
Cole Slough
Kings River
RIVERDALE
MURPHY SLOUGH WEIR
COLE SLOUGH WEIR
REYNOLDS WEIR
LEMOORE WEIR
ISLAND WEIR
LAST CHANCE WEIR
DUTCH JOHN CUT WEIR
CRESCENT WEIR
ARMY WEIR
North Fork
Crescent Bypass
Clarks Fk
South Fork Kings River
STINSON WEIR TO COLE SLOUGH WEIR
NEW LEVEE CONSTRUCTION, LEVEE REPAIR, AND DEBRIS REMOVAL
1968 - 1976
CROOKED SLOUGH
CULVERT STRUCTURE
1943-1944
HANDFORD
GOSHEN
VISALIA
LEMOORE
HEINLEN CUT
CLOSURE
1943-1944
SOUTH FORK KINGS
CHANNEL IMPROVEMENT
1943-1944
ARMY WEIR
CONSTRUCTED
1943-1944
EMPIRE WEIR NO. 1
EMPIRE WEIR NO. 2
TULARE
CORCORAN
TULARE LAKE
N
Scale in Miles
5 4 3 2 1 0 5 10
PINE FLAT DAM
KINGS RIVER, CALIFORNIA
KINGS RIVER CHANNEL IMPROVEMENT
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
Prepared: H.T.M., T.G.K.
Drawn: T.G.K.
Date: JANUARY 1979

CHART 7


Exceedence frequency per hundred years
99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 .5 .2 .1
STATISTICS
Peak 1-Day 3-Day 7-Day 15-Day 30-Day
Mean 4.022 3.787 3.633 3.491 3.371 3.258
Std. Dev. .467 .449 .411 .357 .316 .283
Skew .150 .150 .150 .150 .100 .000
Eq. Yrs. 78.0 81.8 82.0 82.3 82.4 82.5
Plotting positions are correlated with 83 years of record at Piedra
Curves based on expected probability
LEGEND
Peak
1-Day
3-Day
7-Day
15-Day
30-Day
Flow in 1,000 c.f.s.
400 300 200 100 50 40 30 20 10 5 4 3 2 1 .5 .4
5 10 20 50 100 200 500 1000
Exceedence interval in years
Drainage Area = 1545 sq. mi.
Period of Record
1955 - 1978
PINE FLAT LAKE
KINGS RIVER, CALIFORNIA
RAIN FLOW FREQUENCY
UNREGULATED CONDITIONS
KINGS RIVER BELOW PINE FLAT DAM
Corps of Engineers, Sacramento, Calif.
Prepared: H.T.M., L.H.C. Date: FEBRUARY 1979



SHEET 2 OF 2 CHART 8

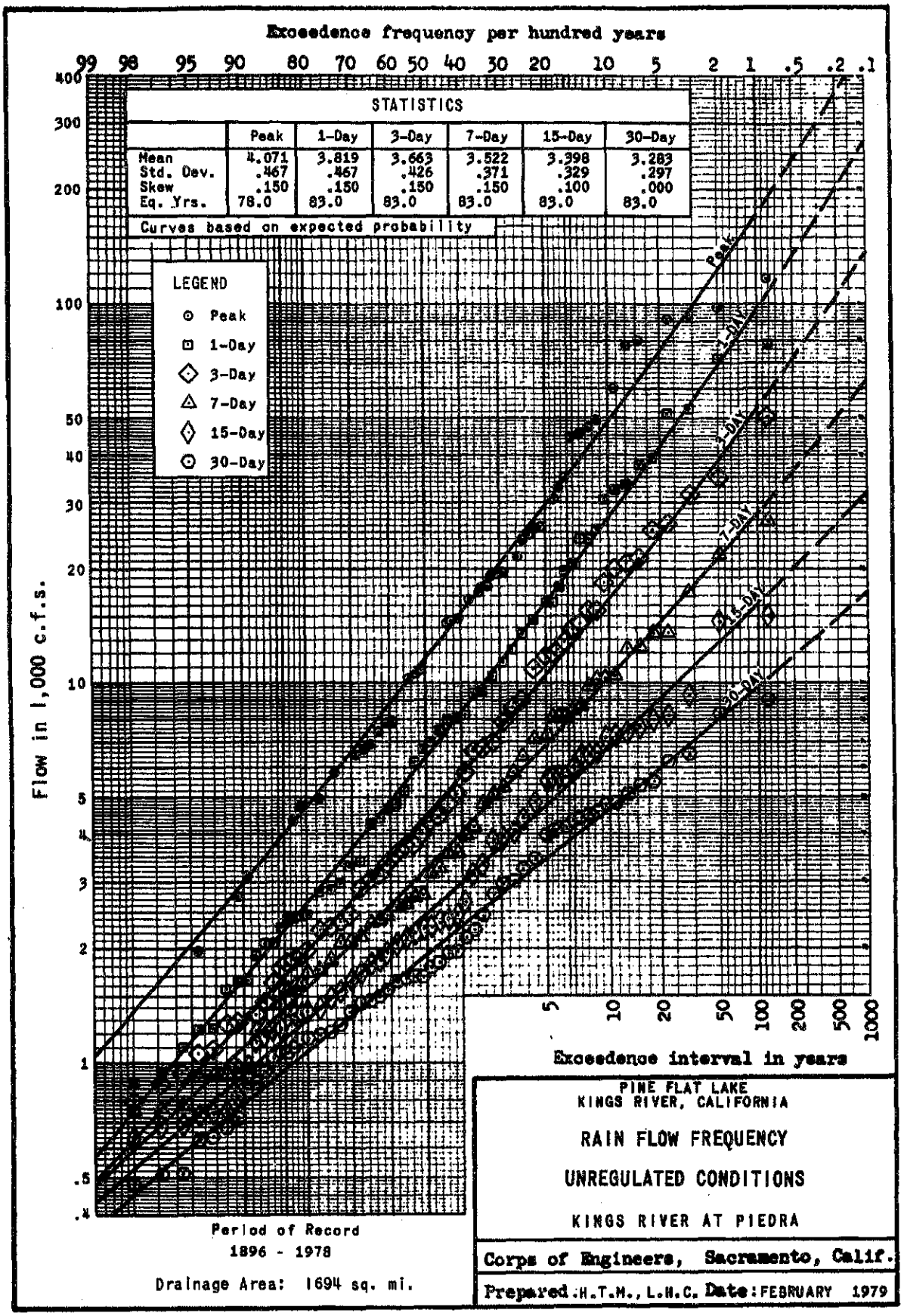

Exceedence frequency per hundred years
99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 .5 .2 .1
400
300
200
100
50
40
30
20
10
5
4
3
2
1
.5
.4
Flow in 1,000 c.f.s.
STATISTICS
Peak 1-Day 3-Day 7-Day 15-Day 30-Day
Mean 4.071 3.819 3.663 3.522 3.398 3.283
Std. Dev. .467 .467 .426 .371 .329 .297
Skew .150 .150 .150 .150 .100 .000
Eq. Yrs. 78.0 83.0 83.0 83.0 83.0 83.0
Curves based on expected probability
LEGEND
Peak
1-Day
3-Day
7-Day
15-Day
30-Day
Peak
1-DAY
3-DAY
7-DAY
15-DAY
30-DAY
5 10 20 50 100 200 500 1000
Exceedence interval in years
Period of Record
1896 - 1978
Drainage Area: 1694 sq. mi.
PINE FLAT LAKE
KINGS RIVER, CALIFORNIA
RAIN FLOW FREQUENCY
UNREGULATED CONDITIONS
KINGS RIVER AT PIEDRA
Corps of Engineers, Sacramento, Calif.
Prepared H.T.M., L.H.C. Date: FEBRUARY 1979

CHART 9

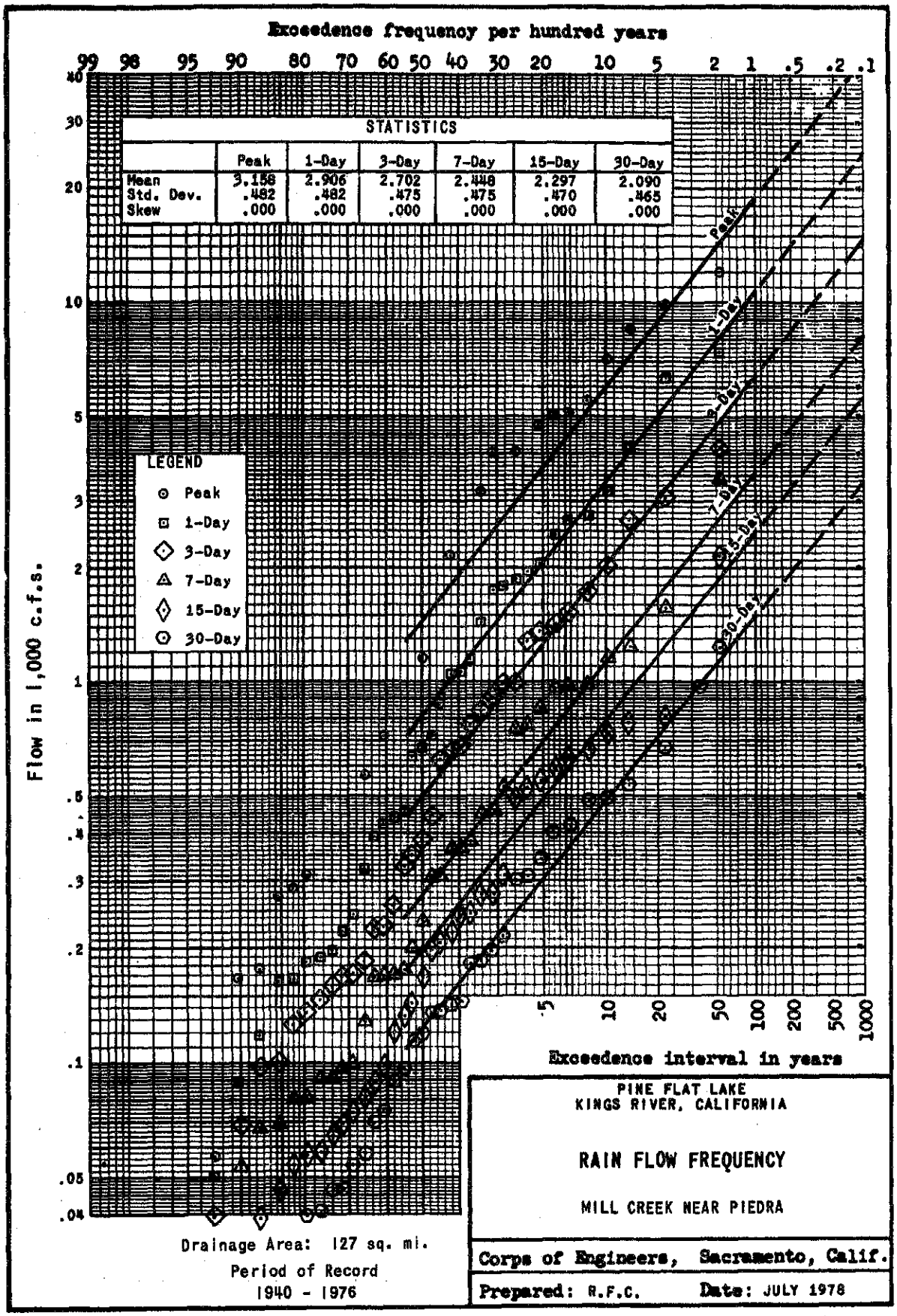
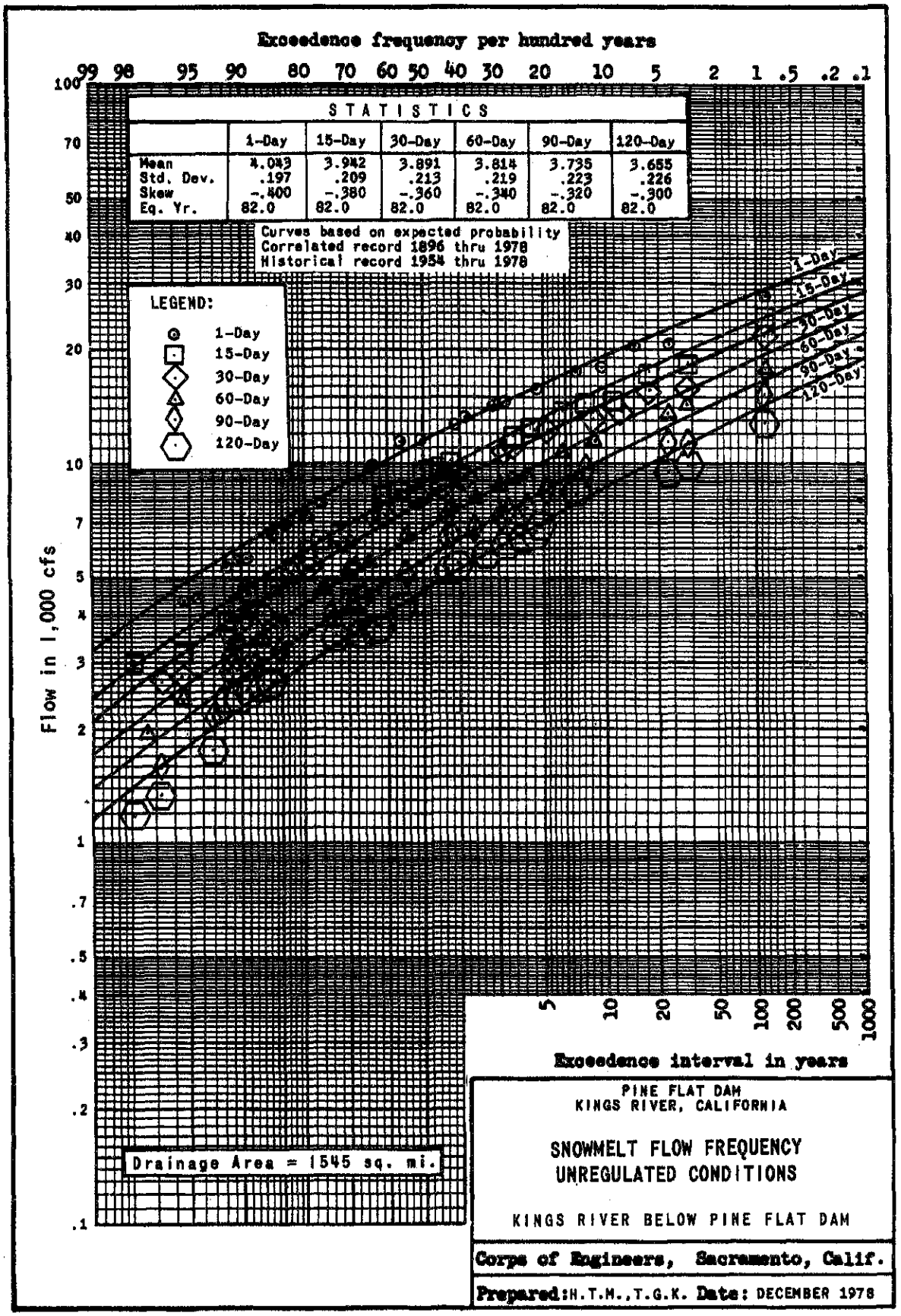
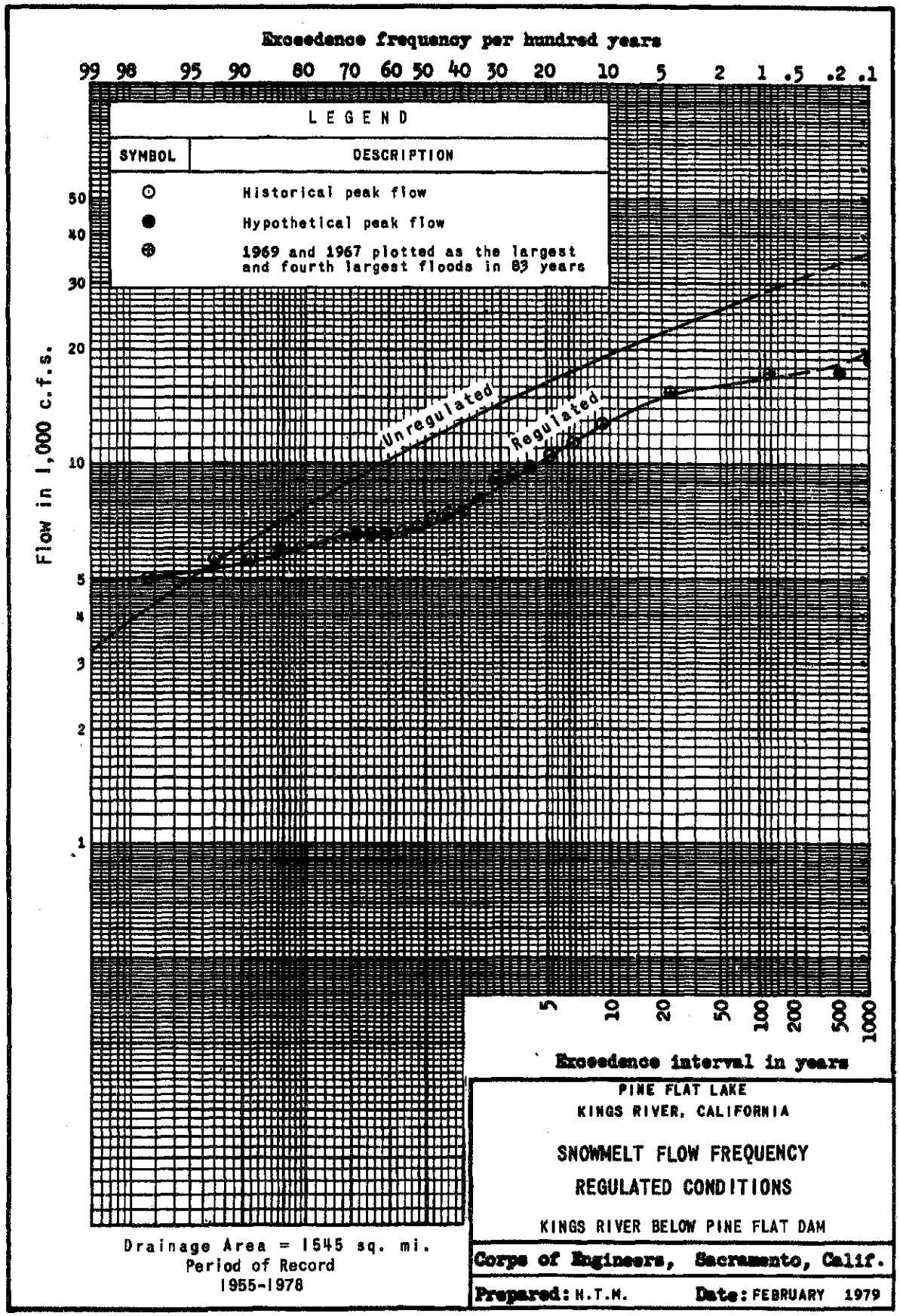
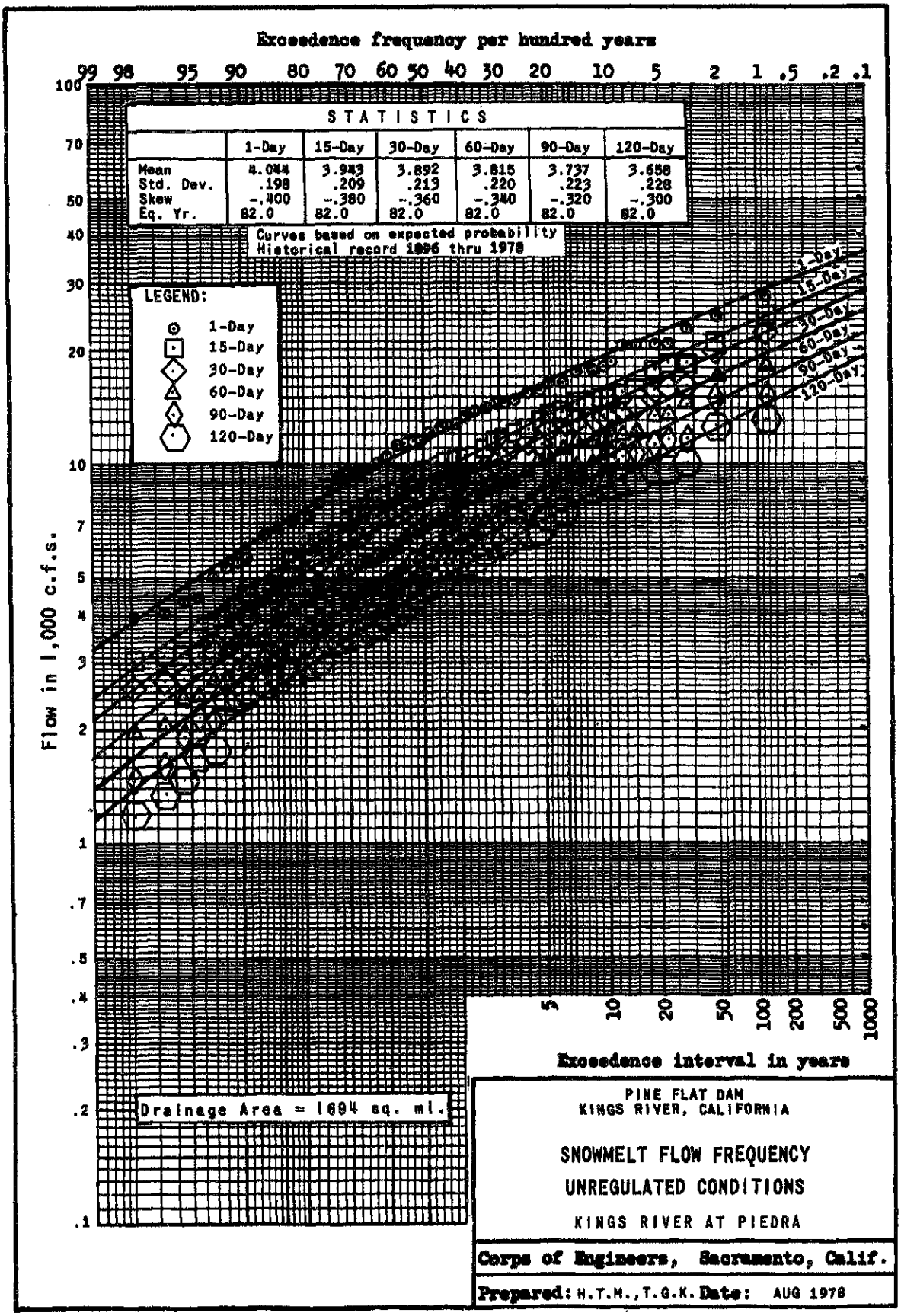

Exceedence frequency per hundred years
99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 .5 .2 .1
40
30
20
10
5
3
2
1
.5
.4
.3
.2
.1
.05
.04
Flow in 1,000 c.f.s.
STATISTICS
Peak 1-Day 3-Day 7-Day 15-Day 30-Day
Mean 3.158 2.906 2.702 2.448 2.297 2.090
Std. Dev. .482 .482 .475 .475 .470 .465
Skew .000 .000 .000 .000 .000 .000
LEGEND
Peak
1-Day
3-Day
7-Day
15-Day
30-Day
Peak
1-Day
3-Day
7-Day
15-Day
30-Day
.5 10 20 50 100 200 500 1000
Exceedence interval in years
Drainage Area: 127 sq. mi.
Period of Record
1940 - 1976
PINE FLAT LAKE
KINGS RIVER, CALIFORNIA
RAIN FLOW FREQUENCY
MILL CREEK NEAR PIEDRA
Corps of Engineers, Sacramento, Calif.
Prepared: R.F.C. Date: JULY 1978

CHART 10



SHEET 1 of 2 CHART 11


Exceedence frequency per hundred years
99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 .5 .2 .1
LEGEND
SYMBOL
DESCRIPTION
Historical peak flow
Hypothetical peak flow
1969 and 1967 plotted as the largest and fourth largest floods in 83 years
Flow in 1,000 c.f.s.
50
40
30
20
10
5
4
3
2
1
Unregulated
Regulated
5 10 20 50 100 200 500 1000
Exceedence interval in years
Drainage Area = 1545 sq. mi.
Period of Record
1955-1978
PINE FLAT LAKE
KINGS RIVER, CALIFORNIA
SNOWMELT FLOW FREQUENCY
REGULATED CONDITIONS
KINGS RIVER BELOW PINE FLAT DAM
Corps of Engineers, Sacramento, Calif.
Prepared: H.T.M. Date: FEBRUARY 1979



PINE FLAT DAM
KINGS RIVER, CALIFORNIA

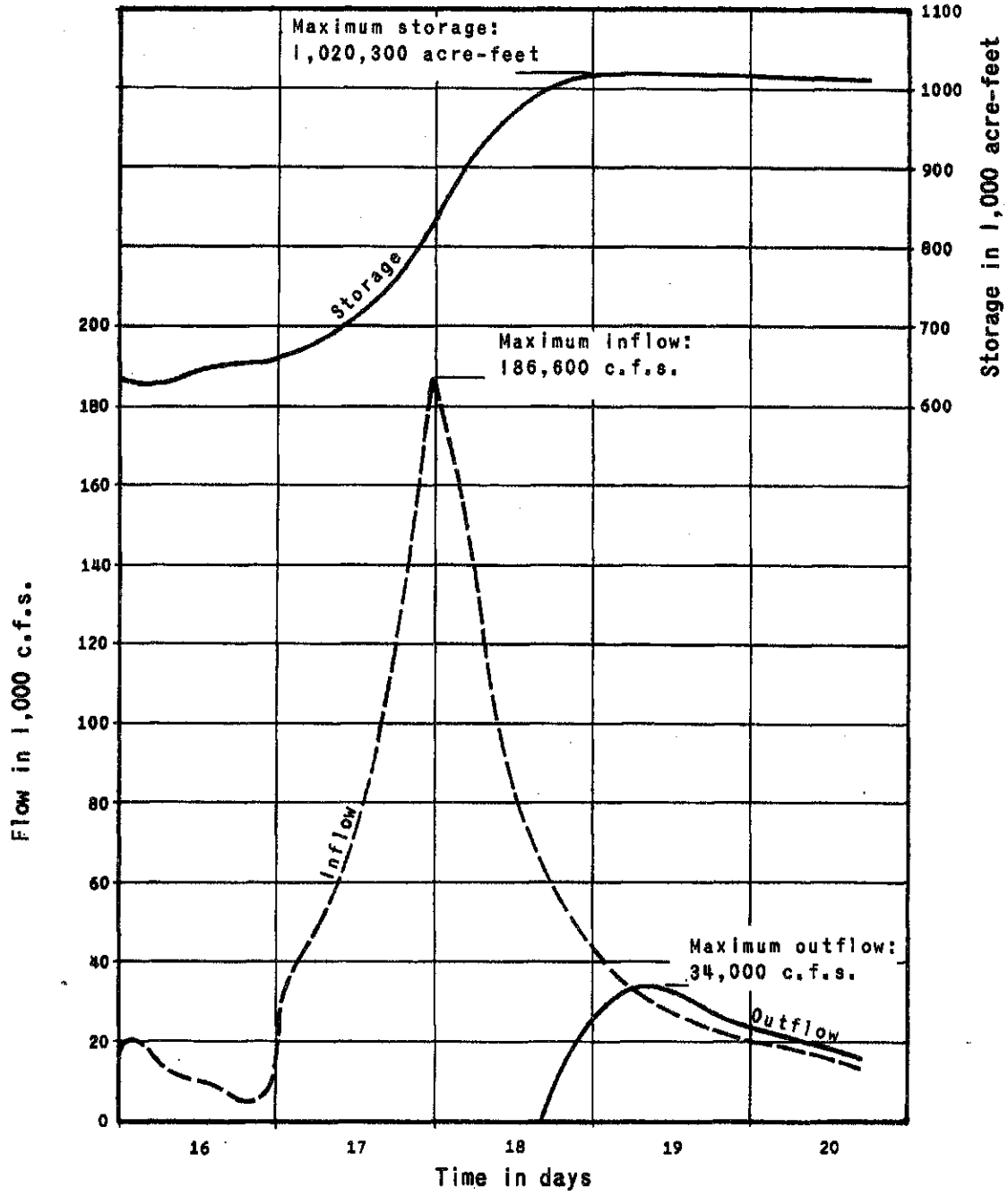
SNOWMELT FLOW FREQUENCY
UNREGULATED CONDITIONS

KINGS RIVER AT PIEDRA

Corps of Engineers, Sacramento, Calif.

Prepared: H.T.M., T.G.K. Date: AUG 1978

CHART 12



MAIN WAVE OF STANDARD PROJECT 30-DAY FLOOD SERIES

PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

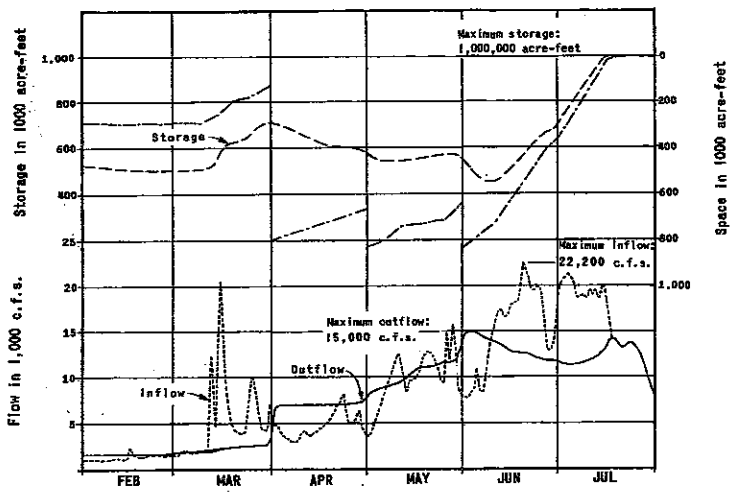
STANDARD PROJECT
FLOOD ROUTING

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

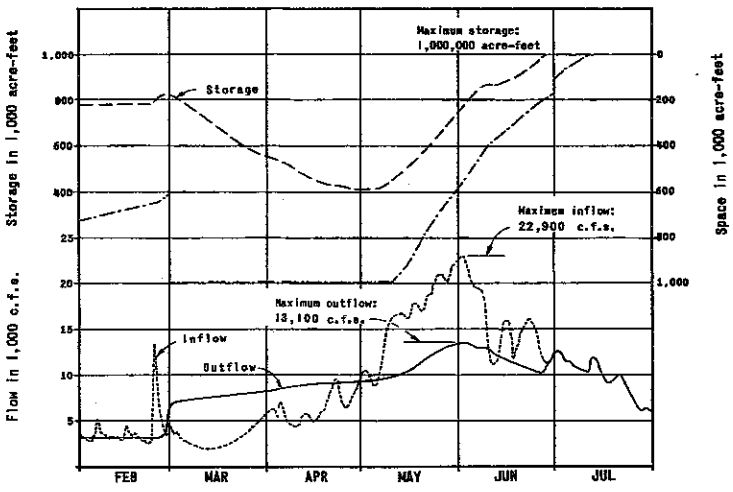
Prepared: H.T.M.
Drawn: L.H.C.

Date: DECEMBER 1978

CHART 13



1906



1969

FIRE FLAT LAKE
KINGS RIVER, CALIFORNIA

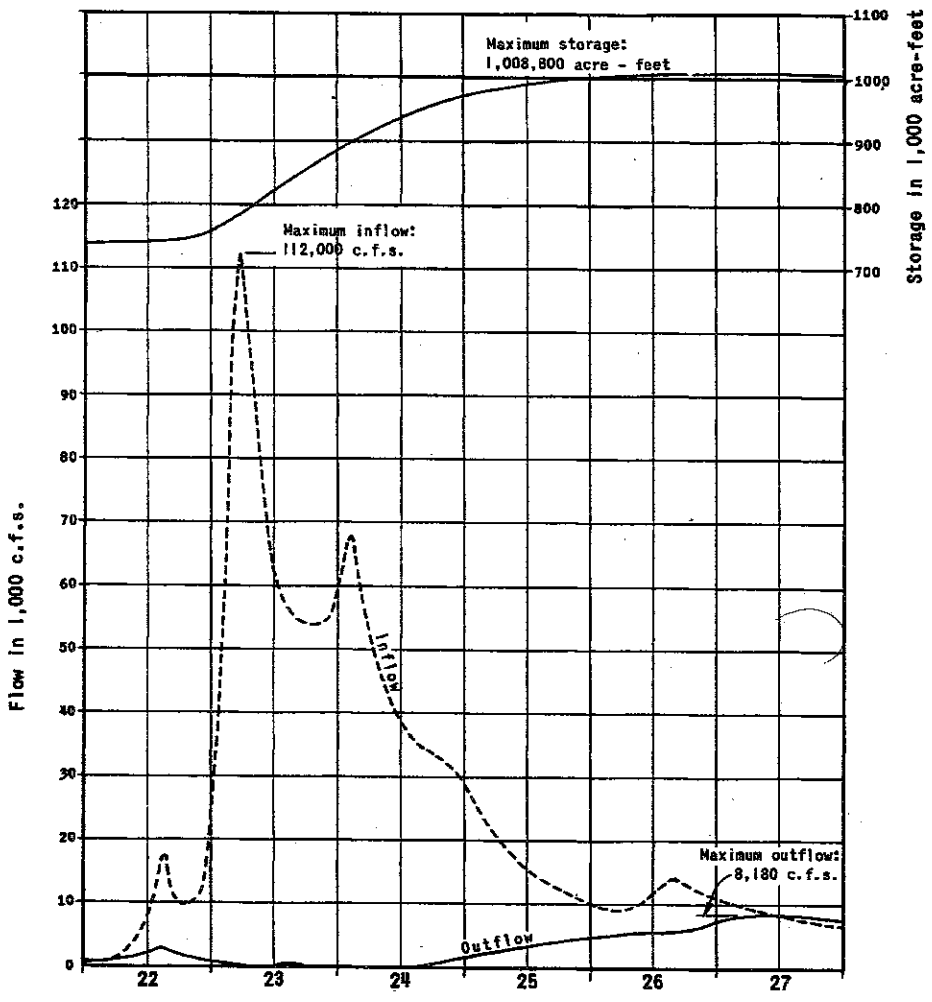
HYPOTHETICAL ROUTINGS
OF HISTORIC
SNOWMELT FLOODS

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: H.T.M.
Drawn: L.H.C.

Date: MARCH 1979

CHART 14



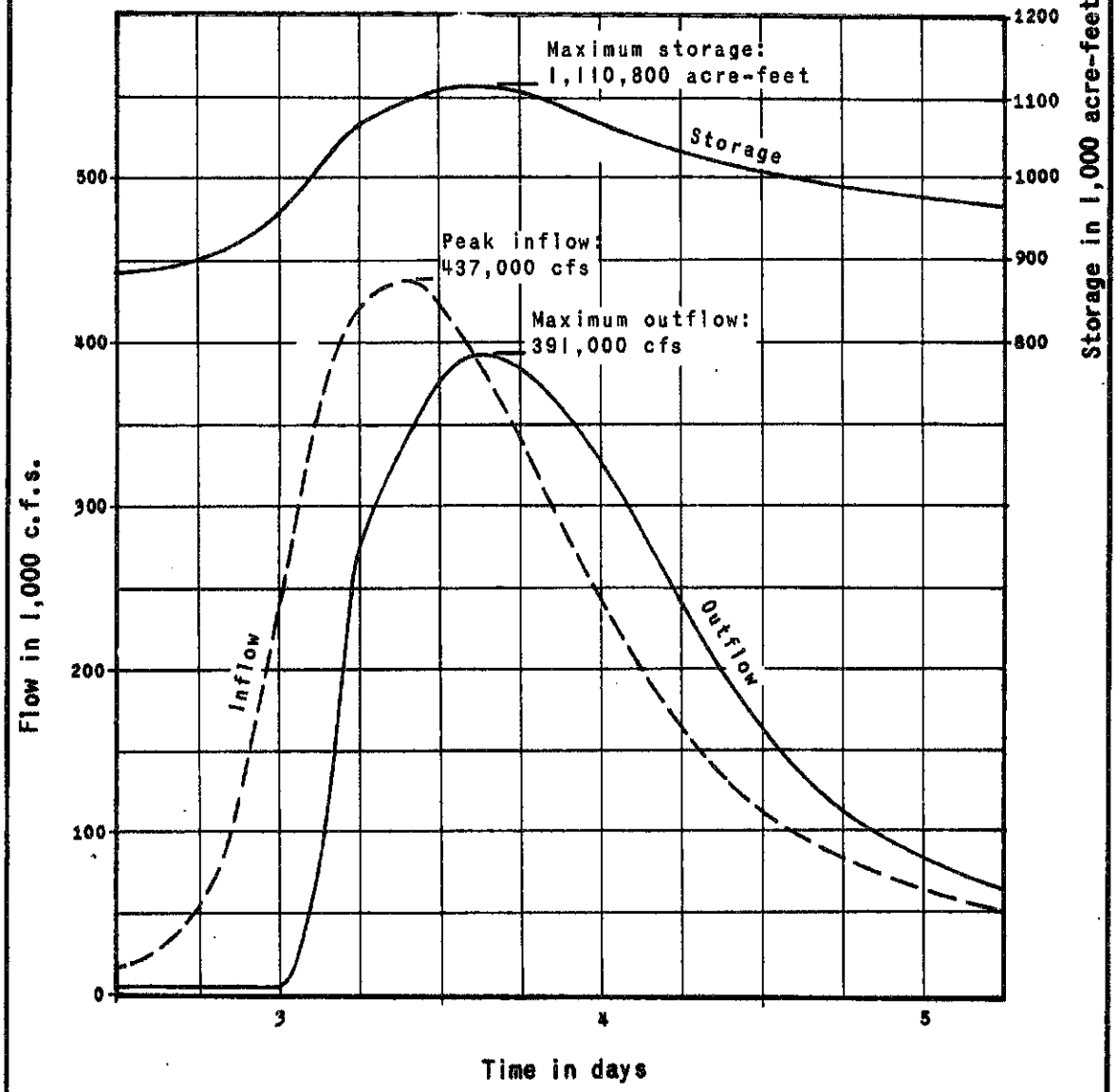
PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

HYPOTHETICAL ROUTING
OF DECEMBER 1955 RAINFLOOD

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: H.T.H.
Drawn: L.H.C.
Date: MARCH 1979

CHART 15



Drainage Area = 1545 sq. mi.

PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

SPILLWAY DESIGN
FLOOD ROUTING

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.R.B.
Drawn: L.R.B.

Date: SEPTEMBER 1954

CHART 16

FISH AND WILDLIFE RELEASES ON KINGS RIVER

The data in this table is based on an agreement between Kings River Water Association and the State of California, dated 11 September 1964.

Minimum release from Pine Flat Dam: 25 c.f.s.

Minimum release at the head of Centerville Bottoms:

UNIMPAIRED RUNOFF OF KINGS RIVER AT PIEDRA FOR WATER YEAR *(acre-feet)*	MINIMUM FLOWS FOR PERIOD *(c.f.s.)*		
	1 OCTOBER THROUGH 15 NOVEMBER	16 NOVEMBER THROUGH 31 MARCH	1 APRIL THROUGH 30 SEPTEMBER
1,000,000 or less	50	50	50
1,100,000	60	50	60
1,200,000	70	50	70
1,250,000	75	50	75
1,300,000	75	50	80
1,400,000	75	50	90
1,500,000 or more	75	50	100

NOTES:

1. The flow at the head of Centerville Bottoms is defined as the sum of the actual flow of Kings River at Piedra and the discharge from the Friant-Kern Canal into Kings River, decreased by diversions to Gould, Fresno, Alta and Consolidated Canals (exclusive of diversion through canal for China Slough Ditch).
2. The minimum flow requirements shown above increase or decrease proportionally to the nearest cubic foot per second between each stage of unimpaired runoff.
3. The minimum release requirements for the period 1 April through 30 September shall be based on actual flows to date of release plus the forecasted subsequent runoff as determined by California Department of Water Resources, assuming median subsequent hydrologic conditions.
4. The minimum release requirements for the period 1 October through 15 November shall be based on the unimpaired runoff of Kings River at Piedra for the immediately preceding water year.
5. No minimum releases shall be made in excess of the calculated daily unimpaired runoff of Kings River at Piedra.

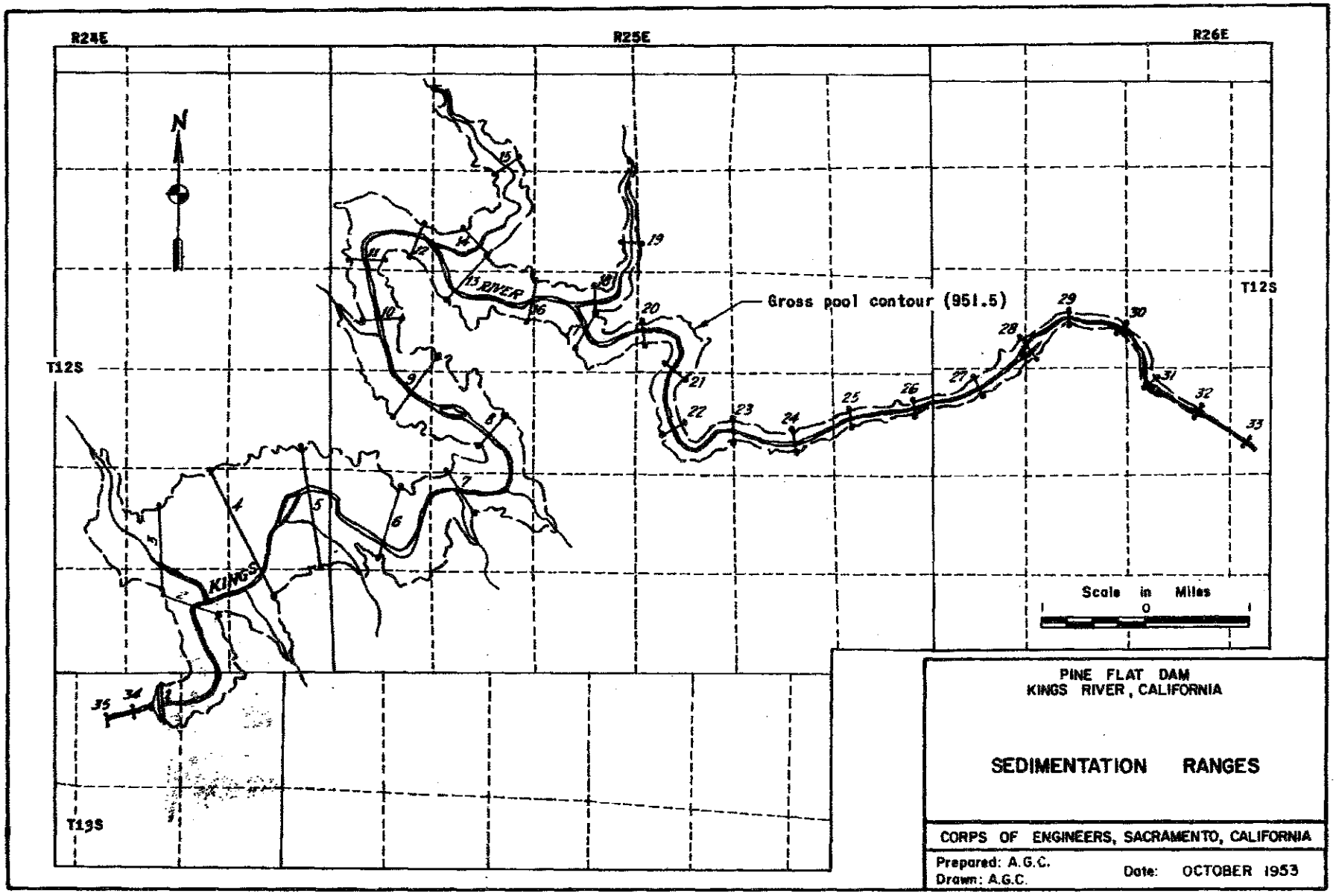

R24E
R25E
R26E
T12S
T12S
T13S
N
KINGS
Gross pool contour (951.5)
Scale in Miles
0
PINE FLAT DAM
KINGS RIVER, CALIFORNIA
SEDIMENTATION RANGES
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
Prepared: A.G.C.
Drawn: A.G.C.
Date: OCTOBER 1953

CHART 18

TWO HOUR UNIT GRAPH FOR 750 SQUARE MILES

TIME IN HOURS	AVERAGE FLOW IN C.F.S.
0	0
2	13,976
4	45,431
6	57,921
8	41,245
10	23,693
12	14,956
14	10,361
16	7,600
18	5,808
20	4,479
22	3,492
24	2,769
26	2,206
28	1,768
30	1,404
32	1,090
34	870
36	722
38	564
40	397
42	286
44	215
46	158
48	110
50	67
52	47
54	33
56	14
58	2
60	0

HISTORIC FLOOD DATA

DATE	TOTAL PRECIPITATION *(Inches)*	34° ELEVATION *(Feet MSL)*	INITIAL LOSS *(Inches)*	CONSTANT LOSS RATE *(Inches per 2 hours)*	FLOW VOLUME AT PIEDRA *(Ac-ft)*	LOCAL RUNOFF VOLUME AT PIEDRA *(Ac-ft)*
18-26 Jan 69	24.7	5700	5.8	.4	369000	69500
1- 7 Dec 66	15.7	8000	7.0	.4	224000	18500
18-25 Dec 55	17.1	8100	2.1	.4	30900	21900

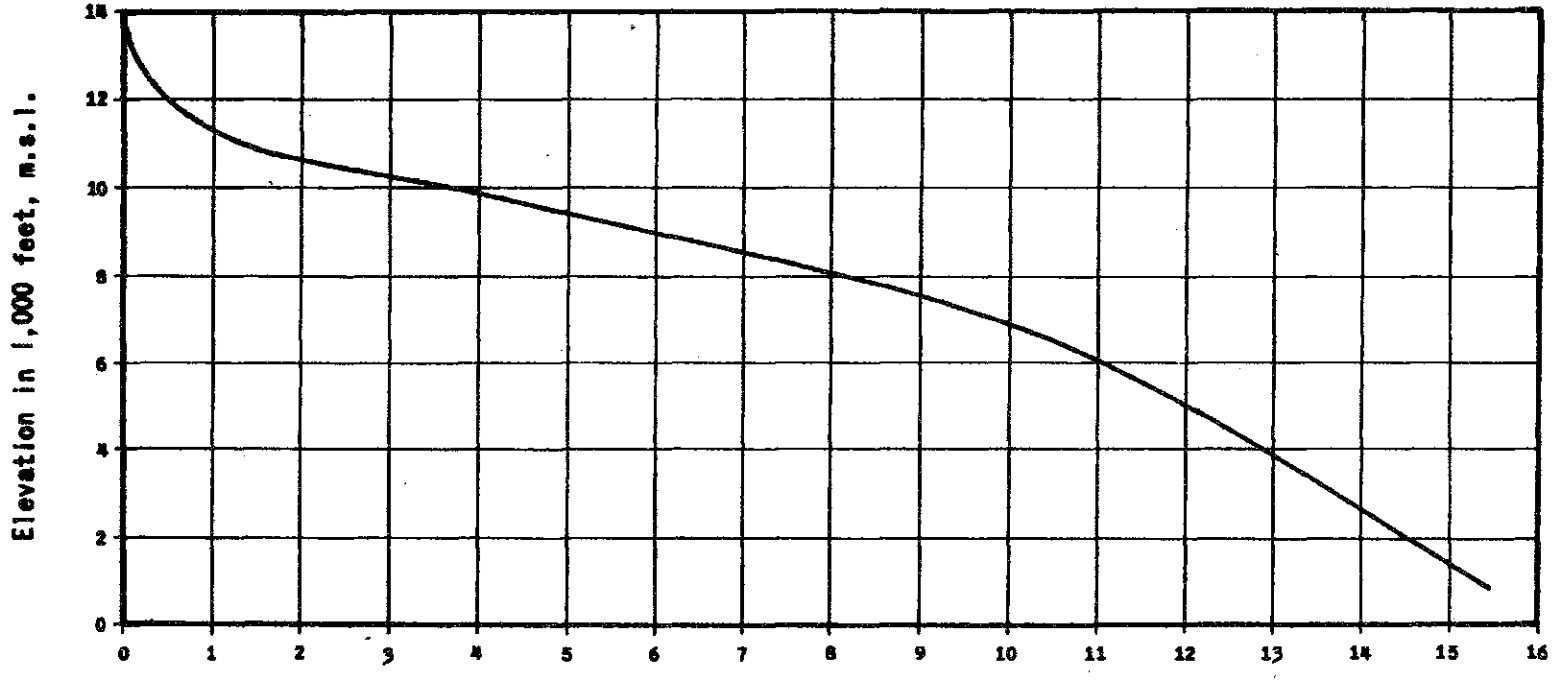
PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

PINE FLAT LAKE
RAINFLOOD
FORECAST CRITERIA

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: H.T.M.
Drawn: N.L.W.
Date: JUNE 1979

CHART 19



Drainage Area = 1545 sq. mi.

PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

AREA-ELEVATION CURVE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.

Date: DECEMBER 1978

CHART 20

SUMMARY OF FORECASTED AND ACTUAL SNOWMELT RUNOFF INTO PINE FLAT LAKE

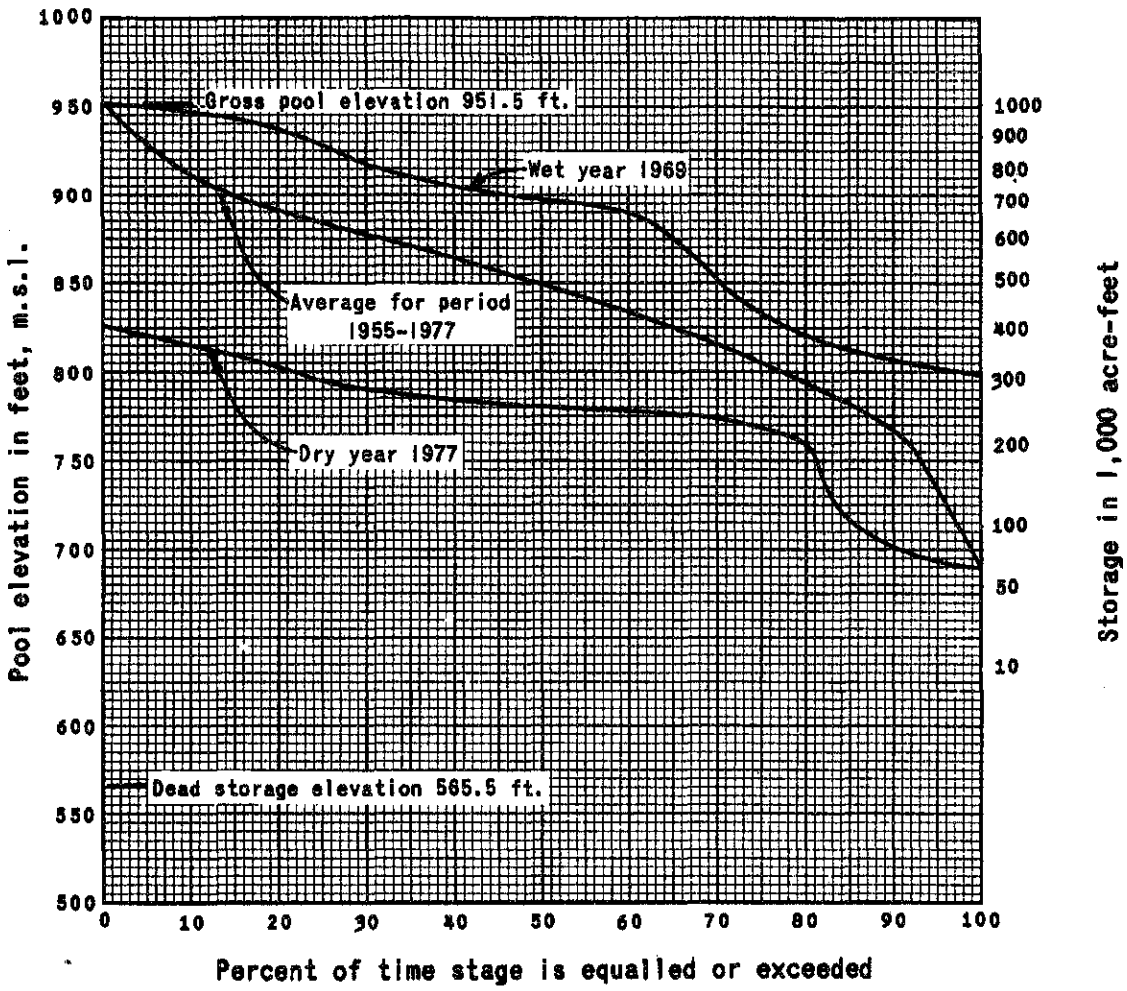
(Flow in 1,000 acre-feet)

WATER YEAR	ACTUAL	1 APRIL – 31 JULY RUNOFF								
		1 FEBRUARY			1 MARCH			1 APRIL		
		FORECAST	ERROR	% ERROR	FORECAST	ERROR	% ERROR	FORECAST	ERROR	% ERROR
1955	860	1,196	+ 336	+ 28	1,148	+ 288	+ 25	739	- 121	- 16
1956	1,591	2,194	+ 603	+ 27	1,847	+ 256	+ 14	1,597	+ 6	0
1957	1,008	849	- 159	- 16	839	- 169	- 20	730	- 278	- 38
1958	1,981	1,150	- 841	- 73	1,260	- 731	- 58	2,150	+ 159	+ 7
1959	528	760	+ 232	+ 30	980	+ 452	+ 46	670	+ 142	+ 21
1960	541	550	+ 9	+ 1	680	+ 139	+ 20	560	+ 19	+ 3
1961	403	770	+ 367	+ 47	500	+ 97	+ 19	420	+ 17	+ 4
1962	1,495	840	- 655	- 77	1,440	- 55	- 3	1,520	+ 25	+ 1
1963	1,423	760	- 663	- 87	770	- 653	- 85	800	- 623	- 78
1964	642	850	+ 208	+ 24	510	- 132	- 26	560	- 82	- 15
1965	1,323	1,500	+ 177	+ 11	1,175	- 148	- 13	1,100	- 223	- 20
1966	833	1,280	+ 447	+ 34	1,090	+ 257	+ 24	780	- 53	- 7
1967	2,321	1,600	- 721	- 45	1,270	- 1,051	- 83	1,650	- 671	- 41
1968	565	930	+ 365	+ 39	720	+ 155	+ 22	620	+ 55	+ 9
1969	3,116	2,200	- 916	- 41	2,900	- 216	- 7	2,950	- 166	- 6
1970	884	1,200	+ 316	+ 26	1,020	+ 136	+ 13	1,000	+ 116	+ 12
1971	820	1,220	+ 400	+ 33	950	+ 130	+ 14	840	+ 20	+ 2
1972	548	1,090	+ 542	+ 49	830	+ 282	+ 34	500	- 48	- 10
1973	1,665	1,320	- 345	- 26	1,610	- 55	- 3	1,840	+ 175	+ 9
1974	1,523	1,380	- 143	- 10	1,130	- 393	- 35	1,450	- 73	- 5
1975	1,266	820	- 446	- 54	980	- 286	- 29	1,350	+ 84	+ 6
1976	303	540	+ 237	+ 43	480	+ 177	+ 36	400	+ 97	+ 24
1977	274	465	+ 191	+ 41	230	- 44	- 19	200	- 74	- 37
1978	2,382	1,600	- 782	- 48	1,945	- 437	- 22	2,350	- 32	- 1
Mean(+)	1,179	1,128	+ 316	+ 31	1,096	+ 215	+ 24	1,116	+ 76	+ 9
Mean(-)	-	-	- 567	- 48	-	- 336	- 31	-	- 204	- 23
Extreme(+)	3,116	2,200	+ 603	+ 48	2,900	+ 452	+ 46	2,950	+ 175	+ 24
Extreme(-)	274	465	- 916	- 87	230	- 1,051	- 85	200	- 671	- 78

GIVEN DATE THROUGH 31 JULY RUNOFF							
1 MAY				1 JUNE			
ACTUAL	FORECAST	ERROR	% ERROR	ACTUAL	FORECAST	ERROR	% ERROR
738	653	- 85	- 13	408	NA	NA	NA
1,352	1,356	+ 4	0	833	NA	NA	NA
886	636	- 250	- 39	568	NA	NA	NA
1,669	1,721	+ 52	+ 3	918	965	+ 47	+ 5
345	397	+ 52	+ 13	153	NA	NA	NA
375	390	+ 15	+ 4	148	NA	NA	NA
287	243	- 44	- 15	125	NA	NA	NA
1,122	1,057	- 65	- 6	699	NA	NA	NA
1,247	844	- 403	- 48	777	NA	NA	NA
513	401	- 112	- 28	246	NA	NA	NA
1,101	1,080	- 21	- 2	690	NA	NA	NA
559	466	- 93	- 20	190	NA	NA	NA
2,104	2,030	- 74	- 4	1,497	1,290	- 207	- 16
425	410	- 15	- 4	178	NA	NA	NA
2,719	2,600	- 119	- 5	1,602	1,585	- 17	- 1
752	818	+ 66	+ 8	354	NA	NA	NA
668	618	- 50	- 8	395	NA	NA	NA
443	330	- 103	- 31	198	NA	NA	NA
1,454	1,550	+ 96	+ 6	705	NA	NA	NA
1,289	1,296	+ 7	+ 1	670	NA	NA	NA
1,160	1,380	+ 220	+ 16	638	NA	NA	NA
229	302	+ 73	+ 24	69	NA	NA	NA
203	125	- 78	- 62	120	NA	NA	NA
2,107	2,325	+ 218	+ 9	1,419	NA	NA	NA
989	959	+ 80	+ 9	567	1,280	+ 47	+ 5
-	-	- 108	- 21	-	-	- 112	- 8
2,719	2,600	+ 220	+ 24	1,602	1,585	+ 47	+ 4
203	125	- 403	- 62	69	965	- 207	- 16

NOTES:

1. NA = Not Available.
2. Forecasts prepared and published by State of California.
3. Computed error based on past performance is not necessarily indicative of the accuracy that may be achieved in the future.



PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

STAGE - DURATION CURVES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: T.G.K.

Date: FEBRUARY 1979

CHART 22

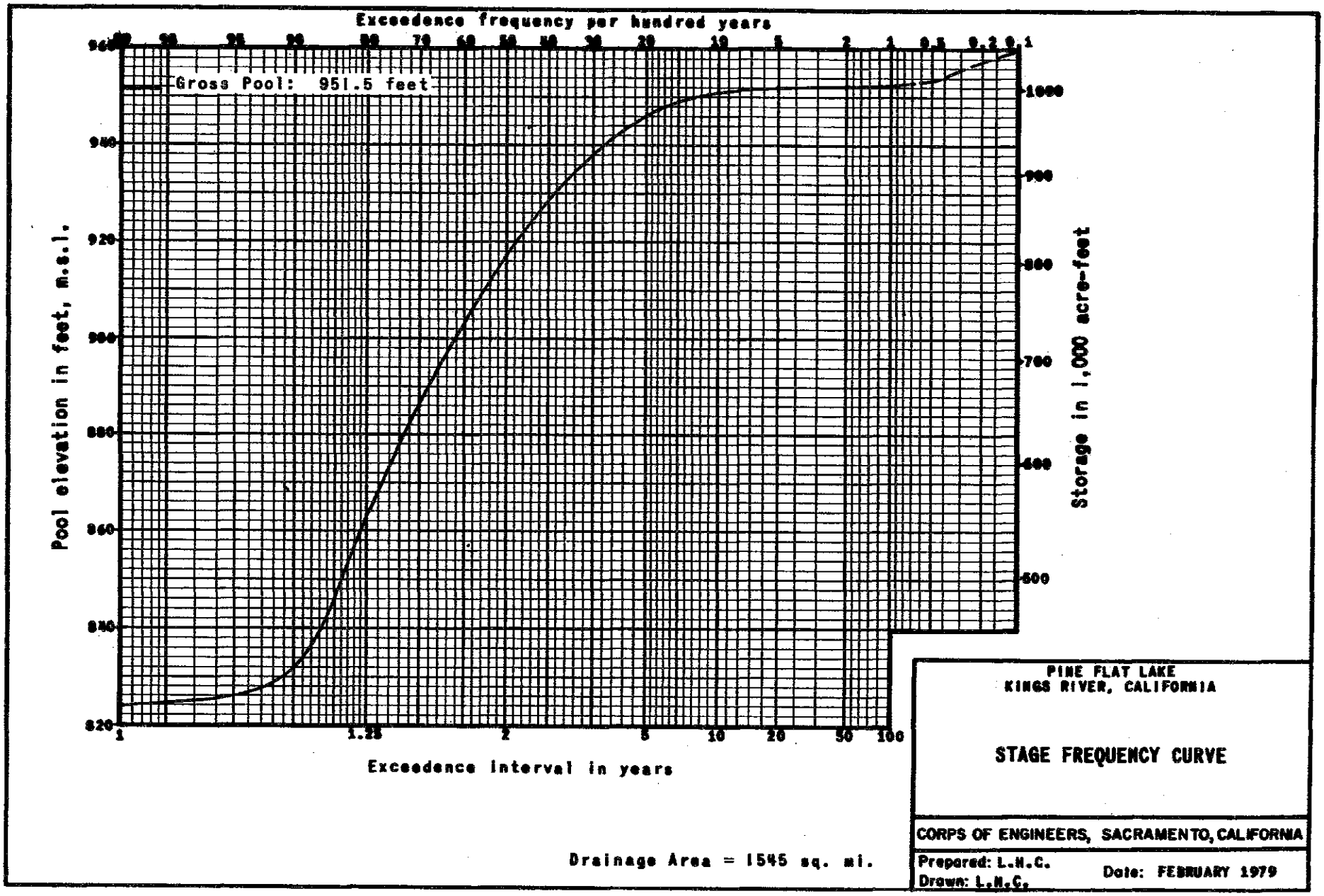
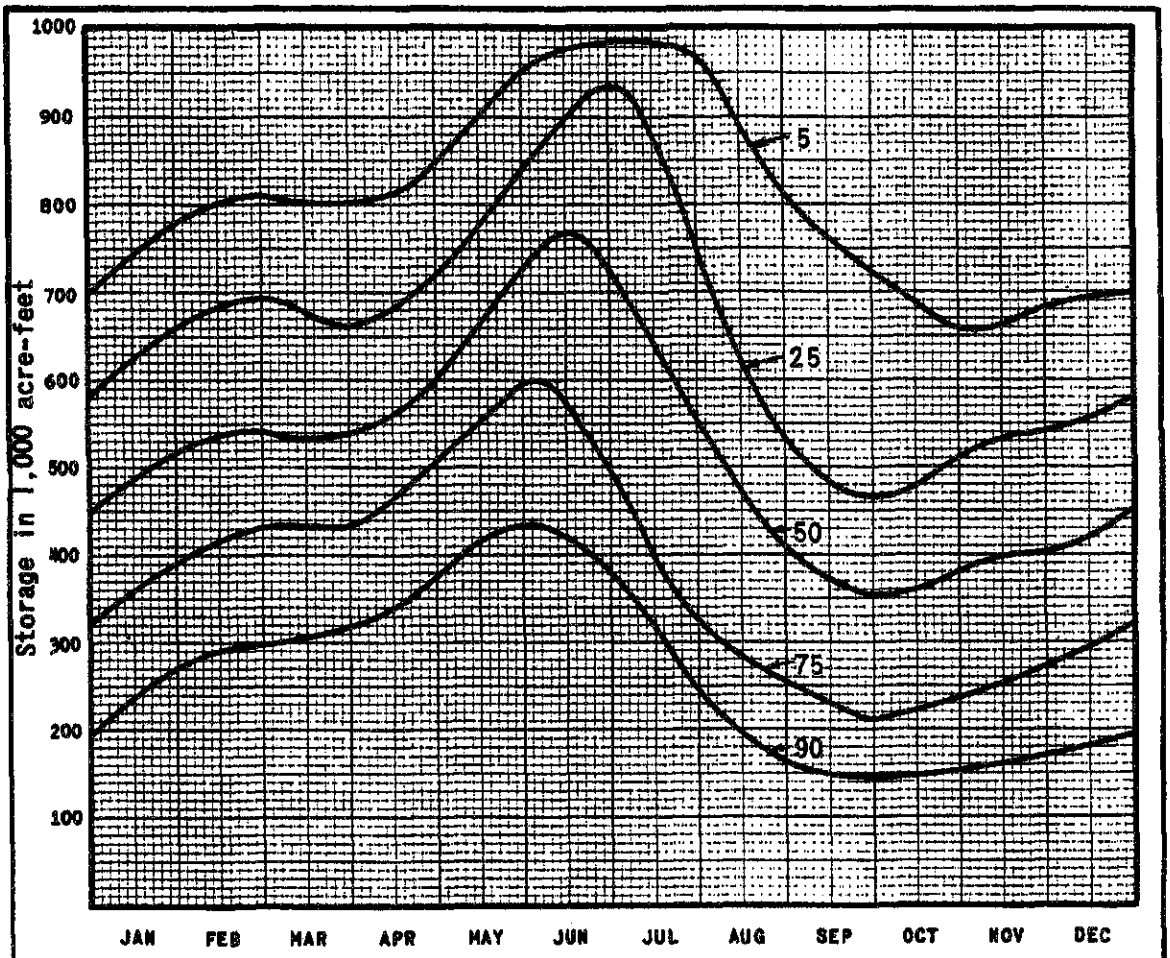

Exceedence frequency per hundred years
Gross Pool: 951.5 feet
Pool elevation in feet, m.s.l.
Storage in 1,000 acre-feet
Exceedence interval in years
1
1.25
2
5
10
20
50
100
PINE FLAT LAKE
KINGS RIVER, CALIFORNIA
STAGE FREQUENCY CURVE
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
Prepared: L.H.C.
Drawn: L.H.C.
Date: FEBRUARY 1979
Drainage Area = 1545 sq. mi.

CHART 23



NOTE:

Indicated value is percentage of years that storage is exceeded on a given date based on total end of month storage for the years 1955-1978. Data extracted from U.S.G.S. water supply papers.

PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

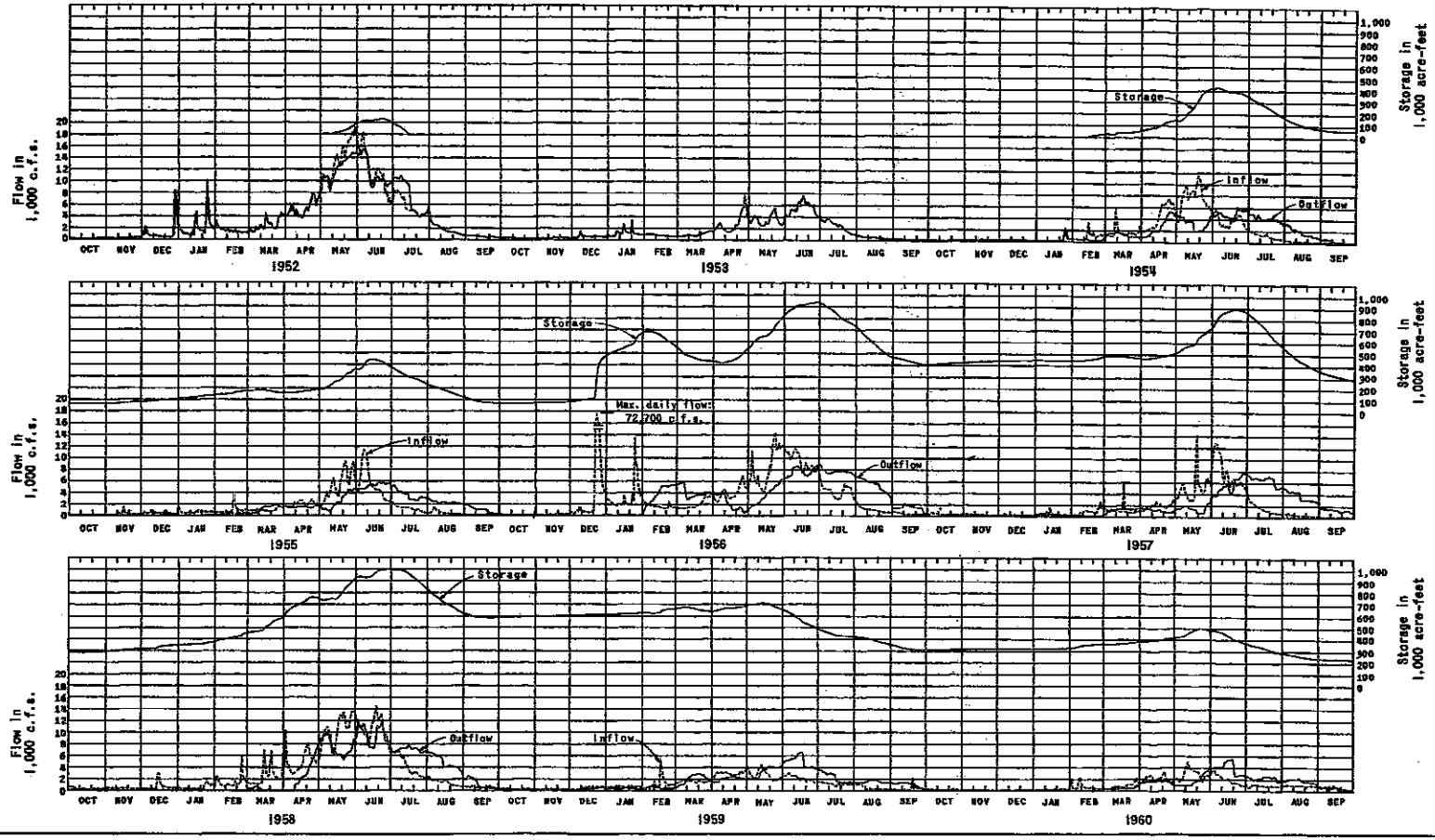
SEASONAL VARIATION OF RESERVOIR STORAGE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.

Date: DECEMBER 1978

CHART 24



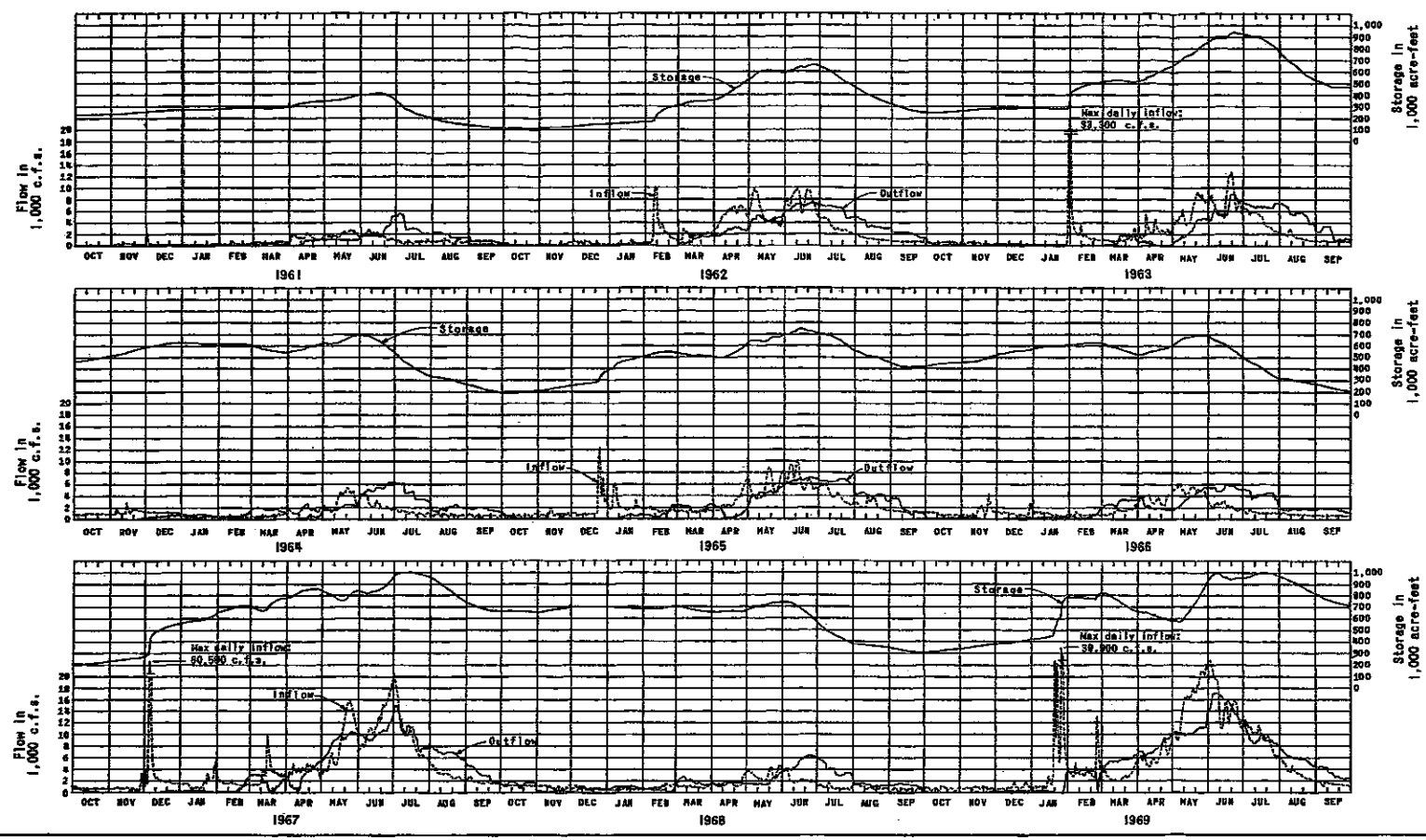
PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

HISTORICAL OPERATION
PINE FLAT LAKE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: H.T.H. Date: JUNE 1979
Drawn: L.H.C.

SHEET 1 OF 3 CHART 25



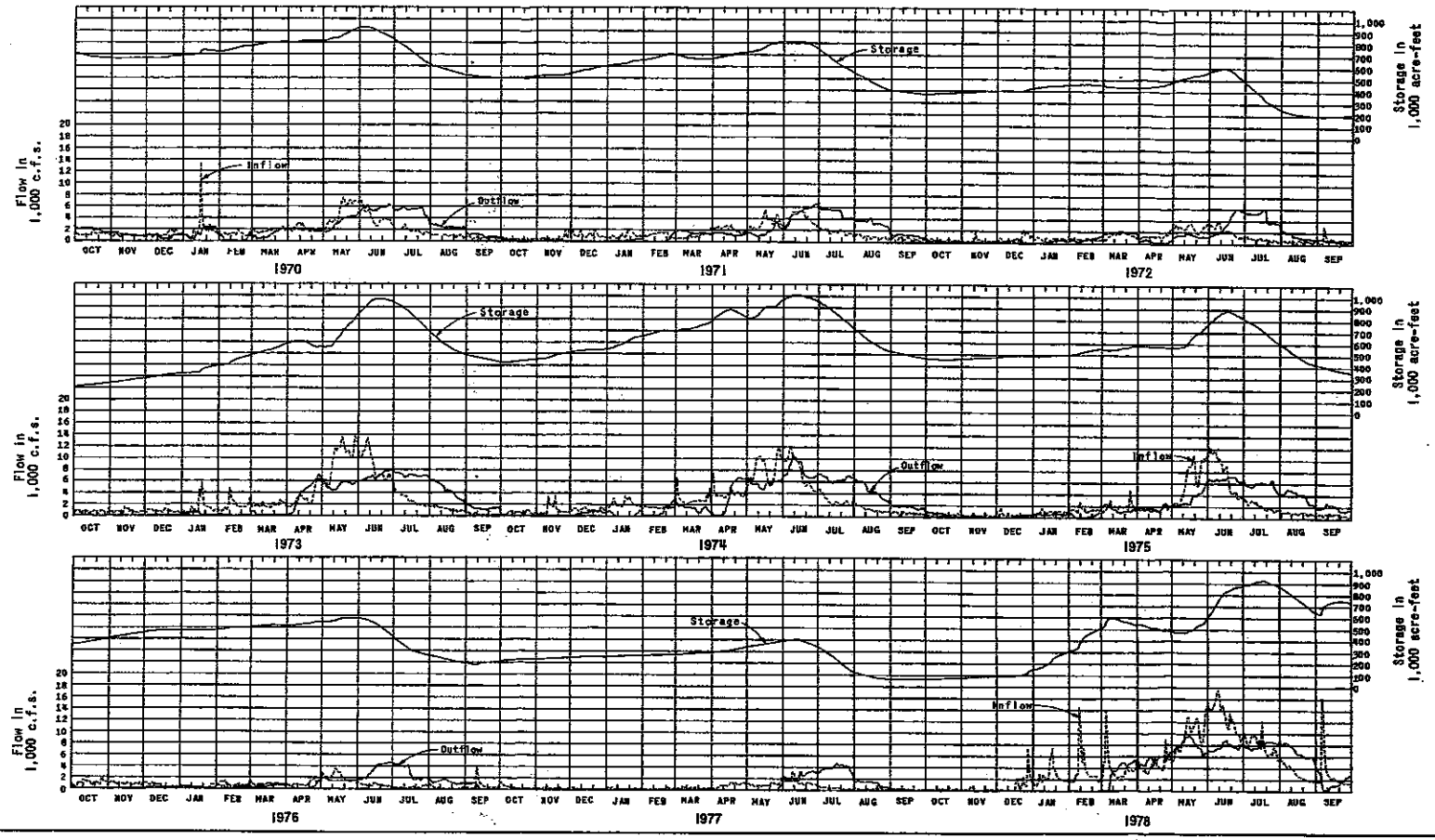
PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

HISTORICAL OPERATION
PINE FLAT LAKE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: N.T.H. Date: JUNE 1979
Drawn: L.H.C.

SHEET 2 OF 3 CHART 25



PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

HISTORICAL OPERATION
PINE FLAT LAKE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: H.T.M. Date: JUNE 1979
Drawn: L.N.C.

SHEET 3 OF 3 CHART 25

RESERVOIR REGULATION MANUAL

FOR

PINE FLAT LAKE

KINGS RIVER, CALIFORNIA

APPENDIX A

STANDING OPERATING INSTRUCTIONS

November 1953
Rev. September 1979

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

RESERVOIR REGULATION MANUAL
FOR
PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

APPENDIX A
STANDING OPERATING INSTRUCTIONS

TABLE OF CONTENTS

LIST OF CHARTS

1. GENERAL

a. This appendix to the "Reservoir Regulation Manual, Pine Flat Lake, Kings River, California" is prepared in accordance with instructions contained in EM 1110-2-3600, paragraph 4-07 (Standing Instructions to Dam Operators) and pertains to duties and responsibilities of the Dam Operator in connection with the functional operation of Pine Flat Lake for flood control, and the reporting of required hydrologic data.

b. Operational instructions to the Dam Operator are briefly outlined with specific emphasis on the Dam Operator's duties and responsibilities during extreme flood emergencies when communication facilities between the dam and Sacramento District Office are disrupted. It is designed for optional separation from the manual, and used as an emergency flood control regulation guide, or as published in conjunction with the "Reservoir Regulation Manual, Pine Flat Lake." To facilitate independent use of this appendix, charts required for emergency flood control operation of Pine Flat Lake are included.

2. OPERATION REQUIREMENTS

Operation of Pine Flat Lake is accomplished by Corps of Engineers personnel under supervision of the Construction-Operations Division of the Sacramento District Office, with instructions on all matters covering flood control operation received directly from the Reservoir Control Section of the Engineering Division. The Park Manager is responsible for:

a. Accomplishing the physical operation of the reservoir in accordance with instructions contained in this manual or issued by the Reservoir Control Section. During storms, this will often require 24-hour attendance at the dam.

b. Calculating and maintaining a continuous provisional record of inflows, outflows, storage, weather data, upstream reservoir storages, and other data specified by the Reservoir Control Section. This information should be recorded on forms designed for that purpose.

c. Reporting by radio (or telephone) to the Reservoir Control Section such data as outlined in paragraphs 8 and 9, and other data that may be requested from time to time.

d. Keeping local interests continuously advised of the operation of the reservoir.

e. Reporting to the Reservoir Control Section any unusual condition in the reservoir or along the downstream channels which might interfere with the planned operation of the reservoir.

f. Maintaining all trash racks clear of trash in order that the outlet gates can be operated systematically and effectively.

g. Maintaining a log of gate operation on the appropriate form furnished, containing (1) change in position of gates, (2) date and time, (3) reservoir water level, and (4) the initials of the individual accomplishing the change.

h. Immediately after the end of each month, dispatching the data specified in paragraph b to the Reservoir Control Section.

i. Making emergency operation changes when contact with the District Office is broken and a clearly defined change occurs that warrants immediate action. Charts A-1 through A-8 are included for use in accomplishing the various operational requirements specified above, and in preparing the required operation reports listed in paragraph 8.

3. LIMITATIONS ON STORAGE

Operational limitations on storage in Pine Flat Lake are specified in paragraphs 6 and 7. There are no legal limitations on storage, as the taking line elevation (961 feet) is above any normal operation level.

4. LIMITATIONS ON RELEASES

Unless flood releases are required, outflows will depend on irrigation and fish requirements. These requirements will be determined by the Kings River Watermaster. Also, any necessary releases in excess of irrigation demands should be restricted as long as possible to channel capacities as listed on chart A-6, or as otherwise determined by the Corps of Engineers. Releases of flood water to Tulare Lake will be delayed as long as possible in order to permit harvesting of crops. Flows in Kings River North should be restricted when they would cause San Joaquin River flows to exceed preproject quantities.

5. OUTLET WORKS

a. Heads under which outlets may be operated at full opening are limited by the ability of the machinery to open and close the slide gates and by the possibility of developing negative pressures within the conduit. The machinery for operating the outlet gates is designed to open and close the gate leaves under 300 feet of head for normal operation and under 390 feet of head for emergency operation. Although model studies indicated that pressures low enough to cause cavitation would not occur, actual operation has shown that cavitation will occur at full gate opening with heads of about 300 feet. Unless further operating experience indicates otherwise, the safe full gate operating head for the lower tier will be assumed to be 285 feet (pool elevation 855) and for the upper tier 184 feet (pool elevation 924).

b. In addition to the restrictions on full gate openings discussed above, it is possible that vibration of the gates or cavitation will further restrict the head under which partial gate openings can be maintained. Although operating experience indicates that these factors are not serious, gate operation schedules contained in paragraph 5d below are designed to minimize the possibilities of excessive vibration or cavitation.

c. Model studies of the upper tier of conduits indicated that when full gate openings were used within the range of pool elevations between 762 and 817 feet surges were observed. In actual operation surge has been observed at pool elevations as high as 831 feet. Such surge action can be eliminated by reducing gate openings to about 7 feet. Although operating experience has indicated that surge action will not have serious consequences, attempts will be made to avoid it by reducing gate openings as necessary in those conduits where surge is observed and increasing gate openings as necessary in other upper-tier conduits.

d. The schedule of gate operation will be as follows:

(1) It is not anticipated that there will be any hydraulic limitation on the sequence or arrangement of gate openings, but it is suggested that the upper and lower tier gates at each level be opened fully in turn in the following order and closed in the reverse order (gates numbered from left to right looking downstream):

Lower tier:	3, 2, 4, 1, 5
Upper tier:	8, 7, 9, 6, 10
Spillway:	All gates simultaneously. (See paragraph 5d(4))

(2) Fine regulation shall not cause gate openings to be less than 2 inches. Openings under 2 inches cause excessive cavitation to the gate leaf lip and gate frames.

(3) At water surface elevations below 751 feet, all releases shall be made through the lower outlets, and the upper outlets and spillway gates shall remain closed.

(4) At water surface elevations between 751 and 924 feet, releases shall be made through the upper outlets insofar as possible, and the lower outlets shall be open only as required to discharge the desired release in cooperation with the upper outlets. Spillway gates shall remain closed within this range. Openings of the upper-tier gates shall be limited to values that do not result in surge action, the probable range of which is indicated on chart A-4. Surge action is observable as a pulsation in outflow at the downstream face of the dam.

(5) At water surface elevations above 924, all outlets shall be closed and regulation made by spillway gates alone. Such regulation can most easily be affected by manipulating one gate at a time, but keeping the maximum difference in the six openings to 1 foot after the initial setting is made and until such time as the spillway gates are to be closed completely.

(6) During the transitions between lower and upper outlets and between upper outlets and spillway gates, care shall be taken to assure that fluctuation in downstream flows is minimized. This requires opening one set of gates in increments simultaneously with the closing of the other set of gates in equivalent increments (increments representing equal changes in release).

6. FLOOD CONTROL OPERATION

a. The release schedule for flood control operation of Pine Flat Reservoir, until emergency spillway releases are required, is given on chart A-8. This diagram is designed to reserve the necessary flood control space during the winter season to control rain floods and to prepare for possible spring snowmelt floods. After 1 February when snowmelt forecasts become available, the diagram indicates the space required to control snowmelt runoff based on the forecast. If the space available is less than that required, the diagram indicates the release in excess of irrigation demand (supplemental release) that must be made to provide protection from snowmelt floods while filling the reservoir at the end of the season. Runoff forecasts shall be provided by the State of California, and releases shall be determined by the Reservoir Control Section of the Corps of Engineers.

b. When the reservoir water surface is near spillway crest elevation (916.5 feet) and the pool is rising rapidly, the reservoir operator shall make frequent checks on the pool elevation and rate of rise and shall keep the Reservoir Control Section informed. The Reservoir Control Section shall then determine whether greater releases are required by the emergency spillway release diagram, chart A-7.

7. CONSERVATION OPERATION

Irrigation releases, including water desired in the Tulare Lake area, should be requested on a day-to-day basis by the Kings River Watermaster. Operation for conservation in accordance with the interim contract with local interests is as follows:

a. All inflow in excess of the release requested by the Kings River Watermaster is stored to the extent that conservation space in the reservoir is available.

b. Water stored for irrigation is released in accordance with the requests of the Kings River Watermaster, which are normally made directly to the reservoir operator.

8. OPERATION REPORTS

a. The reservoir operator shall report the following data by radio or telephone to the Reservoir Control Section each work day between 7:30 a.m. and 9:00 a.m.:

(1) Reservoir stage and storage as of midnight.

(2) Reservoir storage increment (ending at midnight).

(3) Pan evaporation.

(4) Lake evaporation.

(5) Mean daily flows (ending at midnight) of:

(a) Kings River below Pine Flat Dam.

(b) Kings River below North Fork.

(c) Mill Creek near Piedra.

(d) Total inflow.

(6) Storages in upstream reservoirs.

(7) Preproject flow.

(8) Daily precipitation at the dam as measured at 7:00 a.m. and seasonal total to date.

(9) Inches (total and change) of snow at 7:00 a.m., reported by radio reporting hydraulic gages.

When conditions do not warrant weekend or holiday reports, complete reports for each day shall be made on the first day following the non-reporting period. More frequent reports of the above information and reports of other Kings River data will be made in the same manner when requested by the Reservoir Control Section. Forms furnished to the operators are to be used in computing the above information.

b. Immediately after the end of each month, the reservoir operator will dispatch to the Reservoir Control Section all original forms used for observations and computations as specified in paragraphs 2b, 2g and 8a above. The charts and punch tapes for that month from the following instruments will be included.

(1) Recording precipitation gage chart.

(2) Reservoir level recorder punch tape.

(3) Remote recording gages punch tapes.

9. SPECIAL WEATHER AND FLOOD REPORTS

a. During the rainflood season, 1 October to 1 May, the reservoir operator shall call the Reservoir Control Section immediately whenever one of the following occurs:

(1) One inch or more of rainfall occurs at the project during any 6-hour period or 1.5 inches of rainfall during any 24-hour period.

(2) An increase in flow of 2,000 c.f.s. or more at the Kings River inflow station during any 8-hour period.

b. Any special report based on one of the foregoing criteria should include the latest available data concerning the other. On non-working days or at night, these special reports should be telephoned directly to the the Chief of the Reservoir Control Section or his designated alternate.

10. COMPUTATION OF HYDROLOGIC DATA

a. The required hydrologic data to be reported, as specified in paragraph 8 above, for the use in operation of Pine Flat Lake and for official record purposes may be obtained or computed as follows:

(1) Reservoir stage is obtained from the recording pool gage at the dam and storage is obtained from the Pine Flat Lake area-capacity table.

(2) Reservoir storage increment is the algebraic difference between the previous day's recorded midnight storage and the most recent midnight storage.

(3) Pan evaporation is obtained from the class A evaporation land pan located at Pine Flat Dam.

(4) Lake evaporation in inches is equal to the pan evaporation in inches multiplied by the evaporation coefficient shown on chart A-3. For this computation, pan evaporation as measured at 7:00 a.m. is used to compute lake evaporation for the previous day.

(a) Pan evaporation (inches):

$$\frac{\text{x Gross Evaporation Coefficient}}{12}$$

x Average Lake Area (acres) = Acre-Feet
(Round to nearest acre-foot for next computation)
Acre-Feet x 0.50417* = s.f.d. = mean c.f.s. for 24-hours.

*Coefficient shown is for 24-hour day. When changing to daylight savings time or from daylight savings time the coefficients are as follows: for 23-hour day (change to D.S.T.) use 0.52609; for 25-hour day (change from D.S.T.) use 0.48400.

(b) Lake area used when computing evaporation will be the average area for the day; obtained by averaging the midnight areas at the beginning and ending of the period being computed.

(5) Procedures used to compute mean daily flows are detailed in subparagraph 10b below. The gage heights to compute flows required in sub-paragraph 8a (5) should be obtained as follows:

(a) Kings River below Pine Flat Dam from gage reading.

(b) Kings River below North Fork from gage reading.

(c) Mill Creek near Piedra from gage reading.

(d) Computed mean inflow to the lake will be taken as the algebraic sum of the mean outflow, change in lake storage, and evaporation for the lake water surface and will represent mean inflow to the lake from all sources including rainfall on the lake surface.

Mean Daily Outflow (c.f.s.) +
Change in Lake Storage (s.f.d.) +
Evaporation (s.f.d.) =
Mean Inflow (c.f.s.)

(6) Computed preproject flow at the lake will be the mean daily inflow plus evaporation losses from the upstream power reservoirs, (Wishon, Courtright), plus the gain (or minus the loss) in total storage in the four upstream reservoirs (Wishon, Courtright, Balch FB, and Balch AB). When important, an allowance for 12 hours travel time from Wishon and Courtright reservoirs to Pine Flat will be made.

(7) Computed preproject flow at Piedra will be the mean daily preproject flow as computed in subparagraph 10a(6) above, plus Mill and Hughes Creek mean daily flows.

(8) Obtain Kings River below North Fork from radio telemark streamgage.

(9) Precipitation at the dam is measured at the weather station.

b. Mean Daily Flow Computations

(1) Check punch tape for errors in gage height and for time. Time is corrected to the current 15 minutes; gage height to the nearest .01 foot.

(2) Tabulate correct gage height readings at odd hours, starting with 0100 hours. Punch tape correction, if any, should be noted.

(3) Enter current rating table, using shifts as applicable, determine and list flow at each odd hour, using the procedure as indicated for mean daily flow in paragraph 10b (5) below.

(4) Total the 12 flow readings so obtained and divide by 12. This is the mean daily flow.

(5) Mean daily flow will be listed to nearest 0.1 c.f.s. for flows up to 10 c.f.s., and to the nearest 1 c.f.s. for flows above 10 c.f.s. Such values will later be rounded to 3 significant figures by the USGS prior to publication.

(6) When calculating discharge from gage height with a (-) shift correction, enter rating table below the actual height, i.e., if actual gage height is 4.86 and shift is -.02, enter rating table at 4.84 to obtain discharge. For (+) shift, enter rating table above actual gage height.

(7) In order to calculate the gage height for a desired flow under a (-) shift condition, add amount of (-) shift to gage height obtained from table for desired discharge, i.e., if shift is -.03, desired discharge is 5,000 c.f.s., and rating table shows gage height of 10.20 = 5,000 c.f.s., required gage height for 5,000 c.f.s. is 10.20 + .03 = 10.23. For (+) shift, subtract amount of shift from gage height obtained from table for desired discharge.

11. STANDING INSTRUCTIONS DURING FLOOD EMERGENCY

a. Flood Control operation shall be in accordance with instructions from the Reservoir Control Section. During flood periods, close contact will be maintained between project and District personnel on a 24-hour per day basis or as otherwise required.

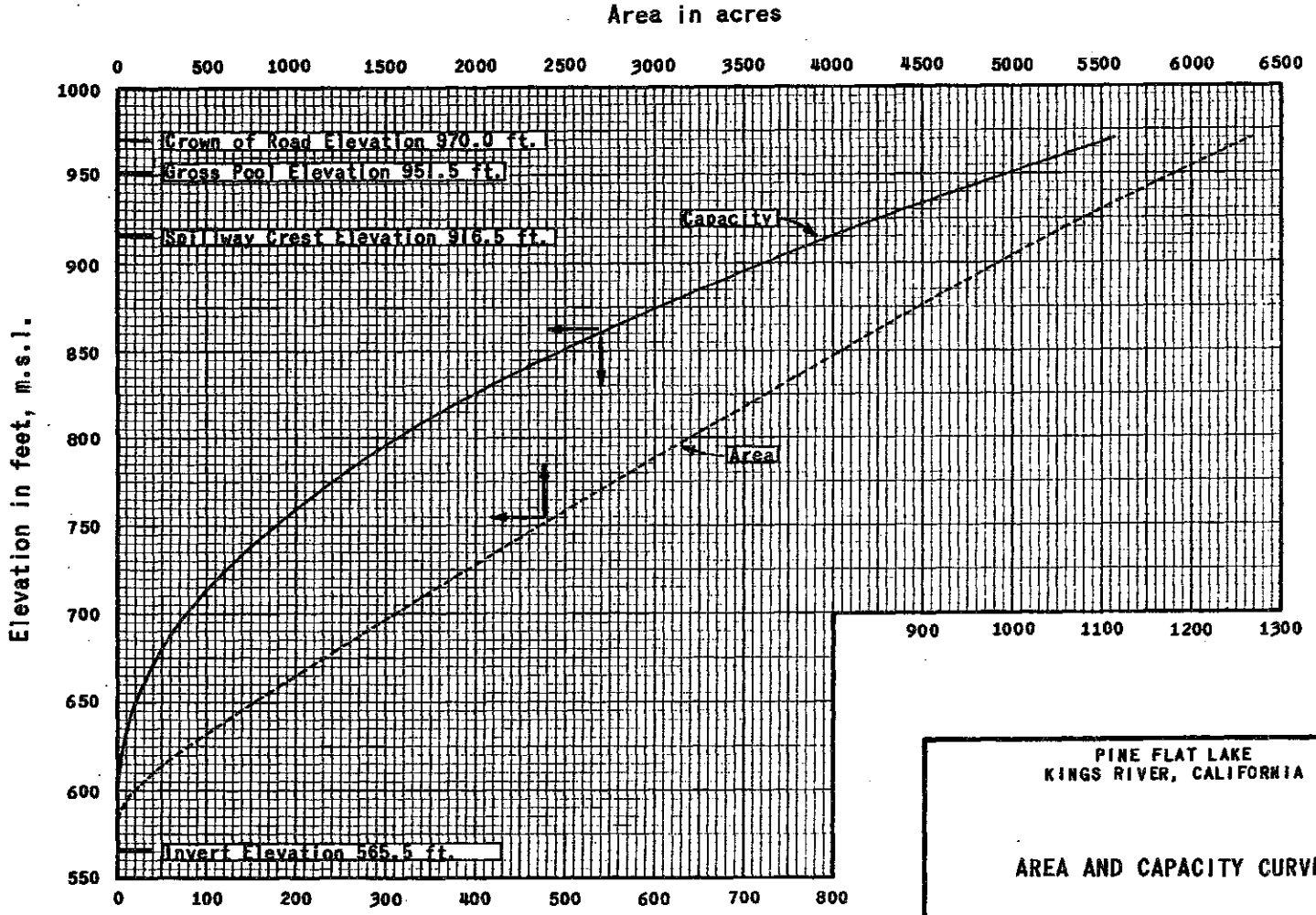
b. If communication is broken between the operating personnel and the Sacramento District Office during a flood emergency, the following procedure is recommended:

(1) Continue releases in accordance with the last instructions received from the Sacramento District and make every attempt to re-establish communication.

(2) If communications cannot be re-established and larger releases are required by the emergency spillway release diagram (chart A-7), release should be increased in accordance with the diagram.

12. MODIFICATION OF INSTRUCTIONS

The operating rules contained herein are subject to temporary modification by the District Engineer during flood or other emergencies. Major changes in the operating rules are subject to prior approval by the Chief of Engineers.



PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

AREA AND CAPACITY CURVES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared:H.T.M.,T.G.K.
Drawn:T.G.K.
Date:

CHART A-1

PINE FLAT RESERVOIR,KINGS RIVER,CALIFORNIA - AREA AND CAPACITY TABLE SEPTEMBER 1975

ELEV FEET	CAP AREA .0	CAP AREA .1	CAP AREA .2	CAP AREA .3	CAP AREA .4	CAP AREA .5	CAP AREA .6	CAP AREA .7	CAP AREA .8	CAP AREA .9
600.0	423	433	443	454	464	475	485	496	507	518
	101	102	103	104	105	106	107	108	109	110
601.0	529	540	551	563	574	586	597	609	621	633
	111	112	113	114	115	116	117	118	119	120
602.0	645	657	669	682	694	707	720	732	745	758
	121	122	123	124	125	126	127	128	129	130
603.0	771	784	798	811	825	838	852	866	880	894
	131	132	133	134	136	137	138	139	140	141
604.0	908	922	936	951	965	980	995	1010	1025	1040
	142	143	144	145	146	147	148	149	150	151
605.0	1055	1070	1086	1101	1117	1133	1148	1164	1181	1197
	153	154	155	156	157	158	159	160	161	162
606.0	1213	1229	1246	1263	1279	1296	1313	1330	1347	1365
	164	165	166	167	168	169	170	171	172	174
607.0	1382	1400	1417	1435	1453	1471	1489	1507	1526	1544
	175	176	177	178	179	180	182	183	184	185
608.0	1563	1581	1600	1619	1638	1657	1676	1696	1715	1735
	186	187	188	190	191	192	193	194	195	197
609.0	1755	1774	1794	1814	1835	1855	1875	1896	1916	1937
	198	199	200	201	202	204	205	206	207	208
610.0	1958	1979	2000	2022	2043	2064	2086	2108	2130	2152
	210	211	212	213	214	216	217	218	219	220
611.0	2174	2196	2218	2241	2263	2286	2309	2332	2355	2378
	222	223	224	225	226	228	229	230	231	233
612.0	2401	2425	2448	2472	2496	2520	2544	2568	2592	2617
	234	235	236	237	239	240	241	242	244	245
613.0	2641	2666	2691	2716	2741	2766	2791	2817	2842	2868
	246	247	249	250	251	252	254	255	256	257
614.0	2894	2920	2946	2972	2998	3025	3051	3078	3105	3132
	259	260	261	262	264	265	266	267	269	270
615.0	3159	3186	3213	3241	3268	3296	3324	3352	3380	3408
	271	273	274	275	276	278	279	280	282	283
616.0	3436	3465	3493	3522	3551	3580	3609	3638	3668	3697
	284	285	287	288	289	291	292	293	294	296
617.0	3727	3757	3787	3817	3847	3877	3907	3938	3969	4000
	297	298	300	301	302	304	305	306	308	309
618.0	4031	4062	4093	4124	4156	4187	4219	4251	4283	4315
	310	312	313	314	315	317	318	319	321	322
619.0	4347	4380	4412	4445	4478	4511	4544	4577	4610	4644
	323	325	326	327	329	330	331	333	334	335

PINE FLAT RESERVOIR,KINGS RIVER,CALIFORNIA - AREA AND CAPACITY TABLE SEPTEMBER 1975

ELEV FEET	CAP AREA .0	CAP AREA .1	CAP AREA .2	CAP AREA .3	CAP AREA .4	CAP AREA .5	CAP AREA .6	CAP AREA .7	CAP AREA .8	CAP AREA .9
620.0	4677	4711	4745	4779	4813	4848	4882	4917	4951	4986
	337	338	340	341	342	344	345	346	348	349
621.0	5021	5056	5091	5127	5162	5198	5234	5270	5306	5342
	350	352	353	354	356	357	358	360	361	363
622.0	5378	5415	5451	5488	5525	5562	5599	5636	5674	5711
	364	365	367	368	369	371	372	374	375	376
623.0	5749	5787	5825	5863	5901	5939	5978	6017	6055	6094
	378	379	380	382	383	385	386	387	389	390
624.0	6133	6173	6212	6251	6291	6331	6371	6411	6451	6491
	391	393	394	396	397	398	400	401	403	404
625.0	6532	6572	6613	6654	6695	6736	6778	6819	6861	6902
	405	407	408	410	411	412	414	415	417	418
626.0	6944	6986	7028	7071	7113	7156	7198	7241	7284	7327
	419	421	422	424	425	426	428	429	431	432
627.0	7371	7414	7458	7501	7545	7589	7633	7678	7722	7767
	433	435	436	438	439	441	442	443	445	446
628.0	7811	7856	7901	7946	7991	8037	8082	8128	8174	8220
	448	449	451	452	453	455	456	458	459	461
629.0	8266	8312	8359	8405	8452	8499	8546	8593	8640	8688
	462	463	465	466	468	469	471	472	473	475
630.0	8735	8783	8831	8879	8927	8975	9024	9072	9121	9170
	476	478	479	481	482	484	485	486	488	489
631.0	9219	9268	9317	9367	9416	9466	9516	9566	9616	9666
	491	492	494	495	497	498	499	501	502	504
632.0	9717	9767	9818	9869	9920	9971	10022	10074	10125	10177
	505	507	508	510	511	512	514	515	517	518
633.0	10229	10281	10333	10386	10438	10491	10544	10597	10650	10703
	520	521	523	524	526	527	529	530	531	533
634.0	10754	10810	10863	10917	10971	11025	11079	11134	11188	11243
	534	536	537	539	540	542	543	545	546	548
635.0	11298	11353	11408	11463	11519	11574	11630	11686	11742	11798
	549	551	552	553	555	556	558	559	561	562
636.0	11854	11911	11967	12024	12081	12138	12195	12253	12310	12368
	564	565	567	568	570	571	573	574	576	577
637.0	12426	12484	12542	12600	12658	12717	12775	12834	12893	12952
	579	580	582	583	585	586	587	589	590	592
638.0	13012	13071	13131	13190	13250	13310	13370	13431	13491	13552
	593	595	596	598	599	601	602	604	605	607
639.0	13612	13673	13734	13796	13857	13918	13980	14042	14104	14166
	608	610	611	613	614	616	617	619	620	622

PINE FLAT RESERVOIR,KINGS RIVER,CALIFORNIA - AREA AND CAPACITY TABLE SEPTEMBER 1975

ELEV FEET	CAP AREA .0	CAP AREA .1	CAP AREA .2	CAP AREA .3	CAP AREA .4	CAP AREA .5	CAP AREA .6	CAP AREA .7	CAP AREA .8	CAP AREA .9
640.0	14228 623	14291 625	14353 626	14416 628	14479 629	14542 631	14605 632	14668 634	14732 635	14795 637
641.0	14859 638	14923 640	14987 641	15051 643	15115 644	15180 646	15245 647	15309 649	15374 650	15439 652
642.0	15505 653	15570 655	15636 656	15701 658	15767 659	15833 661	15899 662	15966 664	16032 665	16099 667
643.0	16165 668	16232 670	16299 671	16366 673	16434 674	16501 676	16569 677	16637 679	16705 680	16773 682
644.0	16841 683	16910 685	16978 686	17047 688	17116 689	17185 691	17254 692	17323 694	17393 695	17462 697
645.0	17532 698	17602 700	17672 701	17742 703	17813 704	17883 706	17954 708	18025 709	18096 711	18167 712
646.0	18238 714	18309 715	18381 717	18453 718	18525 720	18597 721	18669 723	18741 724	18814 726	18886 727
647.0	18959 729	19032 730	19105 732	19178 733	19252 735	19325 736	19399 738	19473 739	19547 741	19621 742
648.0	19695 744	19770 745	19845 747	19919 748	19994 750	20069 752	20145 753	20220 755	20295 756	20371 758
649.0	20447 759	20523 761	20599 762	20675 764	20752 765	20828 767	20905 768	20982 770	21059 771	21136 773
650.0	21214 774	21291 776	21369 777	21447 779	21525 780	21603 782	21681 784	21760 785	21838 787	21917 788
651.0	21996 790	22075 791	22154 793	22233 794	22313 796	22393 797	22472 799	22552 800	22632 802	22713 803
652.0	22793 805	22874 806	22954 808	23035 810	23116 811	23197 813	23279 814	23360 816	23442 817	23524 819
653.0	23606 820	23688 822	23770 823	23852 825	23935 826	24018 828	24101 829	24184 831	24267 832	24350 834
654.0	24434 836	24517 837	24601 839	24685 840	24769 842	24853 843	24938 845	25022 846	25107 848	25192 849
655.0	25277 851	25362 852	25447 854	25533 855	25618 857	25704 859	25790 860	25876 862	25962 863	26049 865
656.0	26135 866	26222 868	26309 869	26396 871	26483 872	26570 874	26658 875	26745 877	26833 879	26921 880
657.0	27009 882	27098 883	27186 885	27274 886	27363 888	27452 889	27541 891	27630 892	27719 894	27809 895
658.0	27899 897	27988 899	28078 900	28168 902	28259 903	28349 905	28440 906	28530 908	28621 909	28712 911
659.0	28803 912	28895 914	28986 915	29078 917	29169 919	29261 920	29353 922	29446 923	29538 925	29631 926

PINE FLAT RESERVOIR,KINGS RIVER,CALIFORNIA - AREA AND CAPACITY TABLE SEPTEMBER 1975

ELEV FEET	CAP AREA .0	CAP AREA .1	CAP AREA .2	CAP AREA .3	CAP AREA .4	CAP AREA .5	CAP AREA .6	CAP AREA .7	CAP AREA .8	CAP AREA .9
660.0	29723	29816	29909	30002	30096	30189	30283	30377	30471	30565
	928	929	931	932	934	935	937	939	940	942
661.0	30659	30753	30848	30943	31037	31132	31228	31323	31418	31514
	943	945	946	948	949	951	952	954	956	957
662.0	31610	31706	31802	31898	31994	32091	32188	32285	32382	32479
	959	960	962	963	965	966	968	969	971	973
663.0	32576	32674	32771	32869	32967	33065	33163	33262	33360	33459
	974	976	977	979	980	982	983	985	986	988
664.0	33558	33657	33756	33855	33955	34055	34154	34254	34354	34455
	990	991	993	994	996	997	999	1000	1002	1003
665.0	34555	34656	34756	34857	34958	35060	35161	35262	35364	35466
	1005	1007	1008	1010	1011	1013	1014	1016	1017	1019
666.0	35568	35670	35772	35875	35977	36080	36183	36286	36389	36493
	1020	1022	1024	1025	1027	1028	1030	1031	1033	1034
667.0	36596	36700	36804	36907	37012	37116	37220	37325	37430	37535
	1036	1037	1039	1041	1042	1044	1045	1047	1048	1050
668.0	37640	37745	37850	37956	38061	38167	38273	38379	38486	38592
	1051	1053	1054	1056	1058	1059	1061	1062	1064	1065
669.0	38699	38806	38912	39020	39127	39234	39342	39449	39557	39665
	1067	1068	1070	1072	1073	1075	1076	1078	1079	1081
670.0	39773	39882	39990	40099	40208	40317	40426	40535	40644	40754
	1082	1084	1085	1087	1089	1090	1092	1093	1095	1096
671.0	40863	40973	41083	41194	41304	41414	41525	41636	41747	41858
	1098	1099	1101	1103	1104	1106	1107	1109	1110	1112
672.0	41969	42081	42192	42304	42416	42528	42640	42752	42865	42977
	1113	1115	1116	1118	1120	1121	1123	1124	1126	1127
673.0	43090	43203	43316	43430	43543	43657	43770	43884	43998	44112
	1129	1130	1132	1134	1135	1137	1138	1140	1141	1143
674.0	44227	44341	44456	44571	44686	44801	44916	45032	45147	45263
	1144	1146	1147	1149	1151	1152	1154	1155	1157	1158
675.0	45379	45495	45611	45728	45844	45961	46078	46195	46312	46429
	1160	1161	1163	1165	1166	1168	1169	1171	1172	1174
676.0	46547	46664	46782	46900	47018	47136	47255	47373	47492	47611
	1175	1177	1179	1180	1182	1183	1185	1186	1188	1189
677.0	47730	47849	47968	48088	48208	48327	48447	48567	48688	48808
	1191	1193	1194	1196	1197	1199	1200	1202	1203	1205
678.0	48929	49049	49170	49291	49412	49534	49655	49777	49899	50021
	1207	1208	1210	1211	1213	1214	1216	1217	1219	1221
679.0	50143	50265	50388	50510	50633	50756	50879	51002	51126	51249
	1222	1224	1225	1227	1228	1230	1231	1233	1235	1236

PINE FLAT RESERVOIR,KINGS RIVER,CALIFORNIA = AREA AND CAPACITY TABLE SEPTEMBER 1975

ELEV FEET	CAP AREA .0	CAP AREA .1	CAP AREA .2	CAP AREA .3	CAP AREA .4	CAP AREA .5	CAP AREA .6	CAP AREA .7	CAP AREA .8	CAP AREA .9
680.0	51373	51497	51621	51745	51869	51994	52118	52243	52368	52493
	1238	1239	1241	1242	1244	1245	1247	1249	1250	1252
681.0	52618	52744	52869	52995	53121	53247	53373	53499	53626	53752
	1253	1255	1256	1258	1259	1261	1263	1264	1266	1267
682.0	53879	54006	54133	54261	54388	54516	54643	54771	54899	55027
	1269	1270	1272	1275	1275	1277	1278	1280	1281	1283
683.0	55156	55284	55413	55542	55671	55800	55929	56059	56188	56318
	1284	1286	1287	1289	1291	1292	1294	1295	1297	1298
684.0	56448	56578	56708	56839	56969	57100	57231	57362	57493	57624
	1300	1301	1303	1305	1306	1308	1309	1311	1312	1314
685.0	57756	57887	58019	58151	58283	58415	58548	58680	58813	58946
	1316	1317	1319	1320	1322	1323	1325	1326	1328	1330
686.0	59079	59212	59345	59479	59613	59746	59880	60015	60149	60283
	1331	1333	1334	1336	1337	1339	1340	1342	1344	1345
687.0	60418	60553	60687	60823	60958	61093	61229	61364	61500	61634
	1347	1348	1350	1351	1353	1355	1356	1358	1359	1361
688.0	61772	61909	62045	62182	62319	62455	62593	62730	62867	63005
	1362	1364	1365	1367	1369	1370	1372	1373	1375	1376
689.0	63143	63280	63418	63557	63695	63833	63972	64111	64250	64389
	1378	1380	1381	1383	1384	1386	1387	1389	1390	1392
690.0	64528	64668	64807	64947	65087	65227	65367	65508	65648	65789
	1394	1395	1397	1398	1400	1401	1403	1405	1406	1408
691.0	65930	66071	66212	66353	66495	66636	66778	66920	67062	67204
	1409	1411	1412	1414	1415	1417	1419	1420	1422	1423
692.0	67347	67489	67632	67775	67918	68061	68205	68348	68492	68635
	1425	1426	1428	1430	1431	1433	1434	1436	1437	1439
693.0	68779	68924	69068	69212	69357	69502	69647	69792	69937	70082
	1441	1442	1444	1445	1447	1448	1450	1452	1453	1455
694.0	70228	70374	70519	70665	70812	70958	71104	71251	71398	71545
	1456	1458	1459	1461	1462	1464	1466	1467	1469	1470
695.0	71692	71839	71987	72134	72282	72430	72576	72726	72874	73023
	1472	1473	1475	1477	1478	1480	1481	1483	1484	1486
696.0	73172	73320	73469	73619	73768	73917	74067	74217	74367	74517
	1488	1489	1491	1492	1494	1495	1497	1499	1500	1502
697.0	74667	74817	74968	75119	75270	75421	75572	75723	75875	76026
	1503	1505	1506	1508	1510	1511	1513	1514	1516	1517
698.0	76178	76330	76482	76635	76787	76940	77092	77245	77398	77552
	1519	1521	1522	1524	1525	1527	1528	1530	1532	1533
699.0	77705	77859	78012	78166	78320	78474	78629	78783	78938	79093
	1535	1536	1538	1539	1541	1543	1544	1546	1547	1549

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700.0	79248	79403	79558	79714	79869	80025	80181	80337	80493	80649
	1550	1552	1554	1555	1557	1558	1560	1561	1563	1565
701.0	80806	80963	81120	81277	81434	81591	81749	81906	82064	82222
	1566	1568	1569	1571	1573	1574	1576	1577	1579	1580
702.0	82380	82538	82697	82855	83014	83173	83332	83491	83651	83810
	1582	1584	1585	1587	1588	1590	1591	1593	1595	1596
703.0	83970	84130	84290	84450	84610	84771	84931	85092	85253	85414
	1598	1599	1601	1602	1604	1606	1607	1609	1610	1612
704.0	85576	85737	85899	86060	86222	86384	86547	86709	86871	87034
	1614	1615	1617	1618	1620	1621	1623	1625	1626	1628
705.0	87197	87360	87523	87687	87850	88014	88177	88341	88506	88670
	1629	1631	1632	1634	1636	1637	1639	1640	1642	1644
706.0	88834	88999	89164	89328	89494	89659	89824	89990	90155	90321
	1645	1647	1648	1650	1651	1653	1655	1656	1658	1659
707.0	90487	90653	90820	90986	91153	91320	91487	91654	91821	91989
	1661	1663	1664	1666	1667	1669	1670	1672	1674	1675
708.0	92156	92324	92492	92660	92828	92997	93165	93334	93503	93672
	1677	1678	1680	1682	1683	1685	1686	1688	1689	1691
709.0	93841	94010	94180	94349	94519	94689	94859	95030	95200	95371
	1693	1694	1696	1697	1699	1701	1702	1704	1705	1707
710.0	95542	95712	95884	96055	96226	96398	96570	96741	96913	97086
	1709	1710	1712	1713	1715	1716	1718	1720	1721	1723
711.0	97258	97431	97603	97776	97949	98122	98296	98469	98643	98816
	1724	1726	1728	1729	1731	1732	1734	1736	1737	1739
712.0	98990	99164	99339	99513	99688	99863	100037	100213	100388	100563
	1740	1742	1744	1745	1747	1748	1750	1751	1753	1755
713.0	100739	100914	101090	101266	101442	101619	101795	101972	102149	102326
	1756	1758	1759	1761	1763	1764	1766	1767	1769	1771
714.0	102503	102680	102858	103035	103213	103391	103569	103747	103926	104104
	1772	1774	1775	1777	1779	1780	1782	1783	1785	1787
715.0	104283	104462	104641	104820	105000	105179	105359	105539	105719	105899
	1788	1790	1791	1793	1795	1796	1798	1799	1801	1803
716.0	106079	106260	106440	106621	106802	106983	107165	107346	107528	107709
	1804	1806	1807	1809	1810	1812	1814	1815	1817	1818
717.0	107891	108073	108256	108438	108621	108803	108986	109169	109352	109536
	1820	1822	1823	1825	1826	1828	1830	1831	1833	1834
718.0	109719	109903	110087	110271	110455	110639	110824	111009	111193	111378
	1836	1838	1839	1841	1842	1844	1846	1847	1849	1851
719.0	111563	111749	111934	112120	112306	112492	112678	112864	113050	113237
	1852	1854	1855	1857	1859	1860	1862	1863	1865	1867

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720.0	113424	113610	113798	113985	114172	114360	114547	114735	114923	115111
	1868	1870	1871	1873	1875	1876	1878	1879	1881	1883
721.0	115300	115488	115677	115866	116055	116244	116433	116623	116812	117002
	1884	1886	1887	1889	1891	1892	1894	1895	1897	1899
722.0	117192	117382	117572	117763	117953	118144	118335	118526	118717	118909
	1900	1902	1903	1905	1907	1908	1910	1912	1913	1915
723.0	119100	119292	119484	119676	119868	120061	120253	120446	120639	120832
	1916	1918	1920	1921	1923	1924	1926	1928	1929	1931
724.0	121025	121218	121412	121605	121799	121993	122187	122381	122576	122771
	1932	1934	1936	1937	1939	1941	1942	1944	1945	1947
725.0	122965	123160	123355	123551	123746	123942	124137	124333	124529	124726
	1949	1950	1952	1953	1955	1957	1958	1960	1962	1963
726.0	124922	125119	125315	125512	125709	125906	126104	126301	126499	126697
	1965	1966	1968	1970	1971	1973	1974	1976	1978	1979
727.0	126895	127093	127291	127490	127688	127887	128086	128285	128485	128684
	1981	1983	1984	1986	1987	1989	1991	1992	1994	1995
728.0	128684	129084	129284	129484	129684	129884	130085	130286	130487	130688
	1997	1999	2000	2002	2004	2005	2007	2008	2010	2012
729.0	130889	131090	131292	131494	131696	131898	132100	132302	132505	132708
	2013	2015	2017	2018	2020	2021	2023	2025	2026	2028
730.0	132910	133114	133317	133520	133724	133927	134131	134335	134539	134744
	2030	2031	2033	2034	2036	2038	2039	2041	2043	2044
731.0	134948	135153	135358	135563	135768	135973	136179	136384	136590	136796
	2046	2047	2049	2051	2052	2054	2056	2057	2059	2060
732.0	137002	137208	137415	137621	137828	138035	138242	138449	138657	138864
	2062	2064	2065	2067	2069	2070	2072	2073	2075	2077
733.0	139072	139280	139488	139696	139905	140113	140322	140531	140740	140949
	2078	2080	2082	2083	2085	2086	2088	2090	2091	2093
734.0	141159	141368	141578	141788	141998	142208	142418	142629	142840	143050
	2095	2096	2098	2100	2101	2103	2104	2106	2108	2109
735.0	143261	143473	143684	143895	144107	144319	144531	144743	144955	145168
	2111	2113	2114	2116	2117	2119	2121	2122	2124	2126
736.0	145381	145593	145806	146019	146233	146446	146660	146874	147088	147302
	2127	2129	2131	2132	2134	2135	2137	2139	2140	2142
737.0	147516	147730	147945	148160	148375	148590	148805	149021	149236	149452
	2144	2145	2147	2149	2150	2152	2153	2155	2157	2158
738.0	149668	149884	150100	150317	150533	150750	150967	151184	151401	151618
	2160	2162	2163	2165	2167	2168	2170	2171	2173	2175
739.0	151836	152054	152272	152490	152708	152926	153145	153364	153582	153801
	2176	2178	2180	2181	2183	2185	2186	2188	2190	2191

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740.0	154021	154240	154460	154679	154899	155119	155339	155560	155780	156001
	2193	2194	2196	2198	2199	2201	2203	2204	2206	2208
741.0	156222	156443	156664	156885	157107	157328	157550	157772	157994	158217
	2209	2211	2213	2214	2216	2217	2219	2221	2222	2224
742.0	158439	158662	158885	159108	159331	159554	159778	160001	160225	160449
	2226	2227	2229	2231	2232	2234	2236	2237	2239	2241
743.0	160673	160897	161122	161346	161571	161796	162021	162247	162472	162698
	2242	2244	2245	2247	2249	2250	2252	2254	2255	2257
744.0	162924	163149	163376	163602	163828	164055	164282	164509	164736	164963
	2259	2260	2262	2264	2265	2267	2269	2270	2272	2274
745.0	165190	165418	165646	165874	166102	166330	166559	166787	167016	167245
	2275	2277	2278	2280	2282	2283	2285	2287	2288	2290
746.0	167474	167703	167933	168162	168392	168622	168852	169082	169312	169543
	2292	2293	2295	2297	2298	2300	2302	2303	2305	2307
747.0	169774	170005	170236	170467	170698	170930	171162	171394	171626	171858
	2308	2310	2312	2313	2315	2317	2318	2320	2321	2323
748.0	172090	172323	172556	172789	173022	173255	173488	173722	173955	174189
	2325	2326	2328	2330	2331	2333	2335	2336	2338	2340
749.0	174423	174658	174892	175127	175361	175596	175831	176066	176302	176537
	2341	2343	2345	2346	2348	2350	2351	2353	2355	2356
750.0	176773	177009	177245	177481	177718	177954	178191	178428	178665	178902
	2358	2360	2361	2363	2365	2366	2368	2370	2371	2373
751.0	179139	179377	179615	179853	180091	180329	180567	180806	181044	181283
	2375	2376	2378	2380	2381	2383	2385	2386	2388	2390
752.0	181522	181762	182001	182240	182480	182720	182960	183200	183441	183681
	2391	2393	2395	2396	2398	2400	2401	2403	2405	2406
753.0	183922	184163	184404	184645	184886	185128	185370	185611	185854	186096
	2408	2410	2411	2413	2415	2416	2418	2420	2421	2423
754.0	186338	186581	186823	187066	187309	187552	187796	188039	188283	188527
	2425	2426	2428	2430	2431	2433	2435	2436	2438	2440
755.0	188771	189015	189260	189504	189749	189994	190239	190484	190729	190975
	2441	2443	2445	2446	2448	2450	2451	2453	2455	2456
756.0	191221	191466	191712	191959	192205	192452	192698	192945	193192	193439
	2458	2460	2461	2463	2465	2466	2468	2470	2471	2473
757.0	193687	193934	194182	194430	194678	194926	195175	195423	195672	195921
	2475	2476	2478	2480	2481	2483	2485	2486	2488	2490
758.0	196170	196419	196668	196918	197168	197418	197668	197918	198168	198419
	2491	2493	2495	2496	2498	2500	2501	2503	2505	2506
759.0	198670	198921	199172	199423	199674	199926	200178	200429	200682	200934
	2508	2510	2511	2513	2515	2517	2518	2520	2522	2523

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760.0	201186	201439	201691	201944	202197	202451	202704	202958	203211	203465
	2525	2527	2528	2530	2532	2533	2535	2537	2538	2540
761.0	203719	203974	204228	204483	204737	204992	205247	205503	205758	206014
	2542	2543	2545	2547	2548	2550	2552	2553	2555	2557
762.0	206269	206525	206782	207038	207294	207551	207808	208065	208322	208579
	2558	2560	2562	2563	2565	2567	2569	2570	2572	2574
763.0	208836	209094	209352	209610	209868	210126	210385	210643	210902	211161
	2575	2577	2579	2580	2582	2584	2585	2587	2589	2590
764.0	211420	211679	211939	212198	212458	212718	212978	213239	213499	213760
	2592	2594	2595	2597	2599	2600	2602	2604	2606	2607
765.0	214021	214281	214543	214804	215065	215327	215589	215851	216113	216375
	2609	2611	2612	2614	2616	2617	2619	2621	2622	2624
766.0	216638	216901	217163	217426	217689	217953	218216	218480	218744	219008
	2626	2627	2629	2631	2633	2634	2636	2638	2639	2641
767.0	219272	219536	219801	220066	220330	220595	220861	221126	221391	221657
	2643	2644	2646	2648	2649	2651	2653	2654	2656	2658
768.0	221923	222189	222455	222722	222988	223255	223522	223789	224056	224323
	2659	2661	2663	2665	2666	2668	2670	2671	2673	2675
769.0	224591	224859	225127	225395	225663	225931	226200	226469	226737	227007
	2676	2678	2680	2681	2683	2685	2687	2688	2690	2692
770.0	227276	227545	227815	228085	228354	228625	228895	229165	229436	229707
	2693	2695	2697	2698	2700	2702	2703	2705	2707	2708
771.0	229978	230249	230520	230791	231063	231335	231607	231879	232151	232424
	2710	2712	2714	2715	2717	2719	2720	2722	2724	2725
772.0	232696	232969	233242	233515	233788	234062	234335	234609	234883	235157
	2727	2729	2730	2732	2734	2736	2737	2739	2741	2742
773.0	235432	235706	235981	236256	236531	236806	237081	237357	237632	237908
	2744	2746	2747	2749	2751	2752	2754	2756	2758	2759
774.0	238184	238460	238737	239013	239290	239567	239844	240121	240398	240676
	2761	2763	2764	2766	2768	2769	2771	2773	2775	2776
775.0	240954	241232	241510	241788	242066	242345	242623	242902	243181	243461
	2778	2780	2781	2783	2785	2786	2788	2790	2791	2793
776.0	243740	244020	244299	244579	244859	245140	245420	245701	245981	246262
	2795	2797	2798	2800	2802	2803	2805	2807	2808	2810
777.0	246543	246825	247106	247388	247669	247951	248233	248516	248798	249081
	2812	2814	2815	2817	2819	2820	2822	2824	2825	2827
778.0	249364	249647	249930	250213	250497	250780	251064	251348	251632	251916
	2829	2830	2832	2834	2836	2837	2839	2841	2842	2844
779.0	252201	252486	252770	253055	253341	253626	253911	254197	254483	254769
	2846	2847	2849	2851	2853	2854	2856	2858	2859	2861

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780.0	255055 2863	255342 2864	255628 2866	255915 2868	256202 2870	256489 2871	256776 2873	257063 2875	257351 2876	257639 2878
781.0	257926 2880	258215 2881	258503 2883	258791 2885	259080 2887	259368 2888	259657 2890	259946 2892	260236 2893	260525 2895
782.0	260815 2897	261104 2898	261394 2900	261684 2902	261975 2904	262265 2905	262556 2907	262847 2909	263138 2910	263429 2912
783.0	263720 2914	264011 2915	264303 2917	264595 2919	264887 2921	265179 2922	265471 2924	265764 2926	266056 2927	266349 2929
784.0	266642 2931	266935 2932	267229 2934	267522 2936	267816 2938	268110 2939	268404 2941	268698 2943	268992 2944	269287 2946
785.0	269582 2948	269876 2950	270171 2951	270467 2953	270762 2955	271058 2956	271353 2958	271649 2960	271945 2961	272241 2963
786.0	272538 2965	272834 2967	273131 2968	273428 2970	273725 2972	274022 2973	274320 2975	274617 2977	274915 2978	275213 2980
787.0	275511 2982	275809 2984	276108 2985	276407 2987	276705 2989	277004 2990	277303 2992	277603 2994	277902 2995	278202 2997
788.0	278502 2999	278802 3001	279102 3002	279402 3004	279702 3006	280003 3007	280304 3009	280605 3011	280906 3013	281207 3014
789.0	281509 3016	281811 3018	282113 3019	282415 3021	282717 3023	283019 3024	283322 3026	283624 3028	283927 3030	284230 3031
790.0	284533 3033	284837 3035	285140 3036	285444 3038	285748 3040	286052 3041	286356 3043	286661 3045	286965 3047	287270 3048
791.0	287575 3050	287880 3052	288185 3053	288491 3055	288796 3057	289102 3059	289408 3060	289714 3062	290020 3064	290327 3065
792.0	290633 3067	290940 3069	291247 3070	291554 3072	291862 3074	292169 3076	292477 3077	292785 3079	293093 3081	293401 3082
793.0	293709 3084	294018 3086	294326 3088	294635 3089	294944 3091	295253 3093	295563 3094	295872 3096	296182 3098	296492 3099
794.0	296802 3101	297112 3103	297422 3105	297733 3106	298044 3108	298354 3110	298665 3111	298977 3113	299288 3115	299600 3117
795.0	299911 3118	300223 3120	300535 3122	300848 3123	301160 3125	301473 3127	301785 3128	302098 3130	302411 3132	302725 3134
796.0	303038 3135	303352 3137	303666 3139	303980 3140	304294 3142	304608 3144	304922 3146	305237 3147	305552 3149	305867 3151
797.0	306182 3152	306497 3154	306813 3156	307128 3157	307444 3159	307760 3161	308076 3163	308393 3164	308709 3166	309026 3168
798.0	309343 3169	309660 3171	309977 3173	310294 3175	310612 3176	310930 3178	311248 3180	311566 3181	311884 3183	312202 3185
799.0	312521 3186	312839 3188	313158 3190	313478 3192	313797 3193	314116 3195	314436 3197	314756 3198	315075 3200	315396 3202

PINE FLAT RESERVOIR,KINGS RIVER,CALIFORNIA - AREA AND CAPACITY TABLE SEPTEMBER 1975

ELEV FEET	CAP AREA .0	CAP AREA .1	CAP AREA .2	CAP AREA .3	CAP AREA .4	CAP AREA .5	CAP AREA .6	CAP AREA .7	CAP AREA .8	CAP AREA .9
800.0	315716	316036	316357	316678	316999	317320	317641	317962	318284	318606
	3204	3205	3207	3209	3210	3212	3214	3215	3217	3219
801.0	318928	319250	319572	319895	320217	320540	320863	321186	321510	321833
	3221	3222	3224	3226	3227	3229	3231	3233	3234	3236
802.0	322157	322481	322805	323129	323453	323778	324103	324427	324753	325078
	3238	3239	3241	3243	3244	3246	3248	3250	3251	3253
803.0	325403	325729	326054	326380	326706	327033	327359	327686	328012	328339
	3255	3256	3258	3260	3262	3263	3265	3267	3268	3270
804.0	328666	328994	329321	329649	329976	330304	330632	330961	331289	331618
	3272	3273	3275	3277	3279	3280	3282	3284	3285	3287
805.0	331947	332276	332605	332934	333263	333593	333923	334253	334583	334913
	3289	3291	3292	3294	3296	3297	3299	3301	3302	3304
806.0	335244	335575	335905	336236	336568	336899	337231	337562	337894	338226
	3306	3308	3309	3311	3313	3314	3316	3318	3320	3321
807.0	338558	338891	339223	339556	339889	340222	340555	340888	341222	341556
	3323	3325	3326	3328	3330	3331	3333	3335	3337	3338
808.0	341890	342224	342558	342893	343227	343562	343897	344232	344567	344903
	3340	3342	3343	3345	3347	3348	3350	3352	3354	3355
809.0	345238	345574	345910	346246	346582	346919	347256	347592	347929	348267
	3357	3359	3360	3362	3364	3366	3367	3369	3371	3372
810.0	348604	348941	349279	349617	349955	350293	350631	350970	351308	351647
	3374	3376	3377	3379	3381	3383	3384	3386	3388	3389
811.0	351986	352326	352665	353004	353344	353684	354024	354364	354705	355045
	3391	3393	3395	3396	3398	3400	3401	3403	3405	3406
812.0	355386	355727	356068	356409	356751	357092	357434	357776	358118	358460
	3408	3410	3412	3413	3415	3417	3418	3420	3422	3423
813.0	358803	359145	359488	359831	360174	360517	360861	361204	361548	361892
	3425	3427	3429	3430	3432	3434	3435	3437	3439	3441
814.0	362236	362581	362925	363270	363615	363960	364305	364650	364996	365341
	3442	3444	3446	3447	3449	3451	3452	3454	3456	3458
815.0	365687	366033	366379	366726	367072	367419	367766	368113	368460	368807
	3459	3461	3463	3464	3466	3468	3469	3471	3473	3475
816.0	369155	369503	369850	370198	370547	370895	371244	371592	371941	372290
	3476	3478	3480	3481	3483	3485	3486	3488	3490	3492
817.0	372640	372989	373339	373688	374038	374388	374739	375089	375440	375790
	3493	3495	3497	3498	3500	3502	3504	3505	3507	3509
818.0	376141	376493	376844	377195	377547	377899	378251	378603	378955	379308
	3510	3512	3514	3515	3517	3519	3521	3522	3524	3526
819.0	379660	380013	380366	380719	381072	381426	381780	382134	382488	382842
	3527	3529	3531	3532	3534	3536	3538	3539	3541	3543

PINE FLAT RESERVOIR,KINGS RIVER,CALIFORNIA - AREA AND CAPACITY TABLE SEPTEMBER 1975

ELEV FEET	CAP AREA .0	CAP AREA .1	CAP AREA .2	CAP AREA .3	CAP AREA .4	CAP AREA .5	CAP AREA .6	CAP AREA .7	CAP AREA .8	CAP AREA .9
820.0	383196	383551	383905	384260	384615	384970	385326	385681	386037	386393
	3544	3546	3548	3549	3551	3553	3555	3556	3558	3560
821.0	386749	387105	387462	387818	388175	388532	388889	389246	389603	389961
	3561	3563	3565	3566	3568	3570	3572	3573	3575	3577
822.0	390319	390677	391035	391393	391752	392110	392469	392828	393187	393546
	3578	3580	3582	3583	3585	3587	3589	3590	3592	3594
823.0	393906	394265	394625	394985	395345	395705	396066	396427	396787	397148
	3595	3597	3599	3600	3602	3604	3606	3607	3609	3611
824.0	397509	397871	398232	398594	398956	399318	399680	400042	400405	400768
	3612	3614	3616	3617	3619	3621	3623	3624	3626	3628
825.0	401130	401493	401857	402220	402583	402947	403311	403675	404039	404404
	3629	3631	3633	3634	3636	3638	3640	3641	3643	3645
826.0	404768	405133	405498	405863	406228	406594	406959	407325	407691	408057
	3646	3648	3650	3651	3653	3655	3657	3658	3660	3662
827.0	408423	408790	409156	409523	409890	410257	410624	410992	411359	411727
	3663	3665	3667	3668	3670	3672	3674	3675	3677	3679
828.0	412095	412463	412831	413200	413568	413937	414306	414675	415045	415414
	3680	3682	3684	3685	3687	3689	3691	3692	3694	3696
829.0	415784	416154	416523	416894	417264	417634	418005	418376	418747	419118
	3697	3699	3701	3702	3704	3706	3708	3709	3711	3713
830.0	419490	419861	420233	420605	420977	421349	421721	422094	422466	422839
	3714	3716	3718	3719	3721	3723	3724	3726	3728	3730
831.0	423212	423585	423959	424332	424706	425080	425454	425828	426203	426577
	3731	3733	3735	3736	3738	3740	3741	3743	3745	3747
832.0	426952	427327	427702	428077	428453	428828	429204	429580	429956	430332
	3748	3750	3752	3753	3755	3757	3758	3760	3762	3764
833.0	430709	431085	431462	431839	432216	432593	432971	433349	433726	434104
	3765	3767	3769	3770	3772	3774	3775	3777	3779	3780
834.0	434482	434861	435239	435618	435997	436376	436755	437134	437514	437893
	3782	3784	3786	3787	3789	3791	3792	3794	3796	3797
835.0	438273	438653	439033	439414	439794	440175	440556	440937	441318	441699
	3799	3801	3803	3804	3806	3808	3809	3811	3813	3814
836.0	442081	442463	442844	443226	443609	443991	444373	444756	445139	445522
	3816	3818	3820	3821	3823	3825	3826	3828	3830	3831
837.0	445905	446289	446672	447056	447440	447824	448208	448593	448977	449362
	3833	3835	3836	3838	3840	3842	3843	3845	3847	3848
838.0	449747	450132	450517	450903	451288	451674	452060	452446	452832	453219
	3850	3852	3853	3855	3857	3859	3860	3862	3864	3865
839.0	453606	453992	454379	454767	455154	455541	455929	456317	456705	457093
	3867	3869	3870	3872	3874	3876	3877	3879	3881	3882

PINE FLAT RESERVOIR,KINGS RIVER,CALIFORNIA - AREA AND CAPACITY TABLE SEPTEMBER 1975

ELEV FEET	CAP AREA .0	CAP AREA .1	CAP AREA .2	CAP AREA .3	CAP AREA .4	CAP AREA .5	CAP AREA .6	CAP AREA .7	CAP AREA .8	CAP AREA .9
840.0	457481 3884	457870 3886	458258 3887	458647 3889	459036 3891	459425 3892	459815 3894	460204 3896	460594 3898	460984 3899
841.0	461374 3901	461764 3903	462154 3904	462545 3906	462935 3908	463326 3909	463717 3911	464108 3913	464500 3915	464891 3916
842.0	465283 3918	465675 3920	466067 3921	466459 3923	466852 3925	467244 3926	467637 3928	468030 3930	468423 3932	468816 3933
843.0	469209 3935	469603 3937	469997 3938	470391 3940	470785 3942	471179 3943	471574 3945	471968 3947	472363 3948	472758 3950
844.0	473153 3952	473548 3954	473944 3955	474339 3957	474735 3959	475131 3960	475527 3962	475923 3964	476320 3965	476716 3967
845.0	477113 3969	477510 3971	477907 3972	478305 3974	478702 3976	479100 3977	479498 3979	479895 3981	480294 3982	480692 3984
846.0	481091 3986	481489 3988	481888 3989	482287 3991	482686 3993	483086 3994	483485 3996	483885 3998	484285 3999	484685 4001
847.0	485085 4003	485485 4005	485886 4006	486286 4008	486687 4010	487088 4011	487490 4013	487891 4015	488292 4016	488694 4018
848.0	489096 4020	489498 4022	489900 4023	490303 4025	490705 4027	491108 4028	491511 4030	491914 4032	492317 4033	492721 4035
849.0	493124 4037	493528 4038	493932 4040	494336 4042	494741 4044	495145 4045	495550 4047	495954 4049	496359 4050	496765 4052
850.0	497170 4054	497575 4055	497981 4057	498387 4059	498793 4061	499199 4062	499605 4064	500012 4066	500418 4067	500825 4069
851.0	501232 4071	501639 4072	502047 4074	502454 4076	502862 4078	503270 4079	503678 4081	504086 4083	504494 4084	504903 4086
852.0	505311 4088	505720 4089	506129 4091	506538 4093	506948 4095	507357 4096	507767 4098	508177 4100	508587 4101	508997 4103
853.0	509408 4105	509818 4107	510229 4108	510640 4110	511051 4112	511462 4113	511874 4115	512285 4117	512697 4118	513109 4120
854.0	513521 4122	513933 4124	514346 4125	514758 4127	515171 4129	515584 4130	515997 4132	516411 4134	516824 4135	517237 4137
855.0	517651 4139	518065 4141	518479 4142	518894 4144	519308 4146	519723 4147	520138 4149	520553 4151	520968 4152	521383 4154
856.0	521799 4156	522214 4158	522630 4159	523046 4161	523462 4163	523879 4164	524295 4166	524712 4168	525129 4170	525546 4171
857.0	525963 4173	526380 4175	526798 4176	527216 4178	527634 4180	528052 4181	528470 4183	528888 4185	529307 4187	529726 4188
858.0	530144 4190	530564 4192	530983 4193	531402 4195	531822 4197	532242 4199	532662 4200	533082 4202	533502 4204	533923 4205
859.0	534343 4207	534764 4209	535185 4210	535606 4212	536027 4214	536449 4216	536870 4217	537292 4219	537714 4221	538136 4222

PINE FLAT RESERVOIR,KINGS RIVER,CALIFORNIA - AREA AND CAPACITY TABLE SEPTEMBER 1975

ELEV FEET	CAP AREA .0	CAP AREA .1	CAP AREA .2	CAP AREA .3	CAP AREA .4	CAP AREA .5	CAP AREA .6	CAP AREA .7	CAP AREA .8	CAP AREA .9
860.0	538559	538981	539404	539827	540250	540673	541096	541520	541944	542367
	4224	4226	4228	4229	4231	4233	4234	4236	4238	4240
861.0	542791	543216	543640	544065	544489	544914	545339	545764	546190	546615
	4241	4243	4245	4246	4248	4250	4252	4253	4255	4257
862.0	547041	547467	547893	548320	548746	549173	549600	550026	550453	550881
	4258	4260	4262	4264	4265	4267	4269	4270	4272	4274
863.0	551308	551736	552164	552592	553020	553448	553877	554305	554734	555163
	4275	4277	4279	4281	4282	4284	4286	4287	4289	4291
864.0	555592	556022	556451	556881	557311	557741	558171	558601	559032	559463
	4293	4294	4296	4298	4300	4301	4303	4305	4306	4308
865.0	559893	560325	560756	561187	561619	562051	562483	562915	563347	563779
	4310	4312	4313	4315	4317	4318	4320	4322	4324	4325
866.0	564212	564645	565078	565511	565944	566377	566811	567245	567679	568113
	4327	4329	4330	4332	4334	4336	4337	4339	4341	4342
867.0	568547	568982	569416	569851	570286	570722	571157	571593	572028	572464
	4344	4346	4348	4349	4351	4353	4354	4356	4358	4360
868.0	572900	573336	573773	574209	574646	575083	575520	575957	576395	576833
	4361	4363	4365	4367	4368	4370	4372	4373	4375	4377
869.0	577270	577708	578146	578585	579023	579462	579900	580339	580779	581218
	4379	4380	4382	4384	4386	4387	4389	4391	4392	4394
870.0	581657	582097	582537	582977	583417	583858	584298	584739	585180	585621
	4396	4398	4399	4401	4403	4405	4406	4408	4410	4411
871.0	586062	586503	586945	587387	587829	588271	588713	589156	589598	590041
	4413	4415	4417	4418	4420	4422	4424	4425	4427	4429
872.0	590484	590927	591370	591814	592257	592701	593145	593589	594034	594478
	4430	4432	4434	4436	4437	4439	4441	4443	4444	4446
873.0	594923	595368	595813	596258	596703	597149	597595	598041	598487	598933
	4448	4450	4451	4453	4455	4456	4458	4460	4462	4463
874.0	599379	599826	600273	600720	601167	601614	602062	602509	602957	603405
	4465	4467	4469	4470	4472	4474	4476	4477	4479	4481
875.0	603853	604302	604750	605199	605648	606097	606546	606995	607445	607895
	4483	4484	4486	4488	4489	4491	4493	4495	4496	4498
876.0	608345	608794	609245	609695	610146	610597	611048	611499	611950	612402
	4500	4502	4503	4505	4507	4509	4510	4512	4514	4516
877.0	612853	613305	613757	614209	614662	615114	615567	616020	616473	616926
	4517	4519	4521	4523	4524	4526	4528	4530	4531	4533
878.0	617379	617833	618287	618740	619195	619649	620103	620558	621013	621467
	4535	4537	4538	4540	4542	4544	4545	4547	4549	4551
879.0	621923	622378	622833	623289	623745	624201	624657	625114	625570	626027
	4552	4554	4556	4558	4559	4561	4563	4565	4566	4568

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ELEV FEET	CAP AREA .0	CAP AREA .1	CAP AREA .2	CAP AREA .3	CAP AREA .4	CAP AREA .5	CAP AREA .6	CAP AREA .7	CAP AREA .8	CAP AREA .9
880.0	626484	626941	627398	627856	628313	628771	629229	629687	630145	630604
	4570	4572	4573	4575	4577	4579	4580	4582	4584	4586
881.0	631062	631521	631980	632439	632899	633358	633818	634278	634738	635198
	4587	4589	4591	4593	4595	4596	4598	4600	4601	4603
882.0	635659	636119	636580	637041	637502	637963	638425	638886	639348	639810
	4605	4607	4609	4610	4612	4614	4616	4617	4619	4621
883.0	640272	640735	641197	641660	642123	642586	643049	643513	643976	644440
	4623	4624	4626	4628	4630	4631	4633	4635	4637	4639
884.0	644904	645368	645832	646297	646761	647226	647691	648157	648622	649087
	4640	4642	4644	4646	4647	4649	4651	4653	4654	4656
885.0	649553	650019	650485	650951	651418	651884	652351	652818	653285	653752
	4658	4660	4662	4663	4665	4667	4669	4670	4672	4674
886.0	654220	654688	655155	655623	656091	656560	657029	657497	657966	658435
	4676	4678	4679	4681	4683	4685	4686	4688	4690	4692
887.0	658905	659374	659843	660313	660783	661253	661724	662194	662665	663136
	4694	4695	4697	4699	4701	4702	4704	4706	4708	4710
888.0	663607	664078	664550	665021	665493	665965	666437	666909	667382	667854
	4711	4713	4715	4717	4718	4720	4722	4724	4726	4727
889.0	668327	668800	669274	669747	670220	670694	671168	671642	672116	672591
	4729	4731	4733	4735	4736	4738	4740	4742	4744	4745
890.0	673065	673540	674015	674490	674966	675441	675917	676393	676869	677345
	4747	4749	4751	4752	4754	4756	4758	4760	4761	4763
891.0	677822	678298	678775	679252	679729	680206	680684	681161	681639	682117
	4765	4767	4769	4770	4772	4774	4776	4778	4779	4781
892.0	682595	683074	683552	684031	684510	684989	685469	685948	686428	686908
	4783	4785	4787	4788	4790	4792	4794	4796	4797	4799
893.0	687387	687868	688348	688829	689309	689790	690272	690753	691234	691716
	4801	4803	4805	4807	4808	4810	4812	4814	4816	4817
894.0	692197	692680	693162	693644	694127	694610	695093	695576	696059	696542
	4819	4821	4823	4825	4826	4828	4830	4832	4834	4835
895.0	697026	697510	697994	698478	698962	699447	699932	700417	700902	701387
	4837	4839	4841	4843	4845	4846	4848	4850	4852	4854
896.0	701872	702358	702844	703330	703816	704302	704789	705276	705763	706250
	4855	4857	4859	4861	4863	4865	4866	4868	4870	4872
897.0	706737	707224	707712	708200	708688	709176	709664	710153	710642	711131
	4874	4876	4877	4879	4881	4883	4885	4887	4888	4890
898.0	711620	712109	712599	713088	713578	714068	714558	715049	715539	716030
	4892	4894	4896	4898	4899	4901	4903	4905	4907	4909
899.0	716521	717012	717503	717995	718487	718979	719471	719963	720455	720948
	4910	4912	4914	4916	4918	4920	4921	4923	4925	4927

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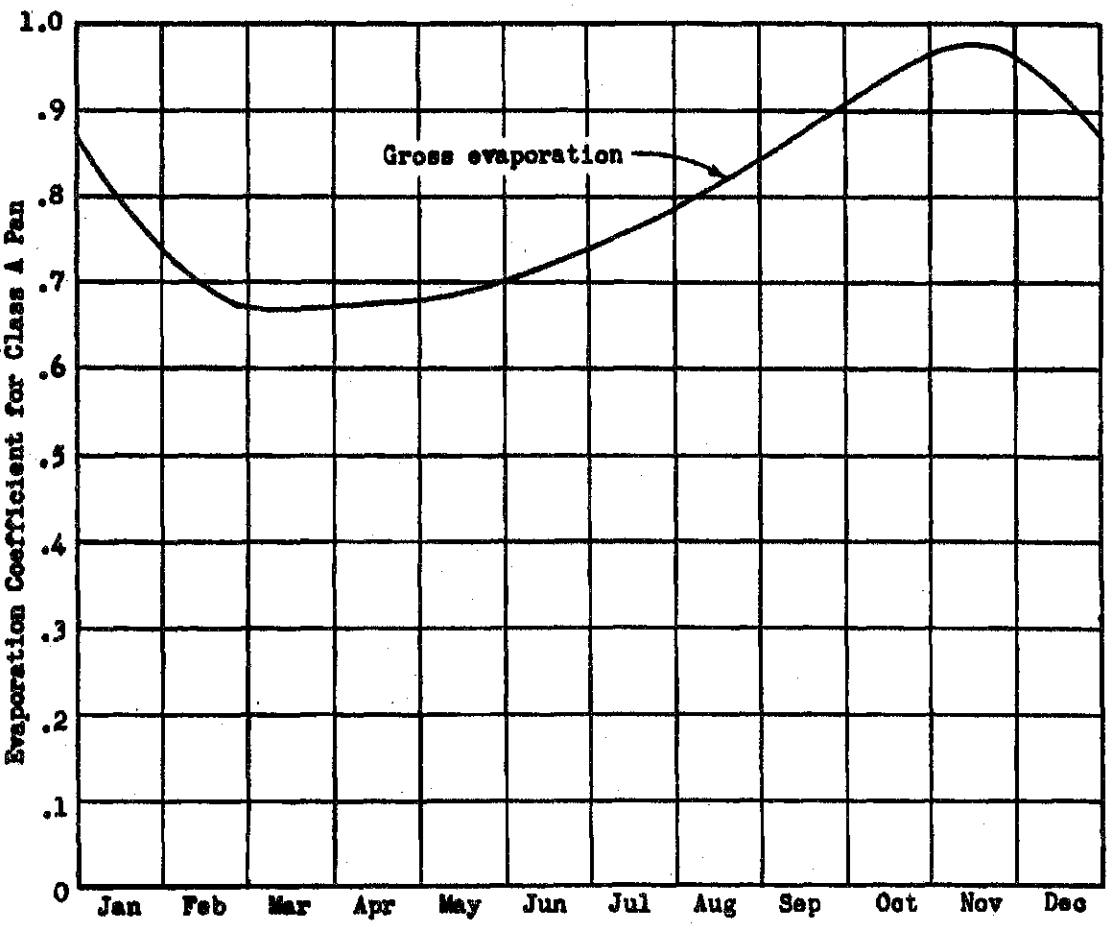
ELEV FEET	CAP AREA .0	CAP AREA .1	CAP AREA .2	CAP AREA .3	CAP AREA .4	CAP AREA .5	CAP AREA .6	CAP AREA .7	CAP AREA .8	CAP AREA .9
900.0	721441	721934	722427	722920	723414	723907	724401	724895	725389	725884
	4929	4931	4932	4934	4936	4938	4940	4942	4943	4945
901.0	726379	726873	727368	727864	728359	728854	729350	729846	730342	730839
	4947	4949	4951	4953	4955	4956	4958	4960	4962	4964
902.0	731335	731832	732328	732826	733323	733820	734318	734816	735313	735811
	4966	4968	4969	4971	4973	4975	4977	4979	4981	4982
903.0	736310	736809	737307	737806	738305	738804	739304	739804	740303	740803
	4984	4986	4988	4990	4992	4994	4995	4997	4999	5001
904.0	741303	741804	742305	742805	743306	743807	744309	744810	745312	745814
	5003	5005	5007	5008	5010	5012	5014	5016	5018	5020
905.0	746316	746818	747321	747823	748326	748829	749332	749835	750339	750842
	5022	5023	5025	5027	5029	5031	5033	5035	5036	5038
906.0	751346	751851	752355	752859	753364	753869	754374	754879	755385	755890
	5040	5042	5044	5046	5048	5050	5051	5053	5055	5057
907.0	756396	756902	757408	757915	758421	758928	759435	759942	760450	760957
	5059	5061	5063	5065	5067	5068	5070	5072	5074	5076
908.0	761464	761972	762480	762989	763497	764006	764514	765024	765533	766042
	5078	5080	5082	5084	5085	5087	5089	5091	5093	5095
909.0	766552	767062	767571	768082	768592	769103	769613	770124	770635	771147
	5097	5099	5101	5102	5104	5106	5108	5110	5112	5114
910.0	771658	772170	772682	773193	773706	774218	774731	775244	775757	776270
	5116	5118	5120	5121	5123	5125	5127	5129	5131	5133
911.0	776783	777297	777810	778325	778839	779353	779868	780382	780897	781412
	5135	5137	5139	5140	5142	5144	5146	5148	5150	5152
912.0	781927	782443	782958	783475	783991	784507	785023	785540	786057	786574
	5154	5156	5158	5160	5161	5163	5165	5167	5169	5171
913.0	787091	787608	788126	788643	789162	789680	790199	790717	791236	791754
	5173	5175	5177	5179	5181	5183	5184	5186	5188	5190
914.0	792274	792793	793312	793832	794352	794872	795392	795913	796433	796954
	5192	5194	5196	5198	5200	5202	5204	5206	5208	5210
915.0	797475	797997	798518	799040	799561	800084	800606	801128	801651	802173
	5211	5213	5215	5217	5219	5221	5223	5225	5227	5229
916.0	802696	803220	803745	804266	804790	805315	805838	806363	806888	807413
	5231	5233	5235	5237	5239	5241	5242	5244	5246	5248
917.0	807936	808462	808987	809513	810039	810565	811090	811617	812144	812670
	5250	5252	5254	5256	5258	5260	5262	5264	5266	5268
918.0	813197	813724	814252	814779	815306	815834	816362	816891	817419	817947
	5270	5272	5274	5276	5277	5279	5281	5283	5285	5287
919.0	818476	819005	819535	820064	820594	821124	821653	822183	822714	823245
	5289	5291	5293	5295	5297	5299	5301	5303	5305	5307

PINE FLAT RESERVOIR,KINGS RIVER,CALIFORNIA - AREA AND CAPACITY TABLE SEPTEMBER 1975

ELEV FEET	CAP AREA .0	CAP AREA .1	CAP AREA .2	CAP AREA .3	CAP AREA .4	CAP AREA .5	CAP AREA .6	CAP AREA .7	CAP AREA .8	CAP AREA .9
920.0	823775	824306	824838	825369	825900	826432	826964	827496	828029	828561
	5309	5311	5313	5315	5317	5319	5321	5323	5325	5326
921.0	829094	829627	830160	830693	831227	831760	832295	832829	833363	833897
	5328	5330	5332	5334	5336	5338	5340	5342	5344	5346
922.0	834432	834967	835502	836037	836573	837108	837645	838181	838717	839254
	5348	5350	5352	5354	5356	5358	5360	5362	5364	5366
923.0	839790	840327	840864	841401	841939	842477	843015	843553	844091	844629
	5368	5370	5372	5374	5376	5378	5380	5382	5384	5386
924.0	845166	845707	846246	846785	847325	847864	848404	848946	849485	850025
	5388	5390	5392	5394	5396	5398	5400	5402	5404	5406
925.0	850566	851107	851648	852189	852731	853272	853815	854356	854899	855441
	5408	5410	5412	5414	5416	5418	5420	5422	5424	5426
926.0	855984	856527	857069	857611	858157	858700	859244	859788	860332	860877
	5428	5430	5432	5434	5436	5438	5440	5442	5444	5446
927.0	861421	861966	862511	863057	863602	864148	864693	865240	865786	866333
	5448	5450	5452	5454	5456	5458	5460	5462	5464	5466
928.0	866879	867426	867973	868520	869068	869616	870164	870712	871260	871809
	5468	5470	5472	5474	5476	5478	5480	5482	5484	5486
929.0	872357	872906	873455	874004	874554	875104	875654	876204	876754	877305
	5488	5490	5492	5494	5496	5498	5500	5502	5504	5506
930.0	877855	878406	878958	879509	880061	880612	881164	881716	882268	882821
	5508	5510	5512	5514	5516	5518	5520	5522	5524	5527
931.0	883373	883927	884480	885033	885587	886141	886695	887249	887803	888358
	5529	5531	5533	5535	5537	5539	5541	5543	5545	5547
932.0	888913	889467	890023	890578	891134	891689	892246	892802	893358	893915
	5549	5551	5553	5555	5557	5559	5561	5563	5565	5567
933.0	894471	895029	895586	896144	896701	897259	897817	898375	898934	899492
	5569	5571	5573	5575	5577	5580	5582	5584	5586	5588
934.0	900051	900610	901170	901729	902289	902849	903409	903969	904530	905090
	5590	5592	5594	5596	5598	5600	5602	5604	5606	5608
935.0	905651	906212	906774	907335	907897	908459	909021	909583	910146	910708
	5610	5612	5614	5616	5619	5621	5623	5625	5627	5629
936.0	911271	911835	912398	912962	913526	914090	914654	915218	915783	916348
	5631	5633	5635	5637	5639	5641	5643	5645	5647	5649
937.0	916913	917478	918044	918610	919176	919741	920308	920874	921441	922008
	5652	5654	5656	5658	5660	5662	5664	5666	5668	5670
938.0	922575	923142	923710	924278	924845	925414	925982	926550	927119	927689
	5672	5674	5676	5678	5680	5683	5685	5687	5689	5691
939.0	928257	928827	929396	929966	930536	931106	931677	932248	932819	933389
	5693	5695	5697	5699	5701	5703	5705	5707	5710	5712

PINE FLAT RESERVOIR,KINGS RIVER,CALIFORNIA - AREA AND CAPACITY TABLE SEPTEMBER 1975

ELEV FEET	CAP AREA .0	CAP AREA .1	CAP AREA .2	CAP AREA .3	CAP AREA .4	CAP AREA .5	CAP AREA .6	CAP AREA .7	CAP AREA .8	CAP AREA .9
940.0	933961	934532	935103	935676	936248	936820	937392	937965	938539	939111
	5714	5716	5718	5720	5722	5724	5726	5728	5730	5732
941.0	939685	940259	940832	941406	941980	942555	943130	943704	944279	944855
	5735	5737	5739	5741	5743	5745	5747	5749	5751	5753
942.0	945430	946005	946582	947157	947734	948310	948887	949464	950041	950618
	5755	5758	5760	5762	5764	5766	5768	5770	5772	5774
943.0	951196	951773	952351	952930	953508	954087	954665	955244	955823	956403
	5776	5778	5781	5783	5785	5787	5789	5791	5793	5795
944.0	956983	957563	958143	958723	959304	959884	960465	961046	961627	962209
	5797	5799	5802	5804	5806	5808	5810	5812	5814	5816
945.0	962790	963372	963955	964537	965120	965702	966285	966868	967452	968035
	5818	5820	5823	5825	5827	5829	5831	5833	5835	5837
946.0	968619	969203	969788	970372	970956	971542	972127	972713	973298	973883
	5839	5841	5844	5846	5848	5850	5852	5854	5856	5858
947.0	974469	975055	975642	976228	976815	977402	977989	978577	979164	979752
	5860	5863	5865	5867	5869	5871	5873	5875	5877	5879
948.0	980340	980928	981517	982105	982695	983284	983873	984463	985052	985642
	5882	5884	5886	5888	5890	5892	5894	5896	5898	5901
949.0	986232	986822	987413	988004	988596	989186	989778	990369	990961	991554
	5903	5905	5907	5909	5911	5913	5915	5917	5920	5922
950.0	992146	992739	993331	993924	994517	995110	995704	996298	996892	997486
	5924	5926	5928	5930	5932	5934	5937	5939	5941	5943
951.0	998080	998675	999270	999865	1000460	1001055	1001651	1002246	1002844	1003440
	5945	5947	5949	5951	5953	5956	5958	5960	5962	5964
952.0	1004035	1004632	1005229	1005826	1006424	1007022	1007619	1008218	1008816	1009414
	5966	5968	5970	5973	5975	5977	5979	5981	5983	5985
953.0	1010012	1010611	1011210	1011810	1012409	1013009	1013608	1014209	1014809	1015410
	5987	5990	5992	5994	5996	5998	6000	6002	6004	6007
954.0	1016011	1016612	1017213	1017813	1018416	1019018	1019619	1020223	1020824	1021427
	6009	6011	6013	6015	6017	6019	6021	6023	6026	6028
955.0	1022030	1022633	1023236	1023839	1024443	1025047	1025651	1026256	1026860	1027465
	6030	6032	6034	6036	6038	6040	6043	6045	6047	6049
956.0	1028070	1028676	1029280	1029886	1030492	1031099	1031704	1032311	1032918	1033526
	6051	6053	6055	6057	6060	6062	6064	6066	6068	6070
957.0	1034132	1034739	1035347	1035955	1036563	1037170	1037779	1038388	1038996	1039606
	6072	6074	6077	6079	6081	6083	6085	6087	6089	6091
958.0	1040215	1040824	1041434	1042044	1042654	1043264	1043874	1044486	1045096	1045707
	6094	6096	6098	6100	6102	6104	6106	6108	6110	6113



AVERAGE MONTHLY
EVAPORATION COEFFICIENTS

Jan	0.804	Jul	0.768
Feb	0.696	Aug	0.816
Mar	0.672	Sep	0.876
Apr	0.672	Oct	0.936
May	0.684	Nov	0.960
Jun	0.720	Dec	0.924

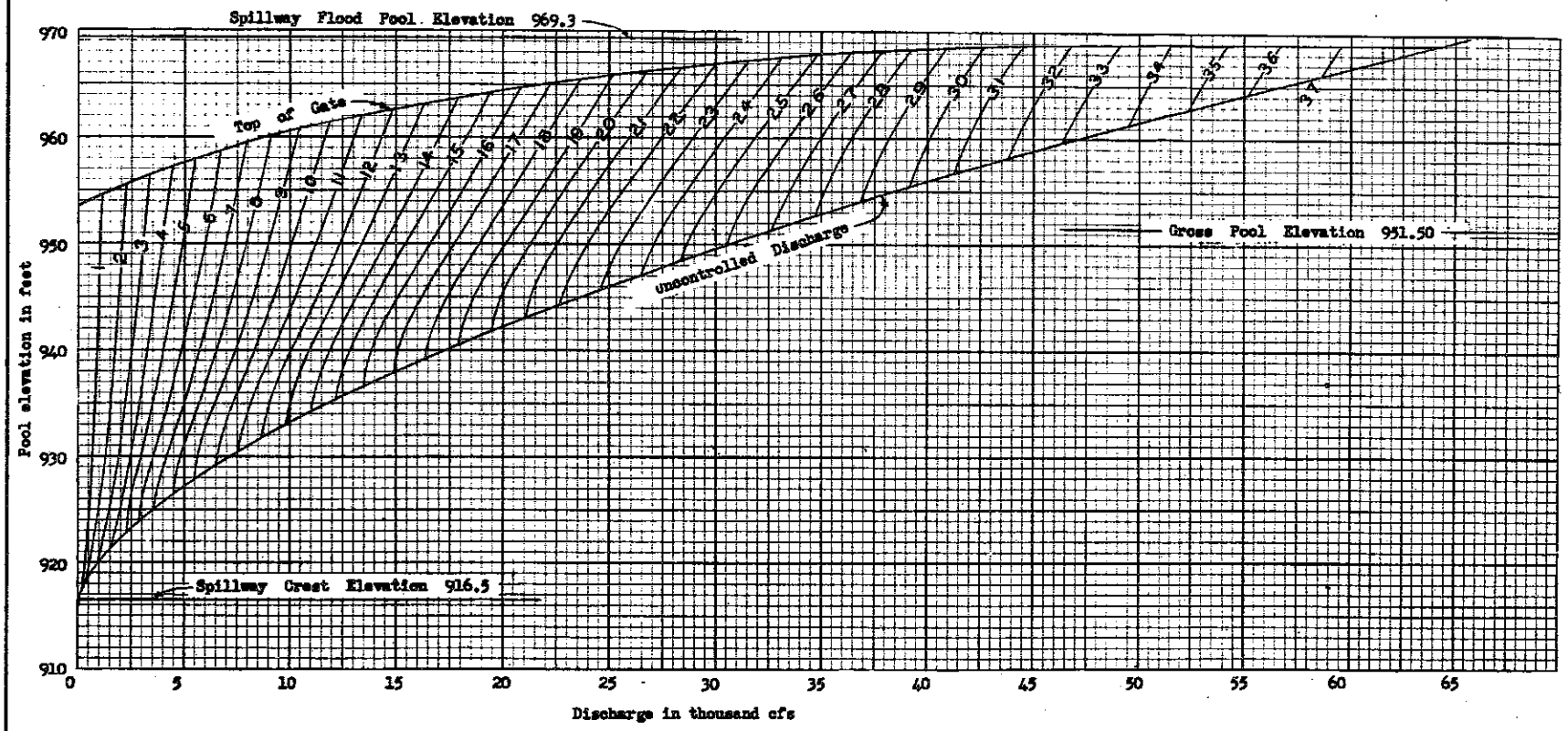
PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

EVAPORATION COEFFICIENTS

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.R.B. Date: SEPTEMBER 1955

CHART A-3



NOTES

1 Ratings are for one of six 42'x 38' radial gates with adjacent gates operating.

2 Parameter is gate opening (hoist chain travel) in feet.

3 Gate seat elevation 915.46 feet.

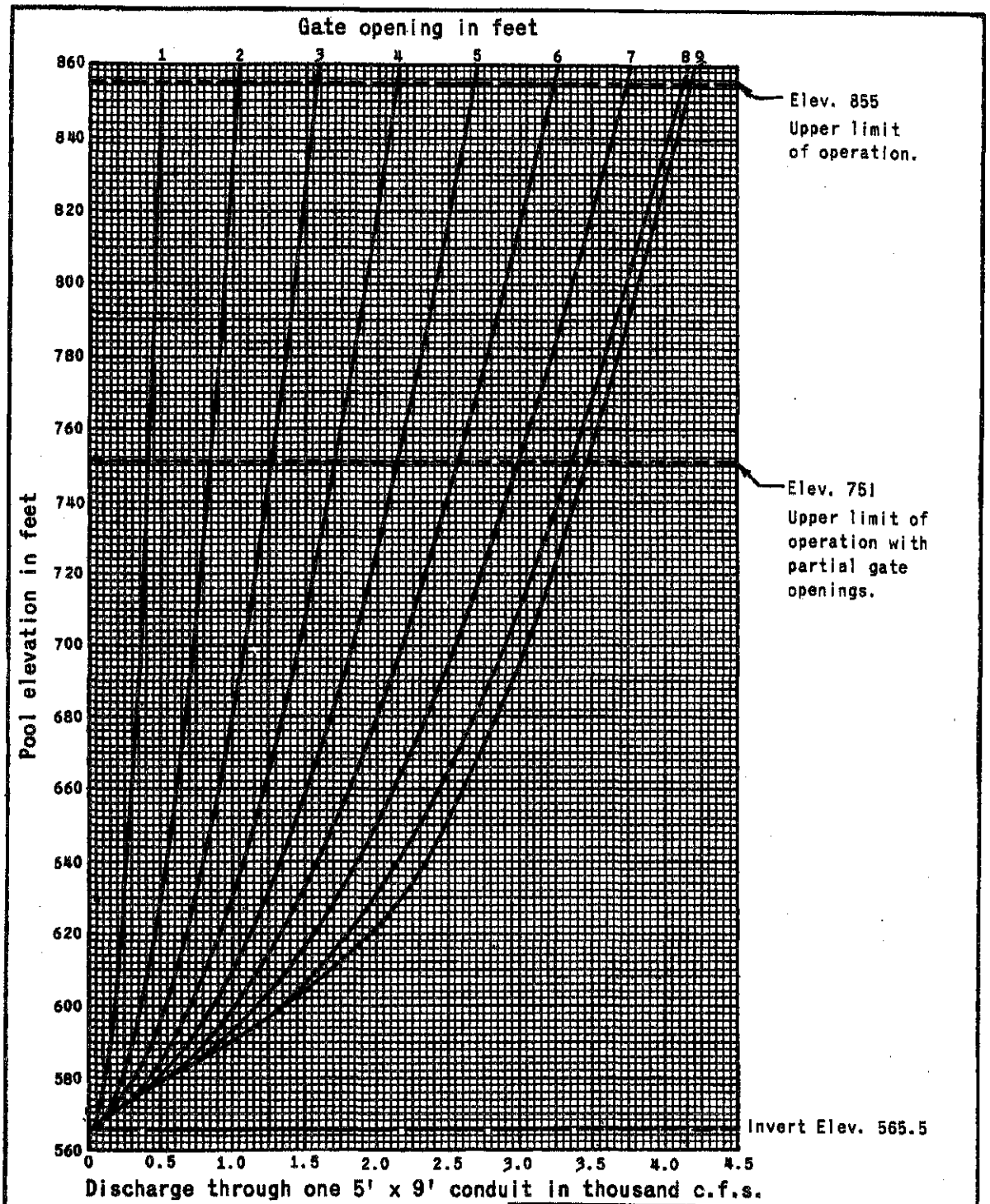
4 At such times as the water flows free (below bottom of spillway gate), discharge is indicated by "uncontrolled discharge" curve regardless of gate opening.

PINE FLAT DAM
KINGS RIVER, CALIFORNIA

SPILLWAY DISCHARGE CURVES
ONE OF SIX SPILLWAY GATES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: H.T.M., T.G.K. Date: DECEMBER 1978
Drawn: T.G.K.



NOTES:

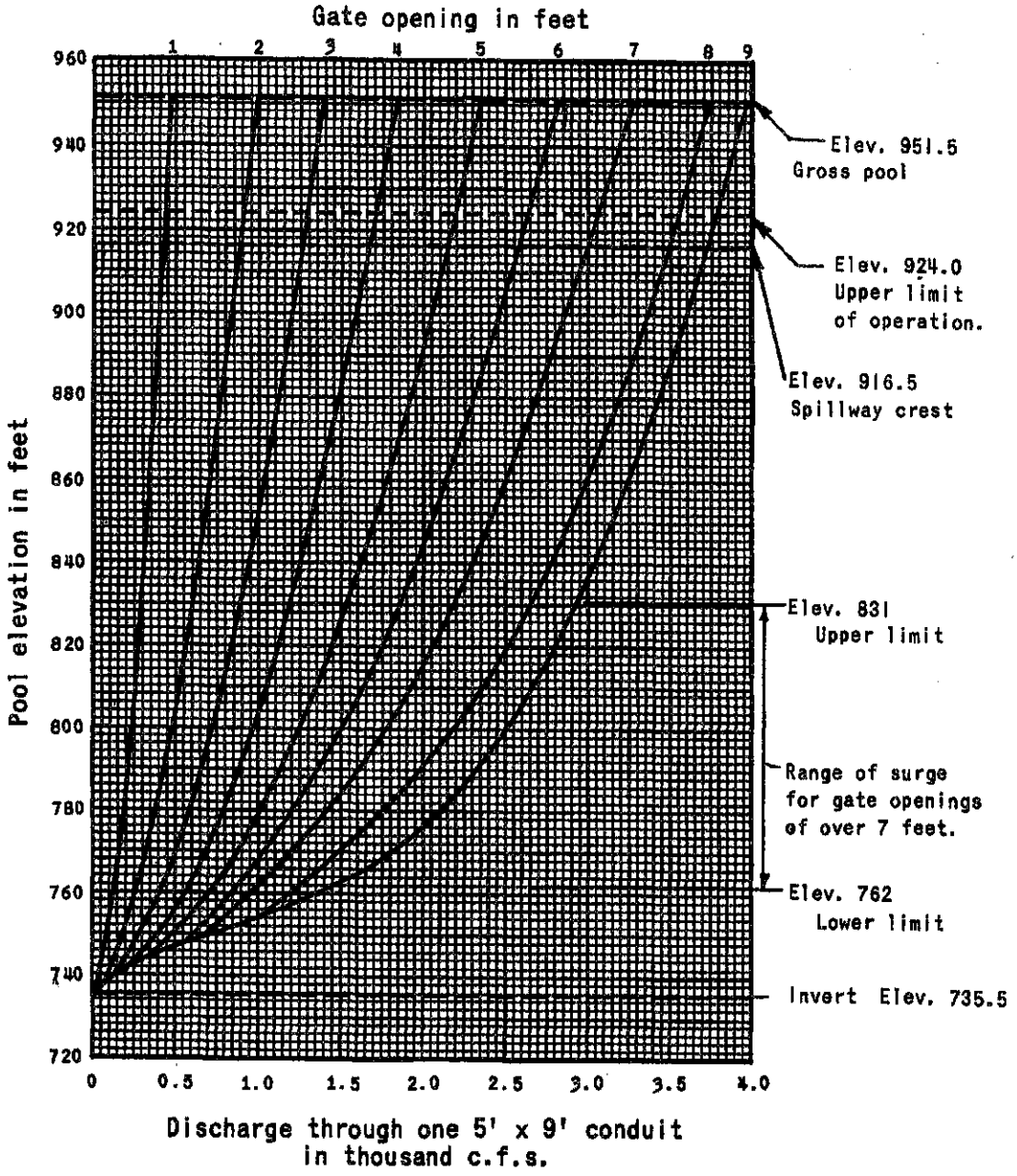
1. Rating for full gate opening is derived from current meter measurements in May and June, 1952, with flows from 8,000 to 15,000 c.f.s.
2. Ratings for partial gate openings are theoretical.

PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

OUTLET DISCHARGE CURVES
ONE OF FIVE LOWER TIER OUTLETS

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: A.G.C. Date: OCTOBER 1953



NOTE:

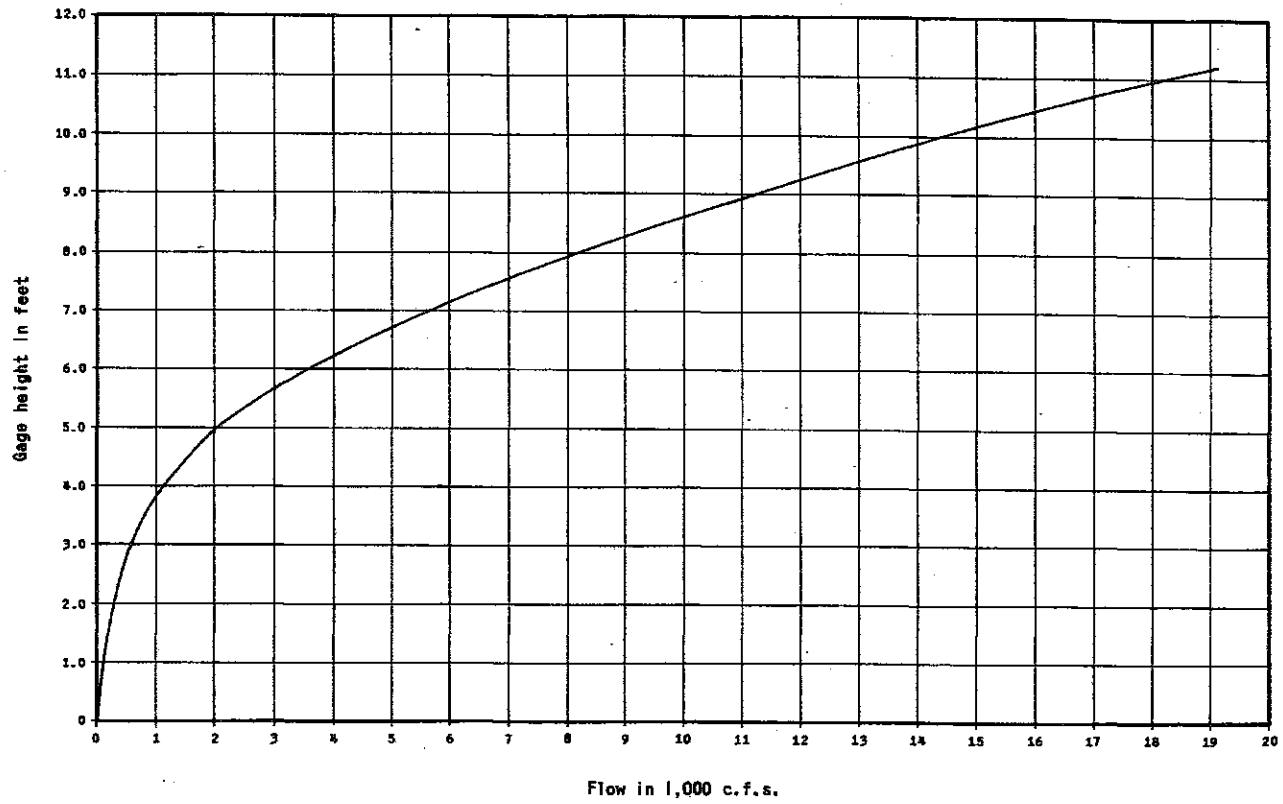
Ratings for all gate openings are theoretical.

PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

OUTLET DISCHARGE CURVES
ONE OF FIVE UPPER TIER OUTLETS

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: A.G.C. Date: OCTOBER 1953



NOTE:

Data extracted from U.S.G.S. Rating Table No. 11 dated 8 April 1976.

PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

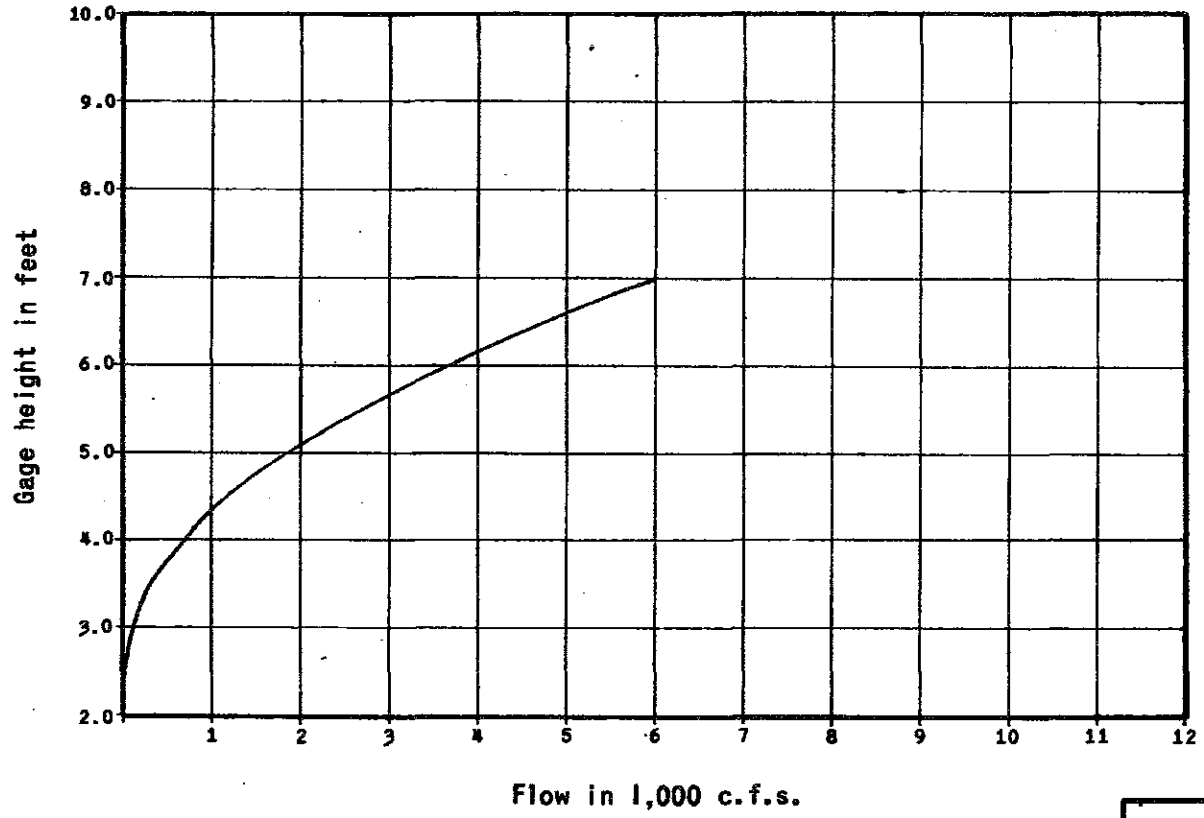
DISCHARGE RATING CURVE

KINGS RIVER BELOW PINE FLAT DAM

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.
Date: FEBRUARY 1979

SHEET 1 OF 3 CHART A-5



NOTE:

Data extracted from U.S.G.S. Rating Table No. 23 dated 1 March 1975.

PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

DISCHARGE RATING CURVE

MILL CREEK NEAR PIEDRA

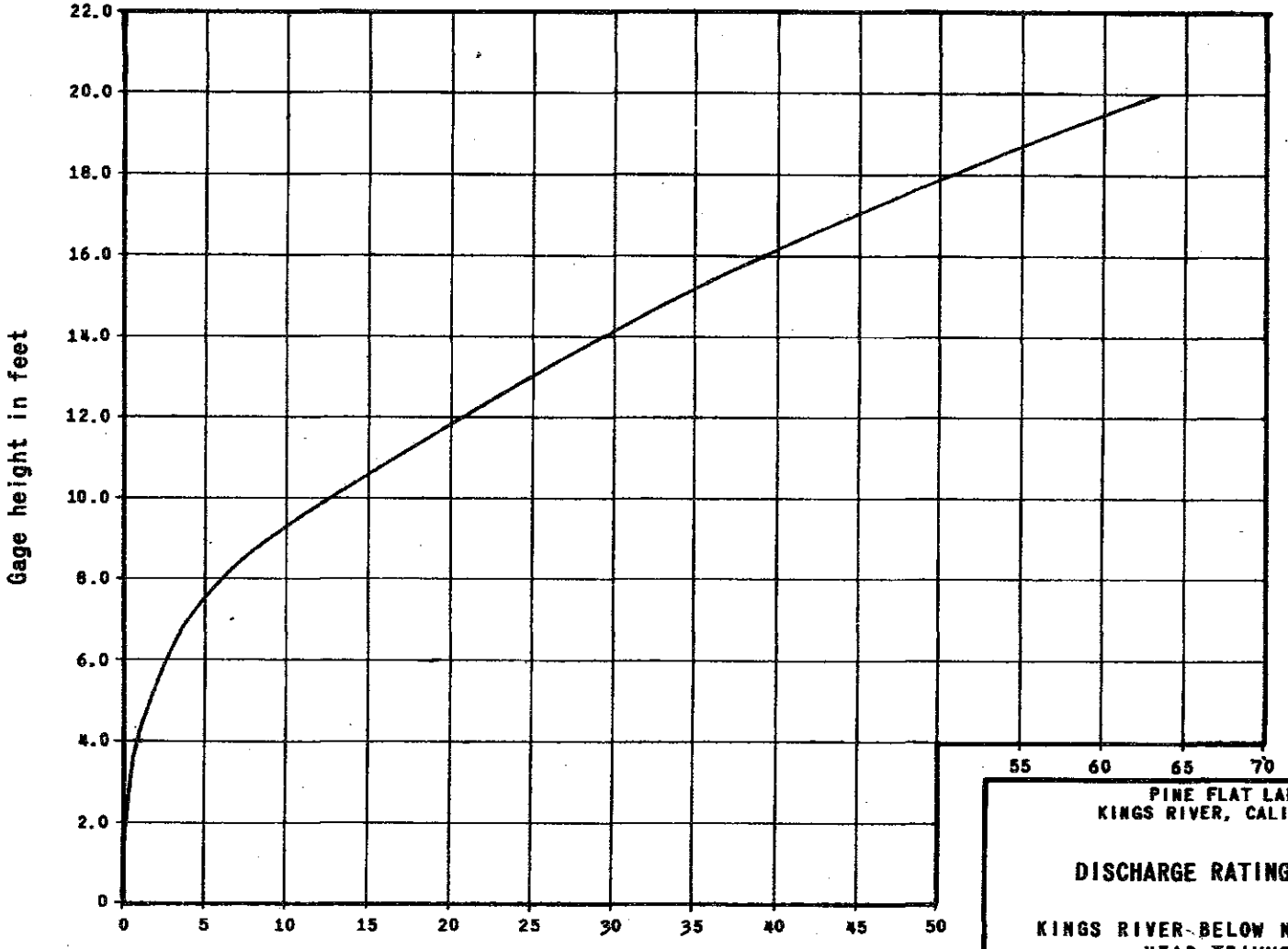
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.

Date: FEBRUARY 1979

GPO 787-059/6992

SHEET 2 OF 3 CHART A-5



NOTE:

Date extracted from U.S.G.S. Rating Table No. 19

PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

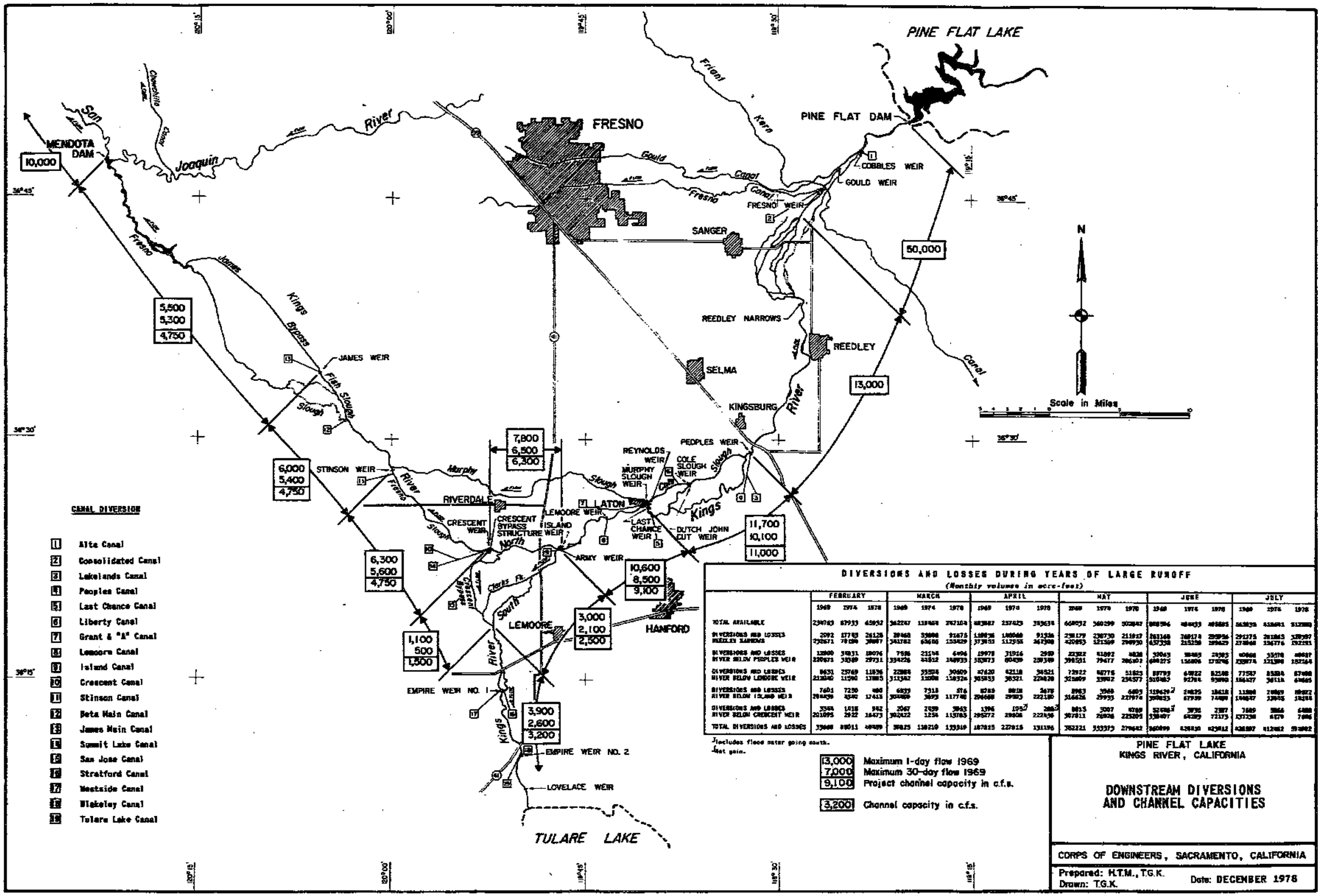
DISCHARGE RATING CURVE

KINGS RIVER BELOW NORTH FORK NEAR TRIMMER

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.
Date: FEBRUARY 1979

SHEET 3 OF 3 CHART A-5



DIVERSIONS AND LOSSES DURING YEARS OF LARGE RUNOFF

(Monthly volumes in acre-feet)

	FEBRUARY 1969	FEBRUARY 1974	FEBRUARY 1978	MARCH 1969	MARCH 1974	MARCH 1978	APRIL 1969	APRIL 1974	APRIL 1978
TOTAL AVAILABLE	234783	87933	65952	362247	119458	267104	483847	257425	393634
DIVERSIONS AND LOSSES REEDLEY NARROWS	2092 232671	17785 70150	26128 39807	20468 341782	53900 65606	91675 155429	110076 373851	100060 112965	91526 267390
DIVERSIONS AND LOSSES RIVER BELOW PEOPLES WEIR	12800 220071	34831 53189	18076 29731	7586 334226	21154 44512	6496 148933	19978 353873	31916 80459	2949 239340
DIVERSIONS AND LOSSES RIVER BELOW LEMOORE WEIR	8631 212040	25749 11590	11836 17885	22084 312342	33504 11008	30409 118326	47420 305853	42118 38321	34521 220820
DIVERSIONS AND LOSSES RIVER BELOW ISLAND WEIR	7601 204439	7250 4340	480 17415	6539 304489	7318 3693	576 117740	8783 296680	8818 29503	3478 222180
DIVERSIONS AND LOSSES RIVER BELOW CRESCENT WEIR	3364 201095	1018 2922	942 16473	2067 302422	2039 1254	5963 113783	1396 295272	195[2] 29906	288[1] 222656
TOTAL DIVERSIONS AND LOSSES	33688	88011	49489	59825	138210	153319	187825	227818	131156

	MAY 1969	MAY 1974	MAY 1978	JUNE 1969	JUNE 1974	JUNE 1978	JULY 1969	JULY 1974	JULY 1978
TOTAL AVAILABLE	608952	560299	502847	888586	484633	488885	565835	458461	512889
DIVERSIONS AND LOSSES REEDLEY NARROWS	238179 420853	238730 321569	211017 290930	261148 657338	268174 215250	295956 299629	291275 273840	281065 156776	320397 192251
DIVERSIONS AND LOSSES RIVER BELOW PEOPLES WEIR	22322 398531	41892 79477	4828 286102	37063 600275	58485 156806	29585 270246	40868 232874	35578 121384	40087 152264
DIVERSIONS AND LOSSES RIVER BELOW LEMOORE WEIR	72922 325809	48775 35902	51825 234577	89795 510483	64822 92784	82148 95890	77587 154437	85504 36511	87080 64665
DIVERSIONS AND LOSSES RIVER BELOW ISLAND WEIR	8963 316626	3568 29933	6603 227974	119439[1] 390853	24825 67959	18618 74880	11588 144847	20869 13966	88827 130184
DIVERSIONS AND LOSSES RIVER BELOW CRESCENT WEIR	8815 307811	3307 26626	4788 225205	32406[1] 538407	3736 64209	2387 72173	7689 537250	5866 6179	6488 7096
TOTAL DIVERSIONS AND LOSSES	382221	353379	279642	560899	426830	425812	428887	412862	593862

1/ Includes flood water going south.

2/ Net gain.

13,000	Maximum 1-day flow 1969
7,000	Maximum 30-day flow 1969
9,100	Project channel capacity in c.f.s.
3,200	Channel capacity in c.f.s.

PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

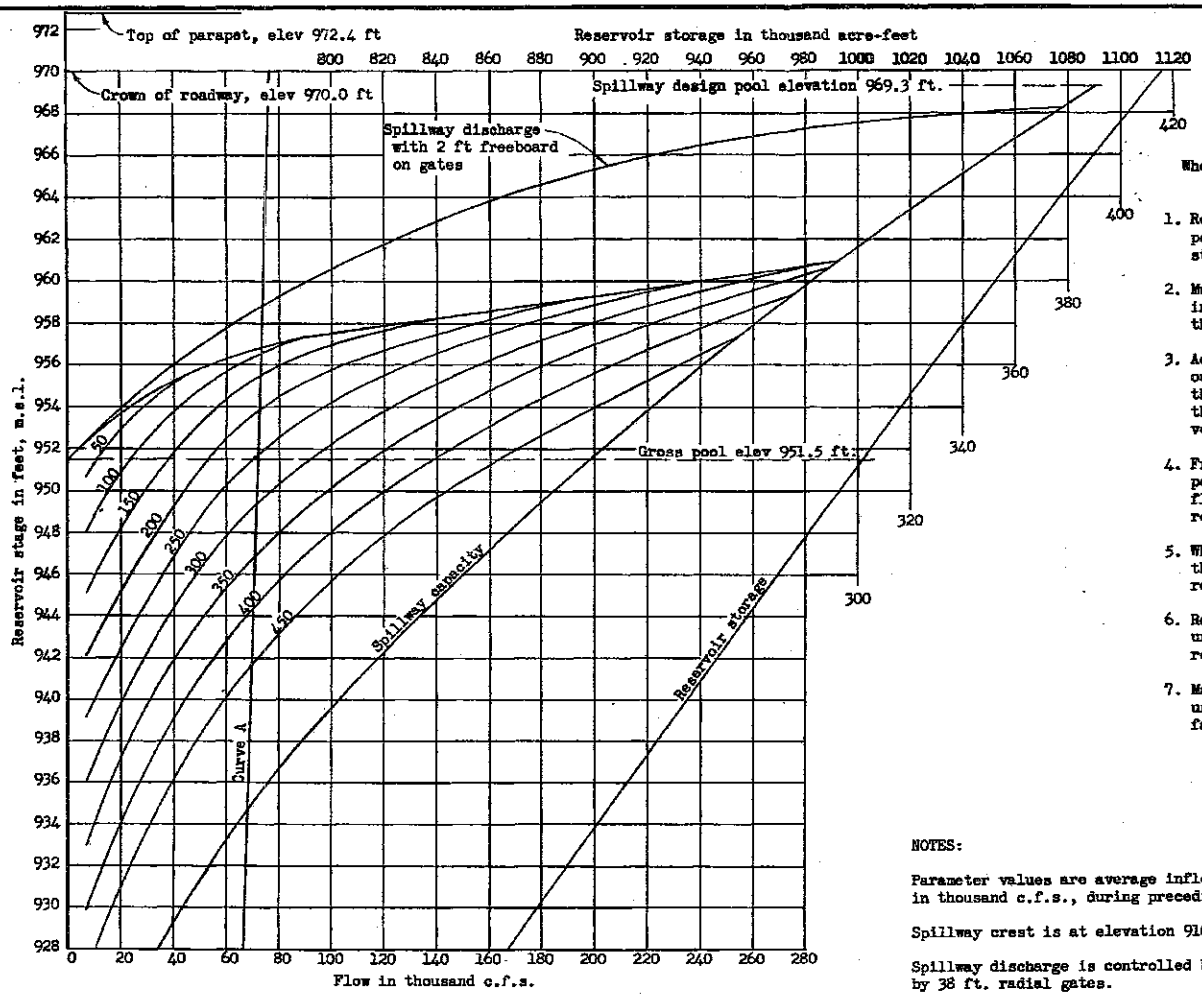
DOWNSTREAM DIVERSIONS AND CHANNEL CAPACITIES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: H.T.M., T.G.K.
Drawn: T.G.K.

Date: DECEMBER 1978

CHART A-6



USE OF DIAGRAM

When reservoir stage is rising:

1. Read from curve A the flow corresponding to the average reservoir stage during the preceding hour.
2. Multiply this value by the rise in reservoir stage, in feet, during the preceding hour.
3. Add this product to the average outflow from the reservoir during the preceding hour. This sum is the average inflow to the reservoir during the preceding hour.
4. From the parameter line corresponding to this inflow, read the flow corresponding to the current reservoir stage.
5. When this value of flow exceeds the current release, increase the release to this value.
6. Repeat steps 1 through 5 each hour until maximum gate opening has been reached.
7. Maintain this maximum gate opening until reservoir stage begins to fall and is below elevation 961.

When reservoir stage is falling and is below elevation 961:

8. Read from curve A the flow corresponding to the average reservoir stage during the preceding hour.
9. Multiply this value by the fall in reservoir stage, in feet, during the preceding hour.
10. Decrease the release by .2 of the product obtained in step 9.
11. Repeat steps 8 through 10 each hour, as long as the reservoir is receding, until the release has been reduced to that required by chart A-8.

- - -

Once operation in accordance with the emergency release diagram is initiated, gate changes shall be made only at such times as criteria under steps 1 through 6 require increased gate openings or criteria under steps 8 through 11 require decreased gate openings, until the release has been reduced to that required by chart A-8.

NOTES:

Parameter values are average inflow to reservoir, in thousand c.f.s., during preceding hour.

Spillway crest is at elevation 916.5 ft.

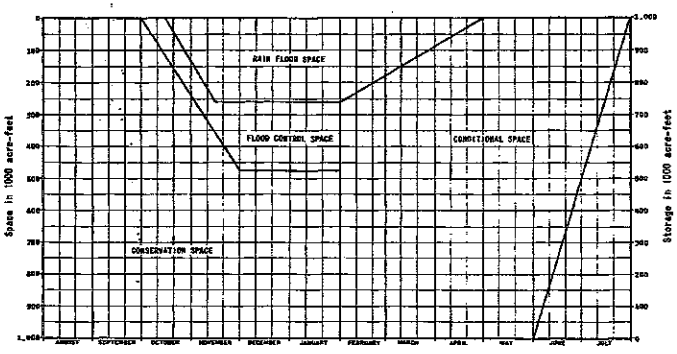
Spillway discharge is controlled by six 42 ft. by 38 ft. radial gates.

PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

EMERGENCY SPILLWAY RELEASE DIAGRAM

CORPS OF ENGINEERS,	SACRAMENTO, CALIFORNIA
Prepared: H.A.K.	Date: MAY 1955

CHART A-7



USE OF DIAGRAM

1. When the storage level is in the range of Conservation Space, flood releases are not required.
2. Water stored in Flood Control Space shall be released as rapidly as possible without exceeding 4,750 c.f.s. below Crescent Weir or causing flood flows in Kings River South. The Flood Control Space shall be decreased by the space available in Wishon and Courtright Reservoirs less 20,000 acre-feet.
3. When water is stored in Rain Flood Space, releases shall be increased to maximum channel capacity in Kings River North and up to maximum channel capacity in Kings River South as necessary to evacuate the Rain Flood Space within 90 days. The Rain Flood Space shall not be reduced by space in upstream reservoirs.
4. When water is stored in the portion of the Conditional Space required for flood control, a supplemental release in addition to irrigation demand must be made. The amount of Conditional Space required for flood control, on a given date, is determined from the forecasted full natural runoff into Pine Flat Lake and the forecasted irrigation demand from that date to 10 June (after 26 May use the Forecasted Irrigation Demand for the next 15 days or until 31 July, whichever is less) using the adjacent diagram. The adjacent diagram is also used to compute the supplemental release.

ADDITIONAL CONSIDERATIONS

1. Reservoir releases will be determined by the instructions hereon unless larger releases are required by the Emergency Spillway Release Diagram (Chart A-7).
2. The Corps of Engineers may direct flood releases to be increased or decreased when deviation from the computed release is warranted by existing conditions.
3. Insofar as possible, the release from Pine Flat shall not cause the flow in any reach of Kings River or Kings River distributaries to exceed the safe channel capacity as determined by the Corps of Engineers at the time of occurrence.
4. The Corps of Engineers may increase or decrease the 20,000 acre-foot adjustment to space transferals from Wishon and Courtright reservoirs based on forecasted runoff and reservoir operation.
5. When the San Joaquin River below Mendota is at flood stage the releases to Kings River North shall not be greater than pre-project flow.

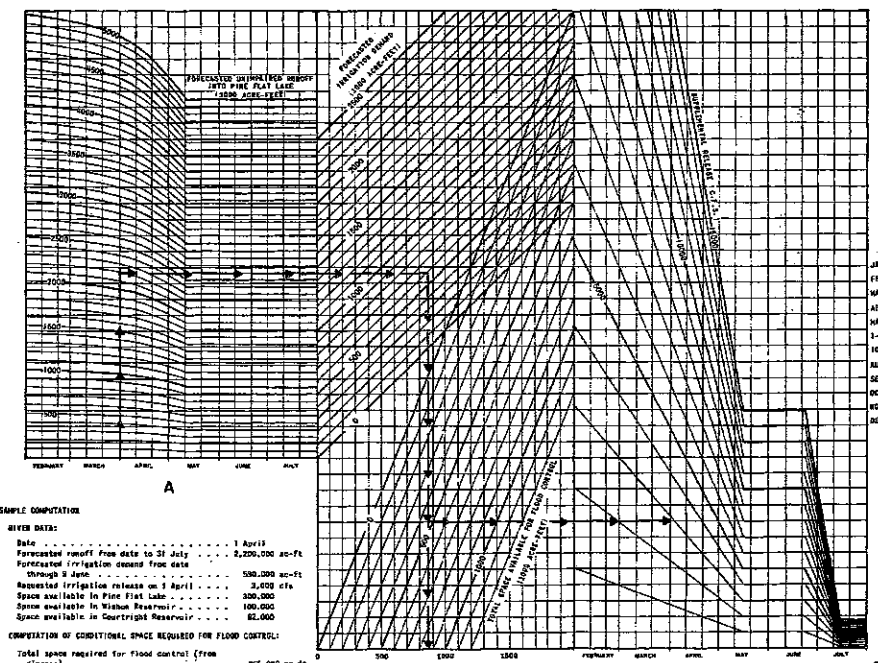
CONDITIONAL SPACE REQUIRED FOR FLOOD CONTROL COMPUTATION

1. Enter margin "A" for the date the required space is being computed, and move upward vertically to the Forecasted Unimpaired Runoff into Pine Flat Lake parameter, which indicates the runoff from that date through 31 July.
2. Move horizontally from the forecasted unimpaired runoff into Pine Flat Lake to the Forecasted Irrigation Demand from that given date to 10 June* (after 26 May use the Forecasted Irrigation Demand for the next 15 days or until 31 July, whichever is less).
3. Move vertically downward from the Forecasted Irrigation Demand to margin "B" to obtain Total Space Required for Flood Control. Decrease this volume by the space available in Wishon and Courtright Reservoirs (less 20,000 acre-feet) to obtain the Conditional Space required for flood control in Pine Flat Lake.

*Irrigation Demands shall be the amount of water determined by the Kings River Watermaster to satisfy diversion requirements, channel losses, spreading, sinking, and other uses.

SUPPLEMENTAL RELEASE COMPUTATION

1. Perform Steps 1 and 2 above using the date for which the release is being computed.
2. Move vertically downward from the Forecasted Irrigation Demand to the Total Space Available for Flood Control on the given date which is the total space available in Pine Flat Lake and Courtright and Wishon Reservoirs (less 20,000 acre-feet).
3. Move horizontally from the Total Space Available for Flood Control to the point directly above the given date on margin "C" to obtain the Supplemental Release (interpolate as required). The Supplemental release must be added to the irrigation demand to obtain the total release.



A

SAMPLE COMPUTATION

GIVEN DATA:

Date	1 April
Forecasted runoff from date to 31 July	2,220,000 ac-ft
Forecasted irrigation demand from date through 9 June	580,000 ac-ft
Requested irrigation release on 1 April	3,000 cfs
Space available in Pine Flat Lake	320,000
Space available in Wishon Reservoir	100,000
Space available in Courtright Reservoir	82,000

COMPUTATION OF CONDITIONAL SPACE REQUIRED FOR FLOOD CONTROL:

Total space required for flood control (from diagram)	865,000 ac-ft
Conditional Reservation Required for Flood control in Pine Flat Lake: 865,000 - (100,000 + 82,000 - 20,000) =	703,000 ac-ft

COMPUTATION OF TOTAL RELEASE FROM PINE FLAT LAKE:

Total space available for flood control = 320,000 + 100,000 + 82,000 - 20,000 =	482,000
Supplemental release (from diagram)	2,900 cfs
Total release = 3,000 + 2,900 =	5,900 cfs

B

C

NORMAL IRRIGATION DEMAND

	(1000 A.F.)	(MEAN C.F.S.)
JANUARY	23	374
FEBRUARY	78	1360
MARCH	122	1990
APRIL	170	2860
MAY	257	4190
1-9 JUNE	104	5830
10 JUNE-31 JULY	665	6450
AUGUST	188	3060
SEPTEMBER	123	2240
OCTOBER	16	262
NOVEMBER	5	84
DECEMBER	19	309

PINE FLAT LAKE
KINGS RIVER, CALIFORNIA

FLOOD CONTROL DIAGRAM

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: H.T.M.
Drawn: L.H.C.

Date: MARCH 1979

CHART A-8

EXHIBIT C

Kings River Licenses Summary

Application Number	16469	10979	353	15231	360	5640	
Permit Number	15720	15716	15713	15719	15714	15715	
License Number, Dated May 18, 1984	11522	11520	11517	11521	11518	11519	
Priority Date of "Right"	July 18. 1955	Feb. 10, 1945	May 24, 1916	March 9, 1953	May 31, 1916	July 30, 1927	
The following are licensed items:							
Description	**Courtright**	**Wishon**	**Tulare Lake Sump**	**Tulare Lake Sump**	**Pine Flat**	**Pine Flat**	**Totals**
Maximum withdrawal af/yr	131,000 af	183,500 af					
Maximum amount held in storage in af	123,300 af	128,600 af			1,008,900 af	1,008,900 af	1,260,800 af
Maximum amount beneficially used by direct diversion			613 cfs	1,096 cfs	5,000 cfs	3,059 cfs	1/1 - 4/30 6,096 cfs
Diversion Season			June	Jan 1- Dec 31	Jan 1- Dec 31	May 1 - July 31	5/1 - 5/31 9,155 cfs
							6/1 - 6/30 9,768 cfs
							7/1 - 7/31 9,155 cfs
							8/1 - 12/31 6,096 cfs
Maximum amount by collection to storage	102,500 af	128,000 af	188,000 af	796,000 af	600,000 af	355,200 af	2,169,700 af
Collection period	Sept 1 - July 31	Jan 1 - Dec 31	Jan 1- June 30	Jan 1- June 30	Sept 1 - July 31	Sept 1 - July 31	
Maximum amount taken from source per year			224,500 af	960,700 af	2,786,000 af	In 360	3,971,200 af
Maximum amount to be place to **beneficial use** per year	In 360	In 360	In 15231	569,600 af	**2,565,000** af	In 360	3,134,600 af
Place of Use	KRWA	KRWA	TLBWSD	TLBWSD	KRWA	KRWA	
Place of Storage	Courtwright	Wishon	Tulare Lake Sump in the following T22S,R20E; T23S, R20E; T24S, R20-22E, MDB&M		Pine Flat	Pine Flat	
Points of Diversion	Courtwright	Wishon	Empire #2	Boundary of Lake	Pine Flat	Pine Flat	
Points of Diversion & Rediversion	60 points	60 points		Boundary of Lake	60 points	60 points	
Purpose	Irrigation including minimum flow requirement	Irrigation	Irrigation	Irrigation, Domestic, and Stockwatering	Irrigation Use	Irrigation, Domestic	

DIRECT DIVERSION (cfs): Maximum **monthly average** of natural flow (includes water stored less than 30 days), but does not include water released from storage.
COLLECTED TO STORAGE: Water delivered to storage for more than 30 days.
TAKEN FROM SOURCE: Water collected to storage plus direct diversions.
BENEFICIAL USE: Water taken from storage plus direct diversions.

EXHIBIT D

EST. 1968
PROVOST& PRITCHARD
CONSULTING GROUP
An Employee Owned Company

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Clovis, CA 93611-9166
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Memorandum

To: Kings River Water Association, and
Consolidated Irrigation District, Fresno Irrigation District & Alta Irrigation District

From: Kevin R. Johansen, P.E.

Subject: SGMA Compliance Issues in Kings River Service Area

Date: May 28, 2019

This memorandum summarizes some of the groundwater issues being faced in the Kings River Service Area and the adverse impact the proposed Semitropic Water Storage District Tulare Lake Storage and Flood Protection Project (TLSFPP) and associated water rights application would have on the ability of the Kings River service area to comply with the Sustainable Groundwater Management Act (SGMA), which is a mandated State law.

Ability of the Kings River Service Area to comply with SGMA

The Kings River Service Area covers the majority of the Kings and Tulare Lake groundwater subbasins, along with a small portion of the Delta-Mendota subbasin. All of these groundwater subbasins have been designated by the Department of Water Resources (DWR) as critically overdrafted and high priority basins under SGMA. Designation as a high priority groundwater basin considers such criteria as total wells in the subbasin, irrigated acreage, reliance on groundwater, and impacts on groundwater, including overdraft and land subsidence. There are seven (7) Groundwater Sustainability Agencies (GSAs) in the Kings Subbasin, six (6) GSAs in the Tulare Lake subbasin and a portion of one GSA within the Delta-Mendota Subbasin as shown in **Figure 1** and as described below, that are located within the Kings River Service Area or Place of Use. The primary goal of SGMA is to stabilize groundwater levels and achieve sustainability of groundwater resources into the future. Some groundwater recharge activities have occurred in the Kings River Service Area for many years, however, groundwater levels continue to decline and must be stabilized to comply with SGMA. In order to achieve SGMA compliance, each priority/overdrafted groundwater basin is required to become sustainable and avoid or mitigate undesirable results including lowering of groundwater levels, reduction of groundwater storage, degradation of water quality, and land subsidence. Some of these undesirable results are already occurring in portions of the Kings and Tulare Lake subbasins and must be addressed by each GSA.

SGMA requires all critically overdrafted and high priority groundwater subbasins to prepare Groundwater Sustainability Plans (GSPs) by January 2020 that identify how the GSAs within the subbasins plan to eliminate groundwater overdraft and achieve sustainability. SGMA allows a period of 20 years for a subbasin to become sustainable, meaning sustainability for the subbasins in the Kings River area must be achieved by 2040. The GSAs within the subbasins are currently in the process of developing their GSPs that will identify how the GSAs plan to

achieve sustainability through implementation of projects to develop additional water supply and/or management actions to reduce water demand. The GSAs are currently conceptualizing and developing additional projects and actions, such as groundwater recharge projects, to utilize additional Kings River high flow water that has historically been discharged out James Bypass. As additional projects are developed by the local GSAs, which are an integral part of achieving compliance with SGMA, another benefit in addition to groundwater recharge is that the projects will also help achieve floodwater protection for downstream communities.

Determining the current amount of annual groundwater overdraft in the Kings and Tulare Lake subbasins, the predominant subbasins in the Kings River Service Area, is still in progress and is dependent on the hydrologic period included in the analysis, but preliminary estimates of the current average annual groundwater overdraft is over 200,000 AF/year for these two subasins. In DWR Bulletin 118-80, Groundwater Basins in California, A Report to the Legislature in Response to Water Code Section 12924, DWR states: "*Kings Basin: Overdraft in the basin was estimated at 289,000 cubic dekametres (234,000 acre-feet) annually in 1975 in the Mid-Valley Canal Areal Study*" and "*Tulare Lake Basin: In the Mid-Valley Canal Areal Study, overdraft for 1975 in the portion of the basin overlying usable ground water was estimated at 52,000 cubic dekametres (42,000 acre-feet) annually*". This estimate by DWR in 1975 totals 276,000 acre-feet of annual overdraft in the Kings and Tulare Lake subbasins, indicating overdraft has been occurring in the region for many years. Groundwater recharge projects constructed in the Kings River Service Area since that time have captured additional high flow water when available for recharge and have reduced the amount of floodwater leaving the service area and reduced the annual groundwater overdraft, but the primary subbasins are still critically overdrafted. As part of GSP preparation, each of the GSAs will be determining the estimated volume of overdraft within their GSA boundary and final groundwater overdraft estimates will not be known until the GSPs are submitted in January 2020. However, preliminary estimates for the annual overdraft for the Kings subbasin is over 120,000 acre-feet per year (AF/yr), while the preliminary estimate of average annual overdraft in the Tulare Lake subbasin is approximately 100,000 AF/yr.

The Kings River is prone to highly variable annual runoff that directly relates to mountain precipitation and winter snowpack. The average annual runoff of the Kings River is approximately 1.7 million acre-feet, ranging from a high of 4,476,400 acre-feet in water year 1982-83 (265% of average) to a low of 361,000 acre-feet in water year 2014-15 (21% of average). The hydrology of the Kings River has produced flood years, on average, about once every three years. However, several flood years often occur in sequence, with significant below-average water years in between those high flow years. In very wet years, some water historically has not been able to be fully delivered and some floodwater has left the service area through the North Fork and James Bypass. Based on historic discharge records at James Bypass, the average annual amount of floodwater that was discharged through James Bypass during the period 1954-2018 (since the construction of Pine Flat Dam) was approximately 184,000 AF/year, well short of the amount required to mitigate the projected annual overdraft volumes in the Kings and Tulare Lake subbasins. To further compound the problem, this historical amount of excess floodwater would not be available today even if the hydrology repeated itself, as further explained later in this memo.

Intentional groundwater recharge activities began in the Kings River Service Area in the 1920's and acreage dedicated to recharge activities has steadily increased over time. However, development of groundwater recharge in the region has not progressed as fast as needed, as evident by the overdraft status of the area, but SGMA has now provided the impetus to develop

additional projects and the need to capture and utilize the full yield of the Kings River to help stabilize groundwater levels in the region. The GSAs within the Kings River Service Area are in the process of planning, and will need to construct, additional projects to capture all available Kings River water and eliminate any floodwater leaving the service area to comply with SGMA and mitigate undesirable results. In that regard, not only is all Kings River floodwater needed to address SGMA requirements within the Kings River area, but additional water supplies are needed to fully close the water resource supply gap. As such, not only is there no excess floodwater available for export, but additional water supplies and/or management actions are required for the Kings and Tulare Lake subbasins to achieve compliance with SGMA.

Reasonably foreseeable projects that are being developed or planned that would utilize Kings River floodwater within the area, including projects identified in the Kings Basin Integrated Regional Water Management Plan (IRWMP) and projects identified in a water rights application filed by Consolidated/Fresno/Alta (the Consolidated application) to appropriate additional floodwater, could utilize all the floodwater that historically has been discharged through James Bypass when fully constructed. **Figure 2** indicates the location of many of the existing recharge basins in the area, as well as a sampling of project locations that GSAs and their member agencies are already developing or planning that will use additional Kings River water. In addition to those projects indicated in Figure 2, more projects are anticipated to be identified as the GSAs continue with preparation of the GSPs. The floodwater discharge out James Bypass is limited to 4,750 cubic feet per second (cfs) and historical flood releases have periodically reached this flowrate. Capturing all of this water will require the construction of a significant number of projects, with local entities in the area committed to doing so. The Consolidated water rights application identified projects within the Kings subbasin itself that would utilize approximately 3,600 cfs and additional projects for recharge and/or storage for direct use are being considered within the Tulare Lake subbasin area to utilize all remaining water. These projects are all planned to be constructed within the 20-year timeframe provided by SGMA to achieve sustainability.

If the TLSFPP is allowed to export Kings River water out of the area of origin, thereby precluding the GSAs in the Kings and Tulare Lake subbasins from capturing needed additional floodwater for groundwater recharge projects, then other management actions to reduce demand would be required, including significant land fallowing, which would have a tremendous negative impact on the agricultural economy and the economic engine of Fresno, Kings and Tulare counties. Besides the economic impact that would be caused by land fallowing, there would be environmental and quality of life impacts such as increased noxious weed production and potential air quality impacts from blowing dust as a result of significant land fallowing.

If the proposed Semitropic Water Storage District application to appropriate Kings River water was approved and the TLSFPP were constructed, there would also be a reduction in channel seepage in the North Fork of the Kings River, further exacerbating the overdraft condition. The TLSFPP Draft Environmental Impact Report (August 2017) states: "*Reductions in seepage from the James Bypass to the regional groundwater basin are expected to occur during periods of flood flows in the James Bypass. Utilizing historic data and analyses of California Central Valley Groundwater-Surface Water Simulation Model (C2VSim) results, seepage losses in the James Bypass between the Kings River and the San Joaquin River are estimated to be approximately 30 percent. The resulting reduction in seepage in the James Bypass ranges up to approximately 42,000 AF in years when water is diverted to the proposed Project*". The data used for the

analysis, along with the assumptions made using the C2VSim Model, are unknown and would need to be reviewed to determine if these seepage impacts are in fact reasonable as presented. However, using the estimated reduction of seepage losses purported in the DEIR of 42,000 AF when floodwater occurs would equate to about 5,700 acres of highly productive cropland that would have to be fallowed to ensure sustainability under SGMA requirements, due to the loss of recharge and resultant ability to pump groundwater each year, using typical crop water requirements. This is noteworthy, as any reduction in recharge/seepage is significant for a critically overdrafted basin. The reduction of flows in the North Fork and resultant seepage reduction will in fact deplete groundwater supplies in an already critically overdrafted groundwater basin and isn't an insignificant impact as claimed in the DEIR.

Subbasin and Groundwater Sustainability Agency descriptions

Kings Groundwater Subbasin

The Kings Groundwater Subbasin (Kings Basin) is a large groundwater Subbasin located within the southern part of the San Joaquin Valley Groundwater Basin, in the Central Valley of California. The Kings Basin boundary is defined in the Department of Water Resources (DWR) Bulletin 118 as DWR Basin No. 5-22.08. The Basin covers approximately 981,000 acres and is a conjunctive use area, where groundwater supplies supplement the available annual surface water supplies. The Kings Subbasin is comprised of the following seven (7) GSAs:

Central Kings GSA

The Central Kings GSA includes the Consolidated Irrigation District, the City of Selma, the Caruthers Community Services District and non-districted land in the County of Fresno, the County of Kings, and the County of Tulare. The area of the Central Kings GSA is approximately 151,000 acres and is predominantly agricultural. The City of Selma, Caruthers and other rural communities in the GSA are solely dependent on groundwater to meet domestic water demands and are considered Disadvantaged Communities. Agencies in the Central Kings GSA have Kings River surface water supplies that average more than 240,000 acre-feet per year.

James Irrigation District GSA

The James Irrigation District Groundwater Sustainability Agency (James GSA) is comprised of James Irrigation District (James ID) and Reclamation District 1606 (RD 1606). James ID and RD 1606 entered into a Memorandum of Understanding in December 2015 to form and manage the James GSA. The area of the James GSA is approximately 29,000 acres. The James GSA is mostly agricultural but includes the City of San Joaquin, which is a Severely Disadvantaged Community. The James ID and RD 1606 have various USBR Central Valley Project (CVP) surface water contracts totaling 45,570 acre-feet per year and Kings River water right entitlements which vary depending on water year type but average 18,000 acre-feet per year over the long-term.

Kings River East GSA

On September 16, 2016, the Kings River East Groundwater Sustainability Agency (KREGSA) was created through California special legislation (SB 37 Vidak). The KREGSA is comprised of a number of local agencies that entered into a Memorandum of Understanding in March 2016, including: City of Dinuba, City of Reedley, City of Orange Cove, Alta Irrigation District, Orange Cove Irrigation District, Hills Valley Irrigation District, Tri-Valley Water District, Kings River Water District, Orosi Public Utility District, Cutler Public Utility District, London Community Services District, East Orosi Community Services District,

Sultana Community Services District, the County of Tulare, and the County of Fresno covering non-districted land. Cities and communities within the Kings River East GSA are all considered Disadvantaged Communities or Severely Disadvantaged Communities. The area of the KREGSA is approximately 192,000 acres. Surface water supplies in the GSA include Kings River and CVP water from the Friant Kern Canal that together average more than 236,000 acre-feet per year.

McMullin Area GSA

The McMullin Area Groundwater Sustainability Agency (MAGSA) was formed as a Joint Powers Authority comprised of the County of Fresno, the Raisin City Water District and the Mid-Valley Water District. The MAGSA area is located within Fresno County and covers approximately 120,000 acres. MAGSA is largely agricultural but does include Raisin City and several small rural communities, which are considered Severely Disadvantaged Communities. The McMullin Area has no regular surface water supplies.

North Fork Kings GSA

On September 16, 2016, the North Fork Kings Groundwater Sustainability Agency (NFKGSA) was created through California special act legislation (SB 564 Canella). The GSA includes the following agencies: Clarks Fork Reclamation District, Laguna Irrigation District, Upper San Jose Water Company, Laton Community Services District, Riverdale Public Utility District, Lanare Community Services District, Crescent Canal Company, Stinson Canal & Irrigation Company, Riverdale Irrigation District, Reed Ditch Company, Liberty Mill Race Company, Burrel Ditch Company, Liberty Water District, Liberty Canal Company and the County of Fresno covering non-districted lands. Cities and communities within the North Fork Kings GSA are all considered Disadvantaged Communities or Severely Disadvantaged Communities. The area of the NFKGSA is approximately 168,000 acres. The GSA includes several rural communities with domestic demands met solely by groundwater. The rest of the area is agricultural. Surface water supplies from the Kings River average approximately 140,000 acre-feet per year.

North Kings GSA

The North Kings Groundwater Sustainability Agency (NKGSA) is a Joint Powers Authority formed in December 2016 through adoption of a Joint Powers Agreement by the following public agencies: Fresno Irrigation District, County of Fresno, City of Fresno, City of Clovis, City of Kerman, Biola Community Services District, Garfield Water District, and International Water District. Following adoption, these founding members approved membership of Bakman Water Company and the Fresno Metropolitan Flood Control District through separate binding agreements. The cities of Fresno and Kerman are both considered Disadvantaged Communities, while the community of Biola is considered a Severely Disadvantaged Community. The area of the NKGSA is approximately 312,000 acres. Domestic demands for the metropolitan area in the cities of Fresno and Clovis are met by a mix of treated surface water and groundwater supplies. Neighboring communities, as well as the City of Kerman, meet domestic demands using groundwater. The remaining agricultural area is conjunctive use. Surface water supplies are from the Kings River and USBR CVP Friant Kern Canal and average more than 540,000 acre-feet per year.

South Kings GSA

The South Kings GSA is a Joint Powers Authority formed in May 2017 that is comprised of the Cities of Fowler, Kingsburg, Parlier, and Sanger. The Del Rey Community Services District joined through a Memorandum of Understanding with the GSA. The cities of Fowler

and Sanger are both considered Disadvantaged Communities, while the city of Parlier and the community of Del Rey are both considered Severely Disadvantaged Communities. The South Kings GSA is approximately 9,800 acres and is nearly exclusively urban. The South Kings GSA has no surface water supply. Water demands are met solely with groundwater.

Tulare Lake Subbasin

The Tulare Lake Subbasin (Tulare Lake) is also a large groundwater Subbasin located within the southern part of the San Joaquin Valley Groundwater Basin, just south of the Kings subbasin. The Tulare Lake subbasin is located in the eastern part of Kings County with State Route 41 being the western border. The Tulare Lake Basin boundary is defined in the Department of Water Resources (DWR) Bulletin 118 as DWR Basin No. 5-22.12. The Basin covers approximately 536,000 acres and the northern and eastern portion of the subbasin is a conjunctive use area, where groundwater supplies supplement the available annual surface water supplies. The historic Tulare Lake area and the southwestern portion of the subbasin do not have usable groundwater supplies. The Tulare Lake Subbasin is comprised of the following six (6) Groundwater Sustainability Agencies (GSA):

Mid-Kings GSA

The Mid Kings GSA covers an area of approximately 97,400 acres located in the northern part of the Tulare Lake Subbasin. The public and private agencies within the Mid Kings GSA are Kings County Water District, City of Hanford, County of Kings, Peoples Ditch Company, Last Chance Water Company, Settlers Ditch Company, and the New Deal Water Company.

South Fork Kings GSA

The South Fork Kings GSA covers an area of approximately 71,300 acres located in the north-western part of the Tulare Lake Subbasin. The public and private agencies within the South Fork Kings GSA are the City of Lemoore, County of Kings, Empire Westside Irrigation District, Stratford Irrigation District, Stratford Public Utility District, Liberty Canal Company, Stratford Irrigation District, Empire Westside Irrigation District, Lemoore Canal and Irrigation Company, John Heinlen Mutual Water Company, Jacob Rancho Water Company and a portion of the Tulare Lake Basin Water Storage District. Stratford is considered a Disadvantaged Community.

Southwest Kings GSA

The Southwest Kings GSA covers an area of approximately 89,900 acres located in the Western part of the Tulare Lake Subbasin. The public and private agencies within the Southwest Kings GSA are the Dudley Ridge Water District, Tulare Lake Reclamation District No. 761, Kettleman City Community Services District, Tulare Lake Basin Water Storage District, and Tulare Lake Canal Company. Kettleman City is considered a Disadvantaged Community.

Tri County Water Authority GSA

The Tri County Water Authority GSA is located in both the Tulare Lake Subbasin and the Tule Subbasin, with approximately 48,120 acres within the Tulare Lake Subbasin. The Tri County Water Authority GSA is located in the south-eastern portion of the subbasin. The public agency within the GSA in the Tulare Lake Subbasin is Angiola Water District.

El Rico GSA

The El Rico GSA covers an area of approximately 228,400 acres located in the center of the Tulare Lake Subbasin. The public and private agencies within the El Rico GSA are Melga Water District, Lovelace Reclamation District, Salyer Water District, Corcoran Irrigation District, Tulare Lake Drainage District and a portion of the Tulare Lake Basin Water Storage District.

Alpaugh Irrigation District GSA

The Alpaugh Irrigation District GSA covers an area of approximately 940 acres located on the south-eastern edge of the Tulare Lake Subbasin. The Alpaugh Irrigation District GSA may be annexed into the El Rico GSA. Alpaugh Irrigation District is the only agency in the Alpaugh Irrigation District GSA.

Delta-Mendota Subbasin

The Delta-Mendota Subbasin (Delta-Mendota) is a large groundwater Subbasin located within the westerly part of the San Joaquin Valley Groundwater Basin, west and northwest of the Kings subbasin. The Delta-Mendota subbasin is located in Stanislaus, Merced, Madera, and Fresno Counties. The Delta-Mendota Basin boundary is defined in the Department of Water Resources (DWR) Bulletin 118 as DWR Basin No. 5-22.07. The Basin covers approximately 747,000 acres. The Delta-Mendota Subbasin is comprised of multiple Groundwater Sustainability Agencies (GSA). A portion of one GSA within the Delta-Mendota Subbasin, the Tranquillity Irrigation District, is located within the Kings River Service Area.

Central Delta-Mendota Multi-Agency GSA

The Central Delta-Mendota Multi-Agency GSA covers an area of approximately 165,761 acres located in the southwesterly and southerly part of the Delta-Mendota Subbasin and was formed in February 2017. The only portion of the Central Delta-Mendota Multi-Agency GSA that is within the Kings River Service Area is the Tranquillity Irrigation District (TID). TID comprises approximately 10,750 acres or less than seven percent of the GSA. TID is within the Kings River Service Area and is the most downstream Kings River Member Unit on the North Fork of the Kings River. TID has various USBR CVP surface water contracts and Kings River water right entitlements which vary depending on the water year type. TID does not have groundwater recharge facilities, though they have a regulating reservoir that can accept diversions and will use Kings River high flows in-lieu of groundwater pumping.

Impacts the TLSFPP would have on communities in the groundwater subbasins within the Kings River Service Area

If the TLSFPP captures and exports Kings River floodwater that would have been used by the GSAs within the subbasins in the Kings River Service Area to stabilize groundwater levels, it will have a direct impact on the communities within the subbasins. As shown in **Figure 3** and listed in **Table 1** below, there are 16 Disadvantaged Communities (DACs) and 25 Severely Disadvantaged Communities (SDACs), as defined by DWR based on US census cities or designated places, within the groundwater subbasins in the Kings River Service Area, the vast majority of which rely solely on groundwater. The City of Fresno is the only community on this list that uses some surface water to supplement groundwater use. In addition, there are numerous residential and ranchette properties within the Kings River Service Area that rely solely on groundwater that will be directly impacted by the inability of the GSAs to comply with SGMA if floodwater is allowed to be exported out of the service area. If the TLSFPP is allowed to export Kings River water out of the area of origin it will have negative consequences on both

the quantity and quality of drinking water for the vast majority of residents in the service area from declining groundwater levels and the lack of water needed for additional recharge.

Table 1

DACs and SDACs within Groundwater Subbasins in Kings River Service Area per DWR

NAME	Population 2014	Households 2014	MHI 2014	Type	Subbasin
Biola CDP	1,017	227	26,750	SDAC	Kings
Bowles CDP	182	39	31,250	SDAC	Kings
Calwa CDP	1,330	330	18,625	SDAC	Kings
Caruthers CDP	3,338	754	44,375	DAC	Kings
Cutler CDP	4,224	996	18,346	SDAC	Kings
Del Rey CDP	1,489	374	31,222	SDAC	Kings
Delft Colony CDP	164	63	8,456	SDAC	Kings
Dinuba city	22,828	5,964	38,509	DAC	Kings
East Orosi CDP	321	70	29,000	SDAC	Kings
Fowler city	5,908	1,696	47,731	DAC	Kings
Fresno city	506,132	160,172	41,455	DAC	Kings
Friant CDP	263	181	18,884	SDAC	Kings
Kerman city	14,110	3,713	45,539	DAC	Kings
Lanare CDP	398	88	47,875	DAC	Kings
Laton CDP	1,144	416	29,865	SDAC	Kings
London CDP	2,080	467	24,816	SDAC	Kings
Malaga CDP	935	241	38,350	DAC	Kings
Mayfair CDP	4,512	1,306	40,625	DAC	Kings
Monmouth CDP	184	68	34,500	SDAC	Kings
Monson CDP	191	48	41,667	DAC	Kings
Orange Cove city	9,473	2,337	27,450	SDAC	Kings
Orosi CDP	8,620	2,031	34,464	SDAC	Kings
Parlier city	14,750	3,611	31,832	SDAC	Kings
Raisin City CDP	232	59	18,750	SDAC	Kings
Reedley city	24,858	6,792	46,002	DAC	Kings
Riverdale CDP	3,881	888	48,350	DAC	Kings
San Joaquin city	4,010	937	25,545	SDAC	Kings
Sanger city	24,587	6,904	42,094	DAC	Kings
Selma city	23,808	6,540	43,143	DAC	Kings
Seville CDP	437	91	34,219	SDAC	Kings
Sultana CDP	813	207	24,282	SDAC	Kings
Traver CDP	910	195	38,359	DAC	Kings
West Park CDP	792	244	36,389	SDAC	Kings
Yettem CDP	285	61	N/A	SDAC	Kings
Corcoran city	23,634	3,615	34,082	SDAC	Tulare Lake
Armona CDP	3,531	970	38,622	DAC	Tulare Lake
Hardwick CDP	184	47	18,250	SDAC	Tulare Lake
Home Garden CDP	1,787	464	32,976	SDAC	Tulare Lake
Kettleman City CDP	1,648	347	41,131	DAC	Tulare Lake
Stratford CDP	1,301	377	23,750	SDAC	Tulare Lake
Tranquillity CDP	724	238	30,441	SDAC	Delta-Mendota

In addition to the DWR information on DACs in Table 1, a detailed DAC study entitled "Disadvantaged Community Water Study for the Tulare Lake Basin", was prepared in 2014 that further identifies large and small community water systems serving DACs and SDACs in the Tulare Lake Basin, which covers the Kings and Tulare Lake groundwater subbasins. The DACs and SDACs identified in this study represent over two-thirds of the population within the Kings and Tulare Lake groundwater subbasins.

Majority of floodwater that historically left the Kings River Service Area would now be used in the service area

Since the construction of Pine Flat Dam that regulates water on the Kings River, floodwater has been discharged out of the Kings River Service Area through the James Bypass on average about once every three (3) years as previously mentioned. A portion of this water reaching the Mendota Pool is utilized by KRWA member units Tranquillity Irrigation District and James Irrigation District, but the majority is discharged out of the service area. However, this historical amount of floodwater leaving the service area would not be available today if the hydrology repeated itself because water demands have increased within the Kings River service area when high flow water is typically available, and the Kings River water rights holders have constructed numerous groundwater recharge projects that capture high flow water now that previously was not able to be utilized. In addition, the GSAs within the Kings and Tulare Lake Subbasins are currently developing additional recharge projects as mentioned above that will capture more high flow water in the future.

As shown in **Figure 4** below, the amount of Kings River water being maintained within the Service Area has been increasing and this trend is expected to continue as additional projects are developed. Figure 4 indicates the total amount of "Kings River for Irrigation" (KRI), which is an indication of actual measured releases into the river, and breaks the river releases each year into two components – discharges out James Bypass and the remainder being maintained within the Kings River Service Area. Items to note in Figure 4 about recent high flow water years on the Kings River include:

- the releases in WY 2010-11 were larger than in WY 2005-06, but less floodwater was discharged out James Bypass and more water was used within the Kings River Service Area,
- KRI was significantly larger in WY 2016-17 than most of the previous years and the amount used in the service area was also significantly more than prior years,
- the amount of water used within the Kings River Service Area in WY 2016-17 (approximately 2.9 million acre-feet) would essentially eliminate the historical James Bypass discharges in nearly all prior years except extraordinarily wet years like WY 1968-69 and 1982-83.

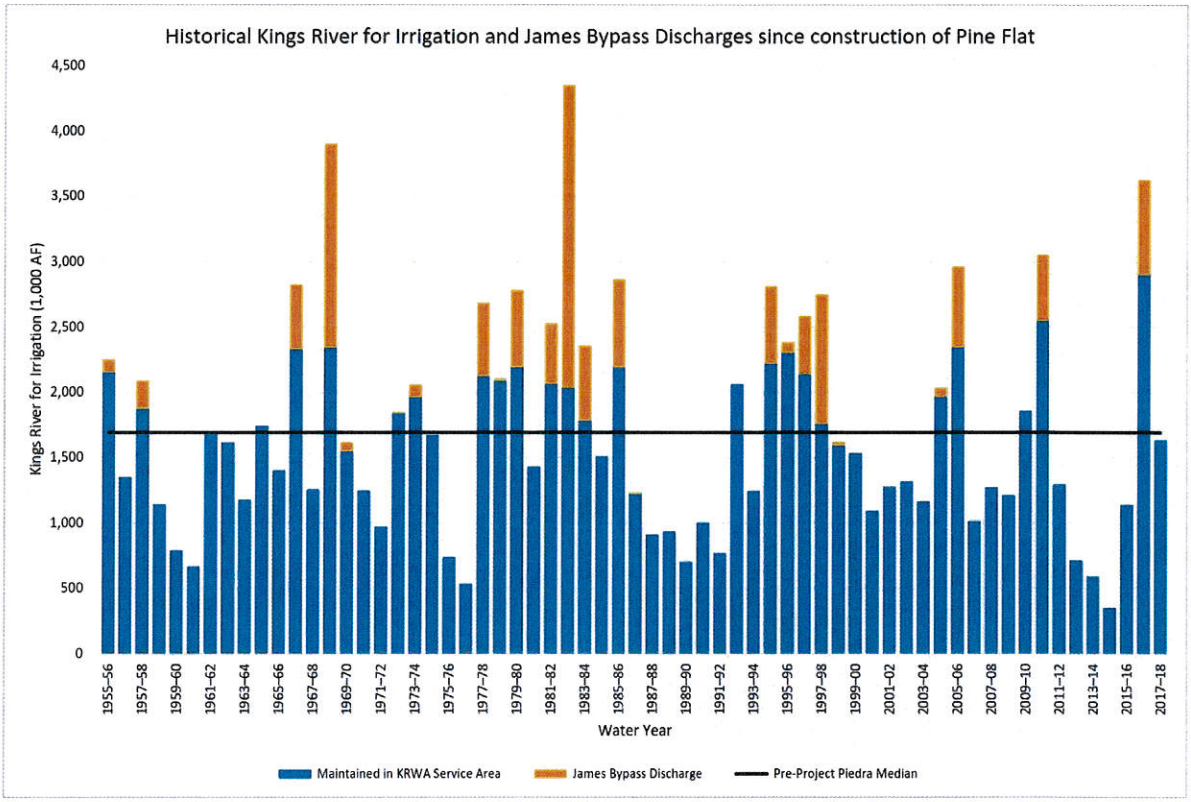
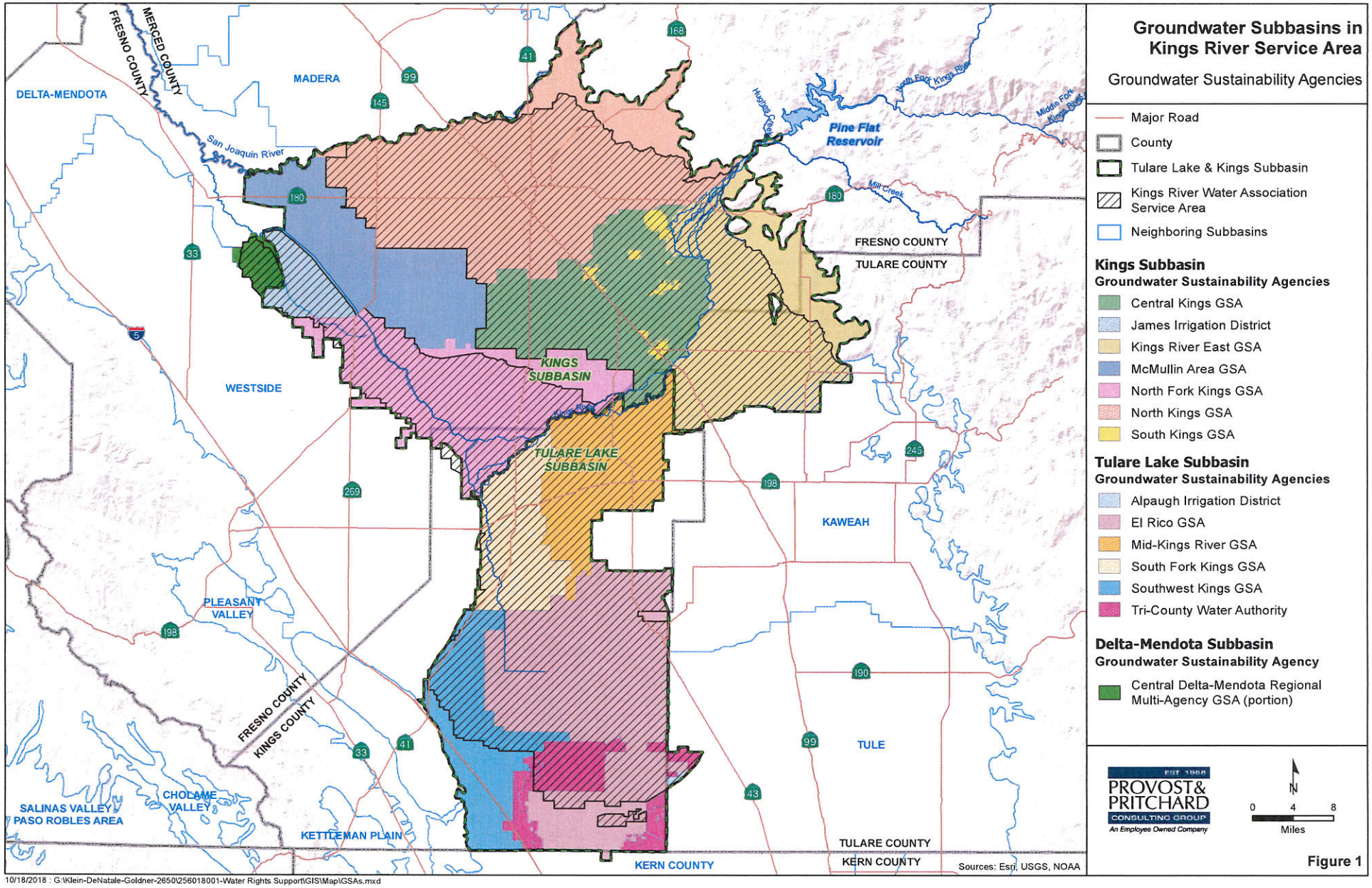


Figure 4

Summary

In summary, there is very little, if any, floodwater available for export to Kern County because the water is already being used, or plans are being developed to use the water, by the GSAs within the Kings River area as projects are developed over the next 20-years to comply with SGMA. If the TLSFPP is allowed to export Kings River water from critically overdrafted subbasins, it will be impossible for the GSAs within the Kings and Tulare Lake subbasins to comply with SGMA and the impacts to those living and working in Fresno, Kings and Tulare Counties will be severe.



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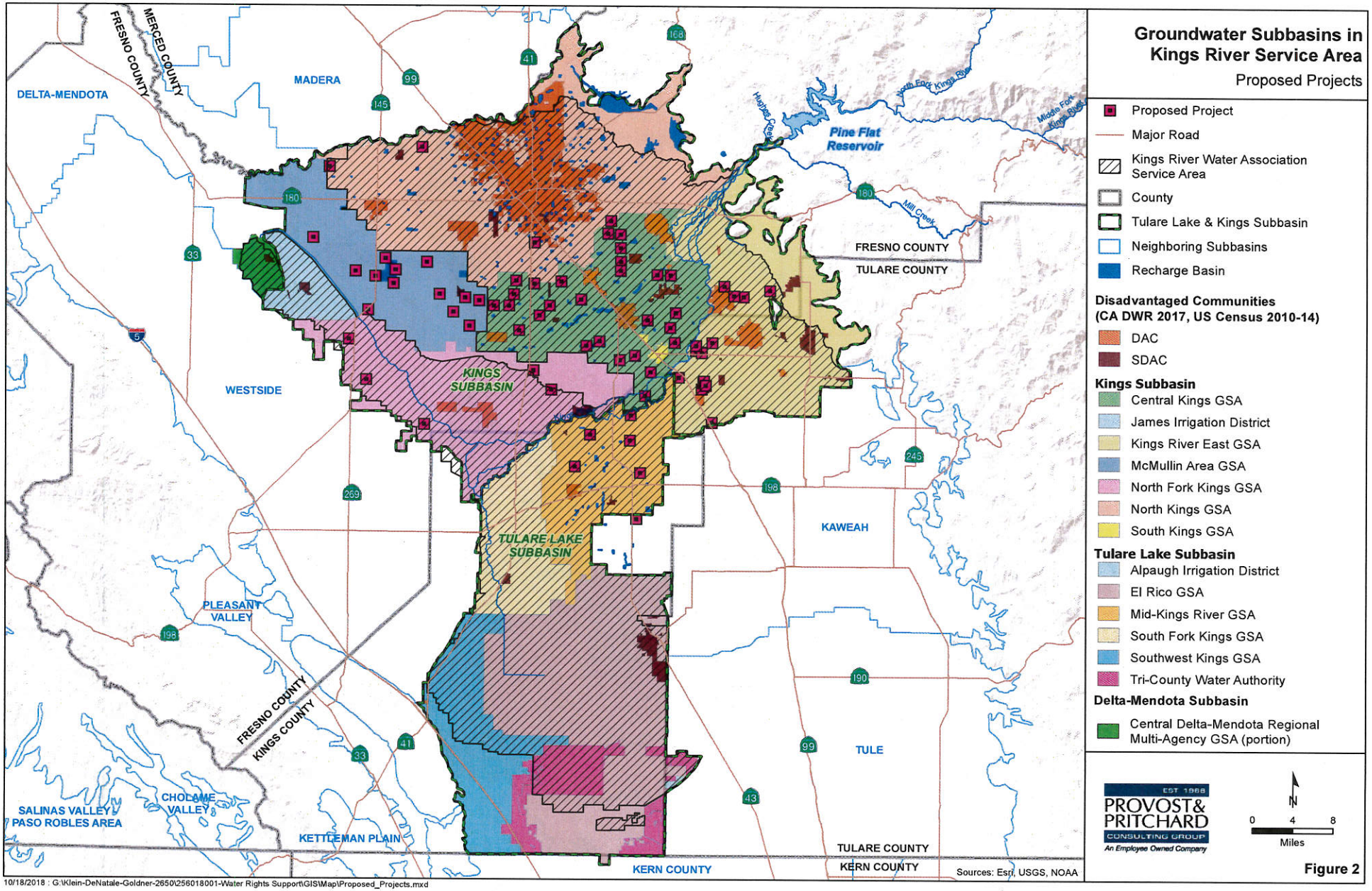
Groundwater Subbasins in Kings River Service Area
Proposed Projects
Proposed Project
Major Road
Kings River Water Association Service Area
County
Tulare Lake & Kings Subbasin
Neighboring Subbasins
Recharge Basin
Disadvantaged Communities (CA DWR 2017, US Census 2010-14)
DAC
SDAC
Kings Subbasin
Central Kings GSA
James Irrigation District
Kings River East GSA
McMullin Area GSA
North Fork Kings GSA
North Kings GSA
South Kings GSA
Tulare Lake Subbasin
Alpaugh Irrigation District
El Rico GSA
Mid-Kings River GSA
South Fork Kings GSA
Southwest Kings GSA
Tri-County Water Authority
Delta-Mendota Subbasin
Central Delta-Mendota Regional Multi-Agency GSA (portion)
DELTA-MENDOTA
MERCED COUNTY
FRESNO COUNTY
MADERA
WESTSIDE
KINGS SUBBASIN
TULARE LAKE SUBBASIN
PLEASANT VALLEY
CHOLAME VALLEY
SALINAS VALLEY / PASO ROBLES AREA
KETTLEMAN PLAIN
KAWEAH
TULE
Pine Flat Reservoir
Mill Creek
Middle Fork Kings River
North Fork Kings River
Hughes Creek
FRESNO COUNTY
TULARE COUNTY
KINGS COUNTY
KERN COUNTY
Sources: Esri, USGS, NOAA
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Figure 2
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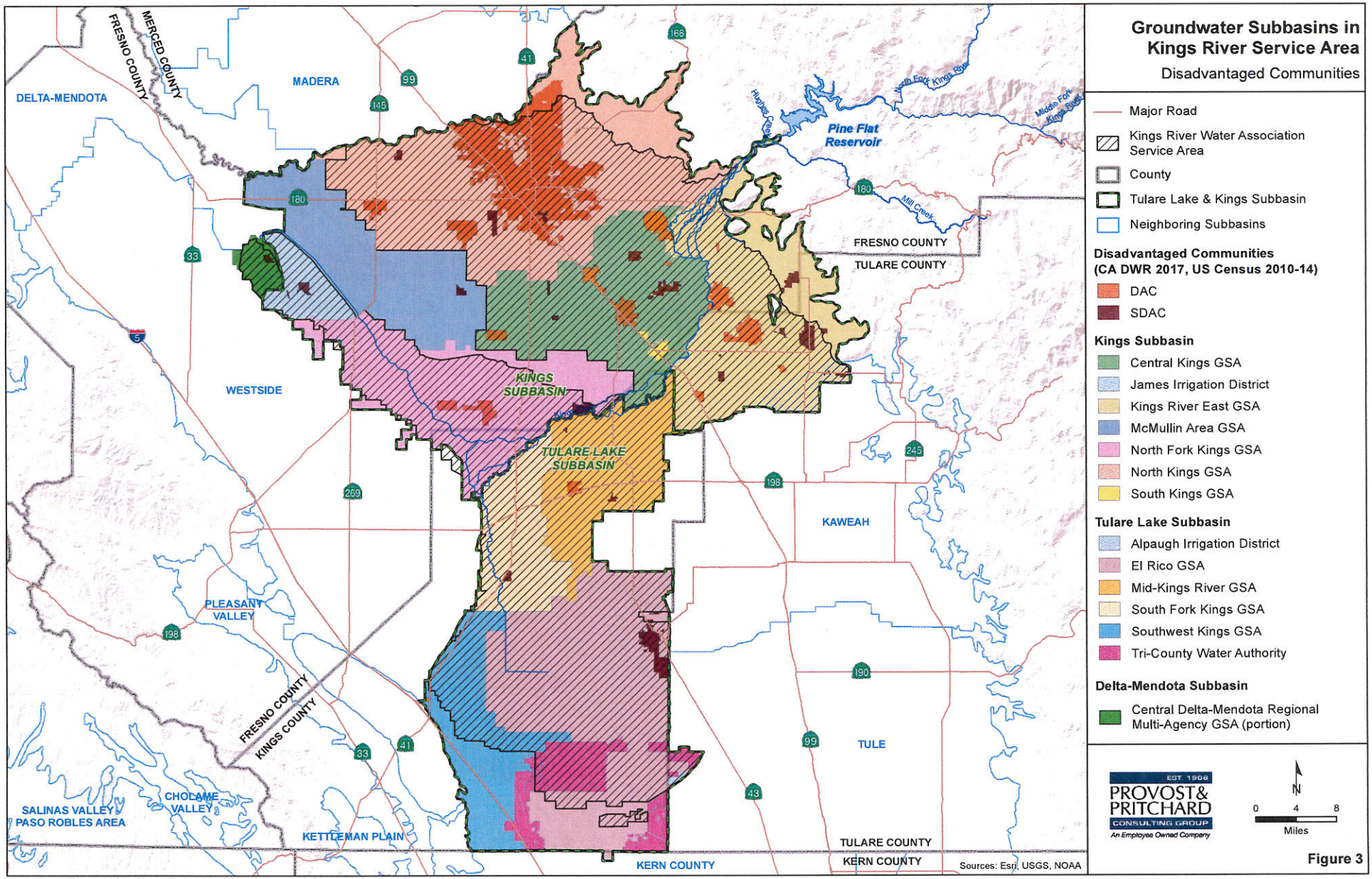

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EXHIBIT E

Attachment 4 – Purpose of Use, Diversion/Storage Amount and Season

This application is to appropriate floodwater leaving the Kings River service area that may be in excess of the current Kings River licenses held by the Kings River Water Association. Runoff on the Kings River is highly variable, ranging from a high of 4,476,300 AF (266.7%) in 1982-83 to a low of 361,000 AF (21.5% of average) in 2014-15. Floodwater is not typically available until the water year hydrology is 150% or more above average, except in years that follow a very wet year (i.e., 1998-99 following 1997-98). The water year on the Kings River is defined as October through September. Since the construction of Pine Flat Dam (completed in 1954), the hydrology of the Kings River has produced flood years on average about once every three years. However, several flood years often occur in sequence, with significant below average water years in between flood years. The season of availability of floodwater on the Kings River is also highly variable, but typically occurs during the months of February through June, although historically floodwater has occurred every month of the year in very large water years like 1982-83. When floodwater is discharged out James Bypass and into the Mendota Pool where the water meets with the San Joaquin River, the typical duration is a little over 100 days on average and the discharge flowrate can approach and occasionally exceed 5,000 cfs.

This application is to appropriate 4,500 cfs of floodwater, some of which is already licensed under the existing KRWA licenses on the Kings River but, for a variety of reasons, was not previously able to be put to beneficial use. The majority of this water will be used for groundwater recharge and underground storage, with some water being used for direct deliveries. It is anticipated that direct deliveries could use up to 500,000 AF in some years, and up to 1,000,000 AF could be put to underground storage in other years. Some water will be used in existing recharge facilities, but the majority of the water will be used in new recharge facilities or direct use achieving in-lieu recharge. The Underground Storage Supplement that accompanies this application includes a map that indicates the location of existing and proposed projects. A list of the currently planned and proposed projects that will utilize the water appropriated by this application is shown below:

Table 4-1 Planned and Proposed Projects

Project Name	Type of Project	Estimated Area (Acres)	Estimated Percolation Rate (ft/day)	Calculated Volume (AF/day)	Calculated Flowrate (cfs)
CID In-District Recharge Projects	Groundwater Recharge	2,000	1.00	2,000	1,000
CID Little Texas Area Recharge Project	Groundwater Recharge	500	1.00	500	250

Project Name	Type of Project	Estimated Area (Acres)	Estimated Percolation Rate (ft/day)	Calculated Volume (AF/day)	Calculated Flowrate (cfs)
FID In-District Recharge Projects	Groundwater Recharge	500	1.00	500	250
AID In-District Recharge Projects	Groundwater Recharge	600	1.00	600	300
KCWD In-District Recharge Projects	Groundwater Recharge	600	0.25	150	75
RCWD In-District Recharge Projects	Groundwater Recharge	2,400	0.50	1,200	600
MVWD In-District Recharge Projects	Groundwater Recharge	1,000	0.50	500	250
LID Recharge Site 11	Groundwater Recharge	70	1.00	70	35
North Fork Kings GSA Elkhorn Property	Groundwater Recharge	40	1.00	40	20
Terranova On-Farm Flood Capture and McMullin Recharge Site	Groundwater Recharge / In-Lieu Recharge	4,000	0.25	1,000	500
JID Distributed Recharge, Bypass and Lassen Projects	Groundwater Recharge / In-Lieu Recharge	800	0.50	400	200
KRCD Coehlo and Gragnani Wetlands Recharge	Groundwater Recharge	1,200	0.25	300	150
WWD Crescent Canal Project	In-Lieu Recharge				200
WWD Lat 6/7 Project	In-Lieu Recharge				170
WWD Lower DMC Pumpback Project	In-Lieu Recharge				500
			Total =	7,260	4,500

Additional projects may be identified as the applicants and the Groundwater Sustainability Agencies in the area develop projects to comply with SGMA.

EXHIBIT F

KRCD
Kings River Conservation District

4886 East Jensen Avenue
Fresno, California 93725

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www.krcd.org
@kingsrivercd

May 29, 2019

State Water Resources Control Board
Division of Water Rights
Attn: Mitchell Moody
P.O. Box 2000
Sacramento, CA 95812-2000

Re: (1) Petition to Revise Declaration of Fully Appropriated Streams (Kings River); (2) Application A032815 to Appropriate Water from the Kings River in Multiple Counties; and (3) Complaint in Support of Petition to Revise and/or Revoke or Request to Notice hearing (Kings River) MSM:A032815

Dear Mr. Moody:

The Kings River Conservation District (KRCD) is writing to express our concerns regarding Semitropic Water Storage District's (Semitropic) above mentioned applications. As a public agency, one of KRCD's key functions is providing flood control for portions of Fresno, Tulare, and Kings Counties. This service is provided to numerous unincorporated areas and more than 100 Disadvantaged Communities (DAC). KRCD also assists its constituency, and other agencies within its service area, with reaching their water use and water quality obligations under the Irrigated Lands Regulatory Program (ILRP), Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS), Sustainable Groundwater Management Act (SGMA), and other related water use and water quality objectives. KRCD's website is www.krcd.org.

It is KRCD's position that Semitropic's proposed Tulare Lake Storage and Floodwater Protection Project (Project) and associated groundwater bank have not received sufficient scientific or environmental analysis and review by Semitropic, and that the potential environmental and economic impacts on KRCD's constituency and supported agencies – including the increased capital, replacement, maintenance, and operational cost burdens the Project would place upon the Kings River Watershed – have not been delineated or mitigated by the Project plan.

Furthermore, removing surface waters from the Kings River service area, and diverting water to the south that normally flows north, would exacerbate groundwater quality, land subsidence, groundwater depletion/over-draft, and interconnected surface waters issues and concerns in a SGMA management area designated as "high" priority by the Department of Water Resources (DWR). These water resource impacts will require mitigation, which would include mitigating for the volume of reduced ground water recharge as a result of the reduced flows in the Kings River North Fork and associated subsidence impacts, and mitigating for the volume of increased seepage and evaporation as a result of increased flows in the South Fork, Crescent Bypass, and Clark's Fork. Mitigating said impacts also applies to related water quality issues and concerns which Kings River Watershed constituents are working to address under the auspices of the current ILRP and developing CV-SALTS program.

In addition to the above concerns, it is important to mention the critical matter of the Kings River's channel capacity. In a related Proposition 1 funding effort, Semitropic included a DWR response as part of their requested funding appeal package. DWR staff indicated that Semitropic provided sufficient information – using 2017 Kings River flow data and additional hydrologic data from the DWR Central Valley Hydrology Study (CVHS) – to support Semitropic's claims that sufficient channel capacity exists in the Kings River, both downstream and south of the Army Weir, and in the Clark's Fork and Crescent Bypass. However, it is evident from historical observed and metered Kings River channel flows that the modeling data used in the CVHS study is of insufficient accuracy for determining if there is adequate operational capacity to meet Project needs. Actual channel conditions in 2017 indicated a lack of capacity – relative to Project requirements – in various reaches of the Kings River. An analysis which more accurately assesses actual and specific channel hydraulic characteristics, capacities, losses, and delivery requirements is necessary for making a determination that there is sufficient channel capacity.

A complete review and analysis of capacity would include the channel section from the diversion point at Army Weir through the Kings River South Fork, as well as from the release point of Pine Flat Dam to the Army Weir diversion point and the Kings River North Fork. An analysis of the Kings River North Fork is required due to a lack of proper and appropriate safety features being included in the design; this is expanded upon below. Without this required, detailed hydraulic review, analysis, and associated mitigation to ensure channel capacities requirements are addressed, rerouting water in the manner described by Semitropic would have significant negative impacts.

Semitropic's lack of due diligence regarding determining actual channel capacities and flooding risk was evident during a December 13, 2017 California Water Commission (CWC) meeting, when Semitropic General Manager Jason Gianquinto noted, after KRCD reiterated concerns with Kings River capacities and associated flooding risk, that "our Project, at the ultimate size, is 2,100 c.f.s. [CEQA documents indicate 2,200 c.f.s.]; less than half of the peak flow. Our likely Project is probably something less given what we learned regarding the South Fork capacity." Mr. Gianquinto's statement is a clear indication that Semitropic does not have a substantive understanding of capacity constraints, delivery service requirements, flooding risk, potential environmental impacts, system losses, the required mitigation to ensure and maintain existing delivery capacity in addition to their desired capacities, or an intent to mitigate these impacts and constraints; despite the fact that these concerns were communicated to Semitropic on a number of occasions. This lack of substantive understanding is delineated in the paragraphs below.

As pertains to the above concerns and regarding specific channel capacities, Semitropic assumes the Crescent Bypass channel section can sustain a capacity of 1,500 c.f.s.; Clarks Fork 2,500 c.f.s.; and the South Fork 3,200 c.f.s. These flow rates are based upon U.S. Army Corps of Engineers (USACE) capacity data from the 1970s and do not reflect existing conditions. During June 2017 flood releases, the South Fork channel section's right bank levee breached one mile below the confluence of the Crescent Bypass and Clarks Fork channel sections. The flow rate at that time was approximately 1,400 c.f.s. This is 800 c.f.s. less than Semitropic's desired flow rate of 2,200 c.f.s. at Empire Weir No. 2 and 1,800 c.f.s. less than Semitropic's assumed South Fork Capacity of 3,200 c.f.s. Furthermore, the Crescent Bypass channel section's capacity during June 2017 flood releases was limited to less than 200 c.f.s., which is 1,300 c.f.s. less than Semitropic's assumed capacity of 1,500 c.f.s. Moreover, Mr. Gianqinto's assumptions do not consider or include additional flow increments to account for losses such as seepage, evaporation, and diversions upstream of the Project diversion point at Empire Weir No. 2. At the location of the

levee breach there was significant channel seepage and little to no levee freeboard, which from a safety standpoint would have reduced the actual capacity well below the previously noted 1,400 c.f.s. It is important to reiterate that these figures do not account for additional flow to address an increase in losses along the entire reach of the Kings River, nor losses in other channels proposed to supply waters to the Project.

Please bear in mind that, during the 2017 flood releases, the entire capacity of these channels was used for water delivery, with no excess capacity remaining. Thus, there was no capacity remaining or available to deliver any water to the Project. Under similar conditions, Semitropic would need to ensure the entire Kings River system has adequate additional capacity to accept and transport their desired 2,200 c.f.s. from Pine Flat Dam through the terminus of the Kings River South Fork/Empire Weir No. 2 diversion point. To ensure 2,200 c.f.s. can be delivered to the diversion point, the entire Kings River channel and levee system would need to be reviewed and analyzed. The review would require ensuring sufficient capacity to address both constituents' Kings Watershed needs, which would require an assessment of deliveries, seepage, evaporation, and flood water diversions, and Semitropic's request, which would require an assessment of additional seepage and evaporation associated with that request. Thus, to ensure 2,200 c.f.s. can be delivered to the Project, it is anticipated that Semitropic would need to increase the capacity of the Kings River South Fork by at least 2,275 c.f.s., increase the capacity of the Clark's Fork and Crescent Bypass by a total of at least 2,300 c.f.s., and increase the capacity of the Kings River upstream of Army Weir by at least 3,000 c.f.s. to account for their desired flow and additional seepage and evaporation losses. Similarly, whatever capacity is desired by Semitropic through the Crescent Bypass would require a similar approach to accommodate that flow along with seepage and evaporation losses for the Kings River between Army Weir and the Crescent Bypass.

Furthermore, a similar analysis is required for the Kings River North Fork, to ensure that section of the Kings River will have excess capacity to accept Project water as a result of unanticipated events. In that regard, if water intended for the Project were to be released from Pine Flat Dam, but the Project could not accept that water due to unanticipated events – such as a pumping system failure – countermeasures would need to be in place to transport and re-divert that flow. All flows released from Pine Flat dam, intended to be delivered through Army Weir, but not yet diverted, would need to be re-diverted to the Kings River North Fork. The diverted flows would require additional North Fork capacity of between 2,300 c.f.s. and 3,000 c.f.s. to mitigate for such an event. This mitigation does not address water in transit that has been diverted south through Army Weir and the Crescent bypass. A safety/spill/storage feature must be added to the Project plan to address this concern.

Ensuring increased capacity within the Kings River South Fork does not guarantee sufficient water can be delivered upstream of Army Weir, nor that it will be released by the Army Corps of Engineers. The same is true of the Kings River North Fork. This further emphasizes the critical need for a thorough and proper hydraulic review and analysis. If limitations are determined upstream, Semitropic would either have to reduce anticipated flows – even if there is sufficient capacity in the Kings River South Fork – or fund capacity improvements in said upstream channel sections, the Kings River North Fork, and all associated levees.

A complete and comprehensive review would require the aforementioned detailed analysis, as well as analyzing corresponding design costs, capital outlays, operations costs, yearly maintenance costs to maintain the needed capacity, ongoing yearly surveys, and potential power consumption. Yearly maintenance may not be possible due to wet soil conditions, making it

impossible to maintain desired flow levels during those years. Assuming the required system modifications are made, the standard of care required would be much greater, as the flows in the Kings River South Fork – and potentially the upstream reaches of the Kings River and Kings River North Fork – would be much greater relative to historical flows. These flows would also need to be maintained at a higher elevation for much longer durations. As a result, the design would need to be more robust to maintain the same pre-modification and post-modification level of safety and risk. These various factors have not been considered in determining the ability of Semitropic's Project to receive either the volume or capacity of water they are requesting to justify their Project, nor the related water right they are requesting from the State Water Resources Control Board.

Because the Project would require flow capacities higher than current channel capacities be maintained for longer durations and at higher elevations, a geotechnical stability and seepage analysis would need to occur along all Kings River reaches where there are current, modified or added levees. Because stability and seepage is currently a concern with the Crescent Bypass, Clarks Fork, and South Fork sections the stability and seepage situation in these reaches would be exacerbated. After a proper stability and seepage analysis, absent reducing Project flows within the stability and seepage limits of the existing Kings River, engineered solutions would need to be incorporated into the Project design as mitigation. This could include a variety of alternatives such as cut-off walls and pumping and tile line drawdown and recovery systems. Furthermore, because the Project would be using the existing Kings River channel from Pine Flat Dam to the Project, and the Kings River North Fork, the Project would be responsible for its proportional share of base capital, operation, maintenance, and replacement costs; costs that are currently funded through property taxes paid by constituents. Project mitigation construction work within and near the Kings River would not fall under current authorized maintenance activities, therefore said construction would be required to obtain various authorizations, permits, reviews, and the like. These include but are not limited to:

1. National Environmental Policy Act (NEPA) Environmental Impact Report (EIR) preparation or substitute
2. California Environmental Quality Act (CEQA) Environmental Impact Report (EIR) preparation or substitute
3. Central Valley Flood Protection Board permit
4. Federal Clean Water Act Section 401 Water Quality Certification
5. Section 404 dredged or fill material permit
6. Section 408 alternation of a public work permit
7. California Department of Fish and Wildlife Section 1600 Lake and Streambed Alternation Agreement

None of the costs associated with the aforementioned factors have been considered in the Project design; the funding of which would be required for the Project to receive said waters. Additionally, increasing and maintaining channel capacities with the noted required higher standard of care will require extensive channel modifications, which will in turn cause associated environmental impacts requiring State and Federal environmental permitting, as well as initial and on-going mitigation. With respect to on-going mitigation, on-going silt removal would be required within all channels, with anticipated dredging when channel conditions do not allow for

other silt removal measures and means. This potential yearly silt removal and dredging may require extensive State and Federal environmental permitting and associated mitigation.

Additionally, many existing, in progress, and anticipated projects are already allocating – or will shortly be allocating – waters which the Project has determined to be available based upon historical data. Without proper consideration of impacts to the Project's anticipated and actual water availability based upon more recent and projected supplies, the viability of the Project and these aforementioned projects will be severely undermined.

The potential impacts on the Kings River service area and its constituency – in particular the disadvantaged constituency within Fresno, Kings, and Tulare counties – are enormous and merit a more extensive analysis and review than has currently been completed for the Project. Because a proper review and analysis has not been completed; all Kings River Waters are allocated; and infrequent additional floodwaters previously uncaptured will be diverted to address SGMA, ILRP, and CV-SALTS requirements; KRCD encourages the State Water Resources Control Board to reject Semitropic's application for a water right on the Kings River.

Sincerely,

Paul G. Peschel

Paul G. Peschel, P.E.
General Manager

PP/CM/dmr

File: 300.112
L19-0052