Technical Memorandum 7

Folsom Reservoir Inflow and Upstream Reservoir Storage for the 1922-2003 Period of Record

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1.0 INTRODUCTION

This technical memorandum documents the approach used to develop monthly Folsom Reservoir inflows and upper American River watershed reservoir storage (used for flood control calculations in Folsom Reservoir) for the period of record (POR) 1922-2003 under future conditions. The data were developed as inputs to the Central Valley Project/State Water Project (CVP/SWP) Simulation Model II (CalSim II).

CalSim II simulates the water resources of California's Central Valley and Sacramento-San Joaquin Delta regions, including the operations of the CVP and the SWP. CalSim II requires as input, however, a monthly inflow time series from the Central Valley headwater watersheds, including the inflows into Folsom Reservoir. Folsom Reservoir inflows include water from the following sources: 1) North Fork American River (NFAR), including the Middle Fork American River (MFAR) inflows to the NFAR, 2) South Fork American River (SFAR), 3) upper Yuba/Bear rivers via South Canal inflow to Newcastle Powerhouse or Mormon Ravine, and 4) local Folsom Reservoir inflows. These areas are shown in Map 1. Flows in the NFAR, MFAR, SFAR, and South Canal are affected by relatively large hydropower projects regulated by the Federal Energy Regulatory Commission (FERC).

Upper American River watershed reservoir storage also is an input to CalSim II that is needed to model Bureau of Reclamation (Reclamation) and U.S. Army Corps of Engineers (Corps) flood management operations of Folsom Reservoir. The Upper American River watershed reservoirs considered in the flood management operations of Folsom Reservoir include: Hell Hole and French Meadows reservoirs (PCWA Middle Fork Project [MFP] [FERC Project No. 2079]) and Union Valley Reservoir (Sacramento Municipal Utility District [SMUD] Upper American River Project [UARP] [FERC Project No. 2101]).

The Folsom Reservoir inflow (NFAR, MFAR, SFAR, Yuba/Bear South Canal, and local inflows) and upstream reservoir storage data set for the 1922-2003 period of record (POR) are described in the sections below. An overview of CalSim II modeling as related to Folsom Reservoir inflow is provided in Attachment A.

2.0 BACKGROUND

The inflow time series typically used in CalSim II for the American River watershed was originally developed from a Department of Water Resources (DWR) HEC-3 Upper American River Model[1] (e.g., SWRI 2000). The inflow nodes in CalSim II are I300 (NFAR), I8 (SFAR) and D308A (South Canal/Newcastle Powerhouse) (see Attachment A). Because PCWA project operations affect MFAR and NFAR inflows to Folsom Reservoir and because new FERC relicensing conditions for hydropower and reservoir storage operations on the NFAR (I300), SFAR (I8), and the Yuba/Bear watershed (D308A) affect (or will affect) inflows to Folsom

[1] Reclamation could not locate a copy of the HEC-3 model (Kristin White, Pers. Comm. 2015).

Reservoir (e.g., monthly inflow patterns within a year), the accuracy of the existing Folsom Reservoir inflow time series data sets used for CalSim II modeling were evaluated. Specifically PCWA evaluated whether or not the CalSim II inflow time series was accurate and if any potential mass balance issues would occur when NFAR inflows were modified under future condition modeling. The evaluation compared the CalSim II inflow time series to historical gage data to evaluate both the accuracy of the percentage split of the NFAR and SFAR inflows and the accuracy of the total inflows to Folsom Reservoir.

To evaluate the percentage split of inflows, CalSim II NFAR inflows (I300 minus D308A) were compared to measured USGS gage data on the NFAR (USGS gage no. 11433800). It was found that compared to the USGS gage data, the CalSim II NFAR inflow time series was under-estimating flow (approximately 10 percent too low). On average, the CalSim II inflows were 190,000 ac-ft per year lower than the gage data. Figure 1 shows the annual average CalSim II NFAR inflow data (I300 minus D308A) compared to the historical USGS gage data on the NFAR at the Auburn Dam site (1973-1985).

To evaluate the accuracy of the total Folsom Reservoir inflow, measured gage data available for Folsom Reservoir provided by Reclamation (Kristin White, Pers. Comm. 2014) were used (Table 1). The comparison of the calculated total Folsom Reservoir inflow and the combined NFAR and SFAR inflow (I300 and I8) from Calsim II showed that the CalSim II inflow data set was relatively accurate (Figure 2).

Based on the review of the CalSim II Folsom Reservoir inflow hydrology, it was determined that updating the NFAR hydrology using appropriate PCWA operations, while keeping the other CalSim II hydrology inputs (SFAR and South Canal, I8 and D308A, respectively) static would cause mass balance issues. In addition, it was determined that because the SFAR and Yuba/Bear South Canal inflows are currently, or will be in the near future, subject to new FERC relicensing operating conditions, a new Folsom Reservoir inflow data set for CalSim II was required.

3.0 FOLSOM RESERVOIR INFLOW HYDROLOGY AND UPSTREAM RESERVOIR STORAGE

For the future conditions, PCWA developed monthly inflows and upstream reservoir storages that incorporate the recent changes in hydroelectric project operations based on new FERC license conditions. FERC hydroelectric projects significantly regulate flows in the NFAR, MFAR, SFAR, and the Yuba/Bear South Canal. These projects are currently being relicensed, or were recently issued new licenses, by FERC, and the new flow and reservoir license conditions have changed (or will change) the volume and timing of inflows into Folsom Reservoir compared to conditions under the previous FERC licenses[2]. The operations models that were developed for

[2] The current MFP FERC license expired on February 28, 2013. The SMUD and PG&E (Chili Bar) FERC licenses were recently issued. The licenses for PG&E's Drum-Spaulding Project and Nevada Irrigation

each of the hydroelectric relicensing projects were used to generate the inflow hydrology. These models were extensively reviewed and developed over multiple years with resource agencies (e.g., U.S. Forest Service, State Water Resources Control Board, California Department of Fish and Wildlife) and non-governmental organizations (NGOs) during the relicensing proceedings of each of the projects. For the rivers with consumptive use (e.g., NFAR and MFAR and Yuba/Bear South Canal), existing levels of demand were used to test the models against existing hydrology. For the future condition modeling, future PCWA demand (buildout demand, approximately 2043) was used for the NFAR and MFAR modeling.

3.1 NORTH FORK AMERICAN RIVER

The MFAR flows into the NFAR approximately four river miles upstream of the Folsom Reservoir high water mark (Map 1). The MFP controls the water releases into the MFAR. The NFAR watershed upstream of the confluence with the MFAR is mostly unimpaired. A small amount of diversion occurs from PG&E's Lake Valley Reservoir and Lake Valley Diversion Dam as part of their Drum-Spaulding Project. This impairment on the upper NFAR is minor, on average diverting 2% of the total unimpaired flow of the NFAR at Clementine.

PCWA developed monthly MFP water demands over the POR for existing and future demand conditions to be used in the modeling of the NFAR and MFAR inflows into Folsom Reservoir. The water demands were integrated into the modeling (e.g., Weaver 2016) consistent with PCWA's water rights and their 120,000 AF water use agreement with Reclamation and PCWA's commitments under the Water Forum Agreement (2000).

3.1.1. Development of Inflow Hydrology and Reservoir Storage over the Period of Record (1922-2003)

MFP OASIS Model

Folsom Reservoir inflows from the NFAR and upstream reservoir storage were developed using PCWA's MFP Operations Simulation Model (MFP OASIS Model) (PCWA 2011) and a Microsoft (MS) Excel spreadsheet that calculated monthly prioritization of PCWA MFP water for PCWA's municipal and industrial (M&I) and irrigation customers (retail and wholesale). The MFP OASIS Model was modified for the Project to operate over the full POR (1922-2003) (Table 2) by ECORP, Consulting Inc. The MFP OASIS model was developed using all available historical United States Geological Survey (USGS) gage hydrology in the NFAR watershed. Additional details of the MFP OASIS Model, including a schematic of the flow routing through the MFP and the modifications to the model are provided in Attachment B.

District's (NID) Yuba-Bear Project in the upper Yuba/Bear River watersheds expired on April 30, 2013. These projects are currently being operated under annual licenses until issuance of new licenses.

3.1.2. Results

The future monthly Folsom Reservoir inflows from the NFAR and upstream MFP reservoir storage for the POR (1922-2003) are provided in Attachment C Table 1. Included are the NFAR flows upstream of the PCWA American River Pump Station (ARPS) (CalSim II I300-D308A) and deliveries of PCWA water to ARPS (D300), Roseville, San Juan Water District (SJWD), and Sacramento Suburban Water District (SSWD). Also included is the combined French Meadows and Hell Hole reservoir storage.

The MFP OASIS model NFAR Folsom Reservoir annual inflow mass balance under existing conditions accurately matched historical USGS data for the NFAR inflows to Folsom Reservoir (Figure 3). Figure 3 (top plot) shows that the NFAR inflows modeled with the MFP OASIS Model are nearly identical to the USGS gage data on the NFAR at the Auburn Dam site (USGS gage no. 11433800; active 1973-1985) located just upstream of Folsom Reservoir (regression y = 0.9988X; R^2= 0.99). The accuracy of the MFP OASIS Model can also be shown by comparison with other available USGS gage data. For example, combining the USGS gage data on the upstream forks of the NFAR (Middle Fork American River near Foresthill [USGS gage no. 11433300]) and NFAR at North Fork Dam [USGS gage no. 11427000]) and correcting for the 3.9 percent accretion that occurs between these gages and the gage at the Auburn Dam site location (1965-2003) produces a strong MFP OASIS Model versus USGS gage data relationship (Y=1.008X, R^2 = 0.99) (Figure 3; bottom plot).

3.2 SOUTH FORK AMERICAN RIVER

Flows in the SFAR are regulated by two hydroelectric projects. SMUD's UARP regulates flows in the upper Rubicon River, Silver Creek, and the South Fork American River above Chili Bar Reservoir, as well as storage in Union Valley Reservoir. Flows immediately downstream of SMUD's UARP project are regulated by PG&E's Chili Bar Hydroelectric Project (FERC Project No. 2155) (Map 1). Operations on the SFAR are primarily driven by hydropower as there is limited consumptive demand in the watershed.

3.2.1. Development of Inflow Hydrology and Reservoir Storage over the Period of Record (1922-2003)

UARP-Chili Bar ResSim Model

South Fork American River watershed inflows[3] into Folsom Reservoir and Union Valley Reservoir storage were obtained from the output of the simulation model (UARP-Chili Bar ResSim Model) developed by the resource agencies during the recent FERC relicensing proceedings of the two projects (Hughes and Mulder 2006). The UARP-Chili Bar ResSim Model was developed using

[3] Data provided by Dudley McFadden (SMUD hydrologist); data set dated 10/18/2012. Data provided to ECORP Consulting, Inc..

the USACE – Hydrologic Engineering Center (HEC) Reservoir Simulation (ResSim) model (Version 2.0) (Table 2; also see Hughes and Mulder 2006). The UARP/Chili Bar hydrology was modeled from WY 1975-2000 using the flow and reservoir operation conditions in the new FERC licenses[4].

Extension of Monthly Inflows and Reservoir Storage over the Period of Record

Monthly Inflows

Folsom Reservoir inflows (annual volume) outside the POR modeled for the FERC projects on the SFAR (years WY 1922-1974; 2001-2003) were estimated using a regression relationship between the annual HEC-3 Model[5] SFAR inflow volume into Folsom Reservoir and the annual Folsom Reservoir inflow volume from the UARP/Chili Bar ResSim model during the WY 1975-2000 time period (Figure 4).

Monthly regression relationships between the WY 1975-2000 monthly HEC-3 SFAR inflows and UARP/Chili Bar ResSim model inflows were used to distribute the annual SFAR inflow volumes over a monthly basis for the extended POR. A regression relationship was developed for each month between the HEC-3 inflow and the UARP/Chili Bar ResSim model flow (Table 3; Attachment D Figure 1). These calculated SFAR monthly inflows were then scaled by an annual scaling factor to match the annual volumes (Attachment D Figure 2). The scaling factors are provided in Attachment D Table 1.

Reservoir Storage

Monthly average Union Valley Reservoir storage over the POR was developed from a combination of data sources depending on the time period: UARP/Chili Bar ResSim model (1975-2000), HEC-3 model (1922-1974), and the USGS gage no. 11441001 (2001-2003).

3.2.2. Results

The annual and monthly SFAR watershed Folsom Reservoir inflows for the POR (1922-2003) are provided in Attachment D Table 2. The monthly Union Valley Reservoir storage volumes for the POR are provided in Attachment D Table 3.

[4] FERC. Order issuing new license re Sacramento Municipal Utility District under P-2101 (Jul 23, 2014). FERC e-Library No. 20140723-3046.

[5] HEC-3 Model data are a long-term data record (1922-2003). The data used for this relationship were the CalSim II Model input data used in the SWP Delivery Reliability Study (2011). Data available at:http://baydeltaoffice.water.ca.gov/modeling/hydrology/CalSim/Downloads/CalSimDownloads/CalSim-IIStudies/SWPReliability2011/index.cfm. Data accessed on 2/29/2012. See Attachment A to this technical memorandum for additional information on the HEC-3 Model.

3.3 YUBA/BEAR RIVER SOUTH CANAL

The upper Yuba/Bear River watershed includes PG&E's Drum-Spaulding Project[6] (FERC Project No. 2310) and NID's Yuba-Bear Hydroelectric Project[7] (FERC Project No. 2266) (YBDS Project) (Map 1). The projects are hydraulically and operationally interrelated. Water entering into Folsom Reservoir from the upper Yuba/Bear rivers primarily flows through the South Canal (up to 375 cfs) and then into Newcastle Powerhouse (the most downstream facility in the Drum-Spaulding Project) or spills into Mormon Ravine and then flows into Folsom Reservoir (PG&E 2011).

3.3.1. Development of Inflow Hydrology and Reservoir Storage over the Period of Record (1922-2003)

YBDS Project Operations Model

Folsom Reservoir inflow from the South Canal was generated using the YBDS Project USACE-HEC ResSim (version 3.0) operations model (YBDS Operations model)[8]. The model was originally developed for existing (2009) and future (2062) levels of demand over the WY 1976-2008 POR. Additional details of the YBDS Operations model[9], including the modifications to the model for the Project are provided in Attachment E. Where needed, model results for an intermediate demand condition were developed by linearly interpolating between the existing (2009) and future (2062) demand model results.

Extension of Monthly Inflows over the Period of Record

Folsom Reservoir inflows for the Calsim II model POR (WY 1922-2003) that were not included in the YBDS Projects' POR (WY 1976-2008) were estimated using annual and monthly regression

[6] PG&E's Drum-Spaulding Project facilities are located primarily on the South Yuba River, Bear River, North Fork of the North Fork American River, and associated tributaries.

[7] NID's Yuba-Bear Project is located primarily within the Middle Yuba River, South Yuba River, and the Bear River watersheds.

[8] The Operations Model is described in various YBDS relicensing documents including in Section E of the Final License applications and Section E of the Amended License Applications, including: Pacific Gas and Electric Company submits the Final License Application for the Drum-Spaulding Project, FERC Project No. 2310 (April 12, 2011), FERC eLibrary Nos. 20110412-5005 through – 5007 and Amendment to Application of Pacific Gas and Electric Company under P-2310 et.al Transmittal of Amended Applications. (June 18, 2012). FERC eLibrary Nos. 20120618-5022, 5023, and 5118.

[9] YBDS relicensing model runs were downloaded from the NID relicensing website available at: http://www.eurekasw.com/NID/Temporary/Forms/AllItems.aspx?RootFolder=http%3a%2f%2fwww%2eeurekasw%2ecom%2fNID%2fTemporary%2fWater%20Balance%20-%20Operation%20Model%20Runs. Study L061812 – Amended Final License Application – EBFSC, filename Yuba-Drum v3 rev 6-L061812-EBFSC-final.zip. Data were downloaded on 7/31/2012.

relationships. An annual regression relationship was developed between the cumulative February + May monthly volumes for the Yuba River Natural Flow Index @ Smartsville and the South Canal annual (WY) flow volume (flow into Newcastle Powerhouse) from 1976-2008 modeled using the YBDS Operations Model. The Yuba River Natural Flow Index @ Smartsville is a long-term and continuous monthly flow data set[10]. Cumulative February inflows reflect water conditions from January and February and the cumulative May inflows reflect the additional early spring runoff conditions (March – May). The regression relationships were then used to estimate annual South Canal flow volume over the full POR (1922-2003) for existing conditions (2009) (Figure 5).

Monthly relationships between the Yuba River Natural Flow Index @ Smartsville and monthly YBDS Operations Model South Canal flows (WY 1976-2003) from the Yuba watershed were first used to estimate South Canal flow volumes over a monthly basis for the POR. Piece-wise linear relationships for existing conditions are shown in Table 4 and Attachment F Figure 1. The calculated monthly South Canal flows were then adjusted by an annual scaling factor (WY basis) (Attachment F Figure 2) to match the estimated annual flow volume (Figure 5). The scaling factors for each year are provided in Attachment F Table 1.

3.3.2. Results

The monthly Folsom Reservoir inflows from the Yuba/Bear Rivers for the POR (1922-2003) are provided in Attachment F Table 2.

3.4 FOLSOM RESERVOIR LOCAL INFLOWS

The watershed area immediately around Folsom Reservoir that contributes local accretions to Folsom Reservoir is defined by the upstream reservoir high-water mark on each of the tributaries and Folsom Dam on the downstream. The contributing watershed area is approximately 97 square miles. To calculate the inflow for the small local watersheds, total inflow for a larger watershed area (403 square miles) bounded by upstream gage locations (NFAR at North Fork Dam [USGS 11427000], MFAR at Foresthill [USGS 11433300], and SFAR at

[10] Data (October 1, 1900 through present) are available from the California Data Exchange Center (CDEC) for the Yuba River near Smartsville gage (Station YRS) at http://cdec.water.ca.gov/cgi-progs/staMeta?station_id=yrs. This relationship was also used for the determination of the water year type categories for the YBDS projects in the USDA-FS Final Section 4(e) Conditions. The water year type categories are based on the California Department of Water Resources (DWR) water year forecast of unimpaired runoff (natural inflow) into the Yuba River at Smartsville as set forth in DWR's Bulletin 120:

- Extreme Critically Dry: equal to or less than 615 thousand-acre-feet (TAF) or 2nd year of a back-to-back Critically Dry Water Years (<=900 TAF)
- Critically Dry: 616 to 900 thousand ac-ft (TAF)
- Dry: less than 901 to 1,460 TAF
- Below Normal: 1,461 to 2,190 TAF
- Above Normal: 2,191 to 3,240 TAF
- Wet: greater than or equal to 3,240 TAF

Chili Bar [USGS 11444500]) were first determined and then scaled by the smaller watershed area. Monthly local inflows for the larger watershed area were calculated for the period of record of the gage data (1976-2003) and the inflow data were extended to the entire POR (1922-2003) by correlating the data to the nearest suitable reference gage, Cosumnes River at Michigan Bar (USGS gage no. 11329500).

3.4.1. Development of Inflow Hydrology over the Period of Record (1922-2003)

Larger Watershed Area Calculated Local Inflow

The local inflow for the larger watershed area was determined using a mass balance calculation (for WY 1976-2003) based on upstream gages and total inflow data at Folsom Dam:

Local Inflow = Folsom Total Inflow – [Yuba-Bear Inputs + NFAR at NF Dam + MFAR at Foresthill + SFAR at Chili Bar]

Where: Folsom Total Inflow = Reclamation Calculated Folsom Reservoir Inflow
NFAR at NF Dam = USGS gage no. 11427000
MFAR at Foresthill = USGS gage no. 11433300
SFAR at Chili Bar = USGS gage no. 11444500
Yuba-Bear Inputs = USGS gage nos. 11425416 + 11425417

The sources of the hydrology inflow data used in the mass balance calculation are provided in Table 5. Figure 6 shows the calculated monthly flow time series for the larger watershed area from 1976-2003. The mass balance approach using the larger watershed area resulted in monthly local inflows consistent with expectations (e.g., some negative local inflow values occurred indicating that slight hydrological losing reaches occur in the lower forks of the American River in the summer months and months with no rainfall in dry years).

Extension of Monthly Hydrology Inflows over Period of Record

To extend the record of calculated local inflow for the full POR (1922-2003), a reference gage was used to develop a relationship between the larger watershed local inflows (calculated using the mass balance approach) and a reference gage. Numerous nearby stream gages were considered for possible selection as the reference gage. Selection of the most suitable reference gage was based on watershed size, elevation, and length and completeness of flow record. Based on this evaluation, the Cosumnes River at Michigan Bar (USGS gage no. 11329500) was selected as the reference gage (Figures 6 and 7).

To extend the Folsom Reservoir larger watershed local inflow with the reference gage, monthly regression equations were developed using historical data from 1976-2003 (time period with overlapping data) (Table 6 and Attachment G Figure 1). The months with low r-squared values were months when flows were low and had little variability. The regression estimated flows versus the calculated flows are shown in Figure 6. The regression equations were then used to estimate local inflow for the larger watershed area when historical data were not available (1922-1975).

Calculated Local Inflow – Smaller Area

The calculated local monthly inflows from the larger watershed (403 square miles) were scaled down to the smaller local watershed area (97 square miles) using a ratio of the small watershed area to the larger watershed area (0.24).

3.4.2. Results

The monthly and annual local inflows (scaled down to smaller watershed area) are provided in Attachment G Table 1.

4.0 RESERVOIR INFLOW MASS BALANCE

To assess the accuracy of the combined NFAR, SFAR, Yuba/Bear South Canal, and local inflows to Folsom Reservoir, total annual PCWA inflow under existing conditions were compared to the historical annual inflow using the Reclamation gaged inflows to Folsom Reservoir (1976-2003). In addition, the PCWA total annual existing condition inflow was compared to the CalSim II inflow (HEC-3 generated) for the same time period. A correspondence of modeled inflows to recent historical inflows was assumed to be a reasonable illustration of the capability of the models to represent future inflow conditions under future demands.

4.1 RESULTS

The PCWA-modeled Folsom Reservoir inflow from the combined NFAR, SFAR, Yuba/Bear Rivers and local inflows (existing demand) versus calculated inflow to Folsom Reservoir (Figure 6 [top]) has a linear relationship through the origin of Y=1.011X, with an R^2 = 0.997. The same PCWA modeled inflow (existing demand) compared to the typical CalSim II inflow to Folsom (Figure 8 [bottom]) had a similar linear relationship through the origin of Y=1.012X and R^2=0.995.

5.0 SUMMARY

NFAR and MFAR, SFAR, Yuba/Bear South Canal, and local inflows into Folsom Reservoir and upstream reservoir storage for the 1922-2003 period of record (POR) were developed for existing and future conditions (2043 demand) in this memorandum. The annual mass balance for the existing conditions models accurately matched gaged inflows to Folsom Reservoir and the annual mass balance was similar to the inflow time series typically used in CalSim II for the American River watershed (HEC-3 model). The new future demand (2043) inflow data set provides an updated accurate flow split (percentage) of NFAR and SFAR inflows into Folsom Reservoir and incorporates the flow patterns (e.g., seasonal) generated from new FERC license conditions for the FERC regulated storage and hydropower projects in the American and Yuba/Bear river watersheds. The hydrology also incorporates the operations of PCWA's MFP Project.

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TABLES

Table 1. Sources of Measured Monthly Hydrology Data for the Calculation of Folsom Reservoir Inflows using a Mass Balance Approach (1975-2003) Based on Data Provided by Reclamation.

	CDEC Gage
Folsom Reservoir[1]	
Folsom Reservoir storage	FOL-LS
Eldorado Irrigation District (EID) Pumping from Folsom Reservoir	Calculated[2]
Folsom Reservoir Pumping (municipal water to City of Roseville, SSWD, SJWD, Folsom, Folsom Prison, and others)	FOL-QP
Folsom Reservoir evapotranspiration	FOL ES and FOL EV
Folsom Dam Outflows	
Powerhouses	FOL-QG
Spill	FOL-QS
Low-level outlet releases	FOL-QU

[1] Recent data are available on the California Data Exchange Center (CDEC) website for Folsom Reservoir (FOL) (http://cdec.water.ca.gov/). Historical data were obtained from Reclamation. See text for details.

[2] EID diversion data from 2001-2012 were obtained from EID water diversion reports (EID 2005, 2007, and 2012) that contain data from the previous 5 years. The monthly average was calculated for the 12-year period of record. The monthly averages were used in the mass balance calculations.

Table 2. Summary of Operations Models Used to Develop Monthly Flows into Folsom Reservoir from the North Fork American River, South Fork American River, and Yuba/Bear River Rivers (1922-2003).

Model Component	Watershed		
	Middle Fork Project: North Fork American Rivers	**UARP/Chili Bar Projects: South Fork American River**	**Yuba-Bear Drum-Spaulding Projects: Yuba/Bear Rivers**
Model Description			
Model	MFP OASIS Model	UARP/Chili Bar HecRes Sim version 2.0	YBDS HecRes Sim version 3.0
Operation Flows[1]	Final USDA-FS 4(e) Conditions[2]	FERC Licenses[1]	Final USDA-FS and BLM 4(e) Conditions[3]
Original Period of Record (WY)	1975-2007	1975-2000	1976-2008
Model Assumptions[2]			
	Same as relicensing model, with the following modifications: • Extended hydrology to 1922 • Inclusion of USDA-FS Final 4(e) flow and reservoir conditions and future water demands • Include Water Forum water releases [3]	Same as relicensing model	Same as relicensing model, with the following modifications: • Use of year of highest demands for PCWA and NID (2001-2009) • Inclusion of new FERC License "Agreement" flow and reservoir conditions [4] • Water year type classifications
Extension of Monthly Hydrology over the Period of Record			
Extension Years (WY)	1922-1974	1922-1974; 2001-2003	1922-1975
Approach	Extended OASIS Model	Regression Relationship with HEC-3 South Fork American River inflows and Scaling	Regression Relationship with Yuba River @ Smartsville Natural Flow Index and Scaling

[1] See text for FERC filing references.

[2] See text for details of model assumptions that may differ from those used during the relicensing proceedings.

[3] See Water Forum Agreement – January 2000, Updated October 2015 pages 269-270. During drier years PCWA will replace water into the American River from re-operation of its MFP reservoirs as part of the Water Forum Agreement.

[4] Includes USDA-FS and BLM Final 4(e) flow and reservoir conditions in reaches with jurisdiction and licensees' conditions included in the licensees' amended license applications submitted to FERC for the other stream reaches and reservoirs.

Table 3. Monthly Relationships between HEC-3 Folsom Reservoir Monthly Inflows and UARP/Chili Bar ResSim Folsom Reservoir Monthly Inflows (WY 1975-2000).

Month	Regression Equation	R^2
January	$y = 0.00002x^2 + 0.66039x$	0.98
February	$y = 0.00001x^2 + 0.79356x$	0.96
March	$y = 0.00002x^2 + 0.68955x$	0.98
April	$y = 0.00000x^2 + 0.78324x$	0.94
May	$y = 0.00002x^2 + 0.77150x$	0.98
June	$y = -0.00000x^2 + 1.06820x$	0.96
July	$y = 0.00033x^2 - 0.17502x + 590.42277$	0.98
August	$y = 0.00050x^2 - 0.22315x + 400$	0.93
September	$y = -0.00001x^2 + 0.87219x$	0.73
October	$y = 0.83853x$	0.61
November	$y = 0.00014x^2 + 0.00066x + 453.17367$	0.99
December	$y = 0.00015x^2 + 0.05521x + 402.24855$	0.98

x = HEC-3 South Fork American River Mean Monthly Flow (cfs) (see text for data source).

y = South Fork American River Mean Monthly Flow (cfs) above Folsom Reservoir from UARP/Chili Bar ResSim Model.

Table 4. Relationships between Yuba River Natural Flow Index @ Smartsville and YBDS Operations Model South Canal Monthly Flows (2009 level of demand) (WY 1976-2003).

Coefficients for Linear Regression Relationships for Monthly Distribution of YBDS Operations Model Annual South Canal Flows						
Month	Linear Estimation			Month	Linear Estimation	
	x (Yuba River Index Natural Flow Yearly Volume [1000 ac-ft])	y (YBDS Ops Model South Canal Flows [cfs])			x (Yuba River Index Natural Flow Yearly Volume [1000 ac-ft])	y (YBDS Ops Model South Canal Flows [cfs])
Jan*	0	0		Jul	0	0
	85	20			1000	1
	285	145			2100	15
	420	310			3000	23
	1700	335			5900	30
Feb	0	0		Aug	0	0
	1000	5			1200	2
	1100	100			1800	35
	2300	325			2200	80
	5900	330			5900	85
Mar	0	0		Sept	0	0
	850	5			1000	2
	1100	250			1100	55
	3000	325			2700	90
	5900	330			5900	110
Apr	0	0		Oct	0	0
	900	5			900	2
	1100	230			1100	30
	3000	250			3000	45
	5900	260			5900	115
May	0	0		Nov*	0	0
	877	5			35	7
	884	135			40	55
	3500	160			140	85
	5900	220			700	90
Jun	0	0		Dec*	0	0
	1000	5			75	20
	1200	50			90	145
	2500	70			390	330
	5900	92			1000	335
*These months use the Yuba River Index Natural Flow Monthly Volume (1000 ac-ft) that corresponds to that month for x.						

Table 5. Sources of Flow Data Used to Develop Local Folsom Reservoir Inflow Hydrology.

Location	Source	Identification Number	Dates	Notes
Total Folsom Reservoir Inflow[1]	USBR CVO		1976-2013	Includes all reservoir releases, storage records, and evaporation estimates.
North Fork American River				
North Fork American River at ARPS	USGS	11433800	1972-1986	
North Fork American River at North Fork Dam[2]	USGS	11427000	1941-present	
Middle Fork American River				
Middle Fork American River at Foresthill	USGS	11433300	1959-present	
South Fork American River				
South Fork American River above Folsom Reservoir (at Lotus)	USGS	11445500	1951-1995	
Accretion flows between Lotus and Folsom Reservoir	SMUD relicensing			
South Fork American River at Chili Bar	USGS	11444500	1965-present	
Yuba/Bear Rivers				
South Canal YB-93	YB-DS Relicensing	Not Applicable	Newcastle PH construction 1969 - 1986	
Newcastle Powerhouse near Newcastle, CA	USGS	11425416 + 11425417	1987-present	

Abbreviations: CVO: Central Valley Operations; YB-DS: Nevada Irrigation District Yuba-Bear Hydroelectric Project (FERC Project No. 2266) and PG&E's Drum-Spaulding Project (FERC Project No. 2310).

1 Total Folsom Lake Outflow was calculated as the sum of spills (QS), Municipal Pumping (QP), Outlet Releases (QU), Generation Releases (QG), and Evaporation (ES). Total Inflow to Folsom Lake was calculated as the monthly increase in Folsom Lake Storage (LS) plus the Total Folsom Lake Outflow. The resulting inflow was found to be consistent with CDEC's Folsom Reservoir (FOL) calculated inflow.

2 This location is also referred to as Clementine Dam.

Table 6. Monthly Relationships between Folsom Reservoir Annual Inflows (mass balance approach) and Cosumnes River Annual Flows (WY 1976-2003).

Month	Regression Equation	R^2
January	y = 0.6356x + 8094.7	0.76
February	y = 0.8152x + 5142.6	0.89
March	y = 0.7436x - 1153.2	0.88
April	$y = 1.09529E\text{-}06x^2 + 4.55815E\text{-}01x - 3.66300E+03$	0.97
May	y = 0.2592x + 736.95	0.57
June	y = 0.2316x - 611.57	0.48
July	y = 0.3109x - 3244	0.51
August	y = 0.8554x - 2657.	0.26
September	y = 0.7461x - 716.4	0.07
October	y = 0.7529x - 1489.8	0.32
November	y = 0.827x + 392.57	0.86
December	y = 0.6465x + 5715.6	0.86
x = Cosumnes River annual inflow (ac-ft) (see text for data source).		

FIGURES

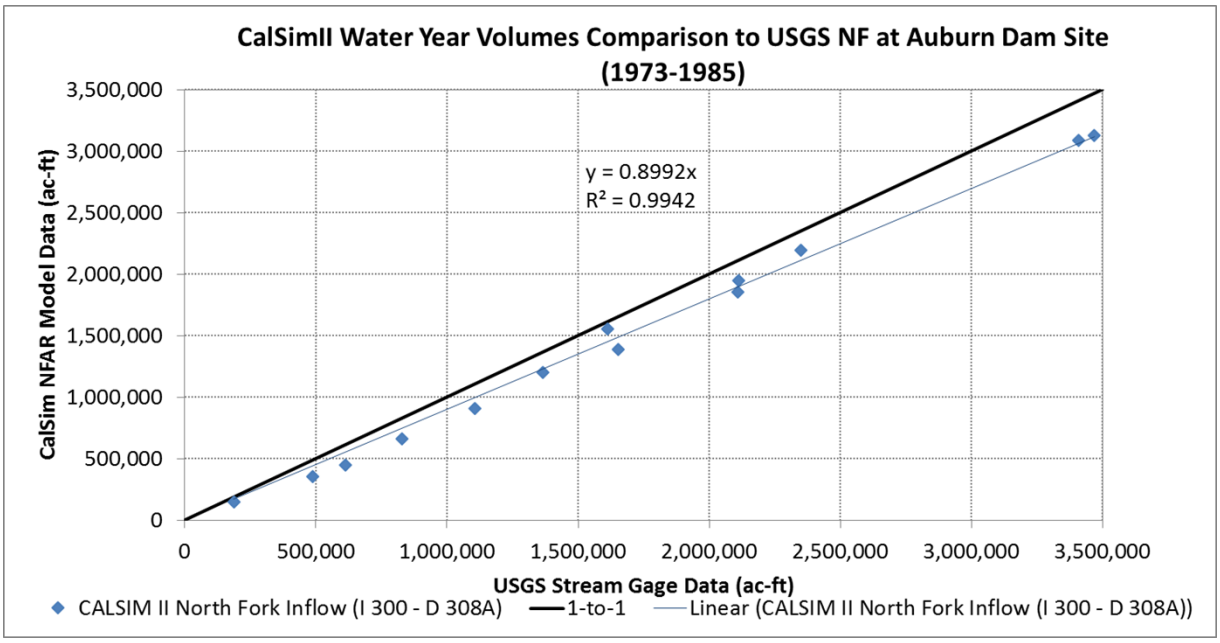


Figure 1. Comparison of CalSim II Annual NFAR Volumes to USGS Gage Data at NFAR Auburn Dam Site (USGS Gage No. 11433800) (1973-1985).

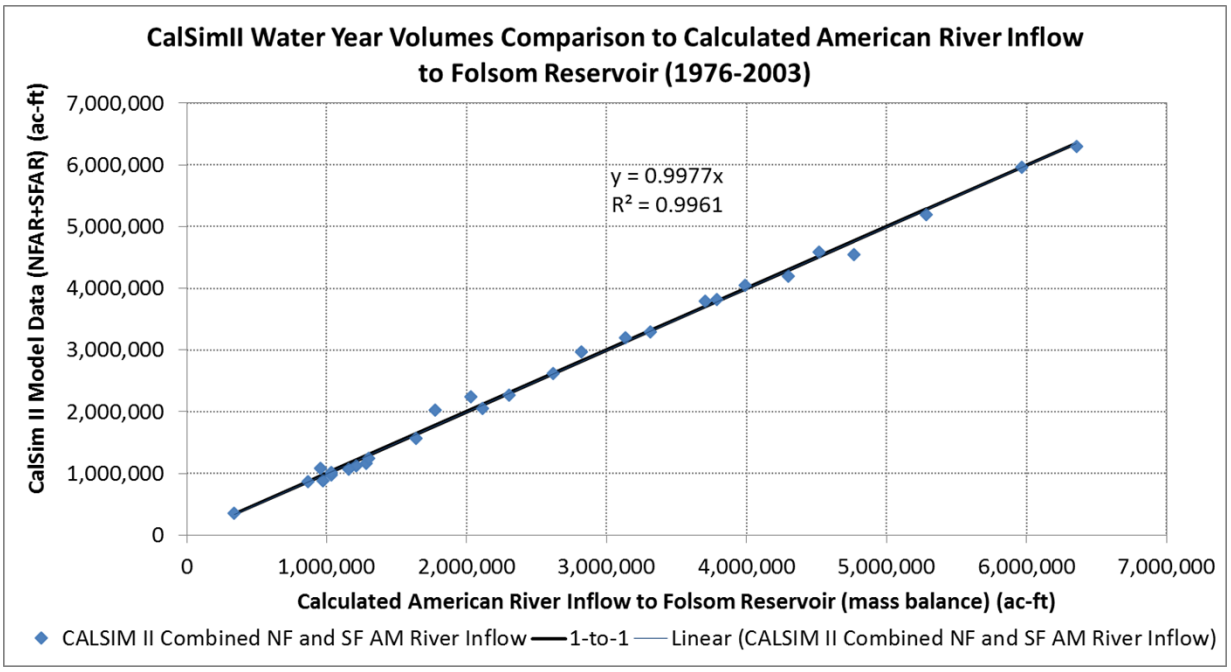
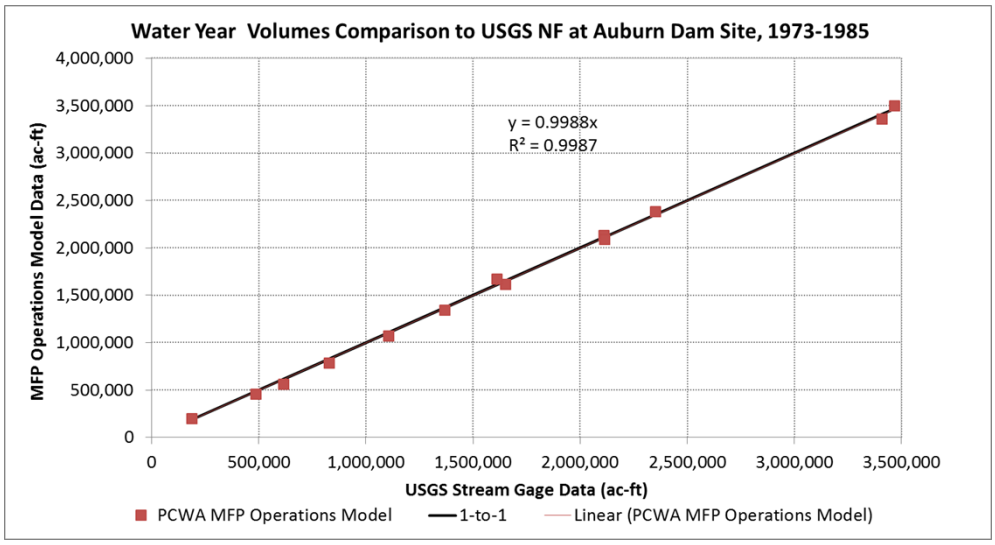


Figure 2. Comparison of Combined CalSim II NFAR and SFAR Water Year Volumes to Reclamation Calculated Folsom Reservoir Inflows (1976-2003).



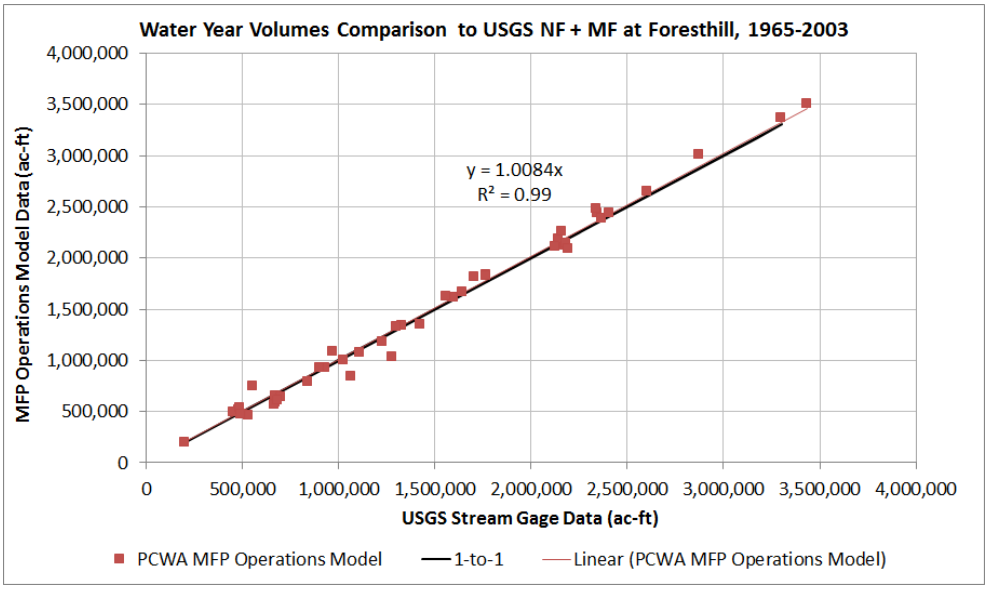


Figure 3. Comparison of MFP Operations Model Annual Volumes to USGS Gage Data at NFAR at Auburn Dam Site (USGS Gage No. 11433800) (1973-1985) (top) and to the NFAR near Foresthill (USGS Gage No. 14433300) and NFAR at North Fork Dam (USGS Gage No. 11427000) (1965-2003) (bottom). (Note: a 1-to-1 correspondence between the data would be represented by a regression equation of Y=1.0X, where Y is the MFP OASIS Model flows and X is USGS gage data).

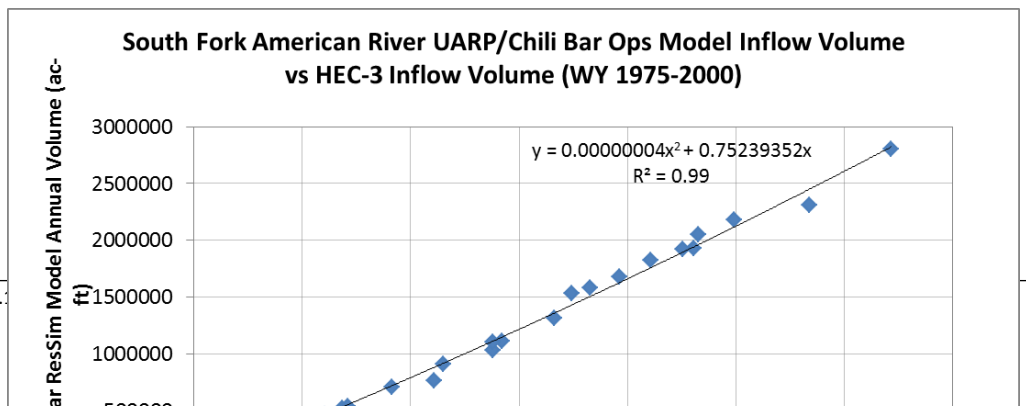


Figure 4. South Fork American River Annual Volume (acre-feet) (UARP/Chili Bar ResSim Model) Relationship with the HEC-3 South Fork American River Folsom Reservoir Inflows (WY 1975-2000).

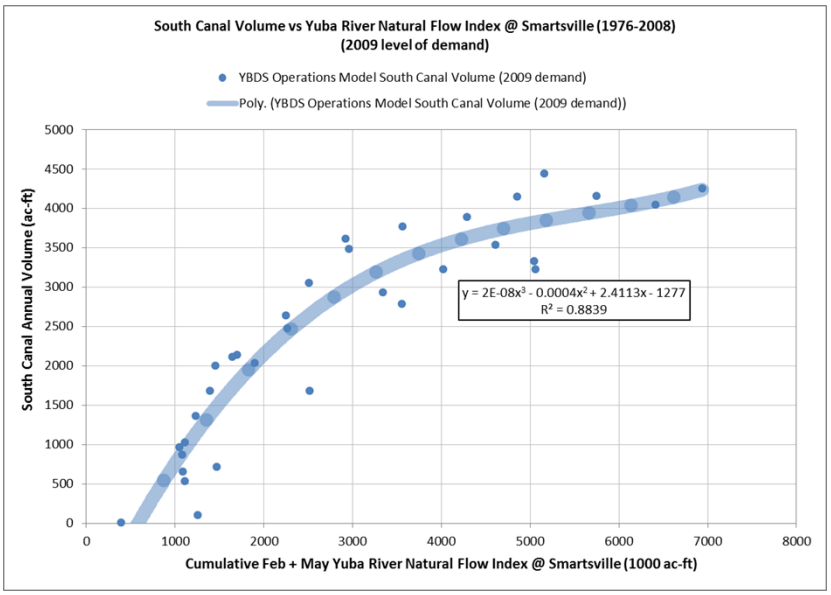
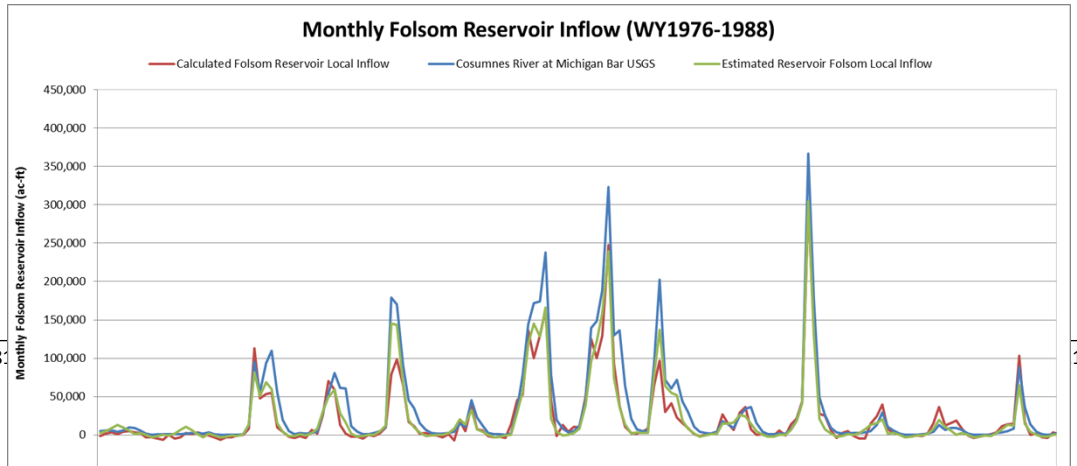


Figure 5. South Canal Annual Volume (acre-feet) (YBDS Operations Model) Relationship with the Yuba River Natural Flow Index @ Smartsville (WY 1976-2008) for 2009 Level of Demand.



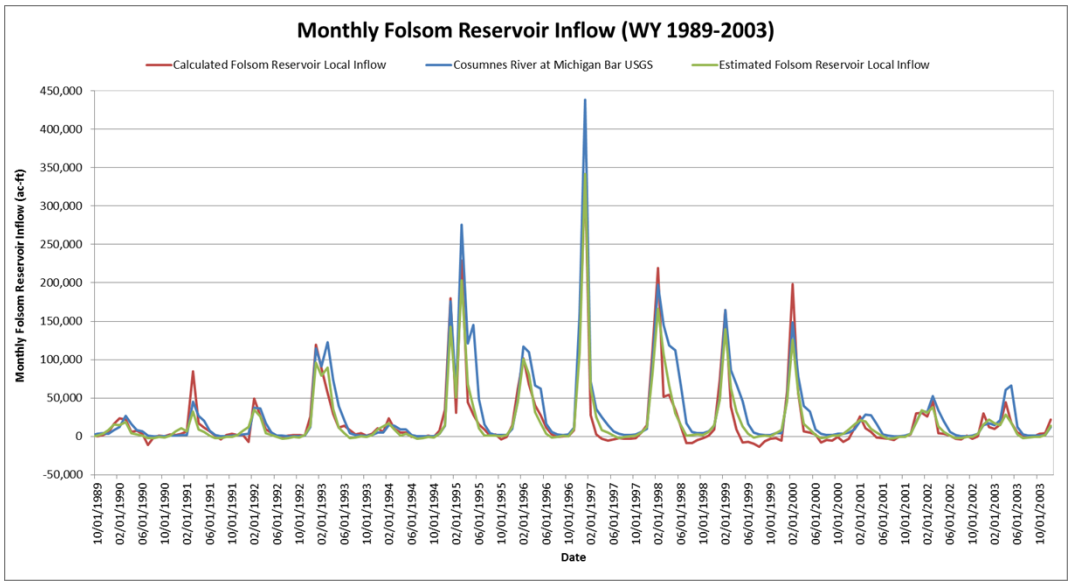


Figure 6. Comparison of Folsom Reservoir Local Inflow (Larger Watershed) Calculated[1], Cosumnes River Measured Flow Volume, and Estimated Folsom Reservoir Local Inflow (Cosumnes River Regression Relationship) (WY 1976-2003).

[1]Calculated: Folsom Reservoir inflow calculated using the mass balance approach. Estimated: using the relationships with Cosumnes River flows. Cosumnes River at Michigan Bar gage data from USGS Gage No. 11329500.

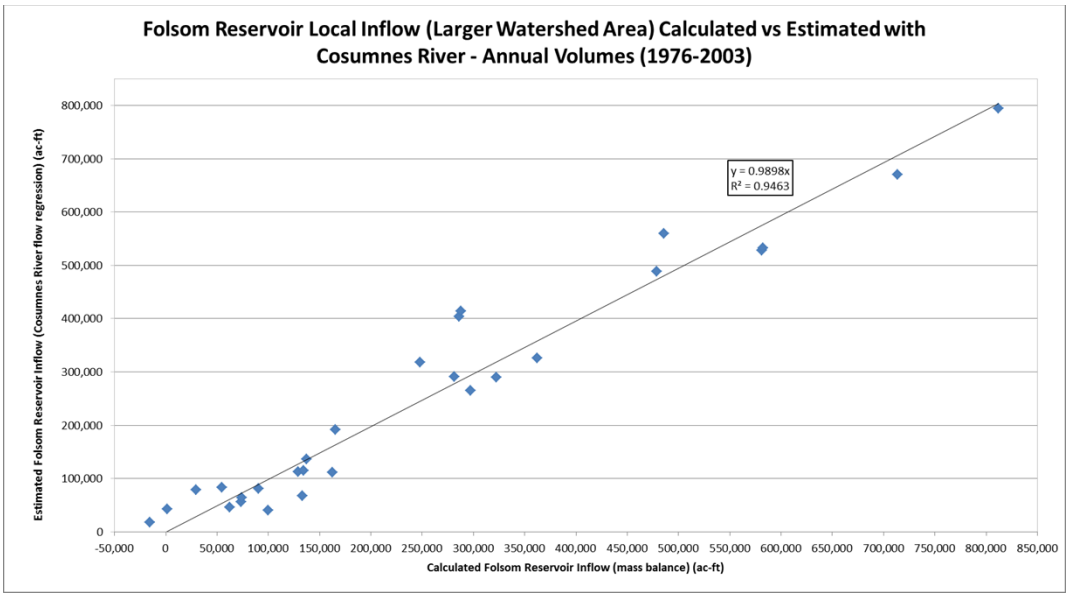
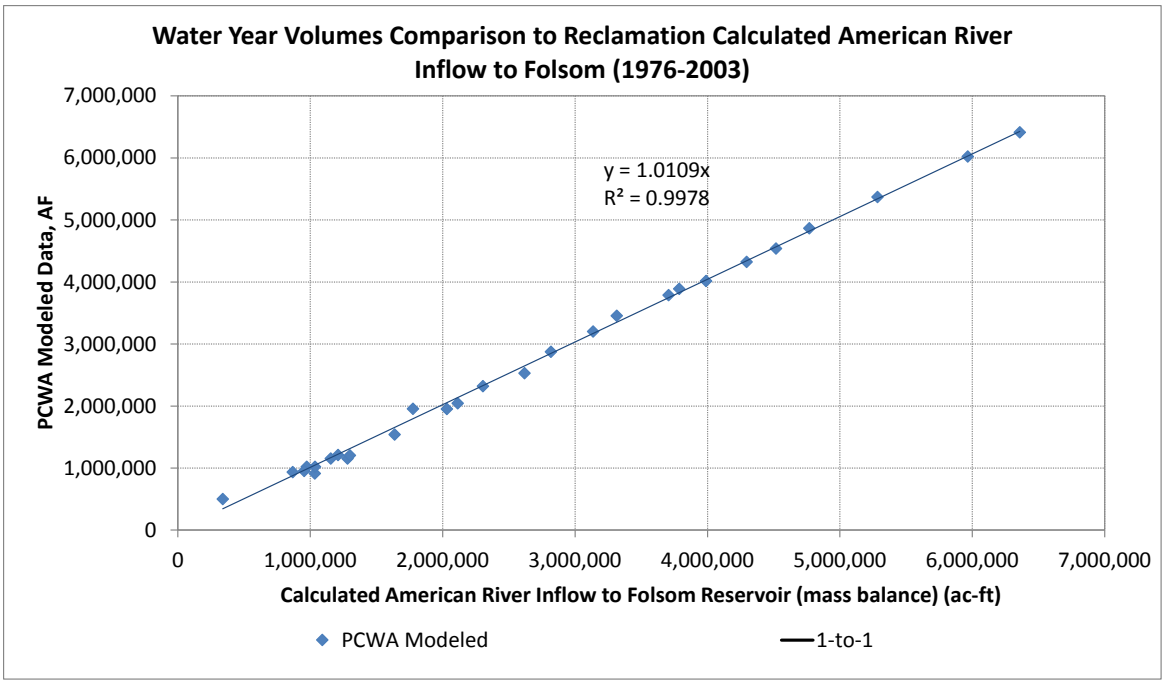


Figure 7. Folsom Reservoir Local Inflow (Larger Watershed) Calculated[1] vs Estimated with Cosumnes River Annual Volumes (WY 1976-2003).

[1]Calculated: Folsom Reservoir inflow calculated using the mass balance approach. Estimated: using the relationships with Cosumnes River flows.



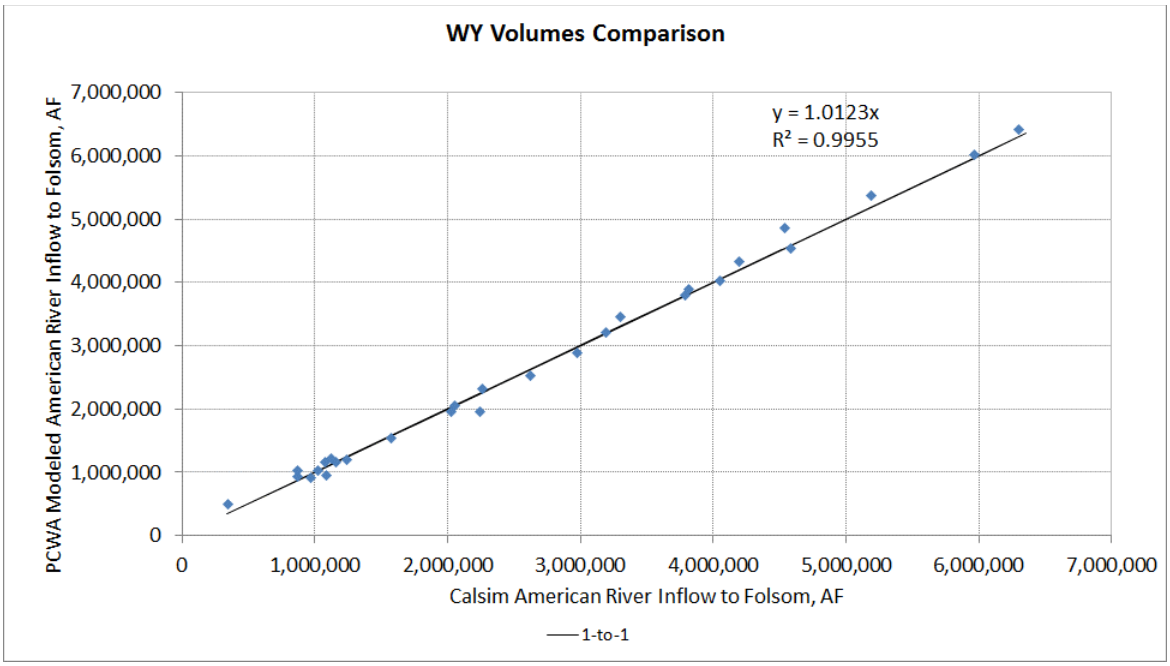


Figure 8. Comparison of Calculated Folsom Inflow Versus PCWA Modeled Folsom Inflow (1976-2003 (Top) and CalSim II Folsom Reservoir Inflows Versus PCWA Modeled Folsom Inflow (1976-2003) (Bottom).

MAP

ATTACHMENT A: HEC-3 and CalSim II Models

CalSim II was developed jointly by the Reclamation and the Department of Water Resources (DWR) for planning related to the integrated CVP and SWP operations. The model is used to evaluate water supply reliability of these two projects at different levels of development (e.g., existing and future) under various assumptions about future facilities and facility operations. The model simulates water resources in the Sacramento-San Joaquin Delta drainage basin, as well as SWP exports to the San Francisco Bay area, Central Coast, and southern California.

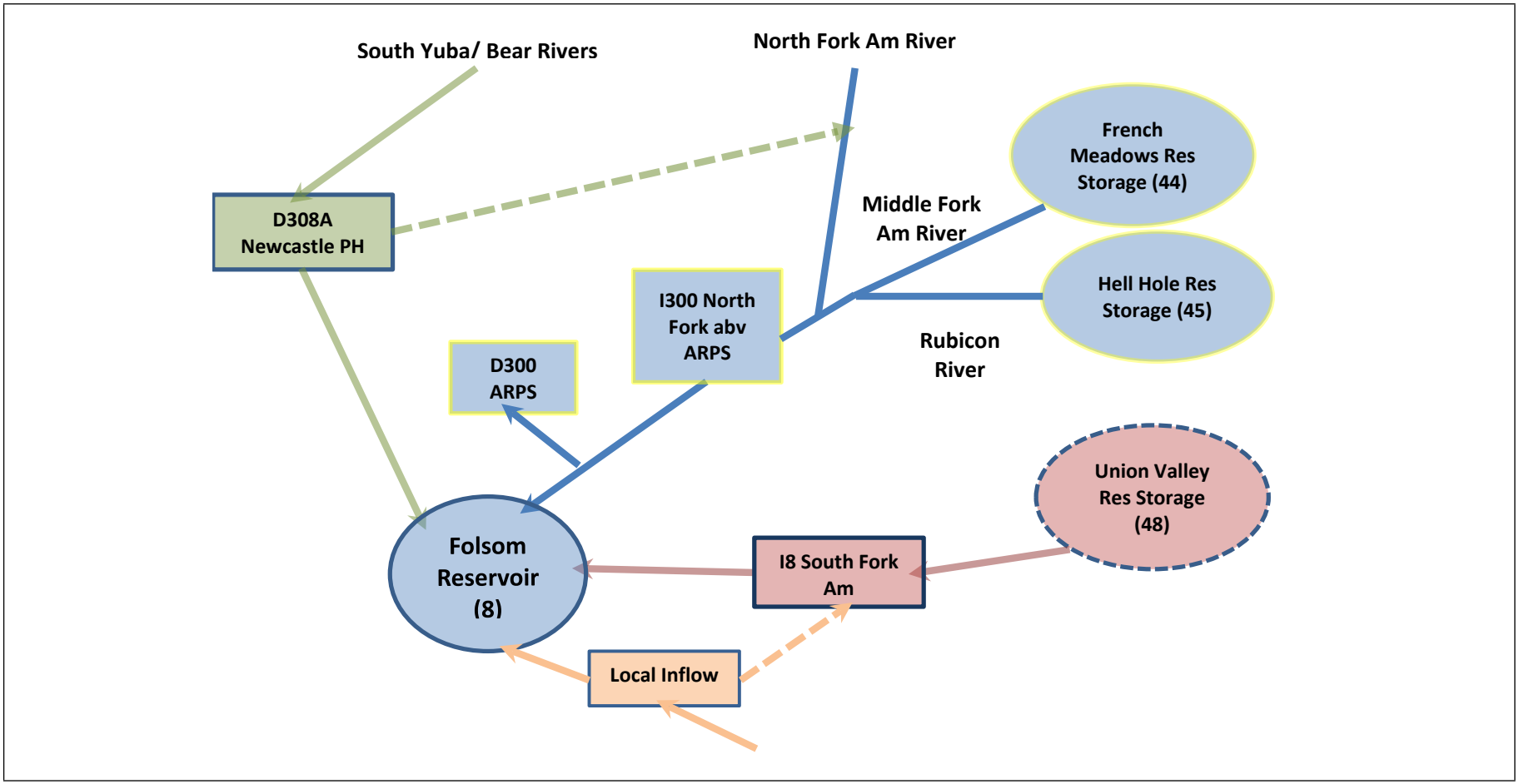
CalSim II simulates CVP and SWP operations over the WY 1922-2003 period of record using a monthly time-step. The major rivers, reservoirs, and CPV/SWP facilities are represented by a network of nodes and arcs in the model. The model uses a mass balance approach to simulate the occurrence, regulation, and routing of water through this network.

The CalSim II model requires input data to perform the routing and operations logic. The CalSim II nodes and arcs applicable to these Folsom Reservoir inflows and upstream reservoir storage are shown in Attachment A Figure 1, and include:

- I300 – North Fork/Middle Fork American River + local accretion flows above the American River Pump Station (ARPS)
- D300 – ARPS diversions
- D308A – Newcastle Powerhouse (Yuba and Bear river watersheds)
- I8 – South Fork American River + local accretion flows + Local Inflow
- 8 – Folsom Reservoir
- 44 – French Meadows Reservoir
- 45 – Hell Hole Reservoir
- 48 – Union Valley Reservoir

The American River Watershed Model (HEC-3 Model), initially developed by the DWR (DWR 1984) and modified by Surface Water Resources, Inc. (SWRI 2000), simulates inflows into Folsom Reservoir (WY 1922-2003) that can also be used as inputs into CalSim II (Attachment A Figure 2). The HEC-3 Model, however, was not available. Additionally, this model is outdated in the sense that it would need to be modified to reflect different levels of demand, modified operations of the projects, or new FERC license conditions for the five hydroelectric projects in the watershed. For the future conditions, PCWA developed inflows that incorporate recent changes in demands, hydroelectric project operations, and FERC license conditions. PCWA used the HEC-3 output data in the development of the extended hydrologic record for the South Fork American River Folsom Reservoir inflows.

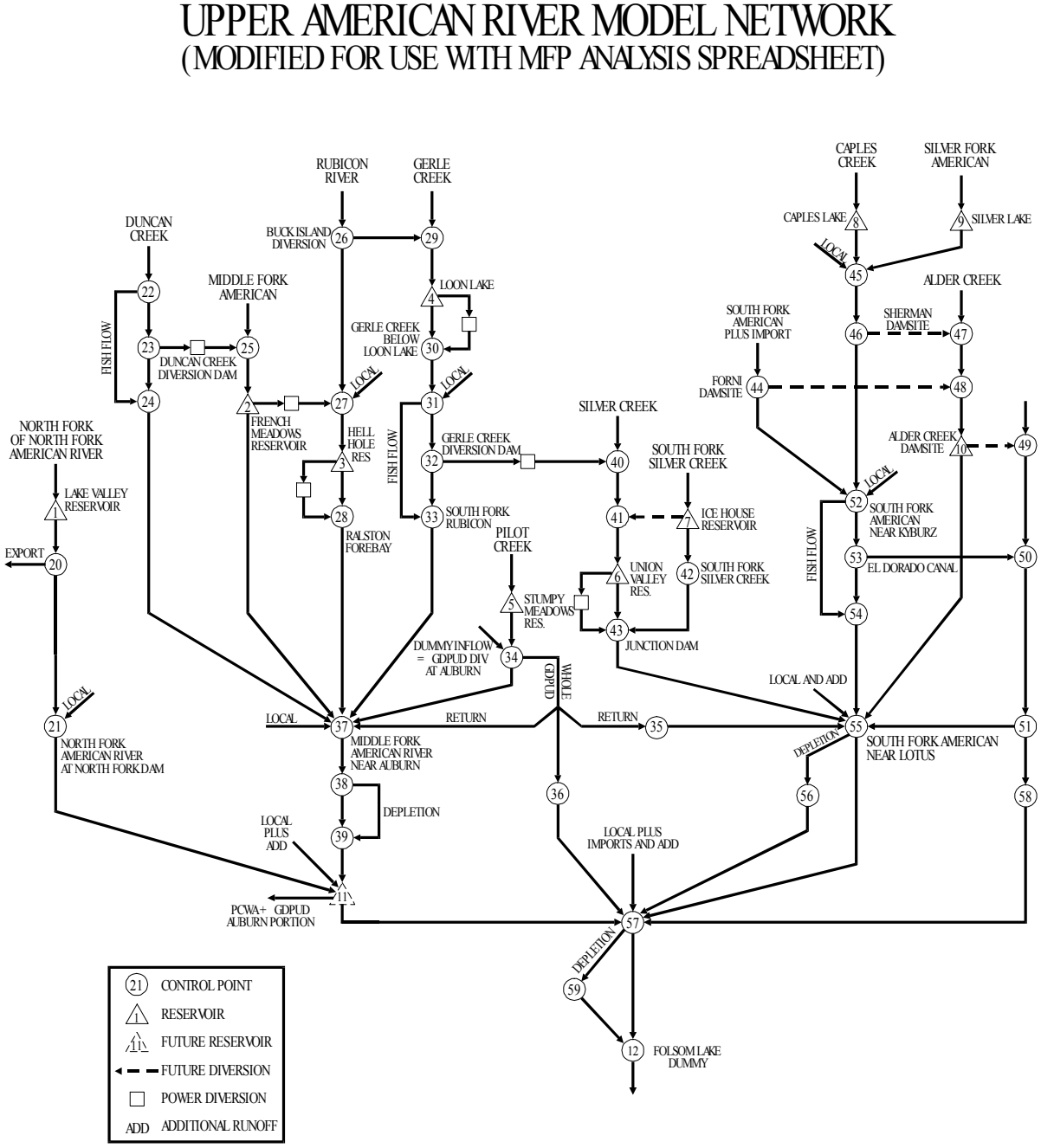
Attachment A Figure 1. CalSim II Folsom Reservoir Inflow Schematic.



*Local Inflow includes the area around Folsom Lake (e.g., Hancock Creek, Acorn Creek, Sweetwater Creek and other small drainages on the south end of Folsom Lake).

Legend:
SOLID LINE: physical routing of flow.
DASHED LINE: flow routing in CalSim II model if different from physical route.

Attachment A Figure 2. HEC-3 Upper American River Model Network Representation (as modified by SWRI 2000).



ATTACHMENT B: PCWA Middle Fork American River Project OASIS Model

Folsom Reservoir inflows from the North Fork/Middle Fork River watershed were developed using PCWA's MFP Operations Simulation Model (MFP OASIS Model) developed during PCWA's MFP relicensing to characterize flow and reservoir elevation conditions under Existing Conditions and other scenarios (PCWA 2011).

A schematic showing the routing of water through the MFP Project is provided in Attachment B Figure 1. The MFP OASIS Model includes a daily time step for analyzing water surface elevations in the MFP Project reservoirs, stream flows in the bypass and peaking reaches, and power generation. The Model also includes an hourly time step for the peaking reach below Ralston Afterbay Dam that more accurately evaluates the effects of daily peaking operations. MFP hydrology was originally modeled for a 33-year period (WY 1975-2007).

MFP OASIS Model Modifications

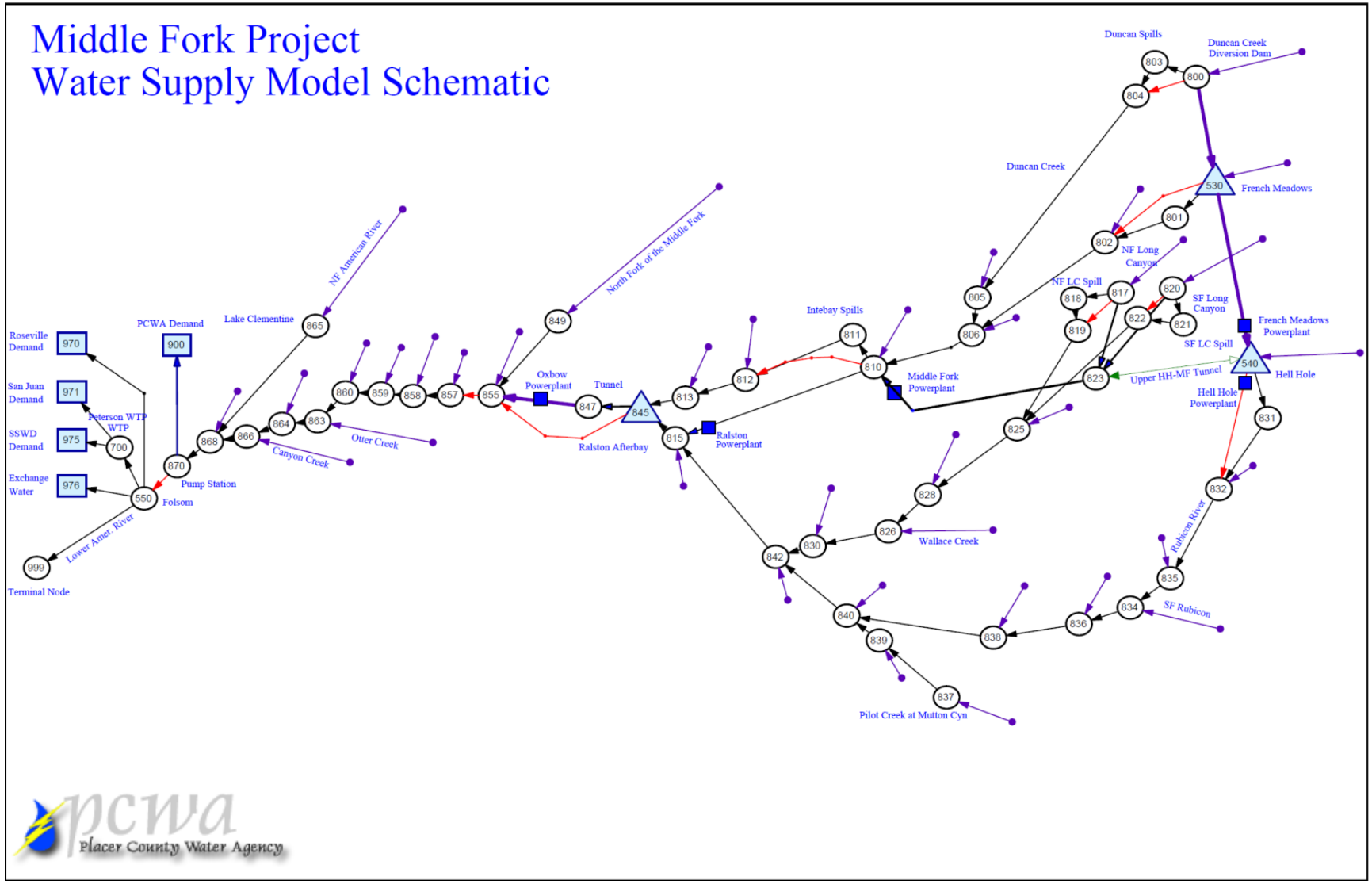
The MFP OASIS Model was modified to generate the monthly inflow hydrology and monthly reservoir storage over the full period of record (1922-2003) for the Project. These modifications included:

- Use of the flow and reservoir conditions set forth in the United States Department of Agriculture – Forest Service (USDA-FS) Final 4(e) Conditions[11];
- Extension of the hydrology analyzed for the relicensing (WY 1975-2007) for the full period of record for the Project (WY 1922-2003);
- More detailed tracking of PCWA's wholesale untreated customer's consumptive demands and use of individual demand patterns for each customer;
- Inclusion of Water Forum replacement water releases (10,000-47,000 ac-ft per yr).

The model was also modified to enable evaluations of different release patterns for Water Forum Agreement replacement water releases. The model includes implementation of Purveyor Specific Water Forum Agreement drier year water supply cutbacks to the City of Roseville and San Juan Water District when the UIFR is <950,000 ac-ft per year and to Sacramento Suburban Water District when UIFR is ≤ 1,600,000 ac-ft per year.

[11] Forest Service submits Final Section 4(e) Conditions. The purpose of this letter is to submit Final Terms and Conditions, pursuant to Section 4(e) of the Federal Power Act, under P-2079. (Dec. 3, 2012). FERC eLibrary Nos. 20121203-5019, 5029, 5030-5034.

Attachment B Figure 1. PCWA's Middle Fork Project OASIS Operations Model Schematic.



ATTACHMENT C: North Fork American River Folsom Reservoir Inflows and Reservoir Storage

List of Tables

Attachment C Table 1. North Fork American River Flows and Storage: NFAR above ARPS (I300-D308A), American River Pump Station (ARPS) (D300), PCWA Water to Roseville, PCWA Water to San Juan Water District, PCWA Water to Sacramento Suburban Water District, and Upstream Storage (French Meadows and Hell Hole Reservoirs).

Month	Monthly Average Flow or Storage (cfs or TAF)					
	Total North Fork American above ARPS (CalSim II I300-D308A) (cfs)	ARPS (CalSim II D300) (cfs)	PCWA Deliveries to Roseville (cfs)	PCWA Deliveries to San Juan Water District (cfs)	PCWA Deliveries to Sacramento Suburban Water District (cfs)	French Meadows and Hell Hole Reservoir Storage (TAF)
10/31/1921	579	129	80	23	37	188
11/30/1921	553	82	49	11	24	164
12/31/1921	949	53	40	8	22	150
1/31/1922	834	38	34	8	21	151
2/28/1922	3587	40	35	8	21	137
3/31/1922	3479	53	0	10	21	117
4/30/1922	4211	78	0	16	34	155
5/31/1922	6741	89	0	27	36	290
6/30/1922	4157	126	0	37	44	340
7/31/1922	1436	159	0	44	43	296
8/31/1922	986	161	16	42	44	249
9/30/1922	717	148	109	36	49	214
10/31/1922	470	129	80	23	37	200
11/30/1922	1029	82	49	11	24	173
12/31/1922	3933	53	40	8	22	161
1/31/1923	2391	40	34	8	21	153
2/28/1923	1814	42	35	8	21	159
3/31/1923	2188	55	0	10	21	178
4/30/1923	4358	79	0	16	34	228
5/31/1923	3972	88	0	27	36	291
6/30/1923	1754	125	0	37	44	307
7/31/1923	1273	158	0	44	43	273
8/31/1923	930	159	85	42	44	229
9/30/1923	681	146	109	36	49	198
10/31/1923	461	128	80	23	37	185
11/30/1923	489	82	49	11	24	165
12/31/1923	455	54	40	8	22	150
1/31/1924	370	41	34	8	21	146
2/29/1924	1126	41	33	8	20	155
3/31/1924	452	46	0	6	0	156
4/30/1924	1092	62	0	10	0	172
5/31/1924	698	69	0	17	0	180
6/30/1924	320	98	0	23	0	167
7/31/1924	363	127	0	27	0	147
8/31/1924	422	150	65	26	0	123
9/30/1924	395	137	81	22	0	103
10/31/1924	336	116	59	14	0	94
11/30/1924	460	75	37	7	0	96
12/31/1924	816	52	30	5	0	103
1/31/1925	912	40	25	5	0	103
2/28/1925	4862	42	26	5	0	146
3/31/1925	2321	55	0	10	21	171
4/30/1925	4182	79	0	16	34	242

5/31/1925	3460	88	0	27	36	297
6/30/1925	1393	125	0	37	44	310
7/31/1925	1002	158	0	44	43	275
8/31/1925	914	160	105	42	44	231
9/30/1925	654	146	109	36	49	199
10/31/1925	420	128	80	23	37	185
11/30/1925	482	82	49	11	24	168
12/31/1925	730	54	40	8	22	150
1/31/1926	593	41	34	8	21	146
2/28/1926	2344	43	35	8	21	162
3/31/1926	1846	56	0	10	0	183
4/30/1926	3239	80	0	16	0	241
5/31/1926	1122	88	0	27	0	272
6/30/1926	542	124	0	37	0	264
7/31/1926	665	157	21	44	0	231
8/31/1926	662	158	126	42	0	195
9/30/1926	500	145	109	36	0	170
10/31/1926	374	128	80	23	0	156
11/30/1926	1895	82	49	11	0	159
12/31/1926	1372	54	40	8	0	150
1/31/1927	2147	36	34	8	0	152
2/28/1927	7785	39	35	8	0	173
3/31/1927	4169	52	0	10	21	162
4/30/1927	6046	77	0	16	34	226
5/31/1927	4517	89	0	27	36	280
6/30/1927	2936	127	0	37	44	291
7/31/1927	1165	160	0	44	43	257
8/31/1927	825	162	16	42	44	220
9/30/1927	661	149	109	36	49	188
10/31/1927	421	129	80	23	37	174
11/30/1927	1228	82	49	11	24	165
12/31/1927	962	53	40	8	22	150
1/31/1928	953	39	34	8	21	150
2/29/1928	1323	39	33	8	20	152
3/31/1928	8015	55	0	10	21	245
4/30/1928	3669	79	0	16	34	282
5/31/1928	2286	89	0	27	36	323
6/30/1928	655	125	0	37	44	313
7/31/1928	830	158	0	44	43	272
8/31/1928	777	160	64	42	44	232
9/30/1928	602	147	109	36	49	201
10/31/1928	343	128	80	23	37	185
11/30/1928	502	82	49	11	24	165
12/31/1928	553	54	40	8	22	150
1/31/1929	382	42	34	8	21	145
2/28/1929	836	44	35	8	21	149
3/31/1929	1343	58	0	10	0	160
4/30/1929	1789	80	0	16	0	185
5/31/1929	1860	88	0	27	0	255
6/30/1929	978	123	26	37	0	270
7/31/1929	882	155	126	44	0	230
8/31/1929	682	157	126	42	0	194
9/30/1929	519	144	109	36	0	168
10/31/1929	305	127	40	23	0	156
11/30/1929	213	82	0	11	0	147
12/31/1929	1915	55	0	8	0	150
1/31/1930	1619	40	0	8	0	151
2/28/1930	1888	42	0	8	0	165
3/31/1930	2804	56	0	10	0	195
4/30/1930	2669	79	0	16	0	240
5/31/1930	1487	88	0	27	0	283

6/30/1930	838	124	0	37	0	285
7/31/1930	787	157	25	44	0	248
8/31/1930	742	159	126	42	0	208
9/30/1930	552	145	109	36	0	180
10/31/1930	352	128	80	23	0	165
11/30/1930	419	82	49	11	0	155
12/31/1930	272	54	40	8	0	149
1/31/1931	471	43	34	8	0	150
2/28/1931	664	44	32	8	0	154
3/31/1931	1183	58	0	8	0	165
4/30/1931	1201	80	0	12	0	187
5/31/1931	811	91	0	21	0	201
6/30/1931	495	124	0	28	0	192
7/31/1931	446	157	9	34	0	169
8/31/1931	480	158	103	32	0	142
9/30/1931	434	142	90	28	0	118
10/31/1931	357	124	65	18	0	105
11/30/1931	290	80	41	9	0	100
12/31/1931	1177	55	33	6	0	110
1/31/1932	1289	40	28	6	0	118
2/29/1932	2505	40	27	6	0	141
3/31/1932	2685	55	0	10	21	176
4/30/1932	3318	79	0	16	34	217
5/31/1932	4702	88	0	27	36	287
6/30/1932	2531	125	0	37	44	317
7/31/1932	1164	158	55	44	43	279
8/31/1932	935	160	126	42	44	233
9/30/1932	605	146	109	36	49	202
10/31/1932	345	128	80	23	37	187
11/30/1932	405	82	49	11	24	167
12/31/1932	448	51	21	8	4	150
1/31/1933	358	38	34	8	21	144
2/28/1933	429	39	0	8	21	143
3/31/1933	1131	57	0	10	0	150
4/30/1933	1927	80	0	16	0	182
5/31/1933	2114	88	0	27	0	237
6/30/1933	1864	123	0	37	0	272
7/31/1933	931	156	105	44	0	233
8/31/1933	682	157	126	42	0	197
9/30/1933	534	144	109	36	0	170
10/31/1933	428	127	80	23	0	157
11/30/1933	343	82	39	11	0	150
12/31/1933	950	55	0	8	0	150
1/31/1934	1364	43	0	8	0	150
2/28/1934	1446	44	0	8	0	162
3/31/1934	2151	58	0	8	0	188
4/30/1934	1389	80	0	12	0	210
5/31/1934	643	88	0	21	0	219
6/30/1934	484	123	0	28	0	208
7/31/1934	437	155	10	34	0	186
8/31/1934	471	157	110	32	0	161
9/30/1934	423	144	96	28	0	139
10/31/1934	331	127	70	18	0	125
11/30/1934	469	82	43	9	0	126
12/31/1934	469	55	35	6	0	128
1/31/1935	1307	39	30	6	0	128
2/28/1935	1505	41	30	6	0	140
3/31/1935	1667	55	0	10	21	154
4/30/1935	6748	79	0	16	34	240
5/31/1935	4707	89	0	27	36	306
6/30/1935	2266	125	0	37	44	327

7/31/1935	1092	158	21	44	43	285
8/31/1935	981	160	126	42	44	234
9/30/1935	616	146	109	36	49	203
10/31/1935	395	128	80	23	37	188
11/30/1935	584	82	49	11	24	165
12/31/1935	510	54	40	8	22	150
1/31/1936	3781	38	34	8	21	159
2/29/1936	6704	39	33	8	20	187
3/31/1936	4148	54	0	10	21	190
4/30/1936	5364	78	0	16	34	249
5/31/1936	4248	89	0	27	36	298
6/30/1936	2261	125	0	37	44	318
7/31/1936	1111	159	21	44	43	281
8/31/1936	946	161	126	42	44	235
9/30/1936	643	147	109	36	49	203
10/31/1936	360	129	80	23	37	189
11/30/1936	393	82	49	11	24	170
12/31/1936	523	54	40	8	22	150
1/31/1937	373	40	34	8	21	145
2/28/1937	2533	42	35	8	15	157
3/31/1937	2740	56	0	10	21	182
4/30/1937	4487	79	0	16	34	225
5/31/1937	4547	88	0	27	36	316
6/30/1937	1527	124	0	37	44	326
7/31/1937	1009	157	21	44	43	286
8/31/1937	951	159	126	42	44	237
9/30/1937	626	146	109	36	49	206
10/31/1937	394	128	80	23	37	192
11/30/1937	885	82	49	11	24	170
12/31/1937	4400	54	40	8	22	166
1/31/1938	1543	35	34	8	21	151
2/28/1938	5174	38	35	8	21	130
3/31/1938	7497	51	0	10	21	143
4/30/1938	6283	77	0	16	34	188
5/31/1938	6762	89	0	27	36	307
6/30/1938	4114	127	0	37	44	329
7/31/1938	1543	161	0	44	43	290
8/31/1938	1026	163	16	42	44	244
9/30/1938	710	150	109	36	49	210
10/31/1938	466	130	80	23	37	196
11/30/1938	675	82	49	11	24	173
12/31/1938	758	52	40	8	22	150
1/31/1939	470	43	34	8	21	148
2/28/1939	632	44	35	8	21	149
3/31/1939	1882	58	0	8	0	169
4/30/1939	2323	80	0	12	0	213
5/31/1939	883	88	0	21	0	237
6/30/1939	486	123	0	28	0	228
7/31/1939	485	155	6	34	0	204
8/31/1939	528	157	121	32	0	176
9/30/1939	438	144	105	28	0	154
10/31/1939	404	127	77	18	0	141
11/30/1939	201	82	48	9	0	135
12/31/1939	253	55	39	6	0	134
1/31/1940	3807	38	33	6	0	161
2/29/1940	5972	39	32	6	0	185
3/31/1940	7538	54	0	10	21	244
4/30/1940	4865	78	0	16	34	300
5/31/1940	3562	89	0	27	36	333
6/30/1940	1408	126	0	37	44	323
7/31/1940	951	159	0	44	43	282

8/31/1940	826	161	16	42	44	239
9/30/1940	628	147	109	36	49	208
10/31/1940	375	129	80	23	37	193
11/30/1940	911	82	49	11	24	165
12/31/1940	2875	53	40	8	22	150
1/31/1941	3317	37	34	8	21	152
2/28/1941	4712	39	35	8	21	179
3/31/1941	3865	53	0	10	21	203
4/30/1941	3611	78	0	16	34	232
5/31/1941	4992	89	0	27	36	301
6/30/1941	1777	126	0	37	44	308
7/31/1941	1122	160	0	44	43	270
8/31/1941	907	162	16	42	44	230
9/30/1941	655	148	109	36	49	199
10/31/1941	419	129	80	23	37	184
11/30/1941	791	82	49	11	24	159
12/31/1941	3445	53	40	8	22	150
1/31/1942	5234	36	34	8	21	171
2/28/1942	5749	39	35	8	21	167
3/31/1942	3123	53	0	10	21	142
4/30/1942	4937	77	0	16	34	189
5/31/1942	4886	89	0	27	36	248
6/30/1942	3338	126	0	37	44	273
7/31/1942	1324	160	0	44	43	246
8/31/1942	831	162	16	42	44	213
9/30/1942	647	149	109	36	49	183
10/31/1942	405	129	80	23	37	168
11/30/1942	1318	82	49	11	24	167
12/31/1942	2897	53	40	8	22	150
1/31/1943	6171	37	34	8	21	174
2/28/1943	3907	39	35	8	21	169
3/31/1943	7067	53	0	10	21	217
4/30/1943	4428	78	0	16	34	267
5/31/1943	2793	89	0	27	36	285
6/30/1943	1502	126	0	37	44	287
7/31/1943	959	160	0	44	43	255
8/31/1943	791	162	16	42	44	220
9/30/1943	623	148	109	36	49	190
10/31/1943	398	129	80	23	37	175
11/30/1943	378	82	49	11	24	161
12/31/1943	408	53	40	8	22	150
1/31/1944	498	42	34	8	21	148
2/29/1944	1018	42	33	8	20	152
3/31/1944	1878	57	0	10	0	166
4/30/1944	1752	80	0	16	0	192
5/31/1944	2617	88	0	27	0	273
6/30/1944	1222	124	0	37	0	283
7/31/1944	876	156	40	44	0	246
8/31/1944	727	158	126	42	0	209
9/30/1944	524	145	109	36	0	181
10/31/1944	334	128	80	23	0	167
11/30/1944	1101	82	49	11	0	161
12/31/1944	1387	55	24	8	0	150
1/31/1945	837	40	34	8	0	150
2/28/1945	5131	42	17	8	0	190
3/31/1945	2083	55	0	10	21	201
4/30/1945	3250	79	0	16	34	238
5/31/1945	3518	88	0	27	36	293
6/30/1945	1474	125	0	37	44	311
7/31/1945	990	158	0	44	43	272
8/31/1945	852	160	85	42	44	230

9/30/1945	611	146	109	36	49	199
10/31/1945	535	128	80	23	37	185
11/30/1945	1444	82	49	11	24	169
12/31/1945	4947	54	40	8	22	161
1/31/1946	2795	39	34	8	21	153
2/28/1946	1368	41	35	8	21	154
3/31/1946	2670	55	0	10	21	180
4/30/1946	3917	79	0	16	34	239
5/31/1946	3398	89	0	27	36	299
6/30/1946	1116	125	0	37	44	312
7/31/1946	944	158	0	44	43	272
8/31/1946	800	160	16	42	44	232
9/30/1946	629	147	109	36	49	201
10/31/1946	403	128	80	23	37	186
11/30/1946	1151	82	49	11	24	167
12/31/1946	1117	54	40	8	22	150
1/31/1947	432	42	34	8	21	150
2/28/1947	1768	43	35	8	21	162
3/31/1947	2436	57	0	10	0	190
4/30/1947	2022	80	0	16	0	226
5/31/1947	1136	88	0	27	0	265
6/30/1947	673	123	0	37	0	264
7/31/1947	652	156	19	44	0	232
8/31/1947	678	158	126	42	0	196
9/30/1947	486	145	109	36	0	170
10/31/1947	541	128	80	23	0	160
11/30/1947	390	82	49	11	0	155
12/31/1947	315	55	40	8	0	150
1/31/1948	1733	40	34	8	0	151
2/29/1948	745	40	33	8	0	149
3/31/1948	1174	55	0	10	21	156
4/30/1948	4716	79	0	16	34	205
5/31/1948	4087	88	0	27	36	284
6/30/1948	2417	125	0	37	44	322
7/31/1948	1130	157	0	44	43	285
8/31/1948	908	159	16	42	44	242
9/30/1948	656	146	109	36	49	209
10/31/1948	374	128	80	23	37	194
11/30/1948	598	82	49	11	24	171
12/31/1948	786	54	40	8	22	150
1/31/1949	380	41	34	8	21	149
2/28/1949	851	43	35	8	21	145
3/31/1949	2516	57	0	10	21	159
4/30/1949	3823	80	0	16	34	227
5/31/1949	3164	88	0	27	36	304
6/30/1949	1072	124	0	37	44	307
7/31/1949	837	156	0	44	43	268
8/31/1949	773	158	24	42	44	229
9/30/1949	599	145	109	36	49	197
10/31/1949	352	128	80	23	37	182
11/30/1949	463	82	49	11	24	164
12/31/1949	453	55	40	8	22	150
1/31/1950	2749	39	34	8	21	153
2/28/1950	3245	41	35	8	21	170
3/31/1950	2876	55	0	10	21	190
4/30/1950	4747	79	0	16	34	243
5/31/1950	4040	88	0	27	36	299
6/30/1950	1915	125	0	37	44	313
7/31/1950	1031	158	21	44	43	276
8/31/1950	901	160	126	42	44	230
9/30/1950	601	146	109	36	49	199

10/31/1950	541	128	80	23	37	188
11/30/1950	7022	82	49	11	24	261
12/31/1950	7836	54	40	8	22	290
1/31/1951	5568	36	34	8	21	273
2/28/1951	4327	39	35	8	21	249
3/31/1951	4090	52	0	10	21	228
4/30/1951	3145	77	0	16	34	262
5/31/1951	2976	89	0	27	36	296
6/30/1951	923	127	0	37	44	299
7/31/1951	903	160	0	44	43	264
8/31/1951	780	162	16	42	44	227
9/30/1951	634	149	109	36	49	196
10/31/1951	468	129	80	23	37	182
11/30/1951	1195	82	49	11	24	162
12/31/1951	3233	53	40	8	22	150
1/31/1952	4315	35	34	8	21	154
2/29/1952	6158	36	33	8	20	134
3/31/1952	5018	51	0	10	21	110
4/30/1952	7585	77	0	16	34	169
5/31/1952	7964	89	0	27	36	276
6/30/1952	4345	127	0	37	44	321
7/31/1952	2082	162	0	44	43	292
8/31/1952	1222	164	16	42	44	246
9/30/1952	726	150	109	36	49	212
10/31/1952	406	130	80	23	37	197
11/30/1952	740	82	49	11	24	164
12/31/1952	1262	52	40	8	22	150
1/31/1953	4699	39	34	8	21	158
2/28/1953	1504	41	35	8	21	162
3/31/1953	1881	54	0	10	21	178
4/30/1953	3926	78	0	16	34	217
5/31/1953	3593	89	0	27	36	257
6/30/1953	2840	125	0	37	44	302
7/31/1953	1525	159	0	44	43	274
8/31/1953	967	160	16	42	44	235
9/30/1953	701	147	109	36	49	203
10/31/1953	430	129	80	23	37	188
11/30/1953	679	82	49	11	24	170
12/31/1953	791	54	40	8	22	150
1/31/1954	1156	40	34	8	21	150
2/28/1954	2223	42	35	8	21	154
3/31/1954	3672	56	0	10	0	197
4/30/1954	4085	79	0	16	0	261
5/31/1954	1947	88	0	27	0	310
6/30/1954	850	124	0	37	0	304
7/31/1954	835	157	0	44	0	267
8/31/1954	765	159	16	42	0	229
9/30/1954	596	146	109	36	0	199
10/31/1954	359	128	80	23	0	184
11/30/1954	569	82	49	11	0	164
12/31/1954	1248	54	40	8	0	150
1/31/1955	1082	42	34	8	0	150
2/28/1955	930	43	35	8	0	156
3/31/1955	1243	57	0	10	0	168
4/30/1955	1883	80	0	16	0	193
5/31/1955	2730	88	0	27	0	274
6/30/1955	1296	123	0	37	0	289
7/31/1955	869	156	21	44	0	253
8/31/1955	790	158	126	42	0	213
9/30/1955	554	144	109	36	0	185
10/31/1955	348	128	80	23	0	170

11/30/1955	449	82	49	11	0	155
12/31/1955	10473	55	40	8	0	235
1/31/1956	8565	35	34	8	0	282
2/29/1956	3726	36	33	8	0	249
3/31/1956	3442	51	0	10	21	218
4/30/1956	3243	77	0	16	34	237
5/31/1956	5077	89	0	27	36	312
6/30/1956	2635	127	0	37	44	318
7/31/1956	1191	161	0	44	43	285
8/31/1956	908	163	16	42	44	242
9/30/1956	702	149	109	36	49	208
10/31/1956	460	130	80	23	37	194
11/30/1956	679	82	49	11	24	173
12/31/1956	763	53	40	8	22	151
1/31/1957	499	40	34	8	21	148
2/28/1957	2959	42	35	8	21	162
3/31/1957	3513	55	0	10	21	203
4/30/1957	2218	79	0	16	34	232
5/31/1957	3803	88	0	27	36	296
6/30/1957	1587	124	0	37	44	315
7/31/1957	969	157	0	44	43	279
8/31/1957	875	159	30	42	44	238
9/30/1957	674	146	109	36	49	204
10/31/1957	463	128	80	23	37	190
11/30/1957	696	82	49	11	24	170
12/31/1957	1237	54	40	8	22	150
1/31/1958	1453	36	34	8	21	150
2/28/1958	6561	39	35	8	21	151
3/31/1958	5461	52	0	10	21	133
4/30/1958	6802	77	0	16	34	192
5/31/1958	6830	89	0	27	36	308
6/30/1958	3455	127	0	37	44	336
7/31/1958	1352	160	0	44	43	299
8/31/1958	1062	162	16	42	44	253
9/30/1958	775	149	109	36	49	216
10/31/1958	417	129	80	23	37	201
11/30/1958	542	82	49	11	24	178
12/31/1958	651	53	40	8	22	151
1/31/1959	1331	42	34	8	21	151
2/28/1959	1913	43	35	8	21	156
3/31/1959	1502	57	0	8	0	173
4/30/1959	1791	80	0	12	0	208
5/31/1959	1089	88	0	21	0	235
6/30/1959	566	123	0	28	0	231
7/31/1959	512	156	0	34	0	206
8/31/1959	474	158	0	32	0	181
9/30/1959	509	144	105	28	0	157
10/31/1959	346	128	77	18	0	143
11/30/1959	188	82	48	9	0	135
12/31/1959	207	55	39	6	0	130
1/31/1960	474	41	33	6	0	130
2/29/1960	3202	41	32	6	0	155
3/31/1960	3465	56	0	10	0	201
4/30/1960	2356	79	0	16	0	247
5/31/1960	1454	88	0	27	0	291
6/30/1960	882	124	0	37	0	290
7/31/1960	761	157	21	44	0	252
8/31/1960	757	159	126	42	0	211
9/30/1960	540	145	109	36	0	183
10/31/1960	340	128	80	23	0	169
11/30/1960	514	82	49	11	0	153

12/31/1960	604	54	40	8	0	143
1/31/1961	316	42	34	8	0	138
2/28/1961	1137	44	35	8	0	148
3/31/1961	1295	57	0	8	0	159
4/30/1961	1712	80	0	12	0	187
5/31/1961	1501	88	0	21	0	229
6/30/1961	737	123	0	28	0	233
7/31/1961	577	156	0	34	0	206
8/31/1961	604	157	119	32	0	173
9/30/1961	456	144	104	28	0	149
10/31/1961	325	127	76	18	0	135
11/30/1961	221	82	47	9	0	129
12/31/1961	400	55	38	6	0	131
1/31/1962	388	40	32	6	0	131
2/28/1962	3856	42	33	6	0	152
3/31/1962	2187	56	0	10	0	169
4/30/1962	3832	79	0	16	0	243
5/31/1962	2537	88	0	27	0	293
6/30/1962	1449	124	0	37	0	306
7/31/1962	866	157	0	44	0	270
8/31/1962	766	159	16	42	0	230
9/30/1962	610	146	109	36	0	198
10/31/1962	3584	128	80	23	0	215
11/30/1962	1167	82	49	11	0	182
12/31/1962	2523	54	40	8	0	150
1/31/1963	2705	37	34	8	0	156
2/28/1963	7211	39	35	8	0	189
3/31/1963	2773	53	0	10	21	151
4/30/1963	5709	78	0	16	34	199
5/31/1963	5833	89	0	27	36	273
6/30/1963	2034	126	0	37	44	271
7/31/1963	975	160	0	44	43	241
8/31/1963	824	162	16	42	44	207
9/30/1963	672	148	109	36	49	177
10/31/1963	465	129	80	23	37	162
11/30/1963	1703	82	49	11	24	166
12/31/1963	1087	53	40	8	22	150
1/31/1964	1305	41	34	8	21	150
2/29/1964	1138	41	33	8	20	155
3/31/1964	1165	57	0	10	0	164
4/30/1964	2534	80	0	16	0	209
5/31/1964	2502	88	0	27	0	289
6/30/1964	1499	124	0	37	0	299
7/31/1964	894	156	21	44	0	263
8/31/1964	825	158	126	42	0	221
9/30/1964	581	145	109	36	0	192
10/31/1964	360	128	80	23	0	177
11/30/1964	743	82	49	11	0	162
12/31/1964	12481	55	40	8	0	305
1/31/1965	7199	35	34	8	0	300
2/28/1965	3387	38	35	8	0	273
3/31/1965	2698	52	0	10	21	238
4/30/1965	4814	77	0	16	34	278
5/31/1965	3801	89	0	27	36	307
6/30/1965	2252	127	0	37	44	300
7/31/1965	1171	161	0	44	43	268
8/31/1965	1020	163	16	42	44	232
9/30/1965	1028	149	109	36	49	202
10/31/1965	444	130	80	23	37	188
11/30/1965	944	82	49	11	24	172
12/31/1965	1001	53	40	8	22	150

1/31/1966	1097	41	34	8	21	150
2/28/1966	997	43	35	8	21	155
3/31/1966	1752	57	0	10	0	183
4/30/1966	2501	80	0	16	0	257
5/31/1966	1277	88	0	27	0	307
6/30/1966	641	124	0	37	0	297
7/31/1966	749	156	0	44	0	259
8/31/1966	646	158	16	42	0	222
9/30/1966	607	145	109	36	0	193
10/31/1966	555	128	80	23	0	184
11/30/1966	1125	82	49	11	0	168
12/31/1966	3109	55	40	8	0	150
1/31/1967	3838	37	34	8	0	154
2/28/1967	3462	39	35	8	0	129
3/31/1967	5381	53	0	10	21	127
4/30/1967	4362	78	0	16	34	113
5/31/1967	6561	89	0	27	36	193
6/30/1967	4411	126	0	37	44	303
7/31/1967	1892	160	0	44	43	291
8/31/1967	1112	162	16	42	44	247
9/30/1967	836	148	109	36	49	212
10/31/1967	562	129	80	23	37	195
11/30/1967	706	82	49	11	24	170
12/31/1967	979	53	40	8	22	150
1/31/1968	1145	41	34	8	21	150
2/29/1968	3865	41	33	8	20	199
3/31/1968	2300	56	0	10	0	231
4/30/1968	1917	80	0	16	0	274
5/31/1968	1320	88	0	27	0	310
6/30/1968	770	124	0	37	0	305
7/31/1968	788	157	0	44	0	268
8/31/1968	731	158	17	42	0	231
9/30/1968	659	145	109	36	0	199
10/31/1968	425	128	80	23	0	183
11/30/1968	908	82	49	11	0	174
12/31/1968	1622	55	40	8	0	150
1/31/1969	10259	36	34	8	0	201
2/28/1969	5945	38	35	8	0	165
3/31/1969	4357	52	0	10	21	129
4/30/1969	5873	77	0	16	34	164
5/31/1969	6408	89	0	27	36	294
6/30/1969	3078	127	0	37	44	325
7/31/1969	1265	161	0	44	43	292
8/31/1969	985	163	16	42	44	245
9/30/1969	800	149	109	36	49	208
10/31/1969	612	130	80	23	37	194
11/30/1969	710	82	49	11	24	170
12/31/1969	3558	53	40	8	22	168
1/31/1970	11870	38	34	8	21	279
2/28/1970	3724	40	35	8	21	261
3/31/1970	3484	54	0	10	0	239
4/30/1970	1703	78	0	16	0	248
5/31/1970	1921	89	0	27	0	294
6/30/1970	921	126	0	37	0	312
7/31/1970	916	159	0	44	0	275
8/31/1970	753	161	32	42	0	234
9/30/1970	647	147	109	36	0	201
10/31/1970	416	129	80	23	0	185
11/30/1970	1560	82	49	11	0	178
12/31/1970	3708	53	40	8	0	150
1/31/1971	2916	38	34	8	0	153

2/28/1971	2334	40	35	8	0	157
3/31/1971	3876	54	0	10	21	164
4/30/1971	3494	78	0	16	34	189
5/31/1971	3936	89	0	27	36	243
6/30/1971	2308	126	0	37	44	311
7/31/1971	1245	159	0	44	43	280
8/31/1971	780	161	16	42	44	237
9/30/1971	631	147	109	36	49	203
10/31/1971	448	129	80	23	37	188
11/30/1971	700	82	49	11	24	168
12/31/1971	1285	53	40	8	22	150
1/31/1972	1084	41	34	8	21	150
2/29/1972	1914	41	33	8	20	151
3/31/1972	3226	56	0	10	0	220
4/30/1972	2666	79	0	16	0	254
5/31/1972	2284	88	0	27	0	306
6/30/1972	1051	124	0	37	0	311
7/31/1972	831	157	0	44	0	272
8/31/1972	831	159	113	42	0	226
9/30/1972	646	145	109	36	0	195
10/31/1972	432	128	80	23	0	182
11/30/1972	1057	82	49	11	0	168
12/31/1972	2521	54	40	8	0	150
1/31/1973	5223	38	34	8	0	164
2/28/1973	4040	40	35	8	0	172
3/31/1973	3253	54	0	10	21	180
4/30/1973	3260	78	0	16	34	218
5/31/1973	3928	89	0	27	36	306
6/30/1973	1206	125	0	37	44	317
7/31/1973	888	159	0	44	43	278
8/31/1973	799	161	16	42	44	235
9/30/1973	713	147	109	36	49	201
10/31/1973	475	129	80	23	37	185
11/30/1973	3740	82	49	11	24	213
12/31/1973	4193	54	40	8	22	198
1/31/1974	6668	35	34	8	21	239
2/28/1974	2786	38	35	8	21	202
3/31/1974	7523	51	0	10	21	199
4/30/1974	5537	77	0	16	34	223
5/31/1974	4126	89	0	27	36	286
6/30/1974	2196	127	0	37	44	301
7/31/1974	1388	161	0	44	43	279
8/31/1974	898	163	16	42	44	236
9/30/1974	620	150	109	36	49	199
10/31/1974	378	130	80	23	37	181
11/30/1974	414	82	49	11	24	163
12/31/1974	593	52	40	8	22	150
1/31/1975	830	39	34	8	21	150
2/28/1975	2653	41	35	8	21	154
3/31/1975	3971	55	0	10	21	168
4/30/1975	3120	79	0	16	34	162
5/31/1975	5074	89	0	27	36	250
6/30/1975	2826	125	0	37	44	325
7/31/1975	1250	158	0	44	43	292
8/31/1975	939	160	16	42	44	246
9/30/1975	664	147	109	36	49	208
10/31/1975	673	128	80	23	37	201
11/30/1975	1022	82	49	11	24	184
12/31/1975	1091	54	40	8	22	150
1/31/1976	364	30	34	8	21	150
2/29/1976	398	31	33	8	20	150

3/31/1976	832	34	0	7	0	165
4/30/1976	857	44	0	10	0	186
5/31/1976	895	39	0	18	0	202
6/30/1976	492	60	0	24	0	187
7/31/1976	372	86	0	29	0	168
8/31/1976	462	112	57	28	0	146
9/30/1976	394	102	82	24	0	127
10/31/1976	256	97	60	15	0	118
11/30/1976	215	64	37	7	0	110
12/31/1976	187	41	30	5	0	102
1/31/1977	218	43	25	5	0	99
2/28/1977	224	45	26	5	0	99
3/31/1977	278	57	0	6	0	101
4/30/1977	388	79	0	10	0	112
5/31/1977	628	97	0	17	0	121
6/30/1977	459	129	0	23	0	116
7/31/1977	403	159	0	27	0	94
8/31/1977	474	160	77	26	0	68
9/30/1977	432	142	81	22	0	45
10/31/1977	259	117	59	14	0	33
11/30/1977	193	75	37	7	0	31
12/31/1977	1329	54	30	5	0	58
1/31/1978	4608	38	25	5	0	97
2/28/1978	2859	40	26	5	0	116
3/31/1978	4562	53	0	10	21	172
4/30/1978	4467	78	0	16	34	201
5/31/1978	4077	89	0	27	36	266
6/30/1978	2191	126	0	37	44	309
7/31/1978	1105	159	0	44	43	280
8/31/1978	834	161	16	42	44	238
9/30/1978	769	148	109	36	49	206
10/31/1978	381	129	80	23	37	189
11/30/1978	574	82	49	11	24	168
12/31/1978	527	53	40	8	22	150
1/31/1979	1415	41	34	8	21	152
2/28/1979	2121	42	35	8	21	150
3/31/1979	3076	56	0	10	0	179
4/30/1979	2906	79	0	16	0	220
5/31/1979	3646	88	0	27	0	315
6/30/1979	1113	124	0	37	0	322
7/31/1979	882	157	0	44	0	284
8/31/1979	894	159	105	42	0	236
9/30/1979	661	145	109	36	0	203
10/31/1979	454	128	80	23	0	192
11/30/1979	948	82	49	11	0	174
12/31/1979	1332	54	40	8	0	150
1/31/1980	9376	37	34	8	0	279
2/29/1980	7515	38	33	8	0	283
3/31/1980	4487	53	0	10	21	250
4/30/1980	3448	78	0	16	34	276
5/31/1980	3543	89	0	27	36	304
6/30/1980	2152	126	0	37	44	307
7/31/1980	1130	160	0	44	43	284
8/31/1980	859	162	16	42	44	242
9/30/1980	732	148	109	36	49	206
10/31/1980	414	129	80	23	37	190
11/30/1980	364	82	49	11	24	169
12/31/1980	540	53	40	8	22	150
1/31/1981	654	42	34	8	21	150
2/28/1981	1021	44	35	8	21	167
3/31/1981	1804	57	0	10	0	187

4/30/1981	1634	80	0	16	0	238
5/31/1981	956	88	0	27	0	276
6/30/1981	508	123	0	37	0	269
7/31/1981	604	156	0	44	0	235
8/31/1981	596	157	57	42	0	200
9/30/1981	493	144	109	36	0	171
10/31/1981	580	127	80	23	0	160
11/30/1981	4588	82	49	11	0	231
12/31/1981	7797	55	40	8	0	319
1/31/1982	5324	32	34	8	0	289
2/28/1982	9098	35	35	8	0	319
3/31/1982	6714	49	0	10	21	308
4/30/1982	11394	75	0	16	34	343
5/31/1982	7138	89	0	27	36	350
6/30/1982	3223	127	0	37	44	345
7/31/1982	1482	161	0	44	43	311
8/31/1982	1035	163	16	42	44	261
9/30/1982	939	150	109	36	49	228
10/31/1982	1060	129	80	23	37	238
11/30/1982	2480	82	49	11	24	218
12/31/1982	5290	51	40	8	22	207
1/31/1983	4424	31	34	8	21	179
2/28/1983	7957	34	35	8	21	160
3/31/1983	11330	48	0	10	21	174
4/30/1983	5818	73	0	16	34	158
5/31/1983	7602	85	0	27	36	235
6/30/1983	5512	122	0	37	44	349
7/31/1983	2633	156	0	44	43	347
8/31/1983	1425	158	16	42	44	298
9/30/1983	1236	145	109	36	49	246
10/31/1983	635	126	80	23	37	236
11/30/1983	5027	80	49	11	24	305
12/31/1983	9066	50	40	8	22	319
1/31/1984	3846	37	34	8	21	297
2/29/1984	3260	38	33	8	20	266
3/31/1984	3702	53	0	10	0	249
4/30/1984	2710	78	0	16	0	262
5/31/1984	3197	89	0	27	0	298
6/30/1984	1624	126	0	37	0	293
7/31/1984	899	160	0	44	0	259
8/31/1984	766	162	16	42	0	221
9/30/1984	633	148	109	36	0	189
10/31/1984	464	129	80	23	0	177
11/30/1984	1608	82	49	11	0	176
12/31/1984	1296	53	40	8	0	150
1/31/1985	580	42	34	8	0	150
2/28/1985	1119	43	35	8	0	159
3/31/1985	1502	57	0	10	0	175
4/30/1985	2671	80	0	16	0	250
5/31/1985	1389	88	0	27	0	302
6/30/1985	718	123	0	37	0	296
7/31/1985	721	156	0	44	0	260
8/31/1985	682	158	16	42	0	222
9/30/1985	654	144	109	36	0	191
10/31/1985	386	128	80	23	0	177
11/30/1985	736	82	49	11	0	163
12/31/1985	1507	55	40	8	0	150
1/31/1986	2742	36	34	8	0	170
2/28/1986	18546	39	35	8	0	295
3/31/1986	8595	52	0	10	21	319
4/30/1986	3346	77	0	16	34	319

5/31/1986	2682	89	0	27	36	322
6/30/1986	1457	127	0	37	44	304
7/31/1986	800	160	0	44	43	268
8/31/1986	776	162	57	42	44	226
9/30/1986	733	149	109	36	49	196
10/31/1986	488	129	80	23	37	183
11/30/1986	461	82	49	11	24	166
12/31/1986	477	53	40	8	22	150
1/31/1987	433	43	34	8	21	148
2/28/1987	1154	44	35	8	21	160
3/31/1987	1532	58	0	8	0	183
4/30/1987	1382	80	0	12	0	231
5/31/1987	802	88	0	21	0	249
6/30/1987	473	123	0	28	0	237
7/31/1987	597	155	0	34	0	205
8/31/1987	604	157	79	32	0	170
9/30/1987	495	144	96	28	0	143
10/31/1987	319	127	70	18	0	129
11/30/1987	215	82	43	9	0	123
12/31/1987	747	55	35	6	0	127
1/31/1988	1382	43	30	6	0	128
2/29/1988	752	43	29	6	0	139
3/31/1988	1001	58	0	8	0	162
4/30/1988	1091	80	0	12	0	190
5/31/1988	921	88	0	21	0	204
6/30/1988	590	123	0	28	0	196
7/31/1988	657	155	66	34	0	163
8/31/1988	565	157	100	32	0	130
9/30/1988	475	144	87	28	0	104
10/31/1988	284	127	63	18	0	90
11/30/1988	884	82	39	9	0	97
12/31/1988	747	55	32	6	0	90
1/31/1989	702	39	27	6	0	91
2/28/1989	996	41	27	6	0	105
3/31/1989	6439	55	0	10	21	211
4/30/1989	3453	79	0	16	34	311
5/31/1989	2262	89	0	27	36	323
6/30/1989	1024	125	0	37	44	320
7/31/1989	820	158	21	44	43	279
8/31/1989	854	160	126	42	44	230
9/30/1989	628	146	109	36	49	199
10/31/1989	542	128	80	23	37	189
11/30/1989	824	82	49	11	24	167
12/31/1989	768	54	40	8	22	144
1/31/1990	991	42	34	8	21	145
2/28/1990	868	43	35	8	21	151
3/31/1990	1766	57	0	8	0	181
4/30/1990	1584	80	0	12	0	235
5/31/1990	1005	88	0	21	0	264
6/30/1990	932	123	2	28	0	267
7/31/1990	831	156	116	34	0	225
8/31/1990	710	158	115	32	0	183
9/30/1990	588	144	101	28	0	153
10/31/1990	316	128	73	18	0	138
11/30/1990	207	82	19	9	0	131
12/31/1990	189	55	0	6	0	126
1/31/1991	192	42	3	6	0	122
2/28/1991	226	44	0	6	0	122
3/31/1991	2395	57	0	10	0	153
4/30/1991	2096	80	0	16	0	193
5/31/1991	1849	88	0	27	0	257

6/30/1991	1066	123	0	37	0	274
7/31/1991	866	156	47	44	0	238
8/31/1991	820	158	126	42	0	195
9/30/1991	605	144	109	36	0	165
10/31/1991	417	127	80	23	0	151
11/30/1991	428	82	49	11	0	140
12/31/1991	419	55	40	8	0	129
1/31/1992	314	43	34	8	0	130
2/29/1992	1884	43	8	8	0	145
3/31/1992	1499	58	0	8	0	173
4/30/1992	1449	80	0	12	0	217
5/31/1992	609	88	0	21	0	223
6/30/1992	427	123	0	28	0	211
7/31/1992	558	155	0	34	0	185
8/31/1992	599	157	106	32	0	152
9/30/1992	465	144	99	28	0	128
10/31/1992	346	127	72	18	0	115
11/30/1992	212	82	45	9	0	109
12/31/1992	1013	55	36	6	0	112
1/31/1993	4306	38	31	6	0	146
2/28/1993	3765	40	31	6	0	140
3/31/1993	6151	54	0	10	21	166
4/30/1993	4334	78	0	16	34	212
5/31/1993	4408	89	0	27	36	296
6/30/1993	2800	126	0	37	44	325
7/31/1993	1161	159	0	44	43	293
8/31/1993	902	161	16	42	44	247
9/30/1993	676	148	109	36	49	211
10/31/1993	391	129	80	23	37	196
11/30/1993	517	82	49	11	24	171
12/31/1993	744	53	40	8	22	150
1/31/1994	377	43	34	8	21	149
2/28/1994	853	44	35	8	21	154
3/31/1994	1268	58	0	8	0	178
4/30/1994	1117	80	0	12	0	214
5/31/1994	999	88	0	21	0	242
6/30/1994	475	123	0	28	0	233
7/31/1994	589	155	0	34	0	201
8/31/1994	491	157	0	32	0	172
9/30/1994	467	144	90	28	0	145
10/31/1994	298	127	70	18	0	131
11/30/1994	464	82	43	9	0	130
12/31/1994	1362	55	35	6	0	128
1/31/1995	8132	32	30	6	0	195
2/28/1995	3763	35	30	6	0	180
3/31/1995	11418	49	0	10	21	236
4/30/1995	6512	74	0	16	34	259
5/31/1995	7757	86	0	27	36	335
6/30/1995	5640	124	0	37	44	350
7/31/1995	2388	157	0	44	43	341
8/31/1995	1285	159	16	42	44	289
9/30/1995	1080	146	109	36	49	238
10/31/1995	464	127	80	23	37	222
11/30/1995	838	81	49	11	24	182
12/31/1995	2154	50	40	8	22	158
1/31/1996	3345	37	34	8	21	156
2/29/1996	8267	38	33	8	20	209
3/31/1996	5514	53	0	10	21	203
4/30/1996	4324	78	0	16	34	252
5/31/1996	6217	89	0	27	36	328
6/30/1996	2213	126	0	37	44	307

7/31/1996	1066	160	0	44	43	270
8/31/1996	867	162	16	42	44	228
9/30/1996	733	148	109	36	49	195
10/31/1996	435	129	80	23	37	179
11/30/1996	1255	82	49	11	24	182
12/31/1996	9789	53	40	8	22	268
1/31/1997	17683	36	34	8	21	319
2/28/1997	3995	38	35	8	21	290
3/31/1997	2874	52	0	10	0	274
4/30/1997	2787	77	0	16	0	299
5/31/1997	2303	89	0	27	0	307
6/30/1997	1076	127	0	37	0	301
7/31/1997	793	161	0	44	0	265
8/31/1997	712	163	16	42	0	227
9/30/1997	657	149	109	36	0	195
10/31/1997	439	130	80	23	0	181
11/30/1997	677	83	49	11	0	163
12/31/1997	851	53	40	8	0	150
1/31/1998	4497	36	34	8	0	166
2/28/1998	7116	38	35	8	0	143
3/31/1998	5357	52	0	10	21	151
4/30/1998	5347	77	0	16	34	162
5/31/1998	5626	89	0	27	36	204
6/30/1998	4479	127	0	37	44	315
7/31/1998	2001	161	0	44	43	300
8/31/1998	1073	163	16	42	44	252
9/30/1998	893	149	109	36	49	217
10/31/1998	506	129	80	23	37	202
11/30/1998	1103	82	49	11	24	181
12/31/1998	1957	53	40	8	22	150
1/31/1999	3639	38	34	8	21	156
2/28/1999	6983	40	35	8	21	167
3/31/1999	4415	54	0	10	21	163
4/30/1999	3676	78	0	16	34	188
5/31/1999	4074	89	0	27	36	272
6/30/1999	2127	125	0	37	44	311
7/31/1999	1095	159	0	44	43	277
8/31/1999	911	161	16	42	44	235
9/30/1999	724	147	109	36	49	201
10/31/1999	460	129	80	23	37	186
11/30/1999	634	82	49	11	24	167
12/31/1999	644	54	40	8	22	150
1/31/2000	2479	39	34	8	21	156
2/29/2000	5485	40	33	8	20	193
3/31/2000	3646	55	0	10	21	219
4/30/2000	3121	79	0	16	34	270
5/31/2000	2818	88	0	27	36	316
6/30/2000	936	125	0	37	44	320
7/31/2000	920	158	0	44	43	279
8/31/2000	840	160	16	42	44	236
9/30/2000	719	146	109	36	49	203
10/31/2000	499	128	80	23	37	188
11/30/2000	628	82	49	11	24	166
12/31/2000	661	54	40	8	22	150
1/31/2001	438	43	34	8	21	148
2/28/2001	948	44	35	8	21	151
3/31/2001	1813	58	0	10	0	180
4/30/2001	1786	80	0	16	0	219
5/31/2001	1318	88	0	27	0	265
6/30/2001	491	123	0	37	0	255
7/31/2001	596	155	21	44	0	224

8/31/2001	600	157	126	42	0	190
9/30/2001	448	144	109	36	0	166
10/31/2001	291	127	80	23	0	151
11/30/2001	495	82	49	11	0	151
12/31/2001	1684	55	40	8	0	150
1/31/2002	2125	41	34	8	0	152
2/28/2002	2067	42	35	8	0	168
3/31/2002	2940	56	0	10	0	200
4/30/2002	3216	79	0	16	0	258
5/31/2002	2244	88	0	27	0	308
6/30/2002	1023	124	0	37	0	316
7/31/2002	830	157	0	44	0	278
8/31/2002	782	159	16	42	0	236
9/30/2002	621	145	109	36	0	202
10/31/2002	339	128	80	23	0	186
11/30/2002	812	82	49	11	0	173
12/31/2002	2312	54	40	8	0	150
1/31/2003	2581	39	34	8	0	162
2/28/2003	1545	41	35	8	0	177
3/31/2003	2181	55	0	10	21	210
4/30/2003	3752	79	0	16	34	232
5/31/2003	4781	89	0	27	36	294
6/30/2003	1598	125	0	37	44	316
7/31/2003	937	158	0	44	43	278
8/31/2003	847	160	16	42	44	236
9/30/2003	712	147	109	36	49	201
10/31/2003	363	128	80	23	37	185
11/30/2003	509	82	49	11	24	165
12/31/2003	1687	54	40	8	22	150

ATTACHMENT D: South Fork American River Folsom Reservoir Inflows and Reservoir Storage

List of Tables

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Attachment D Table 1. Annual Scaling Factors Used in the Development of the South Fork American River Folsom Reservoir Inflows.

Water Year	2009 Demand Annual Scaling Factor	Water Year	2009 Demand Annual Scaling Factor	Water Year	2009 Demand Annual Scaling Factor
1922	0.991947	1956	0.932391	1990	1.027785
1923	1.048413	1957	1.016204	1991	1.078198
1924	0.954349	1958	1.008807	1992	1.016806
1925	0.997309	1959	0.961628	1993	1.030506
1926	0.973109	1960	0.967893	1994	1.033362
1927	1.033466	1961	0.921631	1995	0.970782
1928	1.023316	1962	1.006106	1996	0.952058
1929	0.954839	1963	1.032122	1997	0.958499
1930	1.021519	1964	1.063297	1998	0.986935
1931	0.976178	1965	0.925027	1999	0.933955
1932	0.997491	1966	1.026137	2000	1.005526
1933	0.951615	1967	1.012824	2001	0.940152
1934	0.958717	1968	1.016321	2002	1.032982
1935	1.011350	1969	1.033165	2003	1.041193
1936	1.005265	1970	1.054827		
1937	1.006984	1971	1.057821		
1938	1.016065	1972	1.048324		
1939	0.953090	1973	1.058273		
1940	1.028617	1974	1.065064		
1941	1.038651	1975	1.076527		
1942	1.026152	1976	1.067098		
1943	1.064644	1977	0.508950		
1944	1.007937	1978	1.032301		
1945	1.038617	1979	1.004812		
1946	1.057131	1980	0.969271		
1947	1.014071	1981	1.029907		
1948	0.996438	1982	1.060684		
1949	1.005650	1983	1.008785		
1950	1.009184	1984	0.964321		
1951	0.968588	1985	1.021483		
1952	1.024709	1986	1.007475		
1953	1.009170	1987	1.008678		
1954	1.017065	1988	1.058430		
1955	1.027808	1989	1.161153		

Attachment D Table 2. South Fork American River Folsom Reservoir Monthly Inflows (CalSim II I8-Local Inflow) (WY 1922-2003).

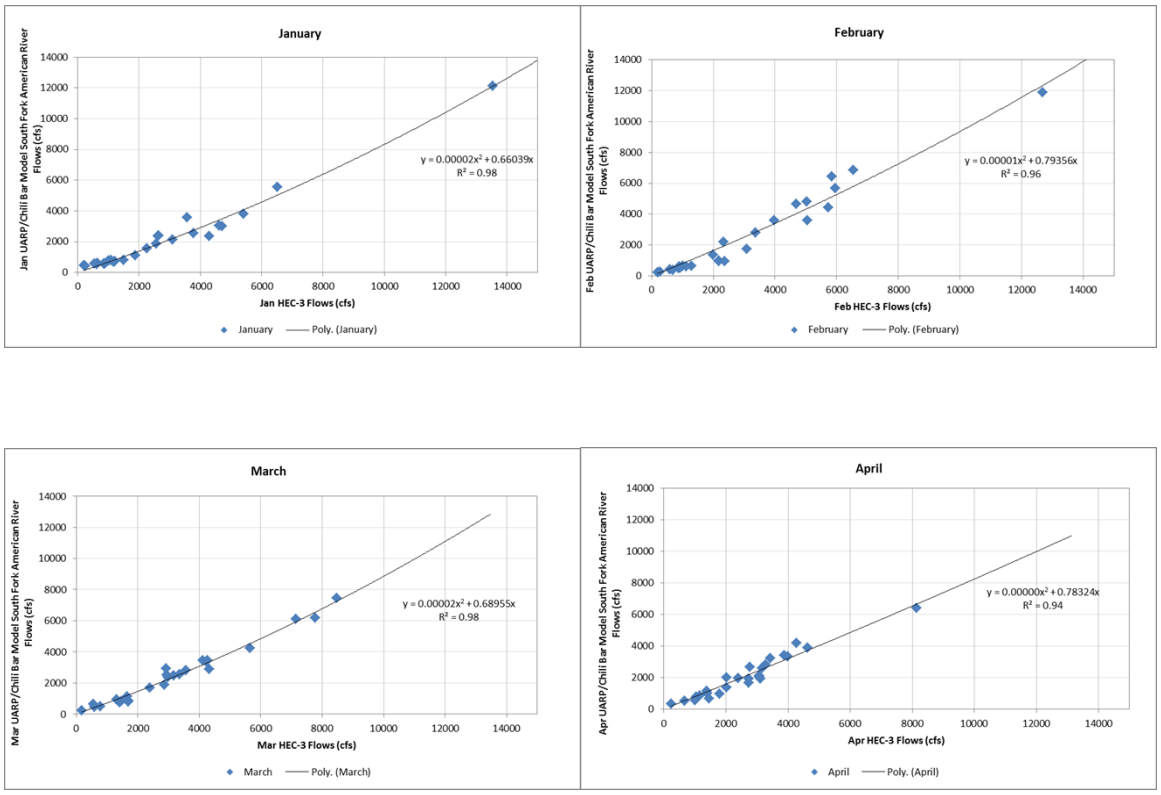
	Monthly Average Flow, cfs											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1921										476	579	911
1922	827	2645	1619	2203	4633	4738	1279	806	890	756	699	2361
1923	1785	1229	1052	2808	3344	1723	1238	914	1034	609	496	486
1924	321	507	229	375	625	801	618	460	479	593	558	580
1925	438	3123	1226	2545	2990	1875	1043	830	937	683	557	602
1926	463	1533	726	2191	777	429	554	423	864	755	1034	831
1927	1354	4900	2125	3697	3257	3349	1242	933	1021	758	818	747
1928	731	971	4803	2820	1937	741	581	708	984	604	533	543
1929	389	636	644	810	1093	899	542	497	847	599	541	894
1930	918	894	1457	1491	998	954	603	772	947	537	562	499
1931	431	425	486	579	814	990	622	452	494	538	524	732
1932	828	2320	1153	1468	2146	2705	1288	827	921	587	519	521
1933	439	427	604	853	974	1390	544	704	835	668	543	717
1934	904	963	957	715	452	320	548	363	556	698	666	633
1935	973	896	1108	3797	3097	2884	1058	862	982	775	603	595
1936	2112	5873	1986	3044	2908	3148	1325	884	1013	695	555	575
1937	573	2653	2384	2098	3121	1355	907	843	954	754	665	1751
1938	1245	4422	4442	3408	4816	4902	1773	1048	1085	669	551	547
1939	473	567	846	963	601	383	542	370	825	786	591	611
1940	2476	3916	4277	3572	2802	1357	863	857	1028	736	627	1253
1941	1655	2841	2138	2160	3470	2170	1209	950	1076	759	673	1503
1942	3312	4001	1515	3078	3814	3969	1865	1089	1076	748	1016	1303
1943	3935	3127	6031	3488	2603	1841	1234	1009	1069	673	570	579
1944	546	1072	1223	950	1384	987	674	834	970	756	896	820
1945	715	4012	1405	1812	2876	1658	1077	857	1005	912	935	3194
1946	1994	1094	1614	2576	2952	1319	899	888	1066	740	709	691
1947	478	931	1219	1102	899	659	576	677	946	963	617	561
1948	1031	552	806	2293	2439	2970	1166	856	977	670	580	623
1949	482	682	1891	1870	2434	950	604	795	960	666	589	563
1950	1630	2123	1492	2909	2732	2594	1168	888	1002	915	5083	6696
1951	3685	3277	3004	2618	2920	1084	598	877	1007	895	768	1769
1952	3665	3259	2994	3783	5073	5527	2167	1415	1287	987	607	796
1953	2005	840	949	1957	2029	3295	1671	1061	1062	739	666	660
1954	772	1093	1788	2425	1595	676	578	848	1026	683	588	800
1955	1135	753	661	1078	1466	1062	652	859	996	667	550	8580
1956	4944	2651	1908	2266	3446	3454	1435	1004	1006	903	616	649
1957	601	1527	2092	1260	2482	1743	837	894	992	807	634	788
1958	1065	3623	3007	5145	4754	4156	1639	1244	1117	675	563	539
1959	873	1278	707	912	643	488	547	384	948	637	524	525
1960	549	1527	1605	1378	861	547	552	581	853	553	552	532
1961	350	504	495	643	766	497	531	348	777	644	566	616
1962	482	2352	1116	2168	1680	1331	720	748	922	1849	700	872
1963	1275	4283	1653	3163	3623	1813	907	864	1069	820	1040	790
1964	1181	737	598	912	1120	855	632	889	984	643	640	9331
1965	4052	2192	1766	3349	2769	2011	1257	1146	1064	849	741	765
1966	911	931	909	1711	953	320	586	564	943	675	713	1243
1967	2499	1638	2625	2782	4296	5036	2300	1130	1221	1060	788	681
1968	821	2288	1258	1018	793	453	581	662	941	760	793	966
1969	5435	4253	2129	3476	4438	4290	1524	1045	1167	958	681	1400
1970	5626	2893	2691	1774	1804	1436	762	916	1045	702	1090	2083
1971	1701	1239	1810	1936	2586	2801	1410	1043	1013	807	691	1004
1972	776	1205	1949	1213	1609	836	634	858	1022	824	813	1023
1973	3497	3421	1942	1959	3243	1290	818	874	1154	926	1600	2449
1974	3638	2277	3862	3704	3434	2746	1624	1223	1283	556	622	670

1975	791	995	1888	1383	3311	3453	1370	970	1115	1179	761	723
1976	631	415	447	513	640	590	535	535	437	421	444	409
1977	467	237	232	339	419	676	499	445	386	360	473	911
1978	2139	1371	2350	2573	2576	2379	1034	894	1361	946	588	580
1979	1128	937	1681	1982	3286	1474	760	720	991	1056	701	705
1980	5570	6420	2834	2099	2726	2172	1417	1011	1181	934	543	591
1981	733	647	862	1136	1092	808	593	507	448	517	1550	3018
1982	3016	6864	4232	6392	5436	3494	1558	1110	1475	1514	1544	3236
1983	3046	5676	7465	4189	5007	7455	4253	1731	1420	1192	4073	7198
1984	3572	2792	2541	1651	2411	1827	959	850	1057	1076	1033	917
1985	754	655	757	1973	1389	881	609	557	1104	576	637	880
1986	1854	11912	6100	3214	2571	1981	968	899	1135	1063	554	498
1987	576	618	843	773	714	624	551	486	424	437	494	593
1988	805	392	493	559	595	710	558	472	423	403	591	548
1989	580	492	2890	1908	1547	1260	655	588	1105	880	658	511
1990	709	538	939	996	822	903	598	509	552	443	459	444
1991	443	265	1127	949	1179	1200	656	550	585	500	563	479
1992	524	952	779	830	589	592	563	483	429	435	469	877
1993	2359	1745	3358	2802	3793	2612	1257	936	1162	922	566	590
1994	577	599	662	665	715	708	583	470	427	429	650	948
1995	3796	2179	6182	3879	5825	5411	3851	1498	1382	1010	652	1086
1996	2384	4654	3445	3404	4275	2285	1097	847	1128	1043	1057	4691
1997	12125	3610	2515	2045	2423	1663	796	746	1126	1003	634	655
1998	2564	4418	3464	3316	3825	6158	3314	1260	1424	1019	838	956
1999	2353	4800	2910	2656	3377	3127	1336	1076	1183	1014	645	605
2000	1554	3604	2471	1911	2687	1495	777	732	858	1047	611	618
2001	582	797	803	1009	868	315	534	359	964	688	660	972
2002	1314	1374	1594	2071	1802	1033	590	818	1021	660	710	1012
2003	1224	993	1103	1943	3418	1749	838	888	980			

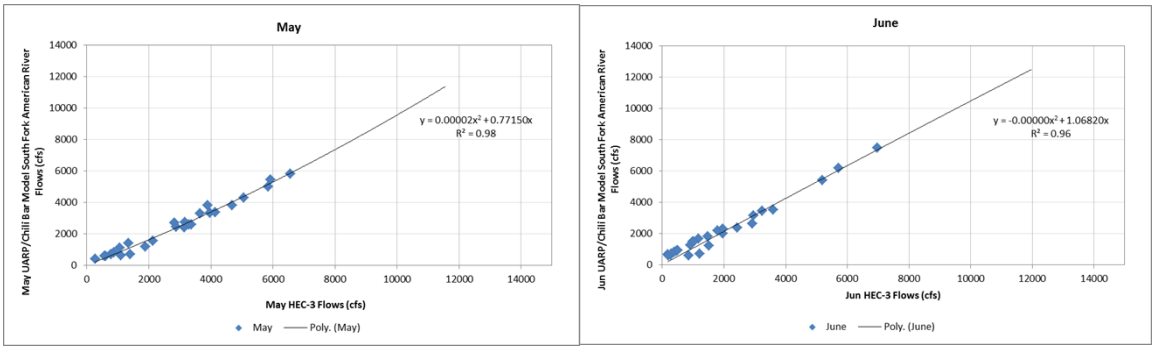
Attachment D Table 3. Union Valley Reservoir Monthly Storage (CalSim II Node 48) (WY 1922-2003).

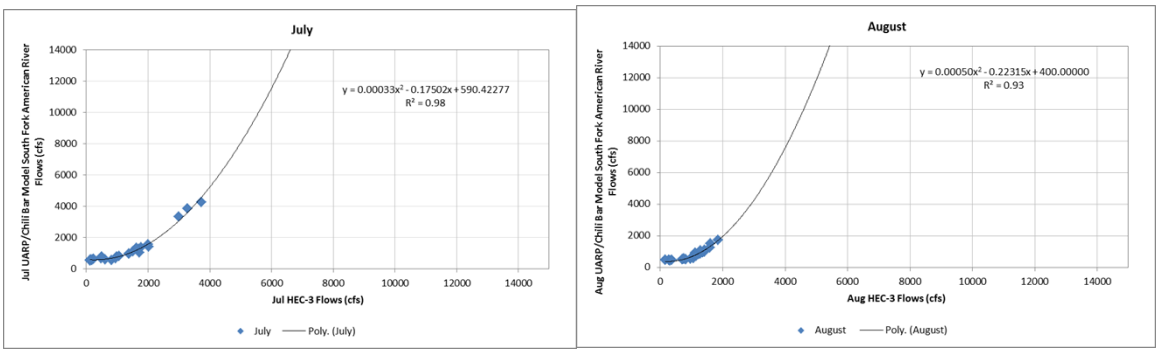
Year	Monthly Union Valley Storage (TAF)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1921	-	-	-	-	-	-	-	-	-	140	120	105
1922	105	118	129	162	237	274	240	195	160	140	120	108
1923	105	116	135	180	220	264	240	195	160	140	120	105
1924	105	118	125	140	141	122	91	65	46	31	23	21
1925	31	75	108	180	225	270	240	195	160	140	120	105
1926	105	116	140	180	208	210	212	195	160	140	120	105
1927	105	120	140	180	224	270	240	195	160	140	122	105
1928	105	115	153	180	220	224	235	195	160	140	120	105
1929	105	108	116	138	189	208	219	195	160	140	120	105
1930	105	120	140	180	220	240	240	195	160	140	120	105
1931	105	110	122	140	141	122	91	65	46	31	20	22
1932	26	34	61	115	220	270	240	195	160	140	120	105
1933	105	106	108	133	177	228	240	195	160	140	120	105
1934	105	120	140	166	174	177	176	181	160	140	120	105
1935	105	113	122	180	241	270	240	195	160	140	120	105
1936	105	120	140	196	254	278	240	195	160	140	120	105
1937	105	115	128	170	232	270	240	195	160	140	120	135
1938	114	120	140	180	262	280	242	195	160	140	120	105
1939	105	109	126	178	196	199	202	195	160	140	120	105
1940	108	120	154	185	226	268	240	195	160	140	120	105
1941	105	120	140	178	236	270	240	195	160	140	120	116
1942	116	120	138	180	220	270	245	195	160	140	120	118
1943	128	122	147	182	220	265	240	195	160	140	120	105
1944	105	110	120	142	220	248	240	195	160	140	120	105
1945	105	120	135	180	220	270	240	195	160	140	121	115
1946	105	120	140	180	222	266	240	195	160	140	120	105
1947	105	119	140	178	220	225	232	195	160	140	120	105
1948	105	118	126	160	220	270	240	195	160	140	120	105
1949	105	109	119	180	220	247	240	195	160	140	120	105
1950	105	120	140	180	236	270	240	195	160	140	206	268
1951	255	243	222	224	222	240	240	195	160	140	120	105
1952	105	120	135	180	276	280	265	218	174	140	120	105
1953	105	120	139	180	220	270	244	195	160	140	120	105
1954	105	119	140	180	220	230	240	195	160	140	120	105
1955	105	111	123	148	218	251	240	195	160	140	120	175
1956	207	199	189	198	248	270	240	195	160	140	120	105
1957	105	120	140	180	220	263	240	195	160	140	120	105
1958	105	120	139	180	265	280	249	197	160	140	120	105
1959	105	118	139	175	198	202	205	195	160	140	120	105
1960	105	120	140	180	215	225	234	195	160	140	120	105
1961	105	120	136	165	197	203	204	195	160	140	120	105
1962	105	120	132	180	220	258	240	195	160	150	120	106
1963	112	143	140	180	228	262	240	195	160	140	128	105
1964	105	116	130	165	220	242	240	195	160	140	120	210
1965	222	214	197	216	230	270	240	201	162	140	120	105
1966	105	113	139	180	220	224	227	195	160	140	120	115
1967	105	120	140	159	220	280	277	241	196	154	120	105
1968	105	120	140	177	213	219	229	195	160	140	125	105
1969	143	136	140	180	265	280	254	204	165	140	120	128
1970	211	208	196	180	220	257	240	195	160	140	126	111
1971	105	120	140	180	220	270	240	195	160	140	120	105
1972	105	120	140	180	220	248	240	195	160	140	120	117
1973	123	120	140	180	226	270	240	195	160	140	150	153
1974	176	164	172	180	226	270	249	200	161	136	124	115
1975	115	128	128	138	236	265	244	218	177	154	149	140
1976	140	142	152	169	188	172	148	124	111	94	79	67

Year	Monthly Union Valley Storage (TAF)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1977	58	58	60	67	79	68	54	35	24	17	9	14
1978	24	40	91	142	214	256	251	222	173	140	123	114
1979	128	137	154	191	258	255	238	216	177	142	135	133
1980	206	205	170	196	244	255	251	221	177	141	124	114
1981	116	133	148	184	210	199	180	160	143	127	183	217
1982	185	209	194	216	269	262	250	220	176	182	186	185
1983	159	140	147	153	248	275	258	228	190	164	227	233
1984	213	177	174	193	252	261	243	219	177	141	150	148
1985	155	165	179	220	248	232	210	194	155	138	126	136
1986	173	231	227	230	261	263	244	218	175	140	123	112
1987	107	116	132	164	185	170	147	127	113	97	84	80
1988	83	91	107	126	146	131	106	81	66	49	39	34
1989	33	46	134	223	261	253	230	213	167	141	128	119
1990	132	139	163	202	222	212	190	171	154	137	120	108
1991	104	105	130	161	203	207	189	171	153	138	124	114
1992	110	122	142	176	184	169	146	125	110	92	79	76
1993	104	127	160	206	246	264	244	218	173	141	123	112
1994	109	111	129	153	182	168	145	125	110	95	86	84
1995	136	140	170	199	248	270	256	227	184	154	136	149
1996	159	186	191	210	265	264	239	219	177	138	150	203
1997	225	203	196	228	264	263	244	225	176	139	124	119
1998	158	138	152	180	239	269	256	224	178	149	139	147
1999	163	154	146	168	247	265	244	217	174	140	124	116
2000	147	161	160	221	266	262	243	215	180	128	85	43
2001	32	35	59	90	113	106	97	86	84	92	98	112
2002	124	141	169	226	253	260	236	203	166	139	130	155
2003	149	150	179	210	253	254	222	195	186	-	-	-

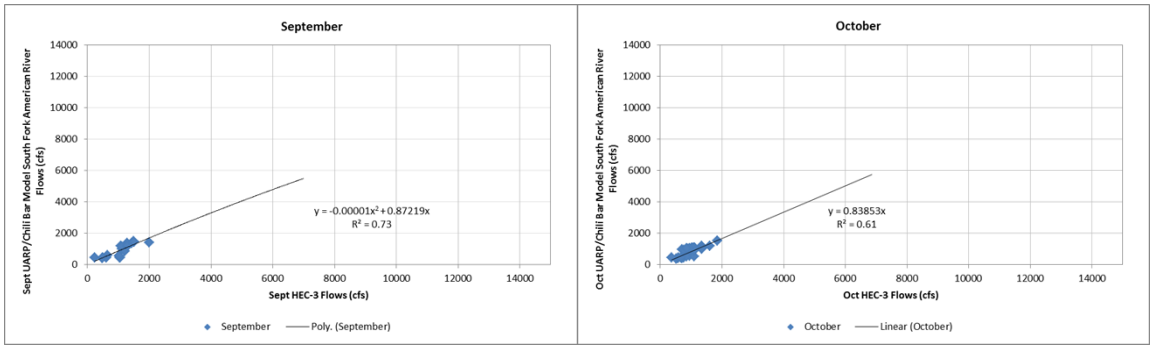


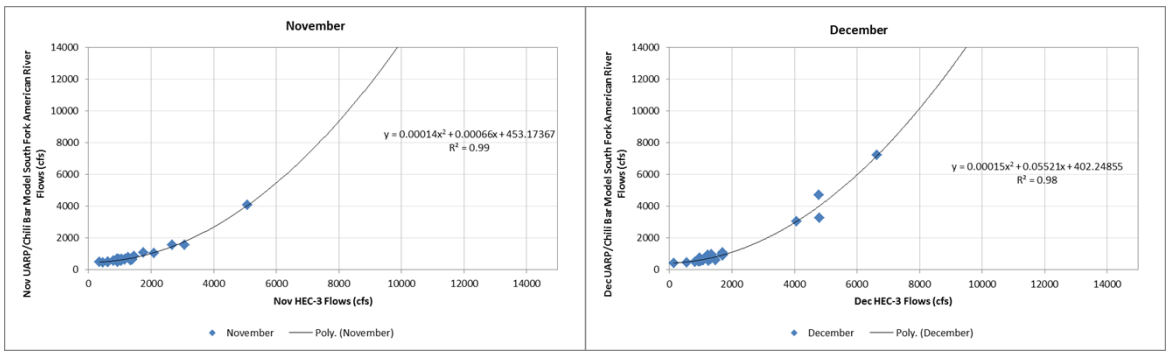
Attachment D Figure 1.HEC-3 Folsom Reservoir Monthly Inflows vs UARP/Chili Bar ResSim Folsom Reservoir Monthly Inflows (WY 1975-2000).





Attachment D Figure 1 (cont.).HEC-3 Folsom Reservoir Monthly Inflows vs UARP/Chili Bar ResSim Folsom Reservoir Monthly Inflows (WY 1975-2000).





Attachment D Figure 1 (cont.).HEC-3 Folsom Reservoir Monthly Inflows vs UARP/Chili Bar ResSim Folsom Reservoir Monthly Inflows (WY 1975-2000).

Attachment D Figure 2. Scaling Factor Calculation.

Error! Bookmark not defined. $M_{i,j} \times \frac{A_j}{\Sigma M_j} = Annual\ Scaling\ Factor$

Where $M_{i,j}$: monthly volume for month *i* in year *j*

A_j: Annual total volume for year *j*

$\sum M_{i,j}$: Sum of all months within year *j*

ATTACHMENT E: Yuba-Bear Drum-Spaulding Operations Model

Folsom Reservoir inflows from the Yuba/Bear River watershed were generated using the YBDS Project operations model (YBDS Operations model) (USACE-HEC ResSim model, version 3.0). The YBDS Project operations model was developed for the FERC relicensing of the YBDS Projects to characterize flow conditions and operations of the two projects[12] and to compare impacts of alternatives. The model was originally developed for existing (2001-2009) and future (2062) levels of demand over a WY 1976-2008 period of record.

YBDS Operations Model Modifications

The YBDS Operations model was modified to generate the monthly inflow hydrology. These modifications included:

- Use of NID and PCWA demands that more accurately estimate supply deficits in drier years;
- Inclusion of flow and reservoir conditions set forth in the new USDA-FS Final Section 4(e) conditions[13], the Bureau of Land Management (BLM) Final Section 4(e) conditions[14], and the licensees[15] that were negotiated by stakeholders; and
- Use of the water year type designation specified in the USDA-FS and BLM Final Section 4(e) conditions that alleviate very difficult water supply shortages for consumptive use in infrequent years with extremely dry conditions[16].

[12] The Operations Model is described in various YBDS relicensing documents including in Section E in the Final License applications and Section E in the Amended License Applications, including: Pacific Gas and Electric Company submits the Final License Application for the Drum-Spaulding Project, FERC Project No. 2310 (April 12, 2011), FERC eLibrary Nos. 20110412-5005 through – 5007 and Amendment to Application of Pacific Gas and Electric Company under P-2310 et.al Transmittal of Amended Applications. (June 18, 2012). FERC eLibrary Nos. 20120618-5022, 5023, and 5118.

[13] Forest Service Final Section 4(e) Conditions, 10(a) Recommendations, Response to Alternative Conditions, and Rationale for Streamflow Information under P-2310. (Nov. 21, 2013). FERC eLibrary No. 20131121-5142.

[14] FINAL Comments, Section 4(e) Conditions and Recommendations BLM - CALIFORNIA under P-2266. (Nov. 21, 2013). FERC eLibrary No. 20131121-5201.

[15] For the reaches not included the USDA-FS or BLM Final 4(e) Conditions, instream flows and reservoir operations included in the licensees' amended applications were used. Amendment to Application of Pacific Gas and Electric Company, Pac. Gas & Elec. Co., Project No. 2310-193 (June 18, 2012), FERC eLibrary No. 20120618-5022 ("License Application Amendment"). Amendment to Application of Nevada Irrigation District under P-2266-096. Yuba-Bear Hydroelectric P-2266 et al. (June 18, 2012). FERC eLibrary No. 20120618-5134.

[16] This USDA-FS and BLM Final Section 4(e) condition water year type designation applies to four specific reaches. The condition specifies that in the second year of two sequential Critically Dry (or drier) years, Extreme Critically Dry water year type flows are implemented. This water year type designation would have been implemented twice within the 1901-2011 period of record. For this modeling, the water year type designation was applied to all reaches, which would result in small differences in

For the YBDS relicensing proceeding, the YBDS Operations model was developed using existing NID and PCWA demands based on average water use between 2001 and 2009[17]. For modeling, PCWA used the highest annual demand levels from 2001-2009 to characterize existing PCWA and NID existing demands in its YBDS Operations model runs. PCWA used its full PG&E contract amount of 100,400 ac-ft for both existing and future levels of demand. PCWA uses all of its 100,400 ac-ft contract water from PG&E in drier years (Attachment E Figure 1). The changes in the NID and PCWA annual demand levels were included to accurately estimate supply deficits in drier years.

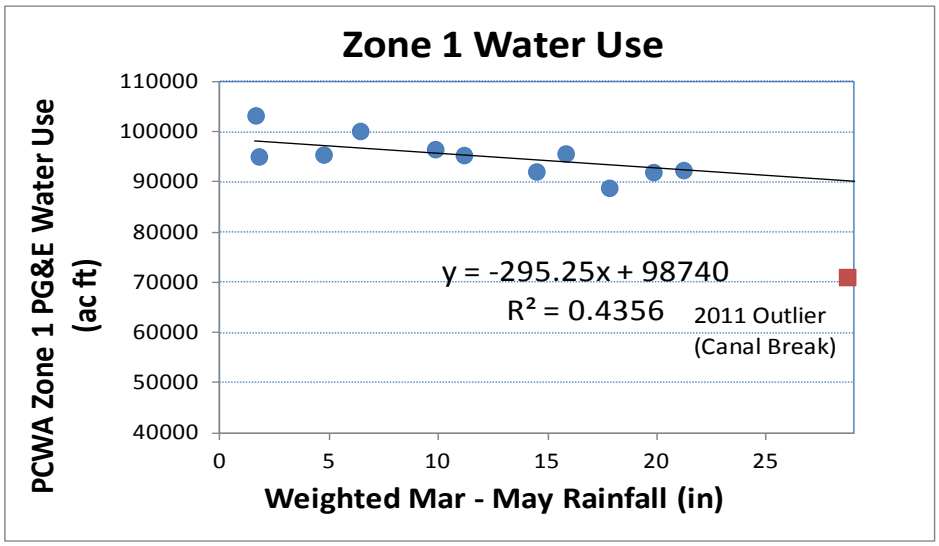
Future Demand

To determine the 2043 future level of demand, PCWA linearly interpolated between the South Canal modeled flows (flow into Newcastle Powerhouse) using the PCWA's existing and NID's peak demand (2001-2009) and South Canal modeled flows using the 2062 future demand (WY 1976-2003). The South Canal flows calculated with 2009, 2043, and 2062 level of demands are shown in Attachment D Figure 2. The assumption in this approach is that changes in demand will occur linearly over time.

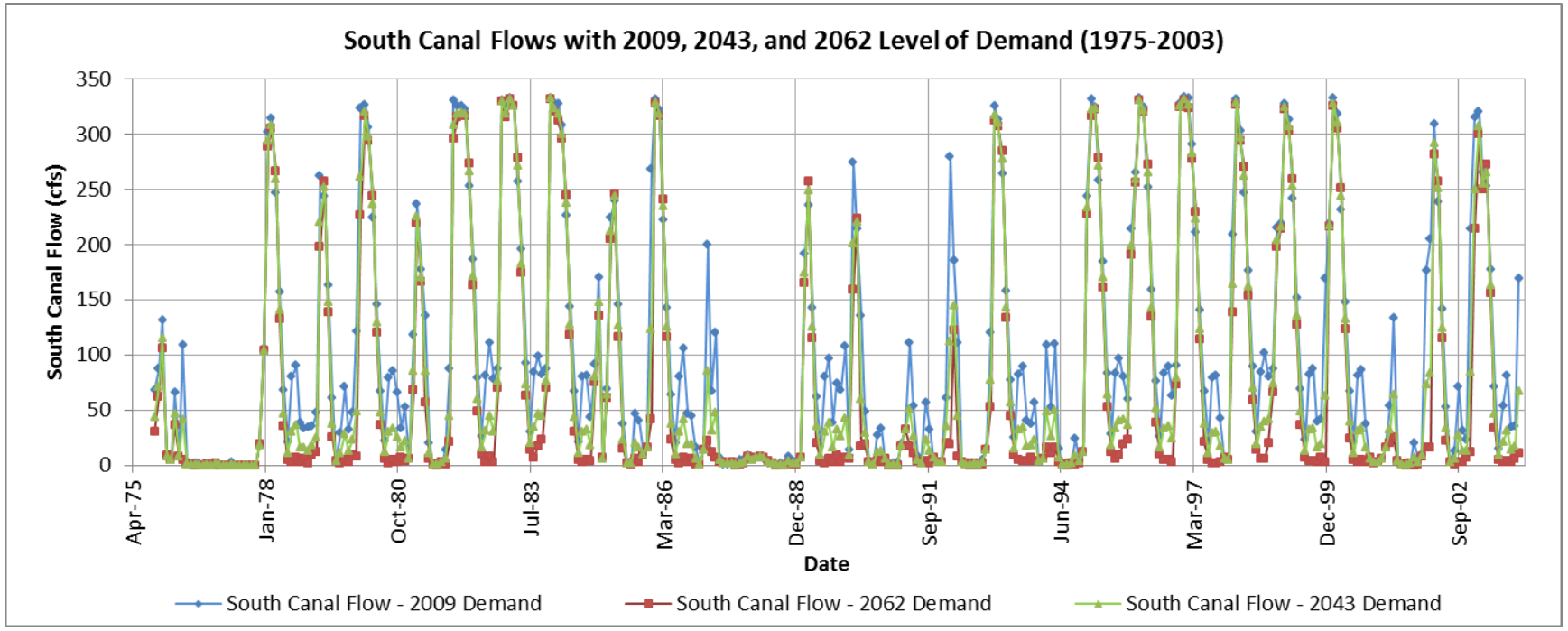
flows in eight YBDS project reaches. This would result in a very minor under-estimation of inflows into Folsom Reservoir in the years when this water year type designation would be implemented.

[17] This approach neglects the fact that "average" demand does not represent either PCWA's actual demand in the year with low spring rainfall or the existing contracts between PG&E and PCWA for water deliveries from the Drum-Spaulding Project. By substituting a lower "average" demand for PCWA's actual demand in years when PCWA fully utilizes its contracted water amounts, PG&E's Operations Model runs underestimate water supply impacts on Placer County residents. PCWA filed numerous documents with FERC as part of the relicensing related to this issue, including Motion to Intervene of the Placer County Water Agency under P-2310 (Jul 30, 2012), FERC eLibrary No. 20120730-5131; Comments of Placer County Water Agency on Amended License Application for the Drum-Spaulding Project, Pacific Gas and Electric Company, Project No. 2310-193 (Jul 30, 2012), FERC eLibrary No. 20120730-5131; and Comments of Placer County Water Agency on PG&E's Draft License Application for the Drum-Spaulding Project (FERC Project No. 2310) (Jan. 28, 2011), FERC eLibrary No. 20110128-5024.

Attachment D Figure 1. Regression of PCWA's PG&E Contract Water Use in Zone 1 with Weighted March – May Rainfall (weighted by month based on irrigation demand).



Attachment E Figure 2. Modeled South Canal Flows Calculated with 2009, 2043 (interpolation), and 2062 Levels of Demand.



ATTACHMENT F: Yuba/Bear River South Canal Folsom Reservoir Inflows

List of Tables

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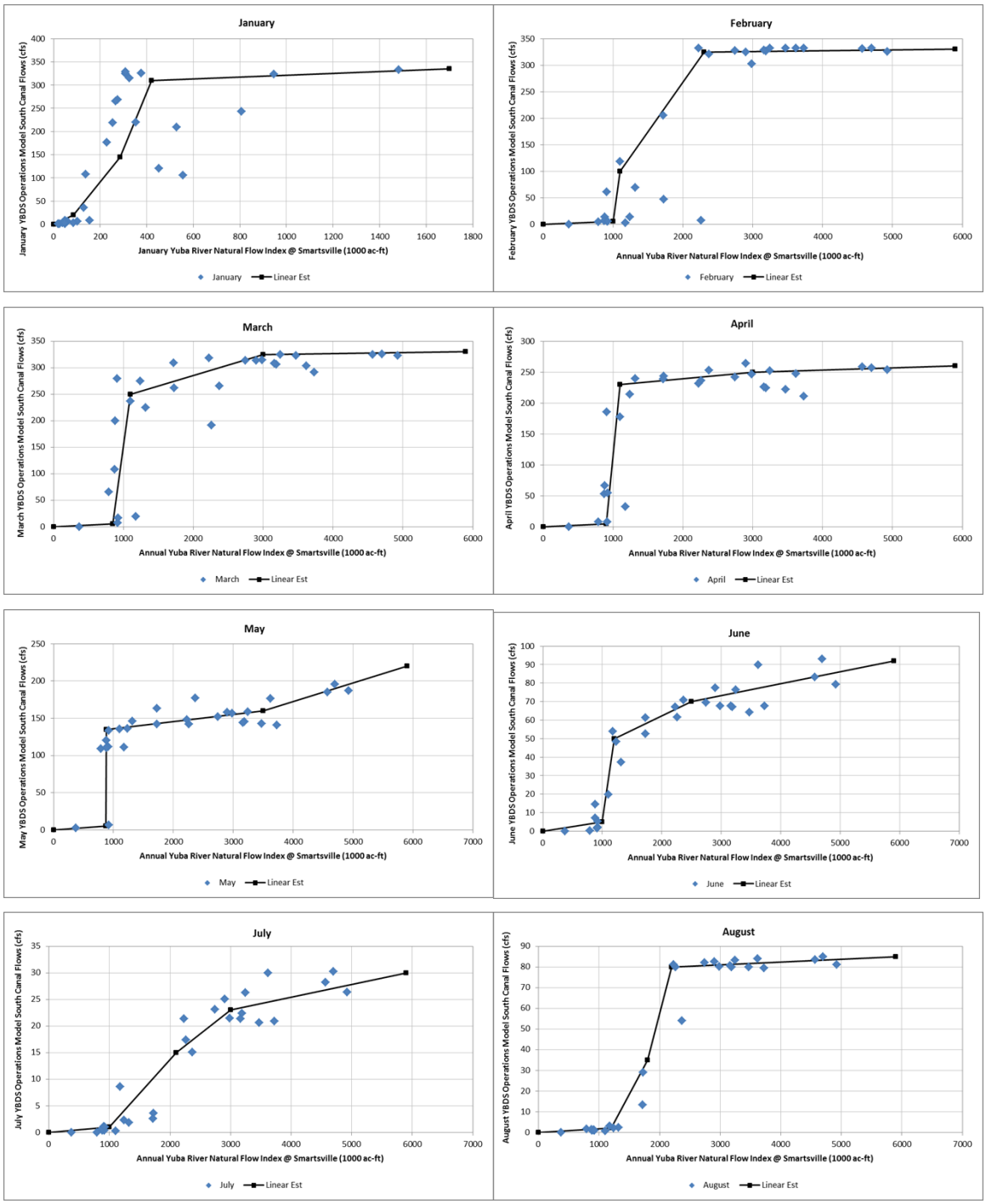
Attachment F Table 1. Annual Scaling Factors Used in the Development of the Upper Yuba/Bear River Watershed Folsom Reservoir Inflows.

Year	Annual Scaling Factor 2009 Demand		Year	Annual Scaling Factor 2009 Demand
1922	0.8822		1963	0.9258
1923	0.7643		1964	0.8274
1924	4.8070		1965	0.7419
1925	0.9350		1966	0.8230
1926	0.9979		1967	0.7859
1927	0.9185		1968	1.0384
1928	0.8716		1969	0.8429
1929	0.8498		1970	0.8042
1930	0.8420		1971	0.8172
1931	1.7727		1972	0.7980
1932	0.8071		1973	0.8156
1933	0.3969		1974	0.7504
1934	1.0620		1975	0.8396
1935	0.8618		1976	0.8711
1936	0.9709		1977	-46.0821
1937	0.8869		1978	1.1279
1938	0.8756		1979	0.9827
1939	1.4830		1980	0.9326
1940	0.9752		1981	0.8090
1941	0.8403		1982	0.6764
1942	0.7933		1983	0.7344
1943	0.8094		1984	0.7942
1944	0.7452		1985	0.8270
1945	0.8920		1986	1.0164
1946	0.8197		1987	0.9167
1947	0.7408		1988	11.5567
1948	0.7820		1989	1.5342
1949	0.7538		1990	0.7241
1950	0.9319		1991	1.3883
1951	0.7555		1992	0.8252
1952	0.8335		1993	1.0443
1953	0.7772		1994	1.0209
1954	0.9355		1995	0.9838
1955	0.5874		1996	0.8444
1956	0.7399		1997	0.7446
1957	0.9148		1998	1.0086
1958	0.9551		1999	0.8341
1959	0.8233		2000	0.8262
1960	0.9815		2001	1.7626
1961	0.6540		2002	0.9574
1962	0.9924		2003	0.7903

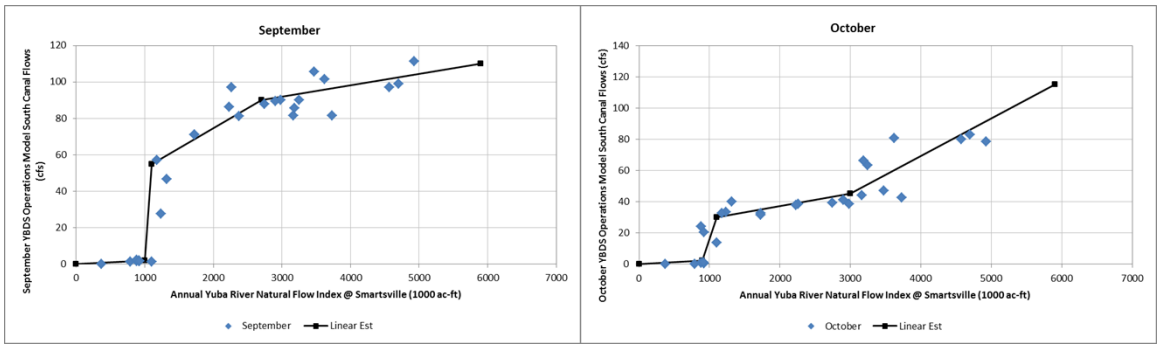
Attachment F Table 2. Yuba/Bear River Watershed Folsom Reservoir Monthly and Annual Inflows (CalSim II D308A) (2009 Demand) (Wy 1922-2003).

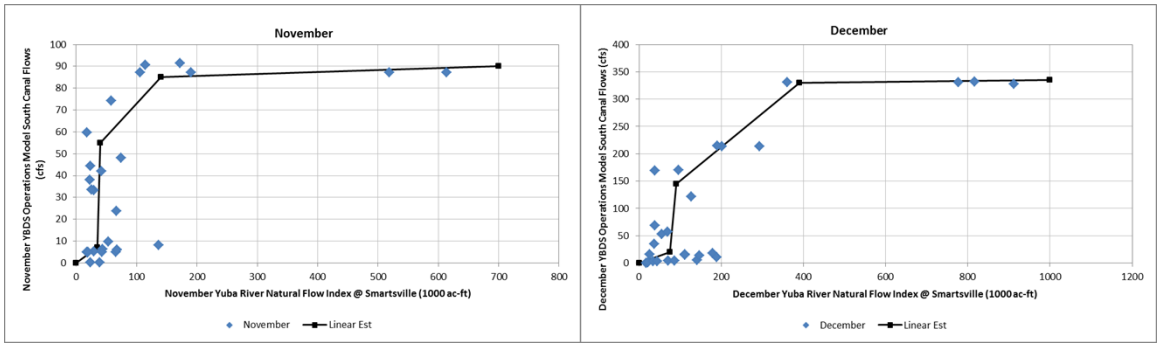
Year	Monthly Average Flow (cfs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1921										45	6	159
1922	43	326	324	250	155	73	23	81	92	38	60	272
1923	70	282	288	240	146	63	15	66	76	1	5	15
`1924	9	3	4	3	3	3	1	1	1	38	59	164
1925	36	292	290	241	147	64	15	71	77	34	40	15
1926	15	195	270	235	142	56	9	24	66	58	87	214
1927	108	327	326	252	161	77	24	82	95	41	85	173
1928	78	325	303	244	150	69	18	80	84	17	17	13
1929	10	14	162	128	136	7	1	2	7	36	3	269
1930	79	235	278	238	144	60	11	37	71	1	57	5
1931	14	3	4	4	4	3	1	1	1	38	14	192
1932	58	290	290	241	147	64	15	70	77	27	3	7
1933	9	79	229	206	137	23	2	2	43	14	5	149
1934	47	5	140	103	136	5	1	2	2	39	63	19
1935	63	314	295	242	148	66	16	80	80	42	6	11
1936	218	325	309	246	151	71	19	81	88	36	3	8
1937	7	242	280	238	144	60	12	42	72	70	75	331
1938	55	327	327	254	173	80	25	82	98	3	42	13
1939	13	5	61	13	135	5	1	2	2	44	4	9
1940	276	326	319	249	154	72	22	81	91	48	64	247
1941	254	326	325	250	157	74	23	81	93	55	64	318
1942	311	327	326	251	159	76	24	82	94	48	84	264
1943	313	326	325	250	156	74	23	81	93	32	6	11
1944	15	155	262	233	140	53	6	13	61	38	75	181
1945	32	290	290	241	147	64	15	70	77	40	78	331
1946	129	325	301	244	149	68	18	80	83	32	72	152
1947	13	150	260	233	140	53	6	11	61	37	59	11
1948	98	271	286	240	146	62	14	59	75	33	36	17
1949	10	172	265	234	141	54	7	18	63	39	6	10
1950	115	310	294	242	148	66	16	80	79	58	90	333
1951	298	327	326	252	161	77	24	82	95	72	74	283
1952	193	328	327	254	175	80	26	83	99	41	6	168
1953	313	325	307	245	151	70	19	80	87	36	62	17
1954	64	253	282	239	145	61	13	48	73	31	55	155
1955	29	135	257	232	139	51	5	7	59	68	55	337
1956	317	327	327	253	172	79	25	82	98	37	57	12
1957	15	261	284	239	145	62	13	53	74	58	61	176
1958	81	327	326	252	161	77	24	82	95	31	23	9
1959	92	125	255	231	138	51	4	4	58	35	3	5
1960	17	212	273	236	143	58	10	29	68	30	58	17
1961	9	105	251	230	137	33	3	2	56	37	4	19
1962	13	255	283	239	145	61	13	49	73	52	67	243
1963	100	326	325	251	158	75	24	81	94	33	86	39
1964	50	172	265	234	141	54	7	18	63	66	62	338
1965	315	327	327	253	170	79	25	82	97	33	70	31
1966	44	161	263	233	140	53	6	14	62	52	82	263
1967	277	326	326	251	158	75	24	81	94	34	6	18
1968	56	189	269	235	142	56	8	23	65	61	70	170
1969	321	327	326	252	164	78	25	82	96	44	49	328
1970	327	326	322	249	154	73	22	81	91	44	85	298
1971	148	326	319	248	154	72	22	81	91	35	57	154
1972	52	215	274	236	143	58	10	30	68	42	85	239
1973	312	325	312	246	152	71	20	81	89	69	89	330
1974	316	327	327	253	172	80	25	82	98	40	47	13
1975	20	325	300	243	149	68	17	80	83	68	87	132

1976	8	4	66	8	109	0	0	2	1	0	0	0
1977	1	0	0	0	2	0	0	0	0	0	0	18
1978	105	302	314	247	156	68	21	80	90	39	33	35
1979	35	48	262	244	163	61	4	29	71	32	48	121
1980	323	327	306	225	145	67	22	80	86	66	34	53
1981	6	118	237	177	135	20	0	1	1	14	87	331
1982	325	326	323	253	187	79	26	81	111	78	87	331
1983	325	333	326	257	196	93	30	85	99	83	87	332
1984	329	328	308	226	144	68	21	81	82	44	91	170
1985	6	70	224	239	146	37	2	2	47	40	10	16
1986	268	332	322	222	142	64	21	80	106	47	44	16
1987	1	14	200	67	120	7	0	1	1	1	5	5
1988	8	5	7	8	6	2	0	1	2	0	8	4
1989	3	7	191	236	142	62	17	80	97	39	74	68
1990	108	14	275	214	136	48	2	2	28	33	5	1
1991	1	3	19	32	111	54	9	3	57	33	5	3
1992	3	61	279	186	111	2	1	1	2	1	5	15
1993	120	325	314	264	158	77	25	83	89	41	38	57
1994	4	6	109	53	110	15	1	1	2	24	6	13
1995	243	331	325	258	185	83	28	84	97	80	60	214
1996	265	332	324	252	159	76	26	83	90	63	91	328
1997	333	332	291	211	140	68	21	80	82	43	5	5
1998	209	332	303	247	177	90	30	84	101	81	87	215
1999	219	328	313	242	152	69	23	82	88	39	42	169
2000	219	332	318	232	148	67	21	81	86	38	5	3
2001	3	6	16	54	133	5	1	1	2	20	6	10
2002	177	205	309	238	142	53	3	13	71	31	24	214
2003	315	321	266	253	177	71	15	54	81			



Attachment F Figure 1. Yuba River Natural Flow Index @ Smartsville vs. YBDS Operations Model South Canal Flow with Linear Estimation for Each Month (WY 1975-2003) (2009 level of demand).





Attachment F Figure 1 (cont.). Yuba River Natural Flow Index @ Smartsville vs. YBDS Operations Model South Canal Flow with Linear Estimation for Each Month (WY 1975-2003) (2009 level of demand).

Attachment F Figure 2. Scaling factor calculation.

$$M_{i,j} \times \frac{A_j}{\Sigma M_j} = Annual\ Scaling\ Factor$$

Where $M_{i,j}$: monthly volume for month *i* in year *j*

A_j: Annual total volume for year *j*

$\sum M_{i,j}$: Sum of all months within year *j*

ATTACHMENT G: Monthly and Annual Local Folsom Reservoir Inflows

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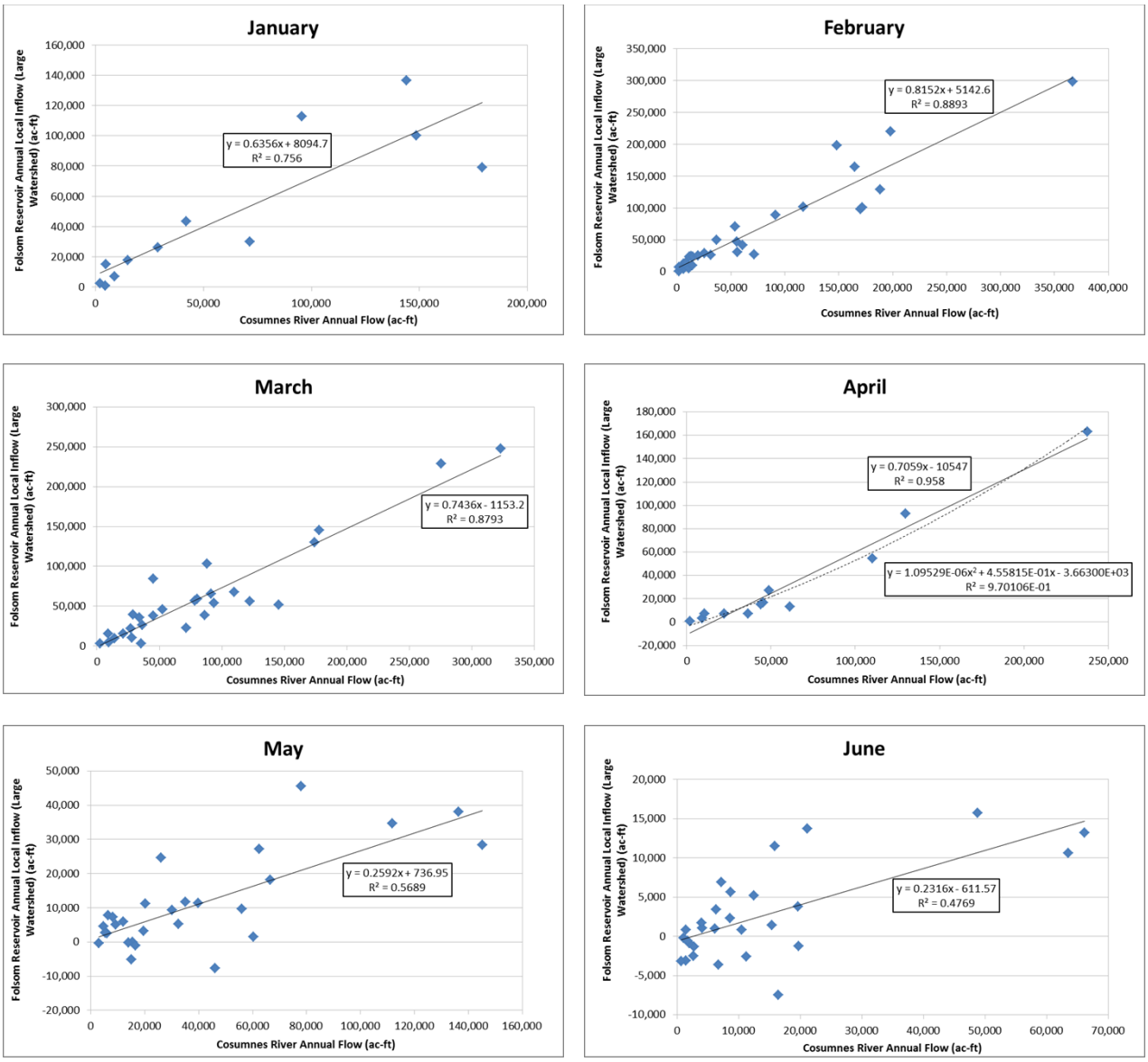
Attachment G Table 1. Folsom Reservoir Local Inflow Monthly Flows (ac-ft) (WY 1922-2003).

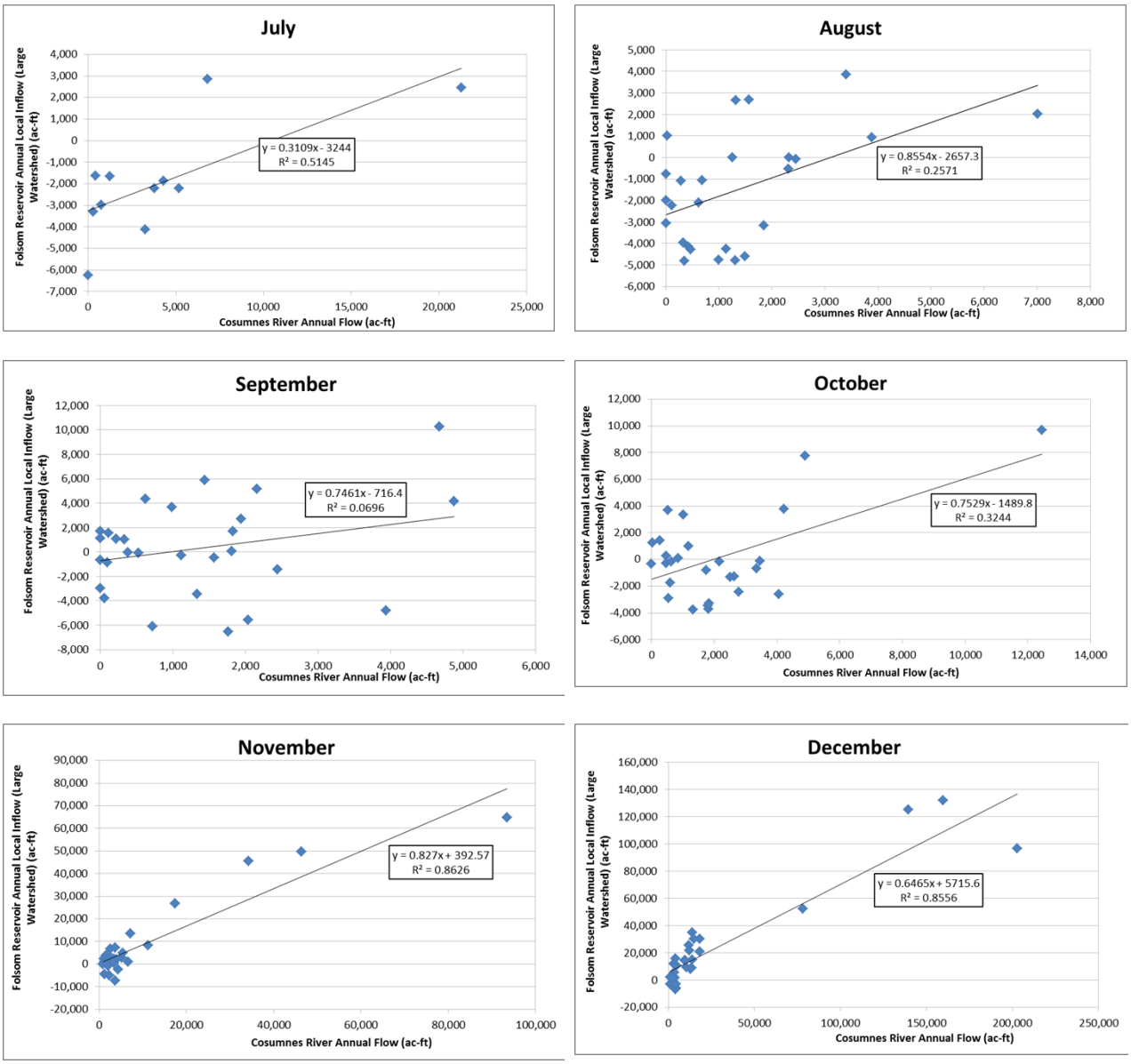
	Month (ac-ft)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1921	-	-	-	-	-	-	-	-	-	-277	321	3513
1922	5433	21663	12160	10138	6229	1669	-465	-483	-129	-153	2467	17517
1923	16098	10057	6776	12434	2695	723	-480	-487	-27	41	492	1875
1924	3115	3414	643	57	365	-132	-703	-637	-172	-200	1143	3713
1925	4750	27674	7655	12610	3132	680	-564	-514	-68	-108	505	1982
1926	2985	11331	3742	5032	898	-50	-691	-636	-166	-253	2963	3571
1927	8429	27188	12478	16370	2803	774	-547	-507	-97	-131	1768	3431
1928	4447	6200	25772	9604	1552	103	-631	-563	-123	-256	534	2071
1929	3534	4897	3362	2580	1462	399	-621	-613	-162	-312	187	2256
1930	5897	4941	9907	3301	1427	176	-655	-609	-135	-260	532	1611
1931	3298	3413	1902	-74	408	-78	-699	-637	-172	-333	401	6316
1932	7349	19035	8056	4329	3350	820	-561	-547	-152	-304	217	1661
1933	3200	2513	3105	1868	2293	935	-589	-603	-168	-236	408	4125
1934	7921	7231	3747	280	457	-1	-685	-637	-172	-309	960	2264
1935	8263	5944	7516	26141	3978	874	-516	-510	-147	-148	480	1800
1936	12844	46925	12828	10518	2612	1006	-502	-476	-95	-250	302	1865
1937	3972	19279	20100	11241	4355	743	-519	-500	-126	-162	719	6064
1938	5691	30350	35504	16816	6731	2015	-267	-180	15	149	920	2121
1939	3404	3475	4567	1896	712	-18	-686	-635	-163	-85	367	1724
1940	16168	26567	28150	11676	1940	236	-610	-614	-155	-233	522	5664
1941	11274	16848	14632	9663	3634	773	-511	-461	-80	-155	730	5035
1942	22198	22020	8067	10355	5493	1884	-236	-153	48	-60	4171	7265
1943	27297	17207	44086	8645	2302	710	-420	-264	1	8	700	2086
1944	4166	7893	8185	2989	2575	522	-582	-570	-154	-287	4635	4236
1945	4986	24730	9712	6513	2664	985	-529	-520	-144	99	2969	18153
1946	12419	6733	11309	7326	2472	446	-562	-533	-128	-60	2137	3244
1947	3699	5687	7425	2909	845	38	-682	-623	-170	106	806	1837
1948	3839	3064	5641	12043	4884	1536	-418	-448	-116	-228	585	2321
1949	3714	4514	14755	7063	2814	462	-608	-559	-124	-246	667	1818
1950	9584	14759	9858	11399	3124	688	-545	-503	-73	285	29510	29450
1951	26677	18122	16700	4853	3109	504	-460	-275	45	390	2029	10509
1952	27855	24141	23100	19701	7419	2268	10	160	284	70	935	3647
1953	12853	5038	5496	5164	2913	1538	-333	-292	-23	-45	971	2308
1954	5059	8041	11457	7346	1760	250	-597	-515	-90	-226	635	4413
1955	9337	5324	3839	2471	2175	352	-598	-562	-114	-254	538	31769
1956	37786	14278	9200	4991	4899	982	-421	-203	92	158	808	2015

	Month (ac-ft)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1957	3511	7991	14757	3008	3255	648	-536	-414	-33	-7	751	2487
1958	6553	21749	26776	37046	5832	1728	-264	-68	123	-14	617	1850
1959	4890	8545	3675	1395	723	-20	-608	-356	-9	-235	255	1614
1960	3417	9420	7296	2697	1310	46	-576	-352	-98	-238	593	1980
1961	2709	2429	1766	325	831	28	-594	-465	-98	-302	263	1765
1962	2694	15306	7593	5550	1643	366	-583	-481	-85	3359	672	3049
1963	5370	24049	6988	18272	5349	977	-400	-256	52	61	2899	2563
1964	7025	3549	2182	2184	1929	281	-562	-302	-54	-226	1281	33590
1965	34143	11709	6687	12588	3095	844	-430	-100	98	-33	1944	4370
1966	6374	6011	5085	3739	881	26	-521	-62	9	-265	909	6969
1967	16341	10306	18086	17422	8309	2908	83	81	211	168	788	2579
1968	5365	10667	6980	2312	915	71	-521	-162	-69	-195	1180	3677
1969	41797	25855	14884	15500	5148	1154	-369	-199	115	235	980	5561
1970	39137	13995	13511	2262	1617	331	-484	19	247	-70	3479	11727
1971	9637	6463	10023	5819	2802	817	-421	-329	4	-35	821	4910
1972	4665	6768	7205	3471	1474	158	-503	17	-4	-22	1395	3825
1973	23172	20408	14929	6241	2900	390	-509	-5	145	192	5163	11603
1974	21671	7936	22926	13258	3203	604	-235	11	115	56	822	2265
1975	4282	11682	16580	8233	5342	1367	-321	39	145	-432	377	762
1976	172	1054	1096	797	588	-746	-794	-1142	-1457	20	-1084	-706
1977	610	268	750	170	-75	-760	-1498	-734	-710	-84	19	1931
1978	27026	11357	12847	13094	2311	918	-533	-1021	-347	-904	1610	428
1979	6258	16846	14204	3151	372	-612	-532	-1147	-64	-302	655	2267
1980	18932	23594	15732	4023	2792	340	687	0	-110	-788	298	-1642
1981	4217	1177	9121	1753	1415	-309	-715	-502	-901	3294	10908	12571
1982	32724	24074	31228	39087	10917	-290	3150	926	2458	2325	11928	30062
1983	23978	30953	59430	22230	9108	2546	587	481	990	1863	15530	23139
1984	7186	9923	5403	3631	2233	198	-451	-21	405	903	6428	3524
1985	1636	6988	8668	1753	7	257	-398	-258	1415	-197	3268	4991
1986	10372	71423	34763	6516	5925	1360	-991	643	1243	-318	-1200	-1149
1987	3567	5774	9512	1683	660	193	-391	-538	-209	-419	599	3781
1988	8709	2901	3715	4500	1881	-215	-895	-479	-153	304	711	2812
1989	3255	3476	24702	4096	-61	410	-671	-948	881	-28	507	1273
1990	3924	5583	5326	1309	1757	830	-2761	-265	263	63	561	501
1991	843	1619	20248	4147	2668	1658	219	-993	369	799	501	318
1992	-1792	11844	6369	2083	1088	-50	-108	244	411	344	258	6132
1993	28701	21291	13490	6903	2720	3294	2018	636	1043	235	840	2505
1994	1315	5537	2326	1138	1214	-131	-100	-186	264	-73	1769	8417
1995	43040	7444	54853	10679	6815	3781	2096	220	651	-887	-178	3434

	Month (ac-ft)											
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1996	14946	24313	16279	9594	6532	2756	662	-127	20	-41	1964	31655
1997	80721	6547	688	-702	-1251	-859	-633	-762	-831	-585	1158	3432
1998	26585	52642	12347	12898	8308	3173	-2047	-2022	-1152	-630	241	2133
1999	17547	39407	9302	2185	-1861	-1793	-2383	-3170	-1563	-826	-575	-1400
2000	13921	47469	13570	1661	1264	553	-1929	-1100	-1329	-160	-1743	-712
2001	2490	6143	2550	1342	-273	-604	-781	-1157	-8	-42	568	7263
2002	7451	6266	10974	954	764	239	-744	-1027	244	-701	119	7271
2003	2949	2293	3748	10583	4359	1244	344	-2	-15	885	1027	5171
2004	5467	9484	7854	1892	832	7	-652	-564	-115	140	945	4035
2005	15302	10454	21348	10188	6245	1580	-289	-130	109	-31	574	15089
2006	22056	13179	27969	58965	6152	1200	-291	105	273	227	996	2592
2007	3938	8181	5944	1490	1001	50	-630	-512	-61	-82	440	1939
2008	5891	5994	3577	1312	1113	74	-650	-582	-143	-220	500	1822
2009	3845	7009	11650	2427	3114	172	-627	-554	-121	-104	332	2125
2010	6085	6336	6920	6423	4238	1936	-427	-389	-41	395	2009	18671
2011	13243	11973	41583	17622	5191	2973	234	196	222	-	-	-



Attachment G Figure 1. Folsom Reservoir Local Annual Inflow (Large Watershed) vs Cosumnes River Annual Flow Regression Relationships (1976-2003). Note: x- and y-axes vary.



Attachment G Figure 1 (cont.). Folsom Reservoir Local Annual Inflow (Large Watershed) vs Cosumnes River Annual Flow Regression Relationships (1976-2003). Note: x- and y-axes vary.