Placer County Water Agency

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August 15, 2006
File No. 01030A

Subject: Middle Fork American River Hydroelectric Project Relicensing
FERC Project No. 2079 - Draft Existing Resource Information Reports

Dear Stakeholder;

Placer County Water Agency (PCWA) is pleased to provide for your review and comment the enclosed "Draft Existing Resource Information Reports" for the Middle Fork American River Hydroelectric Project (MFP or Project) (FERC Project No. 2079). The report narratives, figures, tables and appendices are provided electronically on the enclosed CD. In addition Non-Internet Public (NIP) maps referenced in the text are provided as 11X17 color paper copies. Non-Internet Public (NIP) should not be posted on the Internet.

PCWA's intent in distributing the draft reports is to provide stakeholders with the opportunity to better understand the resources in the vicinity of the MFP early in the relicensing process, and to comment on the content of the material in the reports. PCWA encourages all stakeholders to identify any additional sources of information in the vicinity of the MFP for inclusion in the resource information reports. A final version of the resource reports, incorporating stakeholder comments, will be provided in the Pre-Application Document (PAD), which will be filed with FERC and distributed to the stakeholders by PCWA in late 2007.

PCWA is providing the Draft Existing Resource Information Reports to the stakeholders in three distributions. The first series of reports were distributed to the relicensing stakeholders for review and comment on June 20, 2006. The second series of reports was distributed to the relicensing stakeholders for review and comment on July 18, 2006. The third series of reports (enclosed) are being distributed to the relicensing stakeholders for review and comment on August 15, 2006. The following table shows the general table of contents and distribution schedule for the Draft Existing Resource Information Reports.

		DISTRIBUTION DATES		
		June 2006	July 2006	August 2006
6.0	Introduction	X		
6.1	Description of the River Basin			X
6.2	Geology and Soils	X		
6.3	Water Use			X
6.4	Water Quality			X
6.5	Fish and Aquatic Resources	X		
6.6	Wildlife and Botanical Resources	X		
6.7	Geomorphology	X		
6.8	Riparian Resources	X		
6.9	Recreation		X	
6.10	Land Use		X	
6.11	Aesthetics		X	
6.12	Cultural Resources	X		
6.13	Tribal Resources	X		
6.14	Socioeconomics		X	
7.0	Relative Comprehensive Plans and Resource Management Plans		X	

The text of the reports has been provided to you in Word format so that you may provide your comments as single-text edits, which would be greatly appreciated. Electronic files are currently saved in the following example format: 6.8_Riparian Resources_Narrative_V1_Jun 06.doc. The electronic version of the document with your comments should use the same save name with your initials and/or affiliation added, for example: 6.8_Riparian Resources_Narrative_V1_June 06_PCWA_MT.doc. Remember to show your edits in track changes.

If you choose to provide your comments in another format (e.g. e-mail correspondence or letter), please be clear to differentiate general comments from specific comments or recommendations on individual reports. Comments of a technical nature should include the basis for the comment and any appropriate citations to scientific literature. When providing comments or recommendations, please identify the specific report that you are commenting on and the specific section, page or line (s). This will help PCWA to more effectively address your comments.

PCWA would like to obtain your feedback on this set of Existing Resource Information Reports within 60-days, or by October 16, 2006. Please e-mail electronic comments to relicensing@pcwa.net. You may also provide comments to me at the following address:

Mal Toy
Director of Resource Development
Placer County Water Agency
P.O. Box 6570
Auburn, CA 95604

We appreciate your participation in this project and look forward to receiving your feedback. Please call me at (530) 823-4889 if you have any questions.

Sincerely,

PLACER COUNTY WATER AGENCY

Mal Toy

Mal Toy
Director of Resource Development

MT:bb

Attachment

The text of the Existing Resource Information Reports and all associated tables, figures and appendices are provided on the enclosed CD. Text and tables are provided in their original Microsoft Word or Excel formats. Figures are provided electronically in Adobe Portable Document Format (PDF).

Note that several of the figures discussed in the Existing Resource Information Reports show the location of Project facilities with respect to roads and other landmarks. These figures are considered Non-Internet Public (NIP) and should not be posted on the Internet. Color paper copies of these NIP figures are enclosed in this distribution for reference, as follows:

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[Please note: The Existing Resource Information Reports will be included as Chapter 6.0 in the Pre-Application Document. Therefore, the table of contents begins with 6.0 and not 1.0.]

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ac-ft	acre-feet
ACHP	Advisory Council on Historic Preservation
ACOE	Army Corps of Engineers
ADA	Americans with Disabilities Act
ADAAG	Americans with Disabilities Act Accessibility Guidelines
Advisory Council	Advisory Council on Historic Preservation
AIR	Additional Information Request
ALP	Alternative Licensing Process
APE	Area of Potential Effect
ARB	Air Resources Board
ARPA	Archaeological Resources Protection Act
ARWG	American River Watershed Group
ASR	Additional Study Requests
Auburn SRA	Auburn State Recreation Area
BA	Biological Assessment
BACT	Best Available Control Technology
Basin	American River Basin
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	Best Management Practices
BPR	Bureau of Public Roads
BVET	Basinwide Visual Estimation Technique
CAA	Clean Air Act
CAISO	California Independent System Operator
Cal Trout	California Trout
CCR	California Code of Regulations
CDC	California Department of Conservation
CDEC	California Data Exchange Center
CDF	California Department of Finance
CDFG	California Department of Fish and Game
CDMG	California Division of Mines and Geology
CEC	California Energy Commission
CEII	Critical Energy Infrastructure Information
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHRIS	California Historical Resources Information System
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CO	Carbon Monoxide
CO_2	Carbon Dioxide
Commission	Federal Energy Regulatory Commission
CORP	California Outdoor Recreation Plan
CORRP	California Outdoor Recreation Recovery Planning
CSC	California Species of Special Concern
CSL	California State Library

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CSPS	California State Park Service
CSWRB	California State Water Rights Board
CTR	California Toxics Rule
CWA	Clean Water Act
dbh	diameter at breast height
DEA	Draft Environmental Assessment
DEIS	Draft Environmental Impact Statement
DHS	California Department of Health Services
DO	Dissolved Oxygen
DOE	Department of Energy
DOI	Department of Interior
DOQQ	digital orthorectified quarter quad
DPR	California Department of Parks and Recreation
DRG	Digital raster graphic
DWR	California Department of Water Resources
EDD	California Employment Development Department
EID	El Dorado Irrigation District
EIS	Environmental Impact Statement
ENF	Eldorado National Forest
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FOR	Friends of the River
FPA	Federal Power Act
fps	firm peaking service
FR	The Federal Register
FRI	Four Reservoir Index
FSS	Forest Service Sensitive
ft	feet
GCMP	Granite Chief Wilderness Management Plan
GIS	Geographic Information System
GLO	General Land Office
GPS	Global Positioning System
GPUD	Georgetown Public Utility District
GWHr	gigawatt-hour
HB	Howell Bunger
HBI	Hilsenhoff Biotic Index
hp	Horsepower
HPMP	Historic Properties Management Plan
IFIM	Instream Flow Incremental Methodology
IHA	Indicators of Hydrologic Alteration
ILP	Integrated Licensing Process
IRA	Inventoried Roadless Area
IRMP	Interim Resource Management Plan
kV	kilovolt
LRMP	Land and Resource Management Plan
Lat	latitude

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Long	longitude
Maidu	Maidu Native American
MCL	Maximum Contaminant Limit
MDL	Method Detection Limit
MFP	Middle Fork American River Hydroelectric Project
mg/l	milligrams per liter
MIS	management indicator species
Miwok	Miwok Native American
msl	mean sea level
MTRL	maximum tissue residue level
MW	Megawatt
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NGO	non-governmental organization
NHPA	National Historic Preservation Act
NID	Nevada Irrigation District
NOI	Notice of Intent
NOPR	Notice of Proposed Rulemaking
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NRDC	Natural Resources Defense Council
NTR	National Toxics Rule
NTU	nephelometric turbidity unit
NWIS	National Water Information System
O&M	Operation and Maintenance
OHV	off-highway vehicle
ORV	Outstandingly Remarkable Value
PAD	Pre-Application Document
PAOT	persons at one time
PARC	Protect American River Canyons
PC	Placer County
PCPD	Placer County Planning Department
PCWA	Placer County Water Agency
pdf	Adobe Portable Document Format
PG&E	Pacific Gas and Electric Company
PM&E	protection, mitigation and enhancement
PMF	Probable Maximum Flood
Project	Middle Fork American River Hydroelectric Project
QA/QC	Quality Assurance/Quality Control
REA	Ready for Environmental Analysis
RM	River Mile
ROD	Record of Decision
rpm	revolutions per minute
RV	recreational vehicle
RWQCB	California Regional Water Quality Control Board
SARA	Save the American River Association
SCADA	supervisory control and data acquisition

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SHPO	State Historic Preservation Officer
SMUD	Sacramento Municipal Utility District
SPCC	Spill Prevention, Containment and Countermeasure Plan
SPM	semi-private motorized
SPT	sediment pass-through
SWRCB	California State Water Resources Control Board
TAF	thousand acre feet
TLP	Traditional Licensing Process
TMDL	Total Maximum Daily Load
TNF	Tahoe National Forest
UAIC	United Auburn Indian Community
UARM	Upper American River Model
UARP	Upper American River Project
USBR	United States Bureau of Reclamation
USC	United States Code
USDA	United States Department of Agriculture
USDOC	United States Department of Commerce
USDA-FS	United States Department of Agriculture Forest Service
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
Washoe	Washoe Native American
Watershed	Middle Fork American River Watershed
WTP	Water Treatment Plant
WSR	Wild's Scenic River
WY	Water year

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6.1 DESCRIPTION OF THE MIDDLE FORK AMERICAN RIVER WATERSHED

This report describes the Middle Fork American River Watershed (Watershed) which contains Placer County Water Agency's (PCWA's) Middle Fork American River Hydroelectric Project (MFP or Project). The Federal Energy Regulatory Commission's (FERC's) content requirements for this report are specified in Title 18 of the Code of Federal Regulations (CFR) Chapter. I § 5.6 (d) (3) (xiii), as follows:

> ***River basin description****. A general description of the river basin or sub-basin, as appropriate, in which the proposed project is located, including information on:*
>
> *(A) The area of the river basin or sub-basin and length of stream reaches therein;*
>
> *(B) Major land and water uses in the project area;*
>
> *(C) All dams and diversion structures in the basin or sub-basin, regardless of function; and*
>
> *(D) Tributary rivers and streams, the resources of which are or may be affected by project operations.*

An overview of the American River Basin is presented first, for context, followed by information regarding the Watershed including: overall watershed area and sub-Watershed areas; rivers and streams affected by the MFP; major land and water uses and other dams and diversions in the Watershed. The information presented in this report is entirely based on existing information.

6.1.1 Information Sources

This report was prepared utilizing the following information sources:

- The existing and potential beneficial uses that apply to surface waters within the Watershed were provided in Table II of *The Sacramento River Basin and San Joaquin River Basin Water Quality Control Plan (California Regional Water Control Board 2004).*
- The U.S. Bureau of Reclamation data from the Auburn State Recreation Area and the California Data Exchange Center provided information on the climate associated with the Watershed.
- Sacramento Municipal Utility District informational webpage provided information on the Upper American River Project (FERC Project No. 2101), a hydropower project partially located within the Watershed.

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- The El Dorado County Water Agency's Water Resources Development and Management Plan provided information on the Georgetown Divide Public Utility District's Stumpy Meadow Project, which is located within the Watershed.

These references are cited throughout the text and complete reference information is provided at the end of this report.

6.1.2 Overview of American River Basin

The American River Basin is comprised of three primary forks of the American River referred to as the North Fork, the Middle Fork and the South Fork. In addition, it includes an area surrounding Folsom Reservoir, referred to as the Foothill Drain watershed. Together, the watersheds associated with these three forks and the Foothill Drain encompass a 2,051 square mile area. Of this, the North Fork drains a 349 square foot area. The North Fork originates near the north end of Granite Chief Wilderness and terminates at Folsom Reservoir, near the city of Auburn. The South Fork drains an 801 square mile area. The South Fork originates along the crest of the Sierra Nevada in the Desolation and Mokelumne Wilderness areas and terminates at Folsom Reservoir about 12 miles west of the city of Placerville. The Middle Fork drains a 616 square mile area and joins the North Fork American River approximately 21 miles upstream of Folsom Reservoir Dam. The Foothill Drain watershed encompasses a 285 square mile area. The American River Basin is shown on Figure 6.1-1.

Downstream of Folsom Reservoir, the lower American River is about 23 miles long and bisects the metropolitan Sacramento area, flowing into the Sacramento River near downtown Sacramento.

6.1.3 Description of Middle Fork American River Watershed

The Watershed is situated in the foothills and mountainous uplands of the western slope of the central Sierra Nevada mountain range, primarily within the Tahoe National Forest (TNF) and Eldorado National Forest (ENF). The Watershed is characterized by hot, dry summers and mild, wet winters, with most of the precipitation falling between October and March. Precipitation falls as rain in the lower elevations and snow at elevations greater than 5,000 feet above mean sea level (msl). Elevations higher than about 6,000 feet msl are typically extensively covered by snow until May. Years tend to either be wet or dry with high inter-annual variability, and few years receiving the 'average' amount of precipitation. The annual precipitation in the Watershed ranges between 40 and 70 inches, with an average of 50 inches. The Watershed and its sub-watersheds are depicted on Figure 6.1-2.

The principle MFP facilities located in the Watershed are shown on Figure 6.1-3. A detailed description of the MFP facilities and operations are presented in the Project Description (Section 5.0). The operation of the MFP affects flows, and potentially resources, on the following rivers and streams:

- The Middle Fork American River, from French Meadows Reservoir to its confluence with the North Fork American River;

- Duncan Creek, from the Duncan Creek Diversion to its confluence with the Middle Fork American River;

- The Rubicon River, from Hell Hole Reservoir to Ralston Afterbay;

- North Fork Long Canyon Creek from the North Fork Long Canyon Diversion to its confluence with the main stem of Long Canyon Creek;

- South Fork Long Canyon Creek from the South Fork Long Canyon Diversion to the confluence of the main stem of Long Canyon Creek; and

- Long Canyon Creek from the North Fork/South Fork Confluence to its confluence with the Rubicon River.

Table 6.1-1 provides a summary of the Watershed and sub-watershed areas, stream length, elevations, and stream gradient for waters affected by operations of the MFP.

6.1.4 Major Land Uses in the Watershed

The Watershed is heavily forested, rural in nature and sparsely populated. There are no residential or commercial developments in the immediate vicinity of the MFP. Several paved roads provide the primary access to the MFP vicinity. These include: Mosquito Ridge Road, Ralston Ridge Road, Blacksmith Flat Road and Soda Springs Riverton Road. Access to more remote locations in the Watershed is possible using ancillary roads and trails associated with either the Forest Service Transportation System or the Auburn State Recreation Area (Auburn SRA), located downstream of Ralston Afterbay.

The Project facilities and the land within the FERC Project boundary are located primarily within the ENF and TNF. Private parcels are present throughout the Watershed and within the FERC Project boundary at various locations. Land use within the FERC Project boundary is focused on hydropower generation and recreation. Land use outside the FERC Project boundary is managed mainly for recreation, timber harvest, grazing, natural resource protection, and to a lesser extent mining. Figure 6.1-4 shows the MFP facilities and FERC Project boundary with respect to the land ownership and various land jurisdictions in the Watershed.

6.1.5 Major Water Uses in the Watershed

The existing and potential beneficial uses that apply to surface waters within the Watershed are identified in Table II of *The Sacramento River Basin and San Joaquin River Basin Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board–Control Valley Region, 2004.* The Basin Plan identifies beneficial uses of water in the Watershed as: (1) municipal and domestic supply; (2) agricultural irrigation and stock watering; (3) power generation; (4) contact recreation; (5) non-

contact recreation; (6) coldwater habitat and spawning habitat for fisheries; and (7) wildlife habitat.

Surface water is stored by the MFP and is released for consumptive use, and non-consumptive uses including hydroelectric power generation, recreation, and stream maintenance. The largest consumptive uses of water derived from the Watershed include municipal and domestic water supply and irrigation for agricultural crops. The largest non-consumptive water use in the Watershed is for hydroelectric power generation by PCWA for the MFP and by the Sacramento Municipal Water District (SMUD) for the Upper American River Project (UARP) (FERC Project No. 2101). Other non-consumptive water uses in the Watershed include recreation use (boating, swimming and fishing) and instream flow releases for fish and wildlife habitat. Water use in the Watershed is described in further detail in the Water Use Report (Section 6.3).

6.1.6 Other Dams and Diversions in the Watershed

Aside from the MFP, flows in the Watershed are primarily affected by two other projects, SMUD's UARP (FERC Project No. 2101) and by the Georgetown Divide Public Utility District's (GDPUD's) Stumpy Meadows Project. Maps showing the primary facilities related to these two projects are provided in Appendix 6.1-A. Note that some of SMUD's and GDPUD's facilities lie outside the Watershed.

Within the Watershed, SMUD's UARP influences flows into Hell Hole Reservoir and along the South Fork Rubicon River, a tributary to the Rubicon River entering downstream of Hell Hole Reservoir. GPUD's Stumpy Meadows Project affects flows on Pilot Creek, a tributary to the Rubicon River entering downstream of Hell Hole Reservoir.

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TABLE

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Table 6.1-1. Information on Watershed Area, Stream Length and Gradient of Waters Associated with the MFP.

Stream Name	Total Sub-basin Area (mi^2)	Sub-divided Areas (mi^2)	Stream Length (mi)	Elevation (ft)	Average Stream Gradient (%)
Duncan Creek					
Duncan Creek – Headwaters to confluence with Middle Fork American River (*Map ID = Duncan Creek*)	23.5	-	14.1	Starting: 7045.0 Ending: 3365.6	5.0
Duncan Creek – Headwaters to Duncan Creek Diversion Dam	-	9.9	5.5	Starting: 7045.0 Ending: 5257.7	6.2
Duncan Creek –Duncan Creek Diversion Dam to confluence with Middle Fork American River	-	13.6	8.6	Starting: 5257.7 Ending: 3365.6	4.2
Middle Fork American River					
Middle Fork American River – Headwaters to North Fork American River Confluence	184.5	-	62.3	Starting: 8268.1 Ending: 542.0	2.3
Middle Fork American River – Headwaters to French Meadows Reservoir Dam (*Map ID = French Meadows*)	-	47.0	15.1	Starting: 8268.1 Ending: 5084.2	4.0
Middle Fork American River – French Meadows Dam to Middle Fork Interbay (*Map ID = Upper Middle Fork American River)*	-	18.4	11.6	Starting: 5084.2 Ending: 2488.6	4.2
Middle Fork American River – Middle Fork Interbay Dam to Ralston Afterbay (*Map ID = Upper Middle Fork American River*)	-	22.8	10.8	Starting: 2488.6 Ending: 1158.1	2.3
Middle Fork American River – Ralston Afterbay Dam to confluence with North Fork American River (*Map ID = Lower Middle Fork American River*)	-	96.3	24.7	Starting: 1158.1 Ending: 542.0	0.5

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Stream Name	Total Sub-basin Area (mi^2)	Sub-divided Areas (mi^2)	Stream Length (mi)	Elevation (ft)	Average Stream Gradient (%)
Long Canyon Creek					
Long Canyon Creek – Headwaters to confluence with Rubicon River	49.0	-	28.8	Starting: 6749.1 Ending: 1398.5	3.5
Long Canyon Creek – Confluence of North and South Forks of Long Canyon Creek to confluence with Rubicon River *(Map ID = Long Canyon)*	-	31.3	11.4	Starting: 4119.8 Ending: 1398.5	4.5
North Fork Long Canyon Creek (*Map ID= North Fork*)	-	6.6	6.9	Starting: 6359.0 Ending: 4119.8	6.1
South Fork Long Canyon Creek (*Map ID = South Fork*)	-	11.1	10.4	Starting: 6749.1 Ending: 4119.8	4.8
Rubicon River					
Rubicon River – Headwaters to Middle Fork American River	209.5	-	58.1	Starting: 8076.2 Ending: 1180.3	2.2
Rubicon River – Headwaters to Hell Hole Reservoir Dam (*Map ID = Hell Hole)*	-	113.4	27.7	Starting: 8076.2 Ending: 4531.4	2.4
Rubicon River – Hell Hole Dam to Middle Fork American River (*Map ID = Rubicon River*)	-	96.1	30.5	Starting: 4531.4 Ending: 1180.3	2.1
Other Major Streams in the Watershed					
South Fork Rubicon River – Headwaters to Confluence with Rubicon River (*Map ID = South Fork Rubicon River*)	57.0	-	16.2	Starting: 7556.1 Ending: 3552.6	4.7
North Fork of Middle Fork American River – Headwaters to confluence with Middle Fork American River (*Map ID = North Fork of Middle Fork American River*)	92.5	-	18.8	Starting: 4373.3 Ending: 1069.9	3.3
North Fork American River– Confluence of Middle Fork American River to Folsom High Water Mark (*Map ID = Lower North Fork American River*)	5.5	-	4.0	Starting: 542.0 Ending: 491.1	0.2

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FIGURES

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Placeholder for Figures 6.1-1 -4

Figure 6.1-1 American River Basin

Figure 6.1-2 MFAR Watershed and Sub-watersheds

Figure 6.1-3 Principal Project Facilities and Geographic Setting

Figure 6.1-4 Land Jurisdictions in the MFAR Watershed

Non-Internet Public Information

These Figures have been removed in accordance with the Commission regulations at 18 CFR Section 388.112.

These Figures are considered Non-Internet Public information and should not be posted on the Internet. This information may be accessed from the Placer County Water Agency's (PCWA) Public Reference Room, but is not expected to be posted on PCWA's Website, except as an indexed item.

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APPENDIX 6.1-A

Maps Showing the Sacramento Municipal Utility District's (SMUD's) Upper American River Project and Georgetown Divide Public Utility District's (GDPUD's) System

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N

Folsom North Pumping Project 7,500 AF (16 MGD) GDPUD Diversion

Cool WTP 3 MGD Initial Capacity

Greenwood WTP 5 MGD Initial Capacity

Proposed Canyon Creek Dam & Reservoir 17,500 AF

Proposed Rubicon River Diversion Project 16 - 19 MGD (Pipeline & Tunnel)

Middle Fork American River

North Fork American River

South Fork American River

Rubicon River

Canyon Creek

Pilot Creek

Stumpy Meadows Lake 20,000 AF

Union Valley Reservoir

Silver Creek

Forebay Lake

Jenkinson Lake

Placerville

Coloma

Garden Valley

Green Valley

Weber Creek

Knickerbocker Creek

Georgetown Divide Ditch

Main Georgetown Divide Ditch

Wentworth Springs Georgetown Divide Ditch

Georgetown Divide Ditch

South Fork Rubicon River

Pilot Creek

Gerle Creek

Little Silver Creek

Tadpole Creek

Silver Creek

South Fork Silver Creek

El Dorado Ditch

South Fork American River

North Fork Weber Creek

South Fork Weber Creek

Clear Creek

Sly Park Creek

Camp Creek

Alder Creek

Cedar Ravine

Mother Lode

Fermi

Pleasant Valley

Marshall

Lotus

Plum Creek

49

193

50

LEGEND

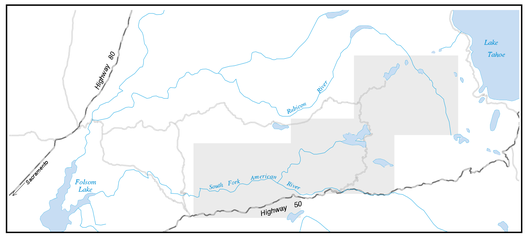
- Georgetown Divide PUD
- Existing GDPUD WTP
- Existing Diversion Dam
- Existing GDPUD Channel
- Existing GDPUD Pipe
- Existing GDPUD Syphon
- Existing GDPUD Tunnel
- WTP
- Proposed GDPUD Pump Station
- Proposed GDPUD Reservoir
- Proposed GDPUD Pipeline
- Proposed GDPUD Tunnel

Figure 5-16
Georgetown Divide Public Utility District Water Supply Options

El Dorado Water Agency/Phase II Water Plan/Graphics/Fig_05_16.ai 6/6/03 (CMS - layout only)

Upper American River Project

FERC Project No. 2101



North

0 1 2 3 4 Miles

SMUD Water Conveyance Facilities

- Tunnel
- Penstock
- Canal
- Powerhouse
- Dam

Roads

- Major Highways
- Secondary Highways, County Roads
- Roads providing general access to SMUD facilities
- Roads providing specific access to SMUD facilities

Land Ownership

- Federal Lands
- Sierra Pacific Industries
- SMUD
- Submerged Land in SMUD Ownership
- Other Landowners

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
The Power To Do More.℠

Loon Lake Reservoir
Union Valley Reservoir
Ice House Reservoir
Jenkinson Lake
Crystal Range
Sierra Mountains
Pleasant Valley
Peavine Ridge
Telephone Ridge
Big Hill
Cheese Camp Ridge
Highway 50
POLLOCK PINES
CAMINO
PLACERVILLE

VESTRA

Prepared by VESTRA Resources, Redding, CA
May 2, 2008

Upper American River Project
FERC Project No. 2101

Southwest Area

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
The Power To Do More.sm

SMUD Water Conveyance Facilities

- Tunnel
- Penstock
- Canal
- Powerhouse
- Dam

SMUD Project Boundary

- UARP Boundary
- Transmission Line Corridor Centerline; Note: Easement Widths vary from 100 to 250 feet.
- Tunnel and Adit Centerline; Tunnel Corridor Project Boundaries are typically 100 feet wide.
- Minor Access Road Centerline; Project Boundaries around minor access roads are typically 12 feet wide.

Land Ownership

- Federal Lands
- Sierra Pacific Industries
- SMUD
- Submerged Land in SMUD Ownership
- Other Landowners

Roads

- Major Highways
- Secondary Highways, County Roads
- Roads providing general access to SMUD facilities
- Roads providing specific access to SMUD facilities

North

0 1 Miles
0 1000 2000 3000 4000 5000 6000 7000 8000 Feet

VESTRA

Prepared by VESTRA Resources, Redding, CA
May 1, 2001

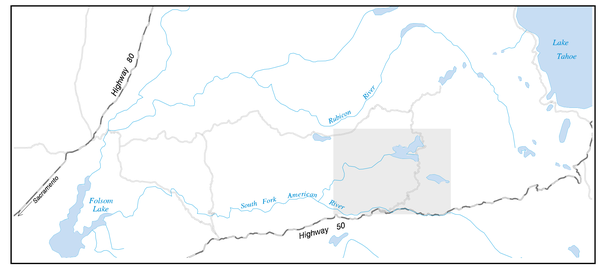
Range 11E | Range 12E | Range 13E

Township 12N | Township 11N | Township 10N

SLATE MOUNTAINS
Slate Mtn.
Big X Mtn.
Brush Creek Dam
Brush Creek Reservoir
Brush Creek Tunnel
Camino Tunnel
Camino Dam
Camino Powerhouse
Ridge
Pollock Pines
Peavine Ridge Road
Cable Pt.
Creek
Reservoir
Independence Point
White Oak Point
Iowa Hill
Slab Creek Powerhouse
Slab
Slab Creek Reservoir
White Rock Powerhouse
White Rock Creek
White Rock Tunnel
Badger Hill Road
Forebay Road
Forebay Lake
Cable Road
North Canyon Road
Canyon Road
Pony Express Trail
Highway 50
POLLOCK PINES
CAMINO
PLACERVILLE
Ski Park Road
Jenkinson Lake
Mosquito Road
Meadow Lane
Schnell School Rd
Hangtown Creek
South Fork American River
North Fork American River

Upper American River Project
FERC Project No. 2101

Southeast Area



SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
The Power To Do More.℠

Range 13E | Range 14E | Range 15E

Township 12N

Township 11N

SMUD Water Conveyance Facilities

- Tunnel
- Penstock
- Canal
- Powerhouse
- Dam

SMUD Project Boundary

- UARP Boundary
- Transmission Line Corridor Centerline; Note: Easement Widths vary from 100 to 250 feet.
- Tunnel and Adit Centerline; Tunnel Corridor Project Boundaries are typically 100 feet wide.
- Minor Access Road Centerline; Project Boundaries around minor access roads are typically 12 feet wide.

Land Ownership

- Federal Lands
- Sierra Pacific Industries
- SMUD
- Submerged Land in SMUD Ownership
- Other Landowners

Roads

- Major Highways
- Secondary Highways, County Roads
- Roads providing general access to SMUD facilities
- Roads providing specific access to SMUD facilities

North

0 1 2 Miles

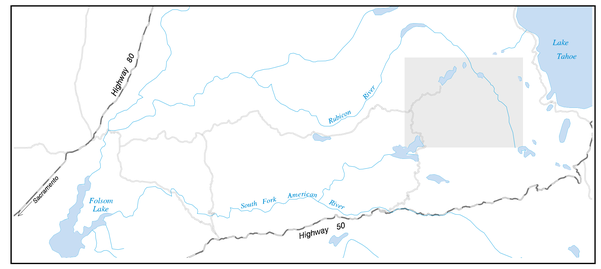
0 1000 2000 3000 4000 5000 6000 7000 8000 Feet

VESTRA

Prepared by VESTRA Resources, Redding, CA
May 1, 2001

Upper American River Project
FERC Project No. 2101

Northeast Area



SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
The Power To Do More.SM

SMUD Water Conveyance Facilities

- Tunnel
- Penstock
- Canal
- Powerhouse
- Dam

SMUD Project Boundary

- UARP Boundary
- Transmission Line Corridor Centerline; Note: Easement Widths vary from 100 to 250 feet.
- Tunnel and Adit Centerline; Tunnel Corridor Project Boundaries are typically 100 feet wide.
- Minor Access Road Centerline; Project Boundaries around minor access roads are typically 12 feet wide.

Land Ownership

- Federal Lands
- Sierra Pacific Industries
- SMUD
- Submerged Land in SMUD Ownership
- Other Landowners

Roads

- Major Highways
- Secondary Highways, County Roads
- Roads providing general access to SMUD facilities
- Roads providing specific access to SMUD facilities

North

0 1 2 Miles
0 1000 2000 3000 4000 5000 6000 7000 8000 Feet

VESTRA

Prepared by VESTRA Resources, Redding, CA
April 27, 2001

Range 14E | Range 15E | Range 16E

Township 14N | Township 13N | Township 12N

Loon Lake Reservoir
Loon Lake Dam
Loon Lake Powerhouse
Loon Lake Tunnel
Buck Island - Loon Lake Tunnel
Buck Island Dam
Buck Island Reservoir
Rockbound Lake
Rubicon Tunnel
Rubicon Tunnel Outlet Channel
Rubicon Dam
Rubicon Reservoir
Gerle Creek Reservoir
Gerle Creek Dam
Gerle Creek Canal
Robbs Peak Forebay
Robbs Peak Tunnel
Robbs Peak Powerhouse
Robbs Peak Reservoir
LOON LAKE ROAD
ICE HOUSE ROAD
Robbs Peak
Robbs Valley
Wench Flat
Two Peaks
Tells Peak
McConnell Peak
Red Peak
Brown Mtn.
Desolation Wilderness
CRYSTAL RANGE
Bugle Lake
Spider Lake
Hidden Lake
Lake Winifred
Richardson Lake
Lake Genevieve
Craig Lake
Shadow Lake
Hidden Lake
Cliff Lake
Phipps Lake
Highland Lake
Lake Zitella
Horseshoe Lake
Robbins River
Fern Lake
McConnell Lake
4-Q Lakes
Leland Lakes
Lake Schmidell
Middle Velma Lake
Upper Velma Lake
Fontanillis Lake
Lake No. 3
Lake Lois
Lake Doris
Lost Lake
Lawrence Lake
Barrett Lake
Top Lake
Pearl Lake
Maud Lake
Gertrude Lake
Tyler Lake
Island Lake
Clyde Lake
Lake Aloha
Francis Lake
Shadow Lake
Gerle Creek
Angel Creek
Rocky Basin Cr.
South Fork Rubicon River
Frog Pond
Camp Creek
Dyer Creek
Wolf Creek
Yellow Jacket Creek
Tells Creek
Bassi Falls
Big Silver Creek
Middle Fork
South Fork Robbins River
Robbins River
Rubicon River
Highway 80
Sacramento
Folsom Lake
Rubicon River
South Fork American River
Lake Tahoe
Highway 50

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6.3 WATER USE

This report describes the water uses in the Middle Fork American River Watershed (Watershed), as they relate to Placer County Water Agency's (PCWA's) Middle Fork American River Hydroelectric Project (MFP or Project). The Federal Energy Regulatory Commission's (Commission or FERC) content requirements for this report are specified in Title 18 of the Code of Federal Regulations (CFR) Chapter I § 5.6 (d) (3) (iii), as follows:

> ***Water resources**. A description of the water resources of the proposed project and surrounding area. This must address the quantity and quality (chemical/physical parameters) of all waters affected by the project, including but not limited to the project reservoir(s) and tributaries thereto, bypassed reach, and tailrace. Components of the description must include:*
>
> *(A) Drainage area;*
>
> *(B) The monthly minimum, mean, and maximum recorded flows in cubic feet per second of the stream or other body of water at the powerplant intake or point of diversion, specifying any adjustments made for evaporation, leakage, minimum flow releases, or other reductions in available flow;*
>
> *(C) A monthly flow duration curve indicating the period of record and the location of gauging station(s), including identification number(s), used in deriving the curve; and a specification of the critical streamflow used to determine the project's dependable capacity;*
>
> *(D) Existing and proposed uses of project waters for irrigation, domestic water supply, industrial and other purposes, including any upstream or downstream requirements or constraints to accommodate those purposes;*
>
> *(E) Existing instream flow uses of streams in the project area that would be affected by project construction and operation; information on existing water rights and water rights applications potentially affecting or affected by the project;*
>
> *(F) Any federally-approved water quality standards applicable to project waters;*
>
> *(G) Seasonal variation of existing water quality data for any stream, lake, or reservoir that would be affected by the proposed project, including information on:*
>
> > *(1) Water temperature and dissolved oxygen, including seasonal vertical profiles in the reservoir;*
> >
> > *(2) Other physical and chemical parameters to include, as appropriate for the project; total dissolved gas, pH, total hardness, specific conductance, cholorphyll a, suspended sediment concentrations, total nitrogen (mg/L as N), total phosphorus (mg/L as P), and fecal coliform (E. Coli) concentrations;*

(H) The following data with respect to any existing or proposed lake or reservoir associated with the proposed project; surface area, volume, maximum depth, mean depth, flushing rate, shoreline length, substrate composition; and

(I) Gradient for downstream reaches directly affected by the proposed project.

The FERC regulations presented above require information on both water quantity and water quality for all waters affected by the Project. This report presents information on water use and quantity. Water quality is addressed in the Water Quality Report (Section 6.4).

6.3.1 Information Sources

A database and literature review was conducted to obtain relevant water use and hydrology data for all waters affected by the MFP. Data for the gaging stations in the Middle Fork American River Watershed are available from the United States Geological Survey (USGS) and from the California Data Exchange Center (CDEC). Data from these two sources were collected and compiled in association with hydrology studies completed during the early phases of relicensing (PCWA 2005). Data from the Sacramento Utility District (SMUD) relicensing studies, including calculations of unimpaired flows and accretions, have also been reviewed and compiled. Additional information on the quality of the USGS flow and flood-peak data from numerous gaging stations within the watershed was obtained from the USGS (Meyer 1998).

6.3.2 Description of the Watershed

The MFP is situated in the foothills and mountainous uplands of the western slope of the central Sierra Nevada mountain range. The MFP facilities are located on the Middle Fork American River, the Rubicon River, Duncan Creek and the North and South Forks of Long Canyon Creek within an area referred to in this report as the Middle Fork American River Watershed (Watershed). The locations of the principle Project facilities are shown on Figure 6.3-1.

As shown on Figure 6.3-2, the Middle Fork American River Watershed is situated in the American River Basin. The American River Basin is comprised of three primary forks of the American River referred to as the North Fork, the Middle Fork and the South Fork. It also includes an area surrounding Folsom Reservoir referred to as the Foothill Drain watershed. Combined, the American River Basin drains a 2,051 square mile area. Of this, the North Fork drains a 349 square mile area, the South Fork drains an 801 square mile area and the Middle Fork drains a 616 square mile area. The Foothill Drain watershed encompasses a 285 square mile area. Elevations in the American River Basin range from a high of over 10,000 feet mean sea level (msl) feet to 343 feet msl feet at Folsom Reservoir near Sacramento, California.

The Middle Fork American River Watershed begins at the headwaters located along the crest of the Sierra Nevada west of Lake Tahoe and extends generally in a westerly direction to Folsom Reservoir. The Middle Fork American River flows approximately 62 miles from its headwaters in the Granite Chief Wilderness to its confluence with the

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North Fork American River, which is located approximately 21 miles above Folsom Dam. The major tributaries to the Middle Fork American River include Duncan Creek, the Rubicon River, and the North Fork of the Middle Fork American River. Information on the streams and rivers associated with the MFP including drainage area, stream lengths and stream gradients is summarized in Table 6.3-1.

6.3.2.1 Climate and Precipitation

The Watershed is characterized by hot, dry summers and mild, wet winters, with most of the precipitation falling between October and March. Precipitation falls as rain in the lower elevations and snow at elevations greater than 5,000 feet above msl. Elevations higher than about 6,000 feet msl are typically extensively covered by snow until May. Years tend to either be wet or dry with high inter-annual variability, and few years receiving the 'average' amount of precipitation. The annual precipitation in the Watershed ranges between 40 and 70 inches, with an average of 50 inches. The wet season is typically between October and March. Little precipitation occurs during the summer and fall, except for occasional thunderstorms.

Precipitation and snowfall accumulation are recorded in the vicinity of the MFP through a network of monitoring and recording stations operated by the National Weather Service, the California Department of Forestry (CDF), the United States Department of Agriculture Forest Service (USDA-FS), the United States Bureau of Reclamation (USBR), and PCWA. Measurements are collected at higher elevations near Duncan Creek (elevation 7,100 feet) down to the lower elevations near Folsom Dam (350 feet). Real-time and historical precipitation data of rainfall and snowfall accumulation are available on the California Data Exchange Center website (http://cdec.water.ca.gov).

Runoff

Runoff is derived from both rainfall and snowmelt and annual amounts can vary greatly depending on the amount and distribution of rainfall within the Watershed. Occasional very intense and localized winter rainstorms result in substantial runoff. The typical snowmelt period when runoff and stream flows are high, is between April through mid-June, occurring slightly earlier in drier years and lasting longer during wetter years.

The mean annual runoff for the Watershed is about 830,000 acre-feet. Calculated runoff into Folsom Reservoir from the American River Watershed is graphically depicted on Figure 6.3-3. These data represent combined flows from the North Fork, Middle Fork, and South Fork American River watersheds. Based on the unimpaired inflows into Folsom Reservoir for the period between 1921 and 2005[1], 26%, 38%, and 36% of the years were classified as wet, medium, and dry water year types, respectively.

[1] The water year types for the years between 2002 and 2005 are estimated from the May Bulletin 120 data for the American River Basin at Folsom (California Department of Water Resources 2005).

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Air Temperature

Air temperatures range from over 100 degrees Fahrenheit (°F) during the summer months to below freezing during the winter in the higher elevations. In the lower elevations, summer high temperatures can reach 100 °F or more, and typically range between 87 and 94 °F. During the winter, high temperatures range between 46 and 54 °F. Temperatures decrease about 3 °F and precipitation increases by about 10 inches for every 1,000 foot increase in elevation (USBR 1992). Summer temperatures in the Watershed are moderated by winds from the south or southwest, originating in the Sacramento/San Joaquin Delta. These winds can cool temperatures by 10 to 20 °F.

6.3.3 Existing and Proposed Uses of Project Waters

The existing and potential beneficial uses that apply to surface waters within the Watershed are identified in Table II of *The Sacramento River Basin and San Joaquin River Basin Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board –Control Valley Region Fourth Edition revised September 2004*. The Basin Plan identifies beneficial uses of water in the Watershed as: (1) municipal and domestic supply; (2) agricultural irrigation and stock watering; (3) power generation; (4) contact recreation; (5) non-contact recreation; (6) coldwater habitat and spawning habitat for fisheries; and (7) wildlife habitat.

Surface water uses in the Watershed include consumptive use for municipal water supply and irrigation, and non-consumptive uses for hydroelectric generation and recreational activities. Water from the Middle Fork American and Rubicon Rivers, and their tributaries, account for a significant portion of the overall water supply provided to the residents and businesses of the County of Placer and northern Sacramento County by PCWA. After generating hydroelectric power in the MFP powerhouses, water is diverted for consumptive purposes from the river below Oxbow Powerhouse, in accordance with PCWA's water rights permits, at one of two diversion points located downstream of the MFP FERC Project Boundary. The two diversion points are the Auburn Pumping Plant, located near the city of Auburn, California, and Folsom Reservoir. Municipal and domestic supply and irrigation for agricultural crops are the largest uses of consumptive water from the watershed.

The largest non-consumptive water use in the Watershed is for hydroelectric power generation by PCWA for the MFP and by the Sacramento Municipal Water District (SMUD) for the Upper American River Project (UARP). Other non-consumptive water uses in the Watershed include recreation use (boating, swimming and fishing) and instream flow releases for fish and wildlife habitat.

6.3.3.1 Overview of the MFP

The MFP is owned and operated by PCWA and is a multi-purpose water supply and hydroelectric generation project designed to control and conserve waters of the Middle Fork American River, Duncan Creek, Rubicon River, Long Canyon Creek, and their respective upstream tributaries. The Project is operated to meet four objectives:

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maintenance of water flows to protect environmental resources, water supply for PCWA customers, generation of electrical energy, and recreational opportunities. Construction of MFP facilities began in 1963 following issuance of the FERC License and operations began in 1967 upon completion of construction activities. The MFP is located in central California within Placer and El Dorado counties, and lies within the boundaries of both the Tahoe and Eldorado National Forests.

The MFP includes two large dams and principal water storage reservoirs, French Meadows and Hell Hole (combined gross storage of 342,583 acre-feet (ac-ft)); two medium dams and reservoirs, Middle Fork Interbay and Ralston Afterbay (combined storage of 2,957 ac-ft); and three small dams and diversion pools, Duncan Creek, North Fork Long Canyon and South Fork Long Canyon. These Project features are shown geographically on Figure 6.3-1 and schematically on Figure 6.3-4. The Project facilities are located at elevations ranging from approximately 5,200 feet msl at Duncan Creek Diversion to approximately 1,200 feet msl at Ralston Afterbay. An elevation profile of the Project facilities is shown on Figure 6.3-5. Information on the MFP diversion facilities in the Watershed is provided in Table 6.3-2. A detailed description of all MFP facilities is provided in Section 5.2 of the Project Description.

6.3.3.2 Project Operations

The headwaters of the Middle Fork American River and its tributaries flow into the French Meadows Reservoir which is impounded by French Meadows Dam (also referred to as LL Anderson Dam). The Duncan Creek Diversion also routes water from Duncan Creek into French Meadows Reservoir via the 1.5 mile-long Duncan Creek - Middle Fork Tunnel. Water stored in French Meadows Reservoir is conveyed to the Hell Hole Reservoir via the 2.6 mile-long French Meadows - Hell Hole Tunnel. Hell Hole Dam impounds water flowing from the upper reaches of the Rubicon River drainage into Hell Hole Reservoir.

Water transported from French Meadows Reservoir to Hell Hole Reservoir via French Meadows – Hell Hole Tunnel, passes through the French Meadows Powerhouse, located on the north shore of Hell Hole Reservoir approximately 1.5 miles east of the Hell Hole Dam. French Meadows Powerhouse has a nameplate generating capacity of 15.3 MW from a single generation unit. The Hell Hole Powerhouse, located at the base of Hell Hole Dam, generates electricity from stream maintenance flow releases into the Rubicon River, and has a nameplate generating capacity of 0.725 MW from a single generator.

Water stored in Hell Hole Reservoir is transported through the 10.4-mile-long Hell Hole – Middle Fork Tunnel to the Middle Fork Powerhouse. Water in the Hell Hole - Middle Fork Tunnel is augmented by diversions from the North and South Forks of Long Canyon creeks. The Middle Fork Powerhouse has a nameplate generating capacity of 122.4 MW from two generating units. The Middle Fork Powerhouse releases water to Middle Fork Interbay, impounded by Interbay Dam, on the Middle Fork American River. Middle Fork Interbay acts as an afterbay for the Middle Fork Powerhouse and as a forebay for the inlet to the Middle Fork - Ralston Tunnel.

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The 6.7 mile-long, Middle Fork - Ralston Tunnel supplies water to a single generating unit at the Ralston Powerhouse. The powerhouse has a nameplate electrical generating capacity of 79.2 MW and discharges to the Ralston Afterbay. The Ralston Afterbay Dam forms Ralston Afterbay located on the Middle Fork American River just downstream of the confluence of the Rubicon River and the Middle Fork American River.

The Ralston Afterbay supplies water to the 403 foot-long Ralston - Oxbow Tunnel and Oxbow Powerhouse at the downstream end of the tunnel. The Oxbow Powerhouse has a nameplate electrical generating capacity of 6.1 MW from a single generator. Water from the Oxbow Powerhouse is discharged to the Middle Fork American River approximately 29 miles upstream of Folsom Reservoir.

The MFP is operated in accordance with parameters defined by the FERC license, water rights permits, water supply contracts, a Power Purchase Contract with PG&E and physical system constraints. Each of these operating parameters are briefly described below. A complete description of Project operations and constraints are provided in Sections 5.5 and 5.6 of the Project Description.

Current License Conditions

The MFP operates under the FERC Project No. 2079 license, issued on March 13, 1963 using water made available through permits and license issued by the State Water Resources Control Board (SWRCB) historically known as the State Water Rights Board (SWRB). The current license conditions contain provisions regarding the operations of the Project such as minimum pool requirements for Project reservoirs, impoundments, and diversions; and, minimum stream maintenance flow releases from Project facilities. Table 6.3-3 summarizes the current minimum pool and minimum stream maintenance flow requirements. Under the existing license, minimum instream maintenance flow releases are based on the California Department of Water Resources (DWR) current year forecast of unimpeded runoff from the American River to Folsom Reservoir.

In addition, the licensee is required to keep and annually submit to the USGS accurate and sufficient records from reservoir and stream gaging stations. The license order also requires that the two tainter gates in the French Meadow Spillway remain blocked open from November 15 through April 1, unless specifically exempted.

Water Rights

PCWA currently has five water rights permits and one license issued by the SWRCB with the MFP. The water rights permits allow for the diversion and storage of water for consumptive use or non-consumptive power production. Four permits, Nos. 13855, 13856, 13857 and 13858 were issued on January 10, 1963 to PCWA by the State Water Resources Control Board (SWRCB). These permits authorize direct diversion and off-stream storage of waters from Duncan Creek, Middle Fork American River, Rubicon River, and the North and South Forks of Long Canyon Creek. Two of the permits (13855 and 13857) authorized beneficial use for MFP Power and Incidental Recreation. Two additional permits (Nos. 18380 and 20754) were issued to the PCWA

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by the SWRCB to authorize power use of water released from Hell Hole Reservoir for stream maintenance and fishery purposes. Permit 18380 has since been licensed by the SWRCB as License 12644. Under these latter two authorizations, power is generated at the Hell Hole Powerhouse, located at the base of the dam. Key provisions of the permits and license relevant to the operations of the MFP are summarized in Table 6.3-4.

PCWA's water rights for power authorize direct diversion of water year round and from storage from November 1 to July 1. The permits for consumptive use authorize direct diversion only from November 1 to July 1, though water previously stored in the MFP reservoirs and then released can be rediverted by PCWA at any time. In addition, an agreement with the United States limits PCWA's consumptive use of water under Permits 13856 and 13858 to a maximum of 120,000 acre-feet of water annually.

PCWA holds sufficient water rights to fully utilize all MFP facilities, including reservoir storage and diversion through tunnels and powerhouses. PCWA's water rights are sufficient to meet all current and reasonably foreseeable consumptive delivery obligations.

The permits also require:

- protection of water quality and aquatic species;
- public access to Project lands and water; and
- minimum pool and minimum stream maintenance flow requirements as described in Table 6.3-3.

PCWA's water rights for the MFP will be subject to review by the SWRCB after December 1, 2007.

Power Purchase Contract

The electrical output of the MFP is contractually obligated to PG&E pursuant to the Middle Fork Project Power Purchase Contract dated April 30, 1963. This power purchase contract includes limits on the timing of diversion of water for consumptive use, which in turn have implications for releases from MFP reservoirs through the generation facilities. The limits for monthly diversions of water are:

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January	0% - 5%
February	0% - 5%
March	2% - 6%
April	5% - 10%
May	9% - 16%
June	12% - 19%
July	13% - 19%
August	13% - 16%
September	12% - 13%
October	4% - 8%
November	0% - 6%
December	0% - 5%

Water Supply Contracts

PCWA has contracts with several entities that relate to the delivery and use of water from the MFP. PCWA's contracts with the San Juan Water District, the City of Roseville and the Sacramento Suburban Water District (formerly the Northridge Water District) provide for the delivery of up to 84,000 acre-feet of water annually, rediverted by these entities at Folsom Reservoir.

Three key elements of the agreements are germane to the operation of the MFP. First, the agreements between PCWA and the USBR, limit PCWA to a total diversion of 120,000 ac-ft per year from the Middle Fork American River for consumptive needs. Secondly, to the extent that PCWA withdraws water for consumptive needs at the American River Pumping Plant from July 1 through October 31, MFP facilities must be operated to release that same amount of water, plus any amount necessary to meet stream maintenance requirements at the American River Pump Station, located below the confluence of the North Fork and Middle Fork American River. Finally, to the extent that PCWA needs to withdraw water for consumptive needs from the Middle Fork American River at the Folsom Reservoir, releases from the MFP facilities do not necessarily need to match the pumping pattern at Folsom Reservoir (Folsom Reservoir is able to temporarily store water for pumping at a later date, if releases from the MFP do not precisely match pumping schedules).

The following two provisions of the agreements between PCWA and USBR may affect MFP operations in some years:

(i) "During dry years when water year total flows into Folsom are less than 600,000 acre feet, PCWA may be required to make releases to ensure that the total of water stored in the MF Project reservoirs at the end of the year is no more than at the beginning of the year.

(ii) PCWA may be required to release during each July, August, September, October, November, and December such amount of water so that the total quantity stored by the MF Project reservoirs

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> shall be no more at the end of each month than it was at the beginning of the month."

Water Forum Agreement

PCWA is a member of the Water Forum, a regional group of water purveyors, water users, environmental groups, and business interests focused on responsible water use plans for the Sacramento/Placer region. The Water Forum participants have developed a set of agreements outlining water use goals, obligations and limitations for the American River Watershed.

PCWA's specific Water Forum commitment includes limiting total usage to amounts commensurate with PCWA's water rights and water usage contracts, and an obligation to attempt to release additional water to the Middle Fork American and Rubicon rivers in the driest years. PCWA has committed, under certain conditions, to release up to 27,000 ac-ft of water, over and above the amount diverted to use, in years when the total unimpaired inflow into Folsom Reservoir is expected to be below 950,000 ac-ft.

Informal Agreements, Arrangements or Accommodations

In addition to the FERC license condition, water rights, and agreements previously described, PCWA has informal arrangements with various recreational interests that affect operations. In conjunction with PG&E, PCWA attempts to make rafting flows available in the Middle Fork American River below Oxbow Powerhouse on a schedule suitable for commercial rafting operations, particularly on weekends and during summer months. In addition, flows are lowered below Oxbow Powerhouse for certain competitive long distance events that must cross the river during those races once per year, including the Western States 100-mile Endurance Run and Western States Trail Ride.

PCWA, in conjunction with PG&E, has made accommodations in flow schedule to meet other interests or needs, such as construction, access or research on the Middle Fork American and Rubicon rivers. Such requests are addressed on a case-by-case basis.

Physical Constraints

The MFP includes various physical constraints that limit water flow, generation, or operational flexibility. Examples of these physical constraints would include reservoir or diversion pool storage capacities, tunnel, penstock and powerhouse flow capacities, discharge pipe and valve capacities and electrical power line capacities. These capacity limitations are discussed for each facility in Section 5.2 of the Project Description and are listed in Table 6.3-2.

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6.3.4 Hydrology

6.3.4.1 Existing Stream Flow and Storage Gages

PCWA currently maintains an extensive network of stream, powerhouse, and reservoir gaging stations in the Watershed to monitor and record the storage and flow of water through the MFP. This network consists of fifteen stations that measure flow in rivers, streams and powerhouses, and two stations that measure reservoir elevation and storage on Project reservoirs. Gaging stations maintained by PCWA are listed in Table 6.3-5 and identified in Figure 6.3-6. In addition to the gages maintained by PCWA, a number of other U.S. Geological Survey (USGS) stream and reservoir gages are present in the Middle Fork and North Fork American River watersheds including those associated with the Georgetown Divide Public Utility District's (GDPUD's) Stumpy Meadows Reservoir and with SMUD's Upper American River Project (UARP). These gages are also identified on Table 6.3-5.

Data from USGS gages in the Middle Fork American River Watershed were collected and compiled into a database. PCWA has also obtained pertinent flow data from SMUD, including existing flow records, estimates of unimpaired flows at a number of locations and calculated accretion flows. A central database containing all of the available flow data is publicly accessible on the Internet at http://www.pcwamfpdata.net. This data is also provided on the enclosed CD. The Internet site includes gage numbers, locations, watershed size, and period of records. In addition, maps and downloadable data reports are available. This database will be updated through 2010 as data becomes available from the USGS. As the data are used to develop hydrology, errors and spurious data will be corrected, and the corrected data added to the database. Data that are corrected or changed will be noted/flagged in the database. Because multiple data sets are available in some locations, the PCWA data website will include the data in which PCWA is most confident (generally USGS data). If data quality is questionable, PCWA will consult with the entities that supplied the data and resource agencies when assembling the data set to be used for the relicensing effort.

6.3.4.2 Installation of New Stream Gages

To augment the existing hydrologic data set, PCWA plans to install seven additional gages in waters affected by the Project to verify the unimpaired hydrology. PCWA evaluated the installation of these gages with the Resource Agencies as part of the Hydrology Study Plan (PCWA 2006). Special-use permits for installation of the gages were obtained from the Tahoe and Eldorado National Forests in late 2005. Figure 6.3-6 shows the locations of the seven proposed gages. PCWA plans to complete the installation of the new gages in late summer or early fall of 2006, depending on access and flow conditions. A complete description of these gages is provided in Appendix 6.3-A.

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6.3.4.3 Hydrologic Analysis

Period of Record

The period of record used to develop hydrology data for the MFP in this report extends from water year 1975 through water year 2003. This time period best represents the recent operation of the MFP since the issuance of the original FERC license. In addition, this period of record is consistent with the period of record used by SMUD during the relicensing of the UARP Project. Some of the hydrology developed for the UARP will be used as part of PCWA's relicensing because SMUD's operations of the UARP upstream of the MFP on the Rubicon and South Fork Rubicon rivers affects water flows within MFP. This time period is of sufficient duration to complete relevant hydrologic statistical analyses, such as Indicators of Hydrologic Alteration (IHA) and flood frequency analyses. Last, records of diversions and stream flows are more complete after 1975 based on a review of the historical records.

River and Stream Hydrology

In the Rubicon and Middle Fork American rivers downstream of Project reservoirs, spills rarely occur due to the large capacities of the reservoirs relative to the runoff volume. During non-spill years, flows within the stream channel are comprised primarily of minimum instream release and accretion flows. Rainfall events may result in comparatively short duration (few days) high flows within the lower watershed. Peak flows during spring runoff in non-spill years are captured in Hell Hole and French Meadows reservoirs. Peak flows in Duncan, North Fork Long Canyon, and South Fork Long Canyon creeks are typically diverted into the Project water conveyance system for power generation. In many years, flows in the Middle Fork American River downstream of Oxbow Powerhouse during the summer and early fall are influenced by peaking operations of the MFP and whitewater boating releases. These operational activities may result in daily changes in the flow regime downstream of Oxbow Powerhouse.

The hydrologic data for the period of record using existing USGS gage information for the rivers, streams, reservoirs, and powerhouses associated with MFP are summarized in Appendix 6.3-B. Seven of the gaging stations for which hydrologic data were summarized have incomplete data records (see Appendix 6.3-C). Four of these gages, listed below, have missing data, are not operational when flows are being diverted, or only record low flows, which skews the monthly exceedance calculations such that some months have unusually low values. The monthly exceedance calculations for the remaining three gages were not substantially skewed by the missing data.

- Middle Fork American River below Interbay Dam, USGS gaging station 11427770;
- South Fork Long Canyon Creek downstream of diversion, USGS gaging station 14433065;
- North Fork Long Canyon Creek downstream of diversion, USGS gaging station 14433085, and;

- Rubicon River below Hell Hole Dam, USGS gaging station 14428800.

The flows presented for the gaging stations located at the three MFP powerhouses listed below, are not recorded but are calculated based on measured generation at each powerhouse:

- Ralston Powerhouse, USGS gaging station 11427765;
- Middle Fork Powerhouse, USGS gaging station 11428600, and;
- Oxbow Powerhouse, USGS gaging station 11433212.

PCWA is currently consulting with Resource Agencies and interested stakeholders to develop an approach for filling in existing data gaps, estimating accretion flows between stream gages, and estimating unimpaired flows upstream of Project facilities. Once an acceptable methodology has been identified, PCWA will update hydrologic information presented in this report and provide a revised draft to the stakeholders for review. The following provides a summary of the existing hydrology in waters associated with the MFP.

Appendix 6.3-B includes the 20, 50, and 80 percent exceedances that present the median, wet, and dry hydrologic conditions in waters associated with the MFP. The monthly flow duration curves are presented in Appendix 6.3-D. The median condition (50 percent exceedance) represents monthly average values where half of the recorded days for that month have exceeded these flows and half have been less, for the period of record. The 20 percent exceedance value represents wetter than normal conditions for each month. These flows would only be exceeded by 20 percent of the recorded days for that location and month. The 80 percent exceedance value reflects dry conditions. For each month, these are flows that were exceeded by 80 percent of the days during the period of record. Monthly mean flows for each gaging station are presented in Appendix 6.3-E. Annual peak discharges are presented in Appendix 6.3-F. Along with information on the accuracy of recording peak flows at gaging locations in waters associated with the MFP is provided in Appendix 6.3-C.

Daily flows in waters associated with the MFP are illustrated in Appendix 6.3-G (includes stream flows, powerhouse flows, and tunnel flows). Hourly flows by month at the CDEC gage at Oxbow Powerhouse, which are the calculated flows based on the measured power generated at Oxbow Powerhouse, from November 26, 1997 to May 31, 2006, are illustrated in Appendix 6.3-H.

6.3.4.4 Reservoir Storage

French Meadows and Hell Hole reservoirs have a combined gross storage of 342,583 ac-ft. Interbay and Ralston Afterbay on the Middle Fork American River contribute an additional 2,959 acre-feet combined gross storage. Information on MFP reservoir and diversion pools including surface area, volume, maximum depth, mean depth, flushing rate, shoreline length, and substrate composition is also provided in Table 6.3-6.

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The volume of water storage in Hell Hole and French Meadows reservoirs is more than 95% of the average annual runoff in the watershed. Water levels in French Meadows and Hell Hole reservoirs are lowered in the late fall and early winter to provide adequate storage and to manage spring runoff (Figure 6.3-7). This drawdown must balance the objectives of providing sufficient storage space to minimize the potential for spilling the reservoirs if the following spring is wet, and retaining sufficient water in storage to ensure that an adequate supply of water to meet instream flow requirements and consumptive demands if the following spring is dry. Historically, the reservoirs have been operated to achieve a combined storage target of 150,000 acre-feet on December 31 of each year. During spring runoff, operating flows are adjusted to store as much water as possible without spilling the reservoirs. After the reservoirs have reached their maximum capacity in late spring or summer, flows are regulated first to meet instream flow requirements, then to meet consumptive water supply requirements, and then to optimize power generation. Appendices 6.3-B and 6.3-D include monthly storage duration curves and exceedence statistics for French Meadow and Hell Hole reservoirs. Storage information on the smaller reservoirs and diversion pools is not available at this time. With the exception of Ralston Afterbay, storage and water surface elevation at these smaller Project reservoirs and diversion pools remain constant when diversions are occurring. Ralston Afterbay storage and water surface elevation may fluctuate daily in the summer and early fall due to peaking operations of the MFP and whitewater boating releases. Both Middle Fork Interbay and Ralston Afterbay are lowered annually in the fall for approximately 6-8 weeks for maintenance at the powerhouses.

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6.3.5 References

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TABLES

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Table 6.3-1. Information on Watershed Area, Stream Length and Gradient of Waters Associated with the MFP (continued).

Stream Name	Total Sub-basin Area (mi^2)	Sub-divided Areas (mi^2)	Stream Length (mi)	Elevation (ft)	Average Stream Gradient (%)
Long Canyon Creek (continued)					
North Fork Long Canyon Creek	-	6.6	6.9	Starting: 6359.0 Ending: 4119.8	6.1
South Fork Long Canyon Creek	-	11.1	10.4	Starting: 6749.1 Ending: 4119.8	4.8
Rubicon River					
Rubicon River – Headwaters to Middle Fork American River	209.5	-	58.1	Starting: 8076.2 Ending: 1180.3	2.2
Rubicon River – Headwaters to Hell Hole Reservoir Dam	-	113.4	27.7	Starting: 8076.2 Ending: 4531.4	2.4
Rubicon River – Hell Hole Dam to Middle Fork American River	-	96.1	30.5	Starting: 4531.4 Ending: 1180.3	2.1
Other Major Streams in the Watershed					
South Fork Rubicon River – Headwaters to Confluence with Rubicon River	57.0	-	16.2	Starting: 7556.1 Ending: 3552.6	4.7
North Fork of Middle Fork American River – Headwaters to confluence with Middle Fork American River	92.5	-	18.8	Starting: 4373.3 Ending: 1069.9	3.3
North Fork American River– Confluence of Middle Fork American River to Folsom High Water Mark	5.5	-	4.0	Starting: 542.0 Ending: 491.1	0.2

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Table 6.3-2. Project Facility Summaries.

DUNCAN CREEK DIVERSION	
DAM	
Type	Gravity
Material	Concrete
Height of Dam Crest above Streambed	32 ft
Dam Crest Length	165 ft
Volume	1,750 cubic yards
Elevation of Dam Crest	5,275 ft
Elevation of Streambed	5,243 ft
Elevation of Spillway Crest	5,265 ft
Stream Maintenance Pipe Capacity	8 cfs
SPILLWAY	
Type	Uncontrolled Overflow
Width	100 ft
Capacity	7,200 cfs
RESERVOIR	
Gross Storage	20 ac-ft
DUNCAN CREEK – MIDDLE FORK TUNNEL	
Nominal Size and Shape	9'-0" W x l0'-0" H / Horseshoe
Length:	
Total	7,864 ft or 1.5 miles
Concrete Lined (Est.)	300 ft
Maximum Diversion Capacity	400 cfs
Invert Gradient	0.0029
FRENCH MEADOWS DAM (LL ANDERSON DAM) AND FRENCH MEADOWS RESERVOIR	
DAM	
Type	Composite
Material	Rock and Gravel Fill
Height of Dam Crest above Streambed	231 ft
Dam Crest Length	2,700 ft
Dam Crest Width	32 ft
Elevation of Dam Crest	5,273 ft
Elevation of Streambed	5,040 ft
Elevation of Spillway Crest	5,244.5 ft
Volume	3,510,000 cubic yards
Slopes – Upstream	2:1
Slopes – Downstream	1.8:1 and 2.0:1
Stream Maintenance Pipe Capacity	8 cfs
Maximum Low Level Outlet Capacity at Water Surface 5262 (full reservoir)	1,430 cfs
SPILLWAY	
Type	Gated Ogee Crest
Type of Gates	Radial
Number of Gates	2
Size of Gates	20' W x 18.5' H
Capacity (Res. Water Surface 5271.0, 2' freeboard)	19,800 cfs
RESERVOIR	
Maximum Operating Water Surface	5,262.0 ft
Minimum Operating Water Surface	5,125 ft
Gross Storage	134,993 ac-ft

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Table 6.3-2. Project Facility Summaries (continued).

FRENCH MEADOWS DAM (LL ANDERSON DAM) AND FRENCH MEADOWS RESERVOIR (continued)	
RESERVOIR (continued)	
Dead Storage (as constructed), at Tunnel Intake lip	7,635 ac-ft
Active Storage (as constructed)	127,358 ac-ft
Area at Maximum Operating Water Surface	1,408 acres
Area at Minimum Operating Water Surface	434 acres
Depth at Minimum Operating Water Surface	77 ft
Shoreline at Maximum Operating Water Surface	9 miles
FRENCH MEADOWS — HELL HOLE TUNNEL	
Nominal Size and Shape	12'-4" Horseshoe
Length:	
Total	13,694 ft or 2.6 miles
Concrete Lined (Est.)	1,617 ft
Steel Lined (Est.)	317 ft
Maximum Discharge	400 cfs
Invert Gradient	0.0025
FRENCH MEADOWS POWERHOUSE	
PENSTOCK	
Length	691 ft or 0.1 miles
Diameter	6'-3" O.D.
POWER PLANT	
Installed Capacity, Generator	15.3 MW
Type of Turbine	Francis
Maximum Tail Water Surface	4,630 ft
Minimum Tail Water Surface	4,608 ft
Maximum Static Head	654 ft
Minimum Static Head	517 ft
Elevation Runner	4,612 ft
R.P.M.	450
HELL HOLE DAM AND RESERVOIR	
DAM	
Type	Rockfill
Height of Dam Crest above Streambed	410 ft
Dam Crest Length	1,570 ft
Dam Crest Width	35 ft
Elevation of Dam Crest	4,650 ft
Elevation of Streambed	4,240 ft
Volume	8,440,000 cubic yards
Slopes - Upstream	2.5:1
Slopes - Downstream	1.4:1
Stream Maintenance Pipe Capacity	20 cfs
Maximum Low Level Outlet Capacity at water surface 4,630 (full reservoir)	852 cfs
SPILLWAY	
Type	Uncontrolled
Elevation of Spillway Crest	4,630 ft
Width at Lip	350 ft
Capacity (Water Surface 4647.1, 2.8' freeboard)	89,500 cfs

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Table 6.3-2. Project Facility Summaries (continued).

HELL HOLE DAM AND RESERVOIR (continued)	
RESERVOIR	
Maximum Operating Water Surface	4,630 ft
Minimum Operating Water Surface	4,340 ft
Gross Storage	207,590 ac-ft
Dead Storage (as constructed), at Tunnel Intake lip	2,533 ac-ft
Active Storage (as constructed)	205,057 ac-ft
Area at Maximum Operating Water Surface	1,253 acres
Area at Minimum Operating Water Surface	185 acres
Depth at Minimum Operating Water Surface	88 ft
Shoreline at Maximum Operating Water Surface	11 miles
HELL HOLE POWERHOUSE	
Installed Capacity, Generator	0.725 MW
Normal Operating Tail Water Surface	4,240 ft
Maximum Static Head	391 ft
Minimum Static Head	101 ft
R.P.M.	1,200
HELL HOLE — MIDDLE FORK TUNNEL	
Nominal Size and Shape	l3'-5" Horseshoe
Length	
Total	55,006 ft or 10.4 miles
Concrete Lined (Est.)	6,780 ft
Steel Lined (Est.)	5,180 ft
Nominal Maximum Discharge, at full reservoir	920 cfs
Invert Gradient	0.0035 and 0.0077
NORTH FORK LONG CANYON DIVERSION	
DAM	
Type	Gravity
Material	Concrete
Height of Dam above Streambed	10 ft
Dam Crest Length	120 ft+
Elevation of Dam Crest	4,720 ft
Elevation of Streambed	4,710 ft
Volume	636 cubic yards
Stream Maintenance Pipe Capacity	2 cfs
SPILLWAY	
Type	Uncontrolled Overflow
Elevation of Spillway Crest	4,716 ft
Width of Spillway Crest	95 ft
Capacity	3,000 cfs

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Table 6.3-2. Project Facility Summaries (continued).

PIPE AND SHAFT TO HELL HOLE MIDDLE FORK TUNNEL	
PIPE	
Diameter	36 In.
Length	3,530 ft or 0.7 miles
SHAFT	
Diameter	6 ft
Depth without 6 ft x 20 ft Standpipe	403 ft
Capacity	100 cfs
Invert Gradient	Vertical
SOUTH FORK LONG CANYON DIVERSION	
DAM	
Type	Gravity
Material	Concrete
Height of Dam Crest above Streambed	27 ft
Dam Crest Length	145 ft
Elevation of Dam Crest	4,650 ft
Elevation of Streambed	4,623 ft
Volume	1,341 cubic yards
Stream Maintenance Pipe Capacity	5 cfs
SPILLWAY	
Type	Uncontrolled Overflow
Width of Spillway Crest	60 ft
Elevation of Spillway Crest	4,640 ft
Capacity	4,000 cfs
SHAFT TO HELL HOLE - MIDDLE FORK TUNNEL	
Diameter	6 ft
Depth without 6’ x 6 ft Standpipe	387 ft
Capacity	200 cfs
Invert Gradient	Vertical
MIDDLE FORK POWERHOUSE *(L.J. STEPHENSON POWERHOUSE)*	
PENSTOCK	
Length	3,653 ft or 0.7 miles
Diameter: Above Bifurcation	9’-0” O.D. to 7-6” O.D.
Diameter: Below Bifurcation	5’-6” O.D.
POWERPLANT	
Number of Units	2
Generator Installed Capacity (Total)	122.4 MW
Type of Turbine	Impulse
Elevation Nozzles	2,536 ft
Elevation Normal Tail Water Surface	2,529 ft
Maximum Static Head	2,096 ft
Minimum Static Head	1,806 ft
R. P. M.	400

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Table 6.3-2. Project Facility Summaries (continued).

MIDDLE FORK INTERBAY	
DAM	
Type	Gravity
Material	Concrete
Height of Dam Crest above Streambed	70.5 ft
Dam Crest Length	233 ft
Elevation of Dam Crest	2,535.5 ft
Elevation of Streambed	2,465 ft
Volume	14,360 cubic yards
Stream Maintenance Pipe Capacity	23 cfs
Low level Outlet Capacity at water surface 2530.0 (full reservoir)	890 cfs
Roadway Width, curb to curb	14 ft
Elevation of Roadway	2,537.67 ft
SPILLWAY	
Type	Gated Ogee Crest
Capacity (Water Surface 2534)	36,506 cfs
Width of Spillway	80 ft Gated, 60 ft Uncontrolled
Number of Gates	4
Type of Gates	Radial
Size of Gates	20’ H x 20’ W
Elevation of Top of Gates	2,530 ft
Elevation of Sill of Gates	2,510 ft
IMPOUNDMENT	
Maximum Operating Water Surface	2,529 ft
Minimum Operating Water Surface	2,502 ft
Normal Operating Water Surface	2,527 ft
Gross Storage	175 ac-ft
Dead Storage (as constructed), at Tunnel Intake lip	2 ac-ft
Active Storage (as constructed)	173 ac-ft
Area at Maximum Operating Water Surface	7 acres
Area at Minimum Operating Water Surface	3 acres
Depth at Minimum Operating Water Surface	37 ft
MIDDLE FORK — RALSTON TUNNEL	
Nominal Size and Shape	l3’-5” Horseshoe
Length	
Total	35,397 ft or 6.7 miles
Concrete Lined (Est.)	8,245 ft
Steel Lined (Est.)	245 ft
Maximum Discharge	836 cfs
Invert Gradient	0.0054

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Table 6.3-2. Project Facility Summaries (continued).

RALSTON POWERHOUSE	
PENSTOCK	
Length	1,670 ft
Diameter	9'-6" O.D. to 8'-O" O.D.
POWERPLANT	
Installed Capacity, Generator	79.2 MW
Type of Turbine	Impulse
Elevation Nozzles	1,186 ft
Static Head	1,344 ft
Maximum flow	924 cfs
R. P. M.	240
RALSTON AFTERBAY	
DAM	
Type	Gravity
Material	Concrete
Height of Dam Crest above Streambed	89 ft
Dam Crest Length	560 ft
Volume	76,300 cubic yards
Elevation of Dam Crest	1,189 ft
Elevation of Streambed	1,100 ft
Streamflow Maintenance Pipe Capacity	155 cfs
Maximum Low Level Outlet Capacity at water surface el. 1179.0 (full reservoir) - calculated	1,132 cfs
Roadway Width, Curb to Curb	12 ft
Elevation of Roadway	1,188.42 ft
SPILLWAY	
Type	Gated Ogee Crest
Capacity at Water Surface 1186	171,200 cfs
Elevation of Top of Gates	1,179 ft
SPILLWAY (continued)	
Elevation of Sill of Gates	1,149 ft
Crest Length	232 ft
Number of Gates	5
Type of Gates	Radial
Size of Gates	30' H x 40' W
IMPOUNDMENT	
Gross Storage	2,782 ac-ft
RALSTON-OXBOW TUNNEL	
Nominal Size and Shape	13'-3" Horseshoe
Length:	
Total	403 ft or 0.08 miles
Concrete Lined	343 ft
Steel Lined	60 ft
Maximum Discharge	1,088 cfs
Invert Gradient	0.12035

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Table 6.3-2. Project Facility Summaries (continued).

OXBOW POWERHOUSE	
PENSTOCK	
Length	5 ft
Diameter	9'-O" I.D.
POWERPLANT	
Installed Capacity, Generator	6.1 MW
Type of Turbine	Francis
Elevation Runner	1,098.5 ft
Static Head	90 ft
Normal Tail Water Surface	1,089 ft
Maximum flow	1,025 cfs
R. P. M.	200
SUMMARY – PROJECT FEATURES	
Power and Energy Production	
Total Installed Capacity (at 0.9 power factor)	223.75 MW
Total Dependable Capacity (at 0.9 power factor)	210.1 MW
Average Annual Energy Production (Based on 38 years of operation: 1967-2004)	1,026,975 MW Hours
Maximum Total Static Head	4,162
Water Supply and Regulation	
Total Gross Storage	345,560 Acre Feet
Project Features	
Earth and Rockfill Dams	11,900,000 Cubic yards
Concrete Dams and Diversions	94,000 Cubic yards
Tunnels and Penstocks	23.2 miles
Project Completed – 1967	

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Table 6.3-3. Minimum Pool and Minimum Stream Maintenance Flow Requirements.

Facility	License Requirement
Minimum Pool Requirements	
French Meadows Reservoir	Minimum Pool (a/f) Forecast / Folsom Reservoir [1] — June-Sept — Oct-May > 2,000,000 a/f — 60,000 — 50,000 1,200,000 – 2,000,000 a/f — 60,000 — 25,000 < 1,200,000 a/f — 28,000 — 8,700
Hell Hole Reservoir	Minimum Pool (a/f) Forecast / Folsom Reservoir [1] — June-Sept — Oct-May > 2,000,000 a/f — 70,000 — 50,000 1,200,000 – 2,000,000 a/f — 70,000 — 25,000 < 1,200,000 a/f — 26,000 — 5,500
Duncan Creek Diversion	Maintain water surface elevation at 5,259 feet elev.
Minimum Stream Maintenance Flow	
Duncan Creek Diversion Dam	Forecast / Folsom Reservoir[1] — Release (cfs) > 1,000,000 a/f — lesser of 8 or natural flow < 1,000,000 a/f — lesser of 4 or natural flow
French Meadows Dam	Beginning of operations to March 17,1981: Forecast / Folsom Reservoir[1] — Release (cfs) > 1,000,000 a/f — 8 at all times Except that total releases shall not exceed 5,800 a/f < 1,000,000 a/f — 4 at all times Except that total releases shall not exceed 2,900 a/f March 18, 1981, and thereafter – no limitation of total release.
Hell Hole Dam	Beginning of operations to March 17, 1981: Forecast / Folsom Reservoir[1] — Release (cfs) > 1,000,000 a/f — 20 June 1 – July 25; 15 July 26 – Aug 5; 10 Aug 6 – Oct 31; 14 Nov 1 – Jan 31; 20 Feb 1 – May 31 Except that total releases shall not exceed 11,000 a/f. < 1,000,000 a/f — 8 June 1 – Dec 1; 6 Jan 1 – March 25; 8 March 26 – May 31 Except that total releases shall not exceed 5,500 a/f. March 18, 1981, and thereafter: Forecast / Folsom Reservoir[1] — Release (cfs) > 1,000,000 a/f — 20 May 15 – Dec 14; 10 Dec 15 – May 14 No limitation of total release. < 1,000,000 a/f — 10 June 1 – Oct 14; 6 Oct 15 – May 31 No limitation of total release.
South Fork Long Canyon Diversion Dam	Forecast / Folsom Reservoir[1] — Release (cfs) > 1,000,000 a/f — lesser of 5 or natural flow < 1,000,000 a/f — lesser of 2.5 or natural flow
North Fork Long Canyon Diversion Dam	Releases to maintain stream flow of 2 cfs or the natural flow, whichever is less, shall be made at all times.

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Table 6.3-3. Minimum Pool and Minimum Stream Maintenance Flow Requirements (continued).

Facility	License Requirement	
Minimum Stream Maintenance Flow (continued)		
Middle Fork Interbay	Forecast / Folsom Reservoir > 1,000,000 a/f < 1,000,000 a/f	Release (cfs) lesser of 23 or natural flow lesser of 12 or natural flow
Oxbow Powerhouse	Releases at Oxbow Powerhouse shall be 75 cfs at all times as measured downstream of the confluence with the North Fork of the Middle Fork. Such releases shall not cause vertical fluctuations (measured in representative section) greater than 3 feet per hour.	

[1]Forecast / Folsom Reservoir = CDWR current year forecast of unimpeded run-off of the American River to Folsom Reservoir.

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Table 6.3-4. Summary of Water Rights Permits

Permit No.	Type of Use	Reference	Source	Direct Diversion		Off-Stream Storage	
13855	Power/ Incidental Recreation	SWRCB[1] (a) –1(a)., p. WR-1	Duncan Creek to French Meadows Reservoir	150 cfs	Jan 1–Dec 31	25,000 af 400 cfs max.	Nov. 1–Jul 1
		SWRCB (a) –1(b)., p. WR-1	Middle Fork Am. at French Meadows Reservoir	290 cfs	Jan 1–Dec 31	95,000 af	Nov. 1–Jul 1
		SWRCB (a) –1(c)., p. WR-1	Rubicon River at Hell Hole Reservoir	657 cfs	Jan 1–Dec 31	129,000 af	Nov. 1–Jul 1
		SWRCB (a) –1(d)., p. WR-1	South Fork Long Canyon to Hell Hole Reservoir or Middle Fork Power Plant	400 cfs	Jan 1–Dec 31		
		SWRCB (a) –1(e)., p. WR-1	North Fork Long Canyon to Hell Hole Reservoir or Middle Fork Power Plant	100 cfs	Jan 1–Dec 31		
		SWRCB (a) –1(f)., p. WR-1	Middle Fork Am. River at Ralston Interbay	1,000 cfs	Jan 1–Dec 31		
		SWRCB (a) –1(f)., p. WR-1	Middle Fork Am. River at Ralston Afterbay	1,225 cfs	Jan 1–Dec 31		
13856	Irrigation, and Incidental Domestic, Recreational, Municipal and Industrial	SWRCB (a) –2(d)., p. WR-2	Duncan Creek to French Meadows Reservoir			25,000 af 400 cfs max	Nov. 1–Jul 1
		SWRCB (a) –2(c)., p. WR-2	Middle Fork Am. River to French Meadows Reservoir			95,000 af	Nov. 1–Jul 1
		SWRCB (a) –1(c)., p. WR-1	Rubicon River to Hell Hole Reservoir	657 cfs	Jan 1–Dec 31	129,000 af	Nov. 1–Jul 1
		SWRCB (a) – 1(a). p. WR-1	North Fork American River at Auburn	1225 cfs	Nov. 1 – July 1		
13857	Power/ Incidental Recreation	SWRCB (a) –3(a)., p. WR-2	Duncan Creek	50 cfs	Jan1–Dec 31		
		SWRCB (a) –3(b)., p. WR-2	Middle Fork Am. River to French Meadows Reservoir	110 cfs	Jan1–Dec 31	10,000 af	Nov. 1–Jul 1
		SWRCB (a) –3(c)., p. WR-2	Rubicon River at Hell Hole Reservoir	155 cfs	Jan1–Dec 31	36,000 af	Nov. 1–Jul 1
		SWRCB (a) –3(d)., p. WR-2	South Fork Long Canyon French to Hell Hole Reservoir			13,000 af 830 cfs max.	Nov. 1–Jul 1
		SWRCB (a) –3(e)., p. WR-2	North Fork Long Canyon to Hell Hole Reservoir			7,000 af 830 cfs max.	Nov. 1–Jul 1
		SWRCB (a) –3(f)., p. WR-2	Middle Fork American River to Ralston Afterbay	705 cfs	Jan 1–Dec 31		

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Table 6.3-4. Summary of Water Rights Permits (continued).

Permit No.	Type of Use	Reference	Source	Direct Diversion		Off-Stream Storage	
13858	Irrigation, and Incidental Domestic, Recreational, Municipal and Industrial	SWRCB (a) –4(a)., p. WR-2	North Fork American River	800 cfs	Nov. 1 – Jul 1		
		SWRCB (a) –4(b)., p. WR-2	Middle Fork American River to French Meadows Dam			10,000 af	Nov. 1 – Jul 1
		SWRCB (a) –4(c)., p. WR-2	Rubicon River at Hell Hole Reservoir.			36,000 af	Nov. 1 – Jul 1
		SWRCB (a) –4(d)., p. WR-2	South Fork Long Canyon to Hell Hole Reservoir			13,000 af 830 cfs max.	Nov. 1 – Jul 1
		SWRCB (a) –4(f)., p. WR-2	North Fork Long Canyon to Hell Hole Reservoir.			7,000 af 830 max.	Nov. 1 – Jul 1
13855-13858	Power/ Incidental Recreation Irrigation, and Incidental Domestic, Recreational, Municipal and Industrial	SWRCB (a) – 5., p. WR-3 Permit	To French Meadows Reservoir			Maximum 133,700 af	
		SWRCB (a) – 5., p. WR-3	To Hell Hole Reservoir			Maximum 208,400 af	
20754[2]	Power/ Incidental Recreation	SWRCB (a)	Hell Hole Reservoir	20 cfs	May 16 – Dec 14		
		SWRCB (a)	Hell Hole Reservoir	30 cfs	Dec 15 – May 15		
		SWRCB (a)	Hell Hole Reservoir	Maximum 17,640 af/yr.			

[1]The State Water Resources Control Board (SWRCB) was historically known are the State Water Rights Board (SWRB).

[2]Also known as Permit 20750.

Source:
State Water Rights Board (SWRB). Decision D-1104. Decision Approving Applications in the Matter of Application 18084, 18085, 18086, and 18087. November 21, 1962.
SWRB. Permit Number 20754 issued 8-18-1994.

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Table 6.3-5. Summary of Gaging Station Locations in the Middle Fork Project Area Watershed (the gages in waters associated with the MFP are shaded in yellow, discontinued gages are shaded in green).

Site Number	Site Name	Latitude	Longitude	Drainage	Elevation	Start Date	End Date
11426190	LAKE VALLEY CN NR EMIGRANT GAP CA	39°17'56''	120°38'31''	ND	ND	10-1-1964	9-30-2003
11426500	NF AMERICAN R NR COLFAX CA	39°2'25''	120°54'6''	308	897 ft	10-1-1911	9-30-1941
11426400	N. SHIRTAIL C NR DUTCH FLAT CA	39°7'49''	120°47'44''	9.1	ND	10-1-1956	9-30-1985
11427000	NF AMERICAN R A NORTH FORK DAM CA	38°56'10''	121°1'22''	715	342 ft	10-1-1941	9-30-2003
11427200	FRENCH MEADOWS PP NR MEEKS BAY C CA	39°4'	120°24'	ND	ND	10-1-1970	9-30-2003
11427500	MF AMERICAN R A FRENCH MEADOWS CA	39°6'35''	120°28'49''	47.9	4920 ft	10-1-1951	9-30-2003
11427700	DUNCAN CYN C NR FRENCH MEADOWS CA	39°8'9''	120°28'39''	9.9	5270 ft	9-1-1960	9-30-2003
11427750	DUNCAN CYN C BL DIV DAM NR FRENCH MEADOWS CA	39°7'59''	120°28'58''	10.5	5210 ft	10-1-1964	9-30-2003
11427760	MF AMERICAN R AB MF PH NR FORESTHILL CA	39°1'31''	120°35'40''	87.8	2540 ft	9-1-1965	9-30-2003
11427765	RALSTON PH NR FORESTHILL CA	39°0'1''	120°43'23''	ND	ND	10-1-1973	9-30-2003
11427770	MF AMERICAN R BL INTERBAY DAM NR FORESTHILL CA	39°1'35''	120°36'9''	89.1	2470 ft	10-1-1965	12-19-2002
11427940	RUBICON-ROCKBOUND TUNNEL NR MEEKS BAY CA	38°59'16''	120°13'29''	ND	6533 ft	10-1-1963	9-30-2003
11427960	RUBICON R BL RUBICON LK CA	38°59'20''	120°13'20''	26.8	ND	2-27-1991	9-30-2003
11428000	RUBICON R A RUBICON SPRINGS NR MEEKS BAY CA	39°1'10''	120°14'46''	31.4	6053 ft	2-1-1910	9-30-1986
11428001	COMBINED RUBICON R-ROCKBOUND TUNNEL CA	39°1'10''	120°14'46''	31.4	ND	1-1-1964	9-30-1983
11428300	BUCK-LOON TUNNEL NR MEEKS BAY CA	39°0'17''	120°15'21''	ND	6425 ft	10-1-1963	9-30-2003
11428400	L RUBICON R BL BUCK ISLAND DAM CA	39°0'20''	120°15'20''	6	ND	10-24-1984	9-30-2003
11428600	MF PH NR FORESTHILL CA	39°1'30''	120°35'43''	ND	ND	10-1-1974	9-30-2003
11428800	RUBICON R BL HELL HOLE DAM CA	39°3'24''	120°24'25''	114	4232 ft	11-6-1965	9-30-2003
11429000	SF RUBICON R A SM NR QUINTETTE CA	38°56'54''	120°23'57''	16.1	ND	2-1-1910	6-30-1914
11429300	ROBBS PEAK PH NR KYBURZ CA	38°53'50''	120°22'38''	ND	4880 ft	10-1-1962	9-30-2003

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Table 6.3-5. Summary of Gaging Station Locations in the Middle Fork Project Area Watershed (the gages in waters associated with the MFP are shaded in yellow, discontinued gages are shaded in green) (continued).

Site Number	Site Name	Latitude	Longitude	Drainage	Elevation	Start Date	End Date
11429340	LOON LK PH NR MEEKS BAY CA	38°58'57''	120°19'27''	ND	ND	10-1-1974	9-30-2003
11429500	GERLE C BL LOON LK NR MEEKS BAY CA	39°0'20''	120°18'52''	8	6250 ft	9-1-1962	9-30-2003
11429800	ROBBS PEAK TU NR RIVERTON CA	38°54'12''	120°22'18''	ND	ND	10-1-1962	9-30-1967
11430000	SF RUBICON R BL GERLE C NR GEORGETOWN CA	38°57'17''	120°24'2''	47.6	4970 ft	8-1-1961	9-30-2003
11430500	SF RUBICON R A MOUTH NR GEORGETOWN CA	38°58'5''	120°27'55''	56.9	ND	7-27-1956	9-30-1962
11431000	RUBICON R NR GEORGETOWN CA	38°57'30''	120°29'5''	195	3350 ft	4-1-1910	11-30-1964
11431500	GEORGETOWN DIVIDE DITCH ABOVE PILOT CREEK	38°56'18''	120°28'42''	ND	ND	10-1-1950	12-31-1961
11431800	PILOT C AB STUMPY MEADOWS RES CA	38°53'41''	120°35'2''	11.7	4280 ft	10-1-1960	9-30-2003
11432000	GEORGETOWN DIVIDE DITCH NR GEORGETOWN CA	38°54'12''	120°36'12''	ND	ND	3-29-1947	9-30-1960
11432500	PILOT C NR GEORGETOWN CA	38°54'14''	120°36'11''	15.1	4120 ft	4-1-1946	9-30-1960
11433040	PILOT C BL MUTTON CANYON NR GEORGETOWN CA	38°55'25''	120°38'27''	21.1	3760 ft	7-1-1961	9-30-2003
11433060	SF LONG CANYON C DIV TUNNEL NR VOLCANOVILLE CA	38°55'25''	102°38'27''	ND	4630 ft	10-1-1965	9-30-2003
11433065	SF LONG CYN C F REL BL DIV TU NR VOLCANOVILLE CA	39°3'4''	120°28'14''	ND	4630 ft	11-27-1988	6-11-2003
11433080	NF LONG CANYON C DIV TU NR VOLCANOVILLE CA	39°2'57''	120°28'56''	ND	4700 ft	10-1-1965	9-30-2003
11433085	NF LONG CYN C F REL BL DIV TU NR VOLCANOVILLE CA	39°2'57''	120°28'56''	ND	4700 ft	11-26-1988	6-5-2003
11433100	LONG CANYON C NR FRENCH MEADOWS CA	39°1'16''	120°30'53''	18	ND	9-1-1960	9-30-1992
11433200	RUBICON R NR FORESTHILL CA	38°59'33''	120°43'14''	315	1362 ft	10-1-1958	9-30-1984
11433212	OXBOW PH NR FORESTHILL CA	39°0'14''	120°44'44''	ND	ND	10-1-1973	9-30-2003
11433260	NF OF MF AMERICAN R NR FORESTHILL CA	39°1'27''	120°43'3''	88.9	ND	8-1-1965	9-30-1985
11433300	MF AMERICAN R NR FORESTHILL CA	39°0'22''	120°45'35''	524	1070 ft	10-1-1958	9-30-2003
11433400	CANYON C NR GEORGETOWN CA	38°56'3''	120°52'21''	12.5	ND	7-1-1966	10-10-1979

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Table 6.3-5. Summary of Gaging Station Locations in the Middle Fork Project Area Watershed (the gages in waters associated with the MFP are shaded in yellow, discontinued gages are shaded in green) (continued).

Site Number	Site Name	Latitude	Longitude	Drainage	Elevation	Start Date	End Date
11433420	MAINE BAR CANYON C NR GREENWOOD CA	38°55'34''	120°56'51''	0.8	ND	10-1-1972	9-30-1986
11433500	MF AMERICAN R NR AUBURN CA	38°55'5''	121°0'51''	614	552 ft	10-1-1911	1-31-1986
11433799	COMB FLOW N FK AMERICAN R + M FK AMERICAN CA	38°52'20''	121°3'18''	ND	ND	10-1-1973	9-30-1981
11433800	NF AMERICAN R BL AUBURN DAMSITE NR AUBURN CA	38°52'20''	121°3'18''	973	ND	5-11-1972	2-6-1986
11434000	NF AMERICAN R A RATTLESNAKE BAR CA	38°48'50''	121°5'35''	996	344 ft	10-1-1930	3-31-1955
11427400	FRENCH MEADOWS RESERVOIR	38°6.6'32''	120°25'49''	47	5263	12-21-64	10-6-2004
11428700	HELL HOLE RESERVOIR	39°3'54''	120°24'50''	114	4630	12-6-1965	10-6-2004

ND = no data available, N/A = Not applicable

Existing Gages associated with the MFP

Discontinued Gages in the watershed

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Table 6.3-6. Summary of General Characteristics of the Middle Fork Project Reservoirs and Small Diversion Impoundments.

Water Storage Facilities	Gross Storage (AF)	Minimum Surface Area (acres)	Maximum Surface Area (acres)	Maximum Operating Water Surface Elevation (ft)	Minimum Operating Water Surface Elevation (ft)	Minimum Depth (ft) (the regs want max and mean)	Flushing Rate (days)	Maximum Shoreline Length (miles)
Reservoirs								
French Meadows Dam	134,993	434	1,408	5,260.0	5,125.0	77	495	9
Hell Hole Reservoir	207,590	185	1,253	4,630	4,340	88	330	11
Middle Fork Interbay Reservoir	175	3	7	2,529	2,502	37	<1	1
Ralston Afterbay	2,782	68	83	1,178	1,167	62	2-3	4
Small Diversion Impoundments.								
Duncan Creek	20							
North Fork Long Canyon Creek	< 1							
South Fork Long Canyon Creek	< 1							

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Table 6.3-1. Information on Watershed Area, Stream Length and Gradient of Waters Associated with the MFP.

Stream Name	Total Sub-basin Area (mi^2)	Sub-divided Areas (mi^2)	Stream Length (mi)	Elevation (ft)	Average Stream Gradient (%)
Duncan Creek					
Duncan Creek – Headwaters to confluence with Middle Fork American	23.5	-	14.1	Starting: 7045.0 Ending: 3365.6	5.0
Duncan Creek – Headwaters to Duncan Creek Diversion Dam	-	9.9	5.5	Starting: 7045.0 Ending: 5257.7	6.2
Duncan Creek –Duncan Creek Diversion Dam to confluence with Middle Fork American River	-	13.6	8.6	Starting: 5257.7 Ending: 3365.6	4.2
Middle Fork American River					
Middle Fork American River – Headwaters to North Fork American River Confluence	184.5	-	62.3	Starting: 8268.1 Ending: 542.0	2.3
Middle Fork American River – Headwaters to French Meadows Reservoir Dam	-	47.0	15.1	Starting: 8268.1 Ending: 5084.2	4.0
Middle Fork American River – French Meadows Dam to Middle Fork Interbay	-	18.4	11.6	Starting: 5084.2 Ending: 2488.6	4.2
Middle Fork American River – Middle Fork Interbay Dam to Ralston Afterbay	-	22.8	10.8	Starting: 2488.6 Ending: 1158.1	2.3
Middle Fork American River – Ralston Afterbay Dam to confluence with North Fork American River	-	96.3	24.7	Starting: 1158.1 Ending: 542.0	0.5
Long Canyon Creek					
Long Canyon Creek – Headwaters to confluence with Rubicon River	49.0	-	28.8	Starting: 6749.1 Ending: 1398.5	3.5
Long Canyon Creek – Confluence of North and South Forks of Long Canyon Creek to confluence with Rubicon River	-	31.3	11.4	Starting: 4119.8 Ending: 1398.5	4.5

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FIGURES

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Placeholder for Figures 6.3-1 and 6.3-2

Figure 6.3-1 Principal Project Facilities

Figure 6.3-2 American River Basin

Non-Internet Public Information

These Figures have been removed in accordance with the Commission regulations at 18 CFR Section 388.112.

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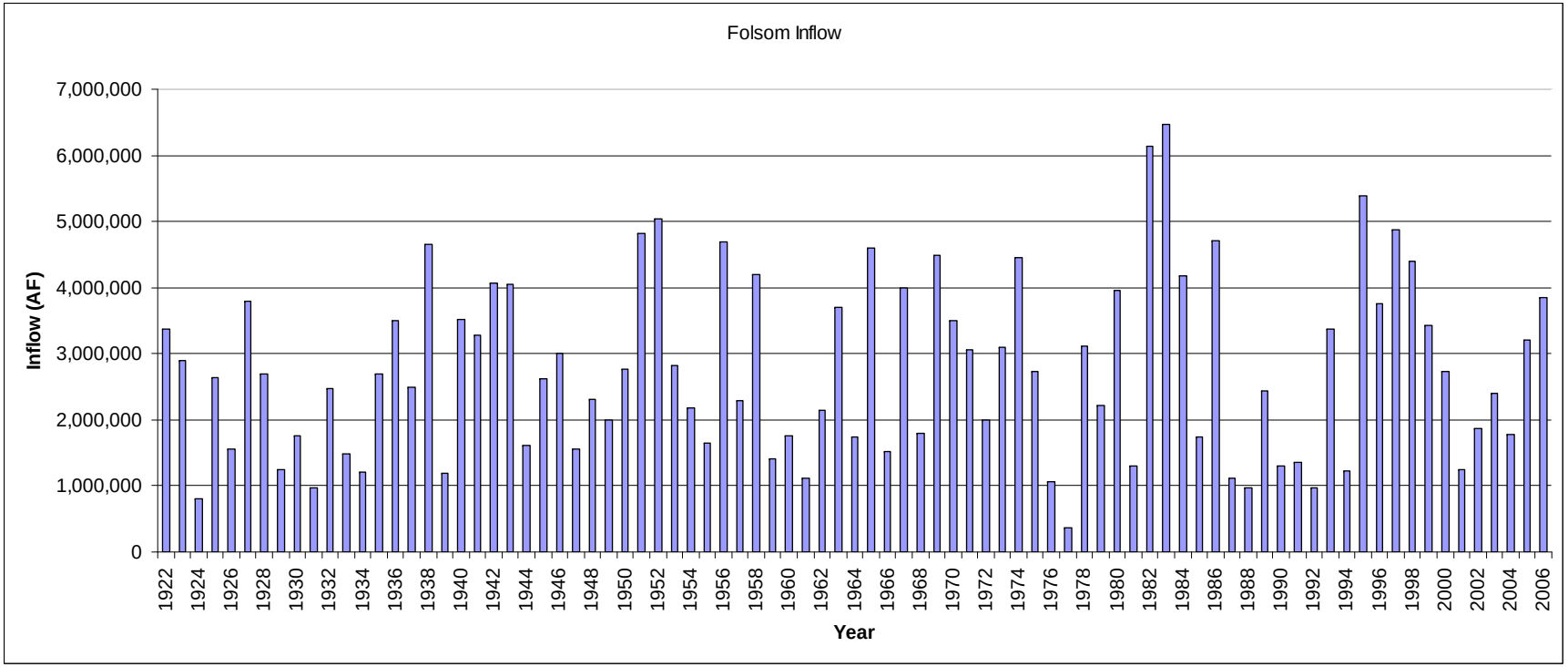
Figure 6.3-3. Mean Annual Runoff into Folsom Reservoir from the American River Watershed



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Placeholder for Figure 6.3-4

Figure 6.3-4 Project Schematic Diagram

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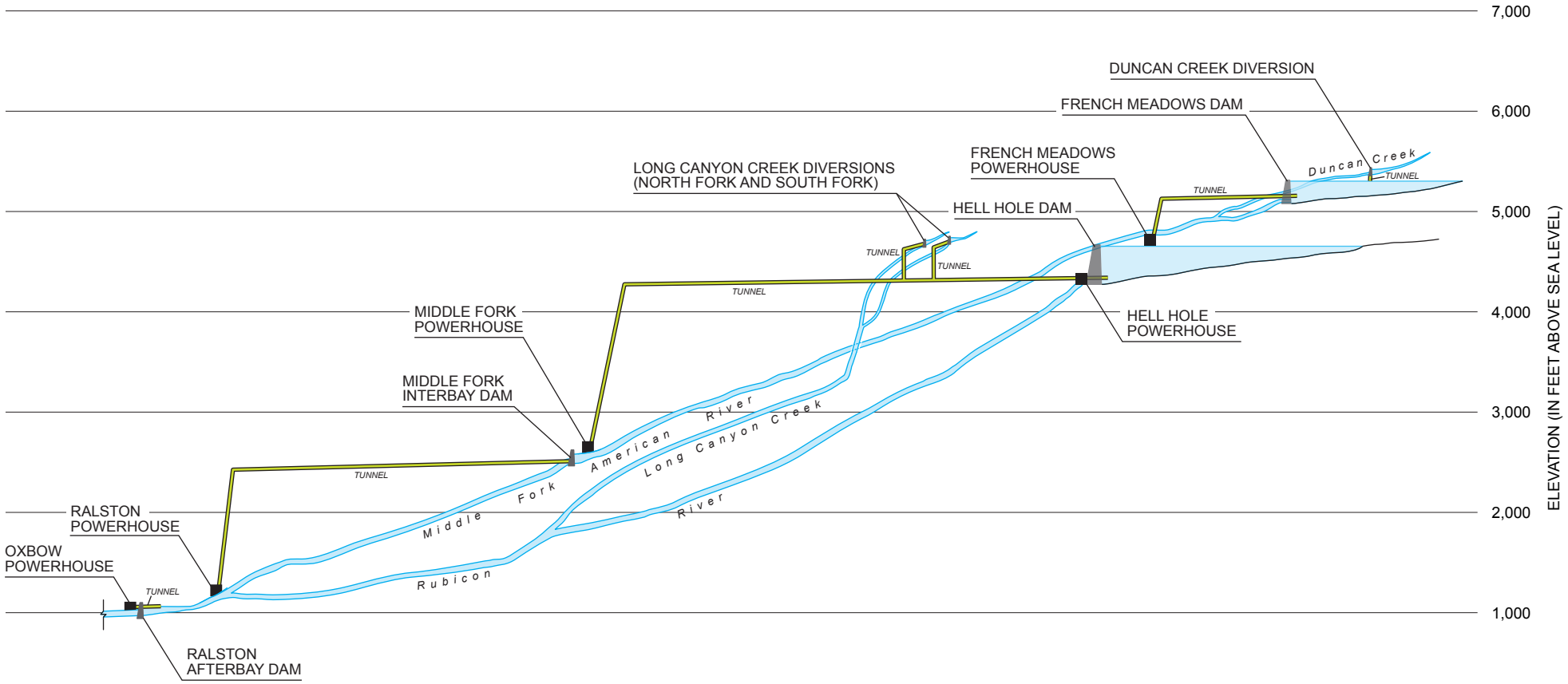

Placer County Water Agency
Middle Fork American River Hydroelectric Project

Figure 6.3-5
Project Profile

Not to scale

Revision date: 5/22/06

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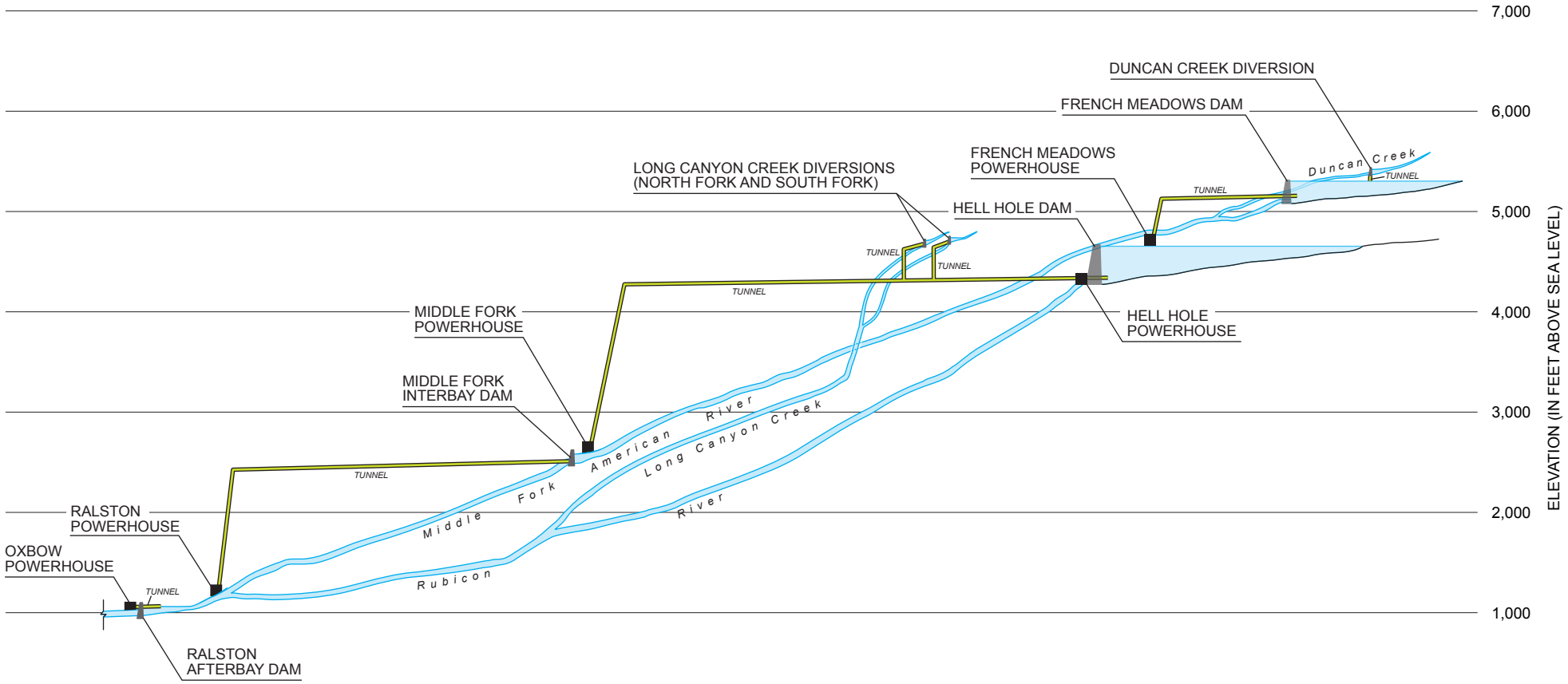

Placer County Water Agency
Middle Fork American River Hydroelectric Project

Figure 6.3-5
Project Profile

Not to scale

Revision date: 5/22/06

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Placeholder for Figure 6.3-6

Figure 6.3-6 Gaging Stations Maintained by PCWA

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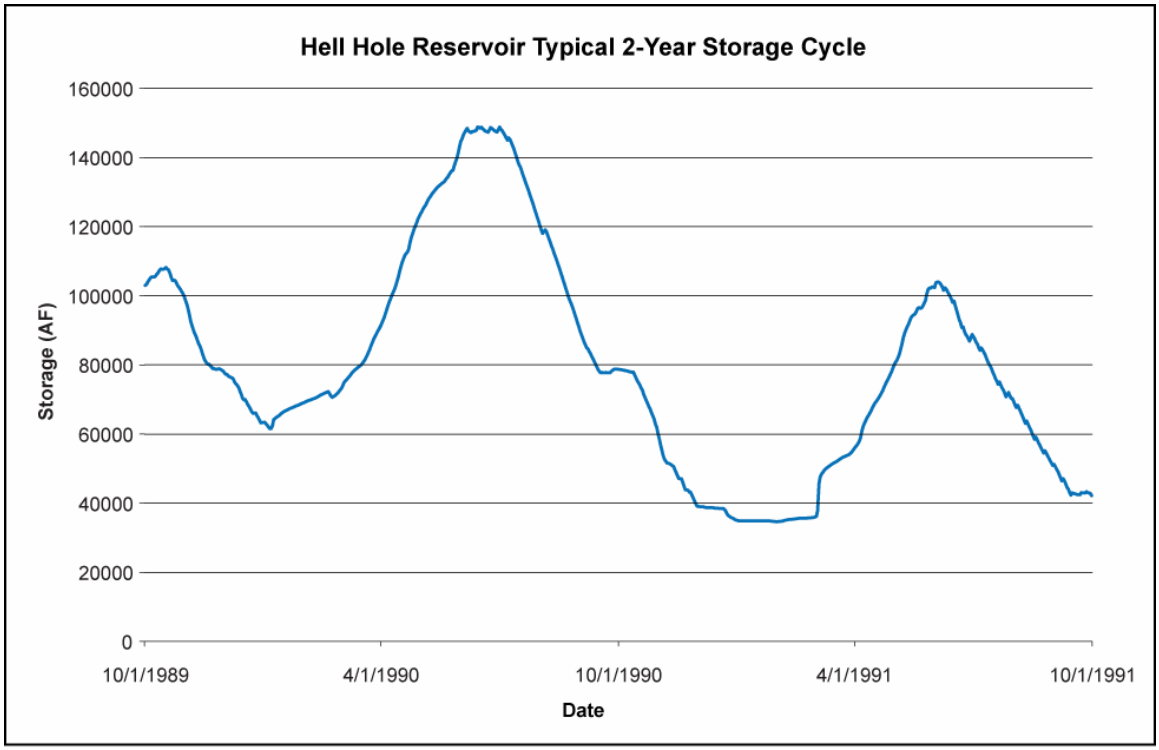
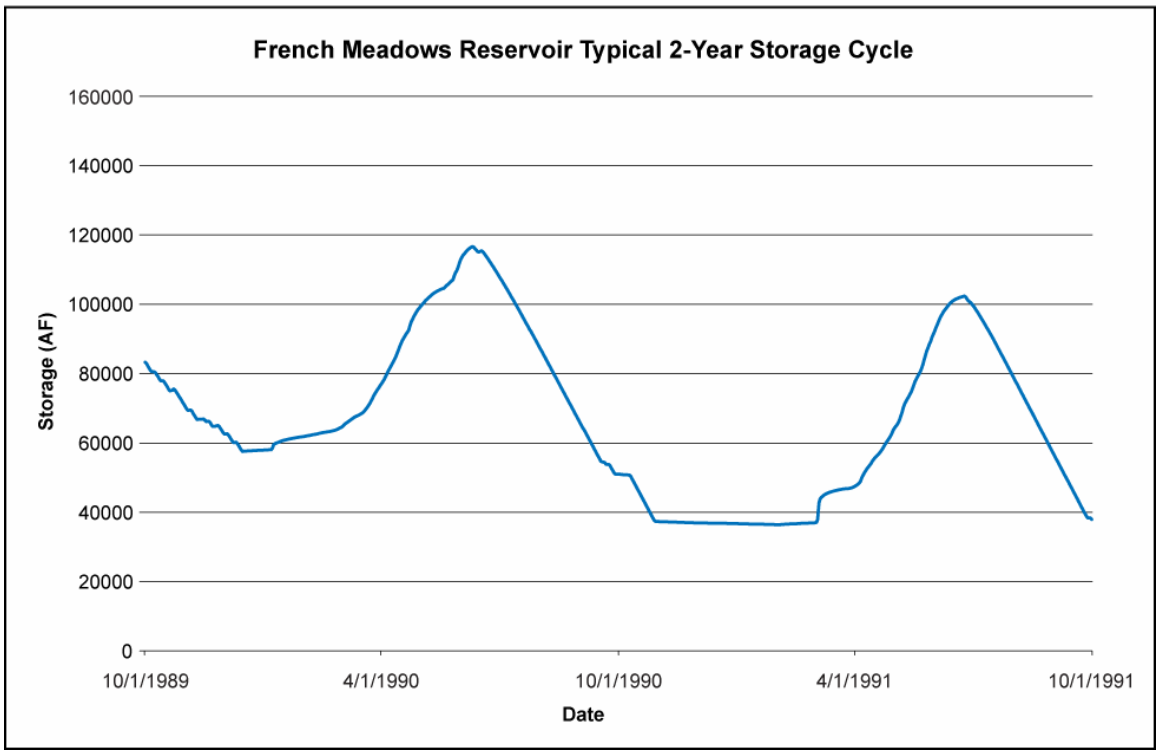
Figure 6.3-7. Hell Hole and French Meadows Reservoirs Typical 2-year Storage Cycles.





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APPENDIX 6.3-A

Location of the Seven Proposed Gages and Access Routes

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The following briefly describes the location of the seven proposed gages and access routes.

P-F1 NF of the MF American River upstream of confluence with MF American.

This site is located on the Middle Fork American River approximately 175-feet downstream of the Circle Bridge on the left bank (looking downstream). The gage will be installed on bedrock. The approximate coordinates are latitude (Lat) 39 01' 24", longitude (Long) 120 43' 15". This site can be accessed by taking Mosquito Ridge Road to Circle Bridge and crossing over the North Fork of the Middle Fork American River.

P-F2 Middle Fork American River above Ralston Afterbay.

This site is located on the Middle Fork of the American River upstream of Ralston Afterbay. The gage will be installed on bedrock. The approximate coordinates are Lat 39 0' 27", Long 120 43' 54". This site is located a few hundred yards upstream of the Ralston Day Use Area and can be accessed using a trail located on the north side of the Middle Fork American River near the bridge.

P-F3 Rubicon River upstream of Ralston Powerhouse.

This site is located directly upstream of the Ralston Powerhouse approximately 500-feet on the right bank. The gage will be installed on bedrock. The approximate coordinates are Lat 38 59' 33", Long 120 43' 14". This site can be accessed from Ralston Ridge Road and involves a very short cross-country hike. The effort at this location will involve reinstalling USGS Gage No. 11433200.

P-F4 Long Canyon Creek just above confluence with Rubicon.

This site is located just upstream of the mouth of Long Canyon Creek, near the confluence of the Rubicon River. The gage will be installed on the right bank (looking downstream) in bedrock. The approximate coordinates are Lat 38 59' 25", Long 120 41' 14". This site can be accessed via Buckeye Flat Road from Ralston Ridge Road. Buckeye Flat Road is an off-highway vehicle (OHV) road that terminates at a washed out section of the road near the Rubicon River about ½ mile downstream of the Long Canyon Creek mouth. A short hike along the Rubicon River to Long Canyon is required to reach the site. This location may be inaccessible during wet conditions.

P-F5 Long Canyon Creek below the confluence of North and South Forks.

This gage will be placed on the right bank approximately 100-feet downstream of the bridge where USFS Road 2 crosses Long Canyon Creek. The gage will be installed on

bedrock. The approximate coordinates are Lat 39 01' 08", Long 120 31' 09". This site can be accessed from USFS Road 2, also known as Eleven Pines Road.

P-F6 Rubicon River below confluence with South Fork Rubicon.

This site is located just upstream of Ellicott's Bridge on USFS Road 2. The gage will be installed on the right bank (looking downstream). The approximate coordinates are Lat 38 57' 36", Long 120 28' 52". The site can be accessed via Wentworth Springs Road, also known as USFS Road 1, to Eleven Pines Road, also known as USFS Road 2. The effort at this location will involve reinstalling USGS Gage No. 11431000.

P-F7 South Fork Rubicon just above confluence with Rubicon.

This site is located on the left bank (looking downstream) of the South Fork Rubicon River, just above its confluence with the Rubicon River. The gage will be installed in bedrock. The approximate coordinates are Lat 38 57' 17", Long 120 24' 02". The site can be accessed via a trail located on the left bank of the Rubicon River at Ellicott's Bridge. The trailhead is difficult to find due to the many campsites and trails in the area. There seem to be two trails that lead in the direction of the South Fork Rubicon. The lower trail near the edge of the terrace above the Rubicon River is washed out about ¼ mile upstream. The trail that leads to the gage site is higher up the slope. This particular trail is difficult to find because it is apparently not frequently used. The 1½-mile trail leads directly to the planned gage site, also the site of discontinued USGS Gage No. 11430500. Some of the old equipment is still visible at the site.

APPENDIX 6.3-B

Exceedance Tables in cubic feet per second for Gaging Stations in the Waters Associated with the MFP.

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Appendix 6.3-B. Exceedance Tables in cubic feet per second for Gaging Stations in the waters associated with the MFP.

Gage No.	Gage Description	Period of Record	Latitude NAD 27	Longitude NAD 27	Exceedances & Summary Statistics	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
Stream Gages																	
11427750	Duncan Canyon Creek below diversion dam near French Meadows	10/1/1964 - 9/30/2004	39°07'59"	120°28'58"	**20**	2	8	13	16	15	18	16	19	12	6	2	1
					50	1	3	7	10	10	13	12	11	8	3	1	1
					80	1	1	3	4	6	8	9	8	4	1	1	0
					Average	2	8	21	29	21	19	16	27	13	4	1	1
					Max	199	674	2,160	2,560	2,020	1,070	690	761	252	105	9	12
					Min	0	0	1	1	1	2	2	2	1	0	0	0
11427700	Duncan Canyon Creek near French Meadows	9/1/1960 - 9/30/2004	38°8'9"	120°28'39"	**20**	2	13	26	40	42	70	112	187	97	8	2	1
					50	1	4	9	14	23	33	66	99	20	3	1	1
					80	1	1	4	5	9	19	39	44	6	1	1	0
					Average	4	17	33	43	41	53	79	120	58	9	2	1
					Max	581	884	2,300	2,800	2,230	1,180	651	924	426	254	24	49
					Min	0	0	1	1	1	3	6	4	1	0	0	0
11427500	Middle Fork American River at French Meadows	10/1/1951 - 9/30/2004	39°06'35"	120°28'49"	**20**	10	11	17	22	50	63	210	364	182	13	10	10
					50	8	9	10	11	11	13	13	12	11	10	9	8
					80	3	6	8	9	9	10	10	9	9	7	5	3
					Average	16	13	34	37	49	53	104	177	103	25	8	9
					Max	3,080	557	11,300	9,980	7,750	2,460	1,930	3,430	1,420	521	84	232
					Min	0	1	2	3	4	4	4	3	3	3	1	0
11427760	Middle Fork American River above Middle Fork Powerhouse near Foresthill	10/1/1965 - 9/30/2004	39°01'31"	120°35'40"	**20**	22	44	92	200	206	272	244	269	90	39	24	20
					50	18	22	37	70	114	150	151	91	47	27	19	18
					80	14	17	23	28	47	93	82	50	30	18	14	14
					Average	27	45	88	172	171	207	177	176	93	36	19	20
					Max	532	1,000	2,400	7,600	4,750	3,180	940	3,570	1,090	570	47	235
					Min	7	8	12	10	14	17	17	17	11	7	6	5
11427770	Middle Fork American River below Interbay Dam	10/1/1965 - 12/19/2002; 2005-present	38°01'35"	120°36'09"	**20**	24	24	25	25	25	27	31	32	31	24	24	24
					50	19	21	23	23	24	24	24	24	24	23	21	20
					80	15	17	18	18	19	21	23	21	19	17	14	13
					Average	25	25	50	63	59	68	77	79	55	26	19	19
					Max	399	2,160	4,040	5,140	8,090	2,330	3,050	1,530	1,250	498	81	70
					Min	1	6	6	1	3	6	5	6	8	6	4	3
11433300	Middle Fork American River Near Foresthill	10/1/1958 - 9/30/2004	39°0'22"	120°45'35"	**20**	799	897	1,250	2,080	2,210	2,570	2,440	2,300	1,430	1,000	998	850
					50	192	517	577	767	1,270	1,420	1,500	1,280	805	663	700	554
					80	87	126	186	249	509	690	680	452	387	201	142	100
					Average	433	637	1,117	1,585	1,808	1,814	1,713	1,548	1,021	665	626	526
					Max	17,000	15,500	65,000	64,500	60,700	23,200	19,500	23,500	4,500	3,640	1,230	1,260
					Min	35	45	44	52	79	79	69	76	50	57	38	38
11433085	North Fork Long Canyon Creek Fish Release below Diversion Tunnel	11/26/1988 - 6/5/2003	39°02'57"	120°28'56"	**20**		4	4	4	4	4	4	4	4			
					50		3	3	3	3	3	3	3	3			
					80		3	2	3	3	3	3	3	3			
					Average	3	3	3	4	3	4	4	3	3			
					Max	4	4	9	13	9	8	7	9	5	0	0	0
					Min	2	3	2	2	2	2	2	2	2	0	0	0
11433065	South Fork Long Canyon Creek Fish Release below diversion tunnel	11/27/1988 - 6/11/2003	39°03'04"	120°28'14"	**20**		5	7	7	7	7	7	7	6	7		
					50		4	4	6	6	6	6	6	6	6		
					80		4	3	4	5	6	6	6	6	6		
					Average		4	5	6	6	6	6	6	6	6		
					Max	0	5	26	29	19	25	18	18	7	7	0	0
					Min	0	4	3	3	3	3	3	3	5	6	0	0
11428800	Rubicon River below Hell Hole Dam	11/6/1965 - 9/30/2004	39°03'24"	120°24'25"	**20**	26	22	22	18	20	22	23	26	25	23	22	22
					50	21	21	14	14	16	16	16	22	22	21	21	21
					80	9	13	12	12	12	13	13	16	19	17	9	9
					Average	20	20	24	57	21	29	21	62	102	43	16	18
					Max	61	678	4,350	17,100	1,190	6,650	557	8,720	1,990	1,350	31	57
					Min	4	7	0	6	6	5	8	8	0	7	0	0

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Appendix 6.3-B. Exceedance Tables in cubic feet per second for Gaging Stations in the waters associated with the MFP.

Gage No.	Gage Description	Period of Record	Latitude NAD 27	Longitude NAD 27	Exceedances & Summary Statistics	Flow Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
Diversions																	
11433080	North Fork Long Canyon Creek Diversion	10/1/1965 - 9/30/2004	39°02'57"	120°28'56"	**20**	0	0	1	7	11	21	24	22	1	0	0	0
					50	0	0	0	0	2	8	12	4	0	0	0	0
					80	0	0	0	0	0	0	2	0	0	0	0	0
					Average	0	1	2	4	7	12	14	11	2	0	0	0
					Max	9	63	88	100	89	83	63	86	56	1	0	1
					Min	0	0	0	0	0	0	0	0	0	0	0	0
11433060	South Fork Long Canyon Creek Diversion	10/1/1965 - 9/30/2004	38°55'25"	120°38'27"	**20**	0	0	3	20	22	46	47	48	11	0	0	0
					50	0	0	0	1	8	18	25	16	0	0	0	0
					80	0	0	0	0	0	5	6	2	0	0	0	0
					Average	0	3	5	10	14	23	29	25	8	0	0	0
					Max	1	251	180	157	178	150	202	181	116	18	1	0
					Min	0	0	0	0	0	0	0	0	0	0	0	0
Reservoir Gages																	
11427400	French Meadows Reservoir Gage	12/21/1964 - 9/30/2004	38°06'32"	120°25'49"	**20**	84,400	71,790	70,100	77,000	90,400	93,400	100,836	123,460	133,491	130,665	114,403	99,499
					50	74,600	61,600	56,800	58,699	60,400	66,700	82,300	102,500	123,200	118,700	104,532	89,116
					80	45,100	41,700	42,864	47,000	48,219	48,876	59,600	83,600	96,627	87,700	69,800	53,400
					Average	68,607	59,902	58,989	63,259	65,807	69,661	80,384	100,591	114,732	109,498	94,889	80,532
					Max	100,035	99,404	112,870	122,900	116,180	121,200	127,900	136,100	137,113	136,405	131,441	112,248
					Min	28,500	29,200	29,800	30,400	30,900	34,000	40,323	46,520	53,654	51,784	33,900	33,100
11428700	Hell Hole Reservoir Gage	12/6/1965 - 9/30/2004	38°03'54"	120°24'50"	**20**	136,818	135,150	128,525	127,700	139,341	161,762	169,950	194,442	203,601	196,800	172,991	147,106
					50	124,081	114,000	105,842	102,302	102,900	108,306	121,900	155,000	186,169	175,000	146,000	124,200
					80	98,100	79,200	77,500	79,100	79,400	79,369	98,000	122,000	142,962	135,793	126,321	102,900
					Average	116,454	109,726	105,251	107,675	109,901	116,448	131,605	156,746	172,579	163,952	143,588	122,734
					Max	167,400	182,702	211,050	213,100	208,845	210,700	208,330	211,100	209,348	209,000	202,018	181,825
					Min	35,000	34,001	40,100	40,200	41,700	51,100	71,900	87,836	83,000	74,400	50,600	37,509
Powerhouse Gages																	
11427200	French Meadows Powerplant near Meeks Bay	10/1/1975 - 9/30/2004	39°04'00"	120°24'00"	**20**	348	344	342	325	345	348	348	354	358	347	345	344
					50	265	0	0	0	93	114	0	0	206	305	301	241
					80	0	0	0	0	0	0	0	0	0	150	183	3
					Average	209	131	106	100	158	167	130	133	193	254	255	218
					Max	411	399	399	416	411	419	416	420	419	417	398	398
					Min	0	0	0	0	0	0	0	0	0	0	0	0
11427765	Ralston Powerhouse	10/1/1973 - 9/30/2004	39°00'01"	120°43'23"	**20**	626	653	706	742	929	932	933	934	932	880	881	750
					50	133	449	279	282	482	634	498	630	617	619	657	524
					80	0	37	17	24	37	64	48	32	263	347	406	124
					Average	299	408	359	376	470	523	491	540	583	582	609	478
					Max	981	939	950	946	950	950	950	950	950	945	950	945
					Min	0	0	0	0	0	0	0	0	0	0	0	0
11428600	Middle Fork Powerhouse	10/1/1974 - 9/30/2004	39°01'30"	120°35'43"	**20**	627	615	697	548	804	871	889	938	932	896	904	754
					50	103	411	256	216	402	487	337	478	606	633	666	502
					80	0	6	0	0	0	0	0	0	262	350	408	91
					Average	289	369	341	298	416	442	410	480	580	590	618	471
					Max	968	932	999	996	993	993	990	996	996	990	962	959
					Min	0	0	0	0	0	0	0	0	0	0	0	0
11433212	Oxbow Powerhouse	10/1/1973 - 9/30/2004	39°00'14"	120°44'44"	**20**	670	790	986	1,040	1,060	1,060	1,060	1,070	1,050	918	888	828
					50	45	466	406	617	820	941	843	857	655	648	677	572
					80	0	38	75	121	193	309	189	105	253	324	376	143
					Average	312	463	473	575	671	755	681	667	644	612	623	517
					Max	1,080	1,080	1,080	1,100	1,100	1,210	1,230	1,110	1,090	1,080	1,080	1,080
					Min	0	0	0	0	0	0	0	0	0	0	0	0

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Appendix 6.3-B. Exceedance Tables in cubic feet per second for Gaging Stations in the waters associated with the MFP.

Gage No.	Gage Description	Period of Record	Latitude NAD 27	Longitude NAD 27	Exceedances & Summary Statistics	Flow Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
Non-Operational Gages																	
11433100	Long Canyon Creek	9/1/1960 - 9/30/1992	39°01'16"	120°30'53"	**20**	3	16	26	53	58	77	81	74	22	8	3	2
					50	2	4	9	13	26	36	35	21	11	4	2	1
					80	1	2	4	5	11	19	18	11	6	2	1	1
					Average	3	17	40	56	62	61	60	45	16	5	2	1
					Max	358	849	2,450	2,200	2,640	1,120	1,000	339	142	79	13	24
					Min	0	0	1	1	2	3	3	3	1	0	0	0
11433200	Rubicon River Near Foresthill	10/1/1958 - 9/30/1984	38°59'33"	120°43'14"	**20**	62	164	338	703	847	867	2,440	1,290	665	118	64	50
					50	45	73	107	167	365	511	870	476	160	77	47	42
					80	27	40	56	78	176	307	461	149	91	51	28	26
					Average	82	167	536	654	689	660	817	722	398	118	49	42
					Max	9,600	5,400	60,000	35,000	44,000	11,100	8,270	3,410	3,230	1,790	310	289
					Min	10	14	18	25	23	31	22	28	17	9	8	7
11433260	North Fork of Middle Fork American River	8/1/1965 - 9/30/1985	39°01'27"	120°43'03"	**20**	40	176	384	677	570	765	703	649	186	70	42	33
					50	29	53	91	243	334	433	450	302	91	45	30	26
					80	21	28	41	77	147	272	255	115	51	30	22	23
					Average	39	186	351	575	480	557	514	399	132	53	33	29
					Max	1,180	6,290	13,900	18,000	9,850	6,730	5,450	1,470	700	570	110	197
					Min	9	11	17	18	21	29	27	31	14	9	8	7

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APPENDIX 6.3-C

Gaps in the Hydrologic Record

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Appendix 6.3-C Gaps in the Hydrologic Record

Seven of the gaging stations for which hydrologic data were summarized have incomplete data records. The exceedance calculations for the following three gages are not skewed by the missing data.

- Middle Fork Powerhouse, USGS gaging station 11428600. Missing water year 1987.
- Oxbow Powerhouse, USGS gaging station 11433212. Missing water years 1985, 1992, 1993, 1996, 1997, and 1998.
- French Meadows Powerhouse, USGS gaging station 11427200. Missing water years 1972, 1974, and 1987.

Four of these gages, listed below, have missing data, are not operational when flows are being diverted, or only record low flows, which skews the monthly exceedance calculations such that some months have unusually low values.

- Middle Fork American River below Interbay Dam, USGS gaging station 11427770. The gage station is missing data for 40 periods, with the longest extending for 130 days. Nine of the missing periods are longer than one week and three are longer than one month. In addition, since 1985, this gage has been operated as a low flow station only.

- South Fork Long Canyon Creek downstream of diversion, USGS gaging station 14433065. Data from this station is missing for 23 periods, with the longest extending for 379 days. Sixteen of the missing periods are longer than six months and two missing periods extend for more than nine months. The gage is not operational when flows are being diverted, which typically occurs from the spring through the fall.

- North Fork Long Canyon Creek downstream of diversion, USGS gaging station 14433085. Data from this station is missing for 23 periods, with the longest extending for 380 days. Eighteen of these periods last for more than one month and fourteen extend for more than six months. This gage is not operational when flows are being diverted, which typically occurs from the spring through the fall.

- Rubicon River below Hell Hole Dam, USGS gaging station 11428800. This gage only records flow flows for meeting minimum instream flow requirements. Spill is calculated by using the spillway rating curve and recorded reservoir elevations, added to the recorded minimum flow.

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APPENDIX 6.3-D

Exceedence Curves for Gaging Stations in Waters Associated with the MFP

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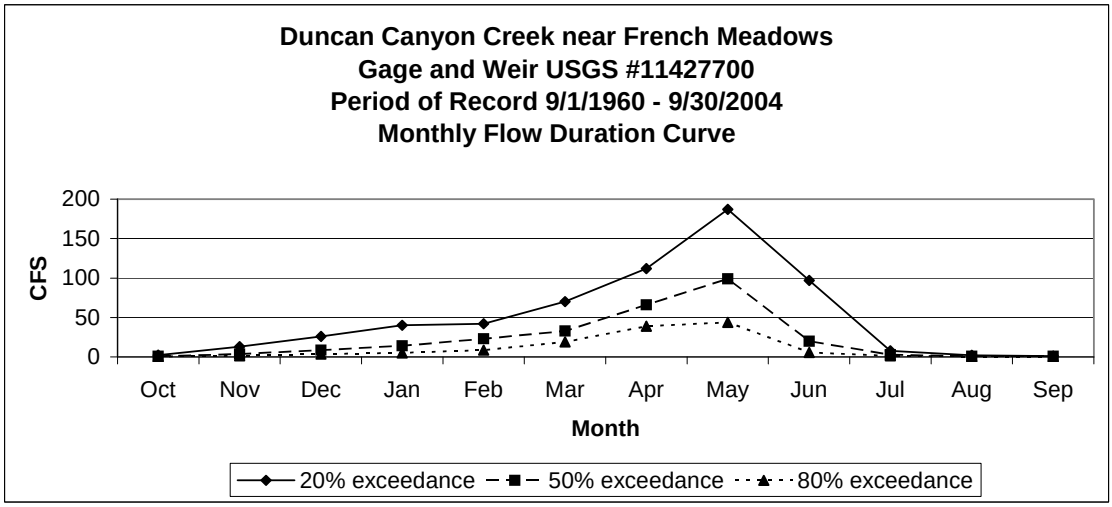
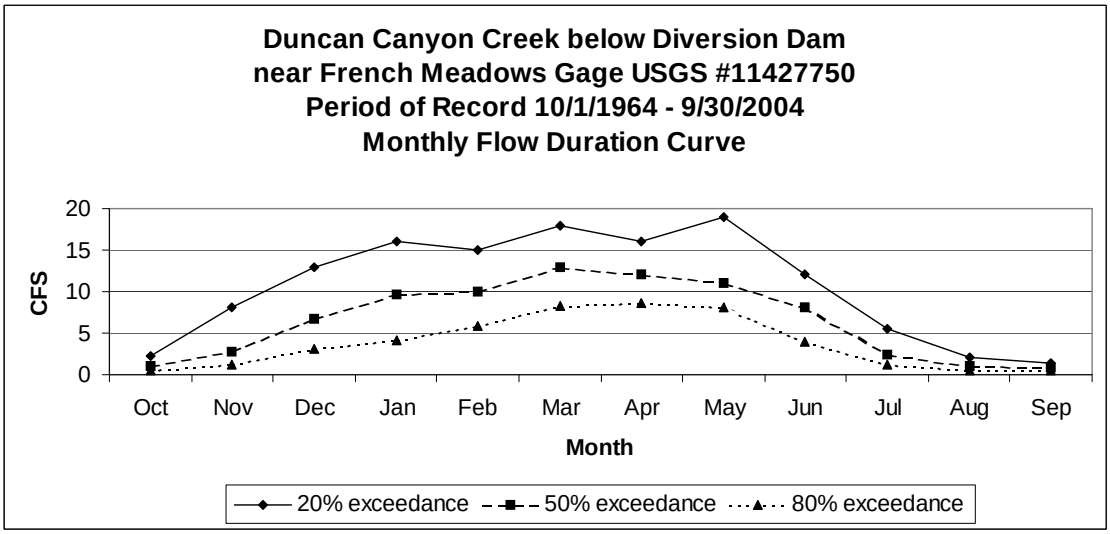
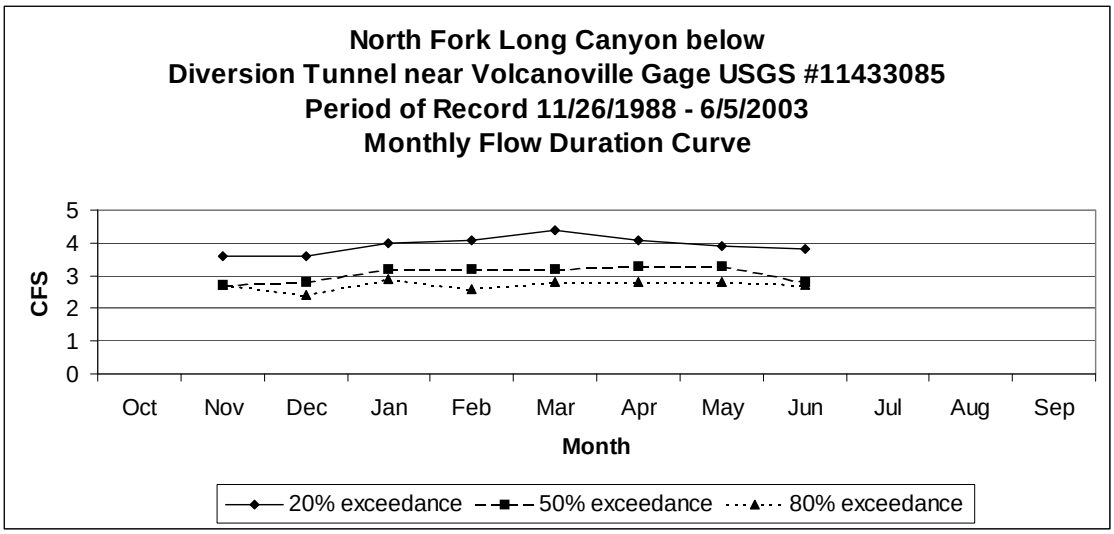
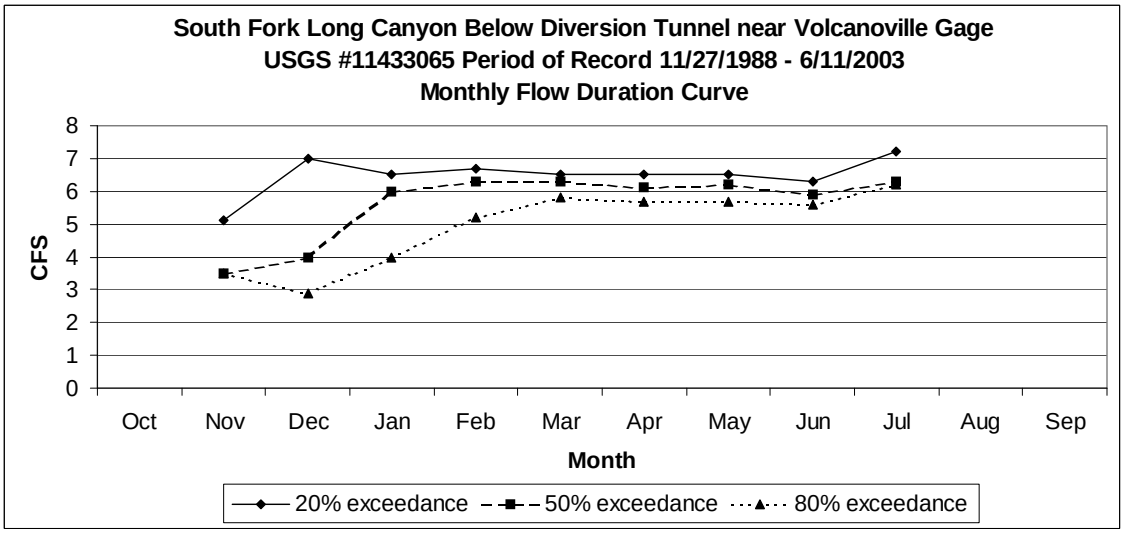
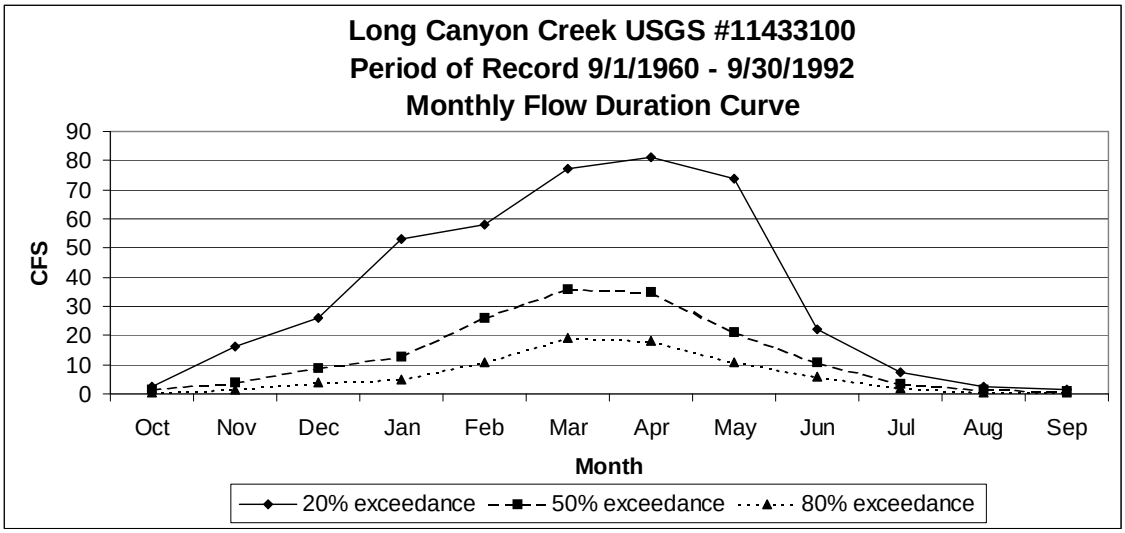
Appendix 6-3.D. Exceedance Curves for Gaging Stations in Water Associated with the MFP.

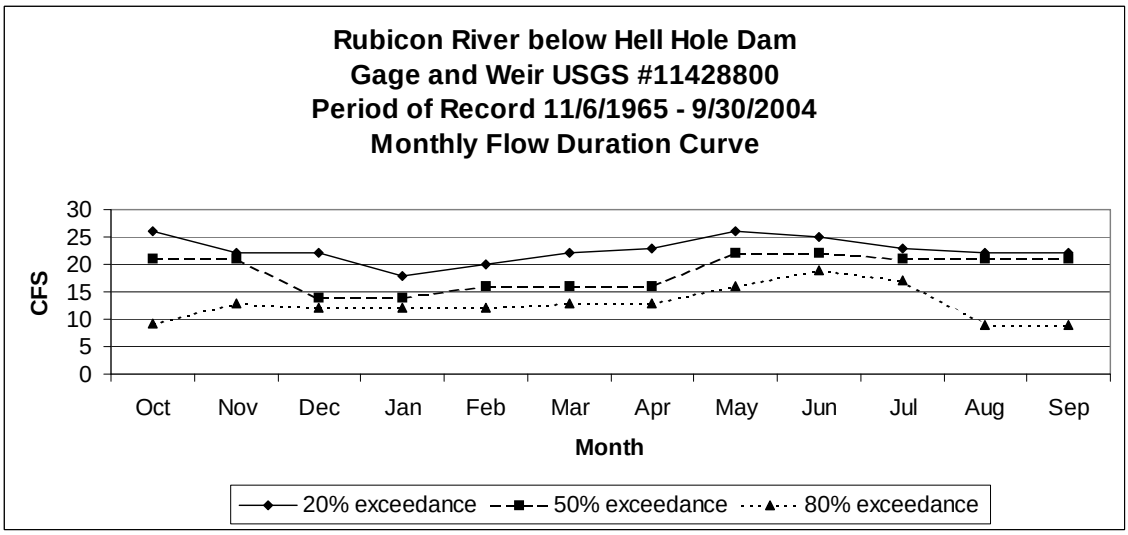


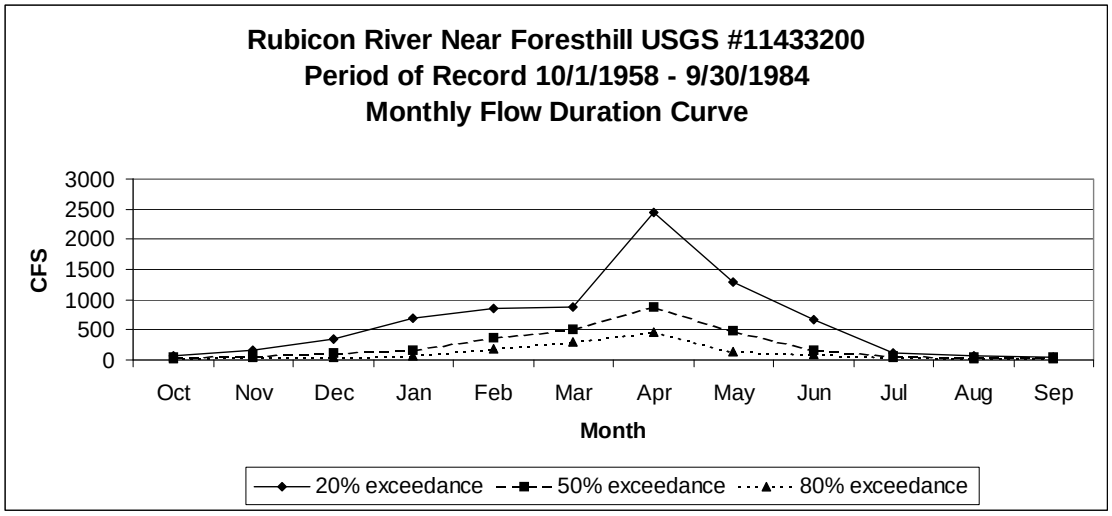


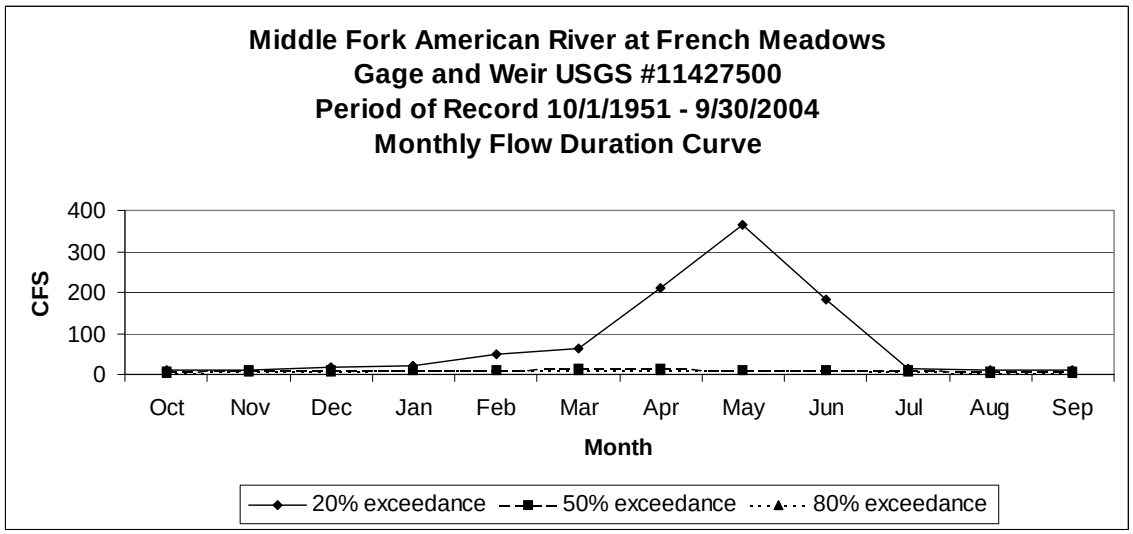

North Fork Long Canyon below
Diversion Tunnel near Volcanoville Gage USGS #11433085
Period of Record 11/26/1988 - 6/5/2003
Monthly Flow Duration Curve
CFS
0
1
2
3
4
5
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance

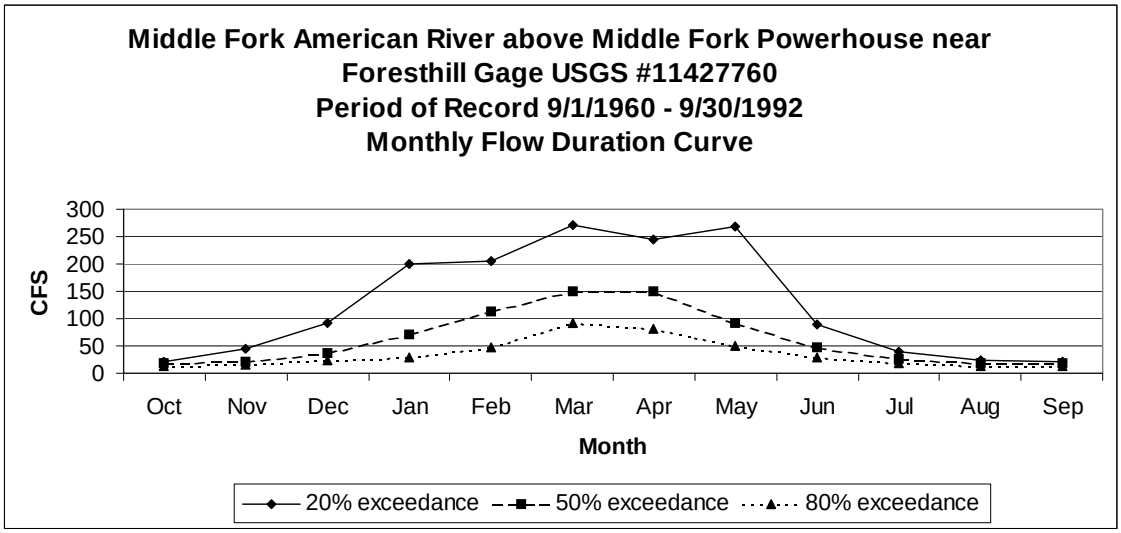

South Fork Long Canyon Below Diversion Tunnel near Volcanoville Gage
USGS #11433065 Period of Record 11/27/1988 - 6/11/2003
Monthly Flow Duration Curve
CFS
0
1
2
3
4
5
6
7
8
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance

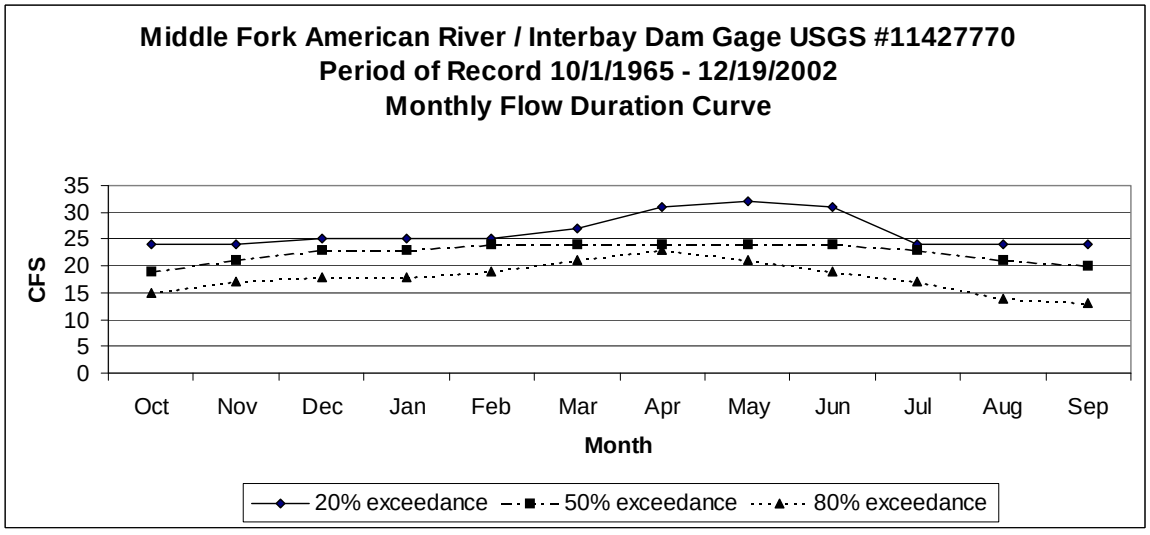

Long Canyon Creek USGS #11433100
Period of Record 9/1/1960 - 9/30/1992
Monthly Flow Duration Curve
CFS
90
80
70
60
50
40
30
20
10
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance

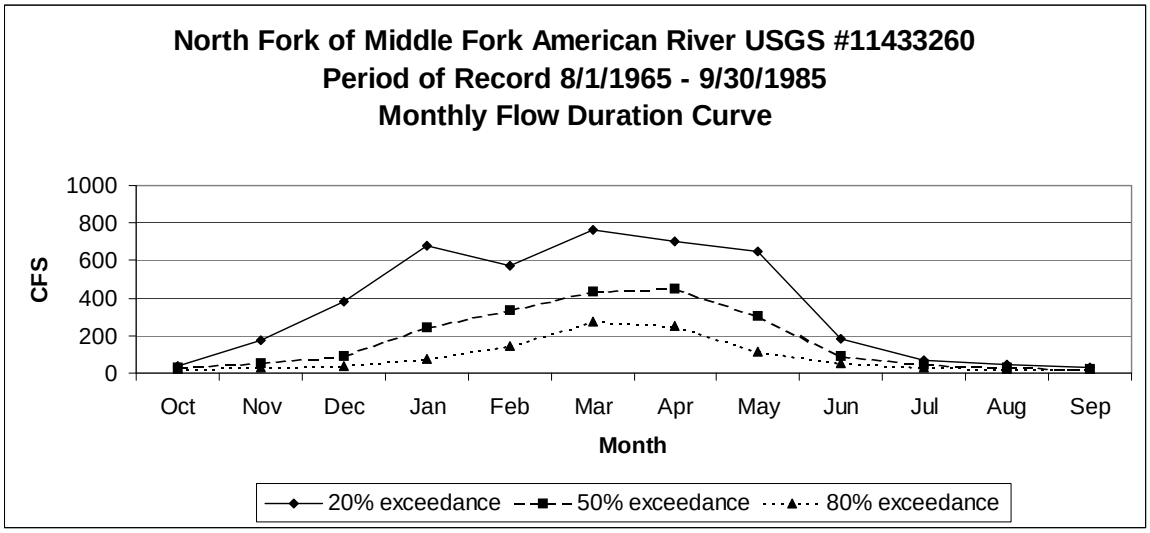

Rubicon River below Hell Hole Dam
Gage and Weir USGS #11428800
Period of Record 11/6/1965 - 9/30/2004
Monthly Flow Duration Curve
CFS
30
25
20
15
10
5
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance

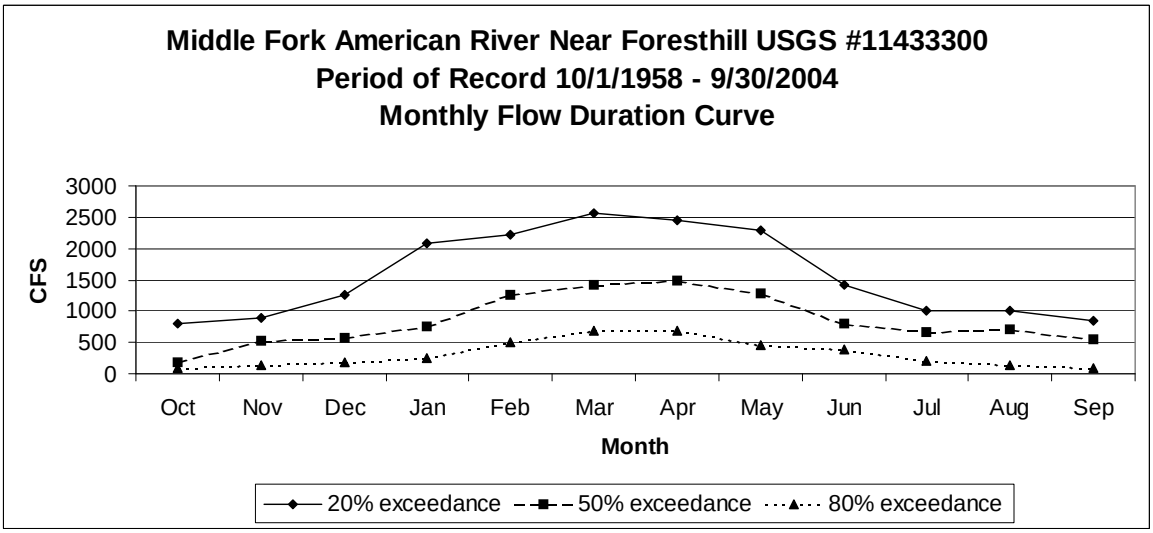

Rubicon River Near Foresthill USGS #11433200
Period of Record 10/1/1958 - 9/30/1984
Monthly Flow Duration Curve
CFS
3000
2500
2000
1500
1000
500
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance

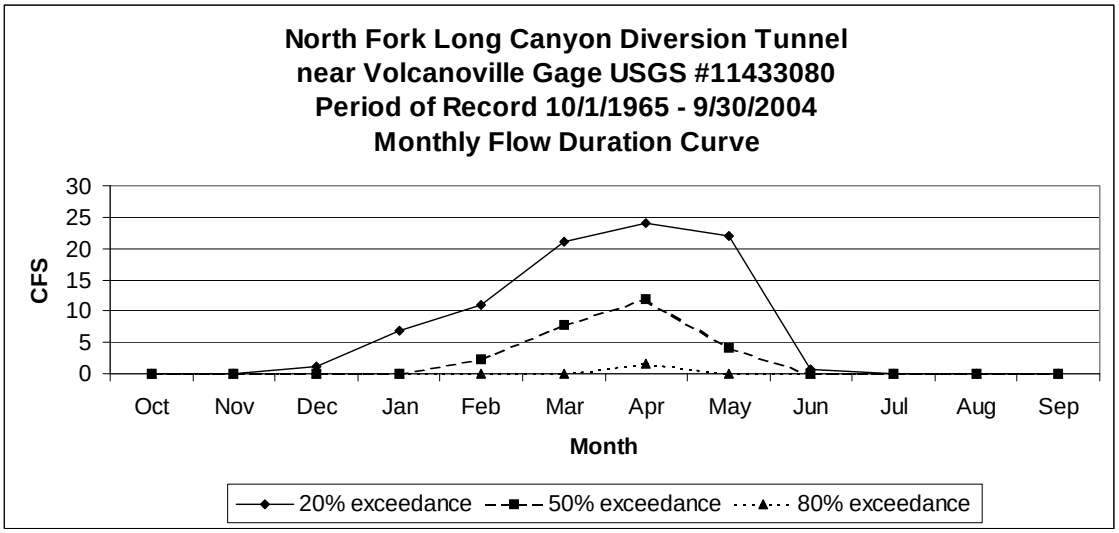

Middle Fork American River at French Meadows
Gage and Weir USGS #11427500
Period of Record 10/1/1951 - 9/30/2004
Monthly Flow Duration Curve
CFS
400
300
200
100
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance

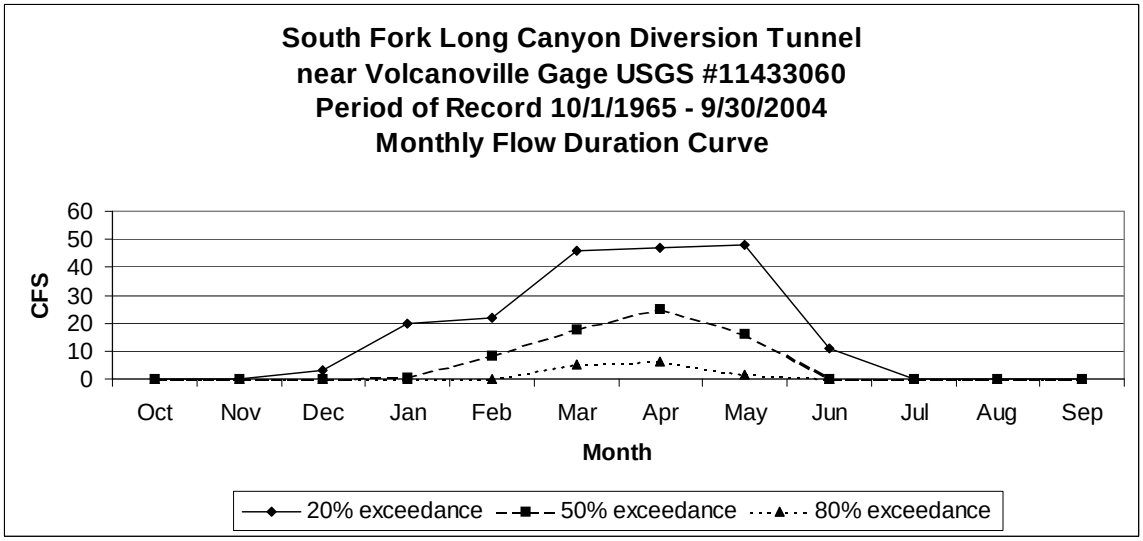

Middle Fork American River above Middle Fork Powerhouse near
Foresthill Gage USGS #11427760
Period of Record 9/1/1960 - 9/30/1992
Monthly Flow Duration Curve
CFS
300
250
200
150
100
50
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance

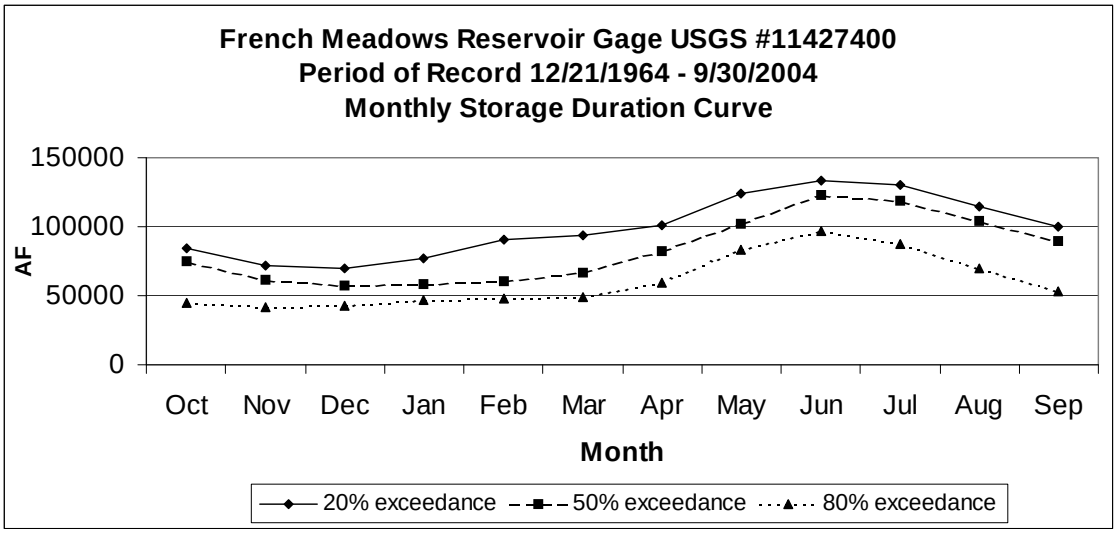

Middle Fork American River / Interbay Dam Gage USGS #11427770
Period of Record 10/1/1965 - 12/19/2002
Monthly Flow Duration Curve
CFS
35
30
25
20
15
10
5
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance

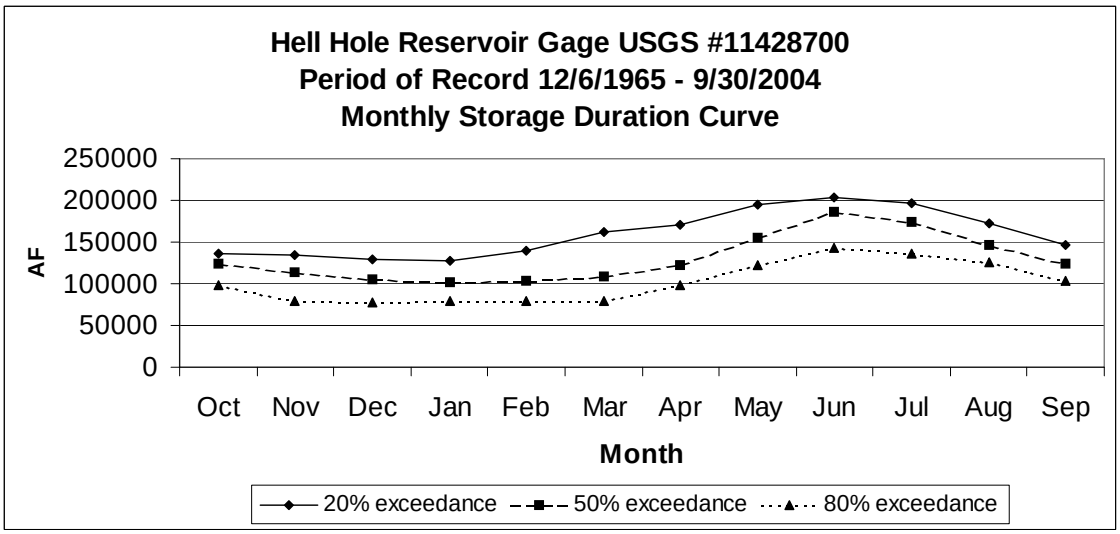

North Fork of Middle Fork American River USGS #11433260
Period of Record 8/1/1965 - 9/30/1985
Monthly Flow Duration Curve
CFS
1000
800
600
400
200
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance

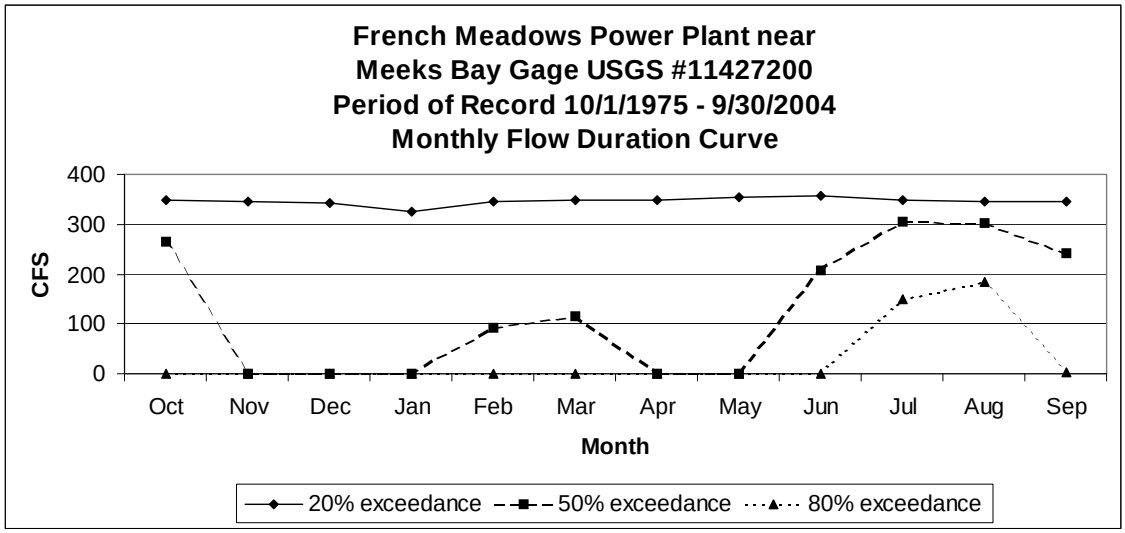

Middle Fork American River Near Foresthill USGS #11433300
Period of Record 10/1/1958 - 9/30/2004
Monthly Flow Duration Curve
CFS
3000
2500
2000
1500
1000
500
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance

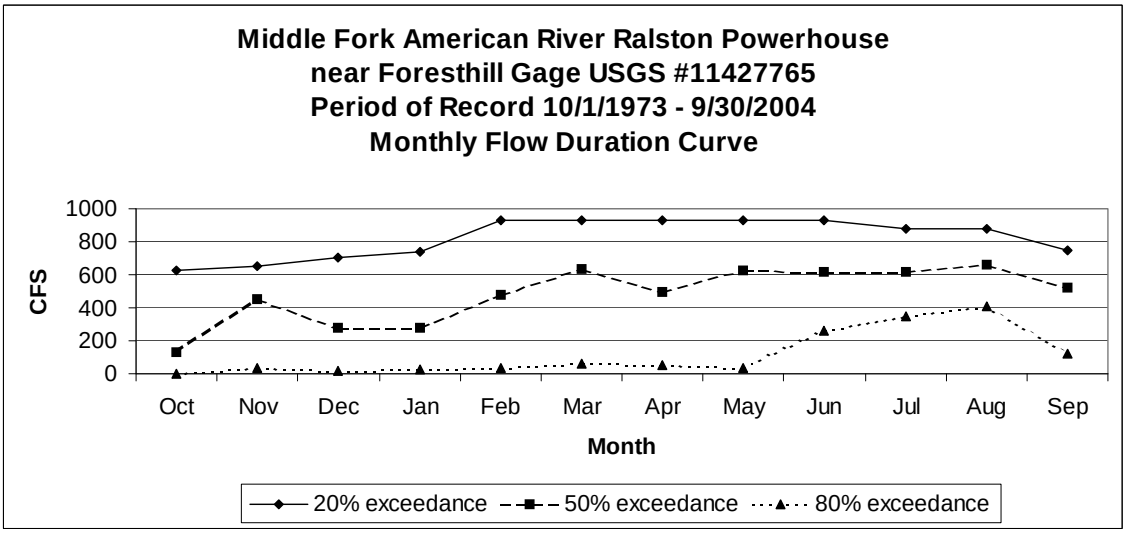

North Fork Long Canyon Diversion Tunnel
near Volcanoville Gage USGS #11433080
Period of Record 10/1/1965 - 9/30/2004
Monthly Flow Duration Curve
CFS
30
25
20
15
10
5
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance

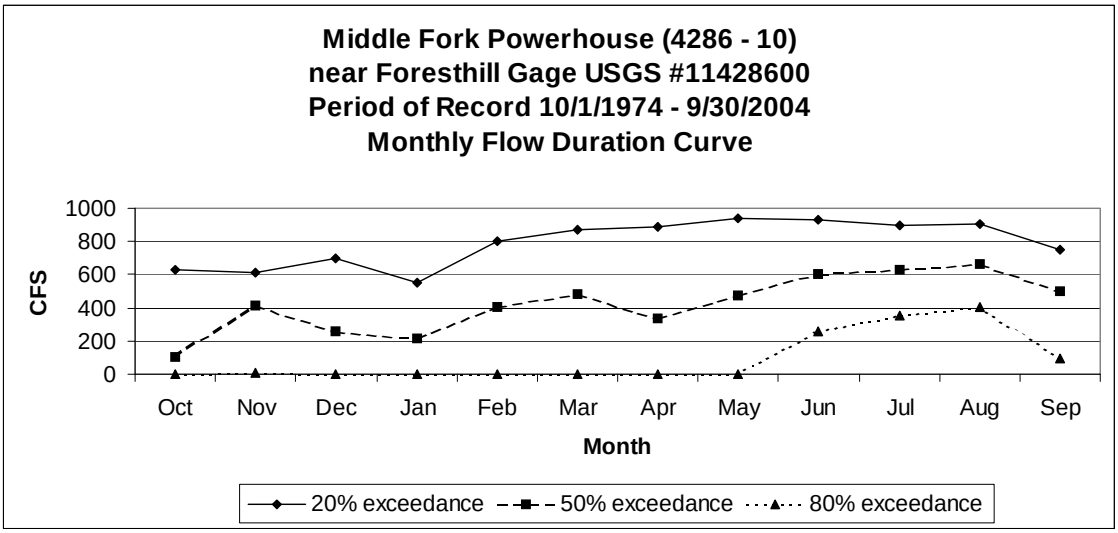

South Fork Long Canyon Diversion Tunnel
near Volcanoville Gage USGS #11433060
Period of Record 10/1/1965 - 9/30/2004
Monthly Flow Duration Curve
CFS
60
50
40
30
20
10
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance

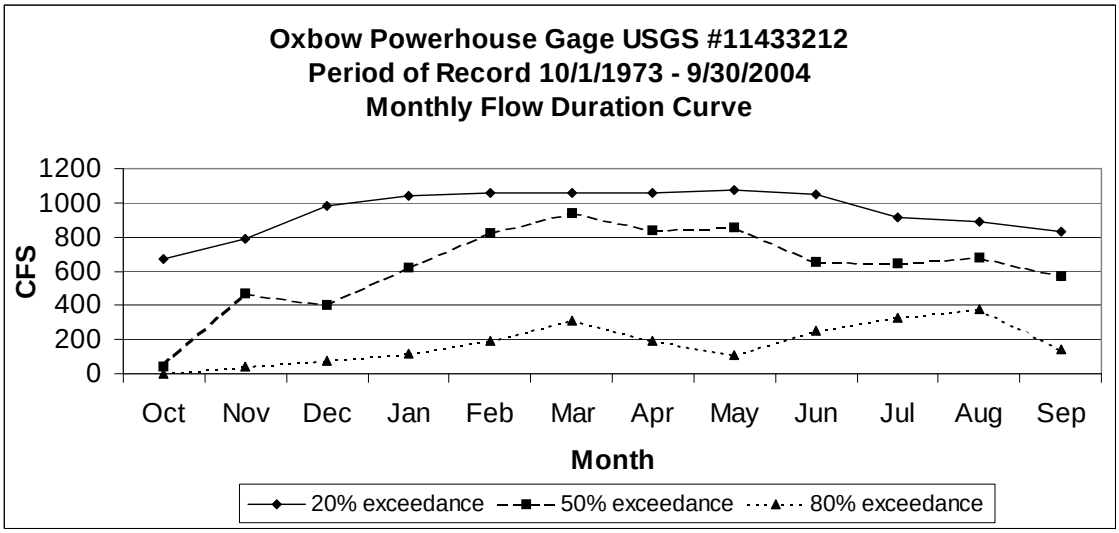

French Meadows Reservoir Gage USGS #11427400
Period of Record 12/21/1964 - 9/30/2004
Monthly Storage Duration Curve
150000
100000
50000
0
AF
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance


Hell Hole Reservoir Gage USGS #11428700
Period of Record 12/6/1965 - 9/30/2004
Monthly Storage Duration Curve
250000
200000
150000
100000
50000
0
AF
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance


French Meadows Power Plant near
Meeks Bay Gage USGS #11427200
Period of Record 10/1/1975 - 9/30/2004
Monthly Flow Duration Curve
CFS
400
300
200
100
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance


Middle Fork American River Ralston Powerhouse
near Foresthill Gage USGS #11427765
Period of Record 10/1/1973 - 9/30/2004
Monthly Flow Duration Curve
CFS
1000
800
600
400
200
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance


Middle Fork Powerhouse (4286 - 10)
near Foresthill Gage USGS #11428600
Period of Record 10/1/1974 - 9/30/2004
Monthly Flow Duration Curve
CFS
1000
800
600
400
200
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance


Oxbow Powerhouse Gage USGS #11433212
Period of Record 10/1/1973 - 9/30/2004
Monthly Flow Duration Curve
CFS
1200
1000
800
600
400
200
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
20% exceedance
50% exceedance
80% exceedance

APPENDIX 6.3-E

Monthly Mean Flows for Gaging Stations in Waters Associated with the MFP.

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Appendix 6.3-E. Monthly Mean Flows for Gaging Stations[1] in Waters Associated with the MFP.

Stream Gages

USGS 11427700 DUNCAN CYN C NR FRENCH MEADOWS CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1960	0.95	4	7.63									0.34
1961	1.52	1.83	7.19	6.42	24.4	18.3	58.4	58.9	13	1.48	0.53	0.47
1962	51.1	7.63	37	5.64	20.8	13.2	122	119	59.3	4.72	1.15	0.6
1963	1.51	29.2	13.4	57.7	95.3	15.9	50	164	36.1	3.95	1.02	0.68
1964	0.77	5.67	256	13.9	12.6	14.4	56.9	114	42.3	3.83	0.99	0.42
1965	1.18	6.84	5.13	31.9	29.8	27.7	118	145	46	5.27	3.5	1.4
1966	0.71	15.1	35.9	5.67	5.6	31.6	103	70.3	5.98	1.28	0.6	0.6
1967	2.17	2	3.7	29.5	36.4	67.3	22.4	162	196	30.9	2.56	1.35
1968	2.14	13.6	8.75	13	76.2	46	70	70.5	13.4	1.75	1.93	1.05
1969	4.44	4.38	78.1	110	26.2	25.5	96.8	240	109	9.57	1.53	0.92
1970	1.37	21.1	21.5	193	36.2	33.8	39.2	88.2	23.1	3.11	0.84	0.54
1971	1.45	5.45	6.63	29.4	34.4	42.8	70.2	136	106	11.5	1.72	0.99
1972	3.41	12.8	45.2	8.45	14.3	88.2	62.8	105	24.5	2.52	0.84	1.4
1973	3.15	70.5	40.1	58	21.6	24.2	82.6	187	45.6	3.34	0.85	1.11
1974	1.26	2.47	4.89	116	25.4	66.8	72.9	169	77.6	20.7	2.54	1.13
1975	10.2	14.5	9.1	11.4	13.9	23.4	27.7	165	139	11.9	2.85	1.05
1976	0.71	1.09	0.76	7.35	8.26	21.4	32.6	29.8	3.51	0.83	1.39	0.88
1977	0.22	3.04	43	1.96	3.24	5.75	12.7	18.7	5.27	0.51	0.19	0.4
1978	0.92	1.82	2.31	37.7	23.3	77.3	82.9	162	98.4	9.68	0.93	2
1979	4.09	10.6	14.4	14.1	11	28.2	62.1	168	34.9	3.02	1	0.53
1980	0.95	1.84	6.95	176	74.9	32.6	89.8	137	66.4	13.2	2.07	0.91
1981	3.44	128	165	4.09	30.2	29.9	62.3	45.1	6.32	0.96	0.38	0.45
1982	24.4	33.8	39.6	31.8	162	74.9	131	217	117	13.6	2.91	4.51
1983	7.25	172	131	29.2	44.6	99.1	64.5	220	316	100	10.4	3.46
1984	2.9	21.6	11.3	61.9	34.3	66.5	73.3	120	26.7	2.67	1.09	0.81
1985	1.47	3.16	24.7	9.91	11.7	17.8	105	82.1	12.1	1.63	0.68	1.58
1986	3.71	2.01	2.48	80.4	291	161	93.2	81.2	18.4	3.09	1.06	2.93
1987	0.8	2.3	17.3	4.49	25.5	31.9	68.6	27.4	3.58	1.04	0.51	0.43
1988	0.44	25.3	12.2	17.3	19.5	36.9	48.6	32.3	8.32	1.49	0.51	0.41
1989	4.12	4.95	5.3	9.32	16.9	141	162	79.1	16	2.24	0.99	1.69
1990	0.91	1.16	1.27	14.9	8.99	35.2	74.3	34.2	20.6	2.62	0.94	0.8
1991	3.13	3.8	3.96	1.76	4.14	41.9	48.3	97.6	39.7	4.13	1.11	0.53
1992	2.45	3.81	12.6	4.09	30.8	38.3	71.1	12.9	2.71	1.54	0.48	0.4
1993	1.39	1.58	4.7	43.1	26.2	109	109	245	110	8.4	1.95	0.94
1994	0.86	6.84	8.36	5.87	8.49	31.7	52.9	46.1	5.42	1.02	0.37	0.47
1995	1.13	1.24	41.4	100	47.5	154	103	238	219	32.2	3.29	1.46
1996	1.26	30.1	193	44.1	145	62	114	225	21.4	3.29	0.99	0.97
1997	2.69	7.56	10.3	213	32.6	51.3	91.2	57.7	13.7	2.88	1.1	1.16
1998	1.96	13.2	24.9	76	34.3	83.8	76.5	157	246	36.9	3.05	2.28
1999	1.56	3.93	4.11	56	44.9	45.6	77.1	207	83	6.26	1.93	0.98
2000	1.97	3.02	4.4	46.8	62.2	45.7	131	112	12.3	2.29	0.88	1.23
2001	0.73	9.92	17.6	4.52	6.09	39.6	59.6	76.6	4.55	1.02	0.43	0.47
2002	0.82	17.1	37.4	31.8	33.5	46.1	140	124	26.4	2.97	1.19	0.85
2003	0.78	2.71	28.5	62	43.7	72.1	57.6	166	47.9	3.79	1.78	0.94
2004				16	31	97.2	116	66.1	8.31	1.99	0.91	0.78

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Appendix 6.3-E. Monthly Mean Flows for Gaging Stations[1] in Waters Associated with the MFP (continued).

USGS 11427750 DUNCAN CYN C BL DIV DAM NR FRENCH MEADOWS CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1964	0.8	5.22	244									
1965	0.061	1.59	3.36	20.4	3.56	2.63	16.7	13.3	2.15	0.44	1.63	0.09
1966	0.63	7.42	7.55	4.63	6.63	13.9	15.9	9.99	4.36	1.42	0.63	0.58
1967	1.17	1.32	1.2	11.5	8.82	56.3	11.1	149	21.7	3.74	2.23	1.39
1968	1.53	7.87	8.11	2.68	37	6.52	4.85	7.65	5.12	1.55	1.06	0.59
1969	2.05	2.65	48.1	97.1	21.4	25	57.7	94	8.98	5.72	1.5	0.82
1970	1.06	7.39	4.39	163	8.22	6.33	7.04	13.9	10.9	2.71	0.7	0.47
1971	1.13	4.39	5.55	7.11	8.97	13	15	13.4	9.74	2.43	1.49	0.78
1972	2.66	9.24	18.9	8.13	10.6	18.5	14	12	9.05	2.41	0.73	1.06
1973	2.37	25.6	12.2	33.9	9.52	5.63	15.1	48.9	3.66	1.43	0.93	1.05
1974	1.26	2.01	3.52	49.7	2.02	5.73	4.8	14.1	12.4	5.68	2.46	1
1975	4.98	4.33	6.69	8.22	11.3	13.8	13.2	65	30.6	4.65	2.6	1.22
1976	0.85	1.19	0.76	5.76	6.89	12.1	8.55	3.88	2.87	0.89	1.12	0.87
1977	0.39	1.29	12.1	1.81	2.93	4.57	5.12	4.34	3.11	0.71	0.28	0.37
1978	0.79	1.66	2.26	10.2	8.52	13.3	7.53	50.8	10.1	5.9	1.22	1.71
1979	1.26	2.26	5.73	10.6	8.05	11.7	8.7	12	7.05	3.14	0.85	0.48
1980	1.02	1.52	5.02	160	22.4	11.3	12.6	8.27	9.28	7.08	1.81	0.92
1981	2.78	76.1	102	3.79	10.7	10.3	7.42	7.32	5.31	0.99	0.39	0.45
1982	17.3	12.2	15.7	7.53	108	32.1	91.7	83.3	10.4	5.81	1.71	2.53
1983	4.33	56.1	42.6	13.7	13.4	48.2	18.5	78	53.1	21.9	5.87	3.61
1984	3.41	10.9	10.3	14.5	12.6	14.7	12.5	8.06	7.53	3.11	1.43	1
1985	1.72	3.44	12.2	9.96	10.4	12.4	15.3	11.4	7.02	1.51	0.87	1.7
1986	3.84	2.17	2.27	27.7	237	80.3	12.6	10.3	8.28	2.98	1.21	2.84
1987	0.78	2.05	9.47	5.24	18.3	14.9	12.5	8.55	3.55	1.04	0.42	0.4
1988	0.45	11.3	5.53	12.2	13.7	11.1	10.3	10.1	4.54	1.57	0.51	0.39
1989	3.31	4.86	5.99	5.6	6.52	24.4	7.98	5.83	8.3	2.37	1.02	1.72
1990	0.88	1.15	1.23	9.98	9.74	11.7	9.98	10.1	9.28	2.91	0.91	0.79
1991	1.59	3.89	3.94	1.69	4.06	21.7	14.3	11.5	8.94	4.17	1.07	0.55
1992	1.23	3.21	8.14	4.42	9.27	10.2	9.4	7.77	2.79	1.65	0.5	0.42
1993	1.49	1.63	4.28	15.1	14	28.8	12.1	12.9	10.4	7.02	2.02	1.02
1994	0.9	4.44	8.11	5.58	6.17	11.1	9.86	9.82	3.89	1.04	0.4	0.48
1995	1.13	1.3	25.7	62.2	9.04	44.8	23.8	76.5	51.1	10.8	3.43	1.48
1996	1.29	9.66	108	17.9	47.9	14.4	13.4	86.9	9.7	3.42	1.09	0.99
1997	2.7	4.26	9.55	225	30.5	17.7	16.3	12.4	10.3	2.98	1.17	1.19
1998	2.02	8.16	13.6	32.3	14.4	32	15.4	19.4	107	10.4	3.1	2.34
1999	1.33	3.78	4.27	16.7	15.5	16.1	18.1	28.4	11.5	5.84	1.95	1.02
2000	1.99	3.03	4.44	14.5	24.4	17	17.2	15.3	9.09	2.37	0.94	1.27
2001	0.78	5.01	11.3	4.65	6.5	15.2	15.2	11.7	4.63	1.09	0.43	0.42
2002	0.89	10.5	15.9	16	17.1	17.8	17.1	10.9	10.2	3.38	1.35	0.9
2003	0.94	2.93	14.2	18.9	15	15.5	15.9	19	12.1	4	1.92	1.09
2004				14.3	16.5	20.8	15.5	12.8	7.65	2.1	0.97	0.83

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Appendix 6.3-E. Monthly Mean Flows for Gaging Stations[1] in Waters Associated with the MFP (continued).

USGS 11427500 MF AMERICAN R A FRENCH MEADOWS CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1951	7.68	32.6	63.8									
1952	2.73	4.31	11.6	40.5	96.1	91.9	458	1,034	775	232	25.3	5.06
1953	2.45	19.2	22.6	152	91.6	132	467	465	543	143	9.03	4.13
1954	0.74	8.15	29.3	33.4	82.3	287	491	353	79	10	2.06	0.94
1955	0.73	4.3	882	28.1	40.1	88.6	187	526	237	20.4	2.88	1.04
1956	6.53	20.6	23.3	377	99.7	153	399	768	405	67.7	6.73	1.65
1957	3.9	19.3	39.9	18.4	190	276	301	472	216	20.9	3.91	1.18
1958	1.95	3.48	5.22	36.2	259	114	289	1,110	600	85.6	9.15	3.02
1959	1.95	1.6	1.76	71	76.6	154	322	210	69.7	6.22	1.57	0.93
1960	0.4	3.53	13	5.57	134	367	412	306	130	7.75	1.84	0.69
1961	0.78	4.26	16.5	12.6	99.3	82.6	238	260	110	7.86	1.58	0.64
1962	222	36.8	146	14.7	82.8	55.2	537	496	259	25.8	4.01	1.59
1963	5.87	106	54	371	561	82.8	239	691	223	28.1	5.67	3.74
1964	1.67	19.8	83.3	42.2	57	81.2	286	452	213	26.2	4.84	2.74
1965	266	42.7	22.3	10.1	10.3	10.1	248	518	54.8	54	15	136
1966	8.28	8.05	11.7	13	11.2	14.2	13.3	69.5	94.4	8.56	8.7	8.93
1967	8.03	8.93	9.09	11.3	11.6	13.3	11.6	15.6	157	33.4	8.42	7.57
1968	9.41	10.3	9.63	9.53	14.9	13.6	13.3	12.1	12.4	11.5	10.1	9.57
1969	8.7	8.72	12.5	21.3	11.1	10.6	18.8	18.4	94.4	9.18	9.83	9.82
1970	8.17	9.18	9.8	25.7	13	12.5	10.1	9.77	11	11.5	10.7	9.47
1971	7	7.22	8.31	9.96	11.4	13.9	14.6	14.1	10.9	10.1	9.99	7.99
1972	7.74	7.85	9.85	9.5	9.58	14.7	12.5	10.7	9.82	9.84	10	9.9
1973	5.81	9.84	9.86	12.2	8.76	8.74	11.8	6.35	7.07	6.68	6.29	5.89
1974	5.84	5.68	5.7	14	8.19	16	13.6	12.4	139	7.3	5.92	5.62
1975	6.09	9.83	9.69	6.86	7.51	10.2	8.96	16.3	12.5	11.9	6.62	5.18
1976	4.52	4.29	3.91	9.46	8.84	8.88	9.44	3.95	3.72	3.8	3.84	3.79
1977	2.75	3.16	5.71	4.37	4.52	4.4	4.47	4.2	3.68	2.98	2.76	2.7
1978	7.7	7.54	7.43	9.81	7.98	12	8.6	5.15	7.52	7.89	7.5	7.83
1979	8.09	7.9	8.43	8.62	8.63	10.3	11.6	7.78	6.18	6.72	6.86	7.54
1980	8.21	7.65	8.49	20.4	9.61	6.87	8.74	7.56	7.76	7.55	7.92	8.19
1981	7.72	13.4	25.7	8.69	9.45	8.87	7.79	8.3	7.43	7.37	7.8	7.7
1982	8.87	10.8	13.8	23.5	201	23.5	181	274	149	8.52	8.08	8.26
1983	8.3	17	23.5	12.8	14.4	19.3	15.9	19.2	171	136	8.45	8.1
1984	8.32	9.95	8.77	53.6	11.2	10.4	9.11	9.25	10.6	8.25	8.56	8.23
1985	9.65	9.16	10.2	8.49	9.08	10.3	12	9.19	8.76	8.48	8.63	8.6
1986	8.71	11	9.17	14	90.1	375	31.7	33.8	37.2	9.46	8.91	9.12
1987	8.87	9.45	9.38	9.26	10.8	11.7	10.4	9.52	9.05	9.37	9.12	9.48
1988	4.9	5.99	5.52	9.92	10	9.67	9.96	10.2	5.56	5.02	4.95	5.18
1989	9.58	9.62	9.19	5.63	6.23	14.8	10.9	7.42	9.36	9.29	9.23	9.54
1990	9.66	9.81	9.79	9.64	9.65	12.1	9.99	9.98	9.82	9.3	9.21	9.73
1991	9.9	9.93	9.73	9.66	9.67	11.5	12.5	9.39	9.89	9.64	9.85	9.72
1992	9.89	9.85	10.6	9.5	11	9.53	9.43	9.49	9.73	9.28	9.65	9.8
1993	10	9.18	9.34	13.7	13.5	18.3	11.6	10.5	10.5	9.87	9.78	9.97
1994	5.35	5.84	6.53	9.35	9.74	11.1	10.1	9.52	4.8	4.83	5.15	5.16
1995	8.91	8.8	10.8	14	7.44	17.7	14	184	272	57.6	9.87	9.38
1996	9.27	10.8	23.3	13	21.2	14.4	12.7	345	18.2	11.4	11	9.87
1997	9.74	9.83	10.1	249	11.6	10.5	10.1	10.6	10.2	9.97	9.52	9.72
1998	9.76	9.99	10.7	16.3	13.3	16	14.4	15.7	138	41.8	10.2	10.1
1999	10.9	9.85	9.96	15.2	18.8	15.9	24.5	445	14.7	9.94	10	9.91
2000	10.7	10.5	9.94	13	16.7	14.5	11.8	10.8	10.9	9.55	9.8	9.93
2001	28	14.3	11.2	9.93	10	12.3	11.8	9.85	9.97	9.62	9.57	9.31
2002	9.61	11.8	13.3	12.4	12.4	14.3	13.1	10.6	9.45	9.52	9.6	9.82
2003	9.18	9.27	11.9	15.8	12	11.1	13.3	12.8	9.97	9.87	9.42	9.29
2004				11	12.6	14.3	10.2	9.19	9.01	9.72	9.28	9.1

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Appendix 6.3-E. Monthly Mean Flows for Gaging Stations[1] in Waters Associated with the MFP (continued).

USGS 11427770 MF AMERICAN R BL INTERBAY DAM NR FORESTHILL CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1965	270	55.9	34.8									
1966	11.3	7.28	27.4	38.7	39.6	109	157	109	109	16.7	16.1	18
1967	6.43	6.38	6.22	78	60.4	245	166	470	313	53	6.94	8.16
1968	15.2	14.6	16.1	6.15	9.32	7.61	11.8	11.7	13.4	12.4	14	14.8
1969	19	18.3	36.1	208	117	151	300	214	168	28	23.6	23.6
1970	19.8	18	19.5	324	26.3	35.6	22.2	28	28.2	20.9	20.2	19.9
1971	26.5	24.8	25.5	21.6	21.8	34.6	59.1	27.1	26.3	23.4	23.6	22.5
1972	20	19.6	19.1	25.3	25.3	27.1	30.2	26.2	30.8	21.9	21.5	20.2
1973	20.2	24	33.8	41.2	22	47.7	48.4	21.5	19.6	18.9	20.5	20.2
1974	19.3	19.1	18.1	80.3	19	25.1	26.7	21.4	147	27.7	21.2	20
1975	18.5	24.3	19	18.1	18.8	18.9	23.6	18.4	18.3	19.3	19.5	19.2
1976	11.2	11	11.7	18.5	21.2	23.9	24.6	13.6	12.8	13	12.4	12
1977	5.84	8.97	9.27	11.2	11.1	11.2	11.6	11.1	11.3	7.52	5.86	5.68
1978	17.6	17	22.6	13	27.3	24.5	24	24	23.7	23.7	23.7	22
1979	18	21	22.2	20.6	24.5	25	23.7	22.1	21.1	21.3	20.6	18.2
1980	13	16.7	21.3	398	214	190	193	97.1	35.9	33.8	23.6	20.4
1981	19.8	37.4	496	18.7	18.6	19.5	23	21.9	22.4	22.3	15.3	9.58
1982	29.8	30.7	57.1	242	928	466	868	857	233	27.2	21	20.2
1983	24.9	140	548	26.6	73.4	508	283	308	261	152	23.7	24.7
1984	23	33.1	33.2	253	30.2	24.6	23.9	41.3	45.9	22.8	22.2	22.4
1985	23.3	25.7	25	29.9	28.5	24	24.4	23.5	23.3	23.4	20.9	24.6
1986			26.2	24	24.3	25	25	58.3	51	31.6	24.2	24.4
1987	16.9	21.1	23.3	23.4	24.1	24	24	24	23.5	20.6	19	15.2
1988	9.4	11.9	12.4	24	23.9	24	23.9	24	13.2	13	12.3	11.9
1989	21.3	24.4	24	13	13	13	13	13	23.4	24	24	23
1990	17.6	19.4	19.3	24	24	24.3	24.5	24.3	24.1	23.8	18	17.2
1991	17.5	22.5	23.3	18.7	21.3		23.8	23.6	23.9	23.9	20.7	17
1992	16.1	20.5	23.1	23.4	23.8	24	24	24	21.9	18.6	15	14.9
1993	24.2	24	24				24	24	24	24	24	23.2
1994	12.1	12	12		24	23.8	24	23.7	13.3	13	12.4	11.8
1995	23.4	23.1			12						23.8	22.1
1996	20.9	23.2				24				24	24	23.4
1997	22.5	23.4	24				23.9	24	23.4	23	23.1	20.8
1998	23.8	23	23		24		24				24	24.2
1999	21.7	23	23						23	23	23	22
2000	20.1	23	23		23	23	23.1	23	23	22.8	19.5	17.2
2001		21.8	23.8	23	23	23	23	23	22.7	17.2	13.4	12.6
2002	20.4	23.5		23.5	23.8	23.8	23.5	23.6	23.9	23.6	23.1	21

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Appendix 6.3-E. Monthly Mean Flows for Gaging Stations[1] in Waters Associated with the MFP (continued).

USGS 11427760 MF AMERICAN R AB MF PH NR FORESTHILL CA

YEAR	Monthly mean streamflow, in ft³/s											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1965	270	55.9	34.8									137
1966	14.2	31.3	105	38.7	39.6	109	157	109	109	16.7	13.4	13.4
1967	19.7	21.1	30.1	132	163	248	146	474	311	60.5	23	19.8
1968	16.9	35.1	47.4	43.8	216	118	93	48.3	33.1	24.5	21.3	15.5
1969	22.7	24.7	145	456	177	151	362	322	169	35.6	22	18.8
1970	21.1	52.6	78.9	680	157	136	74.7	65.8	44.8	29	20.6	18.8
1971	16.8	27.3	44.6	98.5	130	220	233	166	69.4	35.2	23.6	16.7
1972	20.2	41.3	101	56.7	91.5	226	152	85	43.3	27.4	18.9	17.9
1973	19.9	128	144	247	158	160	215	200	45.2	23.5	16.1	16.7
1974	16.4	19.5	24.2	365	104	306	290	152	194	41.5	23.6	17.7
1975	30.5	35	33.4	48.7	109	189	178	335	107	40.5	24.3	17.6
1976	12.2	13.5	12.2	30.5	36.7	63.4	54.5	28.1	18	13.1	13.4	11.8
1977	7.43	12.9	78.5	15.7	18.4	21.7	19.3	21.5	15.4	8.64	6.35	6.59
1978	17.2	18.5	20.3	224	143	273	245	194	57.9	34.7	20.3	21.8
1979	20.8	32.6	42.7	53.8	64.5	165	169	168	49.4	30	19.4	16.3
1980	21.4	22.1	31.3	635	292	200	182	91.8	44.8	34.4	20.4	18.7
1981	24.4	206	413	36.9	72.2	112	101	47.8	32.6	22.2	16.5	13.1
1982	61.3	102	241	237	502	307	601	600	254	62.6	32.9	29.5
1983	29.2	262	408	189	322	456	287	441	356	184	33.2	28
1984	25.5	77.7	61.8	237	139	177	105	75.7	42.8	28.5	21.1	18
1985	20.1	32.3	68.4	49.5	65.4	91.8	179	67.7	36.6	21.4	18	20.2
1986	20.3	20.1	18.2	159	969	696	180	96.4	72	24.2	17.6	23.5
1987	14.2	17.6	46.9	25.6	75.8	107	77.8	37.1	20.9	16.7	12.7	12.9
1988	9.21	46.5	27.4	79.2	73.4	78.5	60.6	52.8	25	13.5	10.2	9.35
1989	25.5	29.4	26.8	34.2	68.9	385	233	70.8	41.1	22.1	17.2	19.4
1990	14.9	16.1	16.5	48.4	53.1	124	79.4	55.1	52.3	22.5	15.7	14.8
1991	18.8	23	22.9	17.1	21.6	114	158	121	55.6	28.1	17.5	14.6
1992	17.1	18.7	54.9	23.8	86.5	102	66.4	33	20.1	16.6	13.5	13.5
1993	20	19.4	27.7	178	169	385	272	152	88.4	38.6	22.7	18.7
1994	11.5	24.7	63.2	29.4	44.3	90.8	60.3	45	19.1	11.4	9.46	9.93
1995	19	18.1	84.7	381	196	515	342	587	451	114	27.8	21.1
1996	18.4	54.6	446	149	472	290	228	523	90.7	42.9	25.2	18.6
1997	21.2	27.4	40.6	781	211	123	121	57.5	43.3	27	19.7	18
1998	21.3	39.8	69.9	200	226	271	235	258	319	79.6	28.3	22.6
1999	18.9	23.2	24	162	301	217	193	540	67.9	32.6	21.1	18.1
2000	21	22.3	26.2	99.1	218	188	145	99.8	48.7	24.2	16.5	17.5
2001	28.5	37	79.6	25.2	42.9	109	112	65.3	25.1	14	11.2	10.9
2002	18.1	57.8	117	131	147	194	186	90	49.7	27.5	20.2	18.4
2003	18.6	25.9	88.8	201	134	135	200	233	68.4	35.6	26.3	20.1
2004				94.2	145	220	114	60.8	36.8	24.5	19.1	16.9

USGS 11433300 MF AMERICAN R NR FORESTHILL CA

YEAR	Monthly mean streamflow, in ft³/s											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1983							3,184	3,796	3,300	1,836	1,142	1,084
1984	582	2,952	4,989	2,458	1,943	2,176	1,447	1,271	1,245	860	795	807
1985	274	1,068	968	379	522	685	1,205	523	616	653	700	696
1986	985-	986	654	1,349	8,815	4,515	1,832	1,273	923	734	757	851
1987	291	471	246	230	509	588	342	218	310	464	535	460
1988	168	103	332	603	381	325	287	249	442	518	434	371
1989	94.2	399	347	485	717	2,786	1,981	1,298	947	806	828	495
1990	426	711	517	295	353	702	412	277	532	856	894	529
1991	559	428	143	85.2	111	854	862	821	857	780	746	517
1992	337	466	158	129	642	550	339	265	426	454	418	304
1993	152	207	569	1,759	1,710	3,025	2,236	1,298	1,292	1,028	1,013	571
1994	556	409	437	323	360	483	299	293	614	514	507	198
1995	237	394	641	3,682	2,031	4,792	3,459	3,788	2,948	1,494	1,060	571
1996	790	644	859	1,375	3,866	2,721	2,260	4,020	1,368	906	848	699
1997	411	828	4,950	8,778	2,302	1,524	1,075	1,023	733	857	1,022	640
1998	666	653	697	1,494	2,733	2,567	2,542	2,471	2,305	1,390	1,113	802
1999	182	745	1,090	1,755	3,310	2,398	1,968	1,650	1,116	857	842	582
2000	474	640	490	1,071	2,387	1,999	1,268	1,215	990	703	722	505
2001	313	714	547	498	573	814	714	614	519	572	677	539
2002	101	179	736	1,001	1,087	1,298	1,134	736	584	491	479	251
2003	234	571	796	1,136	984	1,157	1,603	2,085	1,018	648	674	819
2004	268	392	803	837	1,302	1,481	812	683	533	576	591	578

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Appendix 6.3-E. Monthly Mean Flows for Gaging Stations[1] in Waters Associated with the MFP (continued).

USGS 11433260 NF OF MF AMERICAN R NR FORESTHILL CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1965								41.6	30.8	23.6	75.6	56.8
1966	122	146	383	418	119	46.8	28.5	20.8	21.6	18.8	89	449
1967	546	540	675	418	998	321	84.6	43.9	31.4	35.9	35.7	74.8
1968	228	687	363	262	121	54.3	29	25.7	23.6	31.4	81.7	147
1969	1,342	574	407	971	754	162	74.1	37.4	28.6	50.5	52.5	548
1970	1,654	377	363	194	149	74.9	40.6	26.6	23.7	29.1	148	326
1971	389	392	674	540	434	176	61	40.1	31.3	34.3	61.4	121
1972	185	303	605	424	245	79.7	43.8	29.9	29.2	41.3	109	309
1973	794	564	506	567	395	109	51.2	31.5	30.6	38.1	604	591
1974	1,106	307	1,139	826	425	140	100	43.2	31.5	31.1	43.4	53.7
1975	142	424	660	514	750	213	61.4	44.4	32.5	77.7	80.7	53.5
1976	42.5	80.2	182	157	87.2	37.1	20.7	24.2	20.2	18.4	21	17.6
1977	29.2	33.2	43.7	38.5	47.5	22.8	10.6	9.27	9.07	9.82	36.1	308
1978	793	493	816	694	421	128	41.8	27.2	33.6	22	27.9	34.3
1979	204	223	563	504	566	104	39.1	30.3	24.1	41.7	105	137
1980	2,196	1,154	544	454	305	116	56.5	31.2	23.9	26.8	30.3	46.9
1981	103	215	372	304	115	49.8	29.8	20.8	24.8	40	552	1,409
1982	594	1,606	734	1,338	740	196	78.2	49	57.6	126	319	774
1983	519	979	1,443	891	924	463	132	63.5	43.8	53.4	990	1,424
1984	423	330	412	300	228	88.7	49	32.4	24.7	37.8	249	137
1985	88.4	172	253	476	153	61.8	34.3	23.4	28.1			

USGS 11433085 NF LONG CYN C F REL BL DIV TU NR VOLCANOVILLE CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1989						5.45	5.02					
1990							3.03					
1991							3.97	3.4				
1992						2.95	2.76					
1993					2.52	3.09	2.7	2.75				
1994						2.86	2.81					
1995					2.69		3.5					
1996					3.74	3.36	3.19					
1998					3.23	3.7	3.83	4.36				
1999					4.31	3.74	3.96	3.89				
2000					4.93	4.45	3.84					
2001							3.51					
2002					3.73	4.28	5.1					
2003				3.12	2.69	2.81	2.84	2.89				
2004						2.95	2.68					

USGS 11433065 SF LONG CYN C F REL BL DIV TU NR VOLCANOVILLE CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1988			3.03									
1989				2.96	2.92	4.03	3.28	3				
1990						6.49	6.33	5.85				
1991							6.11	6.32				
1992						6.43	5.94					
1993				6.05	6.58	7.39	5.98	6.57	6.17			
1994						6.57	6.6					
1995					3.56		4.98					
1996					7.66	7.25	6.45					
1998					6.44	6.78	6.16	6.24	6.37			
1999					6.66	6.45	6.28	6.49				
2000					6.74	6.36	6.48	6.25				
2001							5.95	5.8				
2002					6.13	6.16	6.4	6.1				
2003				5.85	5.83	5.77	5.88	6.06				
2004						5.7	5.51					

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Appendix 6.3-E. Monthly Mean Flows for Gaging Stations[1] in Waters Associated with the MFP (continued).

USGS 11433100 LONG CANYON C NR FRENCH MEADOWS CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1960	0.78	2.1	6.14									0.39
1961	0.72	1.25	5.33	3.75	18	27.7	39.5	35.9	9.77	2.01	0.66	0.5
1962	29.7	5.21	23.9	3.71	60.3	32.3	145	62.7	19.6	3.1	1.08	0.52
1963	1.88	24.6	13.4	62	170	37.5	136	150	28.5	6.57	1.95	0.74
1964	1.64	6.68	352	13.9	21.7	26.2	60.6	82.3	29	5.62	2.14	1.63
1965	4.95	11	6.8	155	87	54.1	115	80	28.1	9.44	6.91	5.63
1966	0.91	8.35	25.6	9.7	12	35.7	36.1	12.5	16.3	7.22	0.62	0.92
1967	2.37	2.91	6.32	52.8	42	88.6	29.5	134	44.8	15.6	2.62	1.52
1968	1.38	8.07	11.1	11.9	62.4	27.3	16.7	7.37	5.48	1.54	0.89	0.2
1969	2.22	2.81	37.8	236	61	74.4	166	108	22.9	7.2	2.45	1.4
1970	0.95	11.9	23.7	280	50.9	48.1	27.9	14.1	8.08	2.7	1.51	0.97
1971	1.91	5.68	10.3	29.7	43.9	99.3	55.9	35.5	19.9	8.09	2.73	1.43
1972	2.14	15.3	29.1	13.5	24	54.7	36.1	22.7	9.96	3.16	0.93	1.39
1973	2.47	55.1	74.3	92.6	51.6	50.3	46.4	26.6	11.3	3.08	1.45	1.12
1974	1.58	3.01	6.56	124	37.1	149	142	93	21.6	15.8	3.32	1.45
1975	8.43	23.8	15.9	19.2	36.4	56.4	58.2	62	24.5	6.97	2.97	1.86
1976	1.04	1.23	1.3	9.42	10.2	20	18.6	8.13	3.92	1.82	1.86	1.54
1977	0.39	1.71	18	2.18	3.41	5.91	4.13	5.41	2.33	0.67	0.18	0.3
1978	1.1	1.86	3.03	61.4	40.5	58	49.5	26.1	9.82	4.4	1.7	1.84
1979	2.54	7.27	10.5	17.2	17.5	49.5	40.8	34	13.2	5.1	1.59	0.8
1980	1.23	1.87	5.52	276	133	47	29.2	18.7	9.56	5.86	2.25	1.32
1981	1.47	68.8	218	6.39	17.4	31.8	23.5	15.9	7.58	1.92	0.5	0.38
1982	15.4	41.7	131	87.1	248	145	258	173	25.9	7.77	2.19	3.03
1983	4.02	159	188	89.5	172	255	139	127	72	19.4	4.14	2.15
1984	2.72	21.2	17.1	39.6	30.2	40.2	24.9	16.3	11.5	3.78	1.72	1.46
1985	2.07	6.97	16.1	13.2	18.4	25.5	33.5	13.2	7.33	2.36	1.29	1.57
1986	2.41	2.14	2.49	34	428	191	55.3	17.4	8.02	3.03	1.37	2.48
1987	0.89	2.12	12.1	4.58	21.5	24.7	14.1	8.99	3.91	1.52	0.75	0.59
1988	0.47	14.6	7.76	20.1	14	13.4	13	10.3	6.35	2	0.69	0.37
1989	4.33	6.85	6.77	9.37	17.1	101	32.5	10.4	8.66	3.06	1.42	1.8
1990	0.87	1.21	1.62	13.9	15.1	25.6	16.3	12.6	12.1	4.29	1.53	0.83
1991	1.48	3.61	3.98	1.93	3.55	30.2	32.7	19.3	11.2	5.48	1.62	0.69
1992				4.51	19.2	17.5	12	7.14	2.83	1.55	0.43	0.32

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Appendix 6.3-E. Monthly Mean Flows for Gaging Stations[1] in Waters Associated with the MFP (continued).

USGS 11428800 RUBICON R BL HELL HOLE DAM CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1965			21.4									
1966	30.8	17.5	16.2	15	14.3	10.9	17.2	41	17.6	15	7.26	16.8
1967	10.2	15.7	14.8	16.2	17.3	19.8	17.2	27.1	792	131	10.4	10
1968	10.5	16	14.8	14.3	24.4	25.3	25.2	24.5	23.8	22.3	10.5	9.49
1969	10.1	14.6	15.8	30.8	29.4	29.6	33.2	38	127	25.7	8.95	8.4
1970	8.63	12.2	12.9	28.1	16.7	16.7	21.7	22.6	21.5	20.1	11.7	10.4
1971	9.35	14.7	15.2	13.5	18.6	20.3	23.7	27.4	26.6	24	9.02	8.35
1972	10.4	12.1	13.1	15.3	19.2	24.4	23.1	20.9	19.1	18.5	8	7.3
1973	7.14	15.6	16.1	18.3	19.1	16.7	19.9	25.5	18.7	16.1	8.74	7.62
1974	8.4	11.8	13.2	17.2	18.6	20.1	20	21.6	18.9	46.3	9.3	7.16
1975	8.17	14.7	15	13.5	18.8	20.1	19.4	21.4	16.9	16.4	9.42	7.02
1976	7.84	7.51	7.75	15.1	18.5	17.6	18.2	13.6	7.93	8.59	8.4	8.74
1977	8.34	8.72	20.8	6.24	6.34	6.33	7.78	7.92	7.74	6.93	6.5	6.43
1978	10.3	16.2	14.5	25.9	18.9	23.4	22.2	19	19.1	17.8	11.3	11.5
1979	9.16	14.7	15.9	15.7	18.5	18.1	19.6	20.5	20.5	20.2	10.9	10.5
1980	11.8	14.1	13.7	22.4	22.7	18.8	22.3	19.6	20	19.9	11.5	12.3
1981	10.2	18.8	318	14.9	22.2	21.5	22	22.1	22.1	19.4	10.6	10.2
1982	12.1	14.4	14.4	21.5	172	24	129	544	118	20.4	10.9	9.66
1983	20.6	25.8	25.3	15.7	21.1	24.3	22.1	29.5	653	303	21	21.7
1984	22.1	23.8	17.3	27.7	12.6	12.9	13.8	19.8	21.4	20.7	21.3	22
1985	24.1	24.1	19	12.7	13.5	13.7	16.3	19.4	22.7	23	21.6	22.8
1986	21	22	16.8	15.8	38.1	478	33.2	23.4	71.3	23	22.5	21.6
1987	24.7	21.1	16.2	12	14.1	14.6	14.9	17.5	21.2	20.7	21.1	20.9
1988	40.6	8.89	7.57	12	11	11.4	11.8	17.7	11.3	11	11.1	11
1989	27.5	22.3	16.9	7.76	7.89	15.7	13.9	25.9	22.4	22.2	23	36.7
1990	26.1	22.2	16.7	12.4	12.5	12.6	12.6	18.6	23.3	22.7	22	21.9
1991	34.9	22.4	16.7	12	12.8	15.3	14.7	19.7	22.5	23	23	27.2
1992	28.5	22.1	17.4	12.8	14.7	15.9	14	18.2	22.1	22	22	23.5
1993	22.8	22	16.8	14.7	13	17.5	15.7	21.3	22.7	22.1	22	21.9
1994	26.6	7.67	9.72	13.1	13.6	14.1	14.2	18.5	12.8	13	13.7	35.4
1995	23.8	22.5	18.1	16.4	10.1	24.9	38.1	52.1	1,007	276	23.6	27
1996	25.7	22.3	29.6	16.5	20.2	15.5	15.7	1,053	97.1	23.1	23.4	22.2
1997	25.1	22.3	16.8	1,615	29.7	17.2	13.6	18.6	24.4	23.9	22.9	26.9
1998	25.9	23.3	17	14.9	13.7	15.4	11.9	21.4	421	250	22	24.2
1999	23.3	22	15.8	14.1	15.7	13.8	14.2	19.1	22.9	23	23	23.9
2000	22.7	22	18	14.2	15.3	13.2	13	19	22.2	22.3	22.8	25.6
2001	42.3	34.9	18.2	12	12.9	12.5	12.7	17.8	21.6	21.9	21.4	21.1
2002	37	21.4	16.4	11.9	12.5	13.3	12.2	17.1	20.7	21.5	21.2	37
2003	30.9	21.4	16.9	12.8	12.2	12.4	13	18.2	107	21	21.6	21.4
2004				11.4	11.9	12	11.7	17.8	21	21	21	21.4

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Appendix 6.3-E. Monthly Mean Flows for Gaging Stations[1] in Waters Associated with the MFP (continued).

USGS 11433200 RUBICON R NR FORESTHILL CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1958										36.8	55.1	48.2
1959	501	565	762	1,208	901	379	52.2	21.3	40.9	26.3	20.2	27.6
1960	116	977	1,613	1,603	1,292	617	73.1	32.3	25.9	28.9	72.4	129
1961	72.7	434	457	979	1,157	581	56.2	23.1	22.2	37	39.4	135
1962	104	842	566	2,329	1,829	1,146	155	28.5	13.3	866	134	508
1963	1,292	2,769	431	1,393	2,389	1,143	268	58.2	31.6	49.5	645	208
1964	244	261	326	886	1,104	519	92.7	38.9	29.1	26.8	124	5,544
1965	1,983	1,109	811	1,461	1,340	741	148	112	62.6	52.3	200	92.4
1966	136	147	278	325	133	77.5	47.5	32.4	40.9	48.7	107	300
1967	463	519	834	652	1,068	1,288	369	62.3	47.3	50.2	52.9	91.8
1968	134	483	382	279	135	86.6	61.2	46.5	38.1	49.3	92.9	164
1969	1,746	842	599	1,061	844	337	101	60.8	46.6	60.4	76.2	338
1970	2,124	589	560	256	155	105	68.7	43.9	41.6	53.2	189	376
1971	347	252	487	607	381	206	96.8	58.2	51.7	57.9	93.3	159
1972	147	274	487	404	188	104	66.1	44.5	48.4	59.7	115	166
1973	657	670	597	498	295	126	69.7	49.2	46.9	59	364	493
1974	1,090	404	1,206	1,035	468	176	195	71.4	53.3	58.1	79.5	86.3
1975	128	349	591	567	671	191	98.8	63.9	45	80	94.7	82.1
1976	71.1	88.9	115	107	58.6	29.2	22.9	27.5	26	28.2	28.3	24.1
1977	34	35.2	39.7	30.1	36.6	21.2	11.9	8.84	10.3	11.9	30.6	155
1978	652	447	766	749	400	141	74	44.8	52	42.8	43.6	57.9
1979	177	243	506	481	452	124	77.6	50.9	35.7	46.3	70.1	122
1980	2,554	1,612	781	449	271	148	81.9	56	45.3	40.9	42.7	54.9
1981	88	137	248	220	111	62.9	39.6	25.4	25.4	40.1	359	1,588
1982	711	2,047	1,141	2,180	1,674	403	124	63.8	74.6	131	309	1,024
1983	813	1,358	2,021	1,149	1,215	1,469	548	106	83.7	87.1	894	1,959
1984	627	475	567	343	199	129	78.5	51	42.2			

USGS 11431000 RUBICON R NR GEORGETOWN CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1910	20.5	137	431				1,878	1,397	469	102	17.2	21.2
1911	22.8	35.5	38.1	601	591	881	1,884	2,334	3,232	783	127	27.6
1912	18.4	307	105	68	119	256	512	1,700	1,022	233	39	74
1913	9.55	54	296	98.5	208	325	1,111	1,910	748	216	64.1	18.3
1914				1,179	749	1,239						
1943	14.1	21.6	37.5									
1944	17.4	311	387	74.7	153	326	682	1,791	751	133	23.7	12.8
1945	127	354	806	237	999	397	1,261	1,991	1,068	196	27.9	14.1
1946	33.5	261	216	489	322	682	1,582	2,034	816	147	24.7	15.7
1947	178	116	62.3	105	430	668	961	1,063	363	44.1	13.3	8.02
1948	9.82	105	61.2	482	170	221	1,202	2,030	1,729	297	35.9	13.6
1949	8.42	37.5	28.1	53.3	76.8	217	1,638	2,013	625	69.8	18.5	9.73
1950	155	2,902	2,547	577	581	727	1,759	2,211	1,378	335	38.5	18.2
1951	52.6	238	381	715	834	628	1,370	1,485	545	94.2	22.3	14.2
1952	22.9	30.5	125	243	540	430	2,010	3,726	2,701	1,026	143	41
1953	25.9	94.4	94.6	687	333	488	1,531	1,592	2,023	642	63.6	29.2
1954	8.37	47.8	214	153	351	1,040	1,577	1,380	389	75.7	17.6	11.9
1955	11.2	42	2,960	158	209	372	684	1,789	971	108	22.6	12.7
1956	74	99.3	122	1,465	441	657	1,320	2,488	1,650	373	63.4	36.7
1957	30.9	116	237	96.2	748	936	1,018	1,832	1,094	147	21.5	14.2
1958	16.9	34.1	23.7	206	993	587	1,356	3,731	2,284	481	90.5	27.8
1959	12	7.95	11	383	358	578	1,045	803	353	42.1	12.5	29.8
1960	16.1	45	90.8	48.5	627	1,159	1,324	1,161	570	58	15.7	13.7
1961	32.1	29.5	116	57.4	363	352	860	1,036	546	47.7	17	16.4
1962	639	105	413	90	490	337	1,953	1,613	1,040	140	17.1	4.67
1963	39.9	514	156	918	1,920	326	1,064	1,913	906	181	30.8	15.9
1964	19.5	80.6		132	161	212	611	922	461	65.3	24.1	20.1

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Appendix 6.3-E. Monthly Mean Flows for Gaging Stations[1] in Waters Associated with the MFP (continued).

Diversions

USGS 11433060 SF LONG CANYON C DIV TUNNEL NR VOLCANOVILLE CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1965	0	0	0									
1966	0	0	14.2	0	0.12	15.4	43.6	16.2	0	0	0	0
1967	0.025	0	0.067	3.67	22	14.5	22.7	60.4	47.5	0.66	0	0
1968	0	0	0.49	2.99	20.5	24.9	22.2	11.8	1.09	0	0	0
1969	0.003	0.005	10.4	8.3	1.98	0.44	28.2	36.1	18.3	0.35	0	0
1970	0	3.78	3.82	15.9	11.5	11.5	6.41	10.3	1.57	0	0	0
1971	0	0.36	0.65	7.96	14.1	20.9	41.3	40.2	16.3	0.26	0	0
1972	0	0.56	9.56	3.24	9.23	43.4	27.4	20.5	2.66	0	0	0.001
1973	0	37.2	36.3	18	16.9	17.1	39.3	48.8	7.9	0	0	0
1974	0	0	0	42.1	13.4	0	0	0	7.29	0	0	0
1975	0	0	0	0	2.96	21.3	24.5	80.6	24	0.083	0	0
1976	0	0.011	0	0	0.39	4.92	6.7	6.85	0.76	0	0	0
1977	0	0.49	11.6	0	0.023	0.007	0.71	3.34	1.02	0	0	0
1978	0	0	0.007	35	23.9	58.2	53.6	48.9	15.7	0.38	0	0
1979	0.034	1.93	2.11	3.51	4.94	22.7	38.1	50.1	5.62	0	0	0
1980	0	30	5.07	21.6	13.8	27.7	67.8	37.8	11.9	2.65	0	0
1981	0	23.1	15.3	1.06	7.75	17.7	22.2	8.49	0.085	0	0	0
1982	0	3.2	3.88	0	11.4	0	0	0	6.21	0.79	0	0
1983	0	3.46	38.6	21	3.93	0	0	71.5	35.4	4.54	0.067	0
1984	0	8.51	5.08	34.2	17.9	28.6	25.5	15.6	2.86	0	0	0
1985	0	0.2	8.49	1.51	4.16	9.86	43.9	16.6	0.57	0	0	0
1986	0	0	0	26.3	14	0	3.73	15	1.2	0	0	0
1987	0	0	0	0	1.85	10.9	11.9	2.69	0	0	0	0
1988	0	0.37	1.33	1.67	4.38	7.25	5.31	4.93	0.47	0	0	0
1989	0	0	0	2.67	9.07	77.7	64.7	18.8	0.8	0	0	0
1990	0	0	0	0.55	0.54	18	18	5.81	4.16	0	0	0
1991	0	0	0	0	0	5.97	27.1	28.6	5.28	0	0	0
1992	0	0	0.064	0	7.24	13.5	11.7	0.52	0	0	0	0
1993	0	0	0	17.2	20.1	59.5	62.9	54.3	19.3	0.037	0	0
1994	0	0	0	0	0.19	11.4	10.6	5.95	0	0	0	0
1995	0	0	0	31.1	43.5	62.5	63.2	0	0	0	0	0
1996	0	0	18.9	11.3	77.3	51.2	54.7	21.5	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	30.5	31.4	49.1	50.3	73.7	54	1.32	0	0
1999	0	0	0	21.6	46.3	38.9	42.1	52	10.3	0	0	0
2000	0	0	0	8.65	31.3	35	39.5	25	0.093	0	0	0
2001	0	0	0	0	0	14.1	23.1	12.1	0	0	0	0
2002	0	0	2.98	13.3	20.3	32	47.1	23	2.23	0	0	0
2003	0	0	0	20.4	18.3	25	34.6	54.2	5.87	0	0	0
2004				0	8.83	42.3	30.6	8.67	0	0	0	0

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Appendix 6.3-E. Monthly Mean Flows for Gaging Stations[1] in Waters Associated with the MFP (continued).

USGS 11433080 NF LONG CANYON DIV TUNNEL NR VOLCANOVILLE CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1965	0	0	0									
1966	0	0	0	0	0	8.8	14.1	3.2	0	0	0	0
1967	0	0	6.1	1.9	6.3	5.8	9.8	25.0	19.4	0	0	0
1968	0	0	0.3	1.1	10.1	10.8	12.6	4.1	0.0	0	0	0
1969	0	0.4	0.3	2.7	0.8	0.2	14.1	31.1	2.1	0	0	0
1970	0.1	0.0	1.5	2.6	4.1	2.4	2.1	1.3	0.2	0	0	0
1971	0	2.1	1.2	4.1	6.6	5.9	16.1	15.6	1.6	0	0	0
1972	0	0.0	0.3	1.1	10.1	10.8	12.6	4.1	0.0	0	0	0
1973	0	0.9	3.0	3.0	2.0	3.6	20.5	20.8	1.1	0.2	0.1	0.1
1974	0.1	0.4	0	0	0	0	0	0	0.2	0.1	0	0
1975	0	0	0	0	0.4	5.9	6.9	34.6	4.9	0	0	0
1976	0	0	0.3	1.1	10.1	10.8	12.6	4.1	0.0	0	0	0
1977	0	0	0	0	0	0	0	0.1	0.0	0	0	0
1978	0	0	5.1	13.0	6.9	29.3	27.5	26.2	3.4	0.1	0	0
1979	0	0.1	0.5	3.3	5.1	15.5	22.2	26.5	0.9	0.1	0	0
1980	0	0	0.3	1.1	10.1	10.8	12.6	4.1	0	0	0	0
1981	0	0	0.1	0.7	7.3	8.5	12.4	2.2	0	0	0	0
1982	0.4	13.2	9.0	0	2.9	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	31.0	21.5	0	0	0
1984	0	0	12.1	10.0	7.40	15.21	11.17	6.80	0.31	0	0	0
1985	0	5.2	1.4	0.2	1.9	4.2	22.9	5.8	0.1	0	0	0
1986	0	0.2	7.0	14.7	8.1	0.0	2.6	4.0	0.1	0	0	0
1987	0	0	0	0.1	0.3	6.4	5.6	0.2	0	0	0	0
1988	0	0	0	2.2	5.2	5.8	2.8	0.2	0	0	0	0
1989	0	0.4	0.6	0.9	4.3	34.5	26.7	4.2	0	0	0	0
1990	0	0	0	0.4	0	8.8	6.6	1.8	1.1	0	0	0
1991	0	0	0	0	0	3.7	17.2	12.8	1.2	0	0	0
1992	0.2	0	0.0	0.0	5.4	8.3	5.2	0.0	0.0	0	0	0
1993	0	0	0.2	7.8	10.6	35.5	33.0	24.1	7.0	0	0	0
1994	0	0	0	0	0.5	9.2	6.0	2.2	0	0	0	0
1995	0	0	0	15.2	20.6	28.4	31.7	0.0	0	0	0	0
1996	0	0	0	5.9	35.6	25.2	29.7	8.3	0	0	0	0
1997	0	0	12.7	0	0	0	0	0.0	0	0	0	0
1998	0	0	0	14.3	25.5	21.3	23.7	23.5	1.5	0	0	0
1999	0	0	0	4.4	13.6	18.3	21.4	10.1	0	0	0	0
2000	0	0	0	0	0	10.9	13.0	4.3	0	0	0	0
2001	0	0	0	9.1	13.6	18.9	25.6	6.3	0	0	0	0
2002	0	0	5.4	21.0	11.5	15.9	20.8	29.8	0.7	0	0	0
2003	0	0	0	0	5.3	31.5	15.2	1.4	0	0	0	0
2004	0	0	0	0	0	21.3	33.5	34.5	0	0	0	0

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Appendix 6.3-E. Monthly Mean Flows for Gaging Stations[1] in Waters Associated with the MFP (continued).

Powerhouses

USGS 11433260 NF OF MF AMERICAN R NR FORESTHILL CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1965								41.6	30.8	23.6	75.6	56.8
1966	122	146	383	418	119	46.8	28.5	20.8	21.6	18.8	89	449
1967	546	540	675	418	998	321	84.6	43.9	31.4	35.9	35.7	74.8
1968	228	687	363	262	121	54.3	29	25.7	23.6	31.4	81.7	147
1969	1,342	574	407	971	754	162	74.1	37.4	28.6	50.5	52.5	548
1970	1,654	377	363	194	149	74.9	40.6	26.6	23.7	29.1	148	326
1971	389	392	674	540	434	176	61	40.1	31.3	34.3	61.4	121
1972	185	303	605	424	245	79.7	43.8	29.9	29.2	41.3	109	309
1973	794	564	506	567	395	109	51.2	31.5	30.6	38.1	604	591
1974	1,106	307	1,139	826	425	140	100	43.2	31.5	31.1	43.4	53.7
1975	142	424	660	514	750	213	61.4	44.4	32.5	77.7	80.7	53.5
1976	42.5	80.2	182	157	87.2	37.1	20.7	24.2	20.2	18.4	21	17.6
1977	29.2	33.2	43.7	38.5	47.5	22.8	10.6	9.27	9.07	9.82	36.1	308
1978	793	493	816	694	421	128	41.8	27.2	33.6	22	27.9	34.3
1979	204	223	563	504	566	104	39.1	30.3	24.1	41.7	105	137
1980	2,196	1,154	544	454	305	116	56.5	31.2	23.9	26.8	30.3	46.9
1981	103	215	372	304	115	49.8	29.8	20.8	24.8	40	552	1,409
1982	594	1,606	734	1,338	740	196	78.2	49	57.6	126	319	774
1983	519	979	1,443	891	924	463	132	63.5	43.8	53.4	990	1,424
1984	423	330	412	300	228	88.7	49	32.4	24.7	37.8	249	137
1985	88.4	172	253	476	153	61.8	34.3	23.4	28.1			

USGS 11427765 RALSTON PH NR FORESTHILL CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1973										537	713	132
1974	920	929	751	843	928	839	611	507	646	791	747	132
1975	198	295	654	632	424	753	461	531	765	740	10.3	14.1
1976	272	898	852	69.1	84.9	98.1	46.6	77.3	422	131	140	76.3
1977	87.3	63.6	119	30.4	15.7	69.5	168	320	207	30.5	53.5	125
1978	618	921	883	437	880	399	478	712	415	150	528	232
1979	579	644	226	204	627	484	640	765	653	410	434	567
1980	631	769	939	939	925	628	721	470	464	312	676	833
1981	311	207	206	212	74.4	155	143	94.2	271	195	555	898
1982	924	881	928	908	928	930	886	891	559	611	868	863
1983	726	881	905	931	929	929	932	883	915	426	769	843
1984	931	931	928	663	675	899	666	667	690	149	613	625
1985	132	73.4	115	241	168	437	518	573	594	173	187	254
1986	587	378	470	930	882	679	617	687	740	177	390	138
1987	83.5	114	89.2	46.5	52.9	214	400	495	412	80.3	11.2	86.9
1988	183	109	36.8	30.6	40.4	333	458	391	328	3.16	122	188
1989	290	360	573	898	930	762	694	736	358	324	581	398
1990	58.1	62.8	80.7	57.7	33.7	299	770	820	449	495	345	59.6
1991	5.29	2.93	81.5	104	323	633	660	665	450	230	355	34.9
1992	2.06	61.5	51.6	28.8	119	328	370	354	234	50	109	183
1993	269	603	936	907	636	857	866	910	469	473	305	275
1994	166	53.6	52.2	28.9	82.4	523	456	460	111	181	259	222
1995	631	936	861	925	924	932	922	877	406	680	524	406
1996	408	744	937	941	870	864	716	722	572	286	485	834
1997	4.13	0	575	622	773	565	746	911	515	576	496	488
1998	239	720	799	897	884	913	901	886	603	50.4	491	657
1999	563	779	858	797	840	780	673	687	426	369	491	304
2000	271	496	718	485	697	743	547	596	348	188	574	378
2001	346	264	210	171	295	379	492	610	462	0	17.6	235
2002	386	411	272	311	319	398	390	391	146	162	400	302
2003	444	495	573	426	831	674	514	576	708			

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Appendix 6.3-E. Monthly Mean Flows for Gaging Stations[1] in Waters Associated with the MFP (continued).

USGS 11428600 MF PH NR FORESTHILL CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1974	769	715	120									
1975	694	0.5	0	161	196	467	472	106	679	445	524	758
1976	129	133	74.3	248	842	803	38.3	69.2	94.7	47.2	77	419
1977	28.6	47.9	56.2	83.5	53.4	105	21.1	6.19	54.5	162	311	199
1978	151	516	226	408	792	644	226	742	372	479	722	415
1979	397	410	535	520	574	84.4	52.7	496	470	644	766	642
1980	308	674	814	427	684	945	950	932	609	723	470	462
1981	189	394	873	287	152	119	140	55.2	147	144	93	270
1982	577	804	685	904	839	946	919	982	959	899	899	552
1983	424	595	934	551	640	896	934	948	979	970	907	938
1984	147	560	590	986	869	822	574	648	922	673	677	692
1985	173	173	197	108	35.8	44.9	82.5	126	433	525	577	589
1986				445	580	792	974	883	692	638	700	743
1987	82.1	12.5	63.6									
1988	4.39	90	166	134	69.6	1.39	4.37	21.5	323	456	392	324
1989	318	559	383	263	306	216	749	929	770	710	748	359
1990	487	336	59.2	36.9	38.4	4.23	22.4	10.5	283	777	818	439
1991	216	332	30.8	4.33	1.64	17.8	0	254	606	643	643	433
1992	47.3	104	144	0	6.59	0	0	109	317	358	342	225
1993	472	302	263	131	458	613	698	531	835	876	919	470
1994	176	238	167	155	33.3	3.45	0	63.2	511	449	451	108
1995	685	527	362	378	774	724	951	968	962	912	888	409
1996	283	445	690	285	506	726	892	908	859	715	724	567
1997	563	471	450	298	920	857	566	763	557	753	913	505
1998	51.6	475	617	51.1	485	570	688	736	899	907	900	605
1999	369	480	293	405	539	739	649	309	764	682	697	428
2000	184	559	362	194	314	563	377	647	741	553	597	344
2001	0	2.6	163	325	231	122	85.1	255	366	473	576	424
2002	163	365	222	267	271	89.1	142	262	377	384	389	144
2003				298	415	471	264	669	673	518	583	716

USGS 11433212 OXBOW PH NR FORESTHILL CA

YEAR	Monthly mean streamflow, in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1973										599	918	1,022
1974	1,060	1,076	1,062	1,068	920	1,002	699	571	706	883	844	184
1975	319	684	994	1,009	1,017	902	563	603	846	868	54.5	74.6
1976	328	1,025	993	163	137	115	29.8	55.9	440	121	103	54.6
1977	82.3	61	140	24.7	24.3	44.9	115	277	155	0.71	51.7	261
1978	925	1,064	1,069	1,037	1,068	531	564	799	475	176	544	266
1979	730	934	846	789	1,005	597	737	853	727	448	515	720
1980	896	946	934	1,067	1,061	753	819	533	508	343	755	954
1981	423	341	492	456	143	179	156	85.7	261	219	718	1,033
1982	998	1,002	1,060	1,026	1,043	1,057	1,019	1,002	634	734	1,013	1,043
1983	1,039	1,057	1,027	1,050	1,062	1,053	1,057	1,002	1,036	504	947	1,022
1984	1,054	1,057	1,065	972	903	1,035	772	758	796			
1985										200	270	410
1986	876	817	908	1,028	936	788	705	756	830	162	406	157
1987	132	239	283	125	107	251	440	529	437	85	5.03	153
1988	349	174	96.3	89.7	87.4	378	492	393	327	0	154	241
1989	374	492	1,047	1,075	1,088	884	801	839	423	367	696	474
1990	142	153	339	163	103	398	875	928	494	552	388	52.1
1991	0	21	330	417	529	774	763	754	487			
1993										444	312	315
1994	209	232	261	201	160	502	415	413	105	138	285	356
1995	732	850	846	857	857	843	845	813	405			
1998										43.4	596	812
1999	823	1,014	1,033	1,046	1,019	940	769	776	478	389	543	336
2000	491	950	1,049	817	900	863	617	646	396	198	634	427
2001	379	392	428	374	399	430	522	642	488	0	42.4	441
2002	639	658	757	674	474	464	416	387	145	153	467	449
2003	718	727	845	950	1,079	872	595	638	802	168	323	575
2004	651	783	979	540	551	456	516	516	526	433	441	774

[1] Data is included for gaging stations that are no longer in service

APPENDIX 6.3-F

Annual Peak Discharges (cfs) for Waters Associated with the MFP.

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Appendix 6.3-F. Annual Peak Discharges (cfs) for Waters Associated with the MFP.

	Stream Gages																				Diversions			
	Duncan Near French Meadows		Duncan Below Diversion		MF American River at French Meadows		MF American River Downstream of Interbay		MF American Above Powerhouse near Foresthill		MF American River Downstream of Oxbow Powerhouse		NF Fork Long Canyon Gage		SF Long Canyon Gage		Long Canyon Near French Meadows		Rubicon River below Hell Hole Dam		Rubicon River ds South Fork Rubicon River		NF Long Canyon Diversion Tunnel		SF Long Canyon Diversion Tunnel	
USGS Gaging Station	11427700		11427750		11427500		11427770		11427760		11433300		11433085		11433065		11433100		11428800		11431000		11433080		11433060	
	Q (cfs)	Date	Q (cfs)	Date	Q (cfs)	Date	Q (cfs)	Date	Q (cfs)	Date	Q (cfs)	Date	Q (cfs)	Date	Q (cfs)	Date	Q (cfs)	Date	Q (cfs)	Date	Q (cfs)	Date	Q (cfs)	Date	Q (cfs)	Date
1943													no peak flow data available		no peak flow data available						7,030	6/1/1943				
1944																					3,500	5/7/1944				
1945																					12,800	2/2/1945				
1946																					4,540	12/29/1945				
1947																					4,330	11/23/1946				
1948																					4,160	5/16/1948				
1949																					4,740	5/14/1949				
1950																					5,320	1/22/1950				
1951																					44,600	11/18/1950				
1952					2,100	5/27/1952															5,850	5/27/1952				
1953					3,310	4/27/1953															9,920	4/27/1953				
1954					3,240	3/9/1954															11,800	3/9/1954				
1955					1,040	5/20/1955															3,440	5/20/1955				
1956					16,300	12/23/1955															51,000	12/23/1955				
1957					3,510	5/18/1957															11,500	5/18/1957				
1958					3,010	2/24/1958															8,880	2/24/1958				
1959					835	2/16/1959					6,570	2/16/1959									3,550	2/16/1959				
1960					3,080	2/8/1960					28,000	2/8/1960									8,980	2/8/1960				
1961	260	2/9/1961			736	2/9/1961					4,560	2/10/1961					102	2/9/1961			3,750	4/28/1962				
1962	250	4/27/1962			1,190	4/28/1962					11,300	2/10/1962					340	2/9/1962			58,000	2/1/1963				
1963	2,720	1/31/1963			21,500	1/31/1963					113,000	2/1/1963					3,540	2/1/1963			5,630	11/15/1963				
1964	613	11/14/1963			2,260	11/14/1963					14,600	11/15/1963					262	11/14/1963								
1965	3,650	12/22/1964	3,640	12/22/1964	1,310	4/30/1965	399	10/24/1965	399	10/24/1965	310,000	12/23/1964					4,690	12/23/1964								
1966	170	5/10/1966	66	5/19/1966	418	10/22/1965	1,250	6/22/1967	1,460	3/16/1967	1,980	11/18/1965					107	11/18/1965								
1967	575	3/16/1967	540	3/16/1967	846	6/27/1967	520	2/20/1968	1,390	2/20/1968	17,100	3/16/1967					513	1/29/1967	2,290	6/18/1967						
1968	300	2/20/1968	379	2/20/1968	56	2/20/1968	2,180	1/20/1969	2,540	1/20/1969	8,800	2/20/1968					590	2/19/1968	51	2/20/1968						
1969	1,550	1/19/1969	1,410	1/19/1969	518	6/14/1969	3,910	1/21/1970	3,900	1/21/1970	24,700	1/20/1969					1,610	1/21/1969	646	6/16/1969						
1970	1,910	1/21/1970	1,680	1/21/1970	143	1/21/1970	1,100	3/31/1971	1,420	3/26/1971	34,600	1/21/1970					2,410	1/21/1970	123	1/21/1970						
1971	268	11/25/1970	225	3/26/1971	69	3/26/1971	1,560	6/7/1972	396	2/29/1972	16,400	3/26/1971					985	3/26/1971	50	3/26/1971						
1972	165	5/14/1972	28	3/10/1972	132	5/22/1972	1,230	1/12/1973	1,410	1/12/1973	3,840	2/29/1972					199	2/29/1972	37	2/29/1972						
1973	479	1/12/1973	200	1/12/1973	68	1/16/1973	1,640	1/18/1974	2,110	1/17/1974	13,500	1/12/1973					962	1/12/1973	64	1/12/1973						
1974	690	1/17/1974	320	1/17/1974	794	6/2/1974	980	4/24/1975	945	3/25/1975	16,500	1/17/1974					968	12/29/1973	731	7/10/1974						
1975	347	5/31/1975	230	5/18/1975	57	3/25/1975	86	11/18/1975	381	10/26/1975	11,200	3/25/1975					333	3/25/1975	54	3/25/1975						
1976	237	10/26/1975	197	10/26/1975	27	8/24/1976	534	5/6/1977	97	2/21/1977	1,920	10/26/1975					131	10/26/1975	30	5/4/1976						
1977	70	5/26/1977	7	3/13/1977	24	9/1/1977	246	12/15/1977	330	1/16/1978	1,160	3/11/1977					13	1/2/1977	8	10/1/1976						
1978	355	12/15/1977	304	12/15/1977	51	1/16/1978	1,050	2/6/1979	1,300	1/11/1979	8,640	1/16/1978					248	1/16/1978	240	6/28/1978						
1979	448	1/11/1979	366	1/11/1979	56	1/11/1979	9,900	1/13/1980	9,860	1/13/1980	9,930	1/11/1979					496	1/11/1979	67	1/11/1979						
1980	3,080	1/13/1980	2,980	1/13/1980	161	1/13/1980	796	12/3/1980	549	3/25/1981	66,000	1/13/1980					3,310	1/13/1980	170	1/13/1980						
1981	263	2/14/1981	21	2/14/1981	30	3/25/1981	8,090	2/16/1982	3,980	2/16/1982	5,420	3/25/1981					376	3/25/1981	718	5/6/1981						
1982	1,930	12/20/1981	1,950	12/20/1981	1,100	2/17/1982	3,820	3/13/1983	1,060	6/13/1983	35,700	12/20/1981					2,850	2/16/1982	9,380	12/20/1981						
1983	778	3/13/1983	706	6/13/1983	792	6/12/1983	5,390	11/17/1983	1,330	11/17/1983	42,300	3/13/1983					1,420	3/13/1983	2,490	6/18/1983						
1984	1,730	11/17/1983	1,290	11/17/1983	210	1/1/1984	64	12/31/1984	421	11/28/1984	26,900	11/17/1983					1,200	11/17/1983	102	11/17/1983						
1985	246	4/14/1985	123	11/6/1984	93	5/15/1985			6,100	2/17/1986	3,630	11/28/1984					138	11/27/1984	48	11/28/1984						
1986	3,220	2/17/1986	3,180	2/17/1986	2,870	3/8/1986			718	2/13/1987	78,400	2/17/1986					3,250	2/17/1986	10,700	3/8/1986						
1987	707	2/13/1987	348	2/13/1987	30	2/13/1987			173	1/11/1988	5,580	2/13/1987					298	2/13/1987	38	2/13/1987						
1988	371	1/5/1988	26	12/10/1987	25	9/12/1988			1,150	11/23/1988	1,430	1/11/1988					88	12/10/1987	33	10/12/1987						
1989	786	11/23/1988	494	3/8/1989	42	3/8/1989			295	11/25/1989	8,350	3/25/1989					693	3/8/1989	33	10/12/1988						
1990	193	1/8/1990	21	1/8/1990	18	11/25/1989			1,980	3/4/1991	2,210	11/26/1989					131	11/25/1989	47	10/1/1989						
1991	1,100	3/4/1991	924	3/4/1991	77	3/4/1991			396	2/20/1992	18,000	3/4/1991					975	3/4/1991	67	3/4/1991						
1992	326	2/20/1992	60	2/20/1992	19	2/20/1992			1,250	1/22/1993	4,420	2/20/1992					213	2/20/1992	51	10/1/1991						
1993	593	3/17/1993	388	3/17/1993	60	3/17/1993			143	3/5/1994	18,800	1/22/1993							69	1/21/1993						
1994	168	2/27/1994	17	3/5/1994	64	10/4/1993			2,010	5/1/1995	1,280	12/9/1993							57	9/15/1994						
1995	1,100	5/1/1995	864	5/1/1995	1,290	6/27/1995			6,840	5/16/1996	27,800	5/1/1995							2,030	6/27/1995						
1996	1,510	5/16/1996	1,040	5/16/1996	6,050	5/16/1996			13,900	1/2/1997	37,800	5/16/1996							12,300	5/16/1996			88	12/11/1996	89	12/10/1996
1997	3,630	1/1/1997	3,360	1/1/1997	4,140	1/2/1997			1,690	3/24/1998	123,000	1/2/1997							28,800	1/2/1997						
1998	752	3/24/1998	697	3/24/1998	1,570	6/10/1998			1,270	2/9/1999	14,200	3/24/1998							1,670	6/23/1998						
1999	590	5/24/1999	281	5/24/1999	672	4/30/1999			1,340	2/14/2000	15,800	2/9/1999							44	2/9/1999						
2000	621	1/24/2000	409	2/14/2000	105	2/14/2000			251	3/25/2001	15,700	2/14/2000							63	2/13/2000						
2001	199	4/26/2001	32	3/25/2001	29	12/12/2000			525	3/6/2002	1,710	3/25/2001							35	9/4/2001						
2002	325	4/14/2002	97	11/24/2001	66	10/6/2001			657	12/14/2002	3,990	2/20/2002							55	10/20/2001						
2003	549	12/14/2002	342	12/14/2002	45	5/4/2003			492	2/16/2004	4,510	5/4/2003							856	6/7/2003						
2004	536	2/16/2004	201	2/16/2004	52	2/16/2004					5,750	8/5/2004							59	10/23/2003						

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Accuracy of Peak Flow Data

During 1998, the USGS reviewed and assessed the uncertainty of flow and flood-peak data from twenty gaging station locations operated by the USGS in the American River Basin (Meyer 1998), including a number within the MFP area and watershed:

- Middle Fork American River at French Meadows (Gage No. 11427500)
- Duncan Creek near French Meadows (Gage No. 11427750)
- Rubicon River near Georgetown (Gage No. 11431000)
- Rubicon River near Foresthill (Gage No. 11433200)
- North Fork of Middle Fork American River near Foresthill (Gage No. 1433260)
- Middle Fork American River near Foresthill (Gage No. 11433300)
- Middle Fork American River near Auburn (Gage No. 11433500)

The following table provides information regarding the accuracy of peak flow estimates at gaging stations in waters associated with the MFP.

Gaging Station	Uncertainty About All Peak Flows	Notes
Middle Fork American River at French Meadows (Gage No. 11427500)	± 5 to ± 25%	Jan 31, 1953 peak is an exception
Duncan Creek near French Meadows (Gage No. 11427750)	± 10%	
Rubicon River near Georgetown (Gage No. 11431000)	± 15 to ± 40% for flows between 13,000 and 58,000 cfs + 10 to - 25% for flows between 5,000 and 13,000 cfs ± 4 to ± 7% for flows between 500 and 5,000 cfs	
Rubicon River near Foresthill (Gage No. 11433200)	1963-1983 peaks: ± 10%	1937, 1950, and 1995 peaks are estimates 1960 peak: + 0 to - 35%
North Fork of Middle Fork American River near Foresthill (Gage No. 1433260)	± 15%	Jan 13, 1980 peak: + 0 to - 70%
Middle Fork American River near Foresthill (Gage No. 11433300)	± 2 to ± 4.3%	1960 peak: + 0 to - 40% 1963 peak: + 10 to - 50%
Middle Fork American River near Auburn (Gage No. 11433500)	± 2.3 to ± 6.8% 5,000 to 35,000 cfs: ± 10 to ± 15% 35,000 to 70,000 cfs: ± 15 to ± 25% >70,000 cfs: > 25%	Peaks from 1912 to 1927: ± 10 to ± 30%

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APPENDIX 6.3-G

Daily Flows in Waters Associated with the MFP

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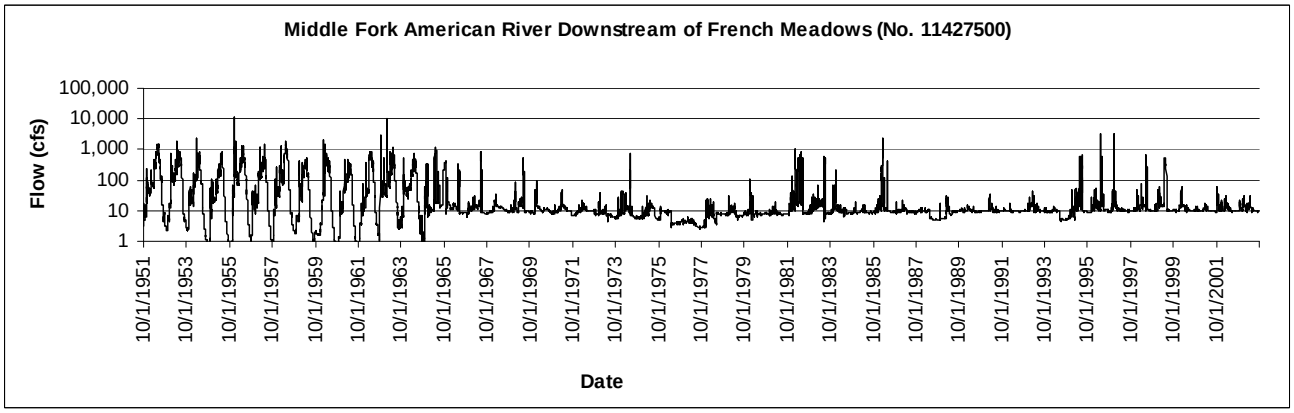
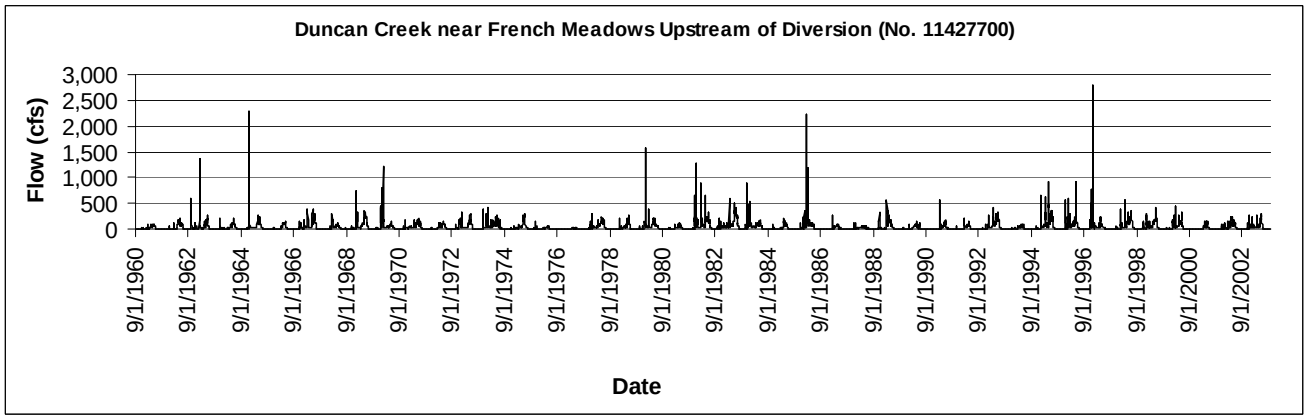
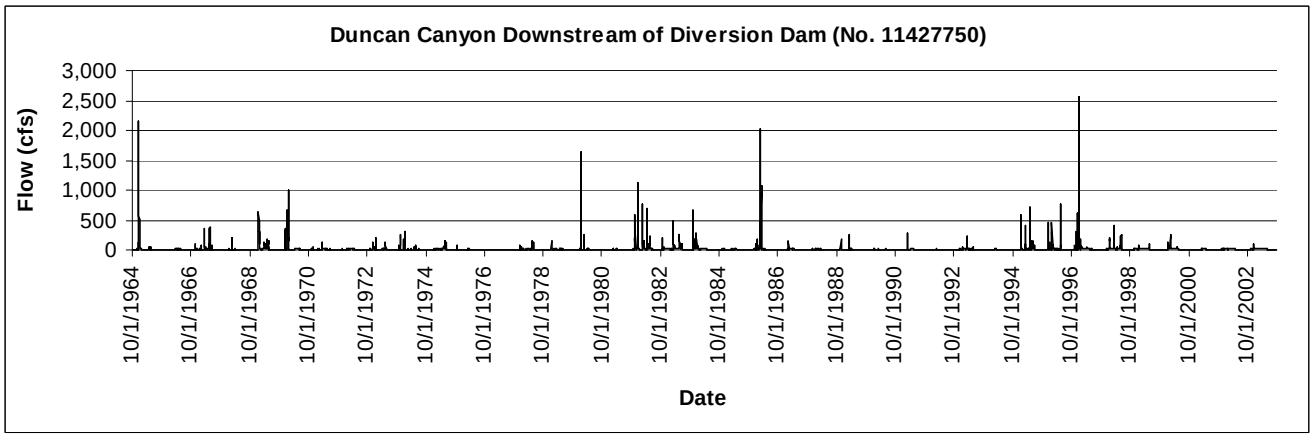
Appendix 6.3-G.Daily Flows in Waters Associated with the MFP







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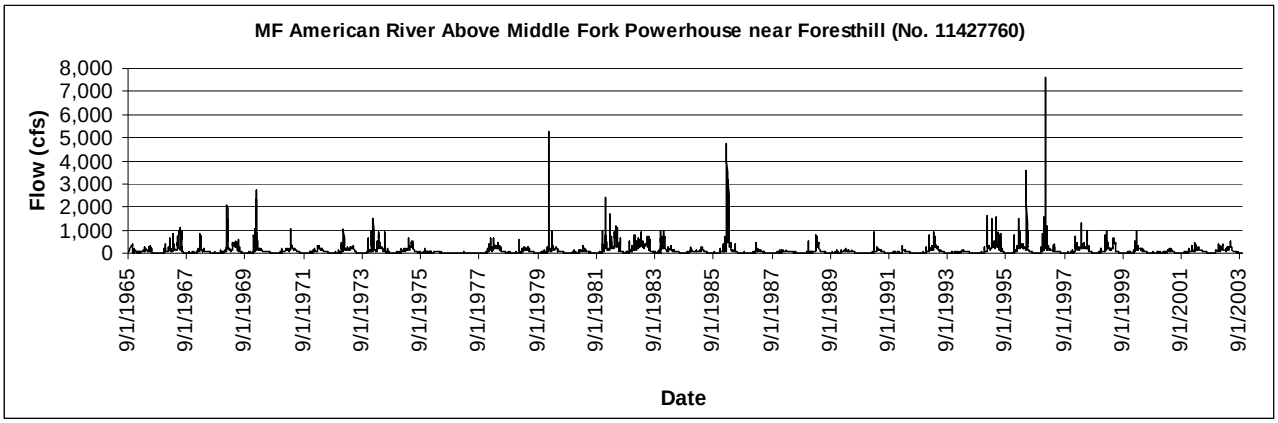
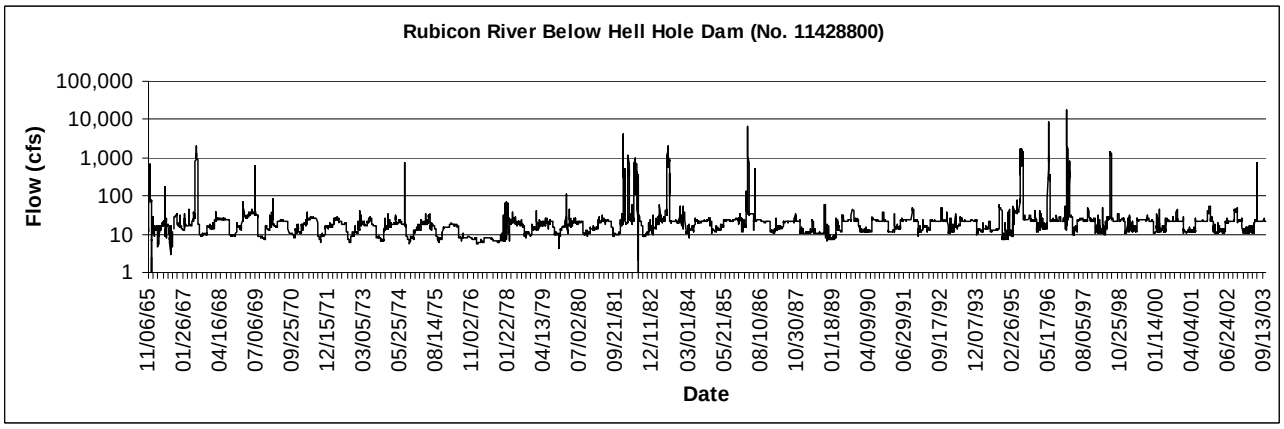
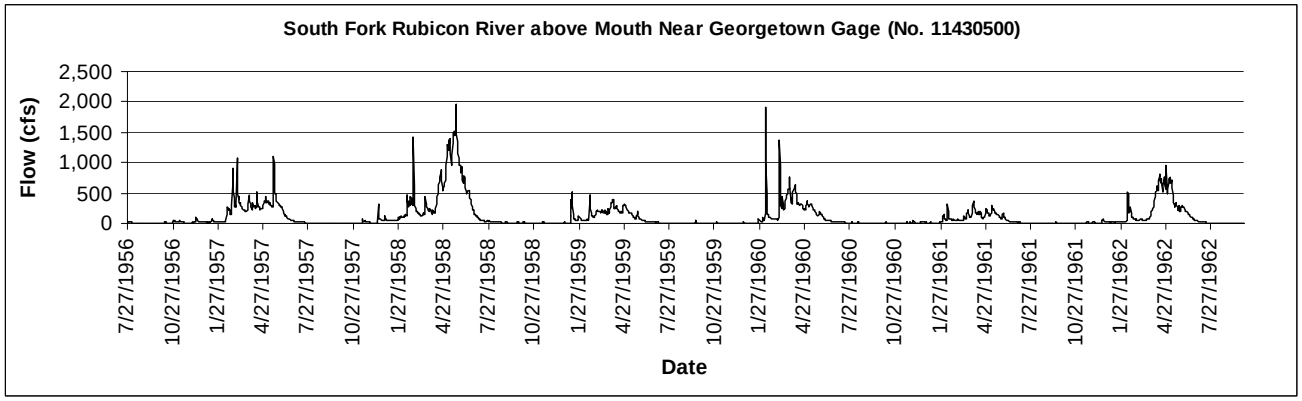
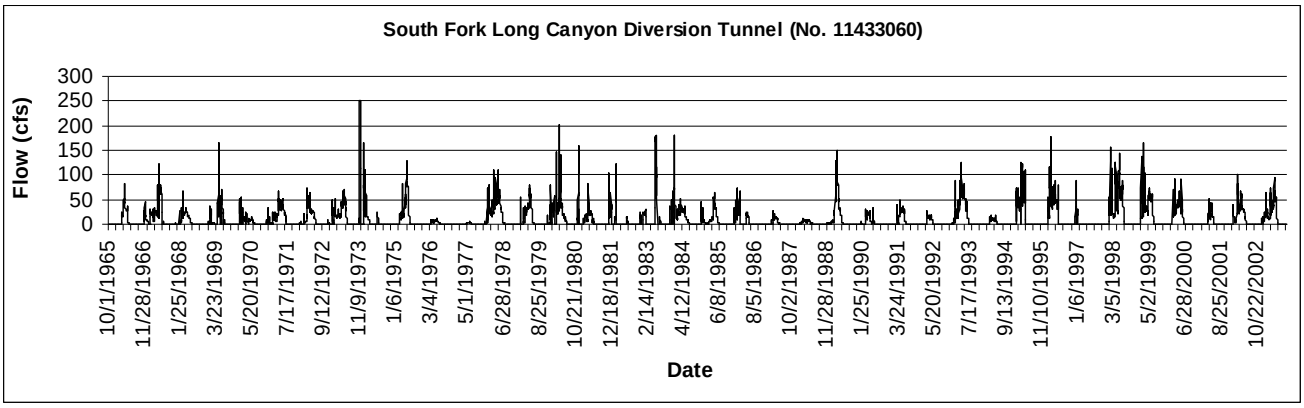
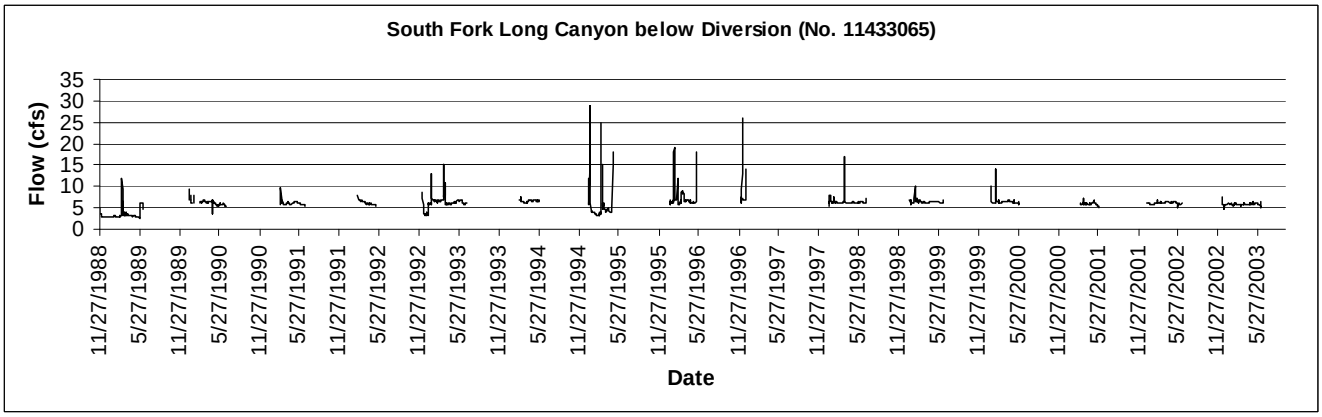
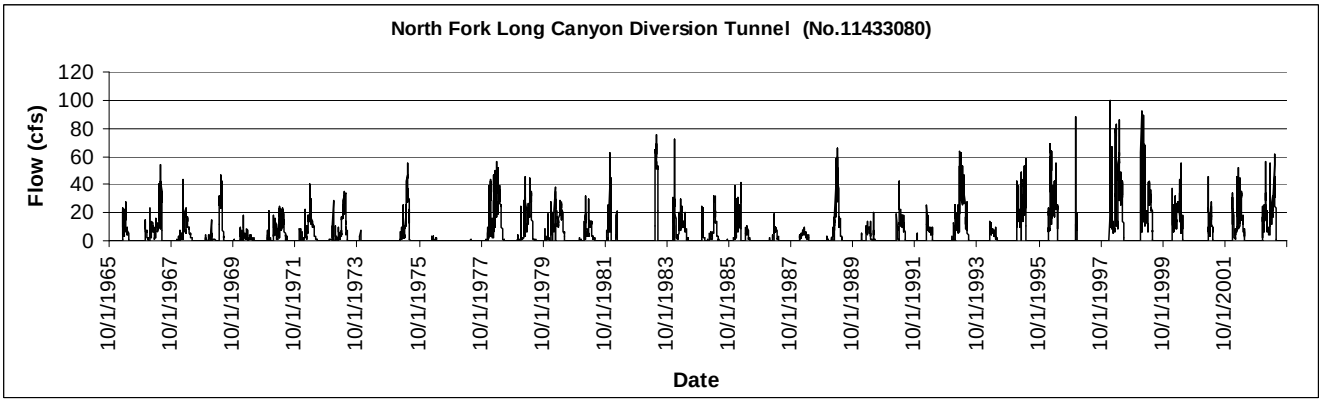

MF American River Above Middle Fork Powerhouse near Foresthill (No. 11427760)
Flow (cfs)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
9/1/1965
9/1/1967
9/1/1969
9/1/1971
9/1/1973
9/1/1975
9/1/1977
9/1/1979
9/1/1981
9/1/1983
9/1/1985
9/1/1987
9/1/1989
9/1/1991
9/1/1993
9/1/1995
9/1/1997
9/1/1999
9/1/2001
9/1/2003
Date

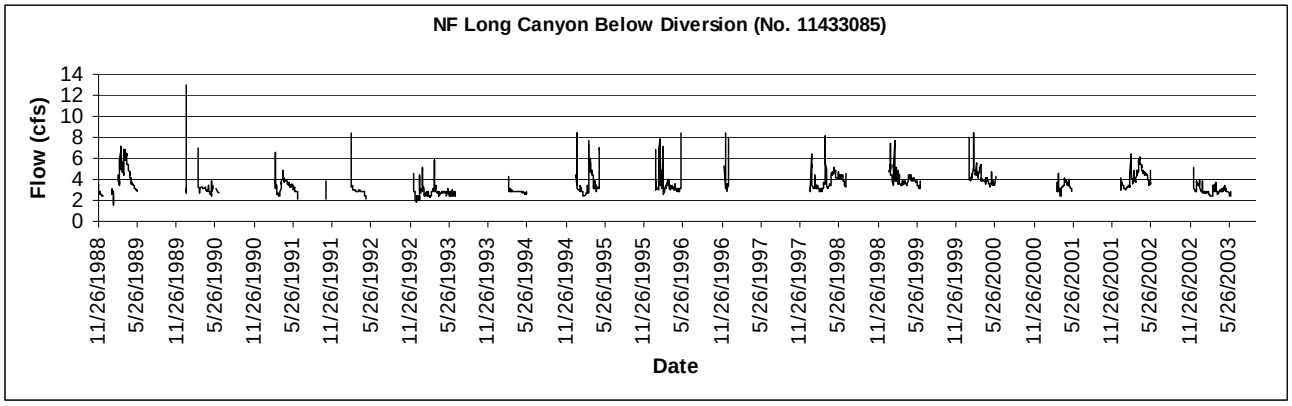

Rubicon River Below Hell Hole Dam (No. 11428800)
Flow (cfs)
100,000
10,000
1,000
100
10
1
11/06/65
01/26/67
04/16/68
07/06/69
09/25/70
12/15/71
03/05/73
05/25/74
08/14/75
11/02/76
01/22/78
04/13/79
07/02/80
09/21/81
12/11/82
03/01/84
05/21/85
08/10/86
10/30/87
01/18/89
04/09/90
06/29/91
09/17/92
12/07/93
02/26/95
05/17/96
08/05/97
10/25/98
01/14/00
04/04/01
06/24/02
09/13/03
Date

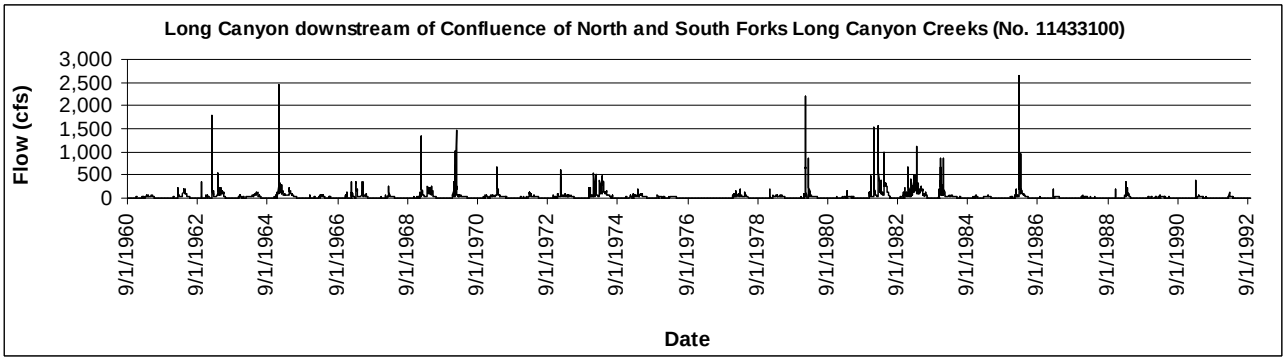

South Fork Rubicon River above Mouth Near Georgetown Gage (No. 11430500)
Flow (cfs)
2,500
2,000
1,500
1,000
500
0
7/27/1956
10/27/1956
1/27/1957
4/27/1957
7/27/1957
10/27/1957
1/27/1958
4/27/1958
7/27/1958
10/27/1958
1/27/1959
4/27/1959
7/27/1959
10/27/1959
1/27/1960
4/27/1960
7/27/1960
10/27/1960
1/27/1961
4/27/1961
7/27/1961
10/27/1961
1/27/1962
4/27/1962
7/27/1962
Date

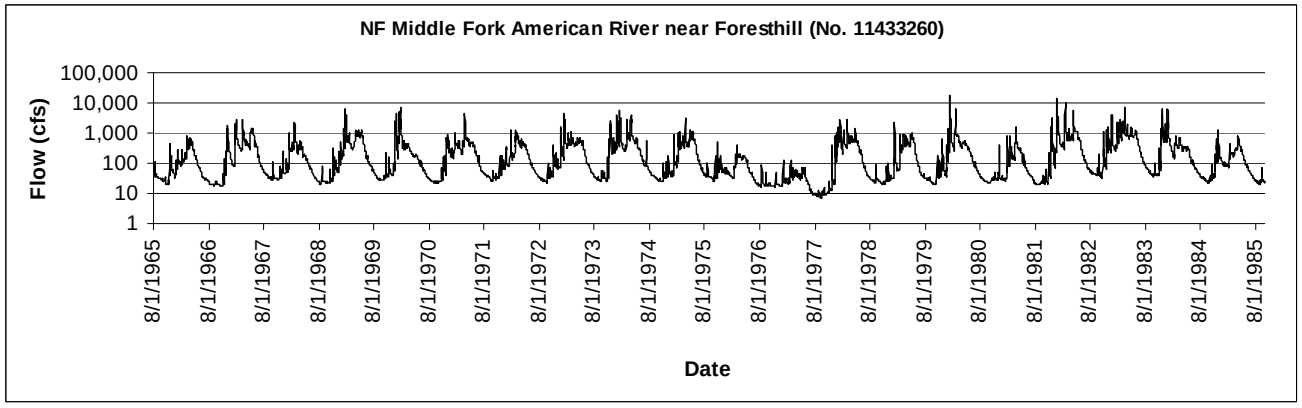

South Fork Long Canyon Diversion Tunnel (No. 11433060)
Flow (cfs)
300
250
200
150
100
50
0
10/1/1965
11/28/1966
1/25/1968
3/23/1969
5/20/1970
7/17/1971
9/12/1972
11/9/1973
1/6/1975
3/4/1976
5/1/1977
6/28/1978
8/25/1979
10/21/1980
12/18/1981
2/14/1983
4/12/1984
6/8/1985
8/5/1986
10/2/1987
11/28/1988
1/25/1990
3/24/1991
5/20/1992
7/17/1993
9/13/1994
11/10/1995
1/6/1997
3/5/1998
5/2/1999
6/28/2000
8/25/2001
10/22/2002
Date

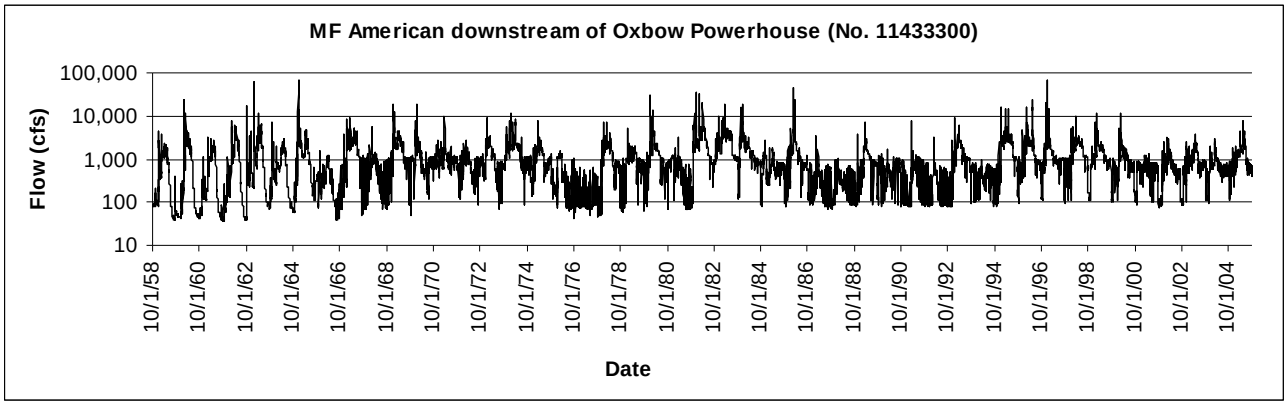

South Fork Long Canyon below Diversion (No. 11433065)
Flow (cfs)
35
30
25
20
15
10
5
0
11/27/1988
5/27/1989
11/27/1989
5/27/1990
11/27/1990
5/27/1991
11/27/1991
5/27/1992
11/27/1992
5/27/1993
11/27/1993
5/27/1994
11/27/1994
5/27/1995
11/27/1995
5/27/1996
11/27/1996
5/27/1997
11/27/1997
5/27/1998
11/27/1998
5/27/1999
11/27/1999
5/27/2000
11/27/2000
5/27/2001
11/27/2001
5/27/2002
11/27/2002
5/27/2003
Date

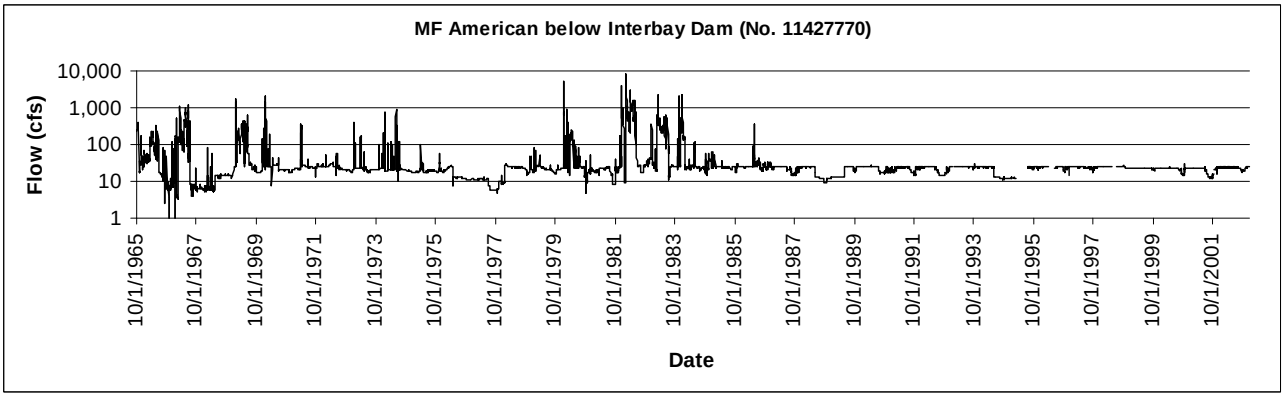

North Fork Long Canyon Diversion Tunnel (No.11433080)
Flow (cfs)
120
100
80
60
40
20
0
10/1/1965
10/1/1967
10/1/1969
10/1/1971
10/1/1973
10/1/1975
10/1/1977
10/1/1979
10/1/1981
10/1/1983
10/1/1985
10/1/1987
10/1/1989
10/1/1991
10/1/1993
10/1/1995
10/1/1997
10/1/1999
10/1/2001
Date

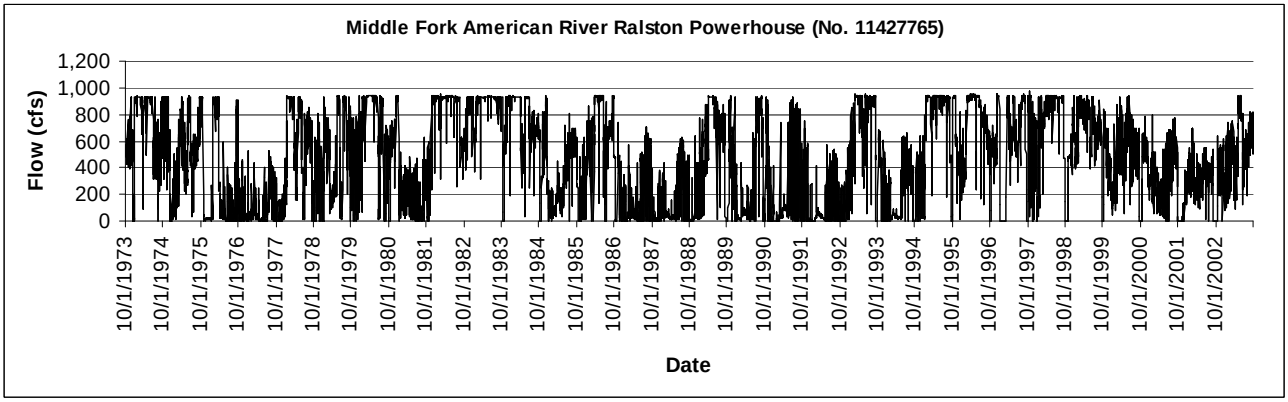

NF Long Canyon Below Diversion (No. 11433085)
Flow (cfs)
14
12
10
8
6
4
2
0
11/26/1988
5/26/1989
11/26/1989
5/26/1990
11/26/1990
5/26/1991
11/26/1991
5/26/1992
11/26/1992
5/26/1993
11/26/1993
5/26/1994
11/26/1994
5/26/1995
11/26/1995
5/26/1996
11/26/1996
5/26/1997
11/26/1997
5/26/1998
11/26/1998
5/26/1999
11/26/1999
5/26/2000
11/26/2000
5/26/2001
11/26/2001
5/26/2002
11/26/2002
5/26/2003
Date

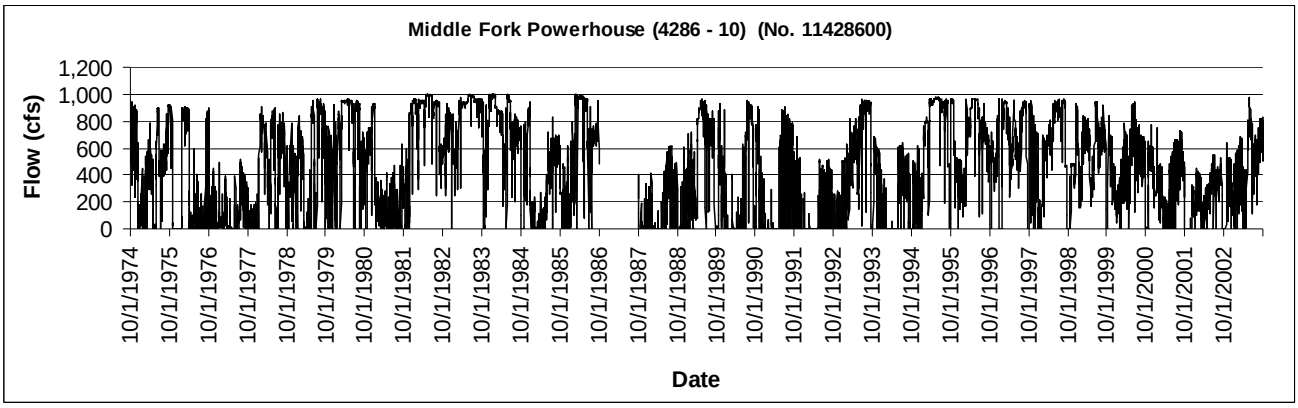

Long Canyon downstream of Confluence of North and South Forks Long Canyon Creeks (No. 11433100)
Flow (cfs)
3,000
2,500
2,000
1,500
1,000
500
0
9/1/1960
9/1/1962
9/1/1964
9/1/1966
9/1/1968
9/1/1970
9/1/1972
9/1/1974
9/1/1976
9/1/1978
9/1/1980
9/1/1982
9/1/1984
9/1/1986
9/1/1988
9/1/1990
9/1/1992
Date

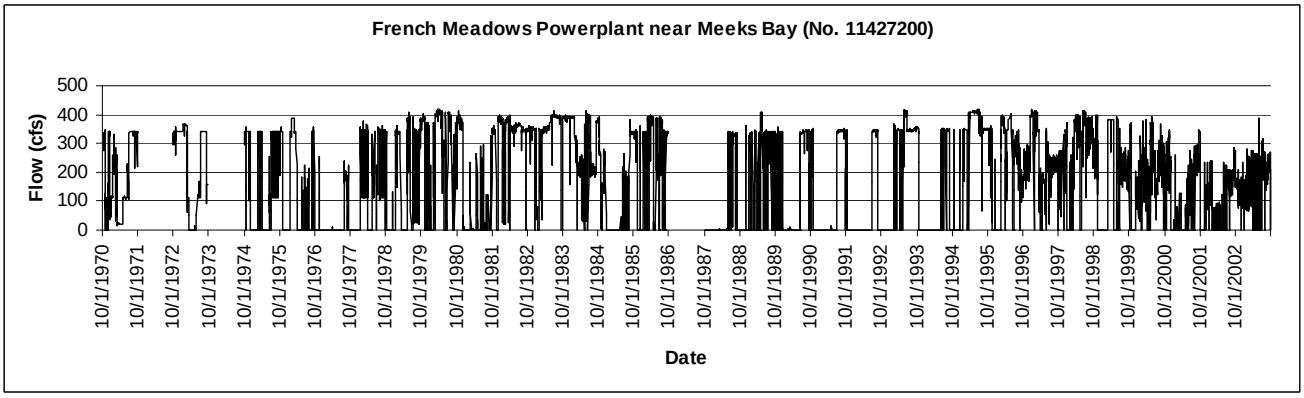

NF Middle Fork American River near Foresthill (No. 11433260)
Flow (cfs)
100,000
10,000
1,000
100
10
1
8/1/1965
8/1/1966
8/1/1967
8/1/1968
8/1/1969
8/1/1970
8/1/1971
8/1/1972
8/1/1973
8/1/1974
8/1/1975
8/1/1976
8/1/1977
8/1/1978
8/1/1979
8/1/1980
8/1/1981
8/1/1982
8/1/1983
8/1/1984
8/1/1985
Date

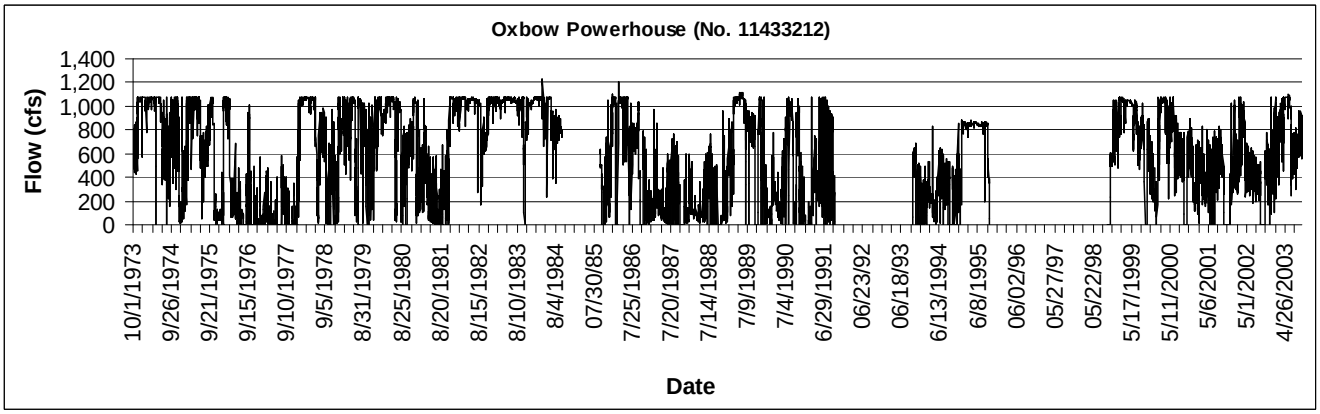

MF American downstream of Oxbow Powerhouse (No. 11433300)
Flow (cfs)
100,000
10,000
1,000
100
10
10/1/58
10/1/60
10/1/62
10/1/64
10/1/66
10/1/68
10/1/70
10/1/72
10/1/74
10/1/76
10/1/78
10/1/80
10/1/82
10/1/84
10/1/86
10/1/88
10/1/90
10/1/92
10/1/94
10/1/96
10/1/98
10/1/00
10/1/02
10/1/04
Date


MF American below Interbay Dam (No. 11427770)
Flow (cfs)
10,000
1,000
100
10
1
10/1/1965
10/1/1967
10/1/1969
10/1/1971
10/1/1973
10/1/1975
10/1/1977
10/1/1979
10/1/1981
10/1/1983
10/1/1985
10/1/1987
10/1/1989
10/1/1991
10/1/1993
10/1/1995
10/1/1997
10/1/1999
10/1/2001
Date


Middle Fork American River Ralston Powerhouse (No. 11427765)
Flow (cfs)
1,200
1,000
800
600
400
200
0
10/1/1973
10/1/1974
10/1/1975
10/1/1976
10/1/1977
10/1/1978
10/1/1979
10/1/1980
10/1/1981
10/1/1982
10/1/1983
10/1/1984
10/1/1985
10/1/1986
10/1/1987
10/1/1988
10/1/1989
10/1/1990
10/1/1991
10/1/1992
10/1/1993
10/1/1994
10/1/1995
10/1/1996
10/1/1997
10/1/1998
10/1/1999
10/1/2000
10/1/2001
10/1/2002
Date


Middle Fork Powerhouse (4286 - 10) (No. 11428600)
Flow (cfs)
1,200
1,000
800
600
400
200
0
10/1/1974
10/1/1975
10/1/1976
10/1/1977
10/1/1978
10/1/1979
10/1/1980
10/1/1981
10/1/1982
10/1/1983
10/1/1984
10/1/1985
10/1/1986
10/1/1987
10/1/1988
10/1/1989
10/1/1990
10/1/1991
10/1/1992
10/1/1993
10/1/1994
10/1/1995
10/1/1996
10/1/1997
10/1/1998
10/1/1999
10/1/2000
10/1/2001
10/1/2002
Date


French Meadows Powerplant near Meeks Bay (No. 11427200)
Flow (cfs)
500
400
300
200
100
0
10/1/1970
10/1/1971
10/1/1972
10/1/1973
10/1/1974
10/1/1975
10/1/1976
10/1/1977
10/1/1978
10/1/1979
10/1/1980
10/1/1981
10/1/1982
10/1/1983
10/1/1984
10/1/1985
10/1/1986
10/1/1987
10/1/1988
10/1/1989
10/1/1990
10/1/1991
10/1/1992
10/1/1993
10/1/1994
10/1/1995
10/1/1996
10/1/1997
10/1/1998
10/1/1999
10/1/2000
10/1/2001
10/1/2002
Date


Oxbow Powerhouse (No. 11433212)
Flow (cfs)
1,400
1,200
1,000
800
600
400
200
0
10/1/1973
9/26/1974
9/21/1975
9/15/1976
9/10/1977
9/5/1978
8/31/1979
8/25/1980
8/20/1981
8/15/1982
8/10/1983
8/4/1984
07/30/85
7/25/1986
7/20/1987
7/14/1988
7/9/1989
7/4/1990
6/29/1991
06/23/92
06/18/93
6/13/1994
6/8/1995
06/02/96
05/27/97
05/22/98
5/17/1999
5/11/2000
5/6/2001
5/1/2002
4/26/2003
Date

APPENDIX 6.3-H

Hourly Flows for Middle Fork American River Downstream of Oxbow Powerhouse

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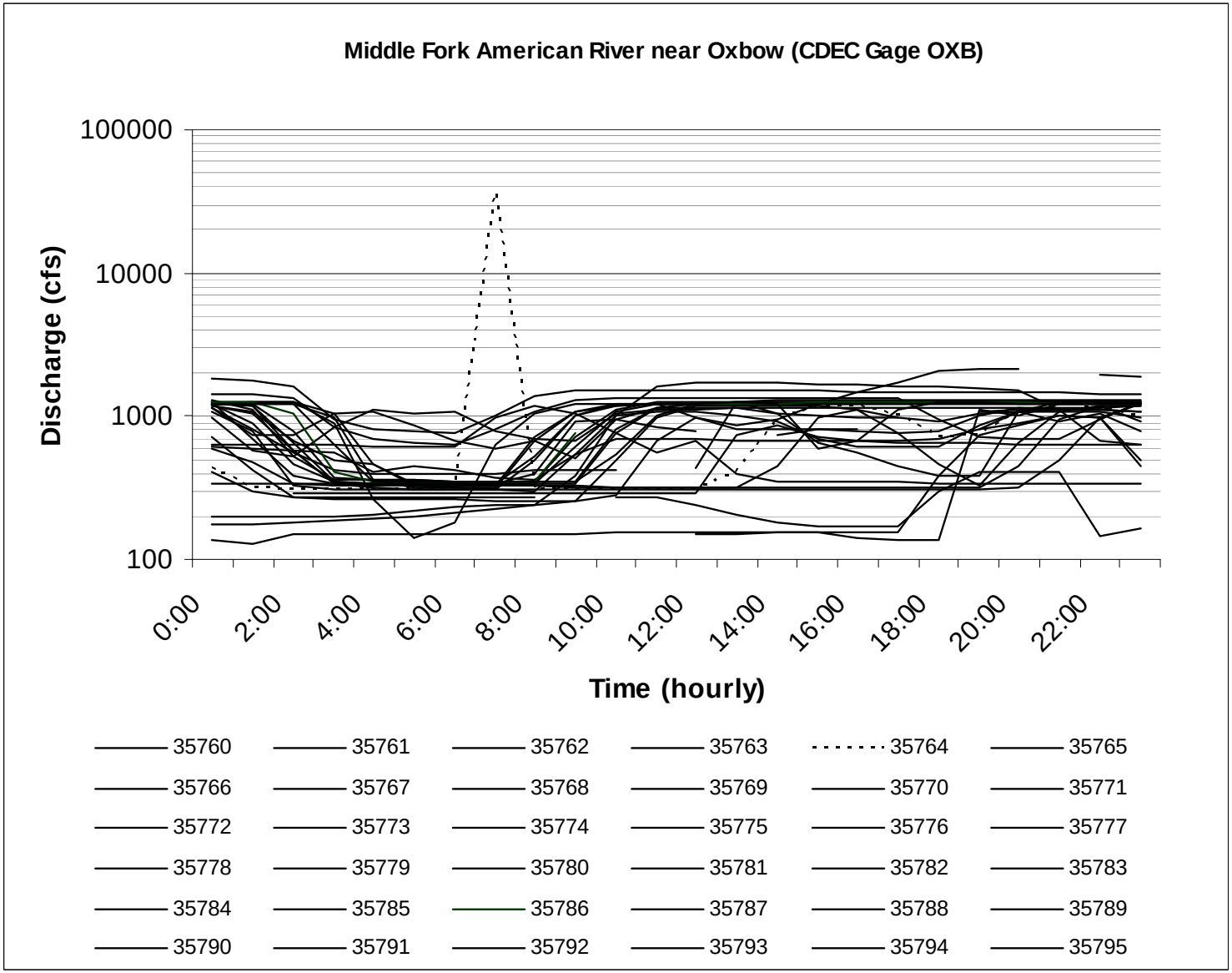
Middle Fork American River near Oxbow (CDEC Gage OXB)
Discharge (cfs)
100000
10000
1000
100
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
35760
35761
35762
35763
35764
35765
35766
35767
35768
35769
35770
35771
35772
35773
35774
35775
35776
35777
35778
35779
35780
35781
35782
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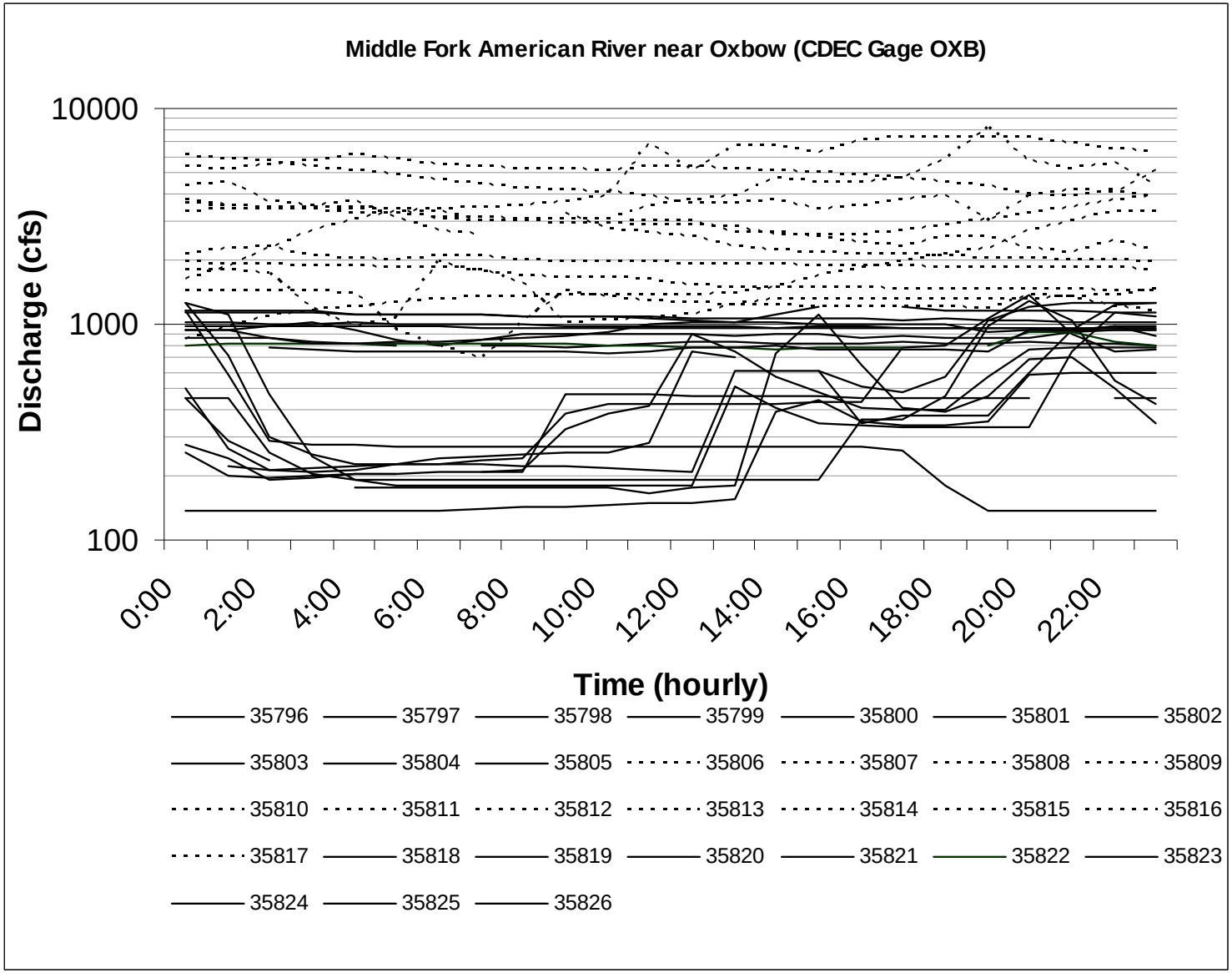
35790
35791
35792
35793
35794
35795


Middle Fork American River near Oxbow (CDEC Gage OXB)
10000
1000
100
Discharge (cfs)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
35796
35797
35798
35799
35800
35801
35802
35803
35804
35805
35806
35807
35808
35809
35810
35811
35812
35813
35814
35815
35816
35817
35818
35819
35820
35821
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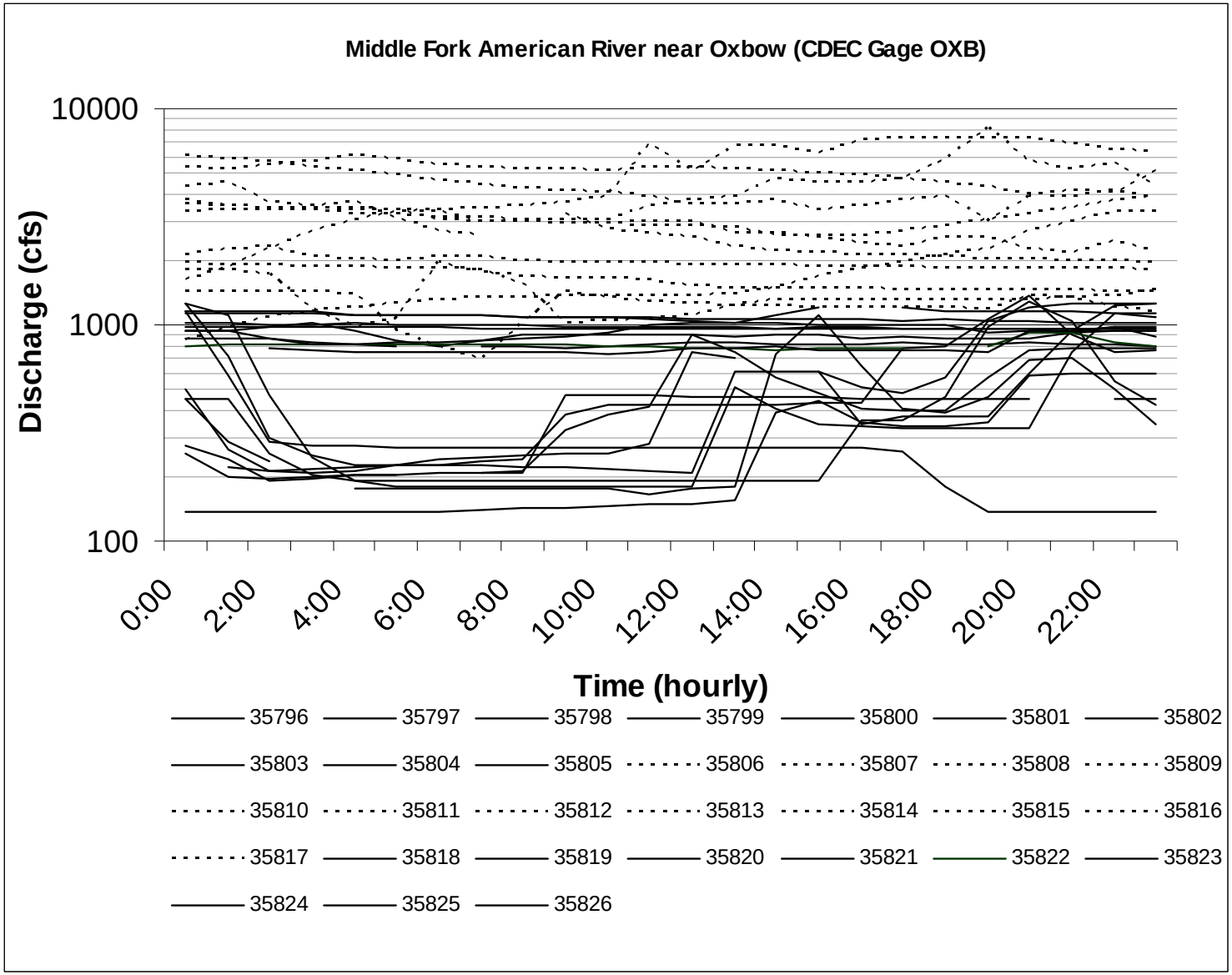
35823
35824
35825
35826


Middle Fork American River near Oxbow (CDEC Gage OXB)
10000
1000
100
Discharge (cfs)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
35796
35797
35798
35799
35800
35801
35802
35803
35804
35805
35806
35807
35808
35809
35810
35811
35812
35813
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35816
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35819
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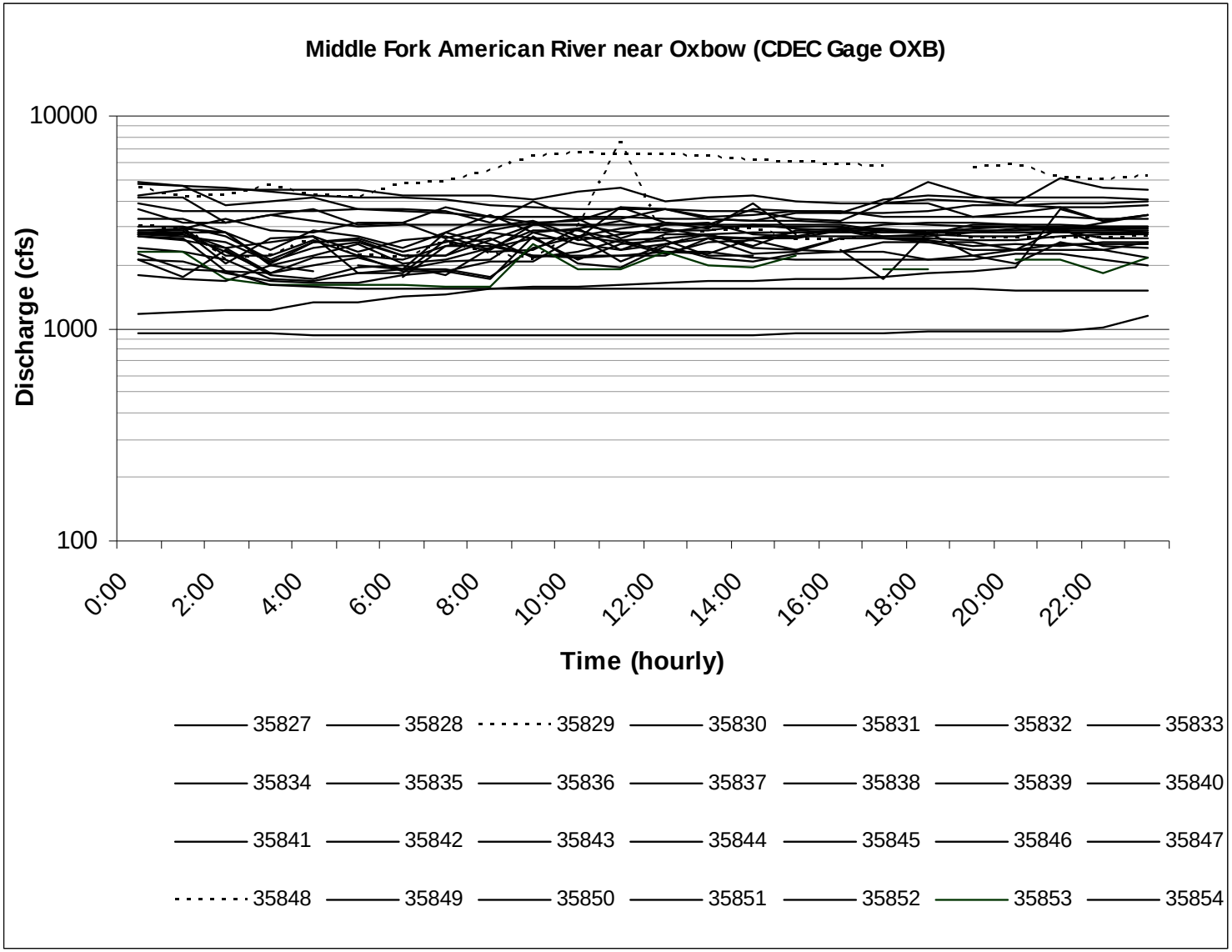
35822
35823
35824
35825
35826



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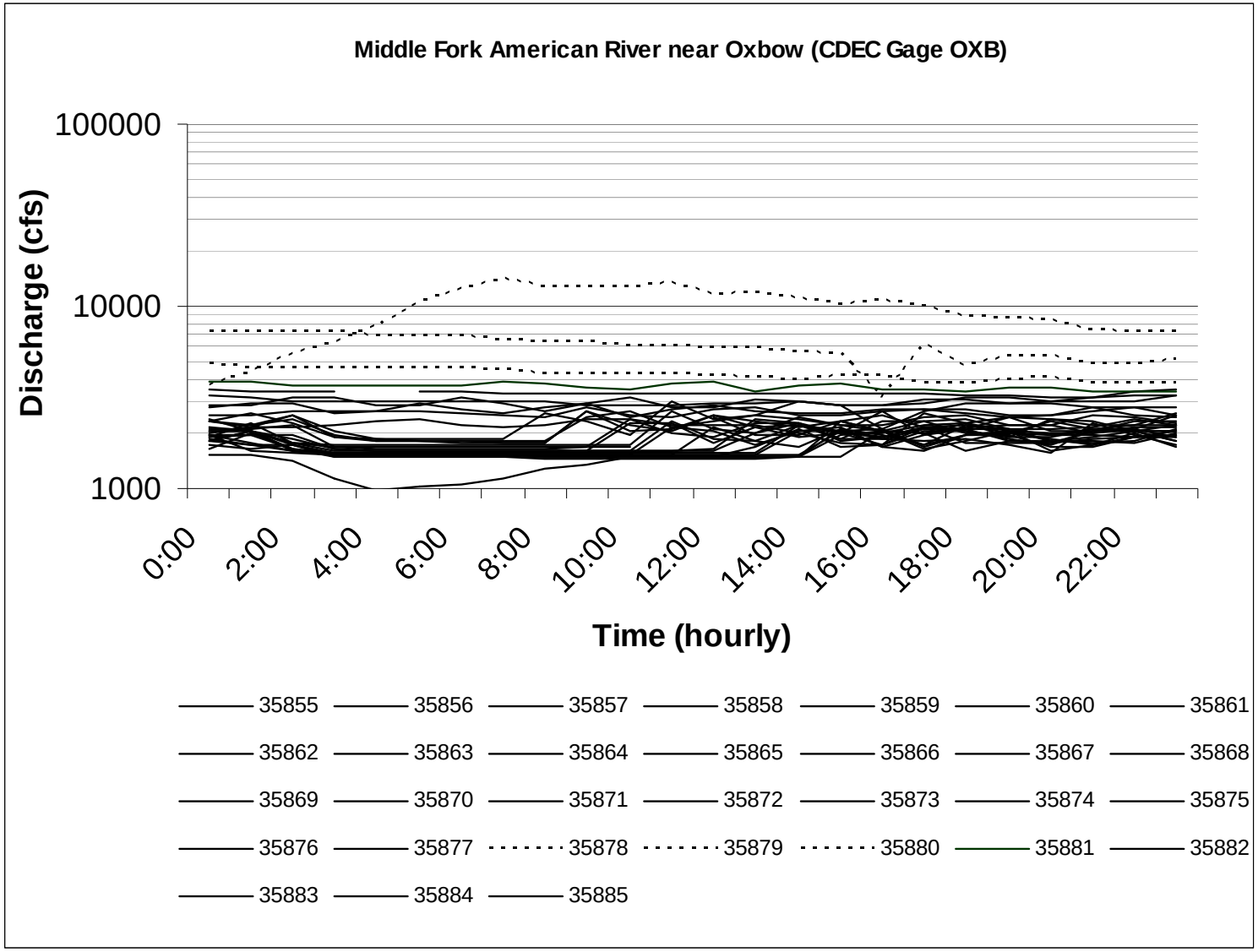
Middle Fork American River near Oxbow (CDEC Gage OXB)
Discharge (cfs)
100000
10000
1000
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
35855
35856
35857
35858
35859
35860
35861
35862
35863
35864
35865
35866
35867
35868
35869
35870
35871
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35883
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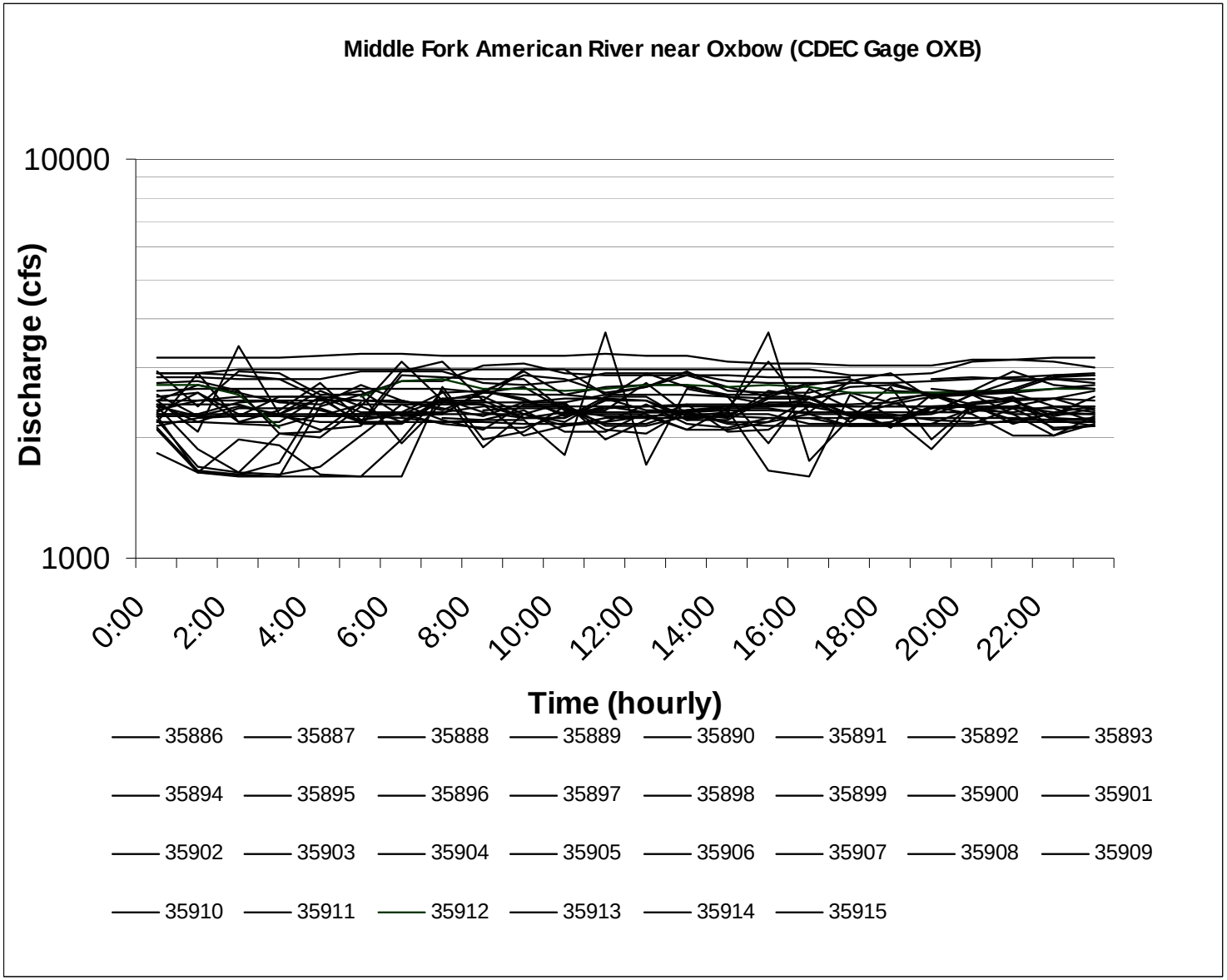
35885


Middle Fork American River near Oxbow (CDEC Gage OXB)
10000
1000
Discharge (cfs)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
35886
35887
35888
35889
35890
35891
35892
35893
35894
35895
35896
35897
35898
35899
35900
35901
35902
35903
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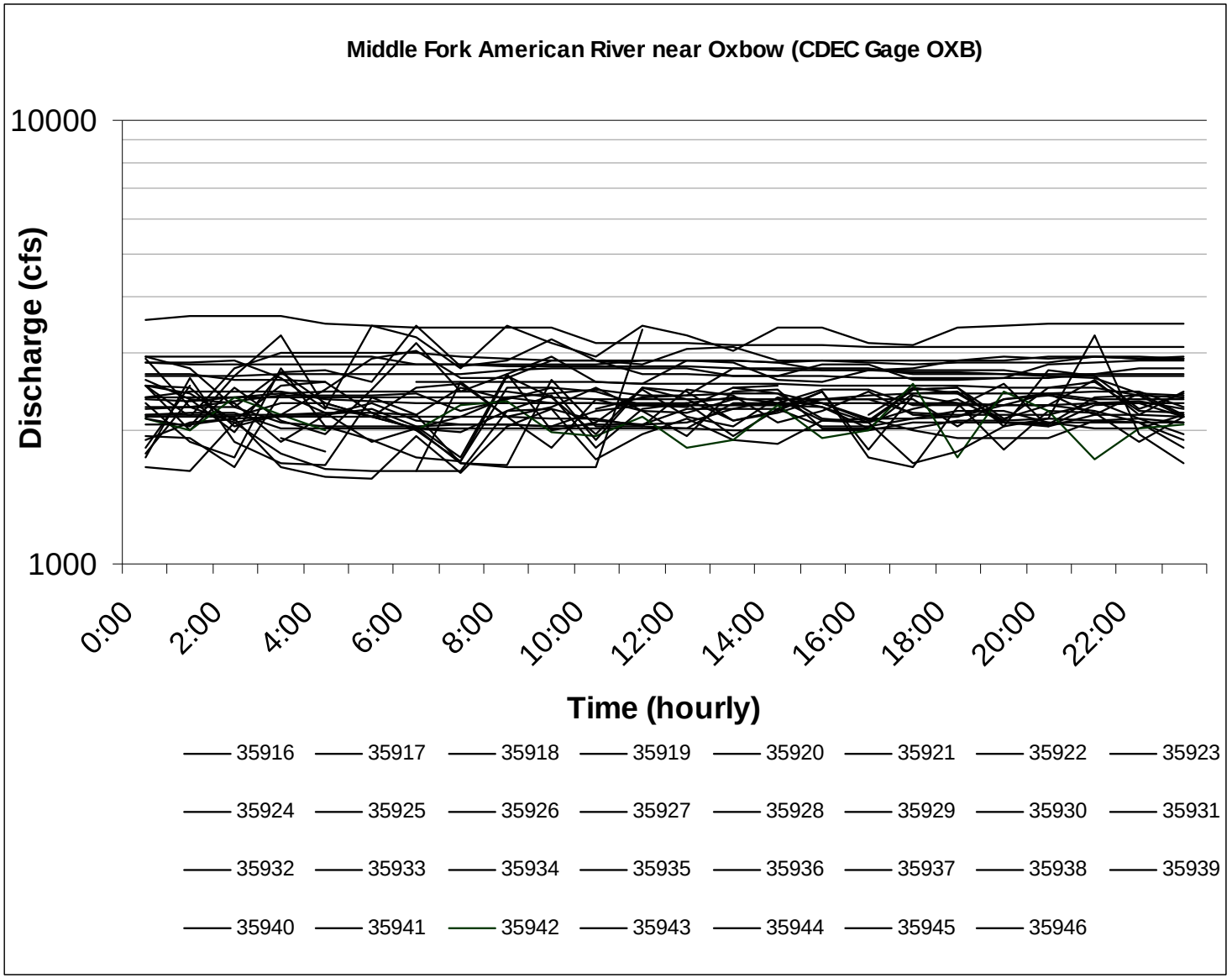
35913
35914
35915



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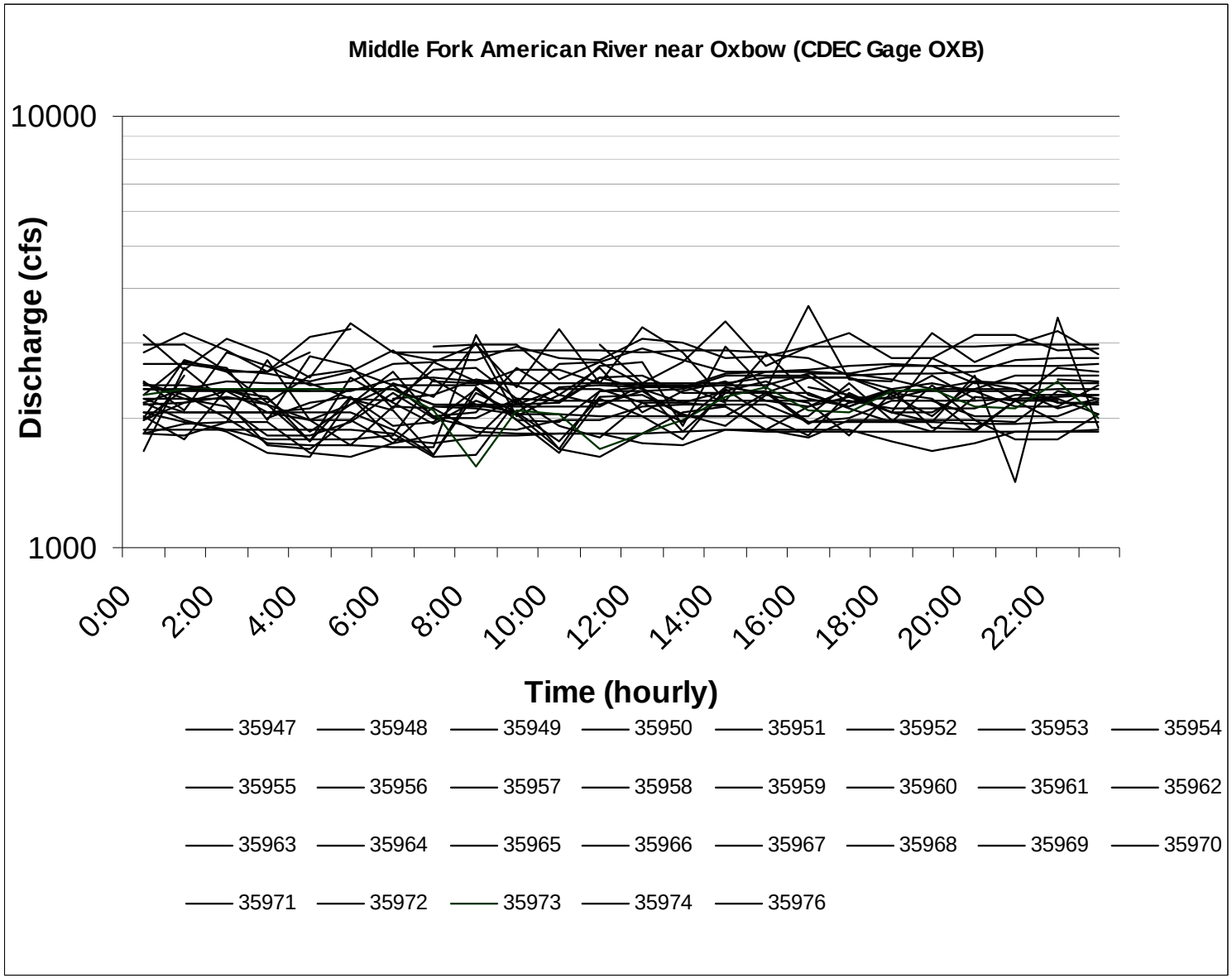

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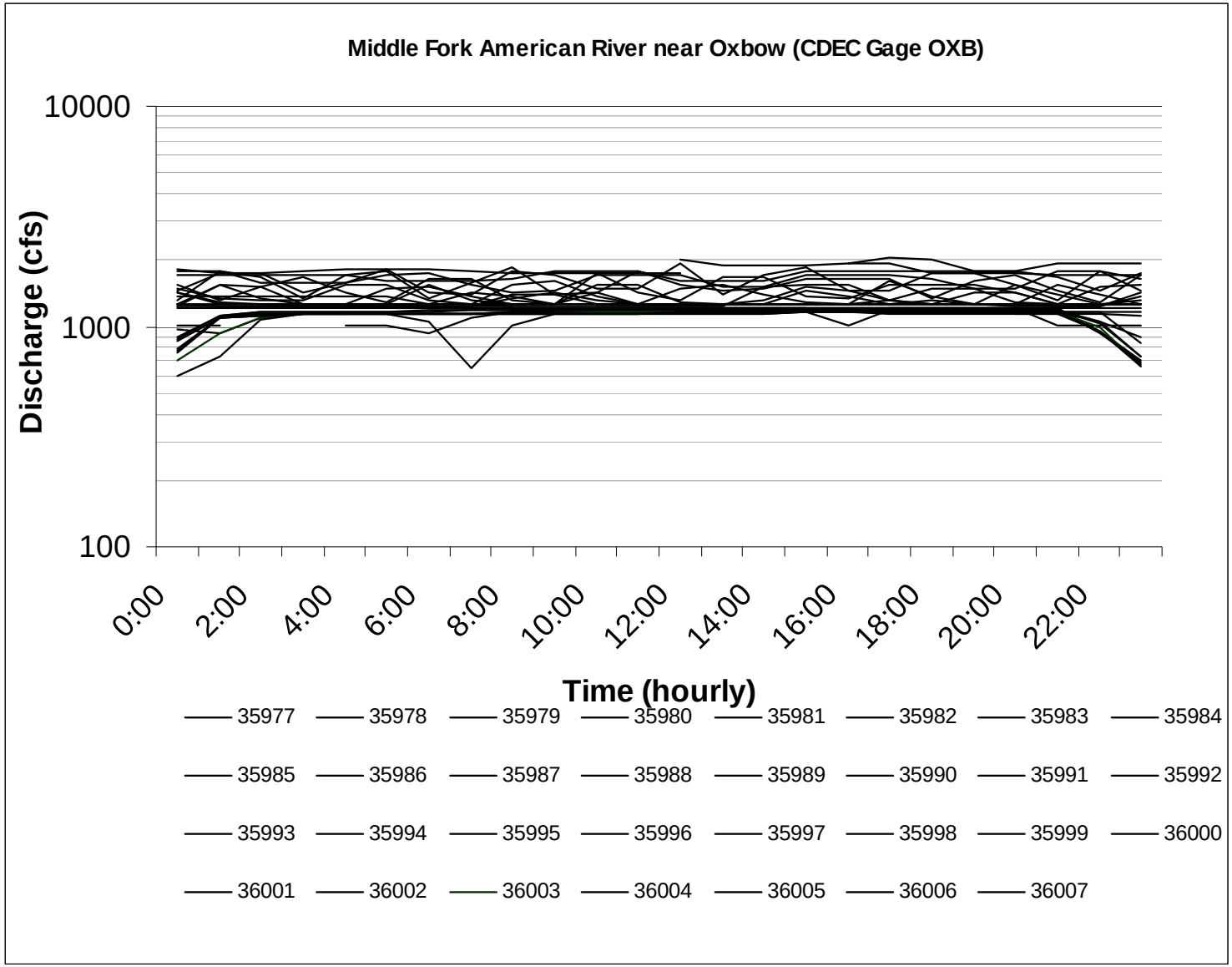

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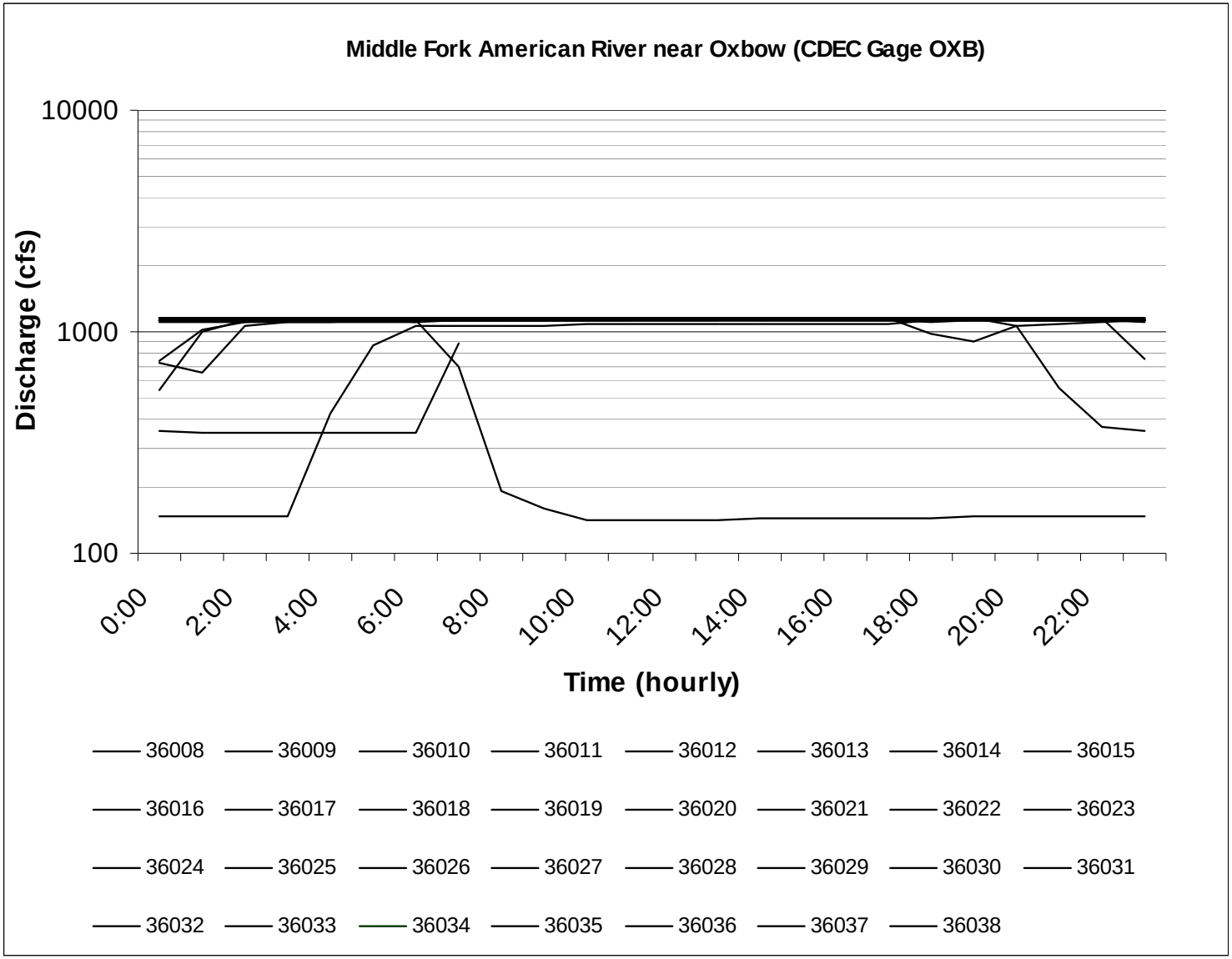

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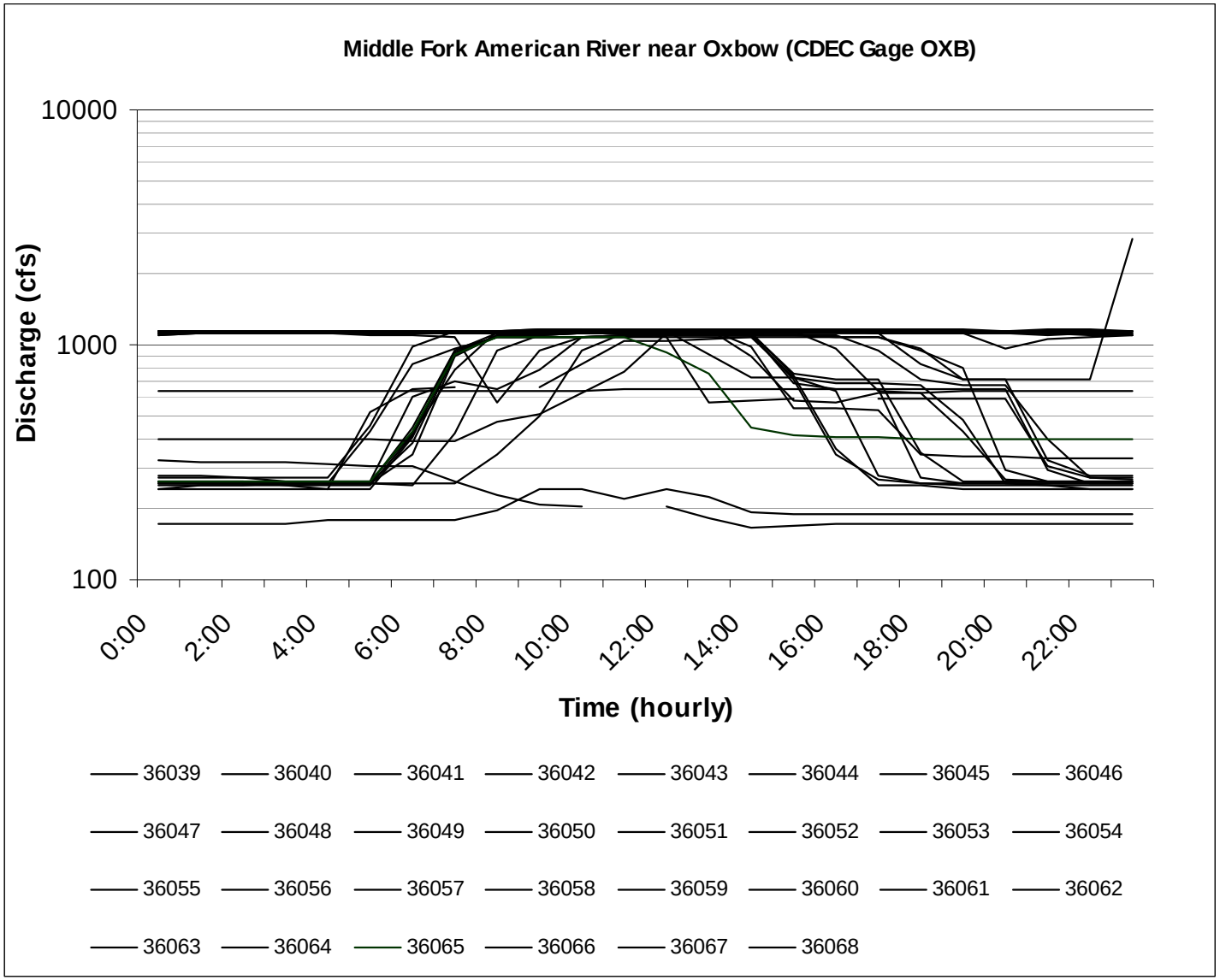

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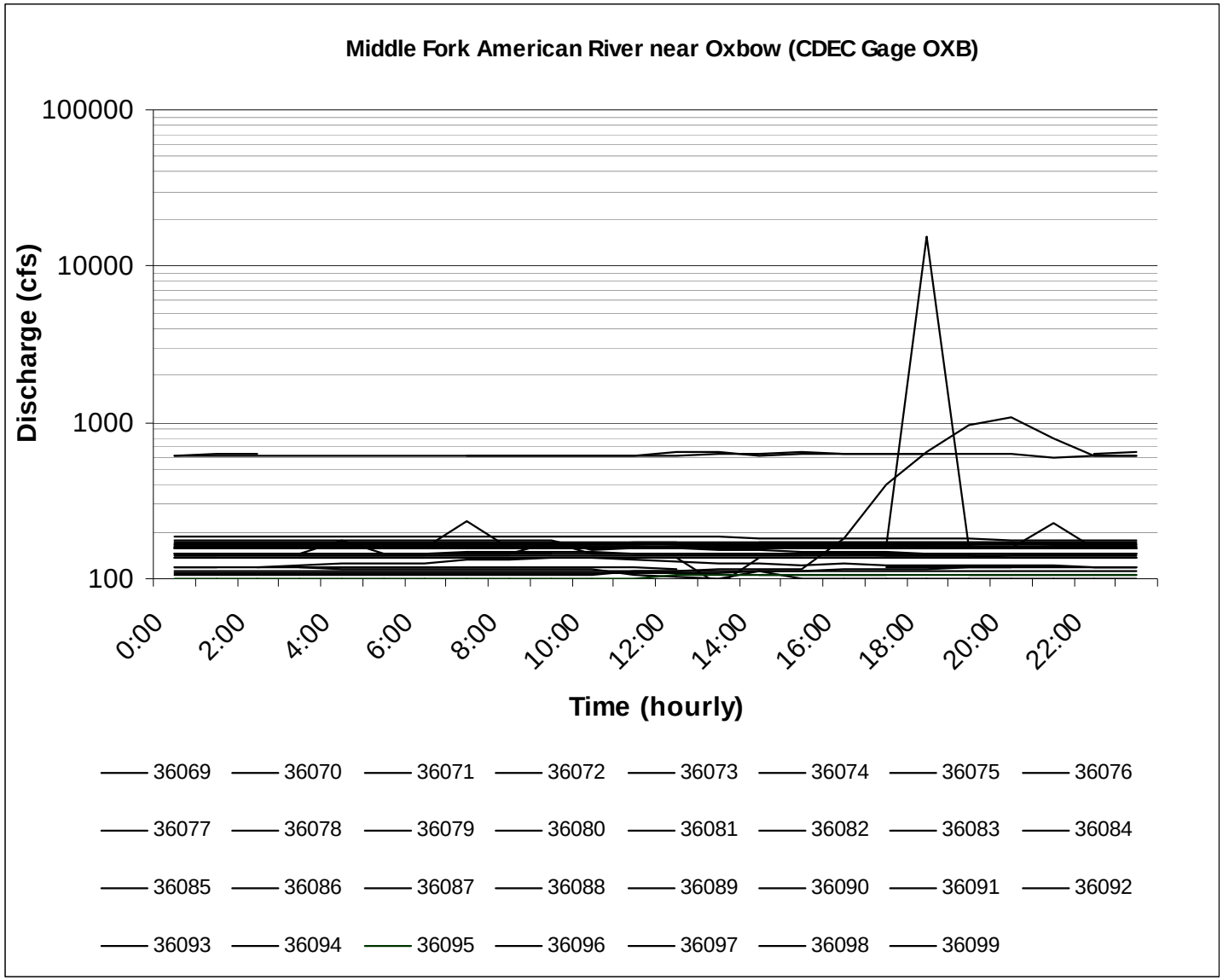
Middle Fork American River near Oxbow (CDEC Gage OXB)
Discharge (cfs)
100000
10000
1000
100
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
36069
36070
36071
36072
36073
36074
36075
36076
36077
36078
36079
36080
36081
36082
36083
36084
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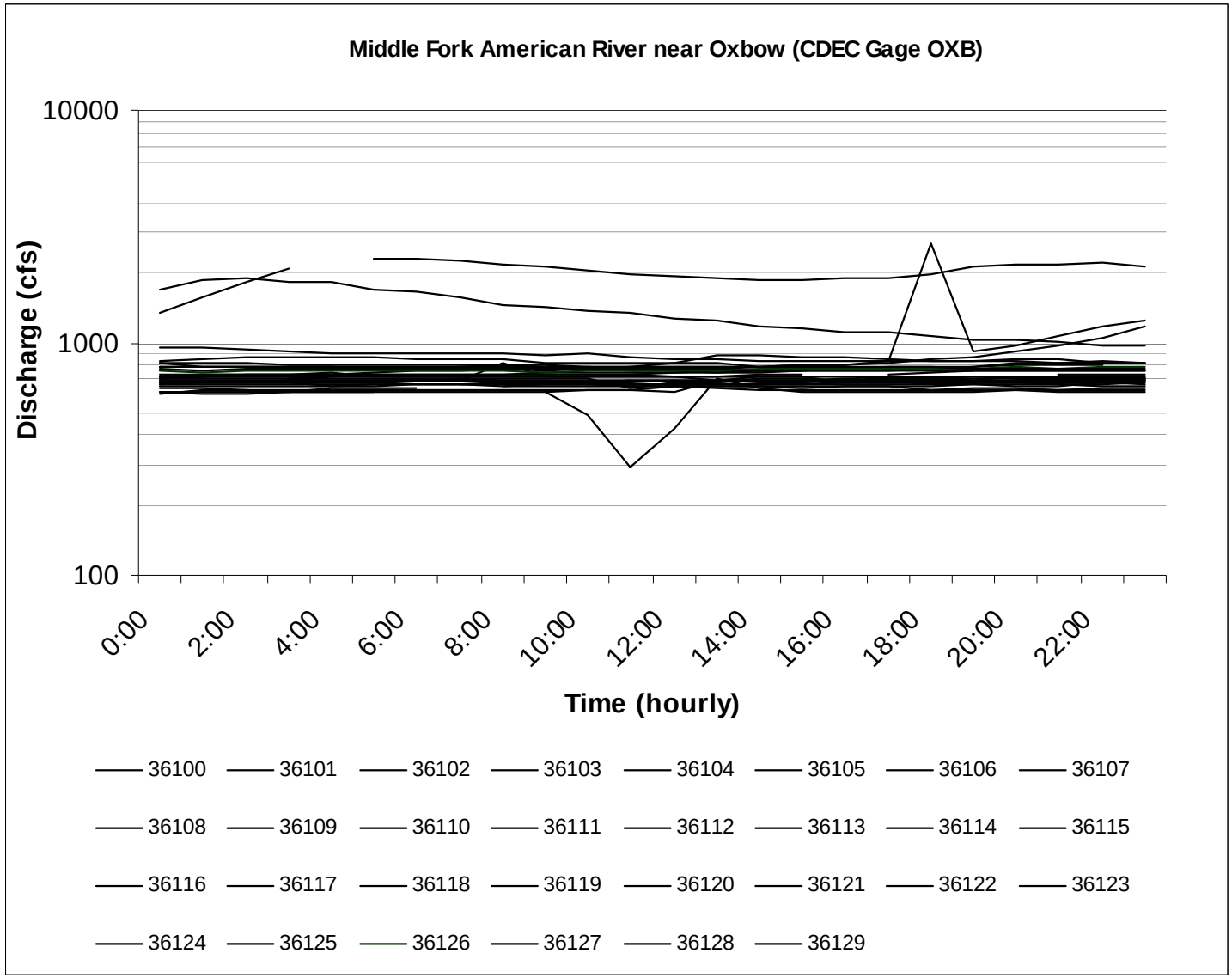
Middle Fork American River near Oxbow (CDEC Gage OXB)
10000
1000
100
Discharge (cfs)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
36100
36101
36102
36103
36104
36105
36106
36107
36108
36109
36110
36111
36112
36113
36114
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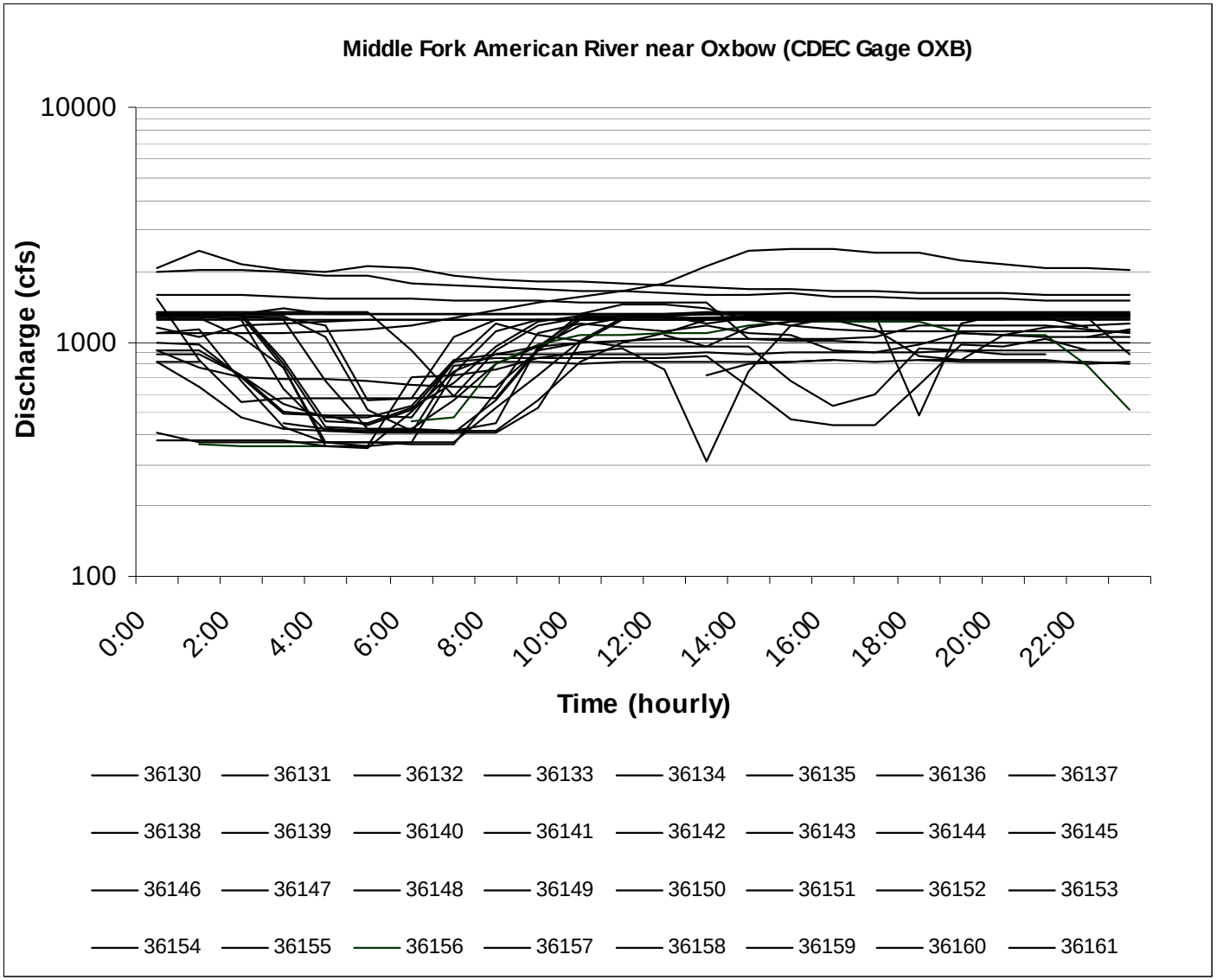
36129



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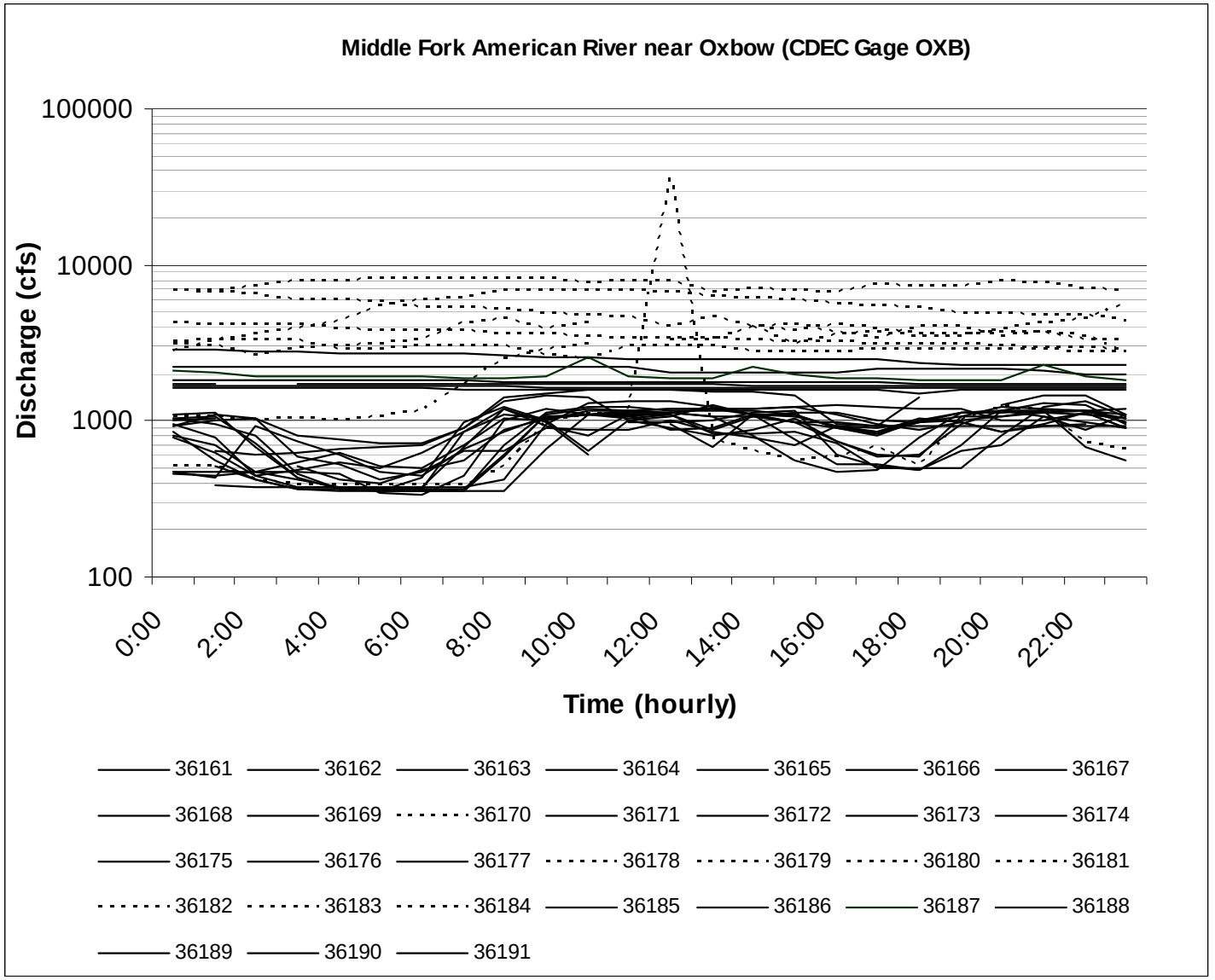
Middle Fork American River near Oxbow (CDEC Gage OXB)
Discharge (cfs)
100000
10000
1000
100
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
36161
36162
36163
36164
36165
36166
36167
36168
36169
36170
36171
36172
36173
36174
36175
36176
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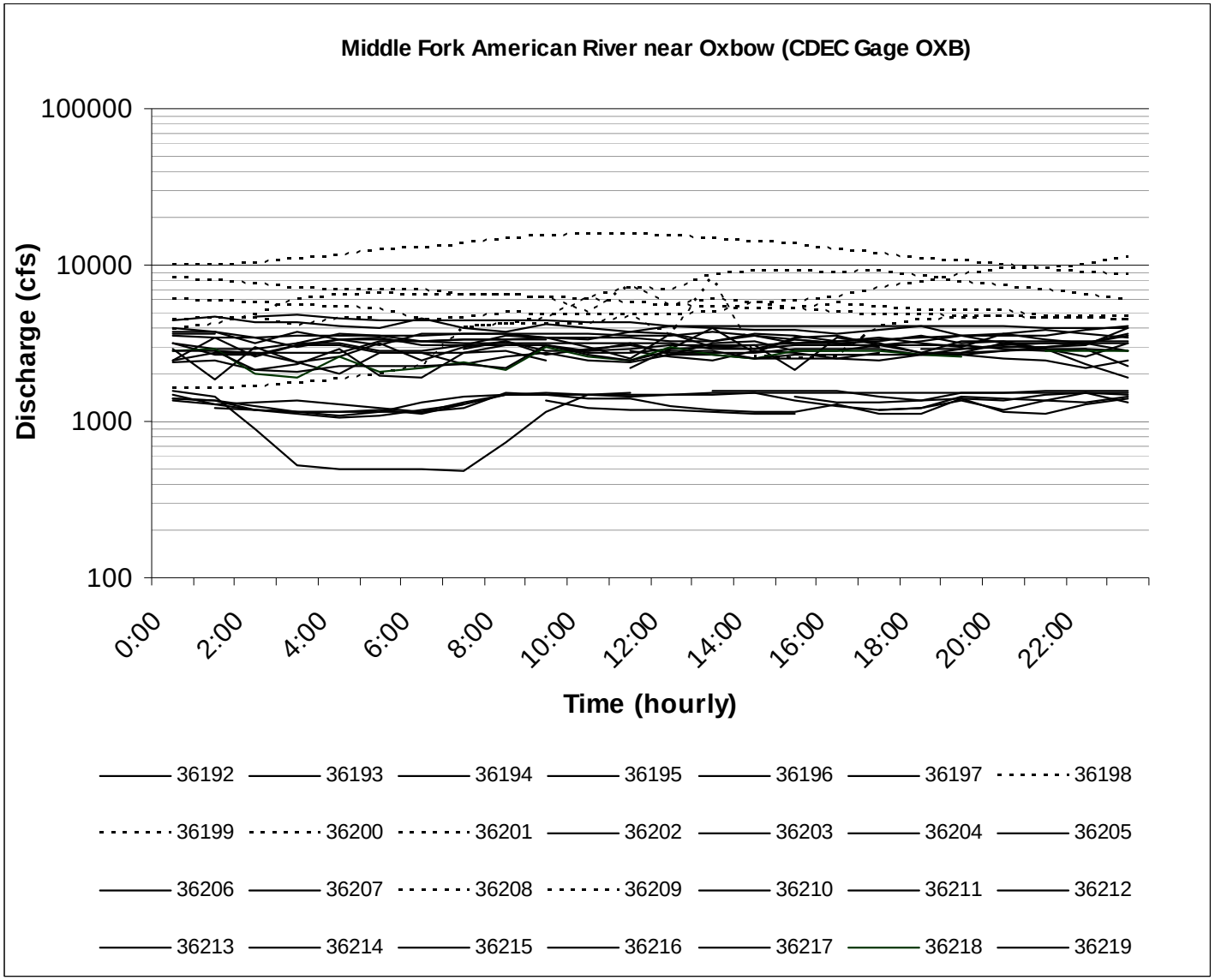
Middle Fork American River near Oxbow (CDEC Gage OXB)
Discharge (cfs)
100000
10000
1000
100
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
36192
36193
36194
36195
36196
36197
36198
36199
36200
36201
36202
36203
36204
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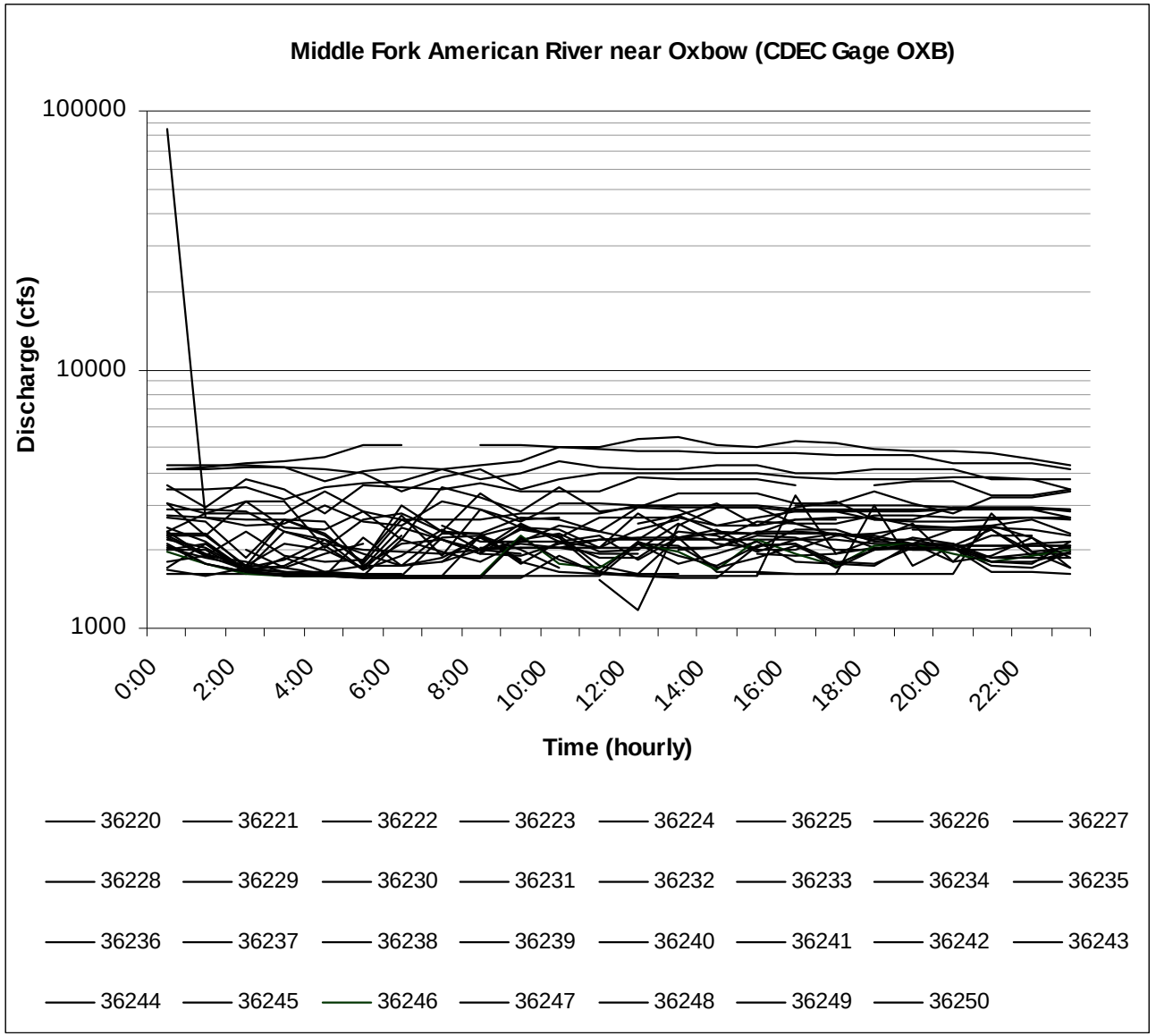
Middle Fork American River near Oxbow (CDEC Gage OXB)
100000
10000
1000
Discharge (cfs)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
36220
36221
36222
36223
36224
36225
36226
36227
36228
36229
36230
36231
36232
36233
36234
36235
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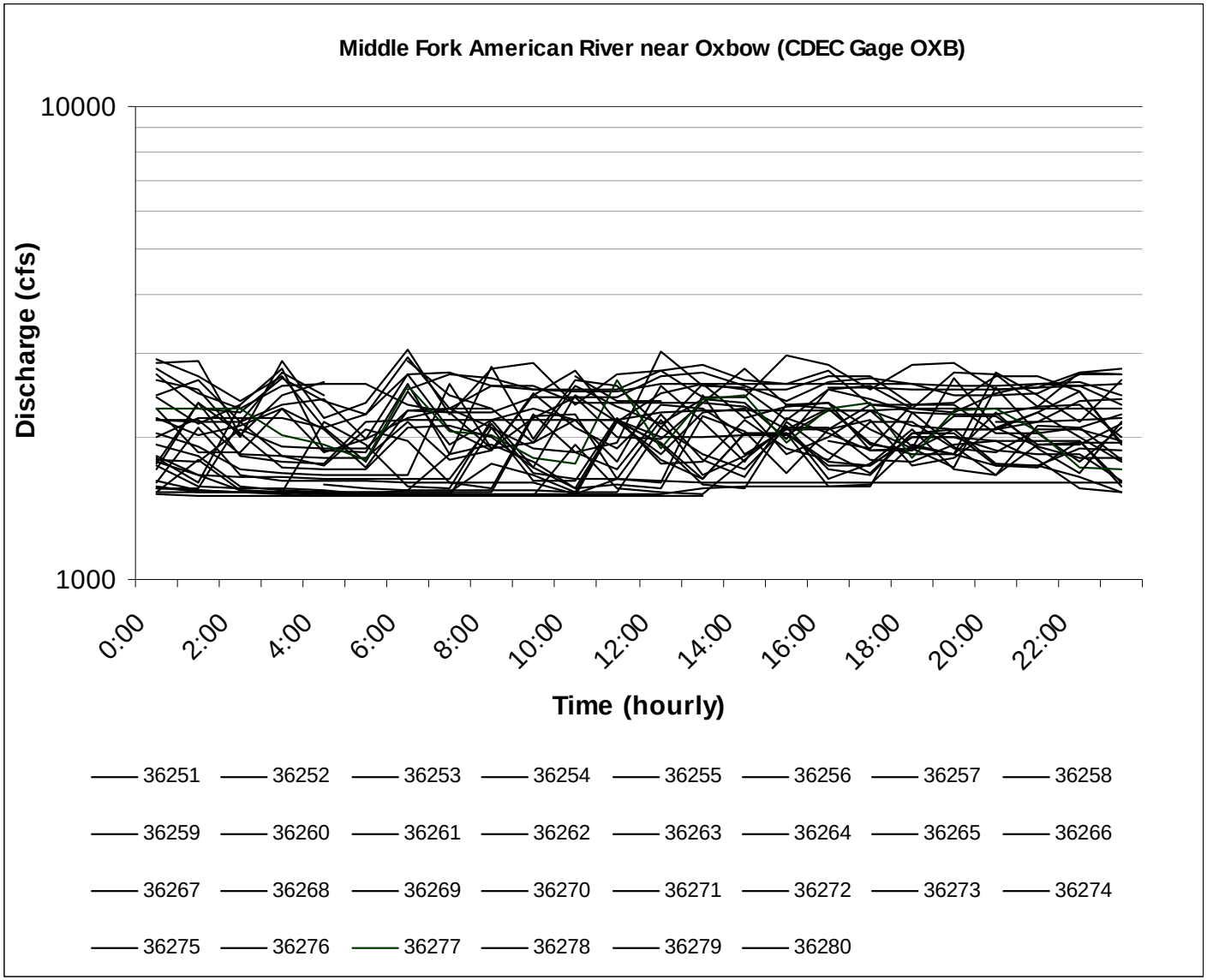
Middle Fork American River near Oxbow (CDEC Gage OXB)
10000
1000
Discharge (cfs)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
36251
36252
36253
36254
36255
36256
36257
36258
36259
36260
36261
36262
36263
36264
36265
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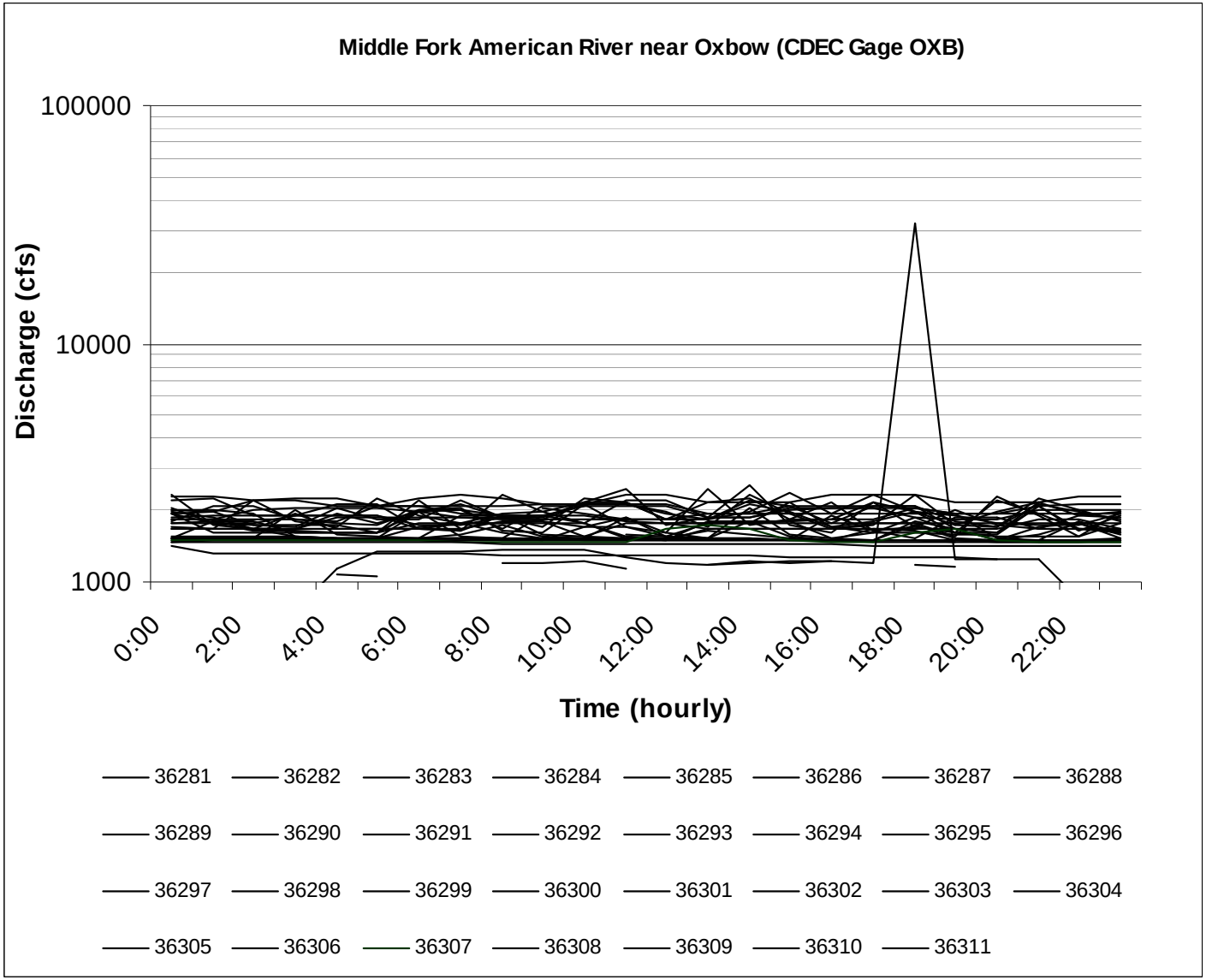
Middle Fork American River near Oxbow (CDEC Gage OXB)
100000
10000
1000
Discharge (cfs)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
36281
36282
36283
36284
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36286
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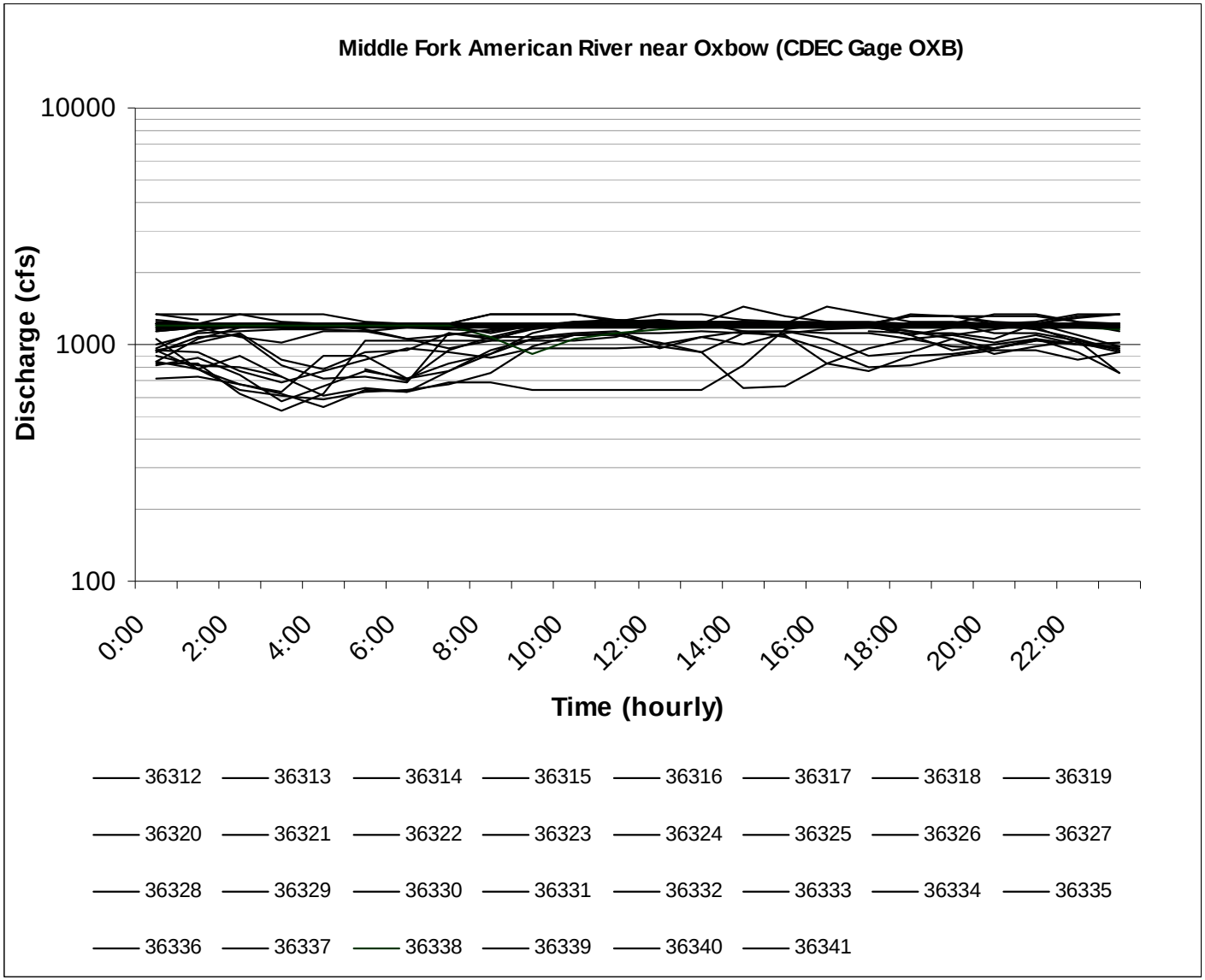
Middle Fork American River near Oxbow (CDEC Gage OXB)
10000
1000
100
Discharge (cfs)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
36312
36313
36314
36315
36316
36317
36318
36319
36320
36321
36322
36323
36324
36325
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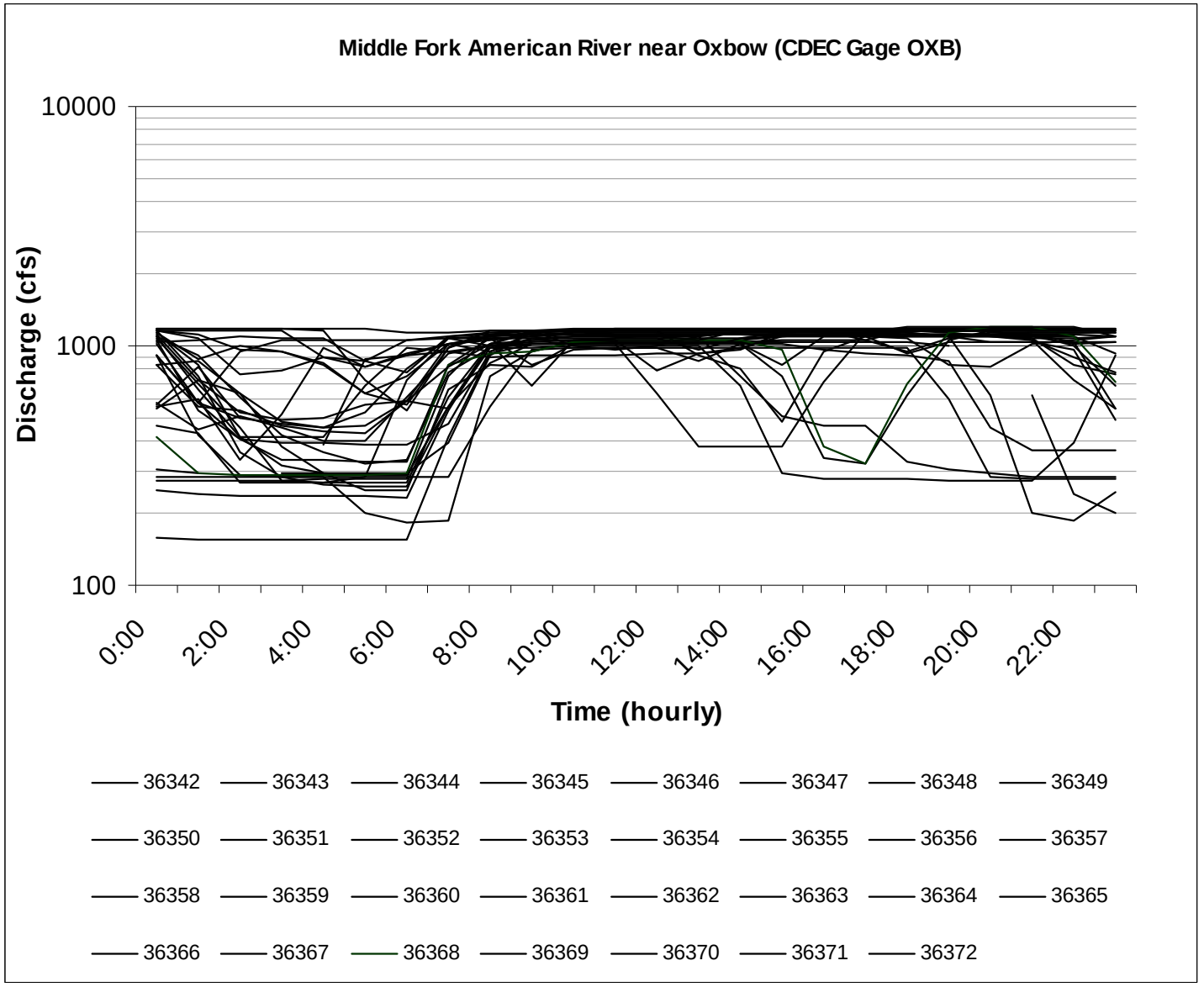

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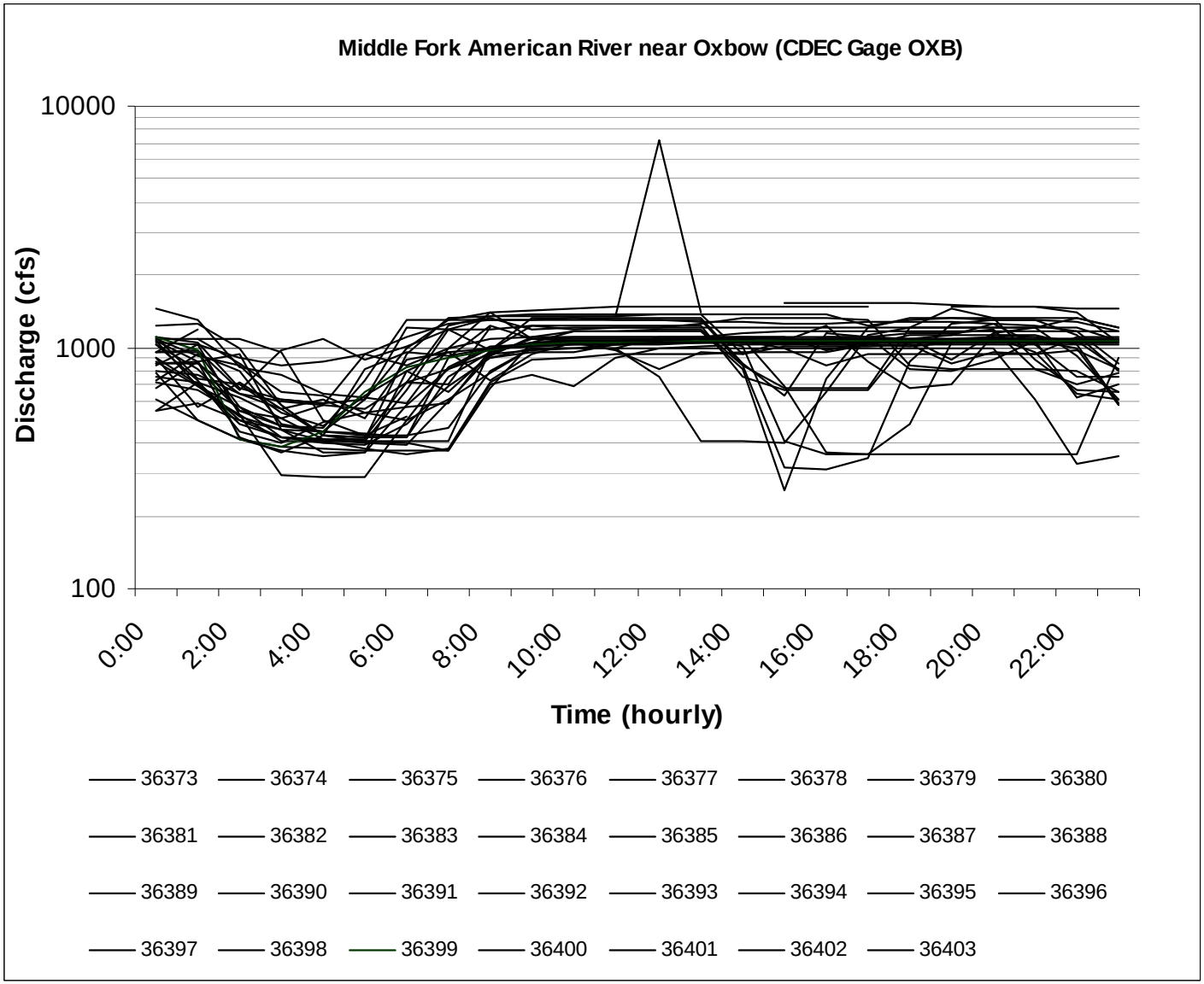

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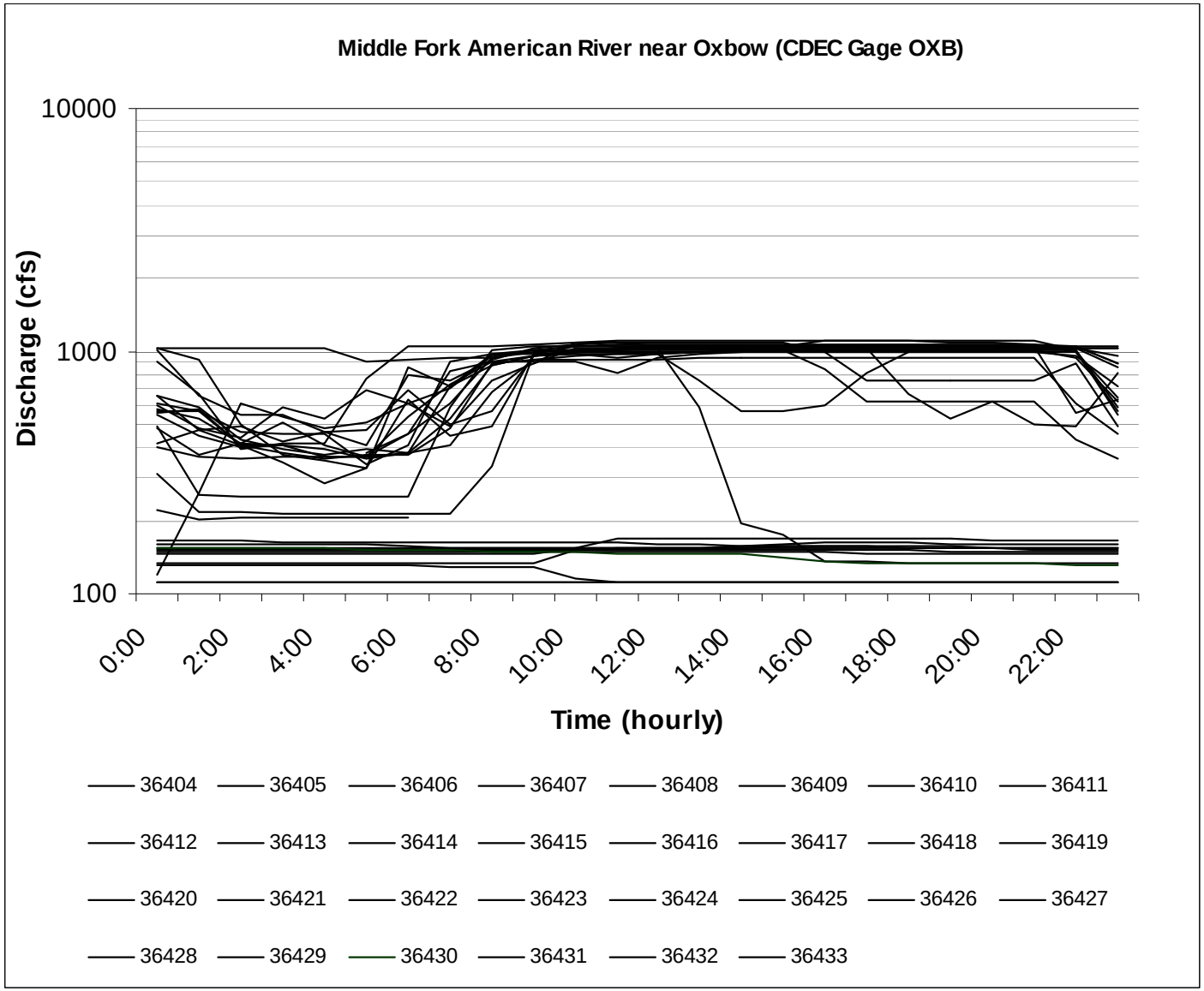
Middle Fork American River near Oxbow (CDEC Gage OXB)
10000
1000
100
Discharge (cfs)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
36404
36405
36406
36407
36408
36409
36410
36411
36412
36413
36414
36415
36416
36417
36418
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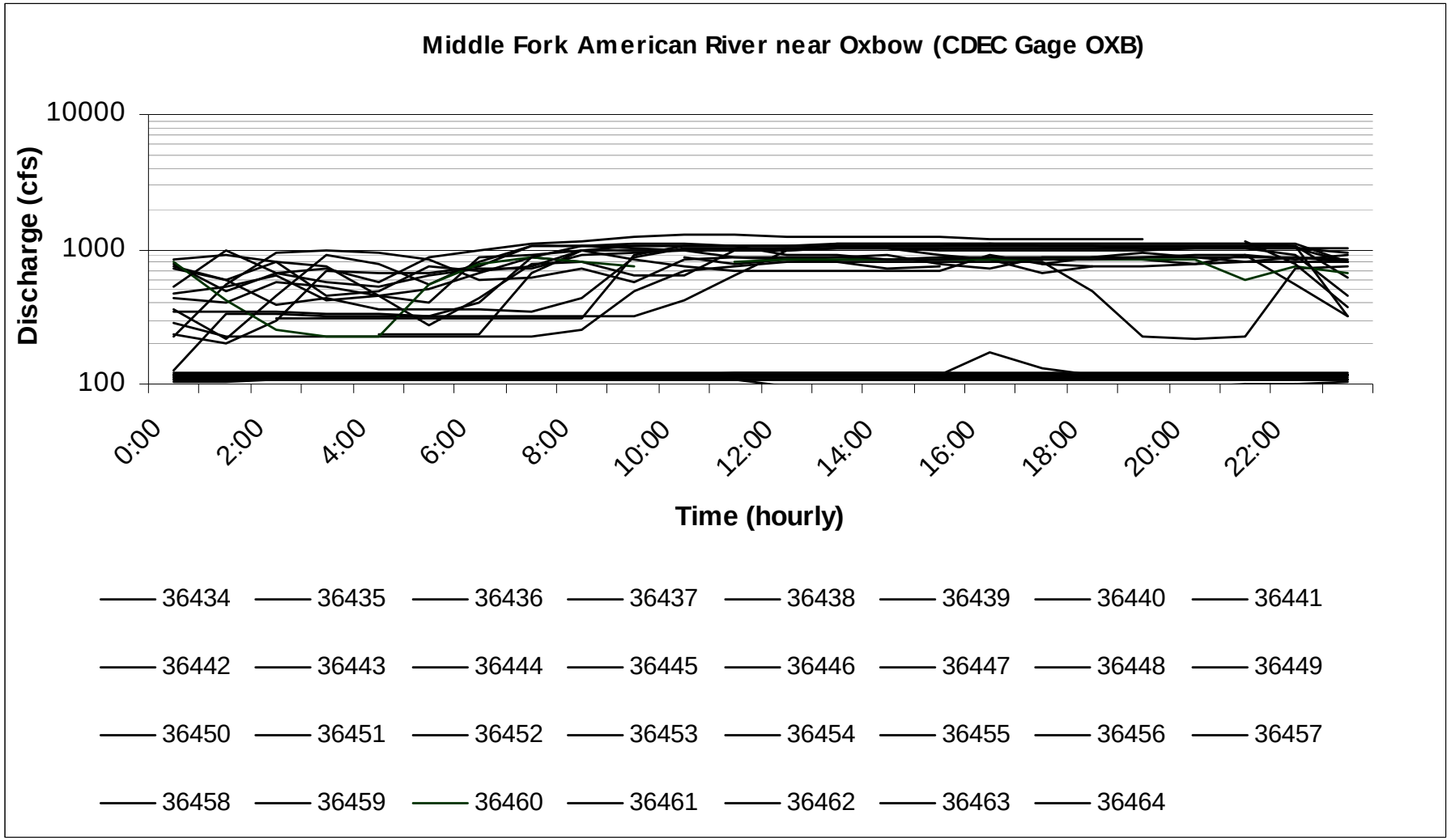
Middle Fork American River near Oxbow (CDEC Gage OXB)
Discharge (cfs)
10000
1000
100
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
36434
36435
36436
36437
36438
36439
36440
36441
36442
36443
36444
36445
36446
36447
36448
36449
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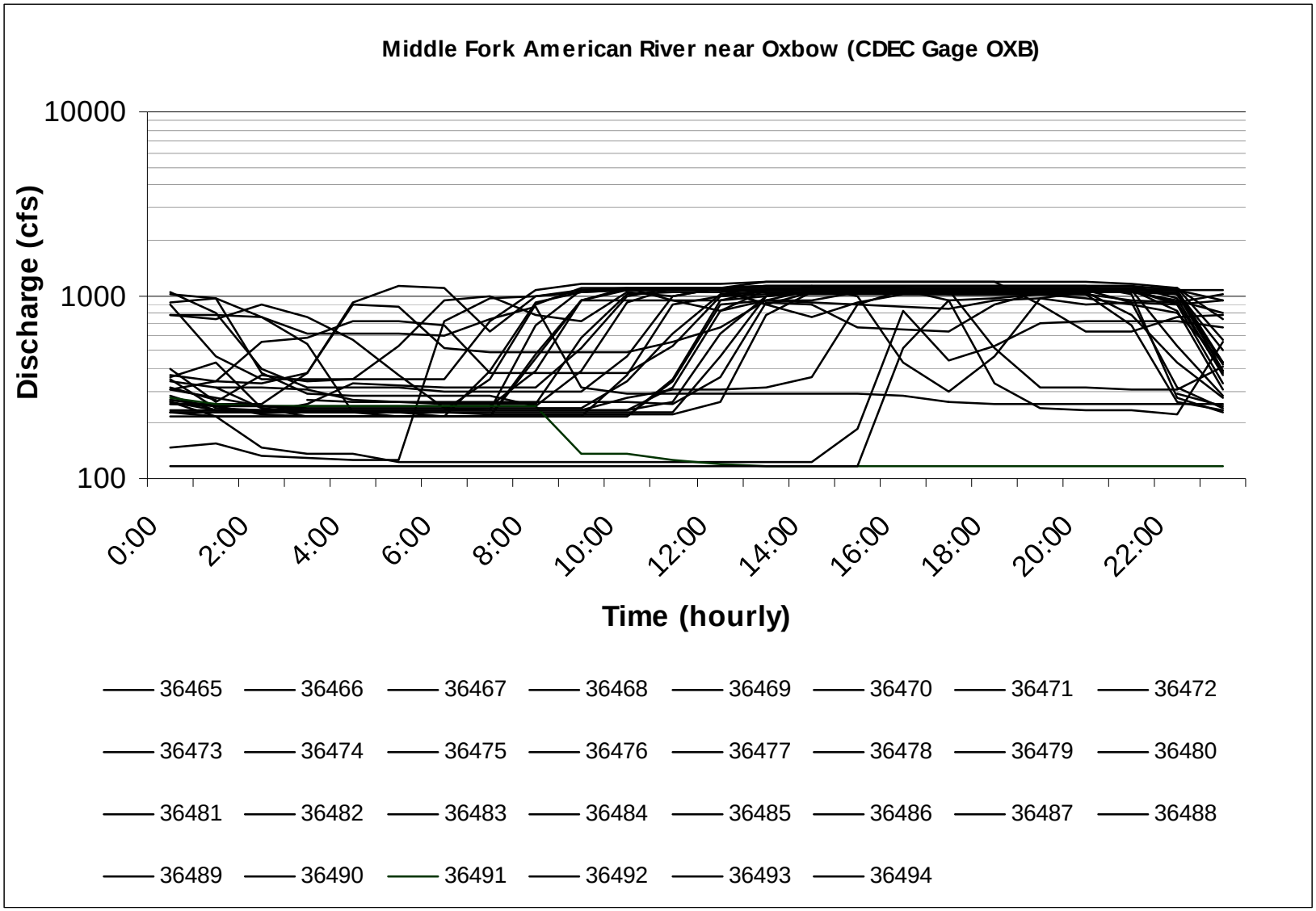
Middle Fork American River near Oxbow (CDEC Gage OXB)
Discharge (cfs)
10000
1000
100
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hourly)
36465
36466
36467
36468
36469
36470
36471
36472
36473
36474
36475
36476
36477
36478
36479
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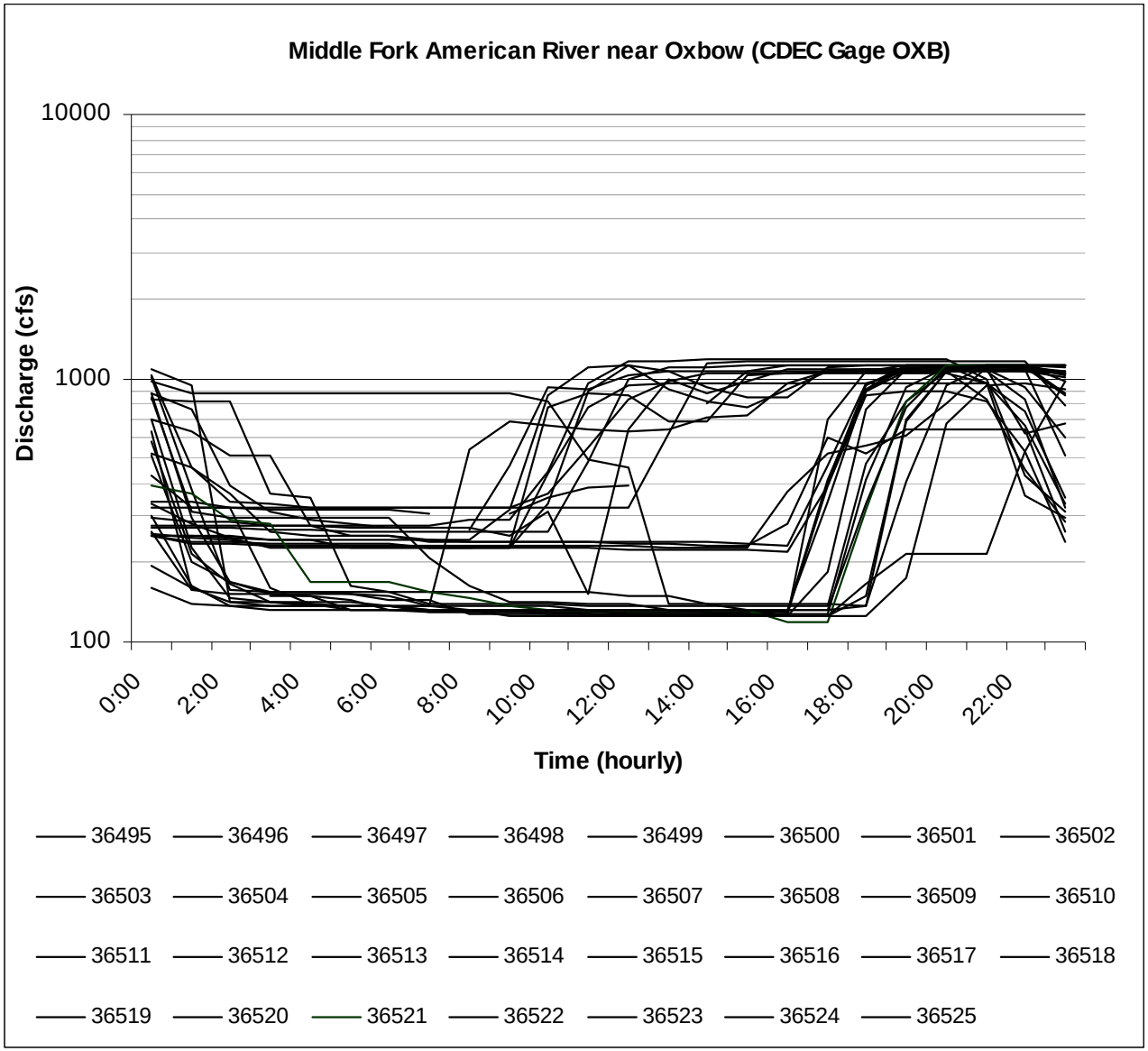

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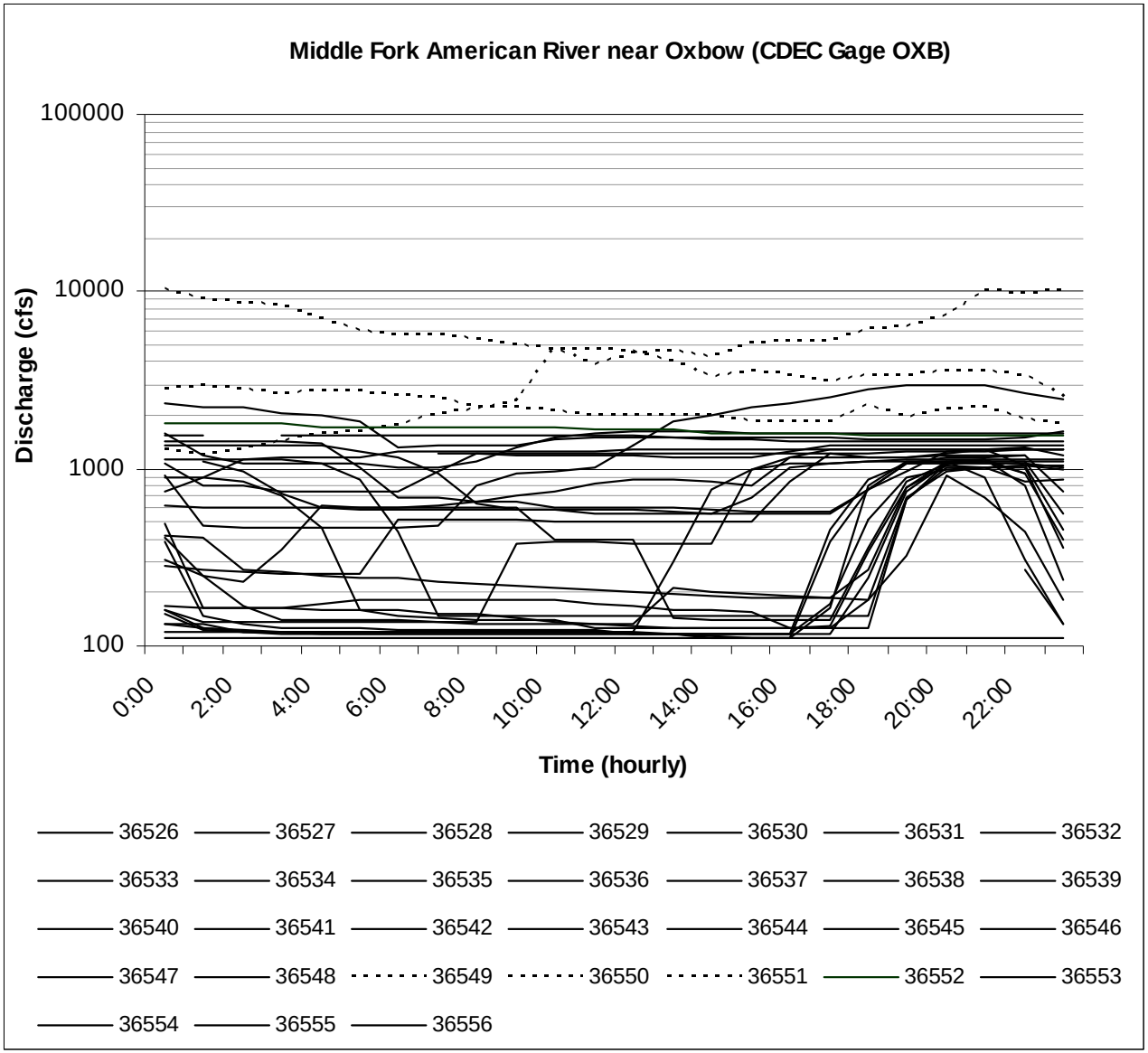
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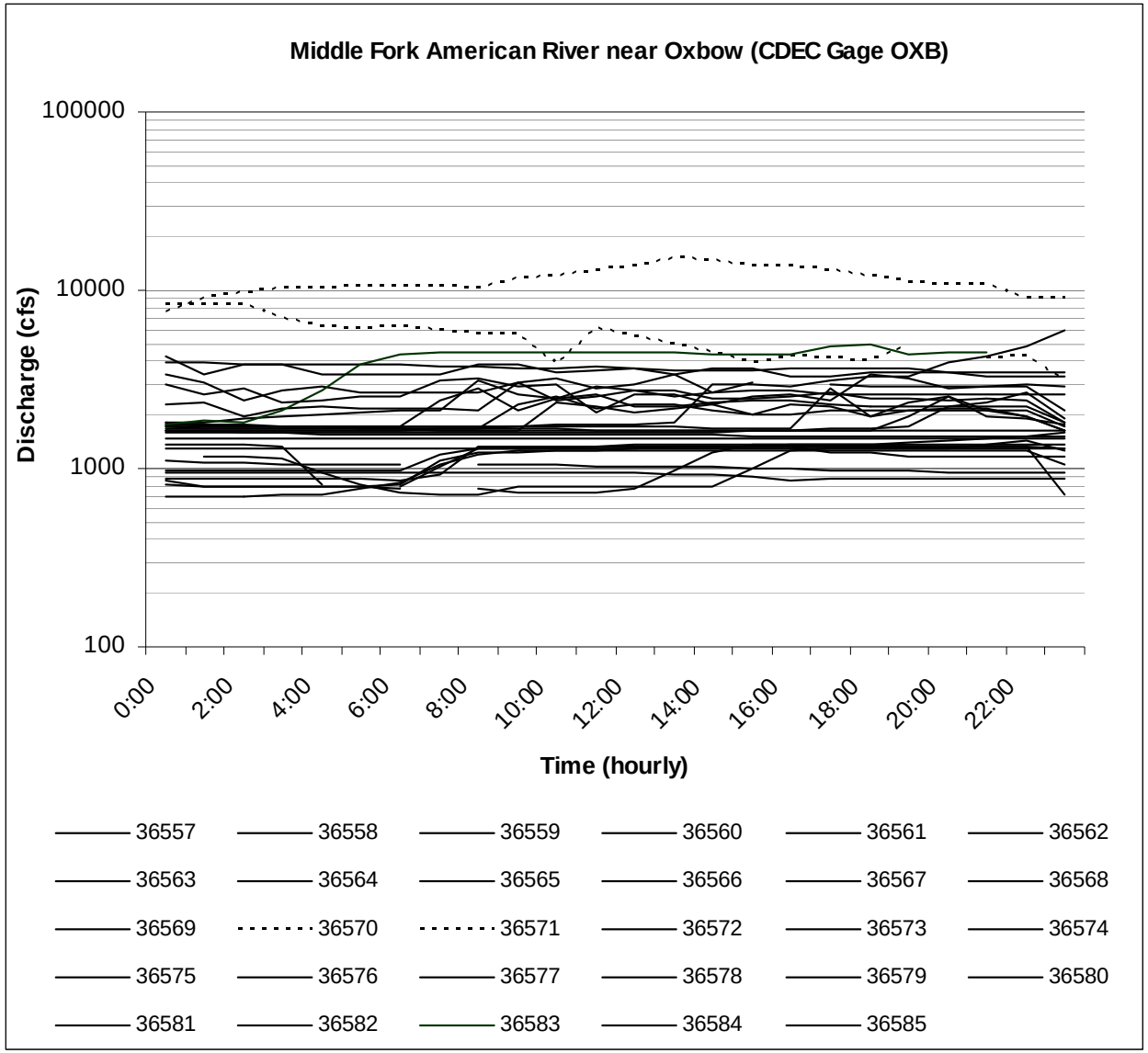
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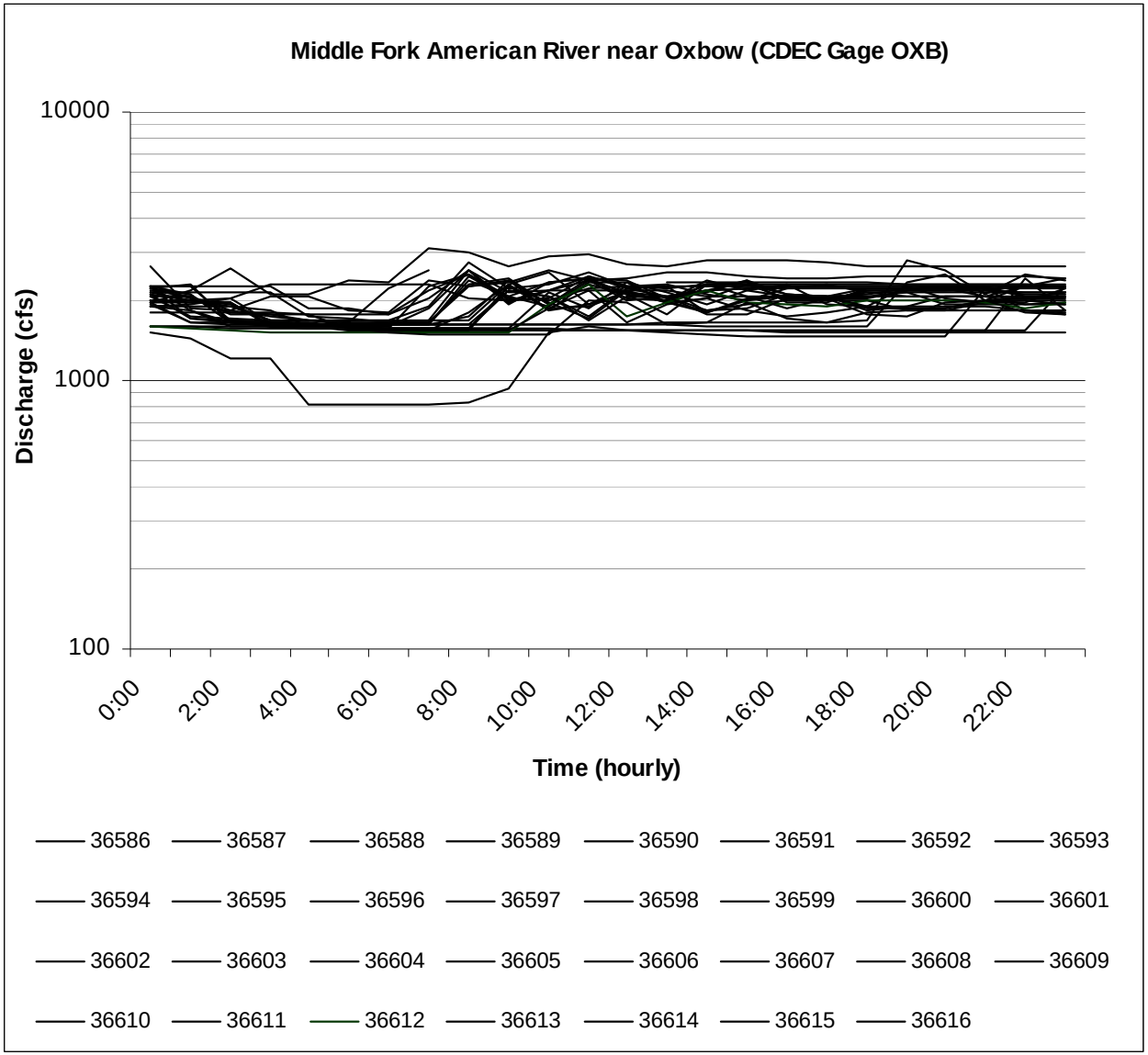
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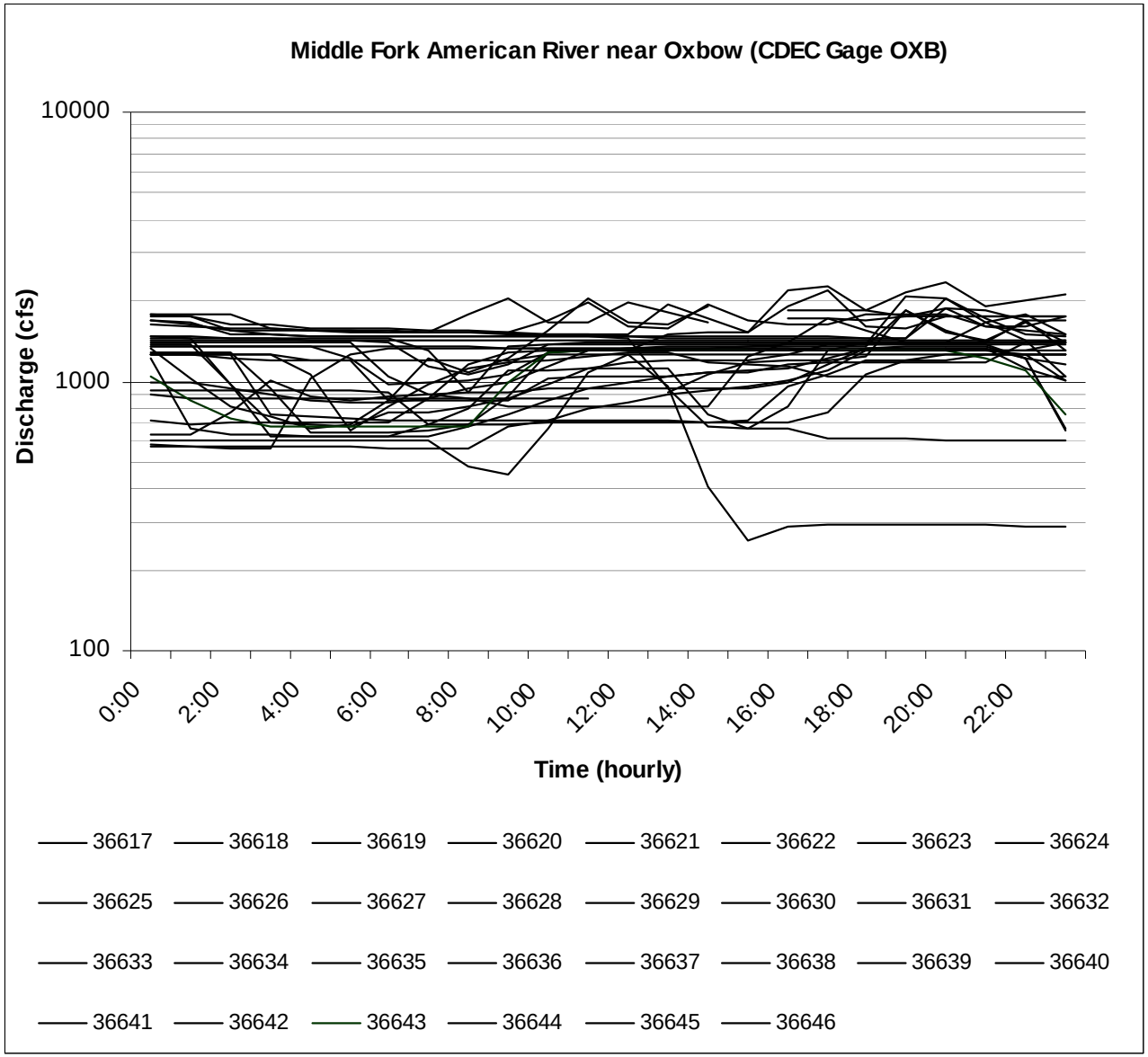
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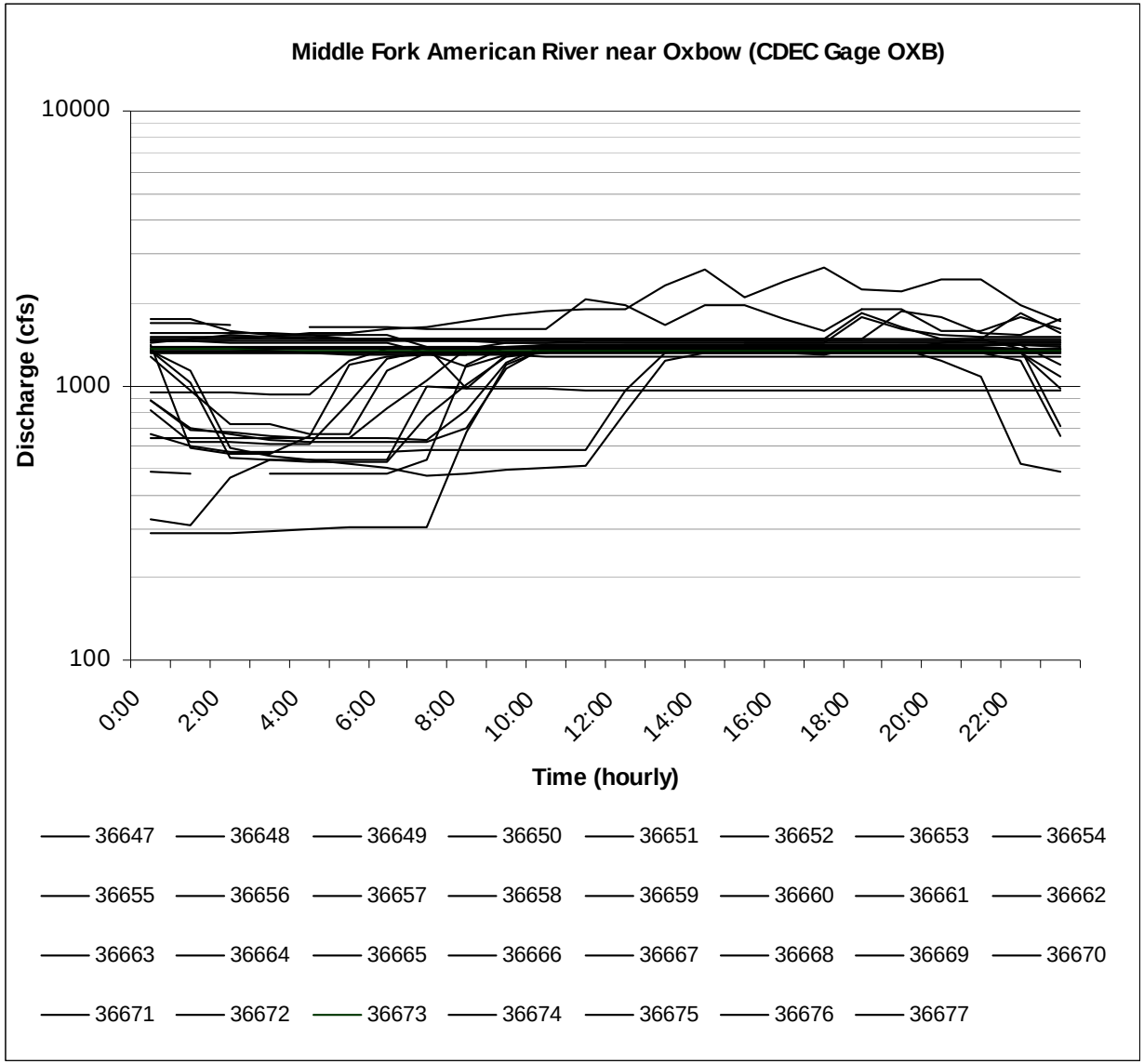
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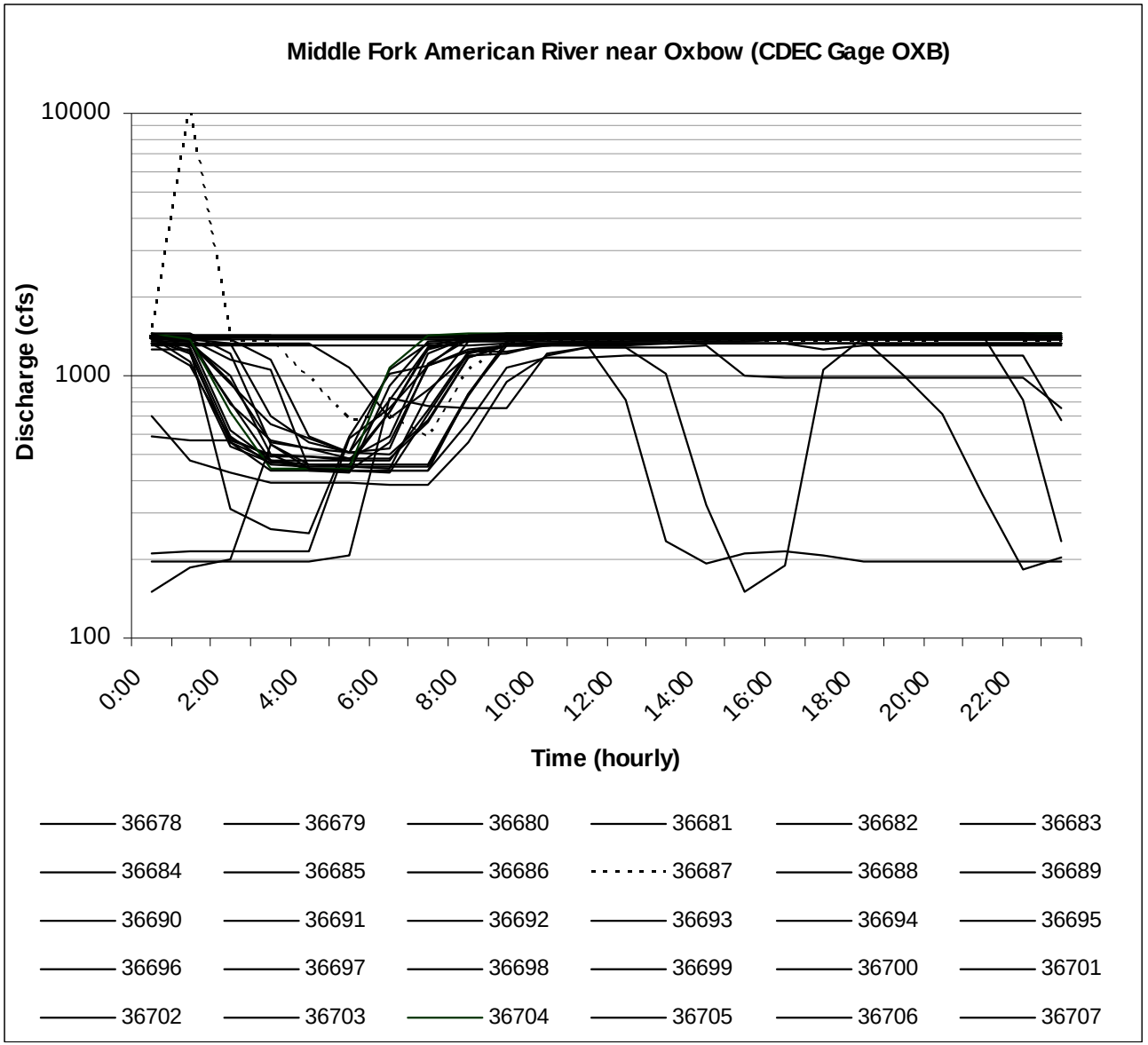
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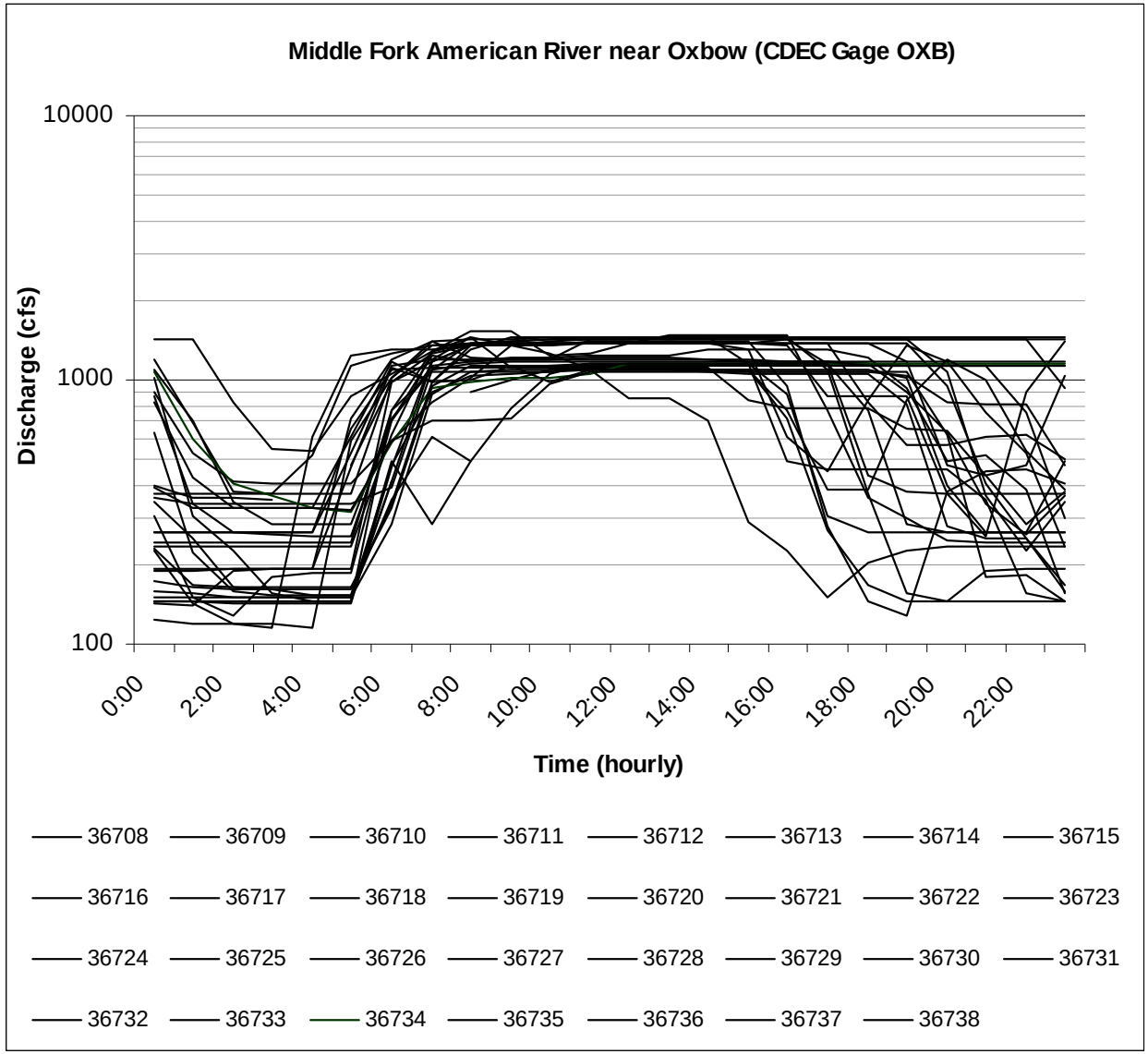
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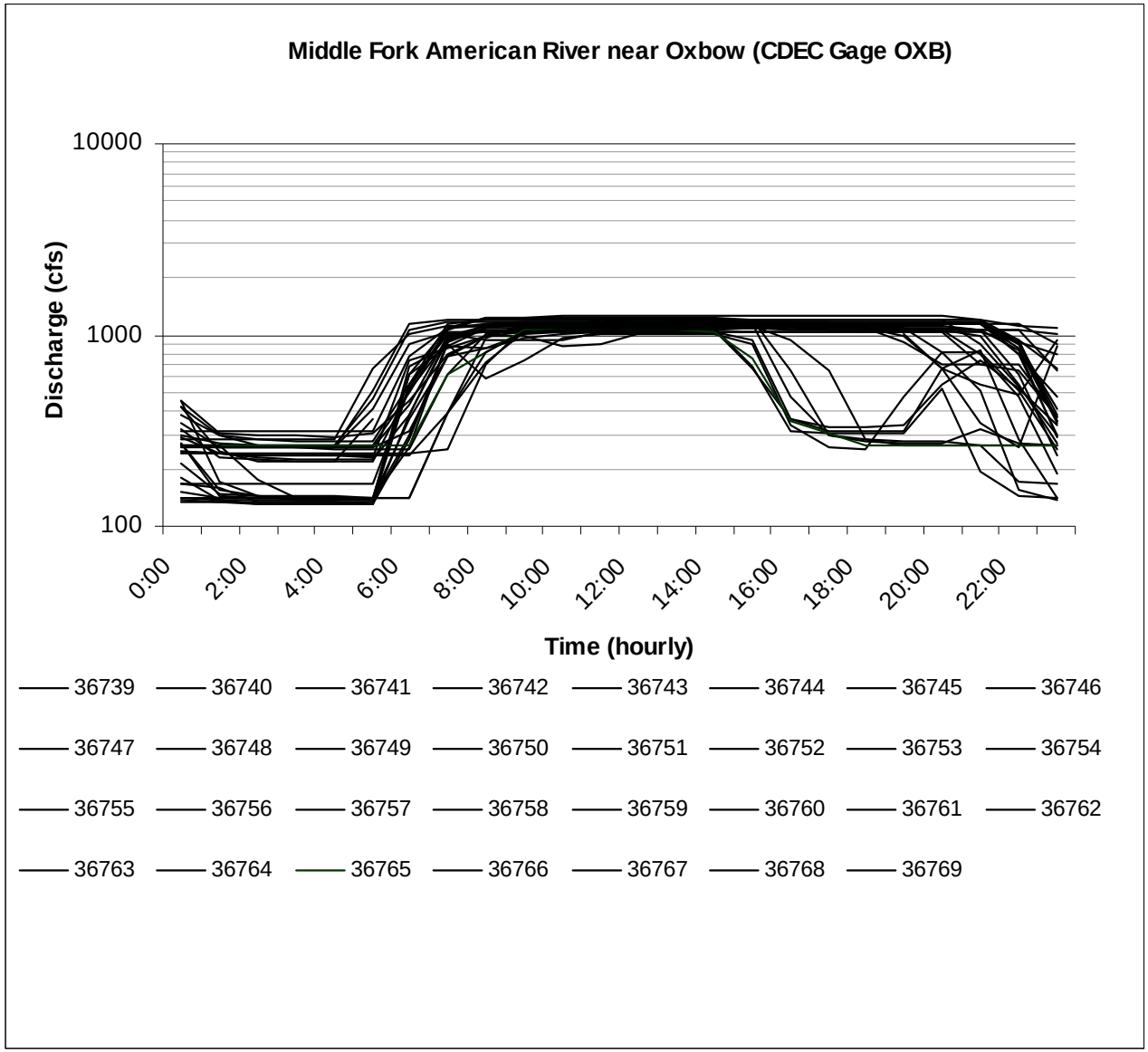
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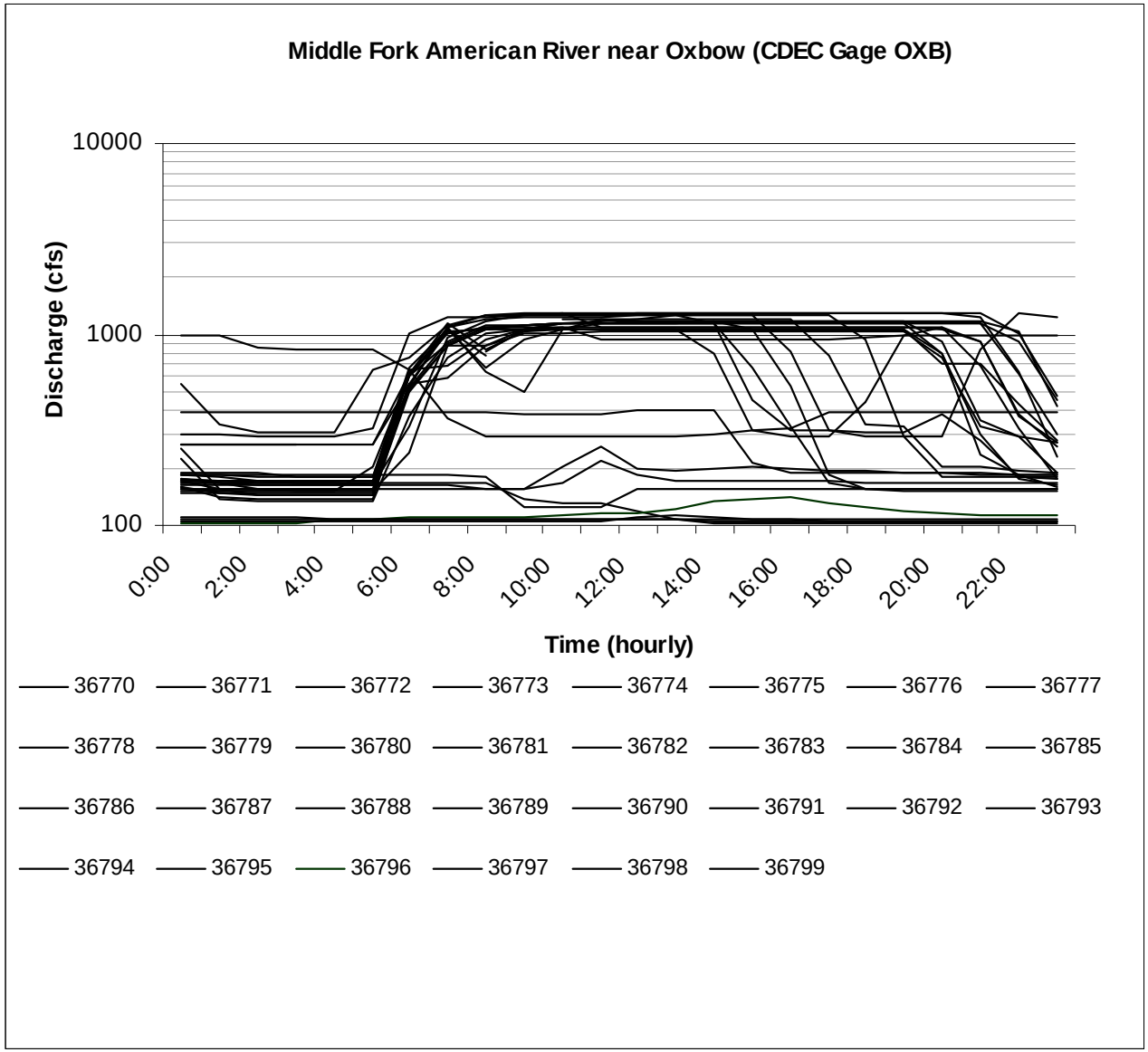
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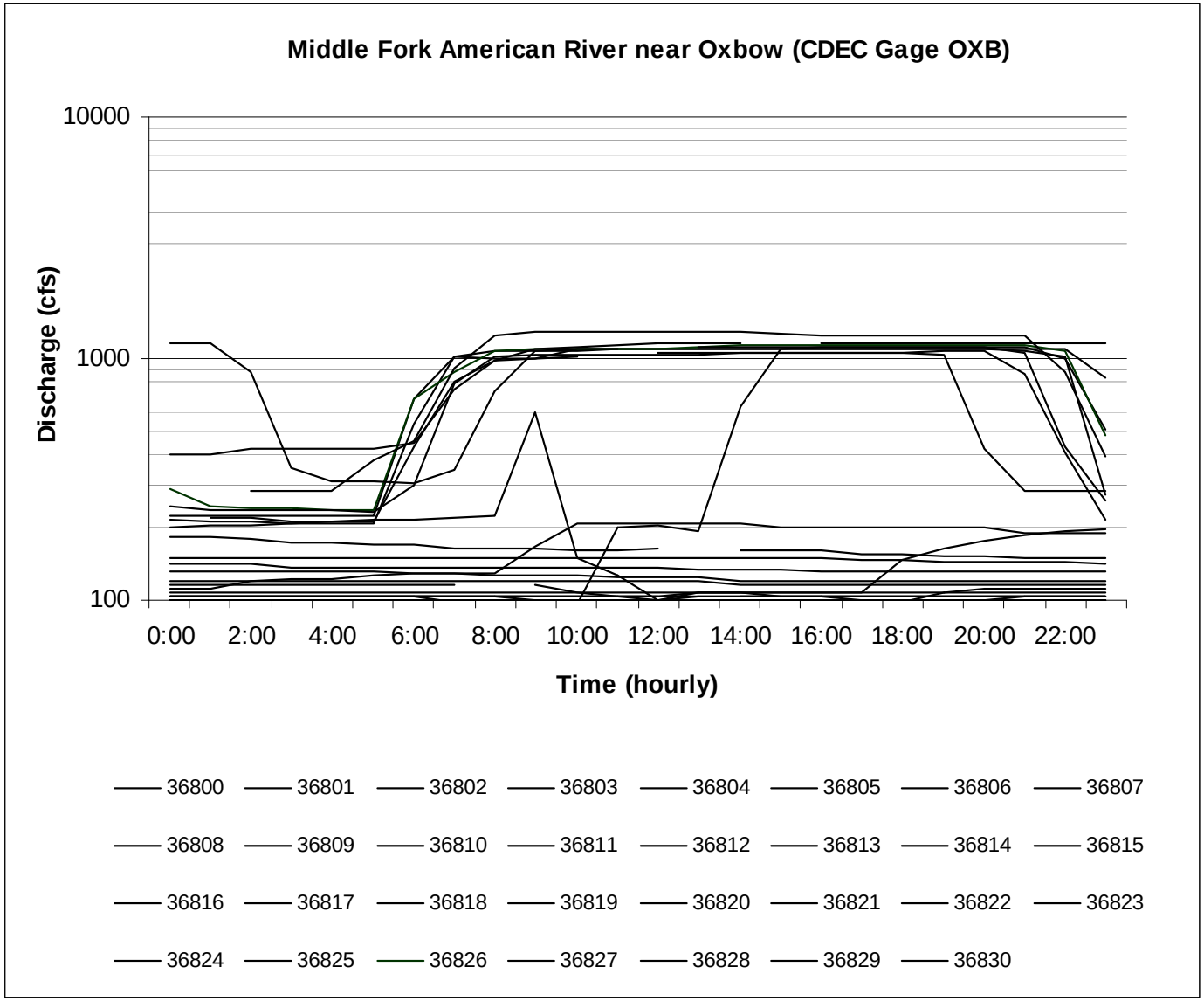
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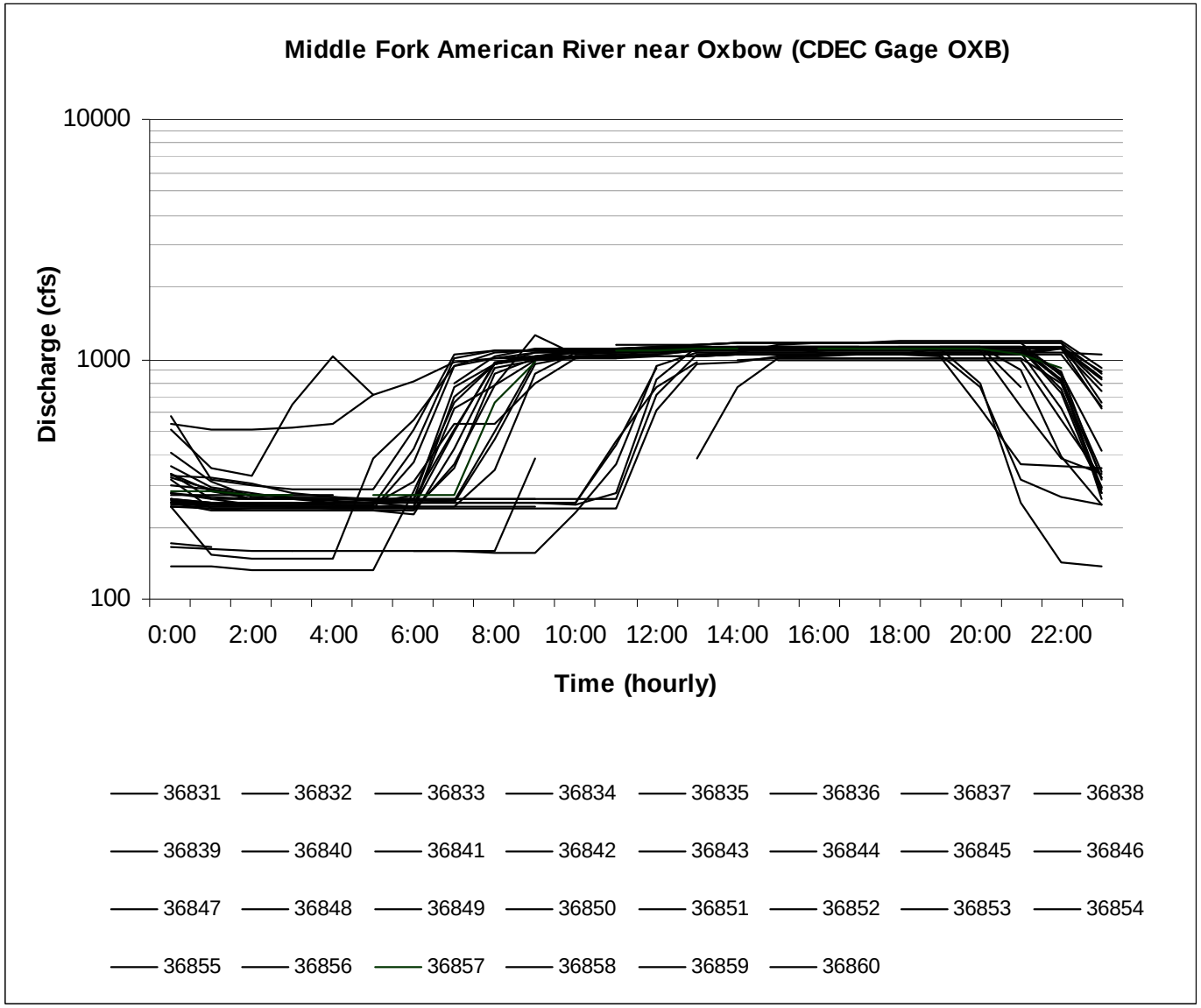

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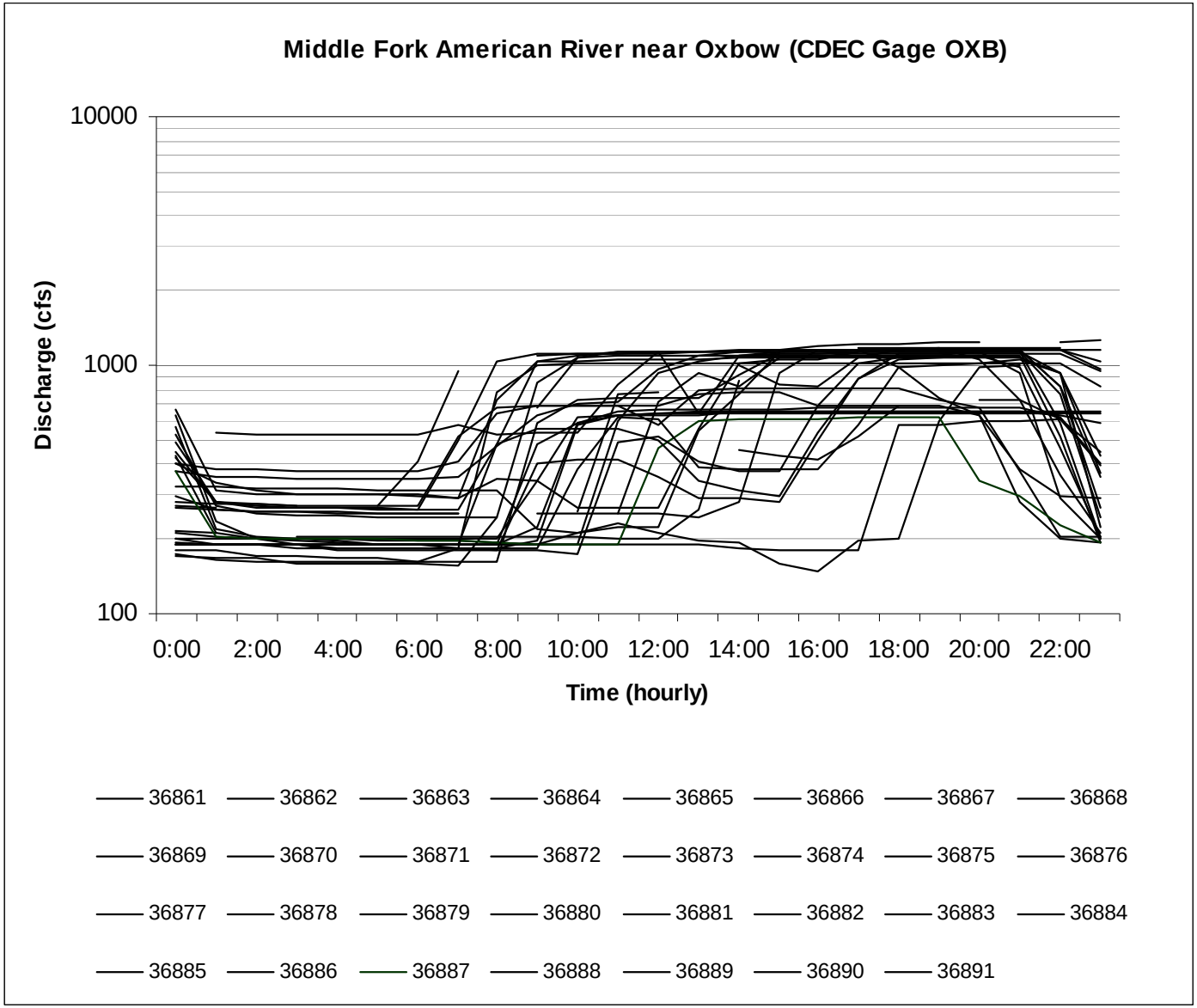
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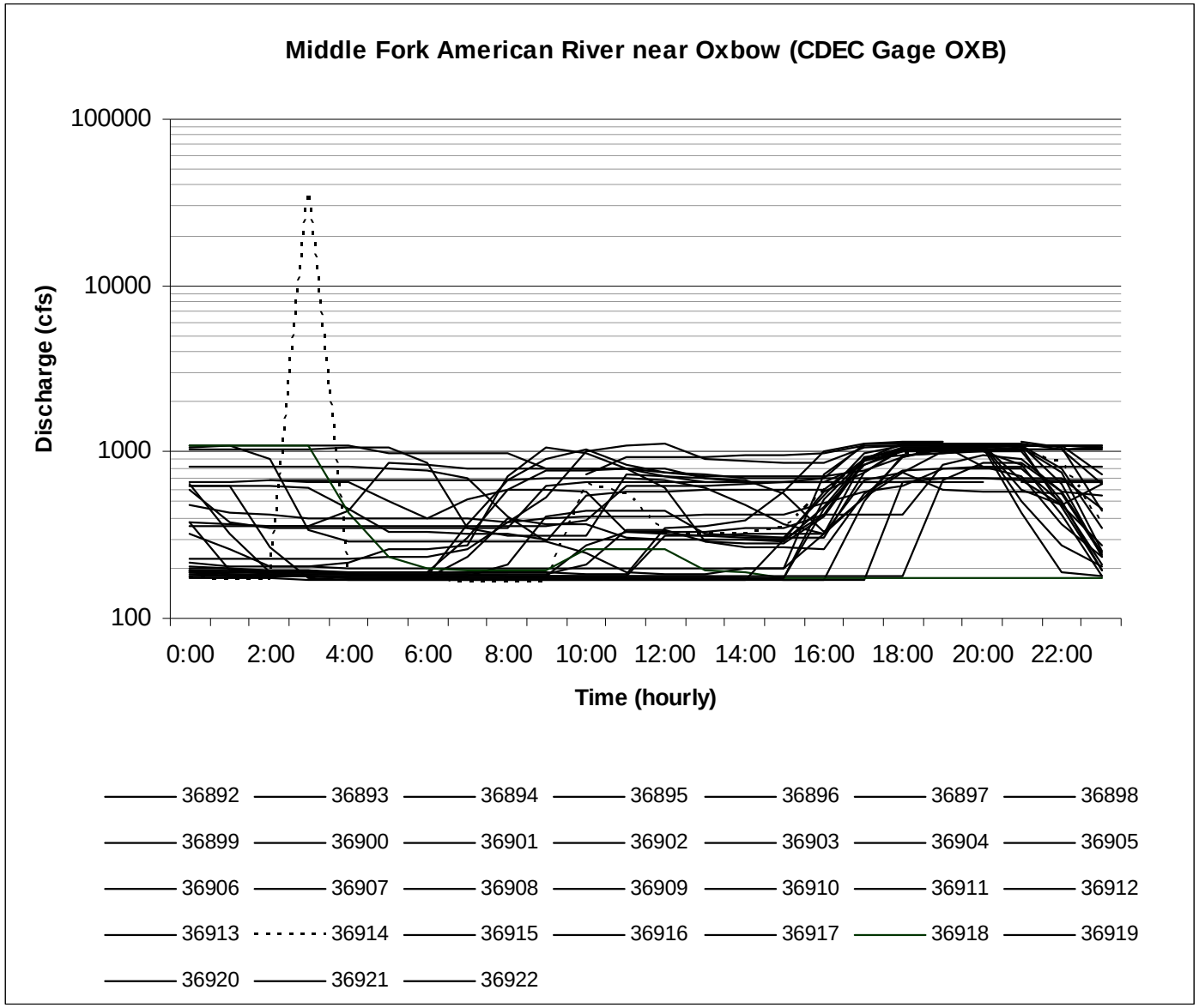
Middle Fork American River near Oxbow (CDEC Gage OXB)
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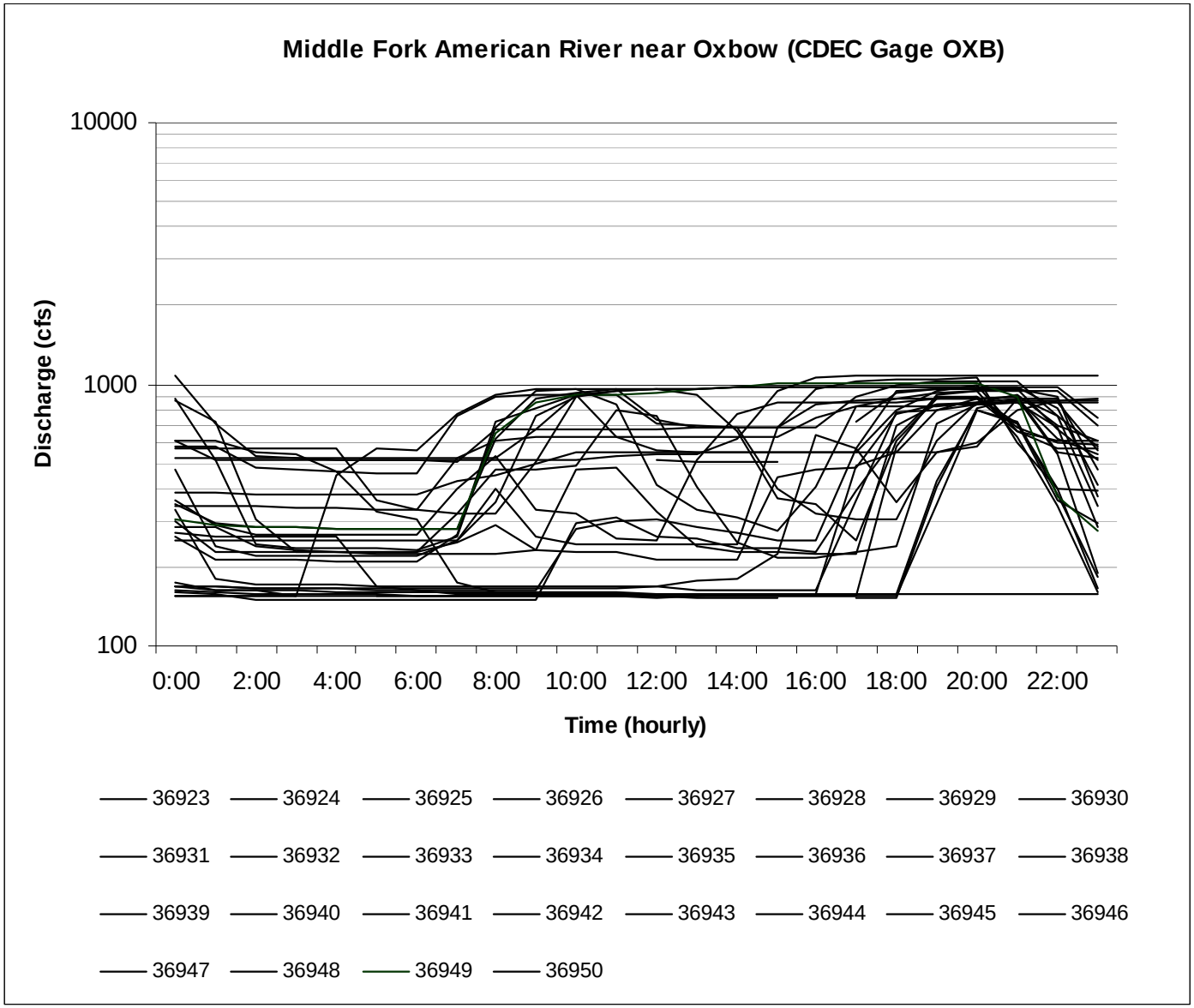

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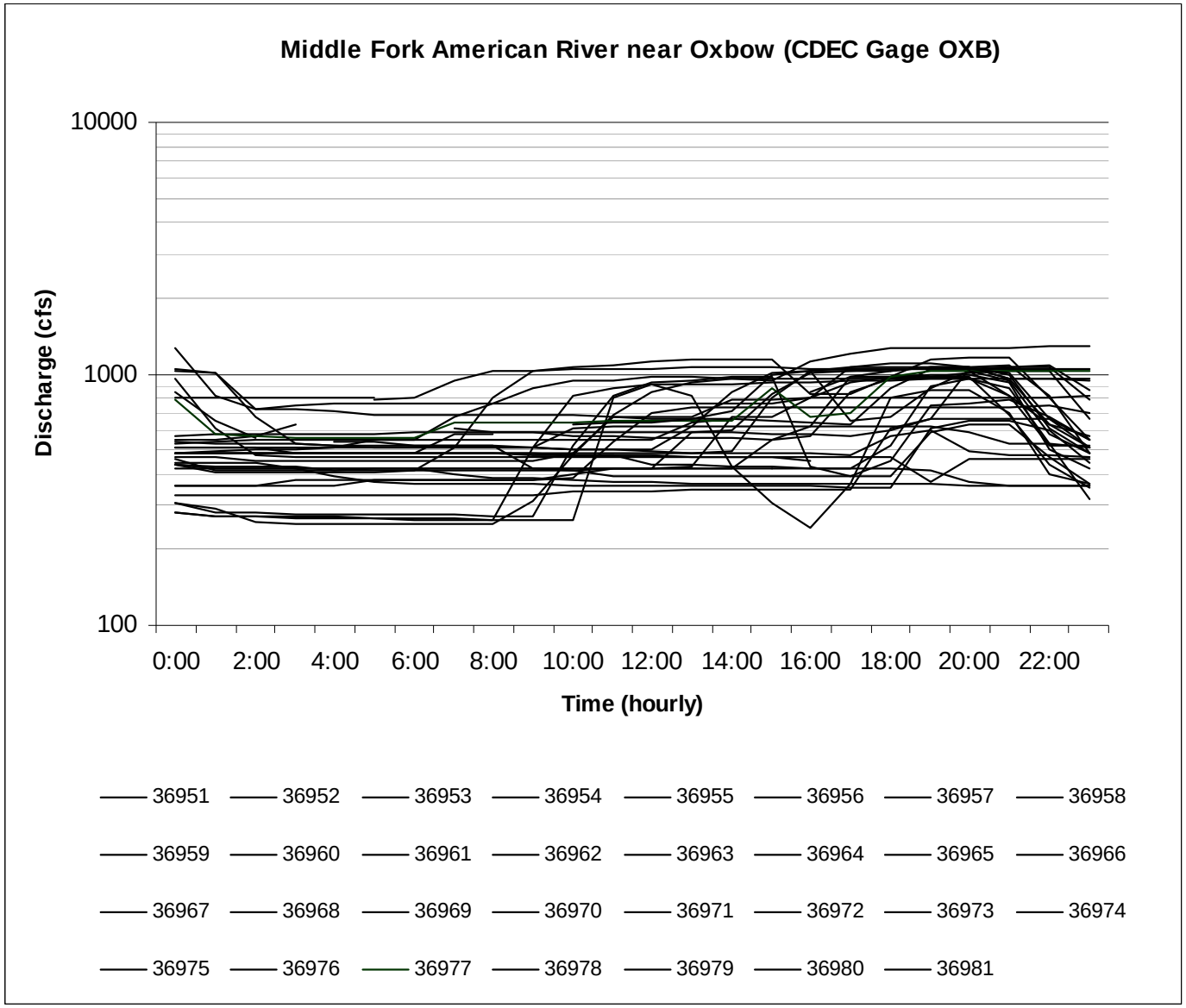
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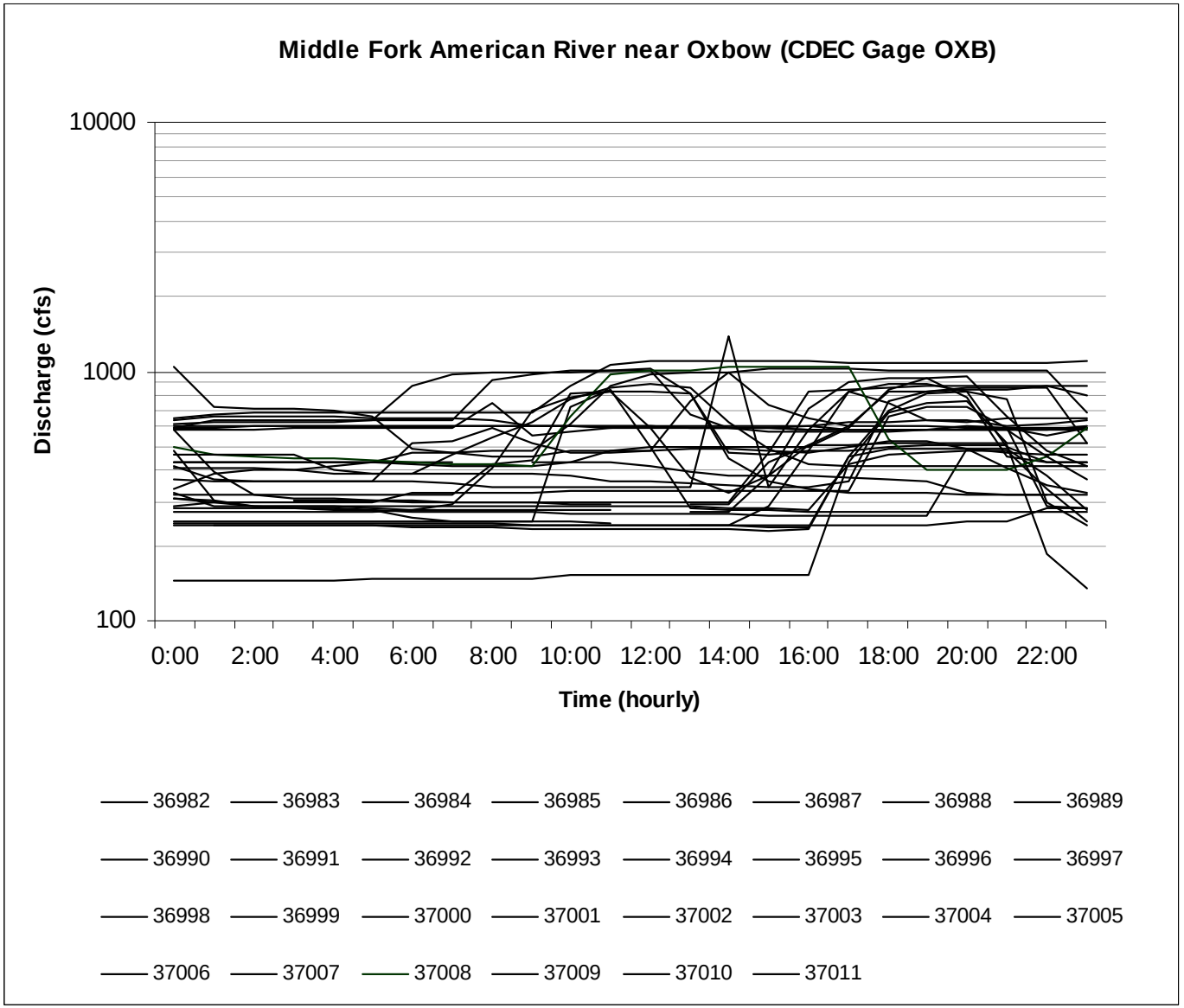
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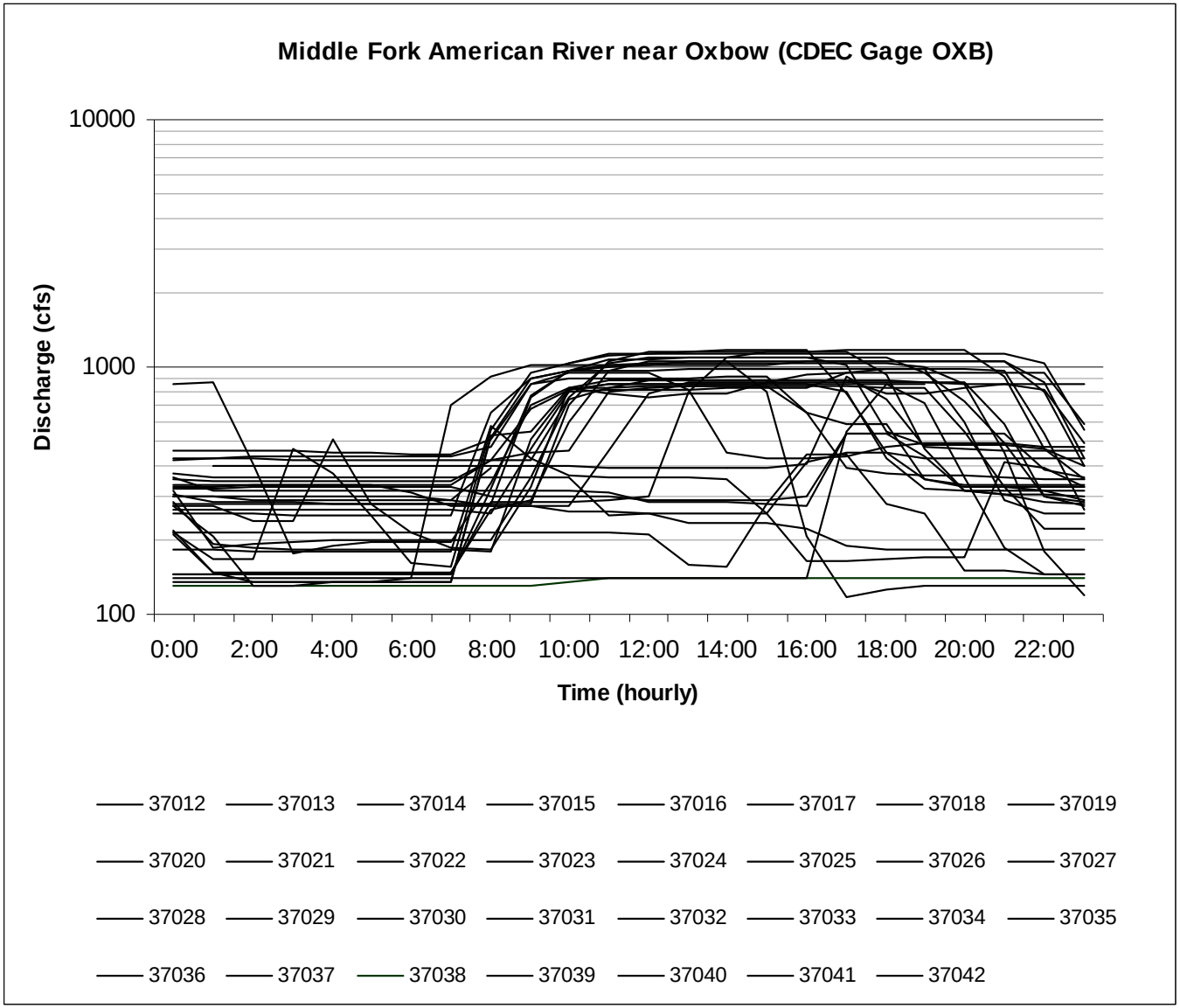

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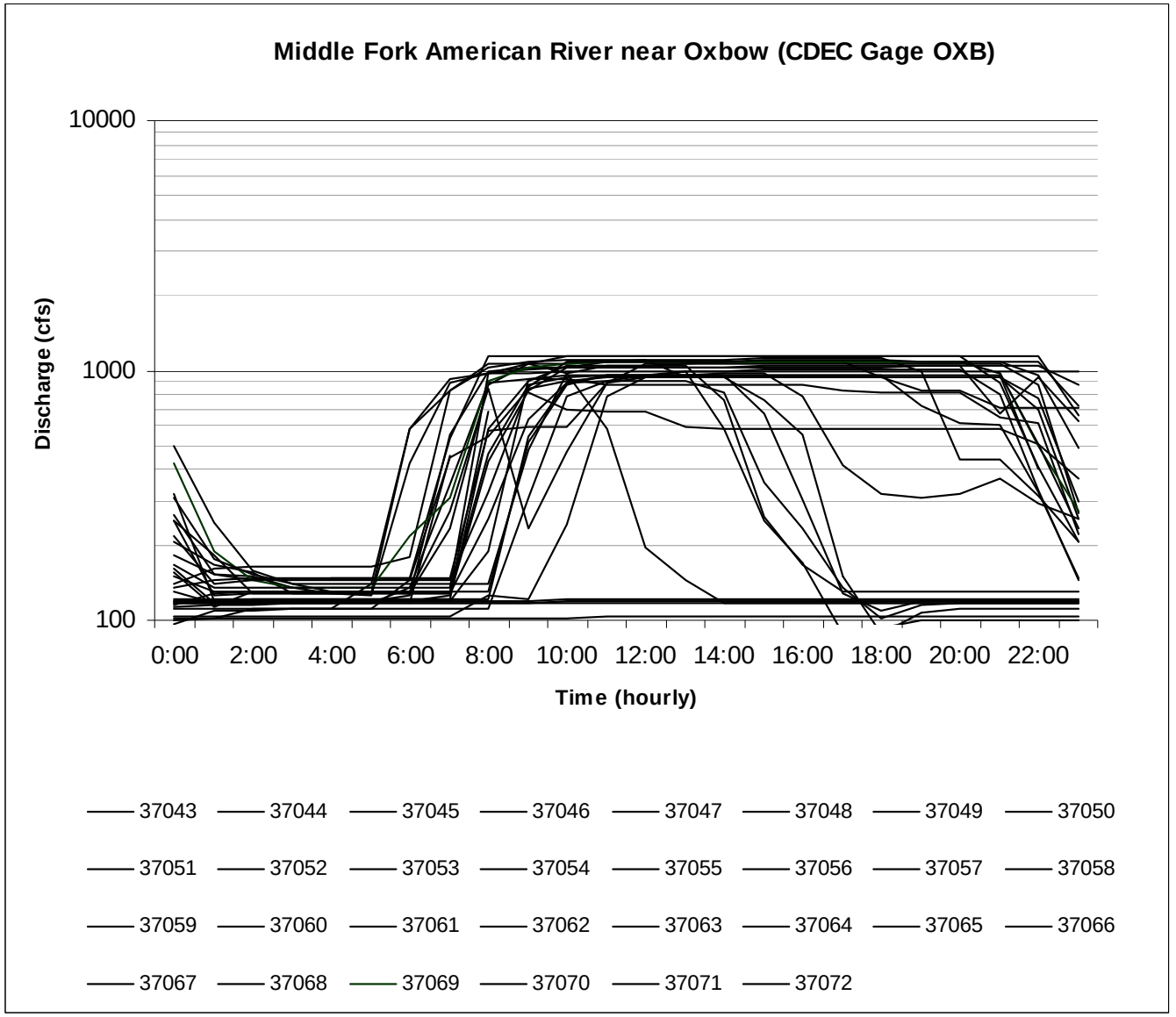
Middle Fork American River near Oxbow (CDEC Gage OXB)
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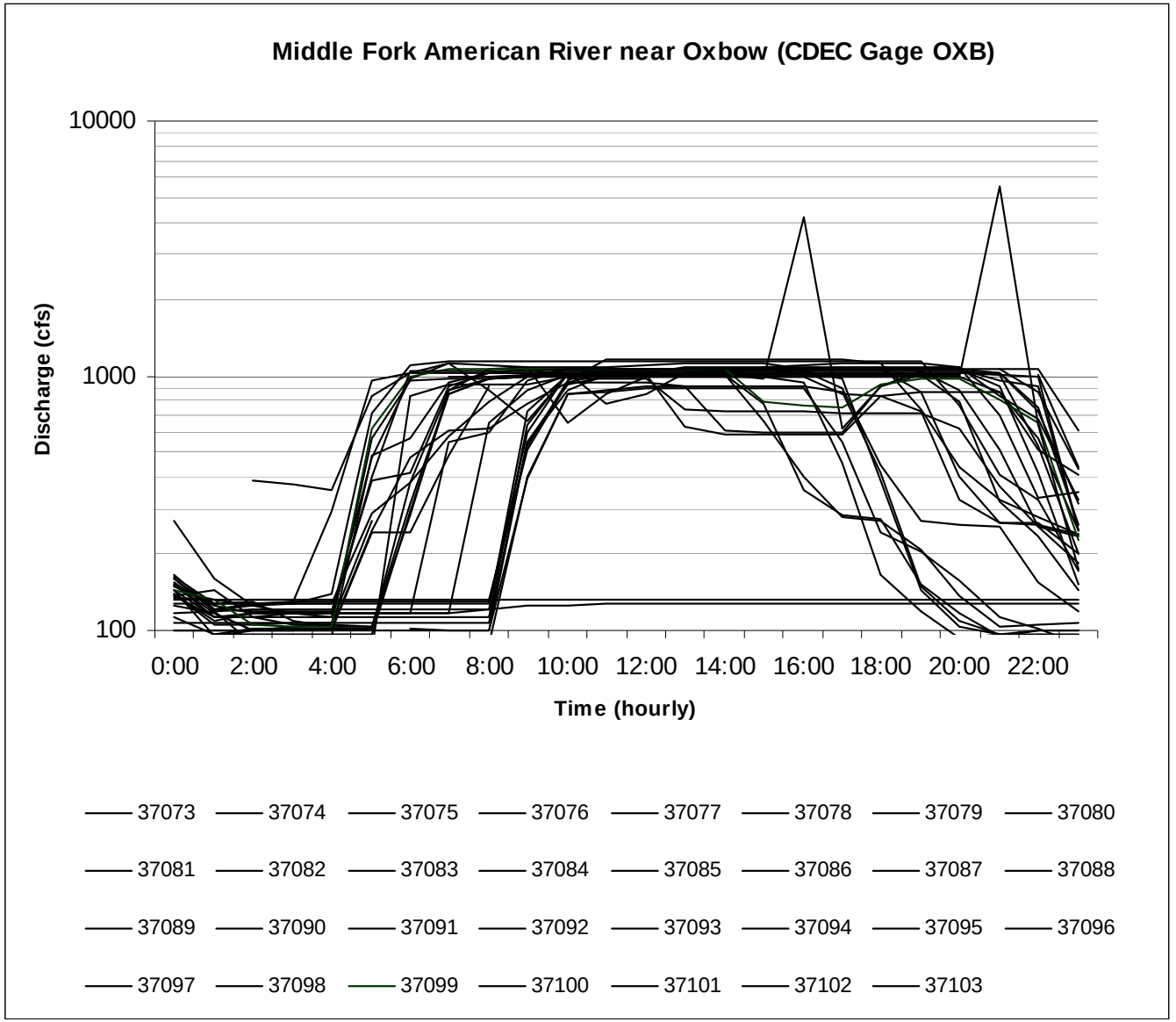
Middle Fork American River near Oxbow (CDEC Gage OXB)
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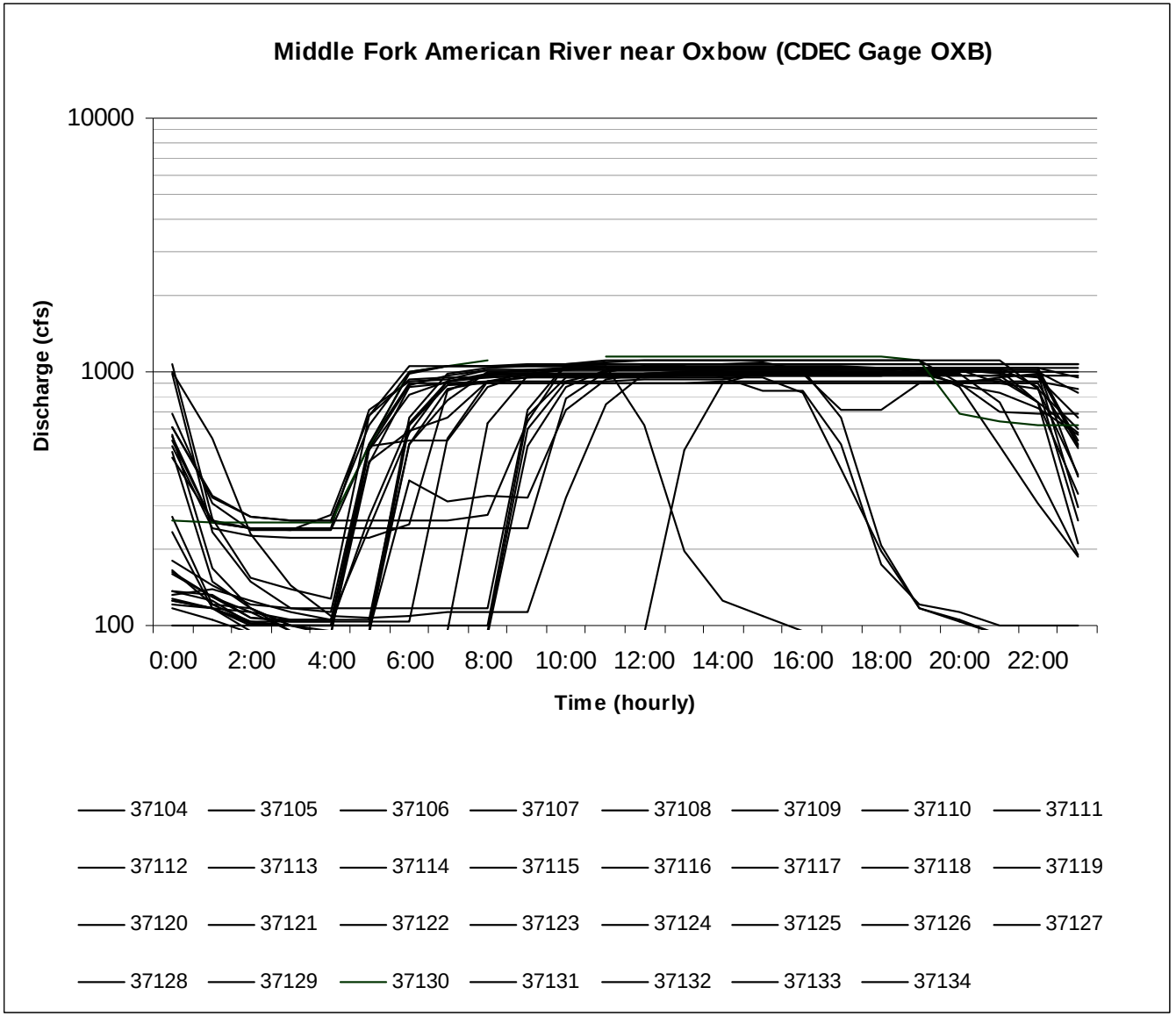
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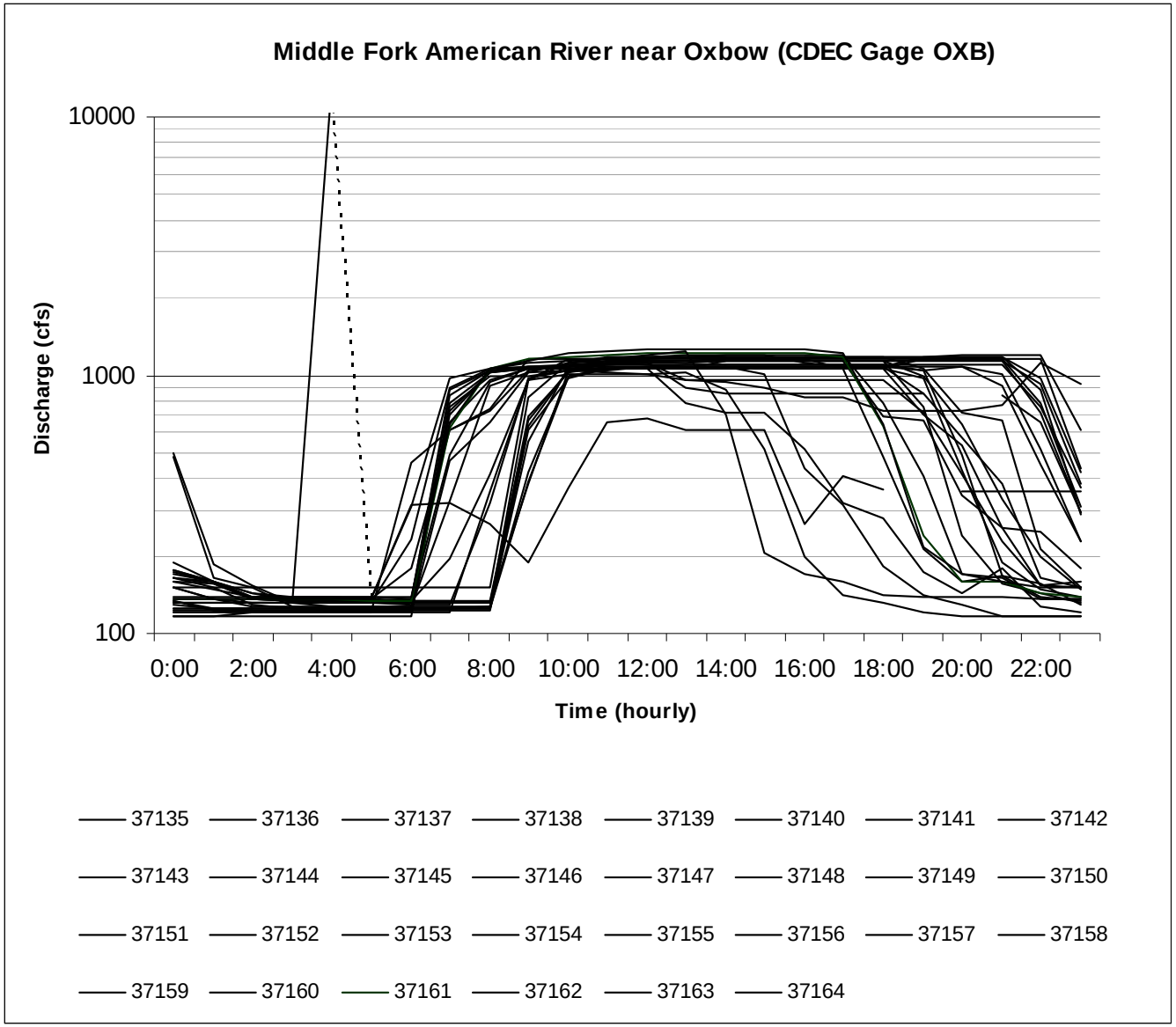
Middle Fork American River near Oxbow (CDEC Gage OXB)
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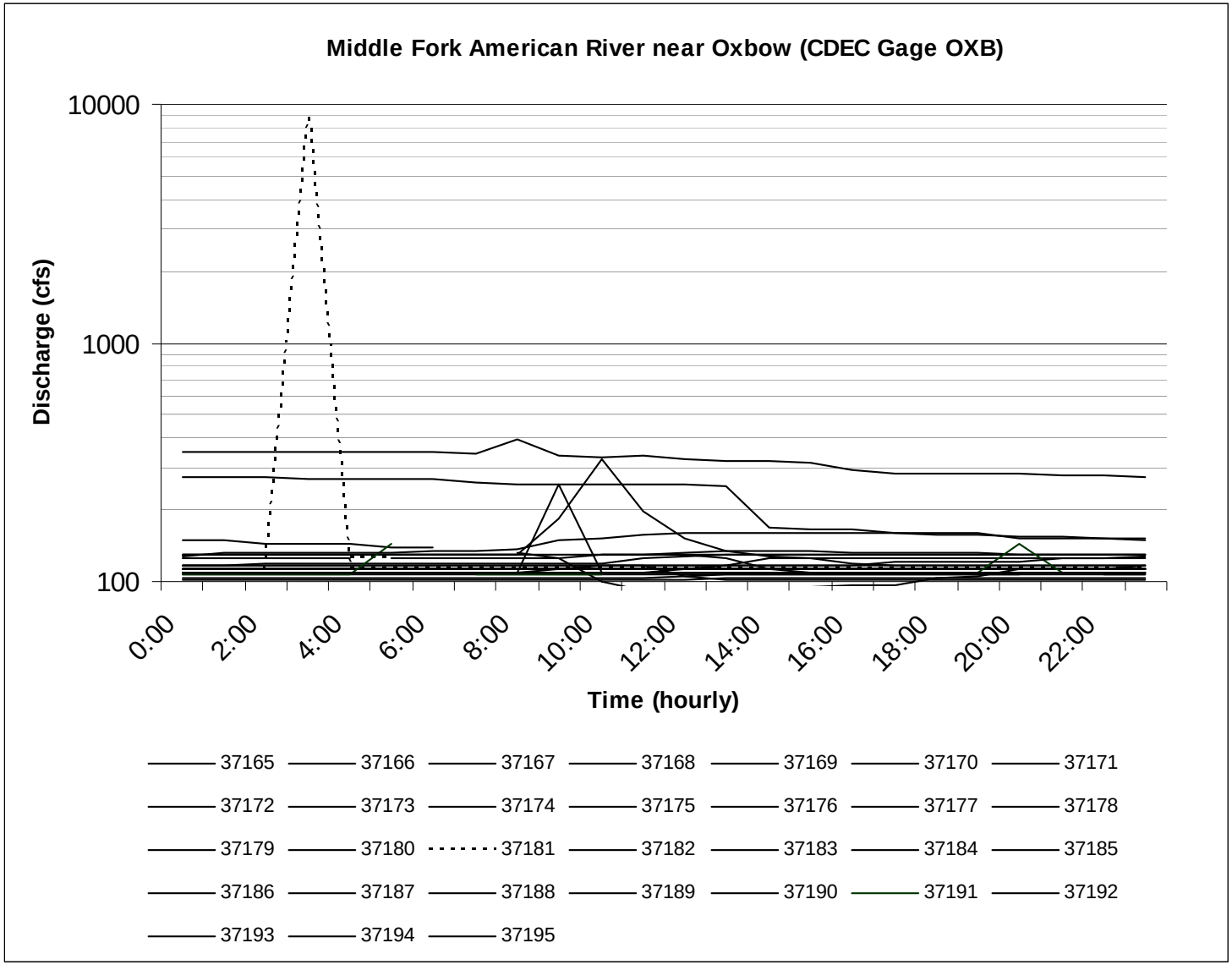
Middle Fork American River near Oxbow (CDEC Gage OXB)
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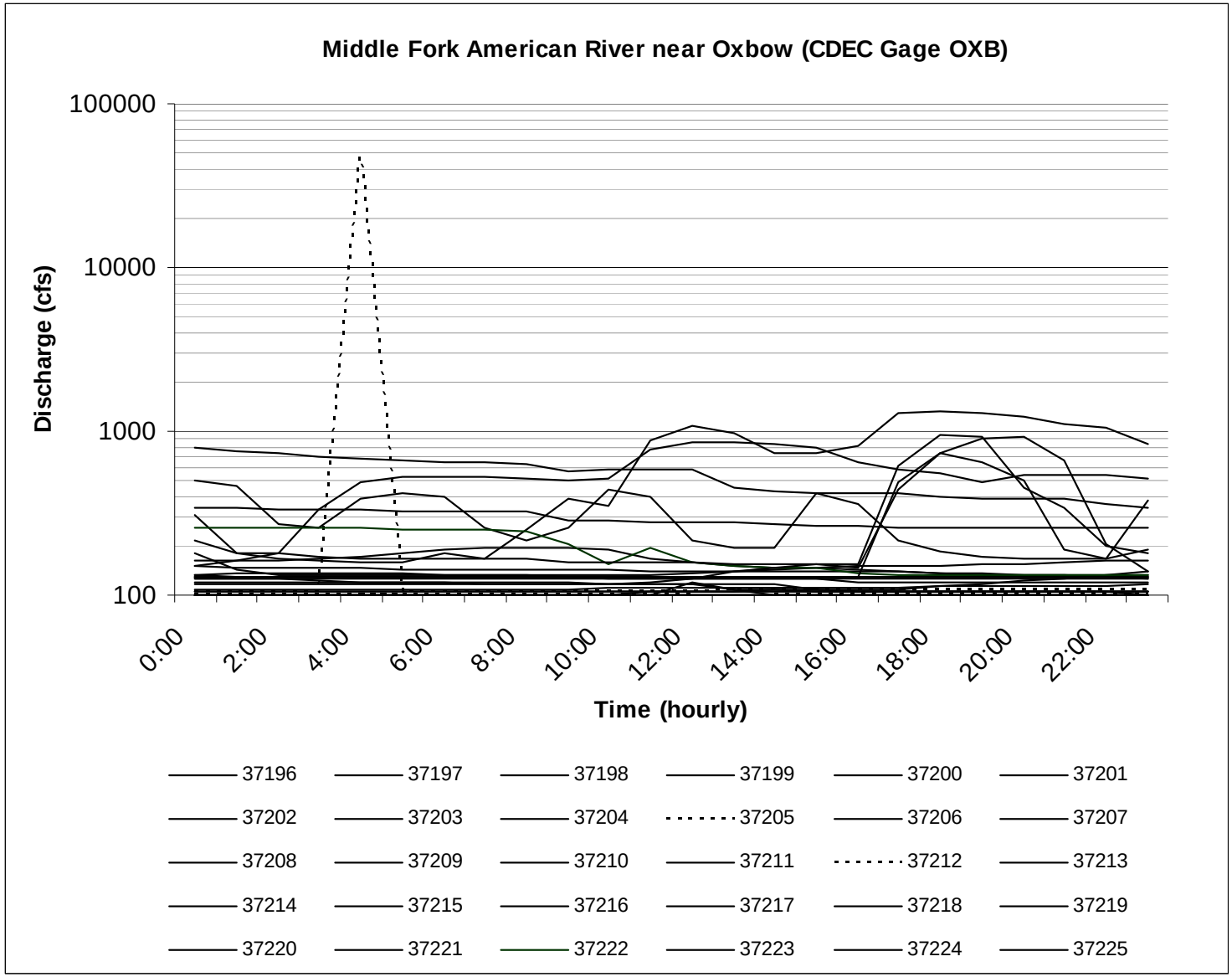
Middle Fork American River near Oxbow (CDEC Gage OXB)
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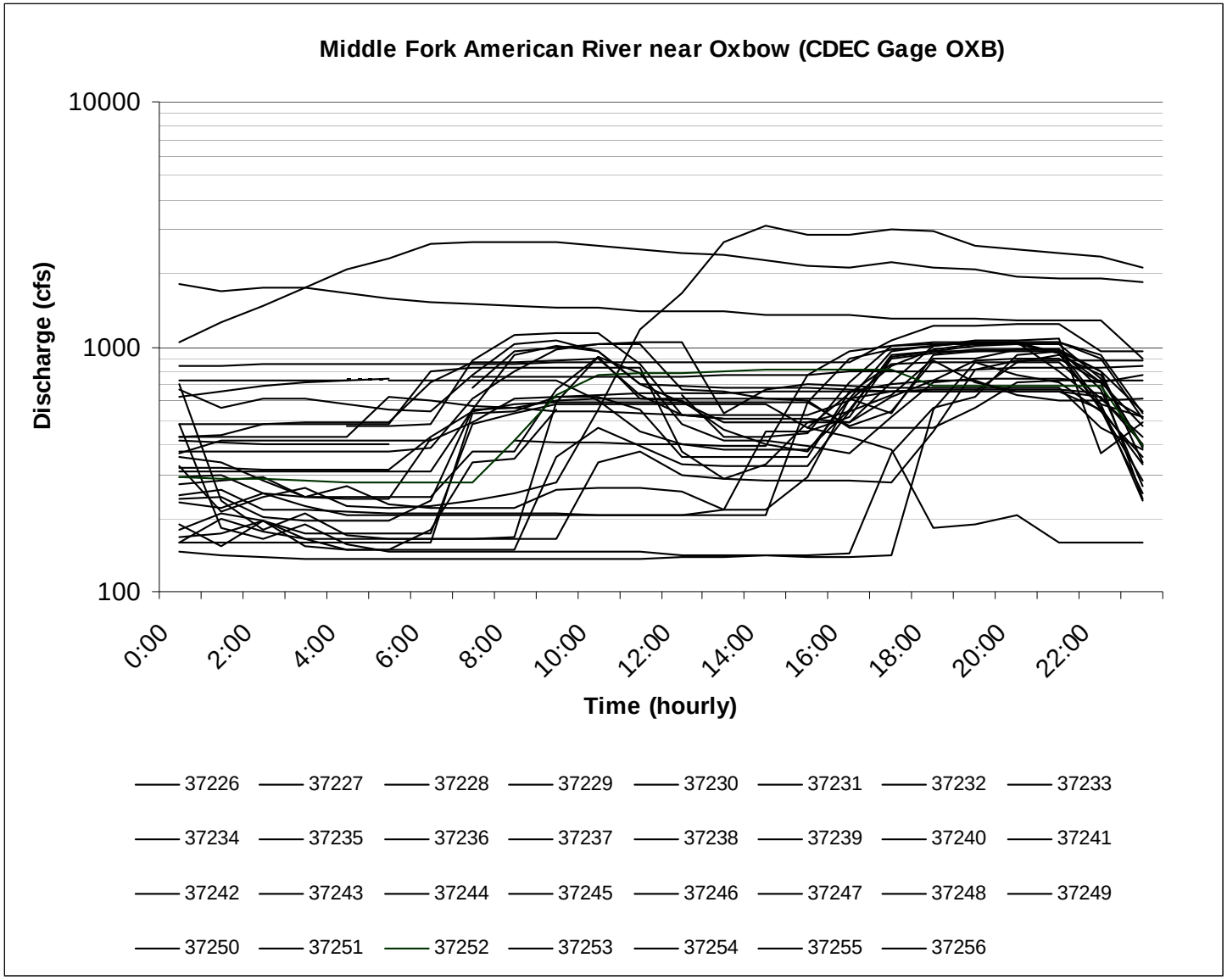
Middle Fork American River near Oxbow (CDEC Gage OXB)
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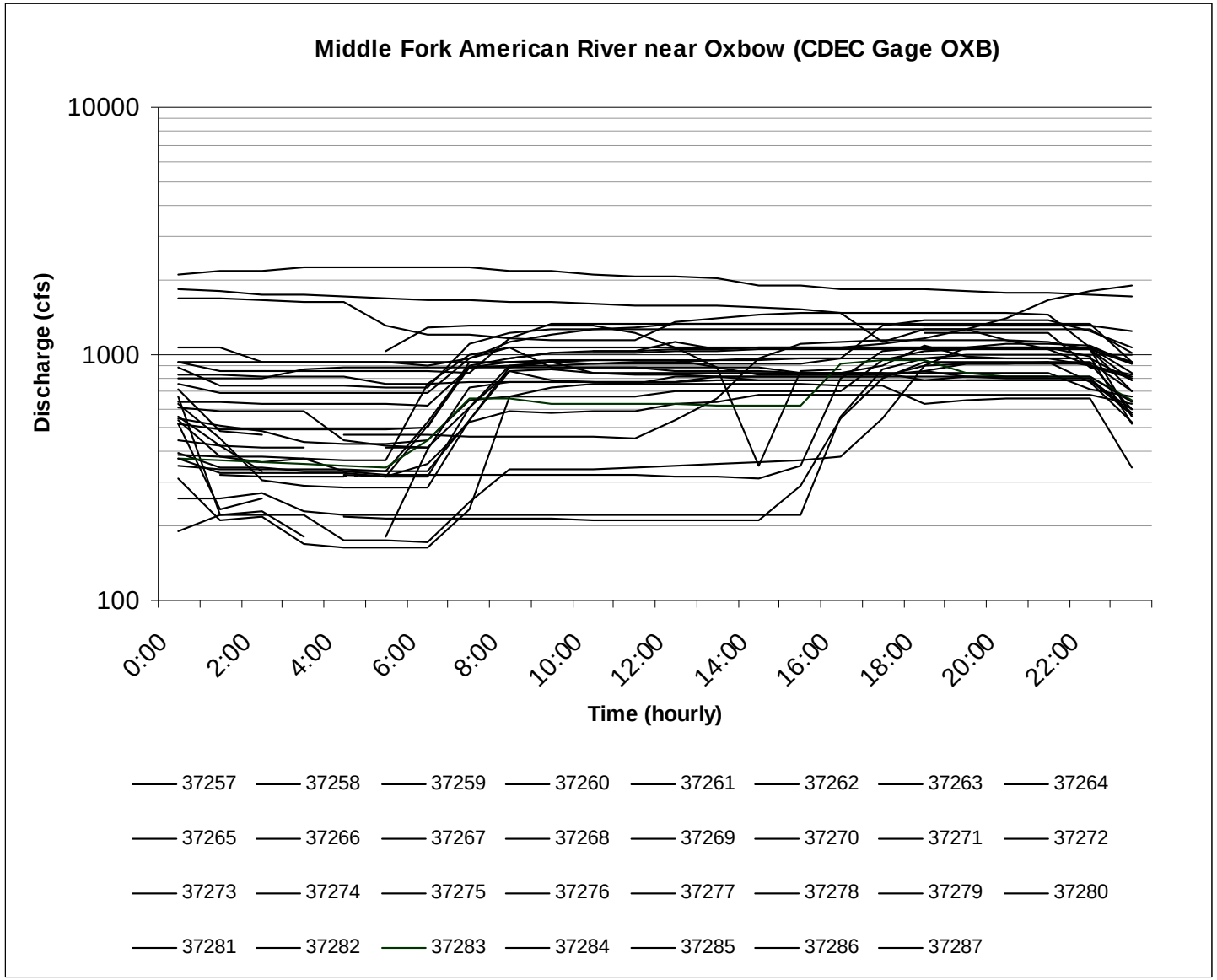
Middle Fork American River near Oxbow (CDEC Gage OXB)
10000
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Discharge (cfs)
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12:00
14:00
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22:00
Time (hourly)
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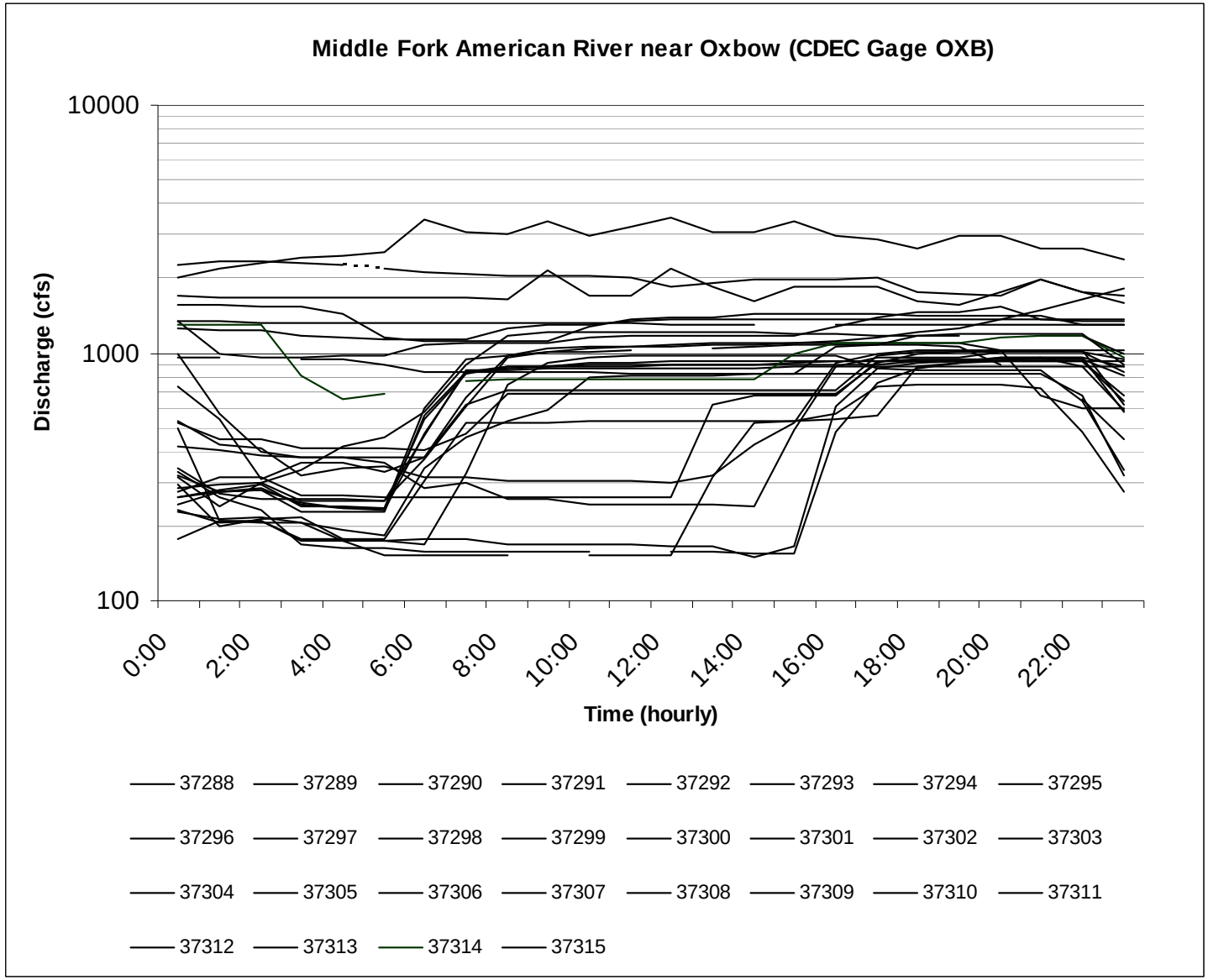
Middle Fork American River near Oxbow (CDEC Gage OXB)
Discharge (cfs)
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Time (hourly)
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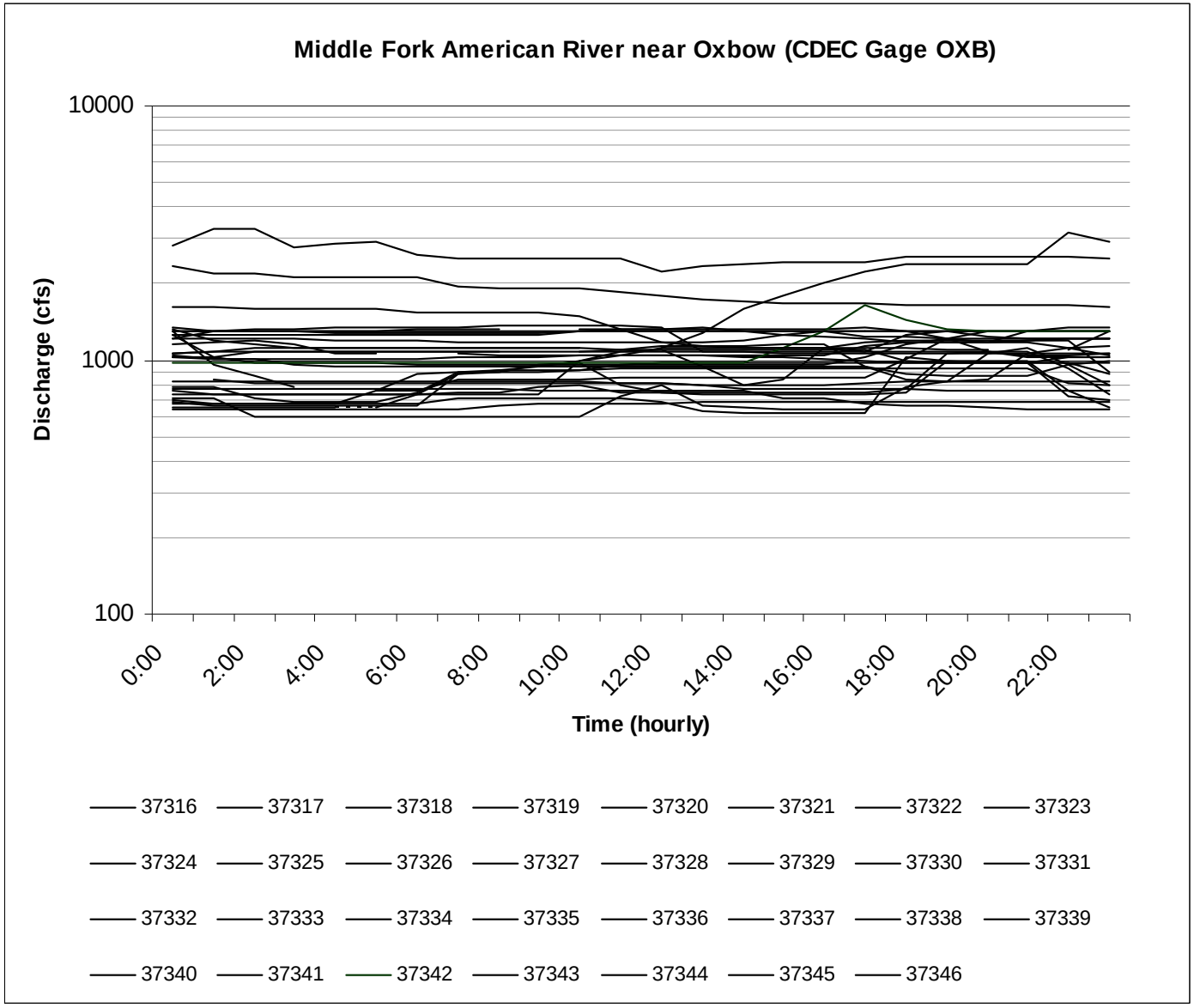

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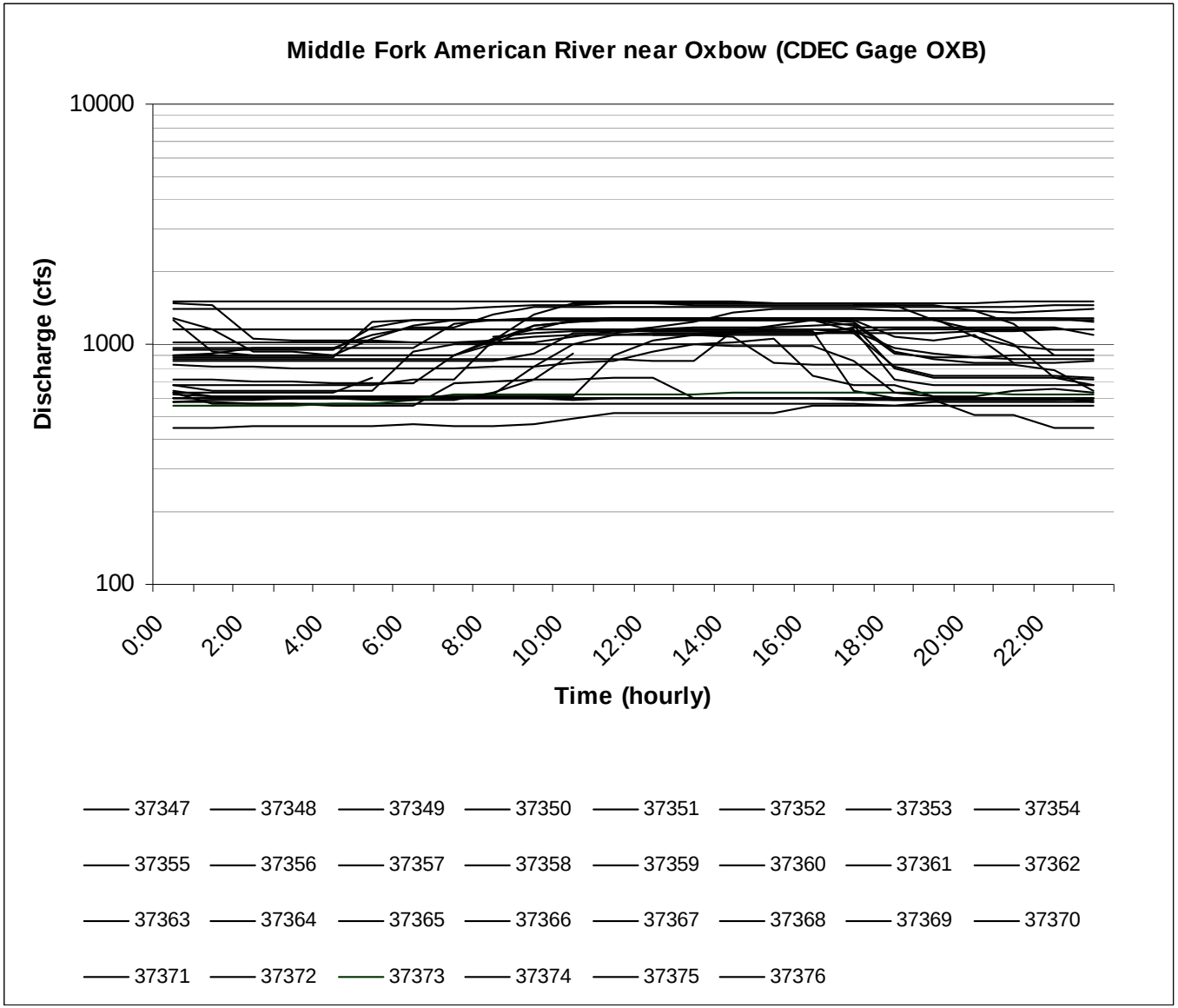
Middle Fork American River near Oxbow (CDEC Gage OXB)
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Discharge (cfs)
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Time (hourly)
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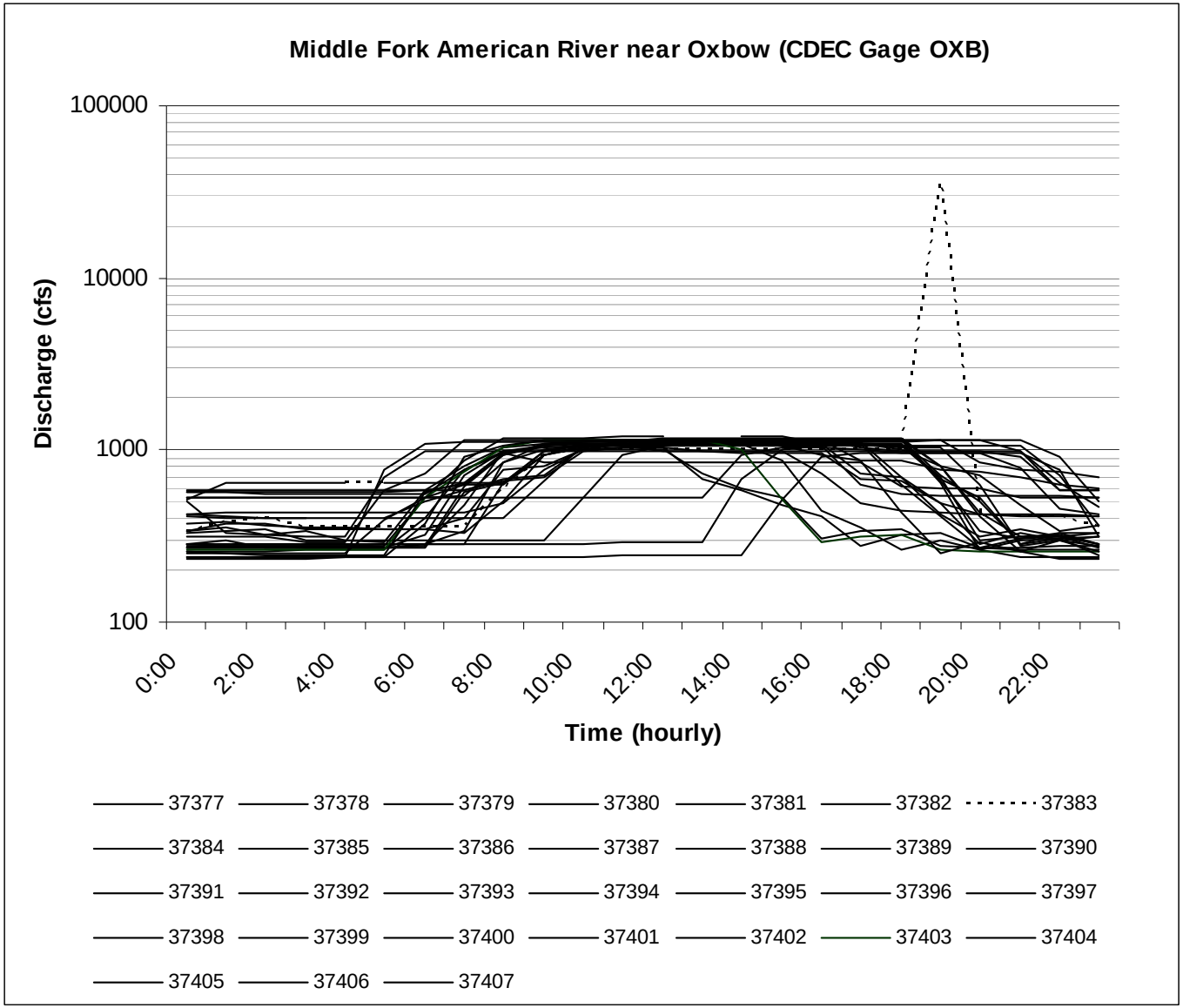
Middle Fork American River near Oxbow (CDEC Gage OXB)
Discharge (cfs)
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Time (hourly)
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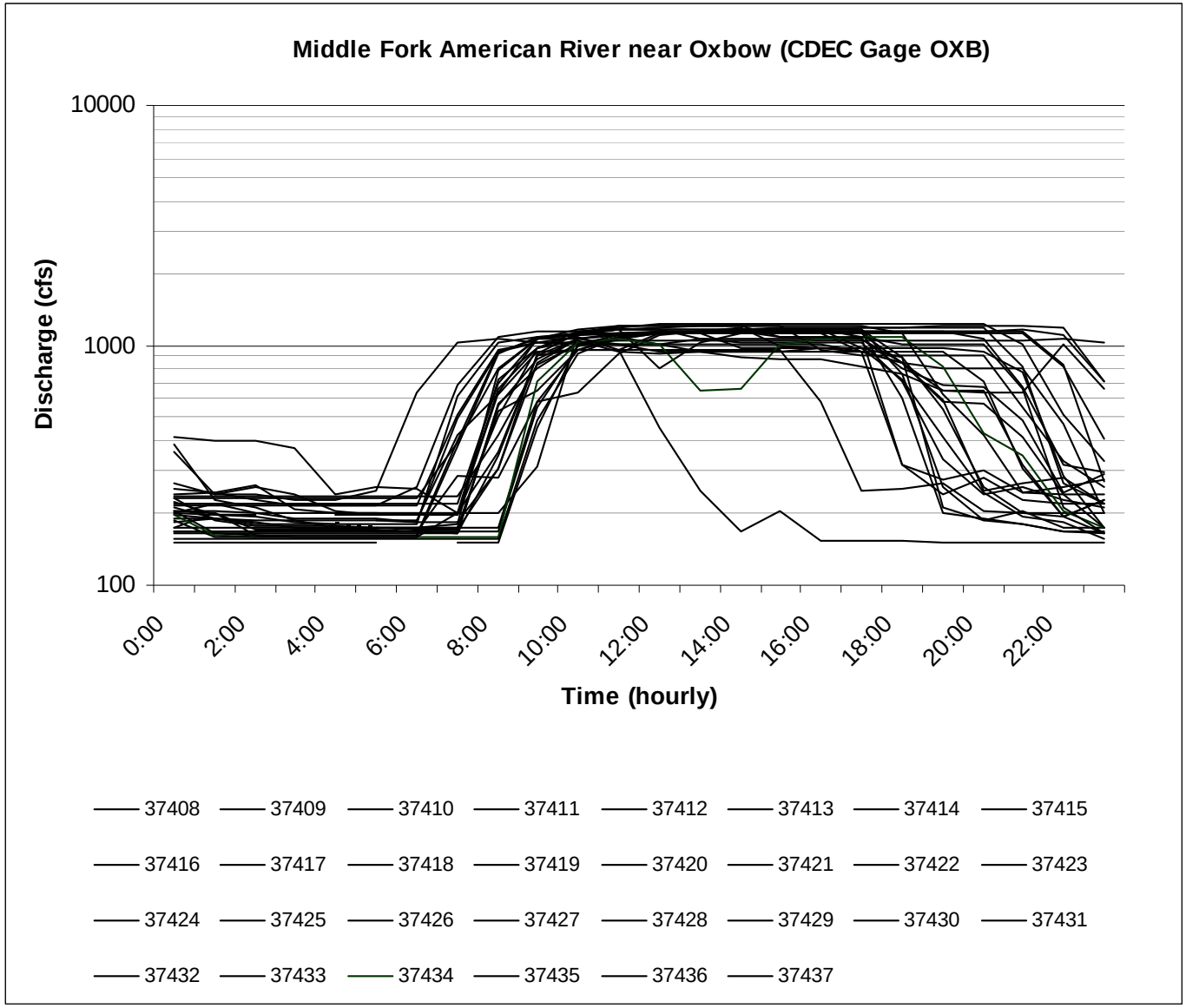
Middle Fork American River near Oxbow (CDEC Gage OXB)
Discharge (cfs)
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Time (hourly)
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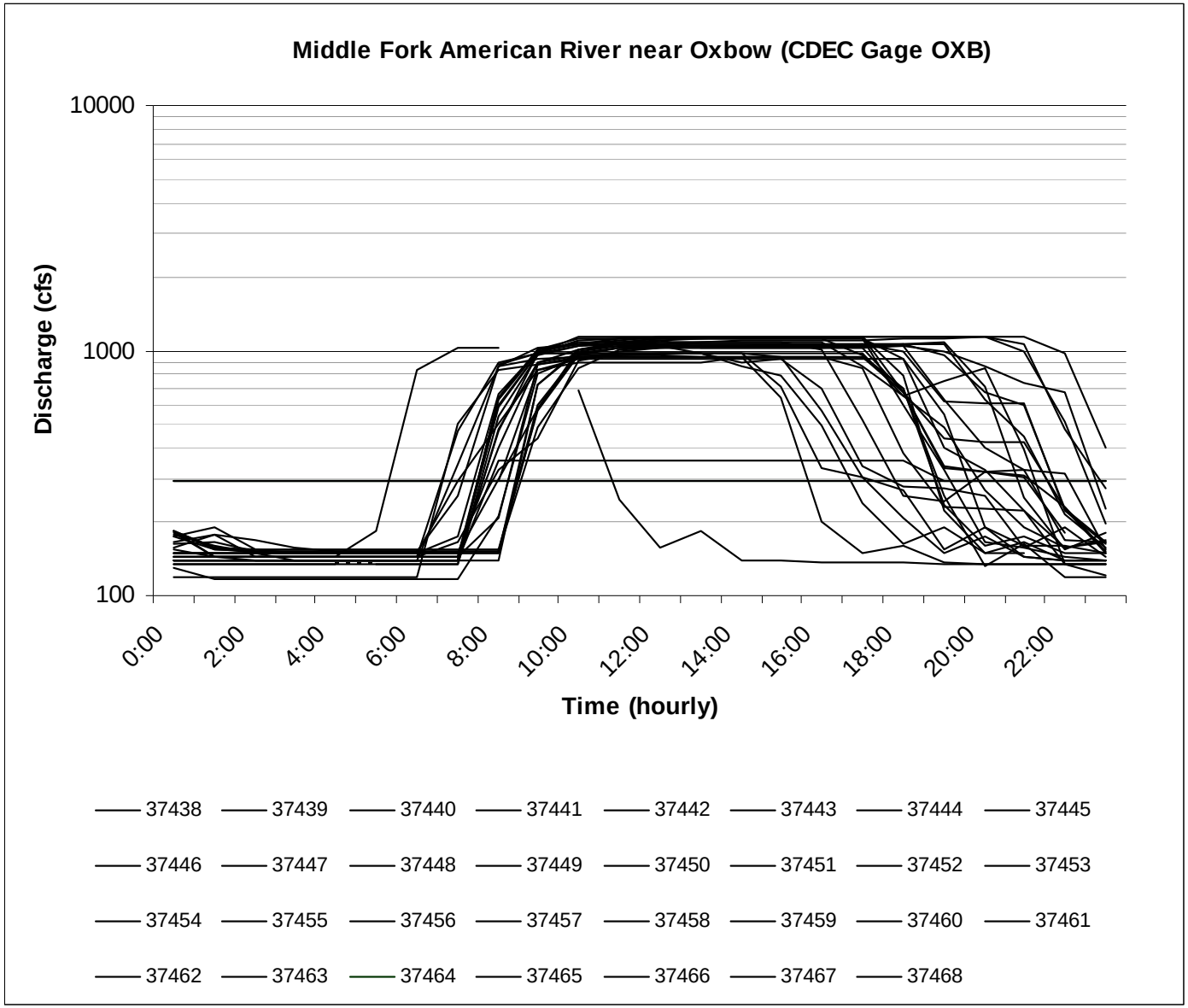
Middle Fork American River near Oxbow (CDEC Gage OXB)
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Time (hourly)
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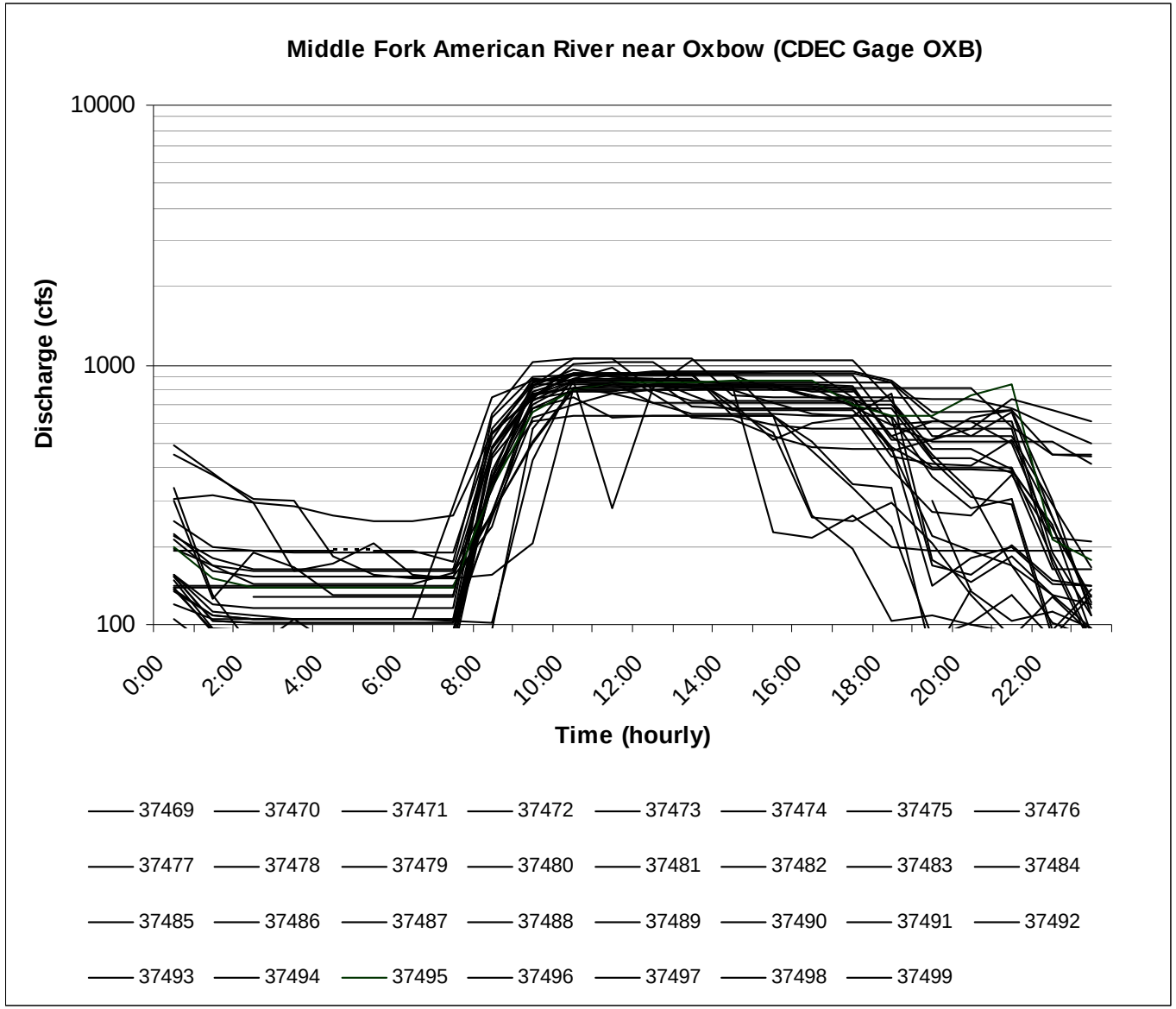
Middle Fork American River near Oxbow (CDEC Gage OXB)
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Discharge (cfs)
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Time (hourly)
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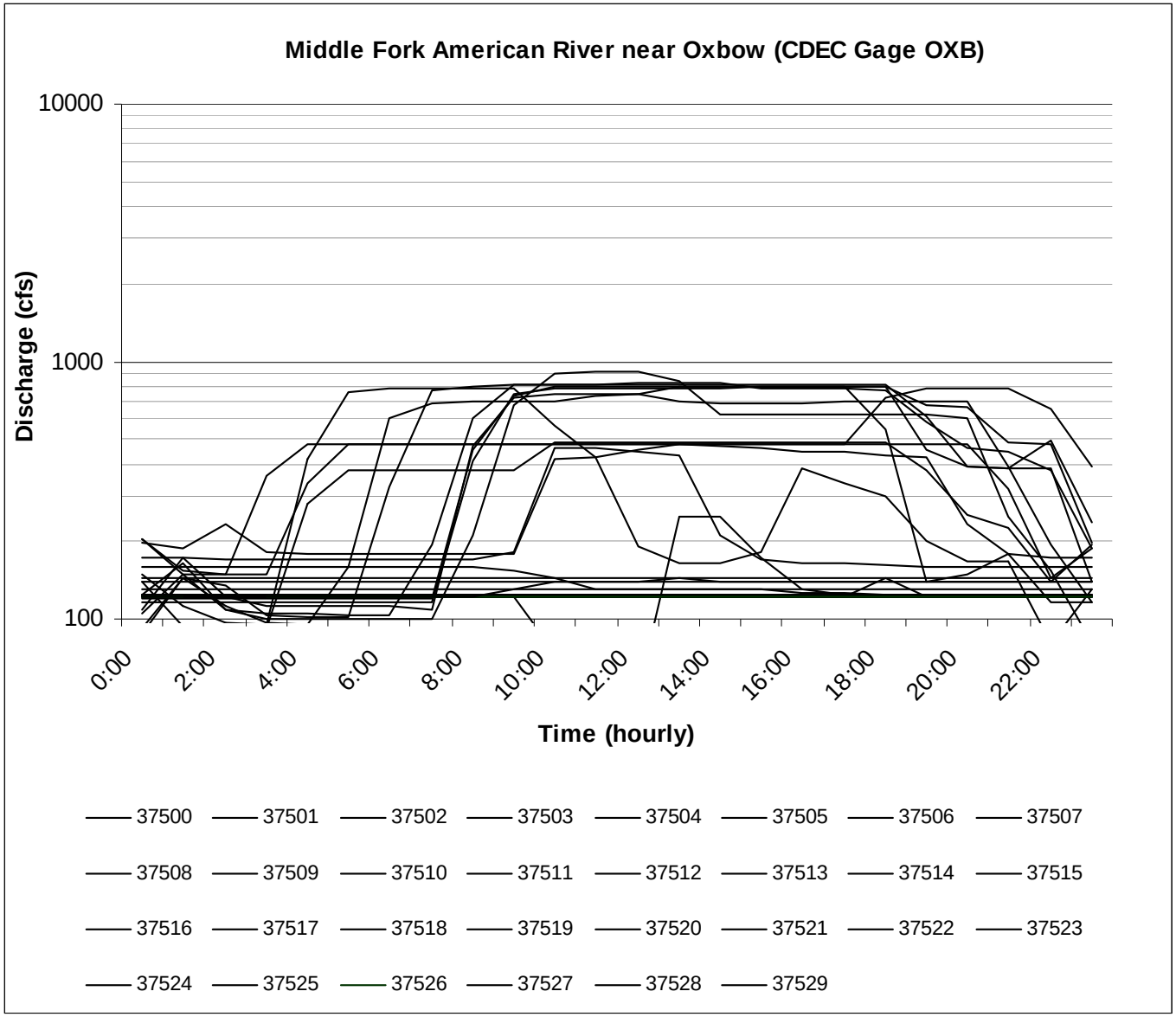
Middle Fork American River near Oxbow (CDEC Gage OXB)
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Discharge (cfs)
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Time (hourly)
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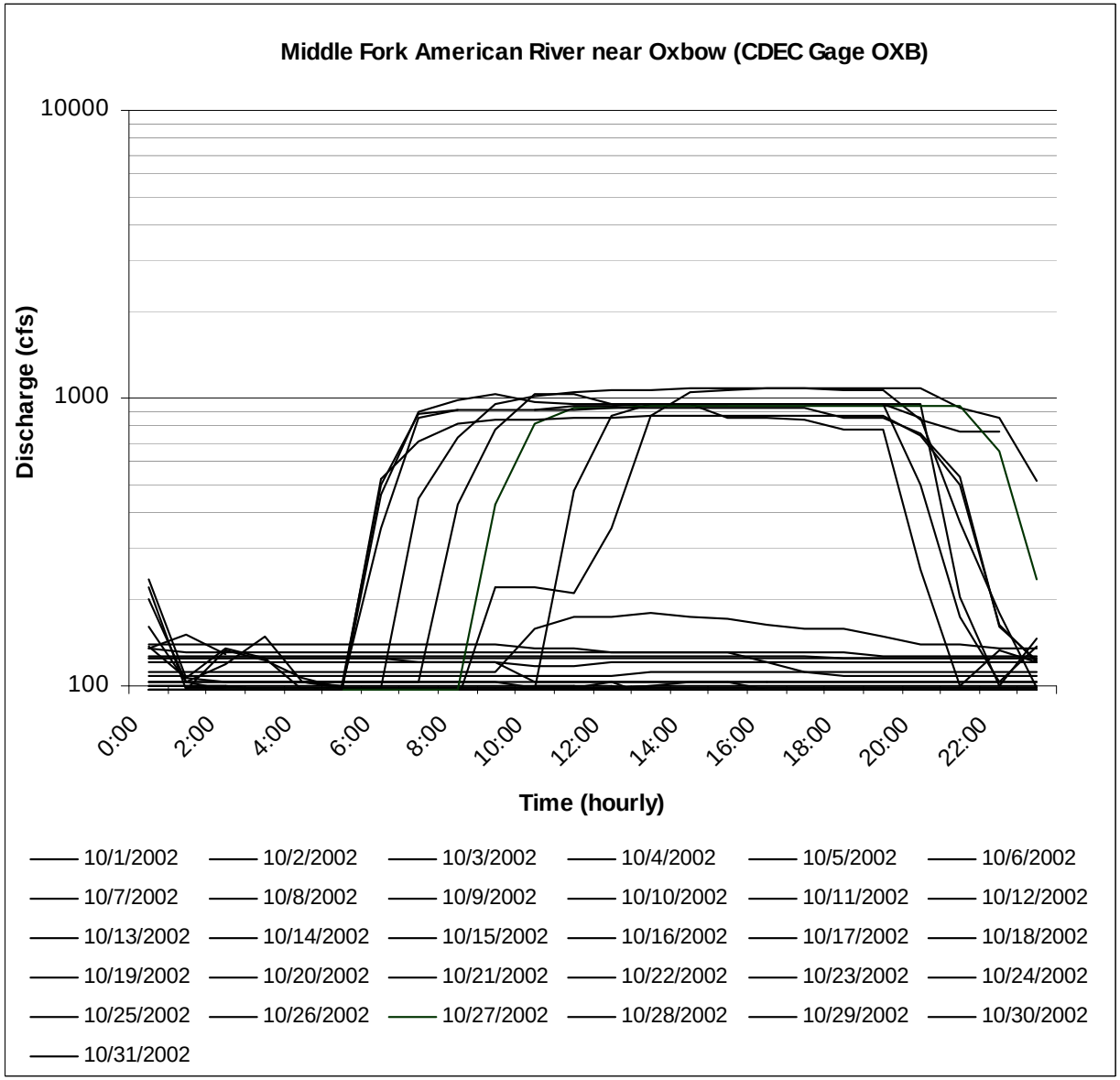

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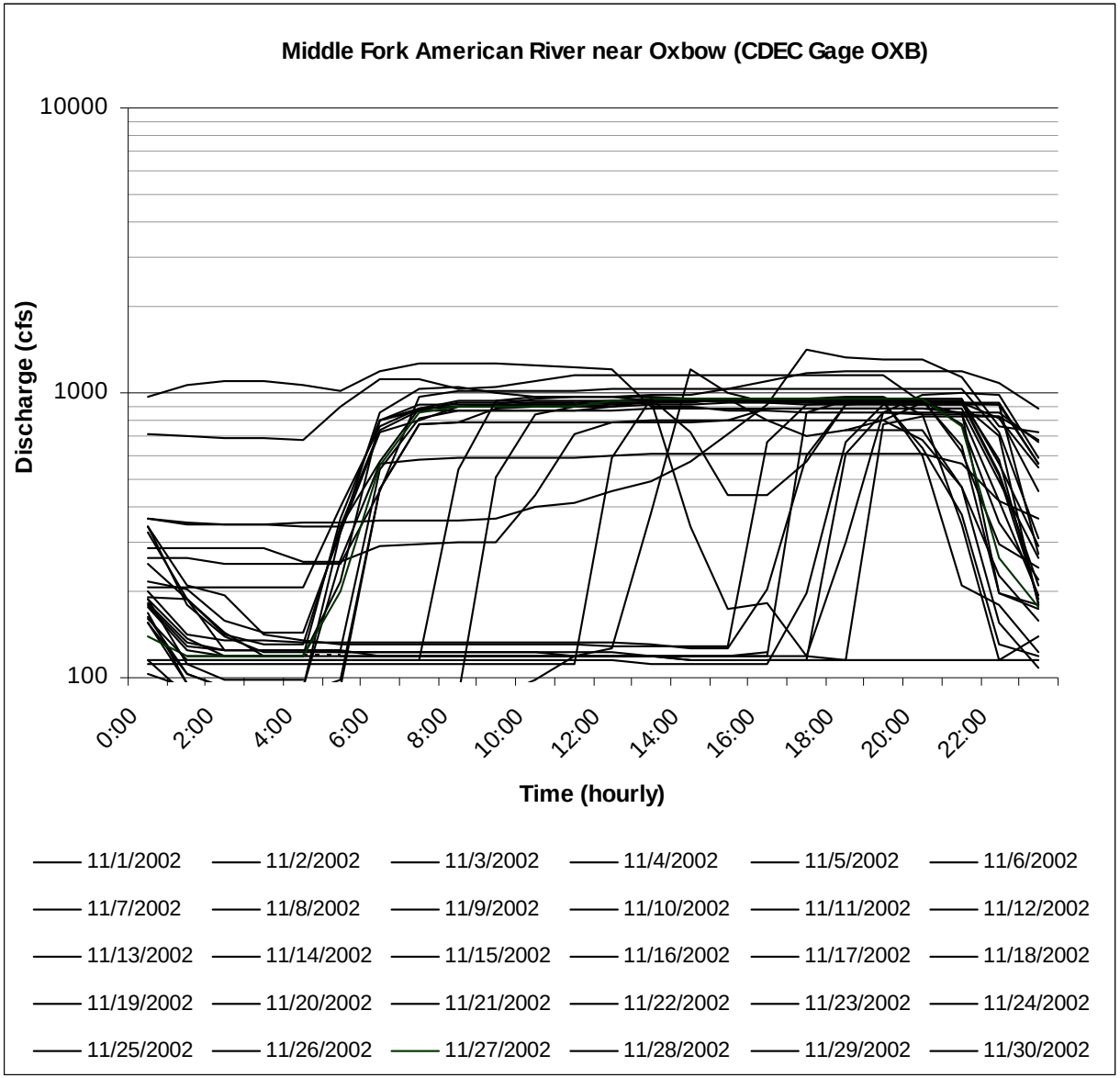

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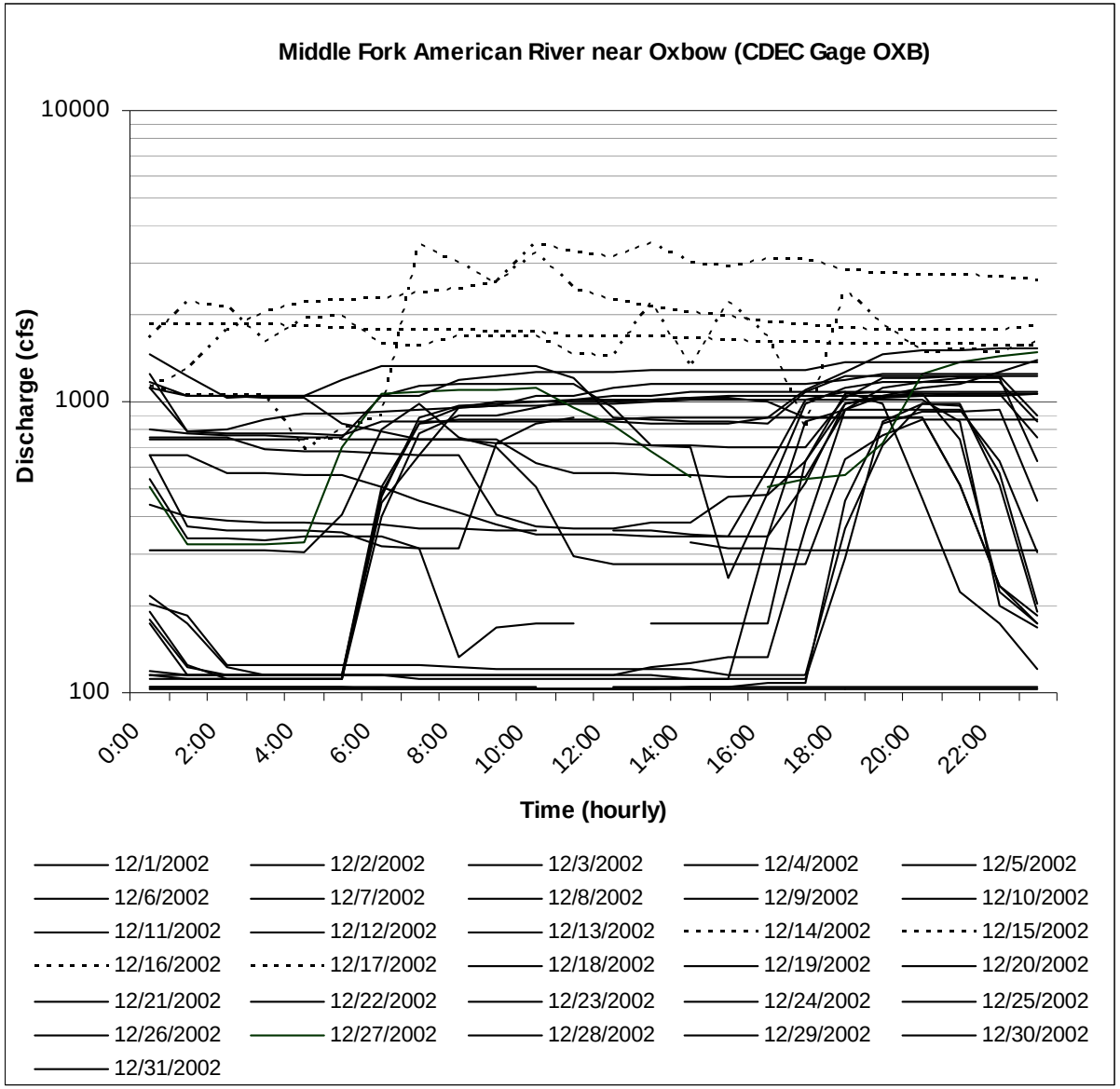

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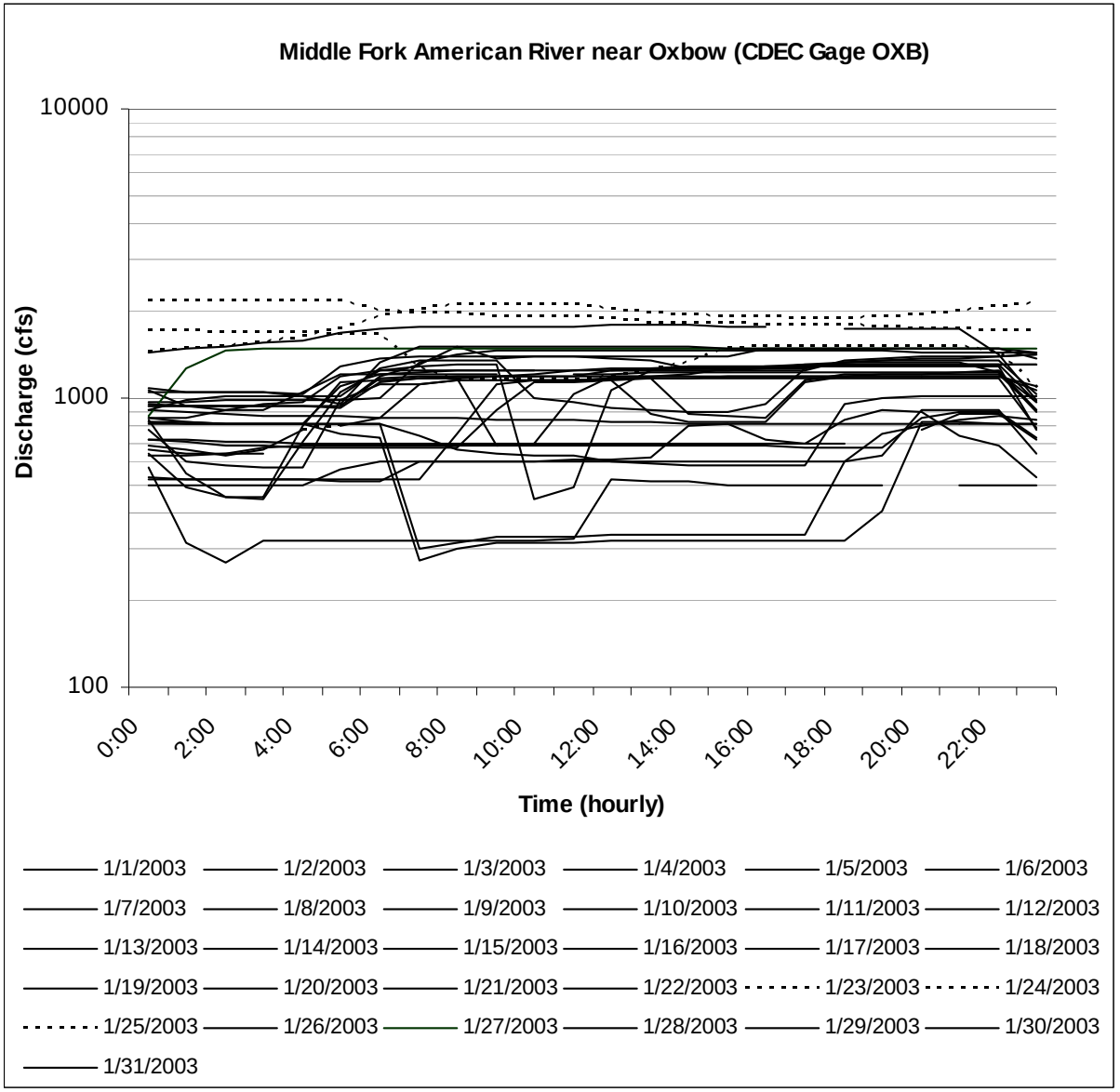

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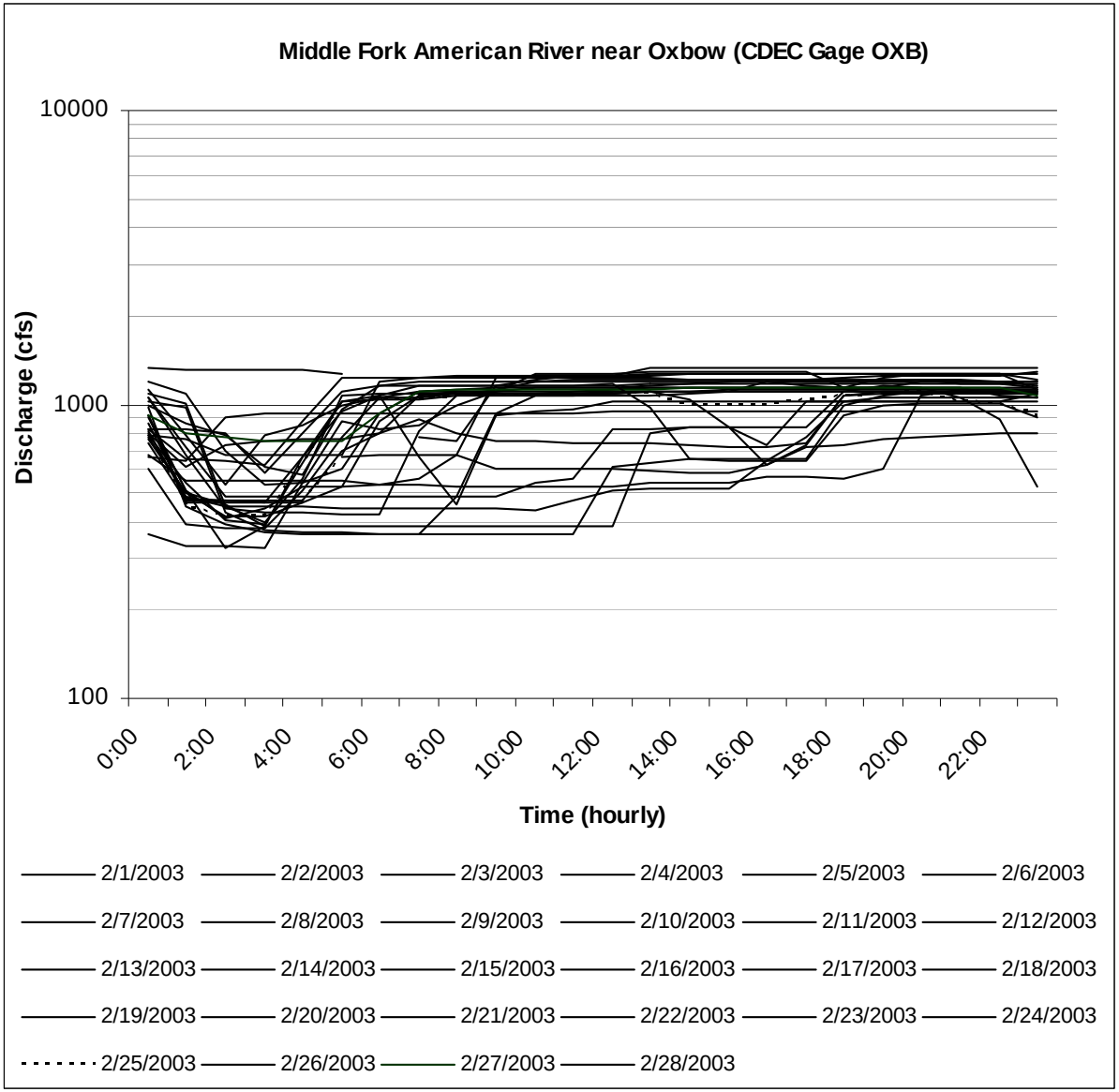

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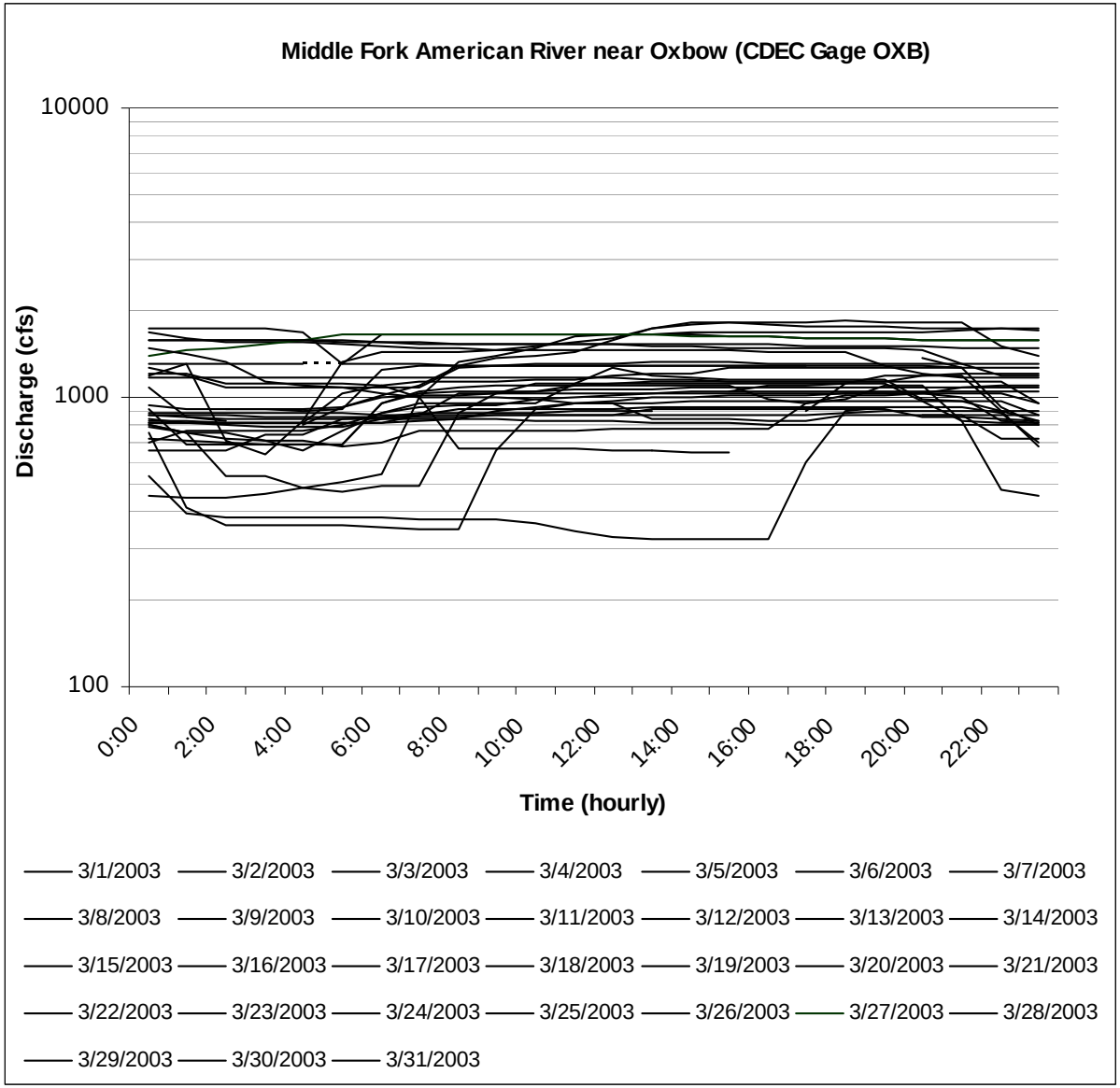

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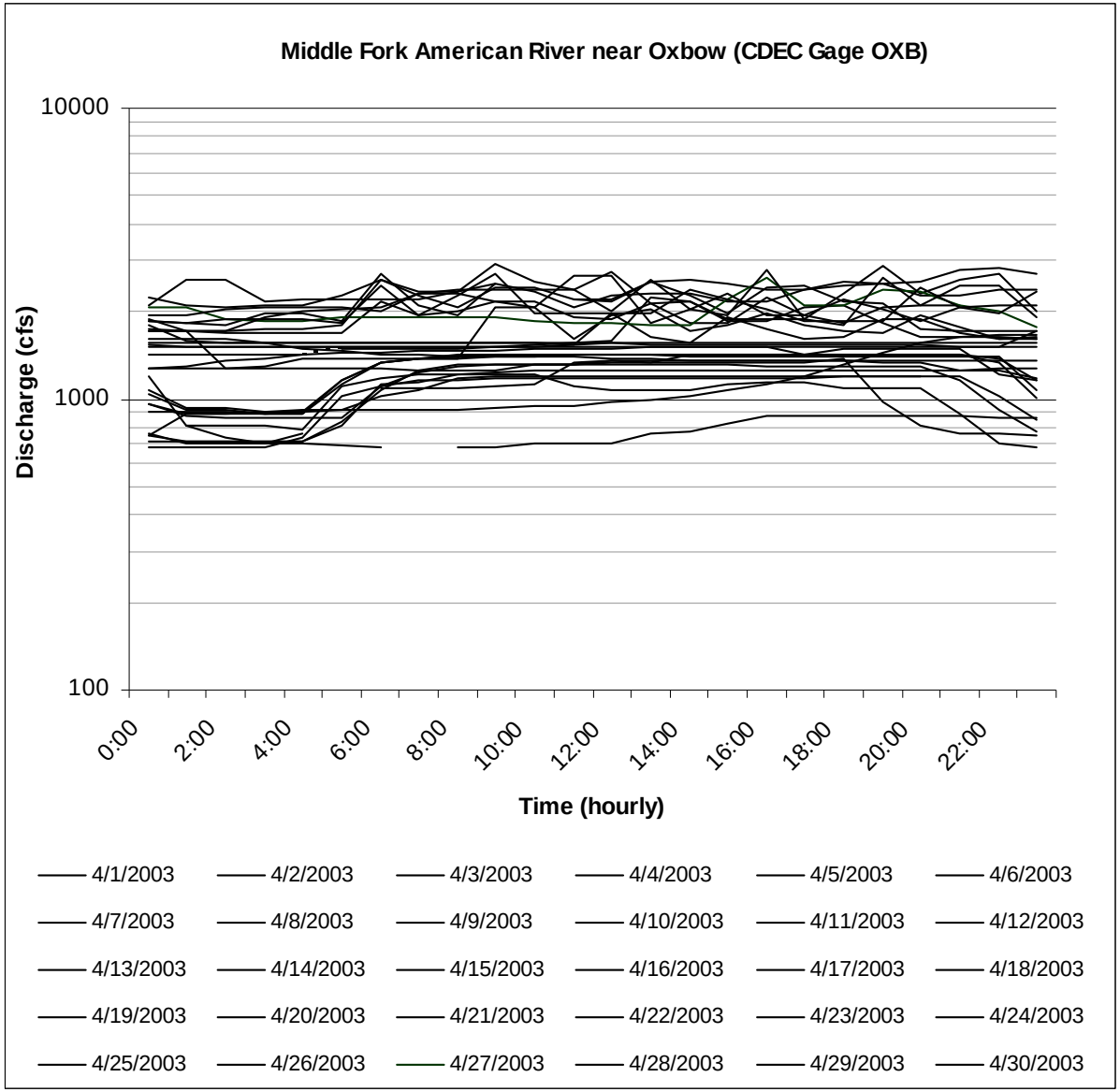
Middle Fork American River near Oxbow (CDEC Gage OXB)
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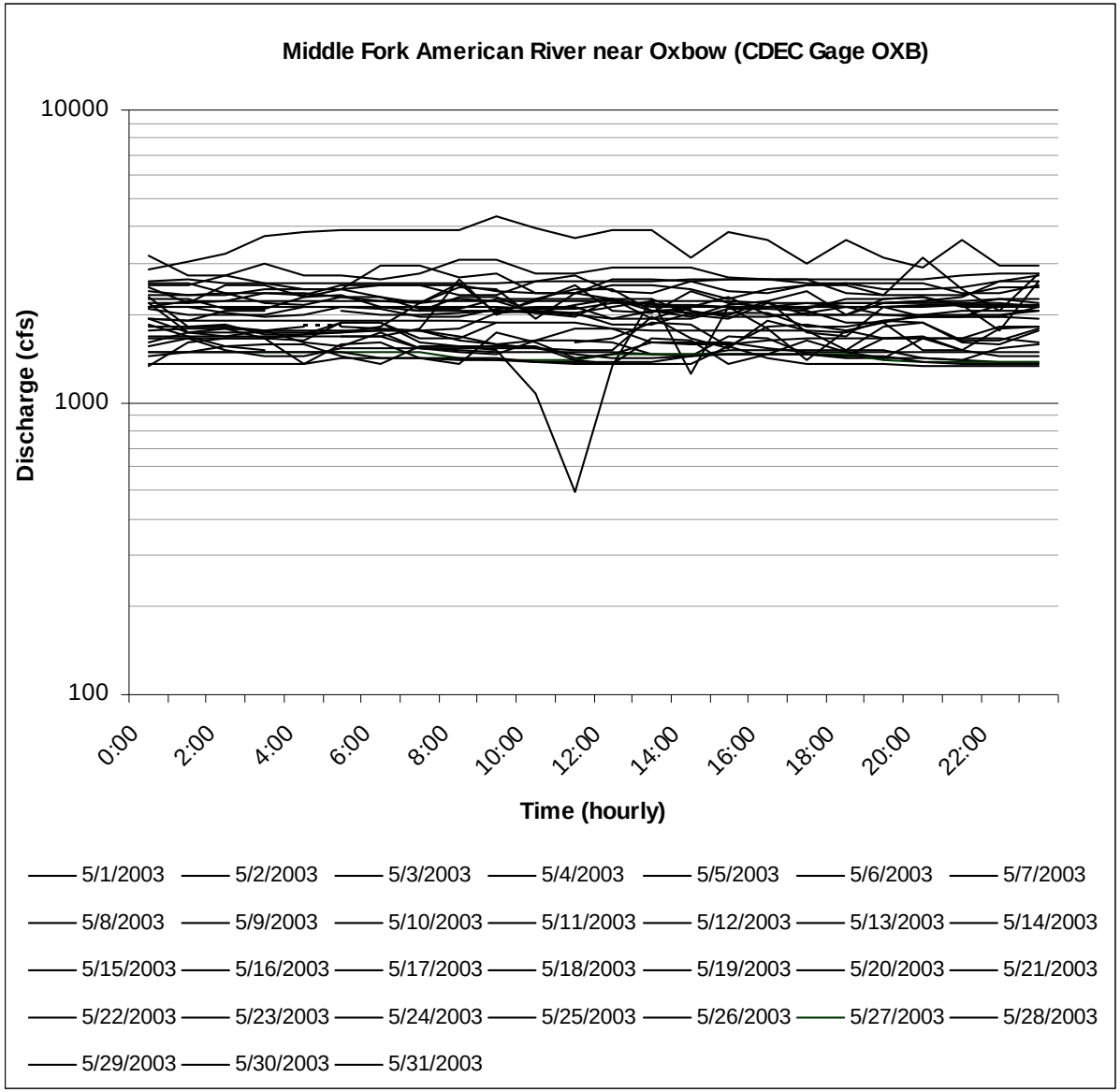
Middle Fork American River near Oxbow (CDEC Gage OXB)
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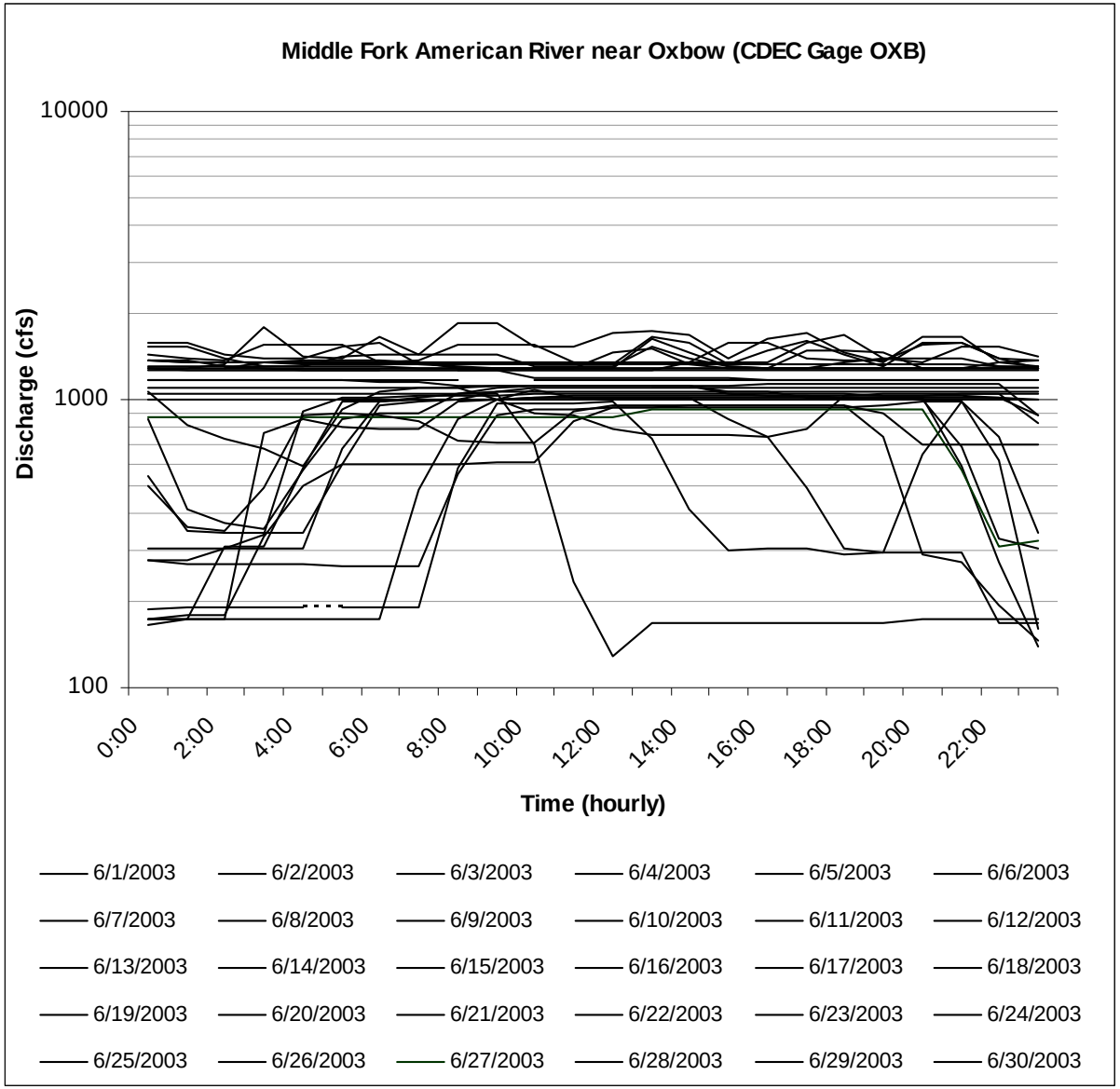
Middle Fork American River near Oxbow (CDEC Gage OXB)
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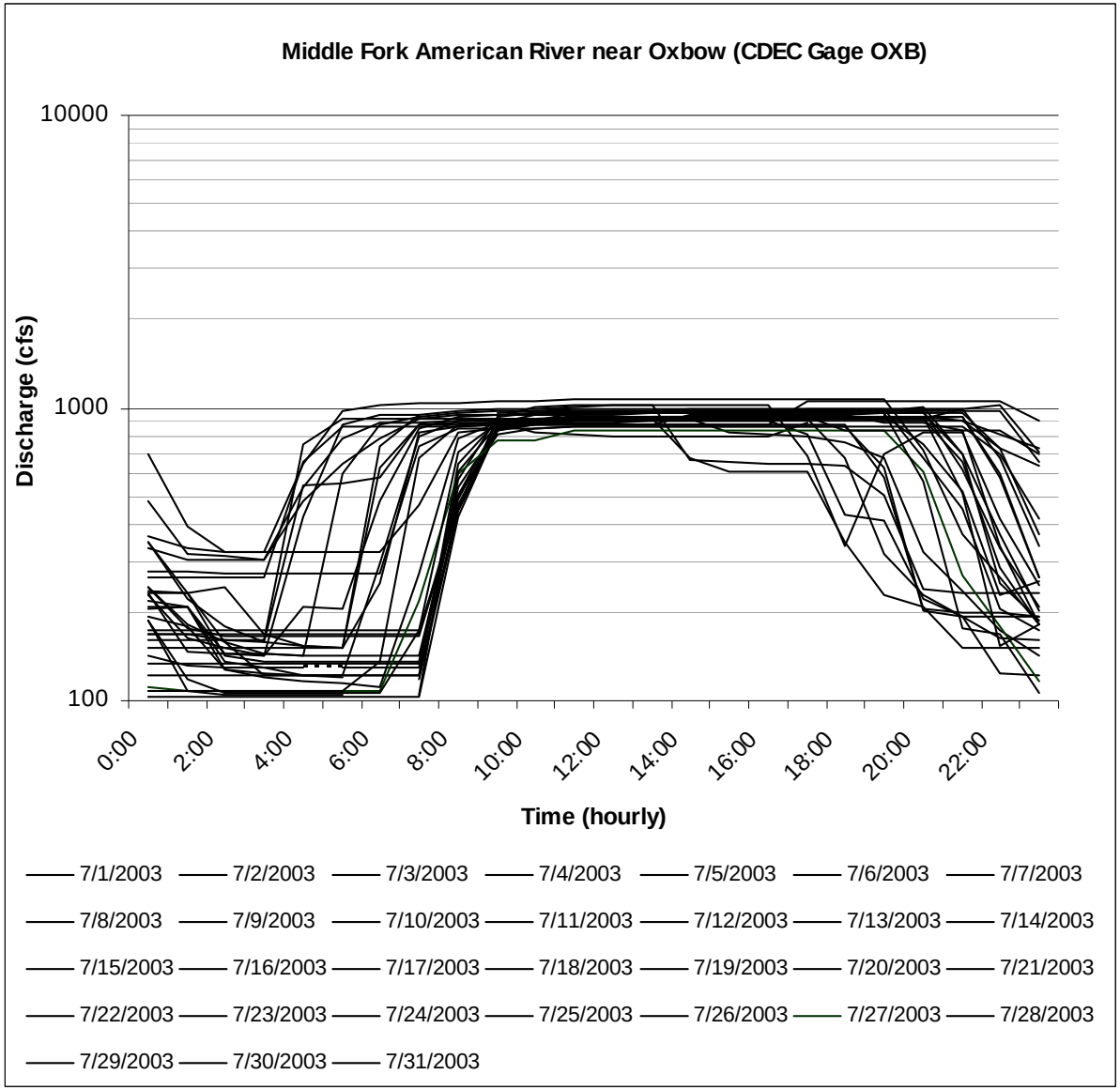

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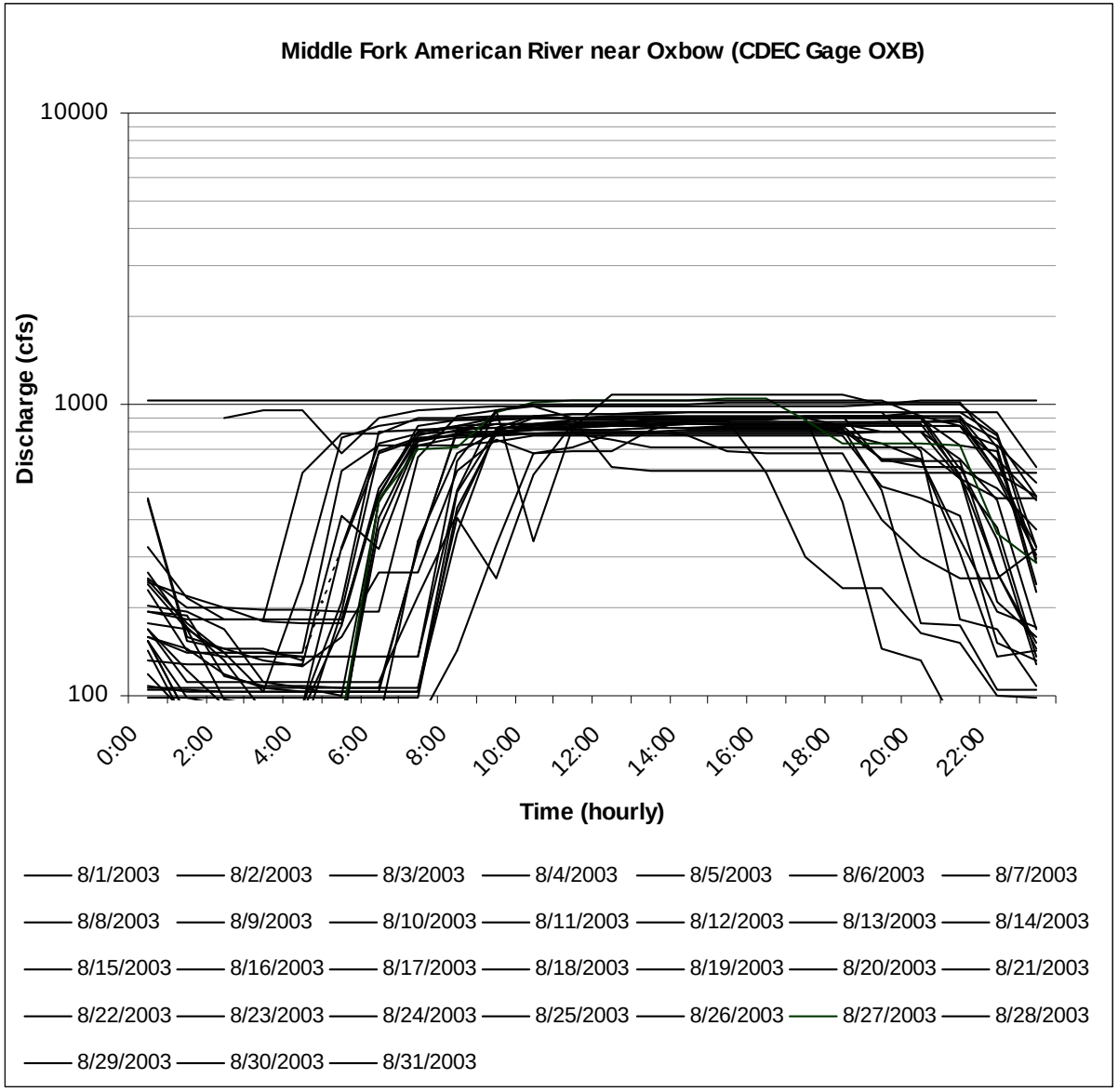
Middle Fork American River near Oxbow (CDEC Gage OXB)
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Time (hourly)
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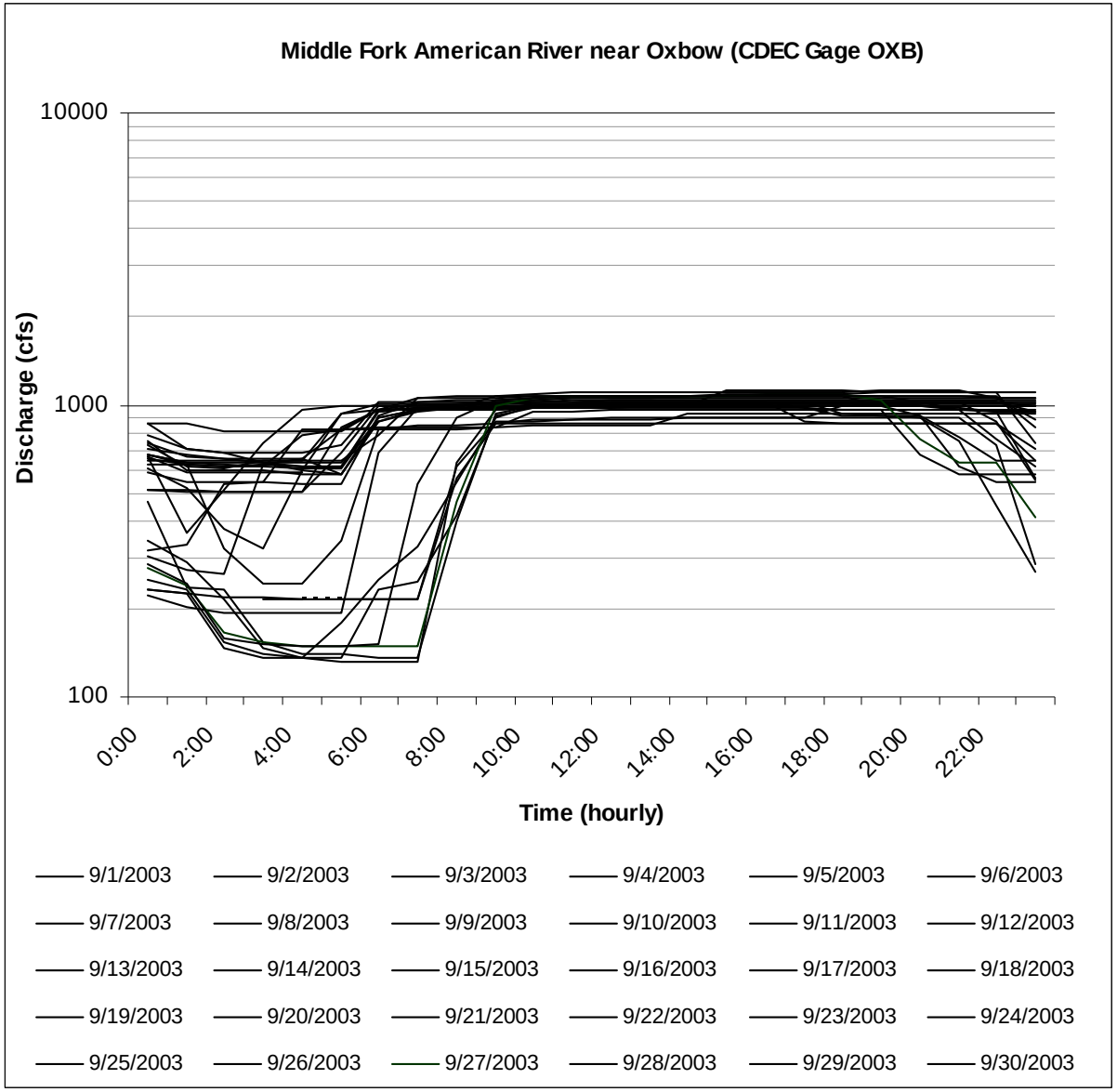

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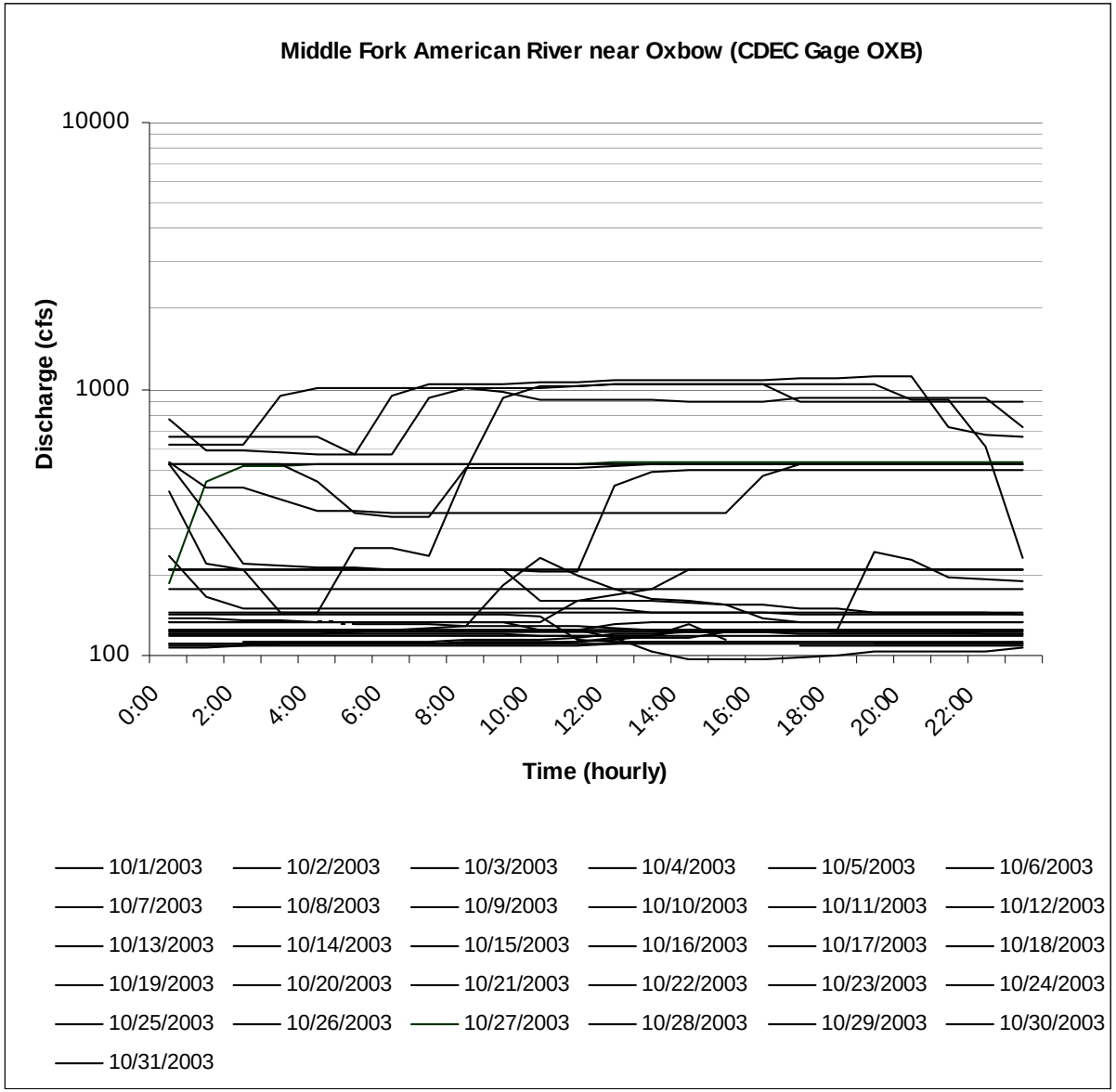

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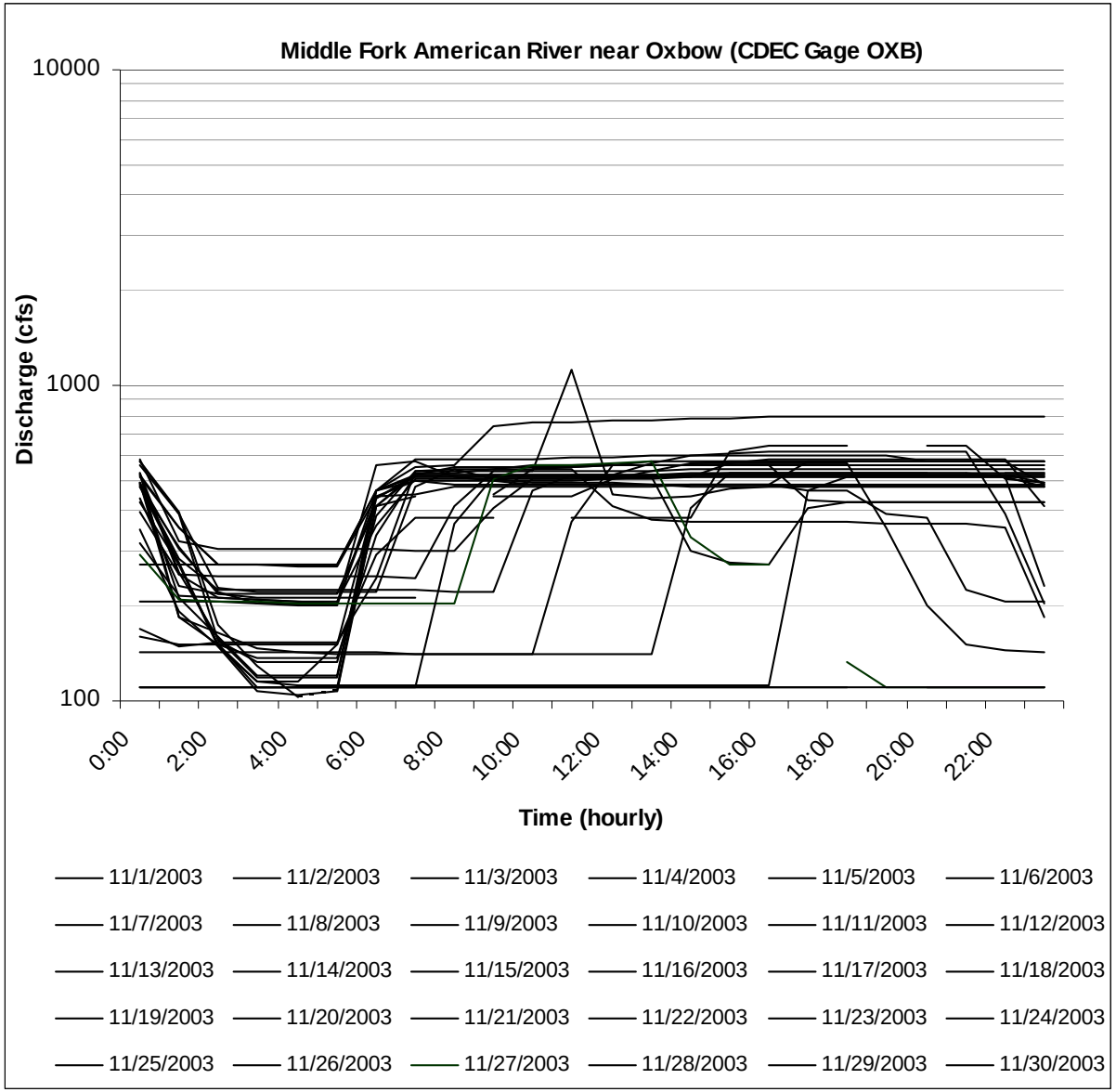

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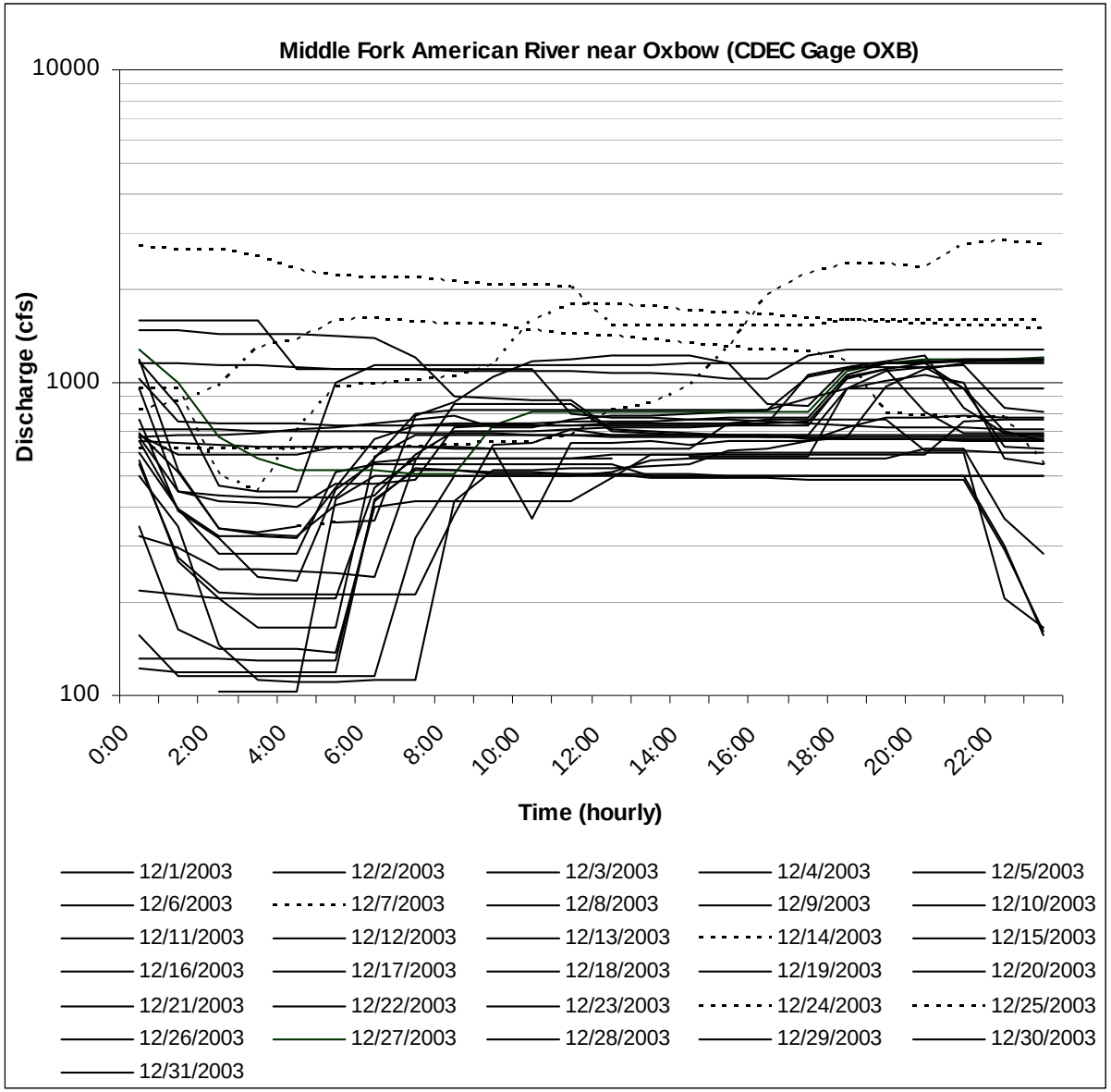

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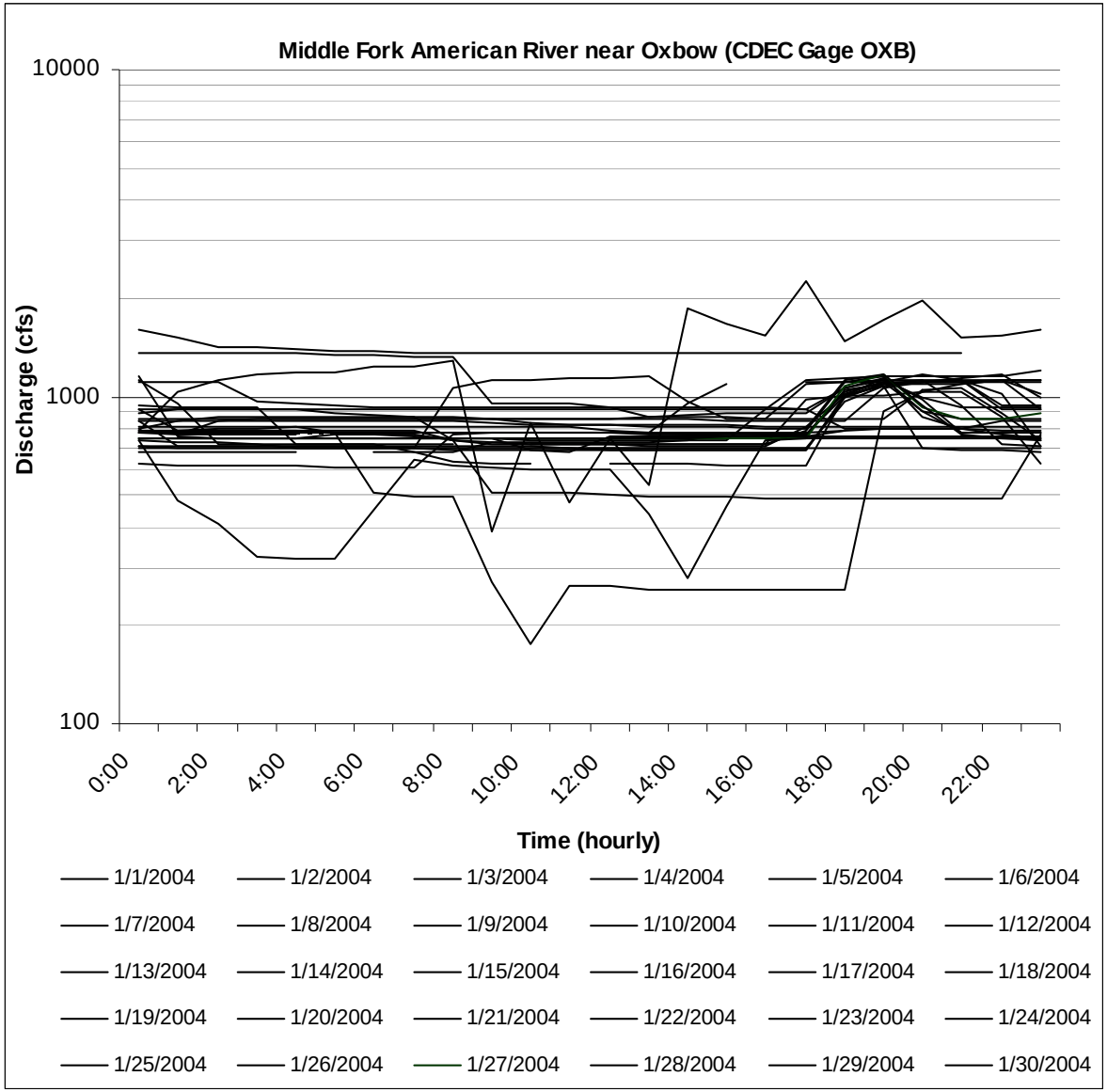

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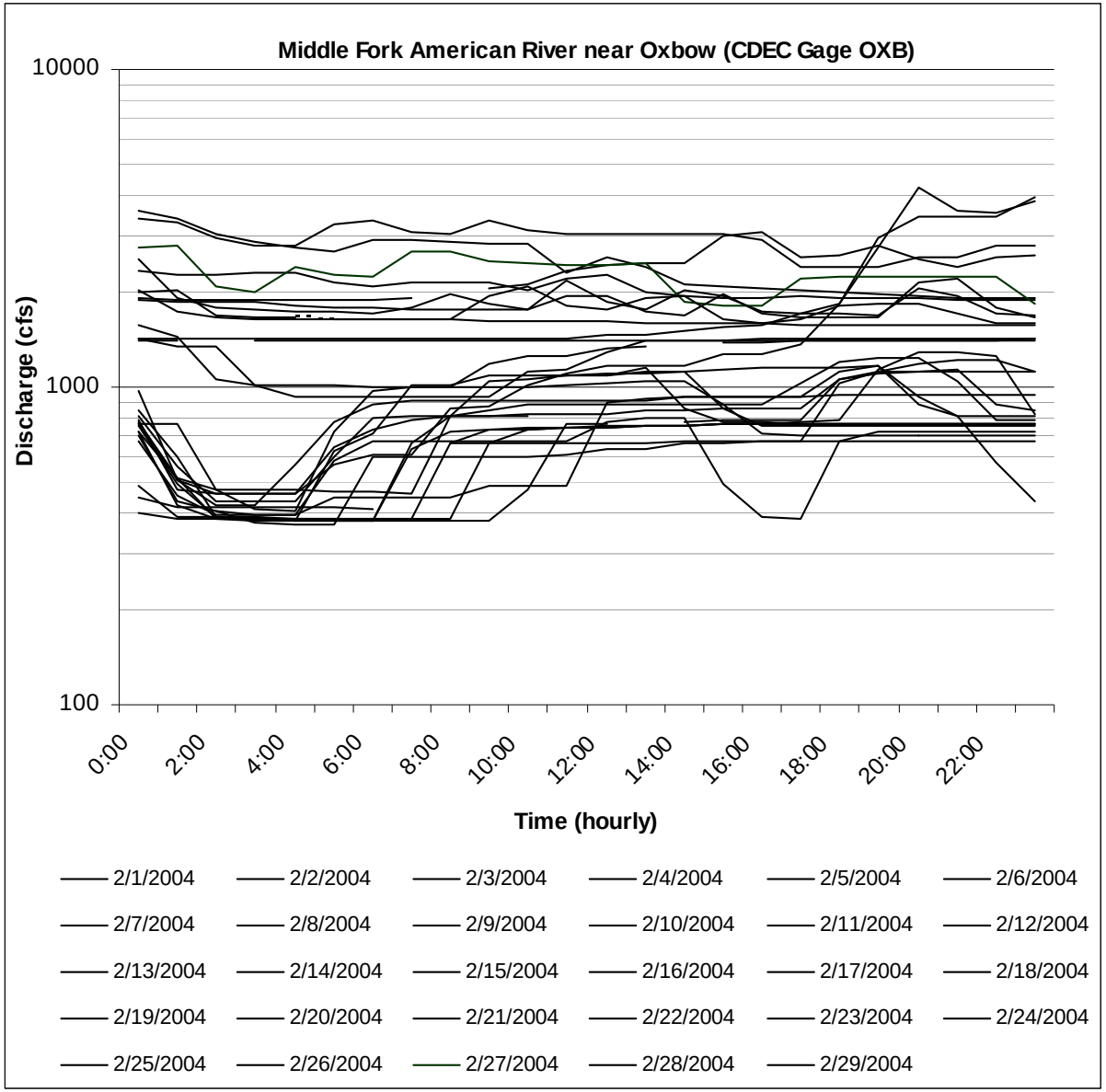

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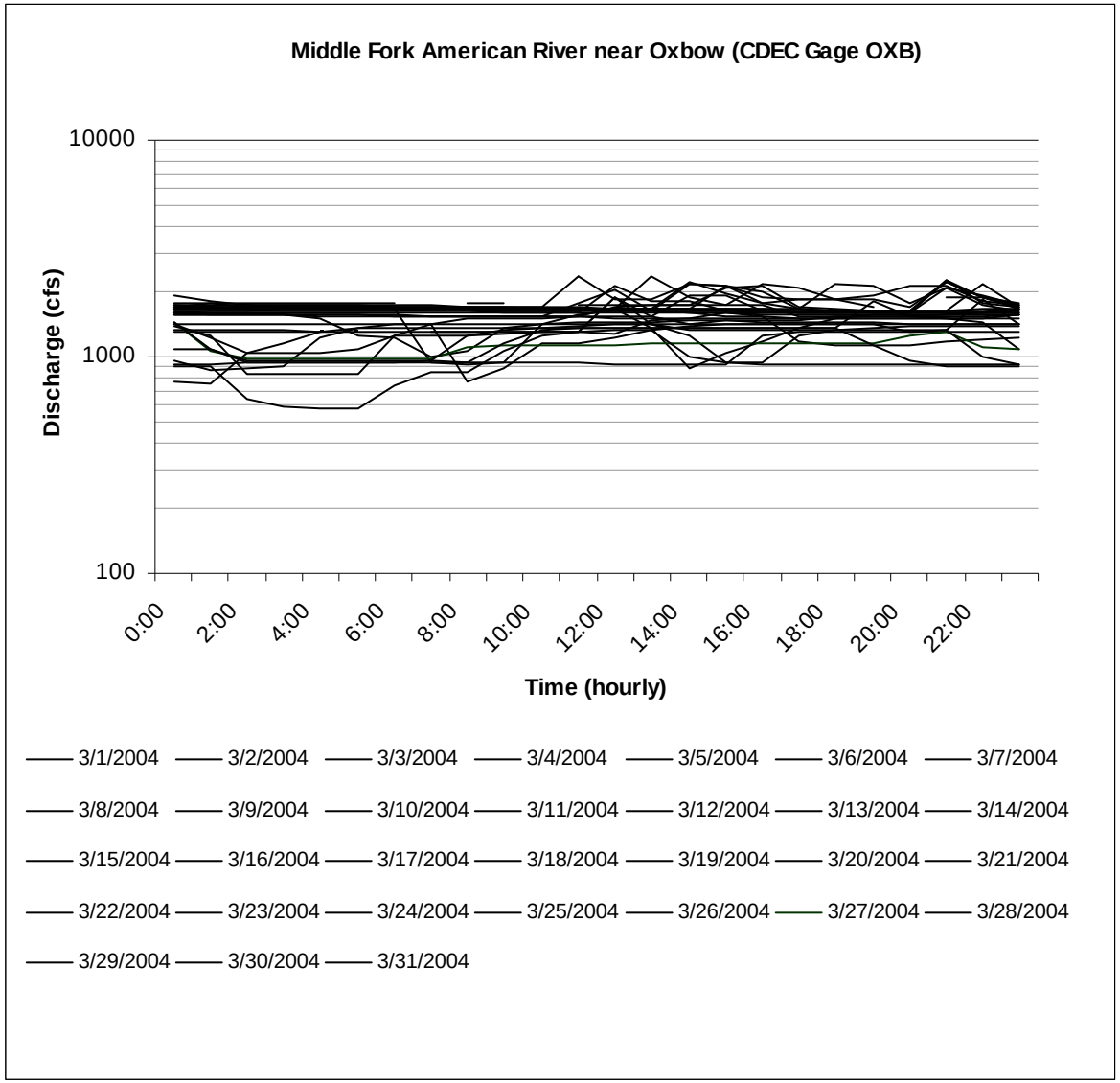

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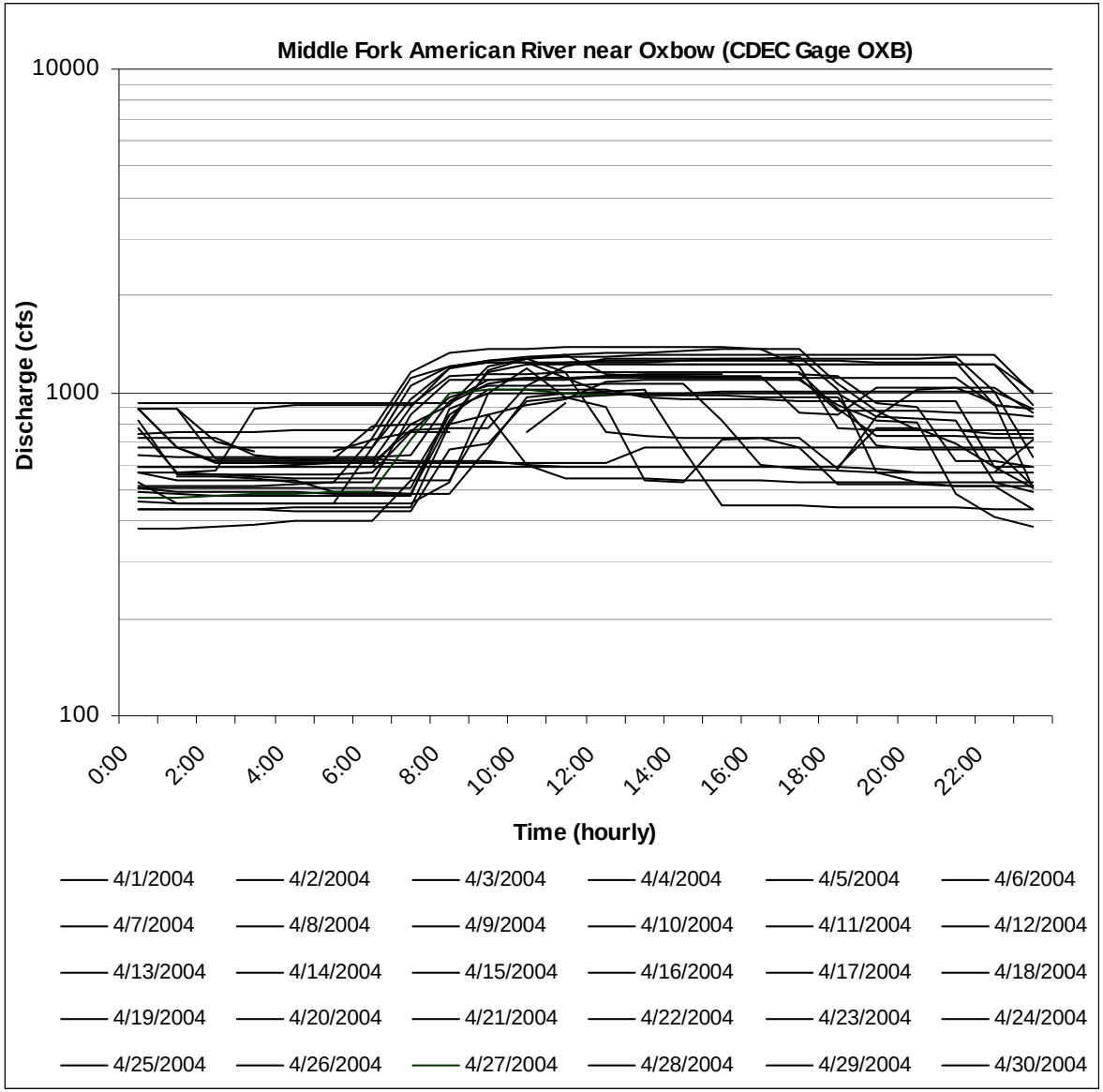

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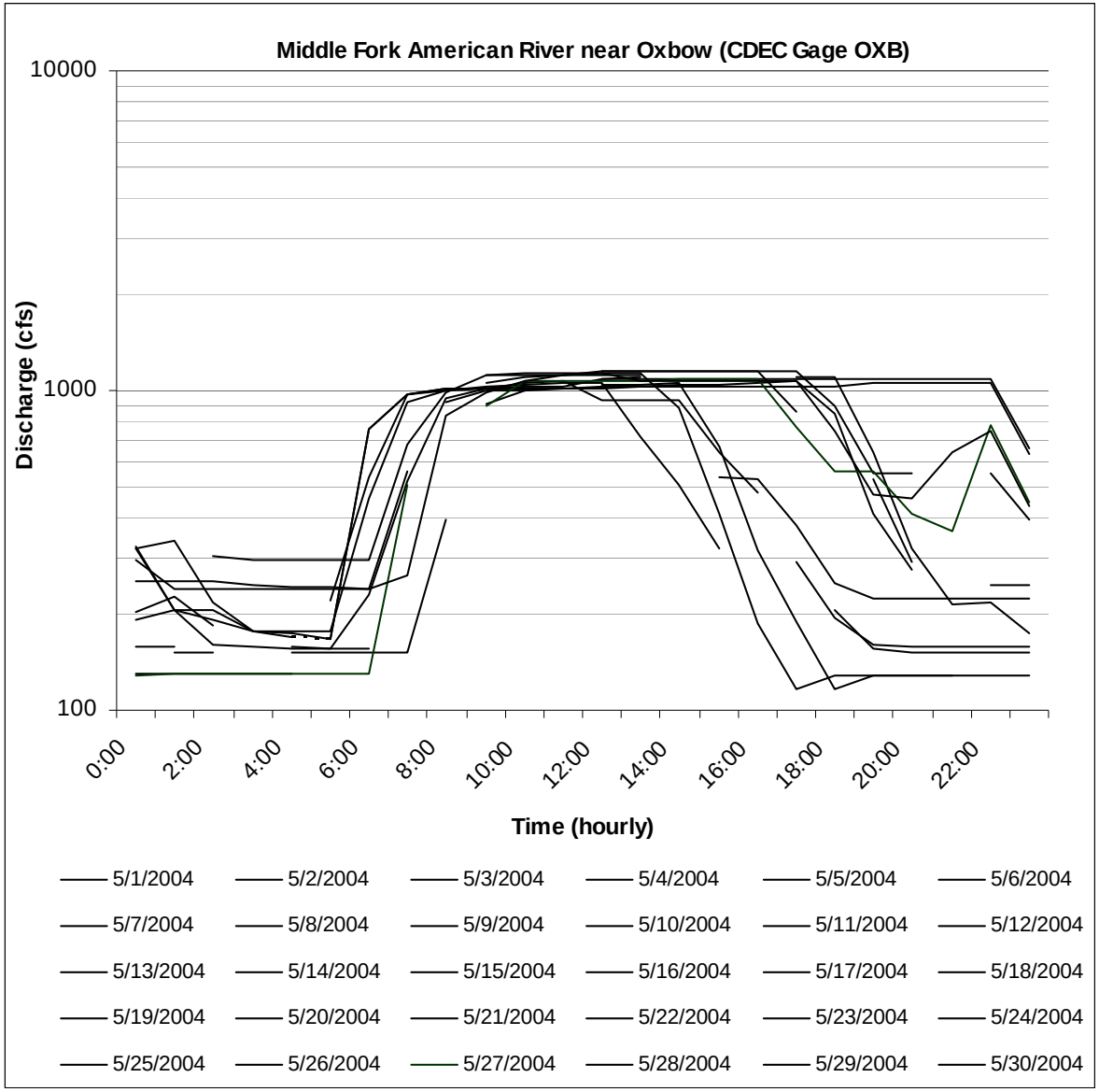

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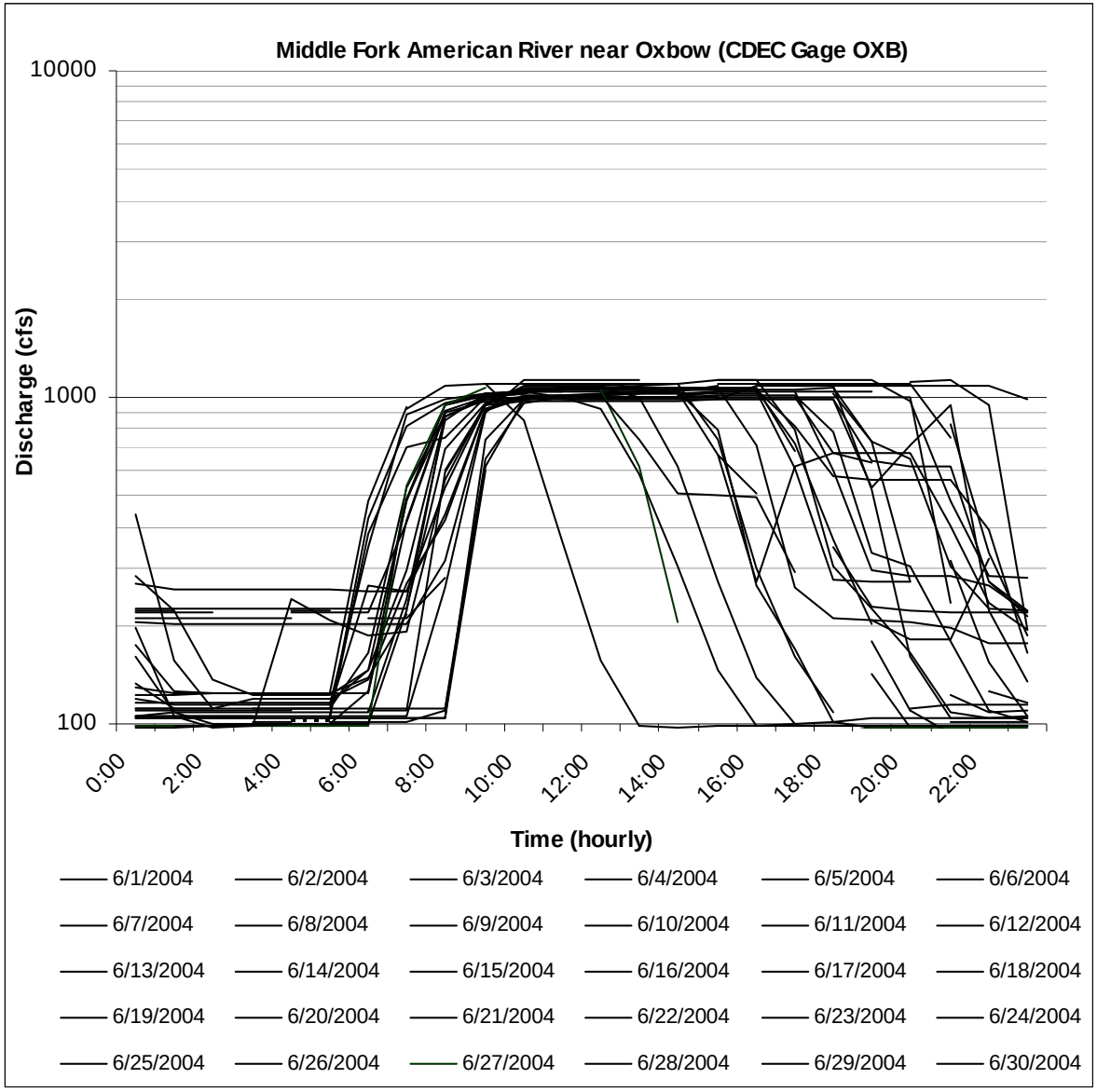

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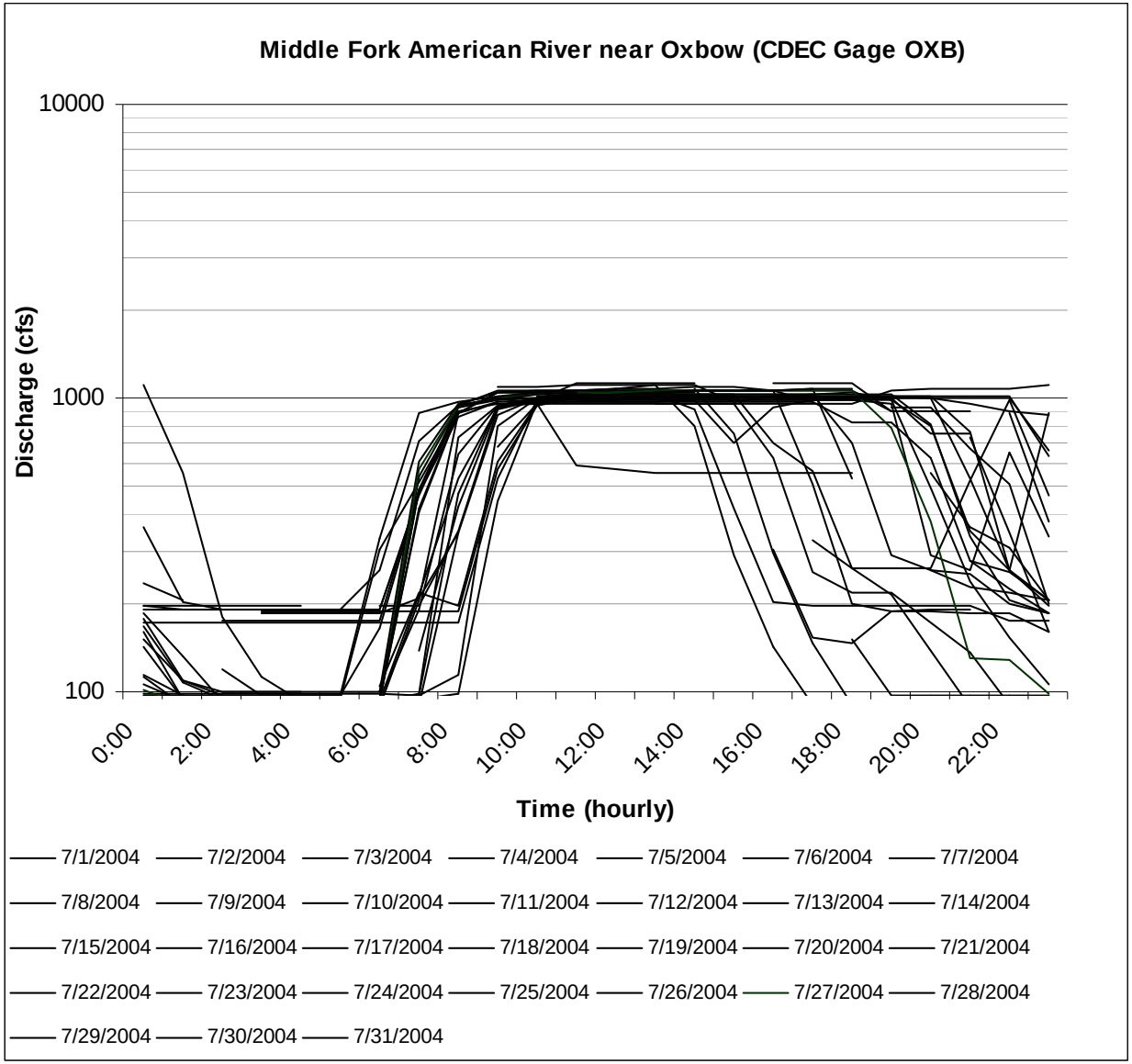

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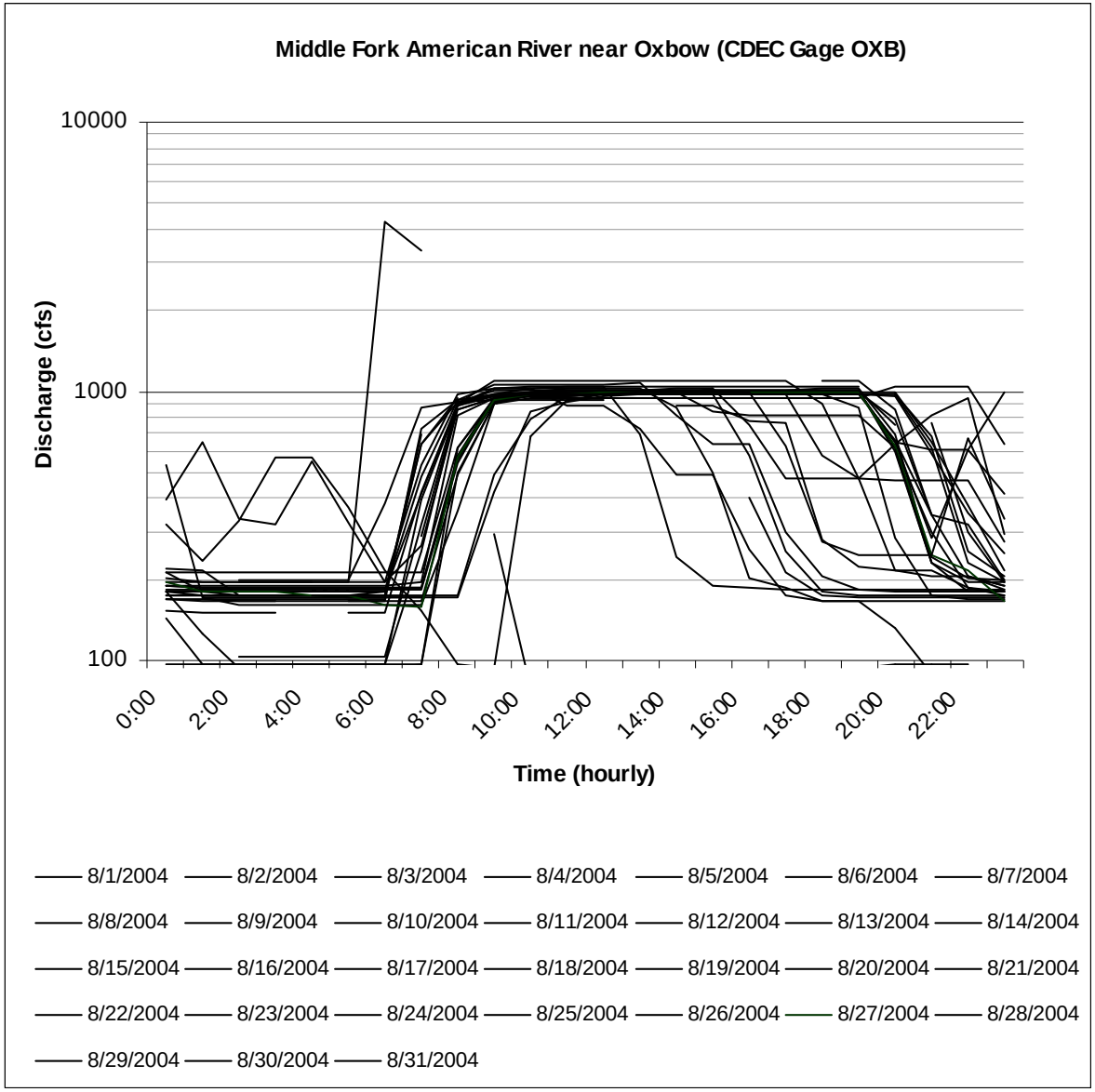

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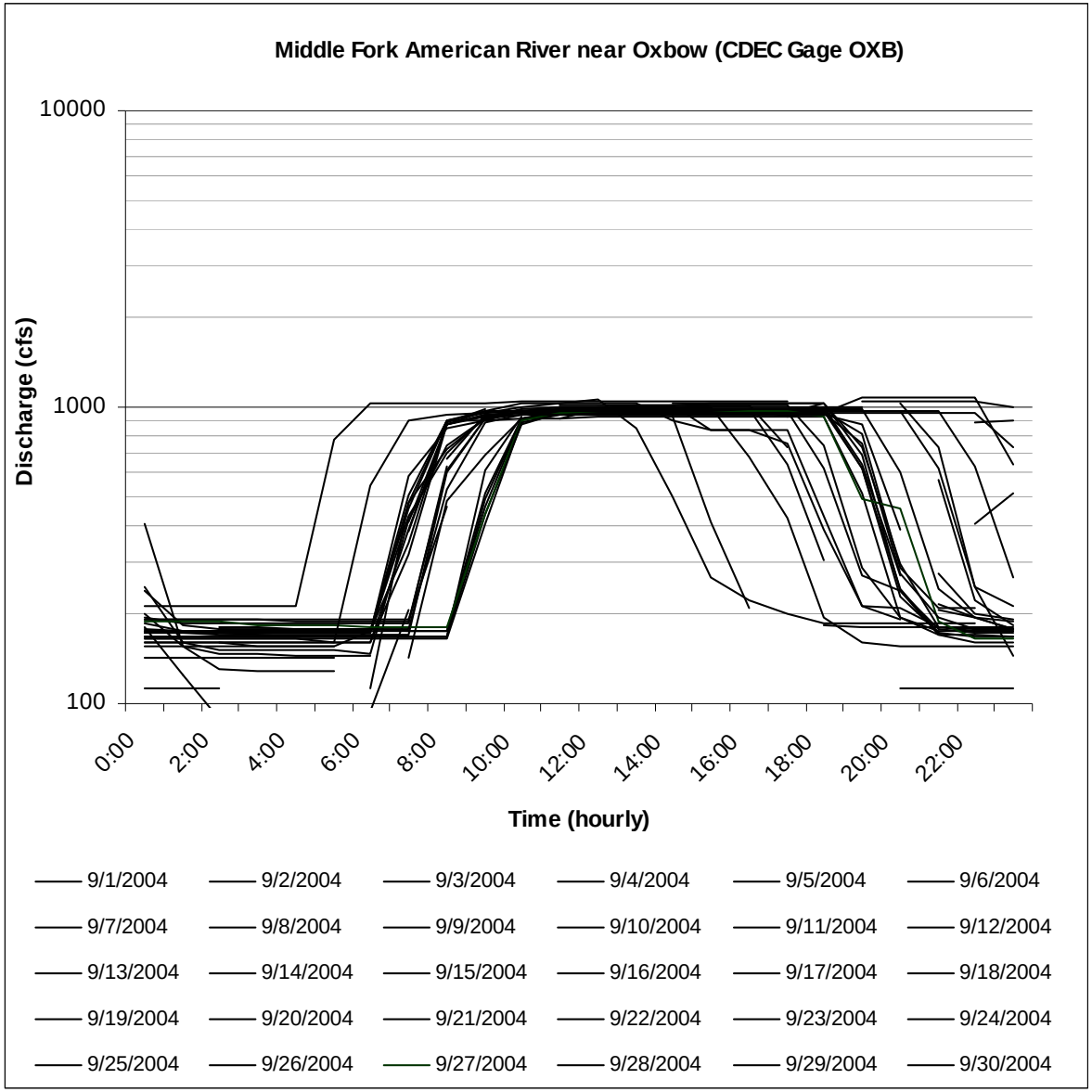

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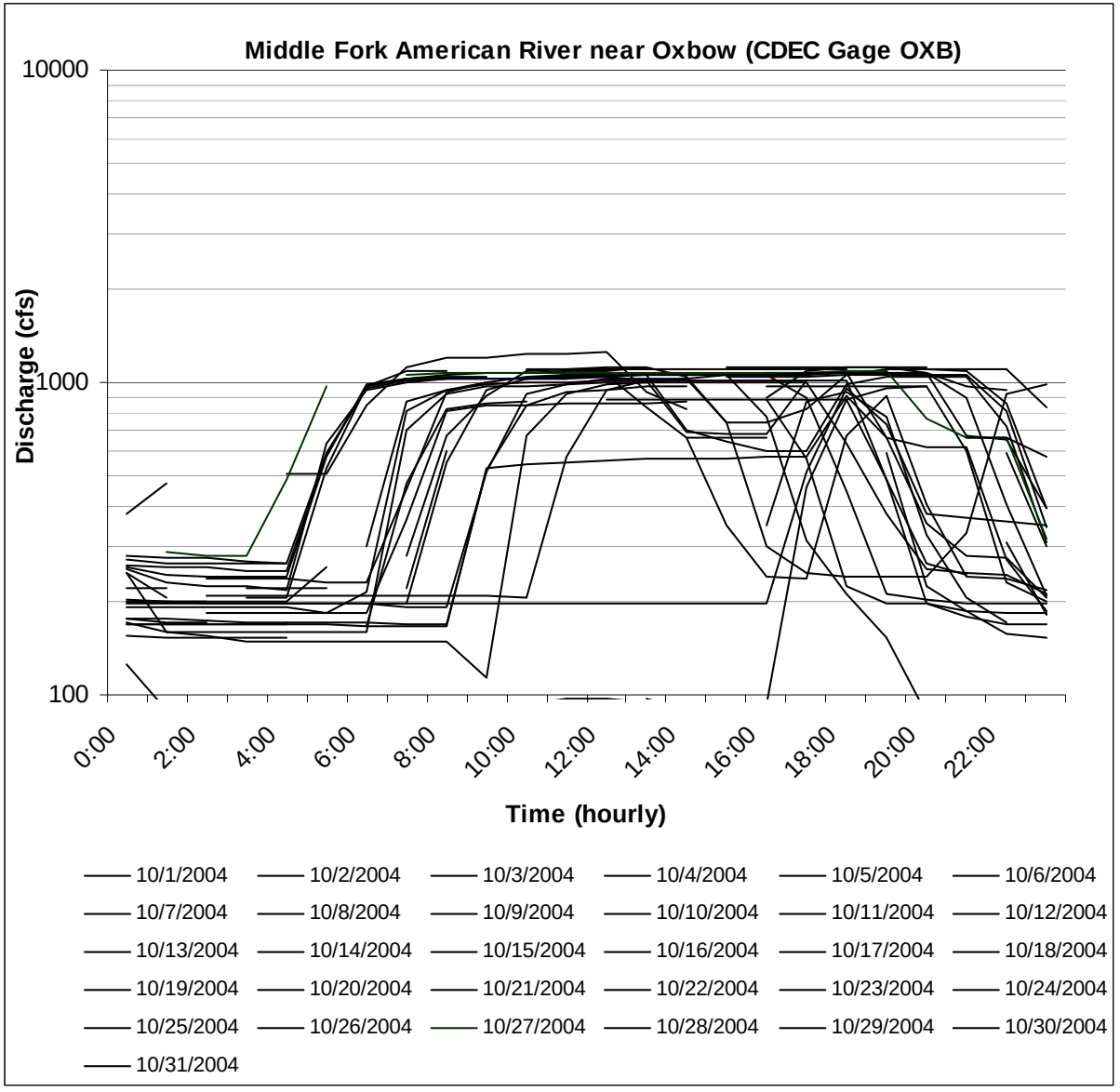
Middle Fork American River near Oxbow (CDEC Gage OXB)
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Discharge (cfs)
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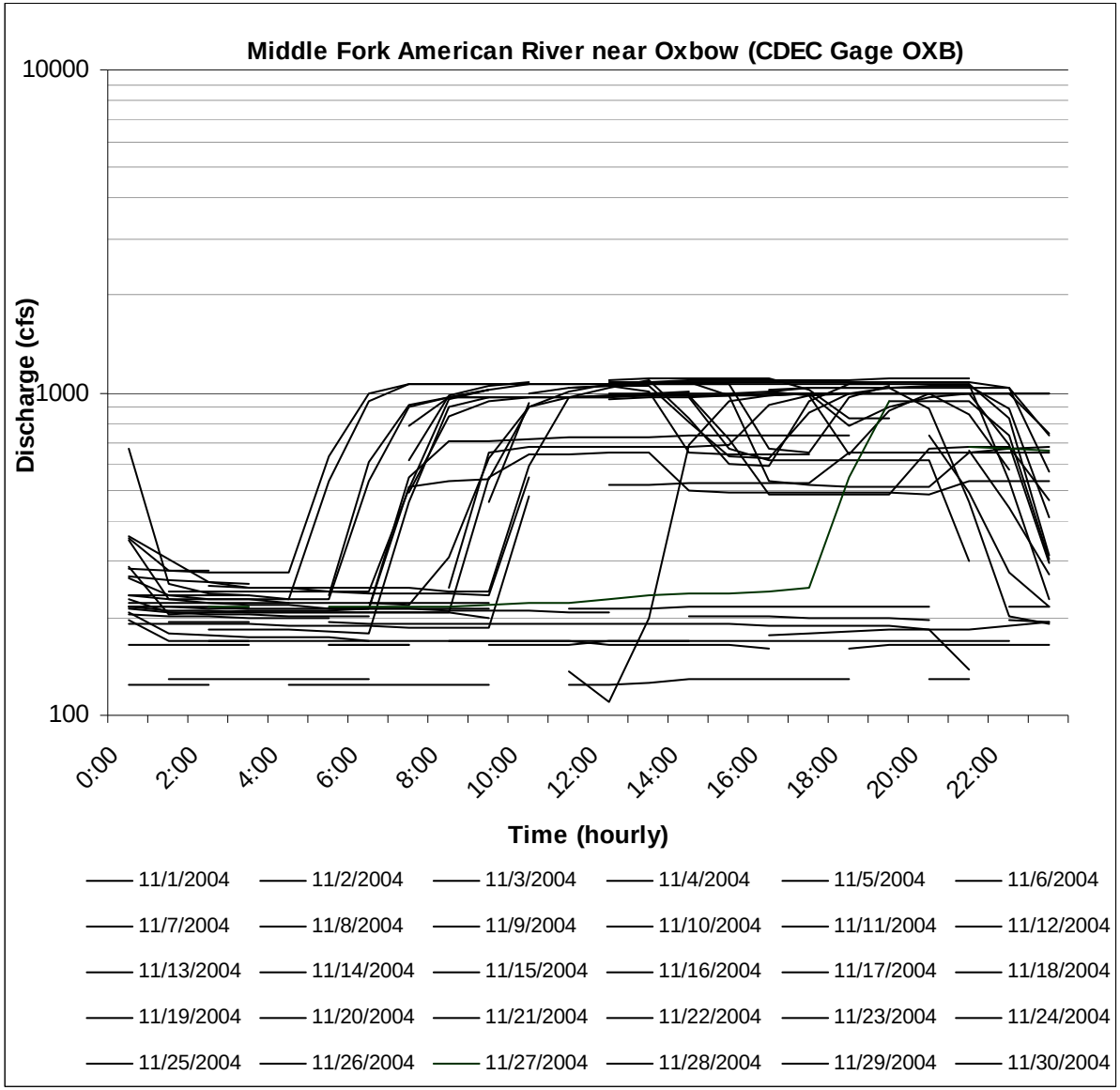

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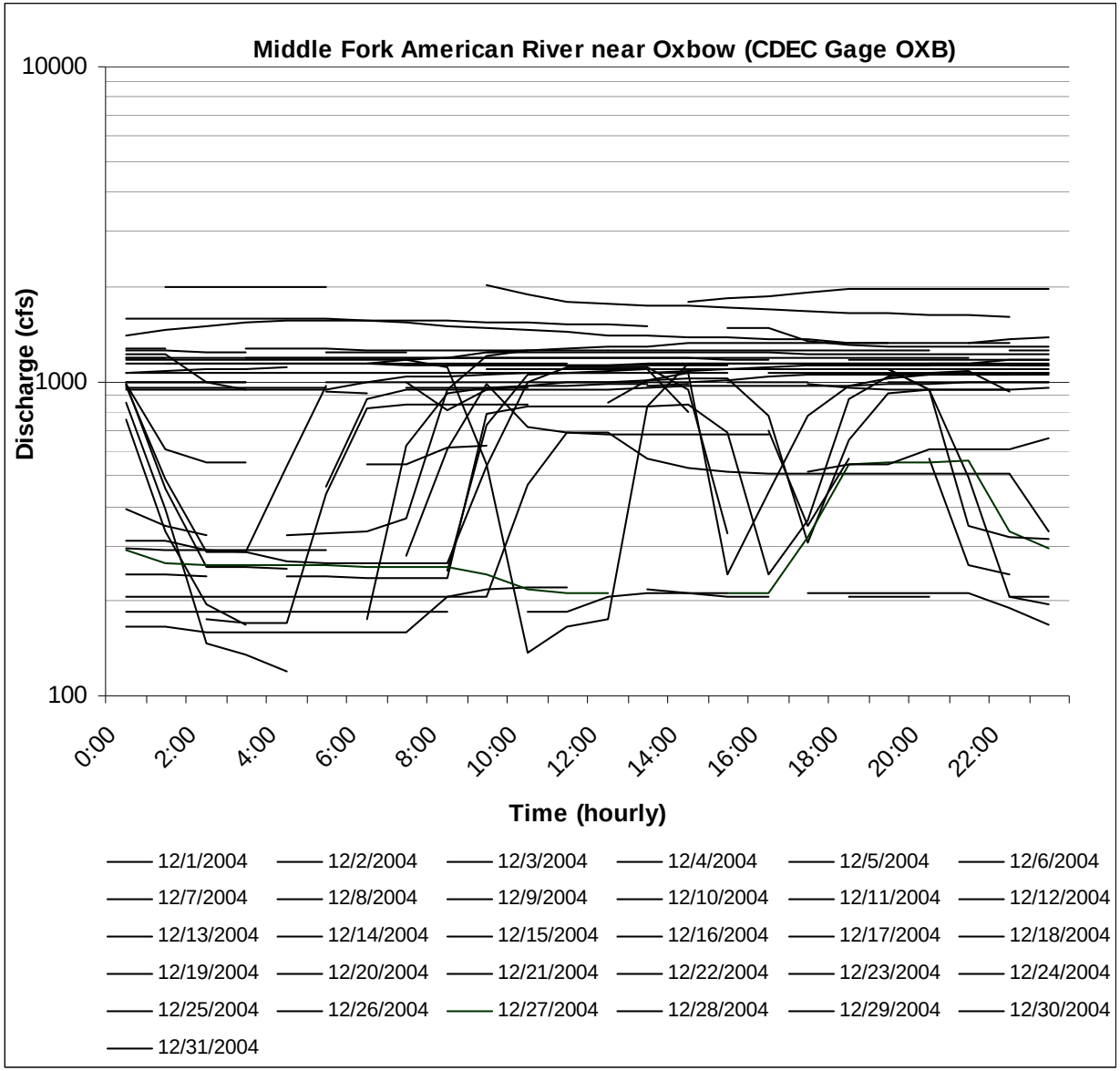

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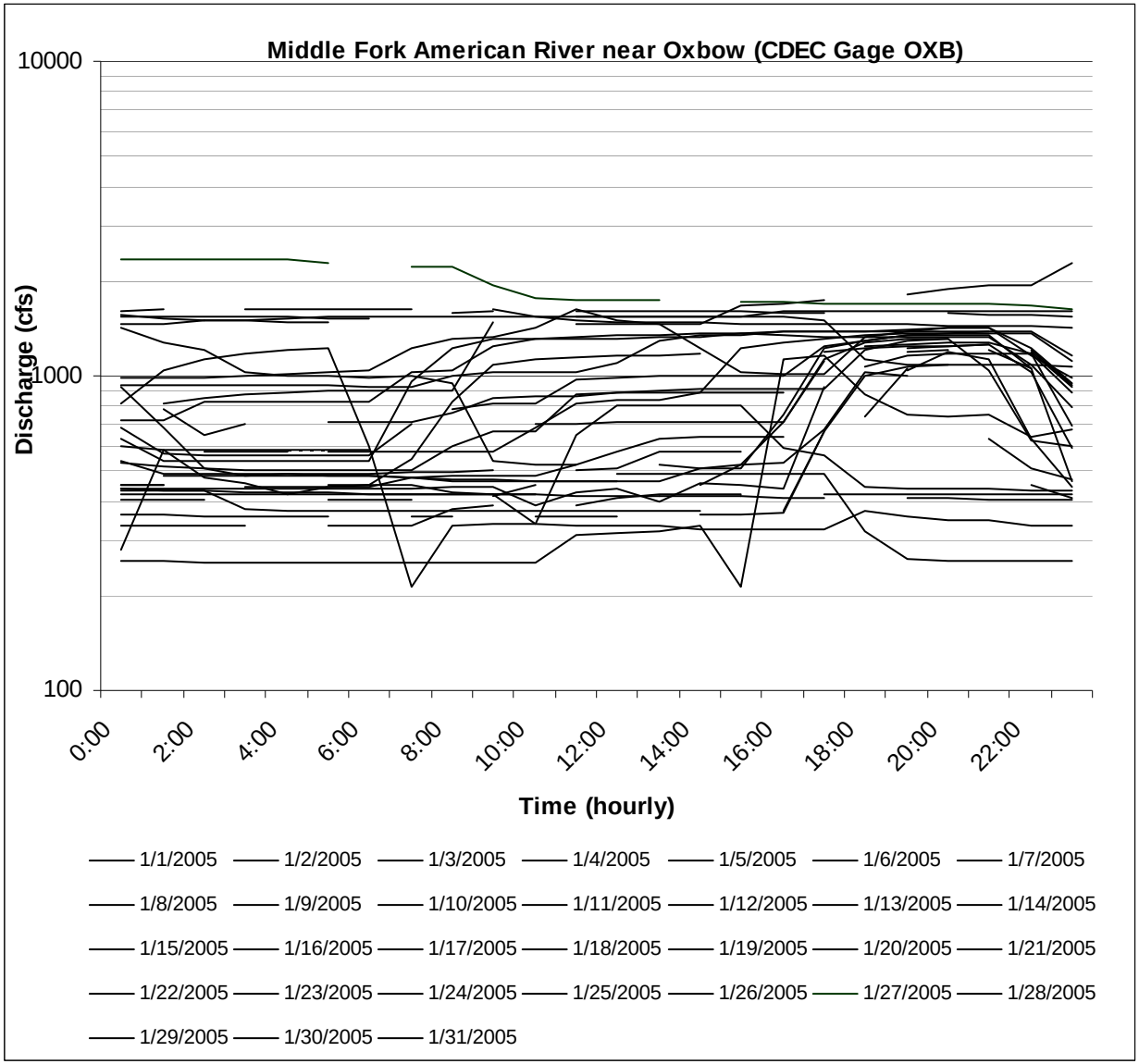
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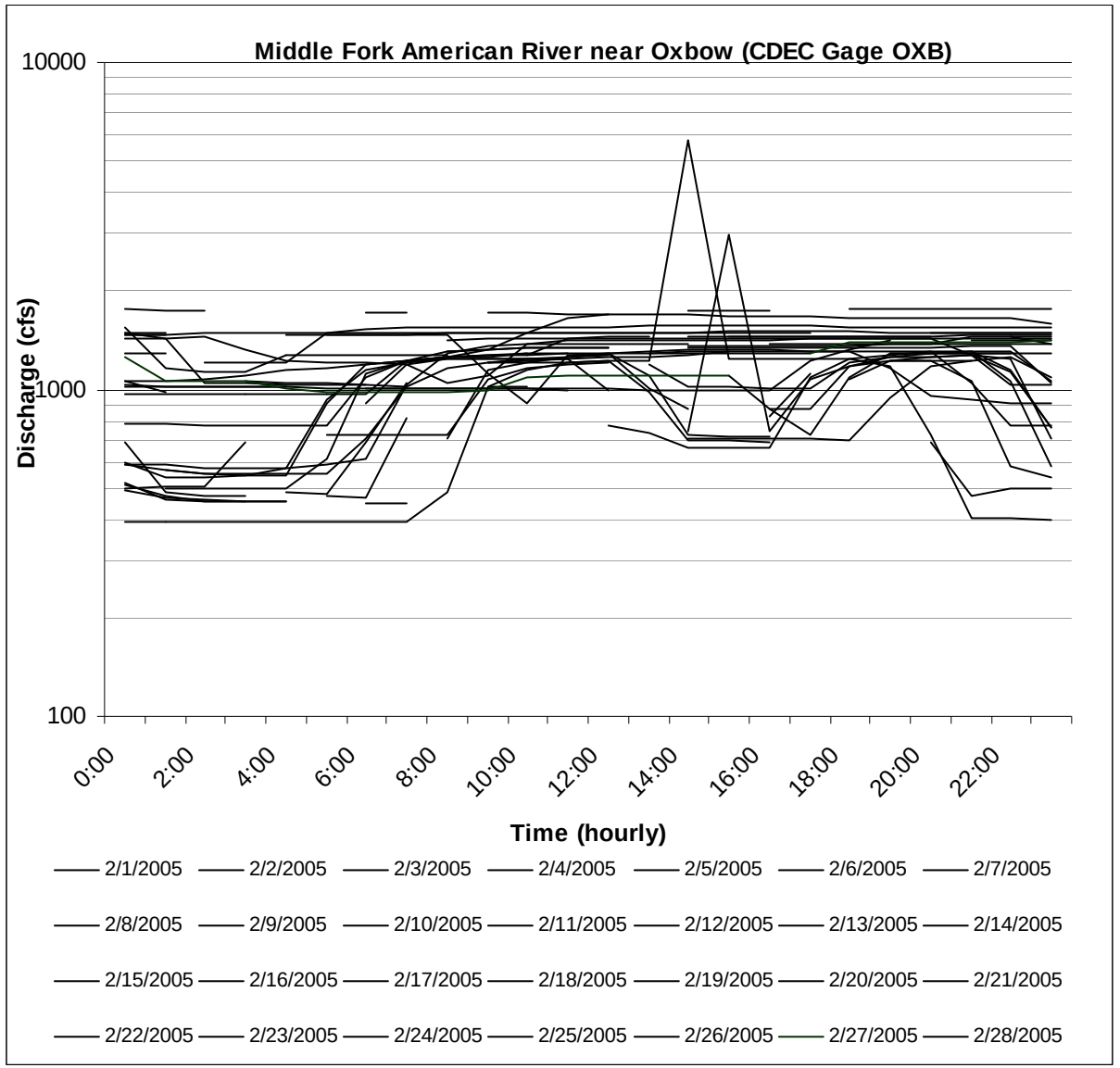

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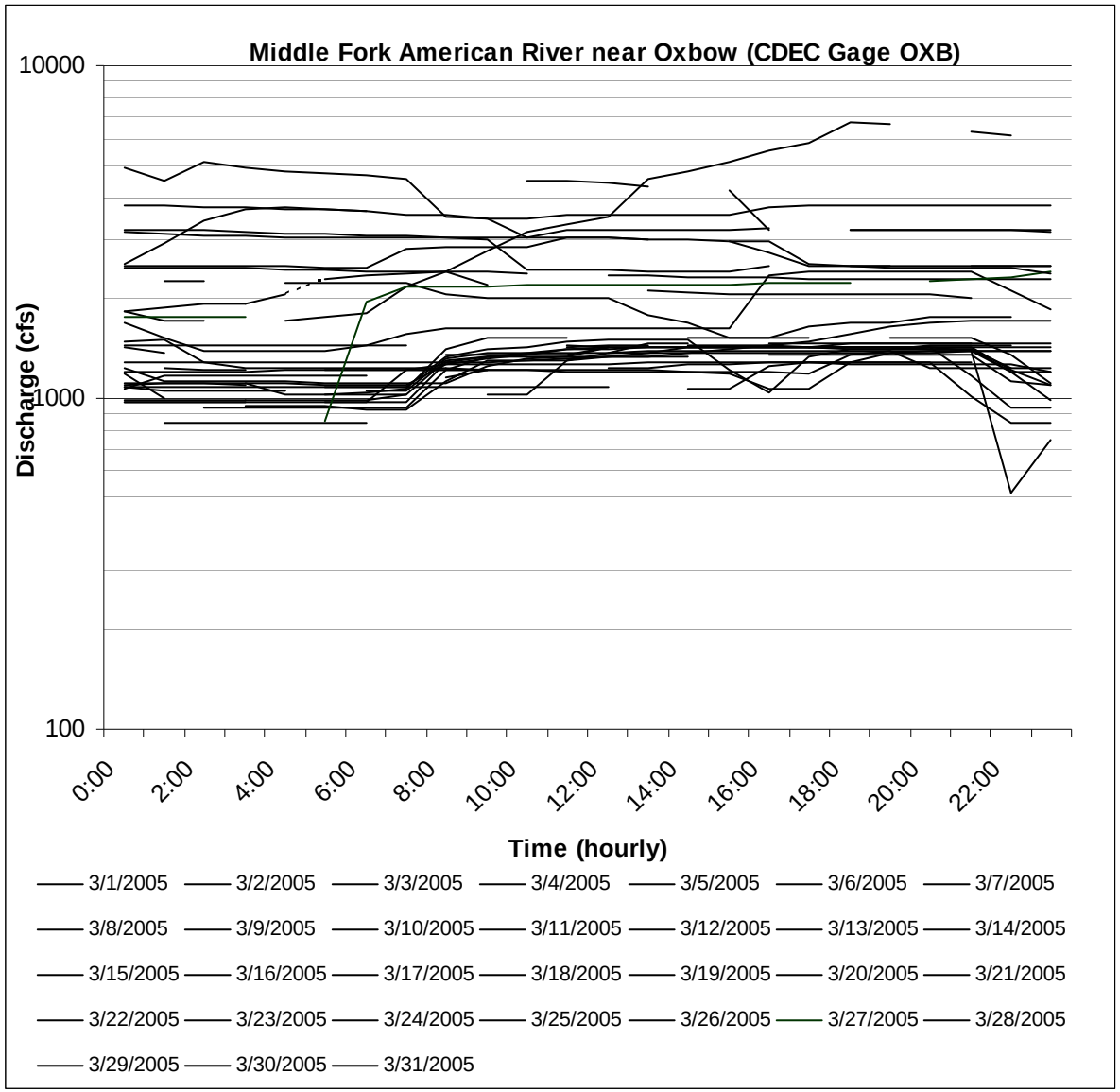
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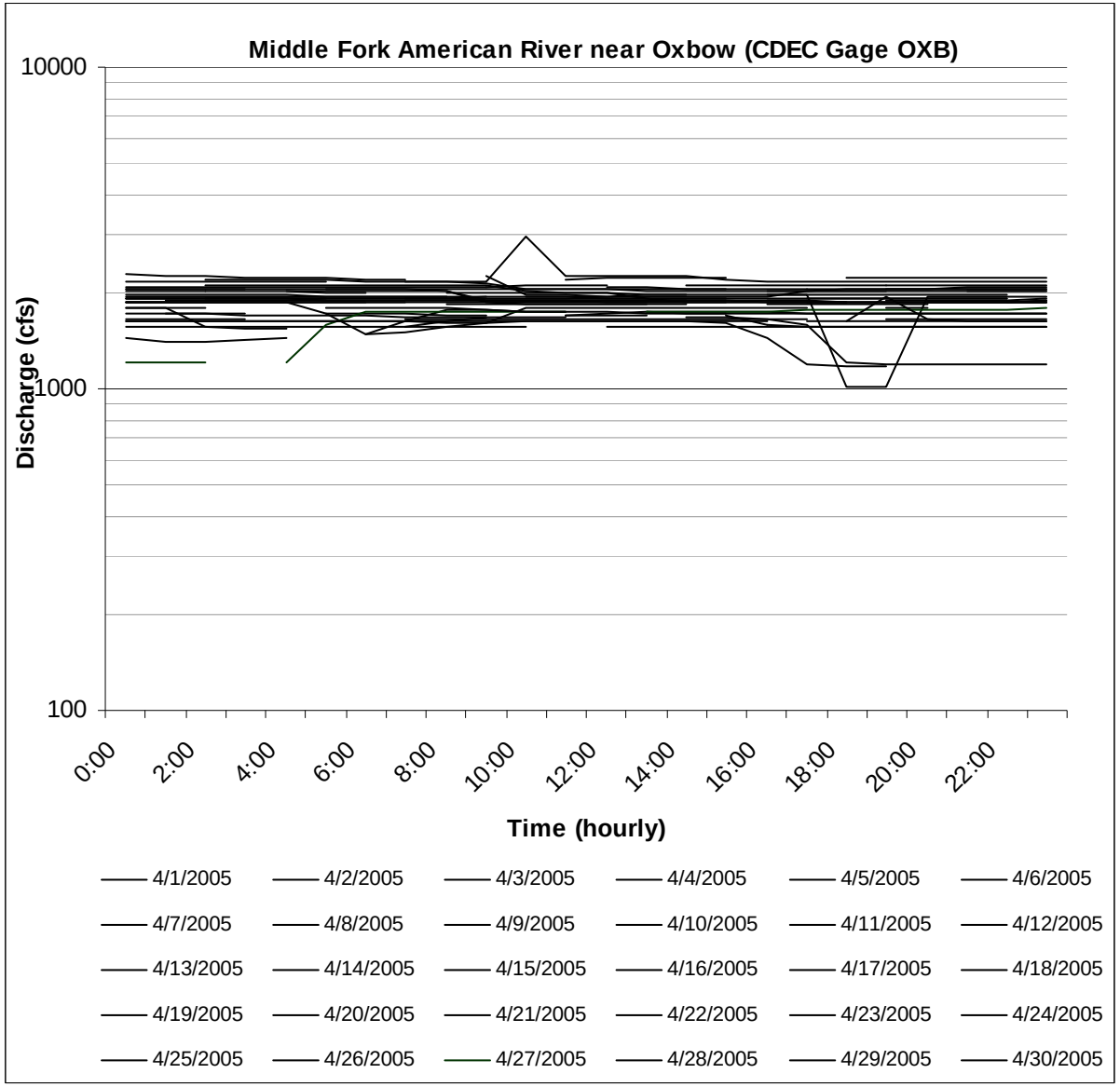
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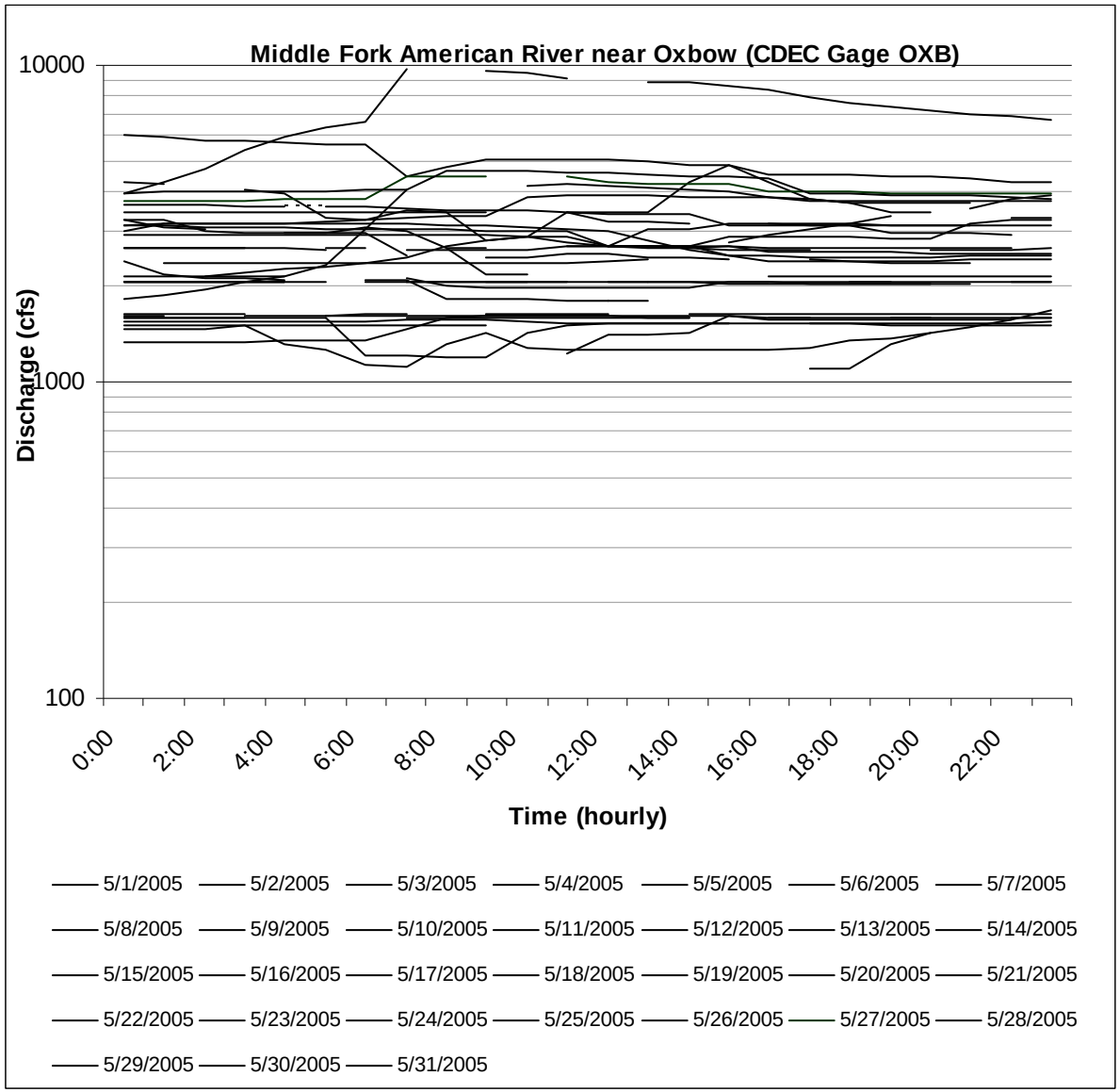

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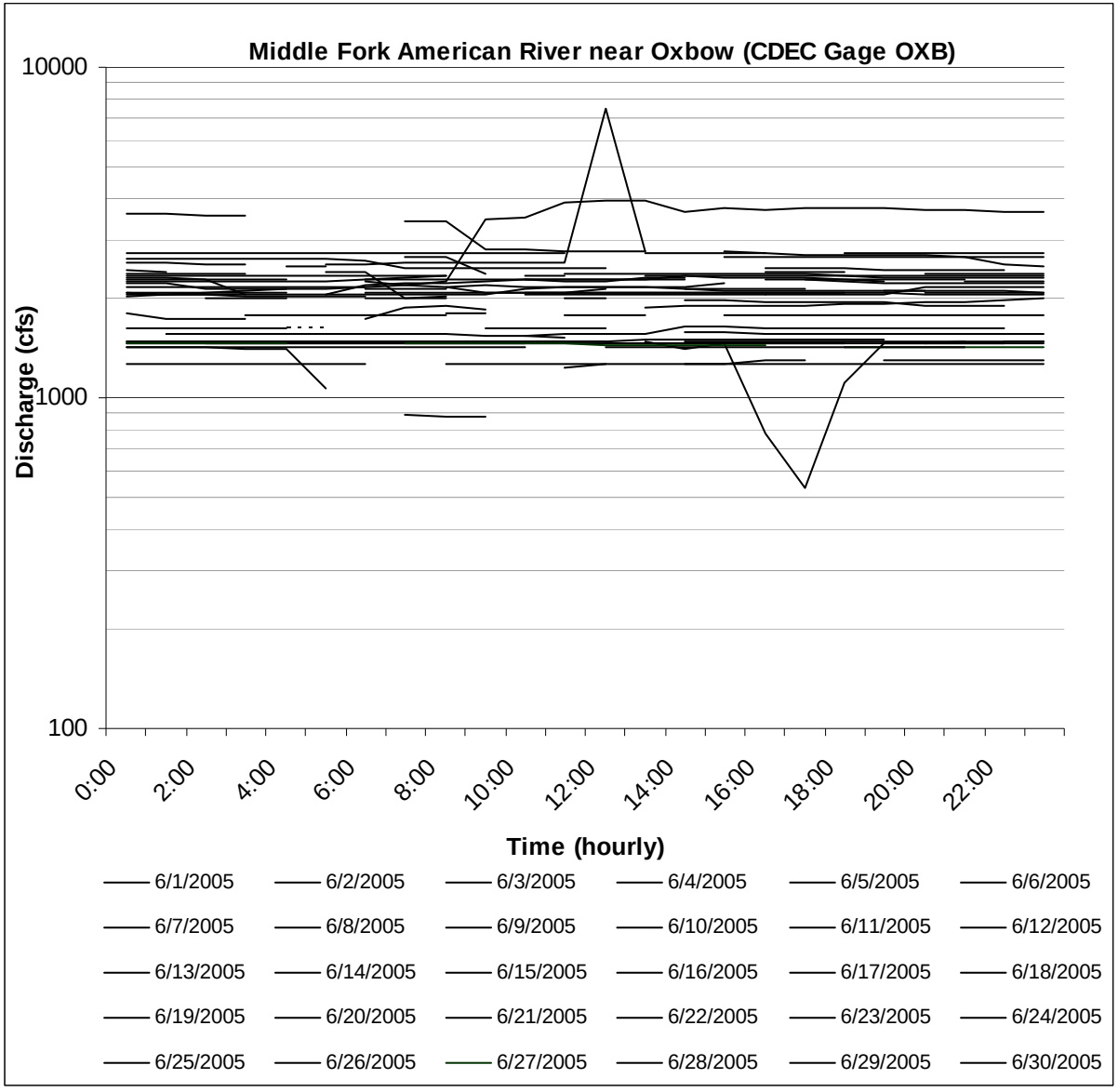

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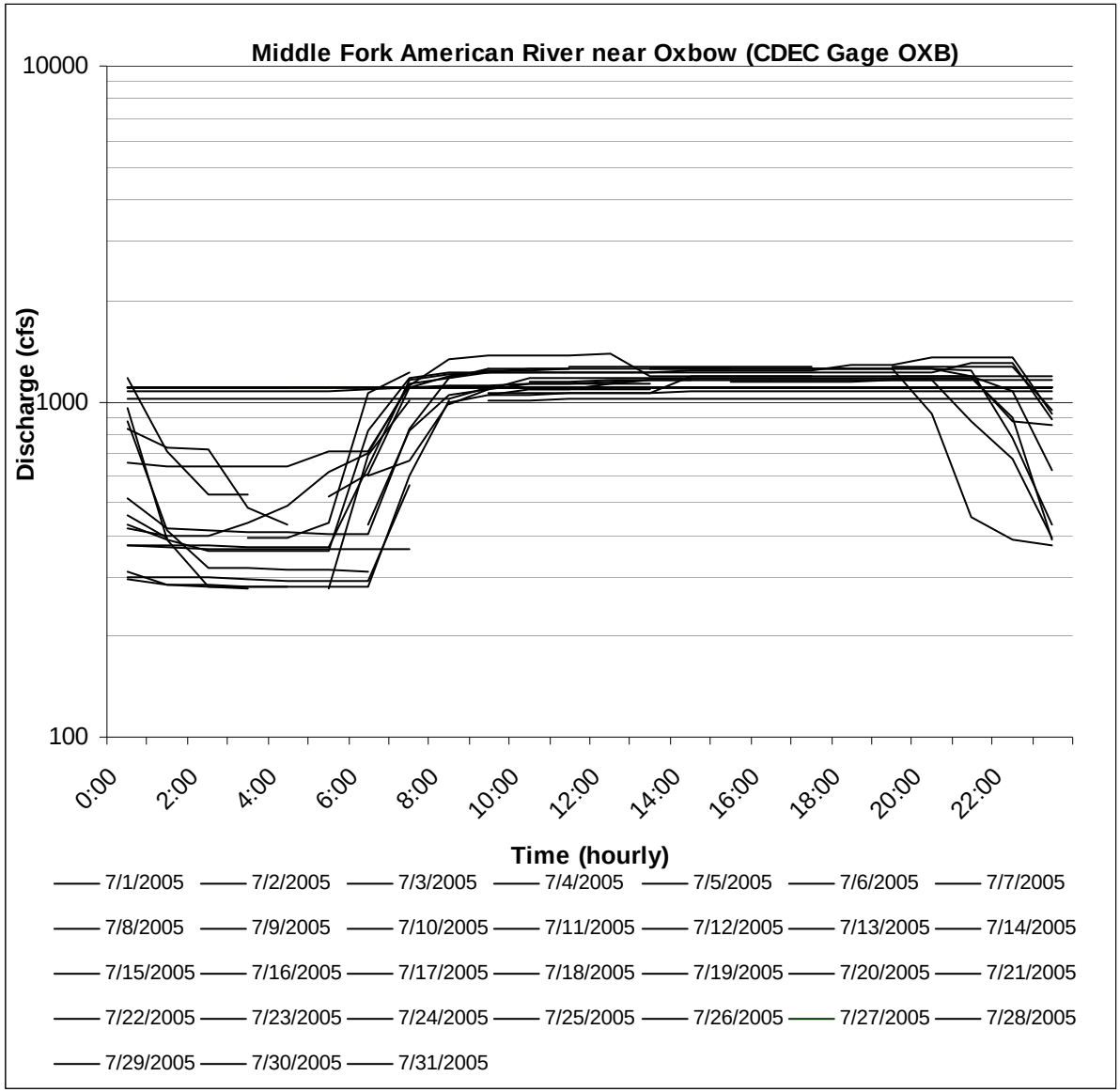
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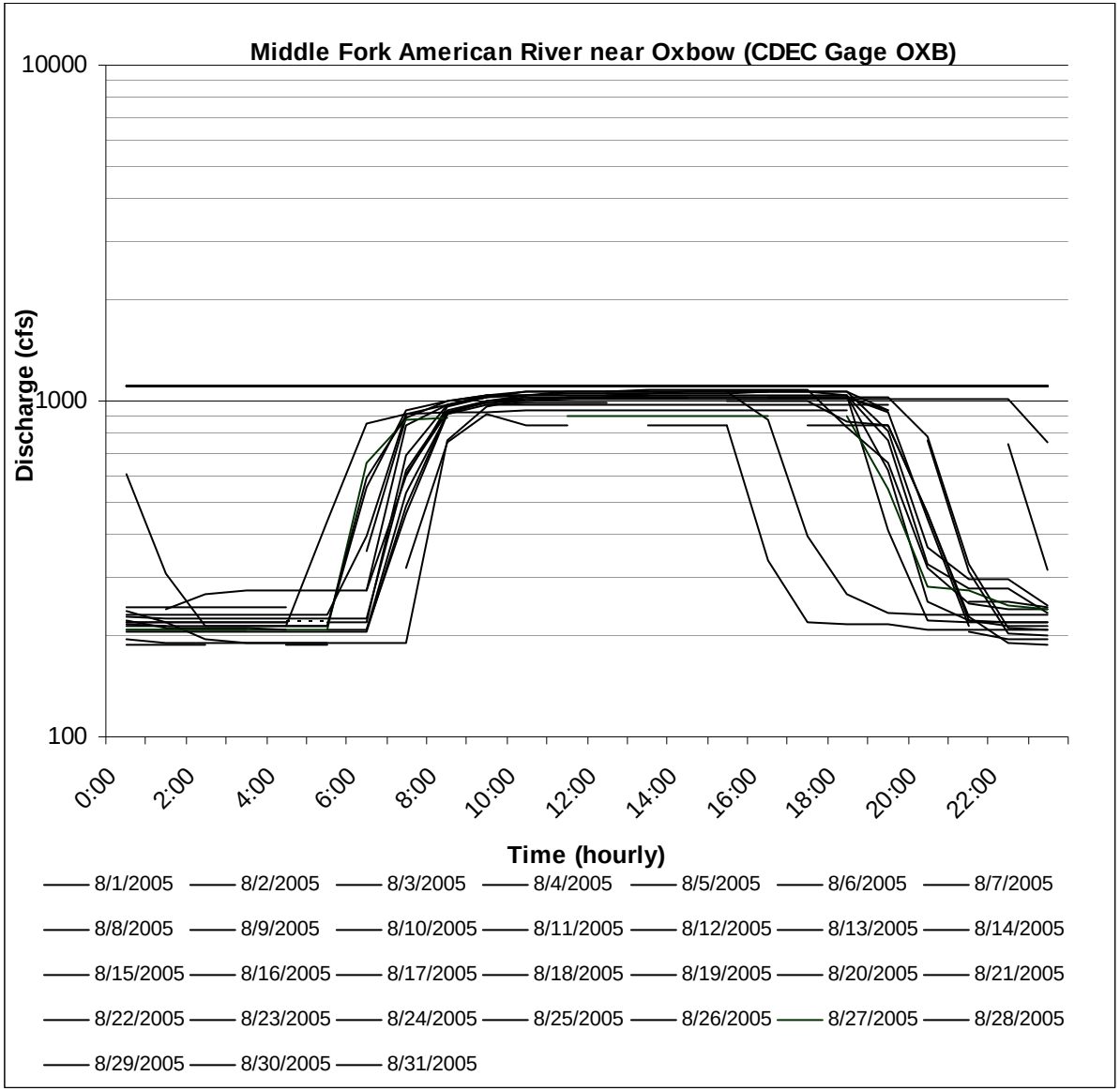
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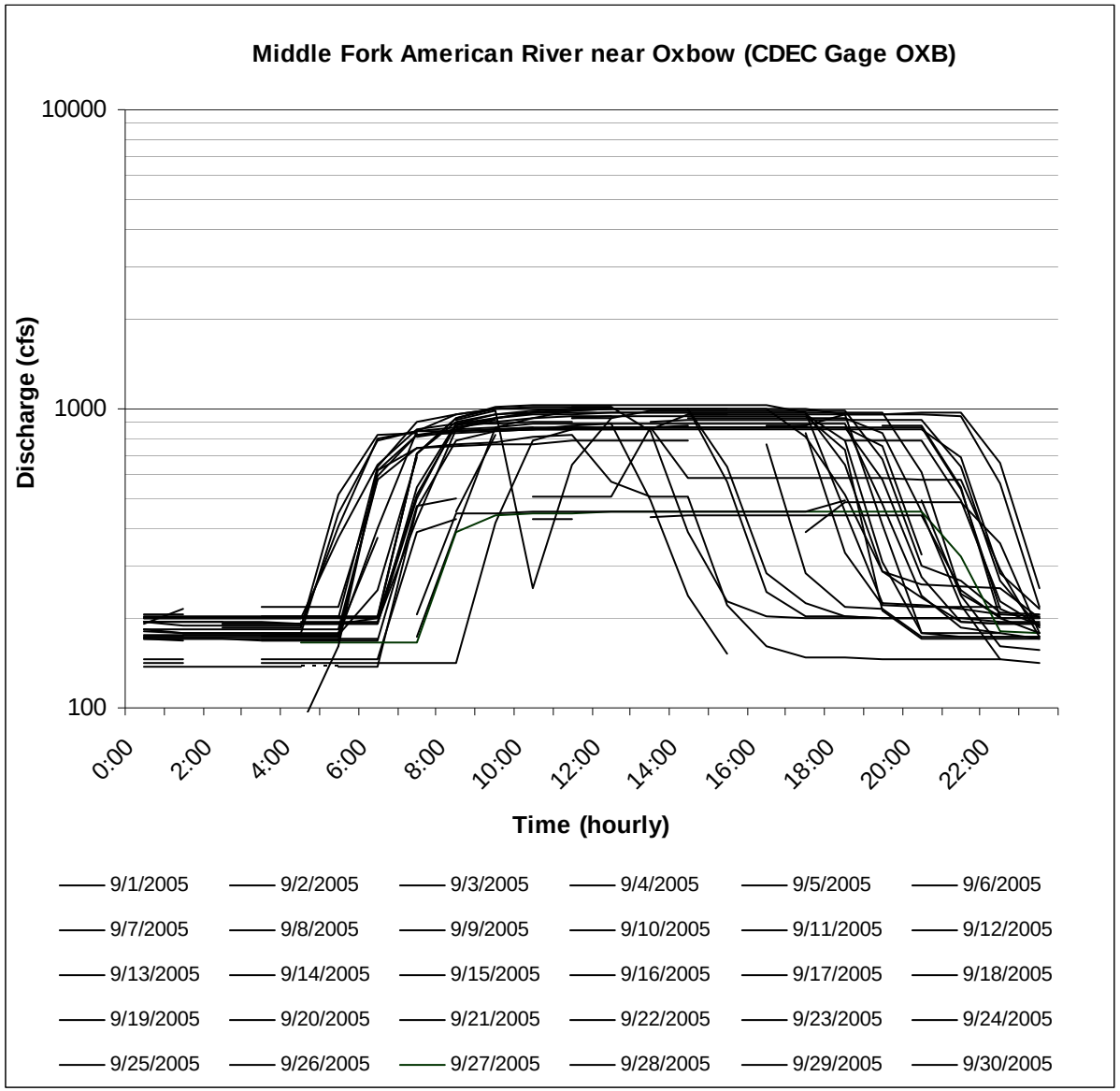

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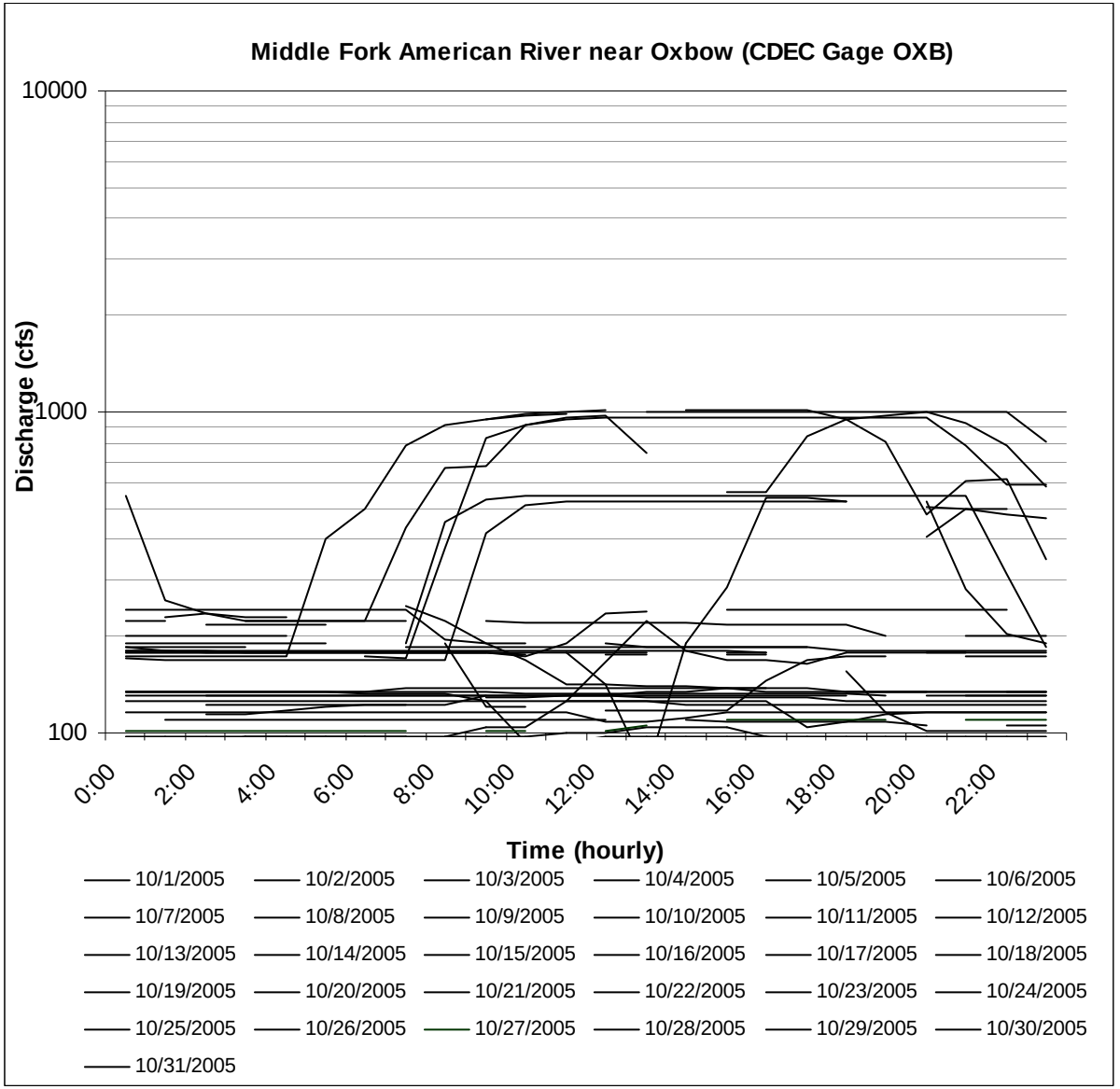

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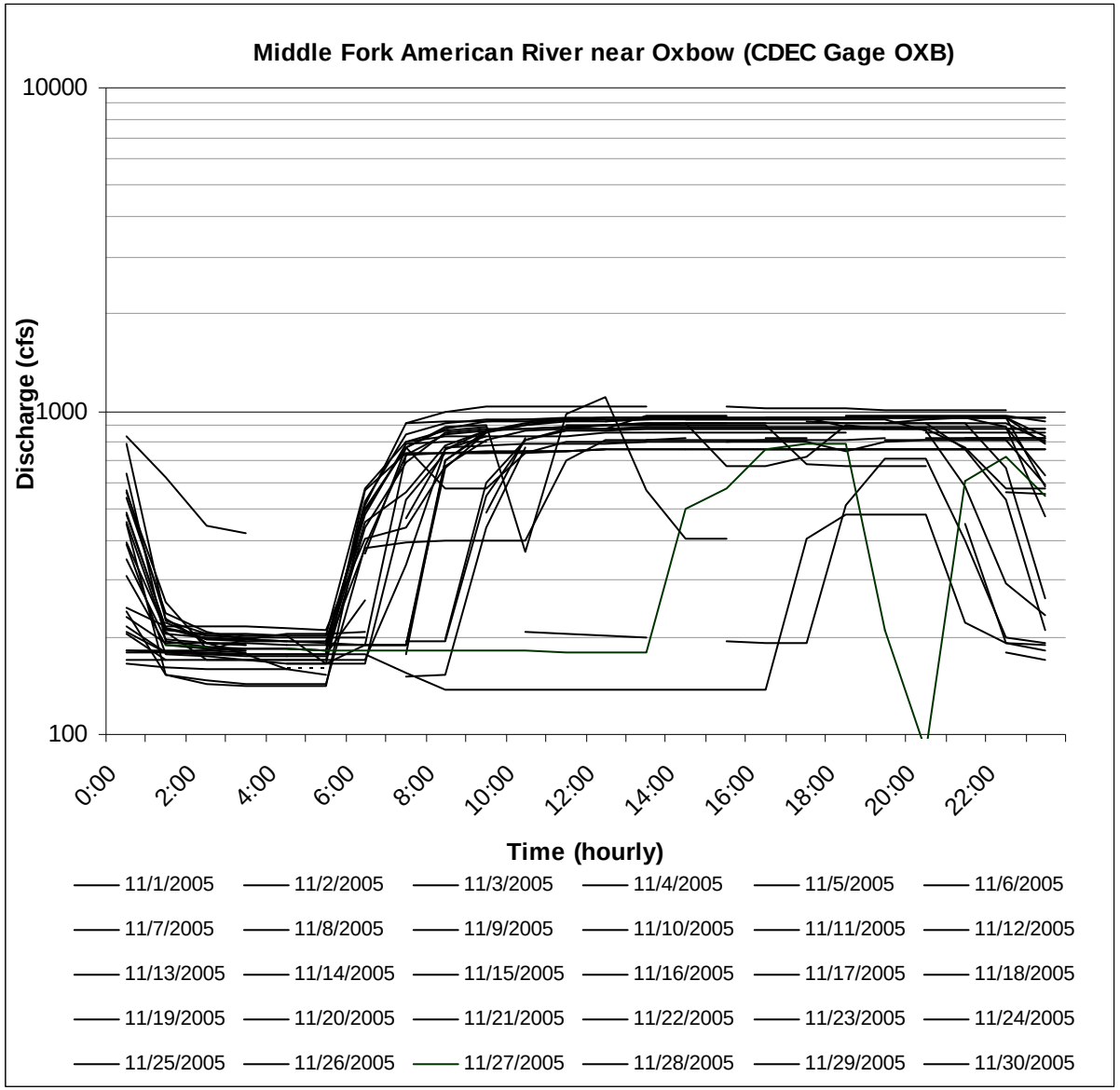

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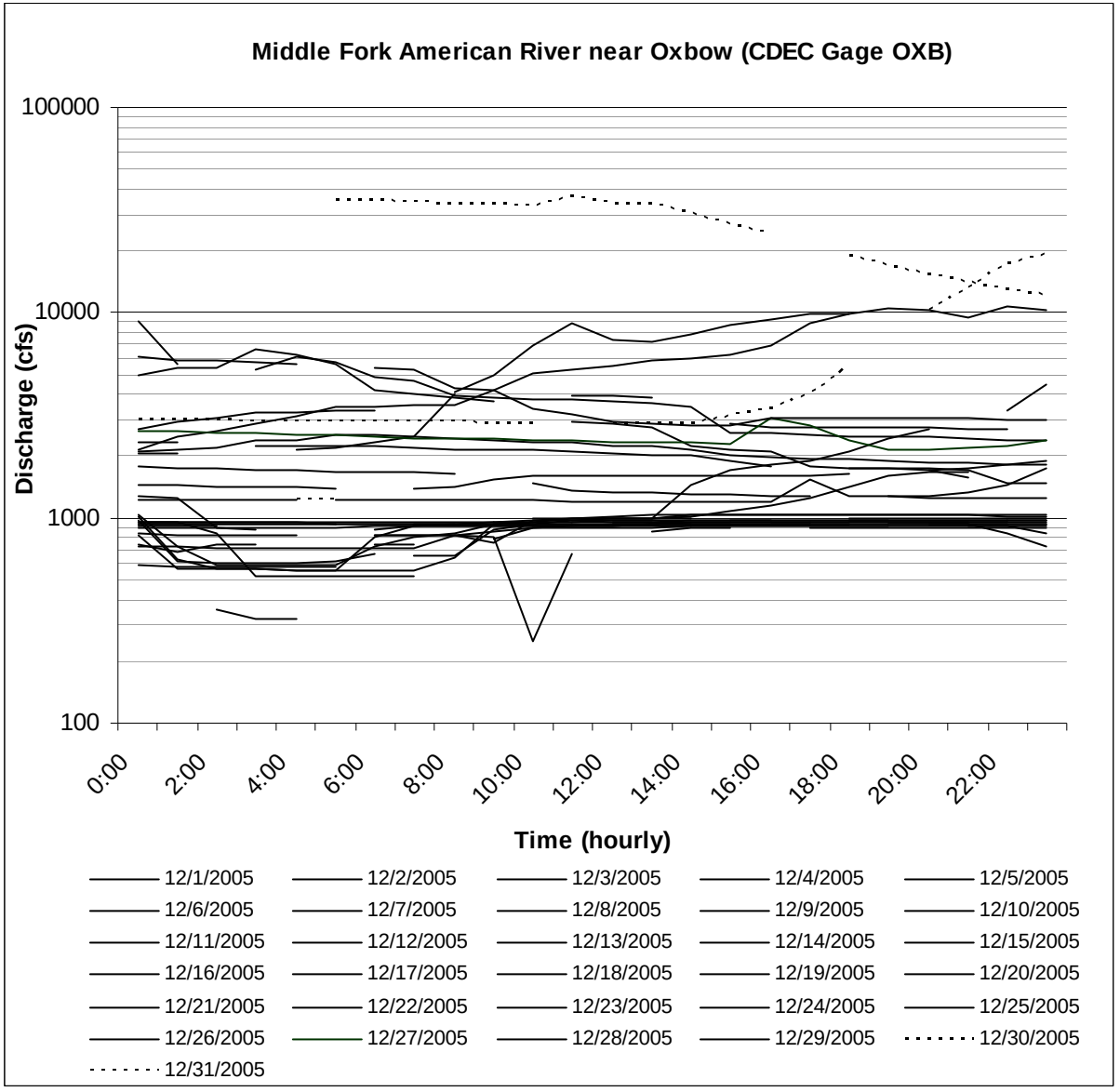

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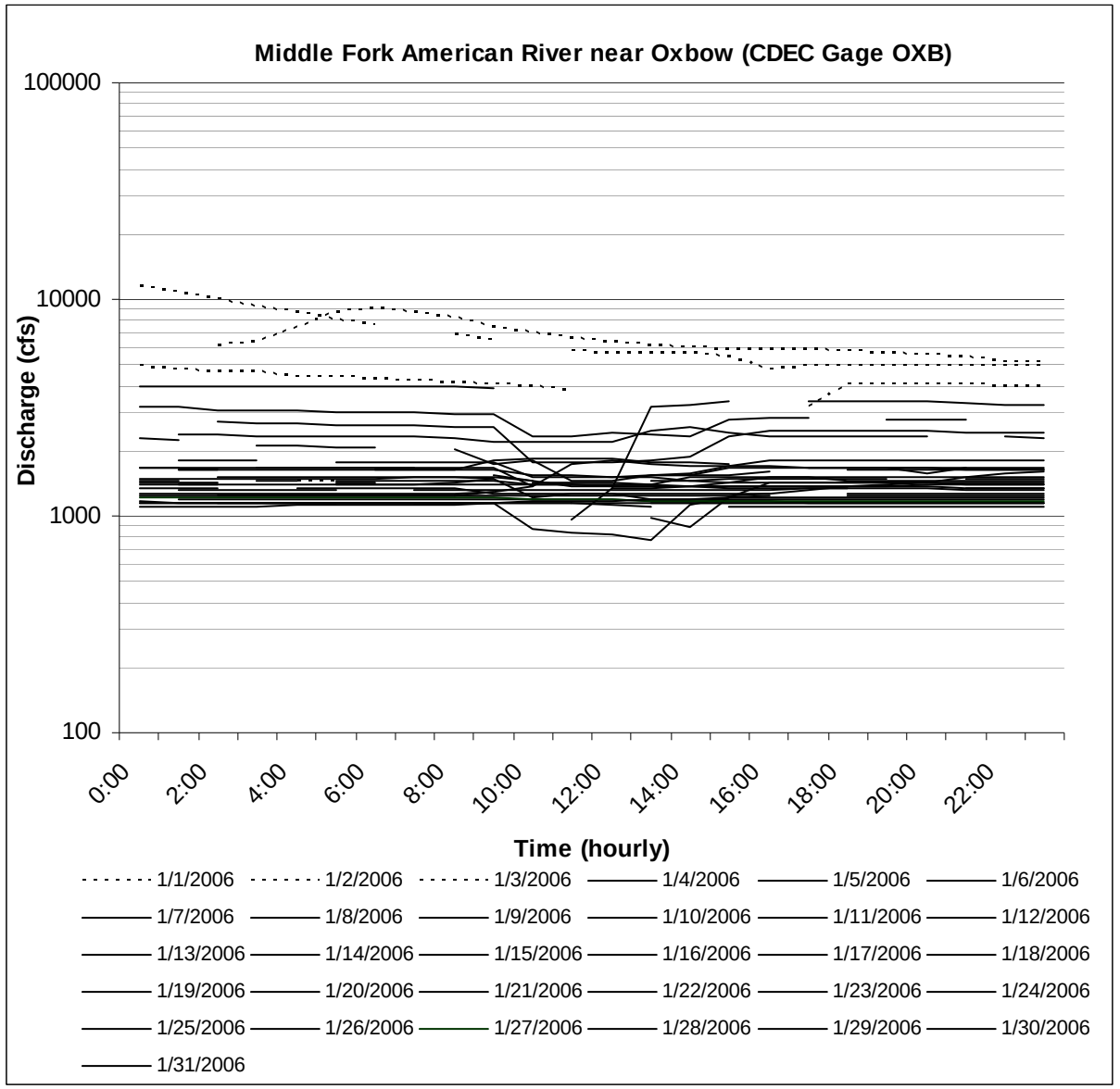
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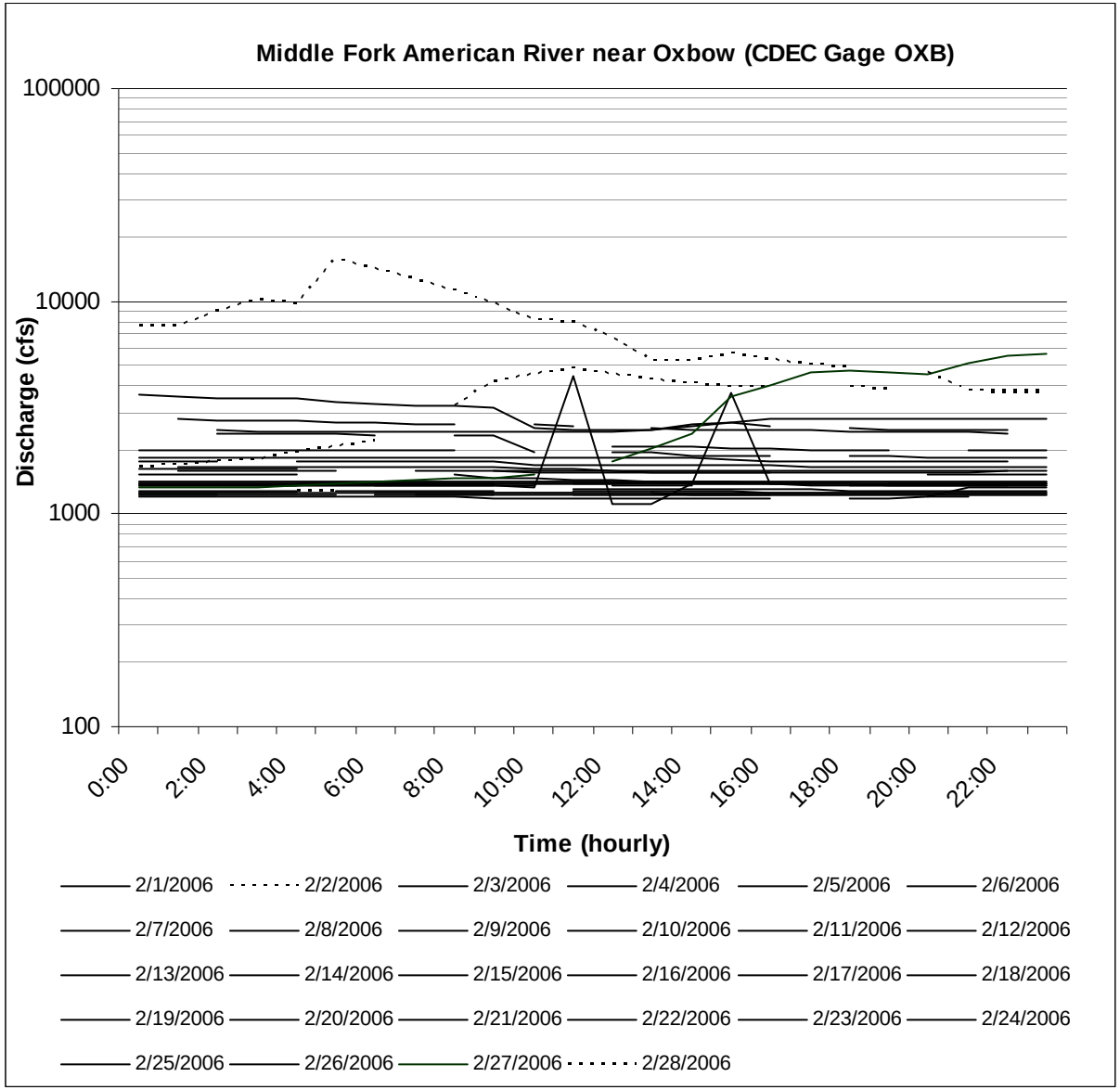

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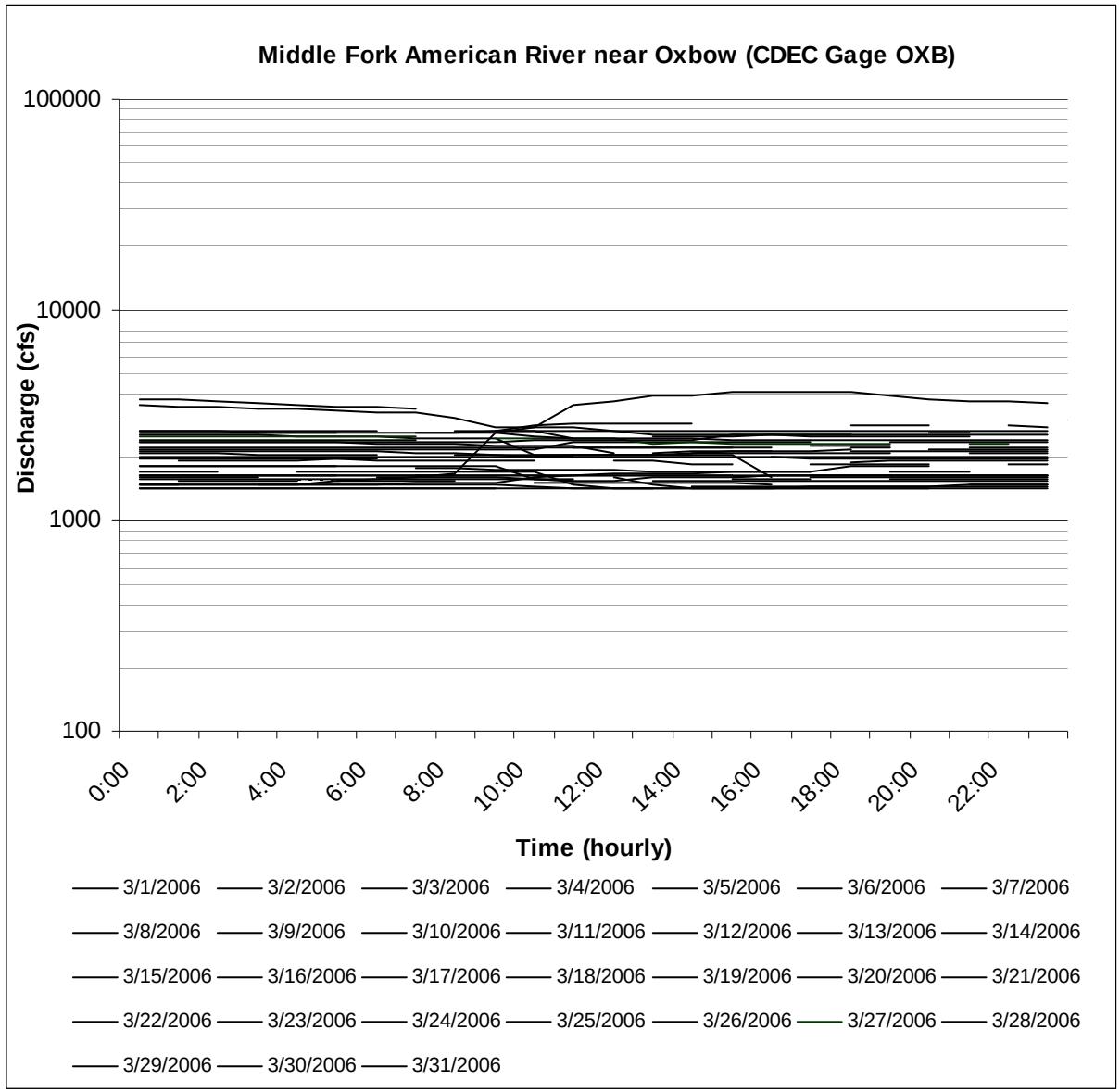

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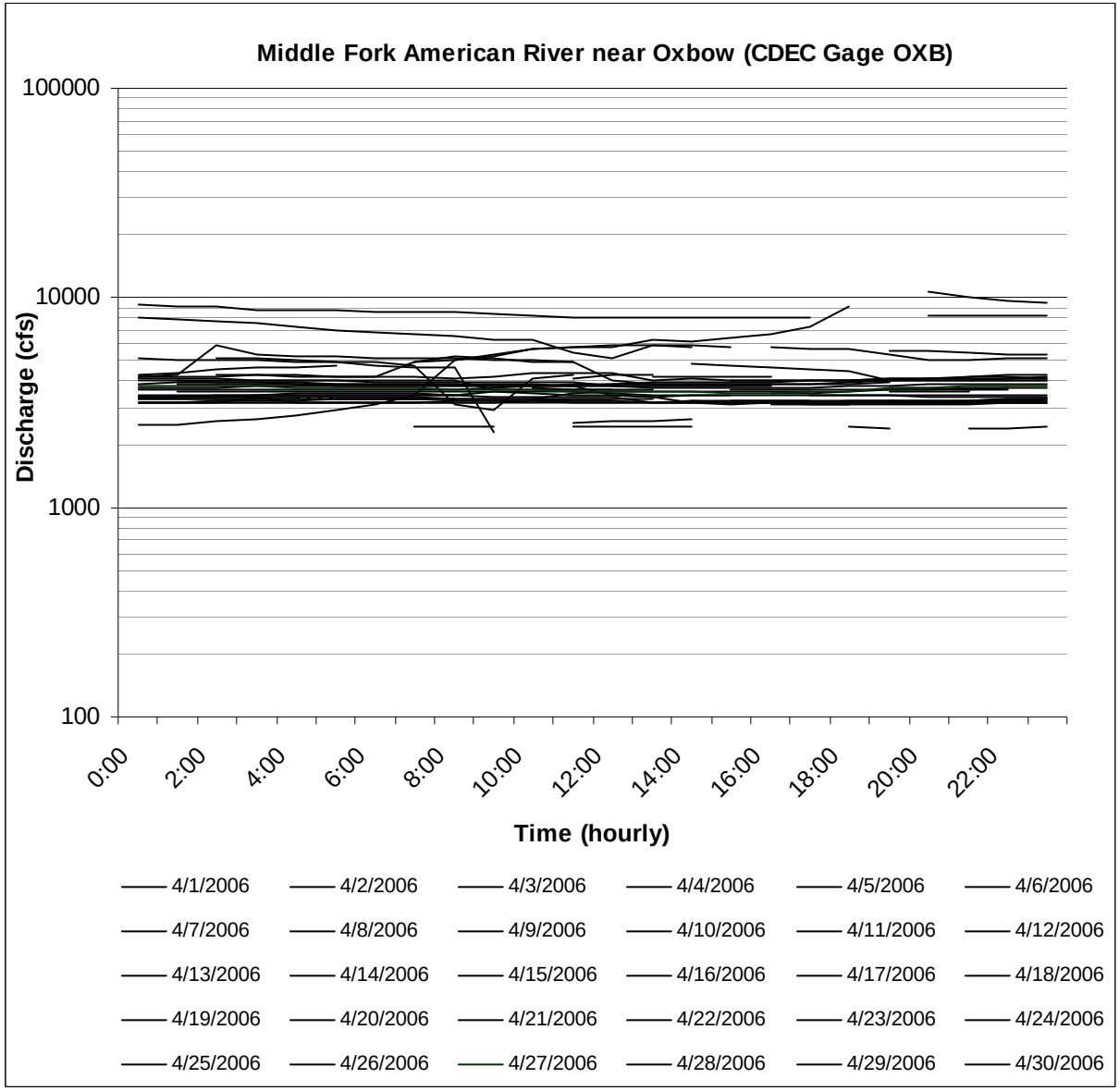

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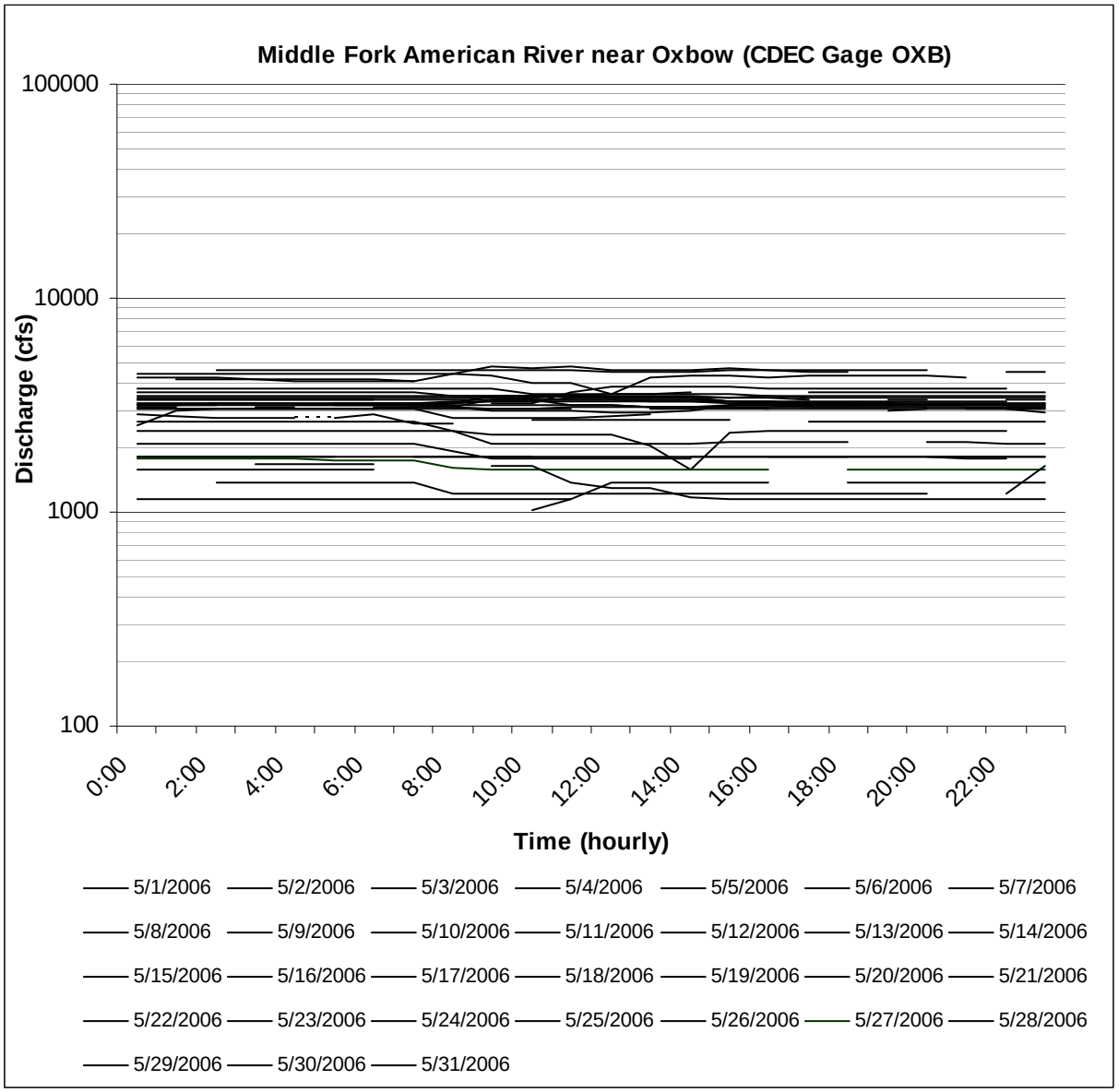

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6.4 WATER QUALITY

This report describes water quality in the waters affected by the Middle Fork American River Hydroelectric Project (MFP or Project). The Federal Energy Regulatory Commission's (Commission or FERC) content requirements for water resources, which also covers water quality, are specified in Title 18 of the Code of Federal Regulations (CFR) Chapter I § 5.6 (d) (3) (iii), as follows:

> ***Water Resources*** *- A description of the water resources of the proposed project and surrounding area. This must address the quantity and quality (chemical/physical parameters) of all waters affected by the project, including but not limited to the project reservoir(s) and tributaries thereto, bypassed reach, and tailrace.*
>
> *(A) Drainage area;*
>
> *(B) The monthly minimum, mean, and maximum recorded flows in cubic feet per second of the stream or other body of water at the powerplant intake or point of diversion, specifying any adjustments made for evaporation, leakage, minimum flow releases, or other reductions in available flow;*
>
> *(C) A monthly flow duration curve indicating the period of record and the location of gauging station(s), including identification number(s), used in deriving the curve; and a specification of the critical streamflow used to determine the project's dependable capacity;*
>
> *(D) Existing and proposed uses of project waters for irrigation, domestic water supply, industrial and other purposes, including any upstream or downstream requirements or constraints to accommodate those purposes;*
>
> *(E) Existing instream flow uses of streams in the project area that would be affected by project construction and operation; information on existing water rights and water rights applications potentially affecting or affected by the project;*
>
> *(F) Any federally-approved water quality standards applicable to project waters;*
>
> *(G) Seasonal variation of existing water quality data for any stream, lake, or reservoir that would be affected by the proposed project, including information on:*
>
> *(1) Water temperature and dissolved oxygen, including seasonal vertical profiles in the reservoir;*
>
> *(2) Other physical and chemical parameters to include, as appropriate for the project; total dissolved gas, pH, total hardness, specific conductance, cholorphyll a, suspended sediment concentrations, total nitrogen (mg/L as N), total phosphorus (mg/L as P), and fecal coliform (E. Coli) concentrations;*

(H) The following data with respect to any existing or proposed lake or reservoir associated with the proposed project; surface area, volume, maximum depth, mean depth, flushing rate, shoreline length, substrate composition; and

(I) Gradient for downstream reaches directly affected by the proposed project.

The FERC regulations presented above require information on both water use and water quality. This report presents information on water quality as defined by subsections (F) and (G) above. Information on the water use is presented in the Water Use Report (Section 6.4).

6.4.1 Information Sources

Existing information regarding water quality was collected and reviewed. Relevant information used to prepare this report was obtained from the following sources.

Water Temperature Information

- Placer County Water Agency (PCWA) collected information on water temperature in stream reaches affected by the MFP and reservoir profiles in 2005. The methods and results of this study are documented in PCWA's 2005 Water Temperature Study Report (PCWA 2006).

Physical and Chemical Water Quality Information

- The U.S. Geological Survey's (USGS) National Water Information System (NWIS) online database provided water quality information that was collected by the USGS at sampling locations along the Middle Fork American River and tributaries in the general vicinity of the Auburn Dam site.

- The U.S. Environmental Protection Agency's (USEPA) storage and retrieval (STORET) online database provided water quality information that was obtained by the Bureau of Reclamation (USBR) from sampling locations on the Middle Fork American River and the North Fork American River and the State Regional Water Quality Board from sampling locations located along the Middle Fork American River and tributaries.

- The 1998 and 2002 updates to the American River Watershed Sanitary Survey provided water quality condition information for the North Fork American River.

- Documents prepared by the Sacramento Municipal Utility District (SMUD) in association with the relicensing of the Upper American River Project (UARP) (FERC Project No. 2101) provided information on water quality conditions in the upper Rubicon River watershed area located upstream of the MFP.

PCWA also consulted with the local Regional Water Quality Control Board (RWQCB) to inquire about any available water quality data in the Middle Fork American River

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Watershed (Watershed). The RWQCB did not have water quality data or reports, nor were they aware of any water quality issues in the Watershed.

6.4.2 Federally Approved Water Quality Standards Applicable to Project Waters

The State of California has responsibility for maintaining water quality standards through implementation of the Federal Clean Water Act (CWA). The RWQCB has established water quality objectives for specific beneficial water uses. The MFP is located in the Central Valley Region – RWQCB. Existing and potential beneficial uses that apply to surface waters within the Watershed are identified in *The Sacramento River Basin and San Joaquin River Basin Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board – Control Valley Region (Fourth Edition revised September 2004)*. Beneficial uses identified in the Basin Plan that pertain to the MFP include: (1) municipal and domestic supply; (2) agricultural irrigation and stock watering; (3) power generation; (4) contact recreation; (5) non-contact recreation; (6) coldwater habitat and spawning habitat for fisheries; and (7) wildlife habitat. The definition of each of these beneficial uses is provided in Table 6.4-1.

The water quality objectives identified in the Basin Plan include both numeric and narrative standards for surface water. Applicable categories of standards include bacteria, biostimulatory substances, chemical constituents, color, dissolved oxygen, floating material, oil and grease, pH, pesticides, sediment, suspended material, taste and odors, temperature, toxicity, and turbidity (Table 6.4-2).

The Basin Plan provides specific numeric objectives for bacteria, which are identified to protect the contact recreation beneficial uses. Biostimulatory substances refer mainly to nutrients such as nitrogen, phosphorous, and organic carbon which can promote aquatic plant growth that may degrade aquatic habitat and diminish recreational values. This is mainly a narrative standard, as are the standards for color, floating material, oil and grease, sediment, suspended material, and taste and odors.

The Basin Plan for chemical constituents provides numeric water quality objectives that are derived from various sources. These objectives include references to maximum contaminant levels (MCLs) that are provided in Title 22 of the California Code of Regulations which sets standards for waters designated for domestic or municipal use. Additional, and often more stringent criteria are provided by the California Toxics Rule (CTR) and the National Toxics Rule (NTR) to protect aquatic life, and human health in the case of mercury. The CTR and NTR provide pertinent toxicity standards (Table 6.4-2).

Specific numeric objectives for dissolved oxygen, pH, and turbidity provided in the Basin Plan are applicable to the Project. The Basin Plan also specifies a water temperature thermal heating criteria that states “Natural water temperatures shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration does not adversely affect beneficial uses. At no time or place shall the temperature be increased more than 5°F (2.8°C) above the natural receiving water.”

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In addition to the Basin Plan, the RWQCB also enforces the water quality objectives published in the California Inland Surface Waters Plan (SWRCB 1991). The water quality objectives in both the Basin Plan and the Inland Surface Waters Plan consider background levels and are based on criteria that protect both human health and aquatic life. If water quality is maintained at levels below these objectives the beneficial uses are considered to be protected.

6.4.3 Water Temperature Information

This section documents the results of the first year (Phase I) of PCWA's water temperature characterization studies for the MFP. A complete description of the methods employed and results obtained from the study are provided in the 2005 Water Temperature Study Report (PCWA 2006). The 2005 Water Temperature Study focused on the primary rivers and tributary streams, upstream and downstream of the MFP dams and reservoirs.

6.4.3.1 Stream Water Temperature Monitoring

The location of each of the water temperature monitoring sites in 2005 is provided in Figures 6.4-1 through 6.4-3 and Table 6.4-3. Based on the Sacramento Valley Water Year Hydrological Index, 2005 was an "above normal (AN)" water year type. Of note, 2005 was characterized by a very wet May (the third wettest on record[1]) and June (the wettest on record), which likely affected water temperatures in the study streams and reservoirs during the monitoring period. Both of the major Project reservoirs spilled during May and June. A total of 9,320 acre-feet (ac-ft) of water spilled at French Meadows Reservoir over a 21 day period, and a total of 31,285 ac-ft of water spilled at Hell Hole Reservoir over a 26 day period. Water diversions ceased at the Duncan Creek Diversion around July 12, and the diversions on the North Fork Long Canyon and South Fork Long Canyon creeks were closed on May 26 and June 29, respectively.

Water temperatures measured in the study streams appear to have been influenced by a number of factors, including: (1) a relatively wet and prolonged spring runoff period that extended into the summer; (2) local rainstorms in June and spills from the Project reservoirs; and 3) the outage of the Project powerhouses in early to mid-October. The reservoir spills and powerhouse outage dates for 2005 are shown on Table 6.4-4.

Corresponding streamflow data is very important for deciphering and understanding observed trends in water temperature data. However, although streamflow monitoring occurs on a continuous basis at several locations along the study streams, these data were not available on a real-time basis (such as in California Data Exchange Center (CDEC), for example) and must undergo substantial compilation and review prior to publishing. Consequently, 2005 streamflow data for the study streams were not available for inclusion in this draft report. Flow information will be included in the next draft of this report.

[1] Based on precipitation data compiled at Georgetown Ranger Station Headquarters, the nearest complete and summarized data to the Middle Fork Project, between 1948 and 2005.

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Middle Fork American River

Water temperature was monitored at 16 locations in the Middle Fork American River, from upstream of French Meadows Reservoir (MF1) to immediately upstream of the confluence with the North Fork American River (MF8). Water temperature also was monitored in three tributaries (not including Duncan Creek or the Rubicon River) to the Middle Fork American River: the North Fork of the Middle Fork American River (NM1); Otter Creek (OC1); and Canyon Creek (CC1).

Water temperatures in the Middle Fork American River from RM 51.9 (MF1), which is located slightly upstream of French Meadows Reservoir, downstream to RM 36.1 (MF3) just downstream of Middle Fork Interbay are shown in Figure 6.4-4. In this area of the Middle Fork American River from June through October 2005, water temperature increased with increased distance downstream from French Meadows Dam. Water temperatures from MF2 essentially represent the release water temperatures from French Meadows Reservoir, which is demonstrated in the relatively flat trend in water temperature at this site. However, because MF2 is 0.6 miles downstream from the reservoir release location, ambient conditions (e.g., warm air temperatures) and reservoir spill, when occurring, can influence water temperatures measured at this location. Observed water temperatures generally were lowest during early June and warmest during mid-July. During the warmest period in July, water temperature increased more than 15°F in the approximately 10 mile-long reach between MF2 and MF3. Water temperatures recorded in the Middle Fork American River upstream of French Meadows Reservoir (MF1) were similar to the water temperatures recorded at MF3, the site located approximately 10 miles downstream from French Meadows Dam, from late July through early October. Following the peak in mid-July, water temperature at each site gradually decreased through the final data collection in October. The abrupt increase and decrease in water temperature during mid-June at MF2 and MF3 coincided with spilling from French Meadows Reservoir and local rainstorms.

Water temperatures in the Middle Fork American River from RM 36.1 (MF3) just upstream of Middle Fork Interbay to RM 26.0 (MF10) just upstream of Ralston Afterbay are shown in Figure 6.4-5. In this reach of the Middle Fork American River from June through October 2005, water temperatures were noticeably cooler at MF4, particularly during mid-July through early August, when compared to the water temperatures measured at the other three monitoring sites. During this period, water temperatures differed between MF4 and MF3 (located 0.6 miles upstream of MF4) by approximately 20°F. Cold water releases from the Middle Fork Powerhouse (which originate in Hell Hole Reservoir and are routed to the Middle Fork Powerhouse through the Hell Hole-Middle Fork Tunnel) into the Middle Fork American River were responsible for the cool water temperatures recorded at MF4. When power operations were suspended from early to mid-October for a maintenance outage, water temperatures recorded at MF4 were more similar to water temperatures recorded at the other three water temperature sites.

Water temperatures at MF10 and MF3 generally were coldest during early June and warmest during mid-July. The abrupt increase and decrease in water temperature

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during mid-June at MF3 coincided with spill from French Meadows Reservoir and local rainstorms. Following the peak in mid-July, water temperature at MF10 and MF3 gradually decreased through the final data collection in October. Data at MF13 were available from mid-September through October, during which water temperatures at MF13 generally were consistent with water temperatures recorded at MF10 and MF3.

Water temperatures in the Middle Fork American River from RM 24.3 (MF6) just downstream of Ralston Afterbay to RM 0.1 (MF8) just upstream of the confluence with North Fork American River are shown in Figure 6.4-6. From June through October 2005 in this reach of the Middle Fork American River, water temperature increased with increased distance downstream. Water temperatures generally were coldest around June 7-8 and warmest during late July and early August. The abrupt change in water temperature during mid-June measured at all four water temperature monitoring sites coincided with spill from French Meadows and Hell Hole reservoirs and local rainstorms. During the warmest period in July, water temperature increased more than 10°F in the approximately 24 mile-long reach between MF6 and MF8. Following the peak in late July/early August, water temperature at each site generally decreased through early September. When power operations were suspended from early to mid-October for a maintenance outage, water temperatures at all four sites increased.

Duncan Creek

Water temperature was monitored at three locations in Duncan Creek, from immediately upstream of the Duncan Creek Diversion Reservoir (DC1) to immediately upstream of the confluence with the Middle Fork American River (DC3) (Table 6.4-3, Figure 6.4-3).

Water temperatures in Duncan Creek from RM 8.8 (DC1) just upstream of the Duncan Creek Diversion to RM 0.0 (DC3) and upstream of the confluence with Middle Fork American River are shown in Figure 6.4-7. Water temperatures in Duncan Creek during June through October 2005 were generally coldest during early June and warmest during mid-July through early August. Water temperatures were warmest at DC2 (RM 8.4) and coldest at DC1 (RM 8.8); trends were not discernible for DC3 because few data were available. From late July through the final data collection in October, water temperatures generally differed between DC2 and DC1 by approximately 4°F. Following peak water temperatures in mid-July through early August, water temperature generally decreased through mid-October.

Rubicon River

Water temperature was monitored at 12 locations in the Rubicon River, from upstream of Hell Hole Reservoir (RR1) to Ralston Afterbay Reservoir (OX1) and the confluence with the Middle Fork American River, and in the South Fork Rubicon River immediately upstream of the Rubicon River confluence (SF1). Water temperature was also monitored in Pilot Creek (PC1), a major Rubicon River tributary, and Five Lakes Creek (FL1), a major Hell Hole Reservoir tributary (Table 6.4-3, Figures 6.4-2 and 6.4-3).

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Water temperatures in the Rubicon River from RM 35.9 (RR1) just upstream of Hell Hole Reservoir to RM 22.7 (RR5) just upstream of South Fork Rubicon River confluence are shown on Figure 6.4-8. Where comparable, water temperatures measured upstream from Hell Hole Reservoir (RR1) were generally colder than downstream at RR2, RR3, RR10, and RR5 during the late spring and early summer and warmer during the mid-summer through the fall. During the summer and fall period, water temperature increased at the four sites downstream of Hell Hole Reservoir with increased distance downstream. Sites RR2 and RR3 remained relatively cool with little variation in water temperature from mid-July through mid-October (the time span data were collected at RR2 and RR3) because of their close proximity to the release point of cool water from Hell Hole Reservoir. Variation in water temperature at RR3 was likely buffered because the river flows subsurface upstream of the monitoring site, limiting the exposure of the water to warming by ambient conditions. During the summer and fall, water temperatures at RR2 and RR3 gradually increased, mirroring the gradual increase in the deep water temperatures in Hell Hole Reservoir (see Section 3.2.1). From June through October 2005, water temperatures at RR1, RR10, and RR5 were coldest in early June and warmest from mid-July through mid-August, then generally decreased gradually from mid-August through October. The abrupt change in water temperature during mid-June at RR1, RR10, and RR5 coincided with spill from Hell Hole Dam and local rainstorms.

Water temperatures in the Rubicon River from RM 22.7 (RR5) just upstream of South Fork Rubicon River confluence to RM 5.3 (RR8) just upstream of Pilot Creek confluence are shown in Figure 6.4-9. From June through October 2005 in this reach of the Rubicon River, water temperatures increased with distance downstream. Water temperatures generally were coldest during early June and warmest during mid-July. The abrupt change in water temperature during mid-June at RR8 and RR5 coincided with spill from Hell Hole Reservoir and local rainstorms. During the warmest period in July, water temperature increased more than 10°F in the approximately 17 miles between RR5 and RR8. For the three sites surrounding the Rubicon River-South Fork Rubicon River confluence, water temperatures during the summer generally were warmest in the South Fork Rubicon River just upstream of the confluence (SF1), and were coldest in the Rubicon River just upstream of the confluence (RR5).

Water temperatures in the Rubicon River from RM 5.3 (RR8) just upstream of Pilot Creek to RM 0.7 (RR4) Ralston Afterbay are shown in Figure 6.4-10. From June through October 2005 in this reach of the river, water temperatures were generally coldest during early June and warmest during mid-July. The abrupt change in water temperature during mid-June at RR8 and PC1 coincided with spill from Hell Hole Reservoir and Stumpy Meadows Reservoir, respectively, and local rainstorms. Water temperatures were warmest at the most downstream Rubicon River water temperature monitoring site (RR4), and water temperatures were coldest in Pilot Creek just upstream of the Rubicon River confluence (PC1). During the summer and fall periods, cold water inflow from Pilot Creek caused water temperatures in the Rubicon River downstream of the Pilot Creek confluence to be slightly colder (RR9) than water temperatures upstream of the Pilot Creek confluence (RR8).

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Long Canyon Creek

Water temperature was monitored at seven locations in Long Canyon Creek (two locations each in the South Fork (SL1 and SL2) and North Fork (NL1 and NL2), and three locations on the main stem, from immediately upstream of the diversions on South Fork (SL1) and North Fork (NL1) Long Canyon creeks to immediately upstream of the confluence with the Rubicon River (LC1) (Table 6.4-3, Figures 6.4-4 and 6.4-5). Water temperature also was monitored in Wallace Canyon Creek (WC1), a major tributary to Long Canyon Creek.

Water temperatures in Long Canyon Creek are shown in Figure 6.4-11. During June through October 2005, water temperatures generally were coldest during early June and warmest during mid-July. The abrupt increase and subsequent decrease in water temperature during mid-June recorded at NL1, NL2, and SL2 coincided with local rainstorms (Figure 6.4-8). Following the peak in mid-July, water temperature at each site generally decreased through the final data collection in mid-October. Water temperatures in South Fork Long Canyon Creek generally were cooler than water temperatures in North Fork Canyon Creek. In South Fork Canyon Creek, water temperatures just below the South Fork Diversion Dam (SL2) typically were several degrees Fahrenheit warmer than water temperatures just above the South Fork Diversion Dam (SL1). In North Fork Canyon Creek, water temperatures just below the North Fork Long Canyon Diversion (NL2) typically were slightly warmer than water temperatures just above the diversion (NL1).

Water temperatures in Long Canyon Creek from RM 11.1 (LC2) downstream to RM 0.0 (LC1) are shown in Figure 6.4-12. Additionally, water temperatures in Wallace Canyon Creek, at RM 1.2 (WC1) from the Long Canyon Creek confluence, are included. Available data indicate that water temperatures were generally warmest during mid-July and coldest during early to mid-October. Following the peak in mid-July, water temperature at each site generally decreased through the final data collection in mid-October. Within Long Canyon Creek, water temperature increased with increased distance downstream. Water temperatures at WC1 were cooler, sometimes by more than 10°F, than water temperatures in Long Canyon Creek.

North Fork American River

Water temperatures in the North Fork American River from RM 21.4 (NF1) immediately upstream of Middle Fork American River confluence to RM 14.9 (NFA) near Auburn Dam site, and water temperatures in the Middle Fork American River at RM 0.1 (MF8) immediately upstream of North Fork American River confluence are shown on Figure 6.4-13 and Table 6.4-3. From June through October 2005, water temperatures at these locations generally were coldest during early June and warmest during late July to early August. The abrupt change in water temperature during mid-June coincided with spill from upstream reservoirs and local rainstorms. Following the peak in early August, water temperatures at each site generally decreased through September. Water temperatures in the North Fork American River upstream of the Middle Fork confluence (NF1) continued to decrease through October, whereas water temperatures in the

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Middle Fork American River (MF8) and the North Fork American River downstream of the Middle Fork American River confluence (NF2 and NFA) slightly increased. This occurred coincident with the annual powerhouse maintenance outage during early to mid-October. Among the water temperature monitoring sites shown on Figure 6.4-18, water temperatures were warmest (by over 10°F) at NF1 (located in the North Fork just upstream of the Middle Fork confluence), and coldest at MF8 (located in the Middle Fork just upstream of the North Fork confluence). Cold water inflow from the Middle Fork American River apparently influenced water temperatures in the North Fork American River. During the warmest period in August, water temperature decreased more than 10°F in the approximately 0.8 miles between NF1 (just upstream of the Middle Fork confluence) and NF2 (just downstream of the Middle Fork confluence). It is important to note that the North Fork American River upstream of the Middle Fork American River is not influenced by large storage reservoirs and low-level reservoir outlet releases (e.g., cold), as is the case for the Middle Fork Middle Fork American River.

6.4.3.2 Reservoir Profile Monitoring

French Meadows Reservoir

Reservoir profiling of water temperature, dissolved oxygen, and specific conductance was performed at French Meadows Reservoir on June 15, July 15, August 16, September 19, and October 25, 2005. The profiling locations in French Meadows Reservoir are shown on Figure 6.4-14.

Throughout the sampling season, the reservoir elevation steadily declined, resulting in a successive decrease in the maximum depth sampled at each profile site. The estimated water surface elevation during each sampling event is as follows:

Date	Estimated Elevation *(feet above msl)*
June 15	5,262
July 15	5,258
August 16	5,248
September 19	5,236
October 25	5,223

For reference, the Middle Fork American River outlet in French Meadows Reservoir is at approximately 5,039 feet above mean sea level (msl), giving a water depth of 184 feet or more below the reservoir water surface during the sampling period.

Water Temperature Profile Results

Water temperature profiles at the sampling site closest to the dam (FM1) in French Meadows Reservoir from mid-June through late October are shown on Figure 6.4-15.

The water temperature profiles at FM1, FM2, and FM3 throughout the sampling period were generally similar (PCWA 2006).

Dissolved Oxygen and Specific Conductance Results

Dissolved oxygen profiles and specific conductance profiles from June through October 2005 are shown on Figures 6.4-16 and 6.4-17, respectively. The individual monthly dissolved oxygen plots and specific conductance plots for sites FM1, FM2, and FM3 are included in the 2005 Water Temperature Study Report (PCWA 2006).

Hell Hole Reservoir

Reservoir profiling of water temperature, dissolved oxygen, and specific conductance was performed at Hell Hole Reservoir on June 15, July 15, August 16, September 20, and October 24, 2005. The profiling sites in Hell Hole Reservoir are shown on Figure 6.4-18.

Throughout the sampling season, the reservoir water surface elevation steadily declined though September, resulting in a successive decrease in the maximum depth sampled at each site. The reservoir elevations were the same during the September and October sampling dates. The estimated water surface elevation at Hell Hole Reservoir during each sampling event is as follows:

Date	Estimated Elevation (feet above msl)
June 15	4,631
July 15	4,624
August 16	4,605
September 19	4,584
October 25	4,584

For reference, the Rubicon River outlet in Hell Hole Reservoir is at approximately 4,288 msl, giving a water depth of approximately 300 feet or more below the water surface during the sampling period.

Water Temperature Profile Results

Water temperature profiles at the sampling site closest to the dam (HH1) in Hell Hole Reservoir from mid-June through late October are shown on Figure 6.4-19. In general, the water temperature profiles are similar throughout the sampling season at HH1, HH2, and HH3 (PCWA 2006).

Dissolved Oxygen and Specific Conductance Results

The Hell Hole Reservoir dissolved oxygen and specific conductance profiles from June through October at profile site HH1 are shown on Figure 6.4-20. Individual monthly

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dissolved oxygen plots for HH1, HH2, and HH3 are included in 2005 Water Temperature Study Report (PCWA 2006).

Ralston Afterbay Reservoir

Reservoir profiling of water temperature, dissolved oxygen, and specific conductance was performed at Ralston Afterbay Reservoir on July 14, August 16, September 19, and October 25, 2005. The single profiling site in Ralston Afterbay Reservoir is shown on Figure 6.4-21.

Ralston Afterbay Reservoir serves as a re-regulating afterbay for the Ralston Powerhouse with the reservoir surface elevation subject to daily fluctuations that typically remained between approximately 1,170 msl and 1,175 msl during the sampling season. However, the elevation decreased to approximately 1,150 msl, during the MFP powerhouse maintenance outage (Figure 6.4-22). Water surface elevations during the four sampling events at Ralston Afterbay Reservoir were as follows:

Date	Estimated Elevation (feet above msl)
July 15	1,172
August 16	1,174
September 19	1,172
October 25	1,172

The October reservoir profile was conducted after the reservoir had returned to its normal operating elevation.

Water Temperature Results

Water temperature profiles of Ralston Afterbay Reservoir during each of the four sampling periods are shown on Figure 6.4-23.

Dissolved Oxygen and Specific Conductance Results

Dissolved oxygen and specific conductance profiles of Ralston Afterbay Reservoir from July through October are shown on Figure 6.4-24.

6.4.4 Physical and Chemical Water Quality Information

The physical and water chemistry conditions in waters affected by the MFP are generally of high quality and conform to regulatory water quality objectives and standards. Based on a review of available existing historical water quality data no indication of persistent, widespread water quality issues were found. The watershed does not contain any urban areas that often are the source of water quality degradation. In addition there are no active landfills in the drainage area of waters affected by the MFP nor are there any municipal wastewater systems which are permitted to discharge

treated effluent to surface waters. While historical mining activity has occurred in the region, water quality issues have not been identified to date in waters affected by the MFP. Mercury and mining are discussed at the end of this report.

The results of relevant water quality information reviewed are summarized below. The historical water quality data (pre-1985) obtained from NWIS (USGS data) and STORET (USBR and SWRCB data) databases are discussed collectively. This is followed by a summary of the results from the American River Watershed Sanitary Surveys, and the results of water quality studies performed in association with the relicensing of the Sacramento Municipal Utility District's (SMUD's) Upper American River Project (UARP).

6.4.4.1 Historical Water Quality Study Results

Historical water quality data (1960's – 1980's) consists of data collected by the USGS, State Regional Water Quality Board and the USBR. This data was obtained from online databases and is provided in Tables 6.4-5 through 6.4-7. The locations of the water quality sampling stations in Table 6.4-5 through 6.4-7 are depicted on Figure 6.4-25 by the map code letter provided in the tables.

Review of the USGS data from the NWIS database indicate that generally all of the constituents analyzed comply with current regulatory standards with the exception of iron and manganese constituents. Elevated concentrations of iron and manganese were detected in water samples collected from the Middle Fork American River above French Meadows in 1979 (Table 6.4-5). Iron was reported in two samples at concentrations of 370 and 650 ug/l and manganese was detected in three samples at concentration of 60, 90 and 140 ug/l. These concentrations are above the secondary maximum containment level (MCL) taste and odor threshold levels for iron and manganese (300 ug/l and 50 ug/l, respectively).

Review of the USBR sampling data from the Middle Fork American River and North Fork American River indicate that generally all of the constituents analyzed complied with current regulatory standards with the exception of a few pH measurements. Seven measurements of pH were either above or below the current regulatory standard of 6.5 to 8.5 (Table 6.4-6). Over a 13-year period between 1968 and 1981 the USBR collected 222 pH measurements from waters in the vicinity of the MFP. Of these pH measurements five measurements were below the 6.5 regulatory level ranging between 5.8 and 6.4, and two measurements were above the 8.5 regulatory level ranging between 8.6 and 9.2.

Review of the SWRCB data collected between 1960 and 1969 from waters in the vicinity of the MFP indicate that the sampling results comply with current regulatory standards (Table 6.4-7).

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6.4.4.2 American River Watershed Sanitary Survey Results

PCWA collects and analyzes water quality samples collected in the North Fork American River at their water intake for the Foothill Water Treatment Plant. These data are published in a report entitled the American River Watershed Sanitary Survey, which is updated every five years. These data represent raw water quality conditions in the North Fork American River prior to treatment and distribution into the PCWA water delivery system.

The 1998 sanitary survey includes tabulated data from the ambient water quality monitoring program. The data summarized was collected between 1993 and 1997 and are presented in Table 6-4-8. The results indicate that chromium was the only inorganic constituent tested which exceeded the current regulatory standard of 0.05 mg/l between 1993 and 1997. However, most of the samples for chromium were well below the regulatory standard. The 1998 sanitary survey states: *"PCWA is currently in compliance with all regulations at both water treatment plants"* (Archibald & Wallberg Consultants 2003).

The 2003 update to the sanitary survey provided an overview of the water quality for the raw influent water from the North Fork American River to the Foothill Water Treatment Plant between 1998 and 2002. The sanitary survey stated: *"The raw water has excellent quality……Fecal coliform and E. coli levels are generally very low."* (Archibald & Wallberg Consultants 2003).

PCWA is continuing to collect water samples at the intake for the Foothilll Water Treatment Plant. Data from this ongoing monitoring effort will be reported in the next American River Watershed Sanitary Survey, due to be published in 2008. Water quality data available through 2006 will be incorporated into future updates of this Water Quality report.

6.4.4.3 SMUD UARP Water Quality Study

SMUD conducted a water quality study for their UARP during 2002 as part of their hydroelectric relicensing process (SMUD 2005). Study results from monitoring sites located on the Rubicon River above Hell Hole Reservoir (6 sites), the South Fork Rubicon River (4 sites), and Gerle Creek (9 sites) are of interest for the MFP because they represent water quality conditions for the water entering MFP reservoirs or water downstream of MFP facilities. Most of these monitoring sites are located within stream reaches, but a few are within smaller reservoirs (i.e., Buck Island Reservoir, Rubicon Reservoir, Gerle Creek Reservoir).

SMUD collected measurements of in-situ parameters as well as water samples that were analyzed by laboratory methods for chemical constituents. Parameters generally included standard in-situ measurements, nutrients, dissolved ions, organic compounds, metals, bacteria, and fish tissue analysis. In general, results of analyses for most water quality constituents evaluated in the study were within Basin Plan standards. The exceptions are described below.

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- The results of SMUD's pH measurements revealed that most values were within the range of 6.0-8.0, with 21 values in the upper Watershed stream reaches that were less than 6.5 (SMUD 2005). During spring runoff sampling events, the majority of pH measurements were less than 6.5, which included monitoring sites in both SMUD project-affected and non project-affected reaches.

- Laboratory analysis of total metals concentrations indicated that the primary MCL criteria were not exceeded (SMUD 2005). However, the secondary MCL criteria for aluminum (200 µg/L) and iron (300 µg/L) were exceeded during some sampling events (SMUD 2005). An aluminum concentration of 230 µg/L was observed on the Rubicon River in 2002. Iron concentrations of 390 µg/L and 340 µg/L were observed in 2003 in the Rubicon Reservoir. Iron concentrations were exceeded in 2004 in Rockbound Reservoir (330 µg/L), Rubicon Reservoir (540 µg/L), and the Rubicon River (340 µg/L).

- Dissolved metals analyses were performed on water samples collected by SMUD during summer/fall 2004 to determine compliance with aquatic life toxicity criteria. The parameters tested include cadmium, copper, lead, nickel, silver, and zinc. The acute and chronic toxicity criteria for these parameters must be calculated on a sample-by-sample basis because they are hardness-dependent. Exceedances of the criteria occurred for all parameters (except nickel) in both SMUD project-affected and non project-affected reaches (Table 6.4-9).

- Fish tissue samples were collected from Loon Lake and Gerle Creek Reservoir in 2003 and analyzed for trace metals in the edible portion (i.e., filet) of the fish. Analyses included arsenic, aluminum, cadmium, chromium, copper, lead, mercury, manganese, nickel, selenium, and zinc. None of the State Water Resource Control Board's Maximum Tissue Residue Levels (MTRL's) were exceeded in these samples. There was one exceedance of the USEPA's 0.3 ppm mercury criterion from Gerle Creek Reservoir: one brown trout contained 0.32 ppm of mercury in the fish filet.

6.4.4.4 Mercury and Mining

The presence of mercury in the Watershed is a potential concern due to the prevalence of historic and abandoned mines. Mercury alloys with gold and was commonly used throughout the Sierra Nevada to recover and process gold at placer (alluvial) mines, and to a lesser extent hardrock (lode) mines. Mercury was commonly used in placer mining operations utilizing hydraulic, dredging, and drift mining methods. At hydraulic mines, placer deposits were stripped using monitors (water cannons) and the resulting water/sediment slurry was directed through sluices and drainage tunnels. The sluices and drainage tunnels were "charged" with mercury and the gold particles in the slurry combined with the mercury to form gold-mercury amalgam. A similar process was used to charge sluice boxes used in dredging and drift mining operations. Dredging involves the removal of gold bearing sediments from the stream channel. Drift mining is the underground mining of placer deposits.

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Mining occurred throughout the Watershed at numerous placer and hardrock mines associated with at least eight major gold mining districts, referred to in the geologic literature as follows: Foresthill; Michigan Bluff; Damascus; Westville; Last Chance; Ralston Divide; Duncan Creek; and Georgetown (CDMG 1970). Major hydraulic mines were present in the Last Chance district, the Michigan Bluff district, and in the Foresthill district (CDMG 1970). Major drift mines were present in the Duncan Peak district, the Damascus district, and in the Last Chance district.

According to the United States Geological Survey (USGS), large amounts of mercury used to recover and process gold in the Sierra Nevada was lost to the environment (USGS 2000). The USGS estimates that the annual loss of mercury from a typical sluice used in association with hydraulic mining was likely to have been several hundred pounds (USGS 1999). The present distribution and fate of the mercury used in historic gold mining operations remains largely unknown, and is the focus of ongoing studies (USGS 2000).

The USGS, in cooperation with other State and federal agencies, has been conducting studies to evaluate the present distribution and fate of mercury used in gold mining operations. To date the focus of the USGS studies have been on the Bear and Yuba River watersheds. Extensive studies have not been conducted in the Watershed. A limited amount of sampling has occurred at the Pond Mine located near Dardanelles Creek, which drains into to the Middle Fork American River, downstream of Oxbow Powerhouse. However, to date, PCWA has not been able to acquire the results of this sampling effort.

Methylmercury

Mercury is a potential neurotoxin which has a tendency to biomagnify in the food chain and is a potential threat to human and ecological health (USGS 1999). It occurs in several different geochemical forms, including elemental mercury, ionic (or oxidized) mercury, and several organic forms, the most important of which is methylmercury. Methylmercury is the form most readily incorporated into biological tissues and most toxic to humans (USGS 2000).

Methylmercury is formed from mercury via a two-step process. The first step involves the oxidation of elemental mercury to ionic mercury. The second step is referred to as methylation and involves the transformation of ionic mercury to methylmercury (USGS 2000). Mercury methylation is controlled by sulfate-reducing bacteria and other microbes that tend to thrive in conditions of low dissolved oxygen, for example the sediment–water interface or in algal mats (USGS 2000). Numerous environmental factors influence the rates of mercury methylation process including, temperature, dissolved organic carbon, salinity, pH levels, oxidation-reduction conditions, and the form and concentration of sulfur in water and sediments (USGS 2000). The concentration of methylmercury generally increases by a factor of ten or less with each step up the food chain (USGS 2000).

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According to the USEPA, fish tissues are the dominant human exposure route for methylmercury (USEPA 2001). Therefore, to protect human health, the USEPA has established a fish tissue residue water quality criterion for methylmercury rather than a water column-based water quality criterion. The USEPA's Tissue Residue Criterion is 0.3 mg methylmercury/kg fish. This is the concentration in fish tissue that should not be exceeded based on a total fish and shellfish consumption-weighted rate of 0.0175 kg fish/day.

6.4.3 References

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TABLES

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Table 6.4-1. The Sacramento River Basin and San Joaquin River Basin Water Quality Control - Definition of Beneficial Uses.

Beneficial Use	Definition
Municipal and Domestic Supply (MUN)	Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.
Agricultural Supply (AGR)	Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing.
Hydropower Generation (POW)	Uses of water for hydropower generation.
Water Contact Recreation (REC-1)	Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, whitewater activities, fishing, or use of natural hot springs.
Non-contact Water Recreation (REC-2)	Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
Cold Freshwater Habitat (COLD)	Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
Spawning, Reproduction and/or Early Development (SPWN)	Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.
Wildlife Habitat (WILD)	Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

Source: Table II of *The Sacramento River Basin and San Joaquin River Basin Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board –Control Valley Region Fourth Edition revised September 2004*.

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Table 6.4-2. Applicable Water Quality Objectives and Standards.

Analyte	Units	State and Federal Criteria		
		Basin Plan[1]	CA TOXIC RULE[2]	NATIONAL TOXIC RULE[3]
Acid Neutralizing Capacity		NS	NS	NS
Alkalinity (as $CaCO_3$)	mg/L	NS	NS	>20[5]
Aluminum	mg/L	0.2	NS	NS
Ammonia as NH_3	mg/L	1.5[6]	NS	1[6]
Antimony	µg/L	6	14	14
Arsenic – Total	µg/L	10	150/340[10]	150/340[10]
Benzene	µg/L	1	1.2	1.2
Beryllium	µg/L	4	NS	NS
Bicarbonate (as $CaCO_3$)		NS	NS	NS
Boron – Total		NS	NS	NS
Cadmium	µg/L	5	Hardness Dependent[10,11]	Hardness Dependent[10,11]
Calcium		NS	NS	NS
Carbonate (as $CaCO_3$)		NS	NS	>20[5]
Chemical Oxygen Demand		NS	NS	NS
Chloride	mg/L	250[4]	NS	NS
Chlorophyll-a		NS	NS	NS
Chromium - Total	µg/L	50	NS	NS
Cobalt		NS	NS	NS
Color		15 units[4,7]	NS	NS
Copper – Total	mg/L	1	1,300[13] and Hardness Dependent[11]	1,300[13] and Hardness Dependent[11]
Cryptosporidium		NS	NS	NS
Cyanide	µg/L	150	5.2/22[10]	100/110[10]
Ethyl-benzene	µg/L	300	3,100	3,100
Fecal Coliform (3x5)	MPN/ 100 mL	200	NS	NS
Fecal Streptococci		NS	NS	NS
Fluoride	mg/L	2	NS	NS
Foaming Agents	mg/L	0.5[4]	NS	NS
Giardia		NS	NS	NS
Hardness (as $CaCO_3$)		NS	NS	>20[5]
Iron – Total	mg/L	0.3[4]	NS	NS
Lead – Total	µg/L	15	NS	NS

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Table 6.4-2. Applicable Water Quality Objectives and Standards.

Analyte	Units	State and Federal Criteria		
		Basin Plan[1]	CA TOXIC RULE[2]	NATIONAL TOXIC RULE[3]
Magnesium		NS	NS	NS
Manganese – Total	µg/L	50[4]	NS	NS
Mercury – Total	µg/L	2	0.05	0.77/1.4[10]
Methylmercury	mg/Kg fish			0.3[17]
Methyl-tertiary-butyl Ether (MtBE)	µg/L	5[4]	NS	NS
Nickel	µg/L	100	610[13], 4,600[14] and Hardness Dependent [10,11]	610[13], 4,600[14] and Hardness Dependent [10,11]
Nitrate (NO_3)	mg/L	45	NS	NS
Nitrite	mg/L	1.0	NS	NS
Nitrogen- Total Kjeldahl (TKN)		NS	NS	NS
Odor		3 units[4,7]	NS	NS
Organic Carbon		NS	NS	NS
Ortho-phosphate (o-PO_4-P)		NS	NS	NS
Oxygen, dissolved	mg/L	7.0[15]	NS	NS
pH	unitless	6.5 – 8.5	NS	6.5 – 9.0
Phosphorus		NS	NS	NS
Potassium		NS	NS	NS
Selenium	µg/L	50	5/20[10]	5/20[10]
Silica		NS	NS	NS
Silver	µg/L	100[4]	Hardness Dependent [10,16]	Hardness Dependent [10,16]
Sodium		NS	NS	NS
Sulfate (SO_4)	mg/L	250[4]	NS	NS
Thallium	µg/L	2	1.7[13], 6.3[14]	1.7[13], 6.3[14]
Toluene	µg/L	40	6.8[13], 20[14]	20[14]
Total Coliform (3x5, 6 hr hold)		NS	NS	NS
Total Dissolved Solids	mg/L	500[4]	NS	NS
Total Petroleum Hydrocarbons (as gasoline and as diesel)		NS	NS	Narr[8]
Total Suspended Solids		NS	NS	NS

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Table 6.4-2. Applicable Water Quality Objectives and Standards.

Analyte	Units	State and Federal Criteria		
		Basin Plan[1]	CA TOXIC RULE[2]	NATIONAL TOXIC RULE[3]
Turbidity	NTU	Narr[9]	NS	NS
Xylenes – Total	μg/L	1750	NS	NS
Zinc – Total	mg/L	5[4]	Hardness Dependent[10]	Hardness Dependent[10]

[1]The Basin Plan for the Sacramento and San Joaquin River Basins rely on California primary and secondary Maximum Concentration Level objectives as criteria for water quality to be used as a municipal & domestic supply for human consumption.

[2]California Toxics Rules are based primarily on USEPA standards developed under the Clean Water Act for human consumption of water and aquatic organisms with an adult risk for carcinogens estimated to be one in one million as contained in the Integrated Risk Information System (IRIS) as of October 1, 1996.

[3]The National Toxics Rules are based on USEPA standards developed under the Clean Water Act for human consumption of water and aquatic organisms with an adult risk for carcinogens estimated to be one in one million as contained in the IRIS as of October 1, 1996. These criteria are to be applied to all states not complying with the Clean Water Act section 303(c)(2)(B).

[4]The criteria listed are secondary Maximum Concentration Levels for California drinking water quality objectives that do not necessarily indicate a toxic amount of contaminate. Rather these standards dictate water quality objectives designed to preserve taste, odor, or appearance of drinking water.

[5]20 mg/L or more as $CaCO_3$ for freshwater aquatic life except where natural concentrations are less (USEPA's 1976 'Red Book). The 'Red Book' also recommends that natural alkalinity not be reduced by more than 25%.

[6]Taste and odor threshold.

[7]Water shall be free of discoloration that causes nuisance or adversely affects beneficial uses. Water shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses. (Sacramento and San Joaquin River Basin Plan, Chapter III: Water Quality Objectives, pgs. 5 and 7, 6 September 2002).

[8]From Compilation of Water Quality Goals – TPH-diesel: taste and odor threshold and USEPA SNARL = 100 ug/L. TPH-gasoline: taste and odor threshold and proposed USEPA SNARL = 5 μg/L.

[9]Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits: where natural turbidity is between 0 and 5 NTU's, increases shall not exceed 1 NTU. Where natural turbidity is between 5 and 50 NTU's, increases shall not exceed 20%. Where natural turbidity is between 50 and 100 NTU's, increases shall not exceed 10 NTU's. Finally, where natural turbidity is greater than 100 NTU's, increases shall not exceed 10%.

[10]Freshwater Aquatic Life Protection, continuous concentration (4-day average)/maximum concentration (1-hour average).

[11]Criteria is expressed as a function of hardness and decreases as hardness decreases. The actual criteria is calculated based in the hardness (as $CaCO_3$) of the sample water.

[12]California primary maximum contaminant level (MCL) for inorganic mercury.

[13]Califorina Toxic Rule (CTR) human health (30-day average) drinking water sources (consumption of water an aquatic organisms).

[14]Califorina Toxic Rule (CTR) human health (30-day average) other waters (aquatic organism consumption only).

[15]For water designated as COLD.

[16]Instantanous maximum.

[17]This value is an Ambient Water Quality Criteria (AWQC) for methylmercury and was published by the U.S. EPA in a document titled Water Quality Criterion for the Protection of Human Health: Methylmercury – Final (EPA – 823-R-01-001, January 2001). This AWQC replaces the AWQC for total mercury published in 1980 and partially updated in 1997.

NS - no standard available

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Table 6.4-3. PCWA Water Temperature Study Site Locations.

Site ID	Site Name	River	Site Location (UTM)		Installation Date
			N	E	
CC1	Canyon Cr Immediately Upstream of MF American R	0.1	681766	4313543	8/11/2005
DC1	Duncan Cr Immediately Upstream of Diversion Dam	8.8	717877	4334888	9/24/2003
DC2	Duncan Cr Downstream of Diversion Dam	8.4	717486	4334533	9/24/2003
DC3	Duncan Cr Immediately Upstream of MF American R	0.0	712401	4323832	9/22/2005
FL1	Five Lakes Cr Upstream of Hell Hole Reservoir	0.0	729486	4329029	9/30/2003
IB1	MF American R Immediately Downstream of MF Powerhouse Outlet	35.9	708045	4322282	8/17/2004
LC1	Long Canyon Cr Immediately Upstream of Rubicon R	0.0	700326	4318266	8/24/2004
LC2	Long Canyon Cr Immediately Downstream of North and South Fork Long Canyon Crs	11.1	714694	4321749	7/7/2005
LC3	Long Canyon Cr Immediately Upstream of Wallace Canyon Cr	6.8	709614	4318063	7/21/2005
MF1	MF American R Upstream of French Meadows Reservoir	51.9	724150	4335051	10/2/2003
MF2	MF American R Downstream of French Meadows Reservoir	46.6	717787	4331970	9/24/2003
MF3	MF American R Immediately Upstream of MF Powerhouse	36.1	708245	4322433	10/9/2003
MF4	MF American R Immediately Downstream of Interbay Dam	35.5	707472	4322410	10/9/2003
MF5	MF American R Downstream of Ralston Afterbay Dam	24.6	694919	4319599	10/9/2003
MF6	MF American R Immediately Downstream of Oxbow Powerhouse	24.3	695064	4319894	10/14/2003
Mf7	MF American R Downstream of NF of the MF American R	23.1	694003	4319890	10/15/2003
MF8	MF American R Immediately Upstream of NF American R	0.1	670230	4309051	10/15/2003
MF9	MF American R Downstream of Ruck-a-Chucky Rapids	8.9	678811	4314844	8/24/2004
MF10	MF American R Immediately Upstream of Ralston Afterbay Reservoir	26.0	696446	4320054	7/7/2005
MF11	MF American R Immediately Upstream of Duncan Cr	39.7	712524	4323980	9/22/2005
MF12	MF American R Midway Between French Meadows Reservoir and Duncan Cr	44.6	716586	4329530	7/8/2005
MF13	MF American R Downstream of Brushy Canyon Cr	29.4	701020	4321465	9/13/2005
MF14	MF American R Downstream of Volcano Canyon Cr	19.6	689844	4319176	8/11/2005
MF15	MF American R Immediately Upstream of Otter Cr	14.3	686039	4314393	8/11/2005
MF16	MF American R Immediately Upstream of Canyon Cr	11.0	681917	4313637	8/11/2005

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Table 6.4-3. PCWA Water Temperature Study Site Locations (continued).

Site ID	Site Name	River	Site Location (UTM)		Installation Date
			N	E	
NF1	NF American Immediately Upstream of MF American R	21.4	670077	4309845	10/15/2003
NF2	NF American Immediately Downstream of MF American R	20.8	669884	4309201	10/15/2003
NFA[1]	NF American R at Auburn Dam Site	14.9	668483	4304903	7/21/1999
NL1	NF Long Canyon Cr Immediately Upstream of Diversion Dam	3.2	717936	4325485	10/2/2003
NL2	NF Long Canyon Cr Immediately Downstream of Diversion Dam	3.1	717941	4325450	9/24/2003
NM1	NF of the MF American R Upstream of MF American R	2.3	697272	4321900	7/7/2005
OC1	Otter Cr Immediately Upstream of MF American R	0.1	685812	4314064	8/11/2005
OX1	Rubicon R Immediately Downstream of Ralston Powerhouse	0.5	696902	4319401	7/7/2005
PC1	Pilot Cr Immediately Upstream of Rubicon R	0.0	700717	4316068	10/24/2003
RR1	Rubicon R Upstream of Hell Hole Reservoir	35.9	729446	4328809	9/30/2003
RR2	Rubicon R Immediately Downstream of Hell Hole Reservoir	30.2	724199	4326074	10/14/2003
RR3	Rubicon R Downstream of Intermittent Reach	28.8	722789	4324656	10/13/2003
RR4	Rubicon R Immediately Upstream of Ralston Powerhouse	0.7	697187	4319108	10/2/2003
RR5	Rubicon R Upstream of SF Rubicon R	22.7	719244	4316581	8/25/2004
RR6	Rubicon R Immediately Downstream of SF Rubicon R	22.5	719150	4316361	8/25/2004
RR7	Rubicon R Between SF Rubicon R and Big Grizzly Canyon Cr	14.3	710726	4310041	9/13/2005
RR8	Rubicon R Immediately Upstream of Pilot Cr	5.3	700778	4315974	8/18/2004
RR9	Rubicon R Immediately Upstream of Long Canyon Cr	3.7	700418	4318194	7/7/2005
RR10	Rubicon R Upstream of Deer Cr	25.3	720865	4319940	9/13/2005
RR11	Rubicon R Downstream of Big Grizzly Canyon Cr	9.5	705591	4313422	9/13/2005
SF1	SF Rubicon R Immediately Upstream of Rubicon R	0.1	719302	4316374	7/1/2005
SL1	SF Long Canyon Cr Immediately Upstream of Diversion Dam	3.4	719006	4325570	9/24/2003
SL2	SF Long Canyon Cr Immediately Downstream of Diversion Dam	3.3	718818	4325494	10/2/2003
WC1	Wallace Canyon Cr Upstream of Long Canyon Cr	1.2	709527	4317055	7/21/2005

[1] Where River Mile equals 0.0 the site is located immediately upstream of the confluence.

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Table 6.4-4. Middle Fork Powerhouse Reservoir Spills and Powerhouse Maintenance Outages.

Reservoir/Powerhouse	Spill Dates/Periods	Outage Dates
French Meadows Reservoir	5/23/05 – 5/31/05; 6/9/05 – 6/20/05	
Hell Hole Reservoir	5/25/05 – 6/19/05	
Middle Fork Interbay Reservoir	5/18/05– 6/27/05; 10/3/05	
Ralston Afterbay Reservoir	3/20/05 - 5/5/05; 5/9/05 – 6/29/05	
Hell Hole Powerhouse		--
Middle Fork Powerhouse		10/03/05 – 10/18/05
Ralston Powerhouse		10/03/05 -10/19/05
Oxbow Powerhouse		10/07/05 – 10/21/05

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Table 6.4-5. Summary of Surface Water Analyses at Sampling Stations on the Middle Fork American River and North Fork American River - U.S. Geological Survey Sampling (Highlighted samples do not comply with the regulatory standards).

| Map Code | Station Location Name / Latitude & Longitude | Date | Time | Parameter | | |

Table 6.4-5. Summary of Surface Water Analyses at Sampling Stations on the Middle Fork American River and North Fork American River - U.S. Geological Survey Sampling (Highlighted samples do not comply with the regulatory standards).

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| Map Code | Station Location Name / Latitude & Longitude | Date | Time | Parameter | | |

Table 6.4-5. Summary of Surface Water Analyses at Sampling Stations on the Middle Fork American River and North Fork American River - U.S. Geological Survey Sampling (Highlighted samples do not comply with the regulatory standards).

Map Code	Station Location Name / Latitude & Longitude	Date	Time	Parameter: Acid Neutralizing capacity	Ammonia (filtered mg/L as NH4)	Ammonia (mg/L as N)	Arsenic (ug/L)	Beryllium (ug/L)	Bicarbonate (mg/L)	Boron (mg/L)	Cadmium (ug/L)	Calcium (mg/L)	Carbonate (mg/L)	Chemical oxygen demand (mg/L)	Chloride (mg/L)	Chromium (ug/L)	Copper (ug/L)	Dissolved Oxygen (mg/L)	Fecal Coliform	Fecal streptococci	Fluoride (mg/L)	Iron (ug/L)	Lead (ug/L)	Magnesium (mg/L)	Manganese (ug/L)	Mercury (ug/L)	Nickel (ug/L)	Nitrate (filtered mg/L)	Nitrite (mg/L as N)	Nitrite plus nitrate filtered	Organic carbon (mg/L)	Organic nitrogen (mg/L)	Orthophosphate filtered (mg/L)	pH (Standard Units)	Phosphorus (mg/L)	Potassium (mg/L)	Selenium (ug/L)	Silica (mg/L)	Sodium (mg/L)	Specific Conductivity	Sulfate (mg/L)	Suspended sediment (mg/L)	Total nitrogen (mg/L)	Water Hardness (mg/L as CaCO3)	Water Temperature (C)	Zinc (ug/L)
Middle Fork American River (continued)																																															
T	MFAR Near Auburn 38 55' 05" 121 00' 51" (cont'd)	23-Nov-62	17:10																																						1			8.3	
		3-Dec-62	(blank)						20	0					3																		7					2.4	47				17		
		8-Dec-62	10:30																																						1			7.2	
		18-Dec-62	10:45																																						101				
		28-Dec-62	15:30																																						1			4.4	
		5-Jan-63	10:35																																						1			3.3	
		14-Jan-63	(blank)						32	0					3																		7.6					2.6	70				28		
		25-Jan-63	15:20																																						1			3.9	
		30-Jan-63	17:10																																						81			8.9	
		7-Feb-63	10:25																																						47			9.4	
			(blank)						21	0					2.8																		7.4					1.9	44				16		
		28-Feb-63	9:20																																						4			9.4	
		18-Mar-63	(blank)						29	0					3.4																		7.5					2.5	61				25		
		28-Mar-63	17:00																																						117			7.2	
		29-Mar-63	16:35																																						16			8.3	
		8-Apr-63	13:10																																						309			8.3	
		13-Apr-63	12:20																																						12			8.9	
		15-Apr-63	16:30																																						27			8.9	
		16-Apr-63	(blank)						25	0					1																		7.7					2.2	52				20		
		6-May-63	11:20																																						46			10.6	
			15:00																																						29			10.6	
		15-May-63	(blank)						20	0		4			1						0			1.1				1.2					7.2		0.4		14	1.9	39	1			14		
		3-Jun-63	(blank)						17	0					1.1																		7.3					1.9	35				18		
		6-Jun-63	8:35																																						6			12.8	
		8-Jul-63	(blank)						26	0					1.8																		7.6					2.2	55				21		
		16-Jul-63	9:20																																						1			22.2	
		6-Aug-63	9:10																																						3			23.9	
		10-Sep-63	9:20																																						3			22.8	
		12-Sep-63	(blank)						42	0		11			4						0.1			2.9				0.6					7.8		1.2		12	3.5	95	6			40		
		11-Oct-63	9:10																																						5			18.9	
		4-Nov-63	(blank)						36	0					6.2																		7.7					3.2	87				34		
		5-Nov-63	9:00																																						2			12.8	
		6-Nov-63	15:15																																						174			10.6	
		30-Nov-63	16:00																																						1			7.8	
		3-Dec-63	9:55																																						1			6.7	
		20-Dec-63	17:15																																						1				
		6-Jan-64	(blank)						27	100					4.4																		7.8					2.4	63				24		
		9-Jan-64	9:45																																						1			5	
		20-Jan-64	15:55																																						5				
		21-Jan-64	11:40																																						138			4.4	
		23-Jan-64	12:50																																						5				
		6-Feb-64	10:40																																						6			5.6	
		25-Feb-64	16:45																																						2				

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Table 6.4-5. Summary of Surface Water Analyses at Sampling Stations on the Middle Fork American River and North Fork American River - U.S. Geological Survey Sampling (Highlighted samples do not comply with the regulatory standards).

Map Code	Station Location Name / Latitude & Longitude	Date	Time	Parameter: Acid Neutralizing capacity	Ammonia (filtered mg/L as NH4)	Ammonia (mg/L as N)	Arsenic (ug/L)	Beryllium (ug/L)	Bicarbonate (mg/L)	Boron (mg/L)	Cadmium (ug/L)	Calcium (mg/L)	Carbonate (mg/L)	Chemical oxygen demand (mg/L)	Chloride (mg/L)	Chromium (ug/L)	Copper (ug/L)	Dissolved Oxygen (mg/L)	Fecal Coliform	Fecal streptococci	Fluoride (mg/L)	Iron (ug/L)	Lead (ug/L)	Magnesium (mg/L)	Manganese (ug/L)	Mercury (ug/L)	Nickel (ug/L)	Nitrate (filtered mg/L)	Nitrite (mg/L as N)	Nitrite plus nitrate filtered	Organic carbon (mg/L)	Organic nitrogen (mg/L)	Orthophosphate filtered (mg/L)	pH (Standard Units)	Phosphorus (mg/L)	Potassium (mg/L)	Selenium (ug/L)	Silica (mg/L)	Sodium (mg/L)	Specific Conductivity	Sulfate (mg/L)	Suspended sediment (mg/L)	Total nitrogen (mg/L)	Water Hardness (mg/L as CaCO3)	Water Temperature (C)	Zinc (ug/L)
Middle Fork American River (continued)																																															
T	MFAR Near Auburn 38 55' 05" 121 00' 51" (cont'd)	2-Mar-64	(blank)						27	0					3.9																			7.9					3.6	62				24		
		3-Mar-64	9:35																																						2		5.6		
		23-Mar-64	17:00																																						3				
		8-Apr-64	10:35																																						6		10		
		4-May-64	(blank)						19	0		4.8			2.2						0			1				0.7						7.7		0.2		12	1.9	39	1			16		
		11-May-64	11:15																																						74		12.2		
		15-Jun-64	8:45																																						6		17.8		
		3-Jul-64	(blank)						28	0					3																			7.8					3.3	60				24		
		23-Jul-64	9:00																																						1		23.9		
		27-Aug-64	8:55																																						1		22.8		
		18-Sep-64	(blank)						46	0		12			5.4									2.7				0.9						7.7		1.4		11	4.7	108	7			41		
		29-Sep-64	8:45																																						2		18.3		
		3-Nov-64	8:50																																						5		12.8		
		12-Nov-64	(blank)						30	0					3.8																			7.3					4	92				34		
		2-Dec-64	15:00																																						271		10		
		10-Dec-64	9:45																																						4		8.9		
		22-Dec-64	13:20																																						2550		8.9		
		14-Jan-65	(blank)						29	0					2																			7.8					3.3	64				26		
		11-Feb-65	11:00																																						25		4.4		
		15-Mar-65	(blank)						28	0					1.3																			7.7					2.4	61				23		
		18-Mar-65	9:55																																						8		9.4		
			11:15																																						6		9.4		
		20-Apr-65	11:50																																						248		11.1		
		14-May-65	(blank)						21	0		5			0.8									0.9				0.3						7.3		0.2		12	1.8	42	2			16		
		17-May-65	9:20																																						208		13.9		
		22-Jun-65	8:15																																						8		18.3		
		13-Jul-65	(blank)						40	0					2.7																			8.1					3.5	90				34		
		3-Aug-65	8:45																																						1		23.9		
		2-Sep-65	(blank)						60	0		15			3.3									2.8				0.2						7.9		2.5		12	3.2	123	6			49		
		14-Sep-65	9:00																																						3		18.9		
		29-Oct-65	10:20																																						2		12.2		
		2-Nov-65	(blank)						49	0			0		3.7																			8					3.8	110				44		
		24-Nov-65	12:04																																						36		10.6		
			12:05																																						36		10.6		
		14-Dec-65	12:45																																						1		7.2		
		5-Jan-66	(blank)						42	0			0		1.8																			7.7					4.7	98				41		
		1-Mar-66	10:15																																						3		7.8		
		24-Mar-66	(blank)						28	0			0		1.2																			7.8					2.2	59				24		
		31-Mar-66	10:30																																						31		13.9		
		12-May-66	(blank)						32	0		10	0		2									0.7				0.6						7.4		1.3		11	2.5	71	5			28		
		19-May-66	9:45																																						10		17.2		
		8-Jul-66	10:00																																						1		21.7		
		25-Aug-66	14:00																																						1		24.4		

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Table 6.4-5. Summary of Surface Water Analyses at Sampling Stations on the Middle Fork American River and North Fork American River - U.S. Geological Survey Sampling (Highlighted samples do not comply with the regulatory standards).

| Map Code | Station Location Name / Latitude & Longitude | Date | Time | Parameter | | |

Table 6.4-6. Summary of Surface Water Analyses at Sampling Stations on the Middle Fork American River and North Fork American River - Bureau of Reclamation Sampling (Highlighted samples do not comply with regulatory standards).

Map Code	Station Location Name / Latitude & Longitude	Date	Time	Parameter																																
				Alkalinity (mg/L)	Boron (ug/L)	Cadmium (ug/L)	Calcium (mg/L)	Chloride (mg/L)	Chlorophyll-A (ug/L)	Chromium (ug/L)	Copper (ug/L)	Hardness (mg/L)	Iron (ug/L)	Lead (ug/L)	Magnesium (mg/L)	Manganese (ug/L)	Mercury (ug/L)	Nickel (ug/L)	Nitrate (mg/L)	Nitrite plus Nitrate (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen (mg/L)	Oxygen, Dissolved (mg/L)	pH (standard units)	Phosphate, Total Soluble (mg/L)	Phosphorus, Dissolved Ortho-P (mg/L)	Potassium (mg/L)	Selenium (ug/L)	Silica (mg/L)	Silver (ug/L)	Sodium (mg/L)	Specific Conductance (µmhos/cm @ 25	Sulfate (mg/L)	Temperature, Water (Degrees Centigrad	Turbidity (Formazin Turb Unit)	Zinc (ug/L)
Middle Fork American River																																				
Q	MFAR upstream with NFAR 38.916667 121.035278	4-Jan-68	1020															0.1	0.10	0.37	7.7	13.6	6.7	0.3	0.00						68		4	1.5	
		15-Feb-68	1115	25			6.6	2.6				22			1.3				0.1	0.10	0.35	0.9	12.3	7.1	0.2	0.01	0.8			3.0	59	1.0	8	5.0	
		13-Mar-68	1300															0.2	0.20	0.06	0.4	12.2	7.7	0.2	0.04								10	15.0	
		8-Apr-68	1235																			12.0	7.6										12	0.0	
		7-May-68	1230	26			9.6	3.1				31			1.6				0.0	0.00	0.05	0.5	10.3	7.9	0.5	0.08	0.6			3.2		4.0	14		
		4-Jun-68	1230																			10.4	7.5										16	5.0	
		10-Jul-68	1025															0.1	0.10	0.10	0.8		7.8	0.5	0.16										
		4-Aug-68	1230																0.00																
		7-Aug-68	1215	33			9.2	3.1				33			2.4				0.1	0.10	0.10	0.6	8.4	8.0	0.5	0.16	0.4			2.0	84	5.0	23	1.0	
		12-Sep-68	1200															0.1	0.10	0.10	0.4	10.4	7.5	0.4	0.03								14	0.4	
		8-Oct-68	1330																			10.8	7.5										14	1.0	
		7-Nov-68	1305	23	500		6.8	3.0				23			1.4				0.7	0.70	0.20	1.0	11.5	8.2	0.0	0.01	1.0		10.2		3.0	60	4.0	14	1.5	
		5-Dec-68	1335															0.1	0.10	0.08	0.5	12.7	7.8	0.0	0.01						60		11	2.0	
		7-Jan-69	1045															0.1	0.10	0.08	0.3	12.8	7.4	0.2	0.01						70		7	1.0	
		20-Feb-69	1330	21	500		5.1	0.0				18			1.2				0.1	0.10	0.08	0.8	12.9	7.2	0.1	0.01	0.8		12.0		2.2	54	1.0	8	4.0	
		11-Mar-69	1150															0.1	0.10	0.19	0.8	13.2	7.2	0.1	0.01						60		9	0.8	
		8-Apr-69	1105															0.1	0.10	0.08	0.5	13.0	7.4	0.1	0.00						45		10	1.0	
		9-May-69	1345	13	300		3.4	0.3				12			0.9				0.1	0.10	0.08	0.9	11.7	7.4	0.1	0.01	0.6		8.0		1.2	27	2.9	16	1.3	
		5-Oct-70	1000															0.1	0.10	0.08	0.4	11.1	7.0	0.0	0.00						37		13	1.1	
		9-Nov-70	950	20	200		6.2	2.0				20			1.0				0.1	0.10	0.08	0.6	11.4	7.0	0.1	0.00	0.7		11.0		2.2	47	1.0	13	3.2	
		11-Mar-71	940																0.10	0.01	0.1	12.5	6.8	0.0	0.00						58		8	1.6	
		12-Apr-71	1030																0.02	0.02	0.6	11.7	7.7		0.01						62		12	4.1	
		13-May-71	1045	16	200		5.2	1.0				18			1.2					0.02	0.02	0.3	11.2	7.6		0.01	0.9		12.0		1.9	43	3.0	14	1.5	
		8-Jun-71	1055																0.02	0.06	0.2	10.1	7.2		0.01						55		17	0.4	
		9-Jul-71	940																			11.0	7.4										15	0.9	
		13-Aug-71	1030	17	200		4.5	1.0				16			1.2					0.30			10.2	7.7		0.01	0.7		11.0		1.3	41	3.0	16	1.4	
		10-Sep-71	955																0.01	0.01	0.2	11.3	7.3		0.01						40		13	1.0	
		7-Oct-71	955																0.01	0.01	0.2	10.7	7.8		0.01						39		15	0.6	
		9-Nov-71	950	18	200		5.5	3.0				19			1.2					0.01	0.01	0.1	12.3	7.8		0.01	0.6		11.0		2.1	49	1.0	10	1.5	
		7-Mar-72	1005																0.01	0.01	0.1	13.2	7.4		0.00						41		10	2.1	
		3-Apr-72	1000																0.01	0.01	0.3	12.6	7.7		0.00						66		12	2.7	
		3-May-72	1050	19	200		5.5	2.0				20			1.4					0.01	0.01	0.2	10.5	7.8		0.00	0.7		11.0		1.1	47	2.0	14	1.0	
		14-Jun-72	1010																0.01	0.01	0.3	9.6	7.7		0.01						71		20	0.9	
		12-Jul-72	1110																0.01	0.01	0.3	9.5	7.9		0.01						63		23	0.9	
		10-Aug-72	950	16				1.0											0.01	0.01	0.1	11.5	8.1		0.01			10.5			39		13	2.0	
		14-Sep-72	1000																0.02	0.03	0.4	11.2	6.9		0.01						42		13	1.0	
		10-Oct-72	1010																0.02	0.01	0.3	10.6	7.5		0.01						44		14	0.6	
		9-Nov-72	1015	20			5.3	0.7				18			1.2					0.02	0.01	0.2	11.7	7.5		0.01	0.6		11.0		1.7	50	2.3	11	2.0	

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Table 6.4-6. Summary of Surface Water Analyses at Sampling Stations on the Middle Fork American River and North Fork American River - Bureau of Reclamation Sampling (Highlighted samples do not comply with regulatory standards).

Map Code	Station Location Name / Latitude & Longitude	Date	Time	Parameter: Alkalinity (mg/L)	Boron (ug/L)	Cadmium (ug/L)	Calcium (mg/L)	Chloride (mg/L)	Chlorophyll-A (ug/L)	Chromium (ug/L)	Copper (ug/L)	Hardness (mg/L)	Iron (ug/L)	Lead (ug/L)	Magnesium (mg/L)	Manganese (ug/L)	Mercury (ug/L)	Nickel (ug/L)	Nitrate (mg/L)	Nitrite plus Nitrate (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen (mg/L)	Oxygen, Dissolved (mg/L)	pH (standard units)	Phosphate, Total Soluble (mg/L)	Phosphorus, Dissolved Ortho-P (mg/L)	Potassium (mg/L)	Selenium (ug/L)	Silica (mg/L)	Silver (ug/L)	Sodium (mg/L)	Specific Conductance (µmhos/cm @ 25	Sulfate (mg/L)	Temperature, Water (Degrees Centigrad	Turbidity (Formazin Turb Unit)	Zinc (ug/L)
Middle Fork American River (continued)																																				
W	MFAR upstream with NFAR 38.916667 121.035278 (cont'd)	13-Dec-72	945																	0.01	0.01	0.1	13.6	7.1		0.01					50		3	0.6	
		6-Feb-73	1030	20	0		5.6	0.7				20			1.4					0.04	0.01	0.2	13.0	7.7		0.01	0.5			1.6	54	3.0	7	4.0	
		20-Mar-73	1025																	0.01	0.01	0.1	12.9	7.6		0.01							7	4.5	
		18-Apr-73	1010																	0.01	0.01	0.1	11.6	7.6		0.01							9	1.0	
		31-May-73	1030				7.0					24			1.6				0.2	0.02	0.01	0.1	9.1	7.6		0.01	1.4			1.6	58	3.8	13	0.9	
		28-Jun-73	1050																	0.03	0.03	0.1	8.2	7.2		0.01							25	1.4	
		24-Jul-73	1120																	0.01	0.01	0.1	9.1	8.1		0.01							23	1.5	
		14-Aug-73	1130	16	0		3.8	1.5				16			1.6				0.1	0.01	0.01	0.1	10.6	7.4		0.01	0.5			1.6	42	2.3	35	0.9	
		19-Sep-73	1110																	0.02	0.01	0.1	9.2	7.5		0.01							15	3.0	
		17-Oct-73	1330																	0.01	0.01	0.1	8.4	8.1		0.01							15	2.0	
		29-Nov-73	1035		0		9.3	3.3				37			3.4				0.1	0.05	0.01	0.2	11.6	5.9		0.01	0.5			2.8	88	41.0	7	4.0	
		14-Dec-73	905	16																0.03	0.01	0.2	12.0	6.6		0.01							6	4.0	
		22-Jan-74	1200																	0.03	0.01	0.2	12.6	7.3		0.01					29		11	5.0	
		26-Feb-74	1320																	0.01	0.01	0.2	12.4	7.1		0.01					34		7	2.1	
		21-Mar-74	1110																	0.02	0.01	0.1	11.6	7.4		0.01					48		13	2.4	
		23-Apr-74	1215																	0.01	0.01	0.1	11.1	7.3		0.01					33		10	1.5	
		21-May-74	1145																	0.01	0.01	0.2	10.8	6.8		0.01					32		12	1.7	
		26-Jun-74	1210																	0.01	0.01	0.1	10.4	7.2		0.01					35		15	1.0	
		24-Jul-74	1045																	0.02	0.02	0.1	9.9	7.1		0.01					42		17	1.2	
		19-Aug-74	1115					1.0												0.01	0.01	0.1	9.2	7.3		0.01					62		19	0.8	
		20-Sep-74	1100																	0.02	0.01	0.1	10.1	7.9		0.01					32		15	2.0	
		22-Oct-74	1140																	0.01	0.01	0.2	10.6	7.6		0.01					28		13	0.9	
		20-Nov-74	1115					1.0												0.01	0.01	0.1	10.7	7.7		0.01					37		11	0.9	
		11-Dec-74	1200																	0.01	0.01	0.1	12.1	7.8		0.01					55		9	2.0	
		29-Jan-75	1235																	0.01	0.01		12.3	7.5		0.01					41		6	1.0	
		19-Feb-75	1145																	0.02	0.01		12.1	7.3		0.01					58		6	4.5	
		24-Mar-75	1127																	0.01	0.01		12.3	7.4		0.01					54		8	4.5	
		21-Apr-75	1350																	0.01	0.01		11.5	7.9		0.01					48		12	1.4	
		20-May-75	1400																	0.01	0.01		11.8	7.4		0.01					31		15	1.4	
		4-Aug-75	1105																	0.07	0.03		9.9	7.8		0.01					40		16	1.6	
		22-Aug-75	1155																	0.01	0.01		10.7	7.6		0.01					47		18	1.3	
		18-Sep-75	1045																	0.02	0.01		10.2	9.2		0.01					37		18		
		22-Oct-75	1235																	0.01	0.01		10.5	8.3		0.01					35		17	1.5	
		20-Nov-75	1320																	0.01	0.01		12.8	7.3		0.01					61		10	2.5	
		17-Dec-75	910																	0.01	0.05		9.2	7.1		0.03					35		7	3.1	
		14-Jan-76	1215																	0.01	0.01		12.4	8.0		0.01					89		7	1.0	
		12-Feb-76	1215																	0.01	0.01		11.8	8.6		0.01					41		9	1.0	
		30-Mar-76	1205																	0.05	0.01		11.3	8.4		0.01					51		11	1.6	

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Table 6.4-6. Summary of Surface Water Analyses at Sampling Stations on the Middle Fork American River and North Fork American River - Bureau of Reclamation Sampling (Highlighted samples do not comply with regulatory standards).

Map Code	Station Location Name / Latitude & Longitude	Date	Time	Parameter																																		
				Alkalinity (mg/L)	Boron (ug/L)	Cadmium (ug/L)	Calcium (mg/L)	Chloride (mg/L)	Chlorophyll-A (ug/L)	Chromium (ug/L)	Copper (ug/L)	Hardness (mg/L)	Iron (ug/L)	Lead (ug/L)	Magnesium (mg/L)	Manganese (ug/L)	Mercury (ug/L)	Nickel (ug/L)	Nitrate (mg/L)	Nitrite plus Nitrate (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen (mg/L)	Oxygen, Dissolved (mg/L)	pH (standard units)	Phosphate, Total Soluble (mg/L)	Phosphorus, Dissolved Ortho-P (mg/L)	Potassium (mg/L)	Selenium (ug/L)	Silica (mg/L)	Silver (ug/L)	Sodium (mg/L)	Specific Conductance (µmhos/cm @ 25	Sulfate (mg/L)	Temperature, Water (Degrees Centigrad	Turbidity (Formazin Turb Unit)	Zinc (ug/L)
Middle Fork American River (continued)																																						
W	MFAR upstream with NFAR 38.916667 121.035278 (cont'd)	27-Apr-76	1240																				9.9	7.8							57		15	1.3	
		25-May-76	1250																	0.01	0.01		8.9	8.4		0.01					67		23	0.9	
		1-Jul-76	1140																	0.03	0.03		9.5	7.4		0.01					66		21	1.3	
		28-Jul-76	825																	0.01	0.01		8.0	6.8		0.01					52		25	1.6	
		24-Aug-76	1245																	0.02	0.01		9.1			0.01					88		24	2.8	
		20-Sep-76	1400																	0.01	0.01		10.0	8.5		0.01					54		20	0.7	
		18-Oct-76	1315																	0.01	0.01		10.6	7.6		0.01					63		16	0.2	
		29-Nov-76	1330																	0.01	0.01		12.4	8.0		0.01					70		7	0.2	
		21-Dec-76	1315																	0.01	0.01		13.4	8.1		0.01					71		4	0.2	
		17-Jan-77	1335																	0.05	0.01		12.6	8.1		0.01					76		6	0.3	
		23-Feb-77	1200																	0.02	0.01		11.2	7.7		0.01					67		10	0.6	
		22-Mar-77	1225																	0.01	0.01		10.9	7.1		0.01					73		11	0.4	
		18-Apr-77	1310						0.3											0.01	0.01		9.8	6.4		0.01					82		18	0.3	
		23-May-77	1400																	0.01	0.01	0.1	9.7	6.8		0.01					84		17	0.4	
		14-Jun-77	1420																	0.01	0.01	0.3	8.9	7.1		0.01					87		23	0.3	
		18-Jul-77	1150						0.3											0.01	0.01	0.1	8.1	7.5		0.01					101		25	0.3	
		22-Aug-77	1300																	0.01	0.01	0.2	9.7	7.3		0.01					49		19	0.4	
		26-Sep-77	1250																	0.01	0.01	0.1	9.7	6.9		0.01					60		18	0.3	
		19-Oct-77	1245						0.6											0.01	0.01	0.1	10.3	7.1		0.01					72		16	0.3	
		28-Nov-77	1315						0.3											0.01	0.01	0.0				0.01					91		10	0.5	
		19-Dec-77	1400						0.5											0.07	0.01	0.2	11.6			0.01					56		7	7.3	
		27-Feb-78	1330																				11.7								48		8	26.0	
		28-Mar-78	1300																				11.2								47		11	11.4	
		24-Apr-78	1230																	0.01	0.01	0.1	11.2			0.01					55		10	4.0	
		8-Jun-78	1420						0.5											0.03	0.01	0.1	10.2	7.8		0.01					45		15	0.9	
		29-Jun-78	1315						0.4											0.01	0.01	0.5	9.3	7.9		0.01					43		21	0.3	
		6-Sep-78	1035				5.0	1.0	1.3			17			1.0					0.04	0.02	0.3	10.0	6.7		0.01	1.0			2.0	44	5.0	13	5.3	
		18-Oct-78	950						0.9											0.01	0.01	0.1	9.8	6.3		0.01					71		15	1.0	
		21-Nov-78	1005						2.4											0.02	0.01	0.4	9.6			0.01					51		10	3.0	
		15-Dec-78	930				15.0	3.0	0.8			54			4.0					0.04	0.05	0.2	11.5	7.4		0.01	1.0			3.0	129	8.0	8	1.5	
		17-Jan-79	1045						1.2											0.06	0.01	0.3	12.8			0.01							5	4.0	
		1-Mar-79	1100				6.0	1.0	2.0			23			2.0					0.07	0.01	1.0	13.2			0.03	1.0			2.0	62	5.0	6	9.0	
		16-Apr-79	1105						0.5											0.01	0.01	0.2	11.0	7.4		0.01							10	2.2	
		16-May-79	845				5.0	1.0	0.5			17			1.0					0.01	0.01	0.1	11.0	7.0		0.02	1.0			1.0	43	5.0	11	2.0	
		14-Jun-79	1000						1.3											0.01	0.02	0.1	9.8	6.6		0.01							13	1.5	
		18-Jul-79	930						0.5											0.03	0.01	0.1	13.0	7.2		0.01							11	4.0	
		7-Aug-79	1000				4.0	1.0	0.6			14			1.0					0.04	0.01	0.4	9.4	7.2		0.02	1.0			2.0	38	8.0	11	1.0	
		11-Sep-79	1115						0.5											0.02	0.01	0.4	10.5	7.7		0.02							14	0.6	

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Table 6.4-6. Summary of Surface Water Analyses at Sampling Stations on the Middle Fork American River and North Fork American River - Bureau of Reclamation Sampling (Highlighted samples do not comply with regulatory standards).

Map Code	Station Location Name / Latitude & Longitude	Date	Time	Parameter																																
				Alkalinity (mg/L)	Boron (ug/L)	Cadmium (ug/L)	Calcium (mg/L)	Chloride (mg/L)	Chlorophyll-A (ug/L)	Chromium (ug/L)	Copper (ug/L)	Hardness (mg/L)	Iron (ug/L)	Lead (ug/L)	Magnesium (mg/L)	Manganese (ug/L)	Mercury (ug/L)	Nickel (ug/L)	Nitrate (mg/L)	Nitrite plus Nitrate (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen (mg/L)	Oxygen, Dissolved (mg/L)	pH (standard units)	Phosphate, Total Soluble (mg/L)	Phosphorus, Dissolved Ortho-P (mg/L)	Potassium (mg/L)	Selenium (ug/L)	Silica (mg/L)	Silver (ug/L)	Sodium (mg/L)	Specific Conductance (µmhos/cm @ 25	Sulfate (mg/L)	Temperature, Water (Degrees Centigrad	Turbidity (Formazin Turb Unit)	Zinc (ug/L)
North Fork American River																																				
W	NFAR Upstream of Middle Fork American River 38.926111 121.038889	29-Oct-79	1310				3.0	2.0	0.8			12			1.0								11.4	7.9			1.0			2.0	66	1.0	13	0.0	
		26-Nov-79	1420						2.8											0.01	0.01	0.3	10.8	7.8		0.01							11	8.0	
		18-Dec-79	1250						1.1											0.01	0.01	0.2	11.5	6.9		0.02							9	1.0	
		8-Jan-80	1345						0.7											0.01	0.01	0.2	11.1	7.2		0.01							10	3.0	
		13-Feb-80	1035				4.0	2.0	0.3			14			1.0					0.03	0.01	0.2	10.9	6.7		0.02	1.0			2.0	44	1.0	7	1.0	
		13-Mar-80	1410						0.2											0.02	0.01	0.3	10.6	7.5		0.02							8	2.0	
		9-Apr-80	1230						0.9											0.01	0.01	0.2	10.4	7.7		0.01							9	1.0	
		14-May-80	1345																	0.01	0.02	0.1	9.4	7.7		0.02							14	2.0	
		4-Nov-80	1217				4.0	1.0	0.5			14			1.0					0.02	0.02	0.1	9.9	7.5		0.01	1.0			1.0	40	2.0	11	0.2	
		16-Dec-80	1212						1.1											0.01	0.01	0.1	12.1	6.4		0.01							8	0.8	
		16-Mar-81	1116				6.0	2.0	0.8			23			2.0					0.01	0.01	0.1	11.2	6.9		0.01	2.0			2.0	62	6.0	10	1.6	
		8-Jun-81	1500				8.0	3.0	0.3			28			2.0					0.03	0.02	0.1	8.3	7.1		0.01	1.0			2.0	76	4.0	26	1.0	
		15-Sep-81	945			10	5.0	2.0	0.6	20.0	20.0	17	50.0	10.0	1.0	50.0	1.0	30.0		0.01	0.01	0.1	9.6	7.5		0.01	1.0		10.0	2.0	50	1.0	18	0.4	10.0
		7-Jan-69	1110																0.1	0.10	0.08	0.8	13.1	7.6	0.0	0.01					110		7	5.0	
		20-Feb-69	1300	33	500		7.4	1.0				31			2.5				0.1	0.10	0.42	1.1	12.7	7.3	0.1	0.01	0.6		13.0		3.0	70	4.0	9	65.0	
		11-Mar-69	1125																0.1	0.10	0.13	0.7	13.3	7.5	0.1	0.01						100		10	1.0	
		8-Apr-69	1045																0.1	0.10	0.08	0.7	12.7	7.5	0.1	0.00						60		10	6.0	
		9-May-69	1300	16	200		4.8	0.7				17			1.2				0.1	0.10	0.08	0.9	12.6	7.4	0.0	0.01	0.5		9.0		0.9	40	1.7	14	8.0	
		5-Oct-70	945																0.1	0.10	0.08	0.3	9.9	7.6	0.0	0.00						127		17	0.7	
		9-Nov-70	930	49	200		16.0	5.0				57			4.1				0.1	0.10	0.08	0.6	11.3	7.3	0.1	0.00	1.0		12.0		3.8	127	10.0	13	10.0	
		11-Mar-71	915																	0.10	0.02	0.2	12.6	7.1	0.0	0.01						89		8	1.2	
		12-Apr-71	1050																	0.02	0.02	0.3	11.9	7.5		0.01						44		11	2.0	
		13-May-71	1020	16	200		5.2	1.0				19			1.4					0.02	0.02	0.3	11.8	7.5		0.01	0.7		10.0		1.7	73	4.0	13	2.4	
		8-Jun-71	1030																	0.02	0.05	0.4	10.4	7.3		0.01						45		15	1.6	
		13-Aug-71	1000	43	200		11.0	2.0				42			3.4					0.10			8.4	7.6		0.04	1.0		15.0		2.8	123	7.0	25	0.9	
		10-Sep-71	935																	0.01	0.01	0.2	9.1	7.8		0.12						112		20	1.0	
		7-Oct-71	935																	0.01	0.01	0.2	9.9	7.8		0.01						119		18	1.3	
		9-Nov-71	930	38	400		12.0	4.0				44			3.4					0.02	0.01	0.1	12.1	7.9		0.01	0.8		12.0		2.8	100	6.0	10	3.4	
		7-Mar-72	940																	0.06	0.09	1.2	13.0	7.2		0.01						69		10	4.6	
		3-Apr-72	940																	0.02	0.01	0.4	12.7	7.2		0.00						51		11	3.1	
		3-May-72	1010	21	200		6.6	2.0				23			1.6					0.01	0.01	0.1	10.8	7.7		0.00	0.6		11.0		1.1	54	2.0	14	2.5	
		14-Jun-72	945																	0.02	0.01	0.2	9.8	7.5		0.01						81		19	2.5	
		12-Jul-72	1050																	0.02	0.01	0.5	8.9	8.1		0.01						96		27	0.8	
		10-Aug-72	920	43				2.0												0.01	0.01	0.1	8.3	8.1		0.01			13.8			118		24	1.3	
		14-Sep-72	940																	0.07	0.01	0.3	9.6	7.6		0.01						118		19	0.7	
		10-Oct-72	950																	0.03	0.02	0.3	9.4	7.3		0.01						130		18	0.7	
		9-Nov-72	950	41			13.0	1.1				46			3.3					0.05	0.01	0.3	11.4	7.7		0.01	0.7		10.0		3.2	109	7.0	11	9.5	

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Table 6.4-6. Summary of Surface Water Analyses at Sampling Stations on the Middle Fork American River and North Fork American River - Bureau of Reclamation Sampling (Highlighted samples do not comply with regulatory standards).

Map Code	Station Location Name / Latitude & Longitude	Date	Time	Parameter																																	
				Alkalinity (mg/L)	Boron (ug/L)	Cadmium (ug/L)	Calcium (mg/L)	Chloride (mg/L)	Chlorophyll-A (ug/L)	Chromium (ug/L)	Copper (ug/L)	Hardness (mg/L)	Iron (ug/L)	Lead (ug/L)	Magnesium (mg/L)	Manganese (ug/L)	Mercury (ug/L)	Nickel (ug/L)	Nitrate (mg/L)	Nitrite plus Nitrate (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen (mg/L)	Oxygen, Dissolved (mg/L)	pH (standard units)	Phosphate, Total Soluble (mg/L)	Phosphorus, Dissolved Ortho-P (mg/L)	Potassium (mg/L)	Selenium (ug/L)	Silica (mg/L)	Silver (ug/L)	Sodium (mg/L)	Specific Conductance (µmhos/cm @ 25	Sulfate (mg/L)	Temperature, Water (Degrees Centigrad	Turbidity (Formazin Turb Unit)	Zinc (ug/L)
North Fork American River (continued)																																					
W	NFAR Upstream of Middle Fork American River 38.926111 121.038889 (cont'd)	13-Dec-72	920																	0.03	0.01	0.2	13.1	6.8		0.01					119		13	2.2	
		6-Feb-73	1015	30			8.7	2.7				35			3.2					0.08	0.01	0.2	12.8	7.8		0.01	0.5			2.8	90	5.1	8	10.0	
		20-Mar-73	1000																	0.01	0.01	0.1	12.5	7.0		0.01							9	3.2	
		18-Apr-73	940																	0.01	0.02	0.1	11.4	7.2		0.01							10	1.9	
		31-May-73	955				4.8	0.9				16			1.0				0.1	0.01	0.01	0.1	9.6	7.7		0.01	1.2			1.2	39	5.1	11	1.7	
		28-Jun-73	1120																	0.03	0.03	0.1	8.7	7.8		0.01							24	0.6	
		24-Jul-73	1140																	0.03	0.02	0.1	9.8	7.9		0.01							18	1.4	
		14-Aug-73	1100	47			11.0	3.1				47			4.7				0.1	0.02	0.02	0.1	9.0	8.2		0.01	0.9			2.8	109	6.6	19	0.6	
		19-Sep-73	1040																	0.02	0.01	0.1	8.2	7.9		0.01							18	1.2	
		17-Oct-73	1215																	0.01	0.02	0.2	8.4	8.2		0.01							19	2.0	
		29-Nov-73	1100				12.0	2.4				41			2.7				0.2	0.03	0.01	0.1	11.7	5.8		0.01	1.4			4.2	103	4.4	7	2.0	
		14-Dec-73	855	33																0.05	0.01	0.2	12.3	7.1		0.01							6	4.5	
		22-Jan-74	1130																	0.05	0.02	0.3	12.1	7.3		0.01					42		12	19.0	
		26-Feb-74	1300																	0.02	0.01	0.2	11.9	7.6		0.01					62		8	4.5	
		21-Mar-74	1050																	0.01	0.01	0.1	11.0	7.4		0.01					52		11	2.4	
		23-Apr-74	1150																	0.01	0.01	0.1	10.5	7.4		0.01					48		12	1.7	
		21-May-74	1120																	0.01	0.01	0.3	9.8	7.0		0.01					42		13	2.5	
		26-Jun-74	1140																	0.01	0.01	0.1	9.0	8.1		0.01					54		21	1.1	
		24-Jul-74	1015																	0.01	0.01	0.1	8.5	7.6		0.01					80		24	1.9	
		19-Aug-74	1050					2.0												0.02	0.01	0.1	8.7	7.3		0.01					85		21	1.0	
		20-Sep-74	1030																	0.02	0.01	0.1	9.4	7.6		0.01					68		19	1.0	
		22-Oct-74	1110																	0.01	0.01	0.2	9.7	8.0		0.01					90		17	2.7	
		20-Nov-74	1050					3.0												0.05	0.01	0.2	11.0	8.0		0.01					115		12	0.8	
		11-Dec-74	1135																	0.03	0.02	0.1	11.8	7.8		0.01					84		9	5.0	
		29-Jan-75	1210																	0.01	0.01		12.5	8.1		0.01					91		7	2.6	
		19-Feb-75	1130																	0.06	0.01		11.9	7.2		0.01					86		7	15.0	
		24-Mar-75	1100																	0.04	0.01		12.0	7.8		0.01					79		9	17.0	
		21-Apr-75	1325																	0.01	0.01		11.6	8.2		0.01					85		13	1.6	
		20-May-75	1340																	0.01	0.01		10.7	7.4		0.01					34		13	5.5	
		4-Aug-75	1050																	0.01	0.01		8.6	7.7		0.01					82		25	1.2	
		22-Aug-75	1135																	0.01	0.01		9.5	7.8		0.01					104		21	2.1	
		18-Sep-75	1030																	0.01	0.01		8.6	8.8		0.01					35		22		
		22-Oct-75	1230																	0.02	0.02		10.0	8.2		0.01					110		17	0.7	
		20-Nov-75	1335																	0.02	0.01		11.3	7.6		0.01					77		11	2.4	
		17-Dec-75	900																	0.03	0.08		9.1	7.1		0.04					32		7	3.1	
		14-Jan-76	1155																	0.01	0.01		12.6	7.8		0.01					81		9	2.6	
		12-Feb-76	1210																	0.01	0.01		11.8	8.6		0.01					108		8	0.7	
		30-Mar-76	1145																	0.01	0.01		10.5	8.4		0.01					86		12	0.0	

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Table 6.4-6. Summary of Surface Water Analyses at Sampling Stations on the Middle Fork American River and North Fork American River - Bureau of Reclamation Sampling (Highlighted samples do not comply with regulatory standards).

Map Code	Station Location Name / Latitude & Longitude	Date	Time	Parameter																																		
				Alkalinity (mg/L)	Boron (ug/L)	Cadmium (ug/L)	Calcium (mg/L)	Chloride (mg/L)	Chlorophyll-A (ug/L)	Chromium (ug/L)	Copper (ug/L)	Hardness (mg/L)	Iron (ug/L)	Lead (ug/L)	Magnesium (mg/L)	Manganese (ug/L)	Mercury (ug/L)	Nickel (ug/L)	Nitrate (mg/L)	Nitrite plus Nitrate (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen (mg/L)	Oxygen, Dissolved (mg/L)	pH (standard units)	Phosphate, Total Soluble (mg/L)	Phosphorus, Dissolved Ortho-P (mg/L)	Potassium (mg/L)	Selenium (ug/L)	Silica (mg/L)	Silver (ug/L)	Sodium (mg/L)	Specific Conductance (µmhos/cm @ 25	Sulfate (mg/L)	Temperature, Water (Degrees Centigrad	Turbidity (Formazin Turb Unit)	Zinc (ug/L)
North Fork American River (continued)																																						
W	NFAR Upstream of Middle Fork American River 38.926111 121.038889 (cont'd)	27-Apr-76	1210																				9.6	7.8							70		15	1.1	
		25-May-76	1235																	0.02	0.01		8.9	8.3		0.01					68		21	1.1	
		1-Jul-76	1115																	0.02	0.03		9.2			0.01					105		21	0.8	
		28-Jul-76	815																	0.01	0.01		7.6	6.9		0.01					52		26	1.4	
		24-Aug-76	1230																				9.5										23	1.7	
		25-Aug-76	1230																	0.01	0.01					0.01									
		20-Sep-76	1315																	0.01	0.01		10.0	8.1		0.01					135		22	0.5	
		18-Oct-76	1230																	0.01	0.01		10.6	8.4		0.01					133		22	0.3	
		29-Nov-76	1245																	0.01	0.01		12.0	7.7		0.01					132		10	1.3	
		21-Dec-76	1240																	0.02	0.01		12.8	8.1		0.01					130		7	0.5	
		17-Jan-77	1250																	0.01	0.01		12.6	7.6		0.01					147		7	4.3	
		23-Feb-77	1120																	0.01	0.01		11.2	7.2		0.01					146		10	3.1	
		22-Mar-77	1200																	0.01	0.01		10.8	7.1		0.01					37		11	0.3	
		18-Apr-77	1240						0.4											0.01	0.01		9.7	6.4		0.01					94		16	0.6	
		23-May-77	1330																	0.12	0.01	0.3	9.6	6.7		0.01					76		16	0.6	
		14-Jun-77	1345																	0.01	0.01	0.1	9.2	6.7		0.01					73		21	0.6	
		18-Jul-77	1120						0.2											0.01	0.01	0.1	9.3	7.2		0.01					96		25	0.4	
		22-Aug-77	1230																	0.01	0.01	0.2	9.6	7.5		0.01					106		26	0.4	
		26-Sep-77	1220																	0.01	0.01	0.1	10.5	6.6		0.01					115		21	0.3	
		19-Oct-77	1210						0.2											0.01	0.01	0.2	10.7	7.0		0.01					119		17	0.3	
		28-Nov-77	1245						0.4											0.01	0.01	0.1	10.7			0.01					153		12	0.4	
		19-Dec-77	1340						0.8											0.19	0.01	0.4	11.5			0.01					104		8	13.2	
		27-Feb-78	1315																				11.6								88		10	0.8	
		28-Mar-78	1230																				11.2								69		11	0.8	
		24-Apr-78	1220																	0.02	0.01	0.1	11.2			0.01					76		10	0.8	
		8-Jun-78	1400						0.4											0.01	0.01	0.1	10.3	7.8		0.01					36		16	1.8	
		29-Jun-78	1300						0.5											0.01	0.01		9.6	7.8		0.01					35		19	0.3	
		6-Sep-78	1020				13.0	2.0	0.7			45			3.0					0.03	0.03	0.4	8.4	6.9		0.01	1.0			3.0	110	8.0	21	1.4	
		18-Oct-78	940						1.0											0.05	0.03	0.5	9.2	6.6		0.02					136		17	2.0	
		21-Nov-78	1000						1.3											0.07	0.03	0.3	10.2			0.01					111		11	4.0	
		15-Dec-78	1000				5.0	2.0	0.9			17			1.0					0.01	0.01	0.1	11.7	7.3		0.01	1.0			2.0	50	8.0	8	0.0	
		17-Jan-79	1035																	0.14	0.01	0.4	13.2	6.5		0.01							6	17.0	
		1-Mar-79	1050					3.0	0.7						4.0					0.06	0.01	0.4	12.2			0.01	1.0			3.0	99	5.0	7	7.0	
		16-Apr-79	1055						0.4											0.01	0.01	0.2	11.2	7.3		0.01							11	1.5	
		16-May-79	825				5.0	1.0	0.4			17			1.0					0.01	0.01	0.1	11.0	7.0		0.02	1.0			1.0	47	5.0	10	3.0	
		14-Jun-79	945						0.6											0.02	0.03	0.1	9.4	6.6		0.01							16	1.0	
		18-Jul-79	915						0.5											0.02	0.01	0.1	9.8	6.6		0.02							21	3.0	
		7-Aug-79	945				13.0	2.0	0.8			45			3.0					0.01	0.01	0.5	8.3	7.1		0.01	1.0			3.0	107	8.0	21	1.0	

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Table 6.4-6. Summary of Surface Water Analyses at Sampling Stations on the Middle Fork American River and North Fork American River - Bureau of Reclamation Sampling (Highlighted samples do not comply with regulatory standards).

Map Code	Station Location Name / Latitude & Longitude	Date	Time	Parameter																																		
				Alkalinity (mg/L)	Boron (ug/L)	Cadmium (ug/L)	Calcium (mg/L)	Chloride (mg/L)	Chlorophyll-A (ug/L)	Chromium (ug/L)	Copper (ug/L)	Hardness (mg/L)	Iron (ug/L)	Lead (ug/L)	Magnesium (mg/L)	Manganese (ug/L)	Mercury (ug/L)	Nickel (ug/L)	Nitrate (mg/L)	Nitrite plus Nitrate (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen (mg/L)	Oxygen, Dissolved (mg/L)	pH (standard units)	Phosphate, Total Soluble (mg/L)	Phosphorus, Dissolved Ortho-P (mg/L)	Potassium (mg/L)	Selenium (ug/L)	Silica (mg/L)	Silver (ug/L)	Sodium (mg/L)	Specific Conductance (µmhos/cm @ 25	Sulfate (mg/L)	Temperature, Water (Degrees Centigrad	Turbidity (Formazin Turb Unit)	Zinc (ug/L)
North Fork American River (continued)																																						
W	NFAR Upstream of Middle Fork American River 38.926111 121.038889 (cont'd)	11-Sep-79	1100						0.5											0.01	0.01	0.2	9.3	7.7		0.01								21	1.0	
		29-Oct-79	1245				9.0	3.0	0.4			39			4.0								10.8	8.1			1.0			3.0	78	2.0	15	3.0	
		26-Nov-79	1400						0.7											0.04	0.01	0.1	10.6	7.6		0.01								11	4.0	
		18-Dec-79	1310						0.3											0.02	0.01	0.3	11.9	7.0		0.02								8	3.0	
		8-Jan-80	1330						0.2											0.03	0.01	0.1	10.8	7.3		0.01								10	3.0	
		13-Feb-80	1045				9.0	2.0	0.1			35			3.0					0.01	0.01	0.1	10.6	6.4		0.01	1.0			3.0	89	9.0	6	1.0	
		13-Mar-80	1400						0.1											0.04	0.01	0.4	10.4	7.6		0.02								10	3.0	
		9-Apr-80	1215						0.4											0.01	0.01	0.1	11.9	7.7		0.01								11	4.0	
		14-May-80	1400						0.9											0.01	0.01	0.1	9.8	7.7		0.03								15	1.0	
		4-Nov-80	1210				14.0	3.0	0.4			51			4.0					0.01	0.03	0.1	8.6	7.4		0.01	1.0			3.0	123	7.0	16	0.2	
		16-Dec-80	1205						0.7											0.03	0.01	0.2	11.6	7.0		0.01								8	9.0	
		16-Mar-81	1110				11.0	3.0	0.5			40			3.0					0.01	0.01	0.5	11.0	6.6		0.01	1.0			2.0	96	9.0	10	5.5	
		8-Jun-81	1455				8.0	2.0	0.3			28			2.0					0.03	0.02	0.1	8.2	7.0		0.01	1.0			2.0	79	7.0	26	2.0	
		15-Sep-81	930			10	16.0	3.0	0.4	20.0	20.0	56	60.0	10.0	4.0	20.0	1.0	30.0		0.01	0.01	0.1	8.3	7.9		0.01	1.0			10.0	3.0	138	8.0	22	0.5	10.0

Source: USEPA STORET Database

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Table 6.4-7. Summary of Surface Water Analyses at Sampling Stations on the Middle Fork American River/Rubicon River and Tributaries - State Regional Water Quality Board Sampling (Highlighted samples do not comply with regulatory standards).

Map Code	Station Location Name / Altitude & Longitude	Date	Time	Parameter Long Name														
				Alkalinity (mg/L)	Boron (ug/L)	Calcium (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Hardness (mg/L)	Magnesium (mg/L)	Oxygen, Dissolved (mg/L)	pH (Standard Units)	Phosphorus, Dissolved Ortho-P (mg/L)	Potassium (mg/L)	Silica (mg/L)	Sodium (mg/L)	Specific Conductance (µmhos/cm @ 25C	Temperature, Water (Degrees Centigrade
D	Duncan Crk Above Mosquito Ridge Rd. 39.121944 120.491944	5-Jun-69	1040									7.1						7.8
N	N. Fork of MFAR Near Foresthill 39.024167 120.7175	10-Sep-59	1145	30	0	9.3	0.3	0	32	2.2	8.7			0.5	14	2.5	84	21.1
		9-May-60	1330	13	30	4.8	0.1	0.1	14	0.5	9.2	7.1		0.1	9.4	0.2	40	15.0
		26-Sep-60	1215	31	20	9.9	0	0.1	33	2.1	8.8			0.4	17	2.4	82	17.2
		27-Apr-61	1130	14	40	4.5	2	0	15	1	10.6			0.3	9.4	1.3	36	9.4
		4-Jun-69	1330	12		3.8	0.1		13	0.9	10.7	7.3	0			1	33	18.1
		22-Oct-69	1415	25		8.3	0.6		26		11	7.2	0			1.5	66	11.7
E	MFAR above Rubicon River 39.015556 120.703333	22-Oct-69	1545	38		16	2.1		44		11.2	7.4				1.8	101	11.7
B	MFAR below French Meadow Dam 39.111944 120.470556	5-Jun-69	1005	11		2.7	0.5		10			6.9				1.2	26	5.6
		23-Oct-69	1500	11		2.5	0.2		12		10.5	6.8				0.9	26	6.1
K	Long Canyon Crk at Mouth 38.99 120.686389	9-May-60	1405	16	20	4.3	0.3	0	12	0.4		7.1		1	21	1.8	42	13.9
		27-Sep-60	1255	33	400	11	5.6	0.1	36	21	8.8			1.4	25	4	99	19.4
		26-May-61	1000	19	0	5	0.5	0	14	0.4	10.1			1	22	2.4	42	12.2

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Table 6.4-7. Summary of Surface Water Analyses at Sampling Stations on the Middle Fork American River/Rubicon River and Tributaries - State Regional Water Quality Board Sampling (Highlighted samples do not comply with regulatory standards).

Map Code	Station Location Name / Altitude & Longitude	Date	Time	Parameter Long Name														
				Alkalinity (mg/L)	Boron (ug/L)	Calcium (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Hardness (mg/L)	Magnesium (mg/L)	Oxygen, Dissolved (mg/L)	pH (Standard Units)	Phosphorus, Dissolved Ortho-P (mg/L)	Potassium (mg/L)	Silica (mg/L)	Sodium (mg/L)	Specific Conductance (µmhos/cm @ 25C	Temperature, Water (Degrees Centigrade
G	Long Canyon Crk above Ramsey Xing	4-Jun-69	1655								9.6	7.1						13.6
	38.998333	24-Oct-69	915	20		4.2	1.7		15		11.1	7				3.1	50	5.6
	120.552778																	
J	Rubicon River at Ellicott Rd.	24-Oct-69	1510	13		5.2	7.8		15		10.4	7				3.4	59	10.0
	38.960278	30-May-85	1045								8.9	7.1	0					11.7
	120.481667																	
L	Rubicon River below Ralston PH	4-Jun-69	1405	11		3.3	0.5		12		12.4	6.9	0.17			1.2	28	9.4
	39.000556	22-Oct-69	1515	12		3.5	1.3		11		11.4	7.2	0			1.1	32	13.3
	120.723333																	
I	Rubicon River below Hell Hole Dam	5-Jun-69	740	5		1.1	0		5		10.1	6.9				1.3	12	11.1
	39.056944	24-Oct-69	1300	13		4	0.7		12		9.5	6.8				1.9	33	10.0
	120.4075																	
H	Rubicon River near Foresthill	30-Sep-52	1215	19	40	5.6	4.8	0	16	0.6	9			1	13	4	53	16.0
	38.989722	11-Sep-59	1300	20	10	7.5	11	0	23	1.1	8.8			1.3	14	5.2	87	21.1
	120.687222	9-May-60	1315	8	20	2.4	0	0	5	0	10.4	6.9		0.5	8	1.2	21	12.2
			1405	16	20	4.3	0.3	0	12	0.4		7.1		1	21	1.8	42	13.9
		27-Sep-60	1310	17	20	6.6	9.2	0	21	1.1	9.1			1.1	13	4.6	74	17.2
		26-May-61	940	11	10	2.8	0.3	0	7	0	10.4			0.4	9.5	1.6	25	11.1

Source: USEPA STORET Database

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Table 6.4-8. Summary of Water Quality Data Collected Between 1993 and 1997 from the North Fork American River at the Source Water Intake for the PCWA Foothill Water Treatment Plant (highlighted sample does not comply with regulatory standards).

Parameter	Units	Minimum	Maximum	Average	Median	95th Percentile
INORGANIC						
Alkalinity	mg/L-CaCO3	16	34	23	na	na
Aluminum	mg/L	<0.05	0.15	0.08	<0.05	0.14
Antimony	mg/L	<0.005	<0.006	0.005	<0.005	0.006
Arsenic	mg/L	<0.001	<0.002	0.001	<0.001	0.002
Barium	mg/L	<0.01	<0.1	0.04	<0.01	0.09
Beryllium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Bicarbonate	mg/L	20	34	26	24	33
Cadmium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Calcium	mg/L	3.6	6	4.8	4.8	5.9
Carbonate	mg/L	<1.0	<1.2	1.1	<1.2	<1.2
Chloride	mg/L	1.1	1.6	1.3	1.3	1.6
Chromium	mg/L	<0.01	0.054[c]	0.021[c]	<0.01	0.047
Specific Conductance	umhos/cm	42	46	44	43	46
Copper	mg/L	<0.01	<0.05	0.025	0.019	0.047
Cyanide	mg/L	<0.003	<0.1	0.027	<0.003	0.085
Fluoride	mg/L	<0.1	0.1	0.1	<0.1	0.1
Hardness	mg/L-CaCO3	12	20	16	16	20
Iron	mg/L	<0.03	<0.1	0.057	0.050	0.094
Lead	mg/L	<0.001	<0.005	0.002	<0.001	0.005
Magnesium	mg/L	0.84	1.3	1.05	1.00	1.27
Manganese	mg/L	<0.01	<0.03	0.01	0.0086	0.03
Mercury	mg/L	<0.0002	<0.001	0.0005	<0.0002	0.0009
Nickel	mg/L	<0.005	<0.01	0.006	<0.005	0.009
Nitrate	mg/L-N	<0.05	<2.0	0.80	<0.5	1.70
Nitrite	mg/L-N	<0.15	<0.4	0.23	<0.15	0.38
pH [b]	-	6.8	7.7	7.2	7.1	7.5
Potassium	mg/L	0.5	0.65	0.58	0.58	0.64
Selenium	mg/L	<0.001	<0.005	0.002	<0.001	0.005
Silver	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	mg/L	1.7	5.1	2.9	2.0	4.8
Sulfate	mg/L	1.7	2	1.8	1.7	2.0
Thallium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Total Dissolved Solids	mg/L	36	53	42	38	52
Zinc	mg/L	<0.01	<0.05	0.02	0.01	0.05
ORGANIC						
Total Organic Carbon	mg/l	1.2	1.6	1.4	1.4	1.6
VOCs (64444-A)	ug/L	ND	ND	na	na	na
SOCs (64444-B)	ug/L	ND/W	ND/W	na	na	na
VOCs (64450-A)	ug/L	ND	ND	na	na	na
Unregulated Organics (64450-B, 64450-C)	ug/L	ND/W	ND/W	na	na	na
PHYSICAL						
Color	-	<3.0	<3.0	<3.0	<3.0	<3.0
Foaming Agent (MBAS)	mg/L	<0.01	<0.02	0.01	<0.01	0.02
Odor	TON	<1.0	<1.0	<1.0	<1.0	<1.0
Temperature[b]	C	7.78	26.67	14.07	14.44	20.47
Turbidity[b]	NTU	0.19	401.1	24.14	1.43	188.90
MICROBIOLOGICAL						
Giardia	#/100 L	NA	NA	na	na	na
Cryptosporidium	#/100 L	NA	NA	na	na	na
Total Coliform[b]	MPN/100ml	2	>1600	140	50	840

[a]Based on available data from January 1993 through December 1997.
[b]Based on monthly data from April 1994 through December 1997, when plant in operation.
[c]Although one sample did exceed the chromium MCL, the average is well below the MCL.
ND - Non Detection, NA - Not Available, na - not applicable, W - Waived
Source: 1998 American River Sanitary Survey by Archibald and Walberg

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Table 6.4-9. Summary of Dissolved Metal Analyses Results from the SMUD UARP that Exceed the Regulatory Criteria.

Site ID	Cadmium (µg/L)		Copper (µg/L)		Lead (µg/L)		Silver (µg/L)		Zinc (µg/L)	
	Result	CCC/CMC[1]	Result	CCC/CMC[1]	Result	CCC/CMC[1]	Result	CMC[1]	Result	CCC/CMC[1]
Rubicon #1					0.13 0.08 0.03	0.04/0.98 0.07/1.87 0.02/0.44				
Rubicon #2			0.75	0.34/0.37	0.31 0.08	0.04/1.01 0.02/0.50				
Rubicon #3a			0.52	0.34/0.37	0.06	0.02/0.50				
Rubicon #5					0.035 0.020	0.01/0.33 0.02/0.44				
Rubicon #6					0.028 0.025 0.05	0.02/0.49 0.02/0.42 0.03/0.74				
Gerle #7	0.14 & 0.043	0.06/0.02	0.42 & 0.32	0.18/0.18	0.016 & 0.019	0.01/0.18			4.7	2.37/2.39
Gerle #14	0.040	0.06/0.02	0.33	0.18/0.18	0.07	0.01/0.18	0.009	0.008		
Gerle #15			0.61	0.45/0.49	0.030	0.03/0.74				
S.F. Rubicon #20			0.85	0.55/0.62	0.07 0.11	0.04/1.01 0.04/1.14			3.4	2.37/2.39
Highland #4			0.30	0.18/0.18	0.025 & 0.045	0.01/0.18				
Gerle Creek Reservoir #R-5	0.07	0.06/0.02	0.21	0.18/0.18						
Rockbound Reservoir #R-2H							0.012	0.004		
Snow Sample	0.19	0.06/0.02	1.90	0.18/0.18	0.13	0.01/0.18				

[1]CCC = Criteria Continuous Concentration or Chronic Criteria; CMC = Criteria Maximum Concentration or Acute Criteria; The CCC and CMC are expressed as a function of the hardness of the water. The actual criteria for these dissolved metals are calculated based on the hardness (as $CaCO_3$) of the water sample.

Source: Sacramento Municipal Utility District (SMUD) – Upper American River Project

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FIGURES

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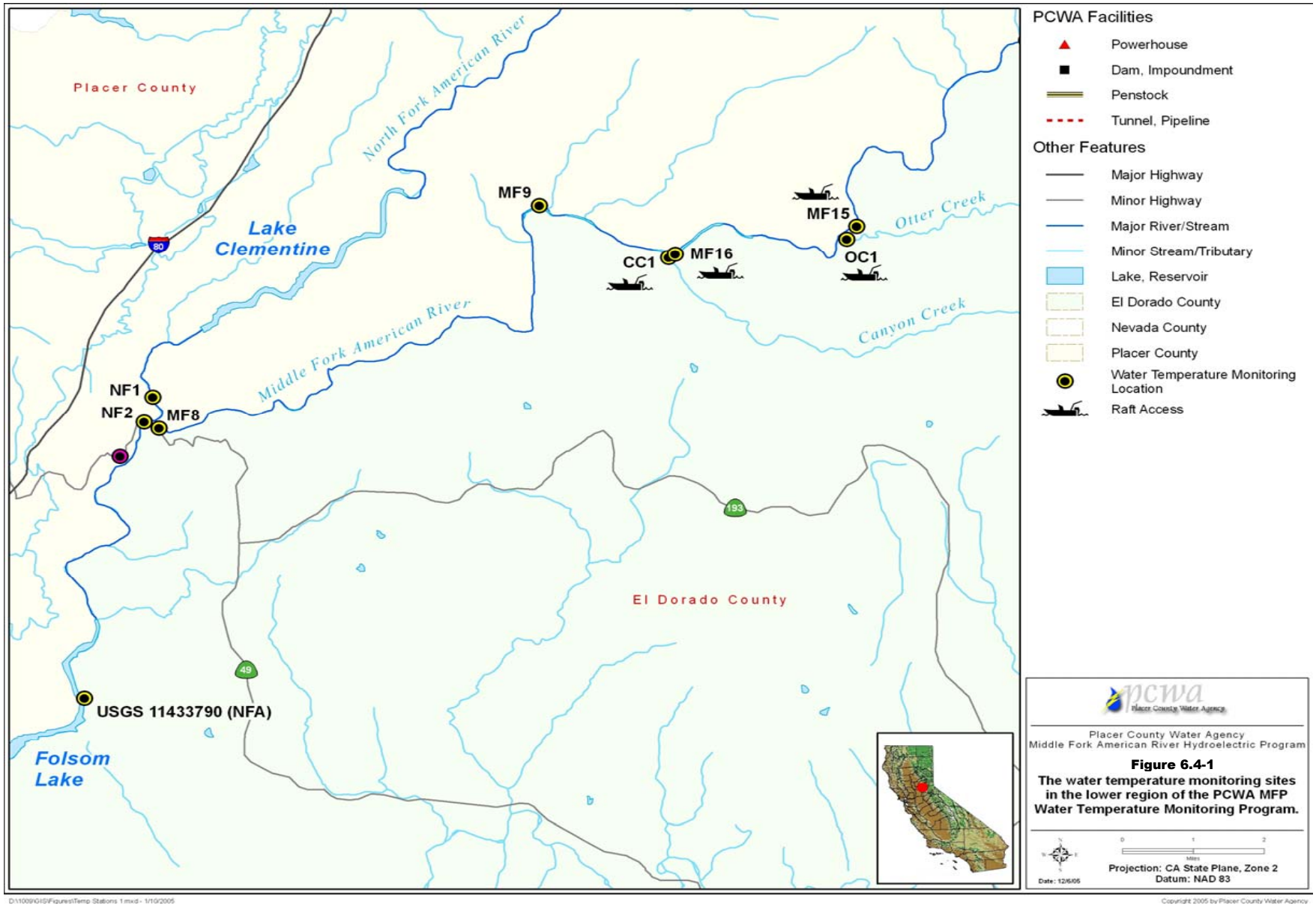

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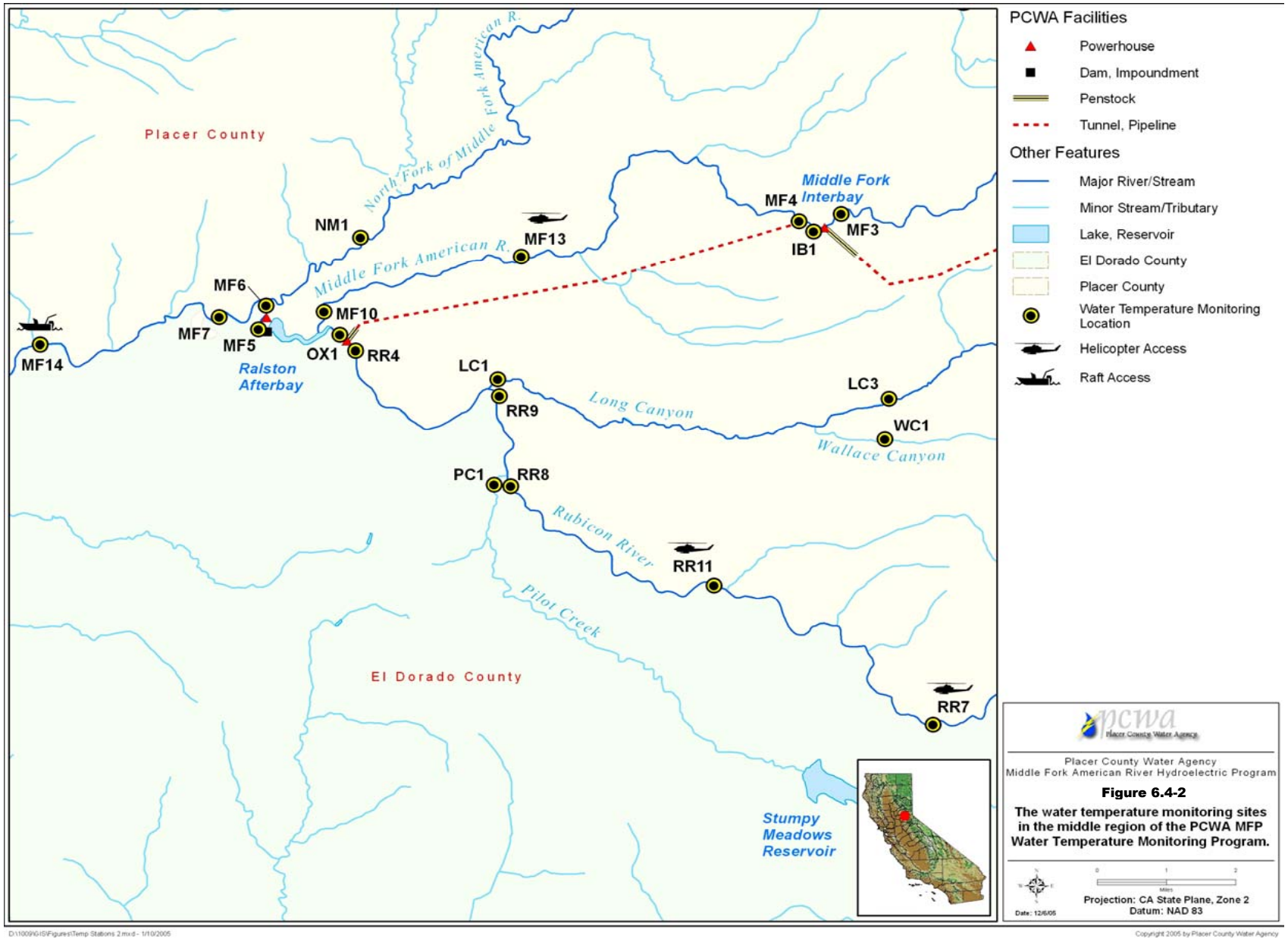

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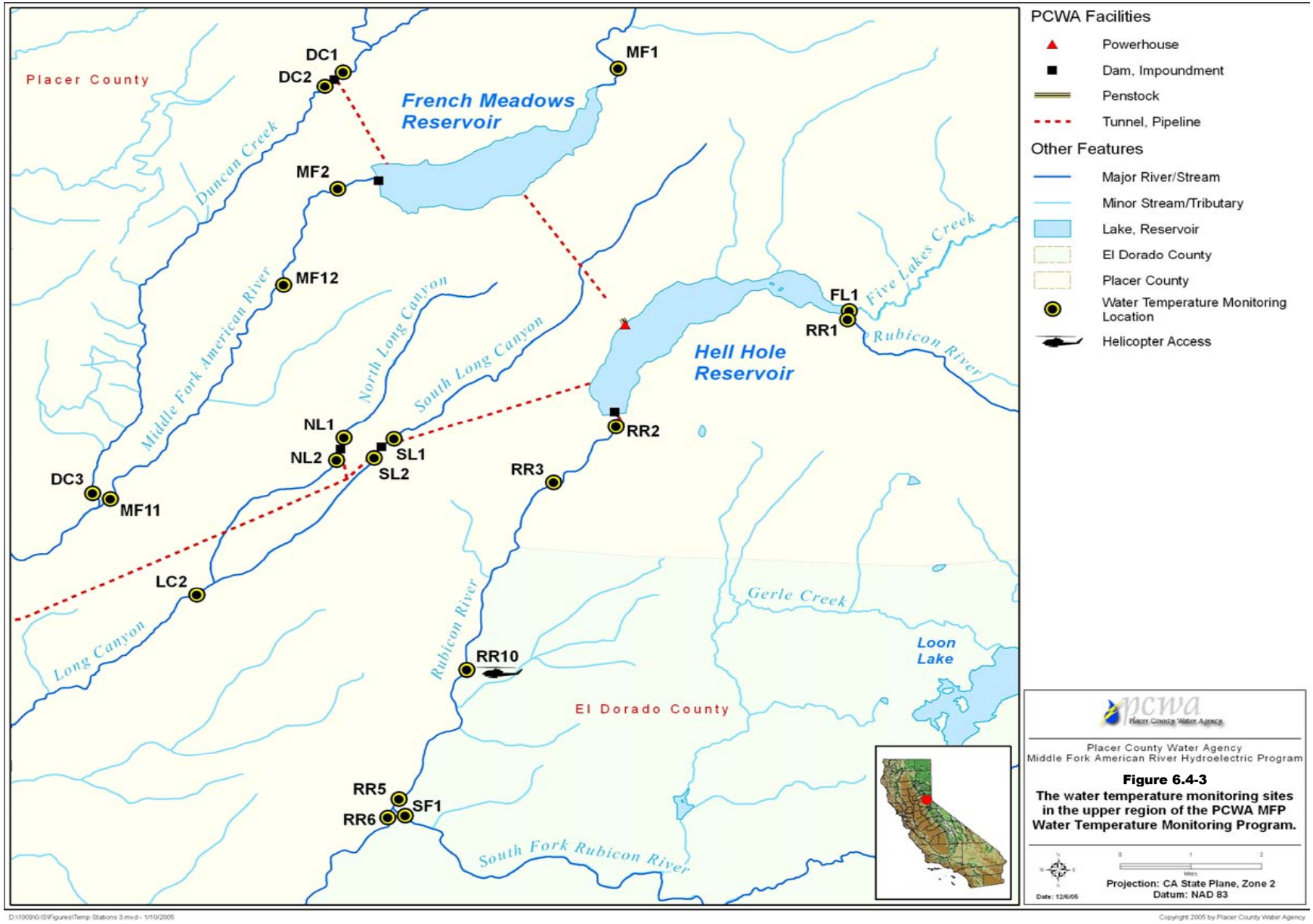

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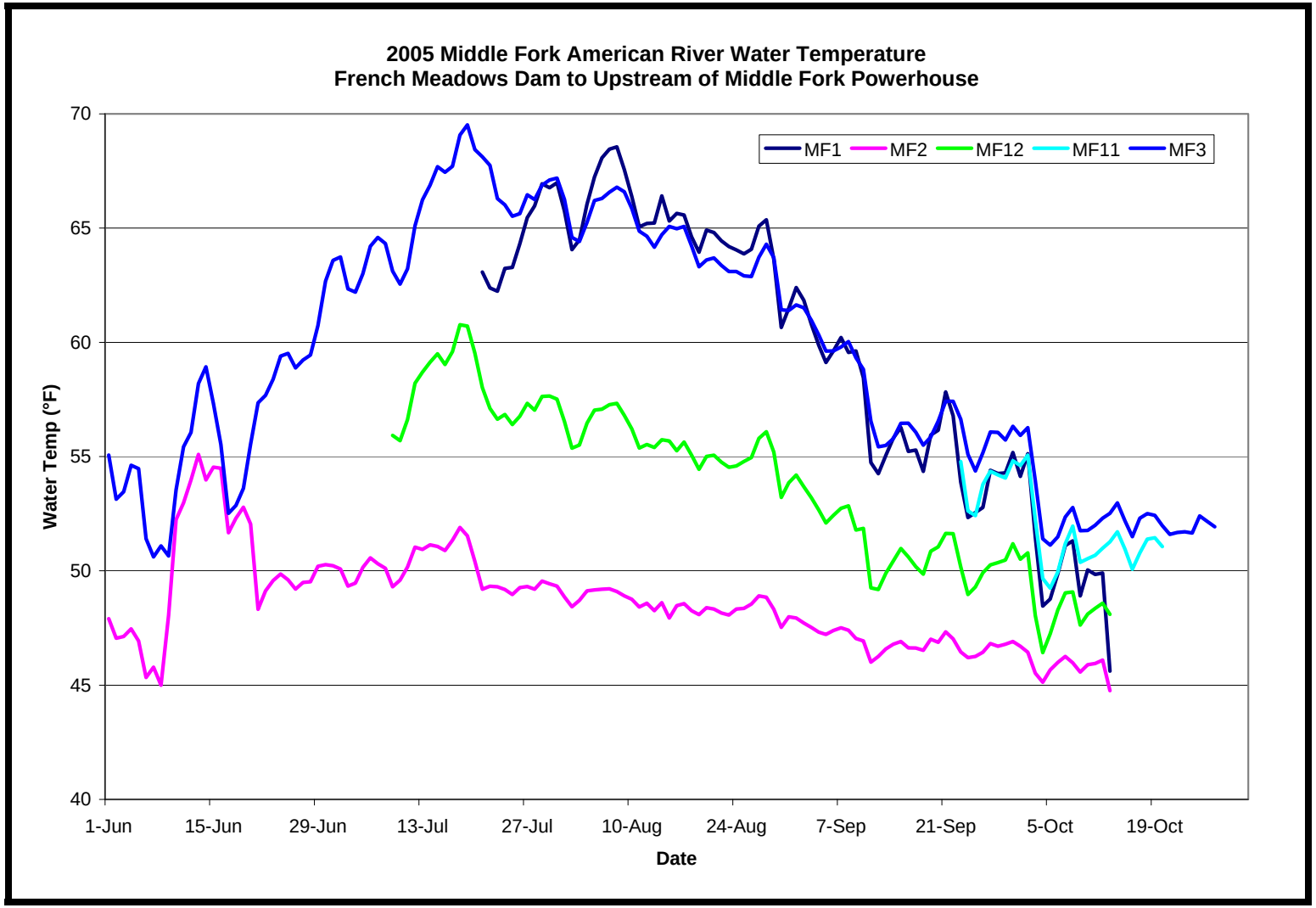

Figure 6.4-4. Summer and Fall Daily Average Water Temperature Data Collected in the Middle Fork American River at Sites MF1, MF2, MF12, MF 11, and MF3. Note: The Differences in the Durations of the Water Temperature Observations are due to Differences in Site Installation and Final Download Dates.

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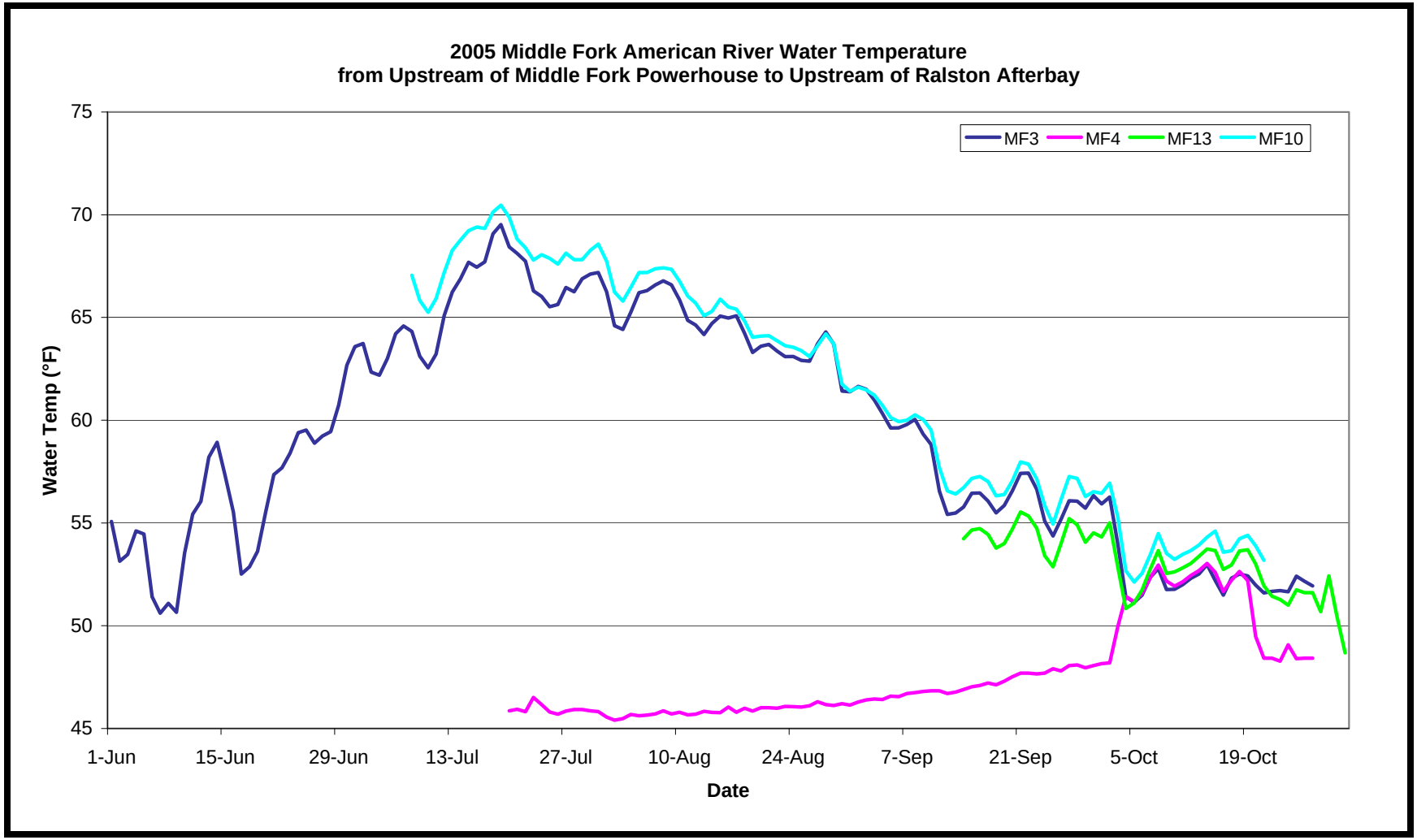

Figure 6.4-5. Summer and Fall Daily Average Water Temperature Data Collected in the Middle Fork American River at Sites MF3, MF4, MF13, and MF10. Note: The Differences in the Durations of the Water Temperature Observations are due to Differences in Site Installation and Final Download Dates.

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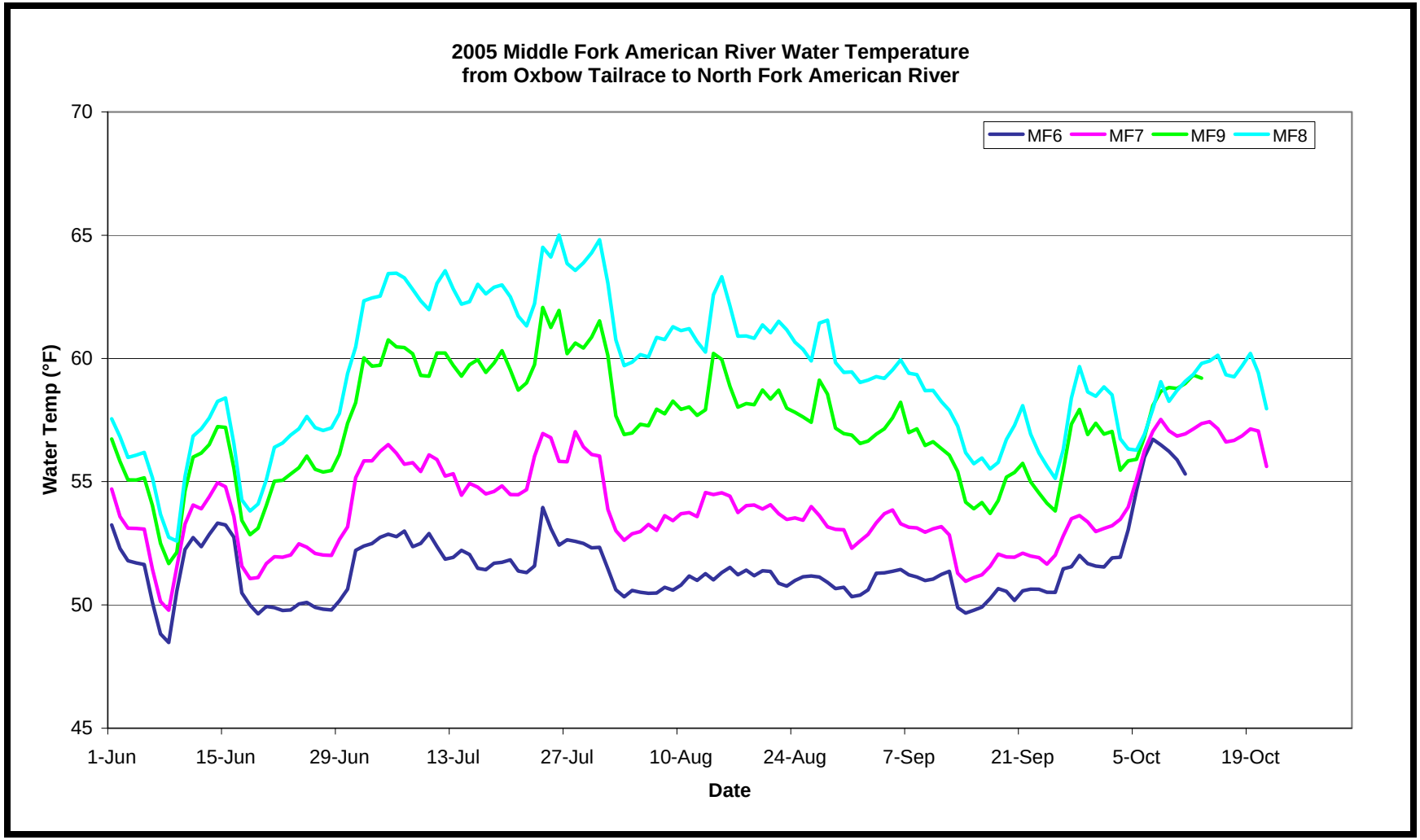

Figure 6.4-6. Summer and Fall Daily Average Water Temperature Data Collected in the Middle Fork American River at Sites MF6, MF7, MF9, and MF8. Note: The Differences in the Durations of the Water Temperature Observations are due to Differences in Site Installation and Final Download Dates.

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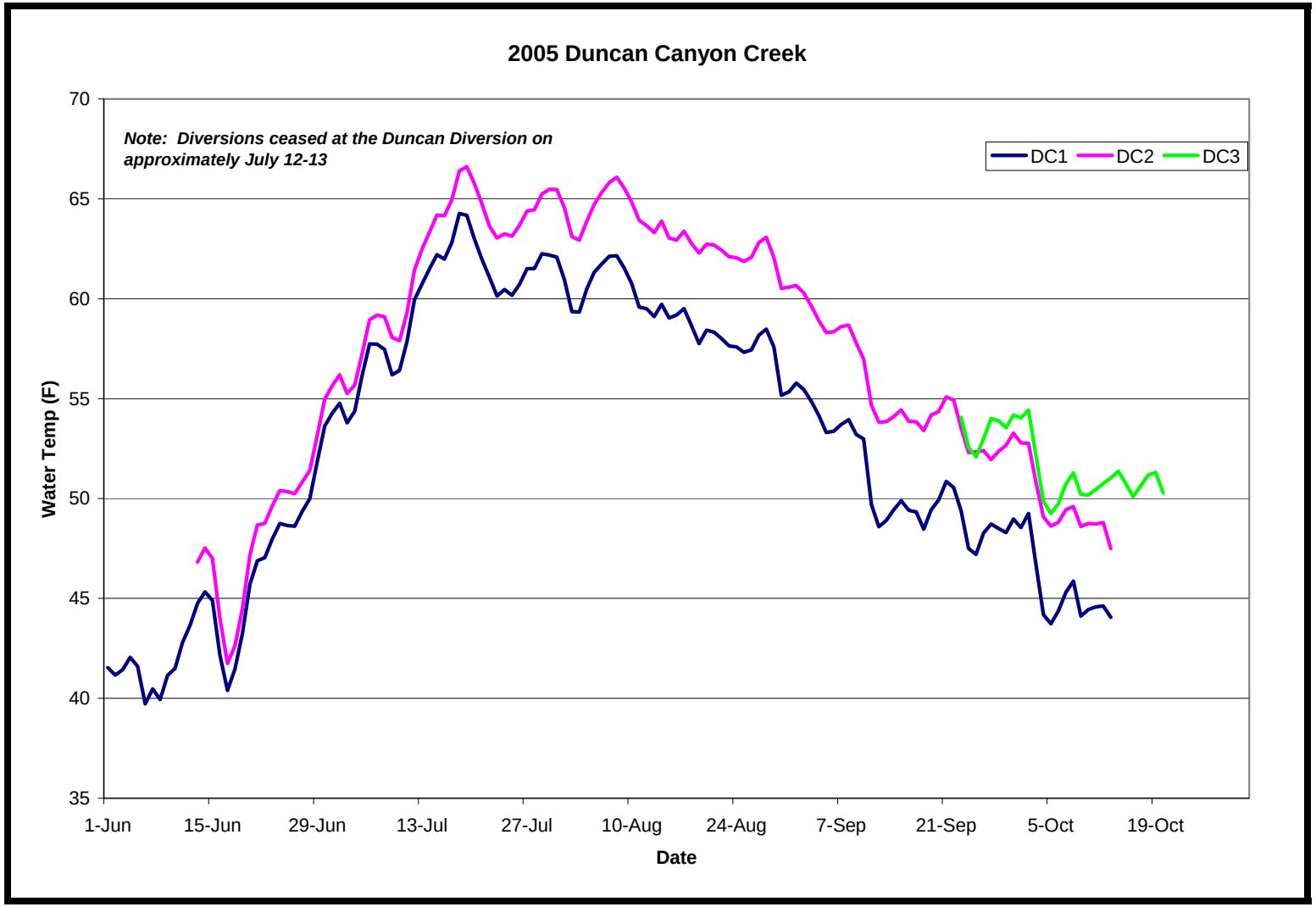

Figure 6.4-7. Summer and Fall Daily Average Water Temperature Data Collected in Duncan Canyon Creek at Sites DC1, DC2, and DC3. Note: The Differences in the Durations of the Water Temperature Observations are due to Differences in Site Installation and Final Download Dates.

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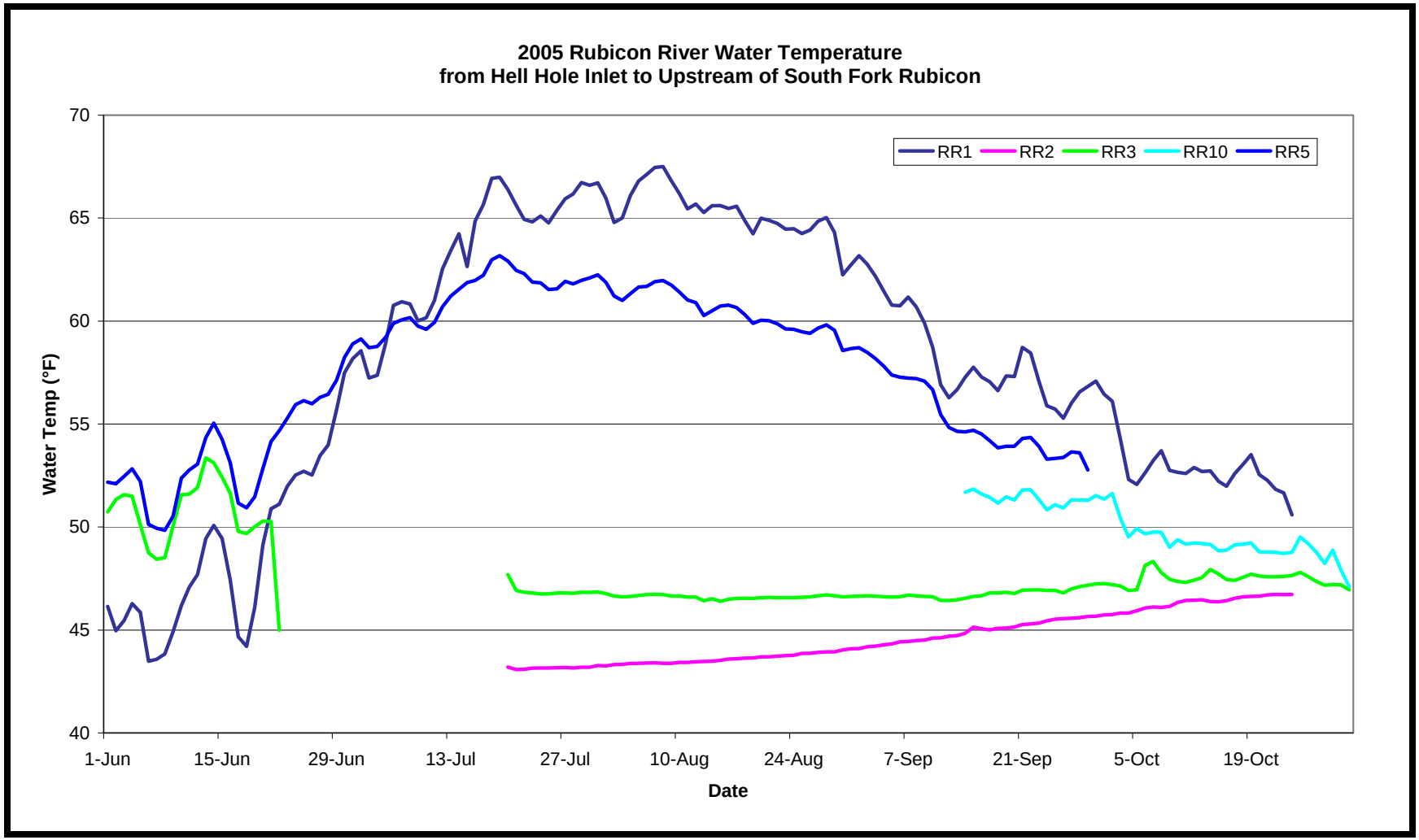

Figure 6.4-8. Summer and Fall Daily Average Water Temperature Data Collected in the Rubicon River at Sites RR1, RR2, RR3, RR10, and RR5. Note: The Differences in the Durations of the Water Temperature Observations are due to Differences in Site Installation and Final Download Dates.

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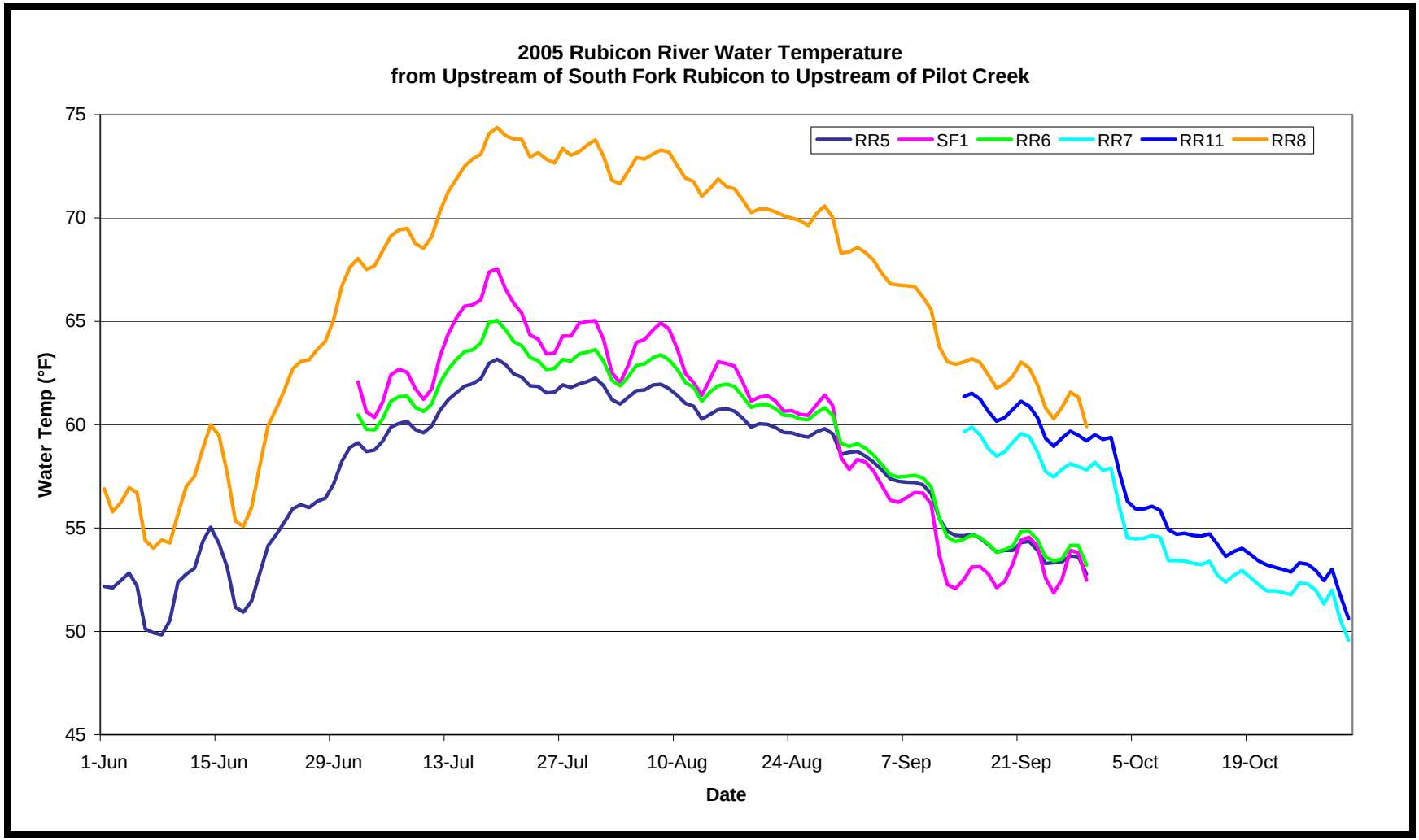

Figure 6.4-9. Summer and Fall Daily Average Water Temperature Data Collected in the Rubicon River at Sites RR5, SF1, RR6, RR7, RR11, and RR8. Note: The Differences in the Durations of the Water Temperature Observations are due to Differences in Site Installation and Final Download Dates.

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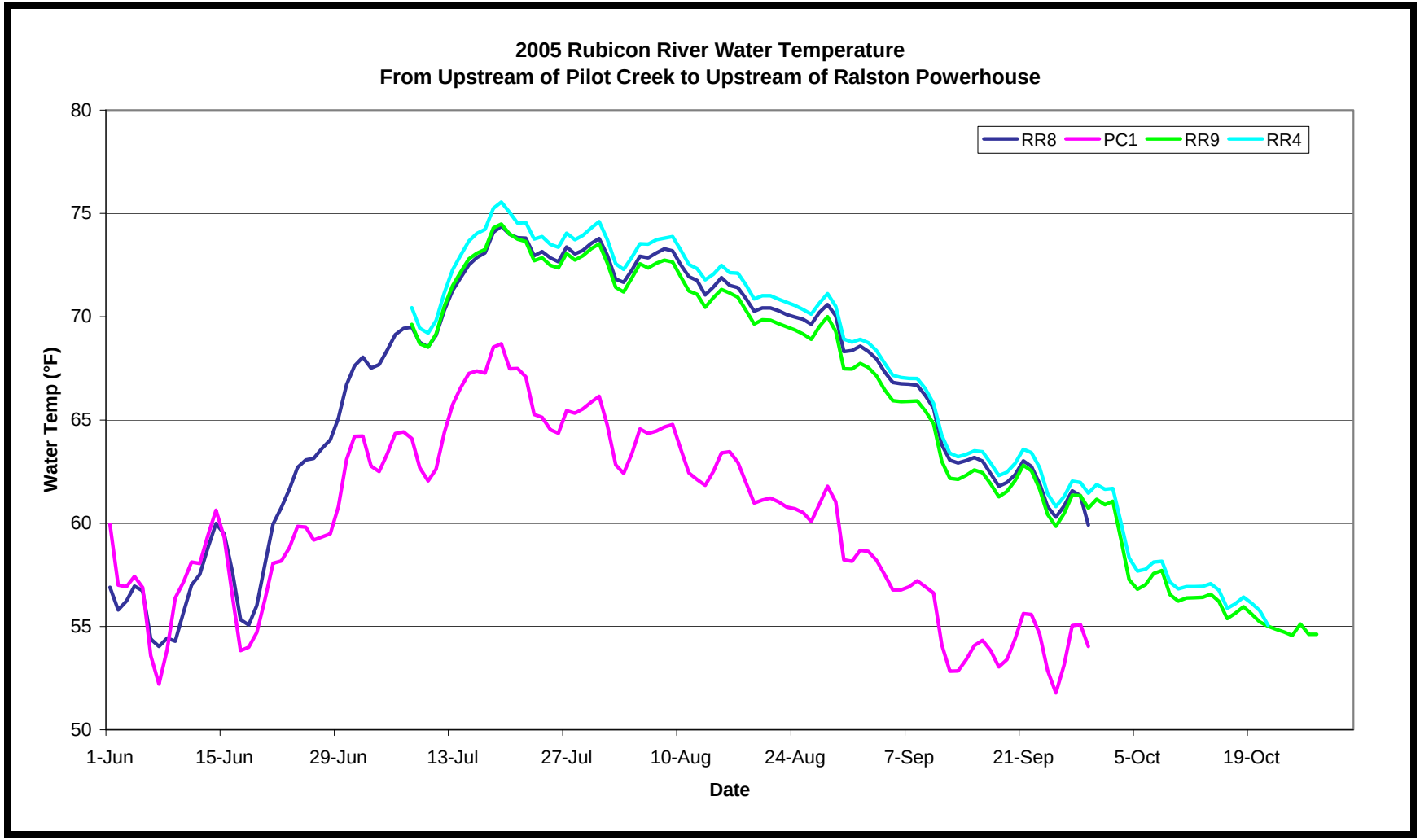

Figure 6.4-10. Summer and Fall Daily Average Water Temperature Data Collected in the Rubicon River at Sites RR8, PC1, RR9, and RR4. Note: The Differences in the Durations of the Water Temperature Observations are due to Differences in Site Installation and Final Download Dates.

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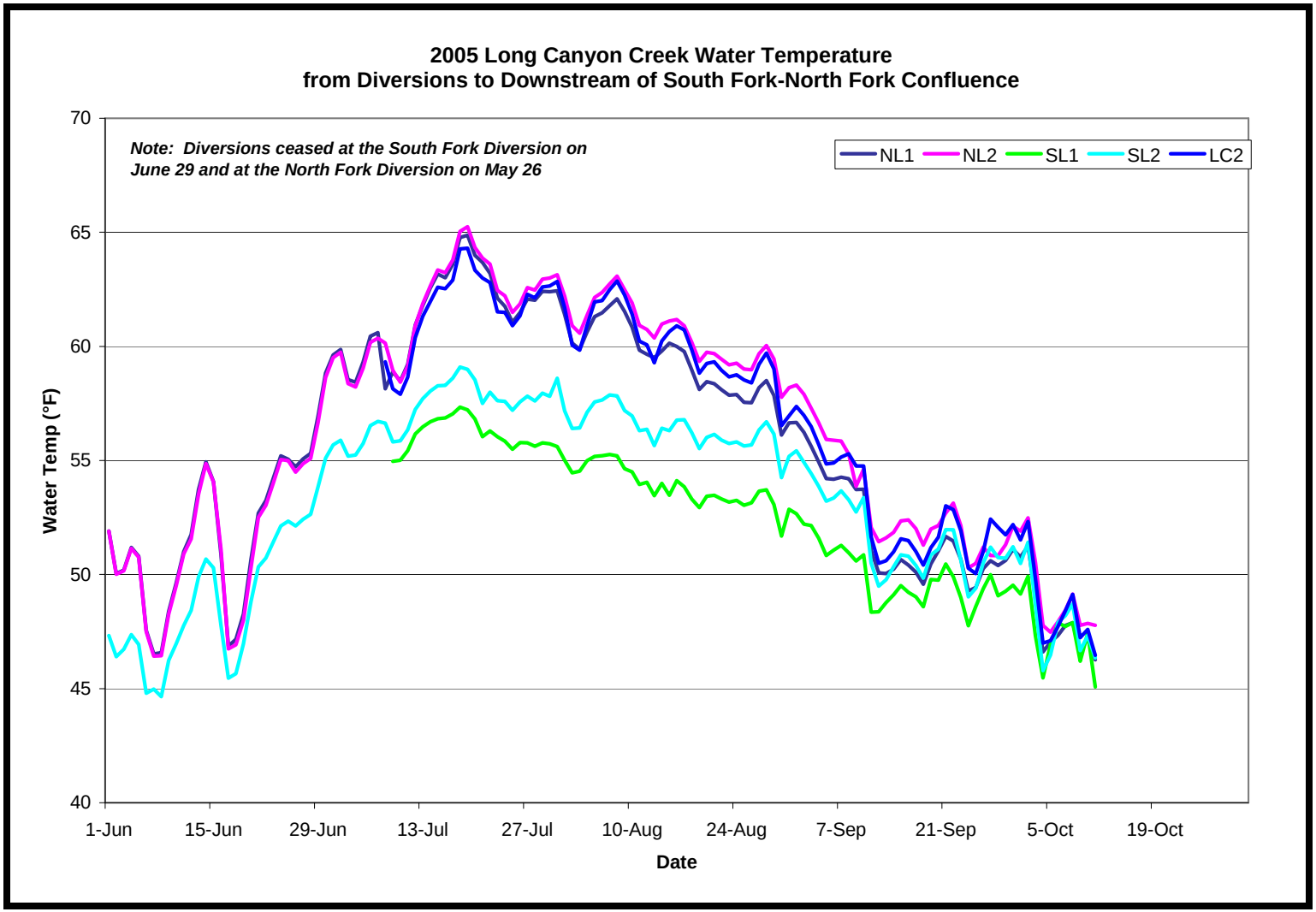

Figure 6.4-11. Summer and Fall Daily Average Water Temperature Data Collected in Long Canyon Creek at Sites NL1, NL2, SL1, SL2, AND LC2. Note: The Differences in the Durations of the Water Temperature Observations are due to Differences in Site Installation and Final Download Dates.

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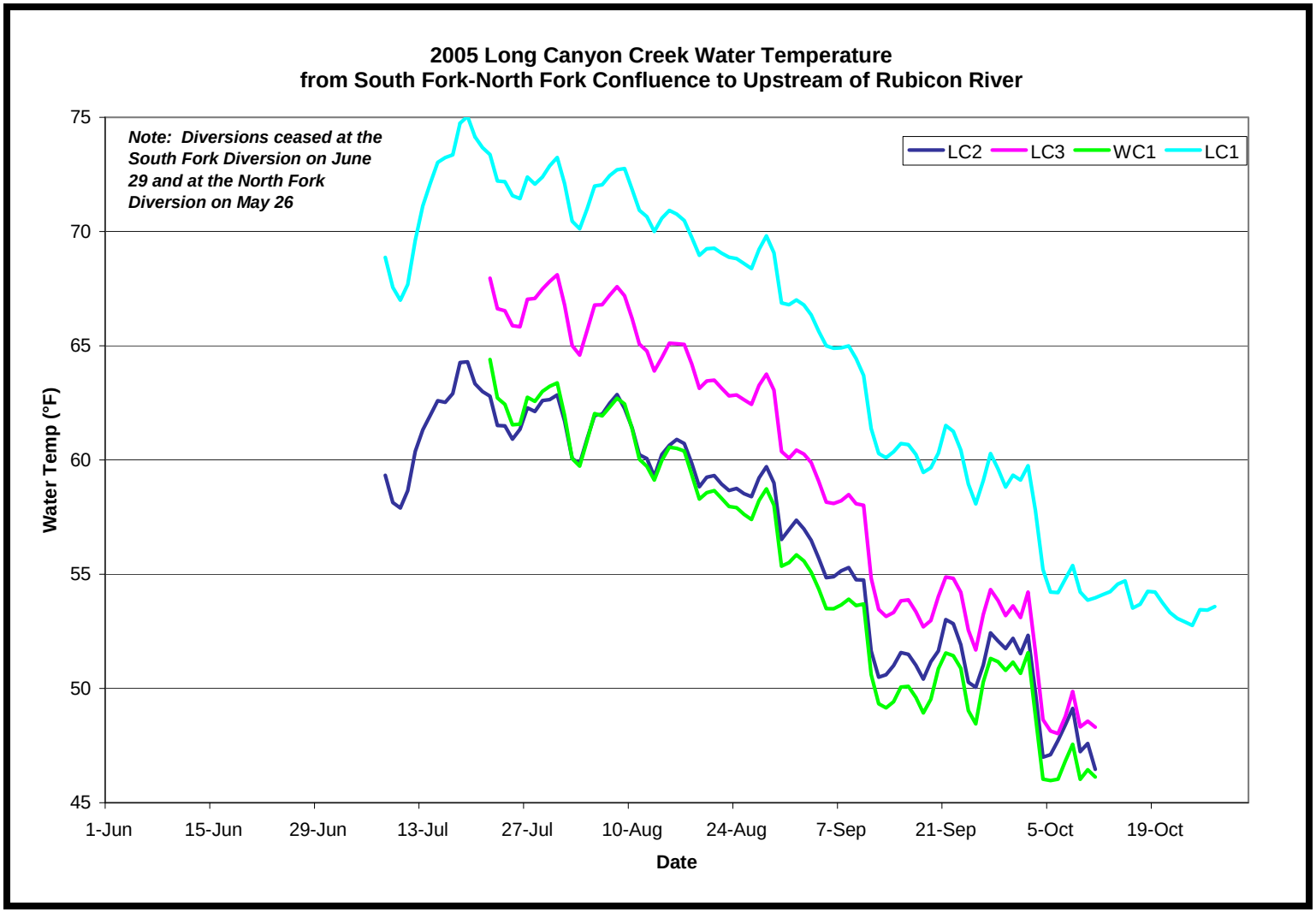

Figure 6.4-12. Summer and Fall Daily Average Water Temperature Data Collected in Long Canyon Creek at Sites LC2, LC3, WC1, AND LC1. Note: The Differences in the Durations of the Water Temperature Observations are due to Differences in Site Installation and Final Download Dates.

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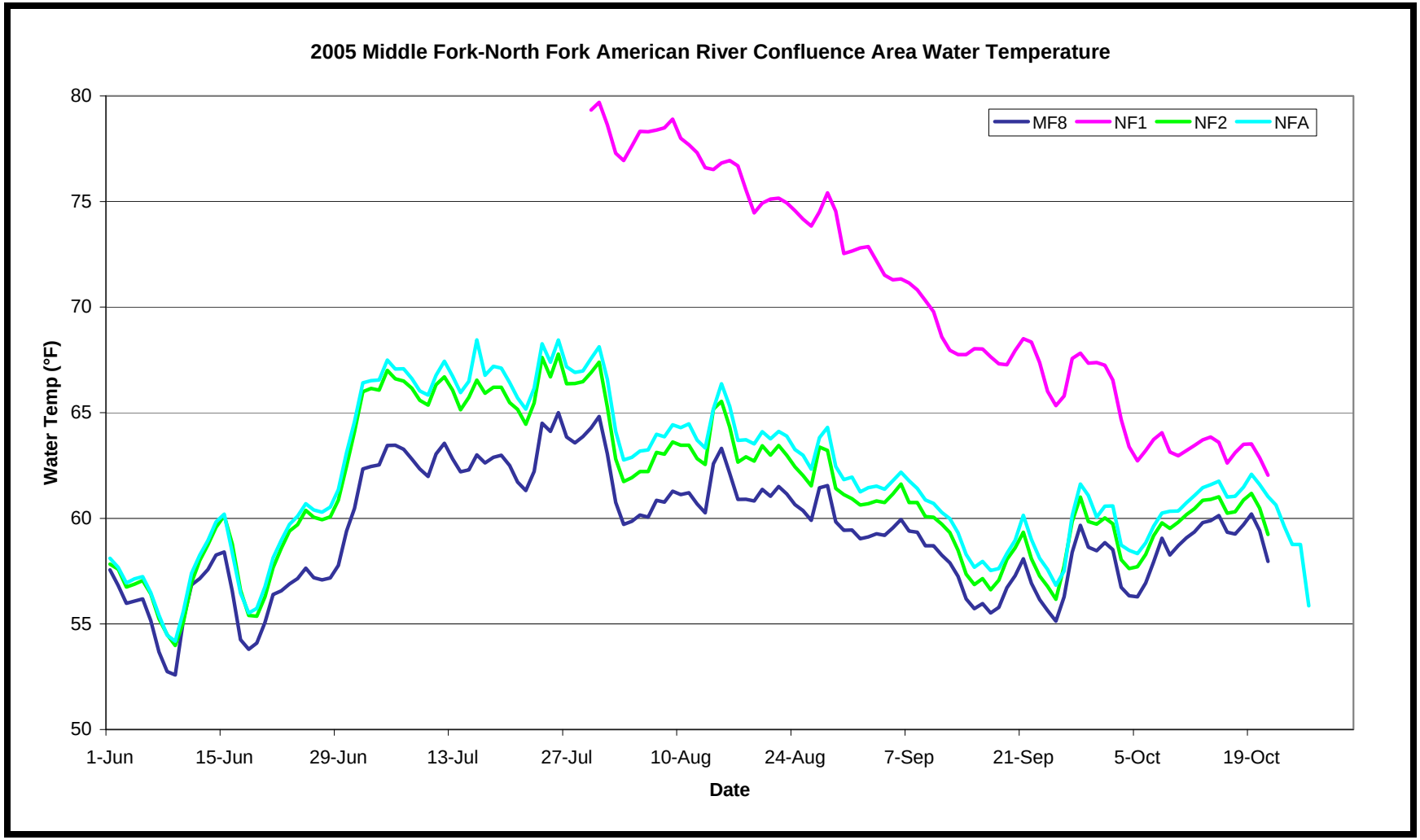

Figure 6.4-13. Summer and Fall Daily Average Water Temperature Data Collected in the North Fork American River and in the Middle Fork American River Immediately Upstream of the North Fork American River Confluence. Note: The Differences in the Durations of the Water Temperature Observations are due to Differences in Site Installation and Final Download Dates.

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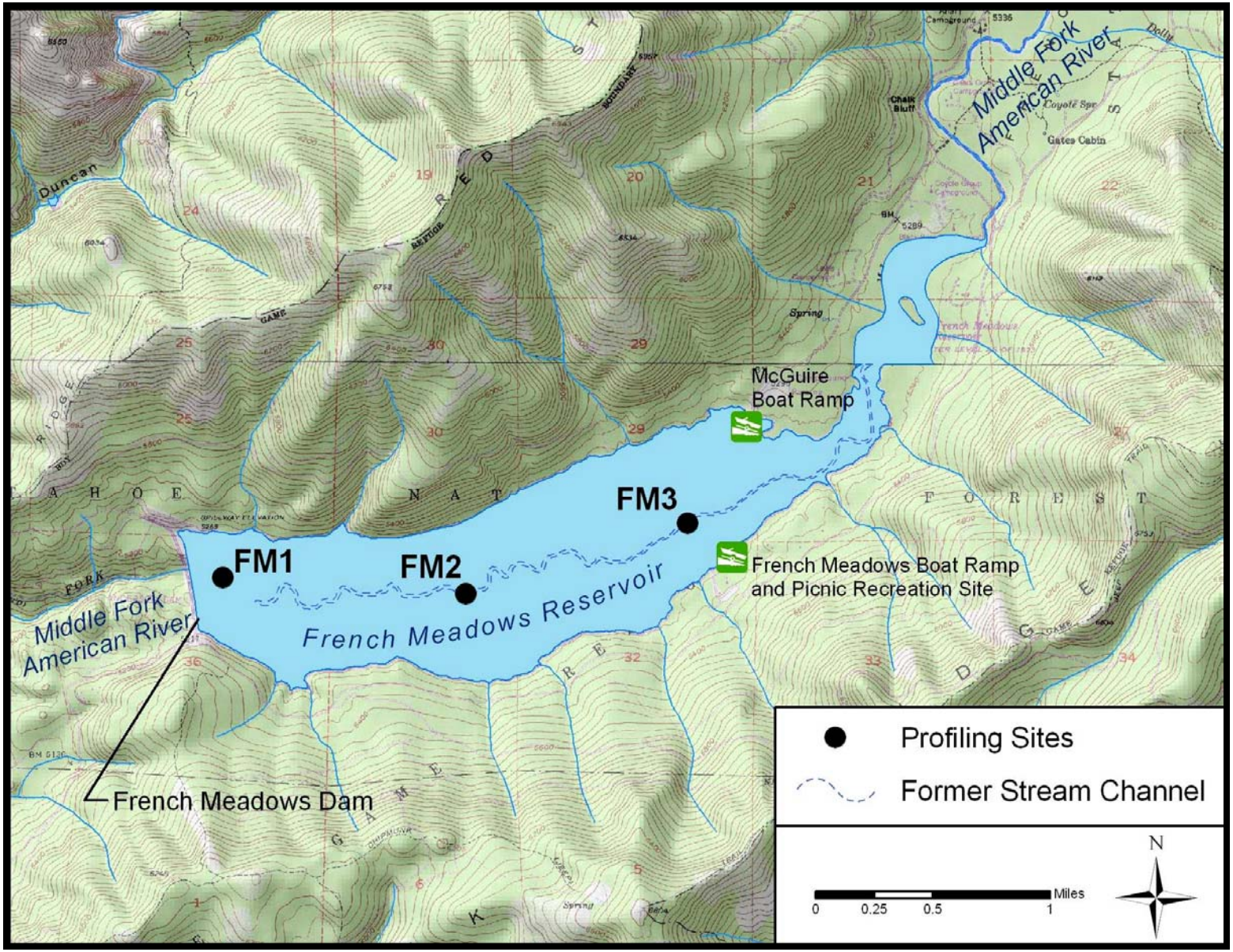

Figure 6.4-14. The Water Temperature Profile Locations in French Meadows Reservoir.

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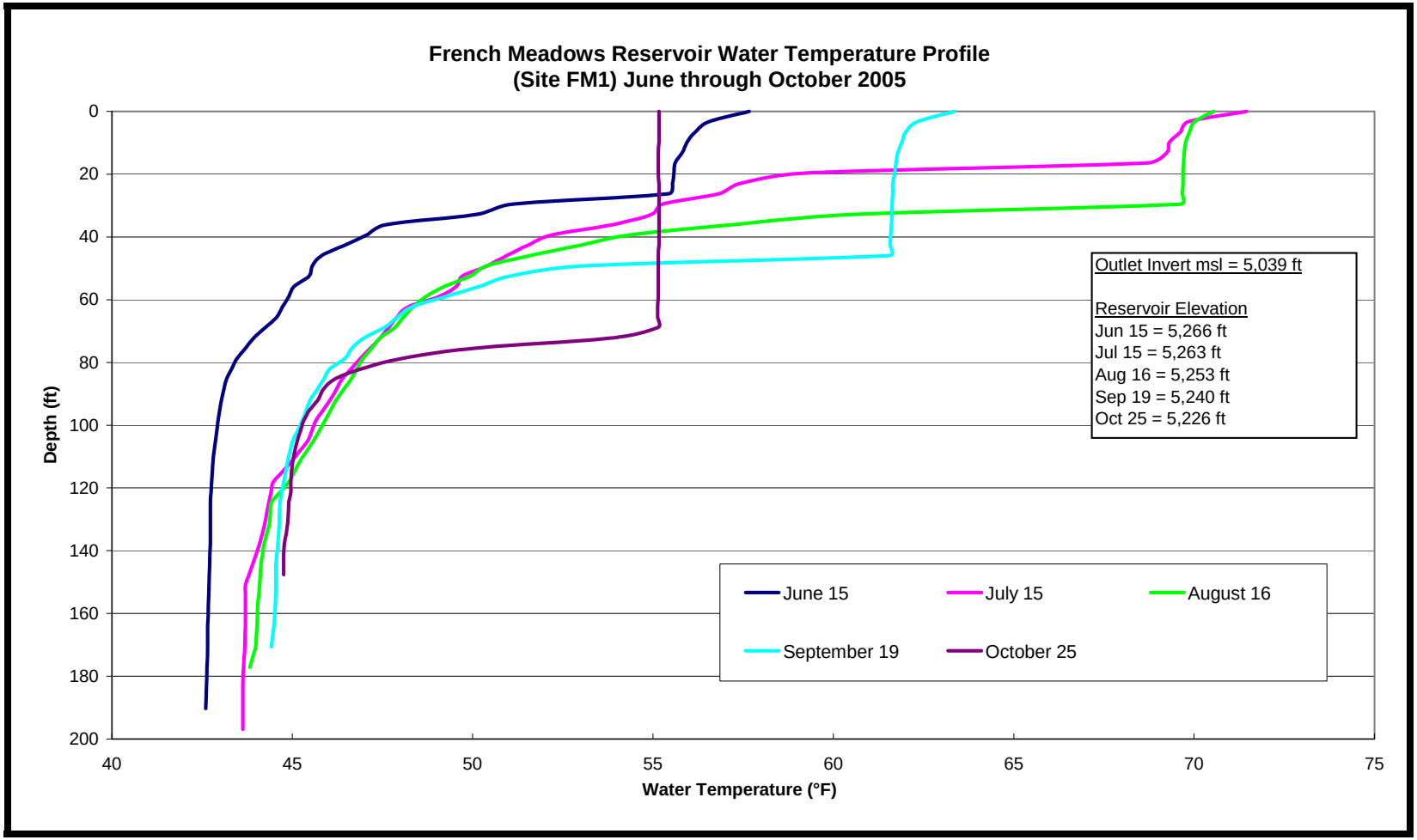

Figure 6.4-15. The French Meadows Reservoir Water Temperature Profiles at Site FM1 (nearest French Meadows Dam) on June 15, July 15, August 16, September 19, and October 25 2005, Including the River Outlet Invert Elevation and the Approximate Reservoir Elevation (msl) for each Sample Date.

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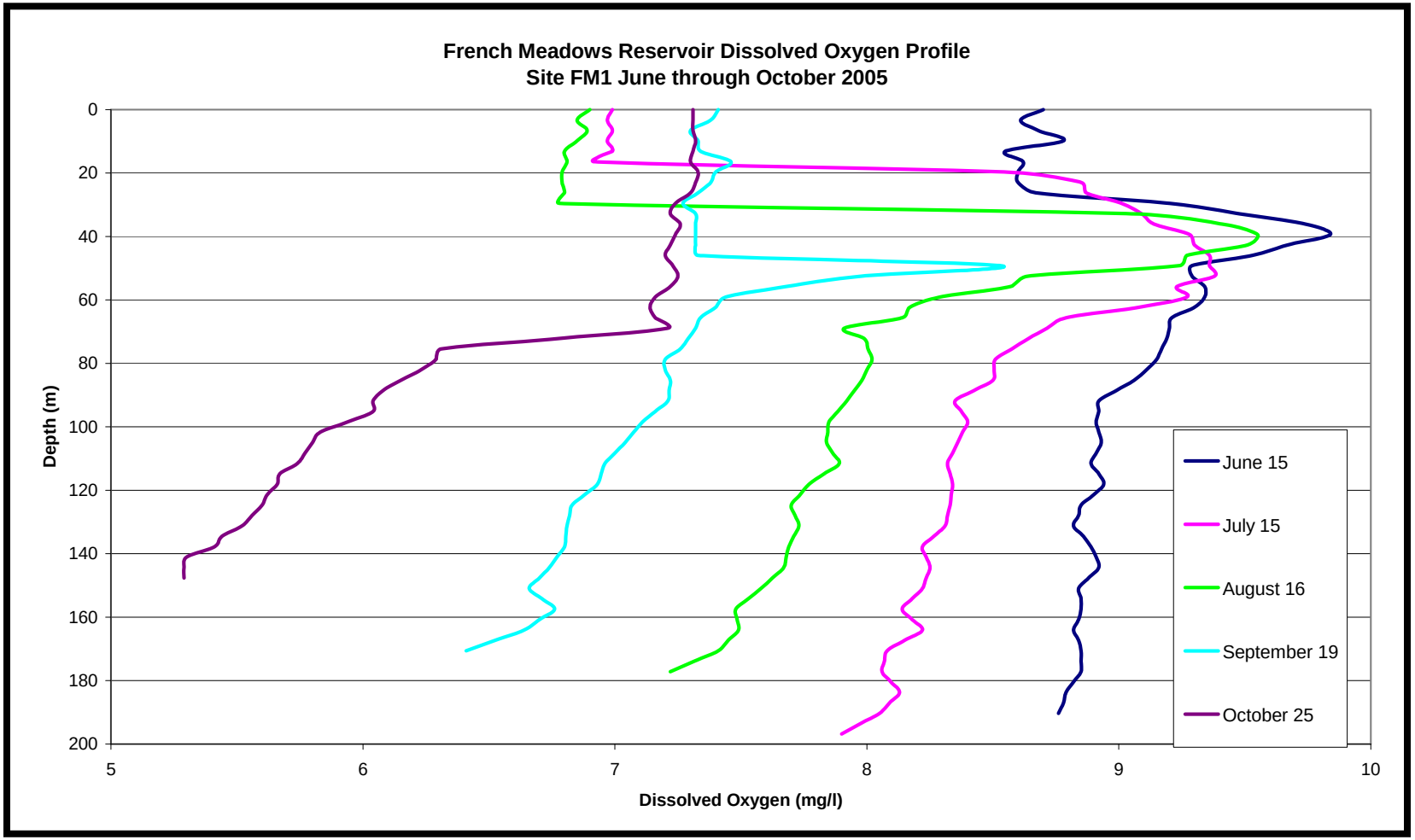

Figure 6.4-16.The French Meadows Reservoir Dissolved Oxygen Profiles at Site FM1 (nearest French Meadows Dam) on June 15, July 15, August 16, September 19, and October 25, 2005.

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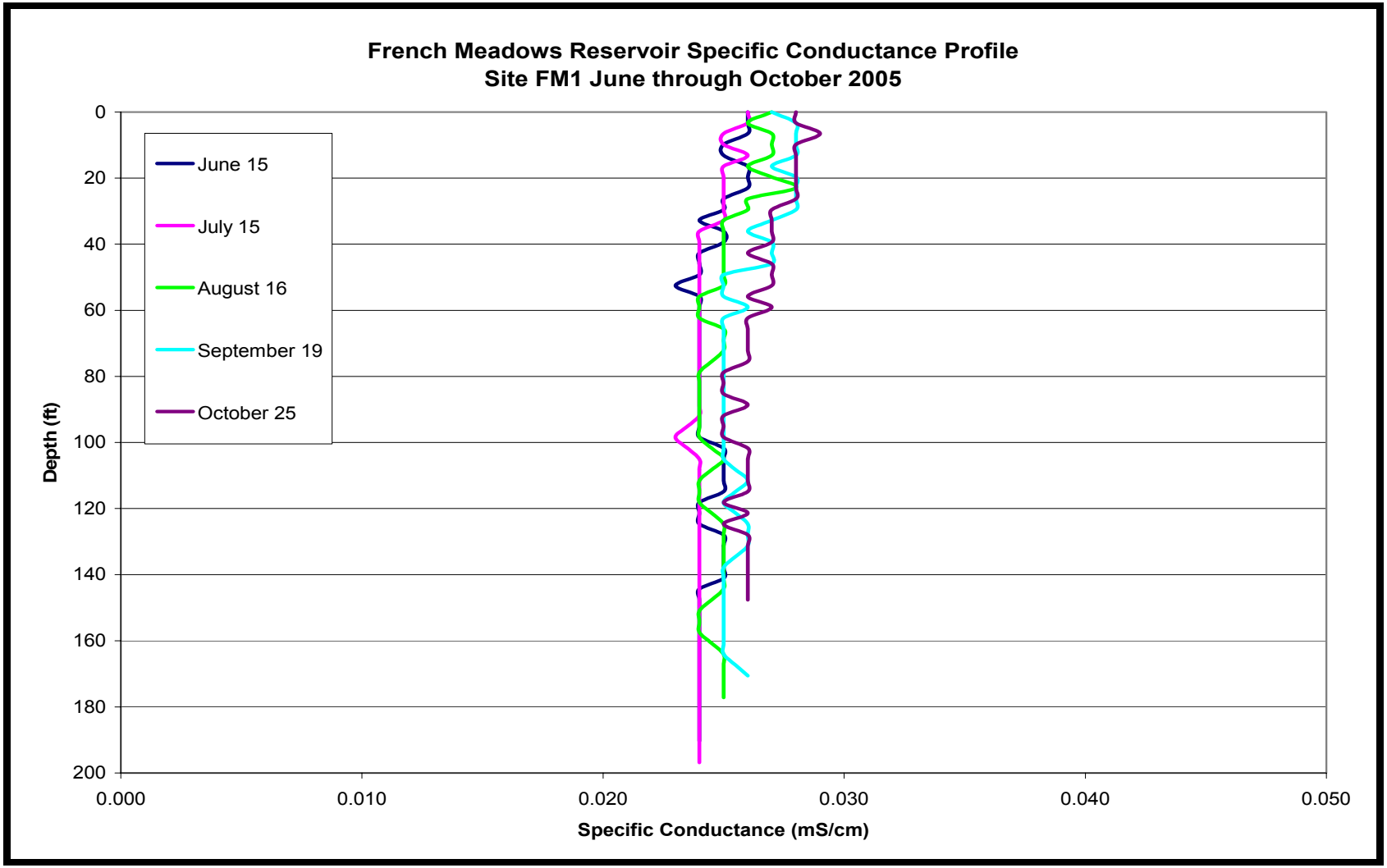

Figure 6.4-17. The French Meadows Reservoir Specific Conductance Profiles at Site FM1 (nearest French Meadows Dam) on June 15, July 15, August 16, September 19, and October 25, 2005.

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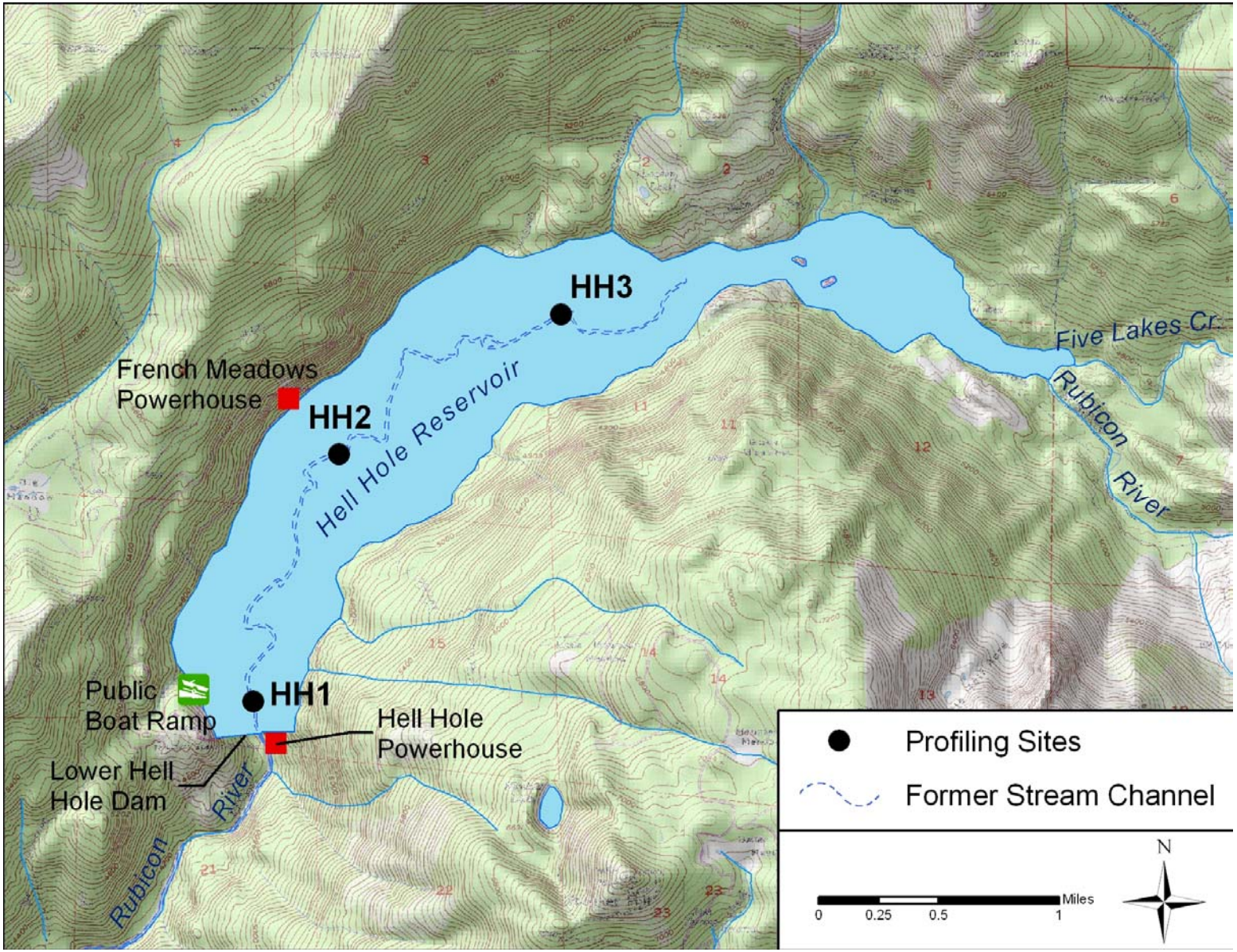

Figure 6.4-18. The Water Temperature Profile Locations in Hell Hole Reservoir.

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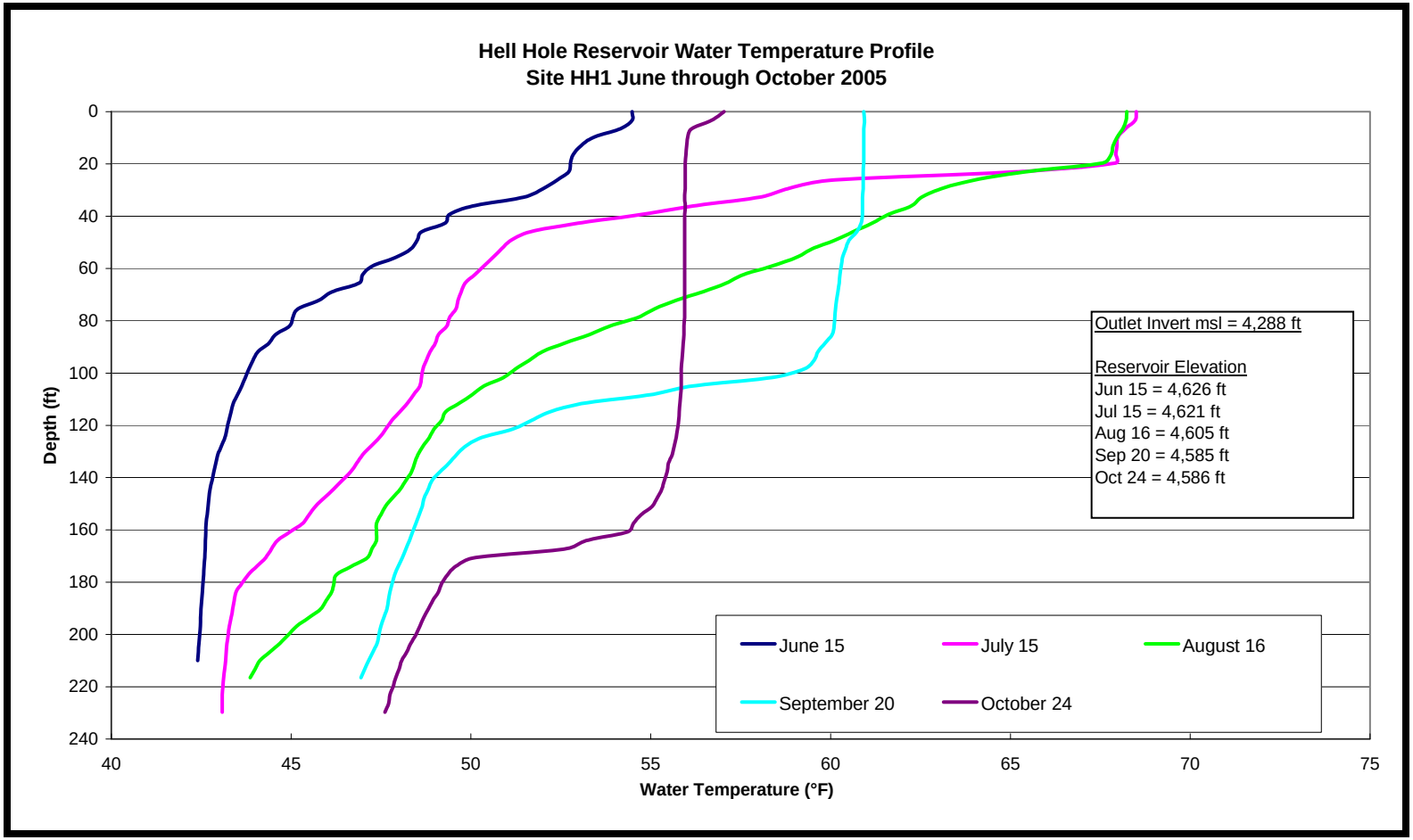

Figure 6.4-19. The Hell Hole Reservoir Water Temperature Profiles at Site HH1 (nearest Hell Hole Dam) on June 15, July 15, August 16, September 20, and October 24 2005, Including the River Outlet Invert Elevation and the Approximate Reservoir Elevation (msl) for each Sample Date.

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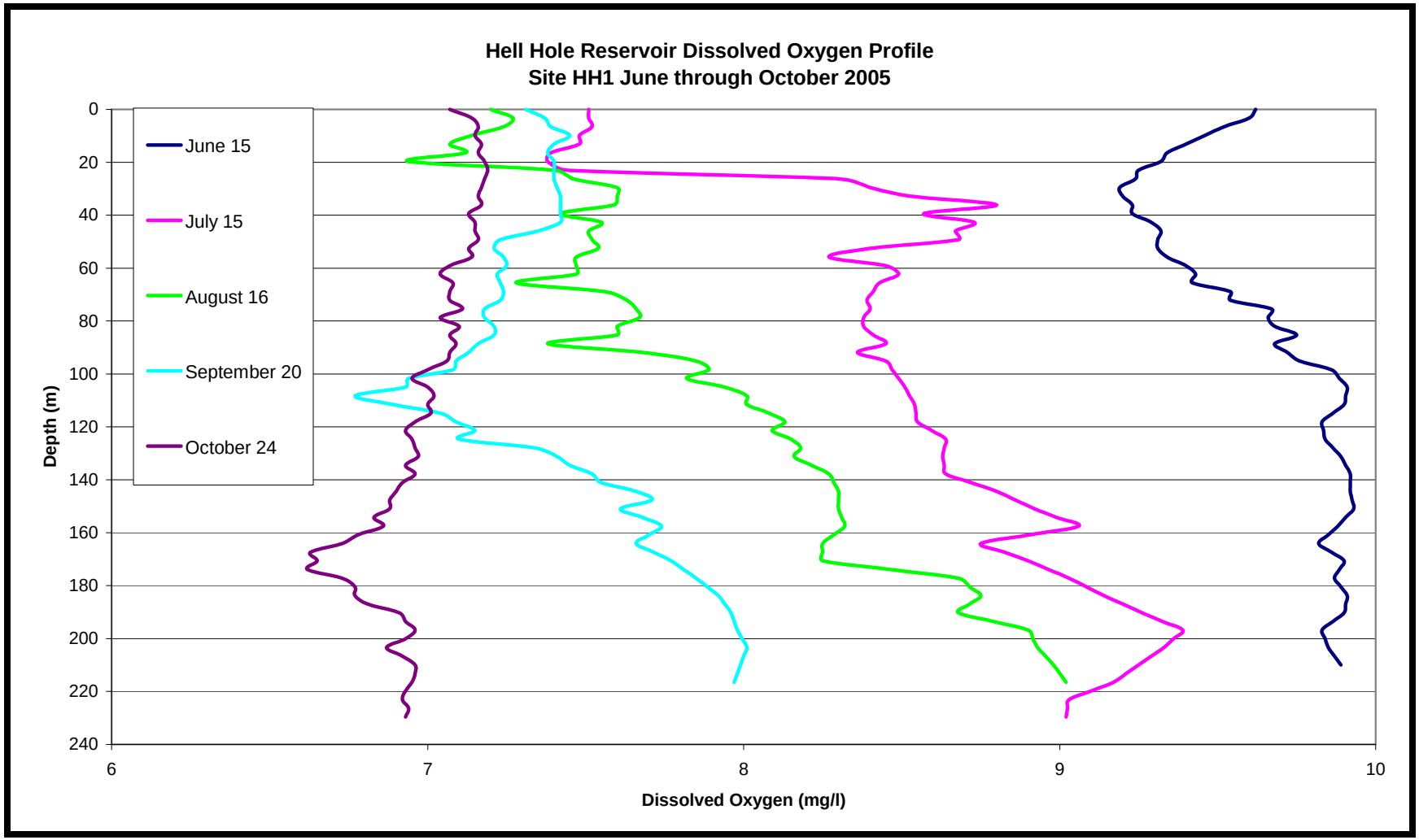

Figure 6.4-20. The Hell Hole Reservoir Dissolved Oxygen Profiles at Site HH1 (nearest Hell Hole Dam) on June 15, July 15, August 16, September 20, and October 24, 2005.

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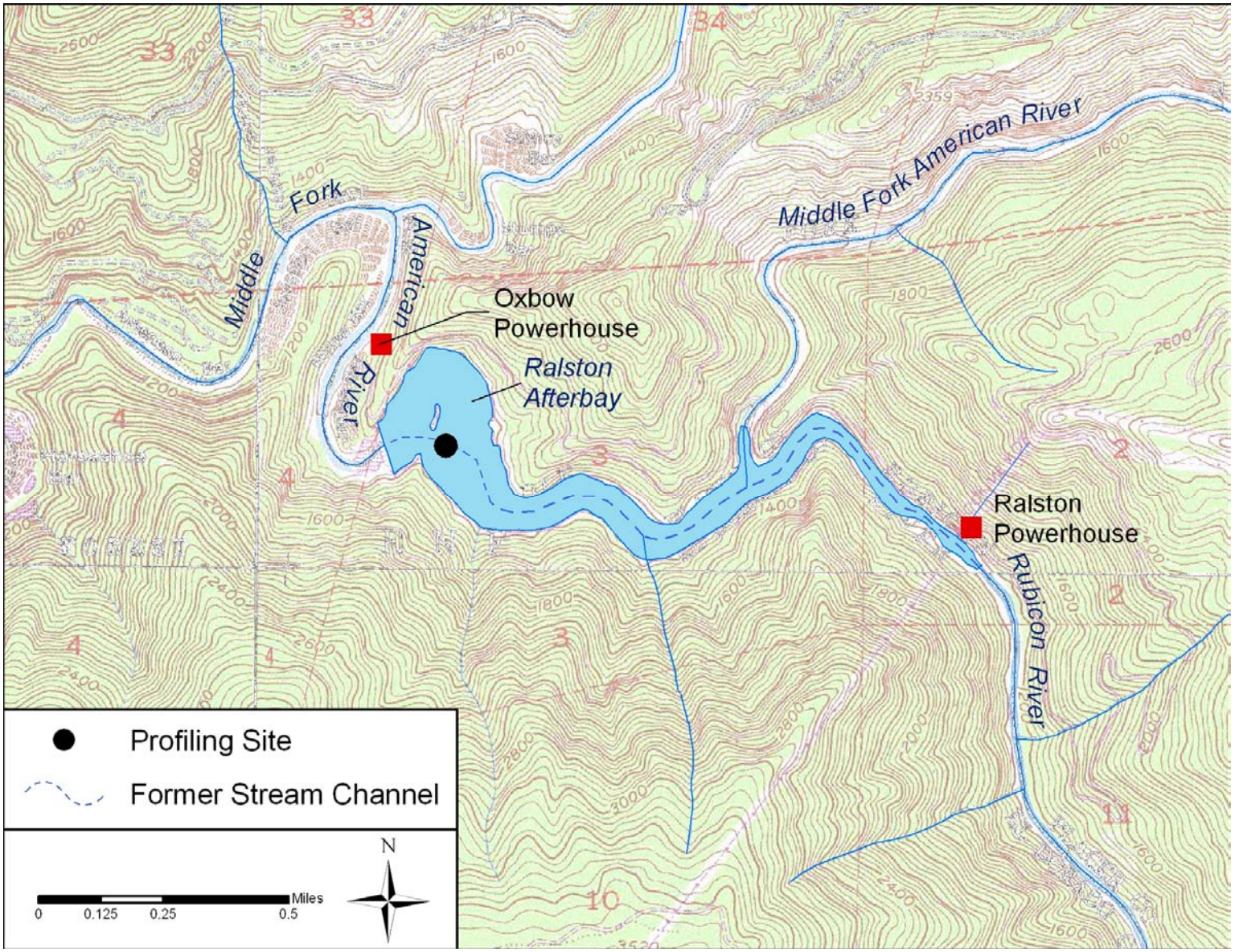

Figure 6.4-21. The Water Temperature Profile Location in Ralston Afterbay Reservoir.

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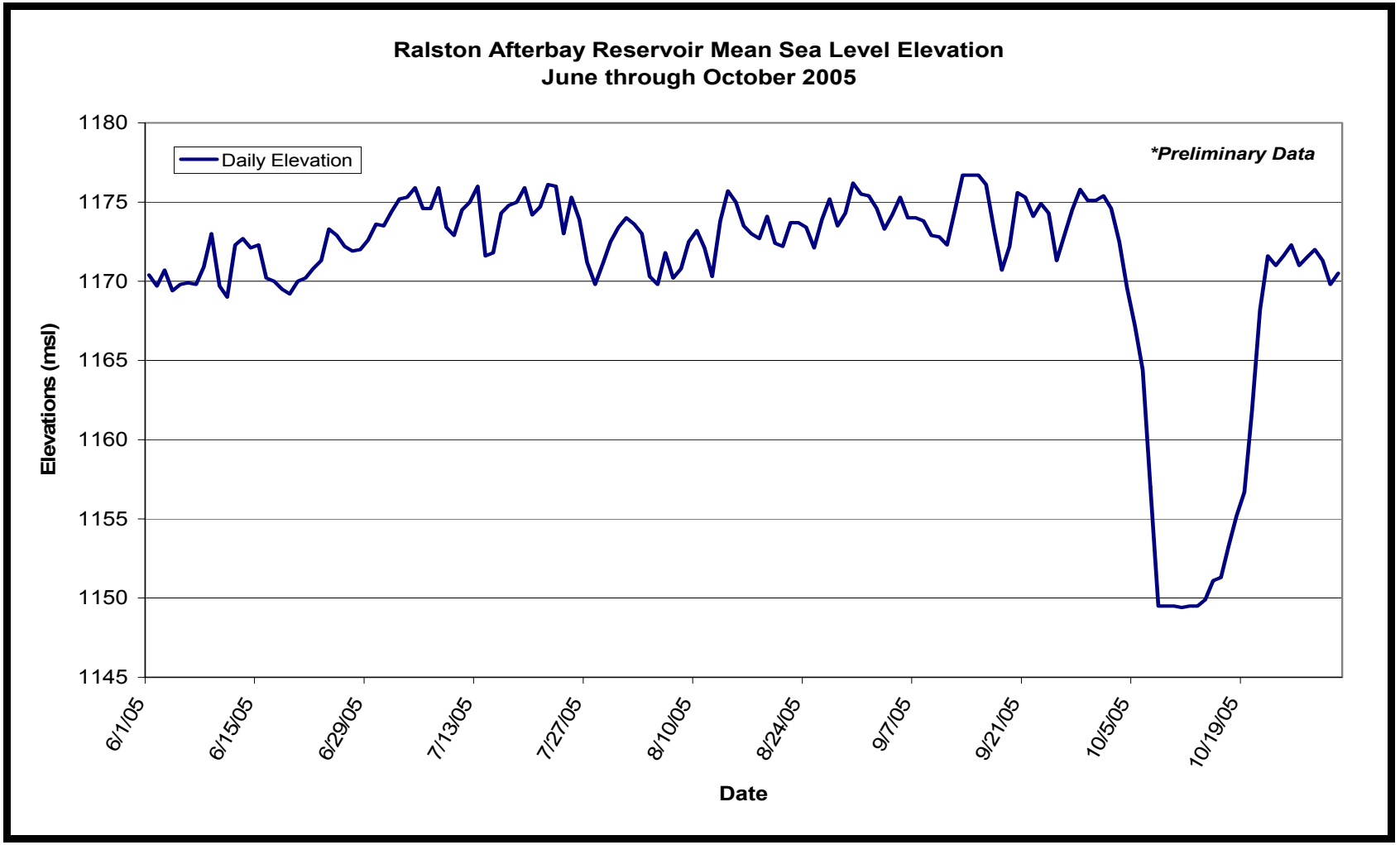

Figure 6.4-22. The Daily Reservoir Elevation at Ralston Afterbay Reservoir during June through October 2005. Note the Decrease in Reservoir Elevation during the MFP Powerhouse Maintenance Outage Period during October. Note: Preliminary data.

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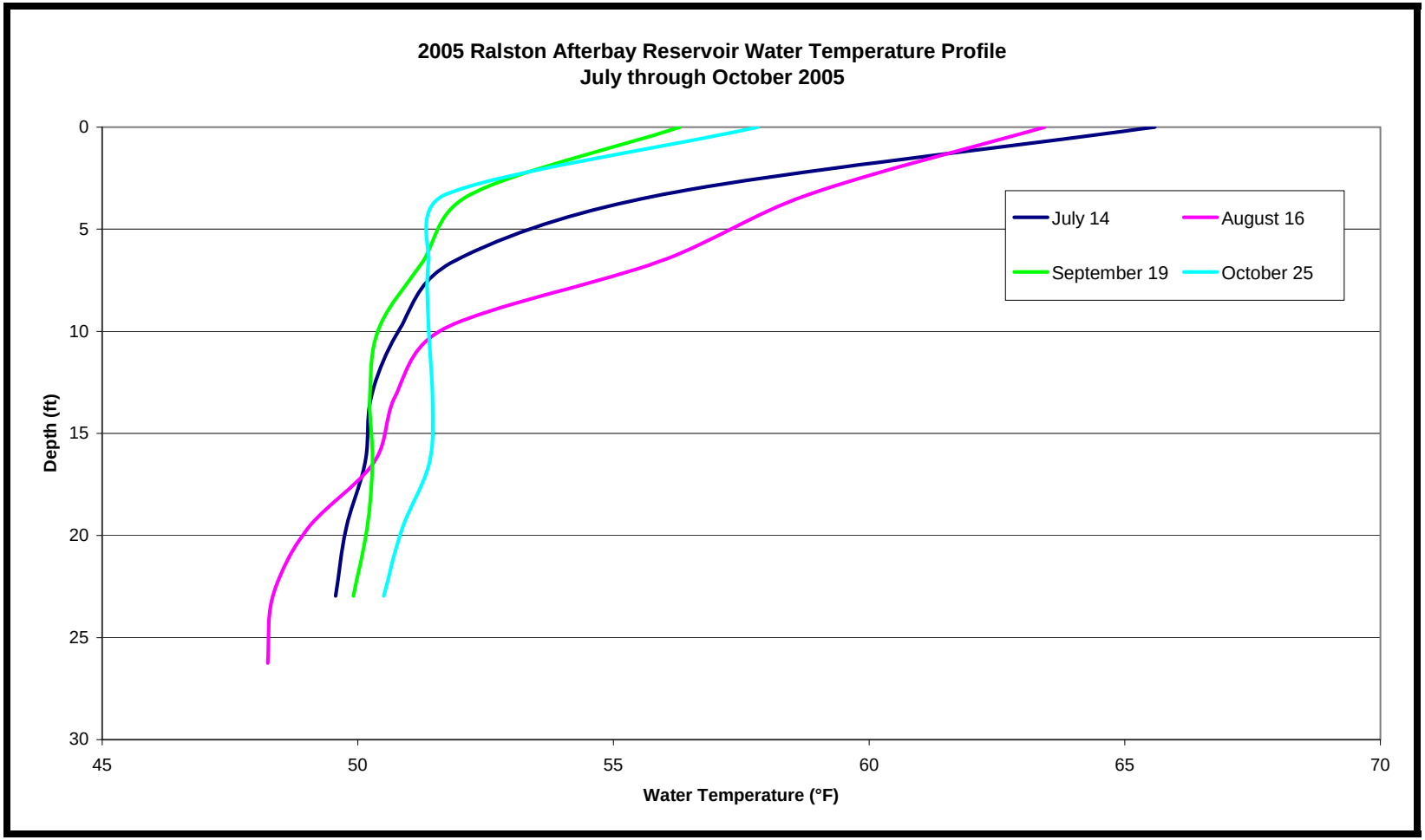

Figure 6.4-23.The Ralston Afterbay Reservoir Water Temperature Profiles on July 14, August 16, September 19, and October 25, 2005.

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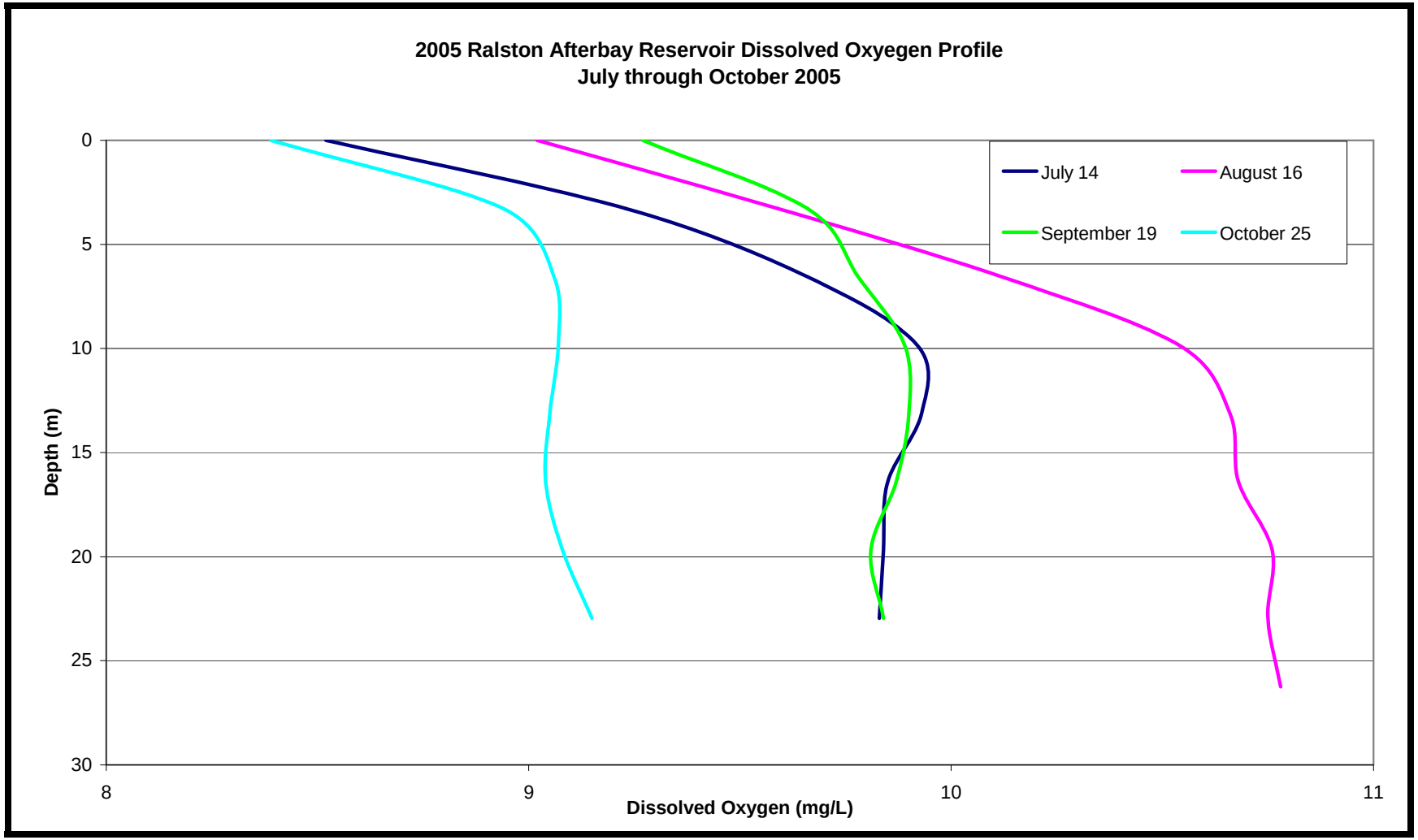

Figure 6.4-24. The Ralston Afterbay Reservoir Dissolved Oxygen Profiles on July 14, August 16, September 19, and October 25, 2005.

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Placeholder for Figures 6.4-25

Figure 6.4-25 Water Quality Monitoring Sites in the Vicinity of the MFP

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