State of California
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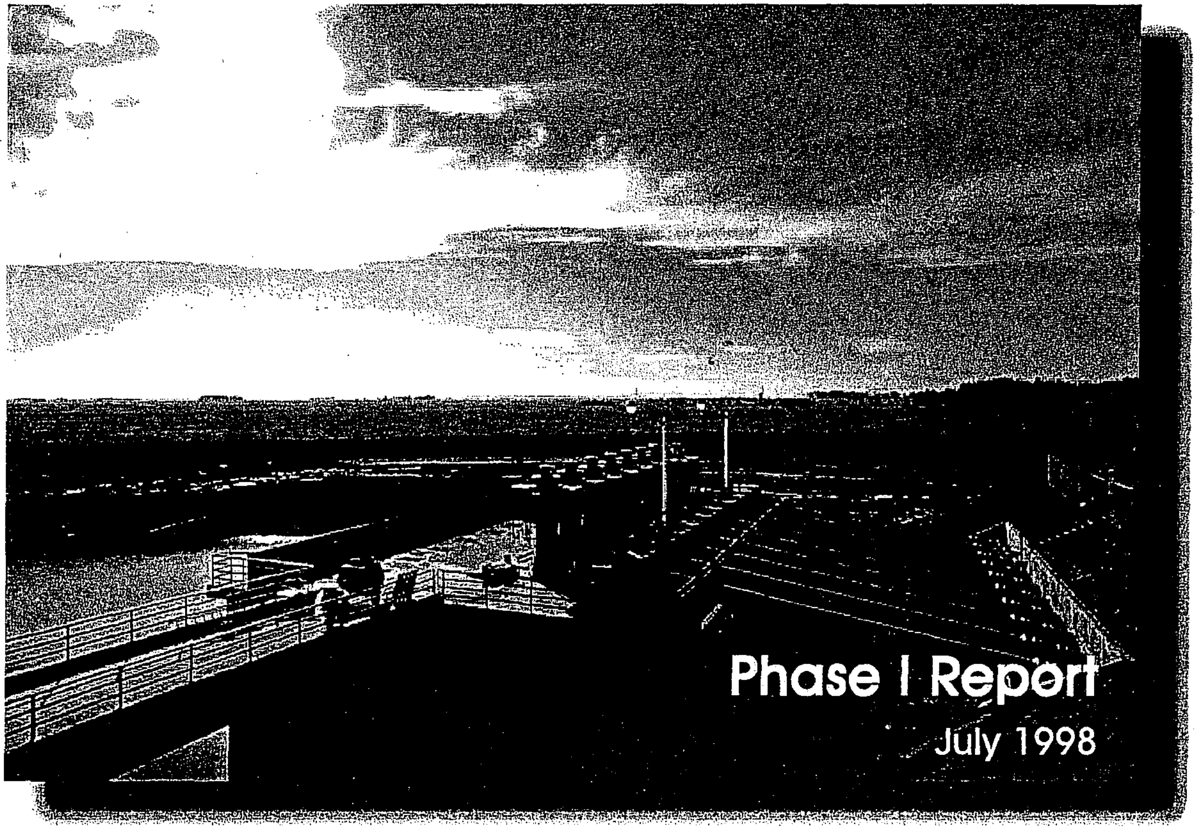
The North Bay Aqueduct Barker Slough Watershed
Water Quality



Phase I Report

July 1998

Pete Wilson
Governor
State of California

Douglas P. Wheeler
Secretary for Resources
The Resources Agency

David N. Kennedy
Director
Department of Water Resources

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FOREWORD

The *California State Water Project Sanitary Survey Update Report, 1996* was written to fulfill the California Department of Health Services requirement of all large utilities to assess their source surface waters and appropriate watersheds. The State Water Project's sanitary survey update was conducted by the Municipal Water Quality Investigations Program within the Division of Planning and Local Assistance. This study identified North Bay Aqueduct drinking water quality as being perhaps the most vulnerable in the State Water Project.

The MWQI Committee (comprised of the urban member of the State Water Contractors and staff from the U.S. Environmental Protection Agency, California Department of Health Services, State Water Resources Control Board, and Department of Water Resources' Division of Planning and Local Assistance and Division of Operations and Maintenance) directed the MWQI Program to begin conducting follow-up activities in the NBA Watershed to further assess the water quality and potential contaminant sources. The *North Bay Aqueduct/Barker Slough Watershed Water Quality Phase I Report* summarizes the result of the first twelve months of this study, which began in July 1996.

Division of Operations and Maintenance staff provided monitoring assistance at the Barker Slough Pumping Plant to collect data used in this report. In addition, an NBA Technical Advisory Committee composed of DWR and Solano County Water Agency staff (including laboratory and plant operations) helped guide the development of the study and interpretation of the results.

William J Bennett

William J. Bennett, Chief
Division of Planning and Local Assistance

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DEPARTMENT OF WATER RESOURCES
David N. Kennedy, Director

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Chief Deputy Director

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Deputy Director

Stephen L. Kashiwada
Deputy Director

L. Lucinda Chipponeri
Assistant Director for Legislation

Susan N. Weber
Chief Counsel

DIVISION OF PLANNING AND LOCAL ASSISTANCE

William J. Bennett	Chief, Division of Planning and Local Assistance
Dennis Letl	Deputy Chief, Division of Planning and Local Assistance
Phil Wendt	Chief, Water Quality Assessment Branch
William Nickels	Chief, Bryte Chemical Laboratory
Dan Otis	Chief, Technical Services Section
Ray Tom	Chief, Quality Assurance /Quality Control Unit

This report was prepared under the supervision of

Richard Breuer	Chief, Municipal Water Quality Investigations Unit

By

A. Marc Commandatore	Environmental Specialist II
Denise Webster	Scientific Aid
Marvin Jung	Consulting Water Quality Scientist Marvin Jung & Associates, Inc. (DWR B-80985)

MWQI Field Support

David Gonzalez	Chief, Field Support Unit
Ian Waters	Associate Engineering Geologist
Walt Lambert	Water Resources Engineering Associate

Lori Weisser	Water Resources Engineering Associate
Diana Stoliker	Water Resources Technician I

Editorial Review, Graphics, and Document Production

Lynda Herren	Supervisor, Division Publications
Brenda Main	Research Writer
Edna Smith	Office Assistant

Project Oversight, Review, and Comment By

NBA Technical Advisory Committee

John Coburn	State Water Contractors
Elaine Archibald	Archibald and Wallberg Consultants
Jaqueline McCall	City of Vacaville
David Okita	Solano County Water Agency
Victoria Shidell	City of Benicia
David Tompkins	City of Vacaville
Niles Fleege	City of Fairfield
Turan Ramadan	City of Napa
Ann Rice	City of Vallejo
Lawrence Joyce	DWR - Operations and Maintenance, Chief, Water Quality Section
Barry Montoya	DWR - O&M, Environmental Specialist III
Richard Gage	DWR - O&M, Delta Field Division Water Resources Engineering Associate

EXECUTIVE SUMMARY

The *California State Water Project Sanitary Survey Update Report, 1996* identified several water quality concerns in the Barker Slough watershed that affected NBA as a source of drinking water. These concerns included high concentrations of organic carbon, trihalomethane formation potential, metals, and coliform bacteria. In response to these concerns, a study of the water quality of surface waters entering NBA from Barker Slough, Calhoun Cut, and Lindsey Slough was initiated.

The study is being conducted in two phases. The first phase began on July 1, 1996 and ended on June 30, 1997. An NBA Technical Advisory Committee was formed to develop a workplan to monitor water quality in the watershed. The NBA TAC is comprised of representatives of the contractors using NBA water and Department of Water Resources' MWQI Unit and Division of Operations and Maintenance staff. The workplan for Phase I monitoring is presented in Appendix A. Phase I was designed to quantify the severity of potential water quality problems. Phase II, which began in September 1997, expands monitoring to include upper Barker Slough watershed sites to further delineate local watershed contributions of contaminants. The workplan for Phase II is presented in Appendix F.

Phase I water samples were collected weekly from July 1996 through June 1997 at four locations in the watershed: (1) the Barker Slough Pumping Plant, (2) Barker Slough at Cook Lane, (3) Calhoun Cut at Highway 113, and (4) Lindsey Slough at the Hastings Island bridge. The parameters measured were temperature, dissolved oxygen, pH, specific conductance, turbidity, bromide, organic carbon, total trihalomethane formation potential, ultraviolet absorbance (at 254 nanometer), alkalinity, aluminum, iron, manganese (dissolved concentrations for the period July 1996 - March 1997, and total concentrations for the period April - July 1997), *Escherichia coli*, and selected pesticides. Sampling results are displayed as tables and figures in Appendix B.

The results showed distinct seasonal (wet and dry) differences in the water quality at all sampling sites. Generally, concentrations of measured parameters increased during the wet period (October through March) and decreased during the dry period (March through September).

Contrary to historical belief, the water quality at BSPP is more heavily influenced by local runoff than by Lindsey Slough. The results indicated that Lindsey Slough had better water quality than the other sampling sites. The Lindsey Slough site is near the confluence of Cache Slough and Miner Slough. The poorest water quality was found upstream in the watershed at the Calhoun Cut and Cook Lane sampling sites. In most cases, the highest levels of DOC, THMFP, *E. coli*, and UVA were observed at both the Calhoun Cut and Cook Lane sampling sites, with the lowest levels observed at the Lindsey Slough site. It appears that water quality in Calhoun Cut is similar to that of

BSPP water quality during the dry season. During this time, upper Barker Slough water is often impounded by the dam on Campbell Ranch and does not influence lower Barker Slough and consequently BSPP water quality. During the wet season, water quality at the pumping plant is similar to that of both Cook Lane and Calhoun Cut.

INTRODUCTION

The *California State Water Project Sanitary Survey Update Report, 1996* identified several water quality concerns in the Barker Slough watershed that affected NBA as a source of drinking water. These concerns included high concentrations of organic carbon, THMFP, metals, and coliform bacteria. In response to these concerns, a study of the water quality of surface waters entering NBA from Barker Slough, Calhoun Cut, and Lindsey Slough was initiated.

The study is being conducted in two phases. The first phase began on July 1, 1996 and ended on June 30, 1997. The NBA TAC was formed to develop a workplan to monitor water quality in the watershed. The NBA TAC is comprised of representatives of the contractors using NBA water and Department of Water Resources' MWQI Unit and Division of Operations and Maintenance staff. The workplan for Phase I monitoring is presented in Appendix A. Phase I was designed to quantify the severity of potential water quality problems. Phase II, which began in September 1997, expands monitoring to include upper Barker Slough watershed sites to further delineate local watershed contributions of contaminants. The workplan for Phase II is presented in Appendix F.

OBJECTIVES

The original objectives of the Phase I study were to determine the magnitude of water quality problems in the watershed, isolate sources of problem water quality constituents within the watershed, and suggest management practices to improve water quality within the watershed. Isolating sources of water quality problems and suggesting management practices to improve water quality were not included in the Phase I water quality program. Instead, these will be addressed in the Barker Slough Watershed Management Program being developed through the Solano County Water Agency. Phase II work will focus primarily on increasing monitoring sites to include upper Barker Slough watershed sites. The additional sites will further delineate watershed contributions to the total load of contaminants found at BSPP.

To meet the workplan objectives, the analysis and interpretation of the Phase I monitoring data focused on the following questions:

1. What is the seasonal water quality variability of water sources flowing into Barker Slough?

2. What are the likely causes of these changes, and do they relate to upstream or nearby land uses or seawater intrusion?

3. How does the water quality of Calhoun Cut, Barker Slough, and Lindsey Slough affect the water quality at BSPP?

4. Are there serious concerns about the water quality at BSPP with respect to treating water to meet new drinking water standards?

STUDY AREA DESCRIPTION

The Barker Slough watershed (Figure B-1) is located in the larger Sacramento River watershed. The lower reaches of Barker Slough are within the northwest section of the Sacramento - San Joaquin Delta. The area of the watershed is about 14.60 square miles (9,340 acres). This area is one-half of what was reported in the *California State Water Project Watershed Sanitary Survey Update Report, 1996*. The revised estimate is considered more accurate because of extensive field surveys that were conducted as part of the current study.

Water is pumped into NBA at BSPP located on Barker Slough. Water from Barker Slough, Lindsey Slough, and Calhoun Cut are drawn in different proportions depending upon local hydrology and seasonal runoff. Water is pumped from Barker Slough via a 72-inch-diameter pressurized pipeline and supporting structures to many north San Francisco Bay area users. BSPP has a design flow capacity of 174 cubic feet per second and has experienced a maximum flow of 142 cfs. NBA users include the cities of Fairfield, Vacaville, Suisun, Napa, Vallejo, Benicia, and Travis Air Force Base.

Land Use

Three general types of land use were observed in the Barker Slough watershed in surveys conducted during the fall of 1997 (Figure B-2). The land uses were (1) cattle and sheep grazing, (2) crop production, and (3) recreation and preserve lands. Cattle and sheep graze an estimated 6,480 acres of the watershed, which includes the lower 70 percent of the watershed. The numbers of cattle and sheep have not been determined. Livestock have access to the waterways upstream of BSPP. In the past, livestock had free access to the areas immediately surrounding BSPP. A chain-link fence was installed by DWR during the summer of 1994. The fence encloses BSPP and has kept livestock away from the immediate vicinity of the Barker Slough intake. Beyond the pumping plant, DWR cannot control land use in the watershed or access of livestock to Barker Slough and other sloughs.

Nearly 21.5 percent of the watershed is comprised of fields of alfalfa, corn, Sudan grass, safflower, and sugar beets. These crops are found in both dry and irrigated fields in the northwest portion of the watershed. Recreation and preserve lands can be found on the Campbell Ranch property and the Jepson Prairie Preserve; they represent 8.5 percent of the watershed.

Geology

The watershed of Barker Slough is in the Great Valley Province and is fairly uniform in surface geology. In general, the watershed is partially filled with clay, silt, sand, and gravel deposited through millions of years of flooding. Approximately

80 percent of the watershed is comprised of alluvium, lake, playa, and terrace deposits, which are both consolidated and semiconsolidated (Jennings 1977). The western portion of the watershed contains both marine and nonmarine deposits in the Markley and Tehama formations (Jennings 1977). Although groundwater is found in all of the younger sediments, only the more permeable sand and gravel aquifers provide enough water to make the installation of wells feasible. Throughout the greater valley and the Barker Slough watershed, these younger sediments overlie older marine sediments containing brackish or saline water.

Soils

Nearly 70 percent of the watershed is of the San Ysidoro-Antioch association, which is described as level to moderately sloping, moderately well-drained sandy loam and loams on terraces (USDA 1977). In the Campbell Ranch area of the watershed (approximately 1.5 miles west of BSPP), the Solano-Pescadero soil association occurs, and is nearly level with somewhat poorly drained loam to clay. These soils are found both on the terraces and in the basins of the watershed. In the extreme northwest region of the watershed, the Caypay-Clear Lake soil association is found. This association is characterized by nearly level to gently sloping, moderately well-drained to poorly drained, silty clay loams to clays, which are found both on the rims and within the basins.

Vegetation

Where agricultural land uses are absent, the native vegetation has been classified as Valley Grassland, which includes dense to somewhat open bunch grass communities with forbs. Native perennial grasslands and vernal pools are examples of natural habitats native to the Central Valley of California found in the Jepson Prairie Preserve in Solano County. This preserve can be found in the southeastern portion of the watershed. The Jepson Prairie Preserve was formerly owned by the Nature Conservancy and is now part of the University of California reserve system.

Jepson Prairie Preserve has the highest density of vernal pools in Solano County (Barbor and Major 1977). The Department of Fish and Game has designated vernal pool communities as significant natural communities and monitors their status through the Natural Heritage Program.

Hydrology

Barker Slough is the location of the NBA intake. Ground elevation changes in the watershed are nearly indiscernible with headwater elevations at 164 feet in the northwest hills to 5 feet at BSPP. This represents a slope of 0.33 percent.

The headwaters of Barker Slough exist on a small ridge 1.5 miles west of the Cypress Lakes Golf Course at the intersection of Foxboro Parkway and Nut Tree Road in Vacaville (Figure B-1). The open fields at the headwaters are being replaced by residential housing south of the West Gate development. The ridge is part of the Markley geologic formation and extends in a northwest to southeast direction that serves as the western boundary of the watershed. The main branch of Barker Slough is not a perennial stream, and the original slough bed has been channelized in the form of irrigation ditches. This channelized portion of Barker Slough is known as the Noonan Drain. The Noonan Drain runs from 1 mile west of Meridian Road and follows the old stream bed of Barker Slough to one-half mile west of Dally Road. The Noonan Drain is maintained by the Solano Irrigation District and has been in place since 1961.

The alteration of Barker Slough is evident by comparing aerial photographs taken by DWR in the fall of 1995 and data found on USGS 7.5 quadrangles (Elmira and Dozier 1953 datum). The 1995 aerial photos show irrigation ditches and channels adjacent to remnant Barker Slough. The 1953 quadrangles show remnant Barker Slough without channels. In wetter years, the older beds of Barker Slough still fill with precipitation runoff. The older beds are visible in late spring. They become green vegetation meanders or swales across surrounding dry pastures.

Observations recorded on October 24, 1996 at the intersection of Hay Road and the Noonan Drain showed no water present other than small (5' x 6"deep) pools of stagnant water. However, by October 29, flow with a depth of 18" to 20" (cross-section 110") was present at this location due to runoff from fall storms. On April 28, 1997, flows were nearly the same as observed on October 29, 1996. These flows were almost entirely of irrigation water (from the Putah South Canal), since recorded precipitation was 0.8" in the watershed for the period February 1, 1997 through May 1, 1997. This indicates that the Noonan Drain above Campbell Ranch has intermittent flows usually in the fall and is dry in the fall when precipitation runoff and irrigation return flows are not present. As water moves further downstream of Hay Road, it is impounded by a series of flumes in the Noonan Drain and moves south at the foot of Dally Road. Approximately one-half mile west of Dally Road the Noonan drain ends and water enters an unnamed drain. One mile south of Dally Road, the unnamed drain water meets the old slough bed of Barker Slough and makes its final turn east to Campbell Ranch. From this point, water moves to Campbell Ranch through several "eroded meanders." A dam impounds all flows on Campbell Ranch, creating a small lake on the ranch property. This dam has been in place since 1966. Releases from the dam occur only when there is a need for the dam drain. On December 16, 1996, releases from the dam were observed.

As Barker Slough water flows into the drain of Campbell Ranch Dam, it is impounded again at the Cook Lane bridge by a beaver dam. Flow is greatly restricted by the beaver dam and could only be observed during storm events. Historically, DWR has calculated flows as high as 700 cfs just above the beaver dam at the Cook Lane bridge. These flows were calculated in January 1952. One mile downstream of the Cook Lane bridge, there are two irrigation pipes (60" diameter) that divert flows from Barker Slough. After this point, flows move unobstructed to the pumping plant.

WATER QUALITY OBSERVATIONS

Water samples were collected each week from July 1996 through June 1997 at four locations (Figure B-1). The sites were (1) BSPP, (2) Barker Slough at Cook Lane, (3) Calhoun Cut at Highway 113, and (4) Lindsey Slough at the Hastings Island bridge. The water samples were collected for field measurements and laboratory analyses. The measured parameters were:

Water Quality Group	**Constituents**
Field Measurements	temperature, dissolved oxygen, pH, specific conductance, turbidity
Disinfection Byproducts Formation Potential and Precursors and Related Parameters	bromide, organic carbon, TTHMFP, UVA-254 nm, alkalinity
Metals	aluminum, iron, manganese (Dissolved: July 1996 - 1997 and Total: April - July 1997)
Microbiological	*E. coli*
Agricultural Chemicals	selected pesticides

Sampling results are displayed as tables and figures in Appendix B. A complete listing of all analytical results, including reporting limits for this study, can be found in Appendix C. The California Department of Health Services Drinking Water Standards Maximum Contaminant Levels can be found in Appendix D. BSPP data are summarized as daily averages in Appendix E. Tide elevation and pumping data can be found in Appendix G.

The water quality observations of July 1996 through June 1997 correlated well with expected seasonal changes. The most significant changes occurred at the onset of heavy rainfall events in mid-December, followed by a “pineapple express” tropical storm on New Year’s eve, and another storm wave in late January. Cumulative rainfall amounts that were measured at nearby Travis Air Force Base are included in the Appendix B figures of weekly water quality data. The watershed received 26.77 inches of rain during the study period, with 16.4 inches occurring during the mid-December through January storms. The 26.77-inch total was 52 percent above the 50-year annual average of 17.6 inches. Mean daily river flows on the Sacramento River at Freeport illustrate the sudden increase in water runoff, upstream dam releases, and flooding that occurred as a result of these major storms (Figure B-3).

WATER QUALITY RESULTS BY PARAMETER

Organic Carbon

Waters high in natural organic carbon may contain substantial quantities of humic and fulvic acids that produce disinfection byproducts upon chlorination at water treatment plants. Federal and State drinking water standards regulate these DBPs. Sources of organic carbon in the watershed include soils, sediments, algae, riparian and crop vegetation, and animal waste. Both total organic carbon and DOC were measured and POC was computed by subtracting DOC values from TOC values at the BSPP (Table B-1). DOC (Figure B-4) is the fraction of TOC in water that passes through a 0.45 micron pore filter, and TOC is the amount of organic carbon in an unfiltered water sample.

Two important parameters related to organic carbon are UVA-254 nm (Figure B-5) and specific absorbance (Figure B-6). UVA-254 nm is an important measurement for the U.S. Environmental Protection Agency Information Collection Rule. Critical relationships exist between UV absorption and the humic fraction of DOC measurements. These relationships are based on the fact that many organic compounds don't absorb in the UV wavelength. Humic compounds do absorb in the UV wavelength and are useful in assessing the THMFP of organic carbon in water. To assess the potential to form THMs, a comparison of UVA-254 nm to DOC is made. The resultant ratio is termed the specific absorbance. Specific absorbance indicates different stages and amounts of humification. Lower specific absorbance (0.0 to 0.03 [UVA-254 nm/DOC]) could indicate fresh organic material or less humic material. Higher specific absorbance (greater than 0.06) could indicate more humic material (DWR 1994).

Bromide

Bromide in surface water is of concern to drinking water supplies because it will increase DBP formation. This increases the possibility of violating MCLs for the total THMs in finished drinking water. Brominated methanes are also generally more difficult to control and remove than chloroform using current treatment technology. There is also evidence that brominated THMs are more carcinogenic than chlorinated THMs. Bromide can also be converted to bromate by the use of ozone as a disinfectant. Bromate will be regulated in the Disinfectant/Disinfection Byproducts Rule at a level of 0.010 mg/L.

There are generally three sources of bromide (DWR 1994). Seawater is the most direct source of bromide. Seawater enters the western Sacramento-San Joaquin Delta as pure seawater, containing an average of 65 mg/L of bromide (California Urban Water Agencies 1995). A second source is from naturally occurring sources in soils and geological formations. Two geological formations exist in the watershed. One of the two, the Markley formation, may contain ancient marine sediments that may be a source of bromide. A third source is from the evaporation of irrigation water that will cause the buildup of salts. Runoff from water applied to fields during irrigation may contain elevated levels of bromides. Dissolved bromide results can be found in Figure B-7.

Total Trihalomethane Formation Potential

Water samples were analyzed for TTHMFP (Figure B-8), which is a test of the maximum capacity of a water source to form THMs upon chlorination. TTHMFP values obtained in this assay do not reflect THM concentrations actually produced in drinking water treatment facilities. Actual THM concentrations produced in drinking water treatment facilities are expected to be much lower than concentrations reported in this study. Chemical disinfection is necessary to prevent bacterial growth and taste and odor problems in a water supply distribution system. Chlorination is a reliable and economical method of disinfection widely used by water treatment plants within the NBA distribution system, along with ozonation. During the chlorination process, chlorine reacts to halogenate certain complex organic compounds and bromide ions in water to form disinfection byproduct compounds including THMs. One THM, chloroform, is a possible carcinogen in humans (Casarett and Doull 1980). THMs measured in the laboratory include four compounds: chloroform, bromodicholoromethane, dibromochloromethane, and bromoform. Data in this study (Figure B-8) reflect the sum of the four compounds measured in the laboratory for a water sample. State and federal governments regulate the total THM levels in drinking water (Appendix D). MCL for finished water for total THMs is currently 100 mg/L and will soon be reduced to 80 mg/L.

Metals

Aluminum (Figure B-9), iron (Figure B-10), and manganese (Figure B-11) are important metals to monitor in drinking water supplies. These metals have the ability to react with other compounds such as organic carbon. They can also interfere with the treatment processes as well as contribute to the finished water quality problems. Aluminum is one of the most abundant elements in the environment. It is found in soils, and acid rain increases the amount of aluminum deposited in the ecosystem. Iron, another common element in the environment, can also react with organic carbon. Iron can stain laundry and plumbing fixtures through the oxidation and precipitation of ferric hydroxide or ferric oxide into small solid iron particles. Manganese works similarly to aluminum and iron in the environment and water supply systems. Manganese at levels of 0.05 mg/L and above can cause black staining of laundry and plumbing fixtures.

Total metals were collected (Figures B-12, B-13, B-14) only during the dry season from April 7, 1997 to July 1, 1997 at all sites (Table B-2). Total metals and dissolved metals can be used to determine particulate metals in the same way total carbon and dissolved carbon are used to determine particulate carbon.

Escherichia Coli

E. coli is a bacterium found in the intestinal tracts of humans and most warm-blooded animals. Therefore, the occurrence of *E. coli* in water samples is considered a specific indicator of fecal contamination. Weekly sampling for *E. coli* was implemented on July 1, 1996 at all four sampling sites in the Barker Slough watershed. The results were obtained using the Colilert 51-Well Quanti-Tray MPN Enumeration Test Procedure for 100 mL samples for enumeration of *E. coli*.

Because of the high values for *E. coli* obtained from the initial samples, subsequent samples were tested using undiluted samples, along with dilutions of 1:10 and 1:100. Reported results were then taken from quantified values obtained from the least diluted sample test. These results are displayed in Table B-2 and Figure B-15.

Pesticides

Measured concentrations of pesticides and organic compounds that were detected at the sampling sites are reported in Table B-3. Pesticides used in various amounts in the watershed include insecticides and herbicides. Results indicate that pesticides may be observed during any season of the year. Except for methylene chloride, none of the measured pesticides or organic compounds exceeded California Department of Health Services or USEPA standards for treated drinking water (Appendix D). Methylene chloride is a common laboratory contaminant. Diuron, an herbicide, was measured at 4.42 μg/L on March 31, 1997. Diuron is currently not regulated and does not have an MCL.

Field Parameters

Field parameters were collected for each sampling event. These parameters include pH, dissolved oxygen, specific conductance, turbidity, and temperature. Field parameters provide valuable measurements for the interpretation of laboratory results.

pH is a measure of the degree of acidity or alkalinity of a solution. Specifically, pH is a measure of the hydrogen ion concentration in a solution. Values for pH are reported on a scale of 0 (acid) to 14 (base) with 7 being neutral. Results for pH can be found in Table B-2 and Figure B-16.

Dissolved oxygen is essential for the maintenance of healthy water bodies. Most aquatic plants and animals need oxygen dissolved in water for survival. Depletions of dissolved oxygen can cause major shifts in both types and diversity of aquatic organisms and can create noxious odors. Dissolved oxygen results can be found in Table B-2 and Figure B-17.

Specific conductance or electrical conductivity is a parameter which is used as screening device. EC is a measure of the ability of a solution to allow an electric current to flow through it. This is the reciprocal of resistance. It can be correlated with total dissolved solids and ionic strength of a solution and is a good general indicator of salinity of water. The unit of measure for specific conductance is microsiemens per centimeter. Results for EC can be found in Table B-2 and Figure B-18.

Turbidity measures the clarity of water. Turbidity is frequently analyzed in the laboratory, but has been performed in the field for this study. Turbidity in water blocks light rays and changes the clarity of water. It can be caused by a variety of materials such as organic and inorganic clays, metals, and organic carbon. Turbidity causes reduced filter runtimes and shields pathogenic organisms from disinfection in water treatment plants. Turbidity is measured in nephelometric turbidity units. Turbidity results can be found in Table B-2 and Figure B-19.

Temperature is related to many of the physical, biological, and chemical characteristics of water. For example, temperature affects solubility of oxygen in water and the rate of chemical reactions. Temperature is reported in degrees Celsius. Temperature results can be found in Table B-2 and Figure B-20.

Storm Event and Yolo Bypass Results

Barker Slough Storm event sampling occurred on October 29, 1996 in accordance with Phase I monitoring as specified by the Phase I Workplan for the Barker Slough Watershed (Appendix A). Most of the runoff in the Barker Slough watershed from this event was contained in the lake on Campbell Ranch. Releases from the lake into Barker Slough were not observed until December 16, 1996. However, releases may have occurred as early as December 9, 1996 according to the owner of Campbell Ranch, Inc.

Storm monitoring was also performed to determine if the Sacramento River system affects the water quality at BSPP during high flow events. Therefore, water quality samples were collected during the first storm event in areas adjacent to the study area, including the Yolo Bypass. Yolo Bypass sampling occurred on December 17, 1996 at the western portion of the Fremont Weir (input site) and on December 18, 1996 at Shag Slough at the Liberty Island bridge (output site). Results are summarized in Table B-4.

Surface water at the Fremont Weir sampling site (western portion) may be biased with Sacramento River water. The eastern portion has a greater percentage of Sutter Bypass water as well as Feather River water. Based on these two sampling events, the Yolo Bypass appears to contribute DOC (Fremont Weir, 1.8 mg/L and Shag Slough, 4.6 mg/L) as surface water moves from north to south. From the data gathered, it is difficult to conclude whether flooding of the Yolo Bypass affected water quality at BSPP. However, sharp increases in organic carbon at sites closest to the Bypass were expected but never observed during the flooding. During the same time period, the closest site to the Yolo Bypass, Lindsey Slough, never exceeded 4.0 mg/L of DOC. Further investigation would be needed to fully characterize water quality changes in the Yolo Bypass.

DATA QUALITY

USEPA methods for sample collection, preservation, and handling of water were followed. Field quality control samples consisted of duplicates and blanks. This quality assurance and quality control investigation was done on Lindsey Slough at Hastings Island bridge, Calhoun Cut at Highway 113, and Barker Slough at Cook Road for the periods of July 1, 1996 through June 30, 1997. BSPP was sampled jointly by Division of Planning and Local Assistance staff for the period of July 1, 1996 through September 30, 1997 and by the Division of Operations and Maintenance staff for the remainder of this study. For this report, O&M performed quality assurance and quality control separately.

Field Duplicates

Sample duplicates are environmental samples divided into two separate aliquots and analyzed independently to determine the repeatability of the analytical method. Duplicates evaluate the precision of both the sampling and laboratory procedures. Relative percent difference of the duplicate results must fall within established control limits. Over the full study, 46 duplicates were collected and RPDs calculated. As a general rule for field duplicates, an RPD of up to 20 percent is acceptable for inorganics and other miscellaneous water quality parameters such as alkalinity and pesticide levels. A 30 percent RPD level is acceptable for organics. Metals generally should not exceed 15 percent. Table B-5 indicates that there are a few analyses outside of the RPD limits. Some alkalinity, aluminum (dissolved and total), bromodichloromethane, dibromochloromethane, iron (dissolved and total) and UVA were outside control limits. With the exception of both dissolved aluminum and iron, 90 percent of the above analyses were within control limits, resulting in acceptable data quality. Of the 44 duplicate samples obtained, both dissolved aluminum and iron had a frequency over 50 percent out of RPD limits. A further investigation was conducted to resolve this issue. It was determined that the filtration process using Millipore filters showed low reproducibility, resulting in a suspicion that the filtration process allowed some of the particulate matter into the filtered sample.

Field Blanks

Field blanks are prepared by transferring double-distilled water into field sampling containers during the sampling event. Field blanks are used to check for any contamination that may occur in the sampling process. The filtered field blank is used to determine if any contamination occurs during the filtering process. In addition to duplicates, 92 field blanks were collected and analyzed: 46 filtered, 46 unfiltered (Tables B-6 and B-7). Of the 92 field blanks obtained, aluminum and iron consistently were measured at low levels. Calculations were performed on both filtered and unfiltered field blanks using DWR field quality control protocol (DWR 1995). In all of the detectable field blanks, laboratory results for the affected stations were well above five times the reported contamination value. Therefore, the data sets involving contaminated field blanks are of good quality.

INTERPRETATION OF TRENDS

Wet Weather Trends

The observations showed how significant heavy local runoff and drainage can affect the water quality at BSPP. There were significant increases in the total, particulate, and DOC concentrations during the two-month wet period. TOC were two to four times higher at BSPP than during the dry months. A comparison of TOC and DOC concentrations showed that up to one-third of the TOC was POC during the storms (Table B-1). The increase in POC is indicative of more particulate matter carried into the sloughs from heavy runoff and drainage. Associated with the higher POC were increases in TOC and DOC, turbidity, soil humus (as indicated by higher UVA-254 nm values and specific absorbance), TTHMFP, bacteria, and metals.

THMFP is directly related to the concentrations of organic carbon and bromide in the water. As more organic matter enters a water supply, THMFP increases. The sources of decaying natural organic matter in the watershed include soil humus and decomposing algae, plant, and animal waste. Heavy growths of emergent tule plants and filamentous algae along the banks of Barker Slough and Calhoun Cut were observed during stream bank and land use surveys. There is also evidence of sheep and cattle grazing and their use of the sloughs as shown by hoof prints, bank slumping, carcasses, dung along the banks, and cattle and sheep observed in the water.

Humic substances are known to form THMs and are characteristically high in aromatic compounds that strongly absorb UV light at 254 nm. There is a direct correlation between organic carbon concentrations and UVA-254 nm measurements. One method to assess the amount of aromatic humic material in a water sample is to compute its specific absorbance. Typical values in the Sacramento-San Joaquin Delta range from 0.02 to 0.20 (DWR 1994). The higher values, generally above 0.030, have been observed in agricultural drain water from peat soil fields in the Delta, which are high in humus. Terrestrial-origin humics are more aromatic and will therefore absorb more UV light than those of an aquatic origin. This is because organic matter of terrestrial origin has a higher lignin content.

Goehl and others (1995) measured the specific absorbances of natural organic matter from different sources. They found the specific absorbances of a commercial soil humic acid to be 0.090; Dismal Swamp (North Carolina) water to be 0.031 (March) and 0.048 (October); Florida groundwater, 0.040; and a cyanobacteria culture of *Anabaena* sp. exudate, 0.020. A comparison of Goehl's data to those in this study indicates that the predominant origin of organic carbon in the sloughs was from land during the storms and from aquatic humus during the dry season. The wet-period specific absorbances ranged from about 0.04 to 0.10 at the Calhoun Cut, Cook Lane, and Lindsey Slough sites. These high values indicate that most of the organic carbon was land derived. During the dry months, the specific absorbances were about 0.02 to 0.04, which indicate that the DOC was less humic (i.e., less aromatic) and a mixture of aquatic and soil humus.

Fecal bacteria (*E. coli*) counts were ten times higher during the storm period than in the dry period. This indicates that there is a large storage of fecal bacteria in the watershed. The sources are most likely from sheep and cattle grazing along the banks and wildlife (e.g., beavers and waterfowl) residing in the sloughs. Significant contamination depends on sufficient rainfall and flow across the land surface to transport bacteria into the sloughs. More extensive studies on fecal bacteria in pastures and watersheds have documented contamination from grazed lands (Pasquarell and Boyer 1995; Howell and others 1995; Edwards and others 1997)

The higher coliform counts correlated with the organic carbon and turbidity increases during the storms. Particulate matter in soil provides favorable conditions for bacterial colonization and survival. Particulate matter, especially clays, shelter fecal coliform from sunlight and provide nutrients, moisture, and other favorable conditions that can promote regrowth in aquatic environments (Howell and others 1996). The increased load of suspended material draining into the sloughs was also shown by sharp rises in turbidity (Figure B-19).

Other expected water quality changes in the sloughs during major winter storms include lower readings of water temperature, EC, alkalinity, pH, and higher dissolved oxygen content. These conditions reflect the combined water qualities of colder rainwater, surface runoff, and groundwater flowing into the tributaries. Rainwater is slightly acidic (pH 5.67 at 25 °C.) and is virtually mineral free (i.e., no dissolved solids). Its purity results in the low alkalinity or lack of carbonates to buffer acidity (Tchobanoglous and Schroeder 1987). As rainwater percolates into the ground, carbon dioxide in the soils (in the form of carbonic acid) and organic (humic and fulvic) acids will lower the pH of the water. The pH at Calhoun Cut and Cook Lane stations decreased from 7.5 to 6 and less during the December - January storms. Lowering pH by one unit is equal to raising the acidity by ten times. Alkalinity fell from dry season ranges of 61 - 270 mg/L to a wet season range of 26 - 234 mg/L at all sites. The chemical composition of rainwater and its reactions with soil as it flowed over and through the soil column resulted in lower alkalinity and pH at the four monitored sites (Figure B-21).

There were also increases in aluminum, iron, and manganese concentrations during the storms. These metals are common in the matrices of many weathered mineral particles (e.g., clays) and are essential for plant growth. The increases in dissolved metal concentrations followed the increasing DOC concentrations and the lower pH. Minerals more readily dissolve under low pH conditions. This would then release trace metals such as iron, manganese, and aluminum (Hem 1970). Differences in pH may have controlled the concentration and frequency of detecting dissolved metals during the storms. BSPP water samples were neutral when pH fell at the other sites in January.

These correlations of DOC with the dissolved metal concentrations show that the metals are associated with particles of less than 0.45 micron in size (e.g., colloidal organic matter, plant exudates). This size fraction is used as the operational definition to classify particulate from dissolved fractions (passes through 0.45-micron filter) of organic carbon and metals.

Some of the metal increases may also be linked to animal and plant detritus transported from land. Iron and manganese are essential minerals for plant growth. Aluminum, one of the most common elements on the earth's crust, often occurs in quantity in plants but may be dispensable. Metal cations and dissolved organic compounds are commonly transported together as metal-organic complexes in surface water and groundwater (Shock 1995). Humic substances and other natural organics chemically interact with trace metals and affect the availability of these metals to microorganisms including algae and bacteria. Sunda (1995) found that these interactions enhance the biological supply of the insoluble nutrient metal iron. Humics increase the solubility and retention of iron in water through chelation of ferric (iron III) and peptization (the stabilization of colloidal iron oxide and hydroxide suspensions). Thermal and photoreductive reactions between ferric and humic compounds reduce ferric to soluble and less highly complex ferrous (iron II), thereby enhancing the bioavailability of iron. Similar thermal and photoreactive reactions occur with manganese oxides.

Horowitz (1985) studied the physical and chemical factors that affect sediment-trace metal concentrations. The bulk distribution of trace metals is related to the grain size of the suspended sediment particles. Manganese, iron, chromium, nickel, copper, and cobalt have their highest concentrations in the less-than-2 micrometer fraction. High concentrations are more commonly associated with fine-grained material. Variations in aluminum and iron content with grain size from the same bottom sediment sample were nearly identical, with manganese being about one to two orders of magnitude lower in concentration. This agrees with the observed dissolved aluminum and iron results in the Barker Slough watershed that were about ten times higher in concentration than manganese.

The lower EC values are attributed to dilution by the high volume of rainwater entering the sloughs. High dissolved oxygen concentrations in the winter are the result of aeration by turbulent mixing and a higher capacity to hold atmospheric oxygen at low water temperatures.

During the extreme December - January storms, water quality at BSPP was more similar in quality (e.g., DOC, *E. coli*, TTHMFP, specific absorbance) to the upstream Barker Slough at Cook Lane station than to the downstream Lindsey Slough station. The large flows in Barker Slough may have also affected the water quality (e.g., turbidity, *E. coli*) observed at the Lindsey Slough site. Minor differences in water quality between BSPP and Lindsey Slough may be an artifact of sampling and dilution. Samples were collected 1 foot below the surface at all sites. Water quality data might have been more similar if water samples were collected at mid-depth or near the bottom at Lindsey as colder, denser water from the shallower Barker Slough flowed along the bottom toward Lindsey Slough. Some particulate matter or dissolved matter may have settled out along the slough from naturally occurring coagulation and flocculation. This might also explain why DOC and coliform values were slightly higher upstream of Lindsey Slough.

Because of the large December - January outflows, seawater intrusion or tidal action had no effects on water quality at Lindsey Slough or the BSPP intake. This conclusion was based on EC, bromide, and alkalinity data.

The study showed that water treatment from source water should be adjusted to remove more TOC that is characteristically higher in THMFP in lower alkalinity water during the winter. Under the proposed Stage 1 D/DBP Rule, as much as 50 percent removal requirement must be met for waters of 8 mg/L or more TOC and less than 60 mg/L alkalinity through enhanced coagulation.

In addition to treating a high TOC water supply, there are concerns about high fecal bacteria concentrations. The data show that upstream land use (e.g., grazing and farming) can have impacts on downstream water quality during the wet months. A combination of overland flow, shallow subsurface flow, and subterranean flow is needed to carry material such as organic matter and fecal bacteria from the land into the sloughs. Upstream land use affects the water quality of the sloughs less when rainfall in the watershed is low and infrequent.

Dry Weather Trends

The water quality changes during the summer and fall were expected to be influenced by agricultural drains, algal blooms and dieoffs, low stream flows, possible seawater intrusion and tides, and warmer weather.

Specific absorbance values lower than those seen during the winter storms suggest aquatic humus as the source of organic carbon during the summer and fall. The extensive growth of riparian plants and filamentous algae in the sloughs may be a dominant supplier of organic carbon when surface runoff is low.

Conditions of warm temperatures, low water circulation, and a nutrient supply are favorable to plant and bacterial growth. Nutrients from animal wastes and fertilizers enter the sloughs during irrigation and drainage. High nutrient loads may perpetuate plant and algal growth in the sloughs and encourage biofilm growth in NBA and the water distribution system. Additional data, such as nutrient concentrations and phytoplankton measurements (e.g., chlorophyll *a*, species enumeration) and specific absorbance characterization of various living and decaying plant material (e.g., algae, tule plants), are needed to confirm this hypothesis.

Indirect indicators of algal blooms or rapid plant growth in the sloughs include high dissolved oxygen saturation during the day from photosynthesis and dissolved oxygen depressions from respiration during the night and overcast periods. Minor shifts in pH will correspond to the photosynthetic activities. There may be a slight drop in water pH due to carbonic acid production from microbial respiration. The amount of pH change will depend upon the alkalinity or buffering capacity of the water. POC and DOC increases might also suggest algal blooms and algal exudates, respectively. Turbidity increases might also correlate with algal blooms. Some of the above changes in water quality were observed but are insufficient by themselves to determine if the riparian plants or algae are the dominant causes.

During the dry period, *E. coli* levels were in the same range (MPN averaging in the low hundreds) at the Calhoun Cut, Cook Lane, and BSPP stations. Lindsey Slough coliform counts were mostly under 20 MPN. The consistently higher coliform levels and fluctuations at Calhoun Cut and in Barker Slough suggest there are continuous inputs and regrowth of coliform bacteria in the area.

The TTHMFP, DOC, and alkalinity in summer and fall were half of the winter storm values. Under the Stage 1 D/DBP Rule, NBA water users need to meet a 35 percent TOC removal rate when TOC is between 4 and 8 mg/L and alkalinity between 60 and 120 mg/L. Water treatment also needs to be adjusted for warmer water temperatures that are favorable to THM formation during disinfection.

The spring 1997 data showed gradual decreases in DOC, specific absorbance, turbidity, and TTHMFP after the December and January storms. Although the major storms had ended, significant runoff (groundwater seepage) continued into spring.

EC readings and bromide data did not indicate seawater migration effects on the water quality at the sites. EC was lowest at the Lindsey Slough station, which would have experienced higher salinity or bromide concentrations than the other three sites if seawater ions were present. EC readings at BSPP were closer to Calhoun Cut's EC values in the summer and fall of 1996 (Note: There was no discharge of water from Campbell Ranch Lake into Barker Slough at Cook Lane until December 9, 1996).

A month after the last major storm in January, sharp increases in EC, bromide, alkalinity, and dissolved manganese were observed at the downstream Cook Lane site.

This is attributed to groundwater in contact with upstream marine deposits (Markley formation) that was still draining into the upper reaches of Barker Slough from the previous storms.

It appears that water from Calhoun Cut and releases from the Campbell Ranch lake into Barker Slough determine some of the water quality characteristics at the BSPP intake. Some effects may be direct, such as changes in EC, while others may be more subtle and indirect, such as contributing nutrients that enhance organic carbon production. During this first year of study, BSPP water quality was predominantly more affected by upstream water quality and land uses than by Lindsey Slough water. Overall, Lindsey Slough water is relatively better in quality as shown by lower EC, *E. coli*, DOC, UVA-254 nm, specific absorbance, and TTHMFP.

Water Quality at BSPP Compared to the Sacramento River at Greenes Landing

How does BSPP water compare to sites on the Sacramento River? The cities of Sacramento and West Sacramento appropriate water from the Sacramento River for domestic and industrial uses. The DOC concentrations, *E. coli.* counts, and turbidity levels at the Sacramento River Greenes Landing station were compared to the BSPP values. Greenes Landing is located about 10 miles downstream of the city of Sacramento's water intake. The water quality at the Greenes Landing station was consistently and significantly better than at BSPP.

DOC concentrations at Greenes Landing (Figure B-22) generally were less than 2 mg/L in the dry months and between 2 and 4 mg/L in the wet months. DOC never exceeded 4 mg/L even during the severe January storms and floods of 1997. The consistently low DOC concentrations (less than 2 mg/L) enable the cities of Sacramento and West Sacramento to avoid additional expensive TOC removal requirements in the dry season. During the wet season, the cities might need to meet the TOC removal requirement of 40 or 30 percent for alkalinities up to 60 mg/L, and at greater than 60 and below 120 mg/L, respectively.

Because the BSPP water supply is much higher in organic carbon than the city of Sacramento's water supply, NBA water utilities must meet higher TOC removal requirements year-round. TOC removal requirements can be as high as 50 percent when Barker Slough DOC or TOC exceeds 8 mg/L during the winter and either 35 or 45 percent depending on alkalinities during the dry season.

Coliform bacteria counts in the Sacramento River were at least ten times less and as much as one hundred times less than at BSPP. Lower bacteria levels reduce the risk of failing to meet federal and State disinfection requirements to protect human health.

Turbidity levels were also consistently lower in the Sacramento River than at BSPP. Water treatment plants that have high turbidity levels in raw water supplies must use more coagulants and flocculants to reduce and settle out the suspended particles which cause high turbidity.

CONCLUSIONS

Determining seasonal variability in water quality of water sources flowing into Barker Slough was the first objective of the study. To answer this question, weekly and storm event sampling was conducted. The sampling results show distinct seasonal (wet and dry) differences in the water quality at all of the sampling sites. Most of the concentrations increased during the wet period and decreased during the dry period of the study. Important seasonal differences were noticed in organic carbon, *E. coli,* metals, alkalinity, and field parameters. Historical data (DWR 1997) helped validate how storms can affect water quality at BSPP. Comparisons of the historical data to Phase I results show that rainfall from storms equaling 1 inch in a 24-hour period can increase most concentrations of water quality parameters throughout the study area. Precipitation must total about 3 inches and releases must be made from Campbell Ranch into Barker Slough before impacts above mean parameter levels are noticed at all sites as well as at the pumping plant. During the dry season, water quality is relatively better; however, organic carbon concentrations remain high.

Phase I results show that land uses above Campbell Ranch (e.g. grazing, farming, recreation, and suburban development) influence the water quality at the Cook Lane site and BSPP primarily during the wet season. During the wet season runoff, management of water and the amount and duration of precipitation are all causes of seasonal changes in water quality at the pumping plant. Specific absorbance calculations are used to confirm this. These values ranged from about 0.04 to 0.10 at the Cook Lane, Calhoun Cut, and Lindsey Slough sites. These high values indicate that most of the organic carbon is land derived during the wet season. Phase II (Appendix F) will investigate the relative effects of land use on water quality by sampling downstream of different land uses. Phase II will also continue to elucidate the wet season impacts on water quality.

During the dry season, impacts to water quality may be caused by extensive riparian plant and filamentous algae growth. These macrophytes and microphytes may be dominant suppliers of organic carbon at the pumping plant during the dry season. Specific absorbance calculations were used to determine dry season sources of organic carbon. These values during the dry months were about 0.02 to 0.04, which indicate that DOC was less humic (i.e., less aromatic) and a mixture of aquatic and soil humus. Additional data, such as nutrient concentrations and phytoplankton measurements (e.g., chlorophyll *a*, species enumeration) and specific absorbance characterization of various living and decaying plant material (e.g., algae, tule plants), are needed to confirm this hypothesis. To further answer this question, nutrient measurements will be made in Phase II of the study as well as in the separate algal study.

EC readings and bromide data do not indicate seawater migration effects on water quality at the sampling sites. EC was lowest at the Lindsey Slough site, which would have experienced higher salinity or have higher bromide concentrations than the other three sites if seawater ions had been present. Therefore, seawater intrusion has been ruled out as an impact to water quality throughout the study area.

The relationship of the hydrologies of Barker Slough, Calhoun Cut, Lindsey Slough, and the influence of pumping at the Barker Slough Pumping Plant is not known. It can be concluded only that water and land uses in the Barker Slough watershed have the most impacts on BSPP during both wet and dry seasons. However, the data show that during the dry season, when water is held back at Campbell Ranch and precipitation is nearly absent, water quality at Calhoun Cut is nearly identical to that of BSPP. This could be coincidental, since both systems are identical in their riparian vegetation and dry season flow regimes. Without detailed hydrologic data showing that water found at the Calhoun Cut and Lindsey Slough sites can be drawn into BSPP, we cannot conclude that both water bodies have the ability to impact water quality at the pumping plant.

There are serious concerns about the water quality at BSPP with respect to treating water to meeting current and new drinking water standards. During the wet season, sudden high turbidity changes and TOC fluctuations present challenges to NBA water treatment plants. These fluctuations in the influent water require immediate response by water treatment plant operators to stay within federal and State drinking water quality standards. Under the enhanced coagulation requirement for TOC removal for low alkalinity waters in the Stage 1 D/DBP Rule, TOC removal rates are the highest, ranging from 40 to 50 percent. BSPP influent has high TOC concentrations under low to mid levels of total alkalinity conditions.

There are increased costs in treatment due to the increased chemical demands of alum, caustic soda, and disinfectants, more frequent backwashing of filters, and additional work to control the formation of THMs in the finished water. During storm events, intermittent increases in turbidity and TOC in the plant influent water at the Travis AFB Water Treatment Plant have caused plant shutdowns and nondelivery of water. These increased costs have resulted in overexpenditures from the planned operating budgets to operate and maintain the water treatment facilities treating NBA water.

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Appendix A

Phase I Workplan for the Barker Slough Watershed

PHASE I WORKPLAN FOR THE BARKER SLOUGH WATERSHED
Municipal Water Quality Investigations Program
Version: September 25, 1996

Introduction

The *California State Water Project Sanitary Survey Update Report, 1996* identified NBA as having several water quality issues which concern SWC using NBA as a source of drinking water. Several water quality issues have been identified which require additional work to characterize the nature and extent of the problem and means of addressing them. These water quality issues include elevated levels of organic carbon, THMFP, metals, and coliforms in the Barker Slough watershed. This workplan was developed to investigate these problems, identify their sources, and identify practices to improve water quality in the watershed.

This workplan has been revised to incorporate elements of a proposal by NBA contractors. The concepts of dividing the workplan into two phases and specifying two elements of monitoring as suggested by the NBA contractors have been adopted. Efforts were made to sample at the frequency suggested by the NBA contractors within the budget set by SWC.

Study Objectives

The study's objectives are to determine the magnitude of the water quality problems in the watershed, to isolate sources of problem water quality constituents within the watershed, and to suggest management practices to improve water quality within the watershed.

The following questions are to be addressed:

- What is the seasonal variability in water quality of water sources flowing into Barker Slough?
- What are or might be the causes of these changes and do they relate to upstream or nearby land uses or seawater intrusion?
- How does the water quality of Calhoun Cut, Barker Slough, and Lindsey Slough affect the water quality at BSPP?
- Are there serious concerns about the water quality at BSPP with respect to treating water to meet new drinking water standards?
- What actions could be taken to protect and improve the water quality of NBA ?

Scope of Work

This study was designed to begin July 1, 1996 and to continue until June 30, 1997. A progress report was produced six months after the study began. This progress report included an analysis of at least two months of water quality monitoring data.

The work was divided into two phases. The first phase quantified water quality constituents at the macro level, and the second phase will identify specific pollutants and consider mitigation measures for those pollutants.

The frequency of sampling was the same for dry and wet weather seasons. Wet weather sampling was conducted in conjunction with storm events and replaced one of the scheduled sampling collections during selected rain and runoff events when possible. The dry weather season is defined from April 16 through October 15. The wet weather season is defined as October 15 through April 15. At least two months of dry weather sampling was obtained.

The work was divided into general classes of pollutants. Within each class of pollutants, grab sample data (Element 1) and grab sample data (Element 2) are defined as specified below.

Element 1 near real-time water quality data was continuously monitored at BSPP and is available on the bulletin board. This information can be used by the NBA water treatment plants for operational purposes.

Element 2 comprises the database of constituents monitored for long-term water quality improvements. The Phase I sample locations initially identified are (1) upstream of BSPP (Cook Lane); (2) BSPP; (3) Calhoun Cut; and (4) Lindsey Slough, west of the juncture with Cache Slough. The data are not real-time and include coliforms, dissolved oxygen, organic carbon, EC, turbidity, pH, alkalinity, metals (Al, Fe, Mn), and pesticides and organic compounds. This information is useful for diagnosis purposes and for trending. Upon evaluation of the macro data collected at these locations, a second set of sample locations were identified. Sampling duration, prior to evaluation of the data, is two months. Additionally, tidal influence was logged during sample collection for evaluation of grab samples.

Phase I

Phase 1 identified water quality constituents by quantification and analyzed the impacts. Water quality sampling is summarized in Table A-1. Analytical and staff costs are summarized in Table A-2.

DOC, TOC, and THMFP

Monitoring data collected for the *California State Water Project Sanitary Survey Update Report, 1996* indicated that NBA had higher levels of DOC, TOC, and THMFP than were seen in other parts of SWP. These elevated levels appear to occur more frequently during the wet winter months.

I. Element 1

   a. Samples were collected by grab and analyzed for the constituents DOC, EC, and turbidity.

   b. A TOC autoanalyzer was not used.

II. Element 2

   a. Grab samples were collected from the following stations (see Table A-1 and A-2, and Figure 1 in Appendix B) and analyzed for THMFP, DOC, EC, turbidity, pH, dissolved oxygen, and temperature.

      1. Upstream of BSPP (Cook Lane)
      2. BSPP
      3. Calhoun Cut
      4. Lindsey Slough

   b. Sample Frequency

      1. See Tables A-1 and A-2.

In addition, DWR's O&M staff collected samples at BSPP monthly and analyzed those samples for THMFP and TOC.

Turbidity

Turbidity was identified in the *Sanitary Survey* as a parameter of concern in the Barker Slough watershed. Elevated turbidity is seen most often during the winter months.

I. Element 1

DWR's O&M has an automated turbidity meter at BSPP and collected samples daily.

Table A-1. Water Quality Sampling Summary

Parameter	**Sampler**	**Frequency**	**Sample Sites**
Element 1: Grab Sample Monitoring			
TOC	MWQI / O&M	weekly / weekly	UpPP, CC, LS / PP
EC	MWQI / O&M	weekly / weekly	UpPP, CC, LS / PP
Turbidity	O&M	daily	PP
Alkalinity	O&M	weekly	PP
Element 2: Grab Sample Monitoring			
THMFP	O&M	monthly	PP
TOC	MWQI / O&M	weekly / weekly	UpPP, CC, LS / PP
DOC	MWQI / O&M	weekly / weekly	UpPP, CC, LS / PP
EC	MWQI / O&M	weekly / weekly	UpPP, CC, LS / PP
Turbidity	MWQI / O&M	weekly / weekly	UpPP, CC, LS / PP
pH	MWQI / O&M	weekly / weekly	UpPP, CC, LS / PP
UVA	MWQI / O&M	weekly / weekly	UpPP, CC, LS / PP
Suspended Solids	O&M	quarterly	PP
Metals (Al/Fe/Mn)	MWQI / O&M	weekly / weekly	UpPP, CC, LS / PP
Pesticides and other Organics	MWQI / O&M	see Table 7-2	UpPP, CC, LS / PP,
Coliforms	MWQI / O&M	weekly / weekly	UpPP, CC, LS / PP

PP - BSPP
UpPP - Upstream of BSPP at Cook Lane
CC - Calhoun Cut
LS - Lindsey Slough, west of the juncture with Cache Slough

Table A-2. Cost of MWQI Analyses and Staff Time

Laboratory Analysis	Number of Stations	Frequency D/W	Samples per Month	Sampling Period	Number of Samples	Lab	Cost per Sample ($)	Total Cost ($)
Coliform-Fecal	4	weekly	12 DPLA 4 O&M	52 weeks	208	Bryte	25	5,200.00
THMFP	1	monthly	1 O&M	1 year	12	Bryte	120	1,440.00
TOC	4	weekly	12 DPLA 4 O&M	52 weeks	208	Bryte	35	7,280.00
DOC	4	weekly	12 DPLA 4 O&M	52 weeks	208	Bryte	35	7,280.00
Alkalinity	1	weekly	4 O&M	52 weeks	52	Bryte	12	624.00
UVA	4	weekly	12 DPLA 4 O&M	52 weeks	208	Bryte	12	2,496.00
Pesticides and Other Organics	6	4-Sept	3 DPLA/1 O&M*	1 year	14	BSK Bryte	1,000	14,000.00
		4-first event	3 DPLA/1 O&M					
		4-Mar						
		2 Causeway	5 DPLA/1 O&M					
		4-June	3 DPLA/1 O&M					
Metals Al, Fe, Mn	4	weekly	12 DPLA 4 O&M	52 weeks	208	Bryte	69	14,352.00
Turbidity	4	weekly	12 DPLA 4 O&M	52 weeks	208	Bryte	INC	0
pH	4	weekly	12 DPLA 4 O&M	52 weeks	208	Bryte	INC	0
EC	4	weekly	12 DPLA 4 O&M	52 weeks	208	Bryte	INC	0
Total Cost of Analyses								**$52,672.00**

Staff Time	Number of Staff	Duration	Frequency	Total Hours	Fraction of a PY	Total Cost ($)
Field Preparation	1	2 hrs/week	52 weeks	104	0.06	6,000.00
Sampling	2	8 hrs/week	52 weeks	832	0.47	47,000.00
Mapping	1	8 hrs/week	4 weeks	32	0.02	2,000.00
Data Mgmt	1	8 hrs/week	4 weeks	32	0.02	2,000.00
Report Writing	1	8 hrs/week	8 weeks	64	0.03	3,000.00
Publication	1	8 hrs/week	4 weeks	32	0.02	2,000.00
Project Management	1	4 hrs/week	52 weeks	208	0.1	10,000.00
Total Staff				**1,304**	**0.72**	**72,000.00**
Grand Total						**$124,672.00**

Note: D/W refers to dry season/wet season
INC: Include with staff time costs
* Routine monitoring under other programs

II. Element 2

a. Grab samples were taken from the following stations and analyzed for turbidity.

1. Upstream of BSPP (Cook Lane)
2. BSPP
3. Calhoun Cut
4. Lindsey Slough

b. Sample Frequency

1. See Tables A-1 and A-2.

pH and Alkalinity

I. Element 1

Samples were collected by grab at BSPP for alkalinity analysis. The samples were not analyzed for pH due to possible changes in pH while the samples were held in the autosampler before sample retrieval.

II. Element 2

a. Grab samples were taken from the following stations and analyzed for pH.

1. Upstream of BSPP (Cook Lane)
2. BSPP
3. Calhoun Cut
4. Lindsey Slough

b. Sample Frequency

1. See Tables A-1 and A-2.

Metals

In the *California State Water Project Sanitary Survey Update Report, 1996*, aluminum, iron, and manganese were found to exceed secondary maximum contaminant levels on an infrequent basis. The exceedances occurred only during the heavy runoff in the winter months. Identification of the source(s) of metals, primarily aluminum, iron, and manganese, are of long-term importance to the NBA users.

I. Element 1

Not applicable

II. Element 2

a. Grab samples were collected at the following stations and analyzed for the metals aluminum, iron, and manganese.

1. Upstream of BSPP (Cook Lane)
2. BSPP
3. Calhoun Cut
4. Lindsey Slough

b. Sample Frequency

1. See Tables A-1 and A-2.

<u>Pesticides and Organic Compounds</u>

I. Element 1

Not applicable

II. Element 2

a. Grab samples were collected at the following stations and analyzed for nitrogen and phosphorus pesticides, chlorinated pesticides, volatile organics, carbamates, and solvents.

1. Upstream of BSPP (Cook Lane)
2. BSPP
3. Calhoun Cut
4. Lindsey Slough
5. Yolo Causeway

b. Sample Frequency

1. Samples were collected during March, June, September, and December. Wet weather samples (March and December) were obtained after a 36-hour rain event or after approximately 1-inch of rainfall. Single samples were collected during the dry weather season (June and September). Tidal action was logged during both wet and dry weather sampling.

2. See Tables A-1 and A-2.

Giardia and *Cryptosporidum*

Giardia and *Cryptosporidium* sampling are Phase II activities.

Coliforms

Enumeration of coliforms is important to NBA water users.

I. Element 1

Not applicable

II. Element 2

a. Samples were collected with the use of a Colilert sampling system at the following stations.

1. Upstream of BSPP (Cook Lane)
2. BSPP
3. Calhoun Cut
4. Lindsey Slough

b. Sample Frequency

1. See Tables A-1 and A-2.

Summary of Water Quality Sampling and Cost Analysis

Table A-1 summarizes the water quality sampling that was conducted for Phase 1 of this study. Table A-2 presented the analytical and staff costs for the study.

Phase 2:

Based on the evaluation of information from Phase 1 and consultation with the NBA contractors, problem water-quality constituents' sources will be further identified and characterized. This may include a survey of land-use practices, further physical reconnaissance, watershed mapping, consultation with local agencies for additional information and monitoring data, and a review of best management practices. The following water quality constituents will be evaluated based on their effects on water quality.

DOC, TOC, THMFP, and Turbidity

Land-use practices and other contamination sources will be identified. This may include source identification sampling on the upstream segments and tributaries of Barker Slough. Livestock grazing may be estimated. Applicable best management practices will be reviewed. Special studies may be initiated to examine ways of reducing the levels of these problem water quality constituents.

Metals

Sources of metals will be evaluated and mitigation measures identified.

Pesticides and Organic Compounds

To determine problem water-quality constituent sources, organics may be analyzed to distinguish between natural and synthetic organic substances.

Giardia and *Cryptosporidium*

Sampling for *Giardia* and *Cryptosporidium* may be initiated during Phase II in the Barker Slough watershed, dependent upon consultation with the Sanitary Survey Action Committee.

Coliforms

Land use in the watershed that may contribute to high coliform will be investigated. Best management practices that would lead to reductions in coliform counts will be reviewed.

Study Coordination:

There will be coordination meetings between DWR and the NBA contractors. In addition, progress reports will be delivered to the MWQI Committee at the quarterly meetings and at meetings of the SWP Sanitary Survey Action Committee.

Reports:

A progress report from the study was prepared on December 30, 1996, and a final report from the study was prepared on November 30, 1997.

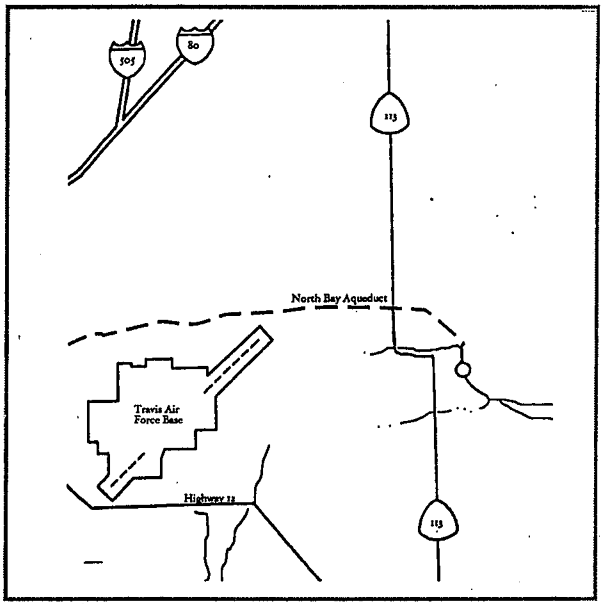
Data Availability:

Data from the study will be stored at DWR headquarters in the water quality assessment database. The data will be available to NBA contractors, Sanitary Survey Action Committee members and MWQI Committee members through the MWQI bulletin board system. Data that are put on the bulletin board system may be preliminary subject to change upon further quality review. Preliminary data should not be published but should be used for internal purposes only.

Appendix B

Figures and Tables

Figure B-1. Barker Slough Watershed



Barker Slough

LEGEND

Sampling Sites

- a *Cook Lane*
- b *Barker Slough Pumping Plant*
- c *Calhoun Cut*
- d *Lindsey Slough*

Approximate area of watershed: 14.60 sq. mi. / 9,340 acres

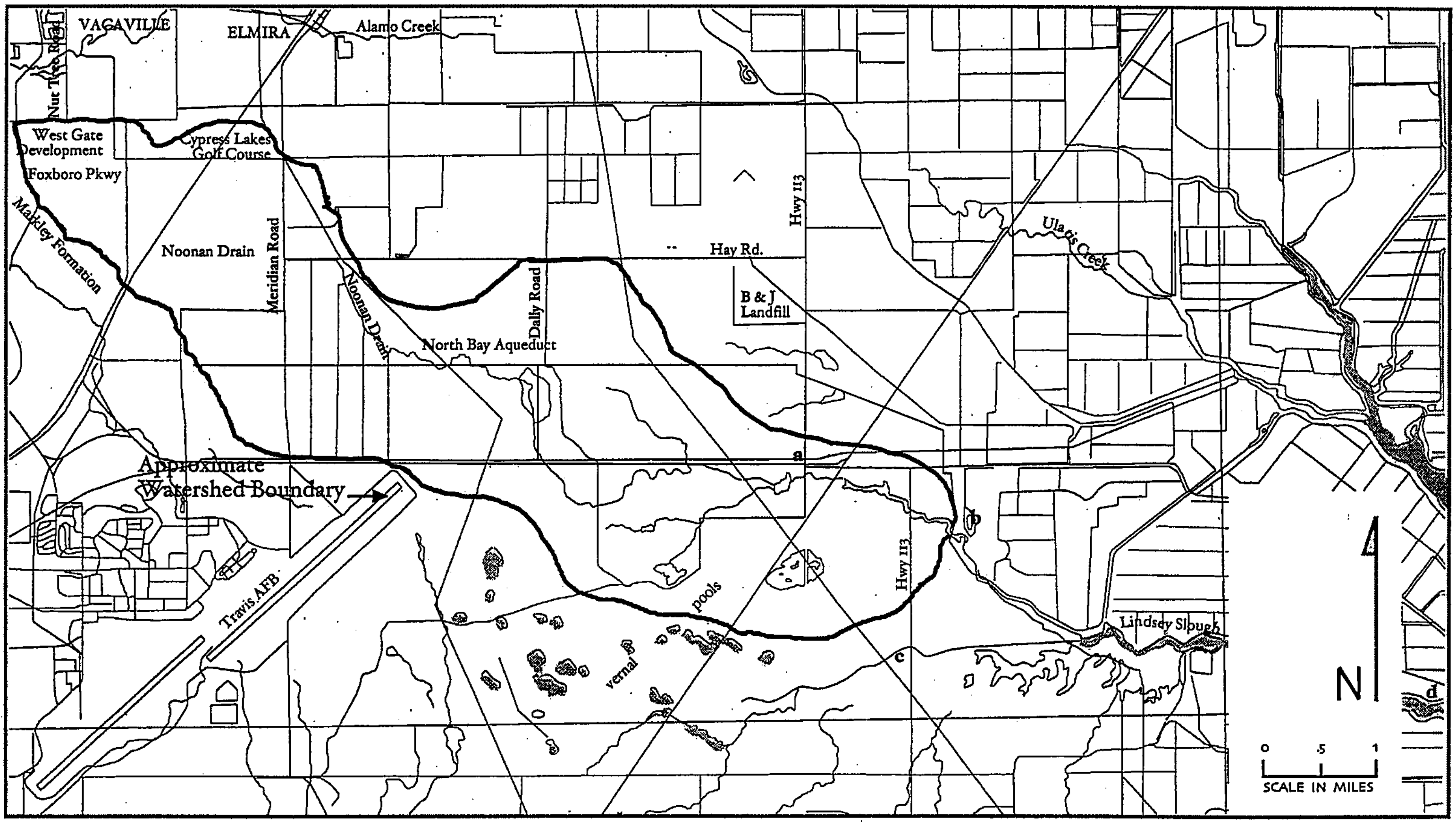
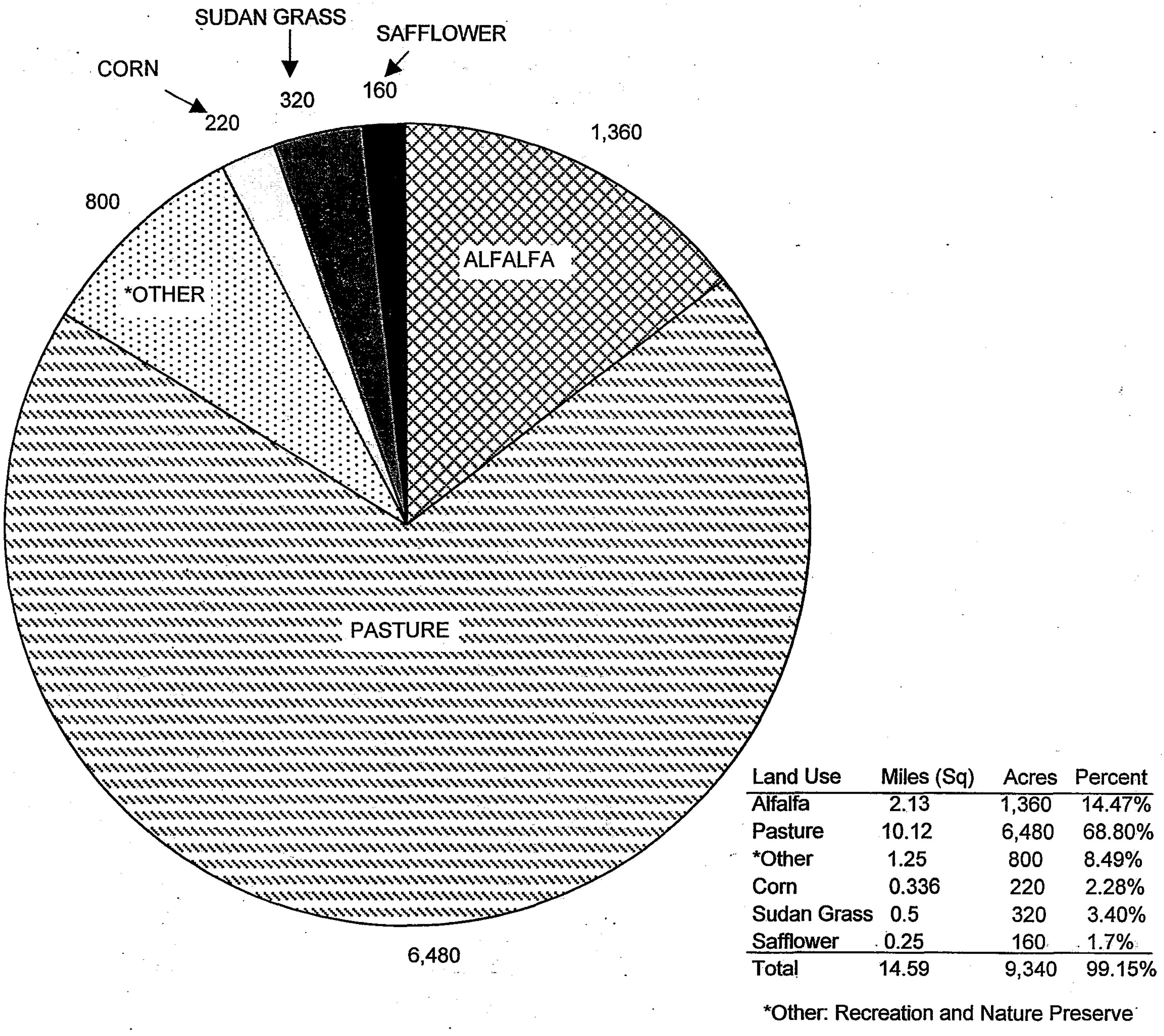


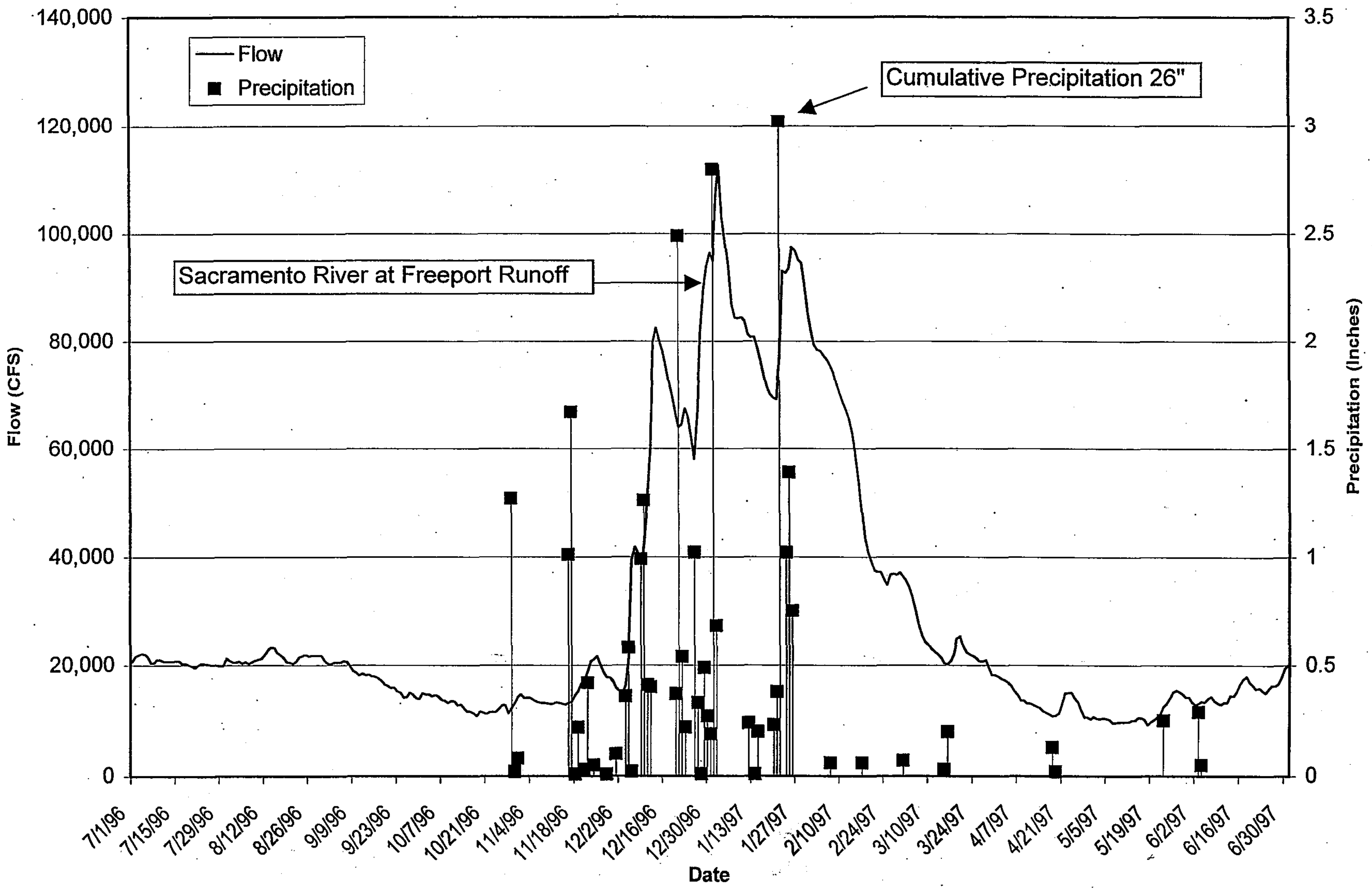
Figure B-2. Barker Slough Watershed Land Use (Summer and Fall 1997) (Acres)



Land Use	Miles (Sq)	Acres	Percent
Alfalfa	2.13	1,360	14.47%
Pasture	10.12	6,480	68.80%
*Other	1.25	800	8.49%
Corn	0.336	220	2.28%
Sudan Grass	0.5	320	3.40%
Safflower	0.25	160	1.7%
Total	14.59	9,340	99.15%

*Other: Recreation and Nature Preserve

Figure B-3. Sacramento River Runoff at Freeport and Precipitation at Travis Air Force Base (July 1, 1996 to July 1, 1997)


Cumulative Precipitation 26"

Sacramento River at Freeport Runoff

Figure B-4. Dissolved Organic Carbon Results for NBA Watershed Study
(July 1, 1996 through June 30, 1997)

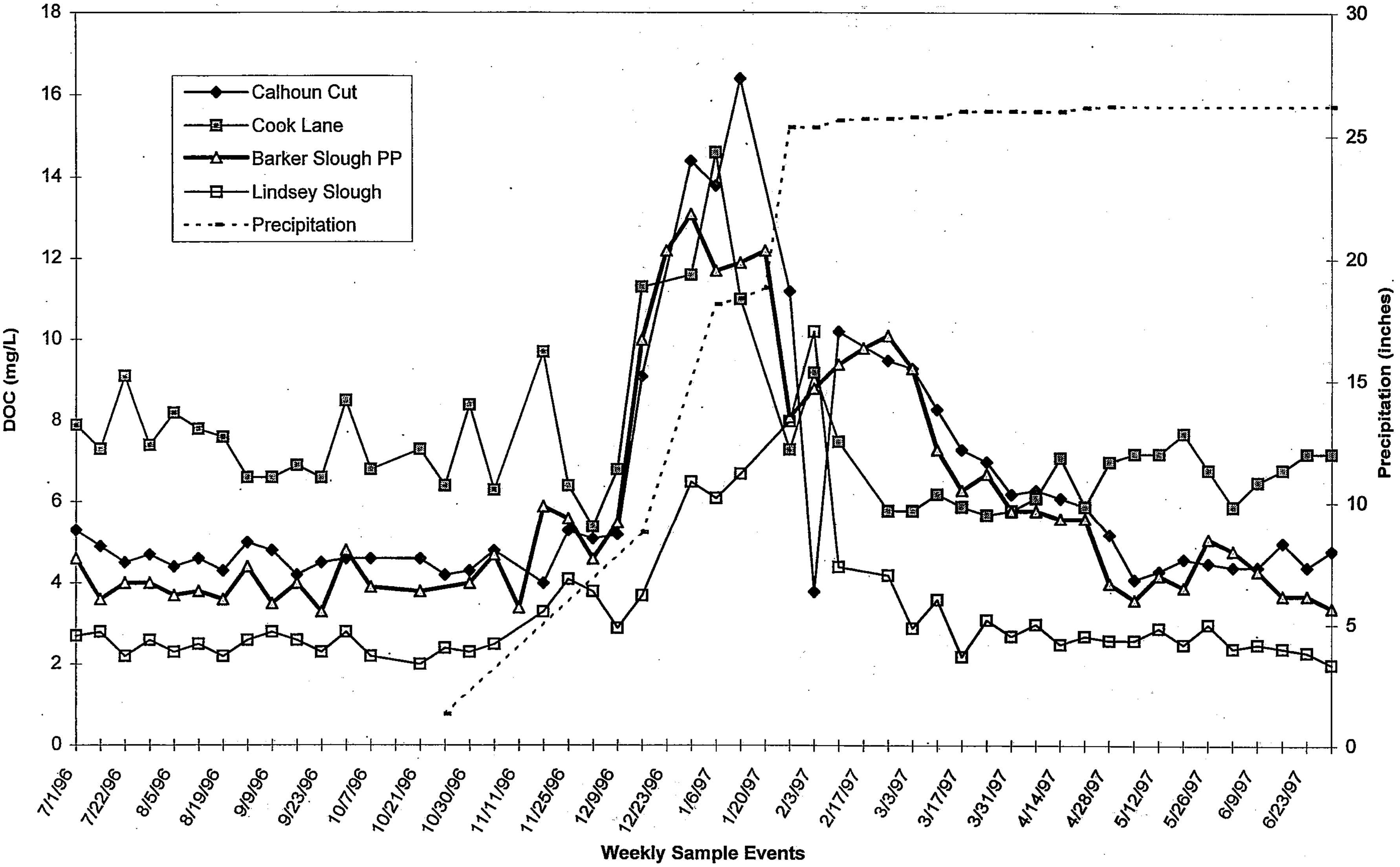


Figure B-5. Ultraviolet Absorbance Values for NBA Watershed Study (July 1, 1996 through June 30, 1997)

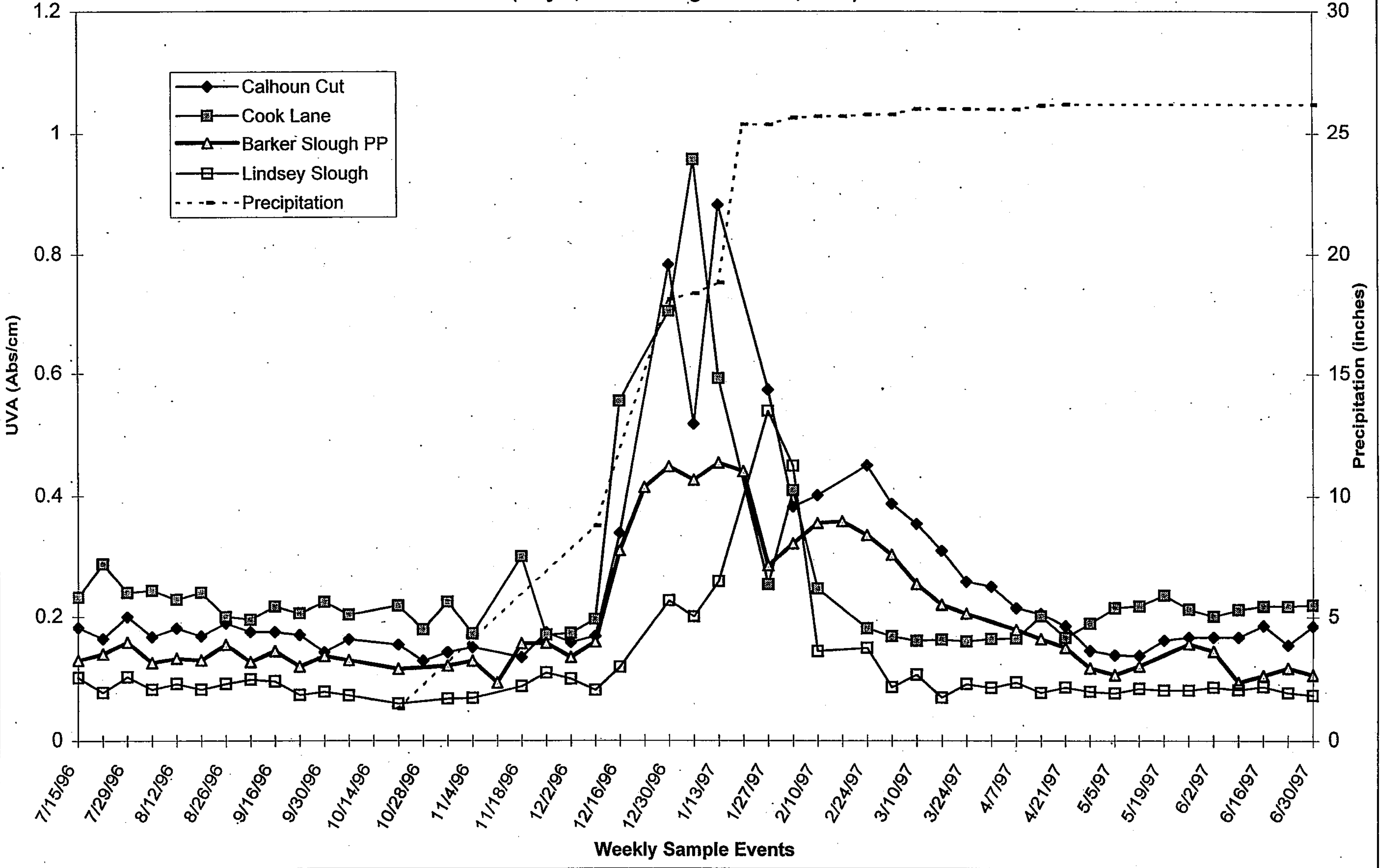


Figure B-6. Specific Absorbance for NBA Watershed Study
(July 1, 1996 through June 30, 1997)(UVA/DOC)

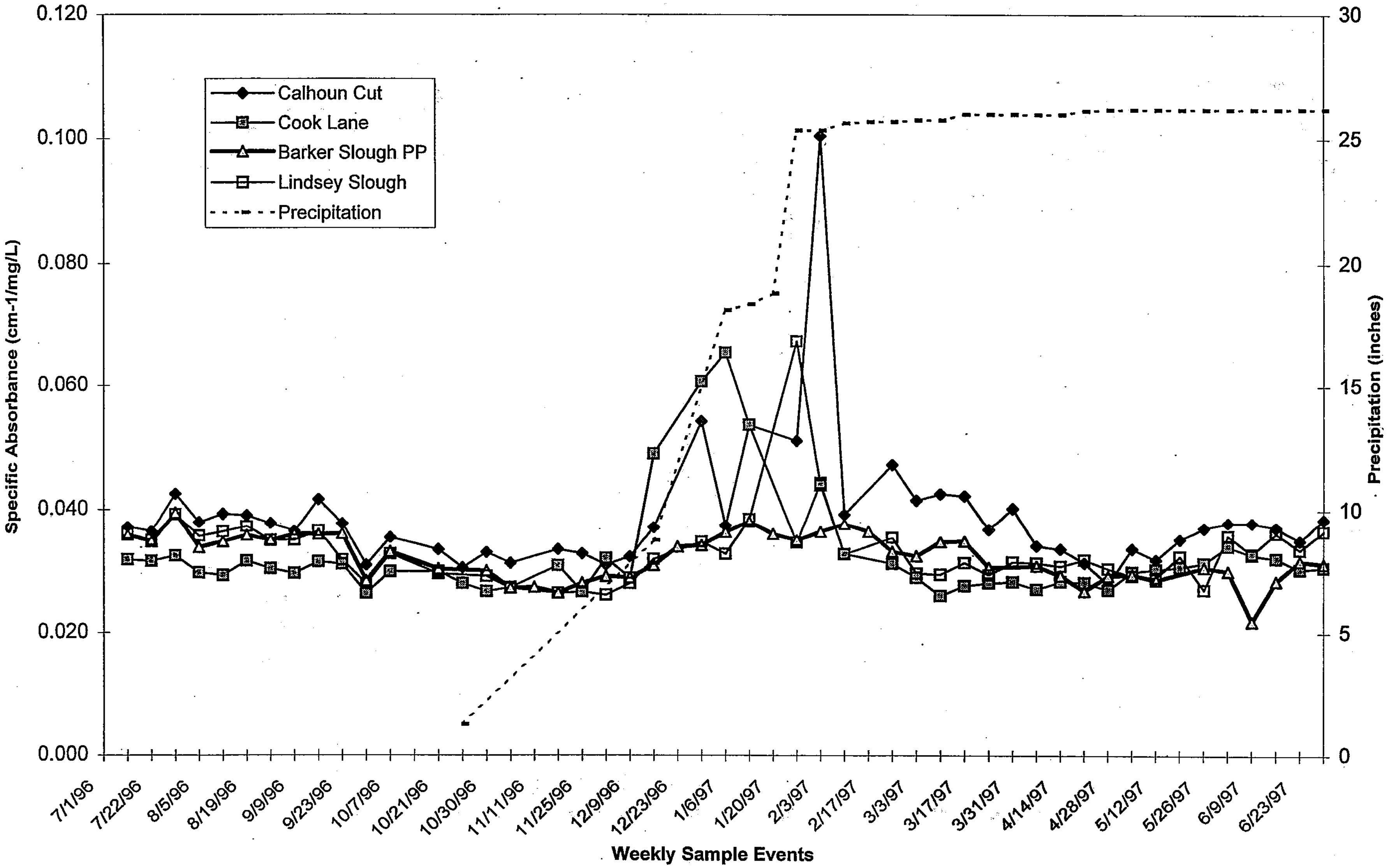


Figure B-7. Dissolved Bromide Results for NBA Watershed Study
(July 1, 1996 through June 30, 1997)

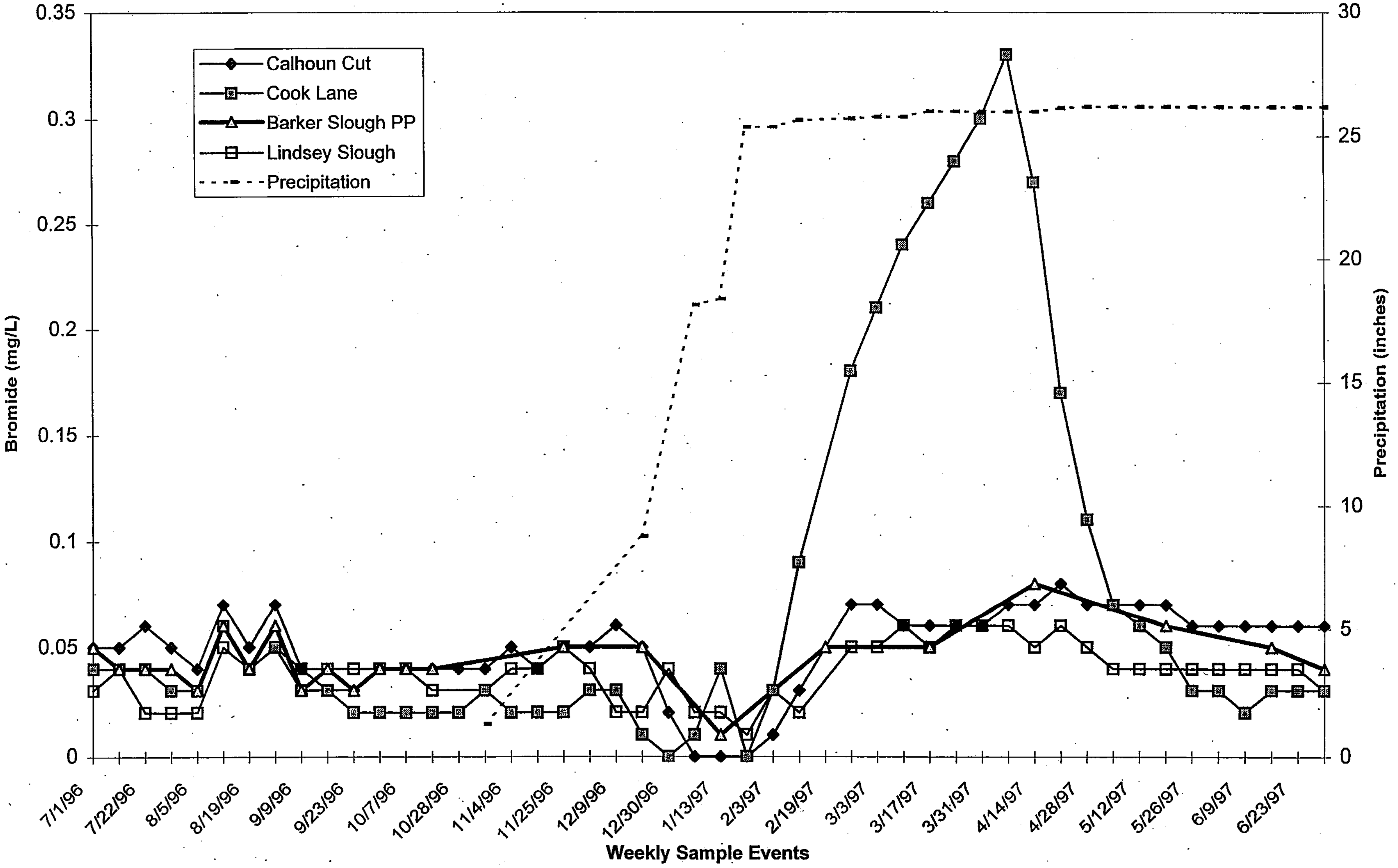
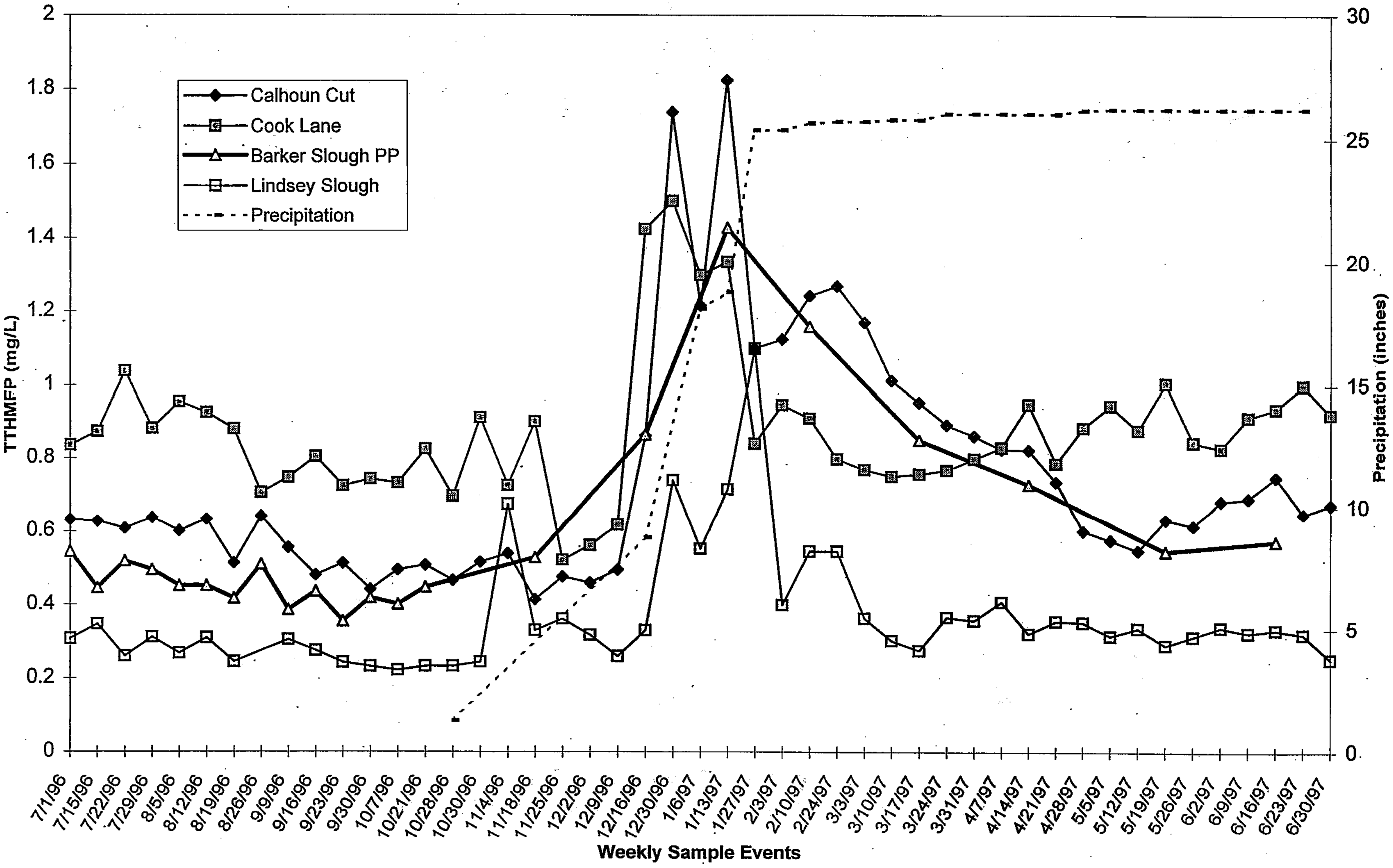


Figure B-8. TTHMFP for NBA Watershed Study
(July 1, 1996 through June 30, 1997)



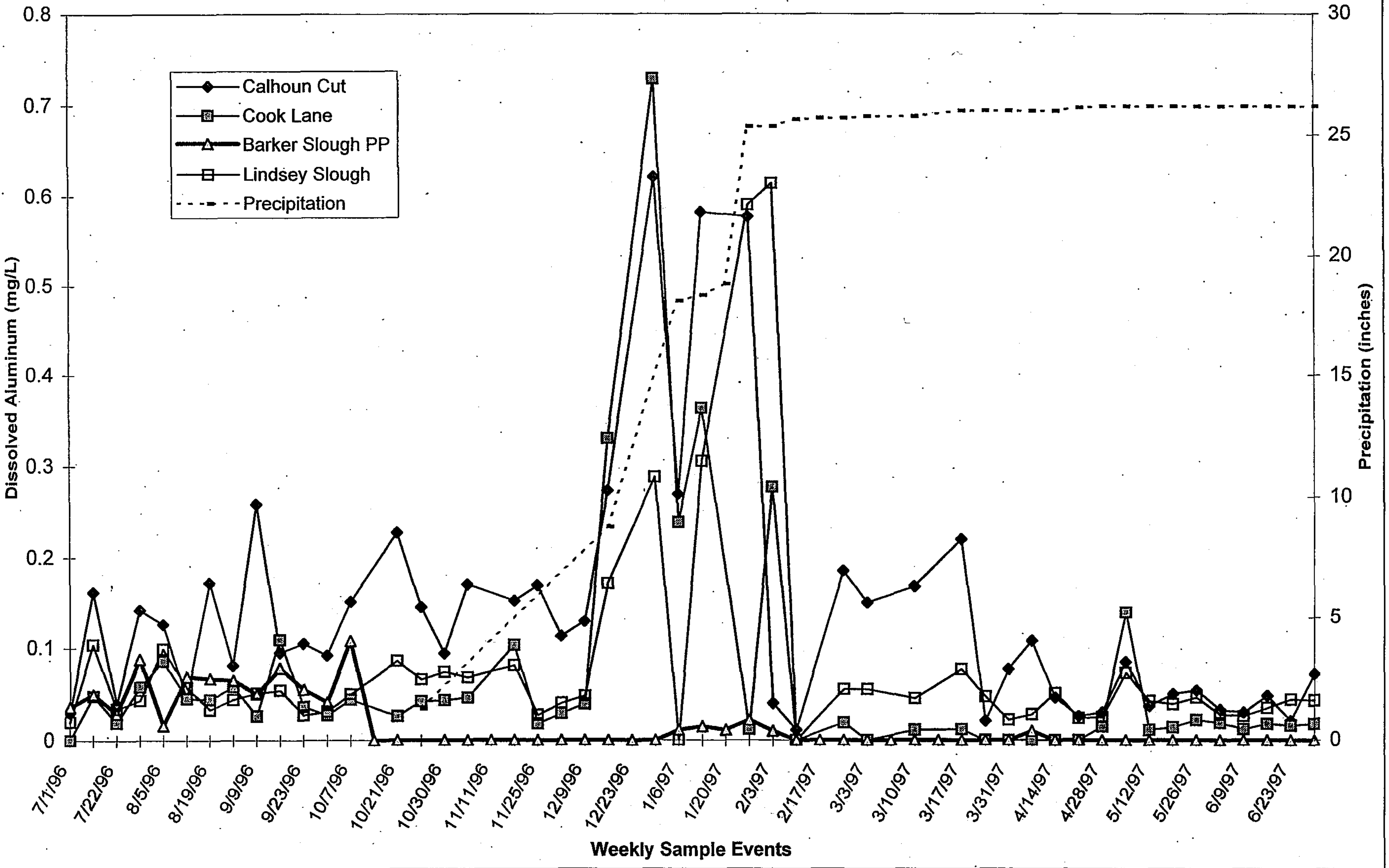


Figure B-9. Dissolved Aluminum Results for NBA Watershed Study
(July 1, 1996 through June 30, 1997)

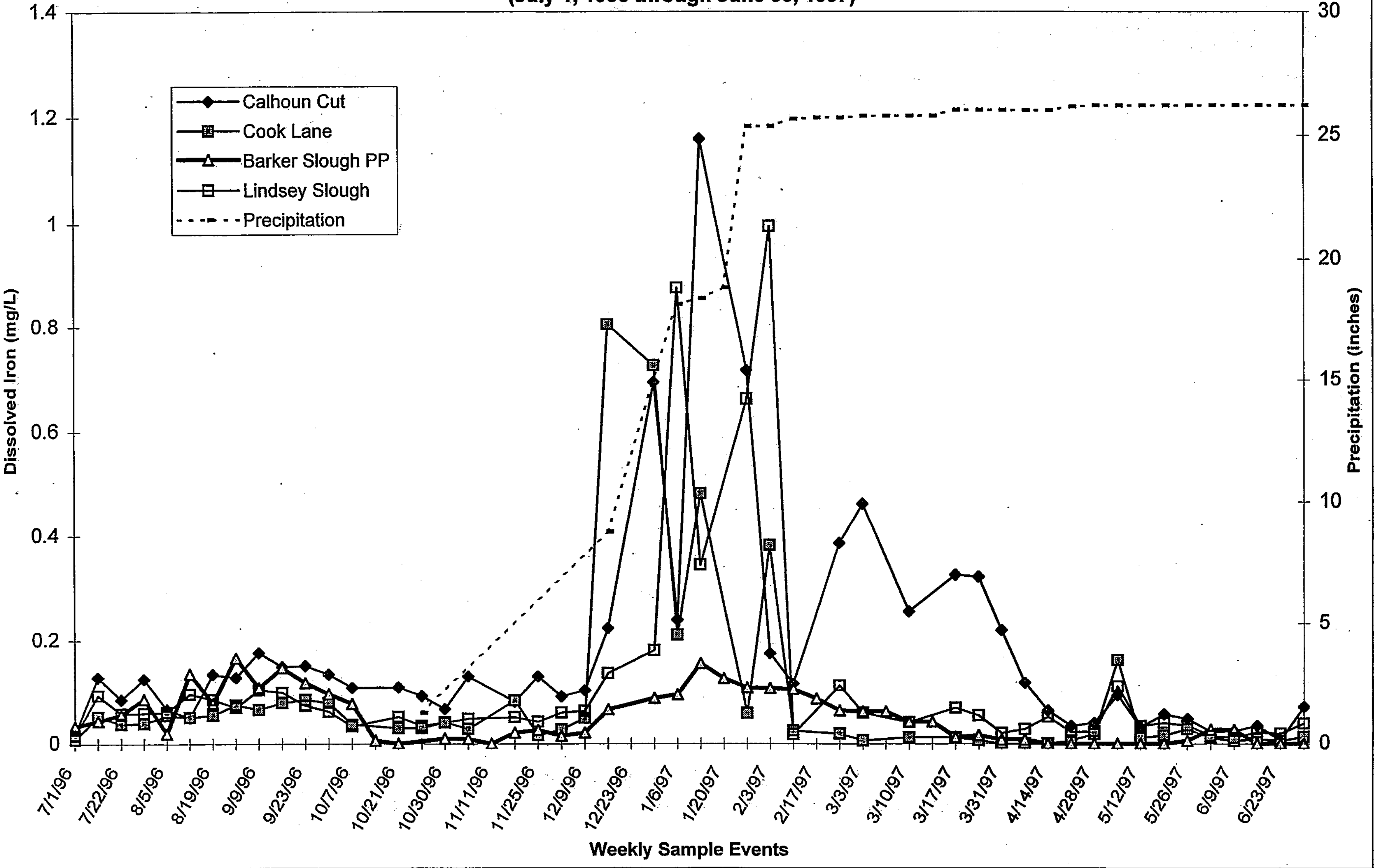


Figure B-10. Dissolved Iron Results for NBA Watershed Study (July 1, 1996 through June 30, 1997)

Figure B-11. Dissolved Manganese Results for NBA Watershed Study (July 1, 1996 through June 30, 1997)

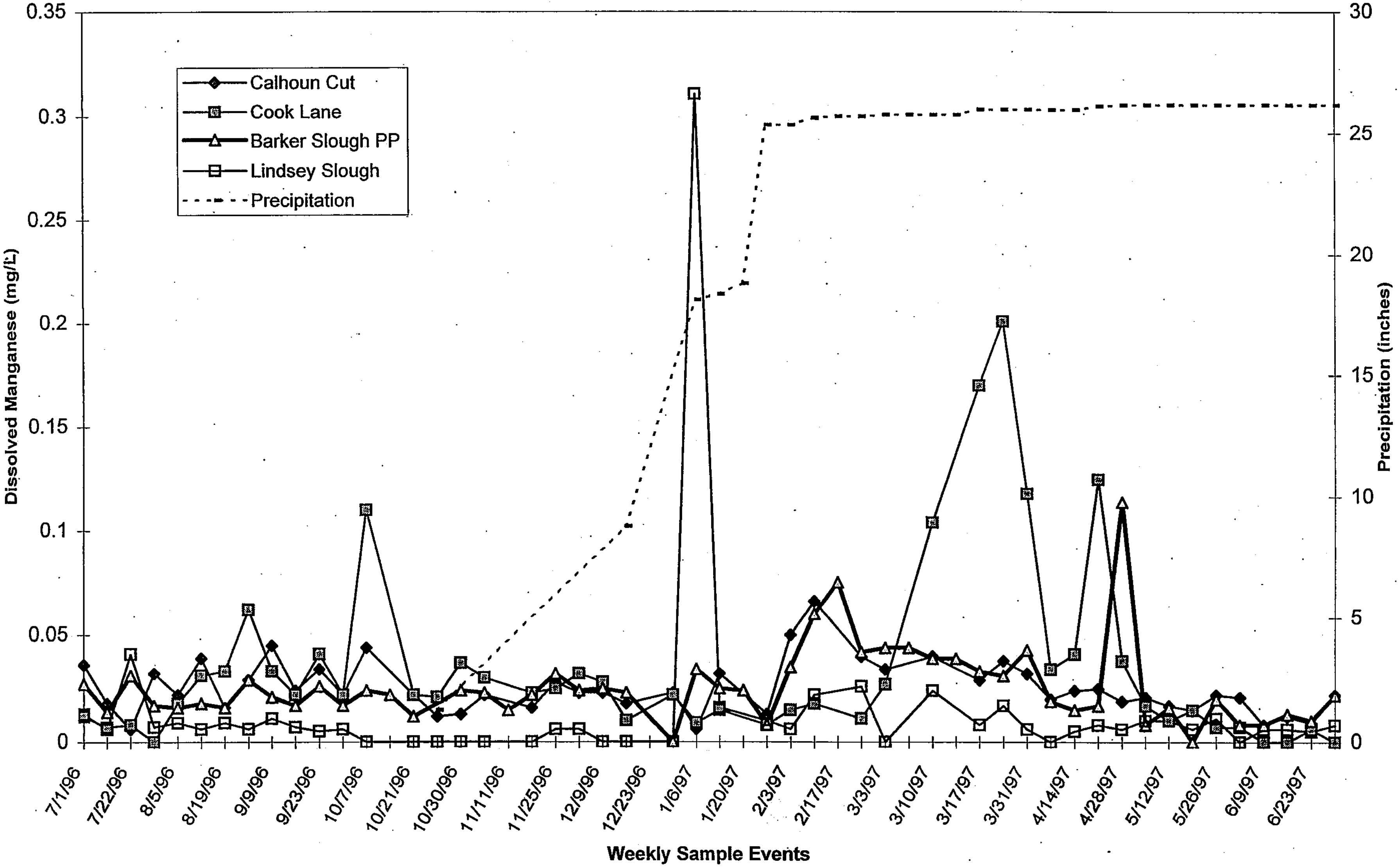


Figure B-12. Total Aluminum Results for NBA Watershed Study
(April 7, 1997 through June 30, 1997)

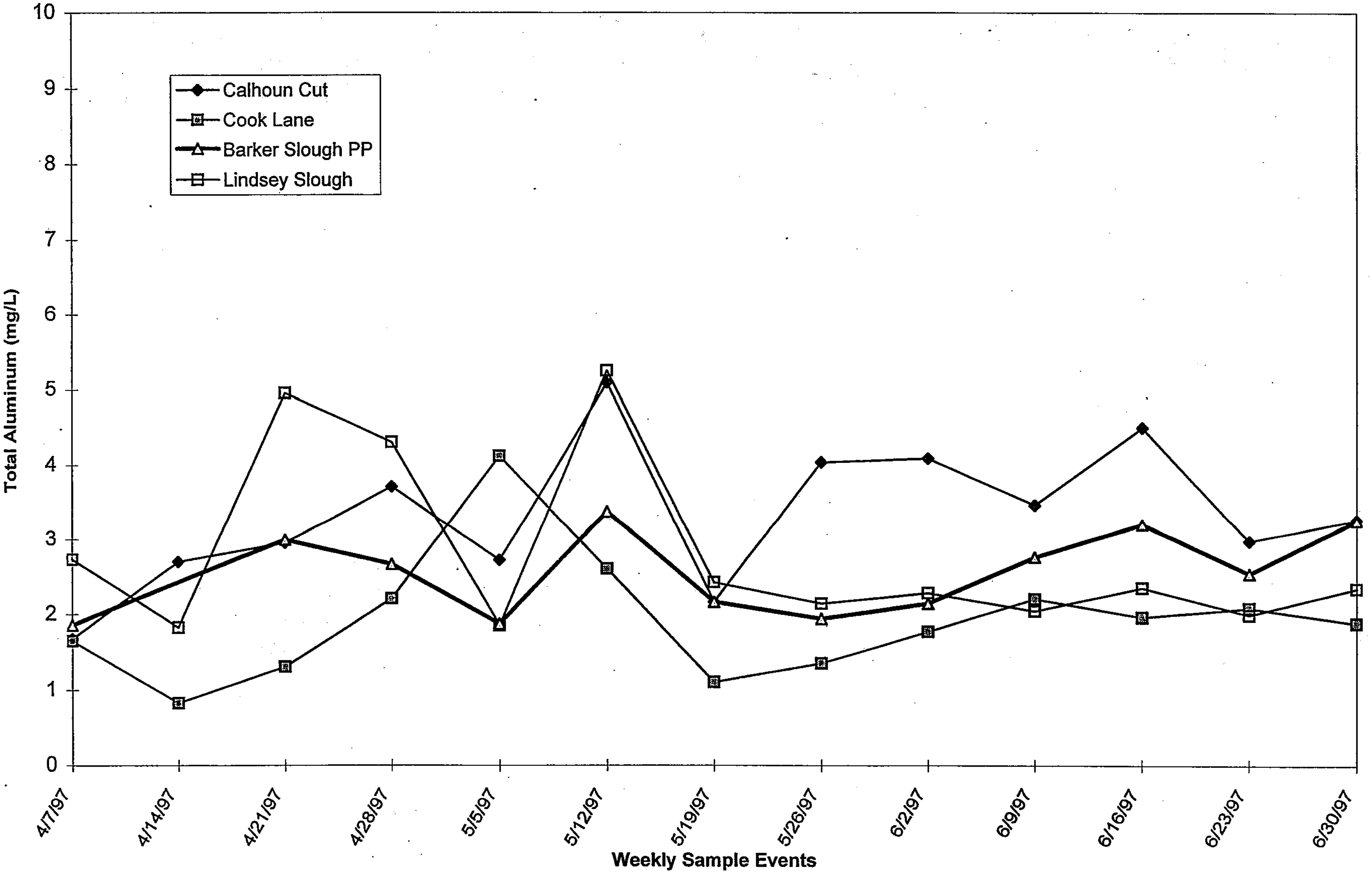


Figure B-13. Total Iron Results for NBA Watershed Study
(April 7, 1997 through June 30, 1997)

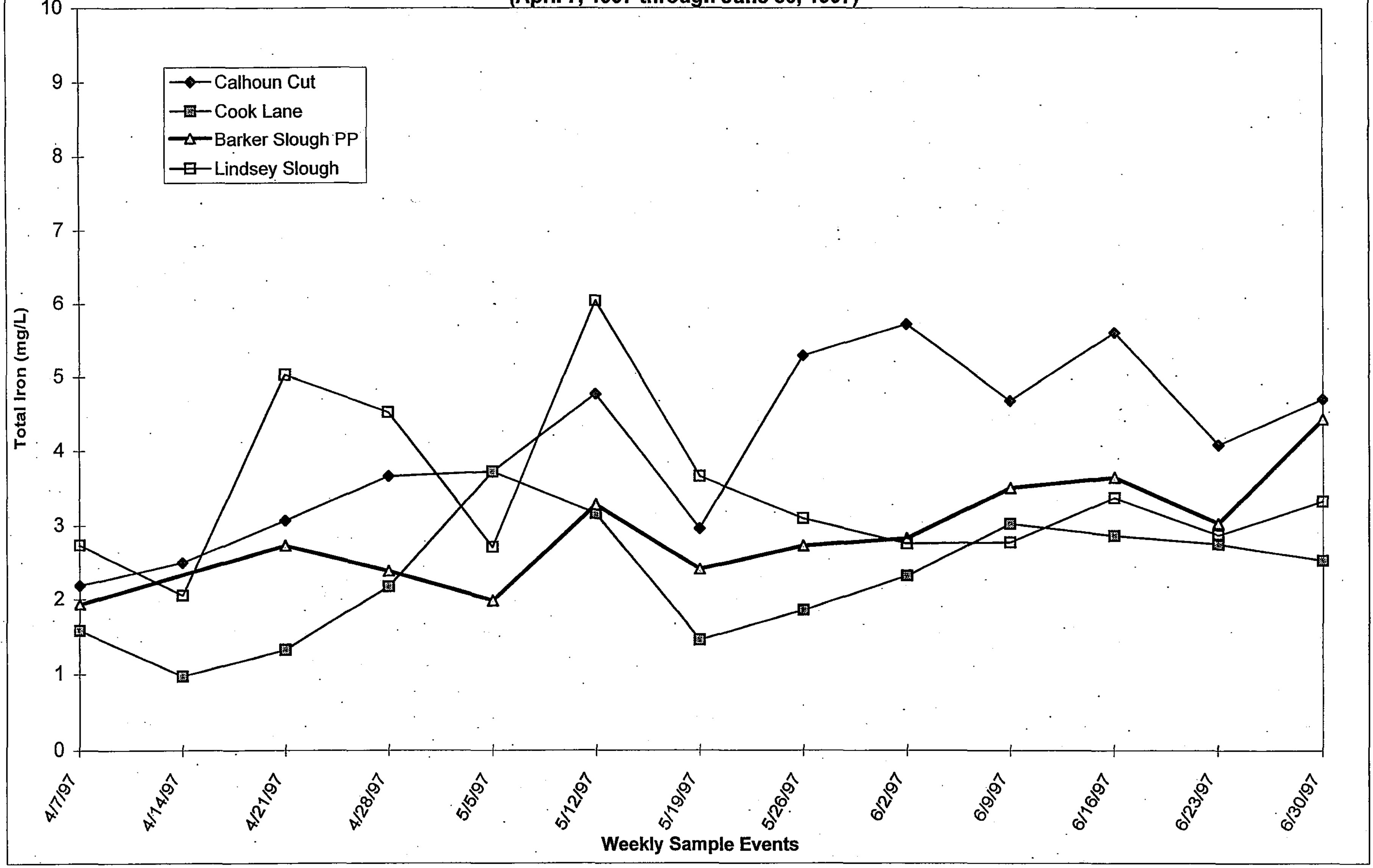


Figure B-14. Total Manganese Results for NBA Watershed Study
(April 7, 1997 through June 30, 1997)

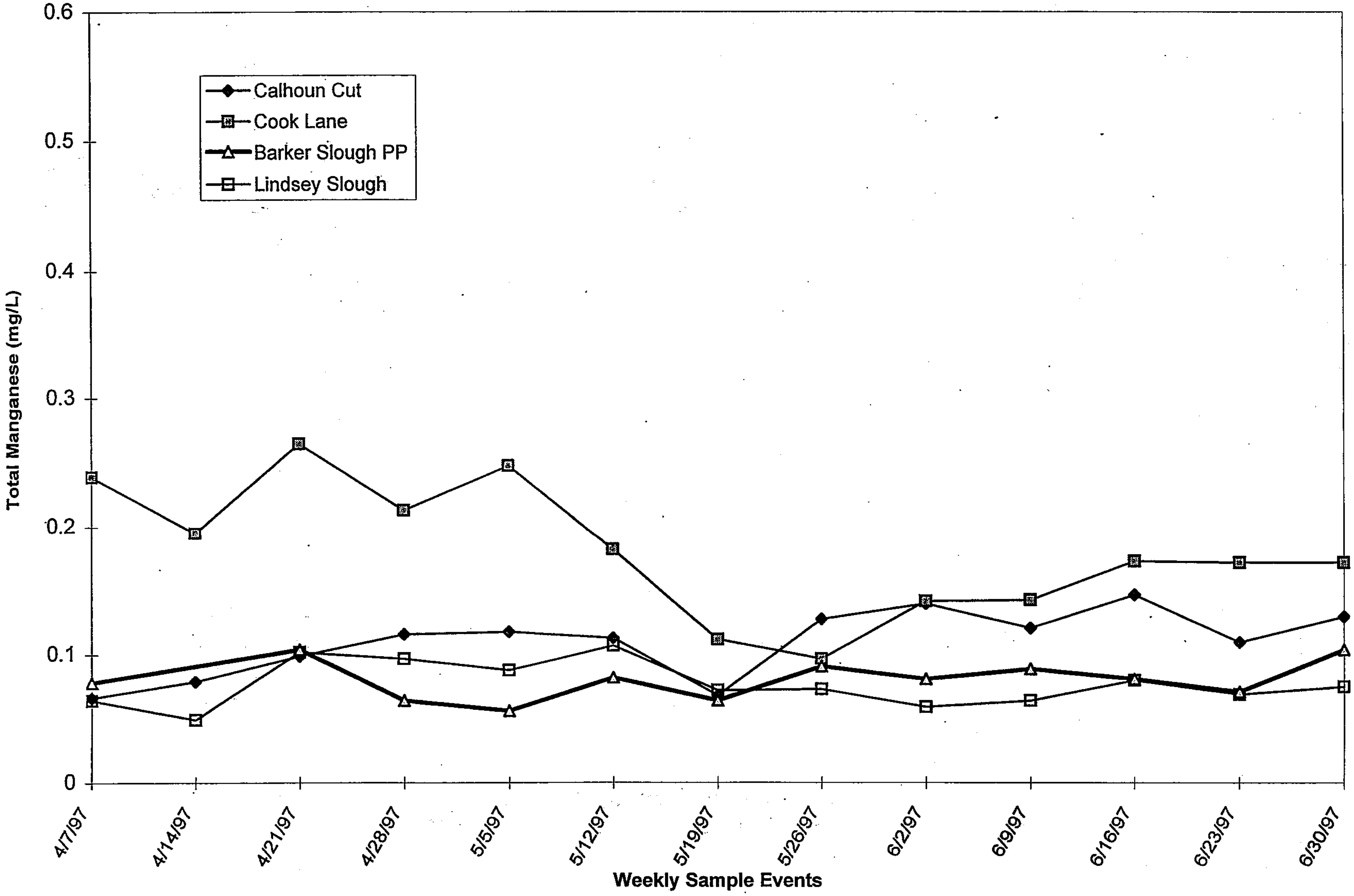


Figure B-15. *E. coli* Results for NBA Watershed Study (July 1, 1996 through June 30, 1997)

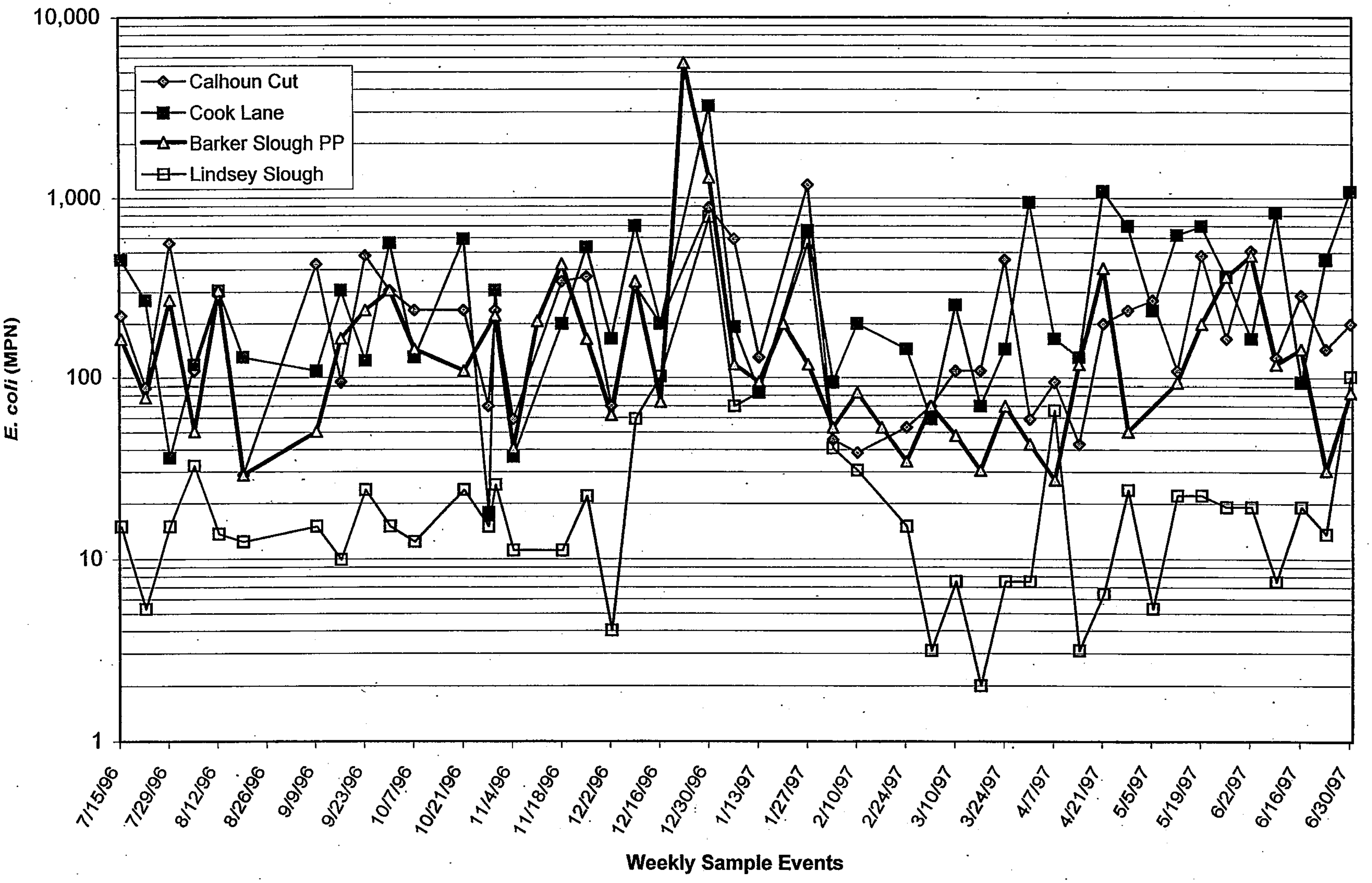


Figure B-16. pH Results for NBA Watershed Study
(July 1, 1996 through June 30, 1997)

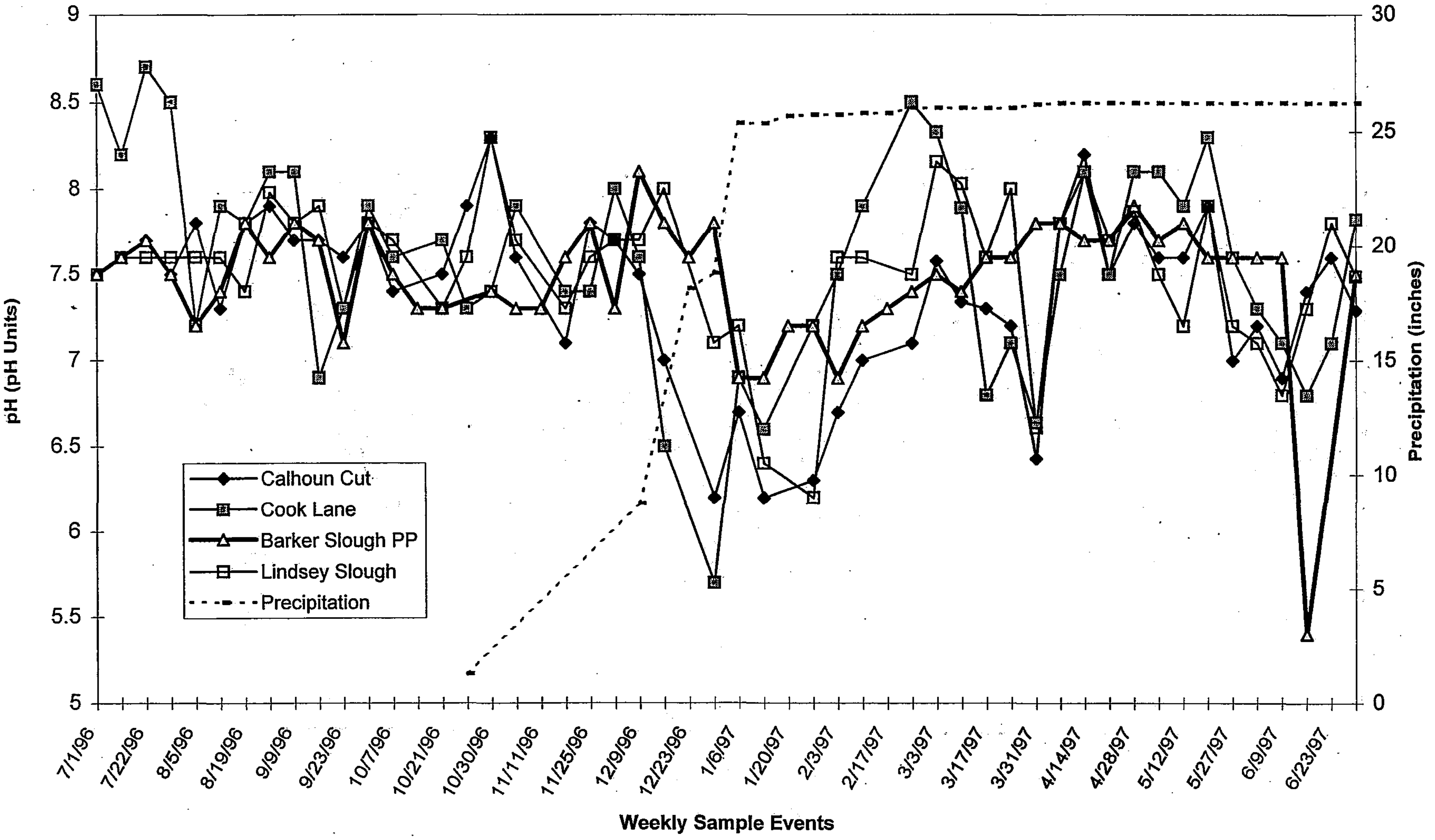


Figure B-17. Dissolved Oxygen Results for NBA Watershed Study
(July 1, 1996 through June 30, 1997)

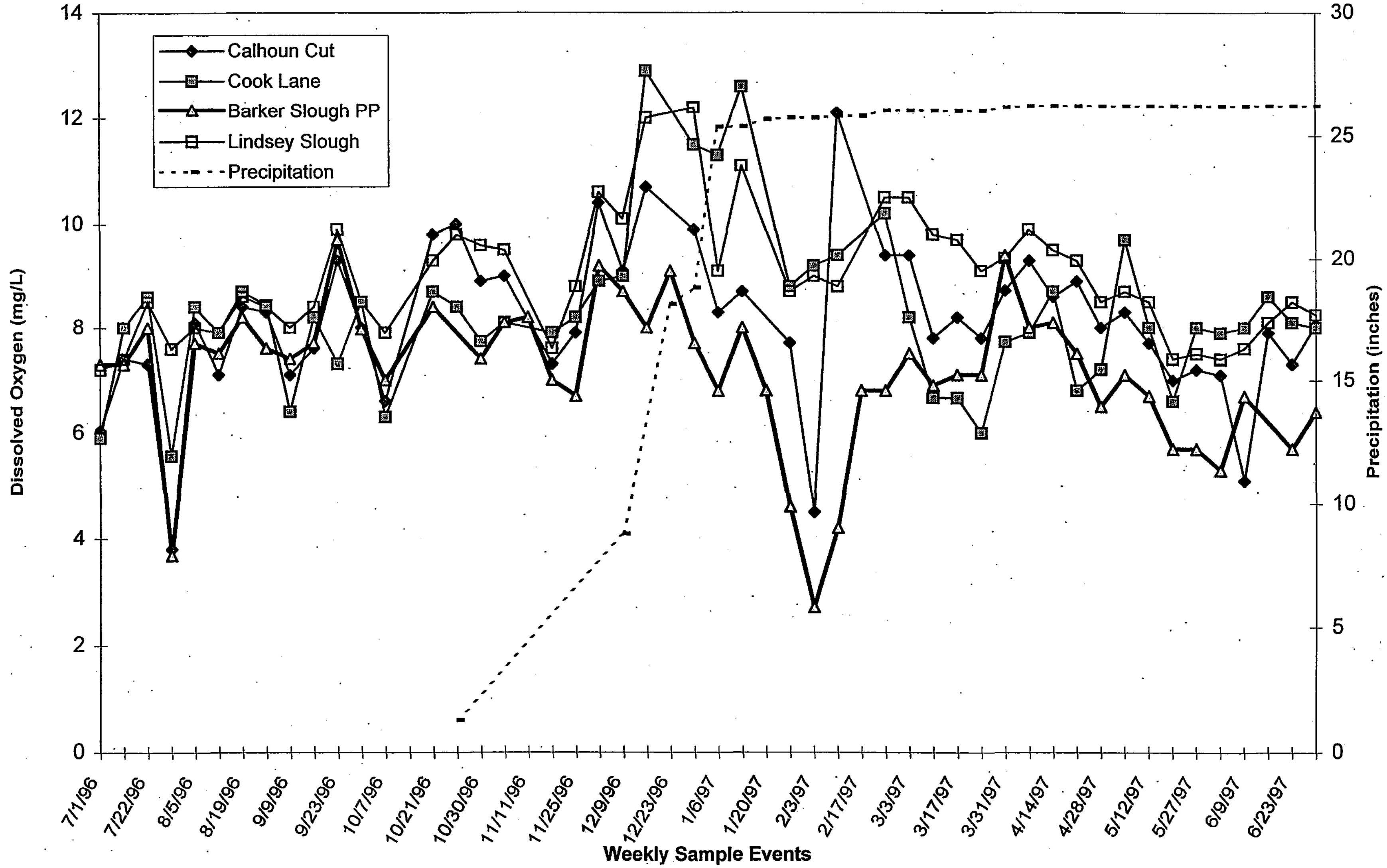


Figure B-18. Electrical Conductivity Results for NBA Watershed Study (July 1, 1996 through June 30, 1997)

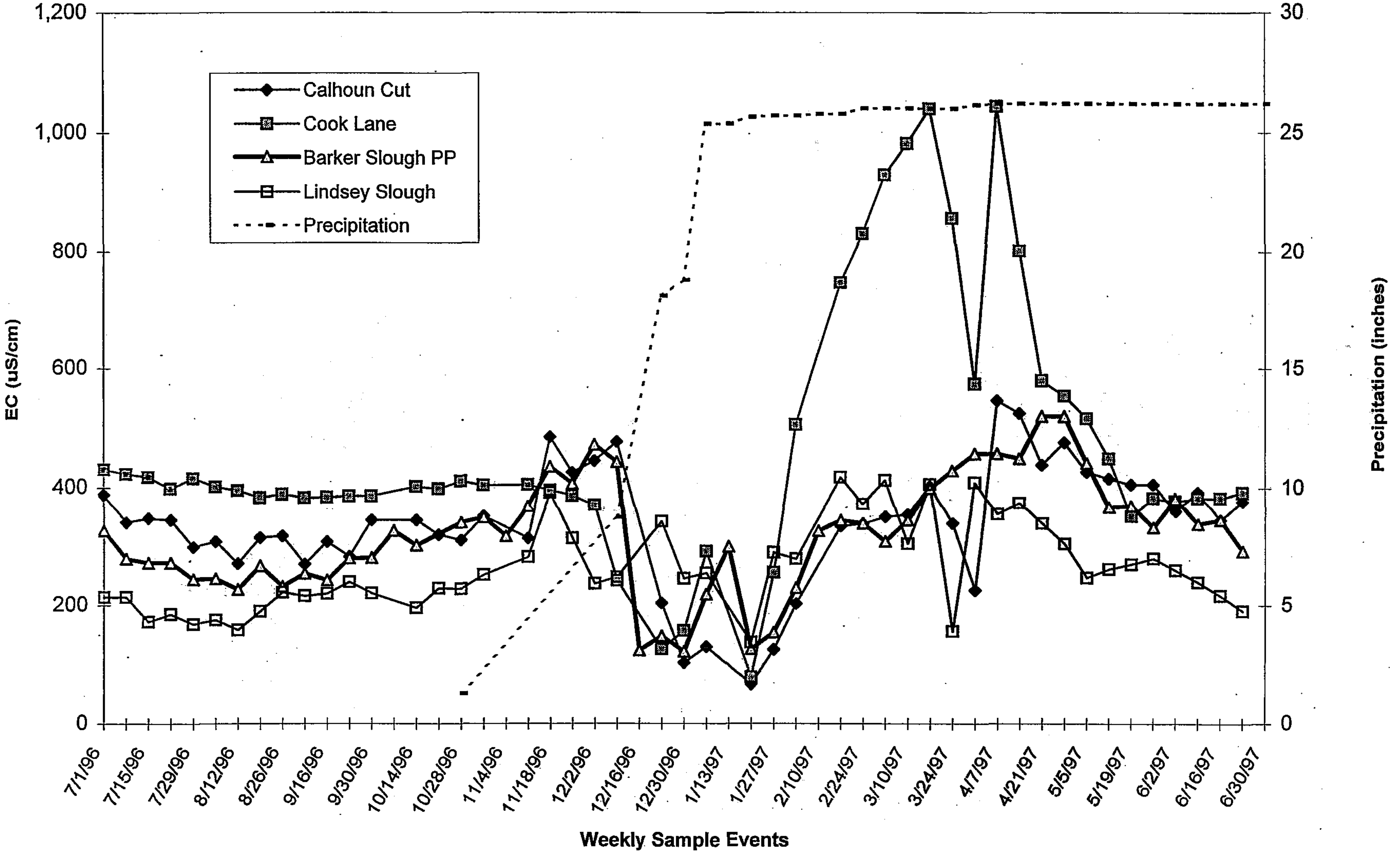


Figure B-19. Turbidity Results for NBA Watershed Study
(July 1, 1996 through June 30, 1997)

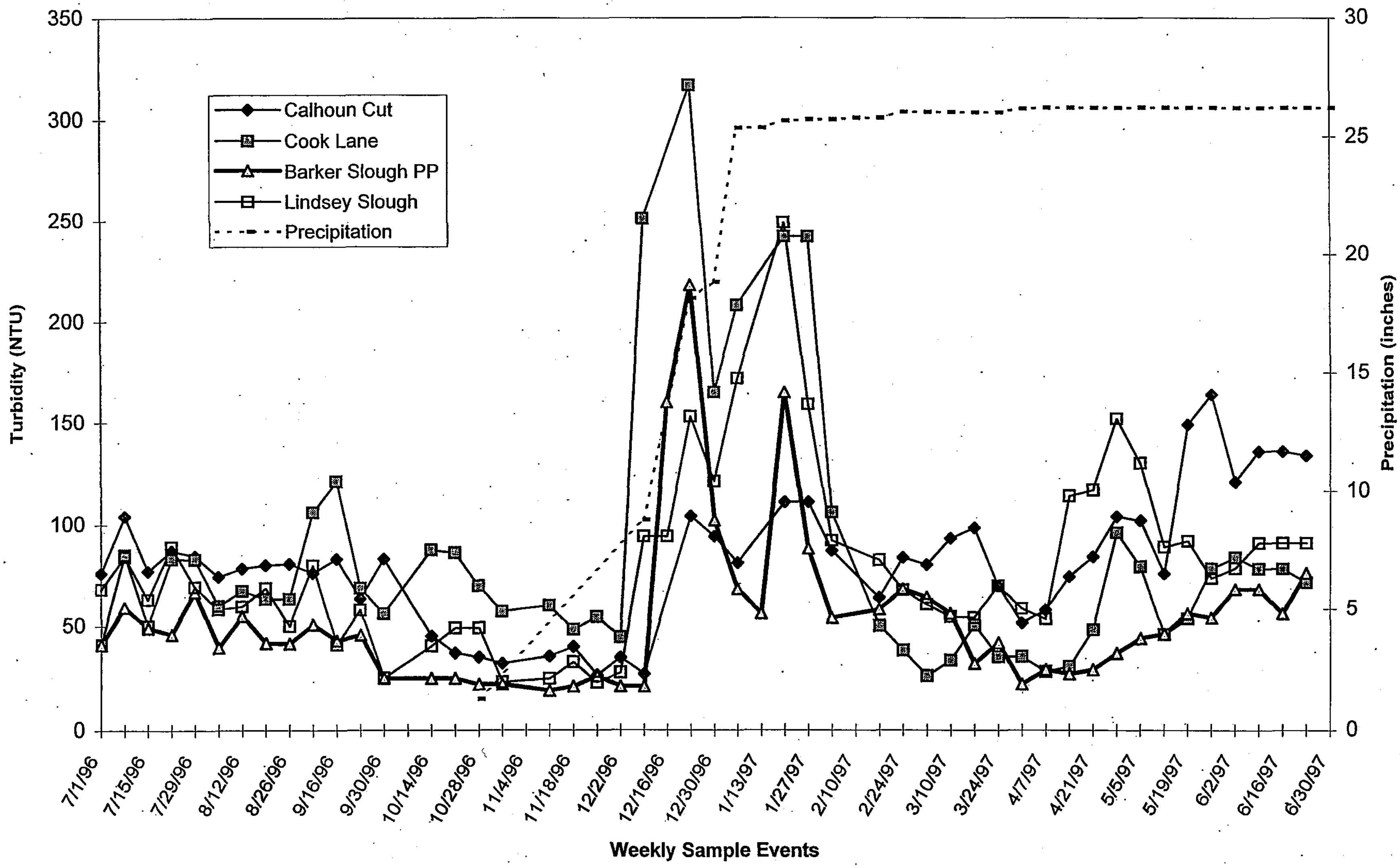


Figure B-20. Temperature Results for NBA Watershed Study (July 1, 1996 through June 30, 1997)

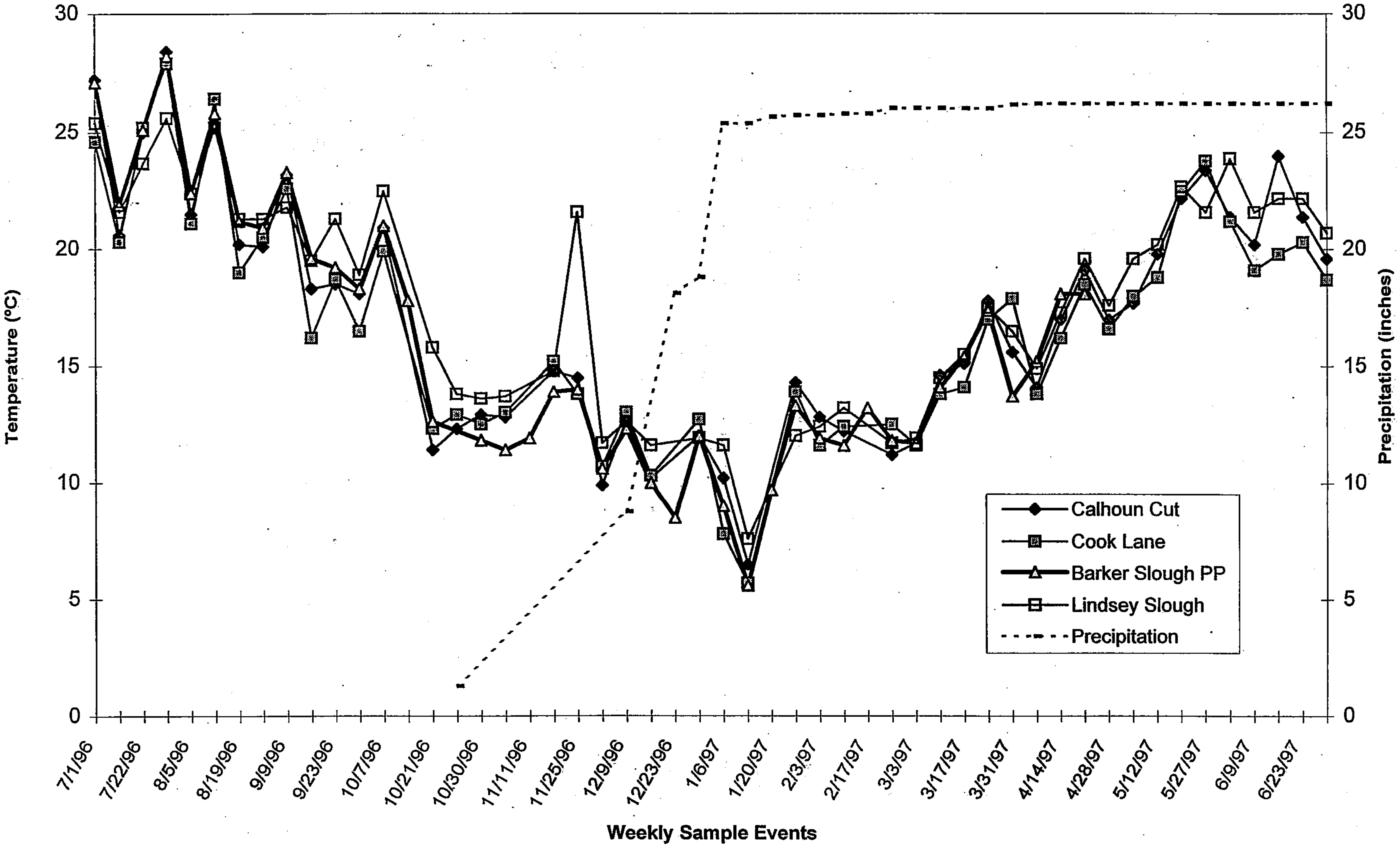


Figure B-21. Alkalinity Values for NBA Watershed Study
(July 1, 1996 through June 30, 1997)

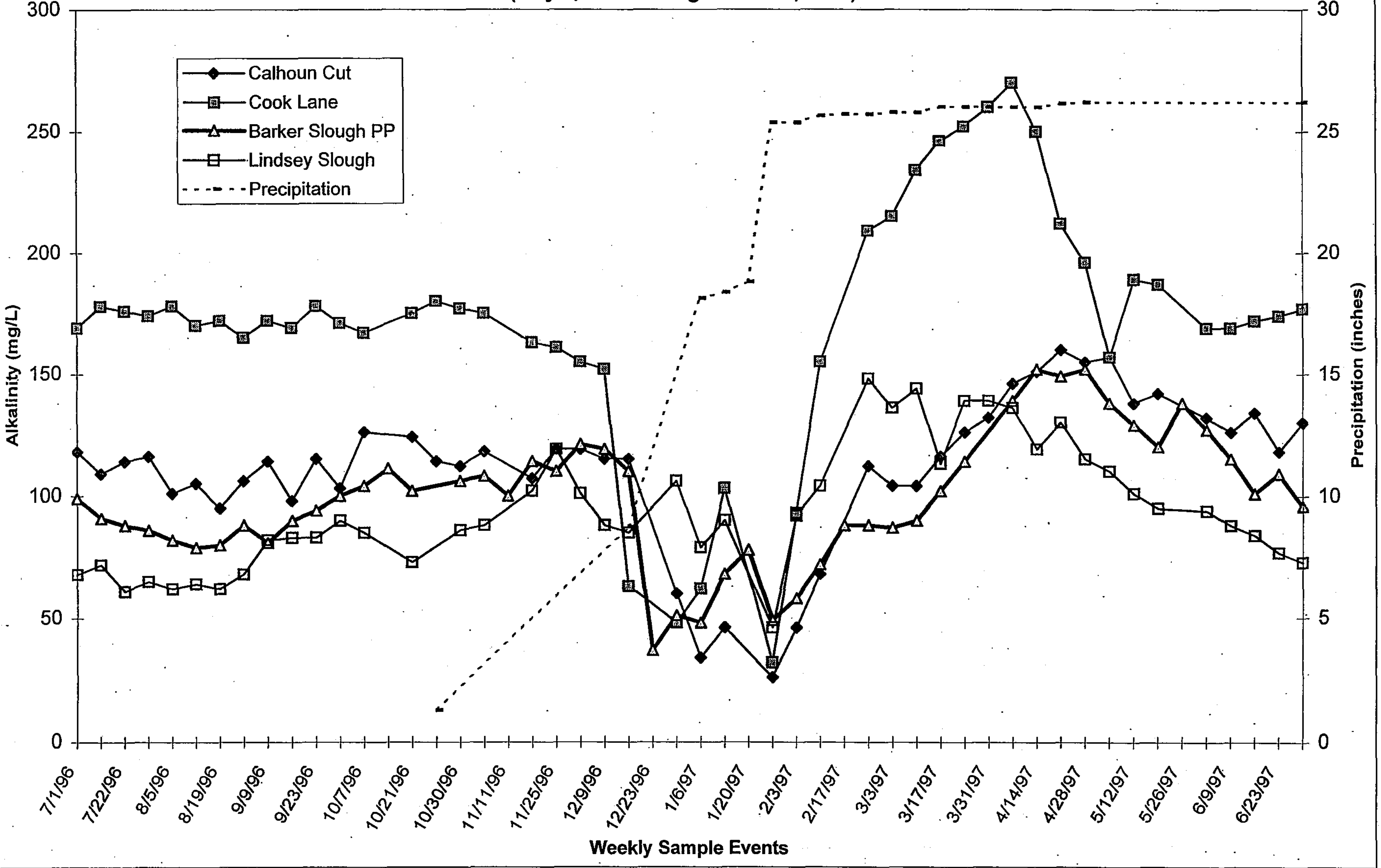


Figure B-22. Greenes and Barker Slough Association of Dissolved Organic Carbon

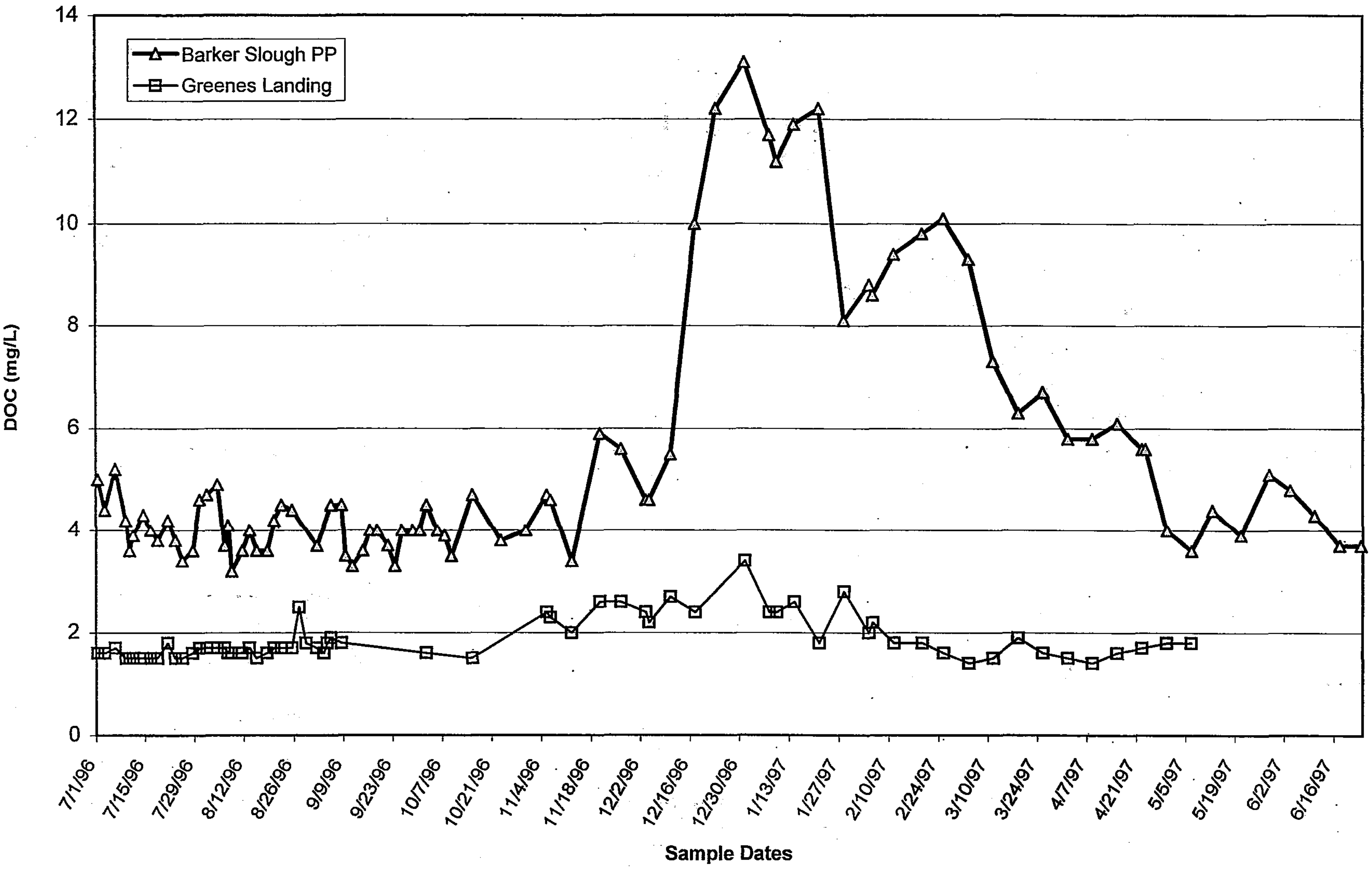


Table B-1. TOC at Barker Slough Pumping Plant Compared to DOC and Particulate Organic Carbon (9/30/96 - 7/1/97)

Sample Date	TOC mg/L	DOC mg/L	POC mg/L	POC Percent of TOC	Percent DOC
9/30/96	5.4	4.8	0.6	11.1%	88.9%
10/7/96	4	3.9	0.1	2.5%	97.5%
10/21/96	4.2	3.8	0.4	9.5%	90.5%
10/30/96	4.8	4	0.8	16.7%	83.3%
11/4/96	5	4.7	0.3	6.0%	94.0%
11/11/96	4	3.4	0.6	15.0%	85.0%
11/18/96	6.6	5.9	0.7	10.6%	89.4%
11/25/96	6.6	5.6	1.0	15.2%	84.8%
12/2/96	5.6	4.6	1.0	17.9%	82.1%
12/9/96	6	5.5	0.5	8.3%	91.7%
12/16/96	11	10	1.0	9.1%	90.9%
12/23/96	18.4	12.2	6.2	33.7%	66.3%
12/30/96	19.9	13.1	6.8	34.2%	65.8%
1/6/97	14.3	11.7	2.6	18.2%	81.8%
1/13/97	14.8	11.9	2.9	19.6%	80.4%
1/20/97	14.1	12.2	1.9	13.5%	86.5%
1/27/97	11.8	8.1	3.7	31.4%	68.6%
2/3/97	12	8.8	3.2	26.7%	73.3%
2/10/97	12.1	9.4	2.7	22.3%	77.7%
2/17/97	12.1	9.8	2.3	19.0%	81.0%
2/24/97	12	10.1	1.9	15.8%	84.2%
3/3/97	10.8	9.3	1.5	13.9%	86.1%
3/10/97	8.9	7.3	1.6	18.0%	82.0%
3/17/97	7.9	6.3	1.6	20.3%	79.7%
3/24/97	7.2	6.7	0.5	6.9%	93.1%
3/31/97	7.2	5.8	1.4	19.4%	80.6%
4/7/97	6.2	5.8	0.4	6.5%	93.5%
4/14/97	6.1	5.6	0.5	8.2%	91.8%
4/21/97	5.6	5.6	0.0	0.0%	100.0%
4/28/97	4.4	4.0	0.4	9.1%	90.9%
5/5/97	4.1	3.6	0.5	12.2%	87.8%
5/12/97	5.9	4.2	1.7	28.8%	71.2%
5/19/97	4.7	3.9	0.8	17.0%	83.0%
5/26/97	5.9	5.1	0.8	13.6%	86.4%
6/2/97	5.6	4.8	0.8	14.3%	85.7%
6/9/97	5.3	4.3	1.0	18.9%	81.1%
6/16/97	4	3.7	0.3	7.5%	92.5%
6/23/97	4.4	3.7	0.7	15.9%	84.1%
6/30/97	4.5	3.4	1.1	24.4%	75.6%
			MEAN	15.7%	84.3%

Table B-2. Data Summary Table

SAMPLING SITE	DOC	TOC	UVA	Alkalinity	SUVA	Br	TTHMFP	Total Al	Total Fe	Total Mn	Diss Al	Diss Fe	Diss Mn	*E. coli*	Turbidity	Diss. Oxygen	EC	Temp.
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	MPN	NTU	mg/L	µS/cm	°C
Calhoun Cut																		
Mean	6.1		0.247	111	0.039	0.05	0.75	3.34	4.07	0.181	0.14	0.175	0.025	252	81	8.1	339	17.2
Min	3.8		0.128	26	0.028	0.00	0.41	1.68	2.19	0.097	0.01	0.006	0.006	29	27	3.8	67	6.5
Max	16.4		0.882	160	0.101	0.08	1.82	5.10	5.72	0.265	0.62	1.16	0.066	1184	164	12.1	547	28.4
Stan. Dev	2.9		0.165	30	0.011	0.02	0.32	0.95	1.17	0.059	0.14	0.212	0.012	232	32	1.5	103	5.1
Wet mean	8.0		0.349	91	0.042	0.04	0.91	NA			0.23	0.291	0.027	164*	63	8.9	296	12.1
Dry mean	5.0		0.182	124	0.037	0.06	0.65	3.34	4.07	0.181	0.08	0.102	0.024	182*	93	7.6	365	20.4
Cook Lane																		
Mean	7.5		0.255	171	0.033	0.07	0.88	1.93	2.29	0.181	0.07	0.086	0.036	400	86	8.3	473	16.8
Min	5.4		0.160	32	0.026	0.00	0.52	0.83	0.976	0.097	0.00	0.000	0.000	18	26	5.6	79	5.7
Max	14.6		0.956	270	0.065	0.33	1.50	4.13	3.72	0.265	0.73	0.806	0.201	3240	317	12.9	1044	27.9
Stan. Dev	1.8		0.153	51	0.008	0.09	0.19	0.83	0.819	0.059	0.13	0.171	0.044	520	65	1.5	223	4.9
Wet mean	8.2		0.325	142	0.037	0.06	0.91	NA			0.13	0.169	0.025	205*	120	9.3	408	12.0
Dry mean	7.0		0.210	190	0.030	0.09	0.86	1.93	2.29	0.181	0.03	0.035	0.042	264*	65	7.7	513	19.8
BSPP																		
Mean	6.0	8.0	0.199	99	0.032	0.04	0.59	2.57	2.91	0.080	0.02	0.050	0.026	287	54	7.1	321	15.9
Min	3.3	4.0	0.093	37	0.022	0.01	0.36	1.86	1.93	0.056	<0.01	<0.005	<0.005	27	19	2.7	122	5.6
Max	13.1	19.9	0.454	152	0.040	0.08	1.43	3.39	4.44	0.104	0.11	0.166	0.114	5600	218	9.7	521	28.2
Stan. Dev	2.8	4.2	0.110	27	0.004	0.01	0.27	0.57	0.728	0.017	0.03	0.049	0.019	818	38	1.4	99	5.5
Wet mean	8.2	10.2	0.274	86	0.033	0.04	0.89	NA			0.00	0.057	0.030	140*	65	7.1	294	11.5
Dry mean	4.4	5.5	0.139	109	0.032	0.05	0.50	2.57	2.91	0.080	0.03	0.042	0.022	110*	46	7.1	340	20.5
Lindsey Sl.																		
Mean	3.3		0.115	94	0.033	0.04	0.37	2.81	3.46	0.077	0.08	0.113	0.014	53	80	8.9	263	17.9
Min	2.0		0.059	46	0.026	0.01	0.22	1.83	2.05	0.049	0.00	0.011	0.000	2	23	7.2	137	7.6
Max	10.2		0.539	148	0.067	0.06	1.10	5.26	6.04	0.107	0.61	0.996	0.311	782	249	12.2	418	25.6
Stan. Dev	1.7		0.092	25	0.006	0.01	0.16	1.20	1.11	0.021	0.12	0.204	0.045	139	44	1.2	76	4.7
Wet mean	4.4		0.167	99	0.033	0.03	0.46	NA			0.15	0.212	0.024	31*	85	9.8	285	13.1
Dry mean	2.6		0.084	91	0.033	0.04	0.31	2.81	3.46	0.077	0.04	0.052	0.008	13*	77	8.4	249	20.8

Wet Season October 15 to March 15
Dry Season March 16 to October 14

* E. coli Wet and Dry means are Geometric.

Table B-3. Pesticides and Organic Compounds

Location	Sample Date	Analyte	Result	Units	RepLmt
COOK	9/30/96	Cyanazine	0.00004	mg/L	0.00001
COOK	10/30/96	Cyanazine	0.00002	mg/L	0.00001
BSPP	12/18/96	Cyanazine	0.00002	mg/L	0.00001
CALHOUN	12/30/96	Cyanazine	0.00003	mg/L	0.00001
COOK	12/30/96	Cyanazine	0.00005	mg/L	0.00001
BSPP	3/19/97	Cyanazine	0.00003	mg/L	0.00001
COOK	3/31/97	Cyanazine	0.00005	mg/L	0.00001

Location	Sample Date	Analyte	Result	Units	RepLmt
LINDSEY	6/16/97	Dacthal (DCPA)	0.00002	mg/L	0.00001

Location	Sample Date	Analyte	Result	Units	RepLmt
COOK	6/16/97	Methidathion	0.00007	mg/L	0.00002

Location	Sample Date	Analyte	Result	Units	RepLmt	Action Level
BSPP	9/30/96	Diazinon	0.00005	mg/L	0.00001	0.014 mg/L
CALHOUN	9/30/96	Diazinon	0.00001	mg/L	0.00001	0.014 mg/L
COOK	9/30/96	Diazinon	0.00001	mg/L	0.00001	0.014 mg/L
COOK	12/30/96	Diazinon	0.00001	mg/L	0.00001	0.014 mg/L

Location	Sample Date	Analyte	Result	Units	RepLmt	1° DHS MCL
COOK	12/30/96	Diuron	0.00075	mg/L	0.00025	Unregulated
LINDSEY	12/30/96	Diuron	0.00045	mg/L	0.00025	Unregulated
COOK	3/31/97	Diuron	0.00424	mg/L	0.00025	Unregulated

Location	Sample Date	Analyte	Result	Units	RepLmt	1° EPA MCL
CALHOUN	10/30/96	Methylene chloride	0.0009	mg/L	0.0005	0.005 mg/L
LINDSEY	10/30/96	Methylene chloride	0.0014	mg/L	0.0005	0.005 mg/L

Location	Sample Date	Analyte	Result	Units	RepLmt	1° EPA MCL
COOK	9/30/96	Simazine	0.00006	mg/L	0.00002	0.004 mg/L
COOK	10/30/96	Simazine	0.00007	mg/L	0.00002	0.004 mg/L
BSPP	12/18/96	Simazine	0.0013	mg/L	0.00002	0.004 mg/L
COOK	12/30/96	Simazine	0.00062	mg/L	0.00002	0.004 mg/L
LINDSEY	12/30/96	Simazine	0.00011	mg/L	0.00002	0.004 mg/L
BSPP	3/19/97	Simazine	0.00006	mg/L	0.00002	0.004 mg/L
CALHOUN	3/31/97	Simazine	0.00007	mg/L	0.00002	0.004 mg/L
COOK	3/31/97	Simazine	0.00014	mg/L	0.00002	0.004 mg/L
LINDSEY	3/31/97	Simazine	0.00007	mg/L	0.00002	0.004 mg/L

Table B-4. Yolo Bypass Sampling Event

Site	*E. coli* MPN/100ml	Alkalinity mg/L	Bromide mg/L	DOC mg/L	UVA Abs/cm	Field DO mg/L	Field EC µS/cm	Field pH	Field Turbidity NTU
Fremont Weir	47.8	67	<0.01	1.8	0.049	10.2	127	6.9	35.2
Shag Slough	165.2	76	<0.01	4.6	0.14	8.5	193	6.9	45.5

Fremont Weir Sampled on 12/17/96
Shag Slough Sampled on 12/18/96

Table B-5. Sample Duplicate Recovery

Analyte	Acceptance RPD (%)	Method (EPA)	Total Analyses Reviewed	Analyses Outside Limits	Frequency of Samples out of Limits (%)
Alkalinity	20	310.1	44	1	2
Aluminum, Dissolved	15	202.2	44	23	52
Aluminum, Total	15	202.2	12	1	8
Bromide*	20	300.0	45	0	0
Bromodichloromethane	30	DWR Modified	44	1	2
Bromoform	30	DWR Modified	44	0	0
Chloroform	30	DWR Modified	44	0	0
Dibromochloromethane	30	DWR Modified	44	1	2
Dissolved Organic Carbon	20	415.1	44	0	0
Iron, Dissolved	15	236.2	44	25	57
Iron, Total	15	236.2	12	1	8
Manganese, Dissolved	15	243.2	44	3	7
Manganese, Total	15	243.2	12	0	0
Ultra-violet analysis	30	Bryte	45	2	4

- ❖ Bromide was analyzed using Bureau of Reclamation, Mid-Pacific Region acceptance criteria for inorganics in water.

Table B-6. Filtered Field Blank Contamination Results

Analyte	No. of samples reviewed	Samples outside limits	Sample Dates Affected	Frequency of Exceedances (%)
Aluminum, Dissolved	46	1	1/13/97	2
Iron, Dissolved	46	3	9/9/96,10/21/96, 1/13/97	6
Manganese, Dissolved	46	0		0

Table B-7. Results of Unfiltered Field Blank Analyses

Analyte	No. of samples reviewed	Samples outside limits	Sample Dates Affected	Frequency of Exceedances (%)
Aluminum, Dissolved	33	0		0
Aluminum, Total	13	4	4/14/97, 4/28/97, 5/5/97, 5/12/97	31
Iron, Dissolved	33	0		0
Iron, Total	13	2	4/14/97, 5/12/97	15
Manganese, Dissolved	33	0		0
Manganese, Total	13	0		0

Appendix C

Data Appendix

Appendix C

Field Parameters

Lab Number	*Station Name*	*Sample Date*	*Sample Time*	*pH*	*DO (mg/L)*	*EC (µS/cm)*	*Water Temp (°C)*	*Turb (NTU)*
BL5503	BARKERNOBAY	7/1/96	1:11 PM	7.5	7.3	327	27.1	41.0
BL5510	BARKERNOBAY	7/15/96	10:15 AM	7.6	7.3	279	21.9	59.2
BL5517	BARKERNOBAY	7/22/96	11:30 AM	7.7	8.0	272	25.1	49.0
BL5532	BARKERNOBAY	7/29/96	11:00 AM	7.5	3.7	272	28.2	46.0
C961795	BARKERNOBAY	8/5/96	11:14 AM	7.2	7.7	244	22.4	66.6
BL5539	BARKERNOBAY	8/12/96	11:00 AM	7.4	7.5	245	25.8	39.7
BL5546	BARKERNOBAY	8/19/96	10:13 AM	7.8	8.2	227	21.2	54.9
BL5553	BARKERNOBAY	8/26/96	11:45 AM	7.6	7.6	267	20.9	41.8
C961953	BARKERNOBAY	9/9/96	12:20 PM	7.8	7.4	232	23.3	41.6
C961960	BARKERNOBAY	9/16/96	10:26 AM	7.7	7.7	254	19.6	50.7
C961967	BARKERNOBAY	9/23/96	9:15 AM	7.1	9.7	243	19.2	43.0
C961974	BARKERNOBAY	9/30/96	9:20 AM	7.8	8.0	280	18.3	45.6
D61000	BARKERNOBAY	10/2/96	8:45 AM	7.3	6.5	316	16.5	38.5
C962041	BARKERNOBAY	10/7/96	9:45 AM	7.5	7.0	281	21.0	44.9
D61001	BARKERNOBAY	10/9/96	12:00 PM	7.3	6.6	289	20.1	33.8
D61006	BARKERNOBAY	10/16/96	1:55 PM	7.3		327	17.8	39.8
D61015	BARKERNOBAY	10/23/96	11:00 AM	7.3	8.4	302	12.6	37.5
D61022	BARKERNOBAY	10/30/96	2:45 PM	7.4		341	11.8	31.2
D61100	BARKERNOBAY	11/5/96	11:15 AM	7.3	8.1	350	11.4	30.2
D61105	BARKERNOBAY	11/13/96	1:45 PM	7.3	8.2	318	11.9	33.5
D61117	BARKERNOBAY	11/20/96	2:50 PM	7.6	7.0	369	13.9	29.6
D61123	BARKERNOBAY	11/25/96	2:30 PM	7.8	6.7	436	14.0	27.0
D61200	BARKERNOBAY	12/4/96	11:30 AM	7.3	9.2	407	10.6	24.5
D61201	BARKERNOBAY	12/9/96	3:00 PM	8.1	8.7	473	12.3	31.4
D61220	BARKERNOBAY	12/18/96	2:00 PM	7.8	8.0	444	10.0	58.9
D61221	BARKERNOBAY	12/23/96	11:30 AM	7.6	9.1	124	8.5	195.9
D61222	BARKERNOBAY	12/30/96	1:30 PM	7.8	7.7	148	12.0	235.5

"D" lab numbers represent samples obtained from DWR Division of Operations and Maintenance.
Field turbidity readings for these samples are daily averages collected by BSPP's autosampler.

Field Parameters *(Continued)*

Lab Number	*Station Name*	*Sample Date*	*Sample Time*	*pH*	*DO (mg/L)*	*EC (µS/cm)*	*Water Temp (°C)*	*Turb (NTU)*
D70111	BARKERNOBAY	1/7/97	1:15 PM	6.9	6.8	122	9.0	151.4
D70117	BARKERNOBAY	1/15/97	2:15 PM	6.9	8.0	219	5.6	110.6
D70120	BARKERNOBAY	1/22/97	8:00 AM	7.2	6.8	300	9.7	117.5
D70125	BARKERNOBAY	1/29/97	2:25 PM	7.2	4.6	126	13.3	185.3
D70208	BARKERNOBAY	2/5/97	8:20 AM	6.9	2.7	154	11.9	83.3
D70209	BARKERNOBAY	2/10/97	1:30 PM	7.2	4.2	230	11.6	85.6
D70218	BARKERNOBAY	2/19/97	2:30 PM	7.3	6.8	327	13.2	80.6
D70224	BARKERNOBAY	2/26/97	11:15 AM	7.4		345	11.8	94.7
D70300	BARKERNOBAY	3/5/97	12:15 PM	7.5	7.5	340	11.7	112.3
D70315	BARKERNOBAY	3/12/97	1:40 PM	7.4	6.9	309	14.1	108.9
D70322	BARKERNOBAY	3/19/97	1:15 PM	7.6	7.1	345	15.4	89.7
D70335	BARKERNOBAY	3/26/97	7:25 AM	7.6	7.1	399	17.4	58.7
D70400	BARKERNOBAY	4/2/97	1:50 PM	7.8	9.4	429	13.7	80.0
D70411	BARKERNOBAY	4/8/97	1:35 PM	7.8	8.0	458	15.2	44.1
D70416	BARKERNOBAY	4/16/97	11:10 AM	7.7	8.1	518	18.1	36.5
D70425	BARKERNOBAY	4/23/97	11:30 AM	7.7		521	18.1	50.5
D70426	BARKERNOBAY	4/28/97	12:30 PM	7.9	7.5	480		
D70508	BARKERNOBAY	5/7/97	10:30 AM	7.7	6.5	414		
D70516	BARKERNOBAY	5/14/97	7:15 AM	7.8	7.1	390		63.3
D70528	BARKERNOBAY	5/21/97	2:45 PM	7.6	6.7	379		89.5
D70543	BARKERNOBAY	5/27/97	2:30 PM	7.6	5.7	404		63.7
D70608	BARKERNOBAY	6/4/97	6:45 AM	7.6	5.3	378		75.0
D70609	BARKERNOBAY	6/11/97	7:20 AM	5.4	6.7	366		81.9
D70626	BARKERNOBAY	6/18/97	12:00 PM					67.9
D70636	BARKERNOBAY	6/25/97	1:45 PM	7.5	5.7	319		70.1
D70708	BARKERNOBAY	7/2/97	11:00 AM	7.7	6.4	290		
BL5505	CALHOUN	7/1/96	1:53 PM	7.5	6.0	388	27.2	76.0
BL5511	CALHOUN	7/15/96	10:45 AM	7.6	7.4	341	20.6	104.0
BL5518	CALHOUN	7/22/96	12:20 PM	7.7	7.3	348	25.0	77.0

"D" lab numbers represent samples obtained from DWR Division of Operations and Maintenance.

Field turbidity readings for these samples are daily averages collected by BSPP's autosampler.

Field Parameters *(Continued)*

Lab Number	*Station Name*	*Sample Date*	*Sample Time*	*pH*	*DO (mg/L)*	*EC (µS/cm)*	*Water Temp (°C)*	*Turb (NTU)*
BL5533	CALHOUN	7/29/96	11:30 AM	7.5	3.8	345	28.4	87.0
C961796	CALHOUN	8/5/96	11:47 AM	7.8	8.1	299	21.5	84.5
BL5540	CALHOUN	8/12/96	11:25 AM	7.3	7.1	308	25.6	74.3
BL5547	CALHOUN	8/19/96	10:35 AM	7.8	8.4	271	20.2	78.3
BL5554	CALHOUN	8/26/96	12:15 PM	7.9	8.3	315	20.1	79.9
C961954	CALHOUN	9/9/96	12:40 PM	7.7	7.1	318	23.2	80.6
C961961	CALHOUN	9/16/96	9:30 AM	7.7	7.6	270	18.3	76.0
C961968	CALHOUN	9/23/96	10:05 AM	7.6	9.3	308	18.5	83.0
C961975	CALHOUN	9/30/96	9:40 AM	7.8	8.0	283	18.1	63.4
C962042	CALHOUN	10/7/96	10:15 AM	7.4	6.6	345	20.9	83.0
C962049	CALHOUN	10/21/96	9:25 AM	7.5	9.8	345	11.4	45.2
C962056	CALHOUN	10/28/96	10:00 AM	7.9	10.0	320	12.3	37.1
C962209	CALHOUN	10/30/96	10:29 AM	8.3	8.9	311	12.9	35.1
C962138	CALHOUN	11/4/96	9:10 AM	7.6	9.0	352	12.8	32.0
C962174	CALHOUN	11/18/96	10:15 AM	7.1	7.3	314	14.8	35.5
C962180	CALHOUN	11/25/96	11:15 AM	7.8	7.9	486	14.5	40.0
C962251	CALHOUN	12/2/96	9:40 AM	7.7	10.4	426	9.9	26.5
C962257	CALHOUN	12/9/96	11:20 AM	7.5	9.1	446	12.7	34.9
C962263	CALHOUN	12/16/96	11:20 AM	7.0	10.7	478	10.2	27.0
C962269	CALHOUN	12/30/96	10:30 AM	6.2	9.9	204	12.0	104.0
C962390	CALHOUN	1/6/97	10:25 AM	6.7	8.3	103	10.2	94.0
C962433	CALHOUN	1/13/97	11:20 AM	6.2	8.7	130	6.5	81.0
C962466	CALHOUN	1/27/97	12:00 PM	6.3	7.7	67	14.3	111.0
C970023	CALHOUN	2/3/97	12:05 PM	6.7	4.5	125	12.8	111.0
C970052	CALHOUN	2/10/97	10:55 AM	7.0	12.1	203	12.2	87.0
C970058	CALHOUN	2/24/97	10:35 AM	7.1	9.4	335	11.2	63.9
C970115	CALHOUN	3/3/97	10:00 AM	7.6	9.4	339	11.7	83.6
C970147	CALHOUN	3/10/97	10:05 AM	7.3	7.8	351	14.6	80.1
C970184	CALHOUN	3/17/97	10:17 AM	7.3	8.2	355	15.1	93.1

Field Parameters *(Continued)*

Lab Number	*Station Name*	*Sample Date*	*Sample Time*	*pH*	*DO (mg/L)*	*EC (µS/cm)*	*Water Temp (°C)*	*Turb (NTU)*
C970198	CALHOUN	3/24/97	10:40 AM	7.2	7.8	403	17.8	98.3
C970204	CALHOUN	3/31/97	11:30 AM	6.4	8.7	340	15.6	69.7
C970237	CALHOUN	4/7/97	9:45 AM	7.8	9.3	226	14.1	51.5
C970266	CALHOUN	4/14/97	9:40 AM	8.2	8.6	547	17.0	57.7
C970278	CALHOUN	4/21/97	9:16 AM	7.5	8.9	526	19.1	74.3
C970284	CALHOUN	4/28/97	11:02 AM	7.8	8.0	439	17.0	84.1
C970316	CALHOUN	5/5/97	9:40 AM	7.6	8.3	477	17.7	104.0
C970339	CALHOUN	5/12/97	8:50 AM	7.6	7.7	427	19.8	102.0
C970368	CALHOUN	5/19/97	9:20 AM	7.9	7.0	416	22.2	75.6
C970385	CALHOUN	5/27/97	12:45 PM	7.0	7.2	406	23.4	149.0
C970425	CALHOUN	6/2/97	9:17 AM	7.2	7.1	406	21.4	164.0
C970491	CALHOUN	6/9/97	9:00 AM	6.9	5.1	361	20.2	121.0
C970501	CALHOUN	6/16/97	9:14 AM	7.4	7.9	393	24.0	136.0
C970515	CALHOUN	6/23/97	9:00 AM	7.6	7.3	346	21.4	
C970527	CALHOUN	6/30/97	9:33 AM	7.3	8.1	378	19.6	134.0
BL5504	COOK	7/1/96	12:33 PM	8.6	5.9	431	24.6	41.0
BL5512	COOK	7/15/96	11:10 AM	8.2	8.0	423	20.3	85.0
BL5519	COOK	7/22/96	12:00 PM	8.7	8.6	418	25.2	50.0
BL5534	COOK	7/29/96	12:00 PM	8.5	5.6	398	27.9	83.0
C961797	COOK	8/5/96	12:11 PM	7.2	8.4	416	21.1	82.8
BL5541	COOK	8/12/96	12:05 PM	7.9	7.9	401	26.4	59.8
BL5548	COOK	8/19/96	10:50 AM	7.8	8.7	395	19.0	67.1
BL5555	COOK	8/26/96	12:45 PM	8.1	8.4	383	20.5	63.2
C961955	COOK	9/9/96	1:00 PM	8.1	6.4	389	22.6	
C961962	COOK	9/16/96	9:00 AM	6.9	8.2	383	16.2	106.0
C961969	COOK	9/23/96	8:57 AM	7.3	7.3	384	18.7	121.0
C961976	COOK	9/30/96	8:37 AM	7.9	8.5	386	16.5	68.6
C962043	COOK	10/7/96	9:00 AM	7.6	6.3	386	19.9	56.0
C962050	COOK	10/21/96	9:00 AM	7.7	8.7	402	12.3	87.5

Field Parameters *(Continued)*

Lab Number	*Station Name*	*Sample Date*	*Sample Time*	*pH*	*DO (mg/L)*	*EC (µS/cm)*	*Water Temp (ºC)*	*Turb (NTU)*
C962057	COOK	10/28/96	9:25 AM	7.3	8.4	398	12.9	86.1
C962210	COOK	10/30/96	9:40 AM	7.4	7.7	411	12.5	69.7
C962139	COOK	11/4/96	8:50 AM	7.9	8.1	404	13.0	57.0
C962175	COOK	11/18/96	9:50 AM	7.4	7.9	405	15.2	59.9
C962181	COOK	11/25/96	10:55 AM	7.4	8.2	396	13.8	48.3
C962252	COOK	12/2/96	9:20 AM	8.0	9.9	387	10.7	54.3
C962258	COOK	12/9/96	10:51 AM	7.6	9.0	371	13.0	44.5
C962264	COOK	12/16/96	10:45 AM	6.5	12.9	242	10.3	251.0
C962270	COOK	12/30/96	9:55 AM	5.7	11.5	126	12.7	317.0
C962391	COOK	1/6/97	10:00 AM	6.9	11.3	157	7.8	165.0
C962434	COOK	1/13/97	11:00 AM	6.6	12.6	292	5.7	208.0
C962467	COOK	1/27/97	11:10 AM	7.2	8.8	79	13.9	242.0
C970024	COOK	2/3/97	10:40 AM	7.5	9.2	256	11.6	242.0
C970053	COOK	2/10/97	10:30 AM	7.9	9.4	507	12.4	106.0
C970059	COOK	2/24/97	10:10 AM	8.5	10.2	748	12.5	50.0
C970116	COOK	3/3/97	9:30 AM	8.3	8.2	831	11.6	38.3
C970148	COOK	3/10/97	9:25 AM	7.9	6.7	930	13.8	26.0
C970185	COOK	3/17/97	9:57 AM	6.8	6.7	982	14.1	33.5
C970199	COOK	3/24/97	10:15 AM	7.1	6.0	1040	17.0	50.4
C970205	COOK	3/31/97	10:45 AM	6.6	7.7	857	17.9	35.2
C970238	COOK	4/7/97	9:22 AM	7.5	7.9	575	13.8	35.2
C970267	COOK	4/14/97	9:05 AM	8.1	8.7	1044	16.2	28.0
C970279	COOK	4/21/97	8:50 AM	7.5	6.8	802	18.5	30.6
C970285	COOK	4/28/97	10:28 AM	8.1	7.2	580	16.6	48.2
C970317	COOK	5/5/97	9:03 AM	8.1	9.7	555	18.0	96.1
C970340	COOK	5/12/97	8:30 AM	7.9	8.0	517	18.8	79.2
C970369	COOK	5/19/97	8:20 AM	8.3	6.6	450	22.5	45.8
C970386	COOK	5/27/97	1:06 PM	7.6	8.0	352	23.8	53.5
C970426	COOK	6/2/97	8:49 AM	7.3	7.9	383	21.2	78.2

Field Parameters *(Continued)*

Lab Number	*Station Name*	*Sample Date*	*Sample Time*	*pH*	*DO (mg/L)*	*EC (µS/cm)*	*Water Temp (°C)*	*Turb (NTU)*
C970492	COOK	6/9/97	8:30 AM	7.1	8.0	378	19.1	83.8
C970500	COOK	6/16/97	8:15 AM	6.8	8.6	383	19.8	78.2
C970514	COOK	6/23/97	8:20 AM	7.1	8.1	383	20.3	
C970526	COOK	6/30/97	8:58 AM	7.8	8.0	393	18.7	71.5
BL5638	FREMONT	12/16/96	12:30 PM	6.9	10.2	127	15.2	35.2
BL5506	LINDSEY	7/1/96	2:45 PM	7.5	7.2	214	25.4	68.0
BL5513	LINDSEY	7/15/96	9:25 AM	7.6	7.4	214	21.6	84.1
BL5520	LINDSEY	7/22/96	10:19 AM	7.6	8.5	172	23.7	63.0
BL5535	LINDSEY	7/29/96	10:40 AM	7.6	7.6	185	25.6	89.0
C961798	LINDSEY	8/5/96	10:30 AM	7.6	8.0	168	22.4	69.2
BL5542	LINDSEY	8/12/96	10:00 AM	7.6	7.9	175	25.2	58.2
BL5549	LINDSEY	8/19/96	9:20 AM	7.4	8.6	158	21.3	59.6
BL5556	LINDSEY	8/26/96	10:30 AM	8.0	8.4	190	21.3	68.5
C961956	LINDSEY	9/9/96	11:15 AM	7.8	8.0	222	21.8	49.9
C961963	LINDSEY	9/16/96	11:04 AM	7.9	8.4	216	19.5	79.7
C961970	LINDSEY	9/23/96	11:42 AM	7.3	9.9	220	21.3	41.0
C961977	LINDSEY	9/30/96	11:00 AM	7.8	8.5	240	18.9	57.8
C962044	LINDSEY	10/7/96	12:00 PM	7.7	7.9	221	22.5	25.1
C962051	LINDSEY	10/21/96	10:20 AM	7.3	9.3	196	15.8	40.4
C962058	LINDSEY	10/28/96	10:40 AM	7.6	9.8	229	13.8	49.1
C962211	LINDSEY	10/30/96	11:21 AM	8.3	9.6	228	13.6	49.1
C962140	LINDSEY	11/4/96	10:00 AM	7.7	9.5	252	13.7	23.0
C962176	LINDSEY	11/18/96	10:55 AM	7.3	7.6	282	14.8	24.7
C962182	LINDSEY	11/25/96	11:50 AM	7.6	8.8	392	21.6	32.7
C962253	LINDSEY	12/2/96	10:20 AM	7.7	10.6	314	11.7	22.9
C962259	LINDSEY	12/9/96	12:00 PM	7.7	10.1	237	12.6	27.6
C962265	LINDSEY	12/16/96	12:00 PM	8.0	12.0	248	11.6	94.0
C962271	LINDSEY	12/30/96	11:10 AM	7.1	12.2	343	11.9	153.0
C962392	LINDSEY	1/6/97	11:00 AM	7.2	9.1	246	11.6	121.0

Field Parameters *(Continued)*

Lab Number	*Station Name*	*Sample Date*	*Sample Time*	*pH*	*DO (mg/L)*	*EC (μS/cm)*	*Water Temp (°C)*	*Turb (NTU)*
C962435	LINDSEY	1/13/97	11:50 AM	6.4	11.1	255	7.6	172.0
C962468	LINDSEY	1/27/97	12:50 PM	6.2	8.7	137	12.0	249.0
C970025	LINDSEY	2/3/97	12:40 PM	7.6	9.0	290	12.4	159.0
C970054	LINDSEY	2/10/97	11:50 AM	7.6	8.8	279	13.2	92.0
C970060	LINDSEY	2/24/97	11:10 AM	7.5	10.5	418	11.7	82.4
C970117	LINDSEY	3/3/97	10:40 AM	8.2	10.5	373	11.9	67.6
C970149	LINDSEY	3/10/97	10:55 AM	8.0	9.8	413	14.5	60.5
C970186	LINDSEY	3/17/97	11:09 AM	7.6	9.7	305	15.5	54.5
C970200	LINDSEY	3/24/97	11:10 AM	8.0	9.1	406	17.5	54.0
C970206	LINDSEY	3/31/97	12:45 PM	6.6	9.4	156	16.5	69.7
C970239	LINDSEY	4/7/97	10:40 AM	7.8	9.9	409	14.9	58.4
C970268	LINDSEY	4/14/97	10:25 AM	8.1	9.5	356	17.3	53.4
C970280	LINDSEY	4/21/97	10:04 AM	7.7	9.3	375	19.6	114.0
C970286	LINDSEY	4/28/97	12:14 PM	7.9	8.5	340	17.6	117.0
C970318	LINDSEY	5/5/97	10:38 AM	7.5	8.7	305	19.6	152.0
C970341	LINDSEY	5/12/97	9:40 AM	7.2	8.5	2470	20.2	130.0
C970370	LINDSEY	5/19/97	10:39 AM	7.9	7.4	262	22.7	88.8
C970387	LINDSEY	5/27/97	10:26 AM	7.2	7.5	270	21.6	91.9
C970427	LINDSEY	6/2/97	10:12 AM	7.1	7.4	280	23.9	73.5
C970493	LINDSEY	6/9/97	10:30 AM	6.8	7.6	260	21.6	78.4
C970502	LINDSEY	6/16/97	10:02 AM	7.3	8.1	240	22.2	91.0
C970516	LINDSEY	6/23/97	9:50 AM	7.8	8.5	217	22.2	
C970528	LINDSEY	6/30/97	10:32 AM	7.5	8.3	191	20.7	91.0
BL5639	SHAG	12/16/96	11:30 AM	6.9	8.5	193	9.7	45.5

Appendix C

Minor Elements Results (mg/L)

Lab Number	*Station Name*	*Sample Date*	*Sample Time*	*Dissolved Aluminum*	*Total Aluminum*	*Dissolved Iron*	*Total Iron*	*Dissolved Manganese*	*Total Manganese*
BL5503	BARKERNOBAY	7/1/96	1:11 PM	0.036		0.033		0.027	
BL5510	BARKERNOBAY	7/15/96	10:15 AM	0.05		0.044		0.014	
BL5517	BARKERNOBAY	7/22/96	11:30 AM	0.029		0.056		0.031	
BL5532	BARKERNOBAY	7/29/96	11:00 AM	0.088		0.086		0.017	
C961795	BARKERNOBAY	8/5/96	11:14 AM	0.016		0.019		0.016	
BL5539	BARKERNOBAY	8/12/96	11:00 AM	0.069		0.135		0.018	
BL5546	BARKERNOBAY	8/19/96	10:13 AM	0.067		0.078		0.016	
BL5553	BARKERNOBAY	8/26/96	11:45 AM	0.065		0.166		0.029	
C961953	BARKERNOBAY	9/9/96	12:20 PM	0.05		0.108		0.021	
C961960	BARKERNOBAY	9/16/96	10:26 AM	0.078		0.147		0.017	
C961967	BARKERNOBAY	9/23/96	9:15 AM	0.055		0.118		0.026	
C961974	BARKERNOBAY	9/30/96	9:20 AM	0.041		0.096		0.017	
D61000	BARKERNOBAY	10/2/96	8:45 AM	< 0.01		0.012		0.014	
C962041	BARKERNOBAY	10/7/96	9:45 AM	0.108		0.077		0.024	
D61001	BARKERNOBAY	10/9/96	12:00 PM	< 0.01		0.005		0.014	
D61006	BARKERNOBAY	10/16/96	1:55 PM	< 0.01		0.006		0.022	
D61015	BARKERNOBAY	10/23/96	11:00 AM	< 0.01		< 0.005		0.012	
D61022	BARKERNOBAY	10/30/96	2:45 PM	< 0.01		0.01		0.024	
D61100	BARKERNOBAY	11/5/96	11:15 AM	< 0.01		0.009		0.023	
D61105	BARKERNOBAY	11/13/96	1:45 PM	< 0.01		< 0.005		0.015	
D61117	BARKERNOBAY	11/20/96	2:50 PM	< 0.01		0.021		0.022	
D61123	BARKERNOBAY	11/25/96	2:30 PM	< 0.01		0.026		0.032	
D61200	BARKERNOBAY	12/4/96	11:30 AM	< 0.01		0.015		0.024	
D61201	BARKERNOBAY	12/9/96	3:00 PM	< 0.01		0.021		0.025	
D61220	BARKERNOBAY	12/18/96	2:00 PM	< 0.01		0.066		0.023	
D61221	BARKERNOBAY	12/23/96	11:30 AM	0.438		0.517		0.358	

"D" lab numbers represent samples obtained from DWR Division of Operations and Maintenance.

Minor Elements Results (mg/L) *(Continued)*

Lab Number	Station Name	Sample Date	Sample Time	Dissolved Aluminum	Total Aluminum	Dissolved Iron	Total Iron	Dissolved Manganese	Total Manganese
D61222	BARKERNOBAY	12/30/96	1:30 PM	< 0.01		0.088		< 0.005	
D70111	BARKERNOBAY	1/7/97	1:15 PM	0.011		0.095		0.034	
D70117	BARKERNOBAY	1/15/97	2:15 PM	0.015		0.155		0.025	
D70120	BARKERNOBAY	1/22/97	8:00 AM	0.011		0.126		0.024	
D70125	BARKERNOBAY	1/29/97	2:25 PM	0.022		0.108		0.008	
D70208	BARKERNOBAY	2/5/97	8:20 AM	0.01		0.107		0.035	
D70209	BARKERNOBAY	2/10/97	1:30 PM	< 0.01		0.105		0.06	
D70218	BARKERNOBAY	2/19/97	2:30 PM	< 0.01		0.087		0.075	
D70224	BARKERNOBAY	2/26/97	11:15 AM	< 0.01		0.064		0.042	
D70300	BARKERNOBAY	3/5/97	12:15 PM	< 0.01		0.062		0.044	
D70315	BARKERNOBAY	3/12/97	1:40 PM	< 0.01		0.042		0.039	
D70322	BARKERNOBAY	3/19/97	1:15 PM	< 0.01		0.012		0.033	
D70335	BARKERNOBAY	3/26/97	7:25 AM	< 0.01		0.016		0.031	
D70400	BARKERNOBAY	4/2/97	1:50 PM	< 0.01		0.008		0.043	
D70411	BARKERNOBAY	4/8/97	1:35 PM	0.01	1.86	0.008	1.93	0.019	0.078
D70416	BARKERNOBAY	4/16/97	11:10 AM	< 0.01		< 0.005		0.015	
D70425	BARKERNOBAY	4/23/97	11:30 AM	< 0.01	3	< 0.005	2.73	0.017	0.104
D70426	BARKERNOBAY	4/28/97	12:30 PM	< 0.01	2.67	< 0.005	2.38	0.114	0.064
D70508	BARKERNOBAY	5/7/97	10:30 AM	< 0.01	1.88	< 0.005	1.98	0.008	0.056
D70516	BARKERNOBAY	5/14/97	7:15 AM	< 0.01	3.39	< 0.005	3.28	0.016	0.082
D70528	BARKERNOBAY	5/21/97	2:45 PM	< 0.01	2.17	< 0.005	2.41	< 0.005	0.064
D70543	BARKERNOBAY	5/27/97	2:30 PM	< 0.01	1.95	0.006	2.73	0.02	0.091
D70608	BARKERNOBAY	6/4/97	6:45 AM	< 0.01	2.15	0.027	2.83	0.008	0.081
D70609	BARKERNOBAY	6/11/97	7:20 AM	< 0.01	2.77	0.026	3.51	0.008	0.089
D70626	BARKERNOBAY	6/18/97	12:00 PM	< 0.01	3.22	< 0.005	3.65	0.013	0.081
D70636	BARKERNOBAY	6/25/97	1:45 PM	< 0.01	2.55	< 0.005	3.04	0.01	0.071
D70708	BARKERNOBAY	7/2/97	11:00 AM	< 0.01	3.27	< 0.005	4.44	0.022	0.104

"D" lab numbers represent samples obtained from DWR Division of Operations and Maintenance.

Minor Elements Results (mg/L) *(Continued)*

Lab Number	*Station Name*	*Sample Date*	*Sample Time*	*Dissolved Aluminum*	*Total Aluminum*	*Dissolved Iron*	*Total Iron*	*Dissolved Manganese*	*Total Manganese*
BL5505	CALHOUN	7/1/96	1:53 PM	0.03		0.018		0.036	
BL5511	CALHOUN	7/15/96	10:45 AM	0.162		0.128		0.018	
BL5518	CALHOUN	7/22/96	12:20 PM	0.039		0.085		0.006	
BL5533	CALHOUN	7/29/96	11:30 AM	0.142		0.125		0.032	
C961796	CALHOUN	8/5/96	11:47 AM	0.126		0.066		0.022	
BL5540	CALHOUN	8/12/96	11:25 AM	0.045		0.05		0.039	
BL5547	CALHOUN	8/19/96	10:35 AM	0.172		0.134		0.016	
BL5554	CALHOUN	8/26/96	12:15 PM	0.081		0.128		0.029	
C961954	CALHOUN	9/9/96	12:40 PM	0.258		0.176		0.045	
C961961	CALHOUN	9/16/96	9:30 AM	0.095		0.149		0.024	
C961968	CALHOUN	9/23/96	10:05 AM	0.105		0.151		0.034	
C961975	CALHOUN	9/30/96	9:40 AM	0.092		0.134		0.022	
C962042	CALHOUN	10/7/96	10:15 AM	0.151		0.108		0.044	
C962049	CALHOUN	10/21/96	9:25 AM	0.227		0.109		0.022	
C962056	CALHOUN	10/28/96	10:00 AM	0.145		0.092		0.012	
C962209	CALHOUN	10/30/96	10:29 AM	0.094		0.067		0.013	
C962138	CALHOUN	11/4/96	9:10 AM	0.17		0.13		0.022	
C962174	CALHOUN	11/18/96	10:15 AM	0.152		0.081		0.016	
C962180	CALHOUN	11/25/96	11:15 AM	0.169		0.13		0.028	
C962251	CALHOUN	12/2/96	9:40 AM	0.113		0.091		0.023	
C962257	CALHOUN	12/9/96	11:20 AM	0.129		0.103		0.023	
C962263	CALHOUN	12/16/96	11:20 AM	0.273		0.224		0.018	
C962269	CALHOUN	12/30/96	10:30 AM	0.621		0.695		0.023	
C962390	CALHOUN	1/6/97	10:25 AM	0.269		0.24		0.006	
C962433	CALHOUN	1/13/97	11:20 AM	0.582		1.16		0.032	
C962466	CALHOUN	1/27/97	12:00 PM	0.577		0.718		0.013	
C970023	CALHOUN	2/3/97	12:05 PM	0.04		0.175		0.05	

Minor Elements Results (mg/L) *(Continued)*

Lab Number	*Station Name*	*Sample Date*	*Sample Time*	*Dissolved Aluminum*	*Total Aluminum*	*Dissolved Iron*	*Total Iron*	*Dissolved Manganese*	*Total Manganese*
C970052	CALHOUN	2/10/97	10:55 AM	0.011		0.116		0.066	
C970058	CALHOUN	2/24/97	10:35 AM	0.185		0.387		0.04	
C970115	CALHOUN	3/3/97	10:00 AM	0.15		0.463		0.034	
C970147	CALHOUN	3/10/97	10:05 AM	0.168		0.256		0.04	
C970184	CALHOUN	3/17/97	10:17 AM	0.22		0.326		0.029	
C970198	CALHOUN	3/24/97	10:40 AM	0.021		0.322		0.038	
C970204	CALHOUN	3/31/97	11:30 AM	0.077		0.22		0.032	
C970237	CALHOUN	4/7/97	9:45 AM	0.108	1.68	0.118	2.19	0.02	0.066
C970266	CALHOUN	4/14/97	9:40 AM	0.046	2.7	0.064	2.5	0.024	0.079
C970278	CALHOUN	4/21/97	9:16 AM	0.026	2.96	0.034	3.07	0.025	0.099
C970284	CALHOUN	4/28/97	11:02 AM	0.03	3.72	< 0.005	3.66	0.019	0.116
C970316	CALHOUN	5/5/97	9:40 AM	0.085	2.73	< 0.005	3.72	0.021	0.118
C970339	CALHOUN	5/12/97	8:50 AM	0.037	5.1	0.032	4.77	0.017	0.113
C970368	CALHOUN	5/19/97	9:20 AM	0.05	2.17	0.057	2.96	0.015	0.068
C970385	CALHOUN	5/27/97	12:45 PM	0.054	4.05	0.048	5.29	0.022	0.128
C970425	CALHOUN	6/2/97	9:17 AM	0.033	4.1	0.023	5.72	0.021	0.14
C970491	CALHOUN	6/9/97	9:00 AM	0.03	3.48	0.024	4.68	0.008	0.121
C970501	CALHOUN	6/16/97	9:14 AM	0.048	4.51	0.034	5.61	0.012	0.147
C970515	CALHOUN	6/23/97	9:00 AM	0.021	2.99	0.006	4.09	0.009	0.11
C970527	CALHOUN	6/30/97	9:33 AM	0.072	3.28	0.071	4.71	0.022	0.13
BL5504	COOK	7/1/96	12:33 PM	< 0.01		0.008		0.012	
BL5512	COOK	7/15/96	11:10 AM	0.048		0.052		0.007	
BL5519	COOK	7/22/96	12:00 PM	0.019		0.038		0.008	
BL5534	COOK	7/29/96	12:00 PM	0.058		0.039		< 0.005	
C961797	COOK	8/5/96	12:11 PM	0.086		0.054		0.018	
BL5541	COOK	8/12/96	12:05 PM	0.045		0.051		0.031	
BL5548	COOK	8/19/96	10:50 AM	0.044		0.055		0.033	

Minor Elements Results (mg/L) *(Continued)*

Lab Number	Station Name	Sample Date	Sample Time	Dissolved Aluminum	Total Aluminum	Dissolved Iron	Total Iron	Dissolved Manganese	Total Manganese
BL5555	COOK	8/26/96	12:45 PM	0.058		0.075		0.062	
C961955	COOK	9/9/96	1:00 PM	0.026		0.066		0.033	
C961962	COOK	9/16/96	9:00 AM	0.109		0.079		0.022	
C961969	COOK	9/23/96	8:57 AM	0.036		0.085		0.041	
C961976	COOK	9/30/96	8:37 AM	0.027		0.079		0.022	
C962043	COOK	10/7/96	9:00 AM	0.044		0.037		0.11	
C962050	COOK	10/21/96	9:00 AM	0.026		0.03		0.022	
C962057	COOK	10/28/96	9:25 AM	0.042		0.03		0.021	
C962210	COOK	10/30/96	9:40 AM	0.043		0.041		0.037	
C962139	COOK	11/4/96	8:50 AM	0.046		0.028		0.03	
C962175	COOK	11/18/96	9:50 AM	0.103		0.083		0.023	
C962181	COOK	11/25/96	10:55 AM	0.018		0.016		0.025	
C962252	COOK	12/2/96	9:20 AM	0.029		0.027		0.032	
C962258	COOK	12/9/96	10:51 AM	0.039		0.049		0.028	
C962264	COOK	12/16/96	10:45 AM	0.33		0.806		0.01	
C962270	COOK	12/30/96	9:55 AM	0.729		0.727		0.022	
C962391	COOK	1/6/97	10:00 AM	0.238		0.211		0.009	
C962434	COOK	1/13/97	11:00 AM	0.363		0.482		0.015	
C962467	COOK	1/27/97	11:10 AM	0.012		0.059		0.008	
C970024	COOK	2/3/97	10:40 AM	0.277		0.383		0.015	
C970053	COOK	2/10/97	10:30 AM	< 0.01		0.025		0.018	
C970059	COOK	2/24/97	10:10 AM	0.019		0.019		0.011	
C970116	COOK	3/3/97	9:30 AM	< 0.01		0.006		0.027	
C970148	COOK	3/10/97	9:25 AM	0.011		0.012		0.104	
C970185	COOK	3/17/97	9:57 AM	0.012		0.012		0.17	
C970199	COOK	3/24/97	10:15 AM	< 0.01		0.006		0.201	
C970205	COOK	3/31/97	10:45 AM	< 0.01		< 0.005		0.118	

Minor Elements Results (mg/L) *(Continued)*

Lab Number	*Station Name*	*Sample Date*	*Sample Time*	*Dissolved Aluminum*	*Total Aluminum*	*Dissolved Iron*	*Total Iron*	*Dissolved Manganese*	*Total Manganese*
C970238	COOK	4/7/97	9:22 AM	< 0.01	1.65	< 0.005	1.58	0.034	0.239
C970267	COOK	4/14/97	9:05 AM	< 0.01	0.829	< 0.005	0.976	0.041	0.195
C970279	COOK	4/21/97	8:50 AM	< 0.01	1.31	0.006	1.32	0.125	0.265
C970285	COOK	4/28/97	10:28 AM	< 0.01	2.21	0.018	2.17	0.038	0.213
C970317	COOK	5/5/97	9:03 AM	< 0.01	4.13	0.162	3.72	< 0.005	0.248
C970340	COOK	5/12/97	8:30 AM	0.011	2.61	0.011	3.16	0.01	0.182
C970369	COOK	5/19/97	8:20 AM	0.014	1.11	0.016	1.45	0.015	0.112
C970386	COOK	5/27/97	1:06 PM	0.022	1.36	0.028	1.85	0.007	0.097
C970426	COOK	6/2/97	8:49 AM	0.019	1.78	0.011	2.32	0.007	0.142
C970492	COOK	6/9/97	8:30 AM	0.012	2.21	0.005	3.03	< 0.005	0.143
C970500	COOK	6/16/97	8:15 AM	0.018	1.97	0.009	2.87	< 0.005	0.173
C970514	COOK	6/23/97	8:20 AM	0.016	2.09	0.005	2.76	0.006	0.172
C970526	COOK	6/30/97	8:58 AM	0.018	1.89	0.013	2.54	< 0.005	0.172
BL5506	LINDSEY	7/1/96	2:45 PM	0.02		0.016		0.013	
BL5513	LINDSEY	7/15/96	9:25 AM	0.104		0.093		0.006	
BL5520	LINDSEY	7/22/96	10:19 AM	0.034		0.058		0.041	
BL5535	LINDSEY	7/29/96	10:40 AM	0.043		0.059		0.007	
C961798	LINDSEY	8/5/96	10:30 AM	0.099		0.061		0.009	
BL5542	LINDSEY	8/12/96	10:00 AM	0.057		0.096		0.006	
BL5549	LINDSEY	8/19/96	9:20 AM	0.033		0.085		0.009	
BL5556	LINDSEY	8/26/96	10:30 AM	0.044		0.07		0.006	
C961956	LINDSEY	9/9/96	11:15 AM	0.051		0.104		0.011	
C961963	LINDSEY	9/16/96	11:04 AM	0.054		0.099		0.007	
C961970	LINDSEY	9/23/96	11:42 AM	0.027		0.074		0.005	
C961977	LINDSEY	9/30/96	11:00 AM	0.031		0.062		0.006	
C962044	LINDSEY	10/7/96	12:00 PM	0.05		0.033		< 0.005	
C962051	LINDSEY	10/21/96	10:20 AM	0.086		0.052		< 0.005	

Minor Elements Results (mg/L) *(Continued)*

Lab Number	*Station Name*	*Sample Date*	*Sample Time*	*Dissolved Aluminum*	*Total Aluminum*	*Dissolved Iron*	*Total Iron*	*Dissolved Manganese*	*Total Manganese*
C962058	LINDSEY	10/28/96	10:40 AM	0.066		0.034		< 0.005	
C962211	LINDSEY	10/30/96	11:21 AM	0.074		0.04		< 0.005	
C962140	LINDSEY	11/4/96	10:00 AM	0.068		0.048		< 0.005	
C962176	LINDSEY	11/18/96	10:55 AM	0.081		0.051		< 0.005	
C962182	LINDSEY	11/25/96	11:50 AM	0.027		0.042		0.006	
C962253	LINDSEY	12/2/96	10:20 AM	0.04		0.06		0.006	
C962259	LINDSEY	12/9/96	12:00 PM	0.048		0.063		< 0.005	
C962265	LINDSEY	12/16/96	12:00 PM	0.171		0.136		< 0.005	
C962271	LINDSEY	12/30/96	11:10 AM	0.288		0.181		< 0.005	
C962392	LINDSEY	1/6/97	11:00 AM	< 0.01		0.878		0.311	
C962435	LINDSEY	1/13/97	11:50 AM	0.305		0.345		0.016	
C962468	LINDSEY	1/27/97	12:50 PM	0.59		0.664		0.01	
C970025	LINDSEY	2/3/97	12:40 PM	0.614		0.996		0.006	
C970054	LINDSEY	2/10/97	11:50 AM	< 0.01		0.018		0.022	
C970060	LINDSEY	2/24/97	11:10 AM	0.055		0.112		0.026	
C970117	LINDSEY	3/3/97	10:40 AM	0.055		0.06		< 0.005	
C970149	LINDSEY	3/10/97	10:55 AM	0.045		0.041		0.024	
C970186	LINDSEY	3/17/97	11:09 AM	0.077		0.069		0.008	
C970200	LINDSEY	3/24/97	11:10 AM	0.047		0.054		0.017	
C970206	LINDSEY	3/31/97	12:45 PM	0.022		0.02		0.006	
C970239	LINDSEY	4/7/97	10:40 AM	0.028	2.73	0.028	2.74	< 0.005	0.064
C970268	LINDSEY	4/14/97	10:25 AM	0.051	1.83	0.052	2.05	0.005	0.049
C970280	LINDSEY	4/21/97	10:04 AM	0.024	4.96	0.022	5.03	0.008	0.102
C970286	LINDSEY	4/28/97	12:14 PM	0.025	4.31	0.024	4.52	0.006	0.097
C970318	LINDSEY	5/5/97	10:38 AM	< 0.01	1.86	0.111	2.71	0.01	0.088
C970341	LINDSEY	5/12/97	9:40 AM	0.042	5.26	0.034	6.04	0.01	0.107
C970370	LINDSEY	5/19/97	10:39 AM	0.039	2.43	0.04	3.66	0.006	0.072

Minor Elements Results (mg/L) *(Continued)*

Lab Number	*Station Name*	*Sample Date*	*Sample Time*	*Dissolved Aluminum*	*Total Aluminum*	*Dissolved Iron*	*Total Iron*	*Dissolved Manganese*	*Total Manganese*
C970387	LINDSEY	5/27/97	10:26 AM	0.046	2.15	0.035	3.1	0.011	0.073
C970427	LINDSEY	6/2/97	10:12 AM	0.028	2.29	0.015	2.76	< 0.005	0.059
C970493	LINDSEY	6/9/97	10:30 AM	0.026	2.05	0.011	2.78	0.006	0.064
C970502	LINDSEY	6/16/97	10:02 AM	0.035	2.36	0.022	3.38	0.006	0.08
C970516	LINDSEY	6/23/97	9:50 AM	0.044	2	0.019	2.88	0.005	0.069
C970528	LINDSEY	6/30/97	10:32 AM	0.043	2.35	0.039	3.34	0.008	0.075
BL5639	SHAG	12/16/96	11:30 AM	0.133		0.121		< 0.005	

Appendix C

Trihalomethane Formation Potential Constituents

Lab Number	*Station Name*	*Sample Date*	*Alkalinity (mg/L)*	*Bromide (mg/L)*	*TOC (mg/L)*	*DOC (mg/L)*	*UVA (Abs/cm)*	*$CHBrCl_2$ (µg/L)*	*$CHBr_3$ (µg/L)*	*$CHCl_3$ (µg/L)*	*$CHBr_2Cl$ (µg/L)*	*TTHMFP (µg/L)*
BL5503	BARKERNOBAY	7/1/96	99	0.05		4.6		45	< 10	500	< 10	545
BL5510	BARKERNOBAY	7/15/96	91	0.04		3.6	0.129	36	< 10	410	< 10	446
BL5517	BARKERNOBAY	7/22/96	88	0.04		4	0.139	39	< 10	480	< 10	519
BL5532	BARKERNOBAY	7/29/96	86	0.04		4	0.158	35	< 10	460	< 10	495
C961795	BARKERNOBAY	8/5/96	82	0.03		3.7	0.125	32	< 10	420	< 10	452
BL5539	BARKERNOBAY	8/12/96	79	0.06		3.8	0.132	32	< 10	420	< 10	452
BL5546	BARKERNOBAY	8/19/96	80	0.04		3.6	0.129	27	< 10	390	< 10	417
BL5553	BARKERNOBAY	8/26/96	88	0.06		4.4	0.154	30	< 10	480	< 10	510
C961953	BARKERNOBAY	9/9/96	81	0.03		3.5	0.126	26	< 10	360	< 10	386
C961960	BARKERNOBAY	9/16/96	90	0.04		4	0.144	26	< 10	410	< 10	436
C961967	BARKERNOBAY	9/23/96	94	0.03		3.3	0.119	25	< 10	330	< 10	355
C961974	BARKERNOBAY	9/30/96	100	0.04		4.8	0.136	29	< 10	390	< 10	419
D61000	BARKERNOBAY	10/2/96	105		5.4	4.5	0.137					
C962041	BARKERNOBAY	10/7/96	104	0.04		3.9	0.129	31	< 10	370	< 10	401
D61001	BARKERNOBAY	10/9/96	95		4	3.5	0.106					
D61006	BARKERNOBAY	10/16/96	111	0.04				38	< 10	410	< 10	448
D61015	BARKERNOBAY	10/23/96	102		4.2	3.8	0.115					
D61022	BARKERNOBAY	10/30/96	106		4.8	4	0.12					
D61100	BARKERNOBAY	11/5/96	108		5	4.7	0.128					
D61105	BARKERNOBAY	11/13/96	100		4	3.4	0.093					
D61117	BARKERNOBAY	11/20/96	114	0.05	6.6	5.9	0.156	39	< 10	490	< 10	529
D61123	BARKERNOBAY	11/25/96	110		6.6	5.6	0.157					
D61200	BARKERNOBAY	12/4/96	121		5.6	4.6	0.134					

"D" lab numbers represent samples obtained from DWR Division of Operations and Maintenance.

Trihalomethane Formation Potential Constituents *(Continued)*

Lab Number	Station Name	Sample Date	Alkalinity (mg/L)	Bromide (mg/L)	TOC (mg/L)	DOC (mg/L)	UVA (Abs/cm)	$CHBrCl_2$ (µg/L)	$CHBr_3$ (µg/L)	$CHCl_3$ (µg/L)	$CHBr_2Cl$ (µg/L)	TTHMFP (µg/L)
D61201	BARKERNOBAY	12/9/96	119		6	5.5	0.159					
D61220	BARKERNOBAY	12/18/96	110	0.05	11	10	0.309	45	< 10	820	< 10	865
D61221	BARKERNOBAY	12/23/96	37		18.4	12.2	0.414					
D61222	BARKERNOBAY	12/30/96	51		19.9	13.1	0.448					
D70111	BARKERNOBAY	1/7/97	48		14.3	11.7	0.426					
D70117	BARKERNOBAY	1/15/97	68	0.01	14.8	11.9	0.454	28	< 10	1400	< 10	1428
D70120	BARKERNOBAY	1/22/97	78		14.1	12.2	0.44					
D70125	BARKERNOBAY	1/29/97	49		11.8	8.1	0.284					
D70208	BARKERNOBAY	2/5/97	58		12	8.8	0.321					
D70209	BARKERNOBAY	2/10/97	72		12.1	9.4	0.355					
D70218	BARKERNOBAY	2/19/97	88	0.05	12.1	9.8	0.358	59	< 10	1100	< 10	1159
D70224	BARKERNOBAY	2/26/97	88		12	10.1	0.335					
D70300	BARKERNOBAY	3/5/97	87		10.8	9.3	0.302					
D70315	BARKERNOBAY	3/12/97	90		8.9	7.3	0.254					
D70322	BARKERNOBAY	3/19/97	102	0.05	7.9	6.3	0.22	55	< 10	800	< 10	855
D70335	BARKERNOBAY	3/26/97	114		7.2	6.7	0.205					
D70400	BARKERNOBAY	4/2/97			7.2	5.8						
D70411	BARKERNOBAY	4/8/97	139		6.2	5.8	0.179					
D70416	BARKERNOBAY	4/16/97	152	0.08	6.1	5.6	0.164	68	< 10	640	< 10	708
D70425	BARKERNOBAY	4/23/97	149		5.6	5.6	0.15					
D70426	BARKERNOBAY	4/28/97	152		4.4	4	0.117					
D70508	BARKERNOBAY	5/7/97	138		4.1	3.6	0.106					
D70516	BARKERNOBAY	5/14/97	129		5.9	4.2	0.12					
D70528	BARKERNOBAY	5/21/97	120	0.06	4.7	3.9		47	< 10	480	< 10	527
D70543	BARKERNOBAY	5/27/97	138		5.9	5.1	0.156					

"D" lab numbers represent samples obtained from DWR Division of Operations and Maintenance.

Trihalomethane Formation Potential Constituents *(Continued)*

Lab Number	Station Name	Sample Date	Alkalinity (mg/L)	Bromide (mg/L)	TOC (mg/L)	DOC (mg/L)	UVA (Abs/cm)	$CHBrCl_2$ (μg/L)	$CHBr_3$ (μg/L)	$CHCl_3$ (μg/L)	$CHBr_2Cl$ (μg/L)	TTHMFP (μg/L)
D70608	BARKERNOBAY	6/4/97	127		5.6	4.8	0.144					
D70609	BARKERNOBAY	6/11/97	115		5.3	4.3	0.094					
D70626	BARKERNOBAY	6/18/97	101	0.05	4	3.7	0.105	54	< 10	500	< 10	554
D70636	BARKERNOBAY	6/25/97	109		4.4	3.7	0.117					
D70708	BARKERNOBAY	7/2/97	96		4.5	3.4	0.106					
BL5505	CALHOUN	7/1/96	118	0.05		5.3		52	< 10	580	< 10	632
BL5511	CALHOUN	7/15/96	109	0.05		4.9	0.182	48	< 10	580	< 10	628
BL5518	CALHOUN	7/22/96	114	0.06		4.5	0.164	48	< 10	560	< 10	608
BL5533	CALHOUN	7/29/96	116	0.05		4.7	0.2	47	< 10	590	< 10	637
C961796	CALHOUN	8/5/96	101	0.04		4.4	0.167	41	< 10	560	< 10	601
BL5540	CALHOUN	8/12/96	105	0.07		4.6	0.181	43	< 10	590	< 10	633
BL5547	CALHOUN	8/19/96	95	0.05		4.3	0.168	34	< 10	480	< 10	514
BL5554	CALHOUN	8/26/96	106	0.07		5	0.189	41	< 10	600	< 10	641
C961954	CALHOUN	9/9/96	114	0.04		4.8	0.175	36	< 10	520	< 10	556
C961961	CALHOUN	9/16/96	98	0.03		4.2	0.175	31	< 10	450	< 10	481
C961968	CALHOUN	9/23/96	115	0.03		4.5	0.17	33	< 10	480	< 10	513
C961975	CALHOUN	9/30/96	103	0.04		4.6	0.142	32	< 10	410	< 10	442
C962042	CALHOUN	10/7/96	126	0.04		4.6	0.163	35	< 10	460	< 10	495
C962049	CALHOUN	10/21/96	124	0.04		4.6	0.154	38	< 10	470	< 10	508
C962056	CALHOUN	10/28/96	114	0.04		4.2	0.128	37	< 10	430	< 10	467
C962209	CALHOUN	10/30/96	112	0.04		4.3	0.142	36	< 10	480	< 10	516
C962138	CALHOUN	11/4/96	118	0.05		4.8	0.15	40	< 10	500	< 10	540
C962174	CALHOUN	11/18/96	107	0.04		4	0.134	34	< 10	380	< 10	414
C962180	CALHOUN	11/25/96	119	0.05		5.3	0.174	36	< 10	440	< 10	476
C962251	CALHOUN	12/2/96	119	0.05		5.1	0.158	40	< 10	420	< 10	460

"D" lab numbers represent samples obtained from DWR Division of Operations and Maintenance.

Trihalomethane Formation Potential Constituents *(Continued)*

Lab Number	Station Name	Sample Date	Alkalinity (mg/L)	Bromide (mg/L)	TOC (mg/L)	DOC (mg/L)	UVA (Abs/cm)	$CHBrCl_2$ (µg/L)	$CHBr_3$ (µg/L)	$CHCl_3$ (µg/L)	$CHBr_2Cl$ (µg/L)	TTHMFP (µg/L)
C962257	CALHOUN	12/9/96	115	0.06		5.2	0.168	45	< 10	450	< 10	495
C962263	CALHOUN	12/16/96	115	0.05		9.1	0.338	52	< 10	810	< 10	862
C962269	CALHOUN	12/30/96	60	0.02		14.4	0.783	39	< 20	1700	< 20	1739
C962390	CALHOUN	1/6/97	34	< 0.01		13.8	0.517	17	< 10	1200	< 10	1217
C962433	CALHOUN	1/13/97	46	< 0.01		16.4	0.882	24	< 20	1800	< 20	1824
C962466	CALHOUN	1/27/97	26	< 0.01		11.2	0.574	< 20	< 20	1100	< 20	1100
C970023	CALHOUN	2/3/97	46	0.01		3.8	0.382	25	< 10	1100	< 10	1125
C970052	CALHOUN	2/10/97	68	0.03		10.2	0.401	44	< 10	1200	< 10	1244
C970058	CALHOUN	2/24/97	112	0.07		9.5	0.45	70	< 10	1200	< 10	1270
C970115	CALHOUN	3/3/97	104	0.07		9.3	0.387	71	< 10	1100	< 10	1171
C970147	CALHOUN	3/10/97	104	0.06		8.3	0.354	63	< 10	950	< 10	1013
C970184	CALHOUN	3/17/97	116	0.06		7.3	0.309	64	< 10	890	< 10	954
C970198	CALHOUN	3/24/97	126	0.06		7	0.258	62	< 10	830	< 10	892
C970204	CALHOUN	3/31/97	132	0.06		6.2	0.25	62	< 10	800	< 10	862
C970237	CALHOUN	4/7/97	146	0.07		6.3	0.215	65	< 10	760	< 10	825
C970266	CALHOUN	4/14/97	151	0.07		6.1	0.205	73	< 10	750	< 10	823
C970278	CALHOUN	4/21/97	160	0.08		5.9	0.185	65	< 10	670	< 10	735
C970284	CALHOUN	4/28/97	155	0.07		5.2	0.145	62	< 10	540	< 10	602
C970316	CALHOUN	5/5/97	157	0.07		4.1	0.138	57	< 10	520	< 10	577
C970339	CALHOUN	5/12/97	138	0.07		4.3	0.137	59	< 10	490	< 10	549
C970368	CALHOUN	5/19/97	142	0.07		4.6	0.162	64	< 10	570	< 10	634
C970385	CALHOUN	5/27/97		0.06		4.5	0.167	57	< 10	560	< 10	617
C970425	CALHOUN	6/2/97	132	0.06		4.4	0.167	64	< 10	620	< 10	684
C970491	CALHOUN	6/9/97	126	0.06		4.4	0.167	61	< 10	630	< 10	691
C970501	CALHOUN	6/16/97	134	0.06		5	0.186	69	< 10	680	< 10	749

Trihalomethane Formation Potential Constituents *(Continued)*

Lab Number	Station Name	Sample Date	Alkalinity (mg/L)	Bromide (mg/L)	TOC (mg/L)	DOC (mg/L)	UVA (Abs/cm)	$CHBrCl_2$ (µg/L)	$CHBr_3$ (µg/L)	$CHCl_3$ (µg/L)	$CHBr_2Cl$ (µg/L)	TTHMFP (µg/L)
C970515	CALHOUN	6/23/97	118	0.06		4.4	0.154	59	< 10	590	< 10	649
C970527	CALHOUN	6/30/97	130	0.06		4.8	0.185	64	< 10	610	< 10	674
BL5504	COOK	7/1/96	169	0.04		7.9		45	< 10	790	< 10	835
BL5512	COOK	7/15/96	178	0.04		7.3	0.232	33	< 10	840	< 10	873
BL5519	COOK	7/22/96	176	0.04		9.1	0.287	38	< 10	1000	< 10	1038
BL5534	COOK	7/29/96	174	0.03		7.4	0.24	31	< 10	850	< 10	881
C961797	COOK	8/5/96	178	0.03		8.2	0.243	35	< 10	920	< 10	955
BL5541	COOK	8/12/96	170	0.06		7.8	0.228	35	< 10	890	< 10	925
BL5548	COOK	8/19/96	172	0.04		7.6	0.24	30	< 10	850	< 10	880
BL5555	COOK	8/26/96	165	0.05		6.6	0.2	25	< 10	680	< 10	705
C961955	COOK	9/9/96	172	0.03		6.6	0.195	27	< 10	720	< 10	747
C961962	COOK	9/16/96	169	0.03		6.9	0.217	24	< 10	780	< 10	804
C961969	COOK	9/23/96	178	0.02		6.6	0.205	24	< 10	700	< 10	724
C961976	COOK	9/30/96	171	0.02		8.5	0.224	22	< 10	720	< 10	742
C962043	COOK	10/7/96	167	0.02		6.8	0.203	22	< 10	710	< 10	732
C962050	COOK	10/21/96	175	0.02		7.3	0.218	25	< 10	800	< 10	825
C962057	COOK	10/28/96	180	0.02		6.4	0.179	25	< 10	670	< 10	695
C962210	COOK	10/30/96	177	0.03		8.4	0.224	32	< 10	880	< 10	912
C962139	COOK	11/4/96	175	0.02		6.3	0.172	25	< 10	700	< 10	725
C962175	COOK	11/18/96	163	0.02		9.7	0.299	30	< 10	870	< 10	900
C962181	COOK	11/25/96	161	0.02		6.4	0.17	22	< 10	500	< 10	522
C962252	COOK	12/2/96	155	0.03		5.4	0.173	22	< 10	540	< 10	562
C962258	COOK	12/9/96	152	0.03		6.8	0.196	28	< 10	590	< 10	618
C962264	COOK	12/16/96	63	0.01		11.3	0.555	24	< 20	1400	< 20	1424
C962270	COOK	12/30/96	48	< 0.01		11.6	0.705	< 20	< 20	1500	< 20	1500

Trihalomethane Formation Potential Constituents *(Continued)*

Lab Number	*Station Name*	*Sample Date*	*Alkalinity (mg/L)*	*Bromide (mg/L)*	*TOC (mg/L)*	*DOC (mg/L)*	*UVA (Abs/cm)*	*$CHBrCl_2$ (µg/L)*	*$CHBr_3$ (µg/L)*	*$CHCl_3$ (µg/L)*	*$CHBr_2Cl$ (µg/L)*	*TTHMFP (µg/L)*
C962391	COOK	1/6/97	62	0.01		14.6	0.956	< 20	< 20	1300	< 20	1300
C962434	COOK	1/13/97	103	0.04		11	0.592	35	< 20	1300	< 20	1335
C962467	COOK	1/27/97	32	< 0.01		7.3	0.253	< 10	< 10	840	< 10	840
C970024	COOK	2/3/97	93	0.03		9.2	0.409	36	< 10	910	< 10	946
C970053	COOK	2/10/97	155	0.09		7.5	0.246	80	< 10	830	< 10	910
C970059	COOK	2/24/97	209	0.18		5.8	0.181	120	< 10	660	18	798
C970116	COOK	3/3/97	215	0.21		5.8	0.168	140	< 10	600	29	769
C970148	COOK	3/10/97	234	0.24		6.2	0.161	150	< 10	560	41	751
C970185	COOK	3/17/97	246	0.26		5.9	0.163	160	< 10	550	47	757
C970199	COOK	3/24/97	252	0.28		5.7	0.16	170	< 10	540	58	768
C970205	COOK	3/31/97	260	0.3		5.8	0.164	170	< 10	580	49	799
C970238	COOK	4/7/97	270	0.33		6.1	0.165	180	< 10	590	60	830
C970267	COOK	4/14/97	250	0.27		7.1	0.201	170	< 10	730	48	948
C970279	COOK	4/21/97	212	0.17		5.9	0.166	120	< 10	650	16	786
C970285	COOK	4/28/97	196	0.11		7	0.189	84	< 10	800	< 10	884
C970317	COOK	5/5/97	157	0.07		7.2	0.215	75	< 10	870	< 10	945
C970340	COOK	5/12/97	189	0.06		7.2	0.218	58	< 10	820	< 10	878
C970369	COOK	5/19/97	187	0.05		7.7	0.236	46	< 10	960	< 10	1006
C970386	COOK	5/27/97		0.03		6.8	0.213	35	< 10	810	< 10	845
C970426	COOK	6/2/97	169	0.03		5.9	0.201	38	< 10	790	< 10	828
C970492	COOK	6/9/97	169	0.02		6.5	0.212	34	< 10	880	< 10	914
C970500	COOK	6/16/97	172	0.03		6.8	0.218	37	< 10	900	< 10	937
C970514	COOK	6/23/97	174	0.03		7.2	0.218	40	< 10	960	< 10	1000
C970526	COOK	6/30/97	177	0.03		7.2	0.22	41	< 10	880	< 10	921
BL5638	FREMONT	12/16/96	67	< 0.01		1.8	0.049	< 10	< 10	140	< 10	140

Trihalomethane Formation Potential Constituents *(Continued)*

Lab Number	Station Name	Sample Date	Alkalinity (mg/L)	Bromide (mg/L)	TOC (mg/L)	DOC (mg/L)	UVA (Abs/cm)	$CHBrCl_2$ (µg/L)	$CHBr_3$ (µg/L)	$CHCl_3$ (µg/L)	$CHBr_2Cl$ (µg/L)	TTHMFP (µg/L)
BL5506	LINDSEY	7/1/96	68	0.03		2.7		28	< 10	280	< 10	308
BL5513	LINDSEY	7/15/96	72	0.04		2.8	0.101	27	< 10	320	< 10	347
BL5520	LINDSEY	7/22/96	61	0.02		2.2	0.077	20	< 10	240	< 10	260
BL5535	LINDSEY	7/29/96	65	0.02		2.6	0.102	22	< 10	290	< 10	312
C961798	LINDSEY	8/5/96	62	0.02		2.3	0.082	18	< 10	250	< 10	268
BL5542	LINDSEY	8/12/96	64	0.05		2.5	0.091	20	< 10	290	< 10	310
BL5549	LINDSEY	8/19/96	62	0.04		2.2	0.082	15	< 10	230	< 10	245
BL5556	LINDSEY	8/26/96	68	0.05		2.6	0.091					
C961956	LINDSEY	9/9/96	82	0.04		2.8	0.098	25	< 10	280	< 10	305
C961963	LINDSEY	9/16/96	83	0.04		2.6	0.095	25	< 10	250	< 10	275
C961970	LINDSEY	9/23/96	83	0.04		2.3	0.073	23	< 10	220	< 10	243
C961977	LINDSEY	9/30/96	90	0.04		2.8	0.078	22	< 10	210	< 10	232
C962044	LINDSEY	10/7/96	85	0.04		2.2	0.072	22	< 10	200	< 10	222
C962051	LINDSEY	10/21/96	73	0.03		2	0.059	23	< 10	210	< 10	233
C962058	LINDSEY	10/28/96				2.4		23	< 10	210	< 10	233
C962211	LINDSEY	10/30/96	86	0.03		2.3	0.067	24	< 10	220	< 10	244
C962140	LINDSEY	11/4/96	88	0.04		2.5	0.068	24	< 10	650	< 10	674
C962176	LINDSEY	11/18/96	102	0.04		3.3	0.087	30	< 10	300	< 10	330
C962182	LINDSEY	11/25/96	119	0.05		4.1	0.109	31	< 10	330	< 10	361
C962253	LINDSEY	12/2/96	101	0.04		3.8	0.099	27	< 10	290	< 10	317
C962259	LINDSEY	12/9/96	88	0.02		2.9	0.081	19	< 10	240	< 10	259
C962265	LINDSEY	12/16/96	85	0.02		3.7	0.118	20	< 10	310	< 10	330
C962271	LINDSEY	12/30/96	106	0.04		6.5	0.226	39	< 10	700	< 10	739
C962392	LINDSEY	1/6/97	79	0.02		6.1	0.2	23	< 10	530	< 10	553
C962435	LINDSEY	1/13/97	90	0.02		6.7	0.258	24	< 10	690	< 10	714

Trihalomethane Formation Potential Constituents *(Continued)*

Lab Number	Station Name	Sample Date	Alkalinity (mg/L)	Bromide (mg/L)	TOC (mg/L)	DOC (mg/L)	UVA (Abs/cm)	$CHBrCl_2$ (μg/L)	$CHBr_3$ (μg/L)	$CHCl_3$ (μg/L)	$CHBr_2Cl$ (μg/L)	TTHMFP (μg/L)
C962468	LINDSEY	1/27/97	46	0.01		8	0.539	< 20	< 20	1100	< 20	1100
C970025	LINDSEY	2/3/97	92	0.03		10.2	0.449	19	< 10	380	< 10	399
C970054	LINDSEY	2/10/97	104	0.02		4.4	0.144	26	< 10	520	< 10	546
C970060	LINDSEY	2/24/97	148	0.05		4.2	0.149	46	< 10	500	< 10	546
C970117	LINDSEY	3/3/97	136	0.05		2.9	0.086	43	< 10	320	< 10	363
C970149	LINDSEY	3/10/97	144	0.06		3.6	0.106	32	< 10	270	< 10	302
C970186	LINDSEY	3/17/97	113	0.05		2.2	0.069	35	< 10	240	< 10	275
C970200	LINDSEY	3/24/97	139	0.06		3.1	0.091	46	< 10	320	< 10	366
C970206	LINDSEY	3/31/97	139	0.06		2.7	0.085	47	< 10	310	< 10	357
C970239	LINDSEY	4/7/97	136	0.06		3	0.094	48	< 10	360	< 10	408
C970268	LINDSEY	4/14/97	119	0.05		2.5	0.077	41	< 10	280	< 10	321
C970280	LINDSEY	4/21/97	130	0.06		2.7	0.086	45	< 10	310	< 10	355
C970286	LINDSEY	4/28/97	115	0.05		2.6	0.079	42	< 10	310	< 10	352
C970318	LINDSEY	5/5/97	110	0.04		2.6	0.076	35	< 10	280	< 10	315
C970341	LINDSEY	5/12/97	101	0.04		2.9	0.084	36	< 10	300	< 10	336
C970370	LINDSEY	5/19/97	95	0.04		2.5	0.081	30	< 10	260	< 10	290
C970387	LINDSEY	5/27/97		0.04		3	0.081	34	< 10	280	< 10	314
C970427	LINDSEY	6/2/97	94	0.04		2.4	0.086	39	< 10	300	< 10	339
C970493	LINDSEY	6/9/97	88	0.04		2.5	0.082	34	< 10	290	< 10	324
C970502	LINDSEY	6/16/97	84	0.04		2.4	0.087	32	< 10	300	< 10	332
C970516	LINDSEY	6/23/97	77	0.04		2.3	0.077	30	< 10	290	< 10	320
C970528	LINDSEY	6/30/97	73	0.03		2	0.073	22	< 10	230	< 10	252
BL5639	SHAG	12/16/96	76	< 0.01		4.6	0.14	12	< 10	390	< 10	402

Appendix D

USEPA and DHS Drinking Water Standards

Appendix D. USEPA and DHS Drinking Water Standards

Contaminants (mg/L)	EPA NIPDWR (pre-1990 Federal and State Drinking Water Standards)	Primary EPA MCL (1995 Federal and State Drinking Water Standards)	Secondary EPA MCL (1995 Federal and State Drinking Water Standards)	EPA MCLG	Primary California MCL (1997 DHS-DWS)	Secondary California MCL (1997 DHS-DWS)	Action Levels
INORGANICS							
Aluminum			0.05-0.2		1	0.2	
Iron			0.3			0.3	
Manganese			0.05			0.05	
pH			6.5-8.5			6.5-8.5	
Specific Conductance						900-1600-	
Turbidity		0.5-1a NTU				5 Units	
TOTAL TRIHALOMETHANES							
Sum of bromodichloromethane, dibromochloromethane, bromoform, and chloroform					0.1		
ORGANICS							
Alachlor (Alanex)	0.002	0.002		0	0.002		
Aldicarb (Temik)	0.01	0.003 (EDP)		0.001	Unregulated		0.01
Aldicarb sulfone	0.04	0.002 (EDP)		0.001	Unregulated		
Aldicarb sulfoxide	0.01	0.004 (EDP)		0.001	Unregulated		
Aldrin					Unregulated		0.00005
Benzene	0.005	0.005		0	0.001		
a-Benzene Hexachloride (a-BHC)							0.0007
b-Benzene Hexachloride (b-BHC)							0.0003
Bromacil (Hyvar X, Hyvar XL)					Unregulated		
Bromobenzene (Monobromobenzene)					Unregulated		
Bromochloromethane (Chlorobromomethane)					Unregulated		
Bromodichloromethane (THM species)		0.10 (0.08 proposed)		0 (proposed)	Unregulated		
Bromoform (Tribromomethane) (THM species)		0.10 (0.08 proposed)		0 (proposed)	Unregulated		
Bromomethane (Methyl Bromide)					Unregulated		

Appendix D. USEPA and DHS Drinking Water Standards

Contaminants (mg/L)	EPA NIPDWR (pre-1990 Federal and State Drinking Water Standards)	Primary EPA MCL (1995 Federal and State Drinking Water Standards)	Secondary EPA MCL (1995 Federal and State Drinking Water Standards)	EPA MCLG	Primary California MCL (1997 DHS-DWS)	Secondary California MCL (1997 DHS-DWS)	Action Levels
n-Butylbenzene (1-Butylpropane)					Unregulated		0.045
Sec-butylbenzene (2-Phenylbutane)					Unregulated		
Tert-butylbenzene (2-Methyl-2-phenylpropane)					Unregulated		
Captan							0.35
Carbaryl (Sevin)					Unregulated		0.06
Carbofuran (Furadan)	0.04	0.04		0.04	0.018		
Chlordane	0.002	0.002		0	0.0001		
Chlorobenzene (Monochlorobenzene)	0.01	0.1		0.1	0.07		
Chloroethane (Ethyl Chloride)					Unregulated		
Chloroform (Trichloromethane)(THM species)		0.10 (0.8 proposed)		0 (proposed)	Unregulated		
Chloromethane (Methyl Chloride)					Unregulated		
CICP (chloroprophan)							0.35
Chlorothalonil (Bravo)					Unregulated		
2-Chlorotoulene (o-Chlorotoluene)					Unregulated		0.045
Diazinon (Basudin, Neocidol)							0.014
Dibromochloromethane (Chlorobromomethane)					Unregulated		
1,2-Dibromo-3-chloropropane (DBCP)	0.0002	0.0002		0	0.0002		
Dibromomethane (Methylene Bromide)					Unregulated		
1,3-Dichlorobenzene (m-Dichlorobenzene)					Unregulated		0.13 (0.02)c,d
1,2-Dichlorobenzene (o-Dichlorobenzene)	0.6	0.6	0.01 (proposed)	0.6	0.6		0.13 (0.01)c,d
1,4-Dichlorobenzene (p-Dichlorobenzene)	0.075	0.075	0.005 (proposed)	0.075	0.005		

Appendix D. USEPA and DHS Drinking Water Standards

Contaminants (mg/L)	EPA NIPDWR (pre-1990 Federal and State Drinking Water Standards)	Primary EPA MCL (1995 Federal and State Drinking Water Standards)	Secondary EPA MCL (1995 Federal and State Drinking Water Standards)	EPA MCLG	Primary California MCL (1997 DHS-DWS)	Secondary California MCL (1997 DHS-DWS)	Action Levels
Dichlorodifluoromethane (Freon 12)					Unregulated		1
1,1 Dichloroethane (1,1-DCA)					0.005		
1,2 Dichloroethane (1,2-DCA)	0.005	0.005		0	0.0005		
1,1 Dichloroethylene (1,1-DCE)	0.007	0.007		0.007	0.006		
Dichloromethane (Methylene Chloride)		0.005		0	0.005		
1,2 Dichloropropane (Propylene dichloride)	0.005	0.005		0	0.005		
1,3-Dichloropropane					Unregulated		
2,2-Dichloropropane					Unregulated		
1,1-Dichloropropene					Unregulated		
Dieldrin					Unregulated		0.00005b
Dimethoate (Cygon)					Unregulated		0.14
Diuron (Karmex, Krovar)					Unregulated		
Endrin	0.002	0.002		0.002	0.002		
Ethion							0.035
Ethylbenzene	0.7	0.7	0.03 (proposed)	0.7	0.7		
Heptachlor	0.0004	0.0004		0	0.00001		
Heptachlor Epoxide	0.0002	0.0002		0	0.00001		
Hexachlorobutadiene (Perchlorobutadiene)					Unregulated		
3-Hydroxycarbofuran					Unregulated		
Isopropylbenzene (Cumene)					Unregulated		
Malathion							0.160
Methoxychlor	0.4	0.04		0.04	0.04		
Methyl Parathion							0.03
Methyl t-butyl ether (MTBE)					Unregulated		0.035
Methylene Chloride (Dichloromethane)	0.005	0.005		0			0.040
Methyl Parathion							0.030
Metolachlor (Metelilacolor)					Unregulated		
Monochlorobenzene (Chlorobenzene)					0.07		

Appendix D. USEPA and DHS Drinking Water Standards

Contaminants (mg/L)	EPA NIPDWR (pre-1990 Federal and State Drinking Water Standards)	Primary EPA MCL (1995 Federal and State Drinking Water Standards)	Secondary EPA MCL (1995 Federal and State Drinking Water Standards)	EPA MCLG	Primary California MCL (1997 DHS-DWS)	Secondary California MCL (1997 DHS-DWS)	Action Levels
Naphthalene (Naphthain)					Unregulated		
Oxamyl (Vydate)		0.2		0.2	0.2		
Parathion							0.030
Pentachloronitrobenzene (Terrachlor)							0.0009
1-Phenylpropane (n-Propylbenzene)					Unregulated		
Polychlorinated biphenyls (PCBs)	0.0005	0.0005		0	0.0005		
Prometryn (Caparol)					Unregulated		
Simazine (Princep)	0.001	0.004		0.004	0.004		
Styrene (Vinylbenzene)	0.1	0.1	0.01 (proposed)	0.1	0.1		
1,1,2,2-Tetrachloroethane					0.001		
1,1,1,2-Tetrachloroethane					Unregulated		
Thiobencarb (Thiobencarb)					0.07	0.001	
Toluene (Methylbenzene)	2	1	0.04 (proposed)	1	0.15		
Total Trihalomethanes (TTHM)		0.1			0.1		
Toxaphene		0.003		0	0.003		
Tribromomethane (Bromoform) (THM species)		0.10 (0.08 proposed)					
1,2,4-Trichlorobenzene (Unsym-Trichlorobenzene)	0.009	0.07		0.07	0.07		
1,1,1-Trichloroethane	0.2	0.2		0.2	0.2		
1,1,2-Trichloroethane (1,1,2-TCA)	0.003	0.005		0.003	0.005		
Trichlorofluoromethane (Freon 11)					0.15		
Trichloromethane (Chloroform) (THM species)		0.1					
1,2,3-Trichloropropane (Allyl Trichloride)					Unregulated		
1,2,4-Trimethylbenzene (Pseudocumene)					Unregulated		

Appendix D. USEPA and DHS Drinking Water Standards

Contaminants (mg/L)	EPA NIPDWR (pre-1990 Federal and State Drinking Water Standards)	Primary EPA MCL (1995 Federal and State Drinking Water Standards)	Secondary EPA MCL (1995 Federal and State Drinking Water Standards)	EPA MCLG	Primary California MCL (1997 DHS-DWS)	Secondary California MCL (1997 DHS-DWS)	Action Levels
1,3,5-Trimethylbenzene (Mesitylene)					Unregulated		
Vinyl Chloride	0.002	0.002		0	0.0005		
Xylenes (all isomers)	10	10	20 (proposed)	10	1.75		

a 0.5 NTU (Nephelometric Turbidity Unit) conventional treatment or direct filtration; 1 NTU, slow sand or diatomaceous earth filtration
b Limit of Quantification
c Taste and Odor Threshold (in parenthesis)
d For single or sum of isomers

Abbreviations

EPA= Environmental Protection Agency
DHS= Department of Health Services
MCL= Maximum Contaminant Level
MCLG= Maximum Contaminant Level Goal
AL= Action Level
EDP= Effective Date Postponed

Appendix E

Barker Slough Pumping Plant Data

Appendix E

Barker Slough Pumping Plant Automated Station Daily Averages

Date	*EC(µS/cm)*	*WaterTemp(°C)*	*Turbidity(NTUS)*	*Fluor(FL)*	*pH(units)*	*Volume(CFS)*	*Volume(AF)*	*Cl*(mg/L)*	*Precip.(in)*
7/1/96	298	20.9	50.11	73	8.13	90.37	7.56	24	0.00
7/2/96	337	23.3	53.63	72	8.15	88.02	7.33	27	0.00
7/3/96	333	22.1	60.46	75	8.19	87.15	7.21	27	0.00
7/4/96	332	21.4	58.99	80	8.19	83.38	6.89	27	0.00
7/5/96	328	20.6	60.73	92	8.16	85.74	7.09	26	0.00
7/6/96	344	21.8	60.05	94	8.10	79.95	6.61	28	0.00
7/7/96	361	22.5	64.37	100	8.16	86.92	7.19	29	0.00
7/8/96	352	21.6	68.10	104	8.25	81.07	6.71	28	0.00
7/9/96	320	20.2	70.83	105	8.24	82.49	6.89	26	0.00
7/10/96	323	21.5	70.93	105	8.24	82.82	6.85	26	0.00
7/11/96	320	21.0	71.97	104	8.27	92.34	7.75	26	0.00
7/12/96	318	20.7	70.54	101	8.27	89.26	7.38	25	0.00
7/13/96	309	20.3	65.61	97	8.26	81.74	6.76	25	0.00
7/14/96	323	21.1	59.76	95	8.26	77.61	6.42	26	0.00
7/15/96	324	20.4	59.30	108	8.30	76.74	6.35	26	0.00
7/16/96	320	19.7	61.23	116	8.31	83.42	6.90	26	0.00
7/17/96	311	20.0	56.38	98	8.27	83.08	6.87	25	0.00
7/18/96	292	20.2	48.61	46	8.21	72.85	6.03	24	0.00
7/19/96	299	21.3	47.98	45	8.21	82.08	6.80	24	0.00
7/20/96	303	22.2	46.63	60	8.18	93.86	8.01	24	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

**** Chloride values are calculated and not measured.***

Barker Slough Pumping Plant Automated Station Daily Averages (Continued)

Date	EC(µS/cm)	WaterTemp(°C)	Turbidity(NTUS)	Fluor(FL)	pH(units)	Volume(CFS)	Volume(AF)	Cl*(mg/L)	Precip.(in)
7/21/96	293	22.9	48.87	69	8.17	92.57	7.89	23	0.00
7/22/96	289	22.7	50.20	69	8.11	88.15	7.33	23	0.00
7/23/96	284	21.7	55.36	65	8.14	92.49	7.83	23	0.00
7/24/96	280	21.2	56.19	65	8.14	79.73	6.59	22	0.00
7/25/96	287	21.5	56.84	65	8.10	80.48	6.66	23	0.00
7/26/96	342	24.2	56.43	66	8.08	84.56	7.24	27	0.00
7/27/96	280	21.6	57.14	67	8.03	83.58	6.91	22	0.00
7/28/96	289	22.0	57.44	56	7.96	77.33	6.40	23	0.00
7/29/96	317	23.6	53.01	61	7.89	89.99	7.55	25	0.00
7/30/96	289	23.0	53.83	69	7.88	85.30	7.06	23	0.00
7/31/96	266	22.5	52.94	71	7.81	87.76	7.26	21	0.00
8/1/96	281	23.0	47.38	67	7.98	95.72	8.01	22	0.00
8/2/96	282	21.9	49.86	72	8.08	82.28	6.80	23	0.00
8/3/96	276	21.6	55.15	75	8.17	88.15	7.32	22	0.00
8/4/96	266	21.6	63.39	72	8.24	90.74	7.56	21	0.00
8/5/96	265	21.4	59.95	70	8.22	80.51	6.66	21	0.00
8/6/96	278	21.0	60.36	70	8.18	78.22	6.47	22	0.00
8/7/96	273	20.7	58.68	70	8.15	80.95	6.70	22	0.00
8/8/96	310	22.7	57.88	68	8.16	81.52	6.77	25	0.00
8/9/96	271	22.3	55.62	66	8.16	91.02	7.55	22	0.00
8/10/96	252	22.3	52.50	65	8.15	89.70	7.43	20	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

** Chloride values are calculated and not measured.*

Barker Slough Pumping Plant Automated Station Daily Averages *(Continued)*

Date	*EC(µS/cm)*	*WaterTemp(°C)*	*Turbidity(NTUS)*	*Fluor(FL)*	*pH(units)*	*Volume(CFS)*	*Volume(AF)*	*Cl*(mg/L)*	*Precip.(in)*
8/11/96	260	22.8	45.38	65	8.14	82.74	6.84	21	0.00
8/12/96	266	23.1	40.84	66	8.13	87.50	7.24	21	0.00
8/13/96	268	23.4	39.26	67	8.10	90.39	7.49	22	0.00
8/14/96	267	23.4	39.23	68	8.11	75.15	6.23	21	0.00
8/15/96	258	22.8	18.01	69	8.10	67.51	5.58	21	0.00
8/16/96	251	22.5	24.43	72	8.15	60.40	4.99	20	0.00
8/17/96	247	21.7	49.71	70	8.27	72.83	6.02	20	0.00
8/18/96	244	20.7	52.01	69	8.27	63.01	5.21	19	0.00
8/19/96	248	20.2	56.51	73	8.32	60.82	5.03	20	0.00
8/20/96	254	19.7	56.01	79	8.30	62.23	5.15	20	0.00
8/21/96	289	21.0	50.93	84	8.27	54.16	4.48	23	0.00
8/22/96	288	21.1	47.92	89	8.23	62.83	5.20	23	0.00
8/23/96	286	21.7	49.42	91	8.21	64.04	5.30	23	0.00
8/24/96	286	21.0	45.86	94	8.22	59.87	4.95	23	0.00
8/25/96	293	19.8	47.41	95	8.30	59.25	4.90	24	0.00
8/26/96	306	19.8	49.89	91	8.30	57.14	4.73	25	0.00
8/27/96	268	19.2	45.22	73	8.27	59.23	4.90	21	0.00
8/28/96	238	19.2	44.67	72	8.24	70.65	5.84	19	0.00
8/29/96	233	20.1	46.61	57	8.24	71.81	5.94	19	0.00
8/30/96	221	20.2	46.28	60	8.26	83.23	6.88	18	0.00
8/31/96	236	20.9	48.70	58	8.27	75.08	6.21	19	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

**** Chloride values are calculated and not measured.***

Barker Slough Pumping Plant Automated Station Daily Averages *(Continued)*

Date	EC(µS/cm)	WaterTemp(°C)	Turbidity(NTUS)	Fluor(FL)	pH(units)	Volume(CFS)	Volume(AF)	Cl*(mg/L)	Precip.(in)
9/1/96	230	20.4	51.14	53	8.28	81.25	6.73	18	0.00
9/2/96	264	20.8	50.96		8.28	84.98	7.03	21	0.00
9/3/96	273	19.9	49.27		8.30	79.10	6.54	22	0.00
9/4/96	280	18.9	47.11		8.29	75.31	6.23	22	0.00
9/5/96	275	18.4	46.23		8.31	80.14	6.62	22	0.00
9/6/96	295	19.7	38.10	42	8.26	74.34	6.14	24	0.00
9/7/96	290	20.9	32.25	89	8.20	72.20	5.96	23	0.00
9/8/96	281	21.4	35.84	87	8.22	76.06	6.29	23	0.00
9/9/96	278	21.8	39.80	71	8.22	78.63	6.50	22	0.00
9/10/96	276	22.0	42.43	45	8.23	69.13	5.71	22	0.00
9/11/96	279	21.3	48.33	51	8.31	65.36	5.41	22	0.00
9/12/96	286	20.5	52.28	47	8.32	52.57	4.35	23	0.00
9/13/96	291	20.2	53.75	60	8.31	57.38	4.75	23	0.00
9/14/96	309	19.8	53.07	81	8.28	60.19	4.98	25	0.00
9/15/96	324	20.2	51.55	63	8.31	68.57	5.67	26	0.00
9/16/96	322	19.4	51.58	59	8.31	63.59	5.27	26	0.00
9/17/96	345	19.9	49.18	74	8.28	57.72	4.78	28	0.00
9/18/96	331	19.2	47.74	77	8.32	62.88	5.21	27	0.00
9/19/96	296	18.1	39.49	65	8.29	65.03	5.38	24	0.00
9/20/96	293	18.7	42.30	63	8.25	67.35	5.57	23	0.00
9/21/96	284	19.3	46.95	63	8.26	63.86	5.28	23	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

** Chloride values are calculated and not measured.*

Barker Slough Pumping Plant Automated Station Daily Averages *(Continued)*

Date	*EC(µS/cm)*	*WaterTemp(°C)*	*Turbidity(NTUS)*	*Fluor(FL)*	*pH(units)*	*Volume(CFS)*	*Volume(AF)*	*Cl*(mg/L)*	*Precip.(in)*
9/22/96	280	18.9	48.91	62	8.29	59.82	4.95	22	0.00
9/23/96	280	18.5	48.82	60	8.30	73.31	6.05	22	0.00
9/24/96	275	17.7	48.53	59	8.33	69.51	5.75	22	0.00
9/25/96	280	17.7	38.77	60	8.28	63.51	5.25	22	0.00
9/26/96	274	17.6	37.99	62	8.37	60.93	5.04	22	0.00
9/27/96	283	17.6	38.98	66	8.35	64.21	5.31	23	0.00
9/28/96	292	17.7	39.38	70	8.36	58.89	4.87	23	0.00
9/29/96	306	18.0	41.95	73	8.32	63.87	5.28	25	0.00
9/30/96	310	17.8	44.37	76	8.37	57.63	4.77	25	0.00
10/1/96	323	17.0	44.68	80	8.37	45.62	3.77	26	0.00
10/2/96	325	16.8	38.50	60	8.34	45.04	3.73	26	0.00
10/3/96	323	16.7	34.37	43	8.29	52.64	4.35	26	0.00
10/4/96	327	17.5	34.87	47	8.27	56.83	4.70	26	0.00
10/5/96	316	17.8	37.16	42	8.25	43.70	3.61	25	0.00
10/6/96	306	18.5	38.12	37	8.24	48.11	3.97	24	0.00
10/7/96	294	19.1	39.35	42	8.24	44.75	3.70	24	0.00
10/8/96	291	19.5	37.99	45	8.24	47.27	3.92	23	0.00
10/9/96	291	19.6	33.76	46	8.27	50.43	4.17	23	0.00
10/10/96	283	18.4	30.47	47	8.33	48.00	3.97	23	0.00
10/11/96	285	17.9	31.61	49	8.32	48.03	3.99	23	0.00
10/16/96	319	16.4	39.82	94	8.53	36.69	3.04	25	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

**** Chloride values are calculated and not measured.***

Barker Slough Pumping Plant Automated Station Daily Averages (Continued)

Date	EC(µS/cm)	WaterTemp(°C)	Turbidity(NTUS)	Fluor(FL)	pH(units)	Volume(CFS)	Volume(AF)	Cl*(mg/L)	Precip.(in)
10/17/96	328	15.5	33.84	102	8.40	32.42	2.68	26	0.00
10/18/96	327	15.1	36.70	105	8.38	32.61	2.69	26	0.00
10/19/96	324	14.5	39.03	114	8.37	28.43	2.35	26	0.00
10/20/96	326	13.6	43.20	123	8.42	27.49	2.27	26	0.00
10/21/96	326	12.6	46.84	131	8.50	32.40	2.69	26	0.00
10/22/96	323	12.5	43.44	134	8.49	48.89	4.03	26	0.00
10/23/96	309	12.8	37.47	83	8.47	49.04	4.05	25	0.00
10/24/96	294	12.9	37.96	35	8.45	41.63	3.45	24	0.00
10/25/96	299	12.5	41.02	38	8.39	41.14	3.40	24	0.00
10/26/96	303	11.3	52.05	41	8.51	37.61	3.12	24	0.00
10/27/96	315	10.5	51.32	42	8.59	46.44	3.85	25	0.00
10/28/96	327	10.5	42.42	35	8.55	48.16	3.99	26	0.00
10/29/96	320	10.6	37.71	34	8.51	42.74	3.55	26	0.03
10/30/96	319	10.8	31.23	34	8.33	25.99	2.15	26	0.00
10/31/96	324	11.4	32.20	37	8.27	32.95	2.73	26	0.00
11/1/96	341	11.4	32.06	37	8.24	26.85	2.22	27	0.00
11/2/96	348	11.9	30.09	35	8.25	31.88	2.63	28	0.00
11/3/96	353	11.6	29.44	35	8.26	36.90	3.05	28	0.00
11/4/96	356	11.6	30.71	34	8.27	31.72	2.63	29	0.00
11/5/96	353	11.2	30.17	36	8.29	35.17	2.91	28	0.00
11/6/96	352	10.4	27.34	31	8.34	34.34	2.83	28	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

** Chloride values are calculated and not measured.*

Barker Slough Pumping Plant Automated Station Daily Averages *(Continued)*

Date	*EC(µS/cm)*	*WaterTemp(°C)*	*Turbidity(NTUS)*	*Fluor(FL)*	*pH(units)*	*Volume(CFS)*	*Volume(AF)*	*Cl*(mg/L)*	*Precip.(in)*
11/7/96	349	10.3	26.43	30	8.34	36.79	3.03	28	0.00
11/8/96	345	10.4	25.66	30	8.32	37.61	3.11	28	0.00
11/9/96	339	10.6	27.30	32	8.30	31.02	2.58	27	0.00
11/10/96	333	10.8	31.50	35	8.28	36.48	3.02	27	0.00
11/11/96	330	11.0	34.33	37	8.25	35.70	2.95	26	0.00
11/12/96	326	11.3	35.26	38	8.22	41.15	3.40	26	0.00
11/13/96	322	11.7	33.45	36	8.21	39.80	3.29	26	0.00
11/14/96	320	11.6	30.76	30	8.23	34.22	2.84	26	0.00
11/15/96	320	11.4	31.36	29	8.23	39.98	3.31	26	0.00
11/16/96	322	10.9	30.91	27	8.22	29.87	2.48	26	0.03
11/17/96	324	10.8	38.37	32	8.27	31.93	2.64	26	0.04
11/18/96	343	12.0	32.45	29	8.15	28.00	2.32	27	0.00
11/19/96	361	12.3	29.69	28	8.12	25.58	2.11	29	0.01
11/20/96	372	12.8	29.63	28	8.08	20.73	1.72	30	0.00
11/21/96	401	14.2	27.39	28	8.01	26.34	2.18	32	0.00
11/22/96	427	14.6	25.95	27	8.07	28.05	2.33	34	0.01
11/23/96	438	14.5	24.92	28	8.04	20.33	1.69	35	0.00
11/24/96	441	14.4	26.17	28	8.01	26.45	2.18	35	0.00
11/25/96	447	14.0	26.95	29	8.03	26.58	2.20	36	0.00
11/26/96	444	13.0	30.70	32	8.13	26.16	2.17	36	0.00
11/27/96	442	12.1	29.80	31	8.16	22.87	1.89	35	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

**** Chloride values are calculated and not measured.***

Barker Slough Pumping Plant Automated Station Daily Averages (Continued)

Date	EC(µS/cm)	WaterTemp(°C)	Turbidity(NTUS)	Fluor(FL)	pH(units)	Volume(CFS)	Volume(AF)	Cl*(mg/L)	Precip.(in)
11/28/96	438	11.9	28.21	31	8.11	26.55	2.20	35	0.00
11/29/96	434	11.3	28.66	32	8.17	25.66	2.13	35	0.00
11/30/96	429	10.9	28.45	33	8.18	20.89	1.73	34	0.00
12/1/96	429	11.3	30.99	37	8.21	25.45	2.11	34	0.01
12/2/96	432	10.7	30.10	38	8.20	26.92	2.23	35	0.00
12/3/96	429	10.1	28.25	37	8.19	25.10	2.09	34	0.00
12/4/96	414	10.2	24.52	30	8.20	23.05	1.91	33	0.01
12/5/96	398	10.9	22.69	21	8.27	22.63	1.86	32	0.03
12/6/96	404	11.2	21.83	21	8.20	27.87	2.31	32	0.01
12/7/96	416	11.5	24.52	23	8.17	25.99	2.15	33	0.00
12/8/96	457	12.1	27.95	25	8.13	22.55	1.86	37	0.00
12/9/96	477	12.4	31.43	26	8.14	26.85	2.21	38	0.02
12/10/96	464	12.7	39.52	32	8.21	22.19	1.83	37	0.05
12/11/96	319	13.6	171.69	121	8.05	24.40	2.02	26	0.01
12/12/96	262	14.7	242.73	160	7.77	24.56	2.02	21	0.01
12/13/96	270	14.7	220.02	141	7.71	23.42	1.94	22	0.00
12/14/96	283	12.4	211.26	136	7.85	25.88	2.14	23	0.00
12/15/96	296	10.8	187.98	118	7.84	21.60	1.78	24	0.00
12/16/96	318	10.4	145.00	98	7.76	23.50	1.94	25	0.00
12/17/96	333	10.2	102.97	78	7.71	19.34	1.61	27	0.00
12/18/96	406	10.3	58.93	45	7.78	31.88	2.64	33	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

**** Chloride values are calculated and not measured.***

Barker Slough Pumping Plant Automated Station Daily Averages *(Continued)*

Date	*EC(µS/cm)*	*WaterTemp(ºC)*	*Turbidity(NTUS)*	*Fluor(FL)*	*pH(units)*	*Volume(CFS)*	*Volume(AF)*	*Cl*(mg/L)*	*Precip.(in)*
12/19/96	457	10.1	35.75	29	7.84	33.68	2.79	37	0.00
12/20/96	471	9.8	30.40	27	7.88	31.52	2.60	38	0.00
12/21/96	437	9.3	50.60	43	7.96	29.63	2.45	35	0.08
12/22/96	183	8.5	230.51	180	7.71	32.64	2.69	15	0.01
12/23/96	129	8.7	195.95	150	7.26	28.79	2.37	11	0.00
12/24/96	133	8.7	181.90	137	7.38	20.56	1.71	11	0.00
12/25/96	150	8.4	180.42	129	7.39	16.33	1.35	12	0.00
12/26/96	168	8.4	176.17	124	7.39	24.46	2.02	14	0.04
12/27/96	167	9.3	189.26	136	7.48	24.20	2.00	13	0.00
12/28/96	131	10.6	214.30	156	7.40	20.29	1.68	10	0.00
12/29/96	133	11.1	214.96	152	7.40	24.31	2.00	11	0.02
12/30/96	140	11.8	235.46	104	7.39	20.75	1.71	11	0.00
12/31/96	136	12.9	244.58	192	7.54	21.43	1.76	11	0.00
1/1/97	131	14.5	247.76		7.53	14.65	1.20	11	0.11
1/2/97	96	15.6	246.22		7.27	18.29	1.51	8	0.02
1/3/97	146	14.2	200.20		7.45	17.90	1.49	12	0.00
1/4/97	131	13.2	191.81		7.35	15.52	1.30	11	0.00
1/5/97	136	12.3	173.46		7.26	21.00	1.74	11	0.00
1/6/97	133	10.1	158.74	2	7.43	18.53	1.55	11	0.00
1/7/97	128	9.4	151.40		7.32	18.81	1.58	10	0.00
1/8/97	129	8.9	133.41		7.31	15.76	1.28	10	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

**** Chloride values are calculated and not measured.***

Barker Slough Pumping Plant Automated Station Daily Averages *(Continued)*

Date	*EC(µS/cm)*	*WaterTemp(°C)*	*Turbidity(NTUS)*	*Fluor(FL)*	*pH(units)*	*Volume(CFS)*	*Volume(AF)*	*Cl*(mg/L)*	*Precip.(in)*
1/9/97	137	8.9	128.80		7.23	19.04	1.59	11	0.00
1/10/97	149	8.8	121.15		7.18	18.95	1.59	12	0.00
1/11/97	158	8.8	118.49		7.22	17.40	1.45	13	0.00
1/12/97	191	8.8	108.85		7.33	20.36	1.70	15	0.01
1/13/97	206	6.5	115.04		7.55	16.58	1.37	16	0.00
1/14/97	197	5.3	121.08		7.56	21.11	1.75	16	0.00
1/15/97	203	5.5	110.58		7.42	15.32	1.25	16	0.00
1/16/97	225	6.2	96.65		7.37	19.70	1.63	18	0.00
1/17/97	233	7.0	93.63		7.36	19.65	1.62	19	0.00
1/18/97	249	7.7	90.31		7.36	20.64	1.70	20	0.00
1/19/97	249	8.0	87.85		7.35	21.04	1.74	20	0.00
1/20/97	250	8.3	87.35		7.34	17.05	1.42	20	0.01
1/21/97	271	9.0	87.34		7.43	16.02	1.31	22	0.01
1/22/97	329	9.9	117.52		7.62	21.33	1.76	26	0.12
1/23/97	113	9.1	350.01		7.48	10.54	0.88	9	0.00
1/24/97	99	9.7	329.20		7.30	16.21	1.35	8	0.02
1/25/97	113	10.7	301.33		7.47	17.05	1.40	9	0.04
1/26/97	96	13.4	278.51		7.39	20.10	1.67	8	0.06
1/27/97	97	13.9	261.14		7.19	19.64	1.62	8	0.00
1/28/97	117	13.2	214.03		7.11	16.52	1.36	9	0.00
1/29/97	123	13.4	185.25		7.14	19.78	1.64	10	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

**** Chloride values are calculated and not measured.***

Barker Slough Pumping Plant Automated Station Daily Averages *(Continued)*

Date	*EC(µS/cm)*	*WaterTemp(°C)*	*Turbidity(NTUS)*	*Fluor(FL)*	*pH(units)*	*Volume(CFS)*	*Volume(AF)*	*Cl*(mg/L)*	*Precip.(in)*
1/30/97	144	13.2	189.29		7.19	16.52	1.35	11	0.00
1/31/97	130	13.1	185.72		7.12	14.76	1.20	10	0.00
2/1/97	148	13.0	177.10		7.17	18.50	1.52	12	0.00
2/2/97	160	12.9	161.59		7.16	18.09	1.49	13	0.00
2/3/97	160	12.4	128.66		7.09	19.91	1.65	13	0.00
2/4/97	157	12.4	55.62		7.06	20.56	1.69	13	0.01
2/5/97	157	12.1	83.34		6.90	16.23	1.34	13	0.00
2/6/97	166	11.5	102.55		7.21	20.74	1.71	13	0.00
2/7/97	177	11.5	97.64		7.26	16.37	1.34	14	0.00
2/8/97	190	11.6	95.29		7.34	19.41	1.60	15	0.00
2/9/97	195	11.4	91.06		7.35	18.81	1.55	16	0.00
2/10/97	213	11.5	85.58		7.36	17.88	1.47	17	0.00
2/11/97	222	11.7	82.35		7.41	20.73	1.70	18	0.00
2/12/97	236	11.6	85.02		7.42	15.95	1.32	19	0.00
2/13/97	250	11.1	93.55	16	7.59	20.28	1.66	20	0.00
2/14/97	253	11.2	76.32		7.55	19.45	1.61	20	0.00
2/15/97	255	12.0	27.38		7.52	19.08	1.57	20	0.00
2/16/97	265	12.3	73.54		7.49	18.93	1.58	21	0.00
2/17/97	272	12.6	84.55		7.53	18.57	1.55	22	0.00
2/18/97	286	12.2	84.19		7.61	17.27	1.44	23	0.00
2/19/97	308	12.8	80.63		7.67	19.68	1.64	24	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

**** Chloride values are calculated and not measured.***

Barker Slough Pumping Plant Automated Station Daily Averages *(Continued)*

Date	*EC(µS/cm)*	*WaterTemp(°C)*	*Turbidity(NTUS)*	*Fluor(FL)*	*pH(units)*	*Volume(CFS)*	*Volume(AF)*	*Cl*(mg/L)*	*Precip.(in)*
2/20/97	334	13.3	80.90		7.67	20.67	1.70	27	0.00
2/21/97	317	13.1	77.40	77	7.60	17.17	1.41	26	0.00
2/22/97	301	13.2	83.15	149	7.61	18.92	1.55	24	0.00
2/23/97	310	12.5	95.27	148	7.76	19.99	1.65	25	0.00
2/24/97	319	11.8	101.52	148	7.85	20.51	1.68	25	0.00
2/25/97	320	11.7	101.41	143	7.81	18.13	1.49	26	0.00
2/26/97	332	12.2	94.68	139	7.74	20.59	1.71	27	0.00
2/27/97	348	12.6	92.57	138	7.74	20.65	1.70	28	0.00
2/28/97	353	12.3	106.16	139	7.75	18.97	1.57	28	0.00
3/1/97	348	12.5	106.78	136	7.77	20.11	1.68	28	0.00
3/2/97	346	12.8	113.60	135	7.77	20.23	1.67	28	0.00
3/3/97	343	12.7	114.93	133	7.73	20.27	1.68	27	0.00
3/4/97	346	12.5	116.62	132	7.71	20.65	1.71	28	0.00
3/5/97	343	12.5	112.34	126	7.53	21.45	1.78	28	0.00
3/6/97	334	12.7	105.85	107	7.63	23.83	1.96	27	0.00
3/7/97	330	13.1	107.73	108	7.62	34.04	2.81	26	0.00
3/8/97	328	13.6	112.56	109	7.64	33.26	2.74	26	0.00
3/9/97	331	14.0	119.09	105	7.64	28.29	2.33	27	0.00
3/10/97	336	14.4	123.02	103	7.63	26.53	2.18	27	0.00
3/11/97	342	15.2	118.03	101	7.63	18.95	1.55	27	0.00
3/12/97	333	14.4	108.92	101	7.66	20.64	1.69	27	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

**** Chloride values are calculated and not measured.***

Barker Slough Pumping Plant Automated Station Daily Averages (Continued)

Date	*EC(µS/cm)*	*WaterTemp(°C)*	*Turbidity(NTUS)*	*Fluor(FL)*	*pH(units)*	*Volume(CFS)*	*Volume(AF)*	*Cl*(mg/L)*	*Precip.(in)*
3/13/97	316	14.2	101.63	100	7.66	25.90	2.14	25	0.00
3/14/97	318	14.2	108.22	96	7.71	24.94	2.06	25	0.00
3/15/97	321	15.0	94.95	93	7.77	25.45	2.10	26	0.00
3/16/97	327	14.4	103.35	94	7.77	19.39	1.60	26	0.01
3/17/97	331	14.6	99.54	90	7.73	21.42	1.76	26	0.00
3/18/97	334	15.0	103.39	89	7.74	16.37	1.34	27	0.00
3/19/97	339	15.7	89.73	86	7.73	23.30	1.92	27	0.00
3/20/97	344	16.1	80.35	86	7.71	20.04	1.66	28	0.00
3/21/97	353	16.8	78.80	85	7.70	18.45	1.53	28	0.00
3/22/97	360	16.9	72.61	83	7.69	19.63	1.61	29	0.00
3/23/97	373	16.6	68.46	85	5.40	21.21	1.75	30	0.00
3/24/97	388	17.3	68.60	84	7.33	11.08	0.91	31	0.00
3/25/97	393	17.1	65.15	84	7.30	7.19	0.59	32	0.00
3/26/97	393	17.8	58.66	84	7.47	7.73	0.64	31	0.00
3/27/97	397	17.3	58.55	90	7.58	9.28	0.77	32	0.00
3/28/97	398	16.7	61.66	93	7.59	11.45	0.95	32	0.00
3/29/97	401	15.8	64.35	95	7.68	8.05	0.67	32	0.00
3/30/97	406	16.6	58.17	97	7.69	14.71	1.22	32	0.00
3/31/97	406	15.7	64.97	104	7.67	13.15	1.08	32	0.00
4/1/97	411	14.6	76.61	116	7.71	16.67	1.38	33	0.00
4/2/97	424	13.2	80.01	135	7.80	8.38	0.70	34	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

**** Chloride values are calculated and not measured.***

Barker Slough Pumping Plant Automated Station Daily Averages *(Continued)*

Date	*EC(µS/cm)*	*WaterTemp(°C)*	*Turbidity(NTUS)*	*Fluor(FL)*	*pH(units)*	*Volume(CFS)*	*Volume(AF)*	*Cl*(mg/L)*	*Precip.(in)*
4/3/97	441	13.1	61.02	150	7.75	4.91	0.40	35	0.00
4/4/97	452	14.0	55.58	168	7.70	15.28	1.26	36	0.00
4/5/97	460	14.1	54.26	195	7.66	12.83	1.06	37	0.00
4/6/97	466	14.0	50.98	219	7.59	15.08	1.24	37	0.00
4/7/97	470	14.1	49.48	236	7.51	6.15	0.49	38	0.00
4/8/97	462	14.7	44.14	267	7.55	11.68	0.97	37	0.00
4/9/97	451	14.7	45.43	437	7.76	24.30	2.02	36	0.00
4/10/97	459	15.1	50.14	565	7.75	17.50	1.45	37	0.00
4/11/97	473	15.4	48.70	683	7.76	17.02	1.41	38	0.00
4/12/97	488	15.8	46.70	788	7.71	19.13	1.58	39	0.00
4/13/97	506	16.5	45.16	888	7.73	19.94	1.64	40	0.00
4/14/97	518	16.8	47.18	834	7.71	21.04	1.73	41	0.00
4/15/97	511	17.8	43.04	905	7.69	40.13	3.32	41	0.00
4/16/97	509	18.3	36.49	753	7.70	30.00	2.48	41	0.00
4/17/97	516	18.8	33.47	253	7.69	20.50	1.70	41	0.00
4/18/97	518	18.4	37.41	328	7.60	29.31	2.43	41	0.00
4/19/97	515	18.5	41.94	589	7.54	26.71	2.21	41	0.00
4/20/97	511	18.9	45.30	472	7.63	25.45	2.10	41	0.00
4/21/97	515	19.3	51.35	246	7.69	37.03	3.07	41	0.00
4/22/97	520	18.9	53.90	85	7.71	47.90	3.95	42	0.00
4/23/97	518	18.4	50.48	90	7.73	61.60	5.09	42	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

**** Chloride values are calculated and not measured.***

Barker Slough Pumping Plant Automated Station Daily Averages *(Continued)*

Date	*EC(µS/cm)*	*WaterTemp(°C)*	*Turbidity(NTUS)*	*Fluor(FL)*	*pH(units)*	*Volume(CFS)*	*Volume(AF)*	*Cl*(mg/L)*	*Precip.(in)*
4/24/97	494	18.2	53.18	55	7.71	66.28	5.49	40	0.00
4/25/97	483	18.1	58.93	-4	7.64	80.09	6.62	39	0.00
5/1/97	455	18.1	65.27	-1	7.62	84.49	6.98	36	0.00
5/2/97	450	17.9	69.11		7.77	78.59	6.49	36	0.00
5/3/97	445	17.9	72.15		7.68	84.08	6.95	35	0.00
5/4/97	448	18.1	76.14		7.52	78.37	6.47	36	0.00
5/5/97	429	20.0	70.25	103	7.54	59.70	4.94	34	0.00
5/9/97	427	20.9	63.94	206	7.58	52.23	4.33	34	0.00
5/10/97	441	20.8	63.25	140	7.44	76.38	6.32	35	0.00
5/11/97	448	20.6	67.43	142	7.31	84.89	7.02	36	0.00
5/12/97	442	21.0	69.41	123	7.16	84.97	7.02	35	0.00
5/13/97	438	21.1	68.04	106	6.73	84.28	6.96	35	0.00
5/14/97	382	20.6	63.28	113	7.41	88.20	7.30	31	0.00
5/15/97	377	21.1	67.39	122	7.79	89.70	7.42	30	0.00
5/16/97	376	22.1	71.84	130	7.57	91.84	7.59	30	0.00
5/17/97	364	22.8	73.75	122	7.44	97.03	8.02	29	0.00
5/18/97	363	23.7	76.04	124	7.48	110.20	9.12	29	0.00
5/19/97	368	23.3	79.14	131	7.49	80.72	6.67	29	0.00
5/20/97	369	21.8	92.72	144	7.44	98.65	8.17	29	0.00
5/21/97	369	20.6	89.48	149	7.36	89.38	7.40	30	0.00
5/22/97	370	20.0	79.17	161	7.14	99.69	8.25	30	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

**** Chloride values are calculated and not measured.***

Barker Slough Pumping Plant Automated Station Daily Averages *(Continued)*

Date	*EC(µS/cm)*	*WaterTemp(°C)*	*Turbidity(NTUS)*	*Fluor(FL)*	*pH(units)*	*Volume(CFS)*	*Volume(AF)*	*Cl*(mg/L)*	*Precip.(in)*
5/23/97	384	19.6	79.37	170	7.20	56.23	4.65	31	0.01
5/24/97	374	19.4	73.01	148	7.57	54.66	4.51	30	0.00
5/25/97	374	19.6	75.77	151	7.56	48.58	4.02	30	0.00
5/26/97	369	19.6	72.32	162	7.47	60.63	5.02	29	0.00
5/27/97	370	21.2	63.72	178	7.52	54.78	4.53	30	0.00
5/28/97	365	21.8	61.26	170	7.62	66.64	5.51	29	0.00
6/2/97	333	22.6	74.01	143	7.73	99.99	8.26	27	0.00
6/3/97	335	21.1	81.22	136	7.67	88.88	7.35	27	0.01
6/4/97	342	21.0	75.03	138	7.52	66.26	5.48	27	0.00
6/5/97	346	21.2	72.62	131	7.52	72.39	5.99	28	0.00
6/6/97	365	21.9	73.28	135	7.47	72.67	6.00	29	0.00
6/7/97	377	22.3	66.15	129	7.26	87.82	7.26	30	0.00
6/8/97	382	22.2	72.95	133	6.78	93.93	7.76	30	0.00
6/9/97	382	21.4	81.87	138	6.44	87.69	7.26	31	0.00
6/10/97	378	21.2	82.84	137	6.94	89.95	7.44	30	0.00
6/11/97	366	21.0	81.89	138	7.24	86.61	7.17	29	0.00
6/12/97	364	20.8	80.50	137	7.67	67.92	5.62	29	0.00
6/13/97	365	20.4	92.82	142	7.55	76.52	6.33	29	0.00
6/14/97	355	21.2	94.15	125	7.33	81.33	6.73	28	0.00
6/15/97	342	21.2	61.98	105	7.42	91.91	7.60	27	0.00
6/16/97	339	21.2	54.97	101	7.48	92.59	7.65	27	0.00

***Source:** DWR Division of Operations and Maintenance Environmental Assessment Branch*

** Chloride values are calculated and not measured.*

Barker Slough Pumping Plant Automated Station Daily Averages (Continued)

Date	EC(µS/cm)	WaterTemp(°C)	Turbidity(NTUS)	Fluor(FL)	pH(units)	Volume(CFS)	Volume(AF)	Cl*(mg/L)	Precip.(in)
6/17/97	337	21.8	50.10	101	7.50	84.71	7.00	27	0.00
6/18/97	334	21.8	67.87	117	7.59	97.95	8.10	27	0.00
6/19/97	337	22.5	60.77	120	7.60	98.59	8.16	27	0.00
6/20/97	338	22.2	79.69	136	7.59	95.49	7.90	27	0.00
6/21/97	340	21.6	82.40	139	7.53	88.80	7.34	27	0.00
6/22/97	343	21.1	84.27	145	7.47	93.72	7.76	28	0.00
6/23/97	346	21.1	82.82	146	7.44	88.79	7.34	28	0.00
6/25/97	318	23.7	70.06	132	7.30	111.69	9.23	25	0.00
6/26/97	318	22.8	80.83	143	7.27	103.72	8.57	25	0.00
6/27/97	315	21.6	92.48	149	7.31	97.75	8.10	25	0.00
6/28/97	306	20.8	107.06	149	7.34	89.84	7.43	24	0.00
6/29/97	297	20.3	112.46	149	7.36	95.85	7.92	24	0.00
6/30/97	293	20.5	113.32	150	7.34	89.08	7.36	24	0.00

Source: DWR Division of Operations and Maintenance Environmental Assessment Branch

**** Chloride values are calculated and not measured.***

Appendix F

Phase II Water Quality Monitoring Workplan

Barker Slough Watershed Management Project
Phase II Water Quality Monitoring Workplan
DWR - Municipal Water Quality Investigations Program
Version: February 20, 1998
FINAL DRAFT

BACKGROUND

Summary of Phase I Water Quality Monitoring Results

Phase I water quality monitoring results indicate that Lindsey Slough has better water quality than other sampling sites, with the poorest water quality found at the Calhoun Cut and Barker Slough/Cook Lane sampling sites. The highest levels of dissolved organic carbon, trihalomethane formation potential, *E. coli*, and UVA were observed at both Calhoun Cut and Barker Slough/Cook Lane. The lowest levels were observed at the Lindsey Slough survey site. It appears that Calhoun Cut water quality is similar to the Barker Slough Pumping Plant water quality during the dry season (when upper Barker Slough water is often held back by a dam on the Campbell Ranch property). During the wet season, water quality at both Cook Lane and Calhoun Cut resemble the water quality at the pumping plant.

Barker Slough Watershed Water Quality Problems

Sudden increases in turbidity and total organic carbon in the BSPP influent require immediate response by water treatment plant operators to stay within federal and State drinking water quality standards. Under the enhanced coagulation requirement for TOC removal for low alkalinity waters in the Disinfectants-Disinfection Byproducts Rule, required TOC removal rates increase, ranging from 40 to 50 percent. BSPP influent has high TOC concentrations [mean (full study), 8 mg/L; wet mean, 10.24 mg/L; dry mean, 5.47 mg/L] with low to mid levels of total alkalinity [mean (full study), 99.16 mg/L; wet mean, 85.9 mg/l; dry mean, 108.76 mg/L].

Increased levels of *E. coli,* total aluminum, iron, and manganese at the BSPP intake require increased use of chemical disinfectant by water treatment plants. This results in increased cost for additional alum, caustic soda, and disinfectants, more frequent backwashing of filters, and additional treatment to control the formation of D-DBPs in the finished water. These increased costs have resulted in overexpenditures by water treatment facilities using BSPP influent.

Intermittent increases in turbidity and TOC in the plant influent water at the Travis AFB Water Treatment Plant periodically cause plant shutdowns and nondelivery of water due to the plant's inability to produce treated water that meets the 0.2 NTU standard.

Historical data at some of the treatment plants suggest that there are occasionally high levels of bromide in NBA. This is of concern to the plants that use ozone because of the pending regulation of bromate as a disinfection byproduct. Recent studies suggest that if plant influent water contains more than 0.05 mg/L of bromide, the finished water may exceed the Phase I maximum contaminant level of 10 μg/L for bromate.

PHASE II WATER QUALITY MONITORING PROGRAM

Phase II water quality monitoring objectives:

1. Expand monitoring sites to include upper Barker Slough watershed sites to further delineate watershed contributions to the total load of contaminants at BSPP
2. Conduct sampling during the wet season, and particularly during storm events, which are the periods of greatest impact on BSPP water quality
3. Attempt to collect hydrological data when and where possible

Water Quality Monitoring

Phase II monitoring began in September 1997 to collect dry-weather data. In addition to the four sites (Calhoun Cut, Cook Lane, BSPP, and Lindsey Slough) monitored in Phase I, two new sites upstream of Campbell Ranch on the Noonan Drain and Barker Slough are also being sampled.

Water quality sampling locations, parameters, and frequency are shown in Table F-1. Instantaneous flows are calculated using a handheld stream current meter (Current Meter: Price AA type) and by measuring a stream cross section. Heavy flooding prohibits the collection of stream flow data at certain sites.

Sampling occurs during or after major storm events (defined as a predicted or recorded 1-inch rainfall in a 24-hour period at Travis AFB). Based on the Phase I data (e.g., January 1997), the greatest impact on BSPP water quality is expected during heavy runoff.

Dry baseline sampling began in September 1997 at the sites monitored in Phase I. Two sites were added: Noonan Drain at Hay Road and Barker Slough at Dally Road (Figure B-1). During the wet season, sampling occurs during or following storm events.

The budget for Phase II is shown in Table F-2. The budget allows for up to 12 monitoring events. If 12 storm events do not occur, sampling may continue into the dry season.

Data Interpretation Tasks

A comparison of bromide to chloride ion ratios and other relationships of mineral composition to electrical conductivity and total dissolved solids will be used to identify the source(s) of bromide in Barker Slough. Relationships of the mineral ions can be used to determine the dominant sources such as seawater, evaporates, brines, or mineral weathering. Formations of marine deposits upstream of Barker Slough are one possible source. The results should indicate whether seawater is a major bromide source to BSPP.

A comparison of the water quality differences between the new monitoring site above the Campbell Ranch lake and below or at the outlet of the lake at Cook Lane will show any changes to water quality from the lake operations.

Nutrient, organic carbon, and coliform data will be assessed. Typically, high concentrations of ammonia, organic nitrogen, and fecal coliform bacteria in streams are indicative of fresh animal waste. Nutrient data will also be used to estimate the potential of the water to enhance algal growth (e.g., eutrophic, mesotrophic, oligotrophic classification).

Measurements of total and dissolved organic carbon, UVA-254 nm, and THMFP will be used to determine the character of organic carbon and possible dominant sources during the wet season. Humic material, which is known to form trihalomethanes when oxidized with chlorine, absorbs ultraviolet light the strongest at the 254 nm wavelength. In MWQI studies of the Delta, the DOC specific absorbance (ratio of UVA-254 nm value multiplied by 100, divided by the DOC concentration) is indicative of its character and source. In the Delta, the DOC specific absorbance values of peat soil drainage are typically above 3 and for lake and river freshwater, about 2. Comparison of the THM yield per unit of DOC will also help characterize sources of carbon in the local watershed.

Coliform bacteria have been shown to have an affinity to colonize on organic-clay particles. These particles protect bacteria against ultraviolet sunlight and provide a nutrient supply. Seasonal changes in particulate organic carbon concentration and of total suspended solids will be compared to *E. coli* results. Turbidity values will also be compared to POC and to TSS values.

Hydrological data will be collected when possible and used to calculate mass loading of contaminants. Rainfall totals will also be compared to contaminat levels and concentration spikes.

Table F-1. Phase II Sampling Locations, Parameters, and Frequency

Locations	Parameters (all sites)	Frequency	Comments
Original Phase I Sites: **(4)** Cook Lane, Calhoun Cut (at Hwy. 113), BSPP, and Lindsey Slough (at Hastings Is. Br.) **New Sampling Locations:** **(2)** Barker Slough at Dally Road, Noonan Drain at Hay Road **Duplicate (1)**(A.k.a. Big Slough at Waterton - fictitious site) **Nutrient Blank (1)** **Total (7)**	Field measurements (Temp., DO, pH, Turbidity, EC) TOC (66) DOC (Filtered in Field)(66D) UVA-254 nm (72) THMFP (8) Std. Mineral (1) Bromide (36), UVA Suspended Solids (55) Std. Nutrients (filtered and unfiltered (2) Fecal Coliforms (*E. coli*)	Storm Events (up to 12)	Storm event driven, wet months (Nov-May), during or within 24 hours after a storm of 1" precipitation or greater

*As of 10/30/97, all sites have been sampled for dry base line sampling.

Table F-2. Phase II Budget

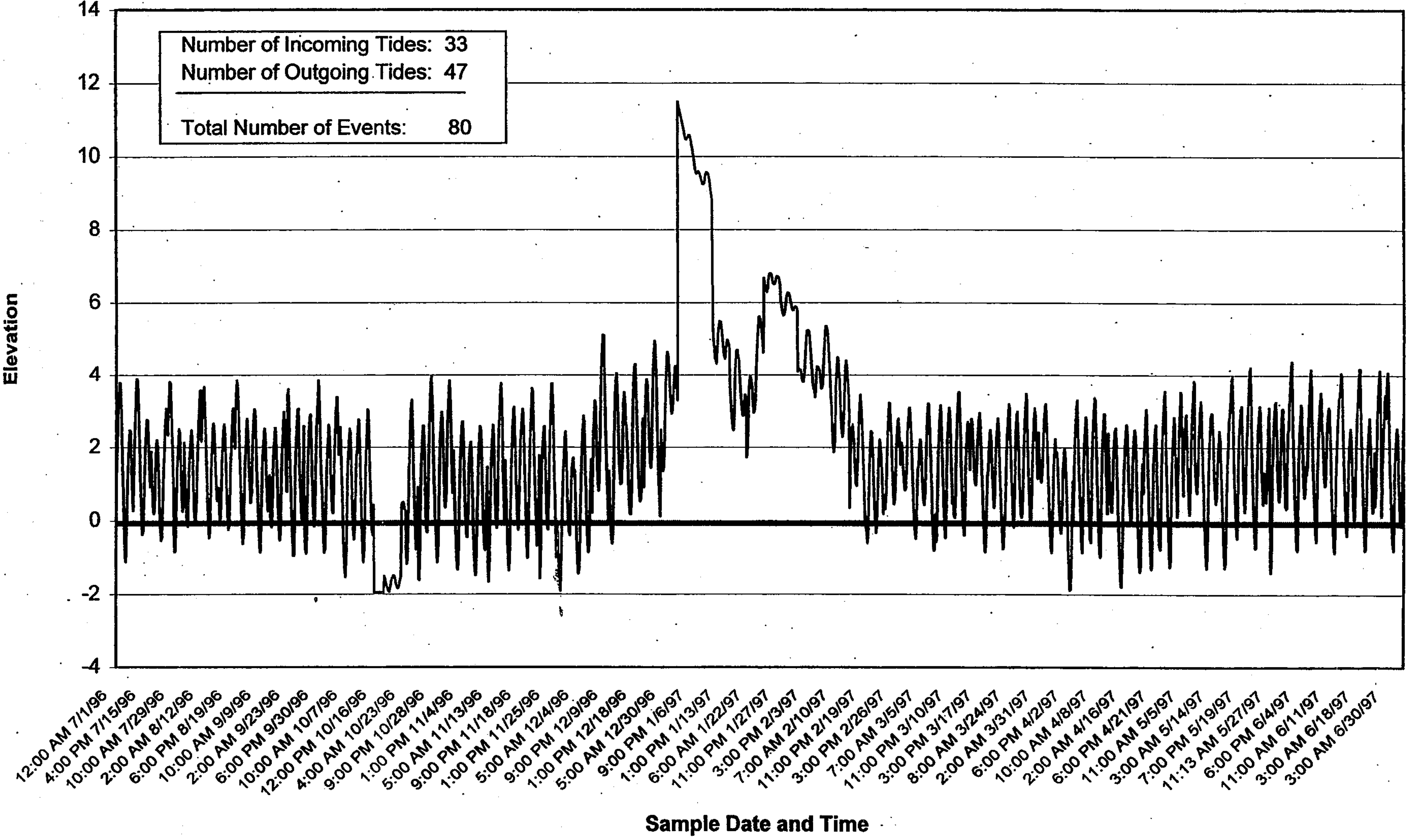
BARKER SLOUGH WATERSHED STUDY PHASE II BUDGET			
LOCATION	STORM SAMPLES (Nov-May) 12 Events (see note)	*TOTAL ANALYSIS COST FOR SAMPLES (1 EVENT per site=$543.00)	STAFF FOR EACH EVENT (1 EVENT = $1600.00)
Noonan Drain at Hay Road	12	12 x 543.00=6516.00	MWQI, O&M, and Central District (Hydrologist)
Barker Slough at Dally Road	12	12 x 543.00=6516.00	MWQI, O&M, and Central District (Hydrologist)
Barker Slough at Cook Road	12	12 x 543.00=6516.00	MWQI, O&M, and Central District (Hydrologist)
BSPP	12	12 x 543.00=6516.00	MWQI, O&M, and Central District (Hydrologist)
Calhoun Cut at Highway 113	12	12 x 543.00=6516.00	MWQI, O&M, and Central District (Hydrologist)
Lindsey Slough at Hastings Island	12	12 x 543.00=6516.00	MWQI, O&M, and Central District (Hydrologist)
Duplicate (Big Slough at Waterton)	12	12 x 543.00=6516.00	MWQI, O&M, and Central District (Hydrologist)
Nutrient Blank	12	12 x 105.00= 1260.00	MWQI, O&M, and Central District (Hydrologist)
TOTALS	96	$46,873.00	$19,200.00
TOTAL SAMPLING COSTS			$66,073.00
DWR PROJECT MANAGEMENT: Data Analysis, Report Writing, Presentations	1 Year	$50,000	$50,000.00
TOTAL PROJECT COST			**$116,073.00**

***Note:** Collection of samples for metals (Al, Fe, Mn) analysis was stopped on 1/29/98. Staff costs are based on 4 staff per event: 2 MWQI, 1 O&M, 1 Hydrologist (Central District). Each event totals $1,600 in staff and equipment costs.

Appendix G

Tide Elevation and Pumping Data

Figure G-1. Tide Elevation at Barker Slough Pumping Plant



Source: DWR Division of Operations and Maintenance.

Table G-1. Barker Slough Pumping (in CFS)

Day	Jul-96	Aug-96	Sep-96	Oct-96	Nov-96	Dec-96	Jan-97	Feb-97	Mar-97	Apr-97	May-97	Jun-97
1	46	103	85	44	26	25	9	18	20	11	87	103
2	94	85	89	43	31	26	11	17	19	6	82	111
3	91	93	82	46	36	25	17	19	20	3	88	95
4	86	97	77	57	31	19	14	20	16	7	82	67
5	89	83	84	43	34	21	19	16	21	6	87	74
6	83	80	76	47	33	27	17	20	24	11	98	74
7	90	84	74	44	35	23	18	16	33	5	91	98
8	84	85	78	46	37	21	14	19	31	8	42	101
9	86	97	81	50	30	26	18	18	28	17	52	93
10	84	95	70	47	35	21	18	17	24	11	79	96
11	93	87	66	32	35	24	16	20	19	11	89	92
12	93	92	52	33	40	21	19	15	19	16	90	63
13	84	97	57	37	38	23	16	19	25	17	88	81
14	80	69	60	41	33	24	20	20	25	20	93	86
15	78	68	70	36	38	21	15	18	25	38	68	99
16	87	60	64	32	28	19	19	18	18	26	100	100
17	86	75	57	31	30	17	18	18	21	20	108	90
18	74	63	63	30	27	31	17	17	16	29	126	108
19	86	60	66	28	25	21	20	20	23	26	83	108
20	105	63	69	27	20	30	17	19	19	25	108	103
21	105	53	64	31	25	28	15	17	18	37	95	95
22	94	63	59	48	27	31	21	18	19	47	109	101
23	101	65	74	48	20	27	18	19	20	64	47	49
24	82	59	70	40	25	20	15	20	7	67	53	92
25	83	58	63	39	26	14	16	18	4	82	47	104
26	93	56	60	36	24	24	19	20	4	92	61	116
27	86	59	64	45	20	24	19	19	7	87	59	107
28	79	72	58	47	26	20	16	18	8	76	65	96
29	97	73	63	41	25	23	19		6	90	102	105
30	89	87	56	25	20	19	16		12	73	101	95
31	94	77		32		18	14		11		98	
Total	2,702	2,358	2,051	1,226	880	713	520	513	562	1,028	2,578	2,802

Source: DWR Division of Operations and Maintenance

Cover photo of Barker Slough Pumping Plant located in the Central Valley Region. Copyright by California Department of Water Resources.