

APPENDIX 13A

SUMMARY OF AVAILABLE DATA RELATED TO WATER QUALITY AESTHETICS

Summary of Available Data Related to Water Quality Aesthetics

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Introduction

This document summarizes available data since 1980 related to water quality aesthetics in the Klamath River. The types of data included in this summary are:

- Turbidity
- Secchi Disc
- Klamath Recreational Survey Water Quality Results

This document is organized to provide 1) brief discussions and summaries of each data type, and 2) attachments containing data tables and graphs of each data type.

Summary of Available Data

Turbidity Data

Turbidity is a measure of cloudiness (caused by light attenuation) of water as affected by suspended matter. E&S Environmental Chemistry Inc., has compiled a database of existing water quality data (see Study Plan 1.1) which contains a table of historic turbidity data from various sources. The data and associated graphs are contained in Attachment C.

The database contains 1257 turbidity data points collected between January 1980 and March 2001. The data were collected at approximately 46 sample sites throughout the Klamath River from Link River to the mouth. The majority of the data were collected at seven of the forty-six sample sites. The data from these seven sites are summarized in the table below and are graphed in Attachment A in time series to show trends in turbidity values.

Sample Site	N	Minimum/Maximum/Average Turbidity Value (NTUs)
Link River @ Mouth (Klamath Falls)	134	3/12.4/65
Klamath River @ Highway 66 (Keno)	126	2/76/10
Klamath Straight @ USBR Pump Station F	117	2/787/31
Klamath River Downstream of Big Bend Powerhouse	67	1/76/10

Sample Site	N	Minimum/Maximum/Average Turbidity Value (NTUs)
Klamath River below Iron Gate Dam	109	0/42/7
Klamath River near Seiad Valley	132	1/170/7

Secchi Disc Data

A Secchi disk is a circular 20-cm disk that is used to measure relative clarity or turbidity of water (especially in lakes and reservoirs) by lowering the disk into the water until it is no longer visible. E&S Environmental Chemistry Inc., has compiled a database of existing water quality data (see Study Plan 1.1) which contains Secchi disc data collected in the Klamath Basin in 2001 and 2002. Locations included Copco No. 1 Reservoir (n=37), Iron Gate Reservoir (n=46), J.C. Boyle Reservoir (n=17), and Keno Reservoir (n=7). Sample locations within each reservoir varied. Graphs of Secchi disc data collected in the Klamath Basin in 2001 and 2002 are included in Attachment B.

The following is a summary table of data ranges that were found at each location:

Site Name	N	Minimum/Maximum/Average Secchi Disc reading (meters)
Keno Reservoir	7	0.3/1.15 /0.8
J.C. Boyle Reservoir	17	0.3/1.6/1.1
Copco No. 1 Reservoir	37	0.45/3.9/2.2
Iron Gate Reservoir	46	0.6/5.0/2.5

Water Quality Survey

EDAW Inc., conducted a Klamath Recreation User Survey (see Study Plan 3.2) in which recreational users were asked questions regarding their experiences on the Klamath River in the Klamath Hydroelectric Project area. When the question was asked “Has water quality ever affected your visit to the Klamath River area?” people had various responses that lend insight into the aesthetic quality of the water in the Klamath River. The Klamath Recreation Survey results are available at <http://newwww.pacificorp.com/File/File24051.pdf> on PacifiCorp’s website. A listing of specific responses related to water quality are contained in Attachment C to this memo.

Summary of survey results related to water quality are as follows:

Has water quality ever affected your visit to the Klamath River area?

	Percent	n
NO	57	407
YES	36	250

If YES, please indicate how reservoir or river water quality has affected the quality of your experience.

	Percent	n
Detracts a lot	36	89
Detracts a little	33	82
No effect	15	38
Adds a little	2	5
Adds a lot	4	12

If YES, please explain...

(Note: the following summary was developed by interpreting key causal factors from responses listed in Attachment C.)

Area	n	Cited Factor (Percent)				
		Algae	Smell	Dirty	Flow¹	Other²
Lake Ewauna/Keno Reservoir	20	40	20	20	0	35
J.C. Boyle Reservoir	16	50	0	50	6	12
Upper Klamath River/Hell's Corner Reach	19	21	0	26	21	26
Copco Reservoir	8	25	0	38	0	50
Iron Gate Reservoir	56	50	5	9	13	32
Other ³	70	33	3	13	16	40
TOTAL	189	39	5	16	15	34

¹ The use of the term "Flow" here includes both flow amount and changes in river or reservoir water levels.

² In these instances, comments did not provide a specific factor, were too general, or could not be clearly interpreted.

³ In these instances, comments did not indicate a specific area, or indicated that the response applied to "all" or "everywhere". Two of the listed comments indicated "below Iron Gate" and four indicated "Upper Klamath Lake".

ATTACHMENT A:
TURBIDITY DATA GRAPHS

Link River at Mouth (Klamath Falls)

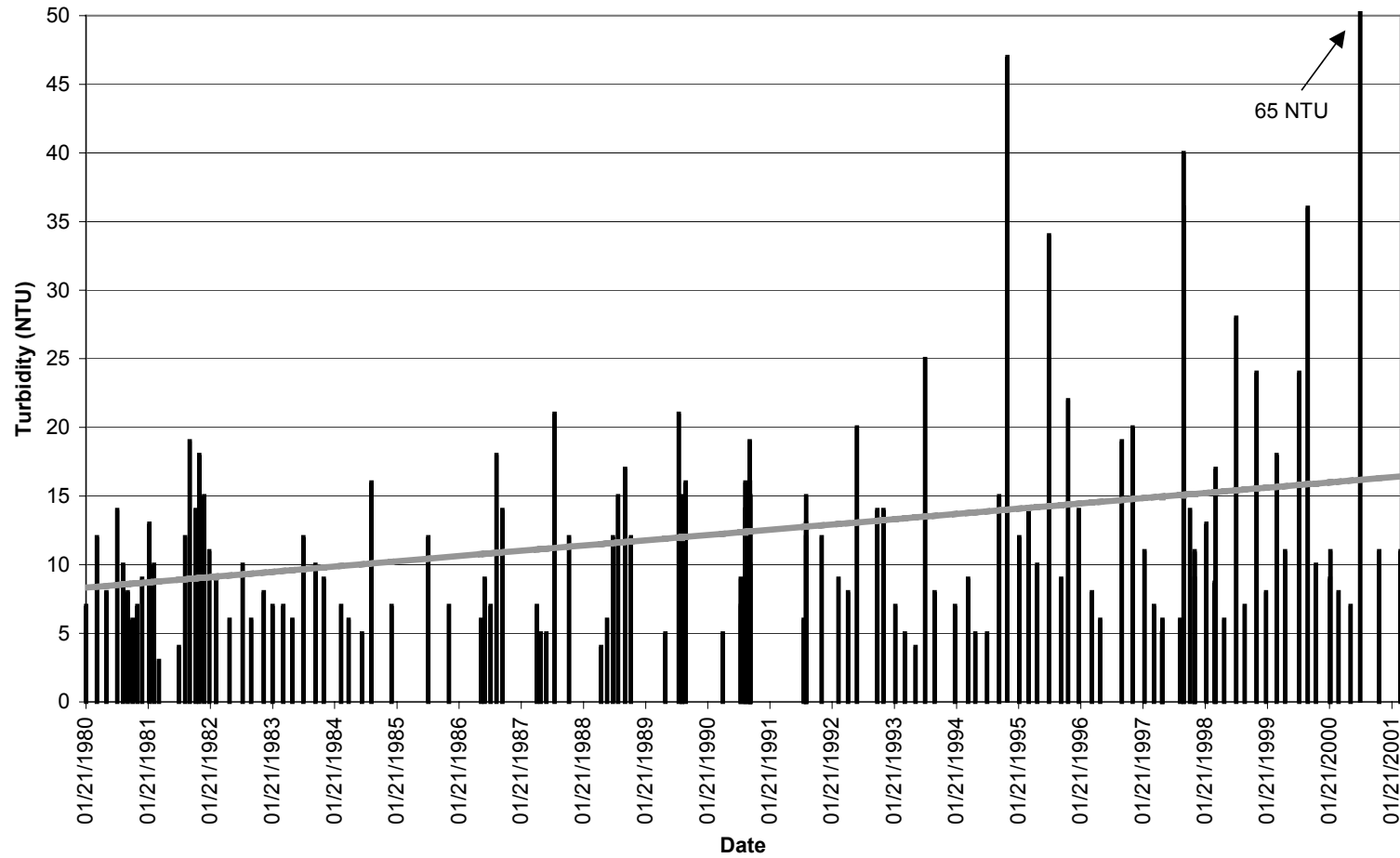


Figure A-1. Turbidity values (in Nephelometric Turbidity Units [NTU]) measured since 1980 in the Klamath River at the Link River mouth. (Gray line is a linear trend fit to the data.)

Klamath River @ Highway 66 (Keno)

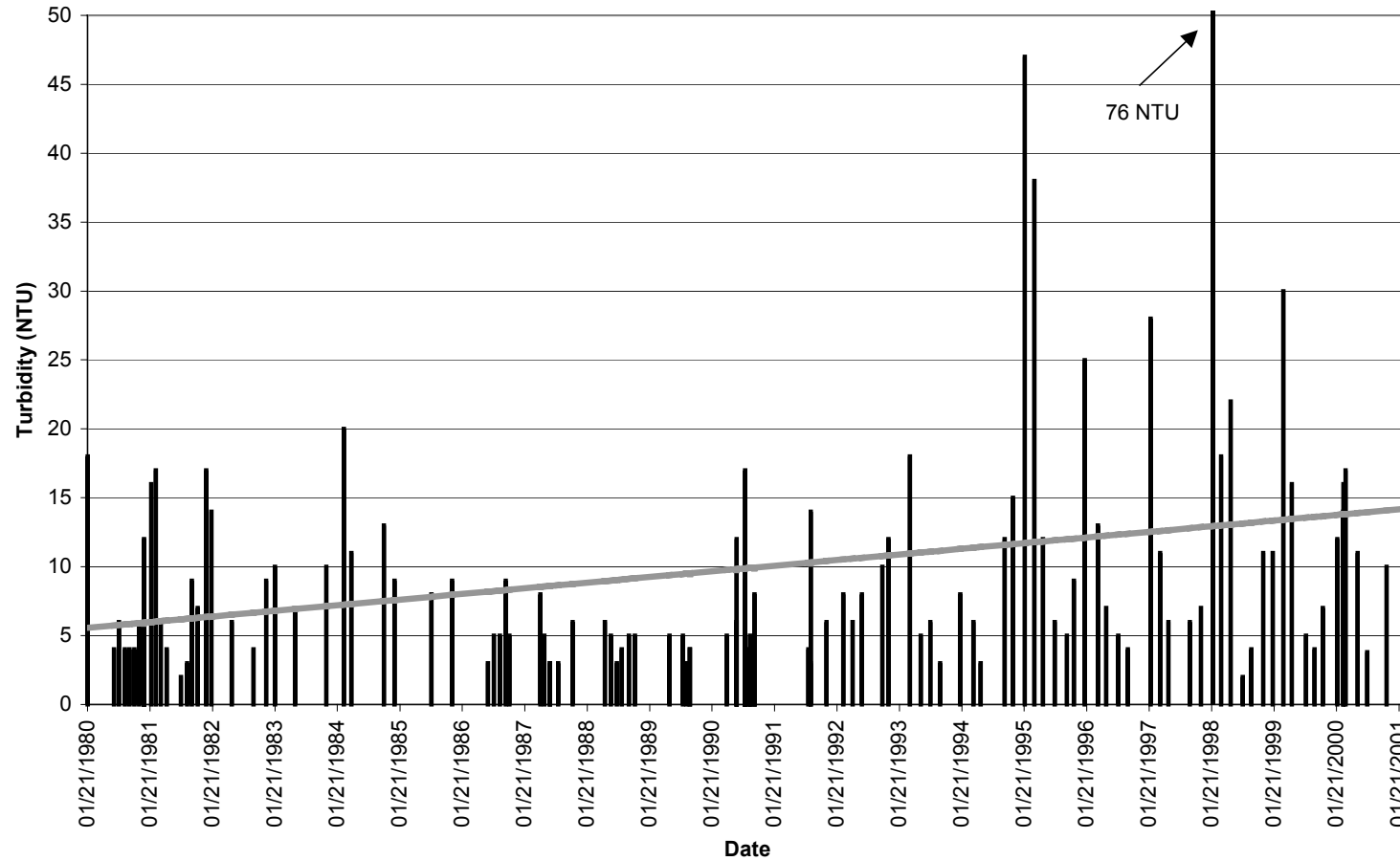


Figure A-2. Turbidity values (in Nephelometric Turbidity Units [NTU]) measured since 1980 in the Klamath River at Highway 66 near Keno, Oregon. (Gray line is a linear trend fit to the data.)

Klamath Straight @ USBR Pump Station F

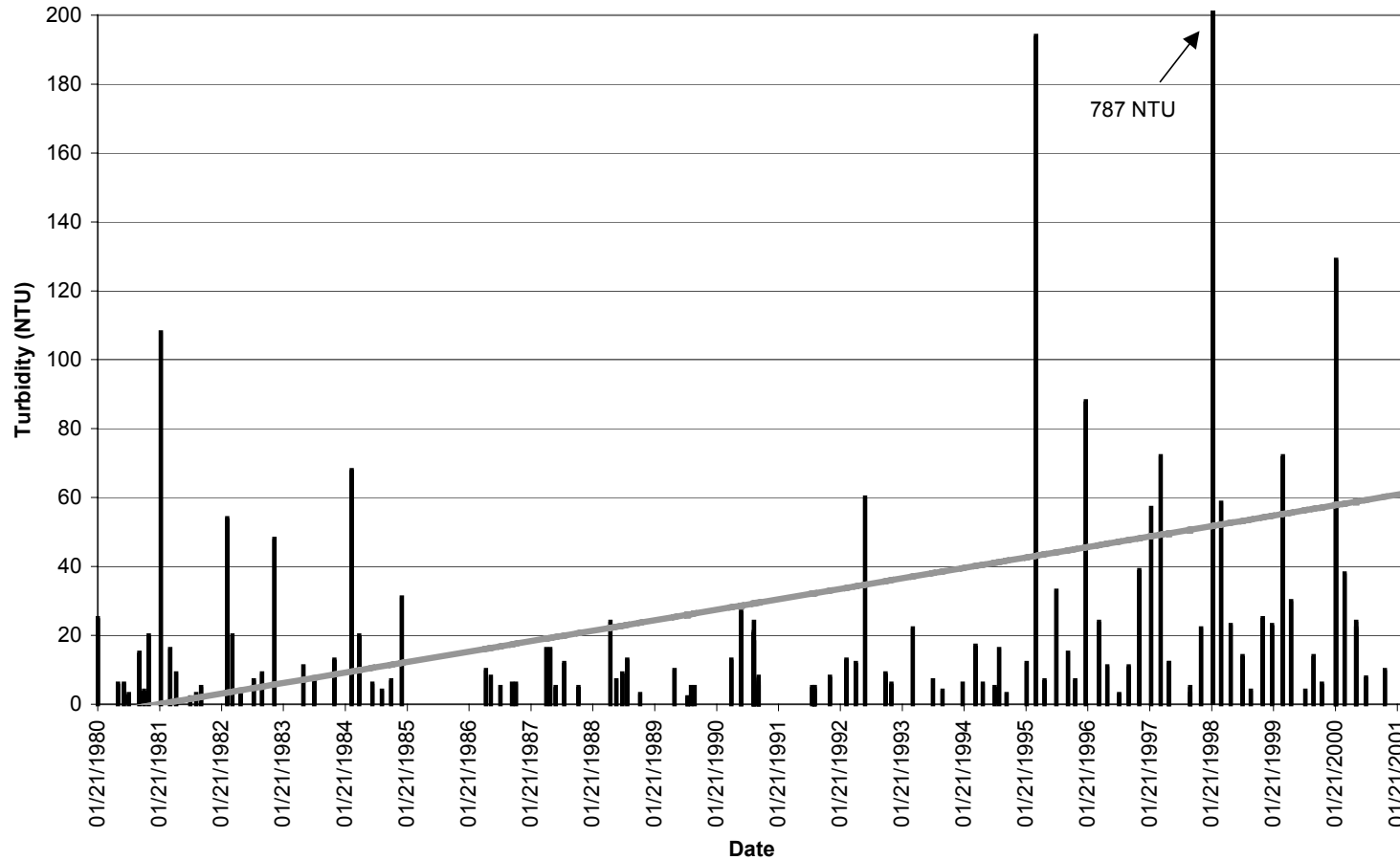


Figure A-3. Turbidity values (in Nephelometric Turbidity Units [NTU]) measured since 1980 in the Klamath Straits at USBR Pump Station F. (Gray line is a linear trend fit to the data.)

Klamath River Downstream of Big Bend Powerhouse

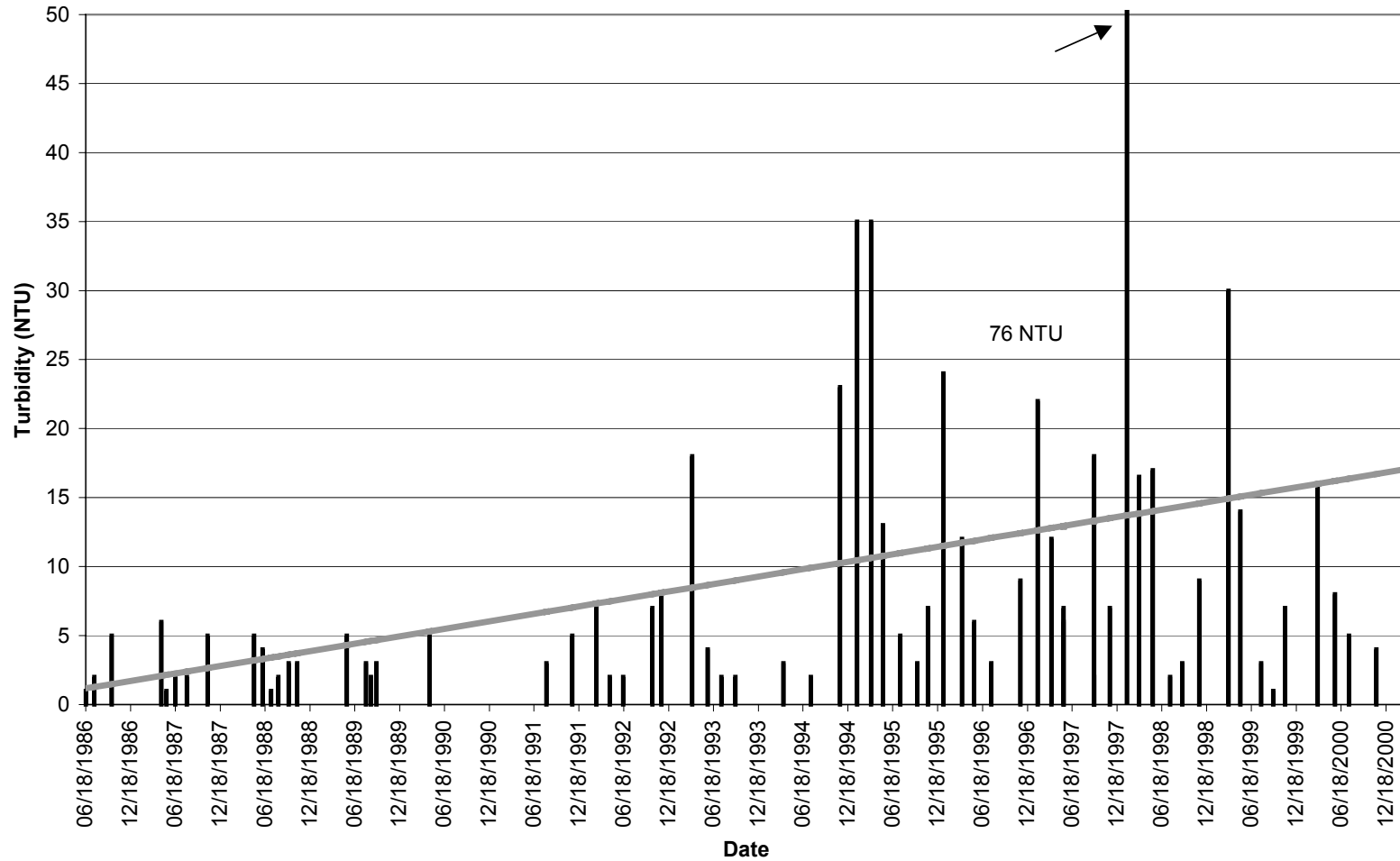


Figure A-4. Turbidity values (in Nephelometric Turbidity Units [NTU]) measured since 1980 in the Klamath River downstream of the J.C. Boyle powerhouse. (Gray line is a linear trend fit to the data.)

Klamath River Below Iron Gate Dam

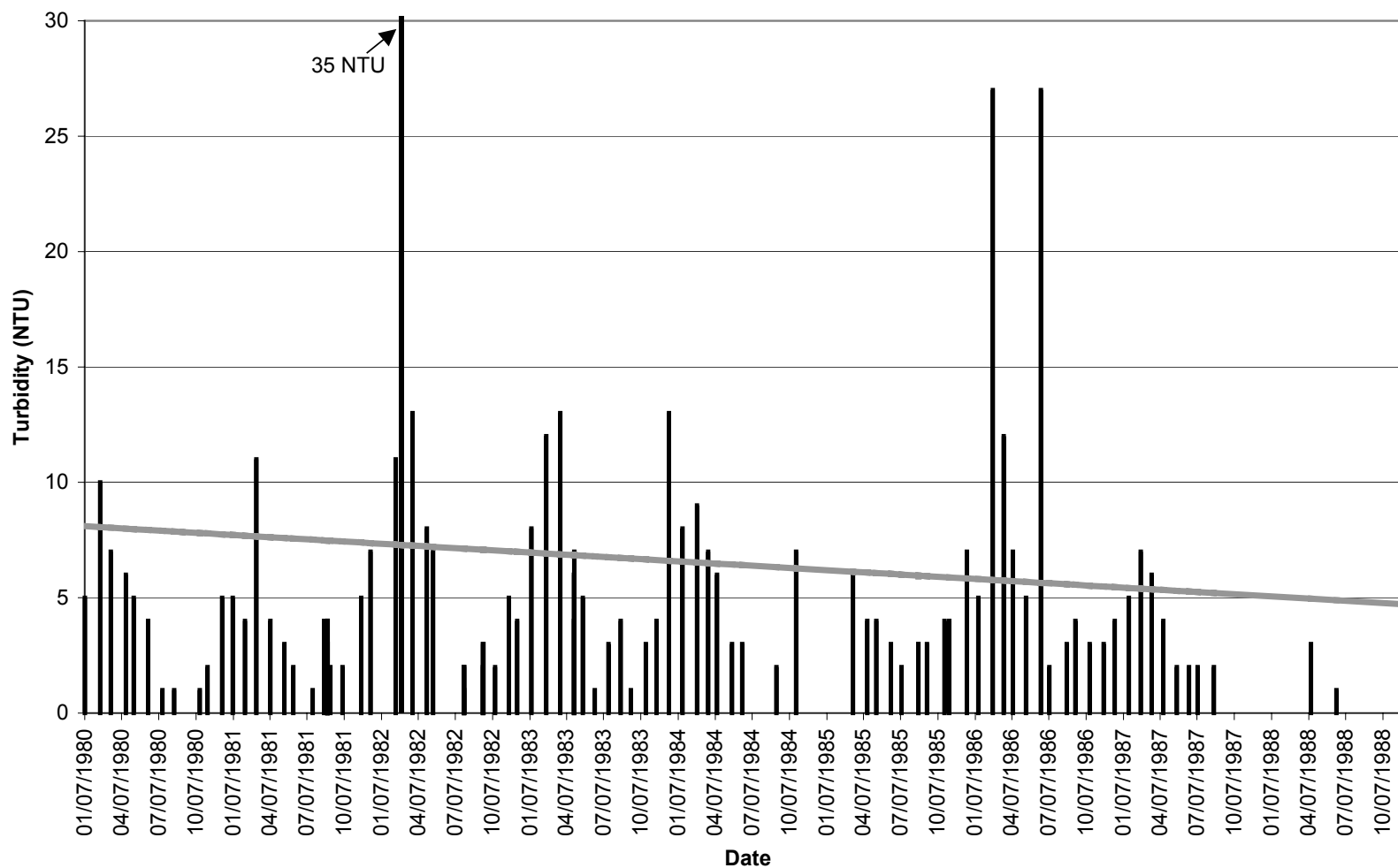


Figure A-5. Turbidity values (in Nephelometric Turbidity Units [NTU]) measured since 1980 in the Klamath River downstream of Iron Gate dam. (Gray line is a linear trend fit to the data.)

Klamath River Near Seiad Valley

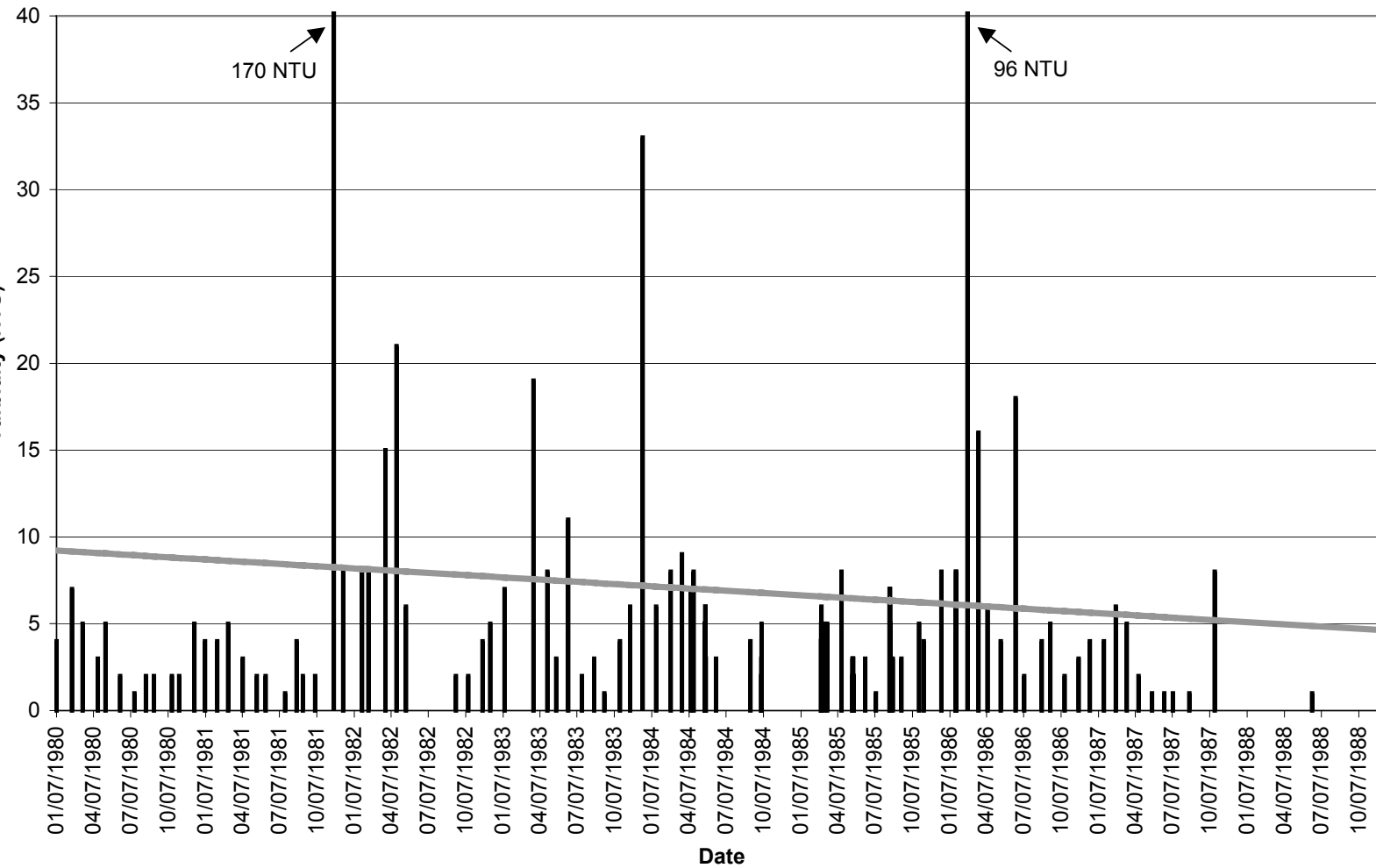


Figure A-6. Turbidity values (in Nephelometric Turbidity Units [NTU]) measured since 1980 in the Klamath River at Seiad Valley, California. (Gray line is a linear trend fit to the data.)

ATTACHMENT B:
SECCHI DISC DATA AND GRAPHS

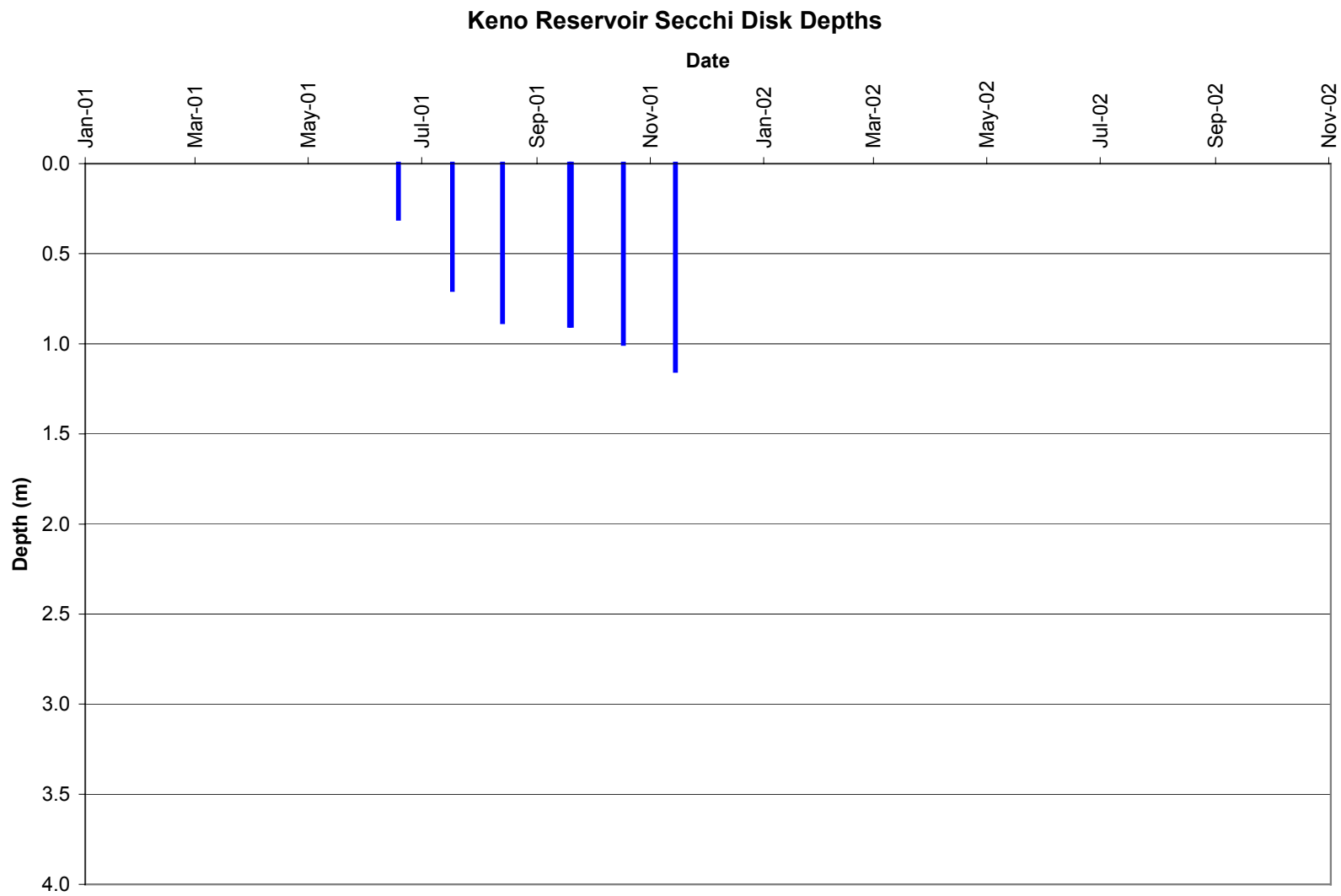


Figure B-1. Secchi disk readings (in meters, m) measured in Keno reservoir.

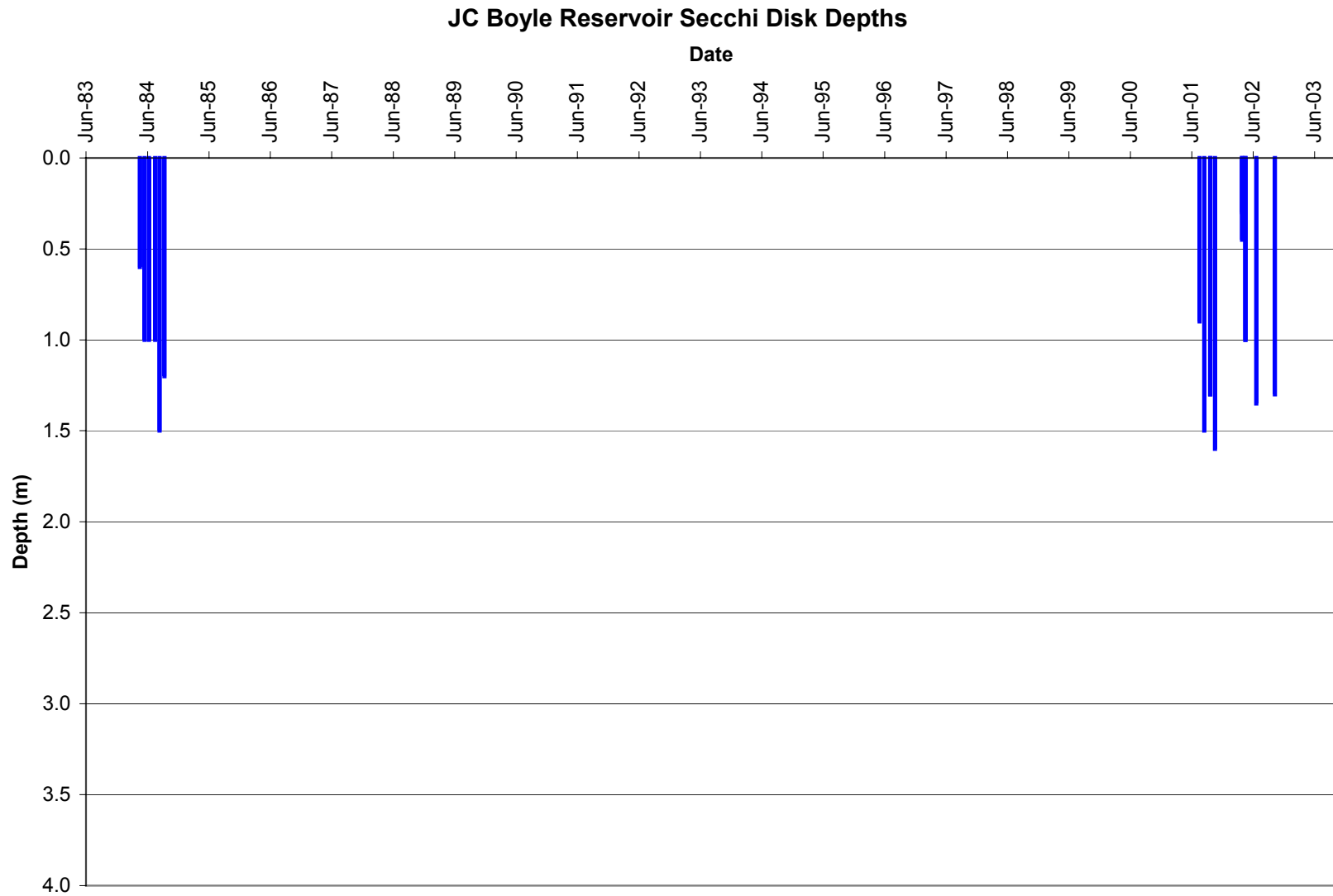


Figure B-2. Secchi disk readings (in meters, m) measured in J.C. Boyle reservoir.

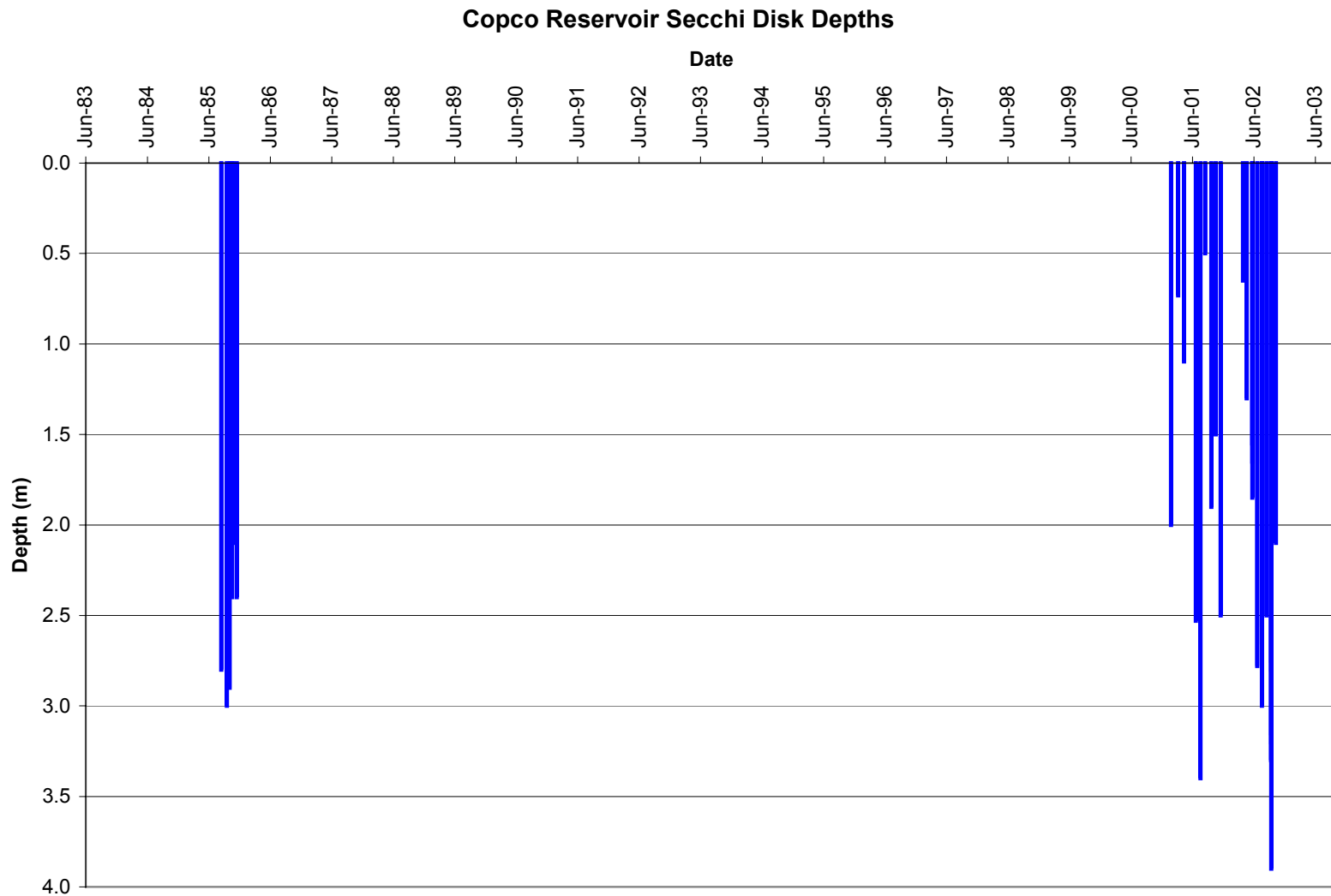


Figure B-3. Secchi disk readings (in meters, m) measured in Copco No. 1 reservoir.

Iron Gate Reservoir Secchi Disk Depths

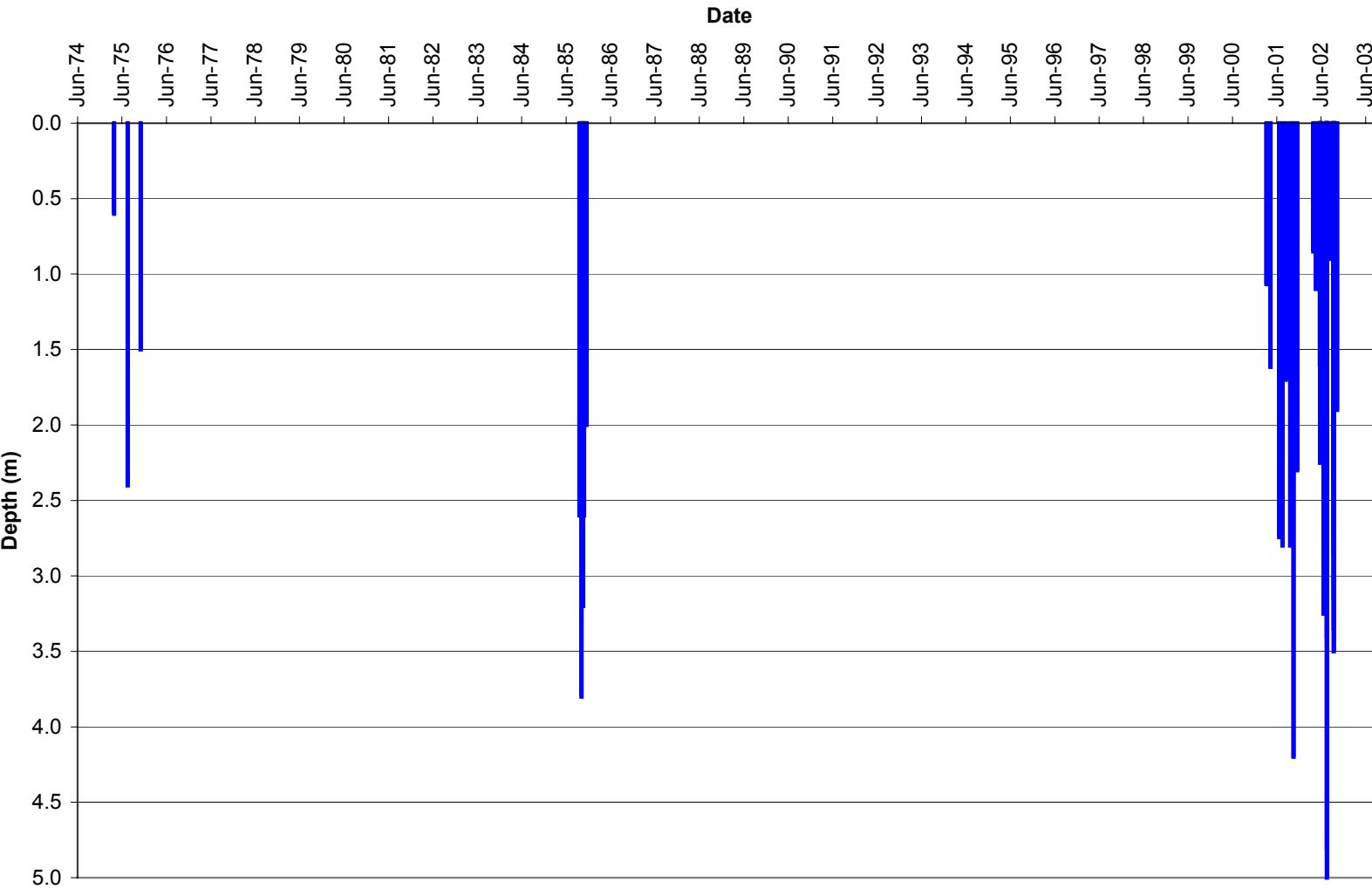


Figure B-4. Secchi disk readings (in meters, m) measured in Iron Gate reservoir.

ATTACHMENT C:
KLAMATH RECREATIONAL SURVEY WATER QUALITY RESULTS

Klamath Water Quality/Aesthetics Survey Responses

GENERAL QUESTIONNAIRE SURVEY

Has water quality ever affected your visit to the Klamath River area?

	Percent	n
NO	57	407
YES	36	250

If YES, please explain....(open-ended responses sorted by area)

Where	When	How
LAKE EUWANA/KENO RESERVOIR		
Keno	Every visit to Keno	cannot swim due to too much algae - So go to other lake to swim. It would be nice if where we visit river was cleaner to swim.
Keno and Lake Ewauna	This year	Bad smell this year
Keno Res.; Klamath Lake	middle summer	algae
Keno Reservoir	going fishing, every time we camp out & walk to water	too much algae
Keno Reservoir	8/11/2001	campsite
Keno River	0	algae smell
Keno, Iron Gate	Late summer	Algae
Klamath	0	lake is so dirty
Klamath Falls	8/25/2001	0
Klamath Lake	0	Stagnant water
Klamath Lake	always	0
Klamath Lake	All year	algae
Klamath Lake	Anytime	Algae
Klamath Lake	0	Algae/dirty
Klamath Lake - too low	0	0
Lake Ewauna Trail	Late spring - early fall	Standing water by trail smells
Lake Ewauna/Veteran's Park	7/1/2001	0
Lake Ewauna/Klamath Falls	Aug-Sept.	0
Miller Island	Last summer	Flotsam
Lake Ewauna	July 1	Smelled-water
J.C. BOYLE RESERVOIR		
JC Boyle	Last year	Saw dead fish in lake
JC Boyle Res.	0	Water Level up and down
near Sportsman's Park	ever since park has been established	0
Topsy	Summer visits	Extremely filthy (also dead fish everywhere)
Topsy	6/2/2002	Dirty can't swim/leachy
Topsy	Now	Muddy from pwr boats
Topsy	Late summer	Algae
Topsy	Today	Algae

Where	When	How
Topsy	Aug or end of July	Green stuff in the water (mucky)
Topsy	Every time	Vegetation overgrowth/algae
Topsy	Since I was young	There is too much muck & algae
Topsy	all the time	moss/slime
Topsy		0 algae
Topsy		0 gross
Topsy Day Use	This trip (6-23-02)	The seaweed was extremely distracting
Topsy Reservoir		0 Dirty algae
UPPER KLAMATH RIVER/HELL'S CORNER REACH		
Hell Corner	Last 3 years on Labor Day	I do not swim in River due to Color and taste
Hell's Corner		0 Water's too high
Hell's Corner	When water is too high	
Hell's Corner		0 Level is low then high, and makes fishing impossible.
Hell's Corner		0 Let the water out at night!!
Hell's Corner Reach & below Iron Gate	everytime	
Hell's Corner Run	This trip	
Hell's Reach	Occasionally	Water releases not ramped down in eve.
Klamath River	Summer	Water too warm for fishing
Klamath River	June through July	Too low of flows
Klamath River	June through July	Too little water
Klamath river	summer	algae--yuk
Rafting upper Klamath & flows effect trip		0 a lot of algae and "suds"
river		0 we didn't get in the river a lot but boating is ok
Upper Klamath River	Last year	Uneven waterflows
Upper Klamath River	Labor Day Weekend	Flow lines
Upper Klamath River	8/4/2001	Algae
Upper Klamath River	July 6th weekend; Labor day weekend	Timing of water release
Upper Klamath River Campground	8/4/2001	Algae
COPCO RESERVOIR		
Copco	Yearly	Green/Blue Algae Bloom - Weeds
Copco	Can be anytime during the summer	
Copco	last summer	
Copco		0 smug in the water
Copco	always	bad water quality
Copco Lake	In past years	"suds" in the river & lake
Copco, Iron Gate	Summers	Affected our timing
Copco/Lower Klamath	~ Late 91	Slimy, green, foamy - yuk
IRON GATE RESERVOIR		
Horseshoe Ranch/on the river below Iron gate dam	Late Summer	the river drops and it gets nasty

Where	When	How
IG Reservoir	0	Smell bad & I don't come up
In the Klamath area	Mid-Sept to June	To cold
Iron Gate	2 weeks ago (end April)	Low water
Iron Gate	0	Low Water
Iron Gate	Summer	Algae bloom
Iron Gate	later in summer	Seaweed
Iron Gate	late summer	Seaweed
Iron Gate	5/6/02-5/12/02	Late turn on
Iron Gate	April 20	Low water
Iron Gate	5/11/2002	Yellow tag - not to use water
Iron Gate	August on	The algae gets to bay
Iron Gate	Late in the summer	Don't come
Iron Gate	Late Summer	Gets yucky
Iron Gate	Years past	Pea green soup, algae
Iron Gate	Late 90's	Too much algae
Iron Gate	Late summer	Algae
Iron Gate	Late in the summer	Gets really dirty
Iron Gate	Late Summer	Lots of stuff in water (plants)
Iron Gate	0	0
Iron Gate	Late Aug-Sept.	0
Iron Gate	Late in the year	Algae
Iron Gate	after Mid Aug.	0
Iron Gate	Late summer	plant life in water
Iron Gate	0	Algae clogs jet ski engines
Iron Gate	late in year	gets skunky
Iron Gate & Copco Lakes	Summertime	Too algae filled to enjoy swimming
Iron Gate & Upper Klamath	0	I like the algae in the lakes
Iron Gate Dam to mouth of Klamath River	August, September	Need more water to be released; water too warm for salmon
Iron Gate Lake	Always	Because the algae grows too close to shore
Iron Gate Res.	7/5/2002	Dirty shoreline; people are slobs
Iron Gate Res.	7/20-7/22/01	0
Iron Gate Res.	Late summer	Algae
Iron Gate Reservoir	August	Poor Water Quality
Iron Gate To I-5	summer	no water!
Iron Gate	Late in summer	Green, thick algae
Iron Gate	Late in summer	Too much algae – jet skis get clogged up
Iron Gate	Late summer	Algae seaweed
Iron Gate	Late summer	Algae is bad
Iron Gate	late in the summer	gets to messy
Iron Gate	end of summer	algae - but I guess that makes less crowds!
Iron Gate	0	too mossy
Iron Gate	Last year	0
Iron Gate	Late summer	too much algae
Iron Gate	Late Summer	0

Where	When	How
Iron Gate	Late summer	Green water
Iron Gate	July 0-2001	0
Iron Gate	7/29/2001	0
Iron Gate & Copco	Summer time	Algae, from water temp or cows??; The smell is disgusting...
Iron Gate & Copco	Winter and late summer	0
Iron Gate & Copco	mid-summer	Algae
Iron Gate & Keno	Late summer	Algae
Iron Gate AKA slimegate	August, sometimes July	0
Iron Gate Res.	Late summer	Algae blooms increase - nasty!
Mirror Cove	Summer	Too much seaweed
Iron Gate	From about July on	too much algae
OTHER		
Algae	0	0
Algae	Late summer	Makes water look dirty
All	Year round	Dirty
April	Iron Gate	Low water
Around docks/campgrounds	Late summer	Hydrilla WEEDS; swimming/fishing
Below Iron Gate	Winter	To High Middy
Below Iron Gate	Summer	Klamath too low; fish sick
But H2O quality effects wildlife and would effect it.	0	0
Can't drink it	0	0
Diamond Lake	8/18/2001	0
everywhere	always	the algae
everywhere	everytime	irrigation pollution
Expectation	0	The trip leaders talked about not wanting to get cut in water because of filth
Fishing on the lower river	0	water levels
Here	Today	Too much seaweed where we like to swim
here	All the time	Moss in water not clean
Here	Now	Weeds Moss Kelp
Lakes	Each Summer	Grass + Water plants
Lower Klamath	Last year	You guys cut our water off. We couldn't farm.
Moss	Summer	Don't come in summer
Not the lake but water in hydrants	0	Its May 11 & still no water or hydrants
off the shore	you can't get on any of the docks	0
Oregon & N. California	0	Low water levels
PPL Park	Last summer	The algae
Sycan, Sprague, Williamson, Klamath River Reservoirs	Last 25 days, next 15 days (<u>Permanent</u>)	Temp., sediments, ague./ Human pollution
Steal gates	Summer of 2001	Protect
The entire basin made useless to both humans & wildlife	Last year	Taking the farmers' water; WE have swam & skied in upper Kl. Lake for 50 years - it's green - but then so is grass.

Where	When	How
The lake	0	Too much moss in lake
Too little experience, however, water quality is extremely important to me and I would avoid an area I know is polluted.	0	0
Upper and Lower Klamath River	today, Sept. 3, 2001	0
Upper Klamath	Last summer	Inaccurate & late water flows released
Upper Klamath	every summer	0
upper Klamath	summer	not quality quantity; river doesn't rise 'till Late Afternoon.
Upper Klamath Lake	Late Summer/Fall	Thick Algae
Upper Klamath Lake	Sat, Sun Aug 5, 6	0
Upper Klamath Lake	Late Spring/Summer	0
Upper Klamath Lake/Agency Lake	Late summer	Algae - stinks
Upper Klamath River System	Warm weather algae	I don't fish or swim in the water.
upper Klamath.	Labor Day 01	polluted
water	0	I don't come as often as swimming in green water is not ideal
Water level too low, Summer '01	0	0
whole Klamath	0	stinks
0	0	When the water smells bad and is too green
0	0	Not enough
0	Early April	0
0	Water warm & is green	0
0	0	Plant growth around lake prevents bank fishing from May-Oct.
0	Last year	0
0	0	Algae
0	0	Need water in hydrants
0	0	Need water faucets
0	0	The algae usually isn' t bad in the river.
0	0	Algae affects skiing enjoyment
0	0	Don't know if water is good
0	0	Too much algae
0	always	prevents swimming
0	0	fishing poor
0	All the time	Dirty water
0	0	Availability of camp water
0	Now	Lots of foam?? River quality
0	Always	Dirty
0	0	Try to do something about algae
0	0	drinking fine - don't care to swim when full of algae
0	0	Algae prohibits good swimming
0	0	It would be nice if the algae could be decreased.

Where	When	How
0	0	lots of floating debris
0	0	algae thick
0	Earlier in the day	Need to release water
0	0	Flows
0	0	foamy

If YES, please indicate how reservoir or river water quality has affected the quality of your experience.

	Percent	n
Detracts a lot	36	89
Detracts a little	33	82
No effect	15	38
Adds a little	2	5
Adds a lot	4	12

HELL'S CORNER REACH BOATER/ANGLER INTERVIEW FORM

Did water conditions affect your trip in any way?

	Percent	n
NO	44	8
YES	56	10

If YES, how....

- Warmer water was nice, has lots of algae
- Several people claimed illness as a result of ingestions (accidental) of river water
- Scummy water, lots of foam, definitely not clean water
- Lots of foam/scum
- Water quality is obviously very poor: the abundance of brown foam very negatively affected my experience on the river.
- Dirty
- Too warm, too polluted, too much agricultural runoff
- Water is nasty
- Water cold coming from dam, pollutes agricultural runoff
- The amount of foam gave me the impression that the water was polluted

Of yes respondents....

- All 10 were on commercial rafting trips.