Klamath River Water Quality Monitoring DataSonde Summary 2004

U.S. Fish and Wildlife Service

In Cooperation with the Karuk and Yurok Tribes

Acknowledgements

For their diligence and effort over the past four years, assistance in funding and general guidance in an ever evolving field

Thanks to the

Yurok Tribe Environmental Program

Karuk Tribe Water Resources

Why document Water Quality of the Klamath River?

- Document WQ conditions that are limiting fishery restoration
- Combined, grab and sonde data provide information on “cause and effect” relationships
- Support regulatory processes
  - TMDL; Klamath River and tributaries
  - FERC Relicensing
- Improve understanding of effects on the ecosystem
- Support Basin-wide efforts of ruling out variables of potential cause to fish health issues

AFWO WQ Monitoring Program

- **Below Iron Gate Dam:** Comprehensive evaluation of water quality conducted by AFWO, and cooperators (Yurok and Karuk Tribes), since spring of 2001.
  - Hydrolab DataSondes
    - Water Temperature
    - Specific Conductivity
    - pH
    - Dissolved Oxygen concentration/ % saturation
  - Independent temperature probes at sonde study sites (Tidbits)
  - Air Temperature and Relative Humidity Data (6 locations)
  - Nutrient grab samples once per month
    - Includes Clorophyll a/ Pheophytin and total and fecal coliform

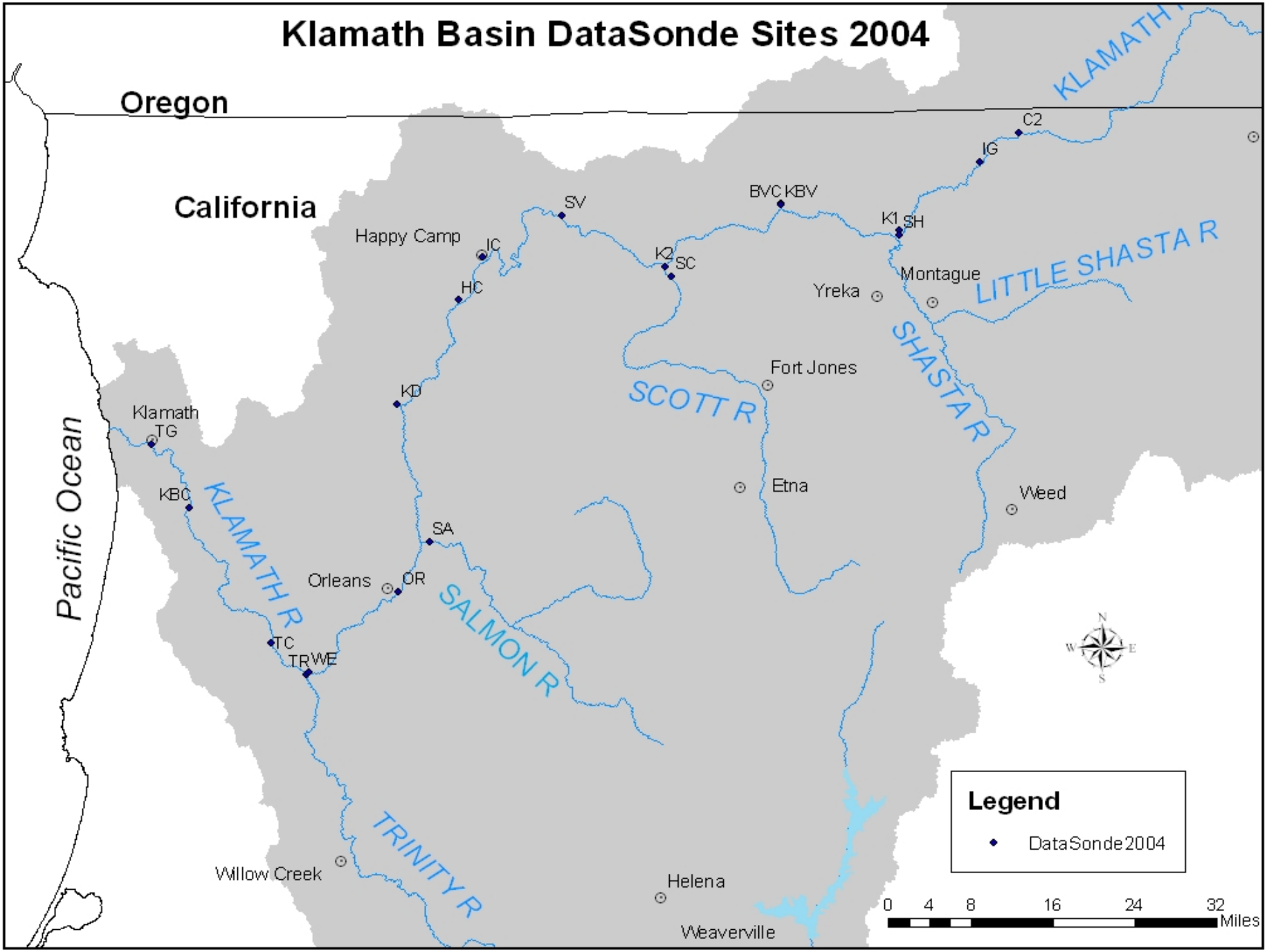
AFWO WQ Monitoring Program 2004

Special studies included:

- Evaluating effects of a pulse flow from Iron Gate Reservoir on downstream water quality
- An investigation of the effects of the Fall turnover of Iron Gate Reservoir on Iron Gate Dam release water quality

2004- DataSonde Sites

- Monitoring from June to mid-October
  - Some sites in earlier, some stayed in to early Dec.
- 12 sites within the Mainstem and selected tributaries
- Additional sites maintained by Cooperators:
  - Yurok - Klamath above Blue Creek
  - Karuk - Klamath above Beaver Creek, Beaver Creek, Indian Creek, Salmon River and Scott River

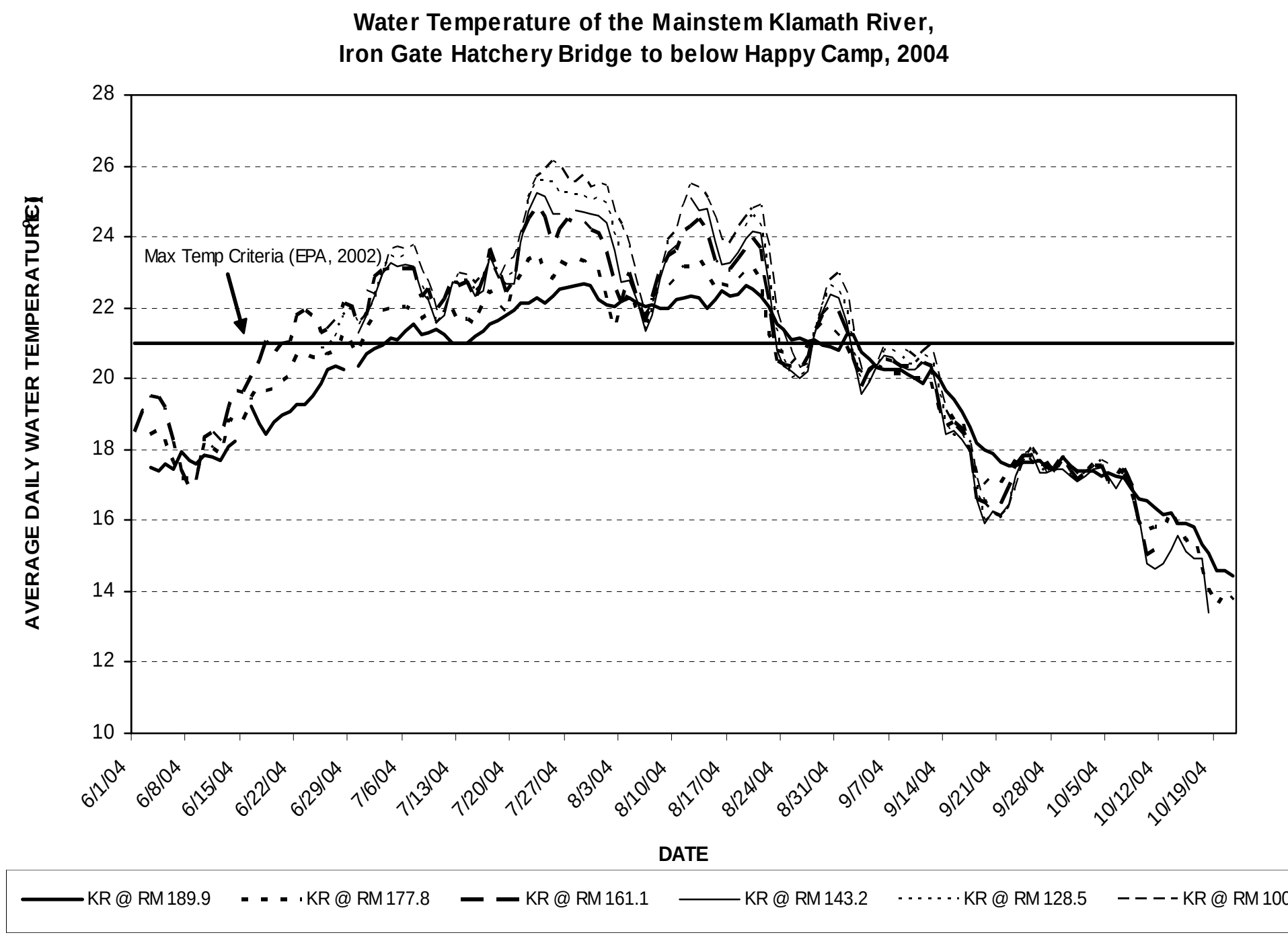

Klamath Basin DataSonde Sites 2004
Oregon
California
Pacific Ocean
KLAMATH R
C2
IG
BVC
KBV
SV
K1
SH
Happy Camp
IC
K2
SC
HC
Montague
Yreka
LITTLE SHASTA R
SHASTA R
Fort Jones
SCOTT R
KD
Klamath
TG
KBC
Etna
Weed
SA
Orleans
OR
SALMON R
TC
TR
WE
TRINITY R
Willow Creek
Helena
Weaverville
Legend
DataSonde2004
0 4 8 16 24 32
Miles

Datasonde Monitoring

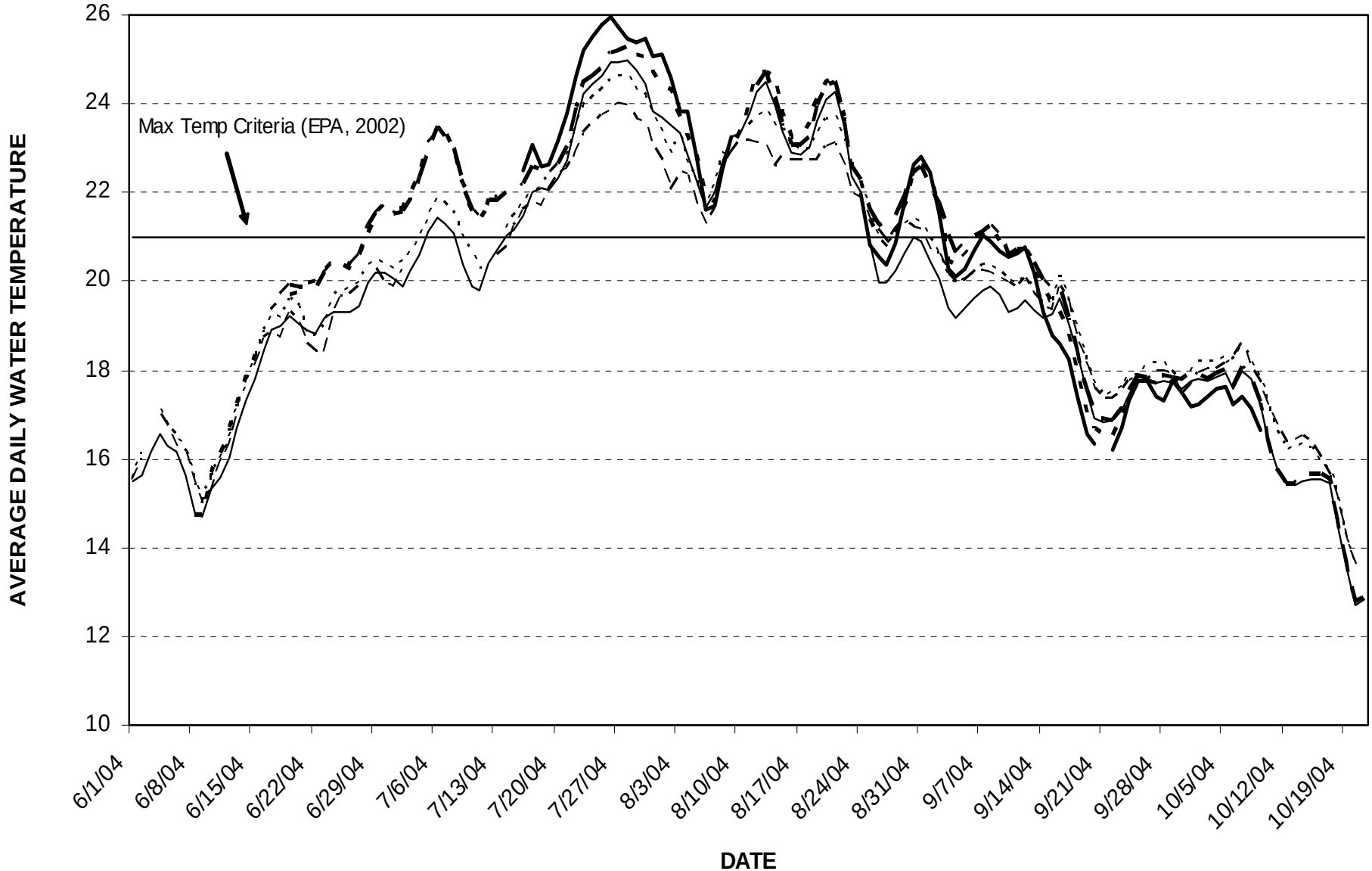
- Data collected at 30 minute intervals
- Rigorous QA/QC program to assure high quality data
- Data incorporated into MS Access database for processing and correction
- Over 600,000 measurements were collected this year (~ 1.7 Million data points since 2001)
- Data Dissemination:
  - 2001 to 2003 at **http://arcata.fws.gov/fisheries/**
  - 2004 Data early March

Water Temperature, Specific Conductance, pH, DO

- Graphics to follow:
  - Average daily values by reach for 2004
  - Mainstem Sites with Average, Min and Max Daily Values:
    - IG Klamath River at Iron Gate Hatchery (RM 189.9)
    - K1 Klamath River above Shasta River (RM 177.8)
    - HC Klamath River below Happy Camp (RM 100.8)
    - WE Klamath River at Weitchpec (RM 43.5)
    - TG Klamath River near Turwar Gage (RM 6.7)
  - Diurnal Variation at selected sites
- - Data for remainder of sites will be presented in end of year report

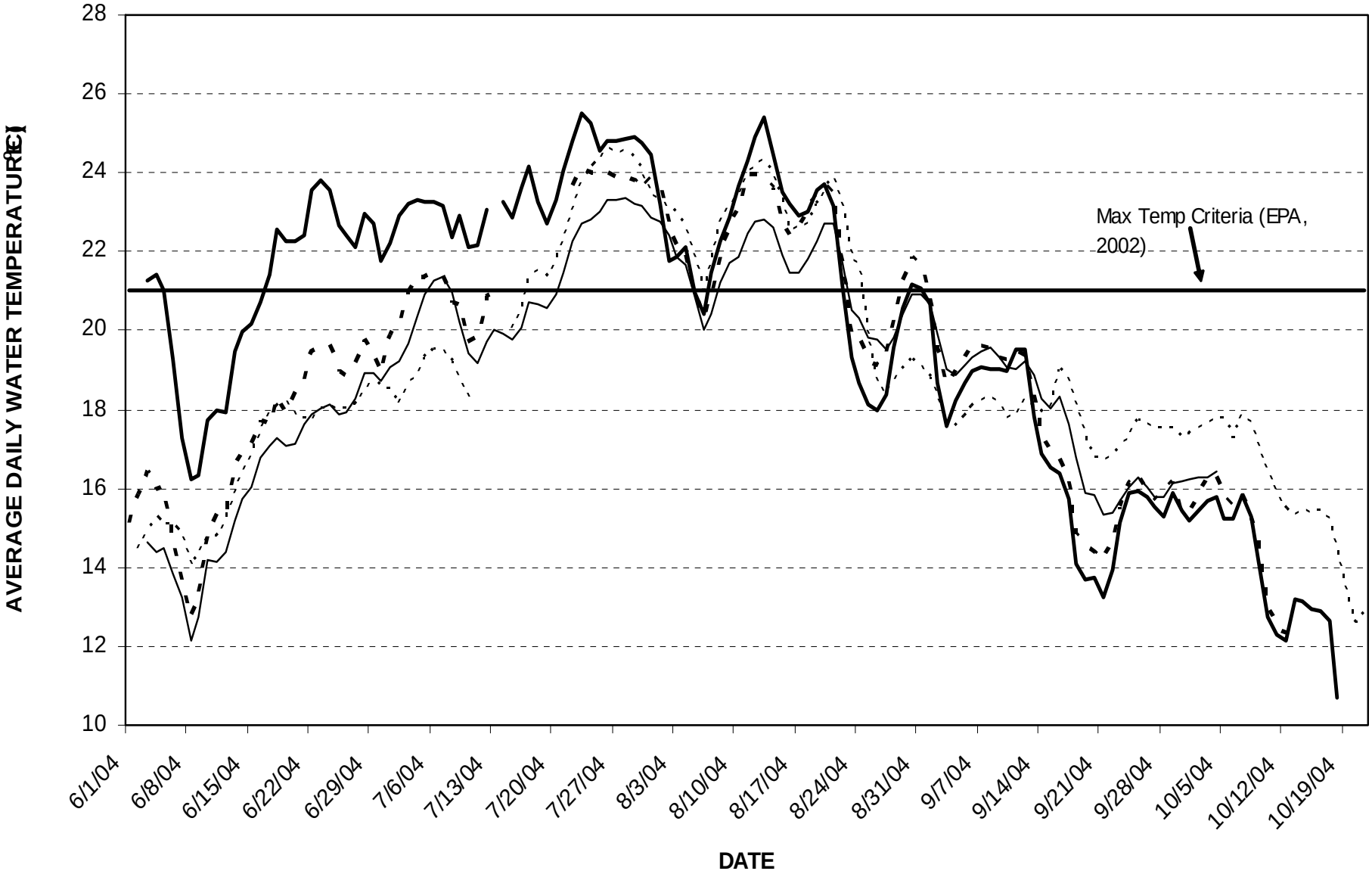

Water Temperature of the Mainstem Klamath River,
Iron Gate Hatchery Bridge to below Happy Camp, 2004
AVERAGE DAILY WATER TEMPERATURE (°C)
28
26
24
22
20
18
16
14
12
10
Max Temp Criteria (EPA, 2002)
6/1/04
6/8/04
6/15/04
6/22/04
6/29/04
7/6/04
7/13/04
7/20/04
7/27/04
8/3/04
8/10/04
8/17/04
8/24/04
8/31/04
9/7/04
9/14/04
9/21/04
9/28/04
10/5/04
10/12/04
10/19/04
DATE
KR @ RM 189.9
KR @ RM 177.8
KR @ RM 161.1
KR @ RM 143.2
KR @ RM 128.5
KR @ RM 100

Water Temperatures of the Mainstem Klamath River, above Dillon Creek to Terwer, 2004



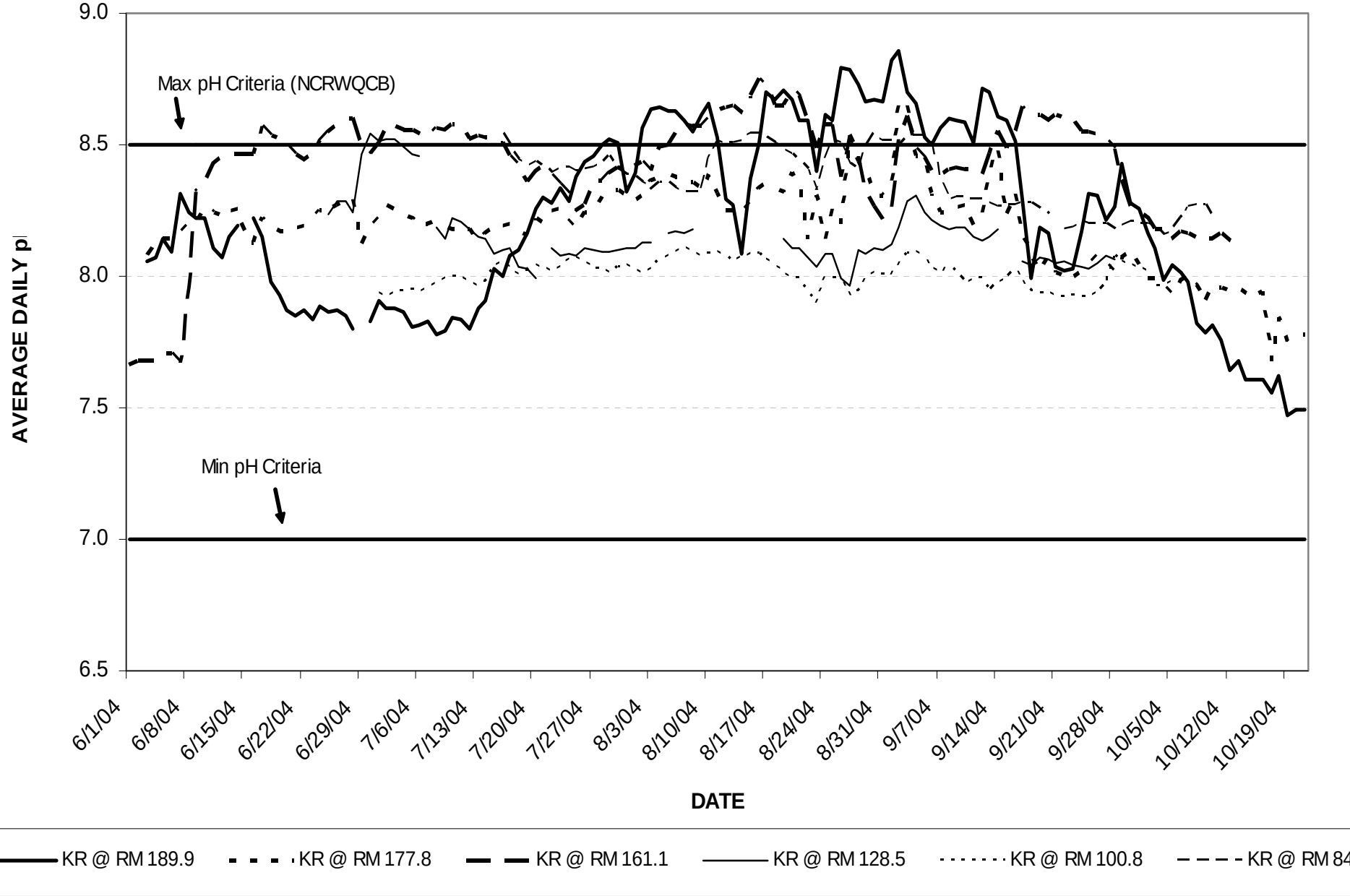
KR @ RM 84.3 | KR @ RM 59.1 | KR @ RM 43.5 | KR @ RM 38.5 | KR @ RM 16.5

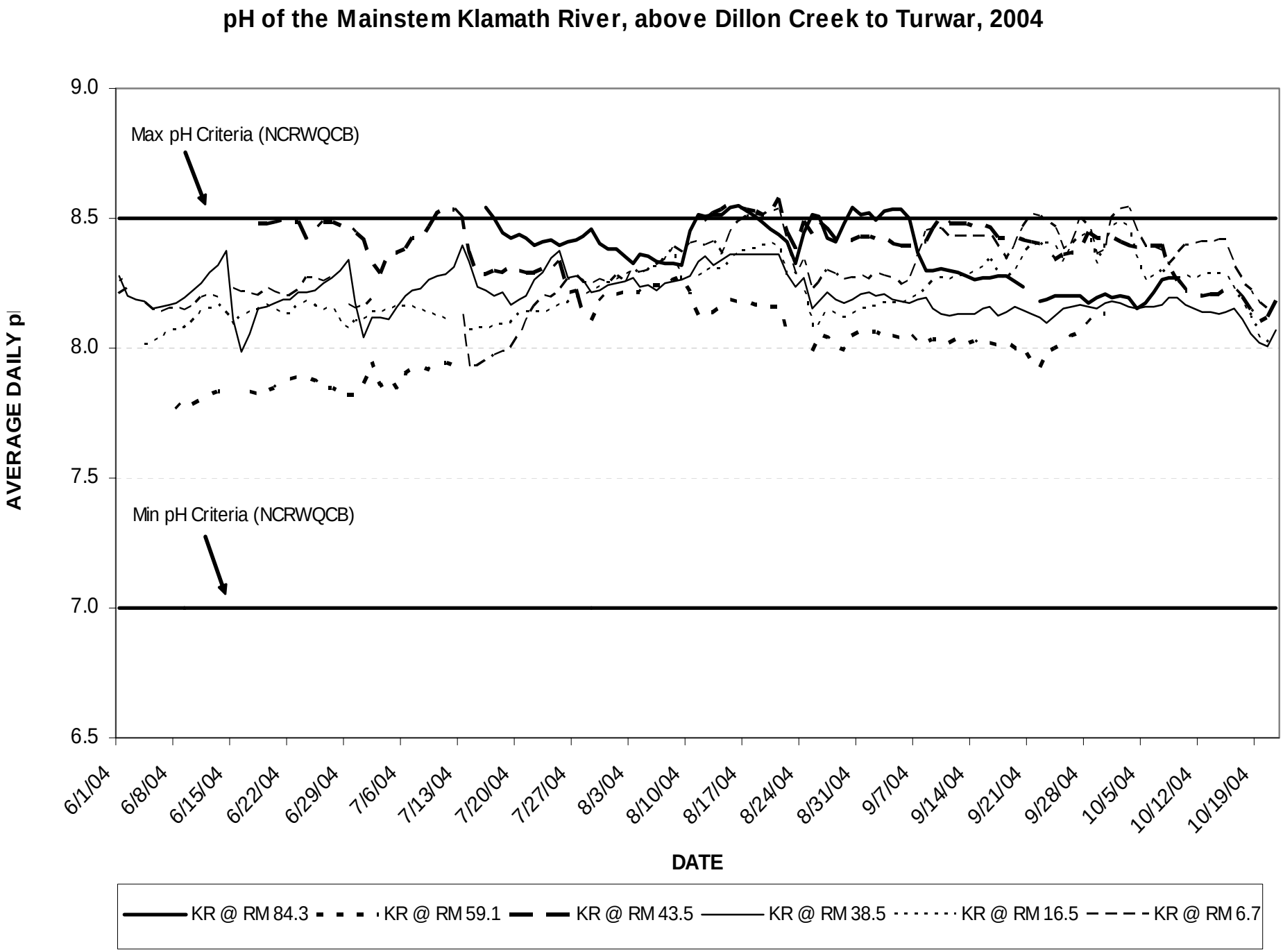
Water Temperatures of Selected Tributaries of the Klamath River, 2004

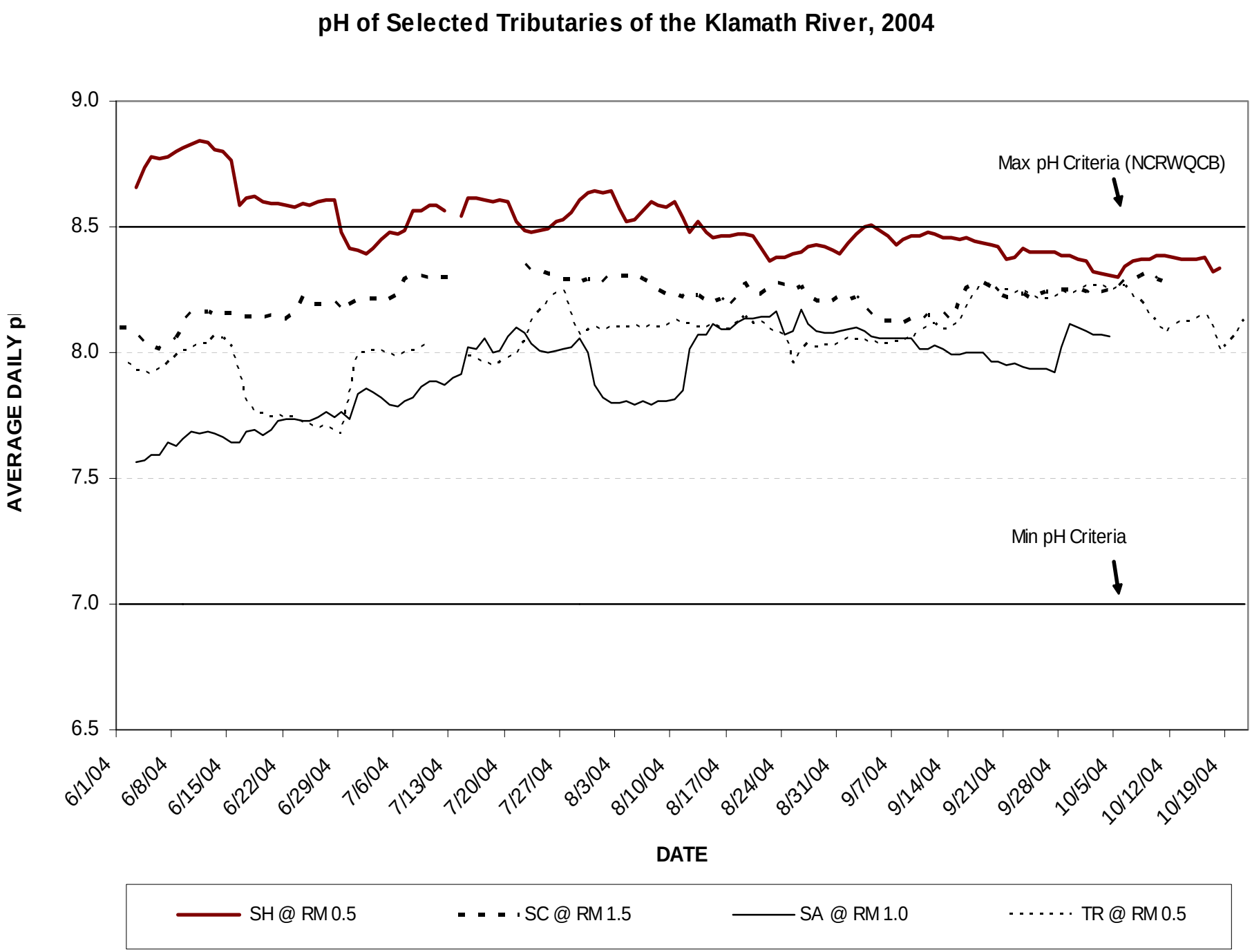


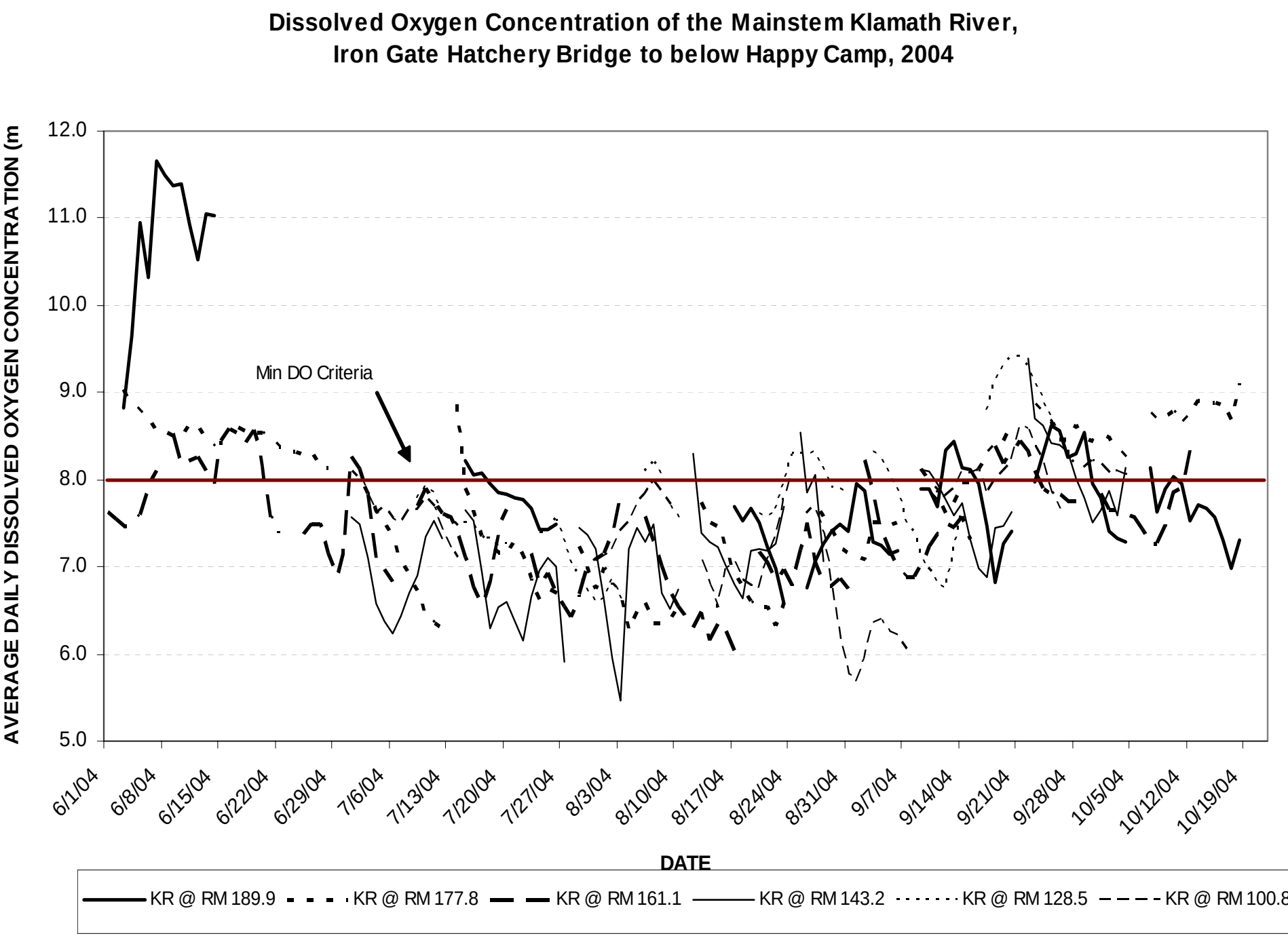
SH @ RM 0.5 | SC @ RM 1.5 | SA @ RM 1.0 | TR @

pH of the Mainstem Klamath River, Iron Gate Hatchery Bridge to below Happy Camp, 2004

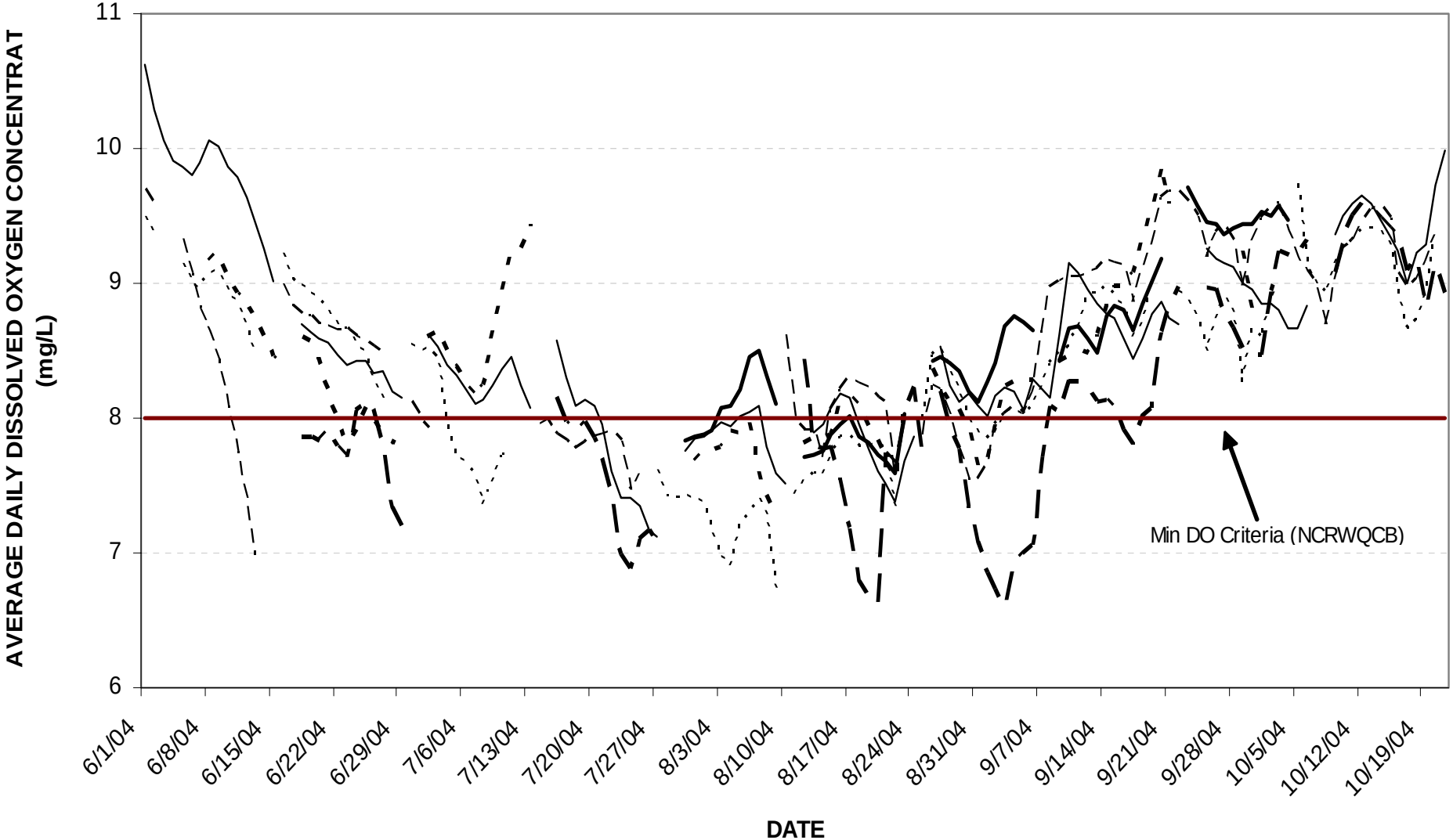



pH of the Mainstem Klamath River, above Dillon Creek to Turwar, 2004
9.0
8.5
8.0
7.5
7.0
6.5
AVERAGE DAILY pH
Max pH Criteria (NCRWQCB)
Min pH Criteria (NCRWQCB)
6/1/04
6/8/04
6/15/04
6/22/04
6/29/04
7/6/04
7/13/04
7/20/04
7/27/04
8/3/04
8/10/04
8/17/04
8/24/04
8/31/04
9/7/04
9/14/04
9/21/04
9/28/04
10/5/04
10/12/04
10/19/04
DATE
KR @ RM 84.3
KR @ RM 59.1
KR @ RM 43.5
KR @ RM 38.5
KR @ RM 16.5
KR @ RM 6.7


pH of Selected Tributaries of the Klamath River, 2004
AVERAGE DAILY pH
9.0
8.5
8.0
7.5
7.0
6.5
Max pH Criteria (NCRWQCB)
Min pH Criteria
6/1/04
6/8/04
6/15/04
6/22/04
6/29/04
7/6/04
7/13/04
7/20/04
7/27/04
8/3/04
8/10/04
8/17/04
8/24/04
8/31/04
9/7/04
9/14/04
9/21/04
9/28/04
10/5/04
10/12/04
10/19/04
DATE
SH @ RM 0.5
SC @ RM 1.5
SA @ RM 1.0
TR @ RM 0.5

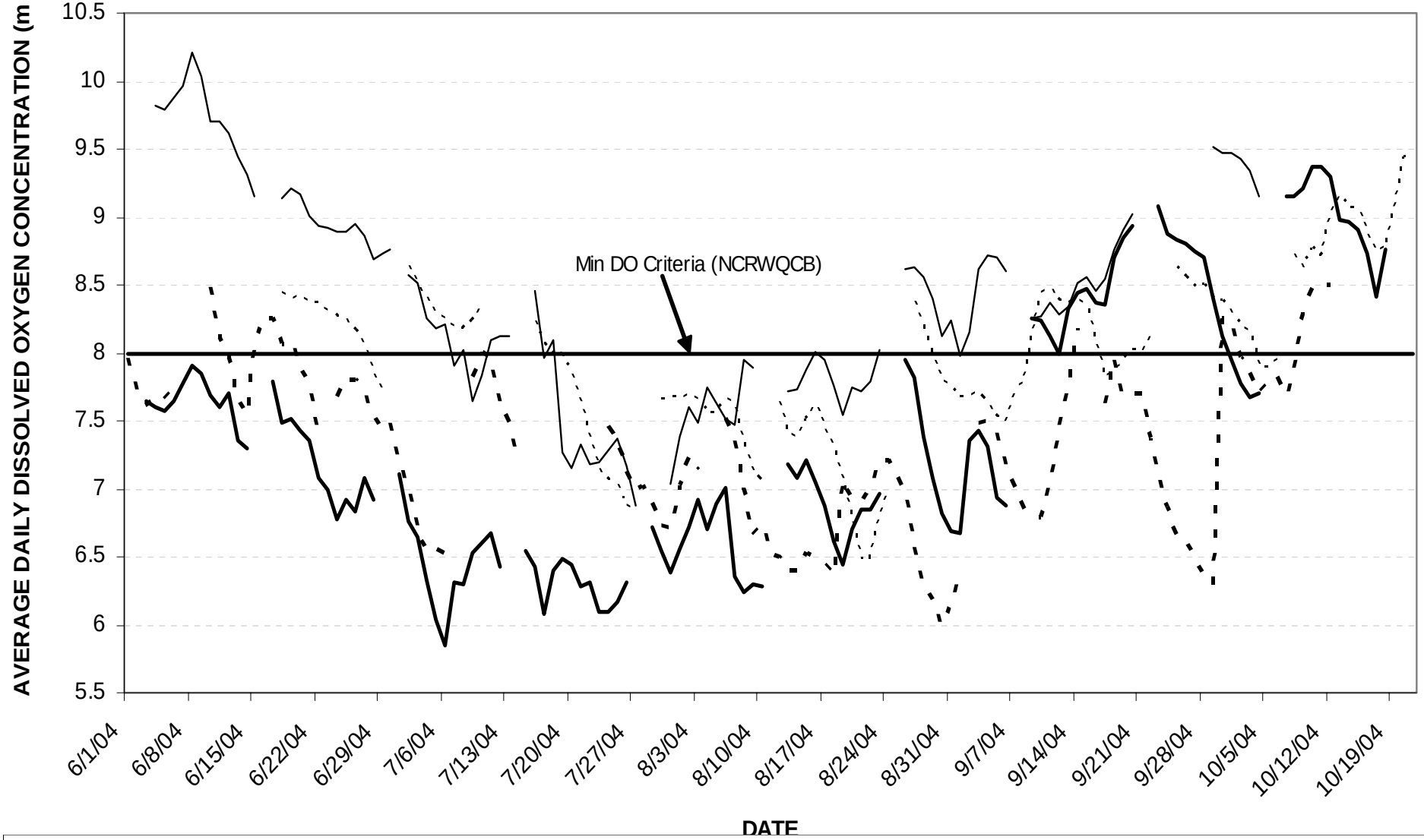

Dissolved Oxygen Concentration of the Mainstem Klamath River,
Iron Gate Hatchery Bridge to below Happy Camp, 2004
AVERAGE DAILY DISSOLVED OXYGEN CONCENTRATION (m
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
Min DO Criteria
6/1/04
6/8/04
6/15/04
6/22/04
6/29/04
7/6/04
7/13/04
7/20/04
7/27/04
8/3/04
8/10/04
8/17/04
8/24/04
8/31/04
9/7/04
9/14/04
9/21/04
9/28/04
10/5/04
10/12/04
10/19/04
DATE
KR @ RM 189.9
KR @ RM 177.8
KR @ RM 161.1
KR @ RM 143.2
KR @ RM 128.5
KR @ RM 100.8

Dissolved Oxygen Concentrations of the Mainstem Klamath River, above Dillon Creek to Terwer, 2004

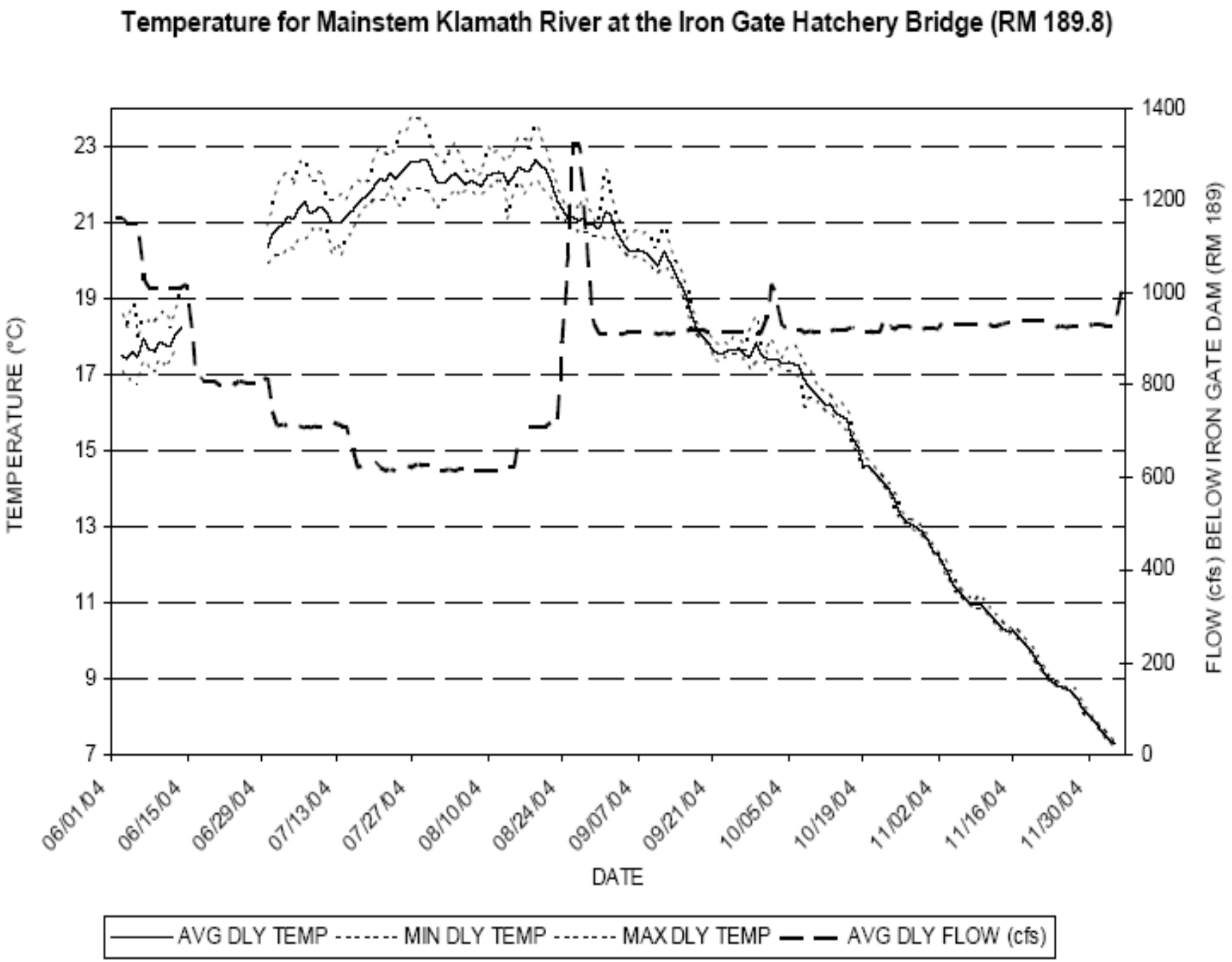


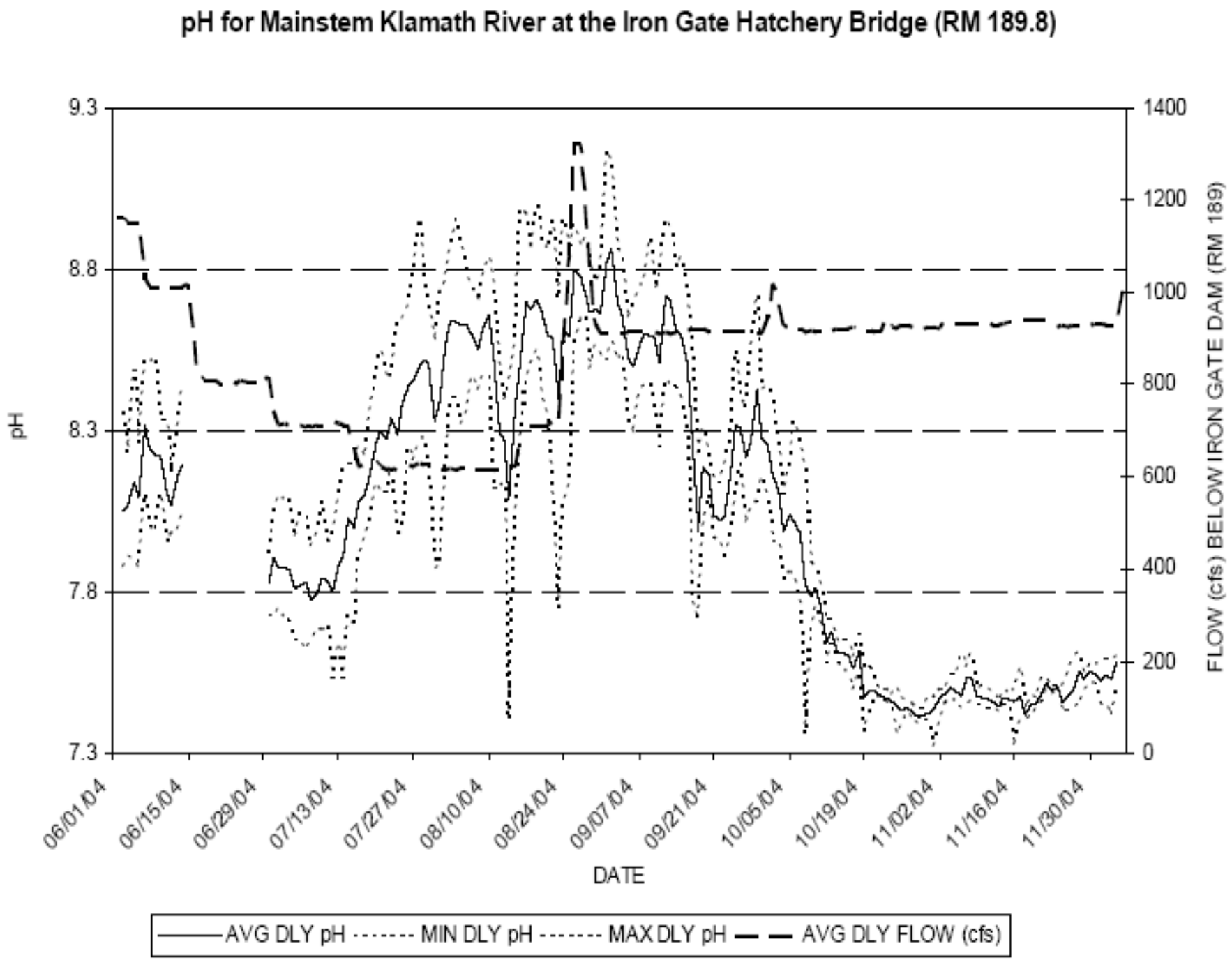
KR @ RM 84.3 | KR @ RM 59.1 | KR @ RM 43.5 | KR @ RM 38.5 | KR @ RM 16.5 | KR @ RM 6

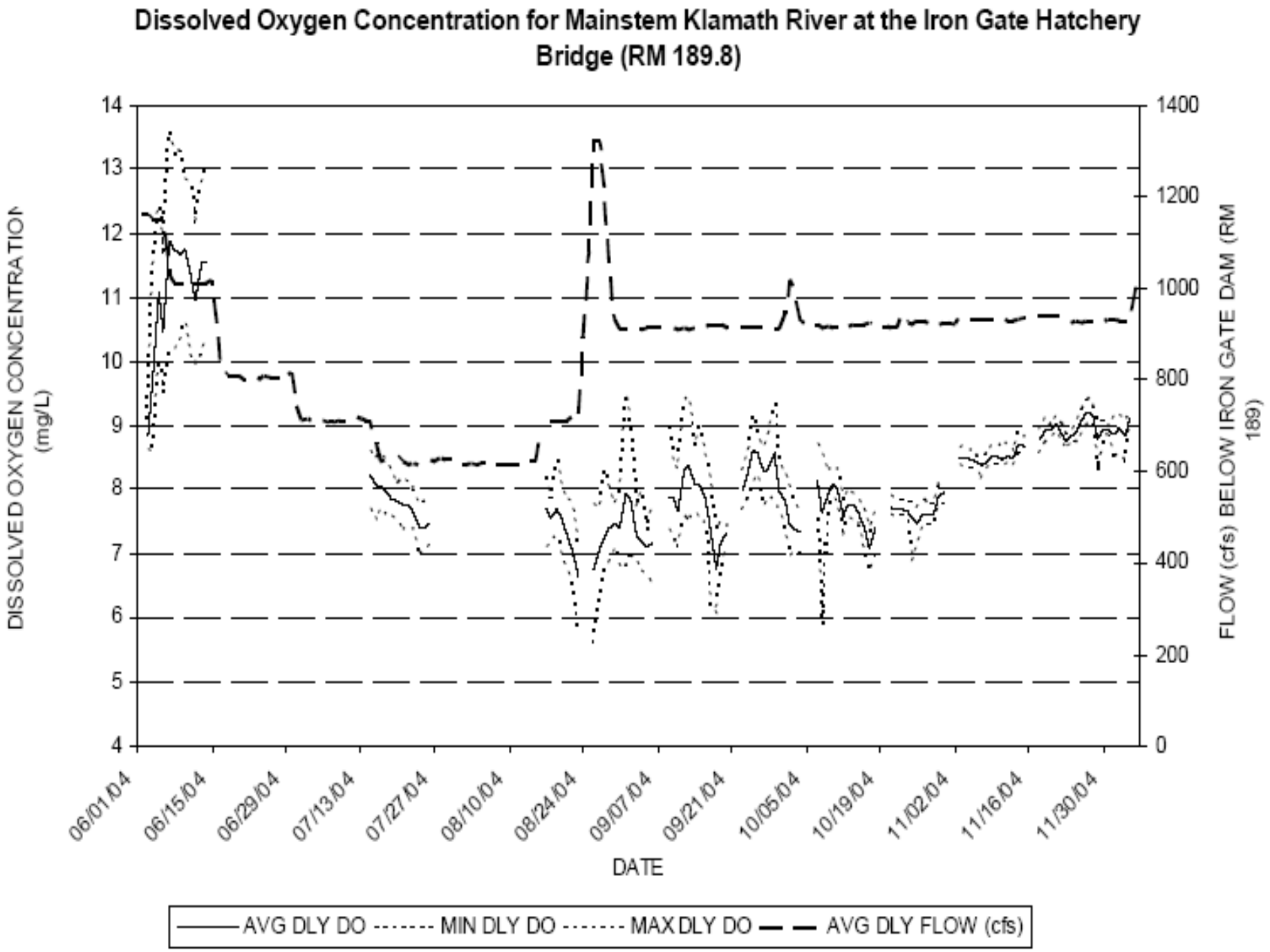
Dissolved Oxygen Concentration of Selected Tributaries of the Klamath River, 2004



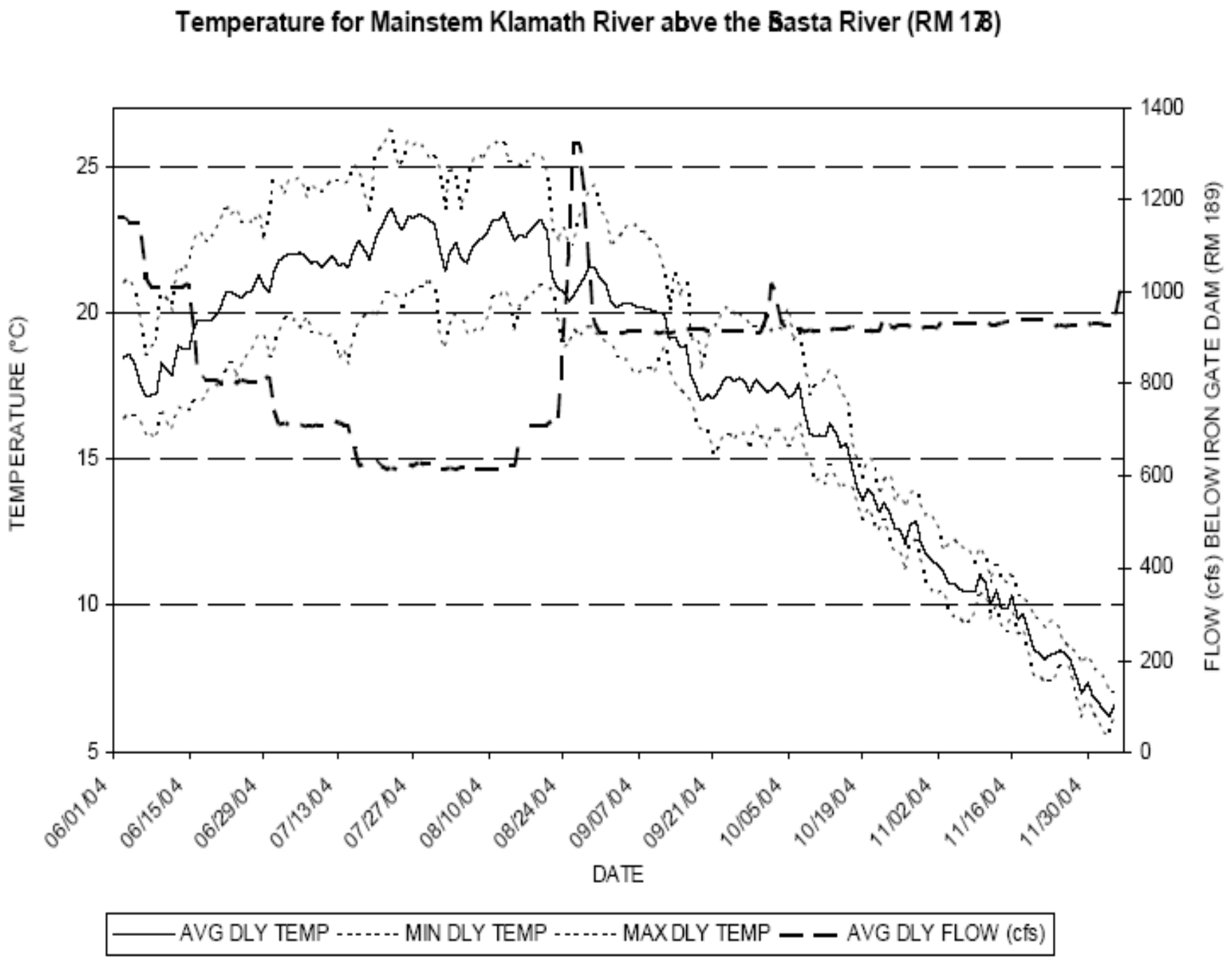
Daily Average, Minimum and Maximum for Iron Gate Hatchery Bridge (RM 189.9)

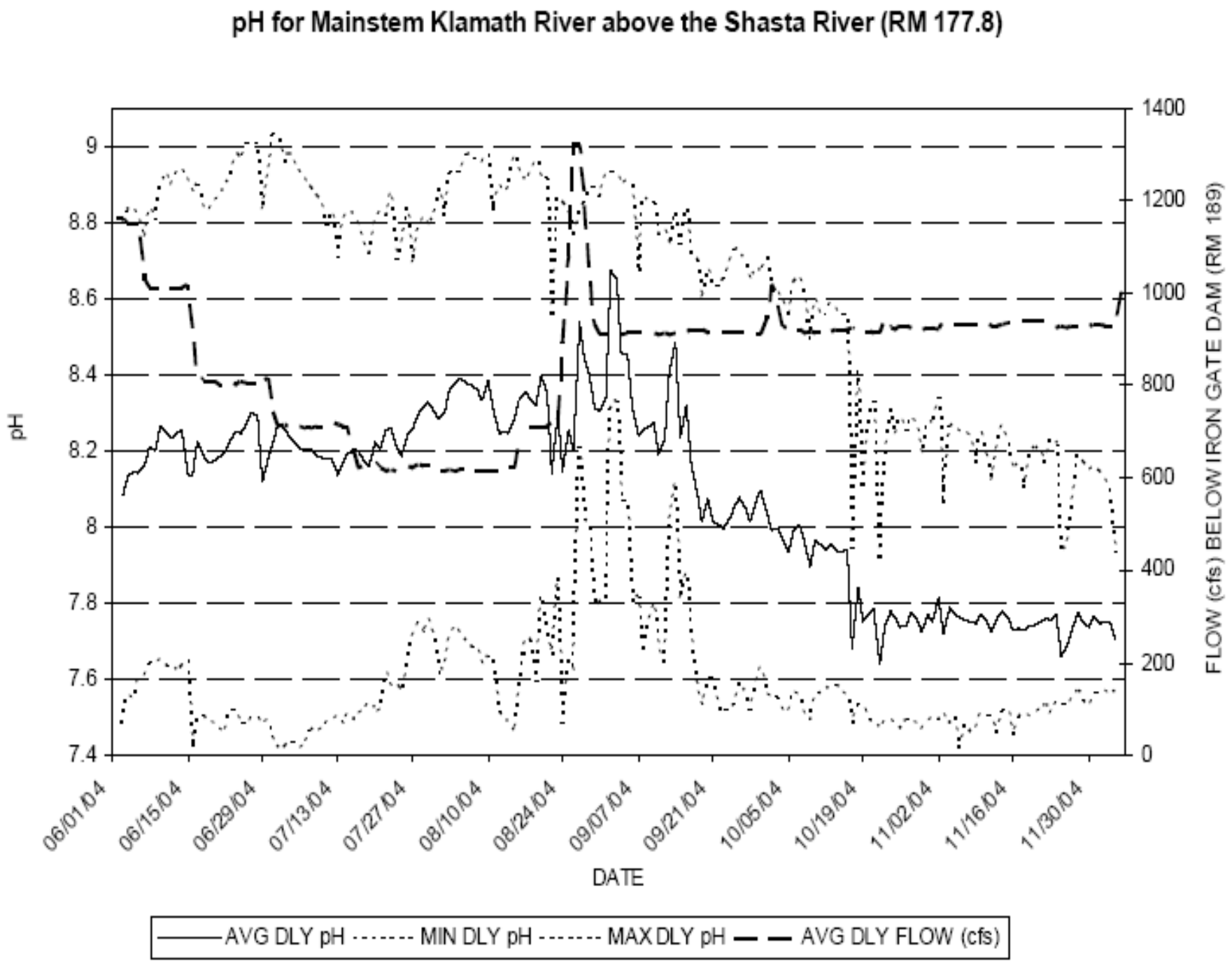

Temperature for Mainstem Klamath River at the Iron Gate Hatchery Bridge (RM 189.8)
TEMPERATURE (°C)
23
21
19
17
15
13
11
9
7
FLOW (cfs) BELOW IRON GATE DAM (RM 189)
1400
1200
1000
800
600
400
200
0
06/01/04
06/15/04
06/29/04
07/13/04
07/27/04
08/10/04
08/24/04
09/07/04
09/21/04
10/05/04
10/19/04
11/02/04
11/16/04
11/30/04
DATE
AVG DLY TEMP
MIN DLY TEMP
MAX DLY TEMP
AVG DLY FLOW (cfs)

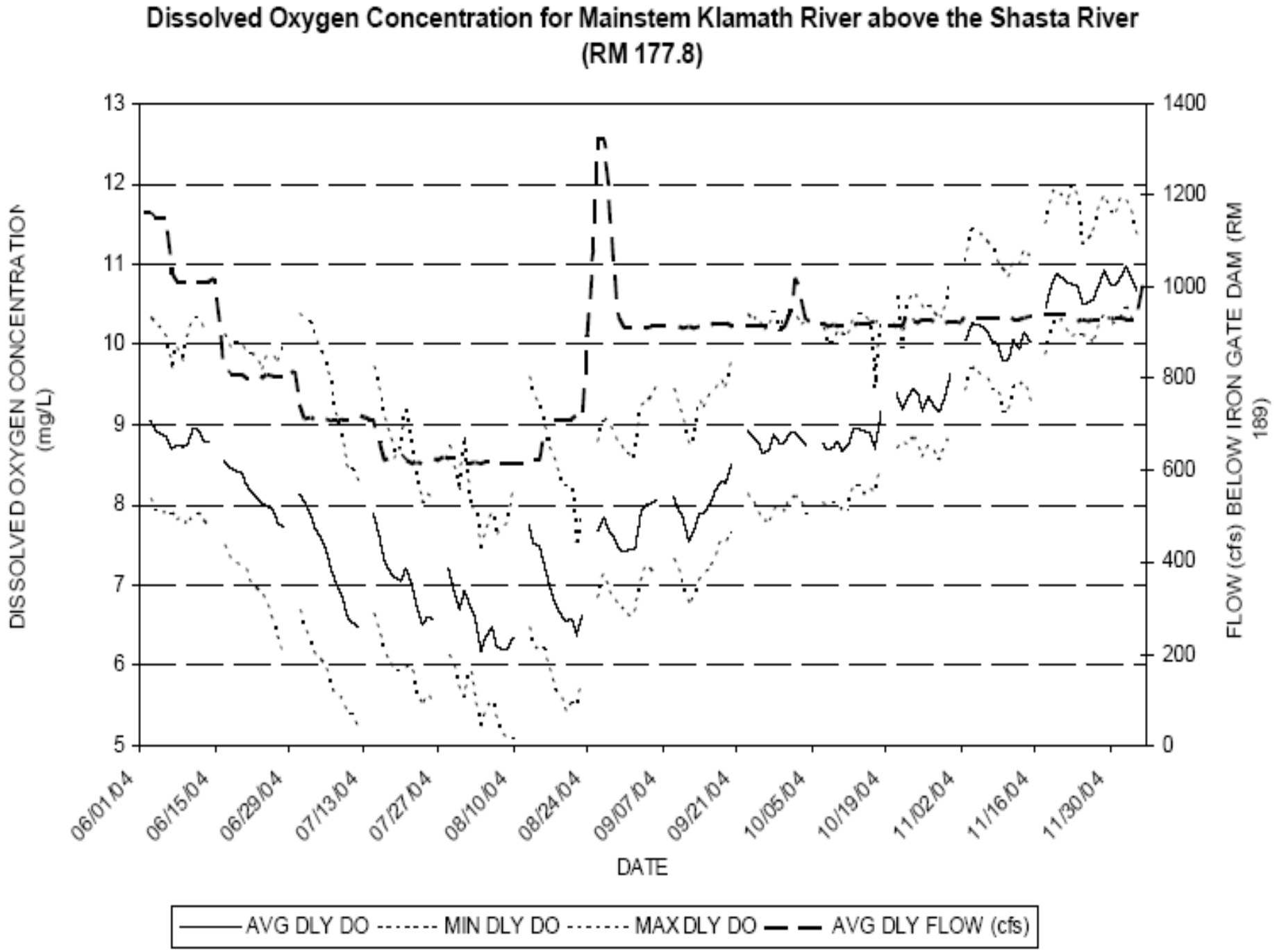

pH for Mainstem Klamath River at the Iron Gate Hatchery Bridge (RM 189.8)
pH
9.3
8.8
8.3
7.8
7.3
FLOW (cfs) BELOW IRON GATE DAM (RM 189)
1400
1200
1000
800
600
400
200
0
06/01/04
06/15/04
06/29/04
07/13/04
07/27/04
08/10/04
08/24/04
09/07/04
09/21/04
10/05/04
10/19/04
11/02/04
11/16/04
11/30/04
DATE
AVG DLY pH
MIN DLY pH
MAX DLY pH
AVG DLY FLOW (cfs)


Dissolved Oxygen Concentration for Mainstem Klamath River at the Iron Gate Hatchery Bridge (RM 189.8)
DISSOLVED OXYGEN CONCENTRATION (mg/L)
FLOW (cfs) BELOW IRON GATE DAM (RM 189)
DATE
14
13
12
11
10
9
8
7
6
5
4
1400
1200
1000
800
600
400
200
0
06/01/04
06/15/04
06/29/04
07/13/04
07/27/04
08/10/04
08/24/04
09/07/04
09/21/04
10/05/04
10/19/04
11/02/04
11/16/04
11/30/04
AVG DLY DO
MIN DLY DO
MAX DLY DO
AVG DLY FLOW (cfs)

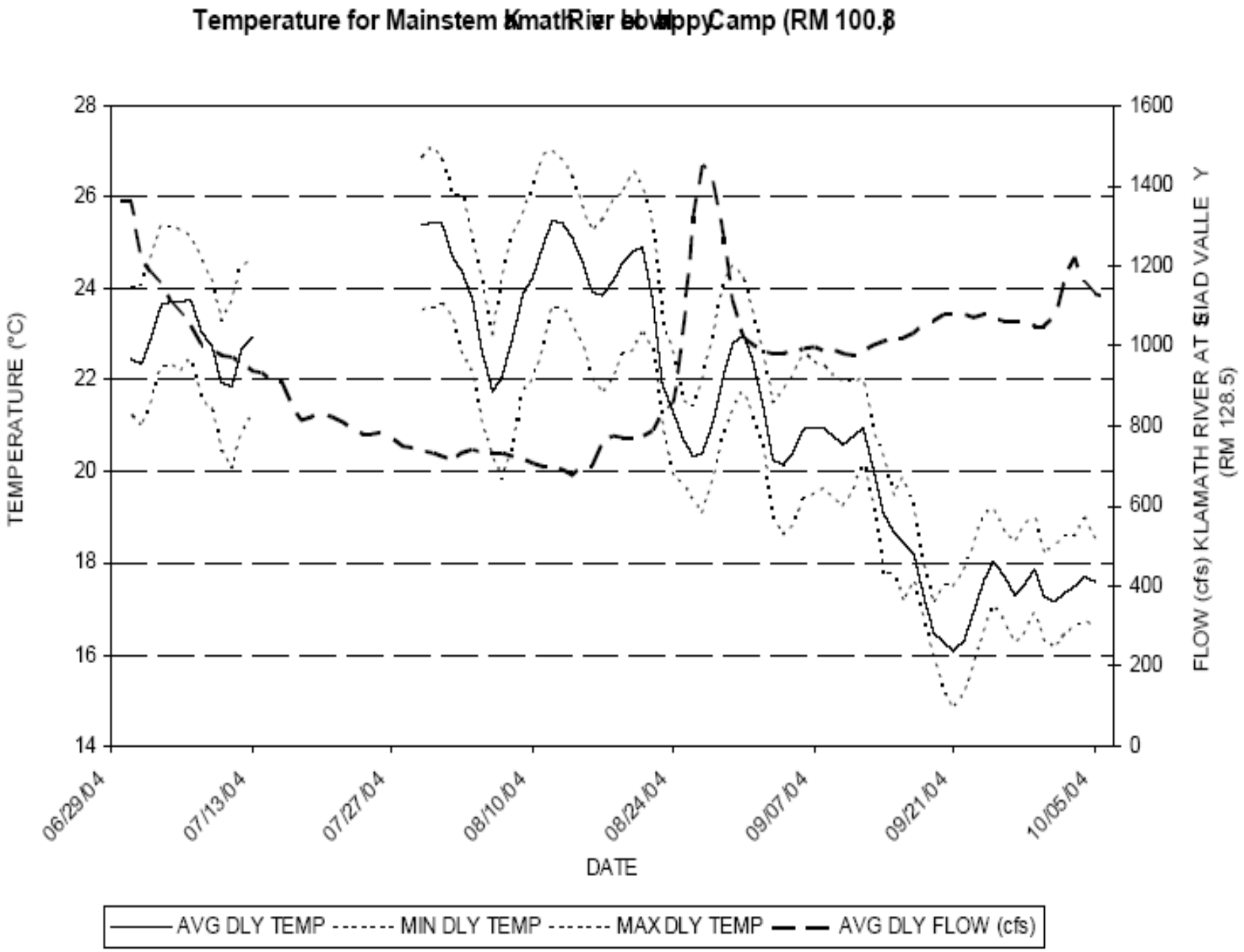
Daily Average, Minimum and Maximum for K1 - Klamath above Shasta River (RM 177.8)

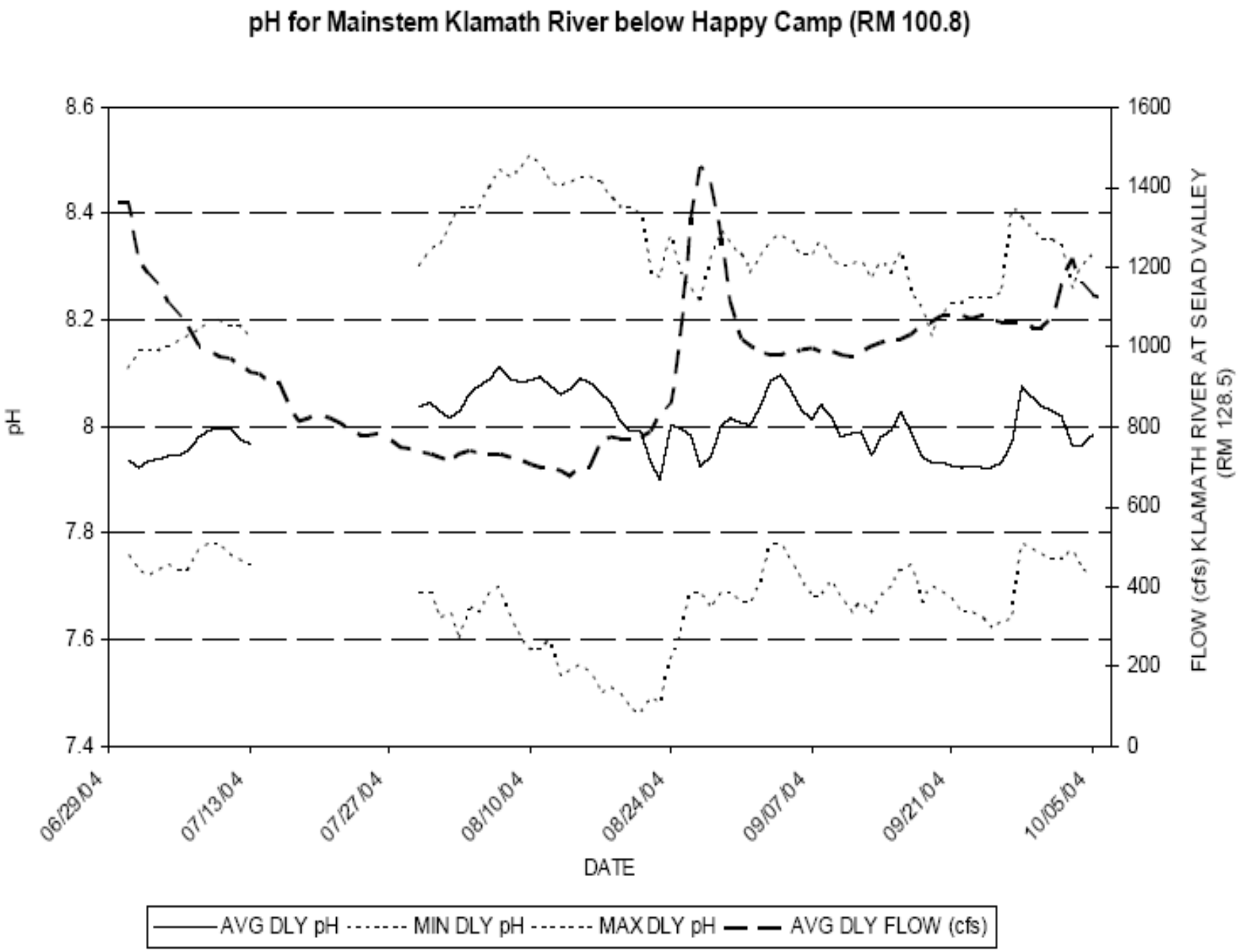

Temperature for Mainstem Klamath River above the Shasta River (RM 178)
TEMPERATURE (°C)
25
20
15
10
5
FLOW (cfs) BELOW IRON GATE DAM (RM 189)
1400
1200
1000
800
600
400
200
0
06/01/04
06/15/04
06/29/04
07/13/04
07/27/04
08/10/04
08/24/04
09/07/04
09/21/04
10/05/04
10/19/04
11/02/04
11/16/04
11/30/04
DATE
AVG DLY TEMP
MIN DLY TEMP
MAX DLY TEMP
AVG DLY FLOW (cfs)

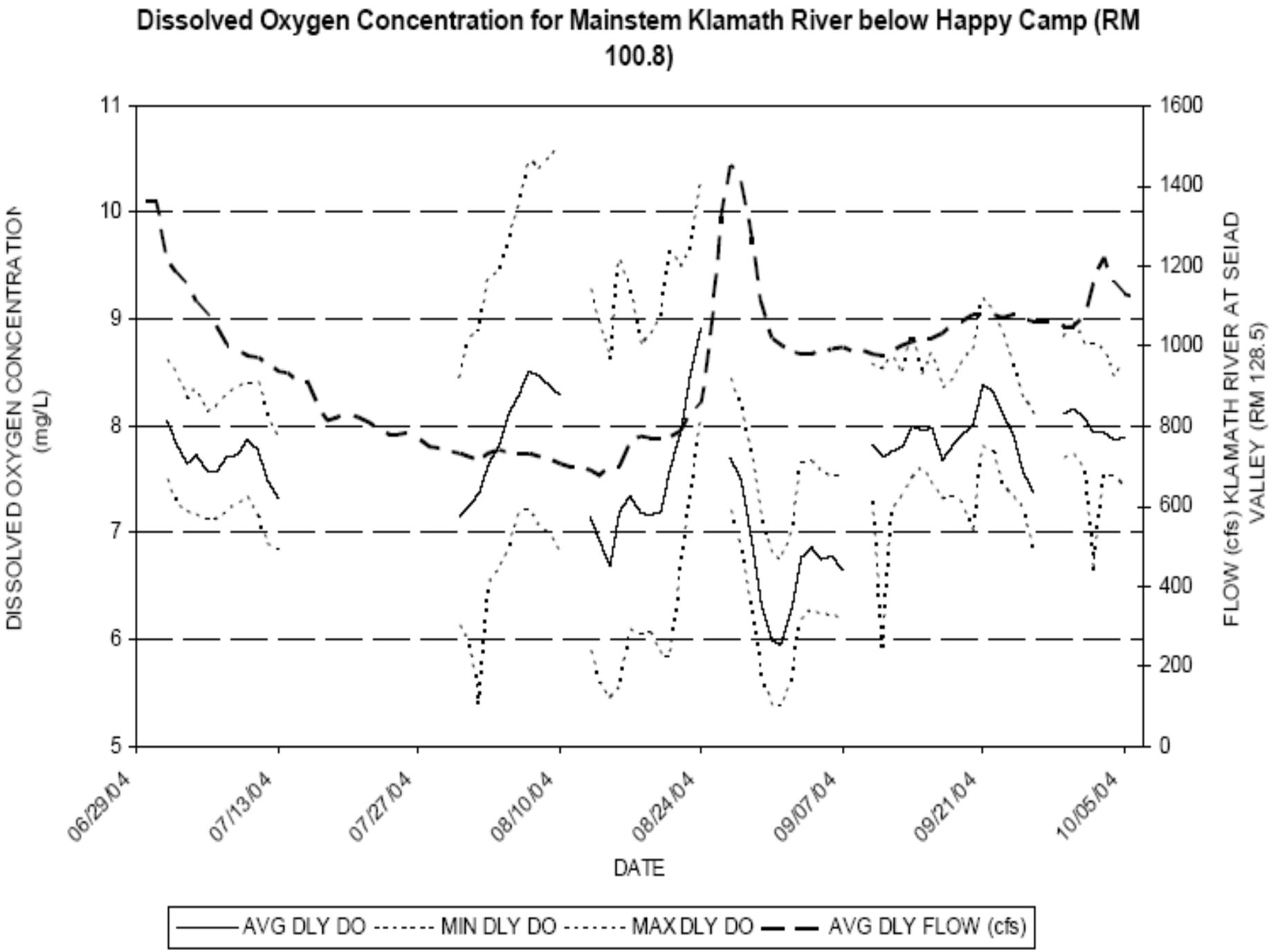

pH for Mainstem Klamath River above the Shasta River (RM 177.8)
pH
9
8.8
8.6
8.4
8.2
8
7.8
7.6
7.4
1400
1200
1000
800
600
400
200
0
FLOW (cfs) BELOW IRON GATE DAM (RM 189)
06/01/04
06/15/04
06/29/04
07/13/04
07/27/04
08/10/04
08/24/04
09/07/04
09/21/04
10/05/04
10/19/04
11/02/04
11/16/04
11/30/04
DATE
AVG DLY pH
MIN DLY pH
MAX DLY pH
AVG DLY FLOW (cfs)


Dissolved Oxygen Concentration for Mainstem Klamath River above the Shasta River
(RM 177.8)
DISSOLVED OXYGEN CONCENTRATION (mg/L)
FLOW (cfs) BELOW IRON GATE DAM (RM 189)
13
12
11
10
9
8
7
6
5
1400
1200
1000
800
600
400
200
0
06/01/04
06/15/04
06/29/04
07/13/04
07/27/04
08/10/04
08/24/04
09/07/04
09/21/04
10/05/04
10/19/04
11/02/04
11/16/04
11/30/04
DATE
AVG DLY DO
MIN DLY DO
MAX DLY DO
AVG DLY FLOW (cfs)

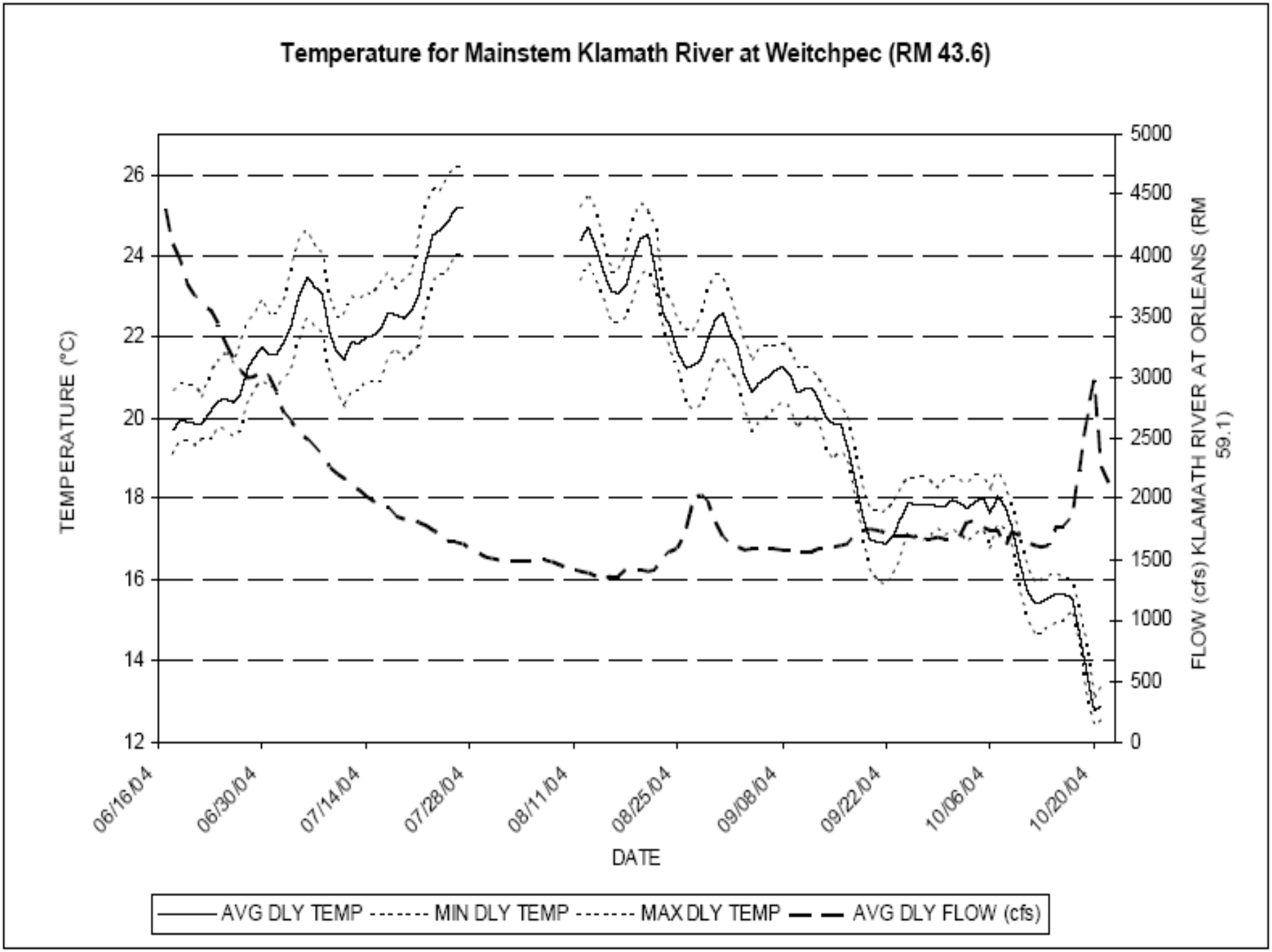
Daily Average, Minimum and Maximum for HC- Klamath River below Happy Camp (RM 100.8)

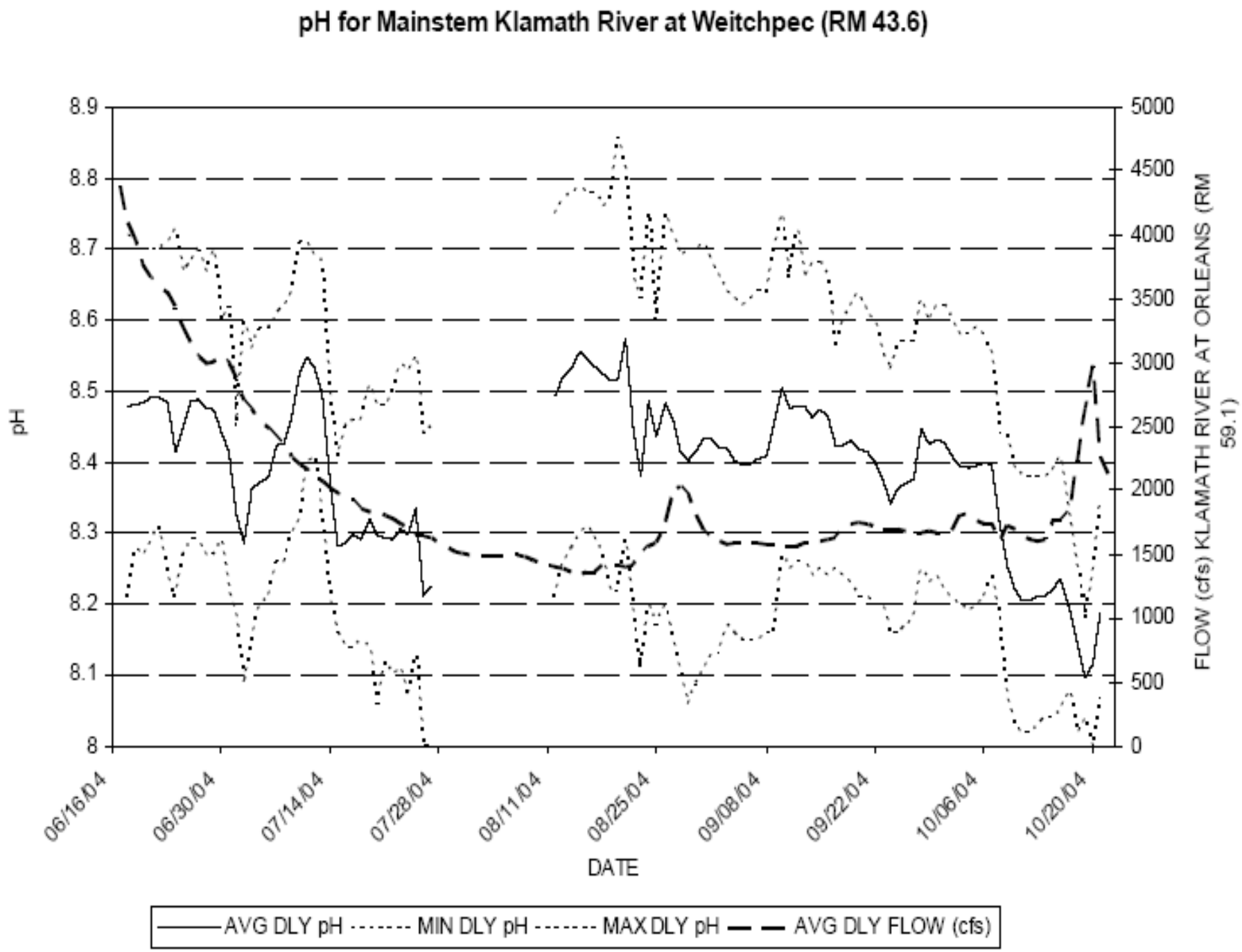

Temperature for Mainstem Klamath River below Happy Camp (RM 100.8)
TEMPERATURE (°C)
28
26
24
22
20
18
16
14
1600
1400
1200
1000
800
600
400
200
0
FLOW (cfs) KLAMATH RIVER AT SEIAD VALLEY (RM 128.5)
06/29/04
07/13/04
07/27/04
08/10/04
08/24/04
09/07/04
09/21/04
10/05/04
DATE
AVG DLY TEMP
MIN DLY TEMP
MAX DLY TEMP
AVG DLY FLOW (cfs)

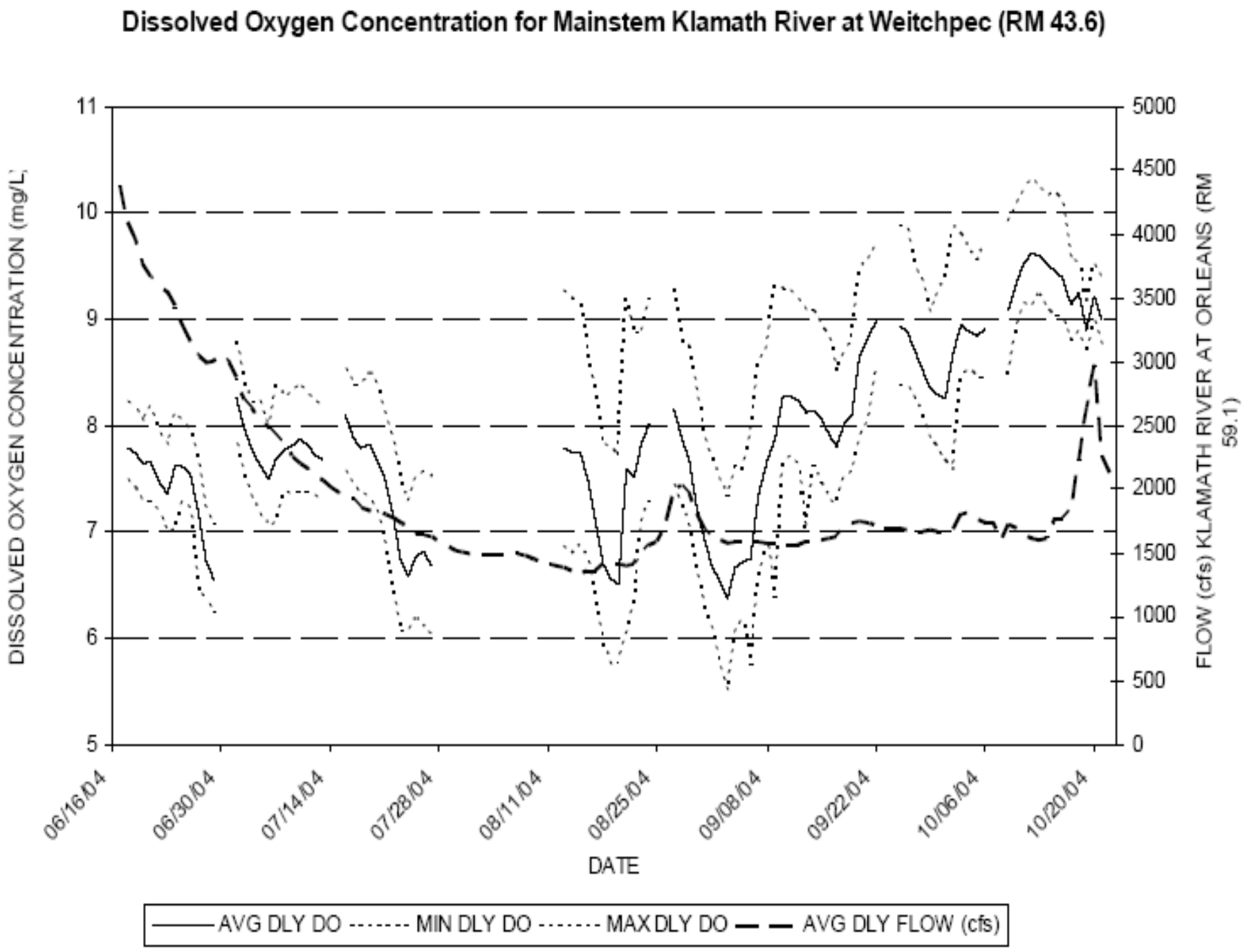

pH for Mainstem Klamath River below Happy Camp (RM 100.8)
pH
8.6
8.4
8.2
8
7.8
7.6
7.4
1600
1400
1200
1000
800
600
400
200
0
FLOW (cfs) KLAMATH RIVER AT SEIAD VALLEY (RM 128.5)
06/29/04
07/13/04
07/27/04
08/10/04
08/24/04
09/07/04
09/21/04
10/05/04
DATE
AVG DLY pH
MIN DLY pH
MAX DLY pH
AVG DLY FLOW (cfs)


Dissolved Oxygen Concentration for Mainstem Klamath River below Happy Camp (RM 100.8)
DISSOLVED OXYGEN CONCENTRATION (mg/L)
FLOW (cfs) KLAMATH RIVER AT SEIAD VALLEY (RM 128.5)
11
10
9
8
7
6
5
1600
1400
1200
1000
800
600
400
200
0
06/29/04
07/13/04
07/27/04
08/10/04
08/24/04
09/07/04
09/21/04
10/05/04
DATE
AVG DLY DO
MIN DLY DO
MAX DLY DO
AVG DLY FLOW (cfs)

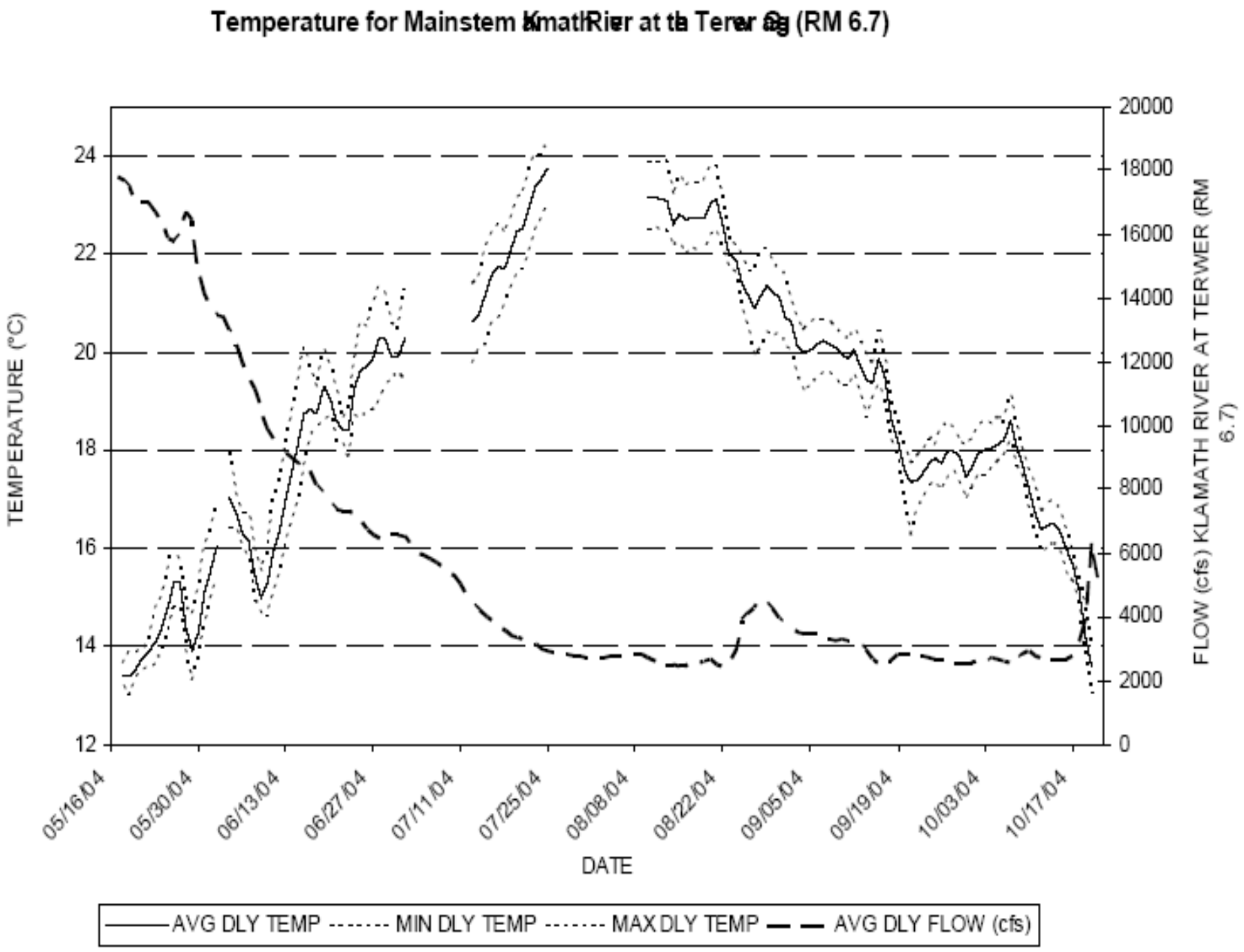
Daily Average, Minimum and Maximum
for
WE- Klamath River at Weitchpec (RM 43.6)

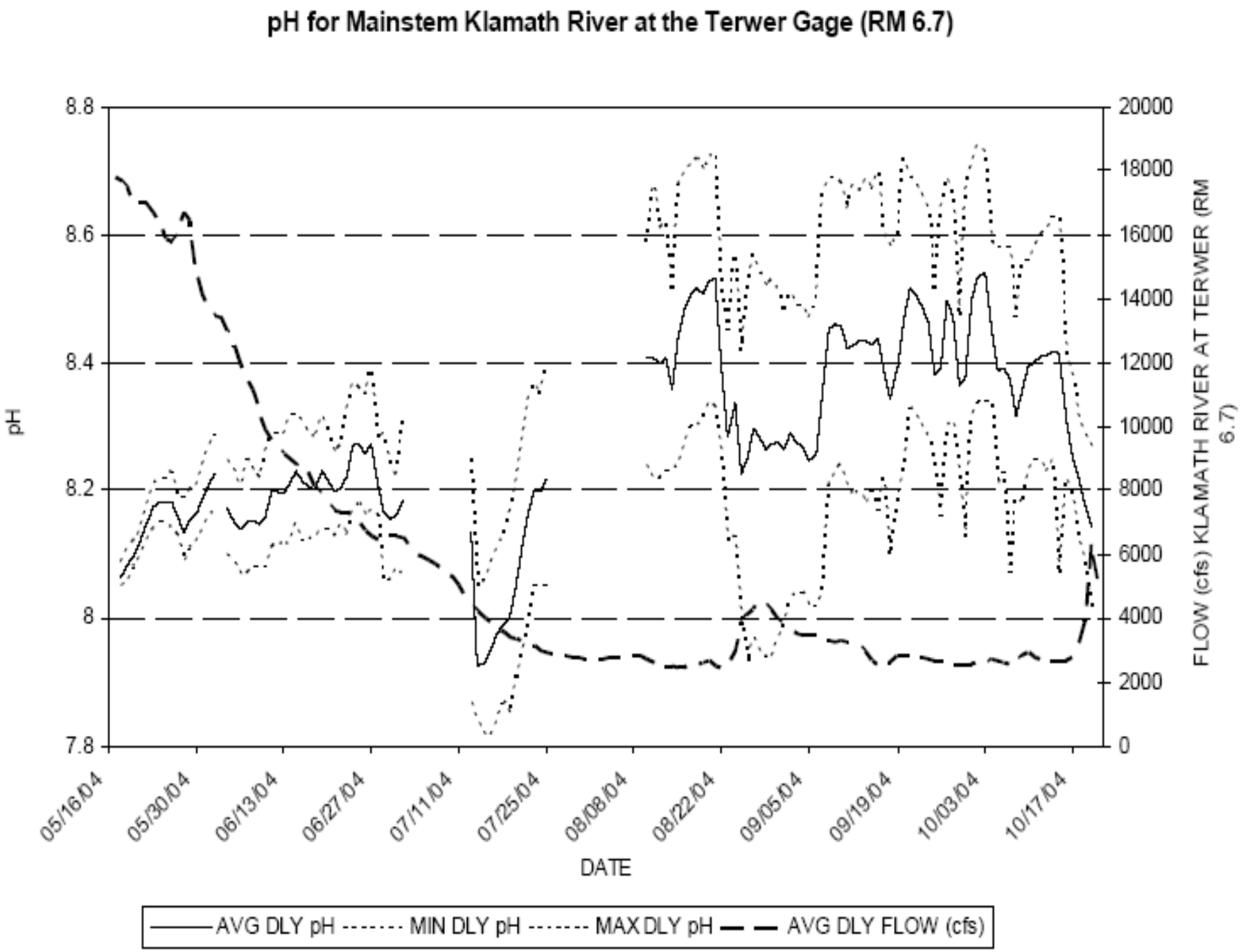

Temperature for Mainstem Klamath River at Weitchpec (RM 43.6)
TEMPERATURE (°C)
26
24
22
20
18
16
14
12
FLOW (cfs) KLAMATH RIVER AT ORLEANS (RM 59.1)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
06/16/04
06/30/04
07/14/04
07/28/04
08/11/04
08/25/04
09/08/04
09/22/04
10/06/04
10/20/04
DATE
AVG DLY TEMP
MIN DLY TEMP
MAX DLY TEMP
AVG DLY FLOW (cfs)

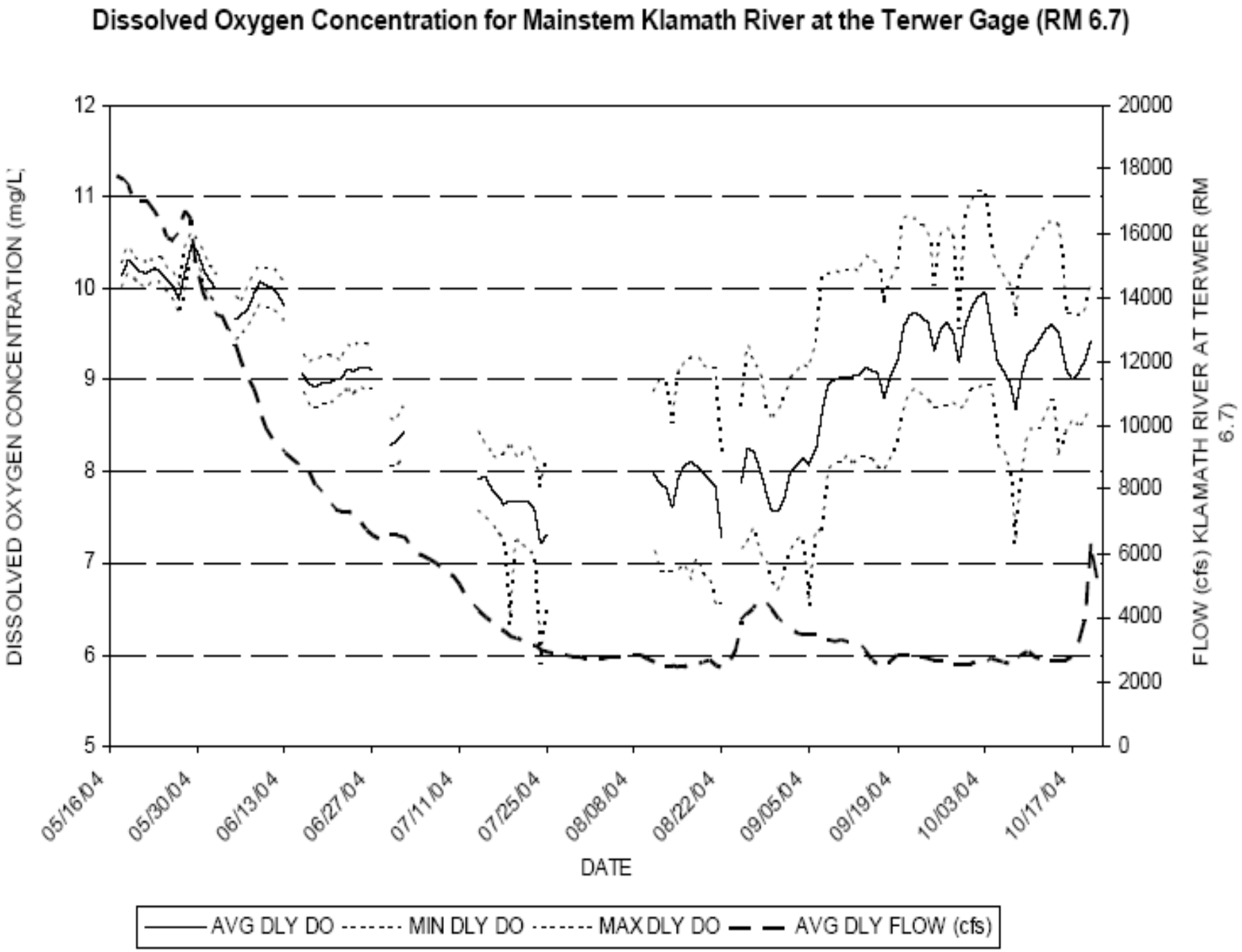

pH for Mainstem Klamath River at Weitchpec (RM 43.6)
pH
8.9
8.8
8.7
8.6
8.5
8.4
8.3
8.2
8.1
8
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
FLOW (cfs) KLAMATH RIVER AT ORLEANS (RM 59.1)
06/16/04
06/30/04
07/14/04
07/28/04
08/11/04
08/25/04
09/08/04
09/22/04
10/06/04
10/20/04
DATE
AVG DLY pH
MIN DLY pH
MAX DLY pH
AVG DLY FLOW (cfs)


Dissolved Oxygen Concentration for Mainstem Klamath River at Weitchpec (RM 43.6)
DISSOLVED OXYGEN CONCENTRATION (mg/L)
FLOW (cfs) KLAMATH RIVER AT ORLEANS (RM 59.1)
11
10
9
8
7
6
5
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
06/16/04
06/30/04
07/14/04
07/28/04
08/11/04
08/25/04
09/08/04
09/22/04
10/06/04
10/20/04
DATE
AVG DLY DO
MIN DLY DO
MAX DLY DO
AVG DLY FLOW (cfs)

Daily Average, Minimum and Maximum for Turwar Gage (RM 6.7)


Temperature for Mainstem Klamath River at the Terwer Gage (RM 6.7)
TEMPERATURE (°C)
24
22
20
18
16
14
12
FLOW (cfs) KLAMATH RIVER AT TERWER (RM 6.7)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
05/16/04
05/30/04
06/13/04
06/27/04
07/11/04
07/25/04
08/08/04
08/22/04
09/05/04
09/19/04
10/03/04
10/17/04
DATE
AVG DLY TEMP
MIN DLY TEMP
MAX DLY TEMP
AVG DLY FLOW (cfs)

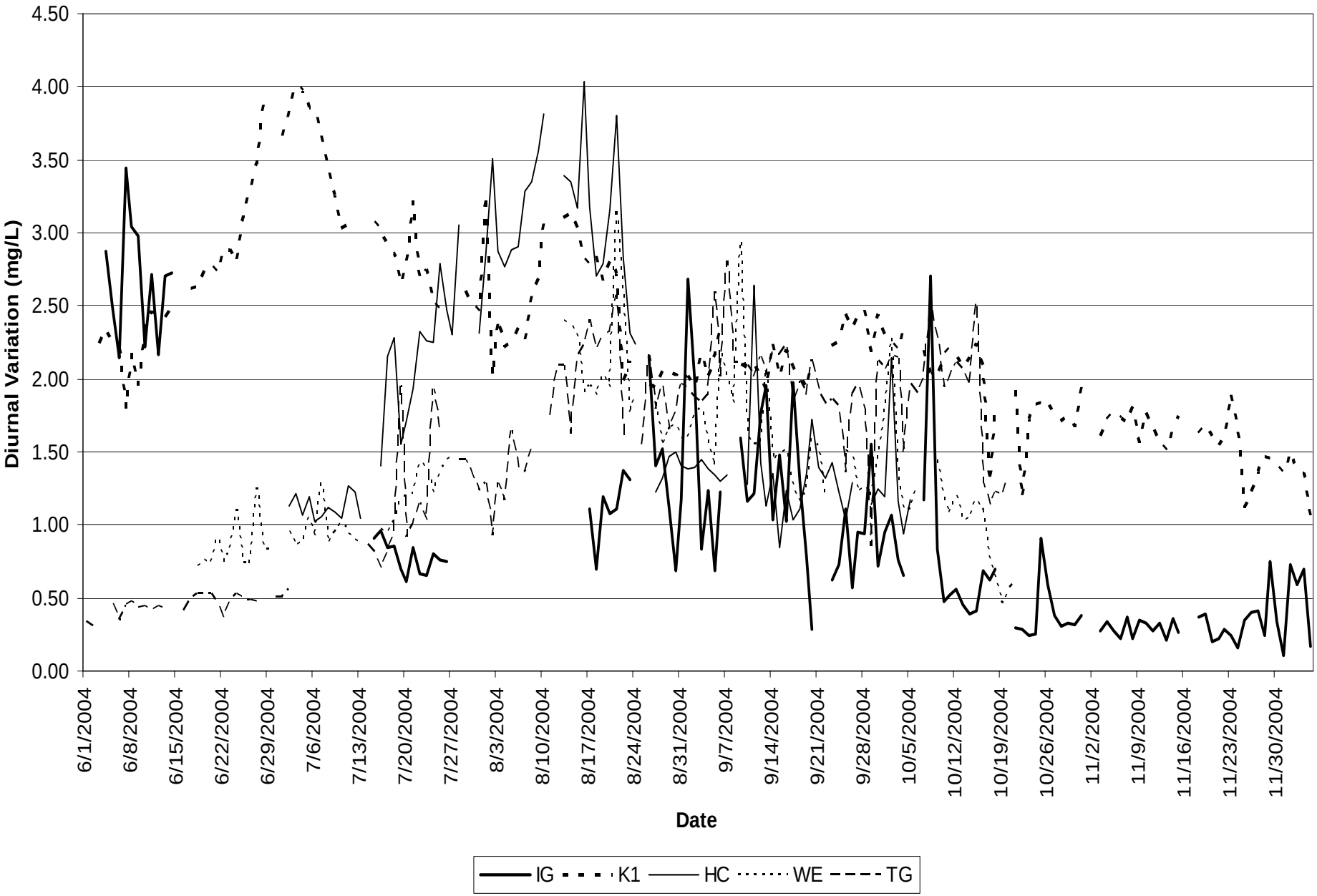

pH for Mainstem Klamath River at the Terwer Gage (RM 6.7)
pH
8.8
8.6
8.4
8.2
8
7.8
FLOW (cfs) KLAMATH RIVER AT TERWER (RM 6.7)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
05/16/04
05/30/04
06/13/04
06/27/04
07/11/04
07/25/04
08/08/04
08/22/04
09/05/04
09/19/04
10/03/04
10/17/04
DATE
AVG DLY pH
MIN DLY pH
MAX DLY pH
AVG DLY FLOW (cfs)


Dissolved Oxygen Concentration for Mainstem Klamath River at the Terwer Gage (RM 6.7)
DISSOLVED OXYGEN CONCENTRATION (mg/L)
FLOW (cfs) KLAMATH RIVER AT TERWER (RM 6.7)
12
11
10
9
8
7
6
5
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
05/16/04
05/30/04
06/13/04
06/27/04
07/11/04
07/25/04
08/08/04
08/22/04
09/05/04
09/19/04
10/03/04
10/17/04
DATE
AVG DLY DO
MIN DLY DO
MAX DLY DO
AVG DLY FLOW (cfs)

Diurnal Variation- DO

- Diurnal variation is higher upriver than downriver
- Larger swings over the course of 24 hours hints at higher primary productivity

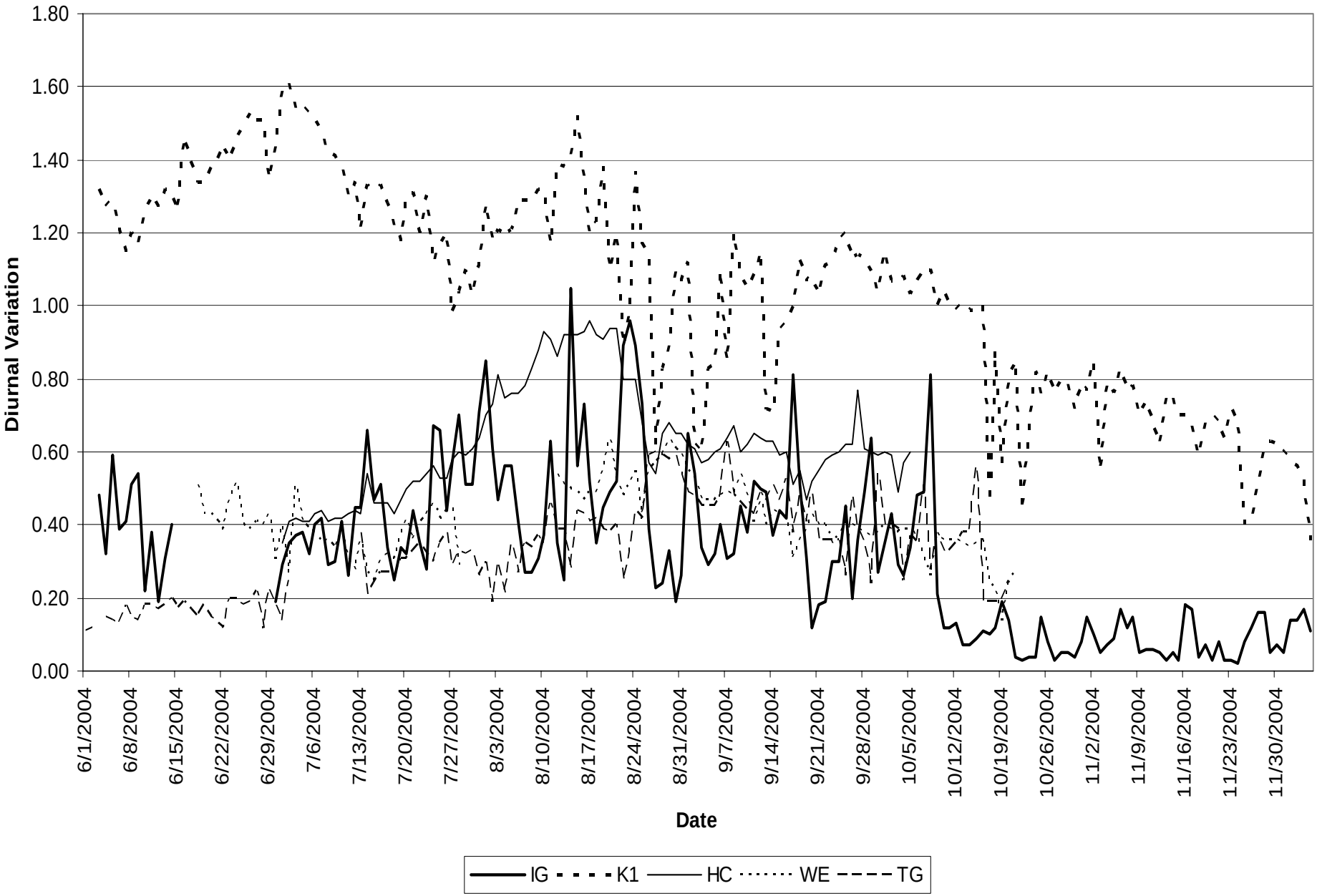
Diurnal Variations in Dissolved Oxygen in the Klamath River, 2004



Diurnal Variation- pH

- Variation is similar to DO, in that larger swings over the course of 24 hours hints at higher primary productivity

Diurnal Variations in pH in the Klamath River, 2004



The End