ATLAS CORPORATION

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RICHARD E. BLUBAUGH
Vice President Environmental
and Governmental Affairs

October 25, 1996

VIA FACSIMILE: (301) 415-5397
Mr. Joseph J. Holonich, Chief
High-Level Waste and Uranium Recovery Projects Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Re: License SUA-917
Docket No. 40-3453
USF&WS Data Review, October 21, 1996

Dear Mr. Holonich:

Transmitted herewith is a copy of the overheads and data presented to the US Fish and Wildlife Service representatives during our video-conference October 21, 1996. Some of the data is duplicated in the data package prepared by Harding Lawson Associates (HLA) sent prior to the meeting. Some of it is an evaluation of the data which we tried to present to you and ORNL over the video connection. As is probably the case, we were not as successful in the application of this new communication technology as we could have been.

A copy of this material will be sent directly to ORNL. Some additional water quality data will be provided as soon as it is received from the laboratory.

It is our understanding, based on the October 21, 1996 meeting, that ORNL will prepare a supplement to its earlier biological assessment and submit the supplement to the FWS in early November. Further to our understanding, the FWS will begin to prepare its biological opinion but will not finalize its draft until receiving the supplement from NRC/ORNL. Mr. Fliegel indicated that if the FWS took the full

NL05

amount of time legally allowed, that the final EIS would not be available for publication until late April 1997. While there was no firm concensus, there was an acknowledgment by all the parties that everything reasonable would be done to keep the process moving in order to maintain the completion target of March 1997.

Please contact me at your convenience should you have any questions with respect to the enclosed material.

Sincerely,

Richard E. Blubaugh

Enclosures
cc: D. Edwards, Atlas
B. Waddell, USFWS (w/o encl.)
G. Ohland, HLA, (w/o encl.)
A. Thompson, Esq., SPPT
R. Reed, ORNL

ATLAS URANIUM MILL AND TAILINGS SITE DATA REVIEW MEETING

OCTOBER 21, 1996

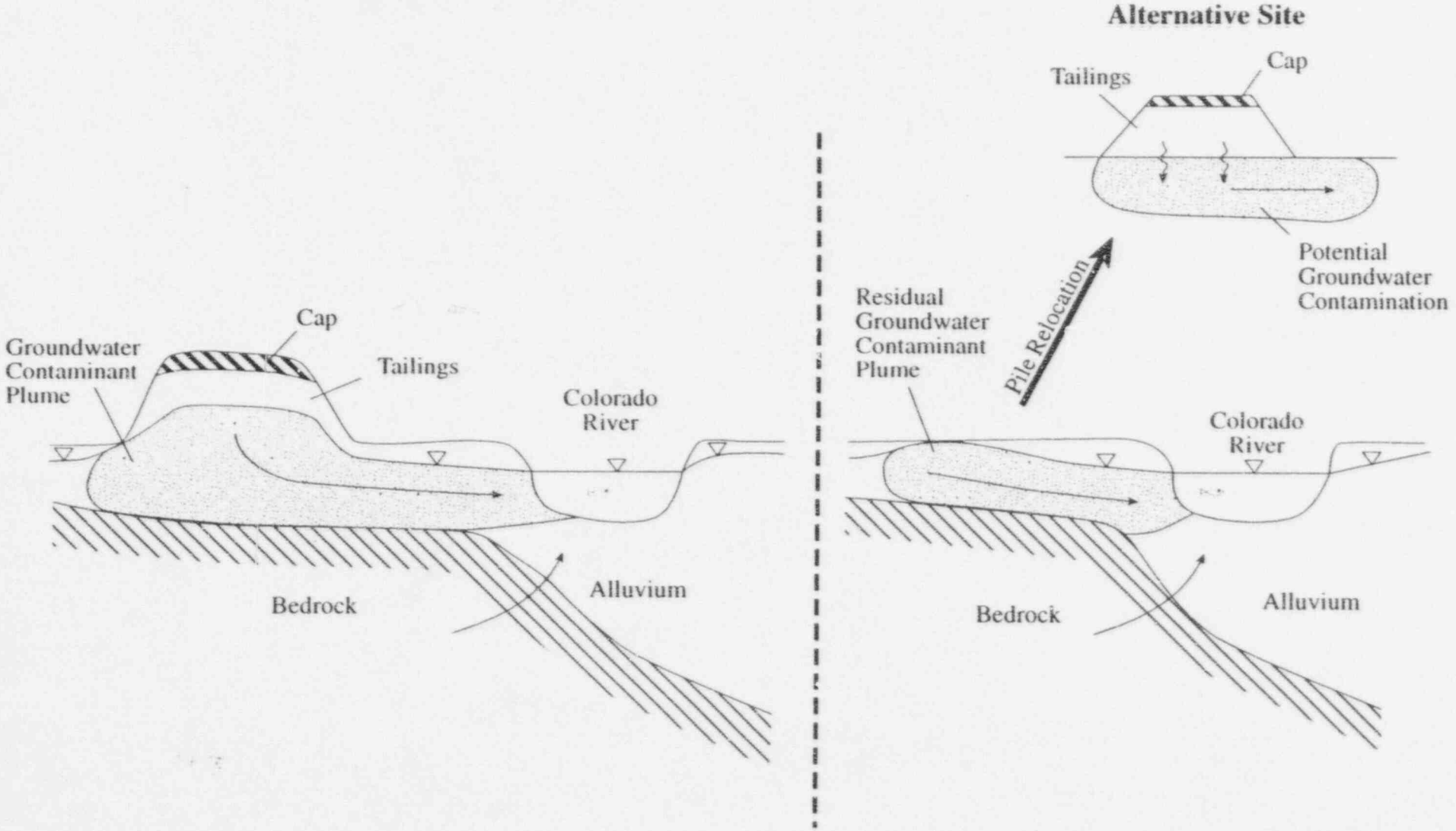
ATLAS CORPORATION

HARDING LAWSON ASSOCIATES

MEETING OBJECTIVES

- Provide overview of available data
- Present conceptual models of regional and local hydrogeology
- Facilitate USFWS' review of available data
- Address USFWS' technical concerns/issues relative to their biological opinion

Statement of the Problem



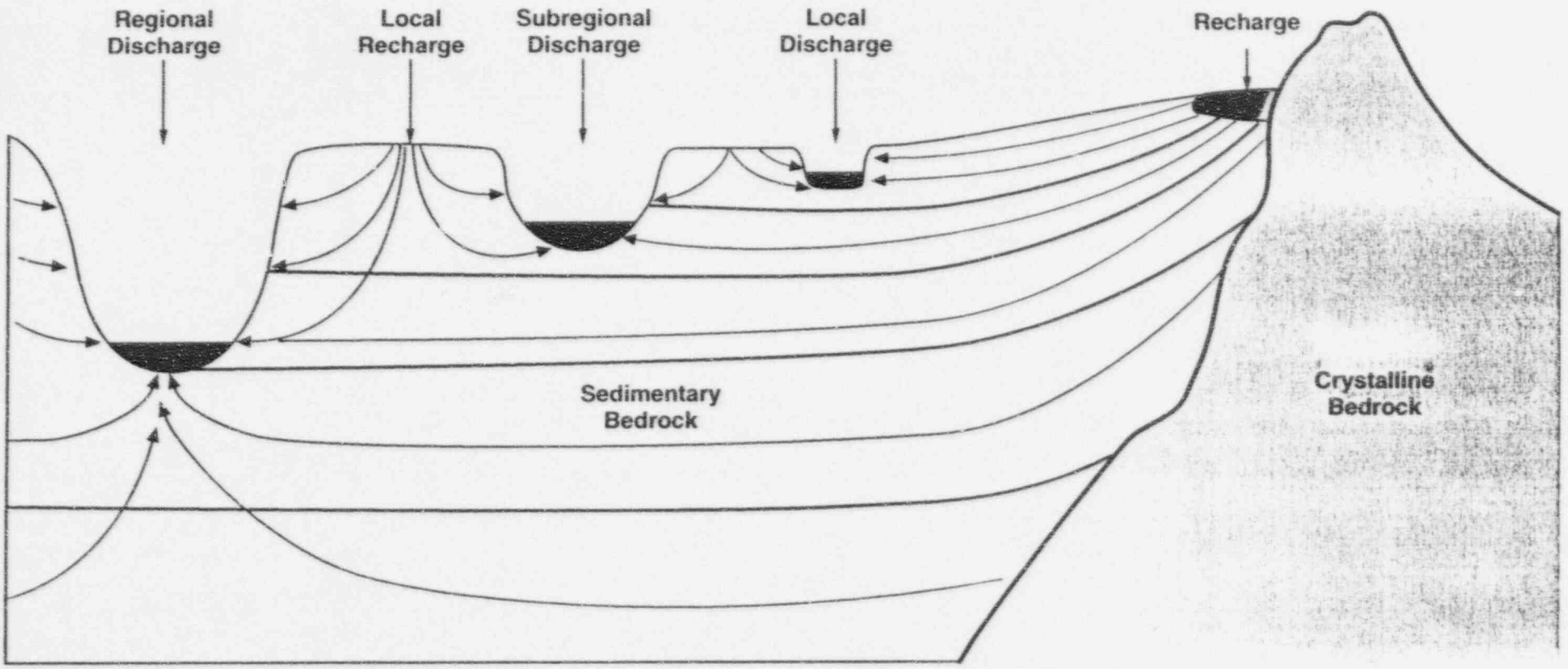
PRESENTATION OUTLINE

- Statement of the Problem
- Regional Hydrogeology
- Regional Surface Water Quality
- Conceptual Model of Local Hydrogeology
- Potential Effects of Tailings Pile on the Colorado River
- NRC Requirements for Groundwater Corrective Action Plan

REGIONAL HYDROGEOLOGY

- Defined by USGS and UGS Studies
- Regional recharge primarily in upland areas
- Regional discharge primarily to Colorado River
- Upward vertical hydraulic gradients from deep bedrock aquifers to shallow aquifers
- Groundwater water quality affected by salt dissolution and uranium deposits

Regional Conceptual Model



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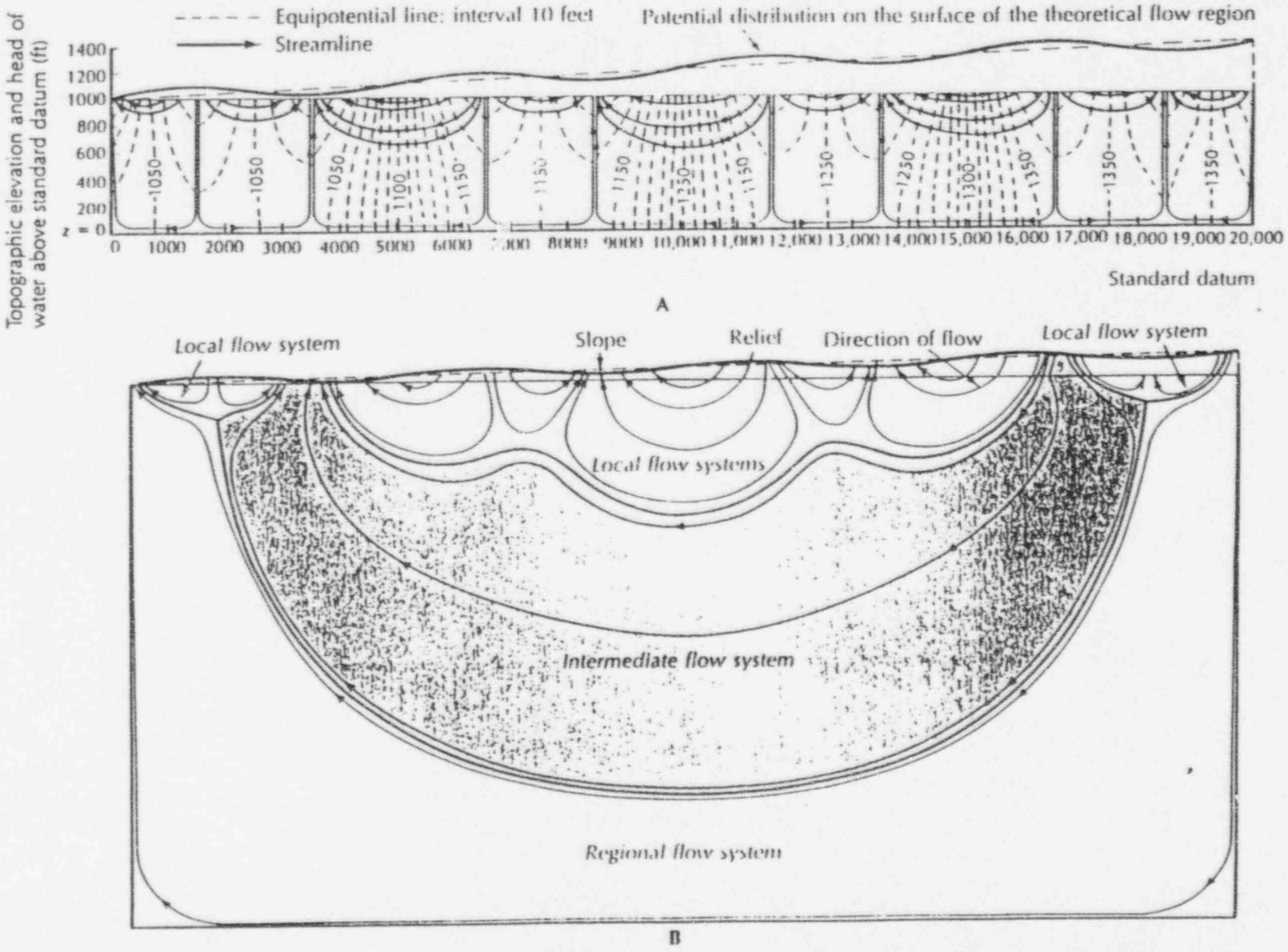


FIGURE 6.4. The effect of increased basin depth is shown on these two figures. In Part A, the basin depth/length ratio is 1:20; in Part B, it is 1:2. The shallow basin has only local flow systems, while the deep basin has local, intermediate, and regional flow systems. The water-table configuration is the same for both basins. SOURCE: J. A. Tóth, *Journal of Geophysical Research*, 68 (1963):4795-4811.

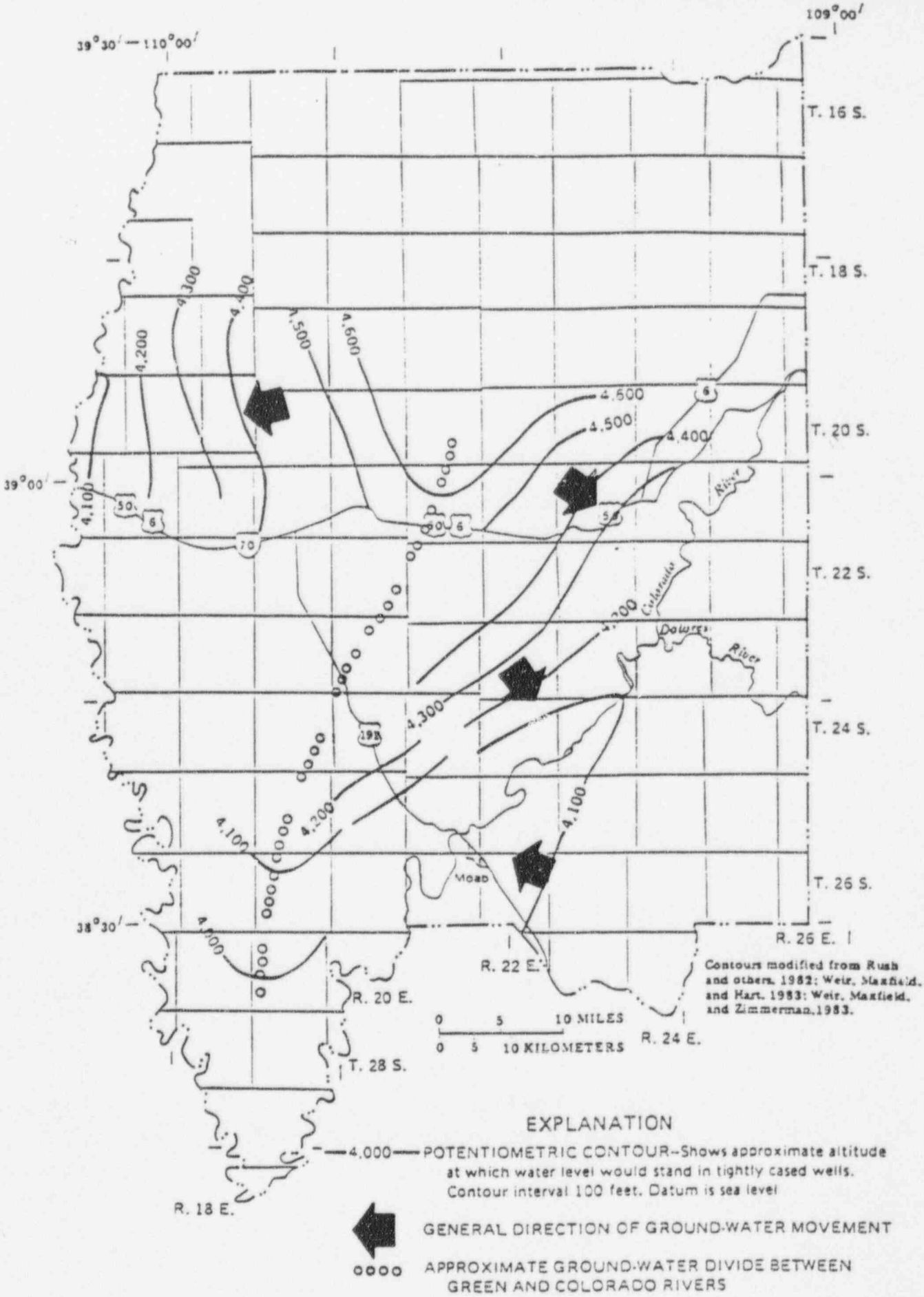


Figure 9.--Approximate potentiometric surface and general direction of movement of water in the upper ground-water system.

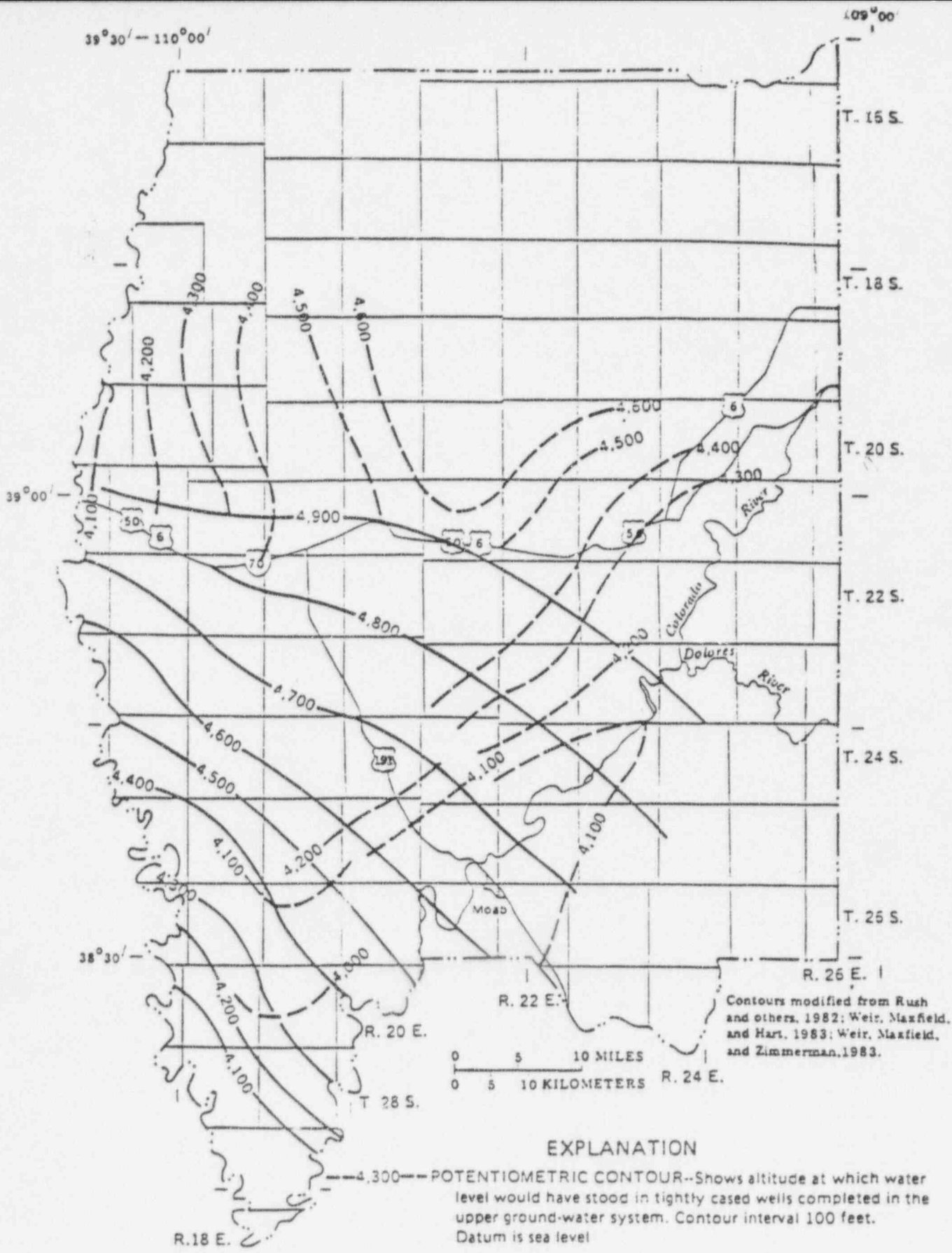
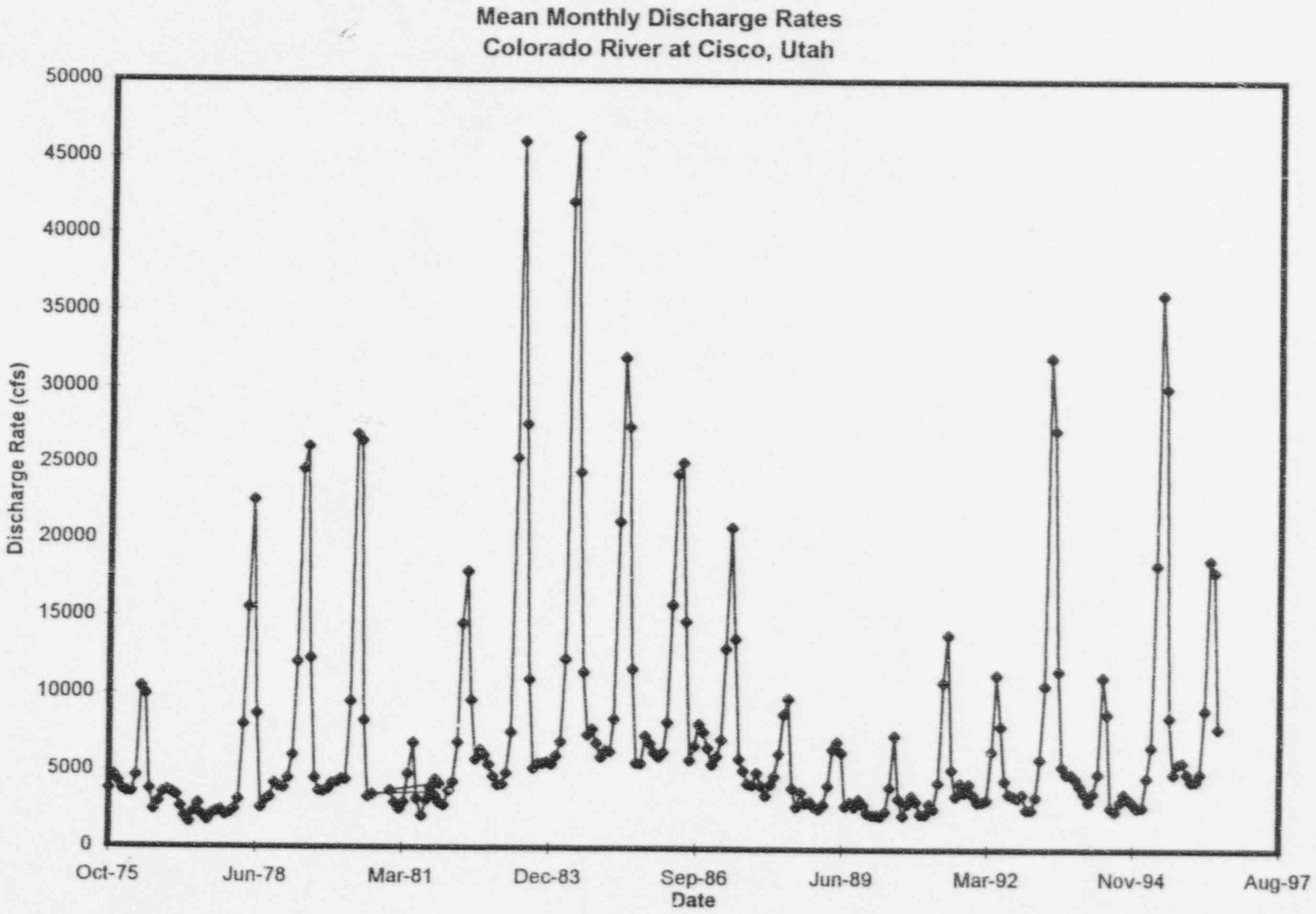
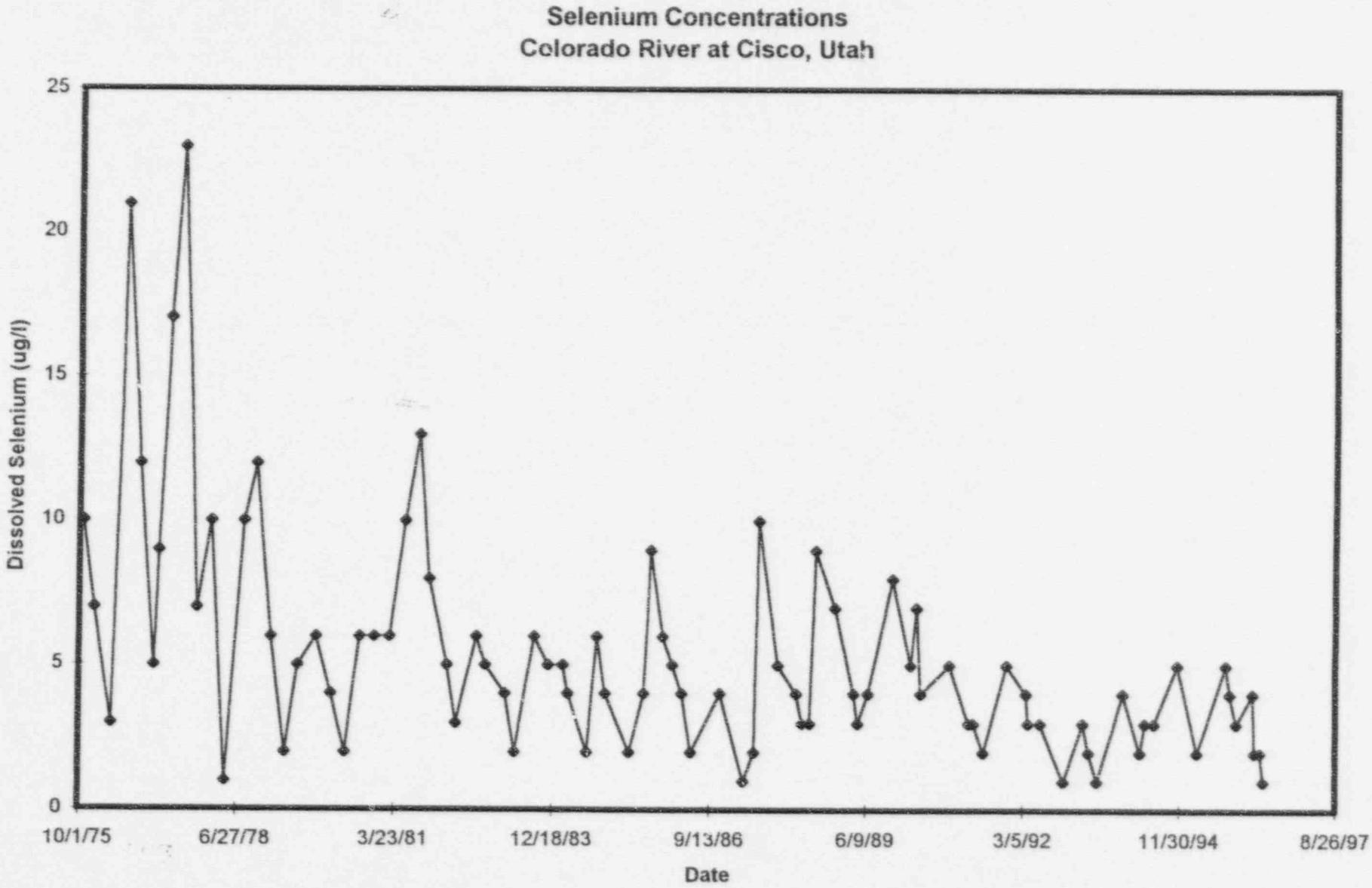


Figure 16.--Approximate potentiometric surface of water in the upper and lower ground-water systems.

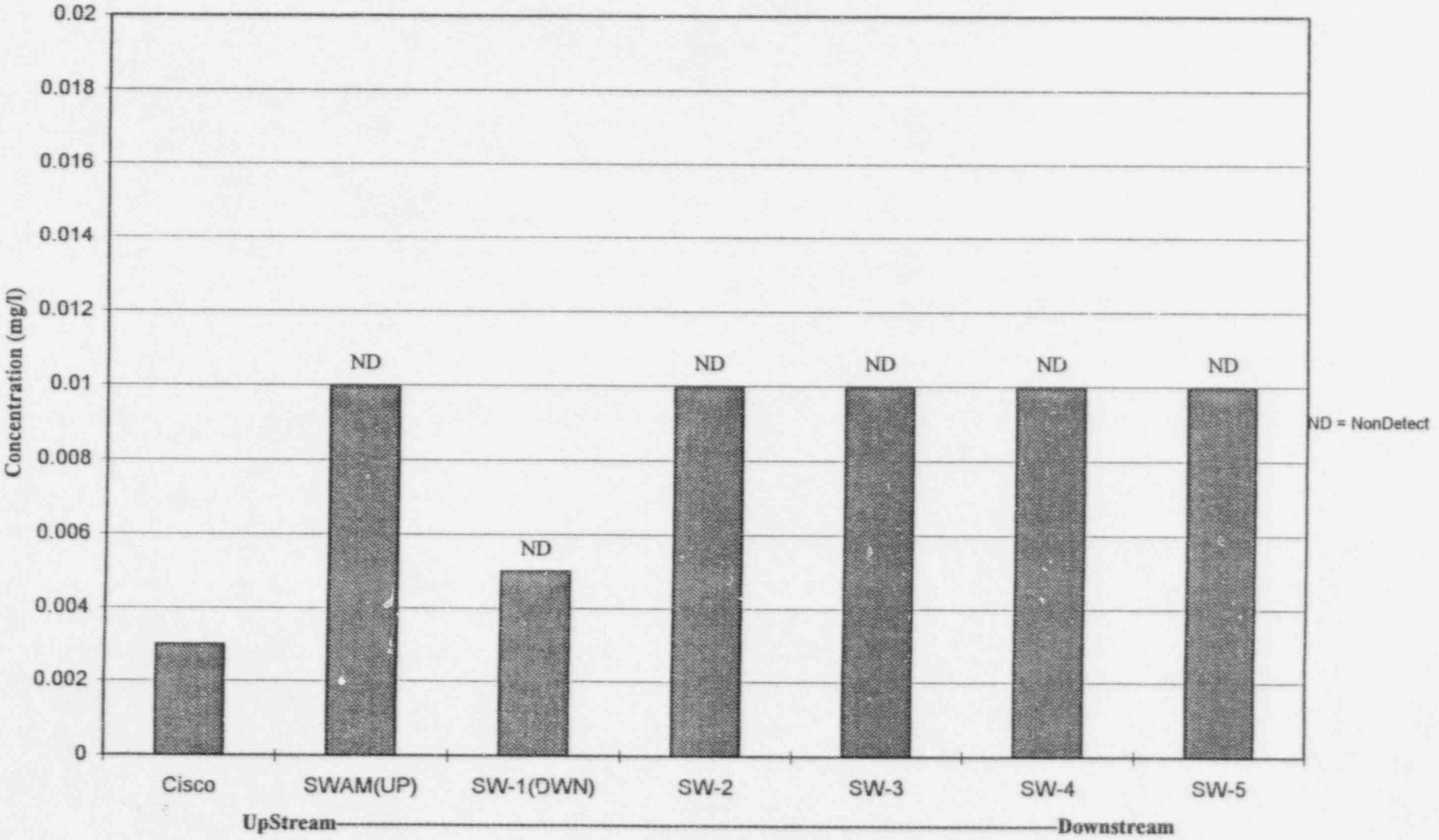
REGIONAL SURFACE WATER QUALITY INFLUENCES

- Ambient or natural influences
  - Storm water and snowmelt runoff
  - Rock-water interactions (e.g., uranium, selenium, etc)
  - Groundwater-surface water interactions
- Anthropogenic influences
  - Agricultural return flows
  - Storm water runoff (municipalities, feedlots)
  - Water treatment plants
  - Mine drainage

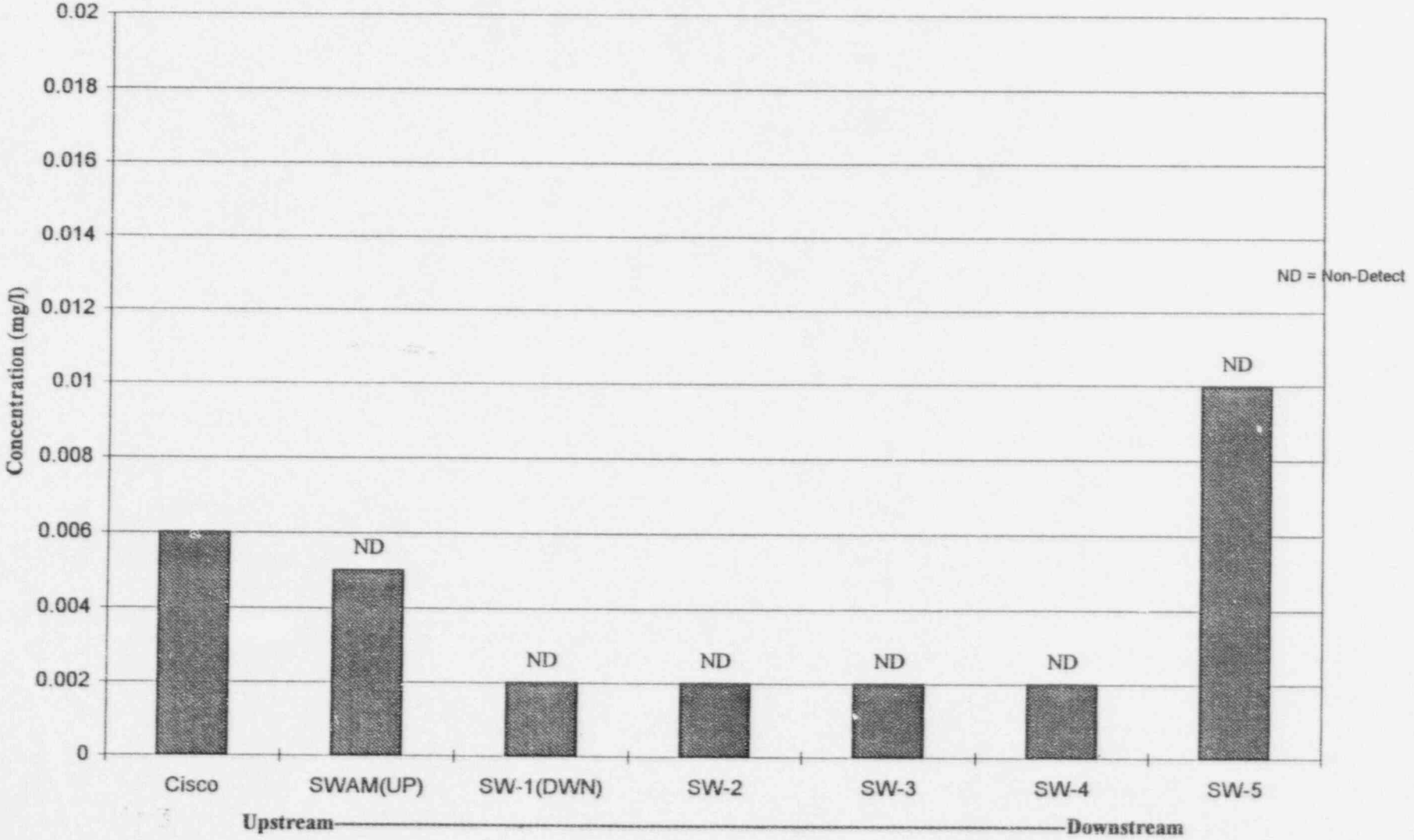

Mean Monthly Discharge Rates
Colorado River at Cisco, Utah
Discharge Rate (cfs)
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Oct-75
Jun-78
Mar-81
Dec-83
Sep-86
Jun-89
Mar-92
Nov-94
Aug-97
Date


Selenium Concentrations
Colorado River at Cisco, Utah
Dissolved Selenium (ug/l)
25
20
15
10
5
0
10/1/75
6/27/78
3/23/81
12/18/83
9/13/86
6/9/89
3/5/92
11/30/94
8/26/97
Date

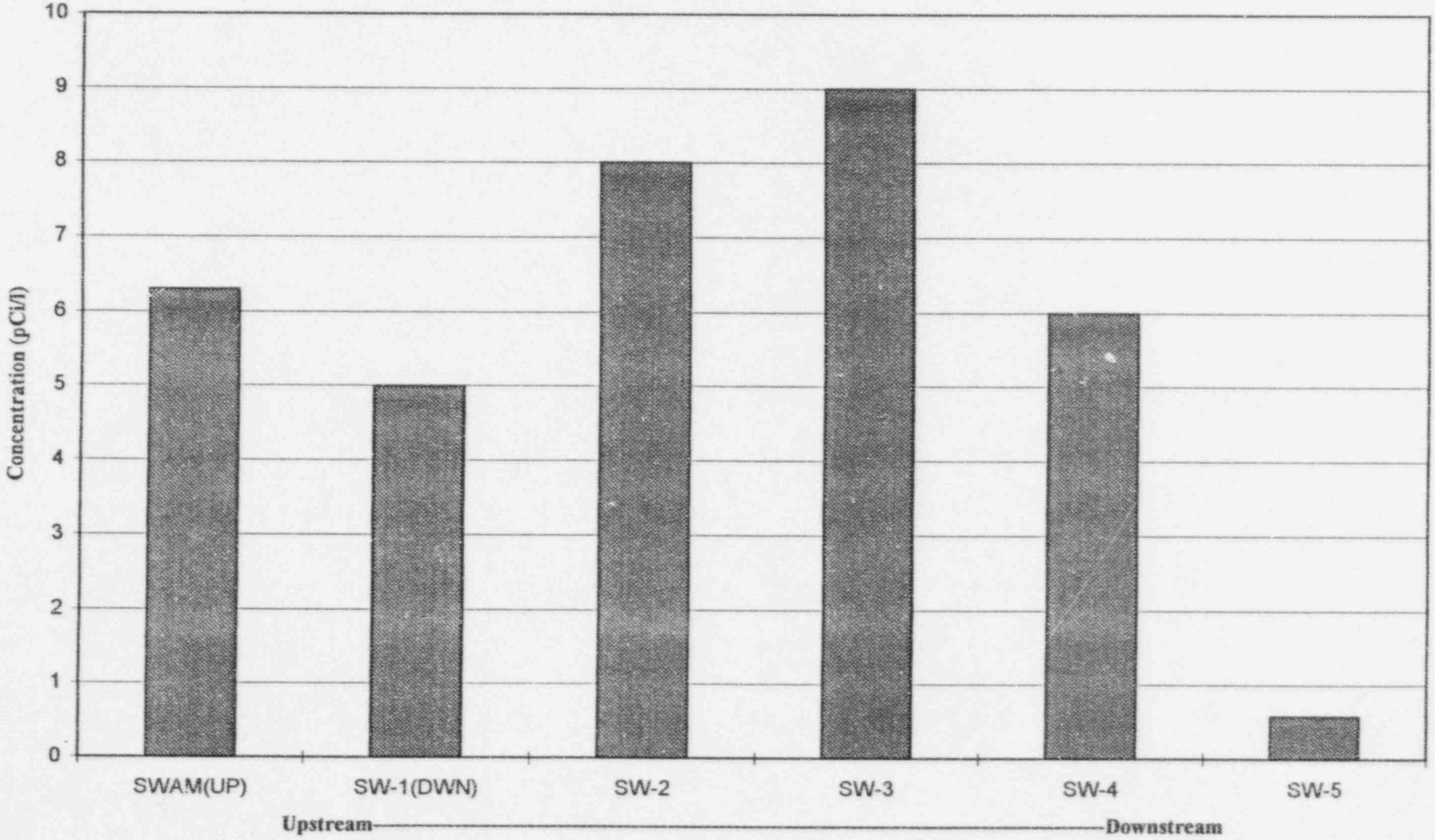
Copper Concentration in Surface Water
USGS and Atlas Data 9/84

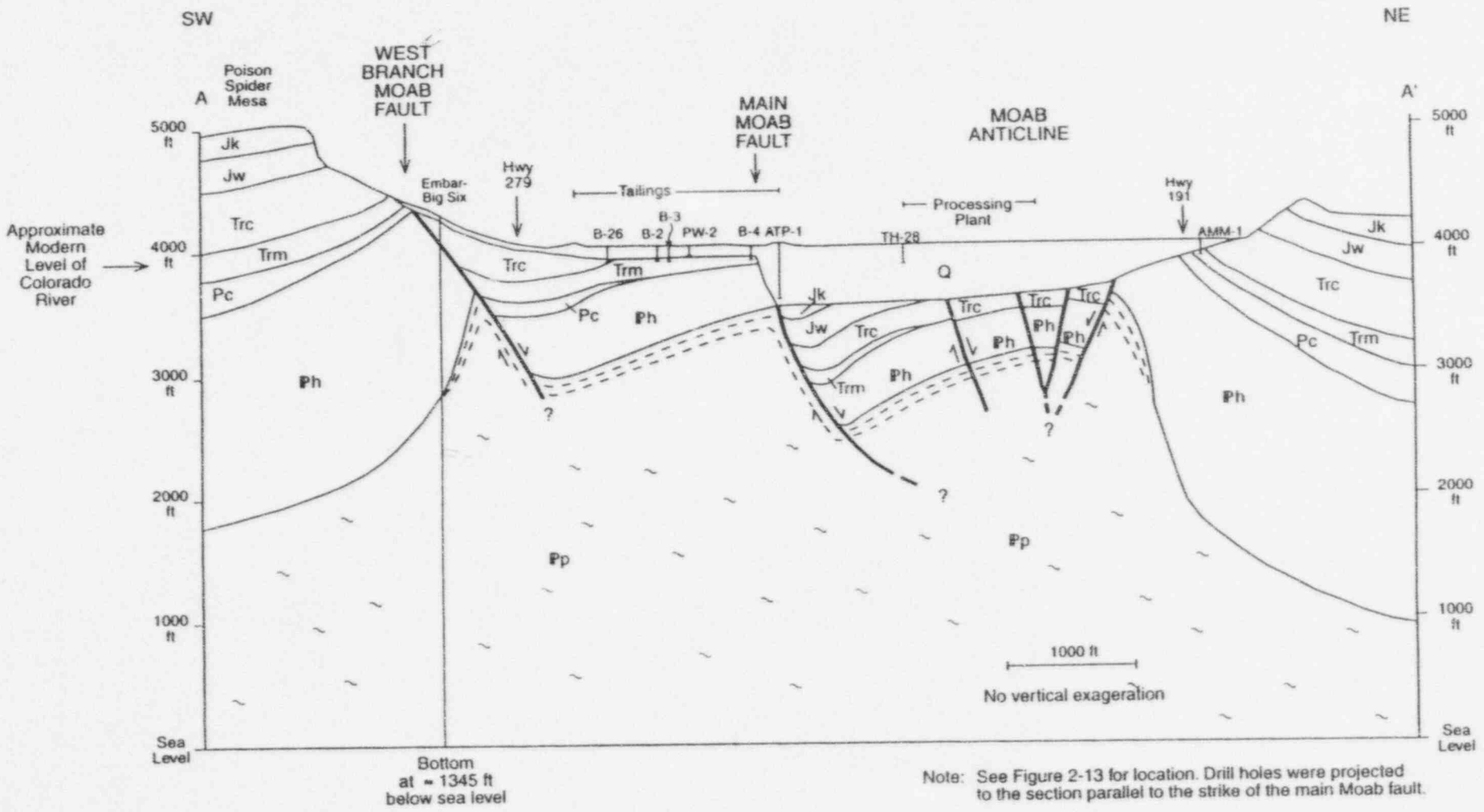


Selenium Concentrations in Surface Water
USGS & Atlas Data 9/84



Uranium Concentrations in Surface Water
Atlas Data 9/84





Note: See Figure 2-13 for location. Drill holes were projected to the section parallel to the strike of the main Moab fault.

EXPLANATION

Fault, arrows show direction of relative movement

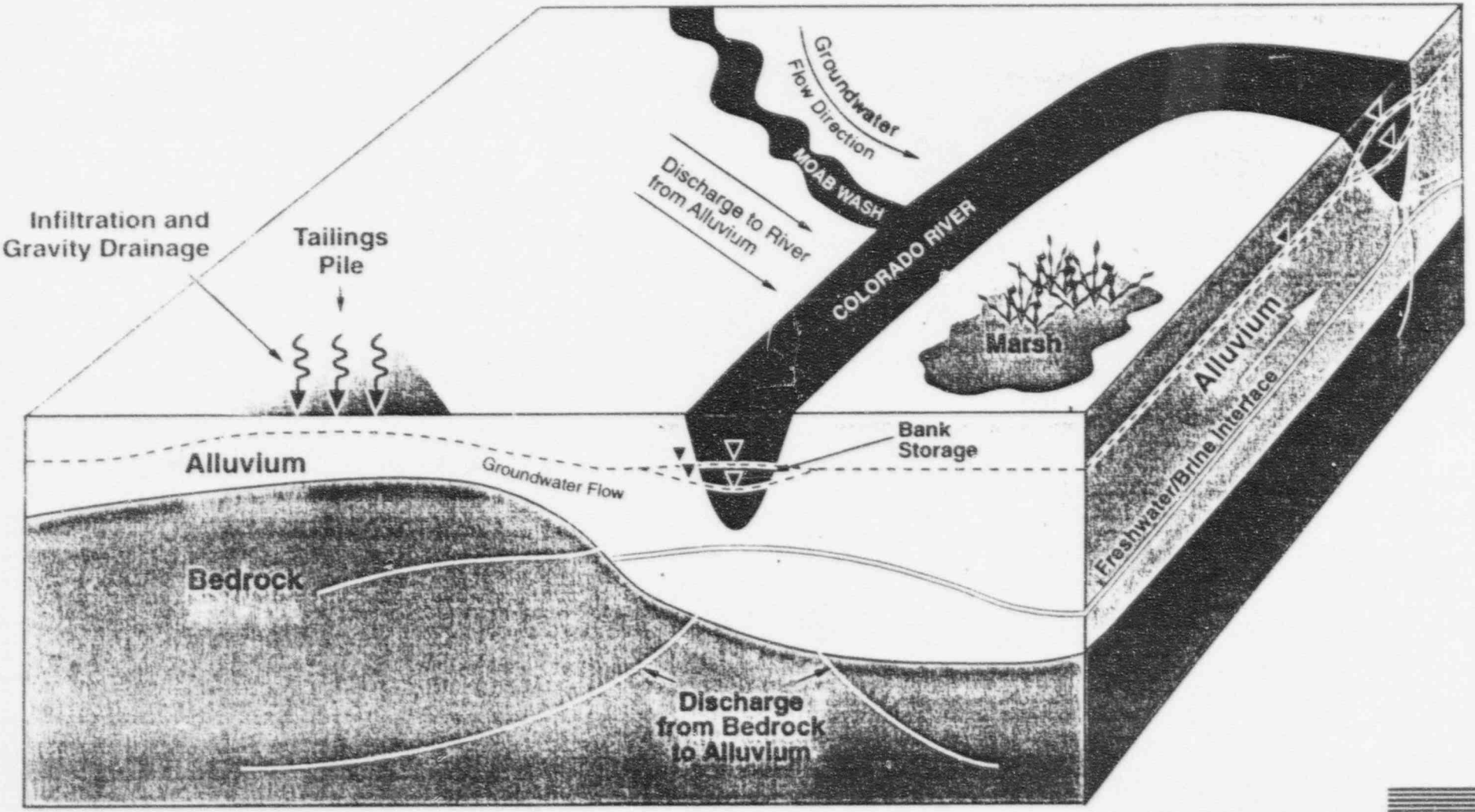
Stratigraphic contact, see Figure 2-5 for explanation of symbols and geologic units.

Caprock at the top of the Paradox Formation (Pp)

Project No. SK9407	Atlas Uranium Mill Tailings Site	GEOLOGIC CROSS-SECTION A-A' FOR STRUCTURAL MODEL A	Figure 2-14
	Woodward-Clyde Consultants		

SK9407-A310/012696/vone, 006

Conceptual Model of Groundwater Flow



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LOCAL HYDROGEOLOGIC CONCEPTUAL MODEL

- Horizontal hydraulic gradients toward Colorado River
- Vertical hydraulic gradients upward within alluvium
- Bank storage in alluvium under high river stage conditions
- Brines from the Paradox Fm. appear to be discharging to the alluvium
- Saltwater-fresh water interface observed at depths less than 100 feet

GROUNDWATER CHEMICAL SIGNATURES

- Tailings pore water = 37,000 mg/l TDS; Na-SO4 water type
- Downgradient groundwater = 22,000 mg/l TDS; Na-SO4 water type
- Colorado River = < 500 mg/l TDS; CaNa-SO4/HCO3 water type

GROUNDWATER CHEMICAL SIGNATURES (CONTINUED)

- Wetlands Preserve groundwater - two types of waters observed
  - North = >3,000 - 44,000 mg/l TDS; NaCa-SO4/HCO3 water type
  - South = <3,000 mg/l TDS; CaNA-SO4/HCO3 water type (similar to River)

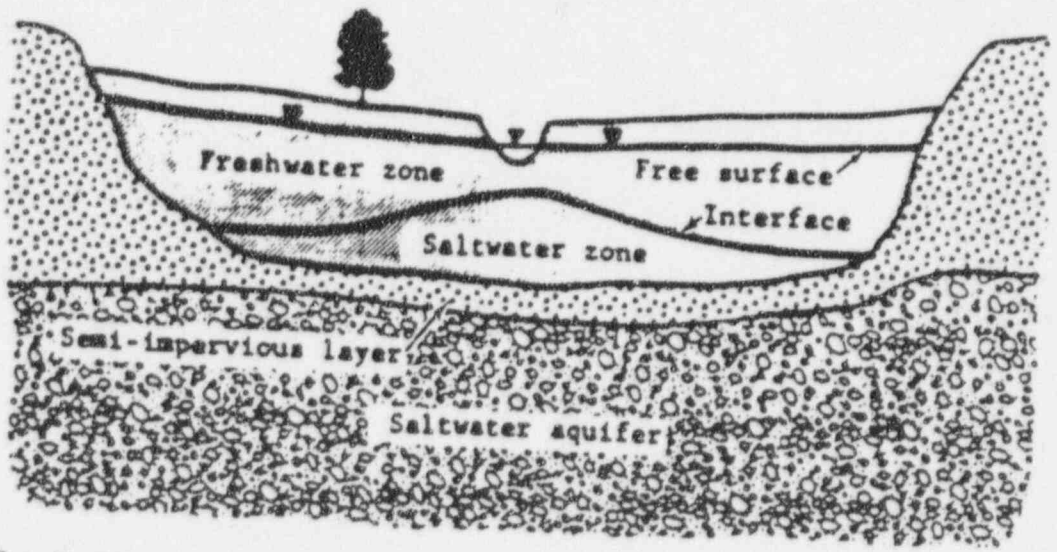


Fig. 6. Hydrogeologic scheme of a hypothetical model of salt-water upconing under a river.

POTENTIAL SOURCES OF GROUNDWATER IN THE ALLUVIUM

- Discharge from the Colorado River into river bank alluvium at high river stage
- Overland flow from the Colorado River during high river stage
- Discharge from bedrock aquifers to alluvium along valley walls
- Groundwater upconing in alluvium due to vertical hydraulic gradients

POTENTIAL EFFECTS OF TAILINGS PILE ON THE COLORADO RIVER

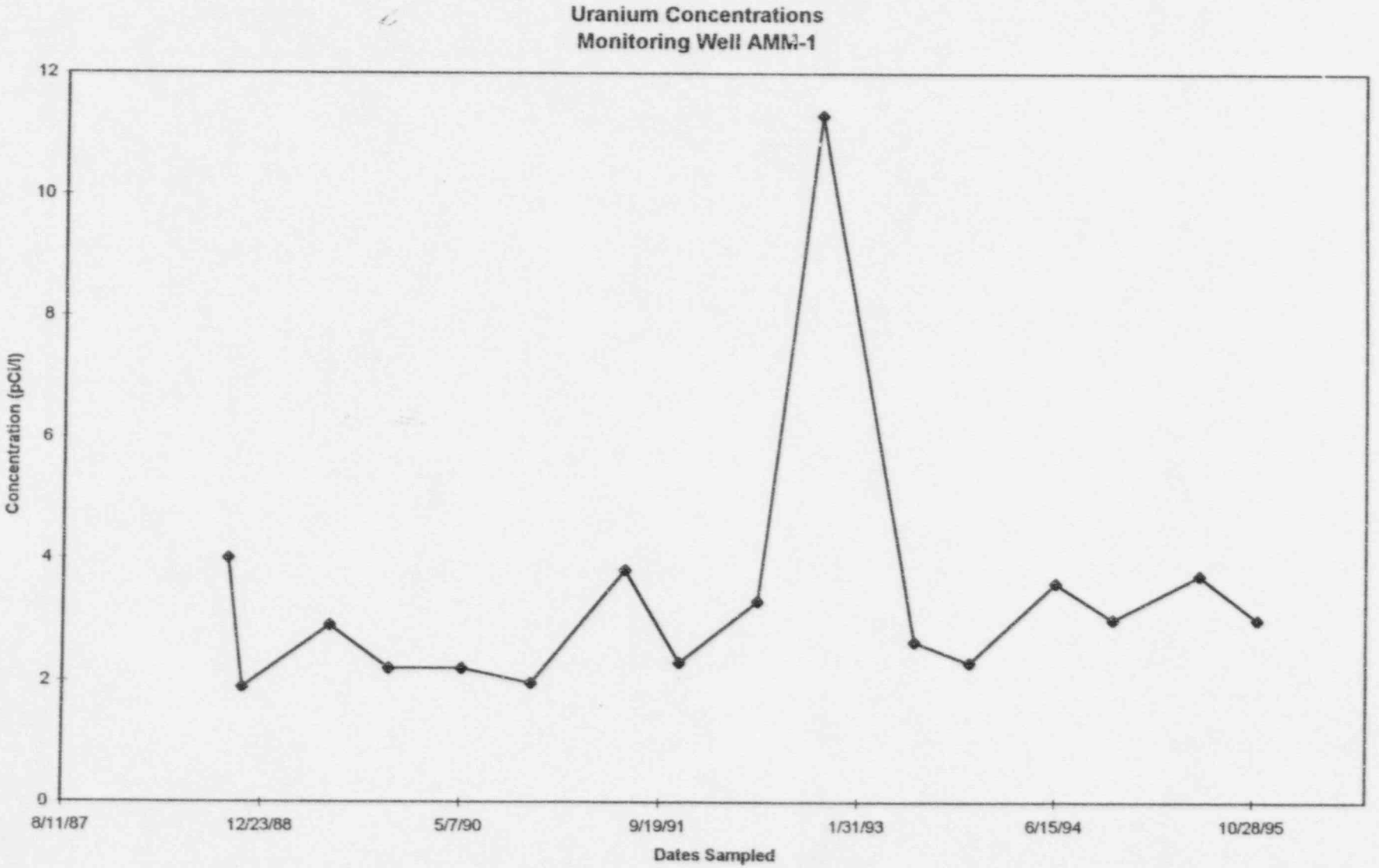
- Evaluated constituents in tailings pile and groundwater at the Atlas site
- Compared groundwater adjacent to the Colorado River with background groundwater quality and concentrations in the Colorado River
- Evaluated surface water, sediment, and fish tissue data for spatial trends

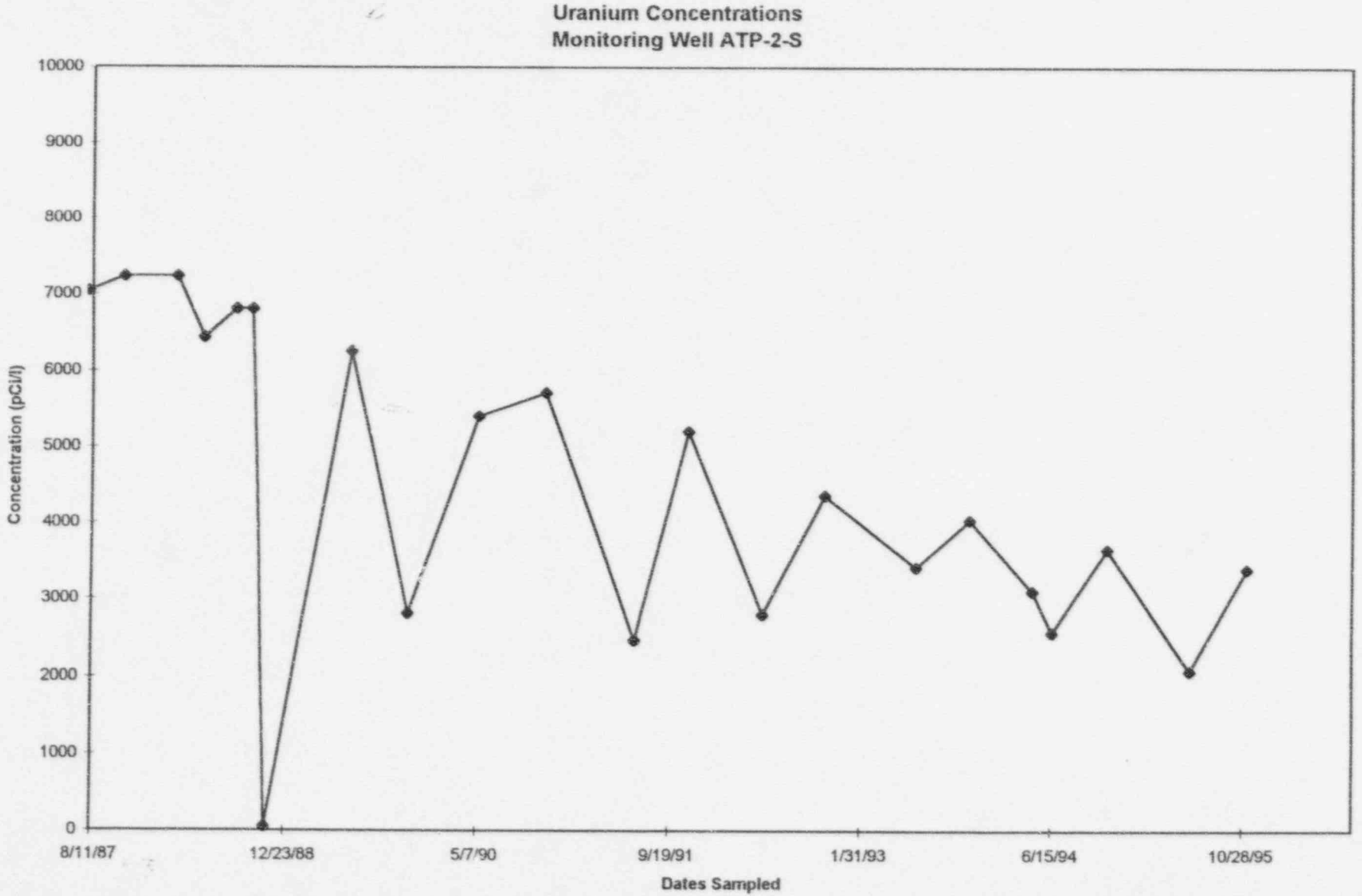
CONSTITUENTS IN TAILINGS PORE WATER AND GROUNDWATER

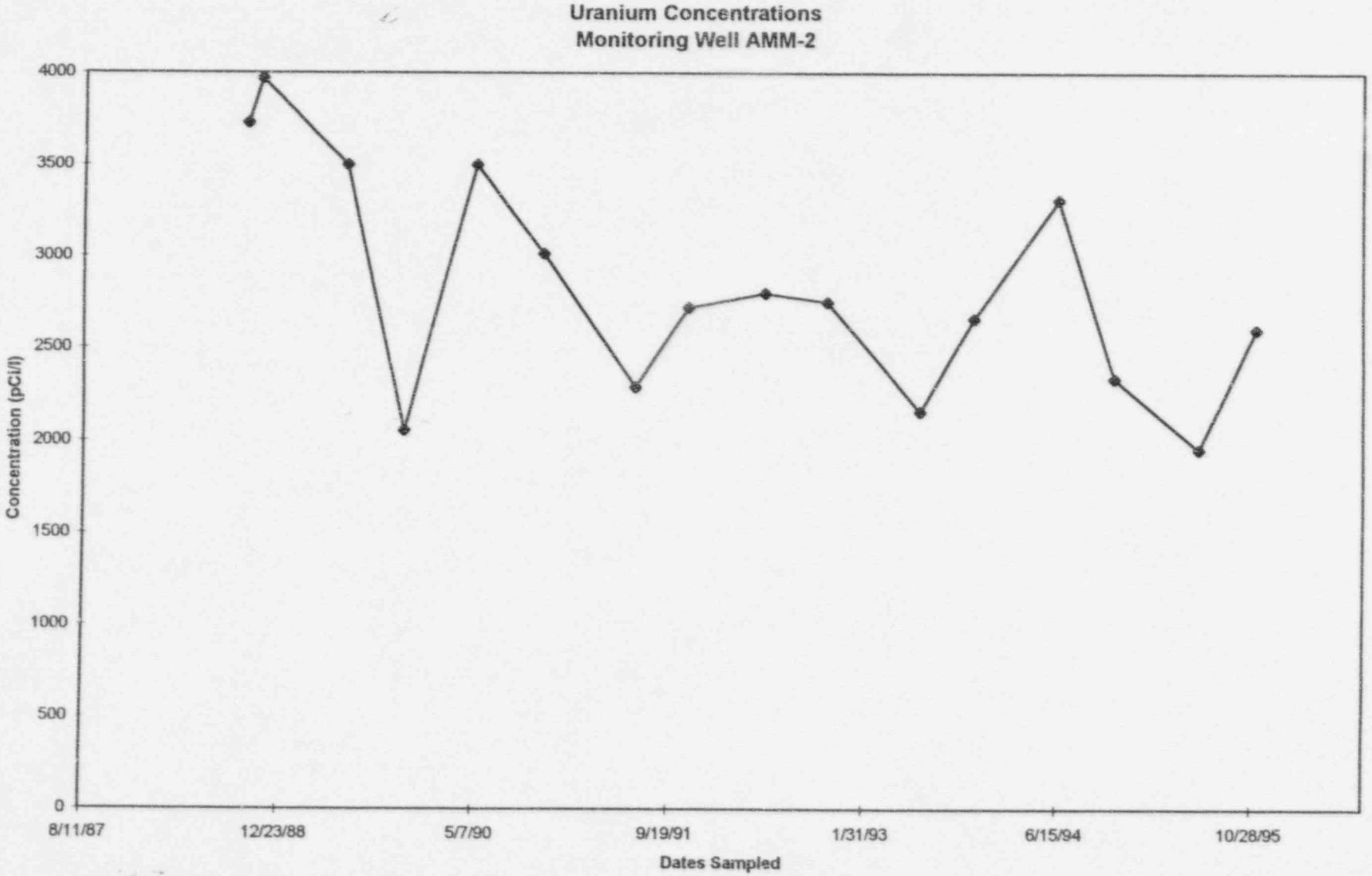
Tailings Pore Water	Well AMM-2
Copper = 13 mg/l	Copper = .077 mg/l
Molybdenum = 2.6 mg/l	Molybdenum = 1.3 mg/l
Nickel = 0.05 mg/l	Nickel = 0.02 mg/l
Nitrate = 123 mg/l	Nitrate = 66 mg/l
Selenium = 0.84 mg/l	Selenium = 0.02 mg/l
Vanadium = 1.7 mg/l	Vanadium = < 0.10 mg/l
Zinc = 0.21 mg/l	Zinc = 0.041 mg/l
Uranium = 17,604 pCi/l	Uranium = 2,302 pCi/l
Radium 226 = 43 pCi/l	Radium 226 = 1.6 pCi/l
Radium 228 = 2.7 pCi/l	Radium 228 = 2.2 pCi/l

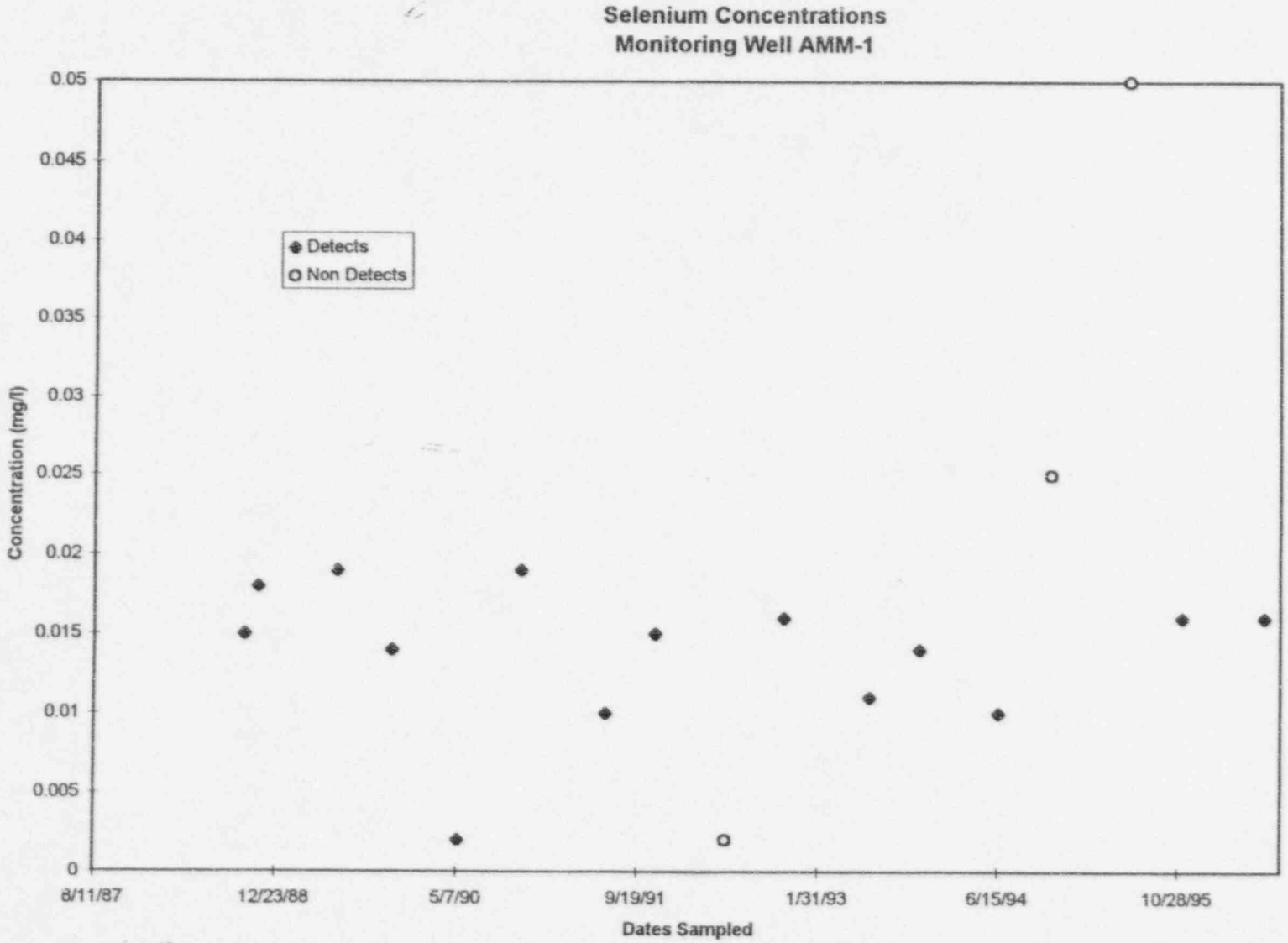
COMPARISON OF GROUNDWATER ADJACENT TO COLORADO RIVER TO BACKGROUND

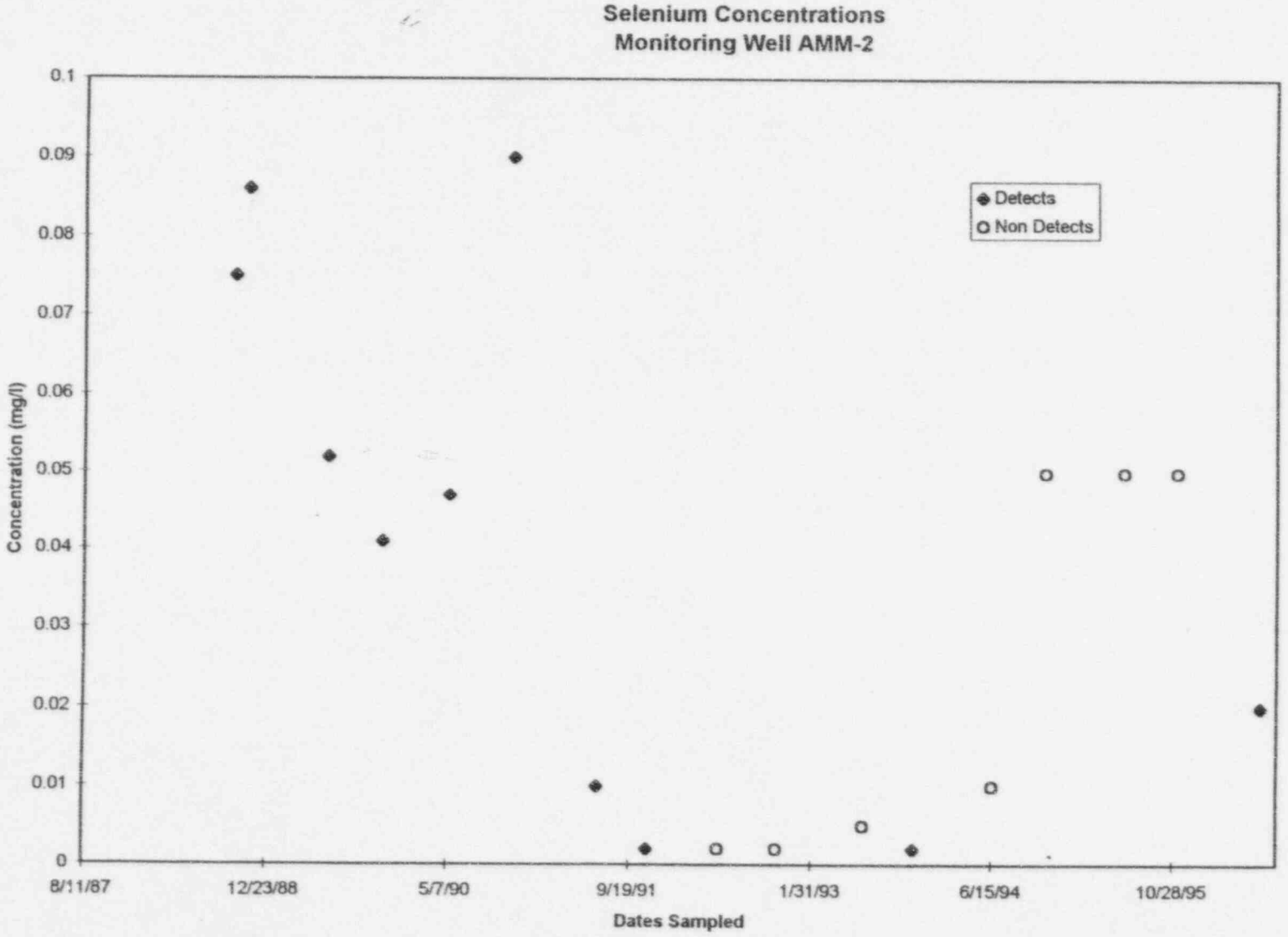
Background (AMM-1)	Well AMM-2
Copper < 0.10 mg/l	Copper = .077 mg/l
Molybdenum < 0.1 mg/l	Molybdenum = 1.3 mg/l
Nickel < 0.04 mg/l	Nickel = 0.02 mg/l
Selenium = 0.016 mg/l	Selenium = 0.02 mg/l
Vanadium < 0.10 mg/l	Vanadium = < 0.10 mg/l
Zinc = 0.012 mg/l	Zinc = 0.041 mg/l
Uranium = 2.64 pCi/l	Uranium = 2,302 pCi/l
Radium 226 < 0.4 pCi/l	Radium 226 = 1.6 pCi/l
Radium 228 < 2 pCi/l	Radium 228 = 2.2 pCi/l

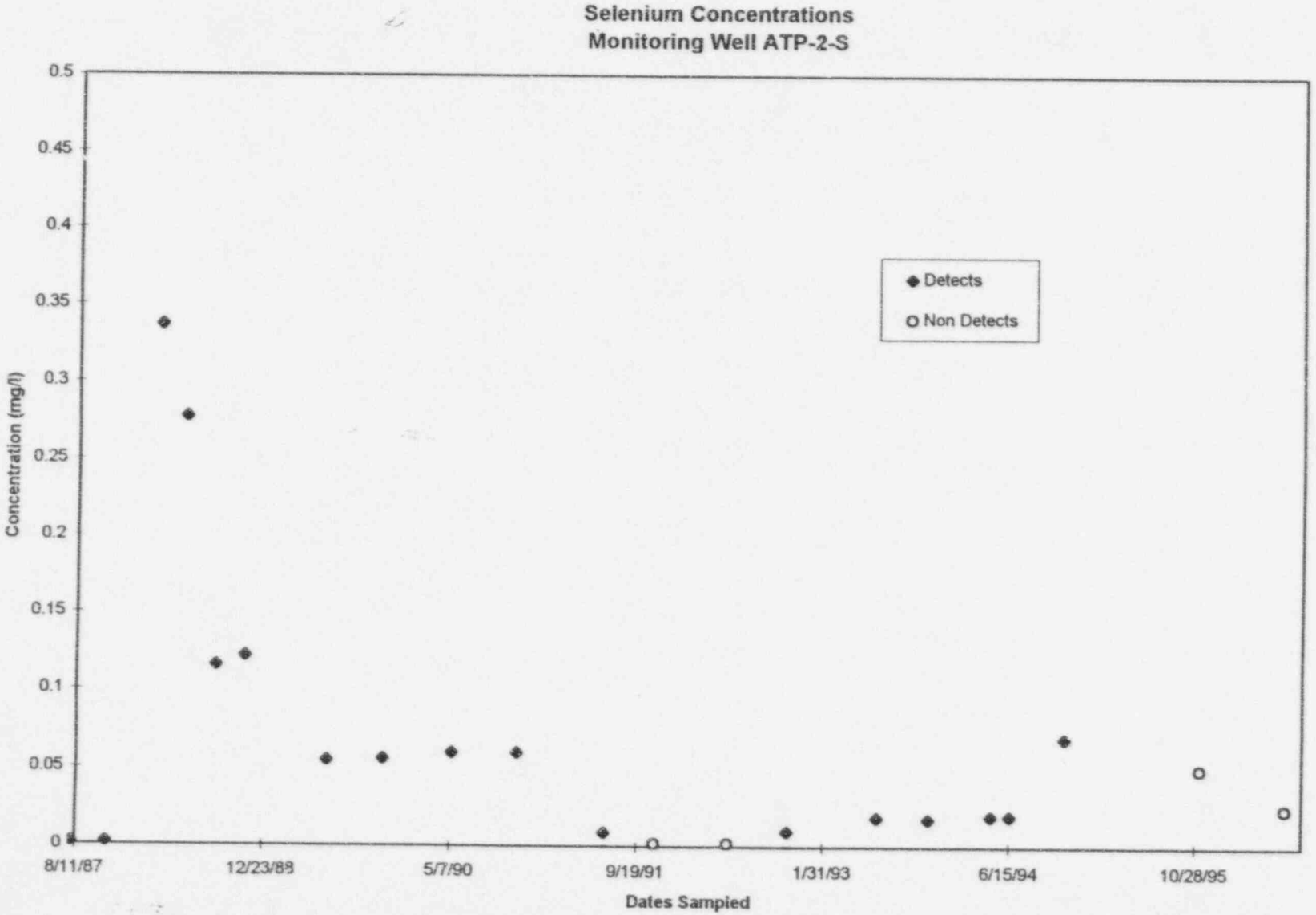

Uranium Concentrations
Monitoring Well AMM-1
Concentration (pCi/l)
0
2
4
6
8
10
12
8/11/87
12/23/88
5/7/90
9/19/91
1/31/93
6/15/94
10/28/95
Dates Sampled

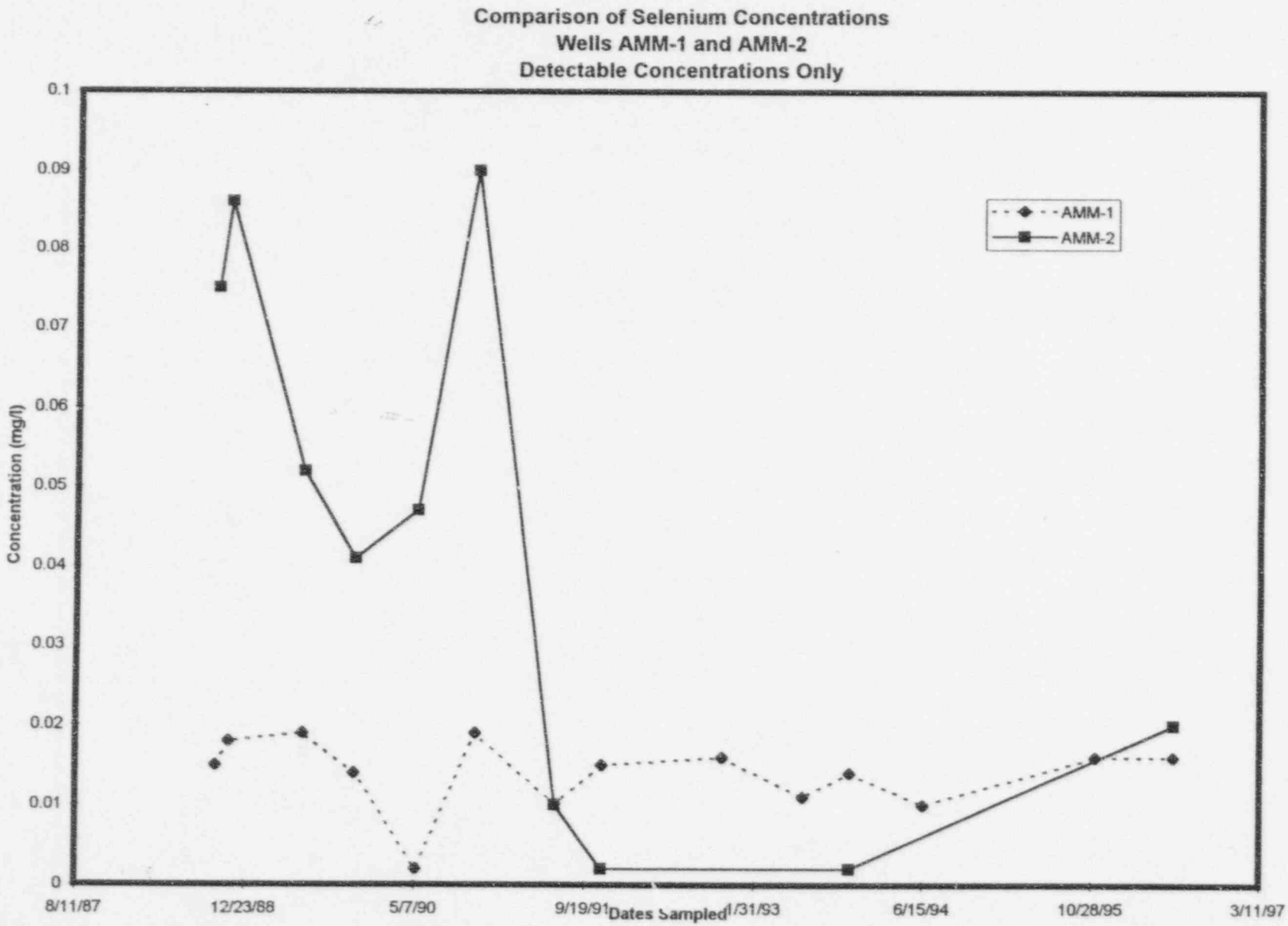

Uranium Concentrations
Monitoring Well ATP-2-S
Concentration (pCi/l)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
8/11/87
12/23/88
5/7/90
9/19/91
1/31/93
6/15/94
10/28/95
Dates Sampled


Uranium Concentrations
Monitoring Well AMM-2
Concentration (pCi/l)
4000
3500
3000
2500
2000
1500
1000
500
0
8/11/87
12/23/88
5/7/90
9/19/91
1/31/93
6/15/94
10/28/95
Dates Sampled

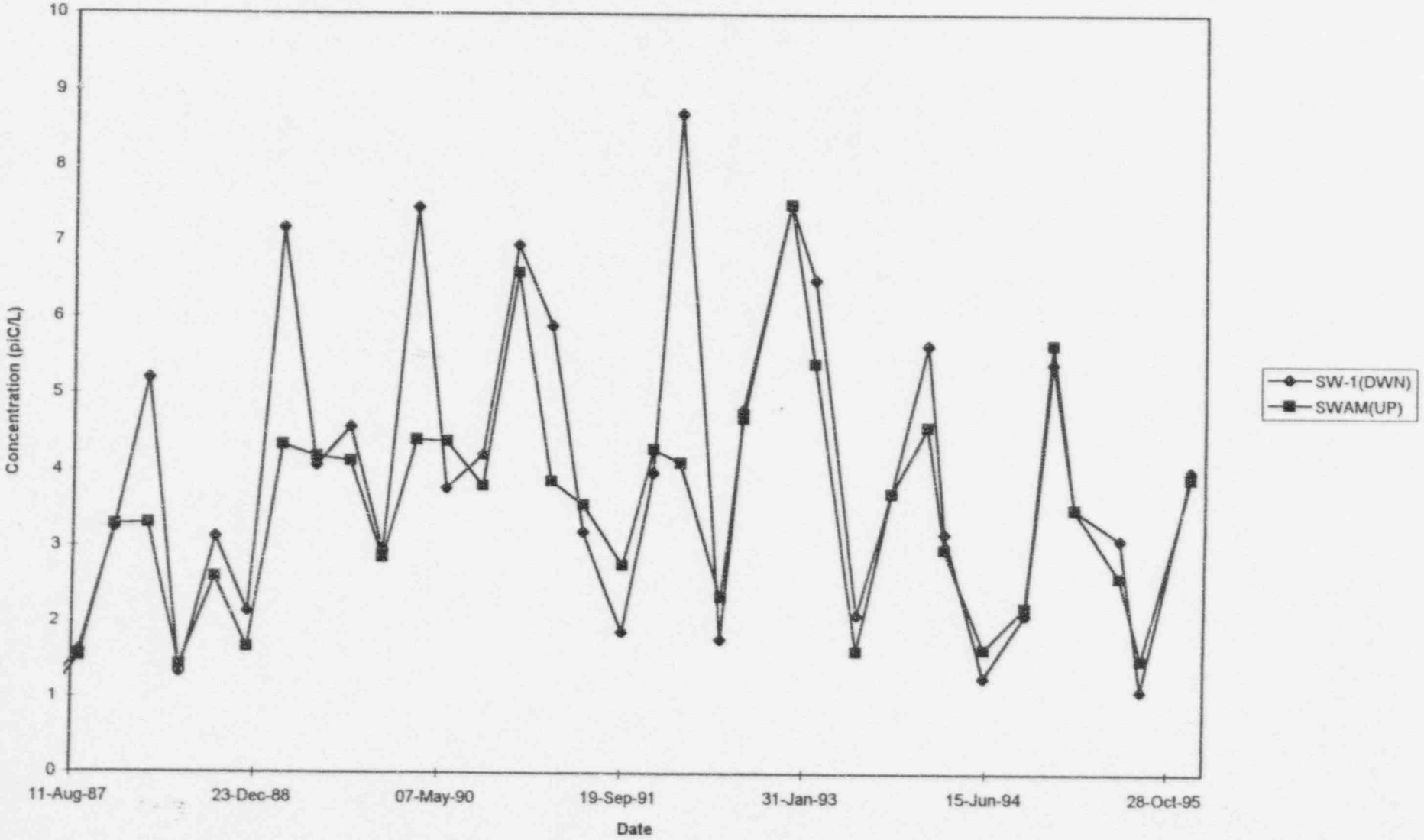

Selenium Concentrations
Monitoring Well AMM-1
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
Concentration (mg/l)
Detects
Non Detects
8/11/87
12/23/88
5/7/90
9/19/91
1/31/93
6/15/94
10/28/95
Dates Sampled

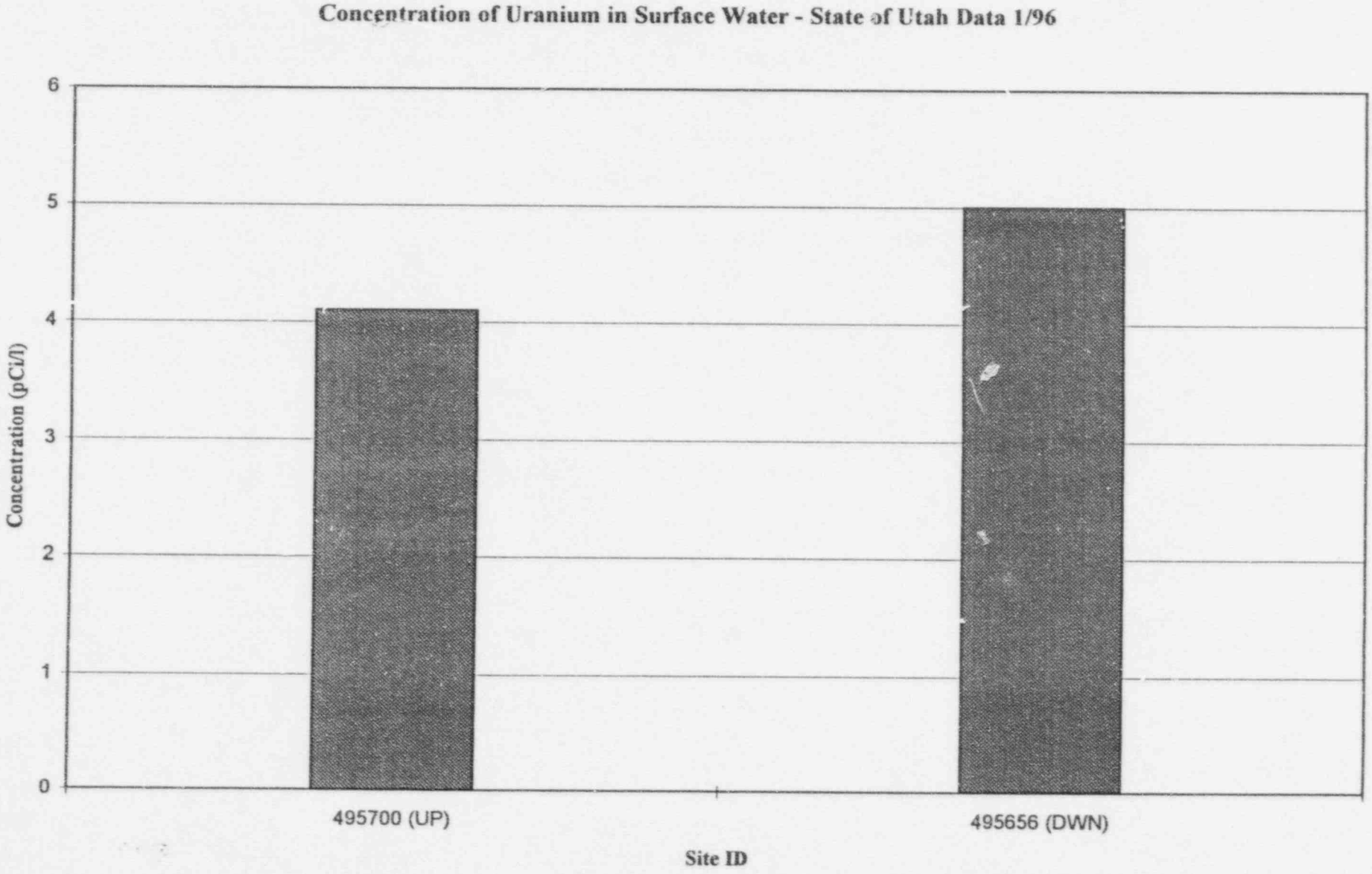

Selenium Concentrations
Monitoring Well AMM-2
Concentration (mg/l)
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
8/11/87
12/23/88
5/7/90
9/19/91
1/31/93
6/15/94
10/28/95
Dates Sampled
Detects
Non Detects


Selenium Concentrations
Monitoring Well ATP-2-S
Concentration (mg/l)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Detects
Non Detects
8/11/87
12/23/88
5/7/90
9/19/91
1/31/93
6/15/94
10/28/95
Dates Sampled

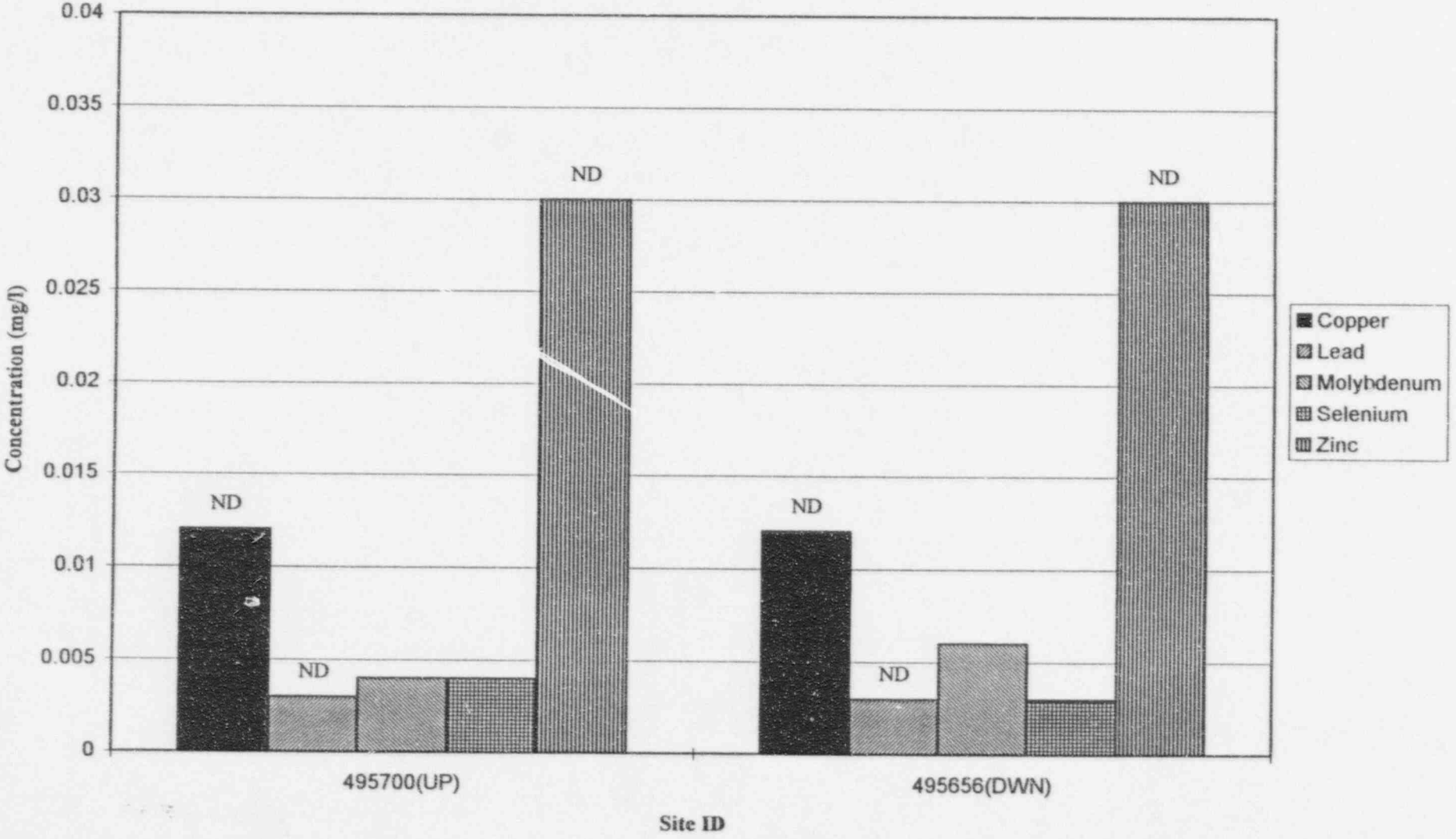

Comparison of Selenium Concentrations
Wells AMM-1 and AMM-2
Detectable Concentrations Only
Concentration (mg/l)
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
AMM-1
AMM-2
8/11/87
12/23/88
5/7/90
9/19/91
1/31/93
6/15/94
10/28/95
3/11/97
Dates Sampled

Uranium Concentrations in the Surface Water

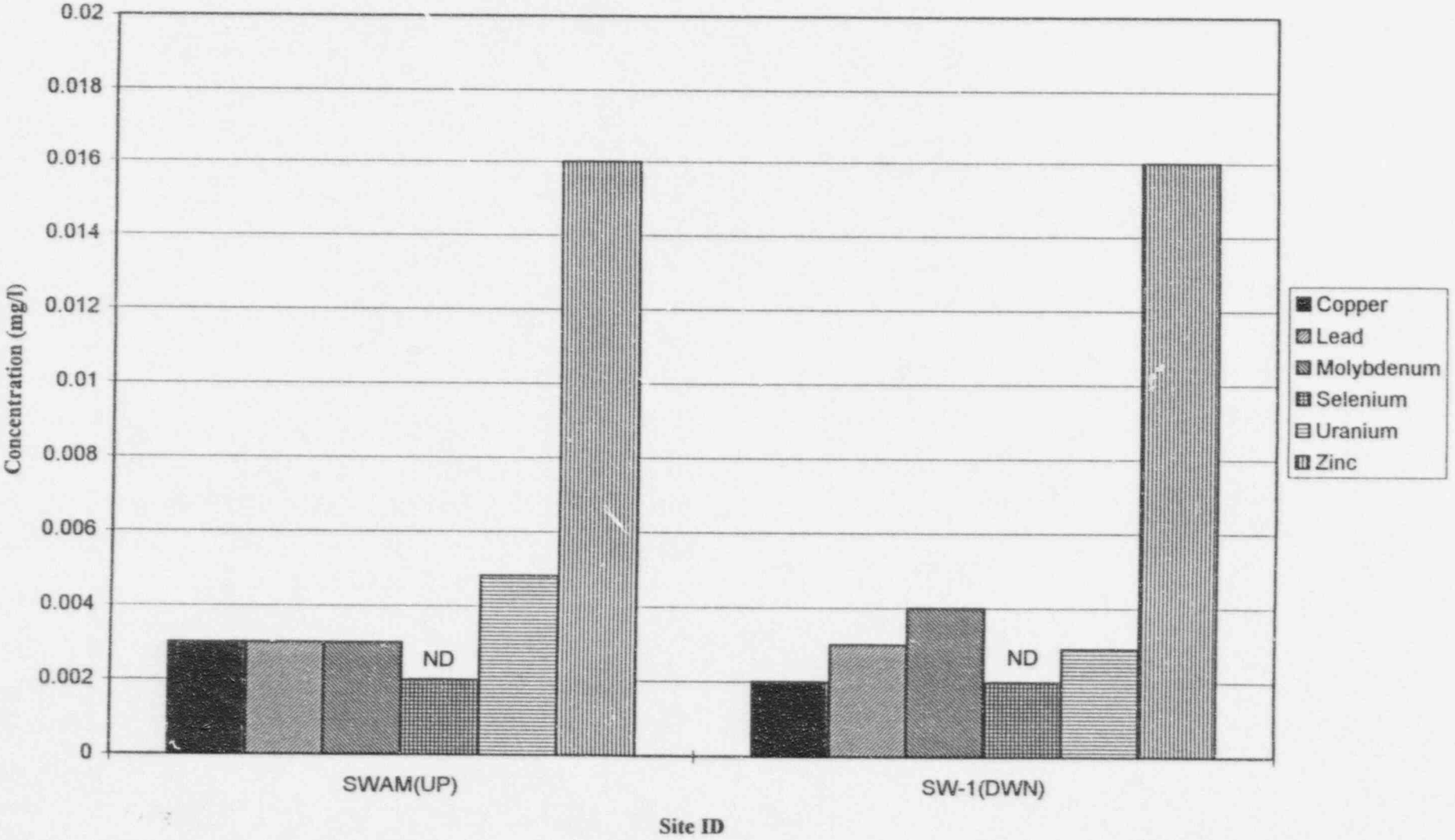



Concentration of Uranium in Surface Water - State of Utah Data 1/96
Concentration (pCi/l)
6
5
4
3
2
1
0
495700 (UP)
495656 (DWN)
Site ID

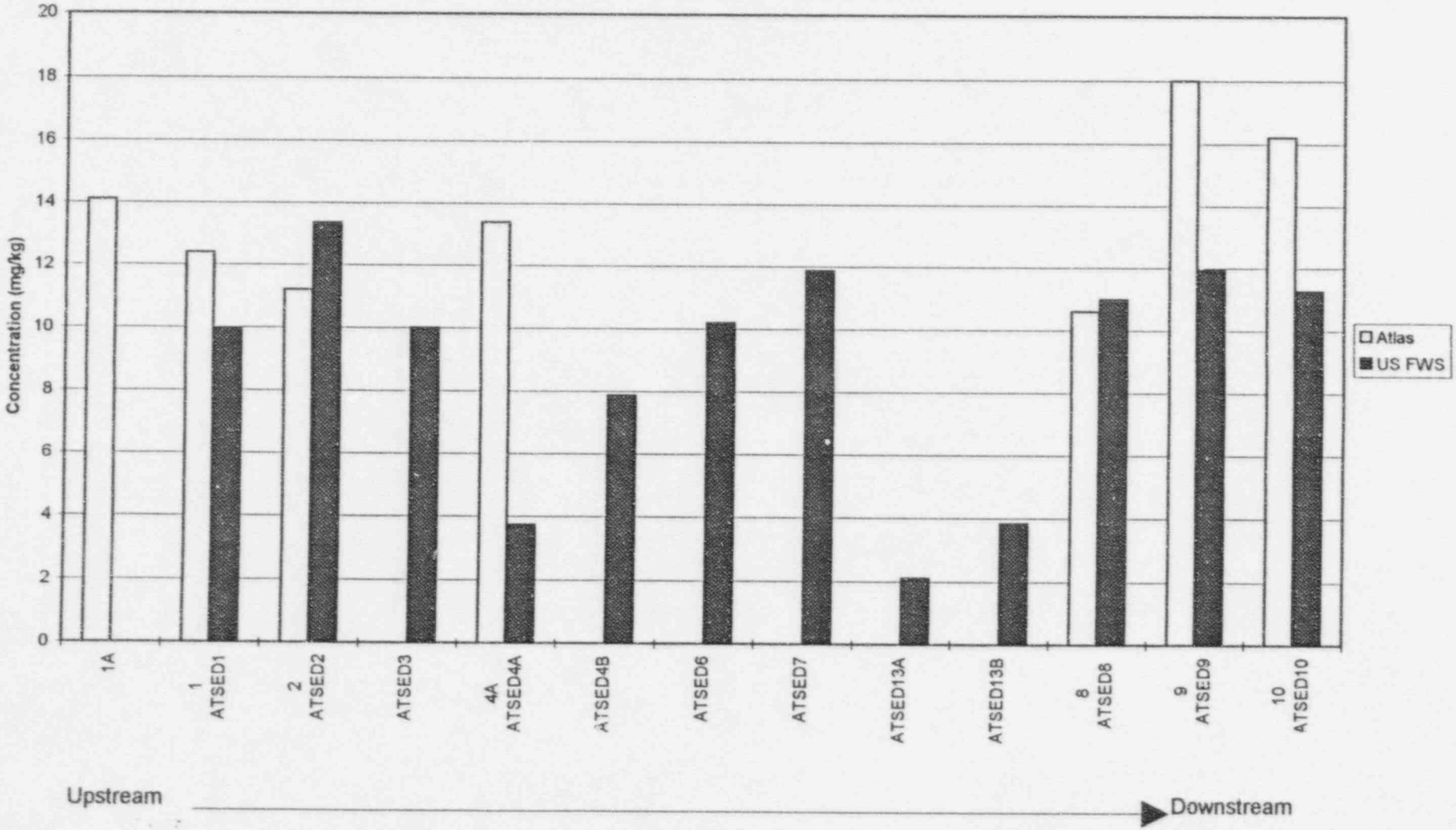
Trace Metals in Surface Water - State of Utah Data 1/96



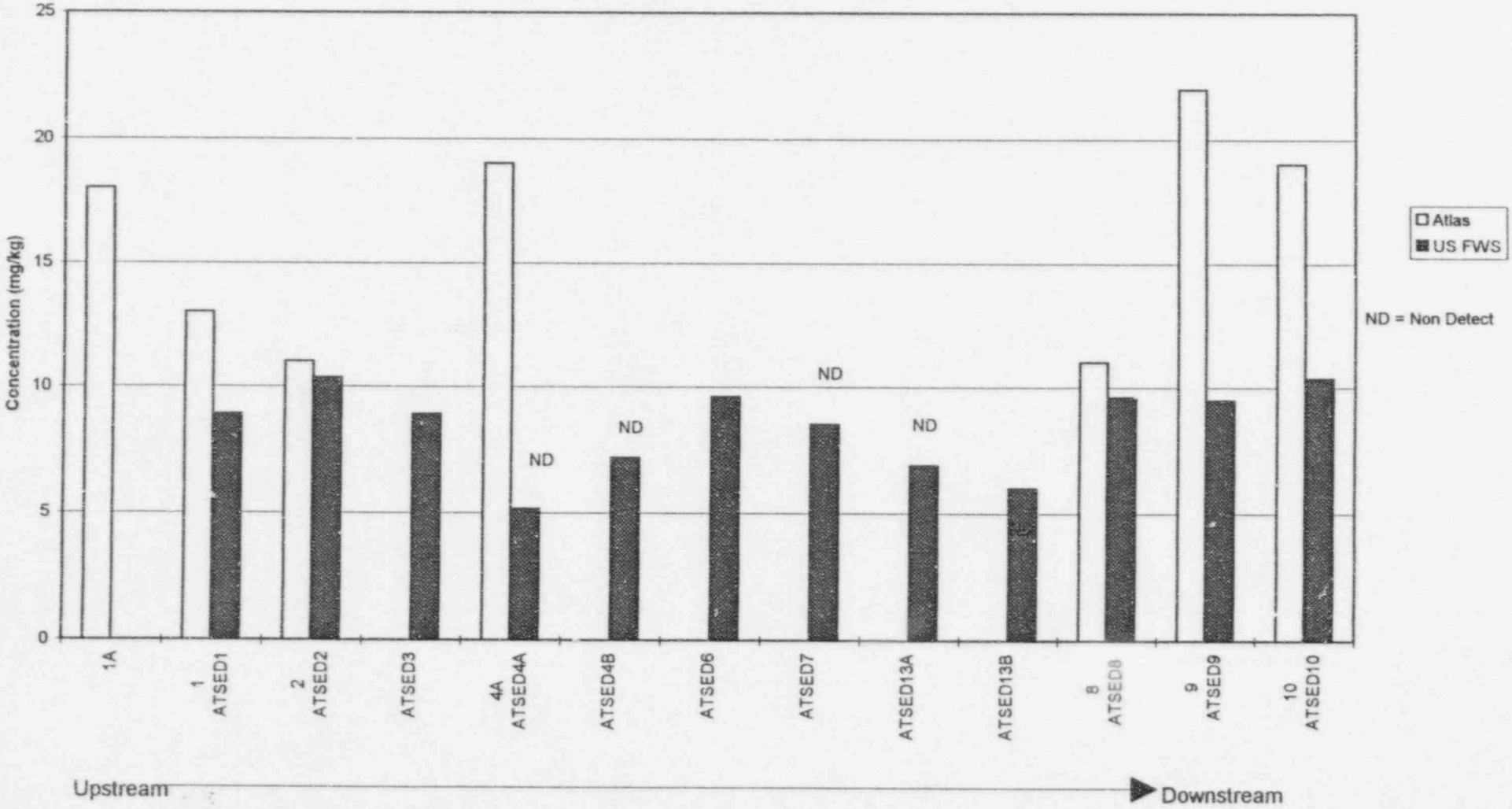
Trace Metals in Surface Water - Atlas Data 9/96



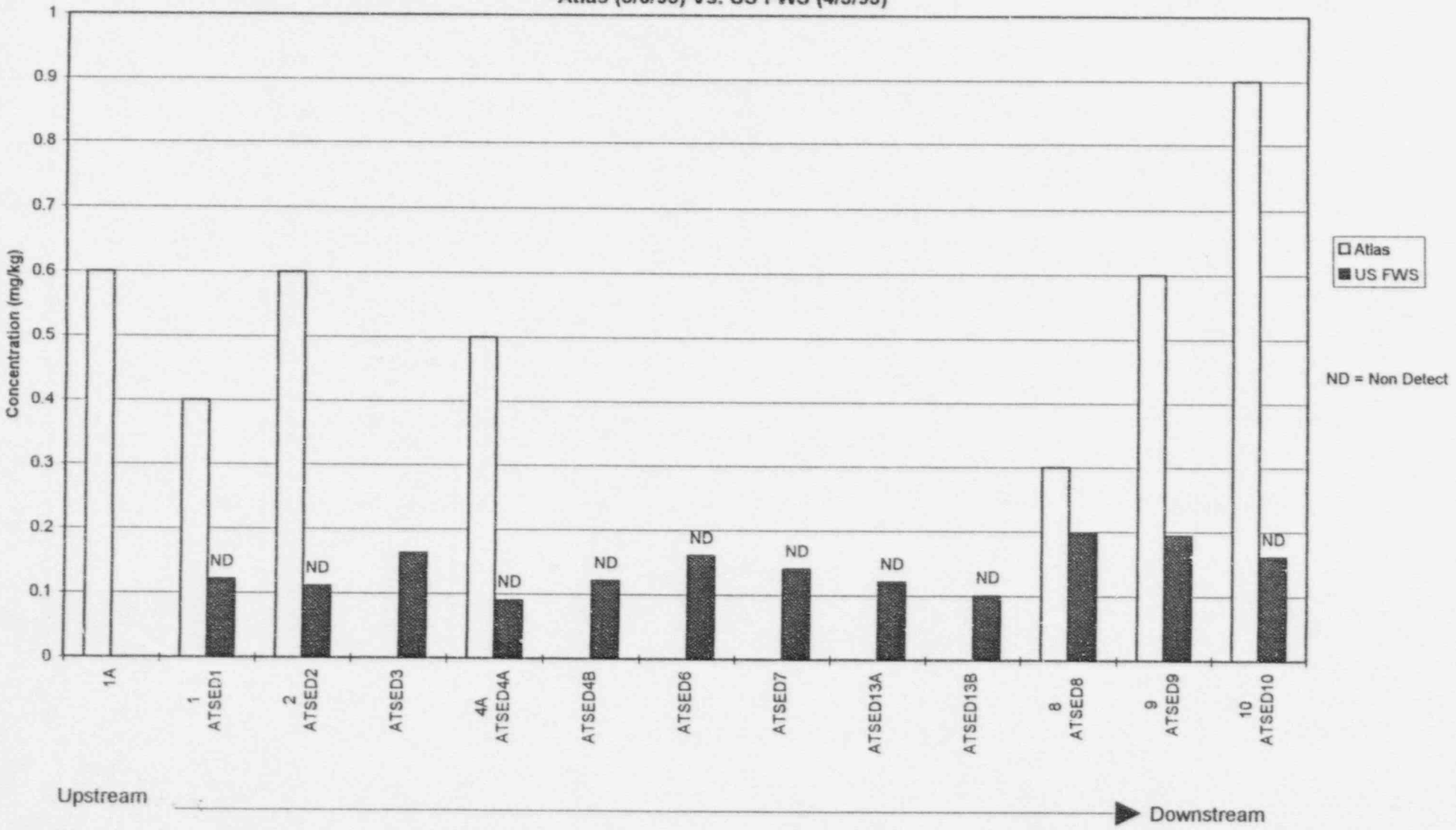
Copper Concentration in Colorado River Sediments
Atlas (5/3/95) Vs. US FWS (4/5/95)

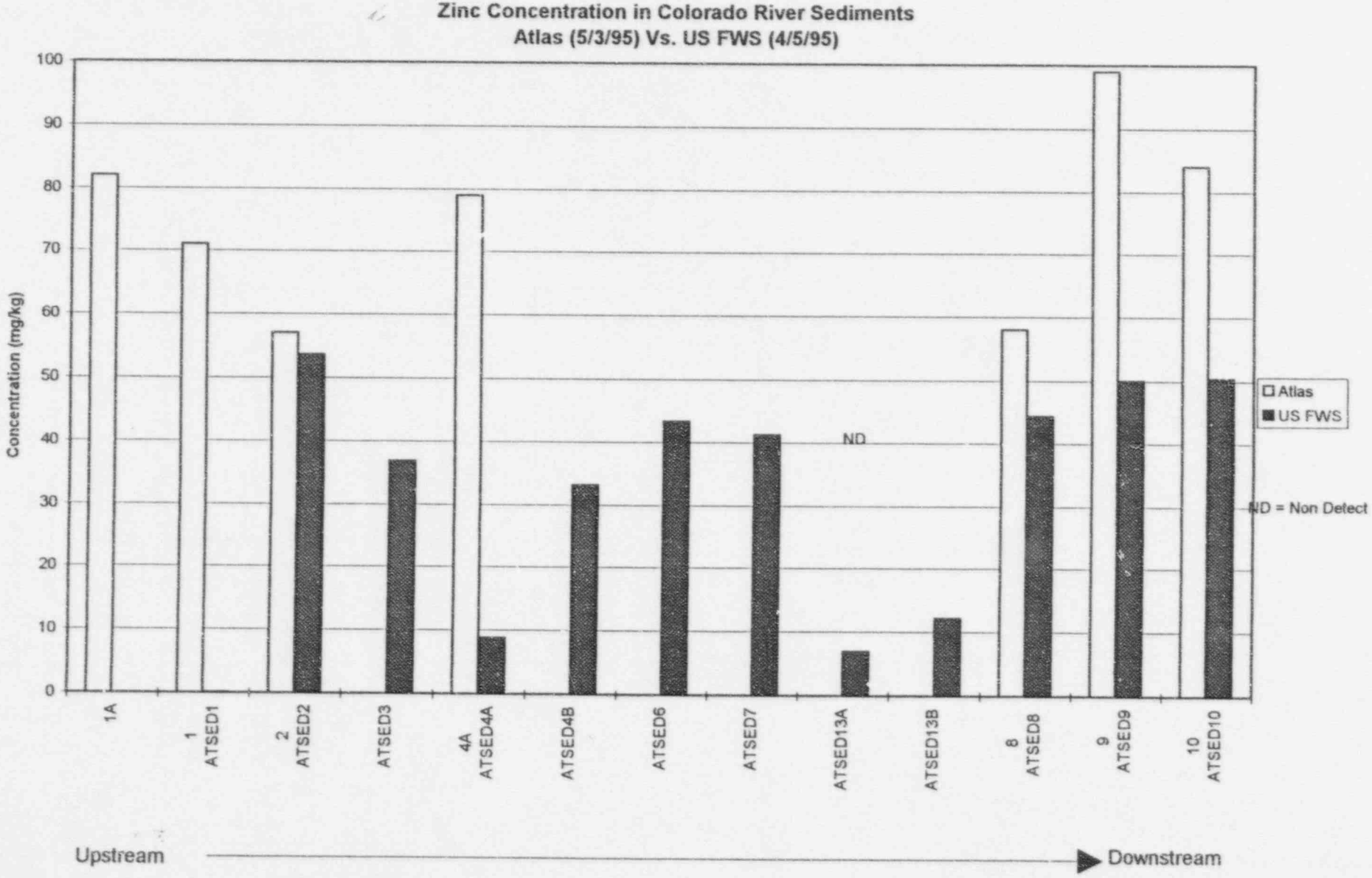


Lead concentration in Colorado River Sediments
Atlas (5/3/95) Vs. US FWS (4/5/95)

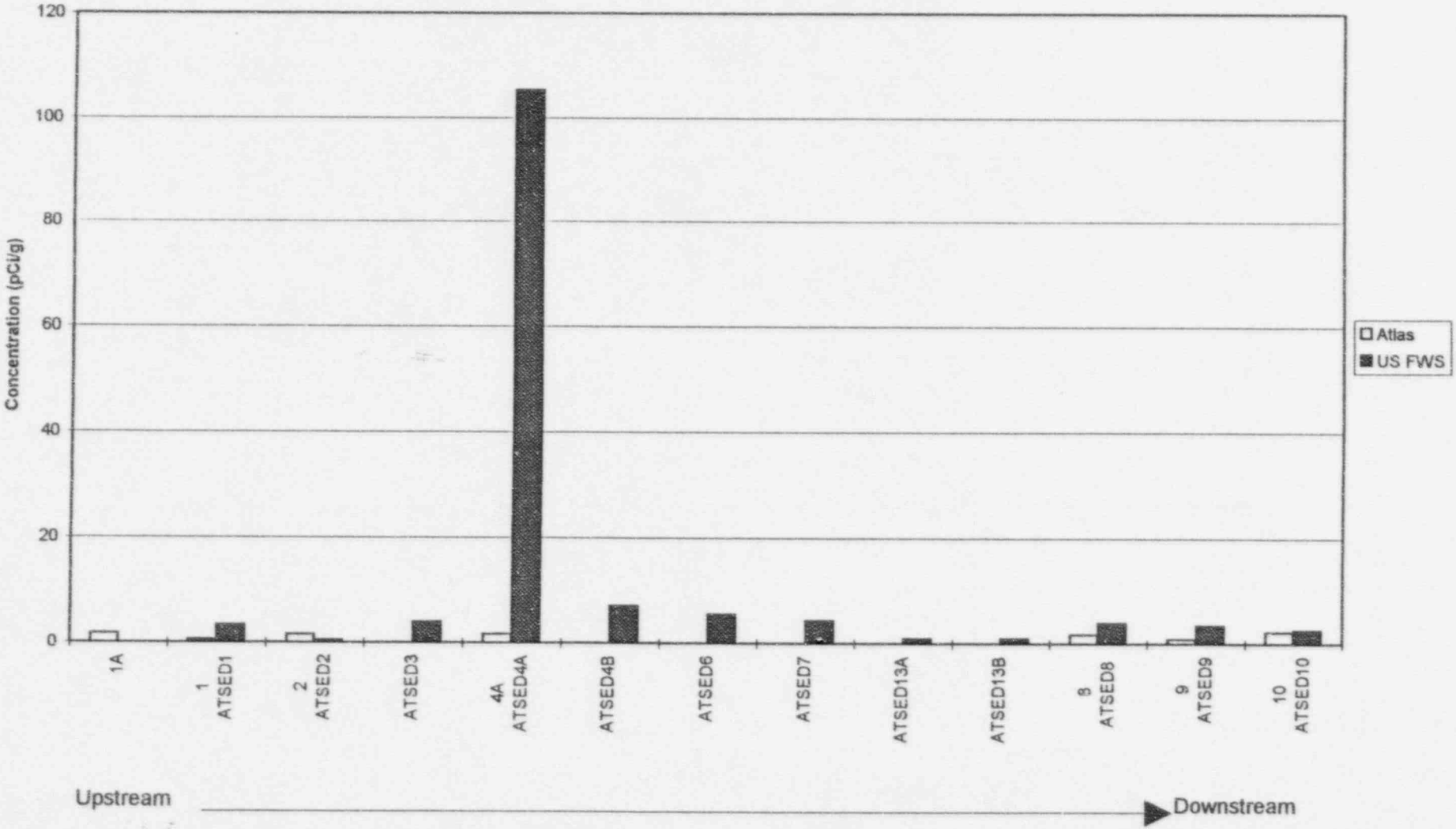


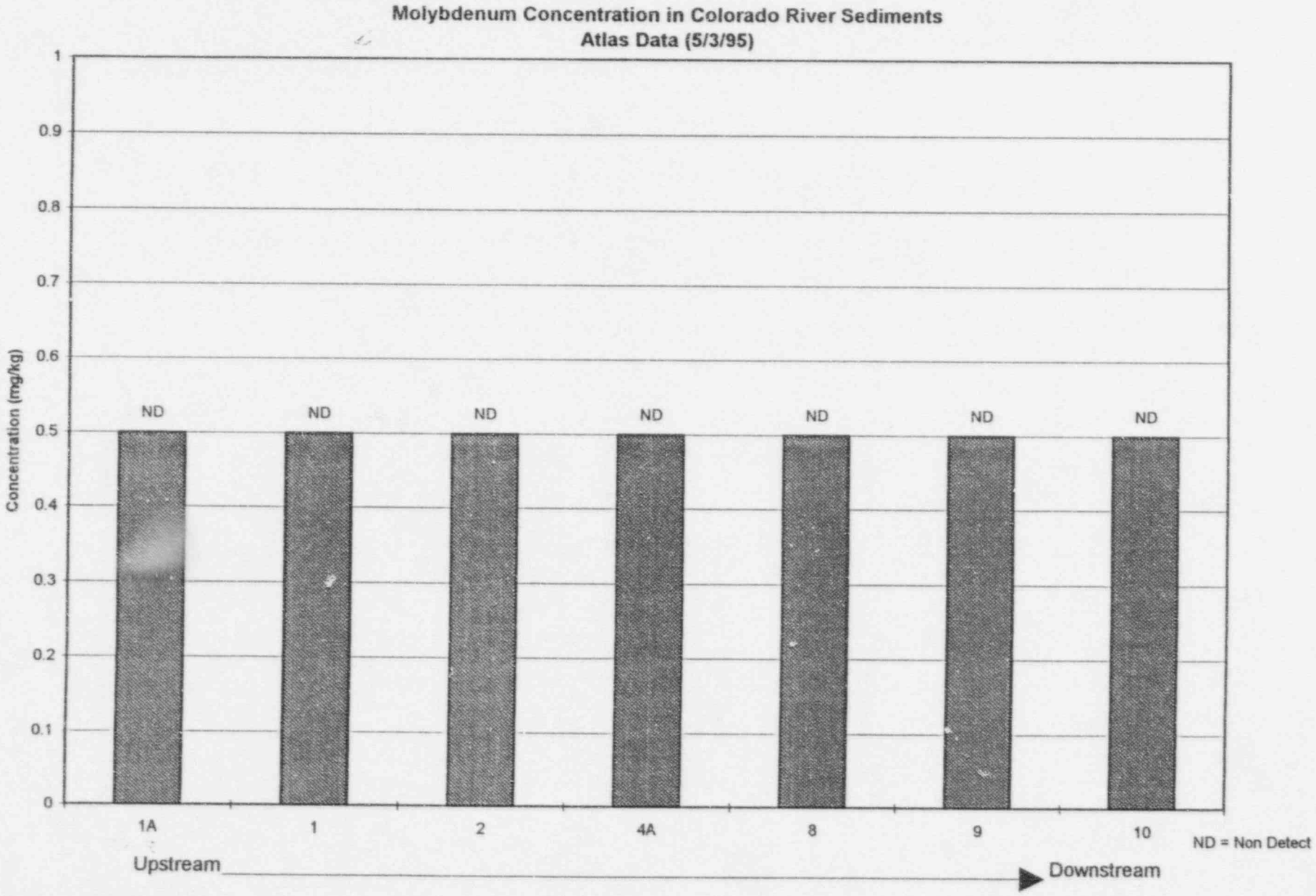
Selenium Concentration in Colorado River Sediments
Atlas (5/3/95) Vs. US FWS (4/5/95)



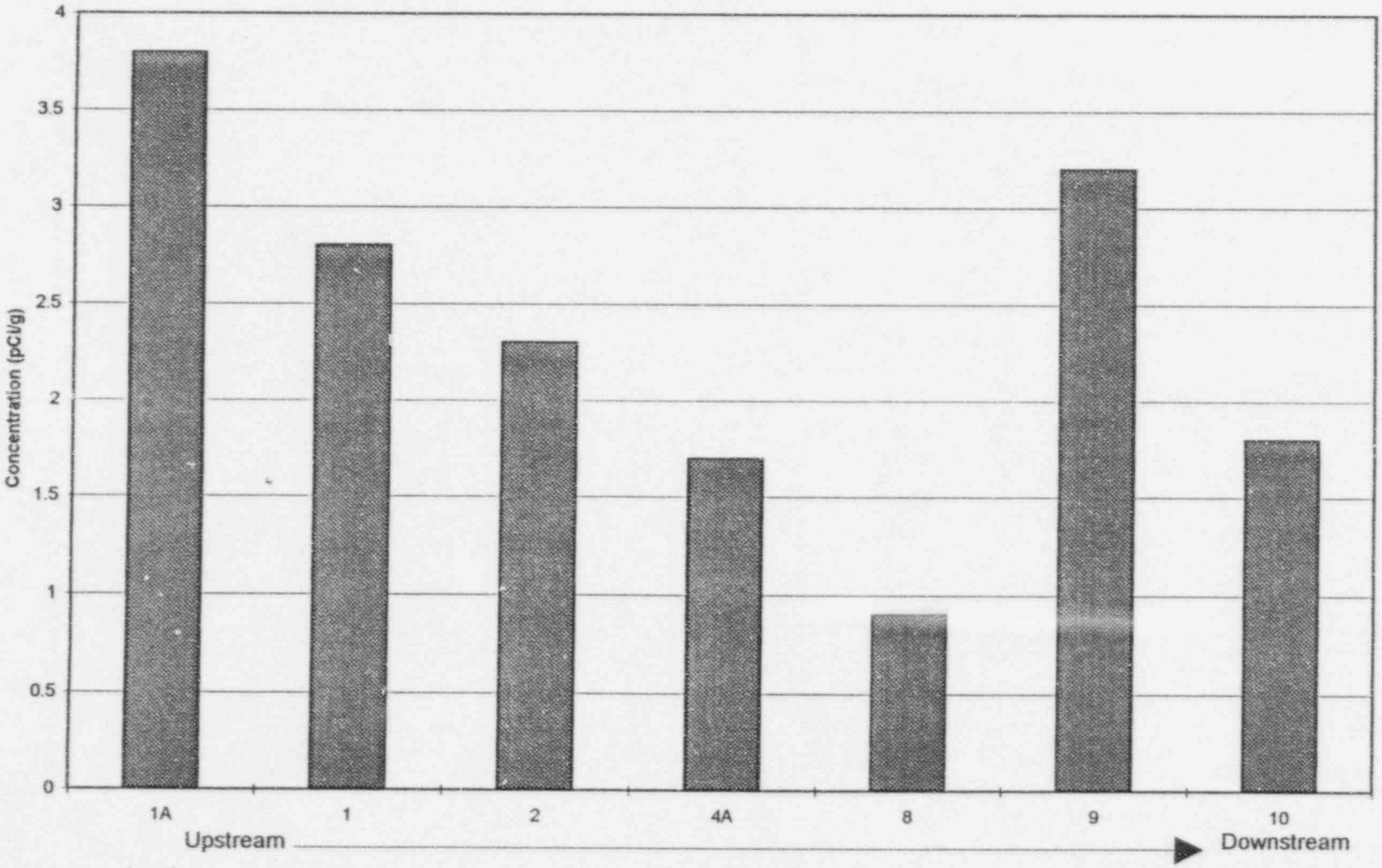

Zinc Concentration in Colorado River Sediments
Atlas (5/3/95) Vs. US FWS (4/5/95)
Concentration (mg/kg)
100
90
80
70
60
50
40
30
20
10
0
ND
Atlas
US FWS
ND = Non Detect
1A
1 ATSED1
2 ATSED2
ATSED3
4A ATSED4A
ATSED4B
ATSED6
ATSED7
ATSED13A
ATSED13B
8 ATSED8
9 ATSED9
10 ATSED10
Upstream
Downstream

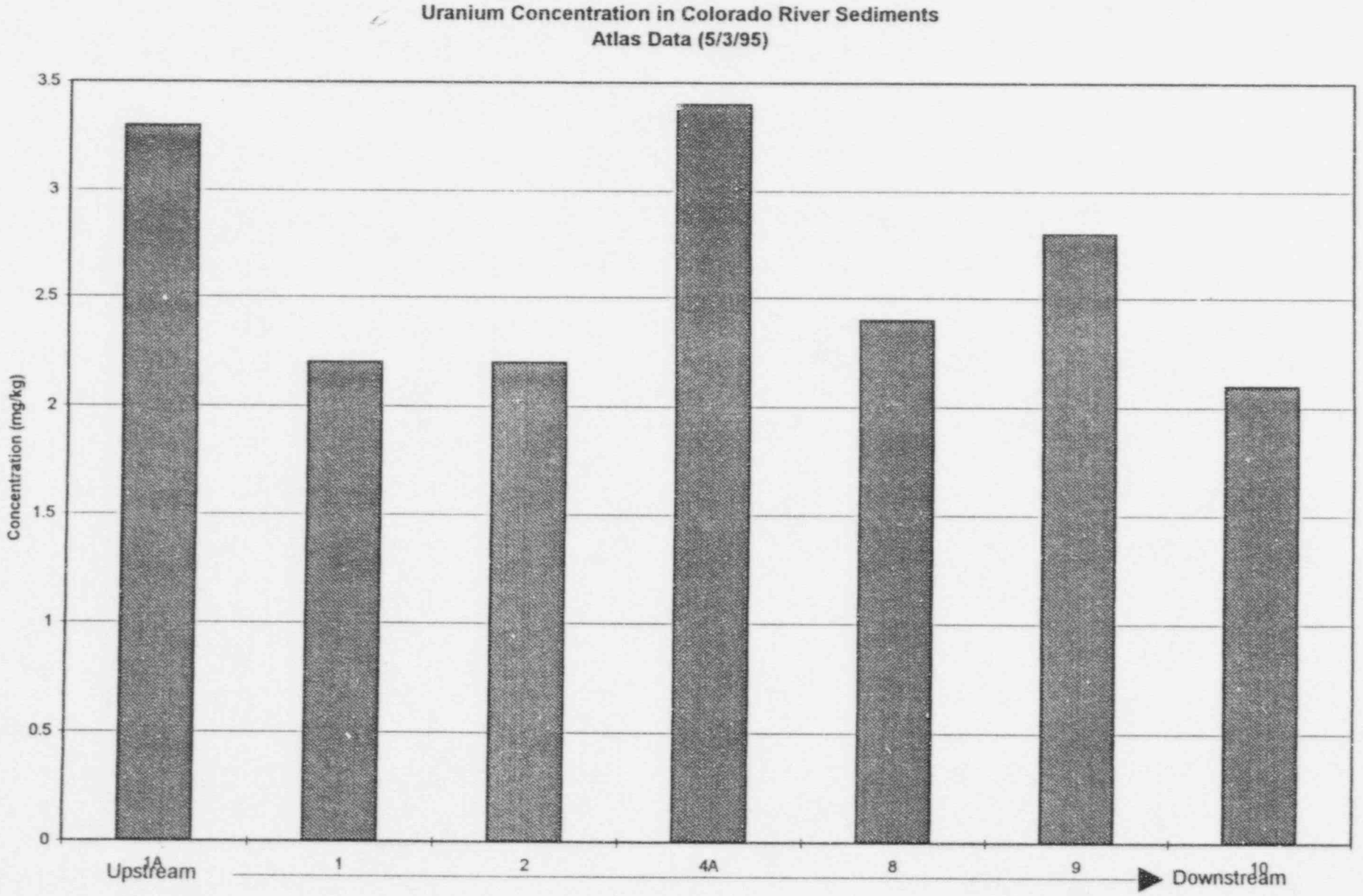
Total U-234, U-235, U-238 Concentration in Colorado River Sediments
Atlas (5/3/95) Vs. US FWS (4/5/95)

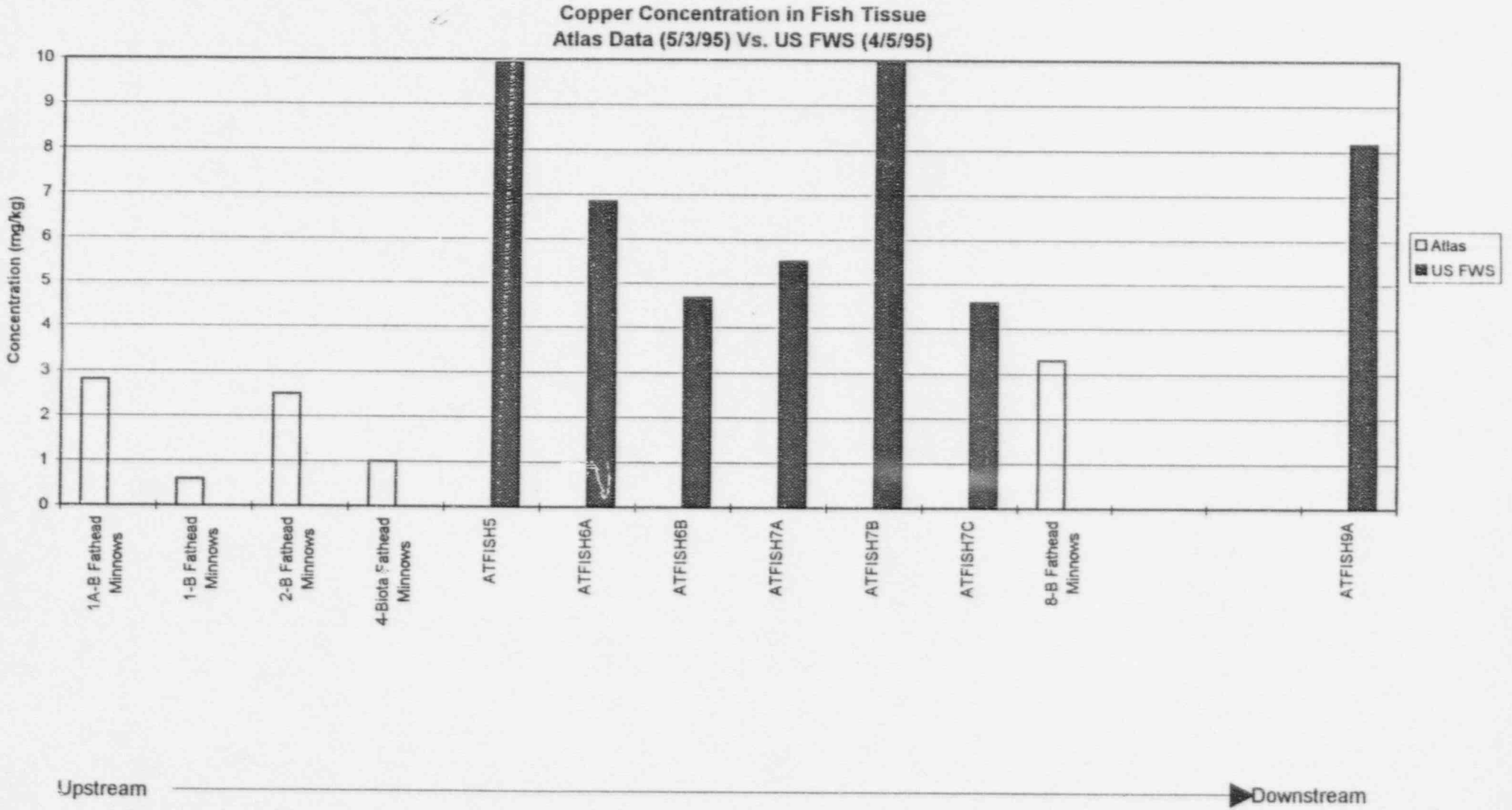


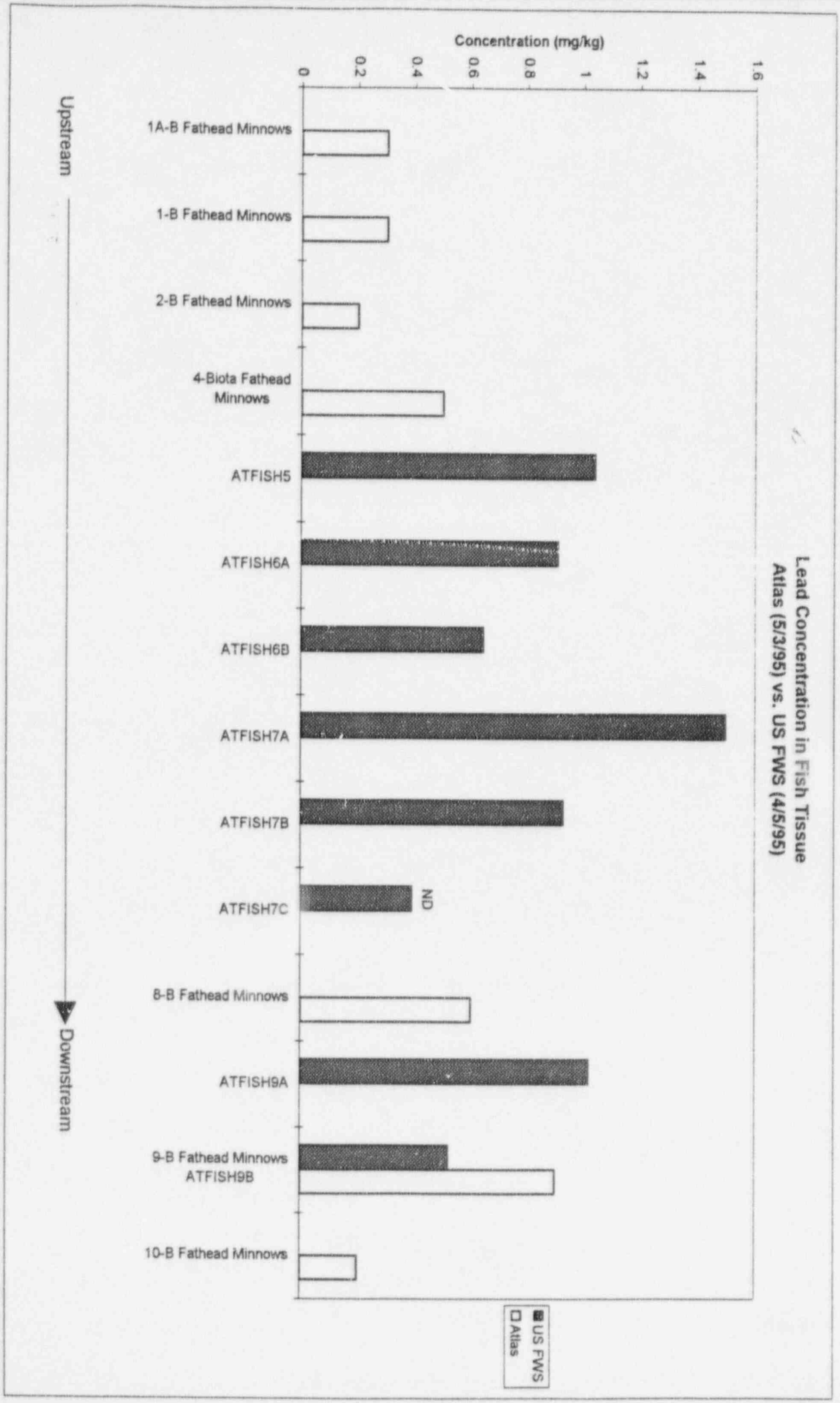

Molybdenum Concentration in Colorado River Sediments
Atlas Data (5/3/95)
Concentration (mg/kg)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
ND
ND
ND
ND
ND
ND
ND
1A
1
2
4A
8
9
10
Upstream
Downstream
ND = Non Detect

RA228 Concentration in Colorado River Sediments
Atlas Data (5/3/95)

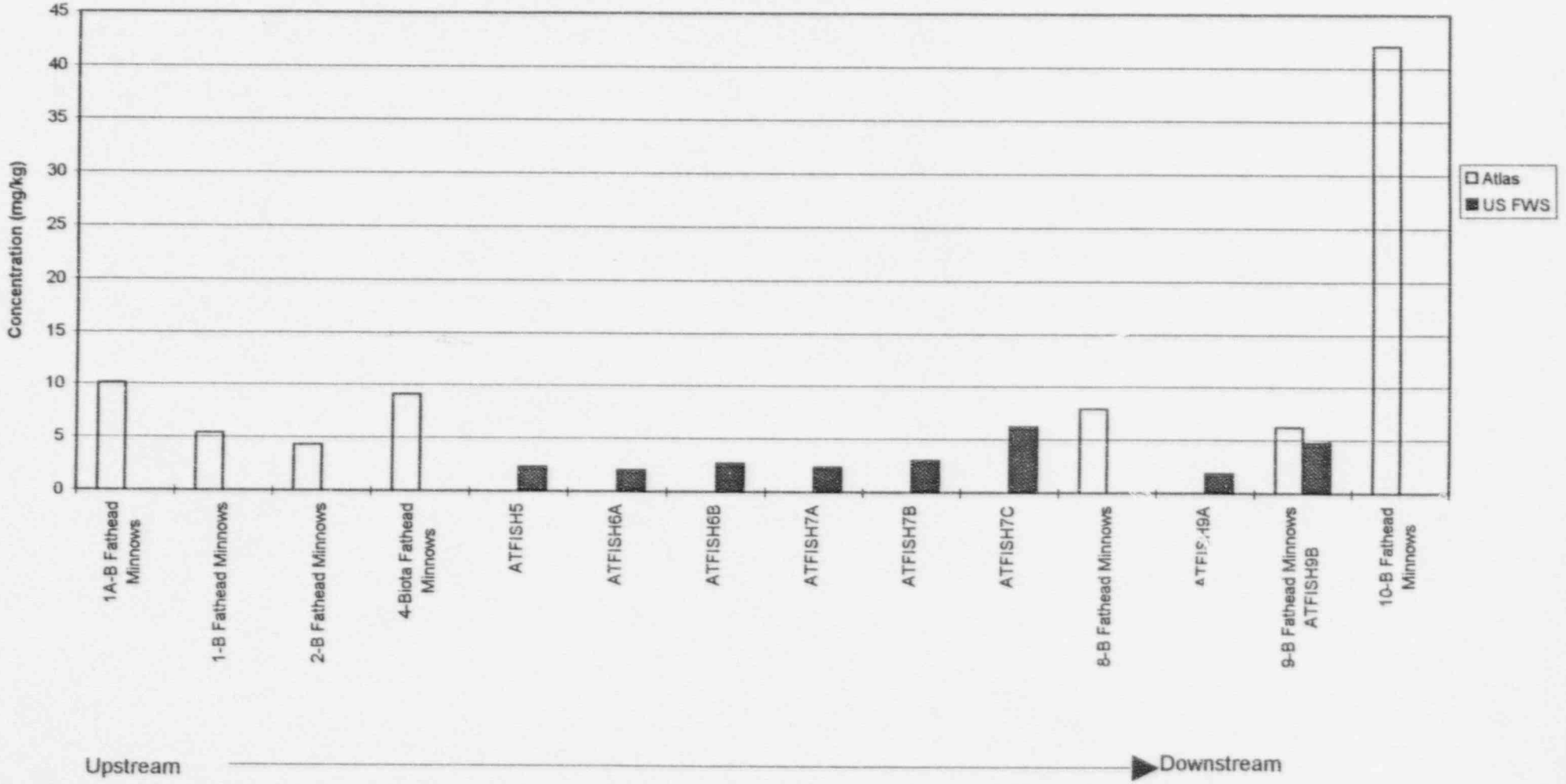


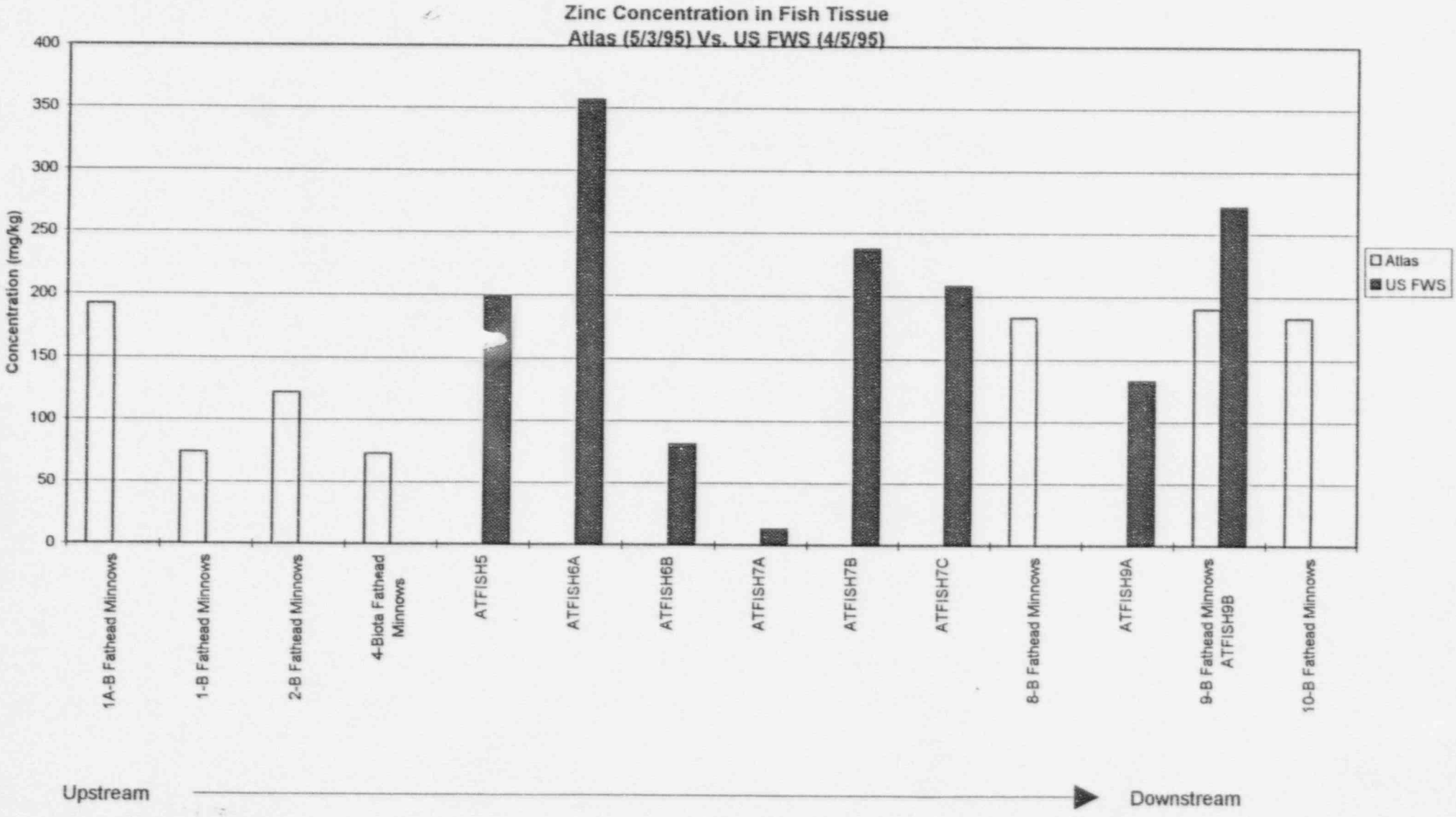

Uranium Concentration in Colorado River Sediments
Atlas Data (5/3/95)
Concentration (mg/kg)
3.5
3
2.5
2
1.5
1
0.5
0
1A
1
2
4A
8
9
10
Upstream
Downstream

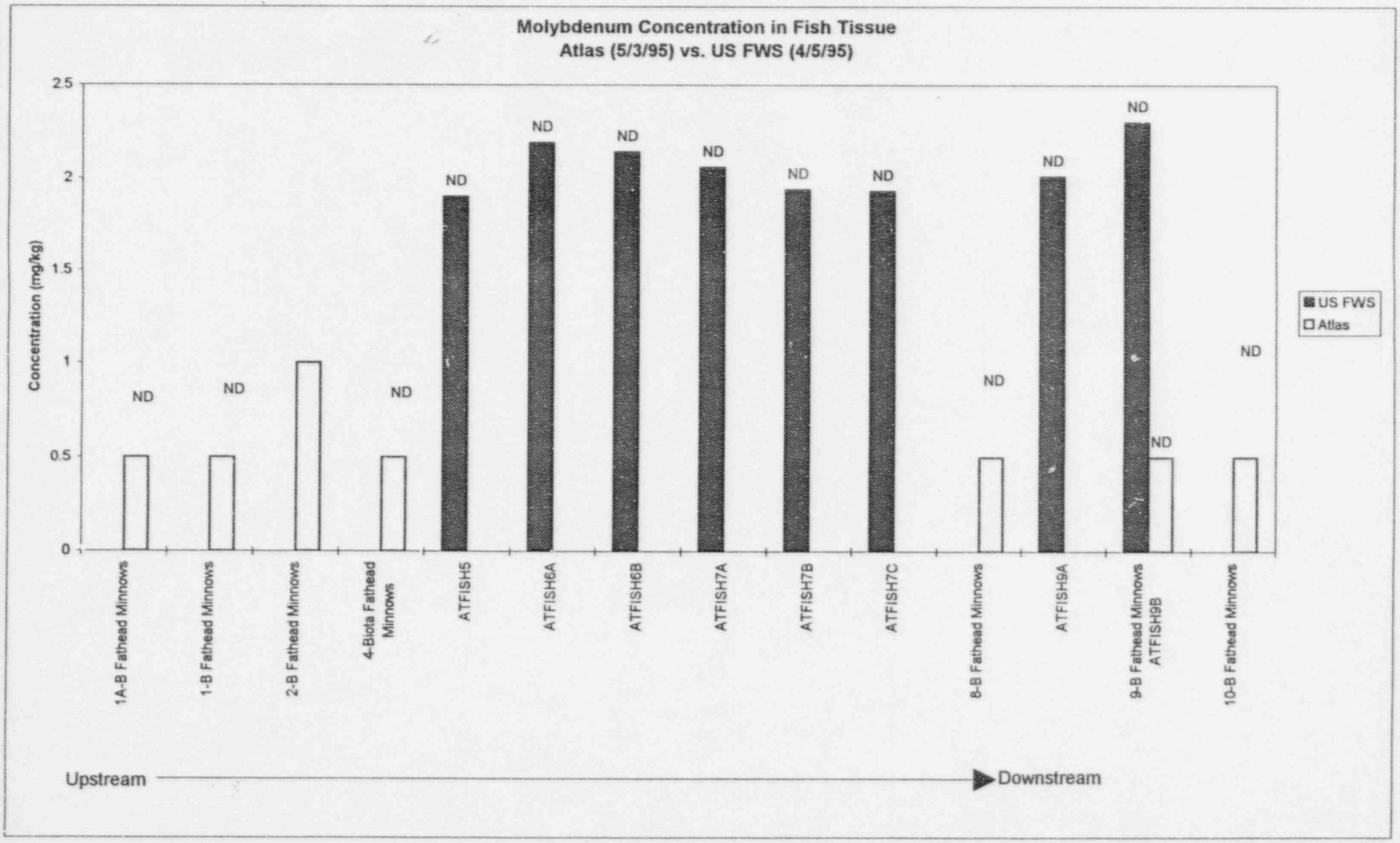

Copper Concentration in Fish Tissue
Atlas Data (5/3/95) Vs. US FWS (4/5/95)
Concentration (mg/kg)
10
9
8
7
6
5
4
3
2
1
0
Atlas
US FWS
1A-B Fathead Minnows
1-B Fathead Minnows
2-B Fathead Minnows
4-Biota Fathead Minnows
ATFISH5
ATFISH6A
ATFISH6B
ATFISH7A
ATFISH7B
ATFISH7C
8-B Fathead Minnows
ATFISH9A
Upstream
Downstream

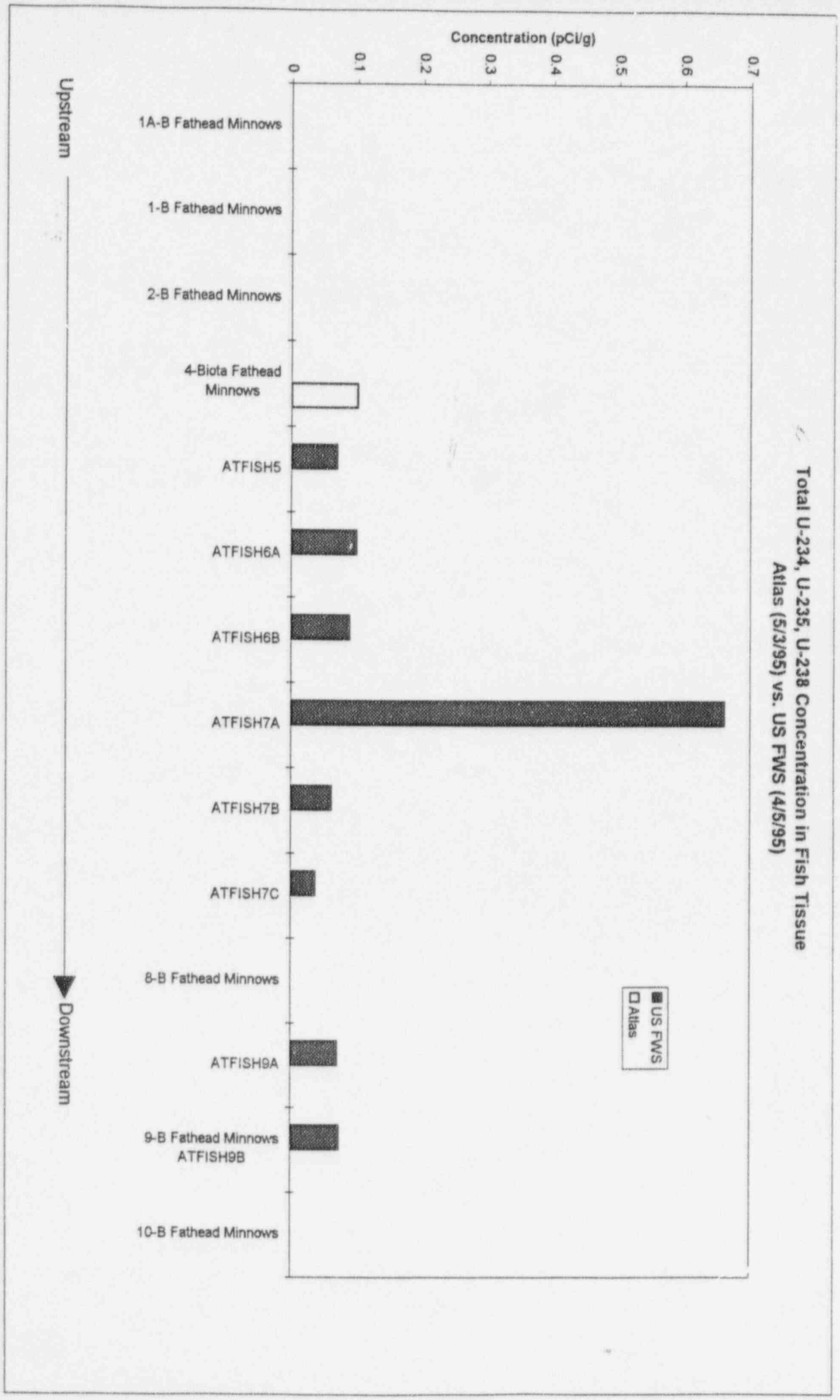

Lead Concentration in Fish Tissue
Atlas (5/3/95) vs. US FWS (4/5/95)
Concentration (mg/kg)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
Upstream
Downstream
1A-B Fathead Minnows
1-B Fathead Minnows
2-B Fathead Minnows
4-Biota Fathead Minnows
ATFISH5
ATFISH6A
ATFISH6B
ATFISH7A
ATFISH7B
ATFISH7C
ND
8-B Fathead Minnows
ATFISH9A
9-B Fathead Minnows ATFISH9B
10-B Fathead Minnows
US FWS
Atlas

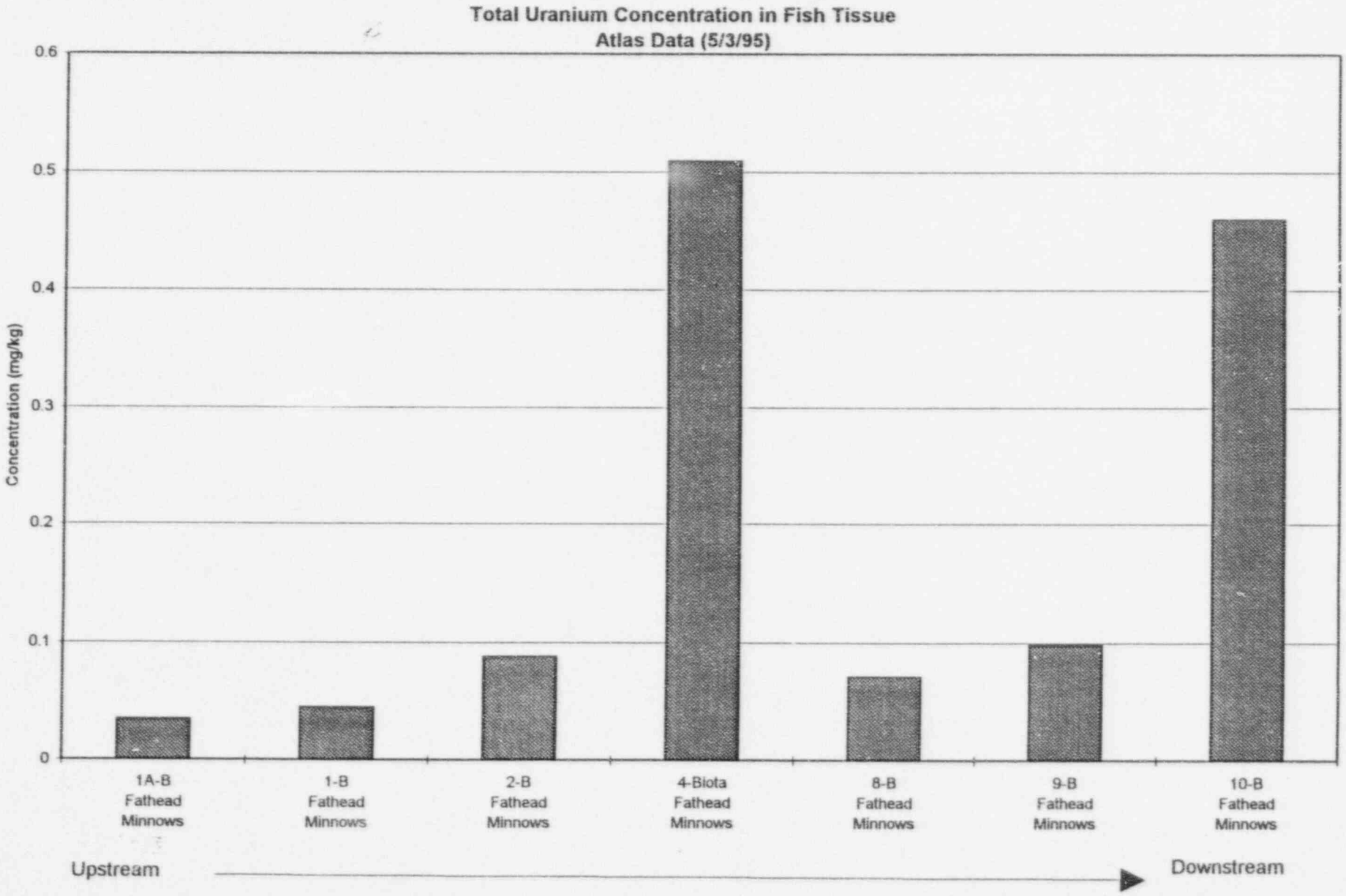
Selenium Concentration in Fish Tissue
Atlas (5/3/95) Vs. US FWS 4/5/95)




Zinc Concentration in Fish Tissue
Atlas (5/3/95) Vs. US FWS (4/5/95)
Concentration (mg/kg)
400
350
300
250
200
150
100
50
0
Atlas
US FWS
1A-B Fathead Minnows
1-B Fathead Minnows
2-B Fathead Minnows
4-Biota Fathead Minnows
ATFISH5
ATFISH6A
ATFISH6B
ATFISH7A
ATFISH7B
ATFISH7C
8-B Fathead Minnows
ATFISH9A
9-B Fathead Minnows
ATFISH9B
10-B Fathead Minnows
Upstream
Downstream


Molybdenum Concentration in Fish Tissue
Atlas (5/3/95) vs. US FWS (4/5/95)
Concentration (mg/kg)
2.5
2
1.5
1
0.5
0
ND
US FWS
Atlas
1A-B Fathead Minnows
1-B Fathead Minnows
2-B Fathead Minnows
4-Biota Fathead Minnows
ATFISH5
ATFISH6A
ATFISH6B
ATFISH7A
ATFISH7B
ATFISH7C
8-B Fathead Minnows
ATFISH9A
9-B Fathead Minnows
ATFISH9B
10-B Fathead Minnows
Upstream
Downstream


Total U-234, U-235, U-238 Concentration in Fish Tissue
Atlas (5/3/95) vs. US FWS (4/5/95)
Concentration (pCi/g)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Upstream
Downstream
1A-B Fathead Minnows
1-B Fathead Minnows
2-B Fathead Minnows
4-Biota Fathead Minnows
ATFISH5
ATFISH6A
ATFISH6B
ATFISH7A
ATFISH7B
ATFISH7C
8-B Fathead Minnows
ATFISH9A
9-B Fathead Minnows ATFISH9B
10-B Fathead Minnows
US FWS
Atlas


Total Uranium Concentration in Fish Tissue
Atlas Data (5/3/95)
Concentration (mg/kg)
0.6
0.5
0.4
0.3
0.2
0.1
0
1A-B Fathead Minnows
1-B Fathead Minnows
2-B Fathead Minnows
4-Biota Fathead Minnows
8-B Fathead Minnows
9-B Fathead Minnows
10-B Fathead Minnows
Upstream
Downstream

SPATIAL TRENDS IN COLORADO RIVER SAMPLES

- No apparent difference in surface water quality upstream vs. downstream of the tailings pile
- Sediment data shows no definitive spatial trends with the possible exception of elevated uranium levels near the Atlas site
- Fish tissue data also shows no definitive spatial trends
- Variability in the data and uncertainity associated with the sources of various constituents makes interpretative of trends difficult

REQUIREMENTS FOR GROUNDWATER CORRECTIVE ACTION PLAN

- General Background Information
- Hazard Assessment
  - Source and Contaminant Characterization
  - Hydrogeologic and Contaminant Transport Assessment
  - Exposure Assessment
- Corrective Action Assessment
- Proposed ACLs

SOURCE AND CONTAMINANT CHARACTERIZATION

- Tailings Production History
- Volume and Content
- Tailings Pore Water Chemistry
- Constituents of Concern
- Contaminant Migration Pathways

HYDROGEOLOGIC AND CONTAMINANT TRANSPORTASSESSMENT

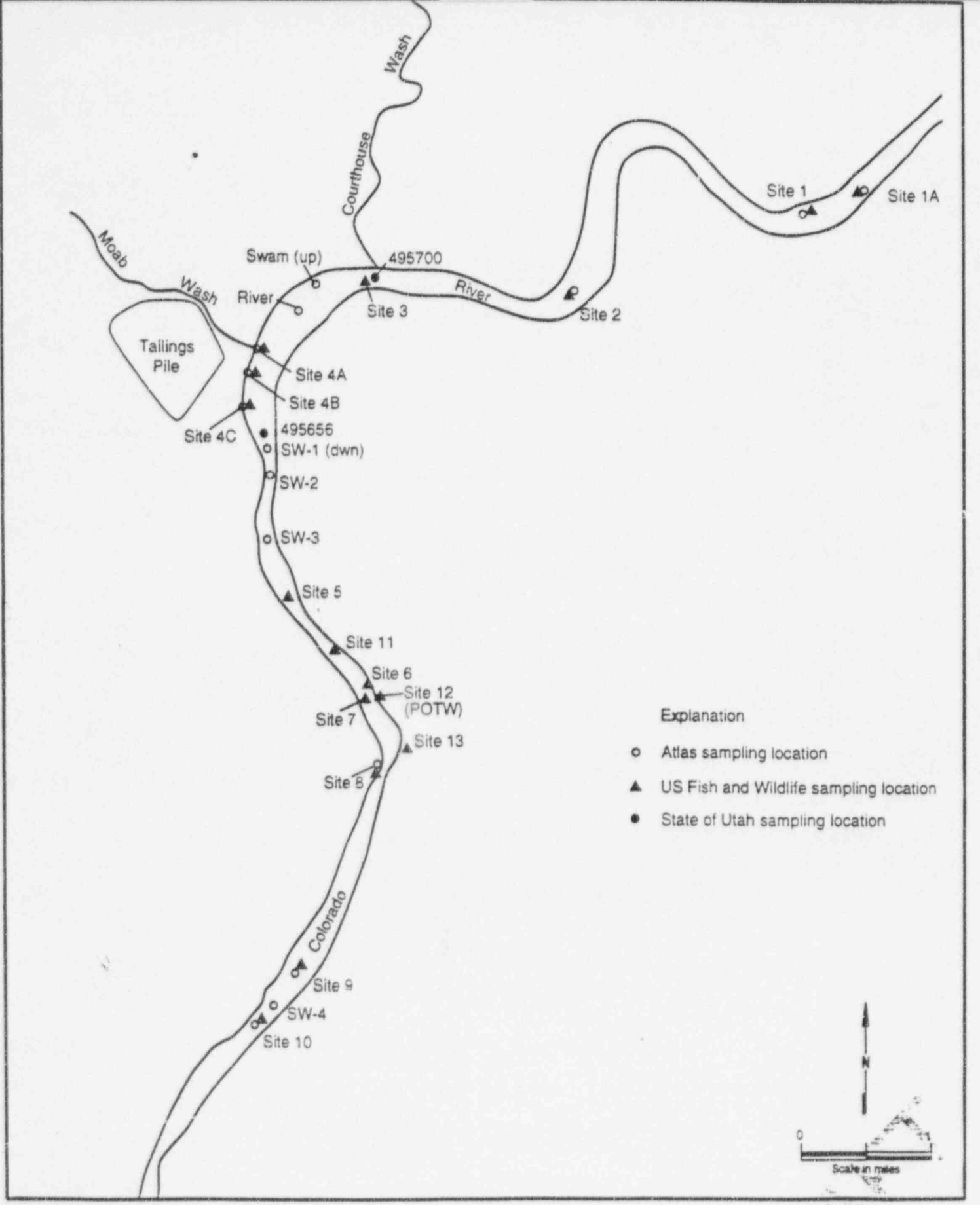
- Hydrogeologic Conceptual Model
- Background Water Quality
- Constituents of Concern
- Transport Assessment

EXPOSURE ASSESSMENT

- Evaluation of Water Resource Classification
- Potential Receptors (Human and Ecological)
- Potential Exposure Scenarios
- Evaluation of Hazards (Human and Ecological)

CORRECTIVE ACTION ASSESSMENT

- Previous Corrective Actions
- Development of Corrective Action Alternatives
- Evaluation of Corrective Action Alternatives
- Demonstration of ALARA Principles



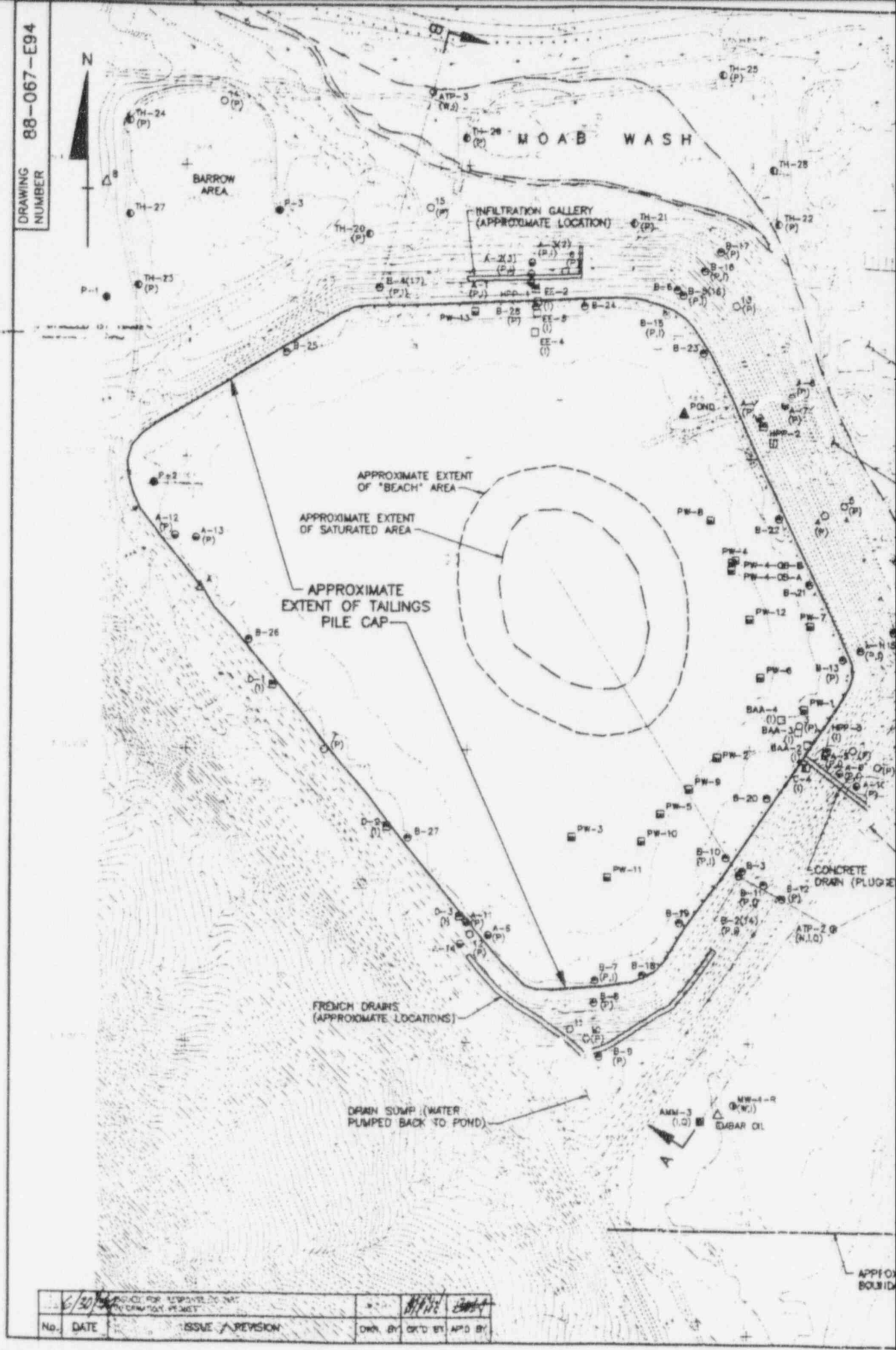
Harding Lawson Associates
Engineering and Environmental Services

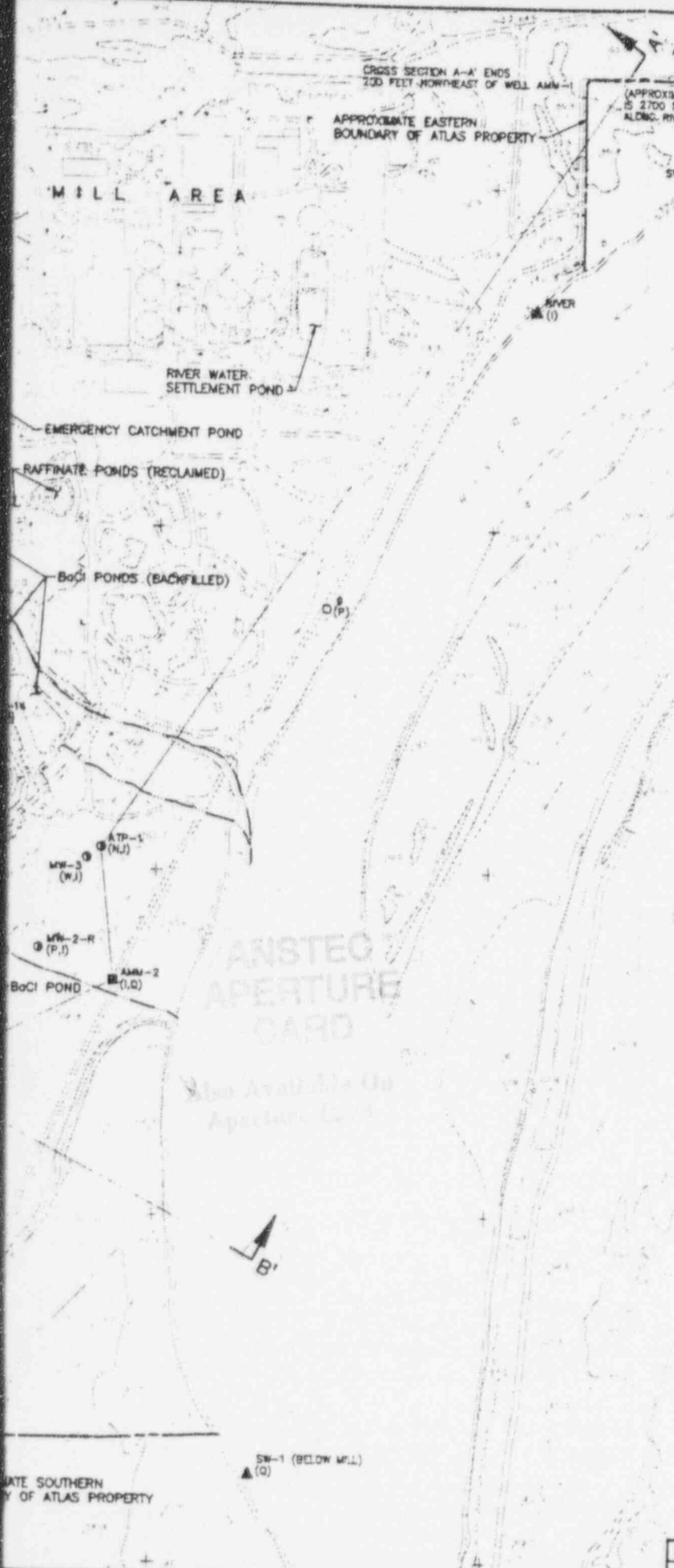
Moab Mill Sampling Sites

Atlas Uranium Mill and Tailings Site
Moab, Utah

FIGURE
2

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
RLB	35546.3.1		10/96	


DRAWING NUMBER 88-067-E94
N
MOAB WASH
BARROW AREA
INFILTRATION GALLERY (APPROXIMATE LOCATION)
POND
APPROXIMATE EXTENT OF "BEACH" AREA
APPROXIMATE EXTENT OF SATURATED AREA
APPROXIMATE EXTENT OF TAILINGS PILE CAP
FRENCH DRAINS (APPROXIMATE LOCATIONS)
DRAIN SUMP (WATER PUMPED BACK TO POND)
CONCRETE DRAIN (PLUGGE
EMBAR CK
No. DATE ISSUE / REVISION DWN. BY CK'D BY APP'D BY



LEGEND:

- 1 ○ — BOREHOLE LOCATION AND DESIGNATION, DRILLED BY DAMES AND MOORE FROM 1972 TO 1974. (P) INDICATES PIEZOMETER WAS INSTALLED
- P-1 ● — BOREHOLE LOCATION AND DESIGNATION, DRILLED BY DAMES AND MOORE IN 1976
- A-1 ◒ — BOREHOLE LOCATION AND DESIGNATION, DRILLED BY DAMES AND MOORE FROM 1977 TO 1978. (P) INDICATES PIEZOMETER WAS INSTALLED, (I) INDICATES GROUND WATER LEVEL CURRENTLY BEING MONITORED
- B-1 ◒ — BOREHOLE LOCATION AND DESIGNATION, DRILLED BY DAMES AND MOORE IN 1978. (P) INDICATES PIEZOMETER WAS INSTALLED, (I) INDICATES GROUND WATER LEVEL CURRENTLY BEING MONITORED
- TH-21 ◐ — BOREHOLE LOCATION AND DESIGNATION, DRILLED BY WOODWARD CLYDE CONSULTANTS IN 1981. (P) INDICATES PIEZOMETER WAS INSTALLED
- ATP-1 ◑ — BOREHOLE LOCATION AND DESIGNATION, DRILLED BY DAMES AND MOORE IN 1982. (P) INDICATES SINGLE PIEZOMETER WAS INSTALLED, (N) INDICATES NESTED PIEZOMETERS WERE INSTALLED, (W) INDICATES MONITORING WELL WAS INSTALLED, (I) INDICATES GROUND WATER LEVEL CURRENTLY BEING MONITORING, (Q) INDICATES GROUND WATER QUALITY CURRENTLY BEING MONITORED
- BAA-2 □ — PIEZOMETER LOCATION AND DESIGNATION, INSTALLED BY DAMES AND MOORE IN 1984. (I) INDICATES GROUND WATER LEVEL CURRENTLY BEING MONITORED
- AMW-1 ■ — MONITORING WELL LOCATION AND DESIGNATION, INSTALLED BY ATLAS MINERALS IN 1988. (I) INDICATES GROUND WATER LEVEL CURRENTLY BEING MONITORED, (Q) INDICATES GROUND WATER QUALITY CURRENTLY BEING MONITORED.
- PW-1 ▣ — MONITORING WELL LOCATION AND DESIGNATION, INSTALLED BY WESTERN TECHNOLOGIES INC. IN 1990
- D-1 ▣ — PIEZOMETER LOCATION AND DESIGNATION, INSTALLED BY DAMES AND MOORE. (I) INDICATES GROUND WATER LEVEL CURRENTLY BEING MONITORED
- C-4 ◧ — WELL/PIEZOMETER LOCATION AND DESIGNATION, ORIGIN UNKNOWN. (I) INDICATES GROUND WATER LEVEL CURRENTLY BEING MONITORED
- A △ — ABANDONED BOREHOLE/WELL LOCATION AND DESIGNATION, DRILLED PRIOR TO 1962. LOCATION APPROXIMATE
- RIVER ▲ — SURFACE WATER DATA COLLECTION POINT. (I) INDICATES WATER LEVEL CURRENTLY BEING MONITORED, (Q) INDICATES WATER QUALITY CURRENTLY BEING MONITORED

A — A' INDICATES LINE OF CROSS SECTION

SURFACE DRAINAGE

NOTE:

1. SEE FIGURE 3 FOR CROSS SECTIONS A-A' AND B-B'.

9610300324-1

SCALE

200 0 200 400 FEET

BOREHOLE, WELL, PIEZOMETER AND SURFACE WATER STATION LOCATION MAP

PREPARED FOR

ATLAS CORPORATION
DENVER, COLORADO

Canonie Environmental

DATE: 5-11-94	FIGURE 2	DRAWING NUMBER 88-067-E94	
SCALE: AS SHOWN			