Inflow Velocity Fields Measured in Whiskeytown Reservoir Using an Acoustic Doppler Current Profiler, 1997

Data Report

by

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United States Department of the Interior
Bureau of Reclamation
Technical Service Center
Water Resources Research Laboratory

December 1997

PEER REVIEW DOCUMENTATION

PROJECT AND DOCUMENT INFORMATION

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Team Leader Tracy Vermeyen Leadership Team Member _____
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Peer Reviewer Tony Wahl (D-8560) Document Author(s)/Preparer(s) Tracy Vermeyen

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REVIEW REQUIREMENT

Part A: Document Does Not Require Peer Review

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Part B: Document requires Peer Review : SCOPE OF PEER REVIEW

Peer Review restricted to the following Items/Section(s):	Reviewer:
Technical merit and content	Tony Wahl

REVIEW CERTIFICATION

Peer Reviewer - I have reviewed the assigned Items/Section(s) noted for the above document and believe them to be in accordance with the project requirements, standards of the profession, and Reclamation policy.

Reviewer: Tony L. Wahl Review Date: 1/26/98
Signature

Preparer: I have discussed the above document and review requirements with the Peer Reviewer and believe that this review is completed, and that the document will meet the requirements of the project.

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Signature

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Figures

Introduction

This data report is a component of a research project studying the effects of plunging inflows on reservoir hydrodynamics and downstream release water temperatures. This project is being conducted by the University of California, Davis (UC-Davis) Civil and Environmental Engineering Department. A complete description of this research project is included in UC-Davis' research proposal which is included in the Data Report submitted in 1996. Reclamation was requested by UC-Davis to provide technical assistance during the field testing at Whiskeytown Reservoir, California. Reclamation has an interest in this research because it pertains to the performance of two temperature control curtains Reclamation installed in Whiskeytown Reservoir in 1993. Reclamation provided assistance with collection of velocity profiles using a RD Instruments ADCP (acoustic Doppler current profiler). Reclamation's assistance was funded by Reclamation's Mid-Pacific Regional Office. This peer reviewed report is the final product of Reclamation's portion of the 1997 field tests and will be submitted to UC-Davis for their use.

Project Summary

The UC-Davis research project was designed to study the entrainment of warm surface water which occurs when a cold water inflow enters a thermally stratified reservoir. The objectives of the research project are to:

- Quantify the processes by which cold inflow water mixes as it plunges into a thermally stratified reservoir
- Quantify how plunging inflows change the horizontal and vertical distributions of velocity fields and temperature stratification in the reservoir
- Examine the effect of diurnal variations in inflow temperature on the velocity fields and temperature stratification in the reservoir
- Evaluate whether a temperature control curtain is effectively controlling temperature stratification and mixing near the plunge zone

The results from these experiments are expected to provide a better definition of the mixing produced by a plunging inflow, and the effectiveness of a temperature control curtain for minimizing this mixing. Likewise, potential improvements to the Oak Bottom curtain could be identified using this data. A one-dimensional model was developed by UC-Davis to simulate temperature stratification in Whiskeytown Reservoir before the curtain was installed. The inflow algorithm for this model will be modified to incorporate curtain influences. The resulting model should be a practical tool which can be used to investigate management strategies for the Lewiston/Whiskeytown reservoir operations.

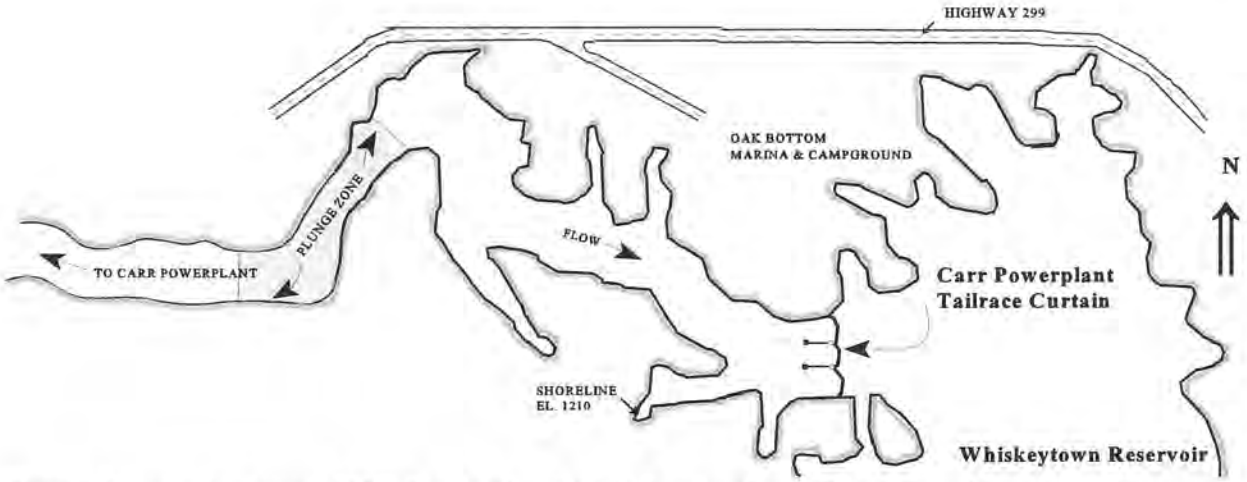

Figure 1. Location map of UC-Davis plunging inflow study site (not to scale).

Location

Whiskeytown Reservoir is part of the Shasta and Trinity Division of Reclamation's Central Valley Project and is located along California Highway 299, 12 miles west of Redding, California (figure 1). UC-Davis chose to study the headwaters of Whiskeytown Reservoir because it has a plunging inflow zone which is influenced by a temperature control curtain. The curtain is located near the Oak Bottom marina and campground (figure 1). Plunging inflows occur when cold water diverted from the Trinity River Basin is discharged through the Judge Francis Carr powerplant into the thermally stratified Whiskeytown Reservoir. Reclamation installed the Oak Bottom curtain to minimize mixing by controlling the amount of warm surface water supplied to the plunge zone.

Field Tests

Reclamation was requested by UC-Davis to provide technical assistance during the field testing. Reclamation provided assistance with velocity profiling using a RD Instruments ADCP. Two field tests were conducted during the summer of 1997. The first test was conducted during the week of August 13, 1997 and the second was conducted from September 3-4, 1997.

Data Collection

Velocity and temperature profiles were collected at the same time to quantify the hydraulic and

thermal characteristics of the plunging inflows. Temperature profiles were collected using a fine scale, Sea-Bird CTD (conductivity, temperature and depth) probe. The CTD probe is capable of temperature resolution of 0.01 °C and a spatial resolution of 5 cm. Continuous temperature profile data at UC-Davis sampling sites were collected with Alpha-Omega 9311 temperature loggers. In addition, Reclamation maintains and operates temperature profiling stations on both sides of the Oak Bottom curtain. The continuous temperature profiling stations were programmed to collect temperature profiles hourly. Velocity data were collected using a RD Instruments 600 kHz ADCP. Reclamation's boat-mounted ADCP was used to collect velocity profiles and to measure cross sectional area at each of the UC-Davis profiling stations. UC-Davis deployed a bottom-mounted 750 kHz Sontek ADP (acoustic Doppler profiler) to continuously measure velocity profiles downstream from the Oak Bottom curtain for a period of 3 to 4 days.

Sampling Sites

Sampling sites were established on both sides of the plunge zone by UC-Davis. The sites were marked with buoys and positioned to encompass the plunge zone. Other sampling sites included Reclamation's continuous temperature profiling stations and UC-Davis' ADP deployment location. A GPS (global positioning system) receiver was used to locate each of the profiling stations and to calculate distances between stations. A listing of the GPS information for the sampling sites is included in Table A1 in appendix A. ADCP transects were collected at most of the sampling locations to survey the site and to determine cross sectional areas. ADCP transects were also used to measure the velocity fields across the channel. Detailed cross sectional information for the other buoy sites is included in Table A2 in appendix A.

Whiskeytown Lake Operations

Hourly operations data for Whiskeytown Lake were provided by Reclamation's Central Valley Operations group. Operations during the field tests are plotted in figures 2 and 3. Reservoir operations during the field tests conducted by UC-Davis are summarized as follows:

- During data collection on August 13, 1997, flow through Carr powerplant was held constant at 1,300 ft^3/sec (36.8 m^3/sec), and flow through Spring Creek powerplant was varied from 1,300 to 3,200 ft^3/sec (90.6 m^3/sec), see figure 2.

- During data collection on September 3, 1997, flows through Carr and Spring Creek powerplants were held constant at 1,720 ft^3/sec (48.7 m^3/sec), see figure 3.

- During data collection on September 4, 1997, flows through Carr and Spring Creek powerplants were held constant at 2,850 ft^3/sec (80.7 m^3/sec), see figure 3.

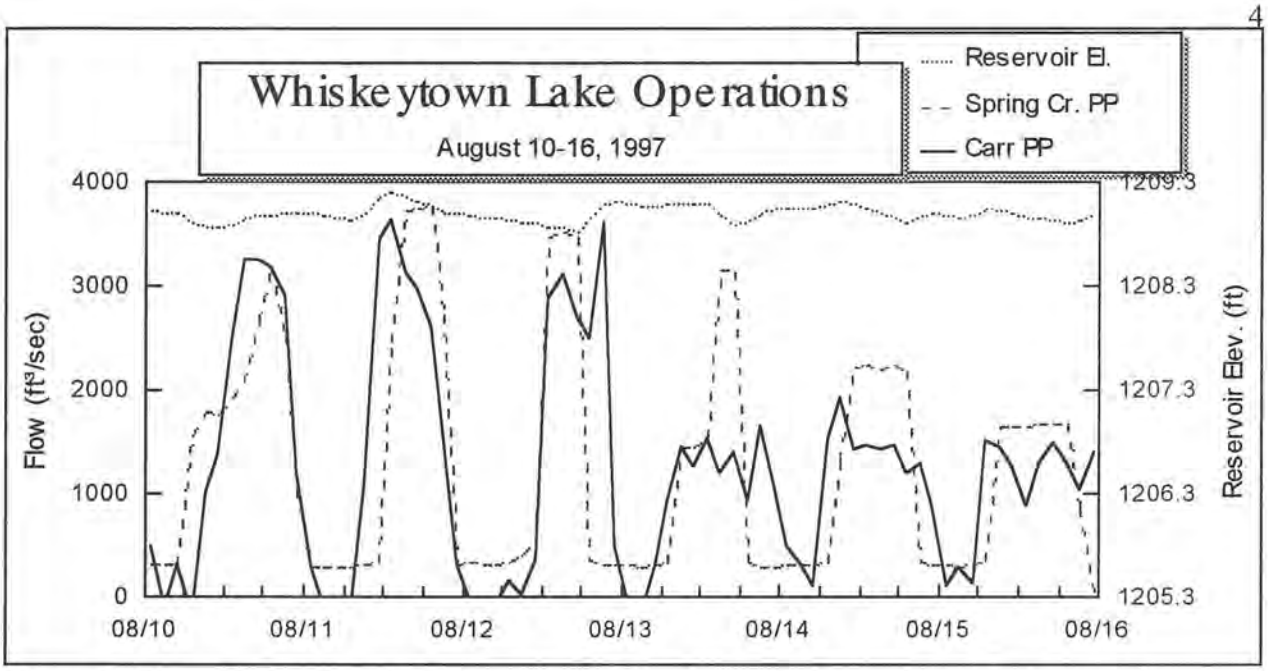

Figure 2. Plot of Judge Francis Carr and Spring Creek Powerplants releases and reservoir elevation for August 10-16, 1997. Note that during the field test on 08/13 the inflow and outflows were unsteady.

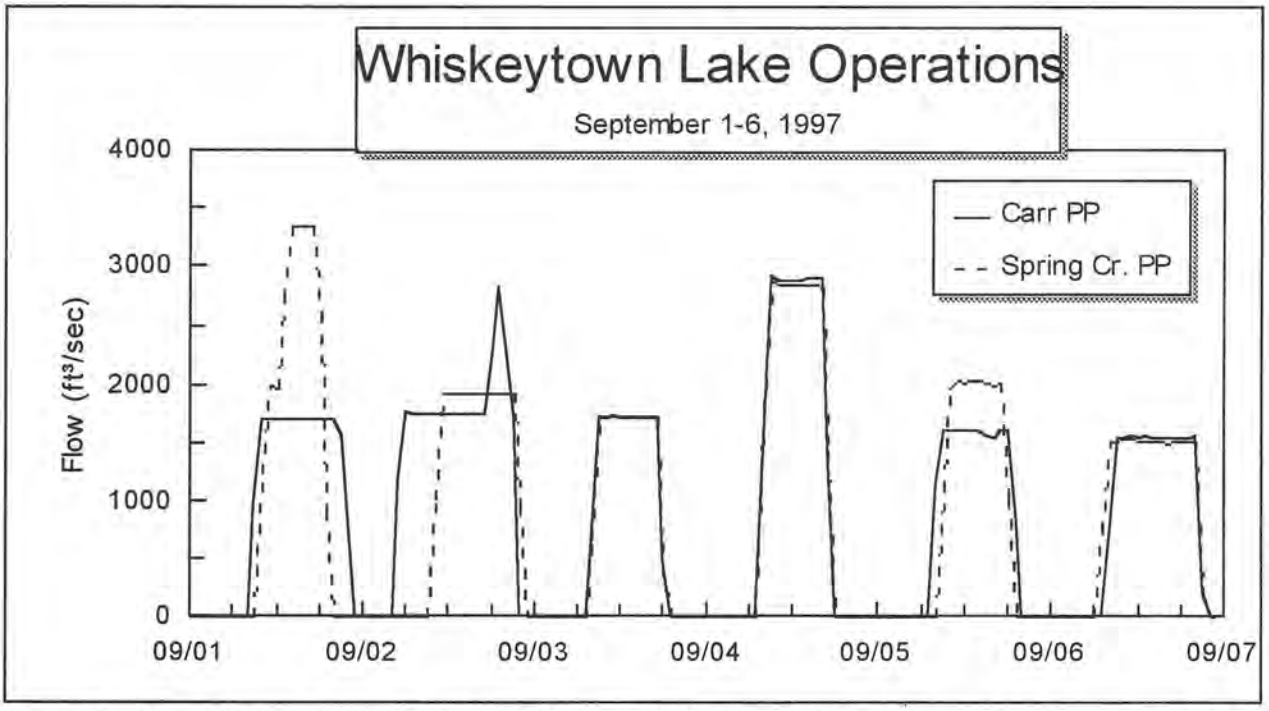

Figure 3. Plot of Judge Francis Carr and Spring Creek Powerplants releases for September 1-7, 1997. Note that during the field tests on September 3 and 4 the inflow and outflows were set equal to each other.

ADCP Data Collection

Reclamation was responsible for collecting velocity profiles at UC-Davis sampling sites while UC-Davis researchers collected conductivity and temperature profiles. Typically, at least 40 ADCP profiles were collected over a 2 to 3 minute period at each sampling site. The ADCP profiles were processed to get an average velocity profile and other statistics.. A review of the statistics of the processed velocity data showed a typical standard deviation of ±10 cm/sec for profile data collected in the vicinity of the plunge zone.

The ADCP configuration used for the RD Instruments Broadband ADCP with a 600 kHz transducer consisted of:

- one-half meter depth cells
- 50 cm surface blanking distance
- five water pings and 4 bottom pings per ensemble of data

A complete listing of the ADCP configuration file used for these tests is included in appendix C.

In addition to velocity profiling, Reclamation's boat-mounted ADCP was used to locate the plunge zone, track the density current, and measure cross sectional properties and discharge at each sampling site. The plunge location was easily tracked by monitoring the water temperature measured on the face of the ADCP transducer. In fact, during the August tests, the ADCP measured a surface temperature change from 12 to 19°C across the plunge zone.

The ADCP velocities shown in figures 4 through 15 are the resultant magnitudes of the velocity components measured in the east and north directions. ADCP velocities can vary in both magnitude and direction for each individual bin which can introduce a bias error into the computed velocity magnitude (this is especially true for very small or zero velocities where the boat motion is much greater than the water velocity). As a result, magnitudes of very small velocities are usually reported as positive values in the 7 to 10 cm/sec range. To overcome this bias error it would be more accurate to sum the east and north velocity vector components resolved about a direction normal to the cross section. This detailed analysis may be required for the plunging inflow study and will be left to UC-Davis researchers. ADCP data files required to perform this analysis will be sent to UC-Davis along with this data report.

August 13, 1997 ADCP Data Collection- ADCP data were collected downstream from the plunge zone. Five profiles were collected across the channel at 15 meter intervals. An isovel plot of the averaged profile data and the bottom profile is shown in figure 4. The isovel plot shows that the flow is concentrated near the left bank (looking downstream) and that the velocities ranged from 15 to 28 cm/sec. The plunge zone was sinuous so the velocity profiles were collected at varying distances downstream from the plunge zone. As a result, water surface temperatures at the profile locations varied from 16°C near the left bank to 18°C near the right bank.

Several ADCP transects were collected downstream from the plunge zone and downstream from the Oak Bottom curtain. The ADCP transect collected 260 meters downstream from the curtain showed the highest velocities occur at the same elevation as the curtain bottom and that the flow is concentrated toward the right bank (see upper plot in figure 5). Also, the acoustic echo intensity plot shows the flow is concentrated along the right half of the channel and below the curtain bottom (see lower plot in figure 5). The strong echo intensity at depth resulted from turbid inflows from Lewiston Reservoir. Normally, echo intensities in a homogenous water column decrease with distance from the ADCP's transducer, but in this case the strong echo intensities at depth were caused by the suspended sediment carried by the reservoir inflow. The rapid reduction in the echo intensity at a depth of 7 meters was likely a result of the reduced productivity of aquatic organisms which also are good acoustic reflectors. The reduced number of aquatic organisms may coincide with the location of the thermocline, but I could not verify this because I do not have the temperature profiles for this day.

September 3, 1997 ADCP Data Collection - ADCP data were collected upstream and downstream from the plunge zone, and a summary of the data files collected is in Table A3. The first set of five profiles was collected across the channel at 15 to 25 meter intervals at a cross section located 850 meters upstream from the plunge zone. An isovel plot of the averaged profile data and the bottom profile is shown in figure 6. The isovel plot shows that the flow is concentrated near the left bank (looking downstream) and that the velocities ranged from 15 to 34 cm/sec. The water surface temperatures at these profile sites varied from 11 °C near the left bank to 12 °C near the right bank. One ADCP transect was collected 850 meters upstream from the plunge zone and it showed a similar velocity distribution as shown in figure 6. The discharge measured during this transect was 38 m^3/sec which compares very well with the 36.8 m^3/sec discharge from Carr Powerplant.

The second set of five ADCP profiles was collected just downstream from the plunge zone. The five profiles were collected across the channel at 20 meter intervals. An isovel plot of the averaged profile data and the bottom profile is shown in figure 7. The isovel plot shows that the flow is concentrated near the right bank (looking downstream) and that the velocities ranged from 15 to 28 cm/sec. The water surface temperatures at the profile locations varied from 20 °C near the left bank to 18 °C near the right bank. An ADCP transect was collected at this cross section and the discharge measured was 56 m^3/sec.

The third set of seven ADCP profiles was collected 100 meters downstream from the plunge zone. The seven profiles were collected across the channel at about 20 meter intervals. An isovel plot of the averaged profile data and the bottom profile is shown in figure 8. The isovel plot shows that the flow was concentrated toward the right bank and the velocities ranged from 15 to 30 cm/sec. The profile data also shows the plunging jet located at 2.5 meters below the water surface. The water surface temperatures at the profile locations varied from 21 °C near the left bank and 19 °C near the right bank. An ADCP transect was collected at this cross section and the discharge measured was 65 m^3/sec.

Several ADCP transects were collected upstream from a point where the inflow separates from the left bank. The transects were collected starting 150 meters upstream from the separation point at about 30 meter intervals in the downstream direction. Figure 9 shows the four transects which illustrate that the flow was concentrated toward the left bank, which is on the outside of a channel bend. For these four transects the water surface temperature along the right bank varied between 12°C and 13°C. However, the water surface temperatures along the left bank increased from 12°C to 18°C with increasing distance in the downstream direction, which indicates that these measurements were taken across the plunge zone. The average discharge measured by the four transects was 52 m^3/sec.

Lastly, two ADCP transects were collected downstream from the Oak Bottom Curtain. These transects showed that the flow was concentrated toward the right bank as shown in figure 10.

September 4, 1997 ADCP Data Collection - ADCP data were collected upstream and downstream from the plunge zone and a summary of the data collected are in Table A4. The first set of six profiles was collected across the channel at 15 to 20 meter intervals at a cross section 190 meters upstream from the plunge zone. An isovel plot of the averaged profile data and the bottom profile is shown in figure 11. The isovel plot shows that the flow was concentrated near the right bank (looking downstream) and that the velocities ranged from 15 to 32 cm/sec. The water surface temperatures at these profile sites were uniform at 11°C from left bank to right bank. One ADCP transect was collected 190 meters upstream from the plunge zone and it showed a similar velocity distribution as shown in figure 11. The discharge measured by this transect was 70 m^3/sec which is considerably lower than the 80 m^3/sec discharge from Carr Powerplant.

A second set of six ADCP profiles was collected just downstream from the plunge zone. The six profiles were collected across the channel at 20 meter intervals. An isovel plot of the averaged profile data and the bottom profile is shown in figure 12. The isovel plot shows that the flow was uniformly distributed across the section and that the velocities ranged from 15 to 28 cm/sec. The underflow interface appears to be located at a depth of 2.3 meters. The water surface temperatures at the profile locations varied from 21°C near the left bank to 15°C near the right bank. An ADCP transect was collected at this cross section and the measured discharge was 86 m^3/sec which is slightly higher than the Carr Powerplant release.

The third set of five ADCP profiles was collected 140 meters downstream from the plunge zone. The five profiles were collected across the channel at about 20 meter intervals. An isovel plot of the averaged profile data and the bottom profile is shown in figure 13. The isovel plot shows that the flow was still skewed toward the right bank and the velocities ranged from 15 to 27 cm/sec. The underflow interface appears to be located at a depth of 4.3 meters. The water surface temperatures at the profile locations were uniform across the section at 22°C. An ADCP transect was collected at this cross section and the measured discharge was 89 m^3/sec.

Several ADCP transects were collected upstream from the plunge zone. The transects were collected starting a few meters upstream from the plunge zone. Successive transects were collected at 25 meter intervals in the upstream direction. Figure 14 shows the four transects which illustrate that the flow was concentrated in the center of the channel. The water surface temperatures along the right bank varied from 16°C to 11°C in the upstream direction. The water surface temperatures along the left bank varied from 18°C to 11°C in the upstream direction. The average flow measured by the four transects was 84 m^3/sec.

Lastly, two ADCP transects were collected downstream from the Oak Bottom Curtain. These transects showed that the flow was concentrated toward the right bank and the highest velocities (20-30 cm/sec) were measured at a depth of 12 meters, which is the same depth as the curtain bottom, see figure 15. Note that the x-axes in figure 15 are different because the transects started on opposite banks.

UC-Davis Acoustic Doppler Profiles

UC-Davis deployed a Sontek ADP with a 3000 kHz transducer to measure velocity profiles about 50 meters downstream from the Oak Bottom curtain. Data were collected from 11:00 a.m. on June 18 until 4:30 p.m. on June 27, 1997. A total of 890 profiles were collected at 5 minute intervals. A maximum profiling depth of 6 meters was used at the deployment site. This limited range resulted from using a 3000 kHz transducer, but it was the only ADP available at the time of this test. Plots of the reservoir inflows and outflows, transducer temperature, and velocity magnitudes for the nine day period are presented in figure 16. These data showed large fluctuations in velocity throughout the period. The velocity fluctuations are attributed to changes in Spring Creek Powerplant releases and to the diurnal fluctuations in the inflow water temperature (measured at the ADP's transducer face). Interpretation of the variations in velocities was difficult considering the reduced flows through Spring Creek Powerplant coincided with the maximum (peak) in the underflow temperatures.

Summary and Conclusions

This cooperative research effort has been a worthwhile effort and has exposed me to some very interesting field measurement equipment and techniques. UC-Davis did an excellent job with project planning and coordinating field work with Reclamation and other agencies. At the conclusion of this project, UC-Davis and Bill Fleenor have committed to deliver final results, data, and other products from this research project to Reclamation. In turn, I will make them available to Reclamation's Mid-Pacific Regional Office (MP-700) and Northern California Area Office.

Specific conclusions from the 1997 field tests are as follows:

- The field tests conducted by UC-Davis were successful in measuring the hydrodynamics and mixing processes associated with a plunging inflow in Whiskeytown Reservoir. The 1997 tests differed from 1996 work in that detailed cross sectional data were collected as opposed to collecting velocity and temperature profiles in the channel's thalweg.

- ADCP data showed that cross sectional velocity distributions were not uniform. The inflow currents vary across the channel as a result of channel morphology and stratified flow hydraulics.

- Reclamation's ADCP and UC-Davis' ADP were valuable tools that were used to define the hydrodynamics of plunging inflows entering Whiskeytown Reservoir and density currents downstream from the Oak Bottom curtain, respectively.

- Reclamation's boat-mounted ADCP was an especially useful tool because, in addition to velocity profiling, it was used to locate the plunge zone, track the density current interface, and measure cross sectional properties and discharge at each sampling site.

- Visual observations of the plunge zone and turbid inflows revealed that it takes several hours to replace warm water which accumulated upstream from the Oak Bottom curtain. The warm water accumulates when flows from Carr powerplant are reduced during peaking power operations.

Acknowledgments

Reclamation's Mid-Pacific Regional Office provided funding for this project, and Peggy Manza was responsible for managing the account. Reclamation's Northern California Area Office provided technician and transportation support for this project.

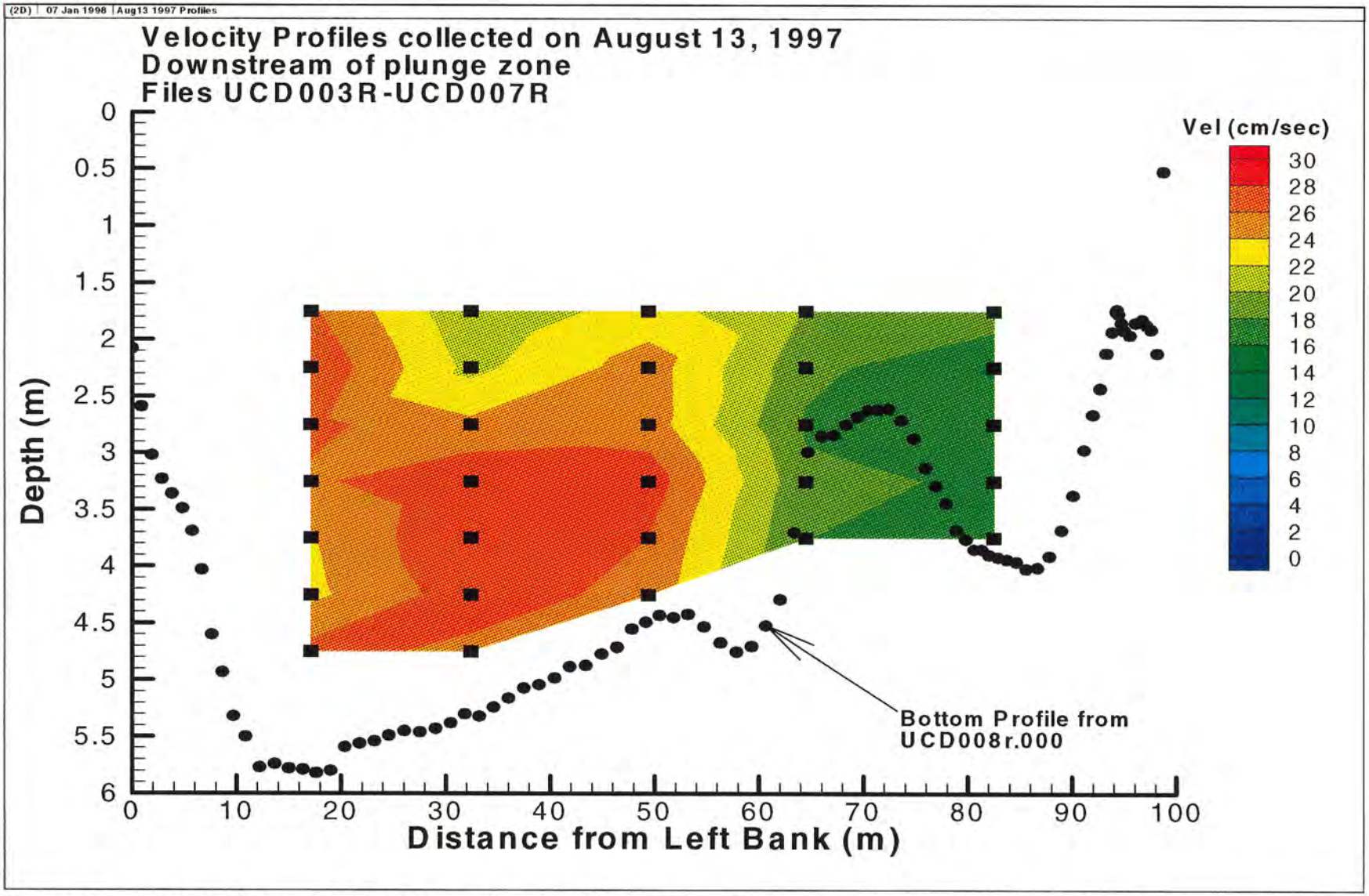

Figure 4. Isovel plot of averaged ADCP data collected at five profiling sites located downstream from the plunge zone. The bottom profile data were extracted from an ADCP transect collected at the same location.

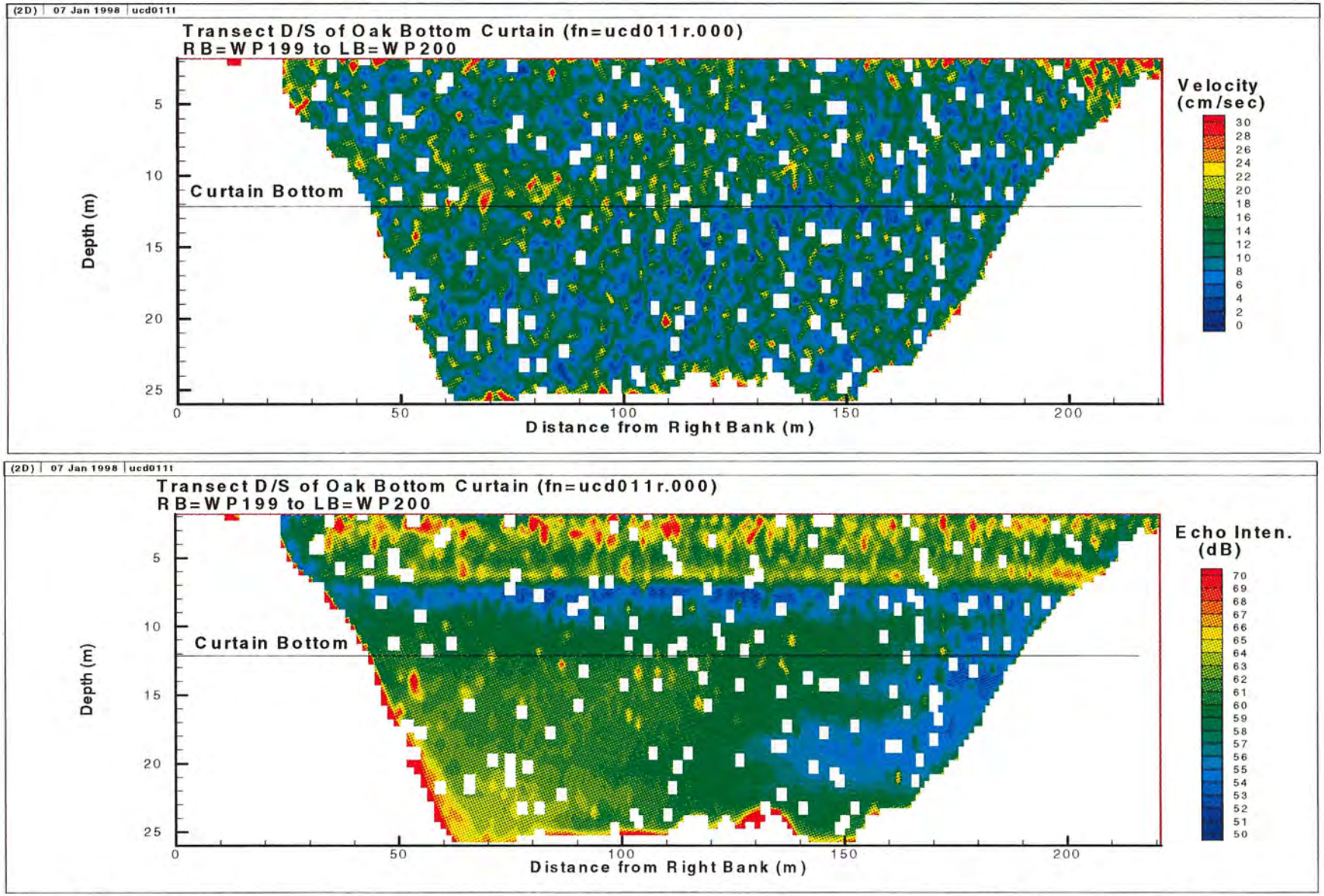

Figure 5. The upper plot shows the velocity distribution collected 260 meters downstream from the Oak Bottom curtain. The lower plot shows the distribution of the echo intensity across the reservoir. This data illustrates the distribution of acoustic reflectors.

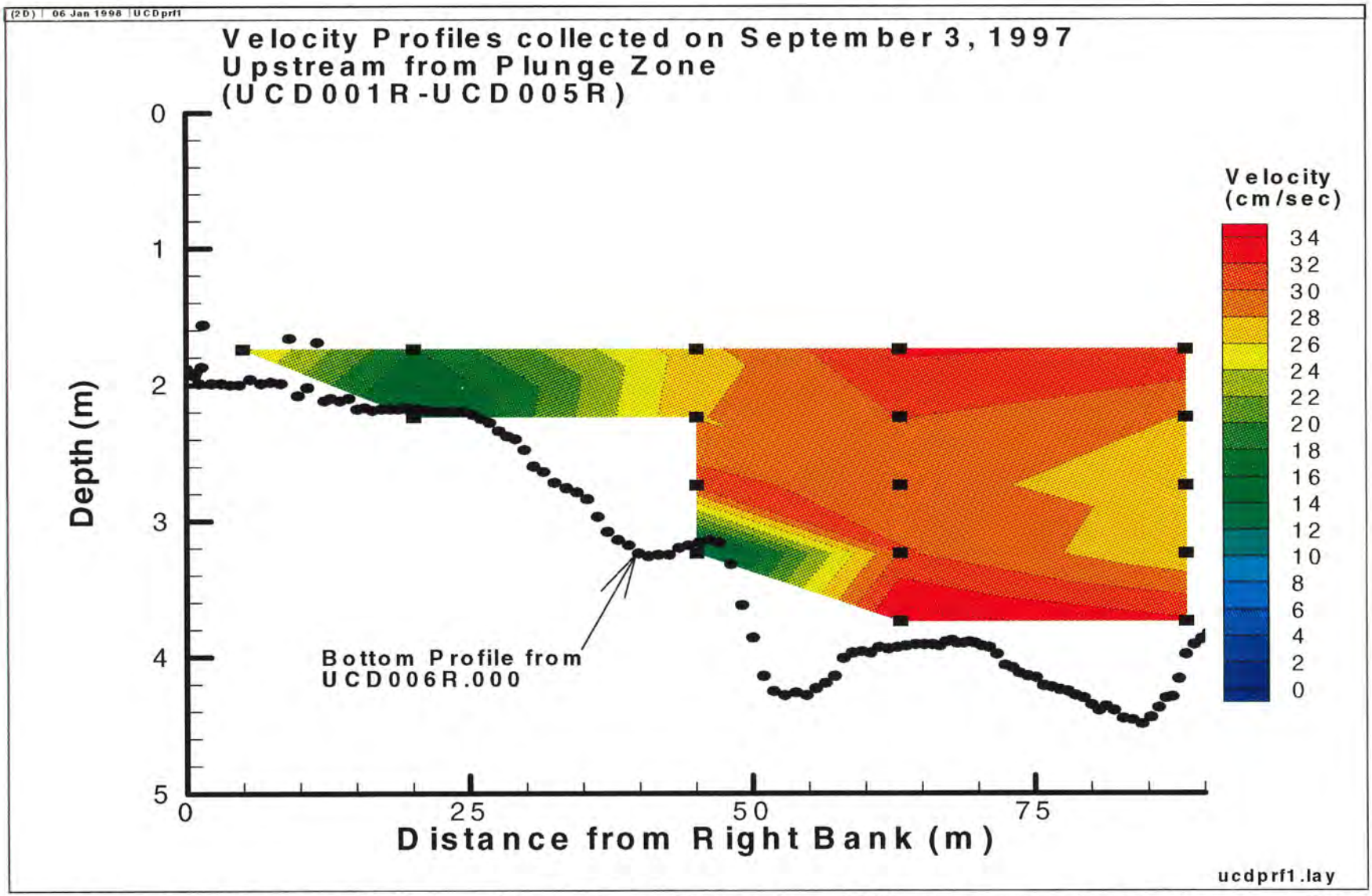

Figure 6. Isovel plot of averaged ADCP data collected at five profiling sites located 850 meters upstream from the plunge zone. The bottom profile data were extracted from an ADCP transect collected at the same location.

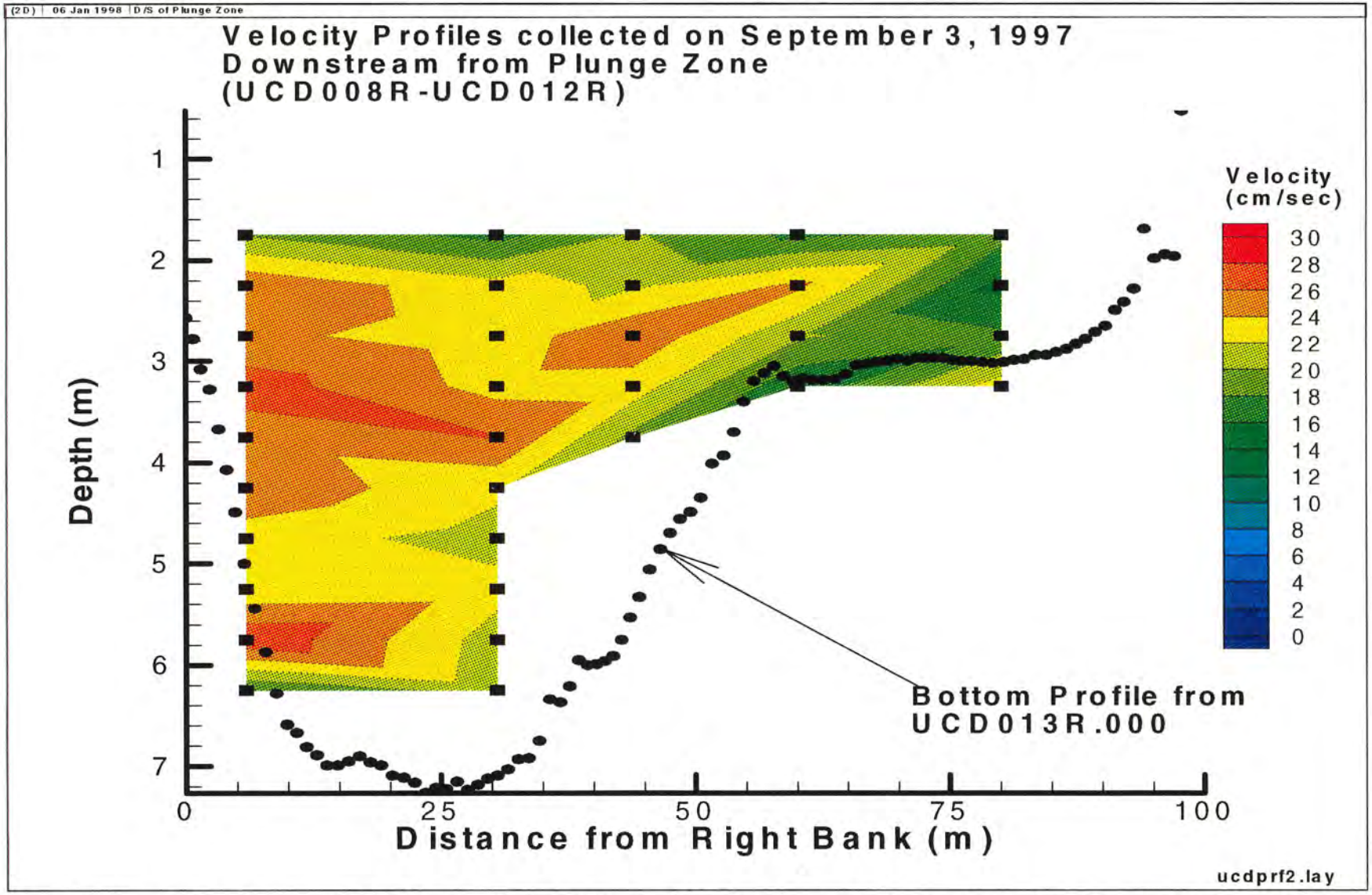

Figure 7. Isovel plot of averaged ADCP data collected at five profiling sites located just downstream from the plunge zone. The bottom profile data were extracted from an ADCP transect collected at the same location.

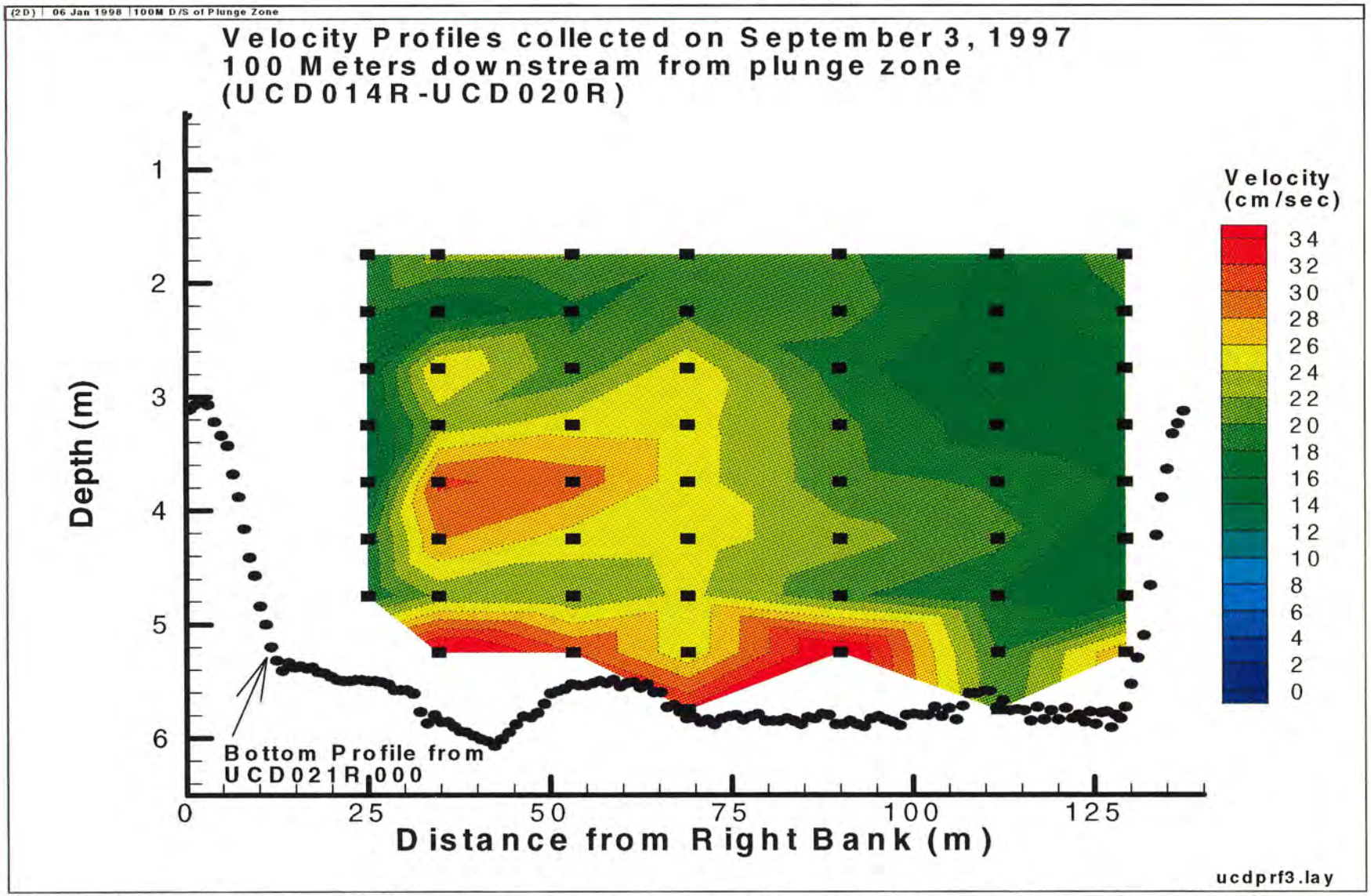

Figure 8. Isovel plot of averaged ADCP data collected at seven profiling sites located 100 meters downstream from the plunge zone. The bottom profile data were extracted from an ADCP transect collected at the same location.

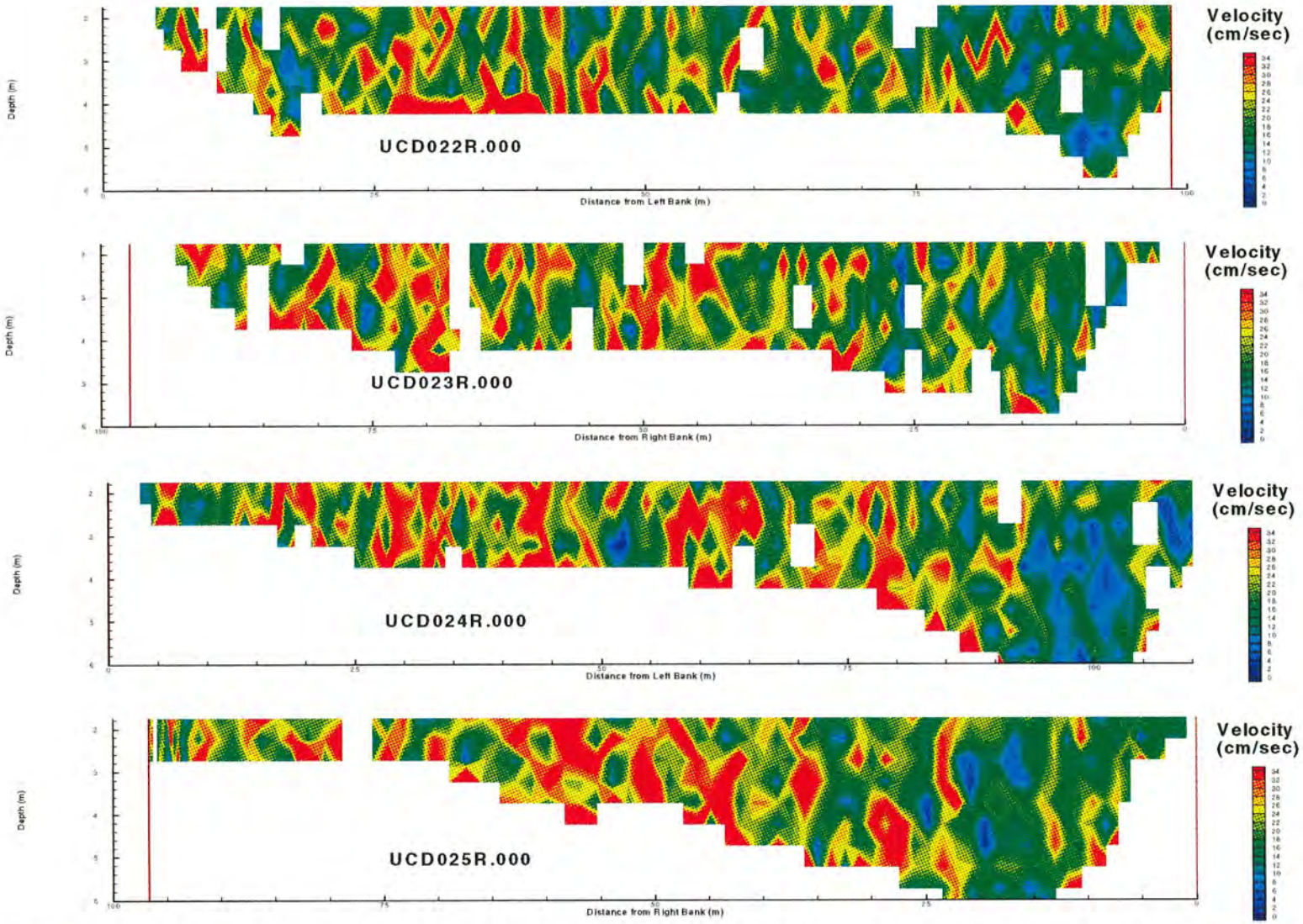

Figure 9. Isovel plots of ADCP transects collected at four cross sections located between 150 and 20 meters upstream from the plunge zone. The top plot was collected 150 meters upstream, the second transect was 100 meters upstream, the third transect was 44 meters upstream and the bottom transect was 20 meters upstream.

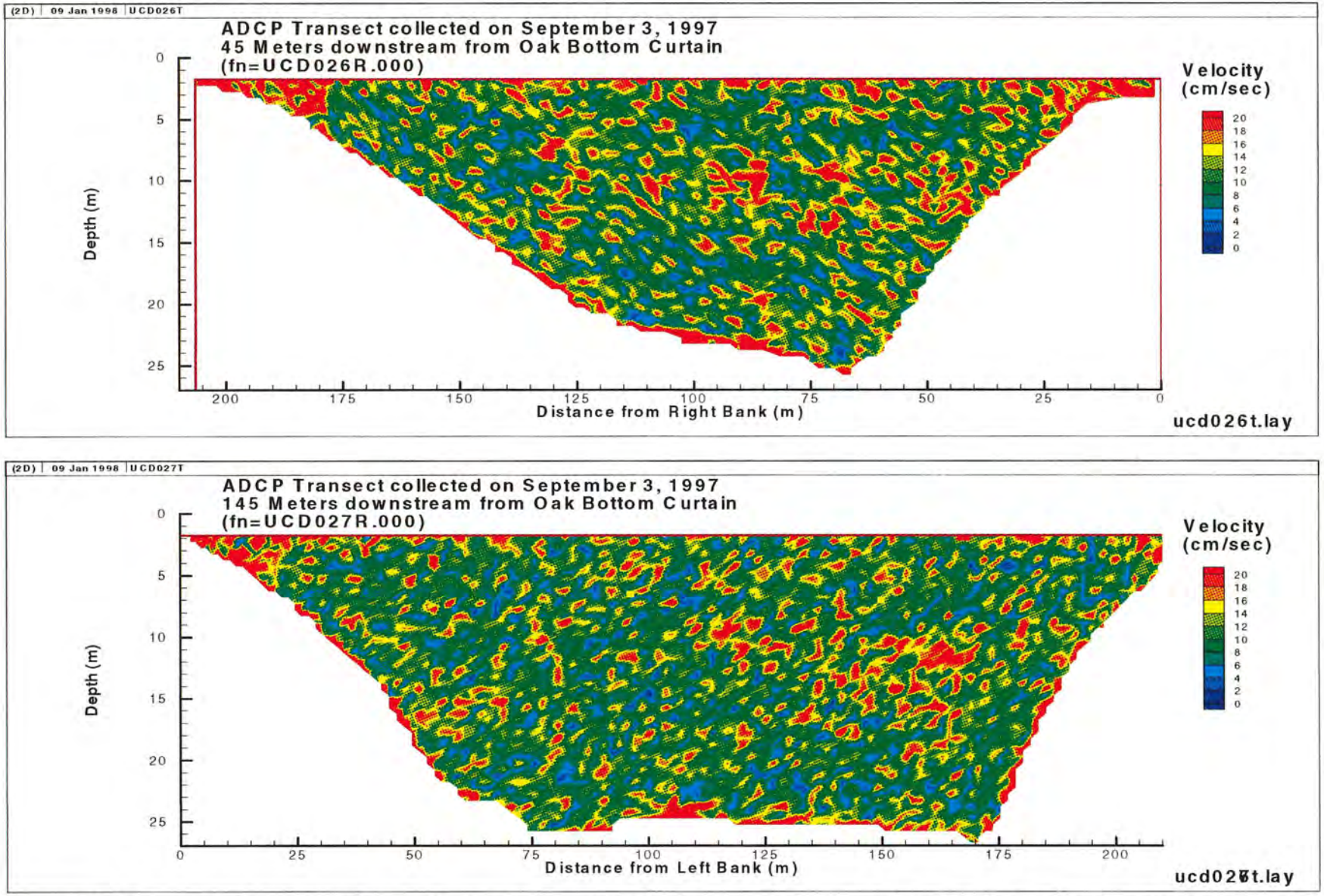

Figure 10. The upper plot shows the velocity distribution collected 45 meters downstream from the Oak Bottom curtain. The lower plot shows the velocity distribution collected 145 meters downstream from the Oak Bottom curtain.

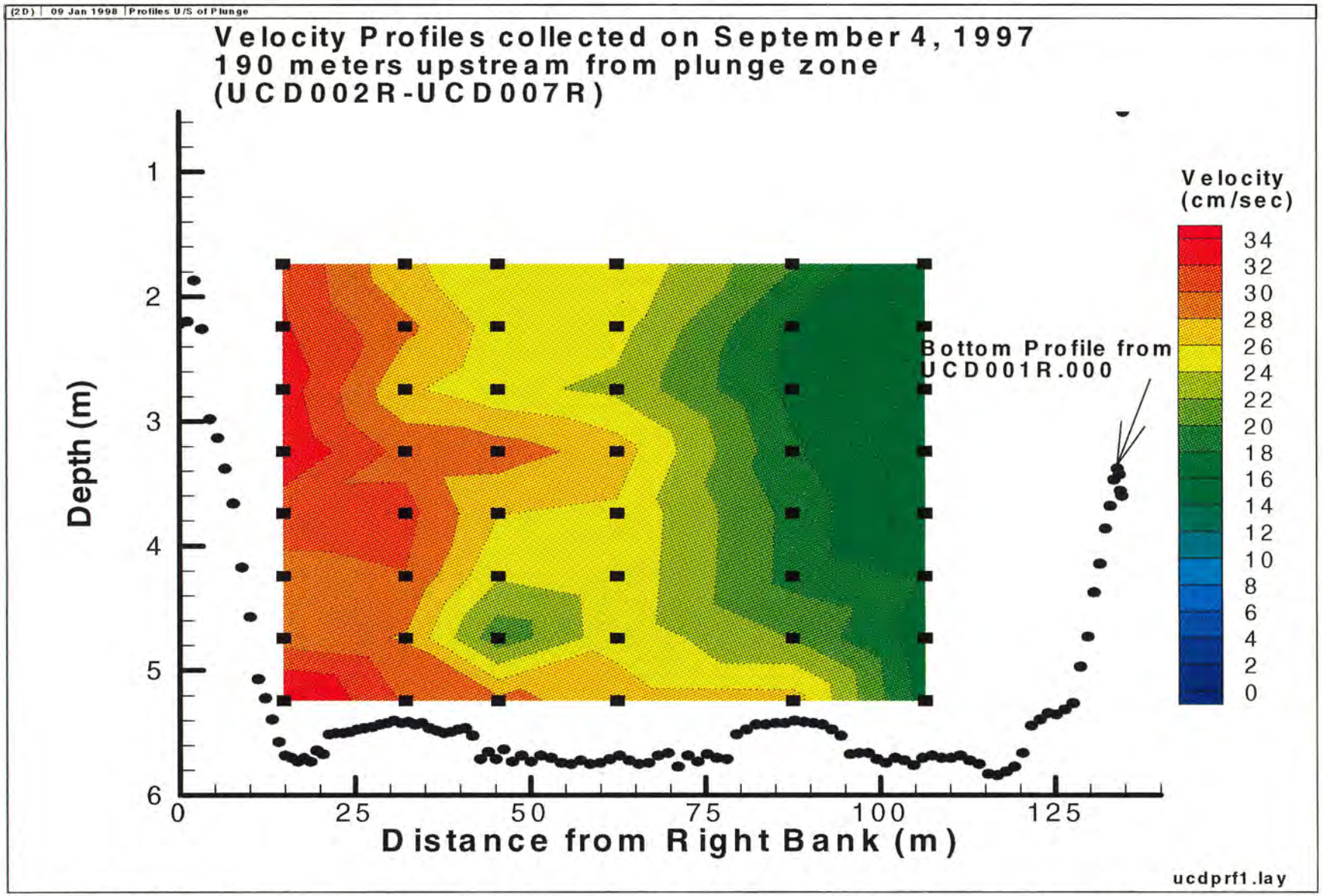

Figure 11. Isovel plot of averaged ADCP data collected at six profiling sites located 190 meters upstream from the plunge zone. The bottom profile data were extracted from an ADCP transect collected at the same cross section.

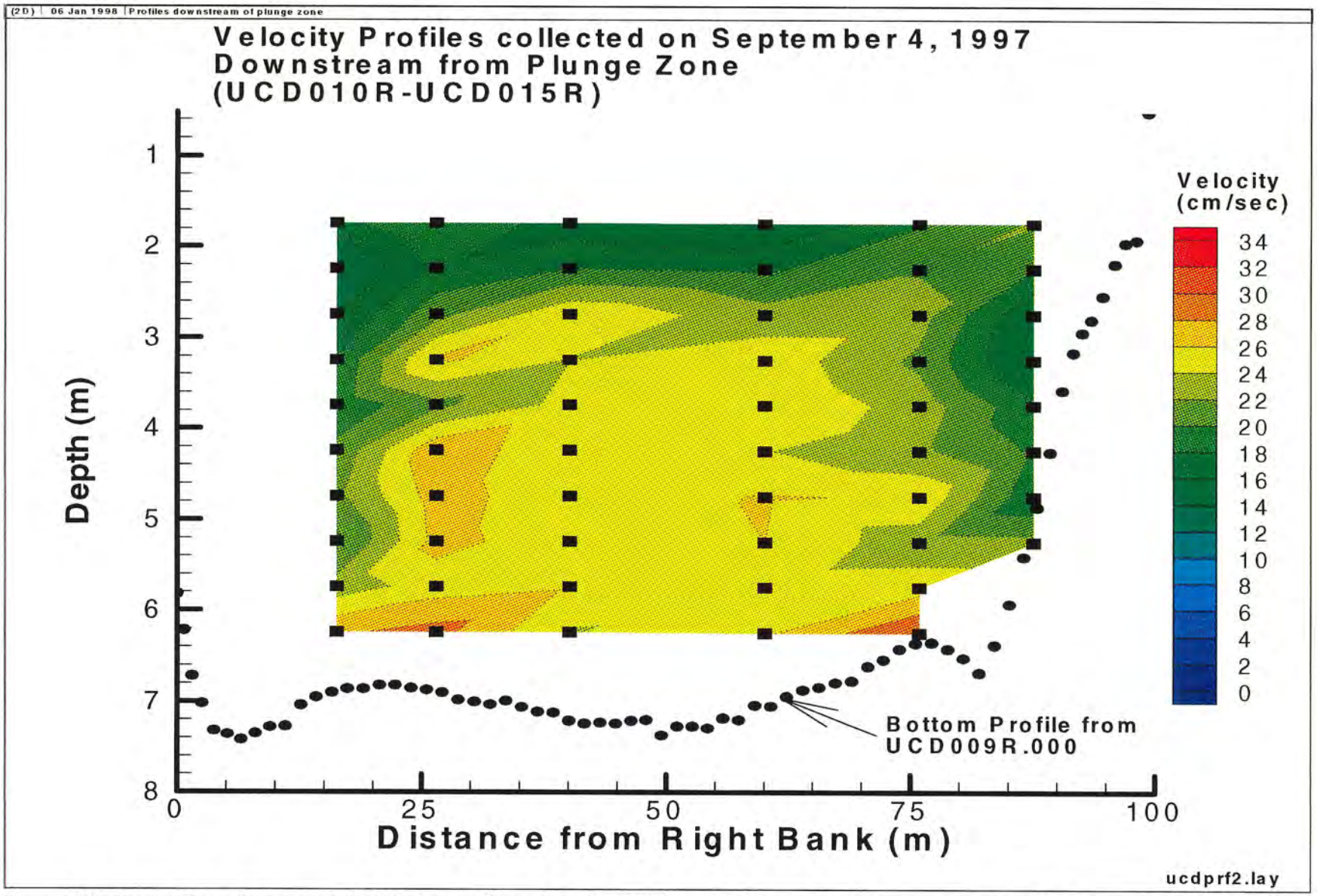

Figure 12. Isovel plot of averaged ADCP data collected at six profiling sites located just downstream from the plunge zone. The bottom profile data were extracted from an ADCP transect collected at the same cross section.

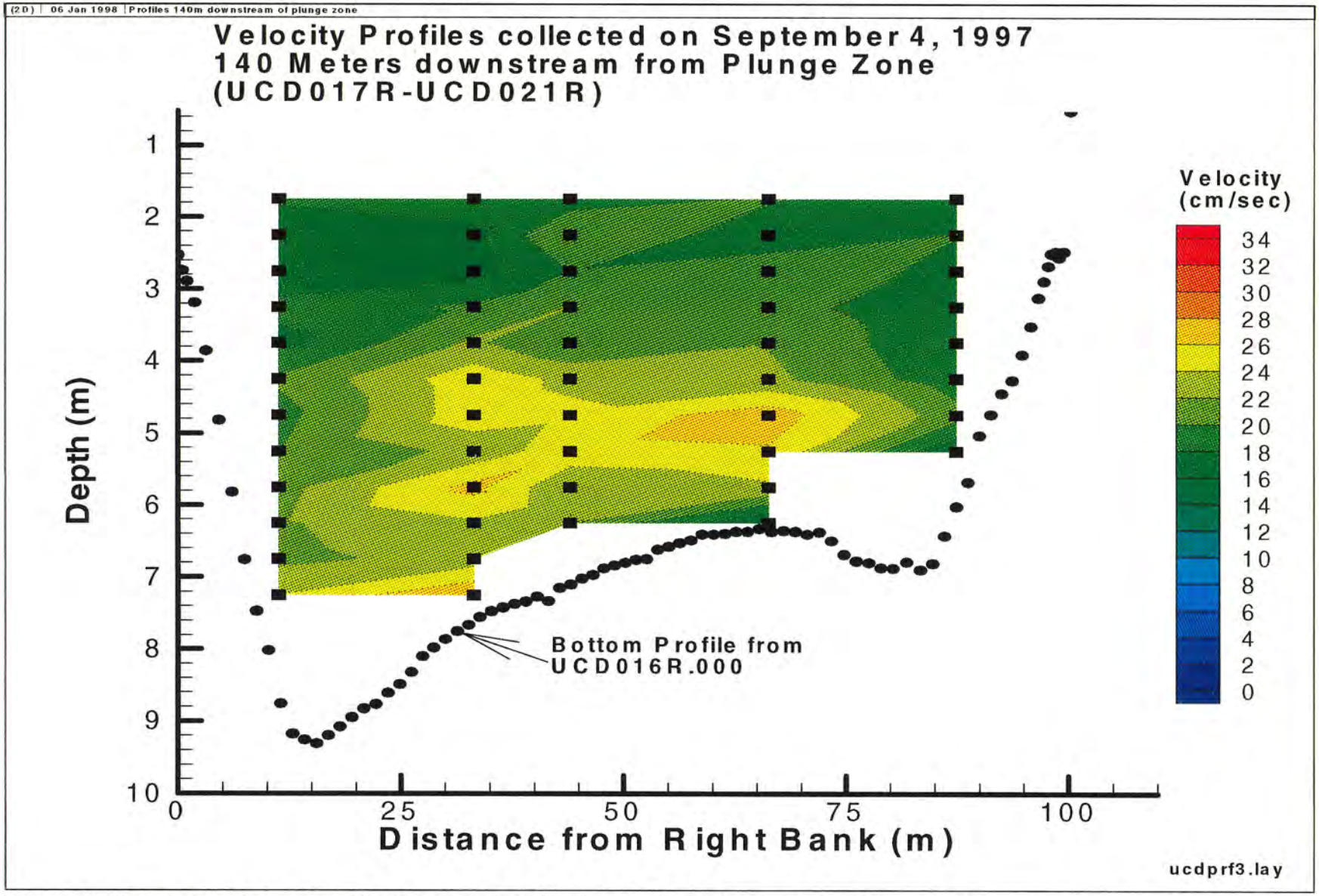

Figure 13. Isovel plot of averaged ADCP data collected at five profiling sites located 140 meters downstream from the plunge zone. The bottom profile data were extracted from an ADCP transect collected at the same cross section.

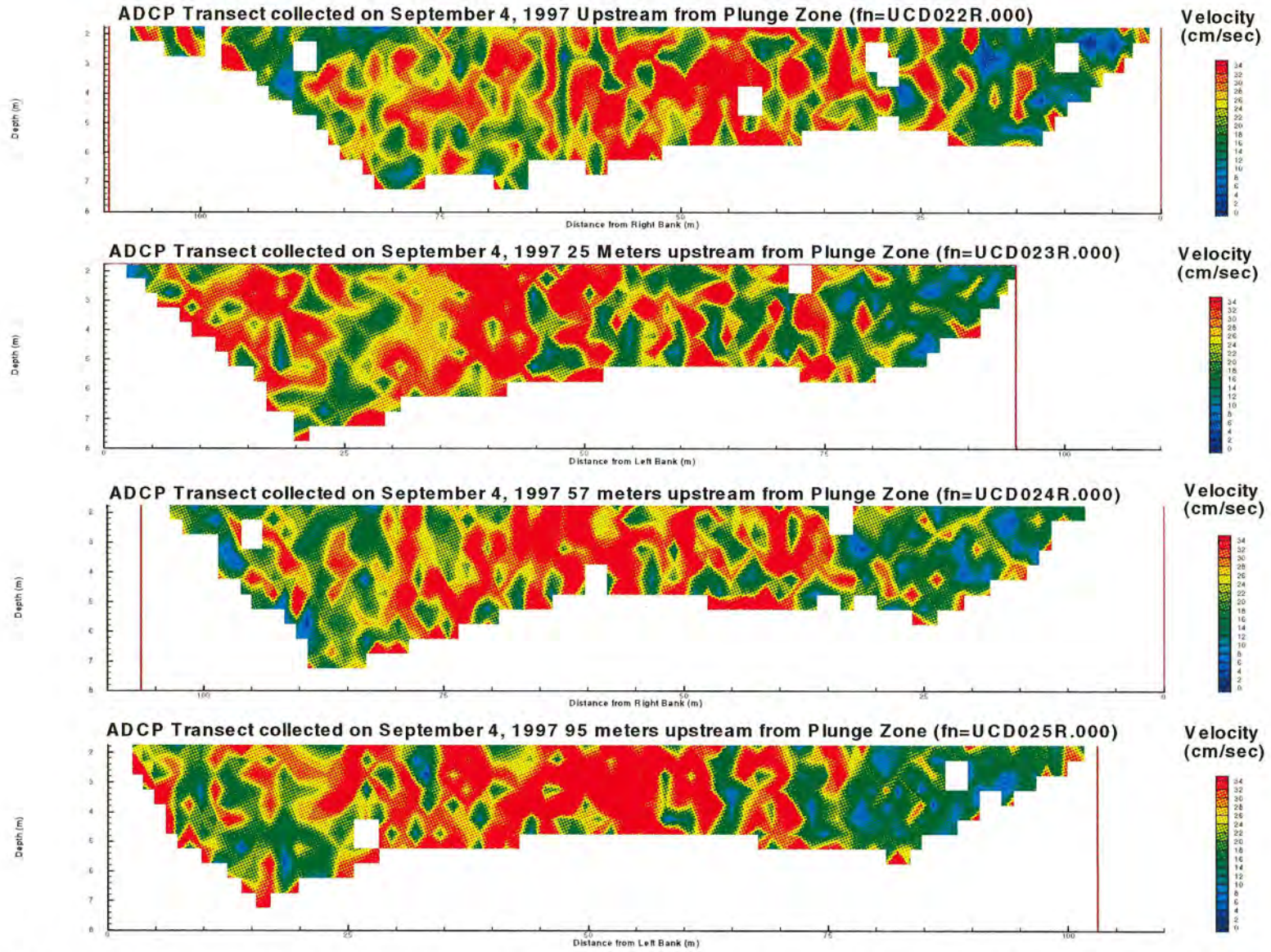

Figure 14. Isovel plots of four ADCP transects collected upstream from the plunge zone. The upper plot is data from an ADCP transect collected just upstream of the plunge zone and each successive transect was collected 25 meters further upstream.

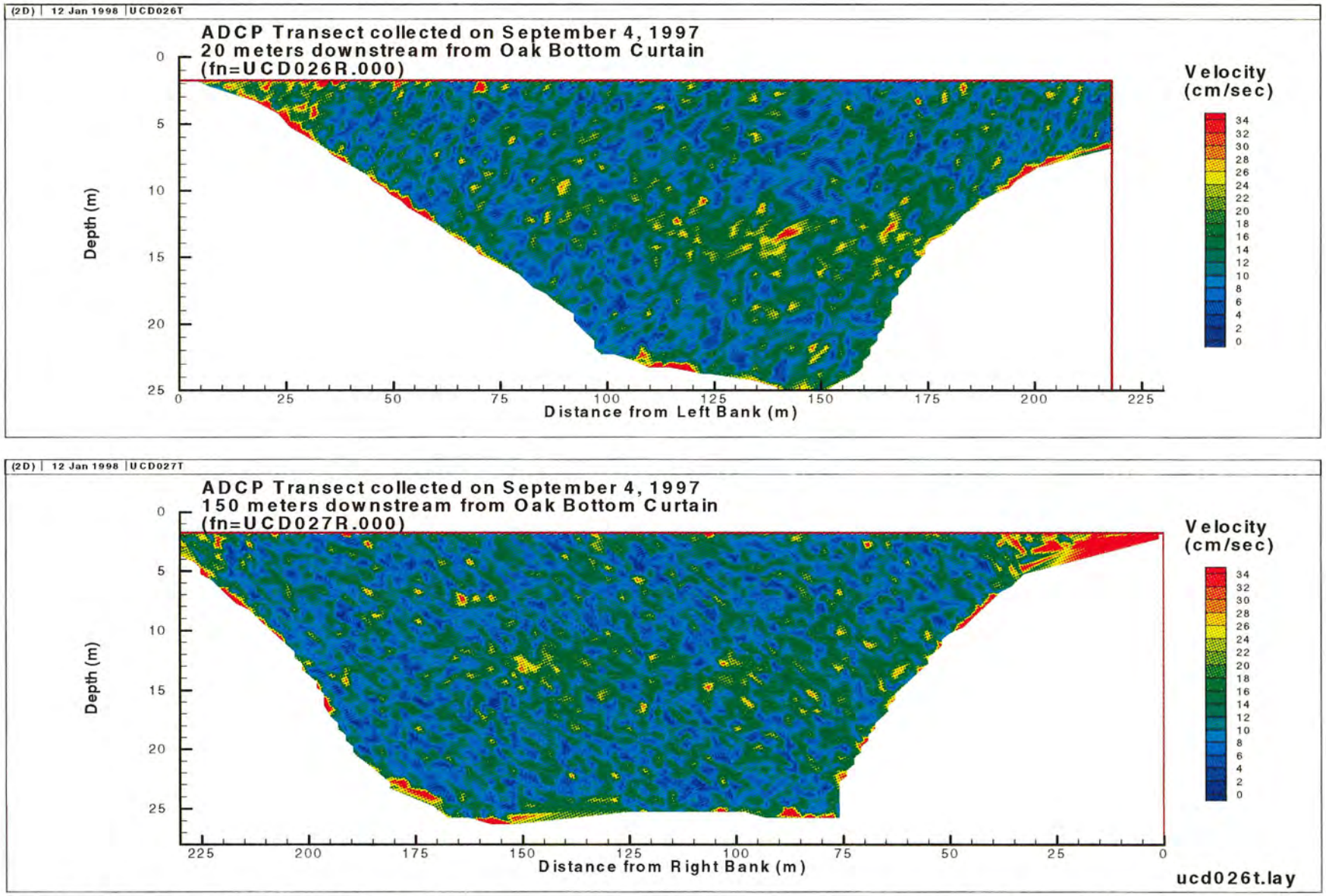

Figure 15. The upper plot shows the velocity distribution collected 20 meters downstream from the Oak Bottom curtain. The lower plot shows the velocity distribution collected 145 meters downstream from the Oak Bottom curtain.

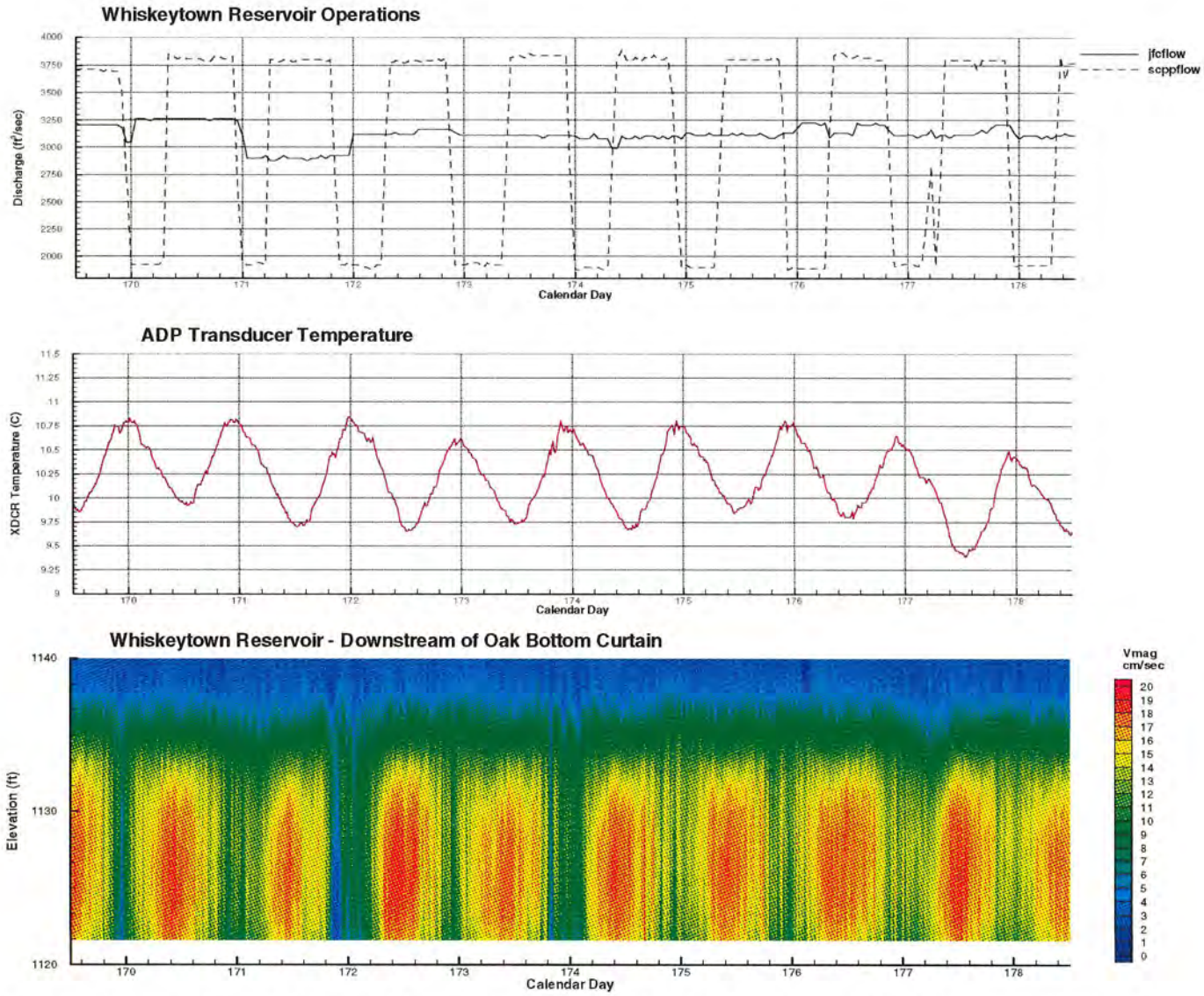

Figure 16. Flow, temperature and velocity data collected from June 18 to June 27, 1997. The temperature and velocity data were using a Sontek ADP with a 3000 kHz transducer. This ADP had a very limited range (about 6 meters) so the velocity profiles are truncated.

Appendices

Appendix A

Table A1. GPS Coordinates for UC-Davis Plunging Inflow Study

Waypoints collected on 8/13/97

WP I.D.	easting(m)	northing(m)	elev(ft)	datum	Coord. Sys.	Unit	Distance Btwn WP (m)
WP192	532464.00	4499878.00	1208.00	WGD	UTM/UPS	10T	
WP193	532458.00	4499862.00	1197.00	WGD	UTM/UPS	10T	17.09
WP194	532455.00	4499847.00	1199.00	WGD	UTM/UPS	10T	15.30
WP195	532443.00	4499835.00	1201.00	WGD	UTM/UPS	10T	16.97
WP196	532441.00	4499820.00	1207.00	WGD	UTM/UPS	10T	15.13
WP197	532431.00	4499805.00	1203.00	WGD	UTM/UPS	10T	18.03
WP198	534701.00	4499662.00	1210.00	WGD	UTM/UPS	10T	2274.50
WP199	534885.00	4499476.00	1216.00	WGD	UTM/UPS	10T	261.63
WP200	534852.00	4499718.00	1207.00	WGD	UTM/UPS	10T	244.24

Waypoints collected on 9/3/97

WP I.D.	easting(m)	northing(m)	elev(ft)	datum	Coord. Sys.	Unit	Distance Btwn WP (m)
WP201	531951.00	4499669.00	1191.00	WGD	UTM/UPS	10T	
WP202	531966.00	4499671.00	1190.00	WGD	UTM/UPS	10T	15.13
WP203	531986.00	4499686.00	1212.00	WGD	UTM/UPS	10T	25.00
WP204	532004.00	4499686.00	1192.00	WGD	UTM/UPS	10T	18.00
WP205	532028.00	4499694.00	1196.00	WGD	UTM/UPS	10T	25.30
WP206	532028.00	4499701.00	1186.00	WGD	UTM/UPS	10T	7.00
WP207	531945.00	4499669.00	1180.00	WGD	UTM/UPS	10T	88.96
WP208	532799.00	4499703.00	1190.00	WGD	UTM/UPS	10T	854.68
WP209	532805.00	4499723.00	1178.00	WGD	UTM/UPS	10T	20.88
WP210	532788.00	4499741.00	1182.00	WGD	UTM/UPS	10T	24.76
WP211	532782.00	4499753.00	1175.00	WGD	UTM/UPS	10T	13.42
WP212	532783.00	4499755.00	1187.00	WGD	UTM/UPS	10T	2.24
WP213	532777.00	4499770.00	1190.00	WGD	UTM/UPS	10T	16.16
WP214	532765.00	4499786.00	1176.00	WGD	UTM/UPS	10T	20.00
WP215	532748.00	4499773.00	1178.00	WGD	UTM/UPS	10T	21.40
WP216	532783.00	4499703.00	1204.00	WGD	UTM/UPS	10T	78.26
WP217	532896.00	4499735.00	1184.00	WGD	UTM/UPS	10T	117.44
WP218	532899.00	4499749.00	1183.00	WGD	UTM/UPS	10T	14.32
WP219	532901.00	4499768.00	1184.00	WGD	UTM/UPS	10T	19.10
WP220	532905.00	4499783.00	1192.00	WGD	UTM/UPS	10T	15.52
WP221	532919.00	4499824.00	1185.00	WGD	UTM/UPS	10T	43.32

WP222	532928.00	4499839.00	1194.00	WGD	UTM/UPS	10T	17.49
WP223	532923.00	4499851.00	1185.00	WGD	UTM/UPS	10T	13.00
WP224	532888.00	4499728.00	1198.00	WGD	UTM/UPS	10T	127.88
WP225	532590.00	4499763.00	1189.00	WGD	UTM/UPS	10T	300.05
WP226	532544.00	4499680.00	1197.00	WGD	UTM/UPS	10T	94.89
WP227	532606.00	4499658.00	1192.00	WGD	UTM/UPS	10T	65.79
WP228	532631.00	4499747.00	1190.00	WGD	UTM/UPS	10T	92.44
WP229	532692.00	4499752.00	1188.00	WGD	UTM/UPS	10T	61.20
WP230	532712.00	4499647.00	1199.00	WGD	UTM/UPS	10T	106.89
WP231	532743.00	4499662.00	1196.00	WGD	UTM/UPS	10T	34.44
WP232	532724.00	4499755.00	1197.00	WGD	UTM/UPS	10T	94.92
WP233	534740.00	4499457.00	1195.00	WGD	UTM/UPS	10T	2037.91
WP234	534702.00	4499669.00	1205.00	WGD	UTM/UPS	10T	215.38
WP235	534850.00	4499717.00	1205.00	WGD	UTM/UPS	10T	155.59
WP236	534883.00	4499488.00	1230.00	WGD	UTM/UPS	10T	231.37

Waypoints collected on 9/4/97

WP I.D.	easting(m)	northing(m)	elev(ft)	datum	Coord. Sys.	Unit	Distance Btwn WP (m)
WP237	535259.00	4499523.00	1195.00	WGD	UTM/UPS	10T	
WP238	532923.00	4499848.00	1174.00	WGD	UTM/UPS	10T	2358.50
WP239	532891.00	4499726.00	1184.00	WGD	UTM/UPS	10T	126.13
WP240	532895.00	4499740.00	1186.00	WGD	UTM/UPS	10T	14.56
WP241	532907.00	4499754.00	1180.00	WGD	UTM/UPS	10T	18.44
WP242	532908.00	4499768.00	1186.00	WGD	UTM/UPS	10T	14.04
WP243	532918.00	4499782.00	1188.00	WGD	UTM/UPS	10T	17.20
WP244	532931.00	4499804.00	1186.00	WGD	UTM/UPS	10T	25.55
WP245	532925.00	4499827.00	1210.00	WGD	UTM/UPS	10T	23.77
WP246	533189.00	4499736.00	1201.00	WGD	UTM/UPS	10T	279.24
WP247	533169.00	4499655.00	1202.00	WGD	UTM/UPS	10T	83.43
WP248	533161.00	4499670.00	1217.00	WGD	UTM/UPS	10T	17.00
WP249	533165.00	4499682.00	1218.00	WGD	UTM/UPS	10T	12.65
WP250	533174.00	4499695.00	1216.00	WGD	UTM/UPS	10T	15.81
WP251	533184.00	4499714.00	1212.00	WGD	UTM/UPS	10T	21.47
WP252	533189.00	4499729.00	1199.00	WGD	UTM/UPS	10T	15.81
WP253	533190.00	4499741.00	1213.00	WGD	UTM/UPS	10T	12.04
WP254	533346.00	4499747.00	1217.00	WGD	UTM/UPS	10T	156.12
WP255	533330.00	4499650.00	1204.00	WGD	UTM/UPS	10T	98.31
WP256	533328.00	4499661.00	1208.00	WGD	UTM/UPS	10T	11.18
WP257	533345.00	4499680.00	1203.00	WGD	UTM/UPS	10T	25.50
WP258	533341.00	4499692.00	1207.00	WGD	UTM/UPS	10T	12.65

WP259	533347.00	4499714.00	1206.00	WGD	UTM/UPS	10T	22.80
WP260	533349.00	4499735.00	1209.00	WGD	UTM/UPS	10T	21.10
WP261	533103.00	4499666.00	1208.00	WGD	UTM/UPS	10T	255.49
WP262	533125.00	4499768.00	1194.00	WGD	UTM/UPS	10T	104.35
WP263	533101.00	4499762.00	1203.00	WGD	UTM/UPS	10T	24.74
WP264	533070.00	4499674.00	1195.00	WGD	UTM/UPS	10T	93.30
WP265	533054.00	4499686.00	1214.00	WGD	UTM/UPS	10T	20.00
WP266	533074.00	4499781.00	1195.00	WGD	UTM/UPS	10T	97.08
WP267	533040.00	4499797.00	1203.00	WGD	UTM/UPS	10T	37.58
WP268	533021.00	4499694.00	1196.00	WGD	UTM/UPS	10T	104.74
WP269	534705.00	4499677.00	1177.00	WGD	UTM/UPS	10T	1684.09
WP270	534756.00	4499464.00	1191.00	WGD	UTM/UPS	10T	219.02
WP271	534899.00	4499484.00	1194.00	WGD	UTM/UPS	10T	144.39
WP272	534856.00	4499723.00	1193.00	WGD	UTM/UPS	10T	242.84

Table A2. ADCP data collected in Whiskeytown Lake on August 13, 1997 (metric units)

filename	Location	No. of Ens	Time	Total time (sec)	Discharge (L/s)	Path dist (cm)	DistMG (cm)	Area (cm^2)	Avg Depth (cm)
UCD001R.000	Profile just D/S of plunge zone at WP190	54	11:44:43	120	-264	1531	383	185573	485
UCD002R.000	Profile D/S of plunge zone at WP191	126	12:16:46	282	-146	1578	34	16563	488
UCD003R.000	Profile at WP193, Left Bank	110	12:47:12	247	558	1113	64	31847	500
UCD004R.000	Profile at WP194	110	13:00:31	247	-258	1603	169	83222	493
UCD005R.000	Profile at WP195	100	13:10:48	223	4139	1438	564	253886	450
UCD006R.000	Profile at WP196	110	13:19:31	245	603	1629	102	42737	421
UCD007R.000	Profile at WP197, Right Bank	110	13:27:25	236	-423	1365	235	70523	300
UCD008R.000	Transect (RB to LB) D/S of plunge	92	13:34:23	201	47396	9869	9206	3415393	371
UCD009R.000	Transect D/S thru plunge to curtain	450	13:40:01	1011	-20490	54962	50689	21644071	427
UCD009R.001	Transect D/S thru plunge to curtain cont...	450	13:40:01	1011	-29857	28184	27517	11392133	414
UCD009R.002	Transect D/S thru plunge to curtain cont...	450	13:40:01	1011	-19334	6364	6356	3553109	559
UCD009R.SUM	Transect D/S thru plunge to curtain cont...	450	13:40:01	1011	-69681	89510	84562	36589313	466.6
UCD010R.000	Transect D/S of Curtain (LbtoRB) LB@WP198	212	15:09:52	535	-64120	20911	20741	32376175	1561
UCD010R.001	Transect D/S of Curtain (LBtoRB)	212	15:09:52	535	-1492	1327	1328	1026712	773
UCD010R.SUM	Transect D/S of Curtain (LBtoRB)	212	15:09:52	535	-65612	22238	22069	33402887	1167
UCD011R.000	Transect D/S of Curtain (RbtoLB)RB@WP199 LB at WP200	195	15:22:15	503	55144	22096	21902	40518172	1850

Table A3. ADCP data collected in Whiskeytown Lake on September 3, 1997

filename	Transect Location	No. of Ens	Time	Total time(sec)	Discharge (L/s)	Path dist (cm)	DistMG (cm)	Area (cm^2)	Avg Depth (cm)
ADCP data collected upstream of plunge zone									
UCD001R.000	Profile at WP201, right bank	50	11:21:21	106	0	1349	441	55532	126
UCD002R.000	Profile at WP202	50	11:25:41	106	216	707	491	85994	175
UCD003R.000	Profile at WP203	50	11:30:38	109	-1580	638	255	72689	285
UCD004R.000	Profile at WP204	50	11:34:34	110	1246	1002	787	268339	341
UCD005R.000	Profile at WP205, left bank	50	11:39:23	110	-655	376	247	89990	364
UCD006R.000	Transect (LB to RB) from WP206 to 207	123	11:42:37	270	-37951	9203	8740	2359864	270
UCD007R.000	bad data file	21	12:01:46	45	795	237	178	48631	273
ADCP data collected just downstream of plunge zone									
UCD008R.000	Profile at WP209, right bank	53	12:08:25	118	806	745	36	20488	574
UCD009R.000	Profile at WP210	50	12:13:38	112	2523	830	299	191427	641
UCD010R.000	Profile at WP211	52	12:18:18	115	-403	1061	134	48472	362
UCD011R.000	Profile at WP213	50	12:26:24	105	903	449	344	95647	278
UCD012R.000	Profile at WP214, left bank	50	12:30:02	105	-248	900	601	191229	318
UCD013R.000	Transect (LBtoRB) from WP215 to 216	101	12:33:12	223	-56082	9783	9176	3716190	405
ADCP data collected 100 meters downstream of plunge zone									
UCD014R.000	Profile at WP216, right bank	50	12:41:42	111	30	595	89	38541	435
UCD015R.000	Profile at WP217	50	12:45:30	111	1316	519	141	70964	504
UCD016R.000	Profile at WP218	57	12:49:42	127	-1594	919	187	96443	515
UCD017R.000	Profile at WP219	50	12:53:28	111	-647	1428	312	165930	532
UCD018R.000	Profile at WP220	52	12:56:57	115	-955	1360	612	308272	504
UCD019R.000	Profile at WP221	50	13:00:37	110	717	722	200	105601	528
UCD020R.000	Profile at WP222, left bank	50	13:04:12	107	-852	755	387	193730	500
UCD021R.000	Transect (LBtoRB) from WP223 to 224	154	13:07:20	343	-65304	13736	13004	6436772	495

ADCP data collected upstream from flow separation point

filename	Transect Location	stop ens	Time	Total time(sec)	discharge (L/s)	path dist(cm)	DistMG (cm)	Area (cm^2)	Avg Depth (cm)
UCD022R.000	Transect (LBtoRB) from WP225 to 226	107	13:20:00	240	-45890	9856	9605	3976645	414
UCD023R.000	Transect (RBtoLB) from WP227 to 228	109	13:25:53	244	49474	9736	9334	3826956	410
UCD024R.000	Transect (LBtoRB) from WP229 to 230	110	13:31:32	245	-54887	11420	11083	4566155	412
UCD025R.000	Transect (RBtoLB) from WP231 to 232	88	13:37:02	195	57088	9669	9147	3860177	422
ADCP data collected downstream of Oak Bottom Curtain									
UCD026R.000	Transect (RBtoLB) from WP233 to 234	130	14:02:50	324	35755	20654	20565	30909243	1503
UCD027R.000	Transect (LBtoRB) from WP235 to 236	152	14:11:02	388	-70948	22783	22469	41859619	1863
Profile collected in mid-lake									
UCD028R.000	Profile at WP237, right bank	117	14:23:43	316	-14228	7164	5861	15497477	2644

Table A4. ADCP data collected in Whiskeytown Lake on September 4, 1997 (metric units).

filename	Location	No. of Ens.	Time	Total time(sec)	Discharge (L/s)	Path dist(cm)	DistMG (cm)	Area (cm^2)	Avg Depth (cm)
ADCP data collected upstream of plunge zone									
UCD001R.000	Transect (LBtoRB)from WP238 to 239	119	13:29:01	265	-70130	13471	13006	6242849	480
UCD002R.000	Profile at WP240, right bank	201	13:36:32	455	6159	2865	2160	1084280	502
UCD003R.000	Profile at WP241	40	13:55:20	89	2146	443	240	117772	490
UCD004R.000	Profile at WP242	40	13:59:00	89	2925	532	333	170988	514
UCD005R.000	Profile at WP243	40	14:02:29	88	3406	518	322	166912	519
UCD006R.000	Profile at WP244	40	14:05:21	88	1954	375	329	161252	490
UCD007R.000	Profile at WP245, left bank	50	14:08:16	111	-895	1133	1020	548874	538
ADCP data collected downstream of plunge zone									
UCD009R.000	Transect (LBtoRB)from WP246 to 247	68	14:17:39	153	-85647	9933	9446	5610859	594
UCD010R.000	Profile at WP248, right bank	41	14:23:48	93	1615	1240	626	408789	653
UCD011R.000	Profile at WP249	40	14:27:17	89	-2937	542	251	155890	620
UCD012R.000	Profile at WP250	40	14:30:16	90	4636	723	453	297365	656
UCD013R.000	Profile at WP251	50	14:33:07	114	1749	1115	741	481536	650
UCD014R.000	Profile at WP252	40	14:36:18	89	1127	983	558	342478	614
UCD015R.000	Profile at WP253, left bank	40	14:39:16	87	243	204	51	25014	494
ADCP data collected 140 meters downstream from plunge zone									
UCD016R.000	Transect (LBtoRB)from WP254 to 255	87	14:43:37	196	-89332	10022	9785	6017853	615
UCD017R.000	Profile at WP256, right bank	40	14:48:16	94	3274	1246	752	552878	735
UCD018R.000	Profile at WP257	40	14:51:16	93	1530	1099	500	383730	768
UCD019R.000	Profile at WP258	40	14:54:31	91	-455	956	580	389491	672
UCD020R.000	Profile at WP259	43	14:57:18	95	4007	1047	641	379485	592
UCD021R.000	Profile at WP260, left bank	40	15:00:28	87	2092	552	435	247531	569
ADCP data collected just upstream from plunge zone									
UCD022R.000	Transect (RBtoLB)from WP261 to 262	98	15:14:55	219	90966	10951	10668	5664652	531

ADCP data collected 25 meters upstream from plunge zone									
UCD023R.000	Transect (LBtoRB)from WP263 to 264	73	15:19:39	163	-89574	9491	9216	5087201	552
ADCP data collected 57 meters upstream from plunge zone									
UCD024R.000	Transect (RBtoLB)from WP265 to 266	94	15:23:27	210	78391	10653	9947	4824372	485
ADCP data collected 95 meters upstream from plunge zone									
UCD025R.000	Transect (LBtoRB)from WP267 to 268	91	15:28:14	202	-78125	10304	10055	5057790	503
ADCP data collected just downstream from Oak Bottom Curtain									
UCD026R.000	Transect (RBtoLB)from WP269 to 270	149	15:50:02	372	-91880	21801	21552	32715635	1518
ADCP data collected 152 meters downstream from Oak Bottom Curtain									
UCD027R.000		152	15:58:09	385	92439	23622	23350	40932054	1753

APPENDIX B

Table B1. Bi-hourly operations at Judge Francis Carr and Spring Creek powerplants for August 10-16, 1997 (from CDEC).

Date	Time	Carr PP (CFS)	Spring Crk. PP (CFS)
08/10/96	01:00	2925.0	1957.8
08/10/96	03:00	3651.6	1924.3
08/10/96	05:00	3460.9	1914.3
08/10/96	07:00	3562.1	2786.6
08/10/96	09:00	2775.7	3749.8
08/10/96	11:00	3365.4	3753.0
08/10/96	13:00	2584.0	3741.5
08/10/96	15:00	3178.4	3751.3
08/10/96	17:00	1957.2	3299.5
08/10/96	19:00	3541.7	3739.1
08/10/96	21:00	2974.1	3743.6
08/10/96	23:00	2916.0	3103.9
08/11/96	03:00	3287.9	2133.1
08/11/96	05:00	3866.0	2134.6
08/11/96	07:00	3568.4	2991.8
08/11/96	09:00	2974.7	3749.8
08/11/96	11:00	2969.2	3741.7
08/11/96	13:00	2788.4	3746.2
08/11/96	15:00	2973.2	3743.0
08/11/96	17:00	3362.1	3747.0
08/11/96	19:00	3310.8	3695.7
08/11/96	21:00	2951.5	3721.0
08/11/96	23:00	3451.7	2869.8
08/12/96	01:00	3424.1	2269.3
08/12/96	03:00	3538.1	2195.7
08/12/96	05:00	3315.2	2156.3
08/12/96	07:00	4083.6	2145.0
08/12/96	09:00	3295.5	2132.4
08/12/96	13:00	3154.6	3731.2
08/12/96	15:00	3135.8	3722.3
08/12/96	19:00	2925.6	3701.1
08/12/96	21:00	3240.4	2266.4
08/12/96	23:00	3581.4	2229.2
08/13/96	01:00	3387.2	2224.1
08/13/96	03:00	3408.5	2245.4

08/13/96	07:00	3606.4	2831.3
08/13/96	09:00	3206.2	3404.7
08/13/96	13:00	2950.0	3725.6
08/13/96	15:00	3337.9	3725.5
08/13/96	17:00	2952.2	3727.7
08/13/96	19:00	2948.8	3724.4
08/13/96	21:00	3215.0	3602.6
08/13/96	23:00	3174.4	3562.0
08/14/96	01:00	2832.9	2246.8
08/14/96	03:00	3374.1	2211.0
08/14/96	05:00	3379.8	2216.7
08/14/96	07:00	3417.0	2253.9
08/14/96	13:00	3332.2	3719.8
08/14/96	15:00	2949.1	3724.6
08/14/96	17:00	2948.8	3724.0
08/14/96	19:00	2947.1	3722.6
08/14/96	21:00	3333.6	3721.2
08/14/96	23:00	3103.1	3680.2
08/15/96	03:00	3364.7	2201.6
08/15/96	05:00	3397.3	2234.2
08/15/96	07:00	3191.2	3002.1
08/15/96	09:00	2934.7	3710.2
08/15/96	11:00	2935.4	3710.6
08/15/96	13:00	3317.5	3705.5
08/15/96	15:00	2936.6	3711.8
08/15/96	17:00	3129.9	3706.9
08/15/96	21:00	2933.2	3708.7
08/15/96	23:00	3108.6	3496.2
08/16/96	01:00	3130.6	2156.6
08/16/96	03:00	3287.5	2133.9
08/16/96	05:00	3107.2	2133.2
08/16/96	07:00	3460.7	2884.1
08/16/96	09:00	2902.2	3677.7
08/16/96	11:00	2957.1	3732.3
08/16/96	13:00	3147.8	3724.8
08/16/96	15:00	3335.0	3722.6
08/16/96	17:00	2944.8	3720.3
08/16/96	19:00	2945.7	3720.8
08/16/96	21:00	2563.5	3726.6
08/16/96	23:00	3171.6	2973.1

Table B2. Hourly operations at Judge Francis Carr and Spring Creek powerplants for September 1-6, 1997 (from Central Valley Operations).

Date	Time	Carr PP (CFS)	Spring Cr. PP (CFS)
09/01/97	00:00	0.0	0.0
09/01/97	01:00	0.0	0.0
09/01/97	02:00	0.0	0.0
09/01/97	03:00	0.0	0.0
09/01/97	04:00	0.0	0.0
09/01/97	05:00	0.0	0.0
09/01/97	06:00	0.0	0.0
09/01/97	07:00	0.0	0.0
09/01/97	08:00	0.0	0.0
09/01/97	09:00	969.6	0.0
09/01/97	10:00	1696.8	1249.3
09/01/97	11:00	1696.8	1989.7
09/01/97	12:00	1696.8	1966.5
09/01/97	13:00	1696.8	2730.0
09/01/97	14:00	1696.8	3354.7
09/01/97	15:00	1696.8	3354.7
09/01/97	16:00	1696.8	3354.7
09/01/97	17:00	1696.8	3354.7
09/01/97	18:00	1696.8	2591.2
09/01/97	19:00	1696.8	902.3
09/01/97	20:00	1696.8	0.0
09/01/97	21:00	1555.4	0.0
09/01/97	22:00	606.0	0.0
09/01/97	23:00	0.0	0.0
09/02/97	00:00	0.0	0.0
09/02/97	01:00	0.0	0.0
09/02/97	02:00	0.0	0.0
09/02/97	03:00	0.0	0.0
09/02/97	04:00	0.0	0.0
09/02/97	05:00	1182.5	0.0
09/02/97	06:00	1773.8	0.0
09/02/97	07:00	1752.7	0.0
09/02/97	08:00	1752.7	0.0
09/02/97	09:00	1752.7	0.0
09/02/97	10:00	1752.7	1024.7
09/02/97	11:00	1752.7	1918.6
09/02/97	12:00	1752.7	1918.6

09/02/97	13:00	1752.7	1918.6
09/02/97	14:00	1752.7	1918.6
09/02/97	15:00	1752.7	1918.6
09/02/97	16:00	1752.7	1918.6
09/02/97	17:00	1752.7	1918.6
09/02/97	18:00	2280.6	1918.6
09/02/97	19:00	2829.7	1918.6
09/02/97	20:00	2280.6	1918.6
09/02/97	21:00	1731.6	1918.6
09/02/97	22:00	0.0	959.3
09/02/97	23:00	0.0	0.0
09/03/97	00:00	0.0	0.0
09/03/97	01:00	0.0	0.0
09/03/97	02:00	0.0	0.0
09/03/97	03:00	0.0	0.0
09/03/97	04:00	0.0	0.0
09/03/97	05:00	0.0	0.0
09/03/97	06:00	0.0	0.0
09/03/97	07:00	0.0	0.0
09/03/97	08:00	656.3	693.9
09/03/97	09:00	1722.7	1713.1
09/03/97	10:00	1722.7	1713.1
09/03/97	11:00	1722.7	1734.8
09/03/97	12:00	1722.7	1713.1
09/03/97	13:00	1722.7	1713.1
09/03/97	14:00	1722.7	1713.1
09/03/97	15:00	1722.7	1713.1
09/03/97	16:00	1722.7	1713.1
09/03/97	17:00	1722.7	1713.1
09/03/97	18:00	512.7	433.7
09/03/97	19:00	0.0	0.0
09/03/97	20:00	0.0	0.0
09/03/97	21:00	0.0	0.0
09/03/97	22:00	0.0	0.0
09/03/97	23:00	0.0	0.0
09/04/97	00:00	0.0	0.0
09/04/97	01:00	0.0	0.0
09/04/97	02:00	0.0	0.0
09/04/97	03:00	0.0	0.0
09/04/97	04:00	0.0	0.0
09/04/97	05:00	0.0	0.0
09/04/97	06:00	0.0	0.0

09/04/97	07:00	0.0	0.0
09/04/97	08:00	1455.6	1799.6
09/04/97	09:00	2911.3	2865.2
09/04/97	10:00	2865.8	2841.5
09/04/97	11:00	2865.8	2841.5
09/04/97	12:00	2865.8	2841.5
09/04/97	13:00	2865.8	2841.5
09/04/97	14:00	2888.5	2841.5
09/04/97	15:00	2888.5	2841.5
09/04/97	16:00	2888.5	2817.8
09/04/97	17:00	1455.6	1420.7
09/04/97	18:00	0.0	0.0
09/04/97	19:00	0.0	0.0
09/04/97	20:00	0.0	0.0
09/04/97	21:00	0.0	0.0
09/04/97	22:00	0.0	0.0
09/04/97	23:00	0.0	0.0
09/05/97	00:00	0.0	0.0
09/05/97	01:00	0.0	0.0
09/05/97	02:00	0.0	0.0
09/05/97	03:00	0.0	0.0
09/05/97	04:00	0.0	0.0
09/05/97	05:00	0.0	0.0
09/05/97	06:00	0.0	0.0
09/05/97	07:00	0.0	0.0
09/05/97	08:00	1147.4	0.0
09/05/97	09:00	1606.4	1106.2
09/05/97	10:00	1606.4	1964.0
09/05/97	11:00	1606.4	2031.7
09/05/97	12:00	1606.4	2009.1
09/05/97	13:00	1606.4	2031.7
09/05/97	14:00	1606.4	2031.7
09/05/97	15:00	1564.7	2009.1
09/05/97	16:00	1543.8	1986.6
09/05/97	17:00	1606.4	2009.1
09/05/97	18:00	1606.4	1015.9
09/05/97	19:00	813.6	0.0
09/05/97	20:00	0.0	0.0
09/05/97	21:00	0.0	0.0
09/05/97	22:00	0.0	0.0
09/05/97	23:00	0.0	0.0
09/06/97	00:00	0.0	0.0

09/06/97	01:00	0.0	0.0
09/06/97	02:00	0.0	0.0
09/06/97	03:00	0.0	0.0
09/06/97	04:00	0.0	0.0
09/06/97	05:00	0.0	0.0
09/06/97	06:00	0.0	0.0
09/06/97	07:00	0.0	757.7
09/06/97	08:00	761.3	1515.5
09/06/97	09:00	1542.6	1515.5
09/06/97	10:00	1542.6	1539.1
09/06/97	11:00	1562.6	1539.1
09/06/97	12:00	1542.6	1515.5
09/06/97	13:00	1562.6	1515.5
09/06/97	14:00	1542.6	1515.5
09/06/97	15:00	1542.6	1515.5
09/06/97	16:00	1542.6	1491.8
09/06/97	17:00	1542.6	1515.5
09/06/97	18:00	1542.6	1515.5
09/06/97	19:00	1542.6	1515.5
09/06/97	20:00	1562.6	1515.5
09/06/97	21:00	220.4	189.4
09/06/97	22:00	0.0	0.0
09/06/97	23:00	0.0	0.0

Appendix C

BEGIN RDI CONFIGURATION FILE: **UCD97.CFG**

```
COMMUNICATIONS
{
ADCP        ( ON   COM1 9600 N 8 1 ) [ Port Baud Parity Databits Stopbits ]
ENSOUT      ( OFF  COM2 9600 N 8 1 ) [ Port Baud Parity Databits Stopbits ]
NAV         ( ON   COM3 4800 N 8 1 ) [ Port Baud Parity Databits Stopbits ]
REFOUT      ( OFF  COM4 9600 N 8 1 ) [ Port Baud Parity Databits Stopbits ]
EXTERNAL    ( OFF  COM4 9600 N 8 1 ) [ Port Baud Parity Databits Stopbits ]
}

ENSEMBLE OUT
{
ENS CHOICE  ( N N N N N N N N ) [ Vel Corr Int %Gd Status Leader BTrack Nav ]
ENS OPTIONS ( NONE  1  8  1  8 ) [ Ref First Last Start End ]
}

ADCP HARDWARE
{
Firmware    ( 5.40 )
Angle       (   20 )
Frequency   (  600 )
System      ( EARTH )
Mode        (    4 )
Orientation (  DOWN )
Pattern     ( CONVEX )
}

DIRECT COMMANDS
{
WS50
WF50
BX330
WN066
WD111100000
WP00004
BP003
WM4
TP000000
WX999
BM4
ET1600
ES00
ED0005
EZ1111111
EX11111
CF11100
}

RECORDING
```

```
{
Deployment ( UCD )
Drive 1   ( C )
Drive 2   ( C )
ADCP      ( YES )
Average   ( NO )
Navigation ( YES )
}

CALIBRATION
{
ADCP depth              (  0.52 m     )
Heading / Magnetic offset ( 0.00     0.00 deg )
Transducer misalignment   (  0.00 deg   )
Intensity scale         (  0.43 dB/cts )
Absorption              (  0.139 dB/m  )
Salinity                (  0.0 ppt   )
Speed of sound correction ( NO    -1.0 )
Pitch & roll compensation (   YES      )
Tilt Misalignment       (  0.00 deg   )
Pitch_Offset            (  0.000 deg   )
Roll_Offset             (  0.000 deg   )
Top discharge estimate    (  CONSTANT   )
Bottom discharge estimate (  CONSTANT   )
Power curve exponent      (  0.1667   )
}

PROCESSING
{
Average every ( 0.00 s )
Depth sounder ( NO )
Refout_info (  1  8  30.00  1.000 0      1) [bins:1st last, limit, weight, format, delaysec]
External_formats  ( N N N N )  [ HDT HDG RDID RDIE ]
External_decode   ( N N N N ) [ heading pitch roll temp ]
}

GRAPHICS
{
Units      ( SI )
Velocity Reference (  BOTTOM  )
East_Velocity     ( -30.5  30.5  cm/s )
North_Velocity    ( -30.5  30.5  cm/s )
Vert_Velocity     ( -30.5  30.5  cm/s )
Error_Velocity    ( -39.6  39.6  cm/s )
Depth             (    1    59   bin )
Intensity         (    0   100    dB)
Discharge         ( -101   101  m3/s )
East_Track        (  -79    70    m )
North_Track       ( -143     6    m )
Ship track        ( 4 bin  61.0  cm/s )
Proj_Velocity     ( -30.0  30.0  cm/s )
Proj_Angle        (  16.0  deg from N )
Bad_Below_Bottom  ( YES )
Line1             ( Whiskeytown Lake Bill Fleenor                )
```

Line2 (UCD plunging flow study Sept 3, 1997)
}

HISTORY
{
SOFTWARE (BB-TRANSECT)
Version (2.72)
}

END RDI CONFIGURATION FILE