Near Shore Water Temperature Data: August 12 to November 14, 2005

Data Delivery Report

By:

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Prepared for:

Grand Canyon Monitoring and Research Center
Flagstaff, Arizona

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Introduction

At the request of the Grand Canyon Monitoring and Research Center (GCMRC), we installed a total of 51 automatic temperature loggers at 11 sites within the Colorado River Ecosystem (CRE). The purpose of deploying the instruments was to monitor near-shore temperatures in two different aquatic habitats during the low-volume fall flow experiment. The loggers were deployed in a pattern that can provide information for ongoing temperature modeling efforts by defining both lateral and vertical temperatures gradients within the near shore environments. This report provides an outline of the methods, identifies some problems encountered, and briefly summarizes the data collected. The purpose of the report is to provide information (metadata) about the collection of the temperature dataset. The edited dataset is included as an Excel spreadsheet on the attached CD-Rom. The CD-Rom also contains the original files (Onset BoxCar 4.3 files, serial # of logger is the first # in filename), individual excel spreadsheets for each logger, original images of the figures in this report, and an ArcMAP shapefile with the temperature logger locations.

Methods

The data collected during this study provides near-shore temperature data during several different flow release patterns from Glen Canyon Dam (Figure 1). The temperature loggers were installed between August 7 and August 17, 2005, adjusted to the lower fall flow regime between September 4 and September 15, 2005, and retrieved between November 14 and November 25, 2005. The combined dataset (fall05temperatures.xls) was edited to delete the time between the change in flows from September 1 until the strings were adjusted to the new flow regime.

The temperature loggers used, Onset HOBO water temp pro, have a 12-bit resolution and a precision sensor accuracy of +/-0.2^{o}C (www.onsetcomp.com).

In cooperation with GCMRC personnel, we devised a relatively easy to install and camouflage system of deploying the sensors. The elevation of the logger "string" was semi-quantitatively estimated using direct observations of the flow levels, then measuring the depth to the low flow level by using the detailed stage discharge relationships developed by the NAU sand bar studies team. The loggers were deployed at each site along a small chain attached to the shoreline, with three loggers per "string" (Figure 2). The first logger (#1) was secured to the chain and a small rock approximately 10-20cm below the low water elevation. Logger #2 was secured to the chain and rock 3m from logger #1. Logger #3 was attached to a piece of floating driftwood directly above logger #2. Ideally, two "strings" were installed at each site: one string within a backwater environment and one within the same eddy system, but outside of the backwater. However, because the loggers were initially installed during a period of relatively high flows (10,500 to 18,000 ft^3/s, Figure 2), backwater habitats did not exist at these sites when the strings were deployed. During the September maintenance visit it was apparent where the backwater habitats existed. At sites where no backwaters existed, only one "string" of temperature loggers was deployed. Conversely, other sites were instrumented with additional loggers during the September visit.

Several problems were encountered with the logger deployment. During the September maintenance trip, most of the driftwood sticks used to float logger #3 had become covered with fine sediment and sunk. We do not know when the sticks ceased being buoyant and therefore, all of the #3 loggers up to the September adjustment should not be used for modeling vertical temperature gradients. In September, new sticks were acquired and attached to logger #3. Upon retrieval in November, we found that several of the sticks had once again sunk, but several were also still floating. Again, we do not know when, during the deployment they sank. The #3 loggers are identified in the spreadsheet as either floaters or sinkers. This designation only applies to the September through November period. Again, all #3 loggers up to the September adjustment should be considered sinkers. Another problem occurred in our estimation of the low water elevation. It was apparent upon downloading that several of the #1 loggers were mistakenly placed within the fluctuation zone and were partially or completely subaerially exposed. This occurred mostly during the August to September period and following the drop to lower flows on November 1, 2005 (Figure 1). It is apparent from the temperature plots where these exposures occurred (Appendix A: site maps and temperature plots). Future deployments should include a different system for floating the #3 sensor. A camouflaged system of artificial floats should be devised that would eliminate the floaters versus sinkers problems encountered with the driftwood sticks and to ensure that the loggers are not exposed to direct sunlight.

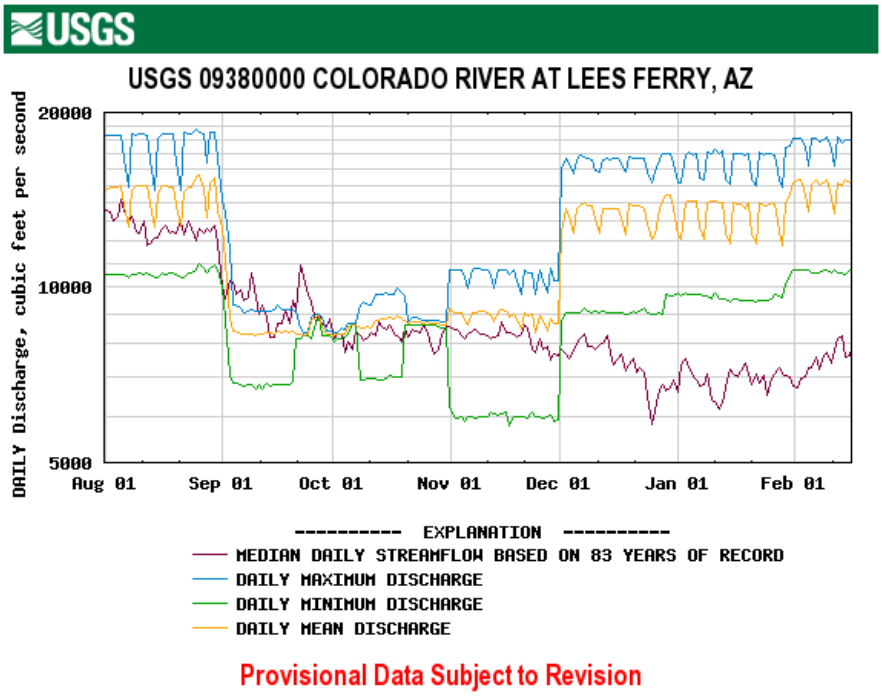


Figure 1. Daily maximum, minimum, and mean discharge of the Lees Ferry gage during study period.

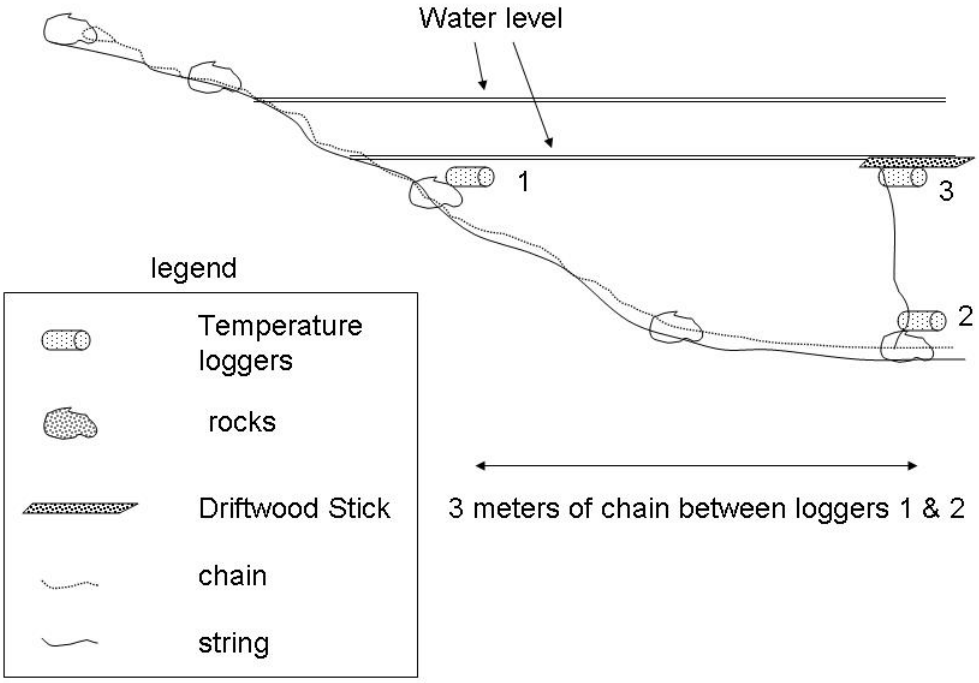
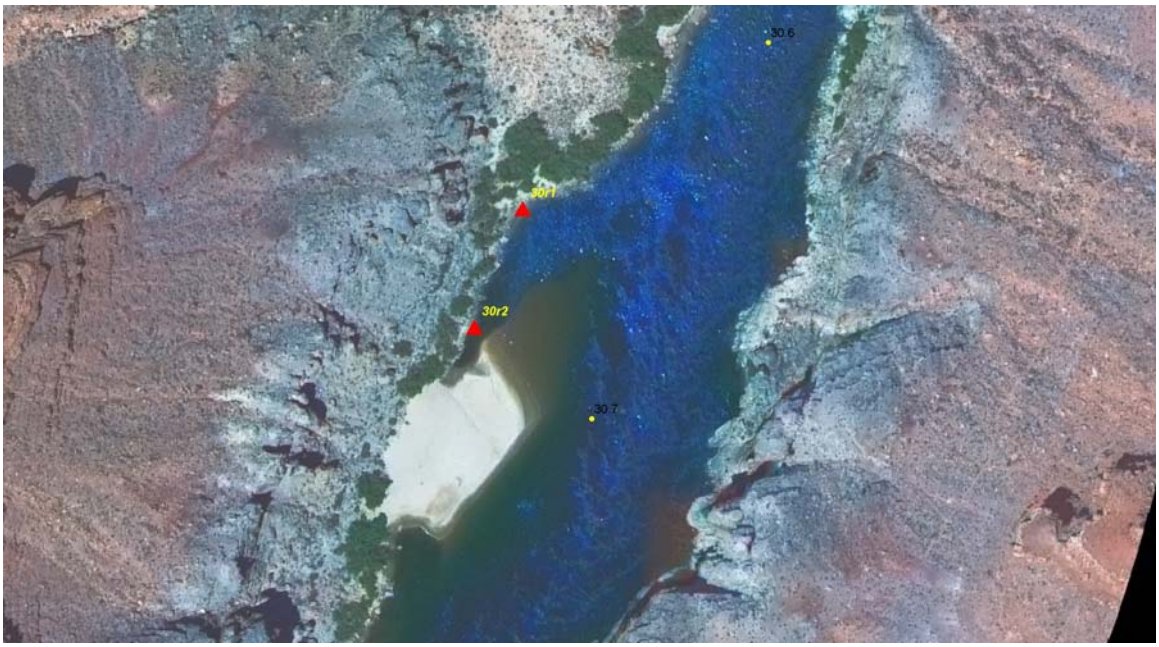


Figure 2. Schematic diagram showing a single temperature logger deployment, or "string", and the logger numbering system.

Appendix A: Site Maps and temperature plots from each string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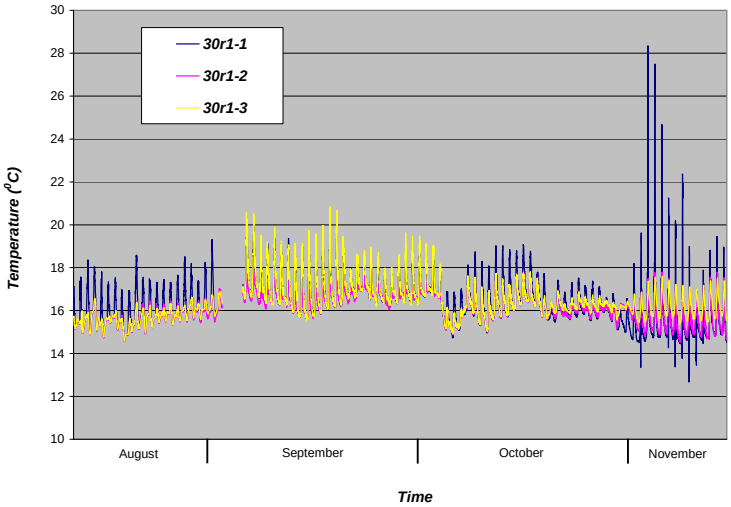
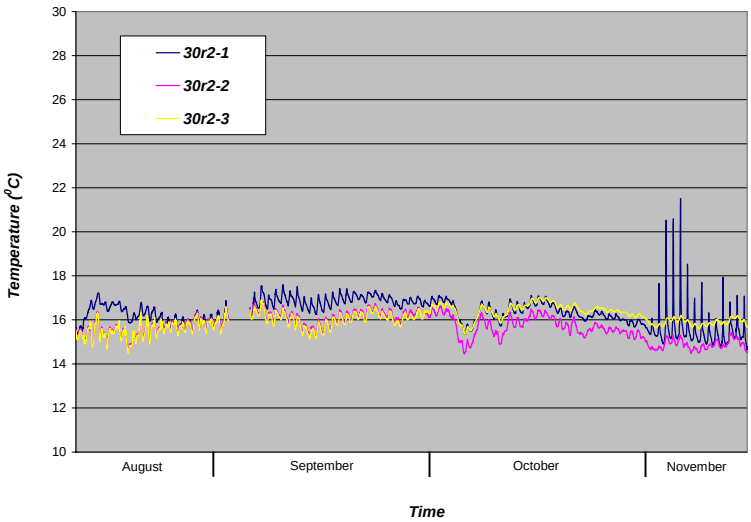
30r1
30r2
30.7


30r1-1
30r1-2
30r1-3
Temperature (°C)
30
28
26
24
22
20
18
16
14
12
10
August
September
October
November
Time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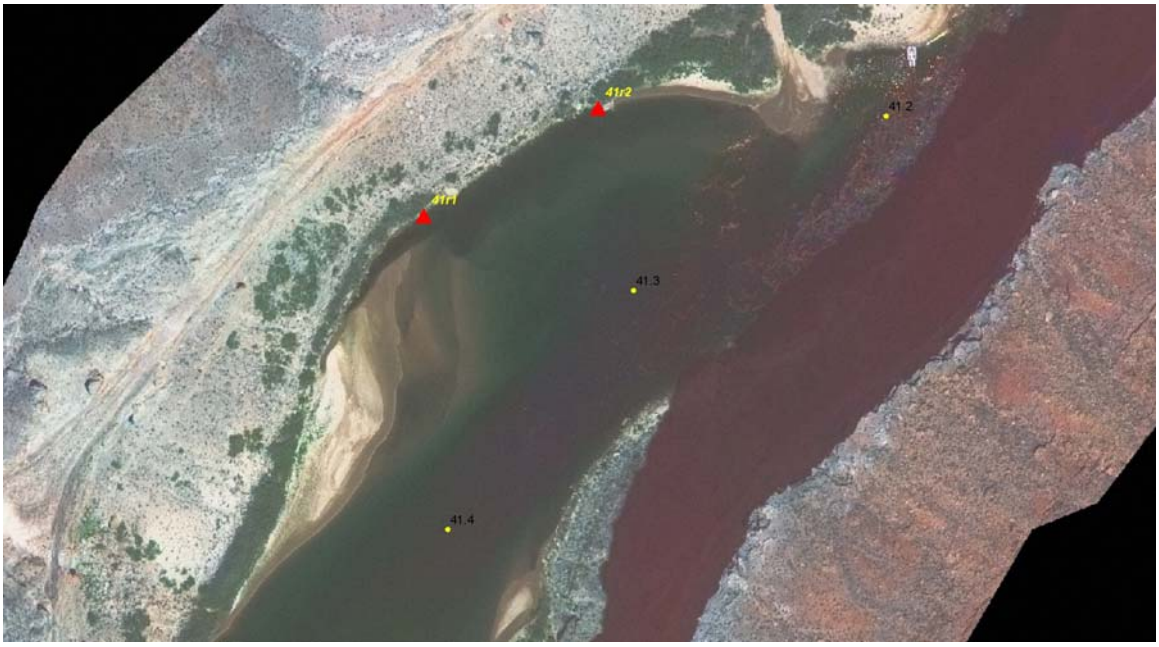
30r2-2
30r2-3
Temperature (°C)
30
28
26
24
22
20
18
16
14
12
10
August
September
October
November
Time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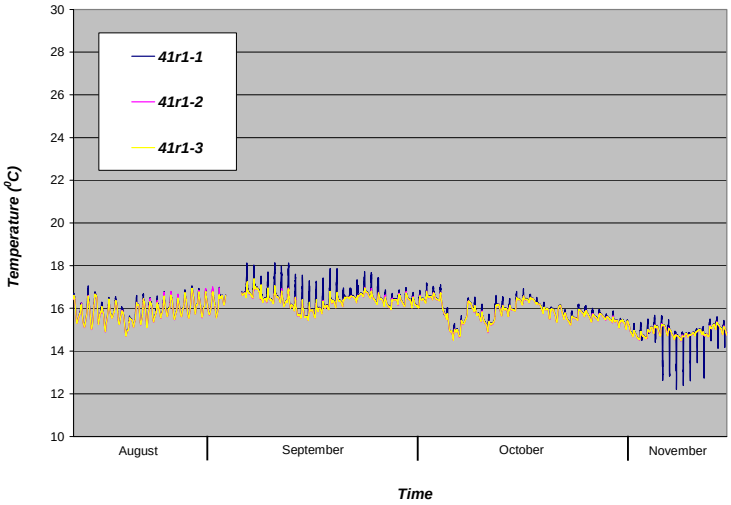
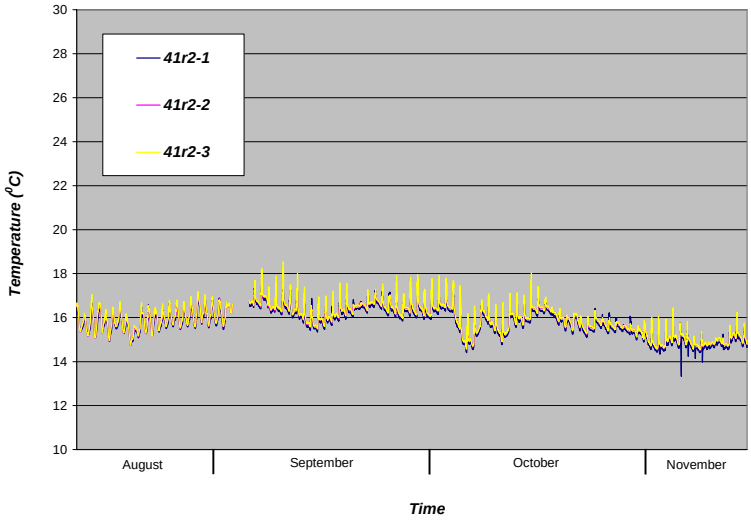
41.2
41r1
41.3
41.4


41r1-1
41r1-2
41r1-3
Temperature (°C)
30
28
26
24
22
20
18
16
14
12
10
August
September
October
November
Time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41r2-2
41r2-3
Temperature (°C)
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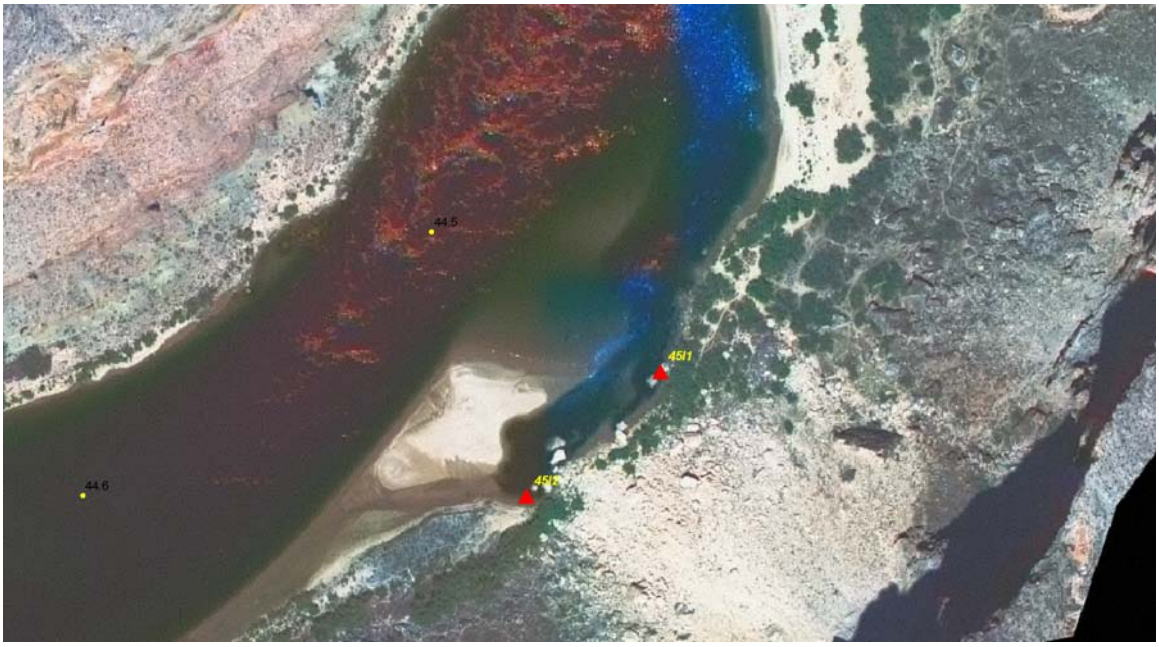
28
26
24
22
20
18
16
14
12
10
August
September
October
November
Time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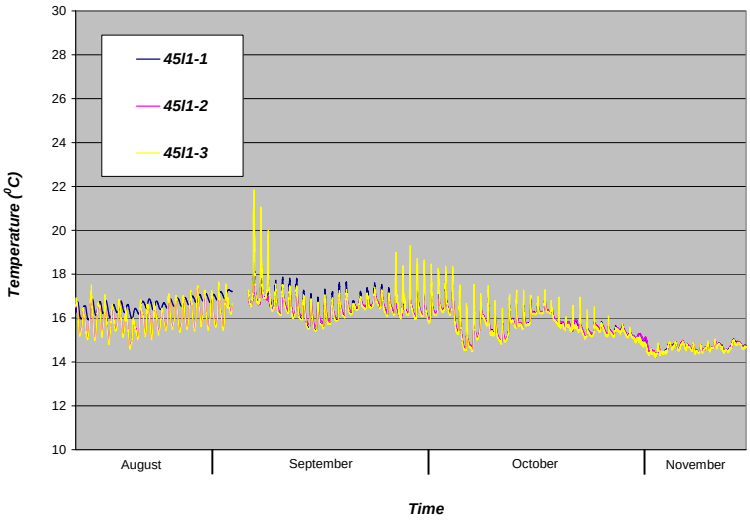
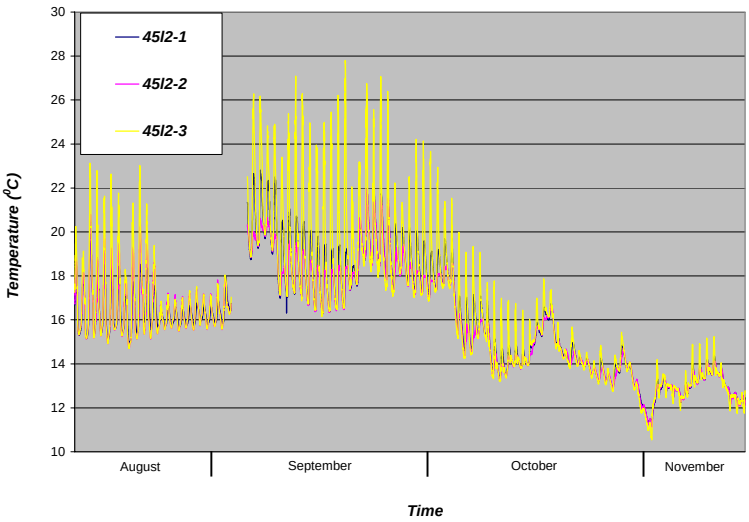
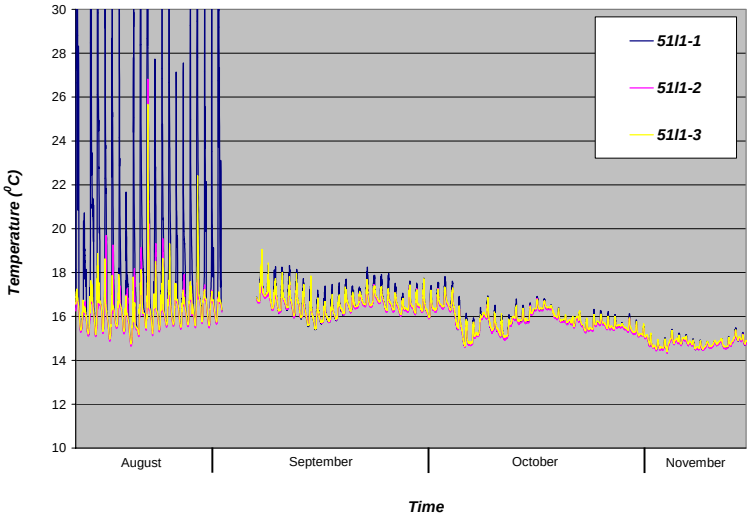
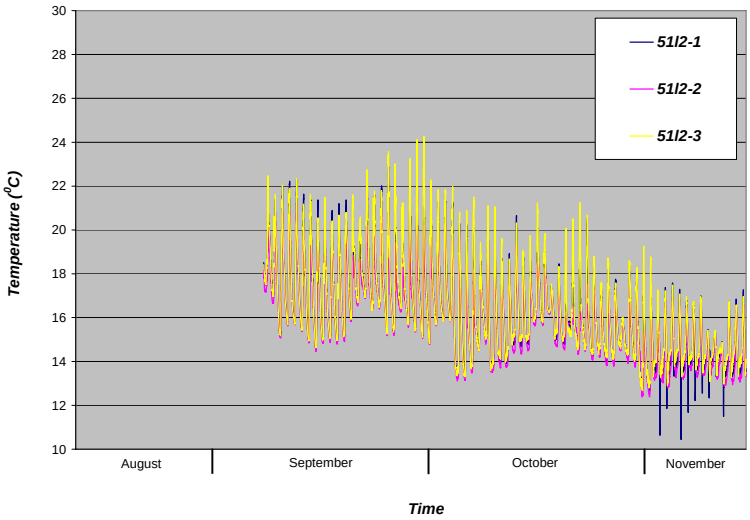
45I1
44.6
45I2


45I1-1
45I1-2
45I1-3
Temperature (°C)
30
28
26
24
22
20
18
16
14
12
10
August
September
October
November
Time


45I2-1
45I2-2
45I2-3
Temperature (°C)
30
28
26
24
22
20
18
16
14
12
10
August
September
October
November
Time

51.3
51I1
51I2
51.4


51I1-1
51I1-2
51I1-3
Temperature (°C)
30
28
26
24
22
20
18
16
14
12
10
August
September
October
November
Time


51I2-1
51I2-2
51I2-3
Temperature (°C)
30
28
26
24
22
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18
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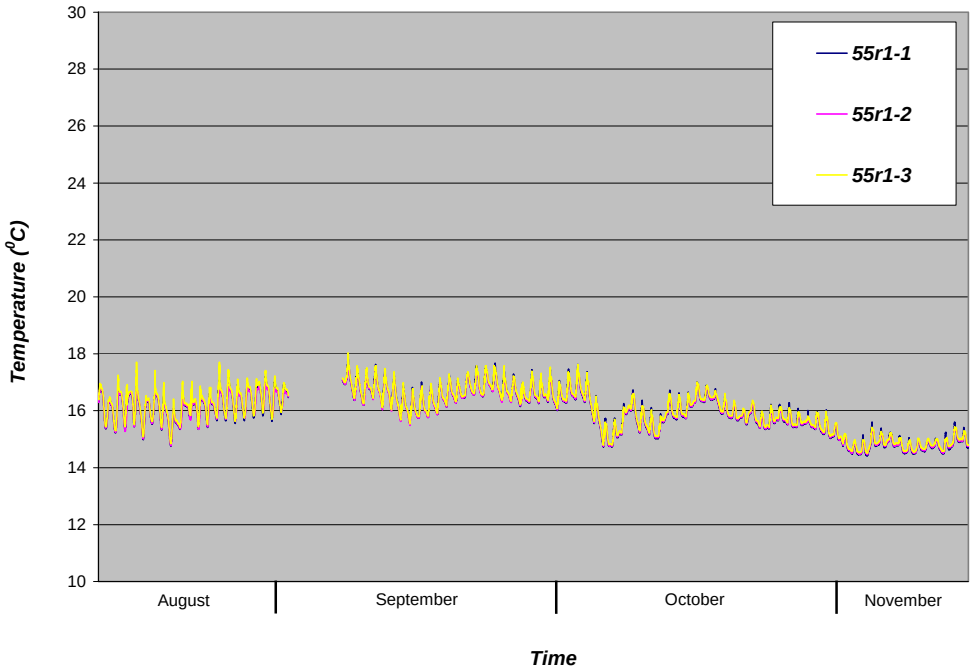
10
August
September
October
November
Time

55r1
55.7
55.8


30
28
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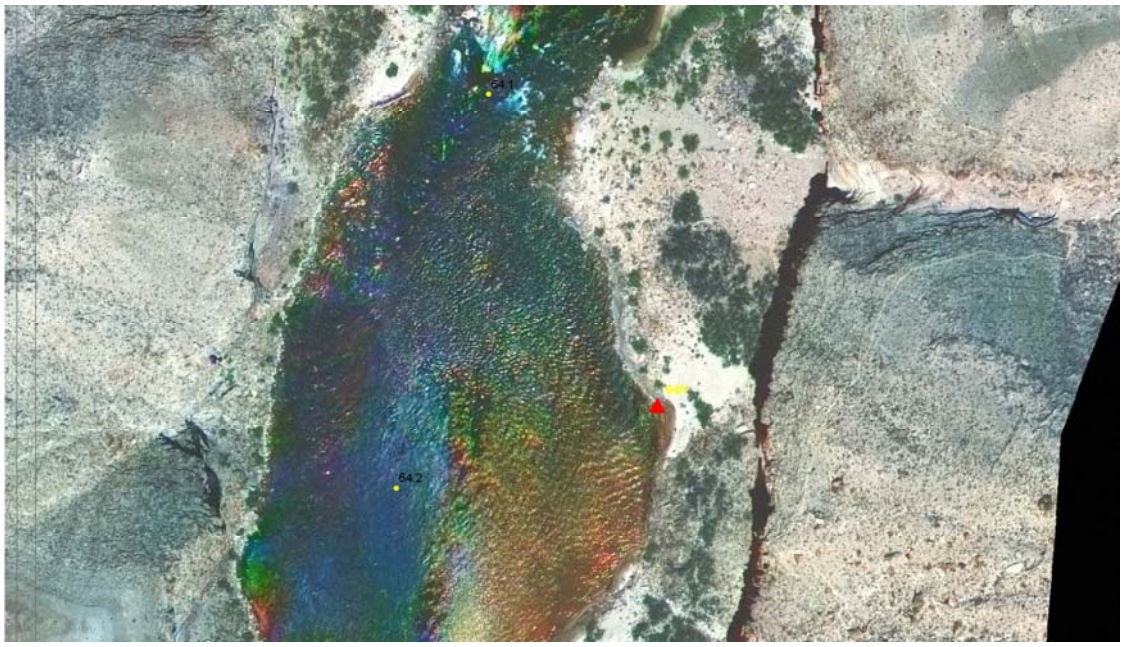
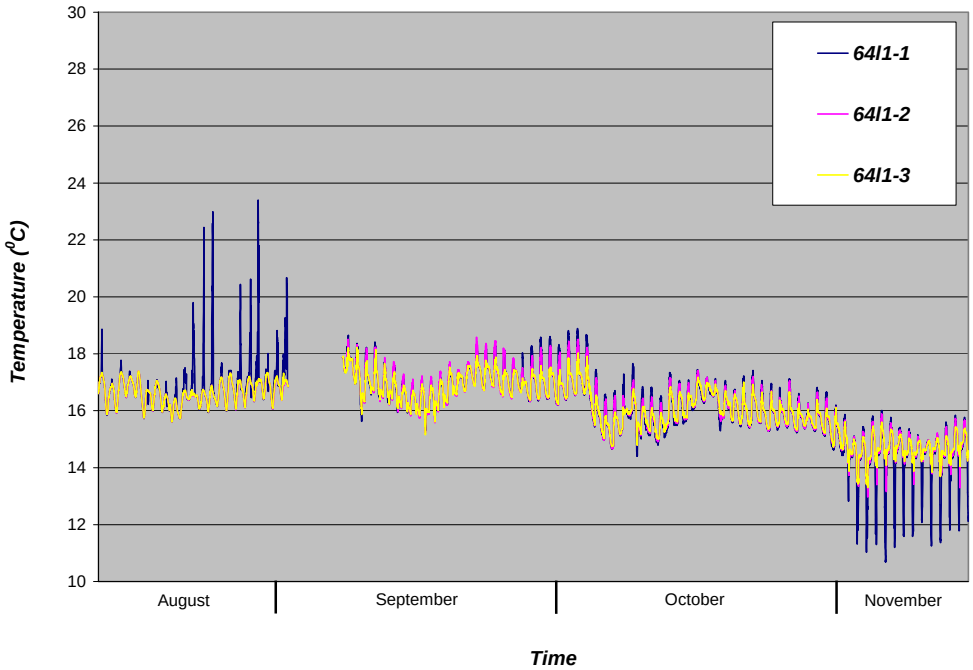
10
Temperature (°C)
55r1-1
55r1-2
55r1-3
August
September
October
November
Time


64.1
64.2


64l1-1
64l1-2
64l1-3
Temperature (°C)
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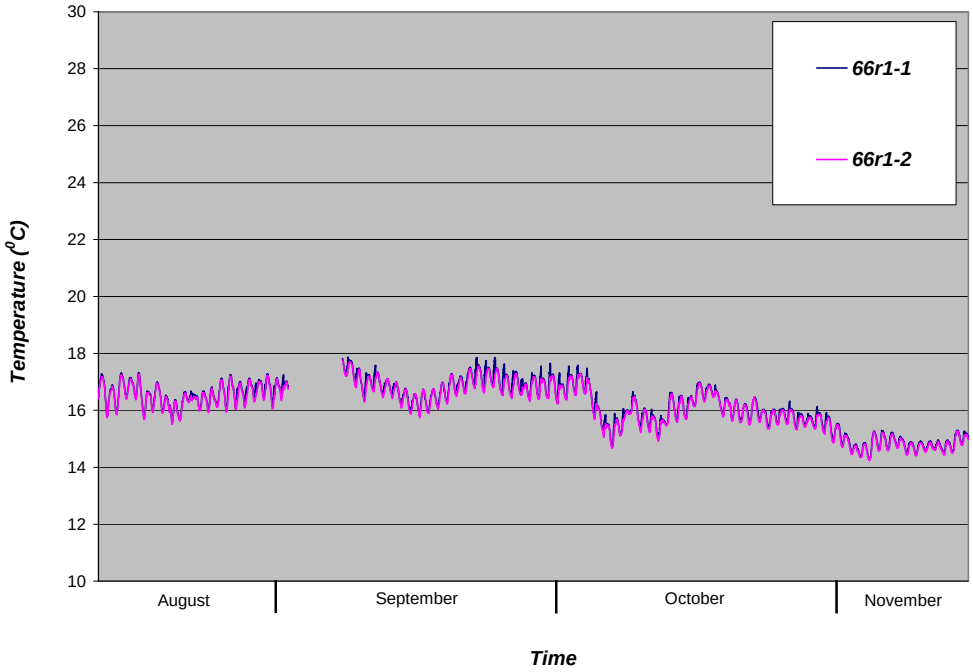
16
14
12
10
August
September
October
November
Time

64.9
66r1
65


30
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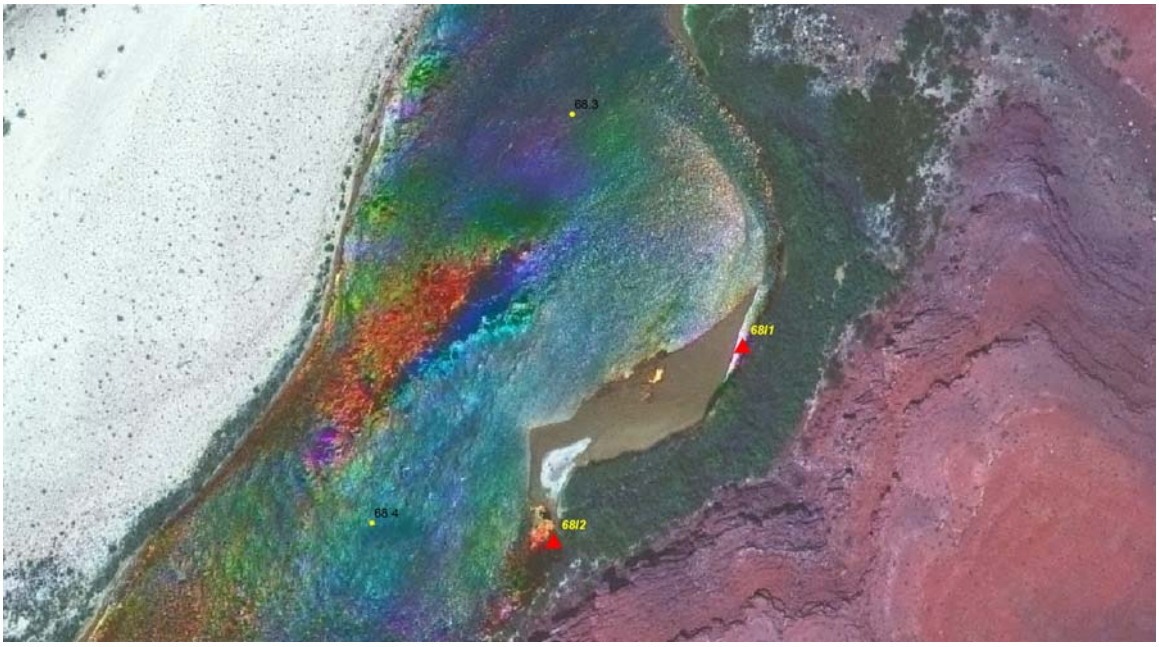
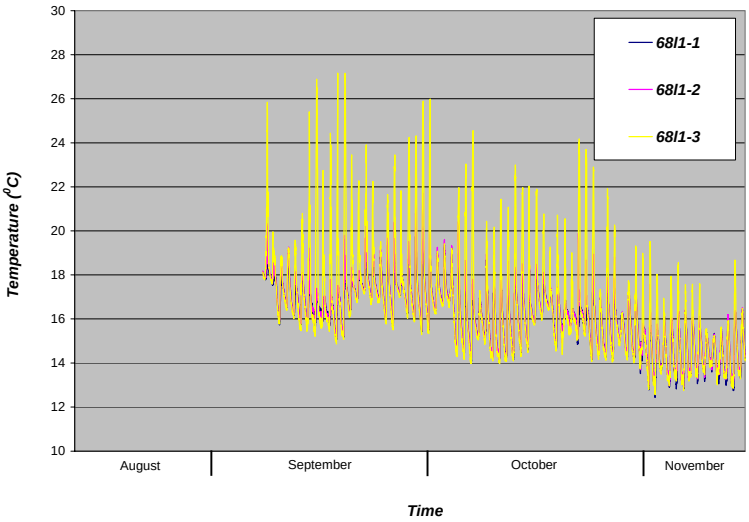
18
16
14
12
10
Temperature (°C)
66r1-1
66r1-2
August
September
October
November
Time


68.3
68I1
68.4
68I2


68I1-1
68I1-2
68I1-3
Temperature (°C)
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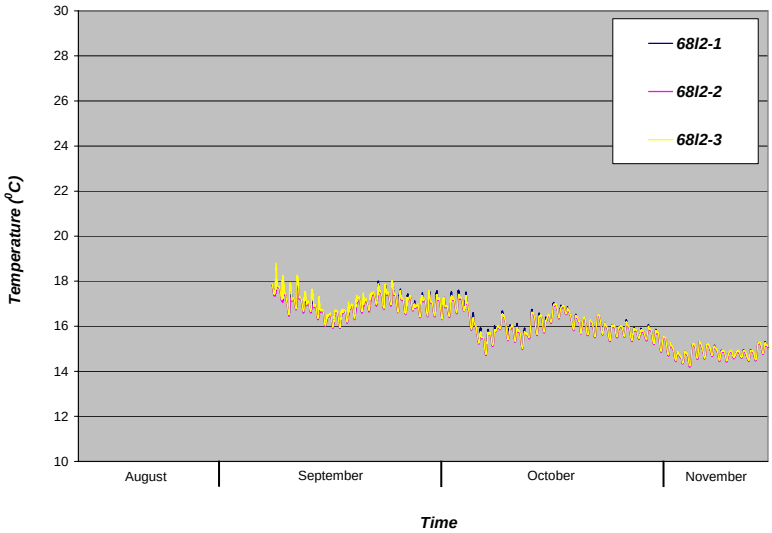
August
September
October
November
Time


68I2-1
68I2-2
68I2-3
Temperature (°C)
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28
26
24
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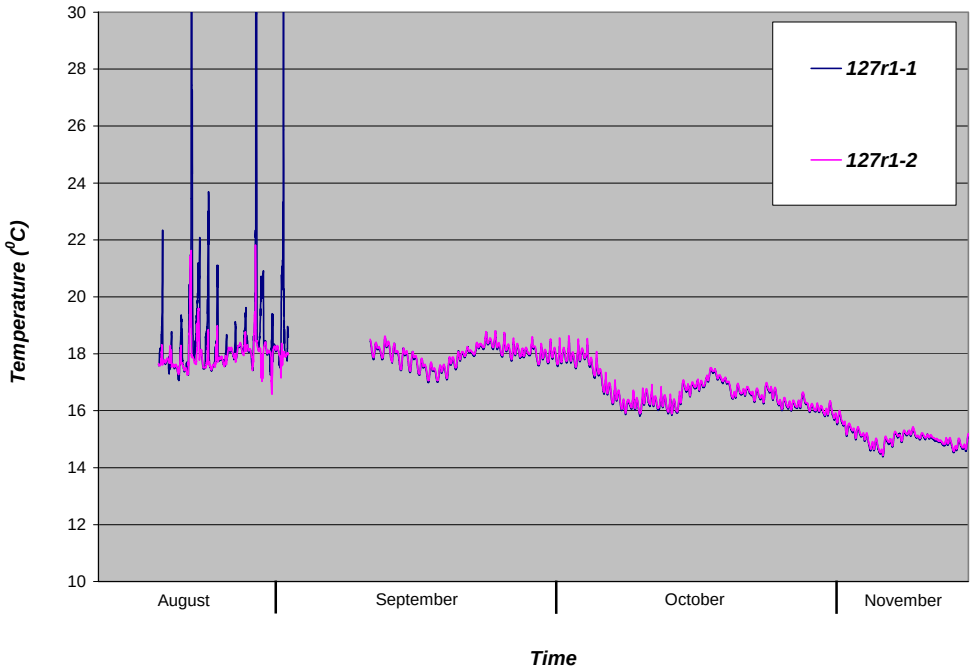
20
18
16
14
12
10
August
September
October
November
Time

126.8
126.7


127r1-1
127r1-2
Temperature (°C)
30
28
26
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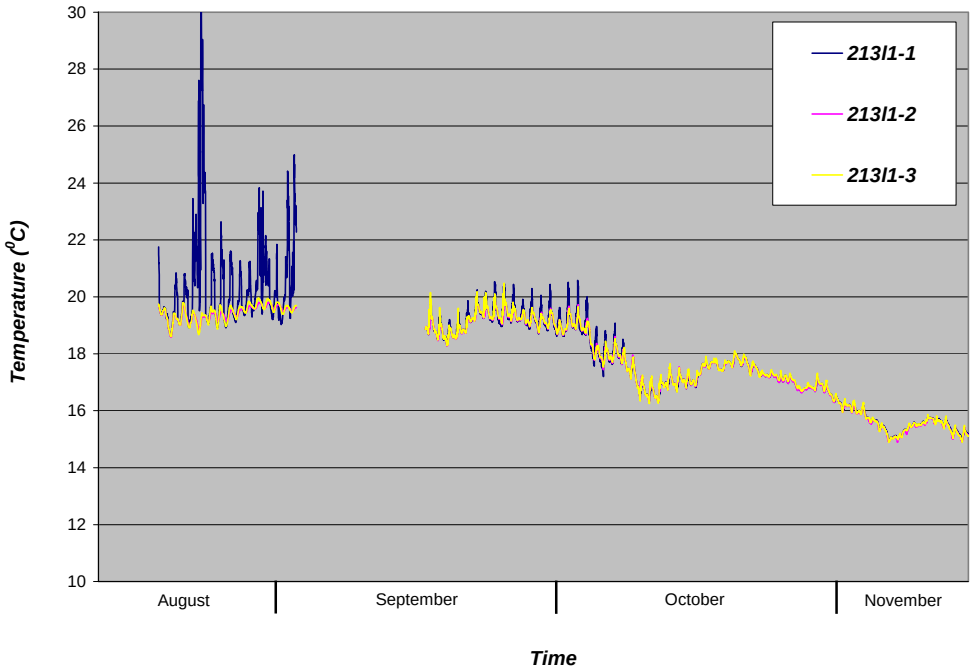
14
12
10
August
September
October
November
Time

213.2
213I1
213.3
213.4


30
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22
20
18
16
14
12
10
Temperature (°C)
213I1-1
213I1-2
213I1-3
August
September
October
November
Time

Appendix B: Field Notes listing logger serial numbers and site

8-5-05 GCY temp deployment
all set to start @ 12:00, 8-12-05

line	loc	Ser #	time deployed
1	30R	781190	1145 8/7/05
1	↓	191	↓
1		192	
2		193	
2		194	
2		195	
3	41R	196	5:30 pm 8/7/05
3		197	
3		198	
4		199	
4		220	
4		221	
5	45L	~~779207~~	
5		779208	
5		779209	
6		210	
6		211	
6		781097	
7	51L	098	
7		099	
7		101	
8	55R	102	8-10-05 11:50
8		103	
8		104	

8-05-05

line	loc	Ser #	time deployed
9	55R	781 105	8-10-05
9	↓	106	Hobos gone! - lost
9		107	active string!
10	64	110	
10		111	
10		112	
11	66	113	
11		114	
11		115	lost!
12	Randy's Rock	116	8-14-05
12		117	
12		118	lost!
13	247	119	~~8-18-05~~
13		120	
13		121	
14	172	122	8-17-05
14		123	
14		124	
15		127	
15		128	
15		129	
16		156	
16		157	
16		158	

not returned lost!

9-6-05 51.4 mile
redeployed original Temp String
& deployed new String in
backwater
15
781127
128
129

68.2 mile 9-7-05
deployed 2 Temp Strings
one in backwater, one outside
~~Dor~~ Same spot as Fritz' deployment
in Sp. 05.

line 1 - Backwater
ser#: 781156
781157
781158
line 2 outside Backwater
781108 -
781109
781125

11-16-05 Temp Recovery
30R - both surface floats sunken
41R - lower backwater float sunk
upper O.K.
45L - both Floats OK
51L both Floats O.K.
55R upper float sunk, lower chain gone possibly stolen
64 Sunk
66 Float lost
68 both O.K.
127 Float lost
214 Float OK.

Appendix C: List of files on CD-Rom

Name	Size	Type
temploggers#1.ppt	37 KB	Microsoft PowerPoint Presentation
temp_location.shx	1 KB	SHX File
temp_location.shp	1 KB	SHP File
temp_location.sbx	1 KB	Adobe Illustrator Tsume File
temp_location.sbn	1 KB	SBN File
temp_location.prj	1 KB	PRJ File
temp_location.dbf	4 KB	DBF File
fieldnotes3.jpg	216 KB	JPG File
fieldnotes2.jpg	88 KB	JPG File
fieldnotes1.jpg	393 KB	JPG File
fall05temps.doc	37,981 KB	Microsoft Word Document
fall05temperatures.xls	6,798 KB	Microsoft Excel Worksheet
crnlf8-05to2-06.gif	16 KB	GIF File
781221-3-194828.dtf	17 KB	BoxCar Pro Document
781220-3-194025.dtf	17 KB	BoxCar Pro Document
781220-3-193917.dtf	17 KB	BoxCar Pro Document
781199-3-195330.dtf	17 KB	BoxCar Pro Document
781198-3-194151.dtf	17 KB	BoxCar Pro Document
781197-3-200504.dtf	17 KB	BoxCar Pro Document
781196-4-192816.dtf	17 KB	BoxCar Pro Document
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779209-8-195111.dtf	17 KB	BoxCar Pro Document
779208-7-193719.dtf	17 KB	BoxCar Pro Document
779207-7-200551.dtf	17 KB	BoxCar Pro Document
213l.jpg	3,899 KB	JPG File
213l1-3.xls	547 KB	Microsoft Excel Worksheet
213l1-2.xls	547 KB	Microsoft Excel Worksheet
213l1-1.xls	547 KB	Microsoft Excel Worksheet
127r.jpg	3,273 KB	JPG File
127r1-2.xls	547 KB	Microsoft Excel Worksheet
127r1-1.xls	547 KB	Microsoft Excel Worksheet
68l.jpg	3,460 KB	JPG File
68l2-3.xls	423 KB	Microsoft Excel Worksheet
68l2-2.xls	423 KB	Microsoft Excel Worksheet
68l2-1.xls	423 KB	Microsoft Excel Worksheet
68l1-3.xls	423 KB	Microsoft Excel Worksheet
68l1-2.xls	423 KB	Microsoft Excel Worksheet
68l1-1.xls	423 KB	Microsoft Excel Worksheet
66r1-2.xls	547 KB	Microsoft Excel Worksheet
66r1-1.xls	547 KB	Microsoft Excel Worksheet

Name	Size	Type
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64l1-2.xls	547 KB	Microsoft Excel Worksheet
64l1-1.xls	547 KB	Microsoft Excel Worksheet
55r.jpg	3,190 KB	JPG File
55r1-3.xls	547 KB	Microsoft Excel Worksheet
55r1-2.xls	547 KB	Microsoft Excel Worksheet
55r1-1.xls	547 KB	Microsoft Excel Worksheet
51l.jpg	3,440 KB	JPG File
51l2-3.xls	423 KB	Microsoft Excel Worksheet
51l2-2.xls	423 KB	Microsoft Excel Worksheet
51l2-1.xls	423 KB	Microsoft Excel Worksheet
51l1-3.xls	547 KB	Microsoft Excel Worksheet
51l1-2.xls	547 KB	Microsoft Excel Worksheet
51l1-1.xls	547 KB	Microsoft Excel Worksheet
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45l2-2.xls	547 KB	Microsoft Excel Worksheet
45l2-1.xls	547 KB	Microsoft Excel Worksheet
45l1-3.xls	547 KB	Microsoft Excel Worksheet
45l1-2.xls	547 KB	Microsoft Excel Worksheet
45l1-1.xls	547 KB	Microsoft Excel Worksheet
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41r2-2.xls	547 KB	Microsoft Excel Worksheet
41r2-1.xls	547 KB	Microsoft Excel Worksheet
41r1-3.xls	547 KB	Microsoft Excel Worksheet
41r1-2.xls	547 KB	Microsoft Excel Worksheet
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30r.jpg	3,725 KB	JPG File
30r2-3.xls	547 KB	Microsoft Excel Worksheet
30r2-2.xls	547 KB	Microsoft Excel Worksheet
30r2-1.xls	547 KB	Microsoft Excel Worksheet
30r1-3.xls	547 KB	Microsoft Excel Worksheet
30r1-2.xls	547 KB	Microsoft Excel Worksheet
30r1-1.xls	547 KB	Microsoft Excel Worksheet