Appendix D: Site Information for the 2009 Umpqua Temperature Study

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Site Summary Data

GIS image scale: 1:2000

TIR temperature image range classified to range of 22°C to 30°C to provide optimum color contrast. Higher temperatures appear as transparent areas.

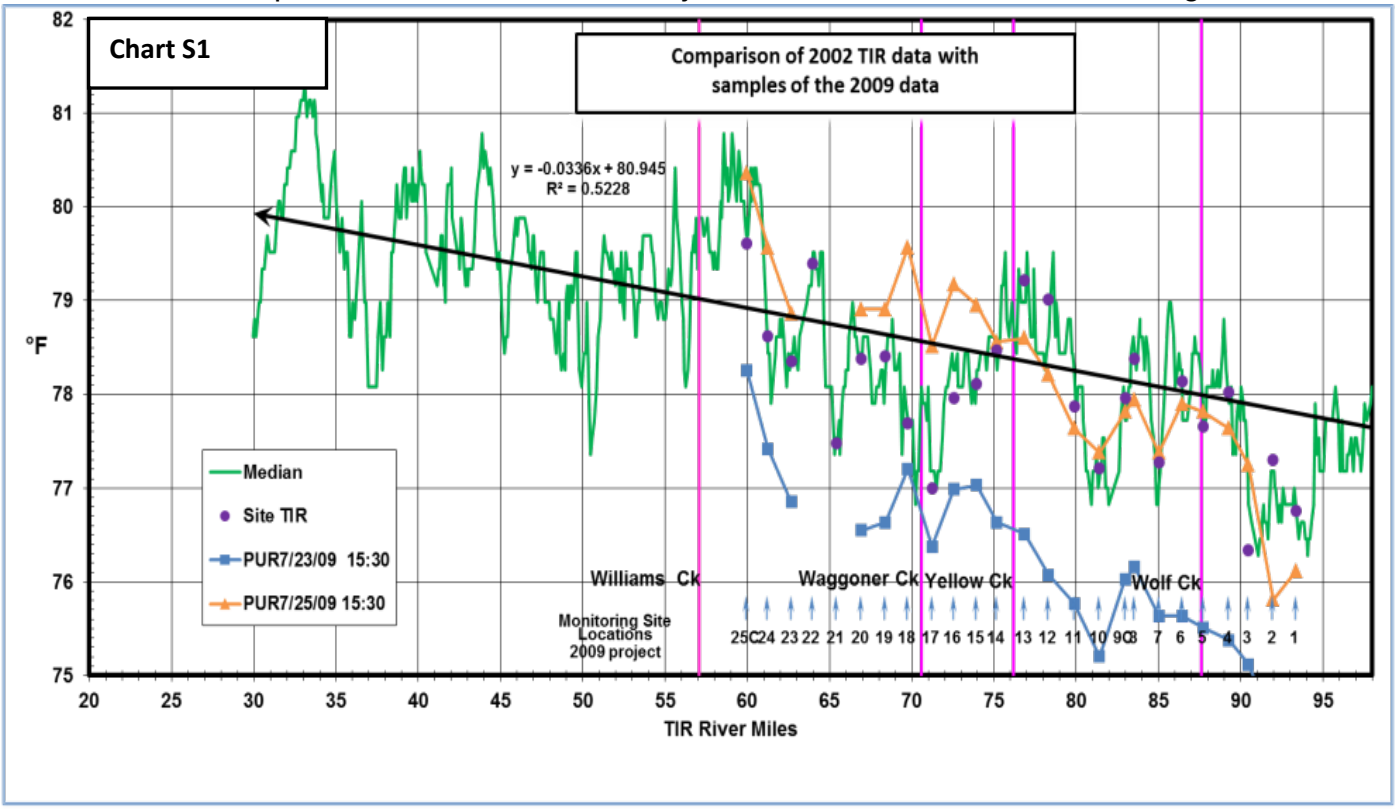
Table 1: Site Data

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
1	93.4	5.6	104.9	104.9	76.8	165.7	365.1	4975.2	404.0	74.6	76.1	-1.05	1.45	0.66
2	92.0	6.0	79.7	79.7	77.3	364.4	368.8	4923.5	401.6	74.5	75.8	-0.56	0.62	0.61
3	90.5	4.0	154.5	154.5	76.3	269.6	245.4	4961.8	403.0	75.1	77.2	-1.57	1.25	1.38
4	89.3	10.0	221.8	41.8	78.0	131.4	165.8	4910.3	395.7	75.4	77.6	0.07	1.03	0.81
5	87.7	10.4	166.1	166.1	77.7	221.9	266.7	5009.2	411.4	75.5	77.8	-0.34	0.58	0.49
6	86.4	14.6	277.0	97.0	78.1	148.3	263.5	4982.9	404.7	75.6	77.9	0.10	0.62	0.35
7	85.0	10.0	322.2	142.2	77.3	299.7	282.5	5000.4	406.3	75.6	77.4	-0.82	0.45	0.48
8	83.6	21.0	175.2	175.2	78.4	198.3	197.9	4941.8	400.9	76.2	77.9	0.24	0.32	0.32
9	83.0	7.6	141.9	141.9	78.0	252.7	255.8	5004.8	413.9	76.0	77.8	-0.20	0.70	0.69
10	81.4	11.6	279.3	99.3	77.2	124.9	113.3	4938.4	396.9	75.2	77.4	-1.00	0.93	1.03
11	79.9	7.8	194.1	14.1	77.9	360.2	349.6	4927.8	401.3	75.8	77.6	-0.39	0.48	0.50
12	78.3	11.8	291.2	111.2	79.0	116.3	98.1	4513.3	328.7	76.1	78.2	0.70	0.98	1.17
13	76.9	12.1	158.2	158.2	79.2	140.2	153.3	4930.1	389.9	76.5	78.6	0.86	0.80	0.73
14	75.2	4.9	155.9	155.9	78.5	349.5	355.9	4991.9	406.0	76.6	78.6	0.05	0.79	0.77
15	73.9	4.0	117.8	117.8	78.1	408.7	405.5	4962.3	404.9	77.0	79.0	-0.35	0.83	0.83
16	72.6	7.7	109.1	109.1	78.0	321.3	333.4	4868.4	394.5	77.0	79.2	-0.55	0.55	0.53
17	71.2	6.4	122.7	122.7	77.0	381.0	392.6	5012.1	409.7	76.4	78.5	-1.55	0.55	0.54
18	69.8	7.0	217.8	37.8	77.7	275.0	291.3	5036.7	391.4	77.2	79.6	-0.91	0.70	0.66
19	68.4	21.0	282.5	102.5	78.4	275.2	346.7	5006.8	409.6	76.6	78.9	-0.24	0.23	0.19
20	66.9	15.4	321.5	141.5	78.4	158.0	210.5	4975.0	399.1	76.6	78.9	-0.32	0.55	0.42
21	65.4	5.3	233.4	53.4	77.5	339.9	293.6	4965.5	403.0			-1.27	0.75	0.87
22	64.0	9.0	118.7	118.7	79.4	196.1	323.0	4964.1	403.1			0.60	0.77	0.46
23	62.7	12.0	147.4	147.4	78.4	276.2	252.2	4893.4	409.3	76.9	78.9	-0.49	0.41	0.45
24	61.2	3.6	267.6	87.6	78.6	284.5	259.4	4952.0	400.8	77.4	79.6	-0.27	1.32	1.45
25	60.0	6.3	241.4	61.4	79.6	333.9	297.8	4928.8	399.6	78.3	80.4	0.68	0.64	0.72
	Maximum Value			Minimum Value									*flow: 1350 cfs	

Description of Table 1 parameters

- Site Number — PUR site reference. Dataloggers for sites 21 and 22 were not recovered.
- TIR River Mile — Distance measurements established by Watershed Sciences for the 2002 TIR Flight to reference the location of their data points. These values are different than the river mile marking on the USGS Quad maps.
- Site Depth — Depth at deployment point. It is typically in the deepest point in the cross section. However, it is not necessarily representative of the upstream conditions.
- River Azimuth — Local orientation based on a straight 500 foot extending upstream from the deployment point.
- Ave Site TIR °F — This is the average temperature extracted from the six points that were sampled in the upstream influence zone. The data came from the TIR GRID files and corresponds to the sampling that Watershed Sciences used to develop the temperature data that they reported.
- Average Zone Width — Average of the six cross section widths taken at each site.
- Width at Site — Widths measured from GIS ortho-photos. They represent summer conditions but not necessarily the exact conditions during the study.
- Solar Radiation — Average results from the six sample points using the ESRI Radiation tool.
- PUR Temperature Data — Samples of the 2009 time-series data collected for the study. The 15:30 time corresponds roughly to the time of the 2002 TIR flight.

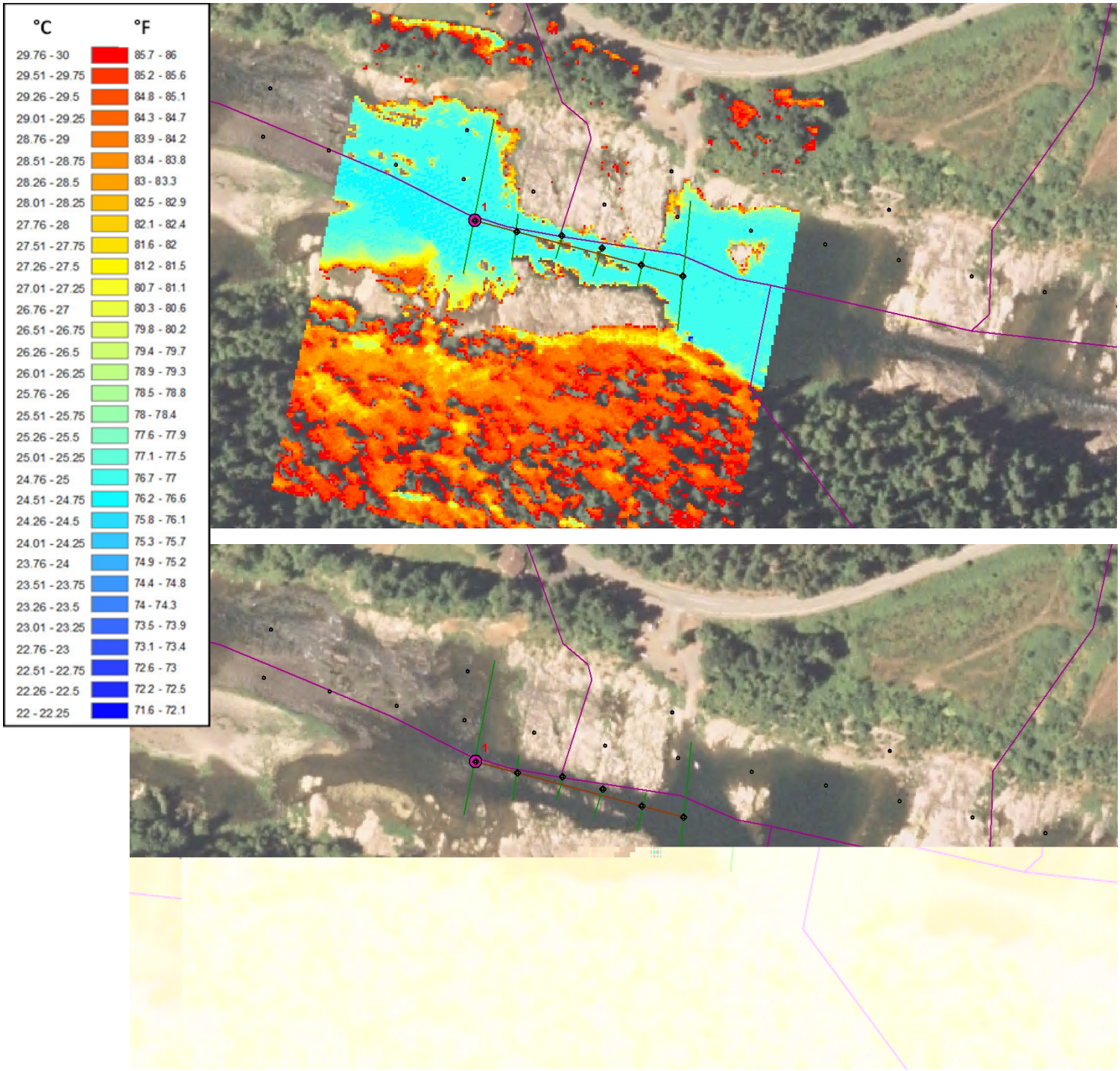
- Deviation of Site TIR from Median Reg — Difference between the site TIR values from the TIR median temperature regression line as shown in Chart S1. This value serves as an index of the relative temperature of each site after adjustment for the downstream heating effect.



- Relative Zone Velocity — A estimate of the average velocity in the upstream zone based on the average width, site depth and a prevailing flow of 1350 cfs.
- Relative Site Velocity — Similar to the above. These provide an indication of the dwell time in the site area.

Thermal Imagery

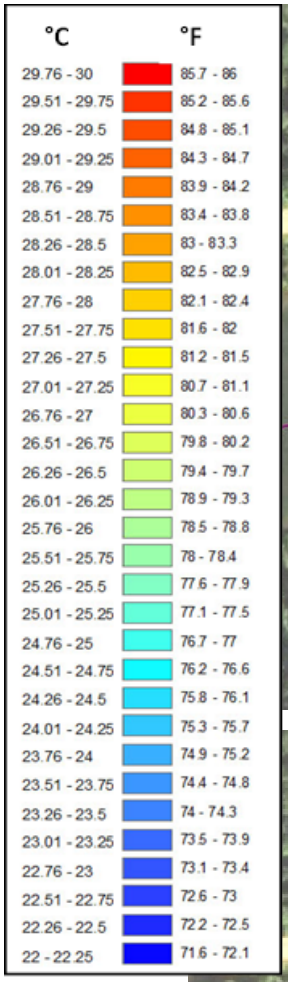
The following charts thermal imagery, site specific information and a brief narrative regarding the relative heating characteristics of each site.

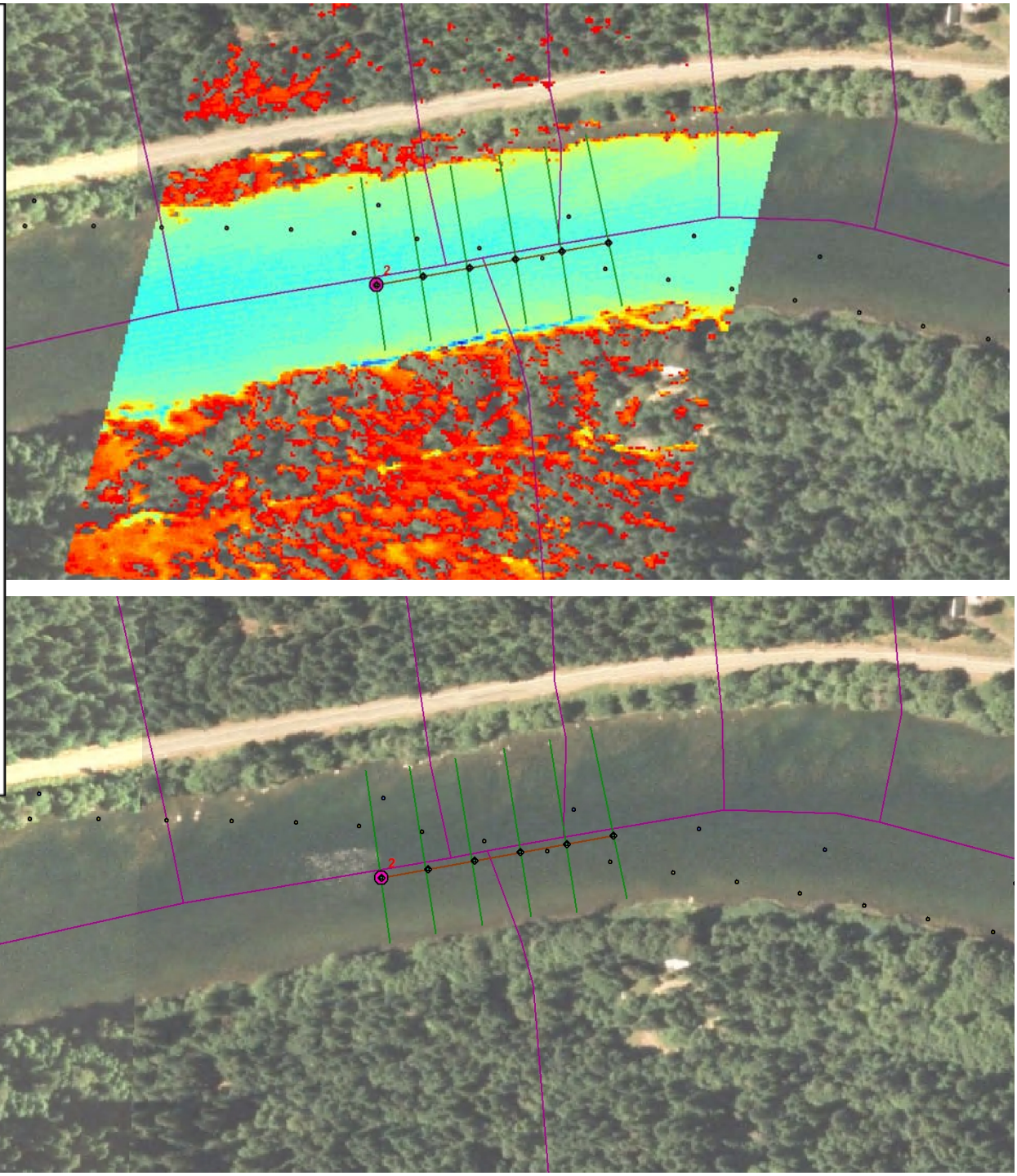


SITE 1

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
1	93.4	5.6	104.9	104.9	76.8	165.7	365.1	4975.2	404.0	74.6	76.1	-1.05	1.45	0.66

Cool site. Aspect favors late afternoon shading. Fast current from deep upstream storage pool. The influence zone had highest relative mean velocity 10 while site velocity is less due to wide channel. Actual current at the site was still high in spite of the wider channel.

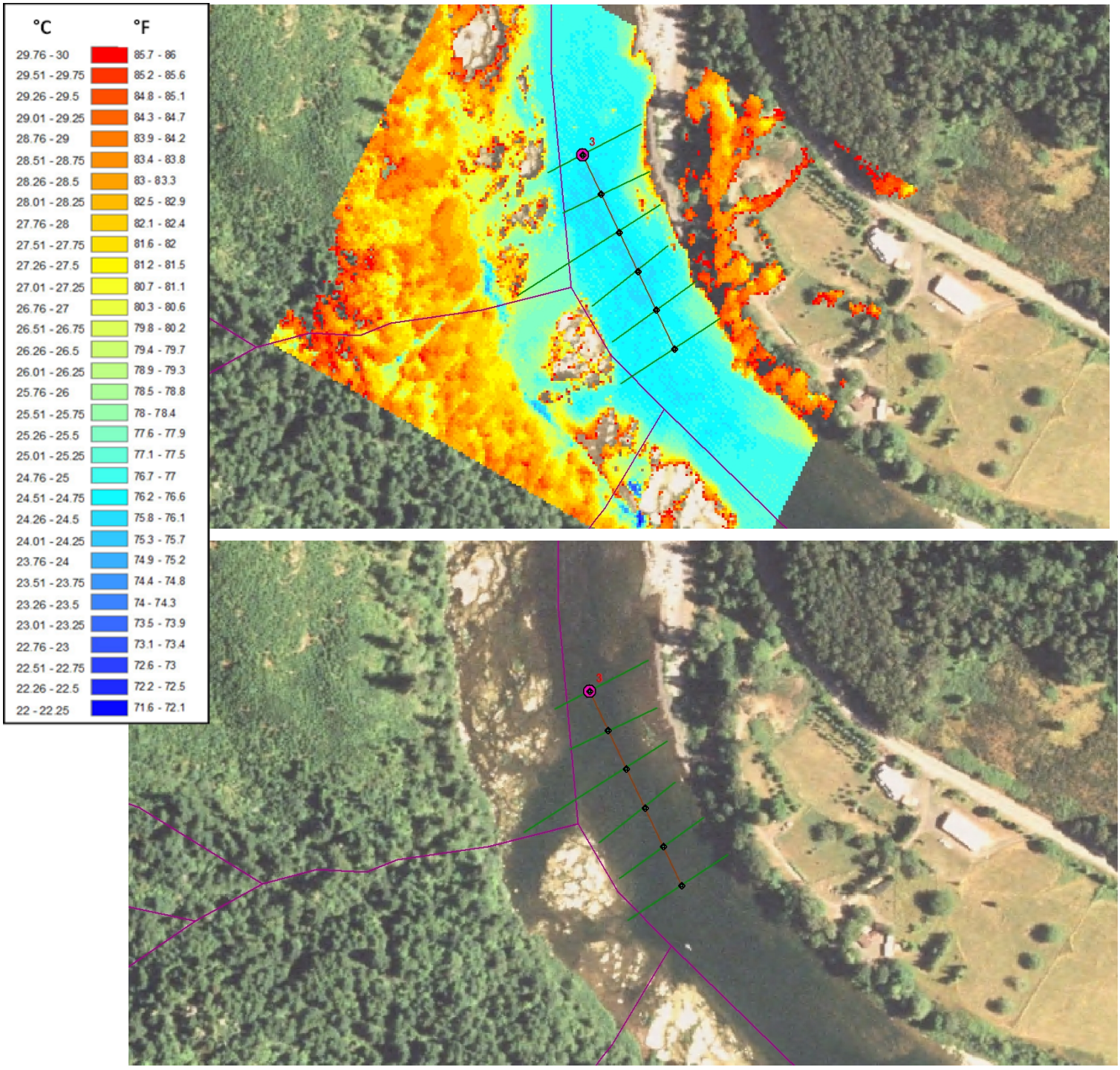




SITE 2

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
2	92.0	6.0	79.7	79.7	77.3	364.4	368.8	4923.5	401.6	74.5	75.8	-0.56	0.62	0.61

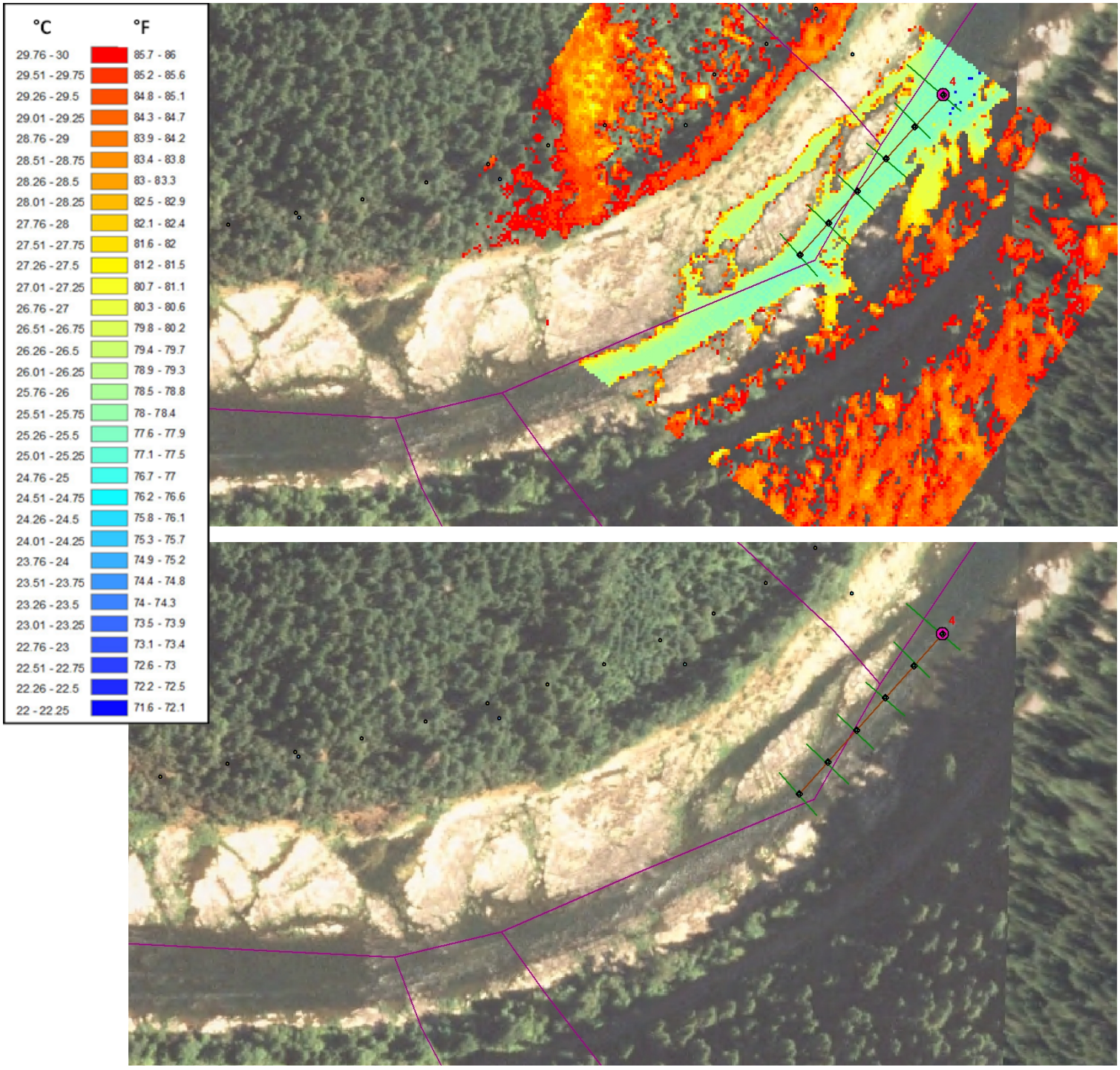
Continued warming. Heating apparent on shallow edges. Note cool edge on south bank due to riparian shading.



SITE 3

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
3	90.5	4.0	154.5	154.5	76.3	269.6	245.4	4961.8	403.0	75.1	77.2	-1.57	1.25	1.38

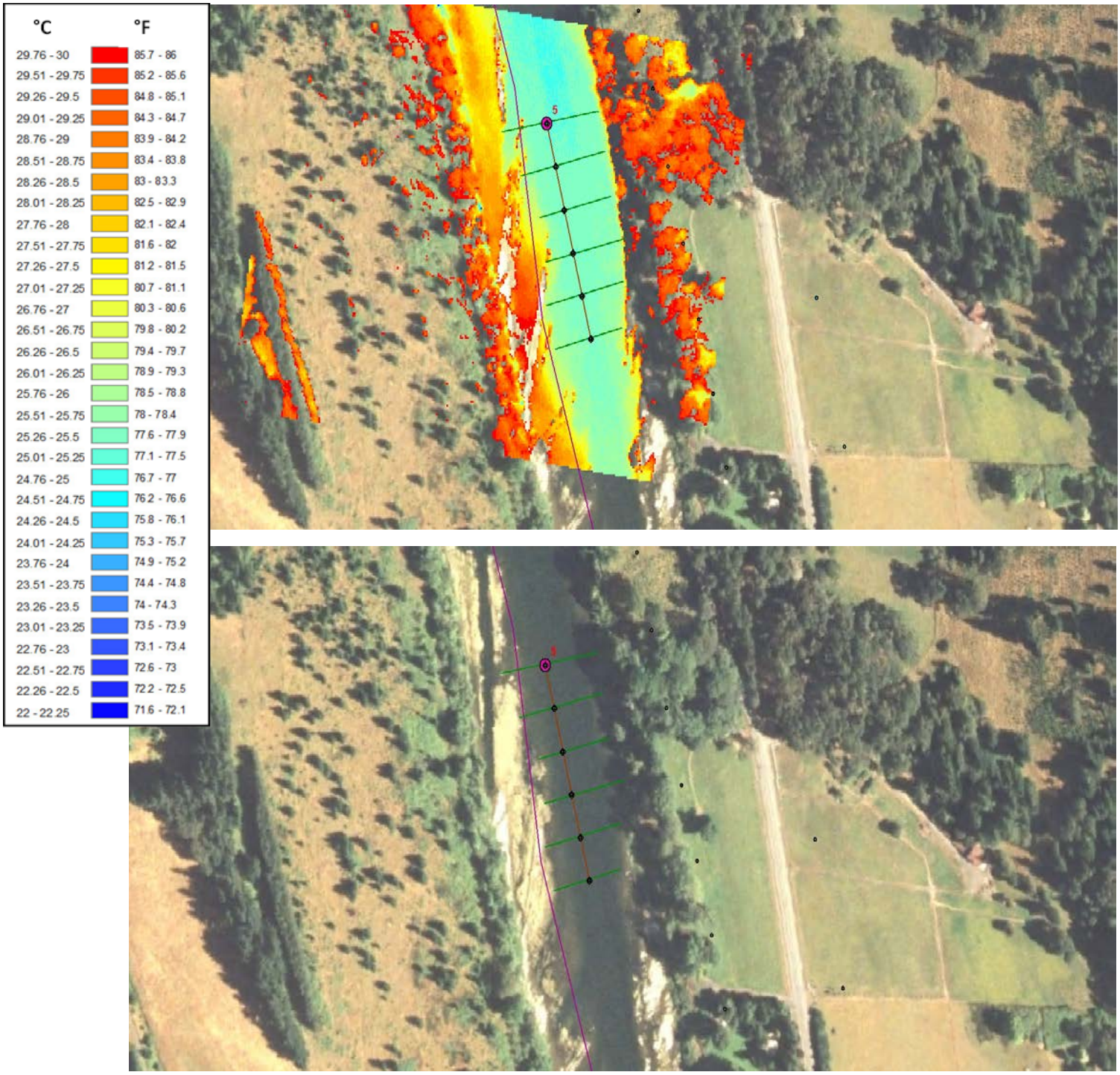
Coolest site. Indications of cooler sources in the sample zone. Possible upwelling or cold pockets? Note cooling influences from the tributaries that is balanced by the shallow water heating. High velocity due to shallow depth.



SITE 4

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
4	89.3	10.0	221.8	41.8	78.0	131.4	165.8	4910.3	395.7	75.4	77.6	0.07	1.03	0.81

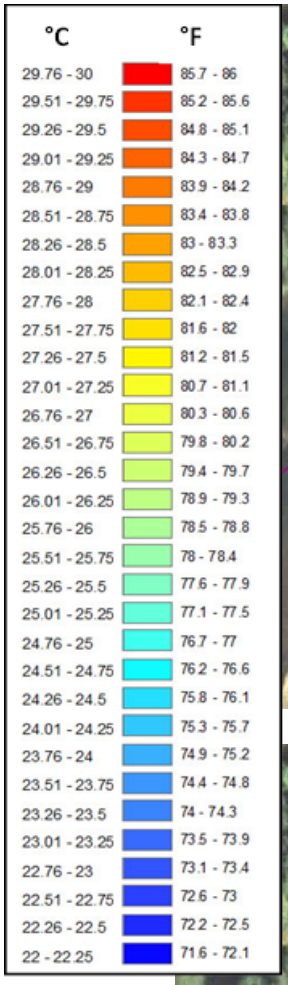
Near median temperature; massive exposed rock surface is relatively hot. High velocity through chute results in steeper temperature gradient along edges. Side channel is about 2 °F warmer.

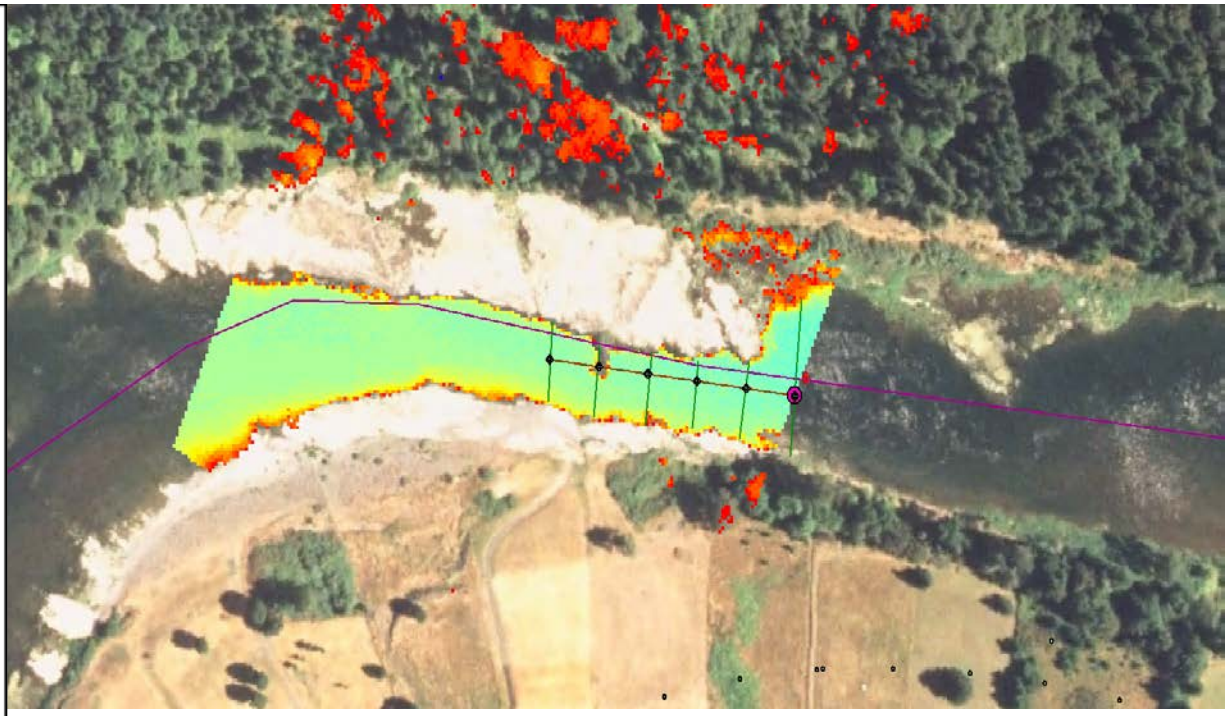


SITE 5

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
5	87.7	10.4	166.1	166.1	77.7	221.9	266.7	5009.2	411.4	75.5	77.8	-0.34	0.58	0.49

Cooler water. Possible cold storage in deeper zone. Side effects not reaching thalweg.

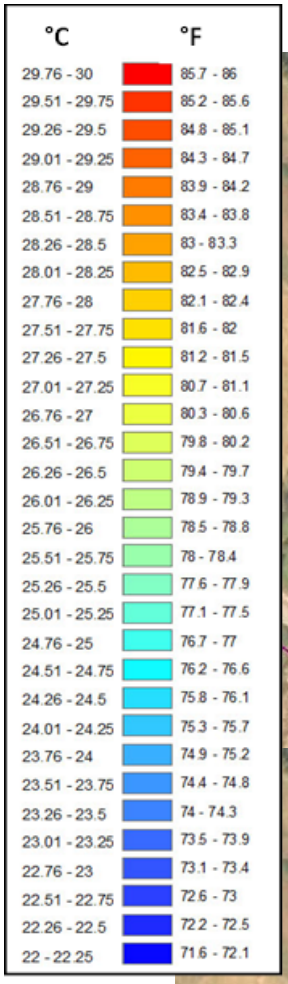


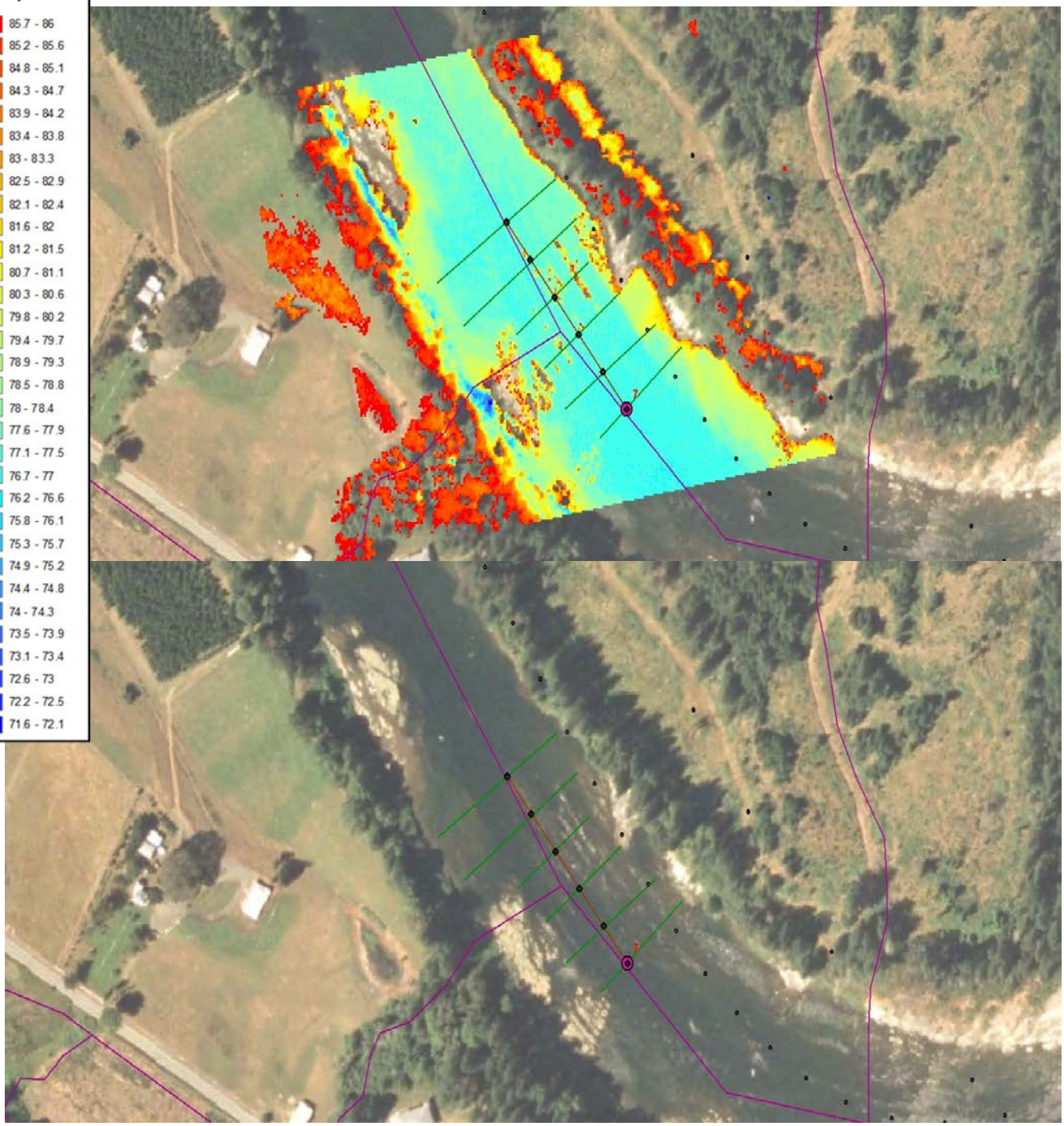


SITE 6

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
6	86.4	14.6	277.0	97.0	78.1	148.3	263.5	4982.9	404.7	75.6	77.9	0.10	0.62	0.35

Near median temperature. High temperatures associated with the bedrock and cleared land. Some recovery cooling is apparent at the deployment point that is downstream from the rock area. High temperature gradient on edges result of slower velocities. Local environment is hot.

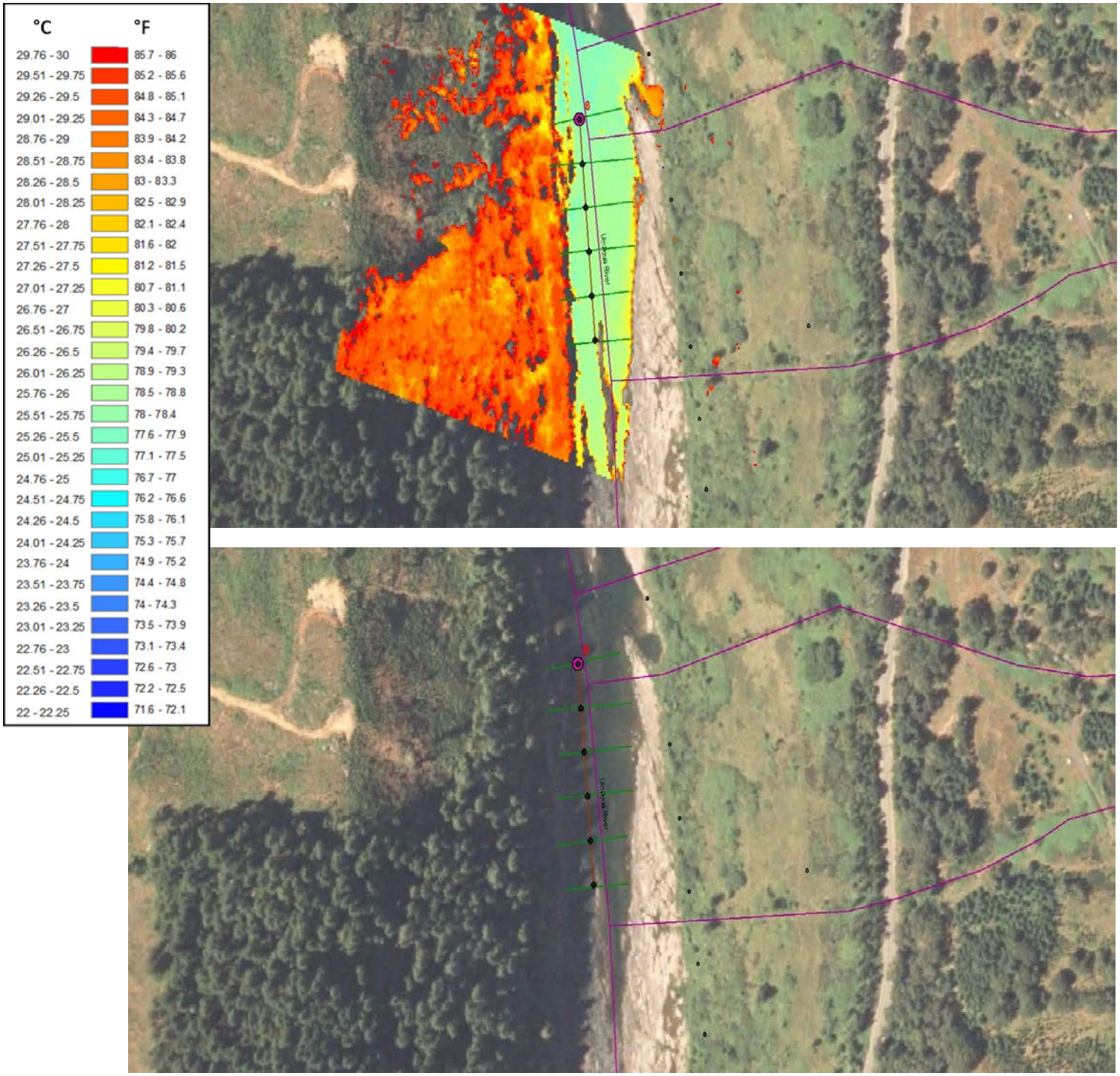




SITE 7

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
7	85.0	10.0	322.2	142.2	77.3	299.7	282.5	5000.4	406.3	75.6	77.4	-0.82	0.45	0.48

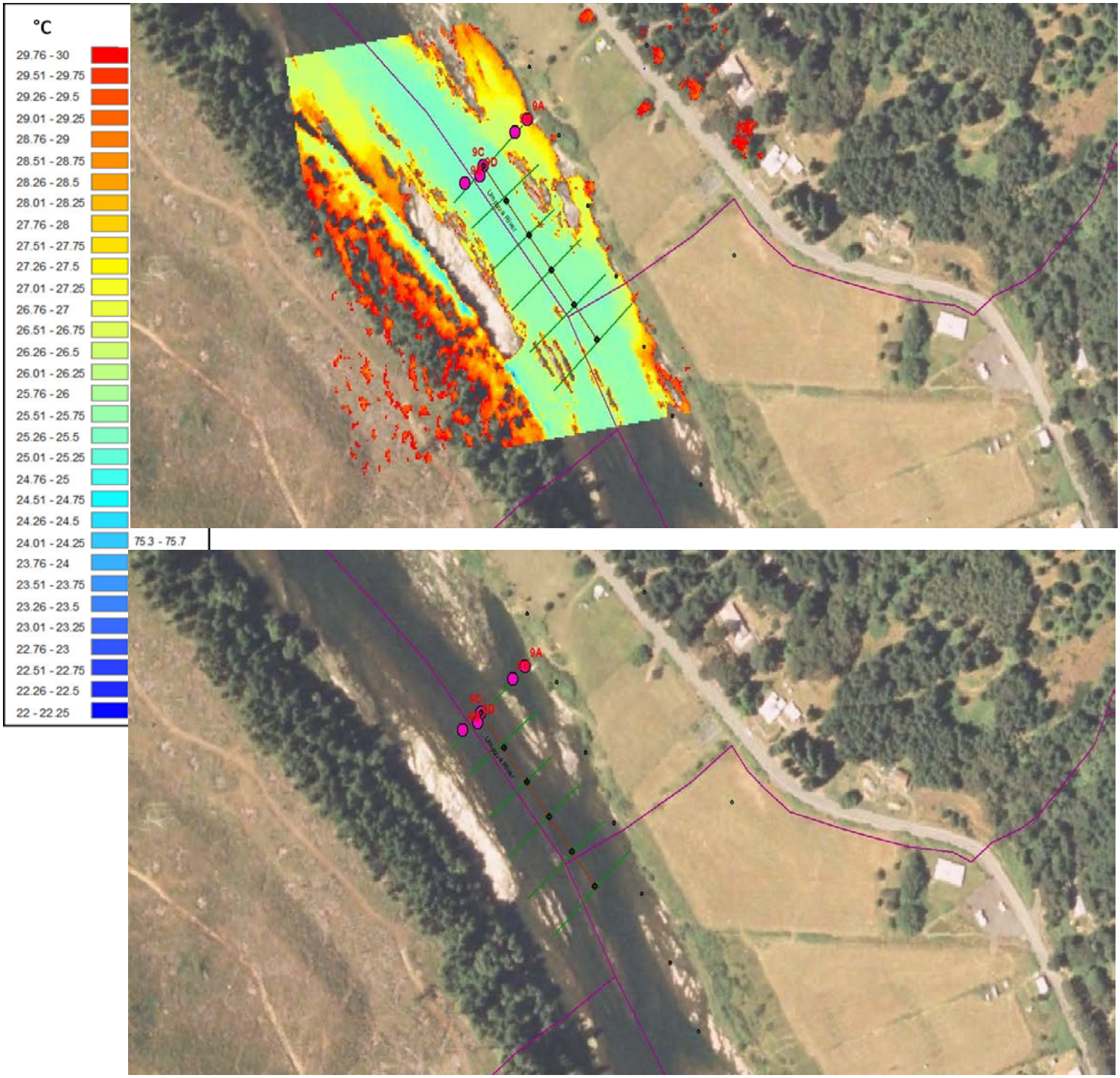
Cooler deep channel – low velocity. Large water mass. Note tributary and shade influences on the west bank.



SITE 8

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
8	83.6	21.0	175.2	175.2	78.4	198.3	197.9	4941.8	400.9	76.2	77.9	0.24	0.32	0.32

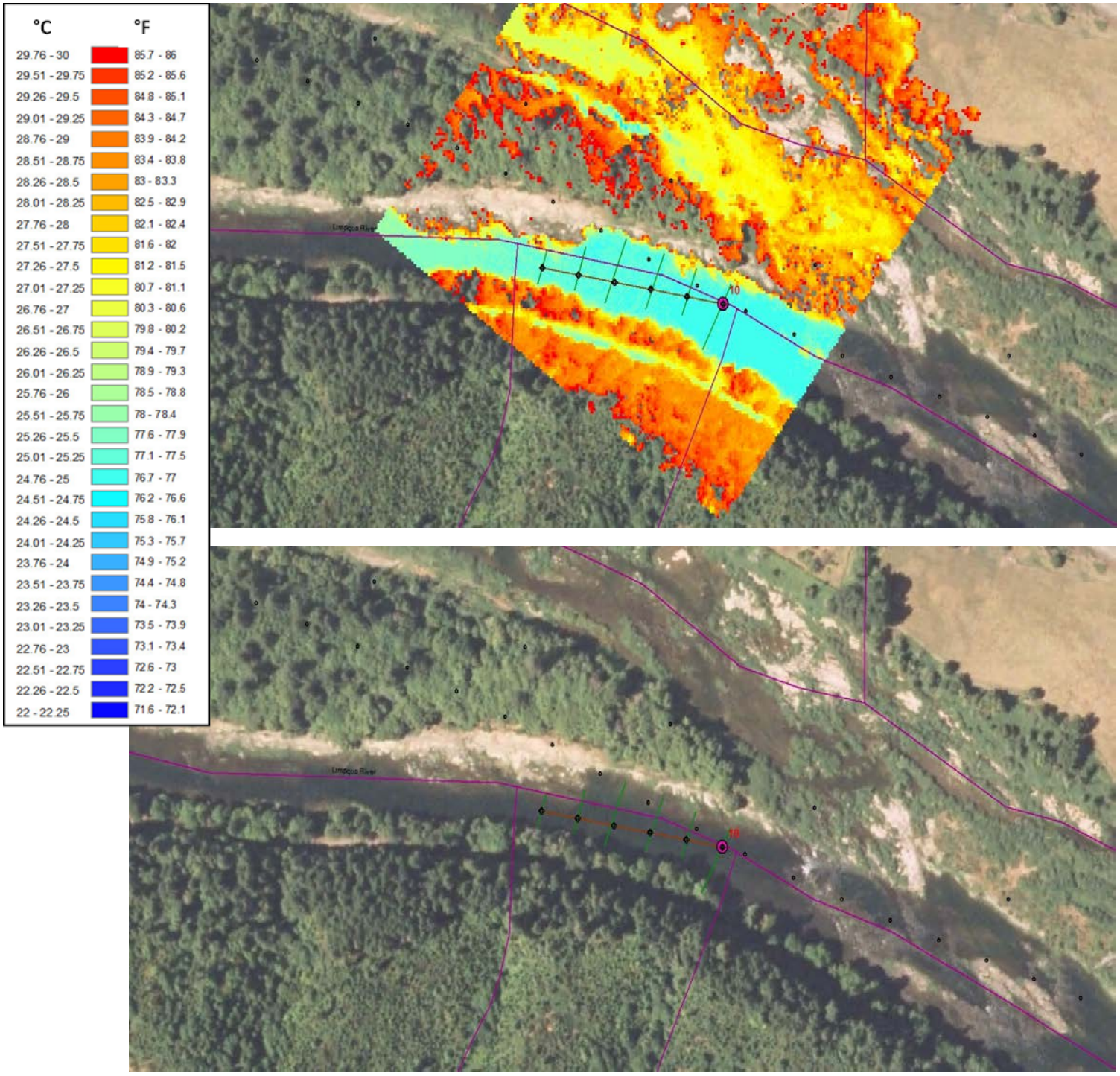
Warm site low velocity, very deep. High exposed bed rock influence. Note heating gradient from the east bank. Cooler conditions apparent downstream of the bed rock.



SITE 9

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
9	83.0	7.6	141.9	141.9	78.0	252.7	255.8	5004.8	413.9	76.0	77.8	-0.20	0.70	0.69

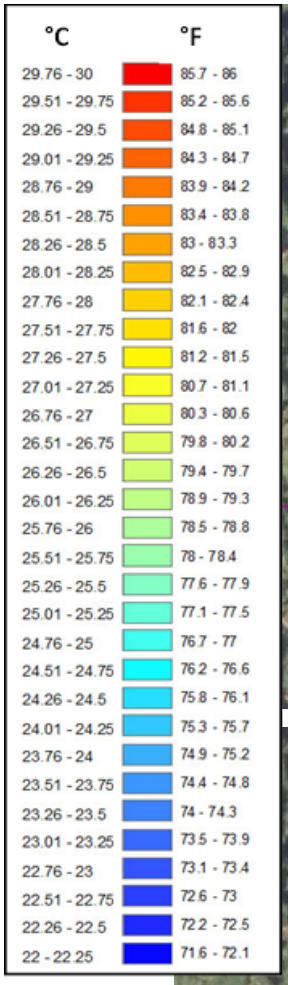
Slightly below median temperature. Significant heating in side eddy areas. Cross section temperature data available at this site. Afternoon solar radiation was highest of all of the sites. Cross section data available.

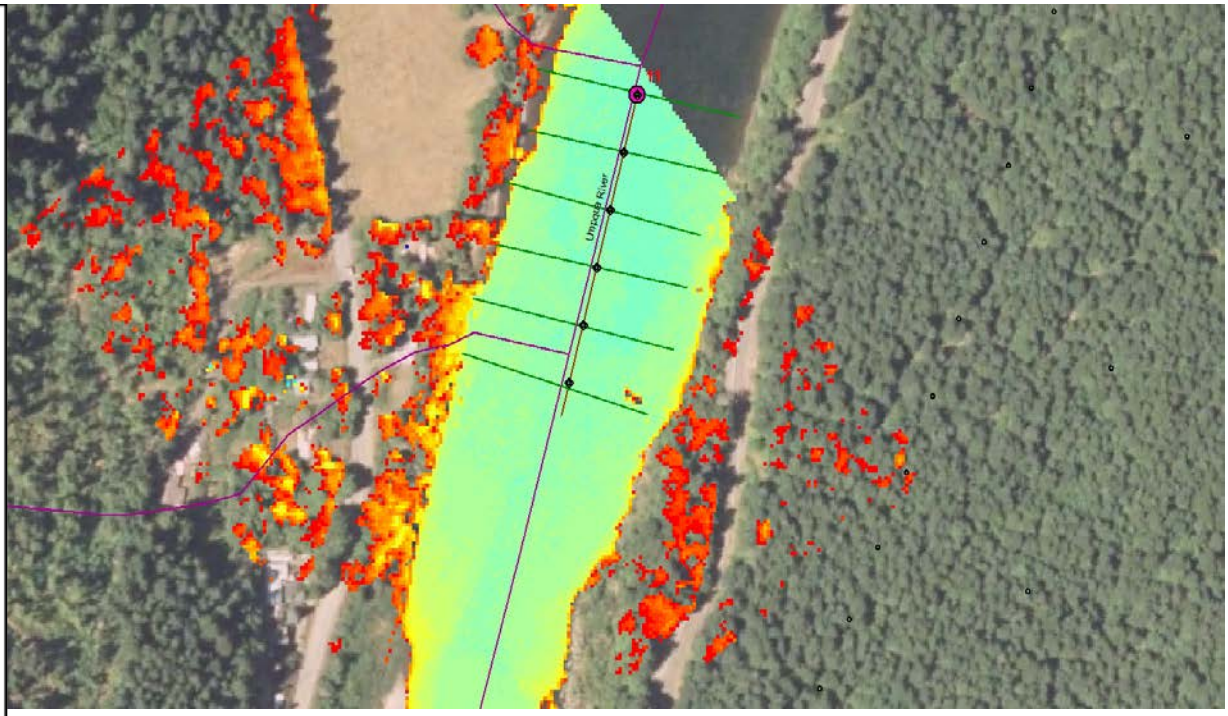


SITE 10

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
10	81.4	11.6	279.3	99.3	77.2	124.9	113.3	4938.4	396.9	75.2	77.4	-1.00	0.93	1.03

One of the cooler sites based on deviation from the median. Note the surrounding environment appears cooler judging from the absence of clear areas in the thermal image. The area adjacent to the upstream bedrock appears to be warmer.

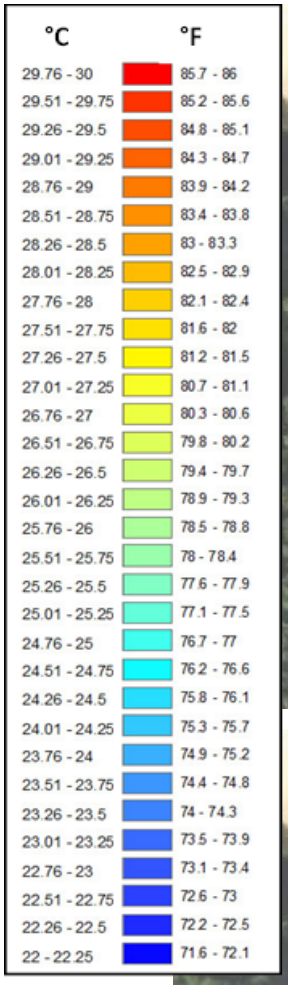


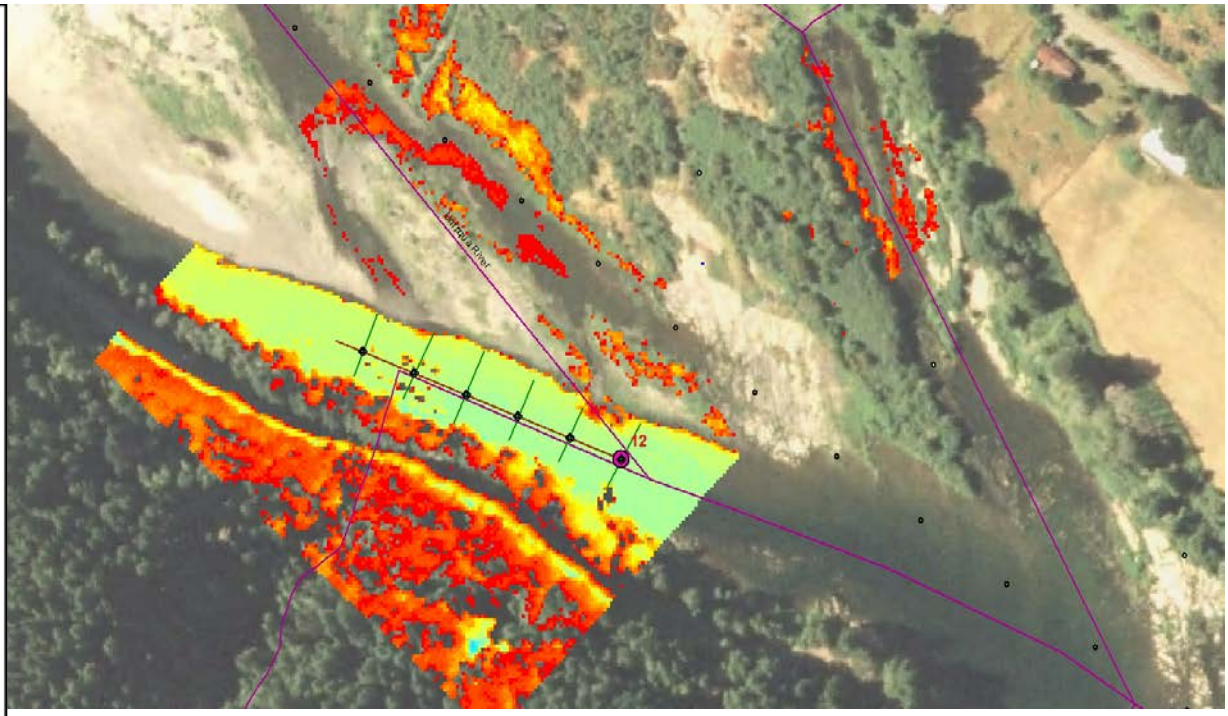


SITE 11

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
11	79.9	7.8	194.1	14.1	77.9	360.2	349.6	4927.8	401.3	75.8	77.6	-0.39	0.48	0.50

On the cool side of the regression line. There appears to be cooler temperatures at the downstream end possibly related to deep, cool pockets in the channel. The local environment looks warm and edge warming is apparent due to the lower velocity. The North-South orientation may be a factor though the radiation calculation did not show a significant difference.

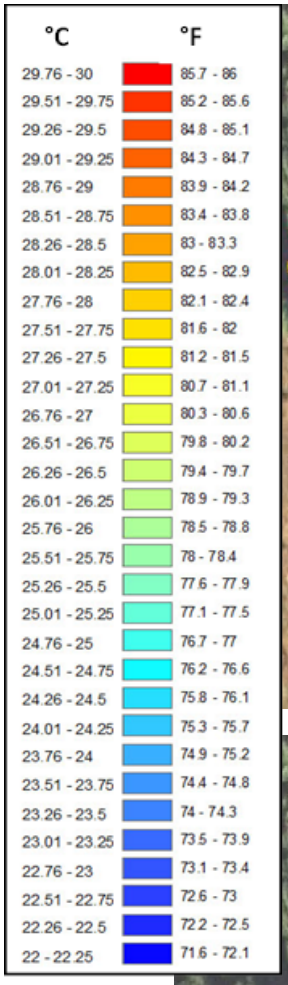


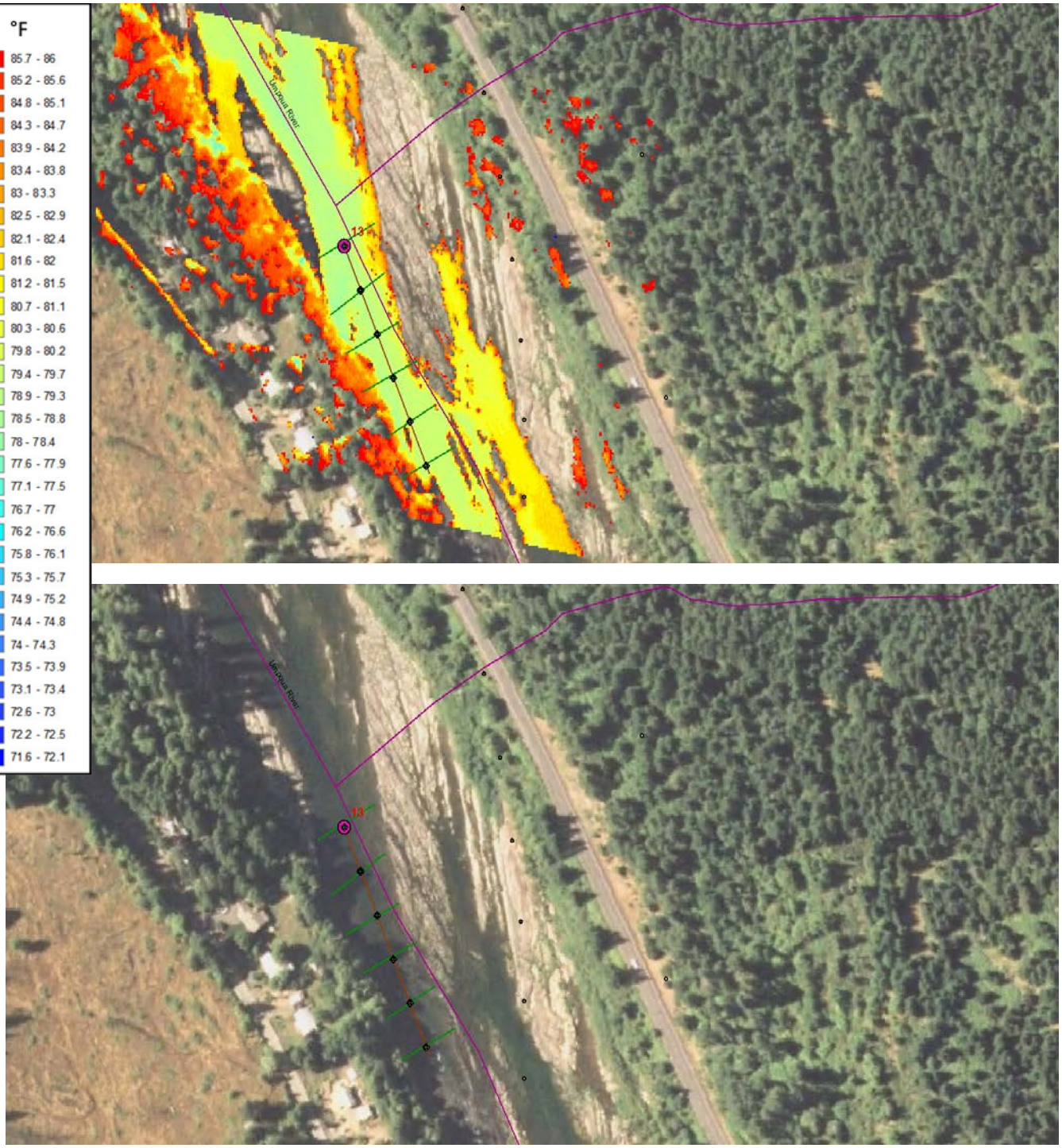


SITE 12

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
12	78.3	11.8	291.2	111.2	79.0	116.3	98.1	4513.3	328.7	76.1	78.2	0.70	0.98	1.17

A warm site. Note the warm environment and heating associated with the north side. Interestingly, this site receives significantly less solar radiation based on the calculations – apparently the result of topographic features on the south west side.

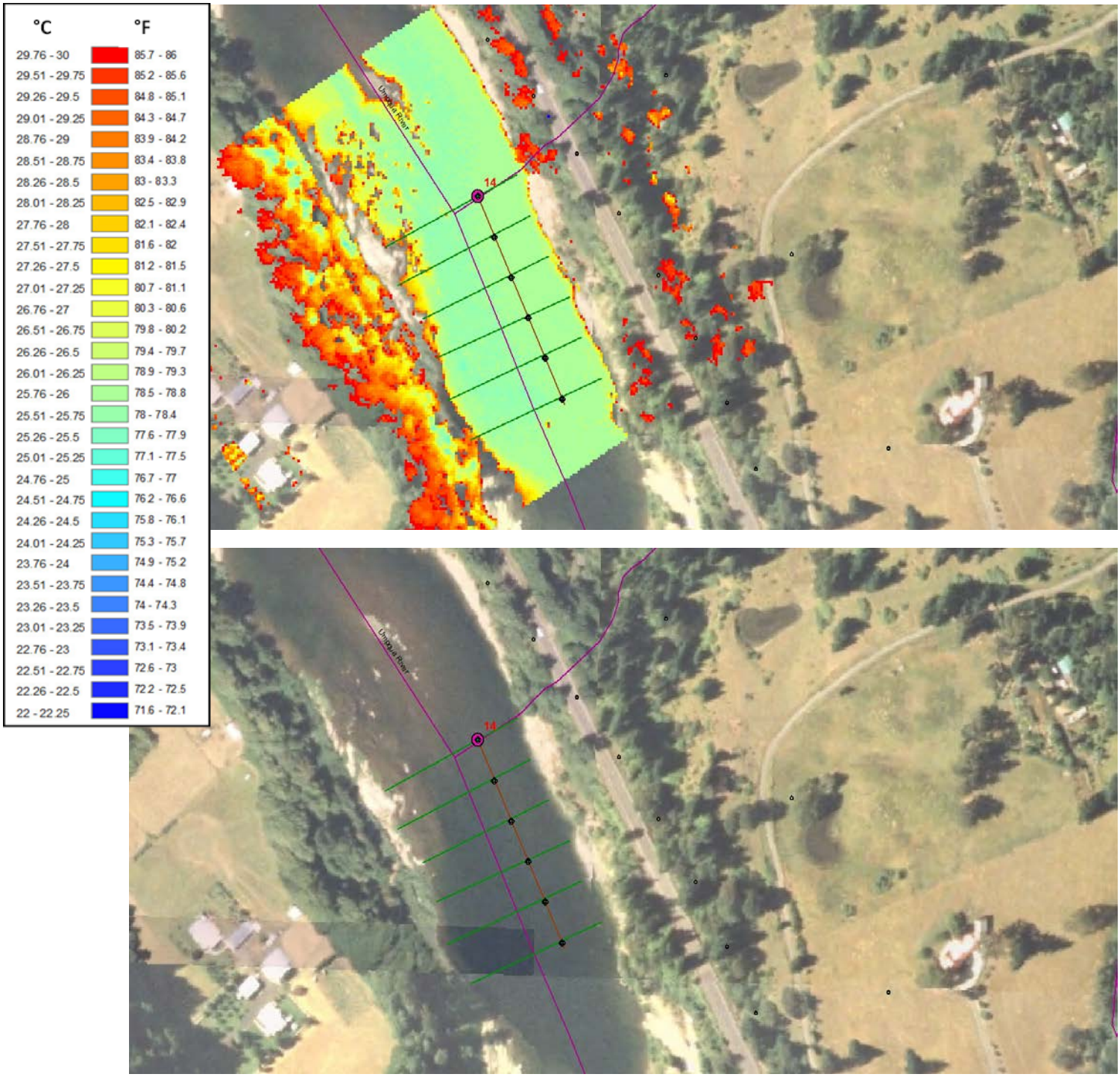




SITE 13

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
13	76.9	12.1	158.2	158.2	79.2	140.2	153.3	4930.1	389.9	76.5	78.6	0.86	0.80	0.73

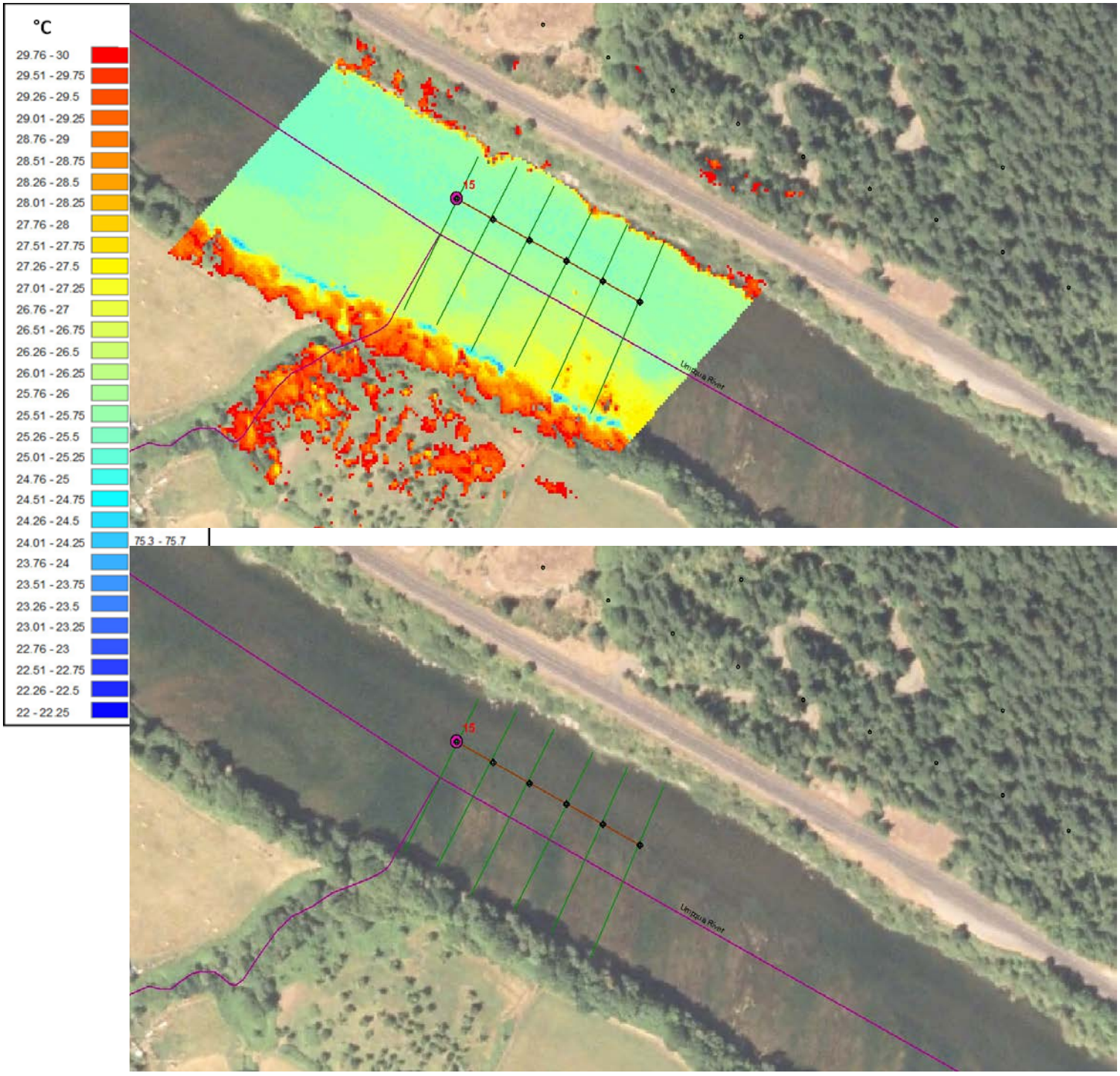
A warmer site with a warm environment - even the trees are warm –perhaps related to the SW aspect of the side slopes.



SITE 14

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
14	75.2	4.9	155.9	155.9	78.5	349.5	355.9	4991.9	406.0	76.6	78.6	0.05	0.79	0.77

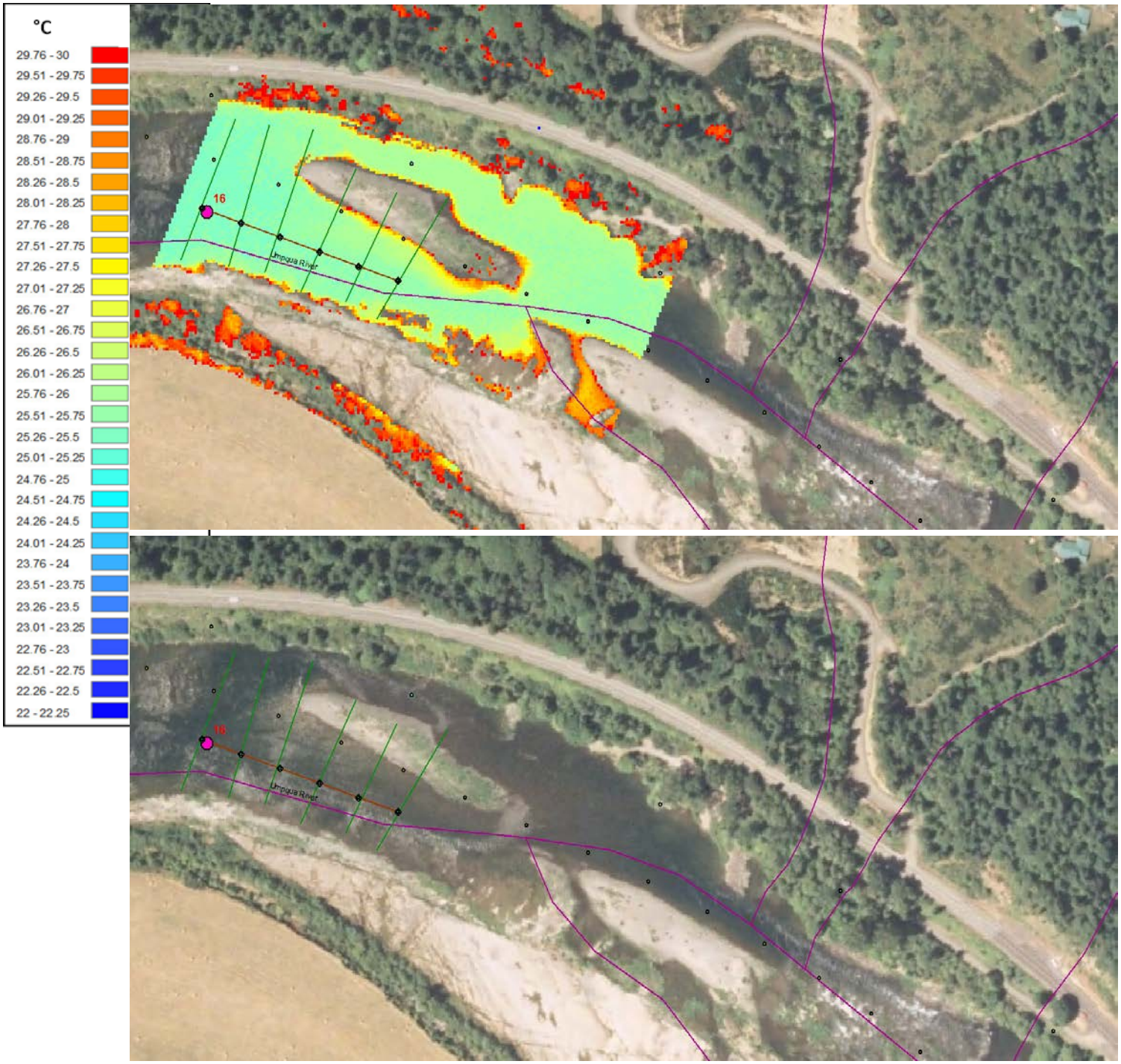
Close to the median temperature line. Exposure is similar to site 13 but without as much exposed bedrock.



SITE 15

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
15	73.9	4.0	117.8	117.8	78.1	408.7	405.5	4962.3	404.9	77.0	79.0	-0.35	0.83	0.83

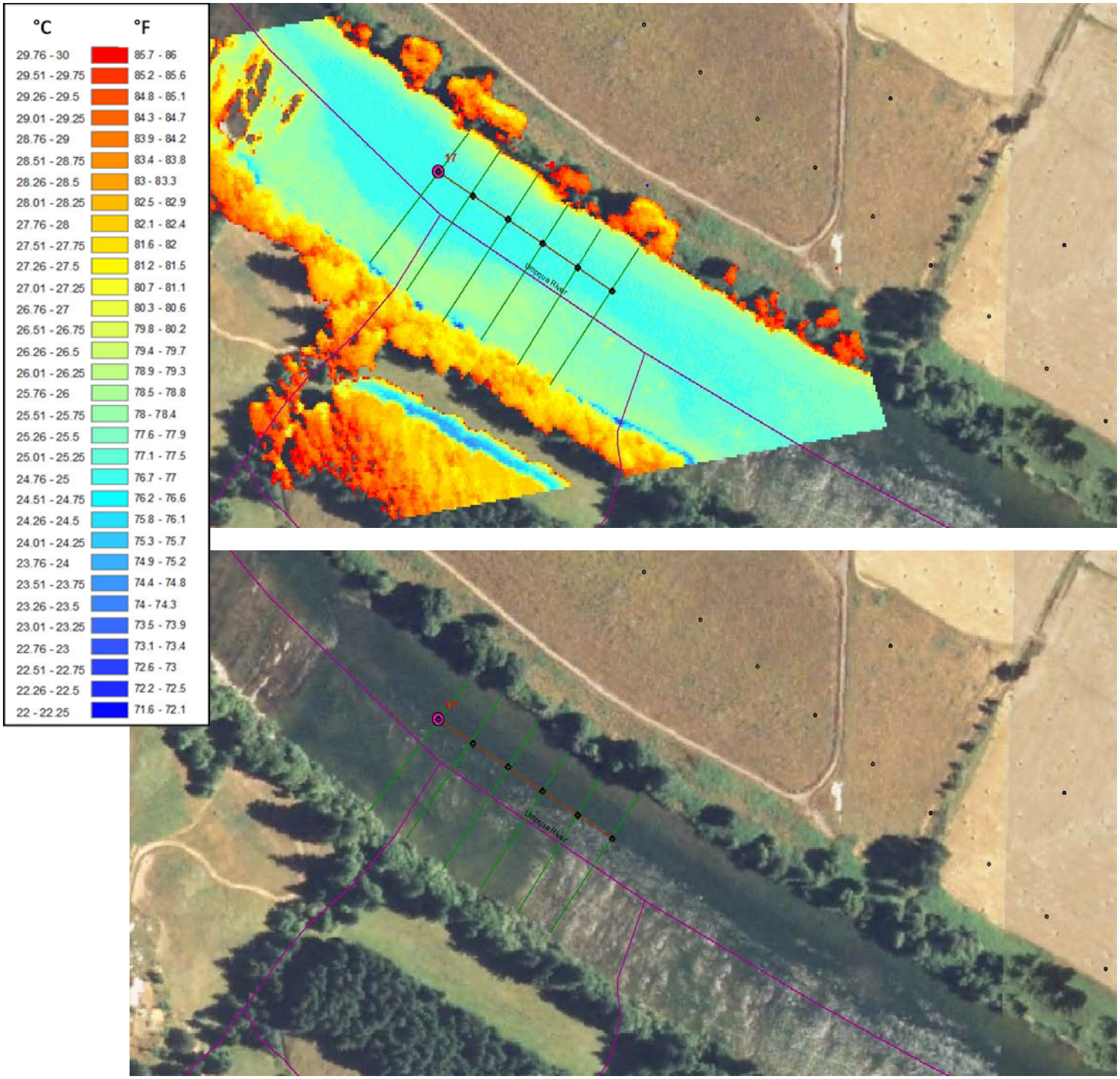
A cooler site. This site is associated with the widest channel. It has a warm surrounding environment. Note the warming in the shallow water along with the cooling from the riparian shade.



SITE 16

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
16	72.6	7.7	109.1	109.1	78.0	321.3	333.4	4868.4	394.5	77.0	79.2	-0.55	0.55	0.53

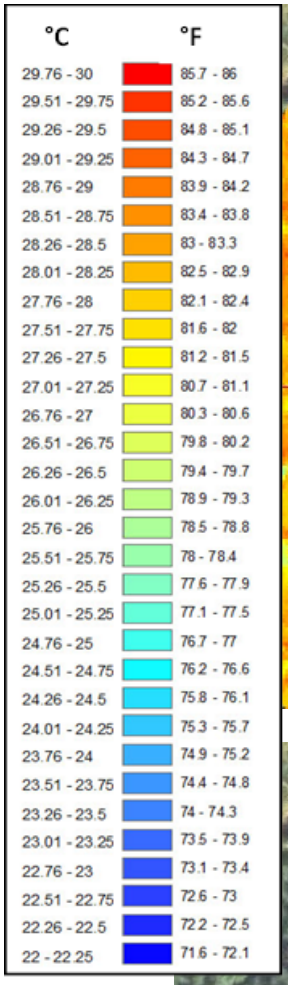
Slightly cooler than site 15. Warm environment. It appears that the temperature may decrease with the amount of bedrock immediately adjacent to the river.

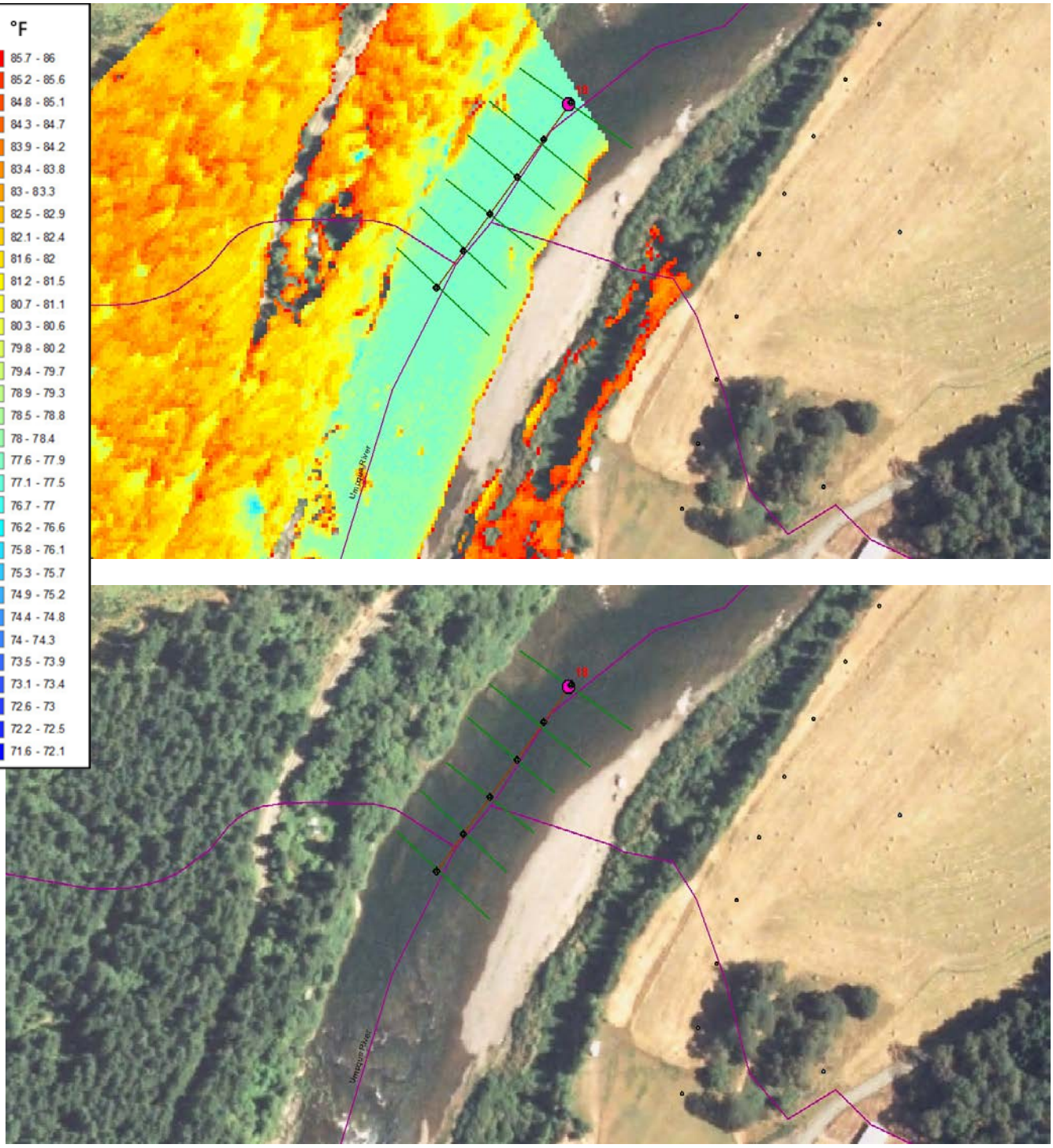


SITE 17

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
17	71.2	6.4	122.7	122.7	77.0	381.0	392.6	5012.1	409.7	76.4	78.5	-1.55	0.55	0.54

One of the coolest sites with respect to the TIR regression line. Slightly cooler environment. Minimal exposed bedrock. Note heating and shade cooling along the lower edge.

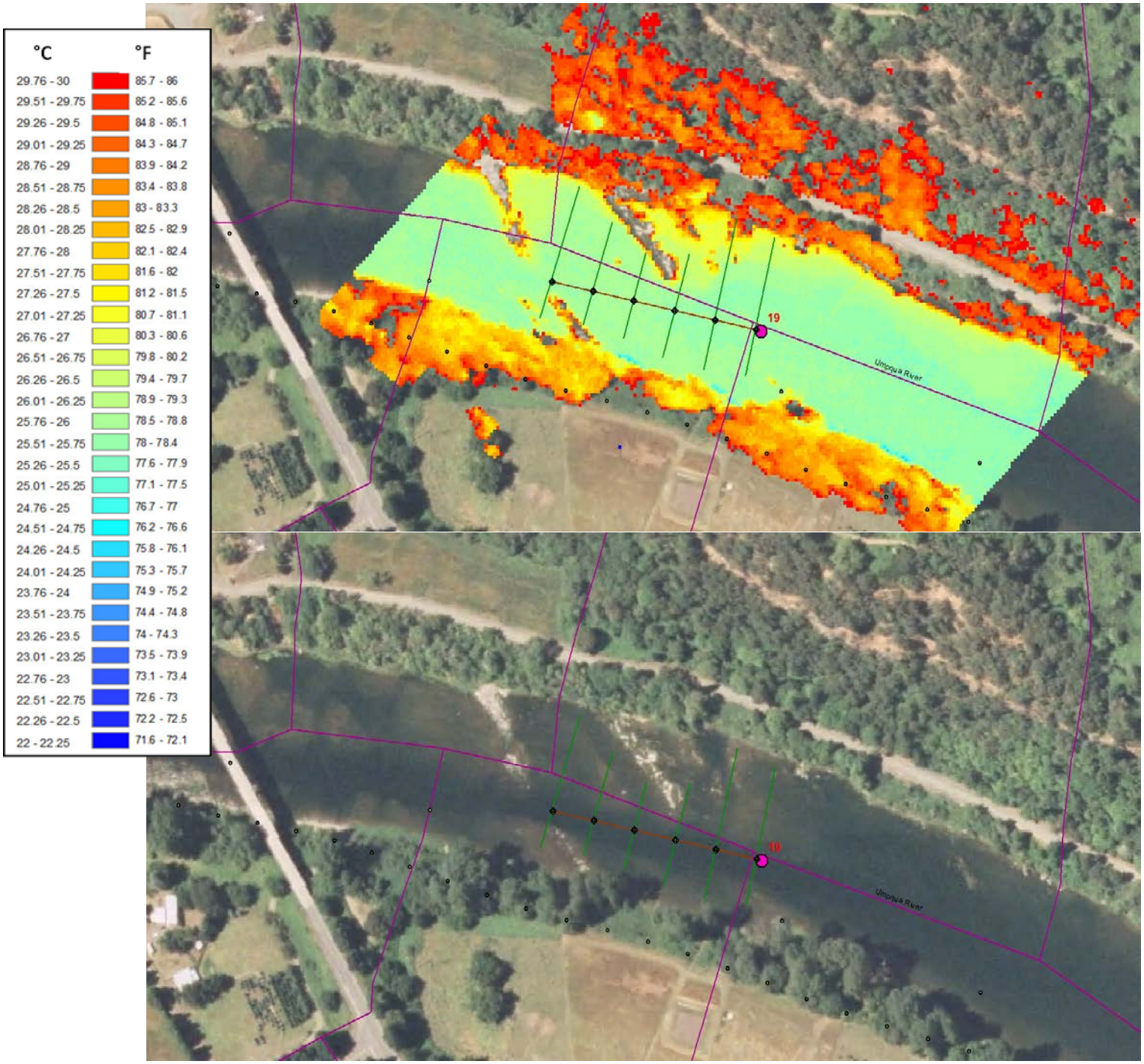




SITE 18

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
18	69.8	7.0	217.8	37.8	77.7	275.0	291.3	5036.7	391.4	77.2	79.6	-0.91	0.70	0.66

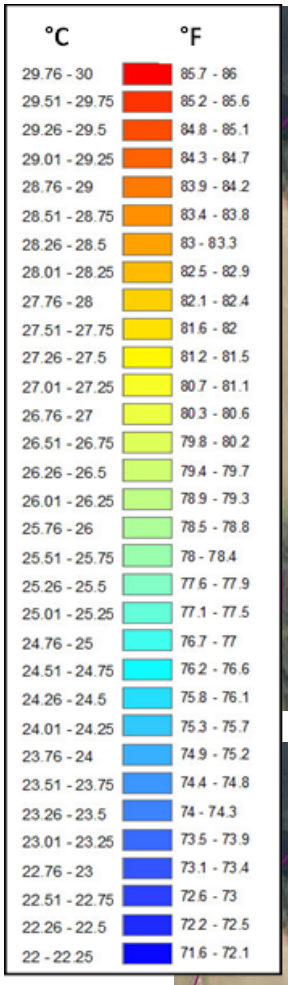
Moderately cool site with a cooler environment on the west side. The feature on the right bank may be a gravel / cobble bar. It doesn't appear to be heating as much as the exposed bed rock areas.

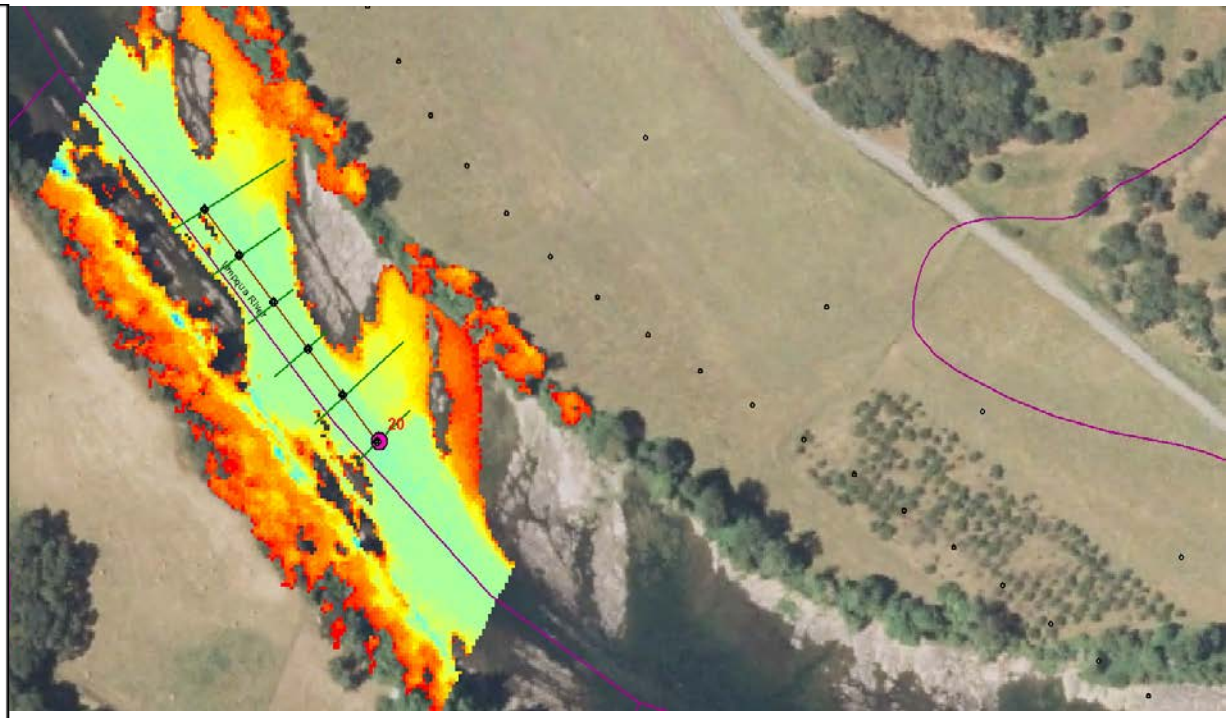


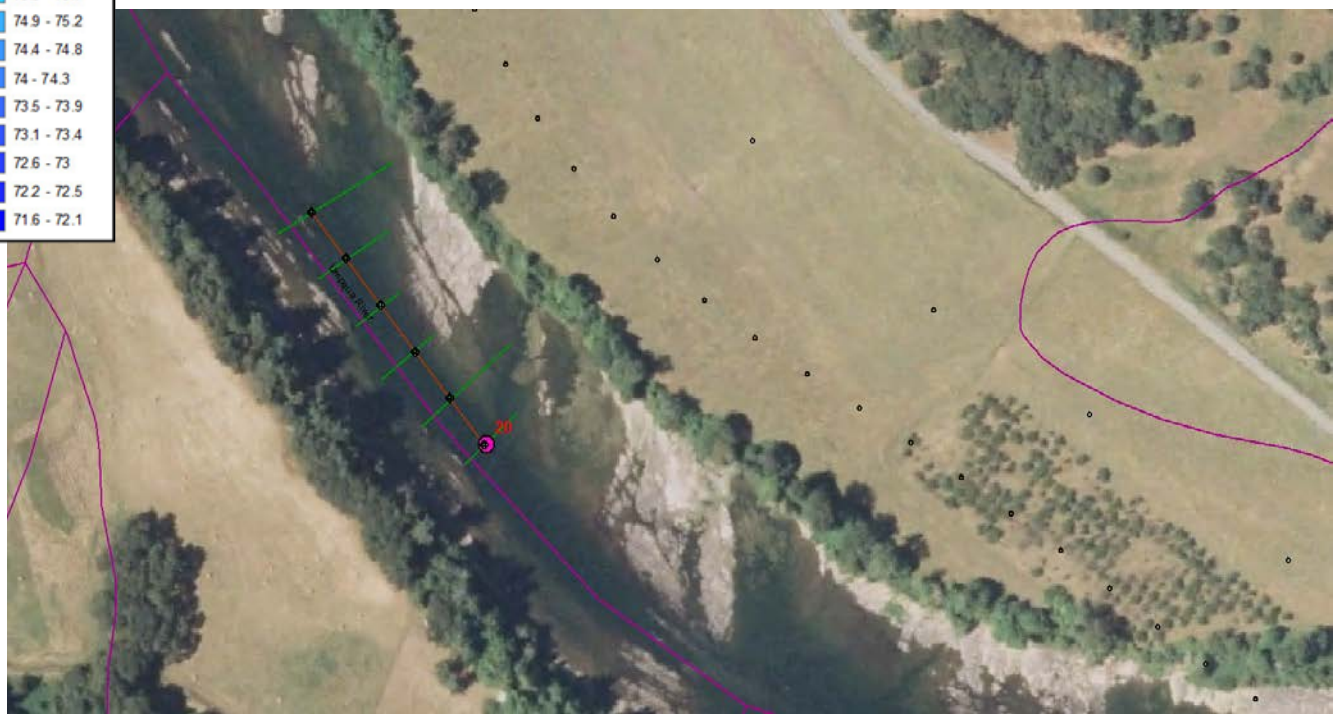
SITE 19

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
19	68.4	21.0	282.5	102.5	78.4	275.2	346.7	5006.8	409.6	76.6	78.9	-0.24	0.23	0.19

Moderately cool site and deep at the deployment point. Relatively small amount of bedrock in the influence zone.



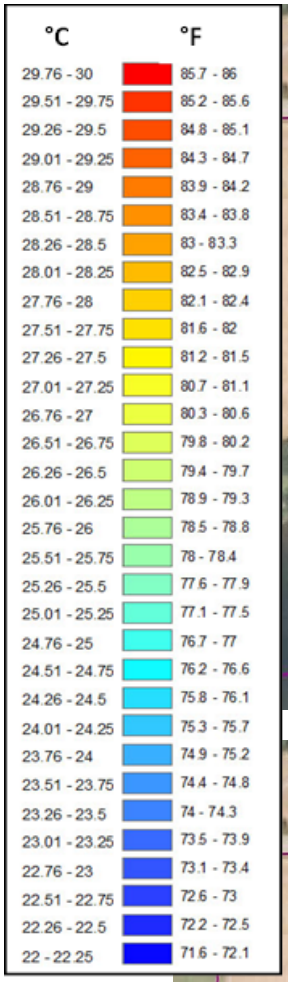


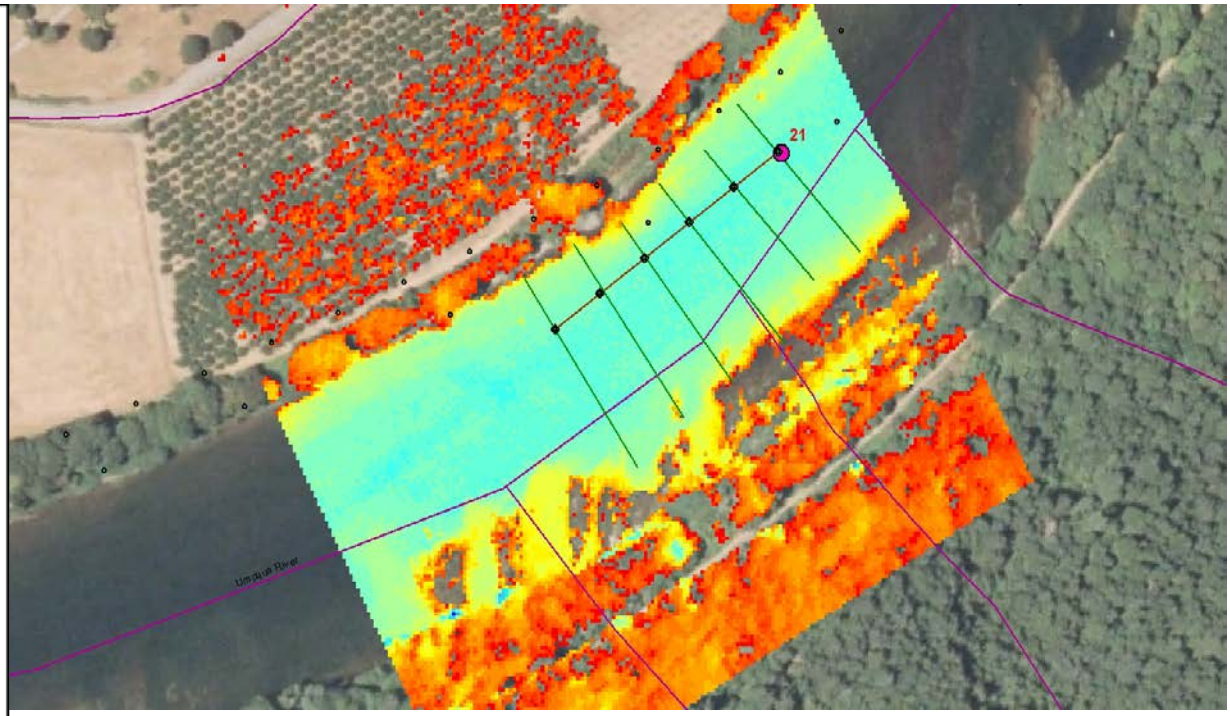


SITE 20

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
20	66.9	15.4	321.5	141.5	78.4	158.0	210.5	4975.0	399.1	76.6	78.9	-0.32	0.55	0.42

Temperature similar to Site 19. Significant bedrock present upstream. It appears that the warm area is restricted to an eddy region. The channel is constricted upstream and the actual flow velocity at the deployment point may be higher since the velocity calculations averaged in the widths associated with the eddy zones.

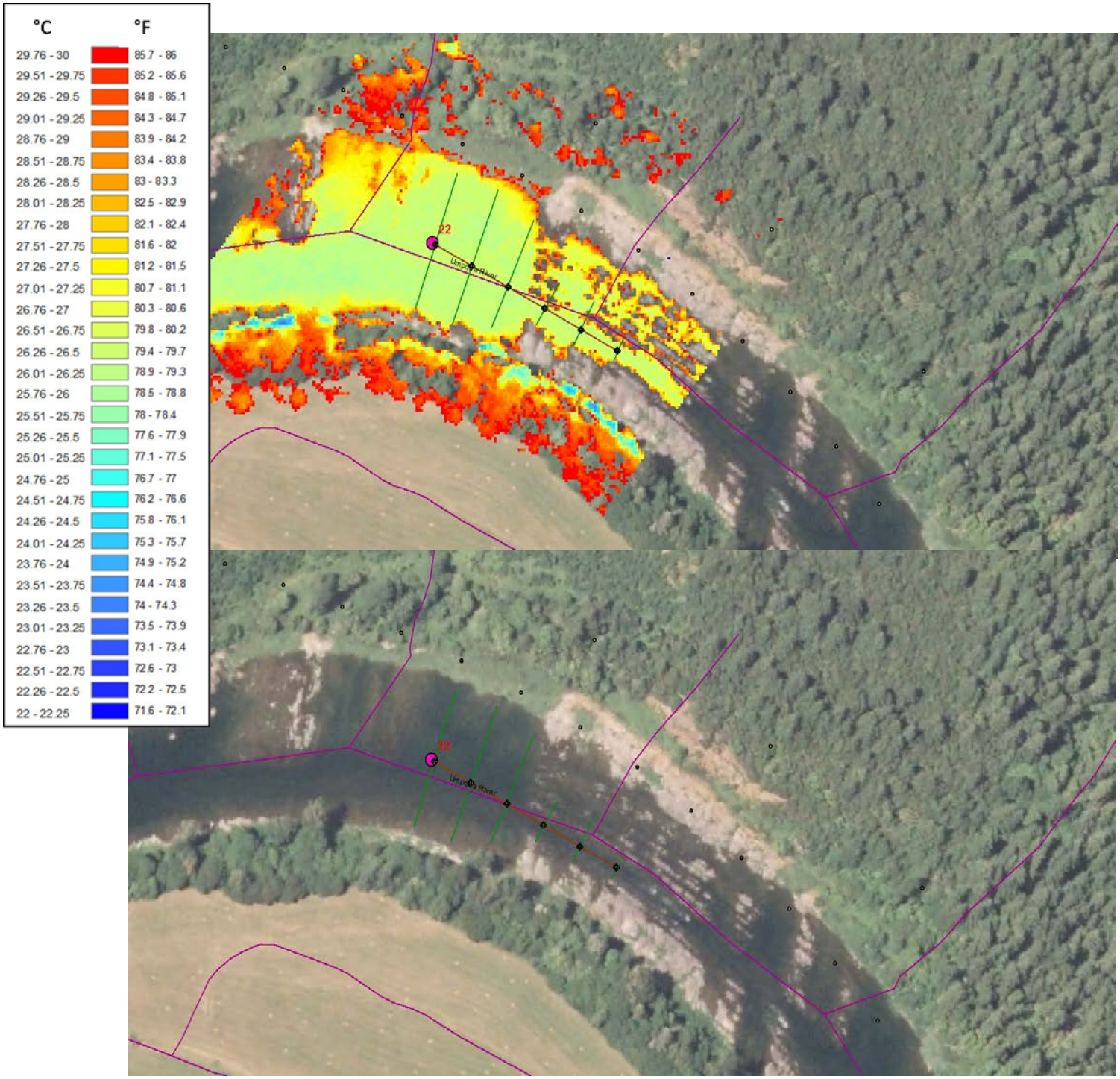




SITE 21

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
21	65.4	5.3	233.4	53.4	77.5	339.9	293.6	4965.5	403.0			-1.27	0.75	0.87

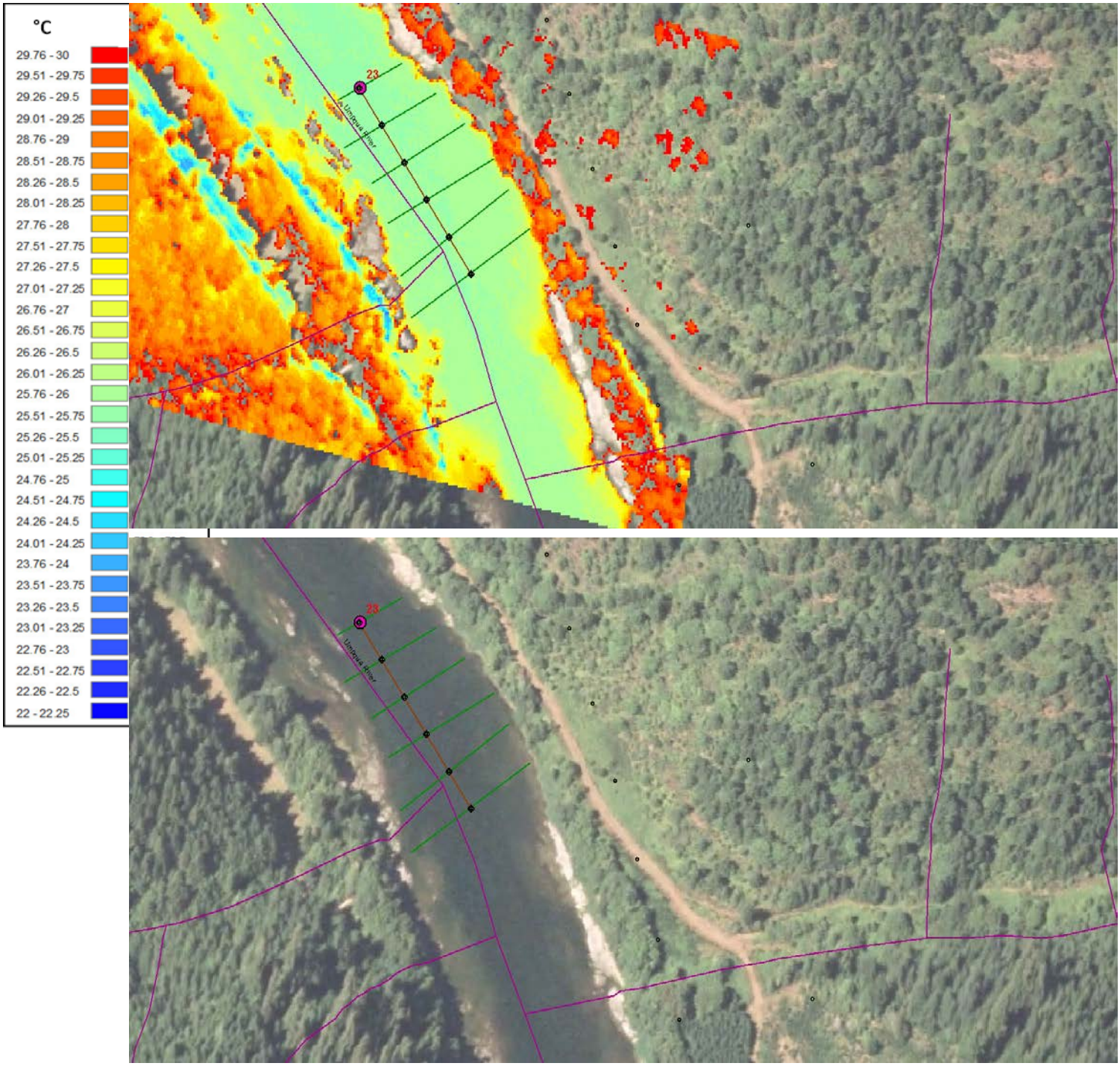
A cool site and the local environment is also relatively cooler. There appears to be some bedrock heating but the higher flow velocity is reducing its influence on the thalweg temperature.



SITE 22

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
22	64.0	9.0	118.7	118.7	79.4	196.1	323.0	4964.1	403.1			0.60	0.77	0.46

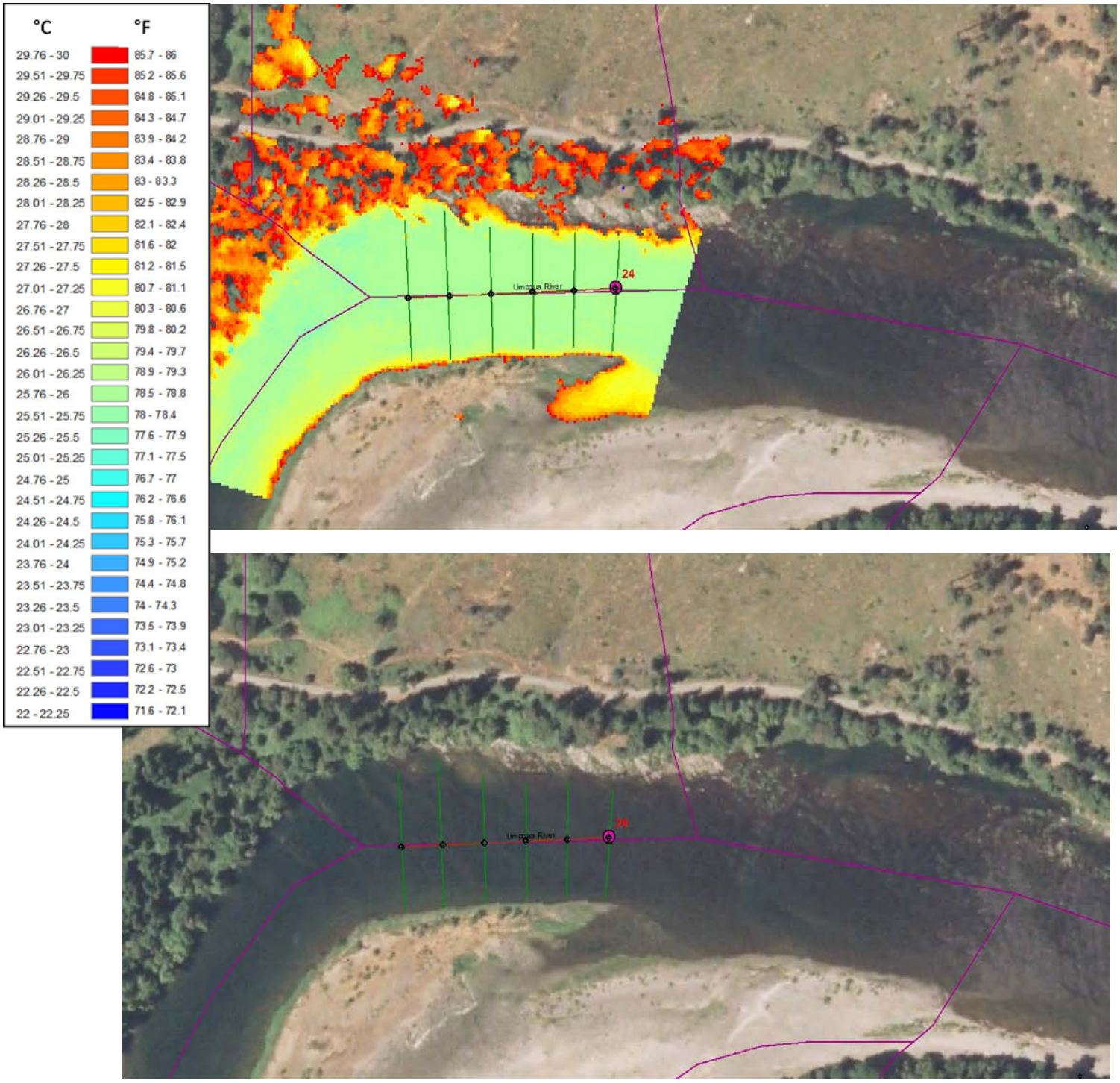
A warmer site. Rapid flow through the upstream bedrock matrix may be serving as an effective heat exchanger that is warming the pool region at the site point.



SITE 23

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
23	62.7	12.0	147.4	147.4	78.4	276.2	252.2	4893.4	409.3	76.9	78.9	-0.49	0.41	0.45

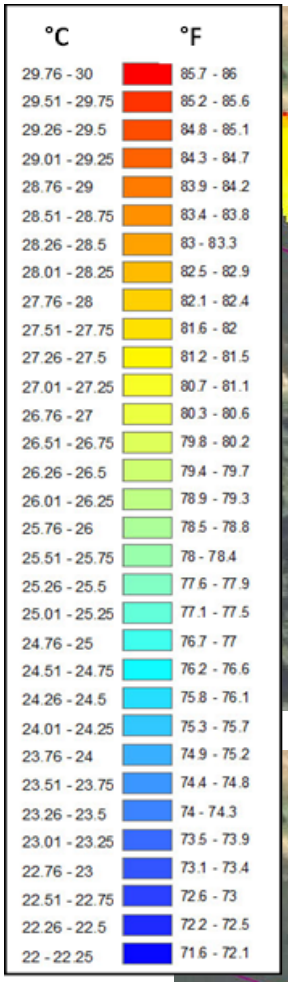
A moderately cool site. A low velocity area with rather minimal exposed bedrock. The environment around the channel is relatively cool.

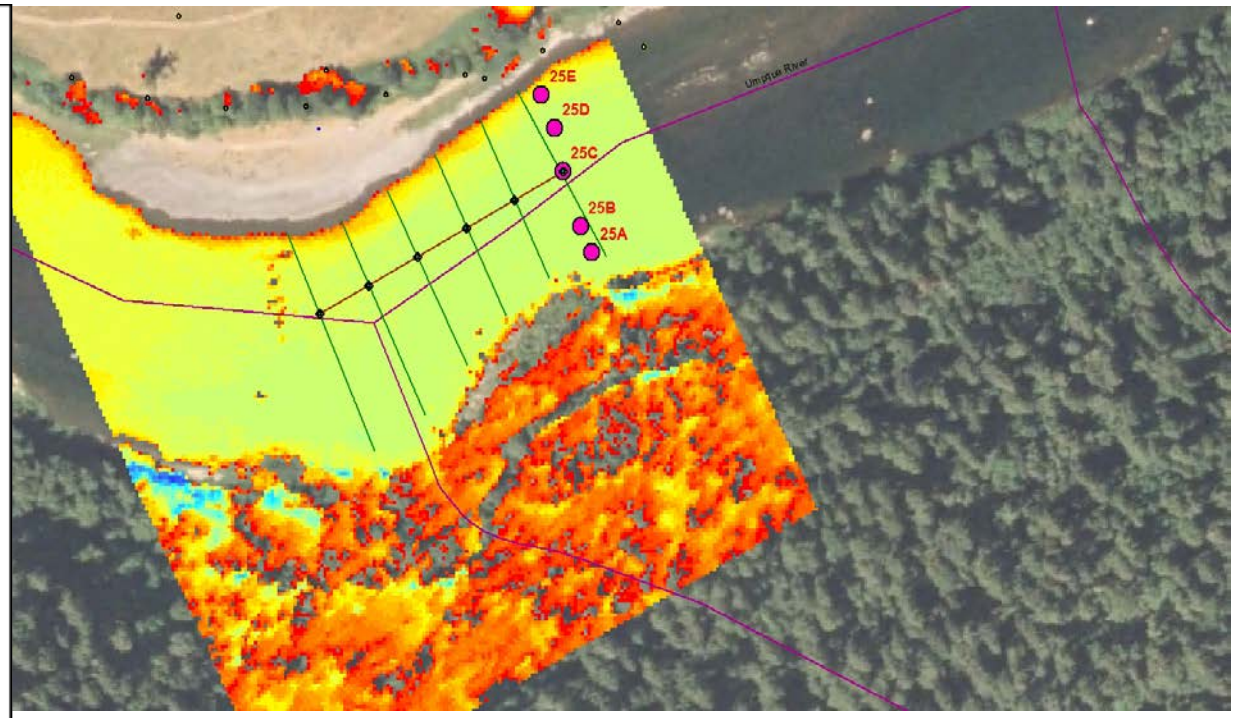


SITE 24

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
24	61.2	3.6	267.6	87.6	78.6	284.5	259.4	4952.0	400.8	77.4	79.6	-0.27	1.32	1.45

Moderately cool site with a large exposed gravel bar that doesn't appear to have as much heating effect as the bedrock areas. The depth is shallow and the flow velocities are high in this area.





SITE 25

Site Number	TIR River Mile	Site Depth Feet	River Azimuth Upstream	River Azimuth range 0-180	Ave Site TIR °F	Average Zone Width Feet	Width At Site (Ft)	Solar Radiation (WH/m^2) calculated for 7/23 00:00-16:00	Solar Radiation (WH/m^2) calculated for 7/23 15:00-16:00	PUR7/23/09 15:30 °F	PUR7/25/09 15:30 °F	Deviation Site TIR from Median Reg	Relative Zone Velocity*	Relative Site Velocity*
25	60.0	6.3	241.4	61.4	79.6	333.9	297.8	4928.8	399.6	78.3	80.4	0.68	0.64	0.72

Relatively warm site. It appears that that there is a large mass of warm water immediately upstream and that it is cooling slightly as it goes around the bend. Upstream photos would need to be examined to evaluate possible reasons for the higher temperature.

Influence of Site Conditions

The following charts compare the relative thermal response of each site with a physical site characteristic..

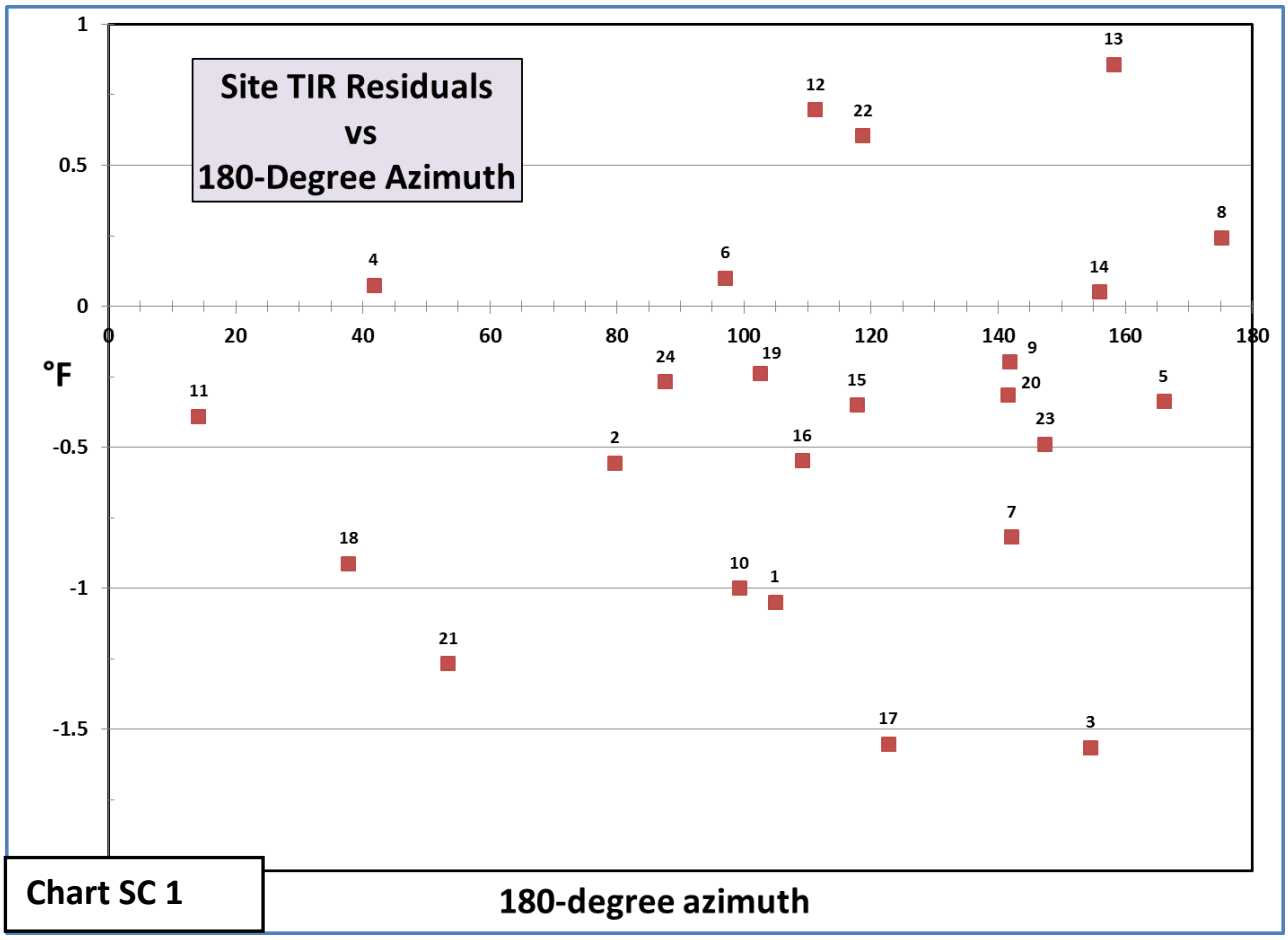


Chart SC 1

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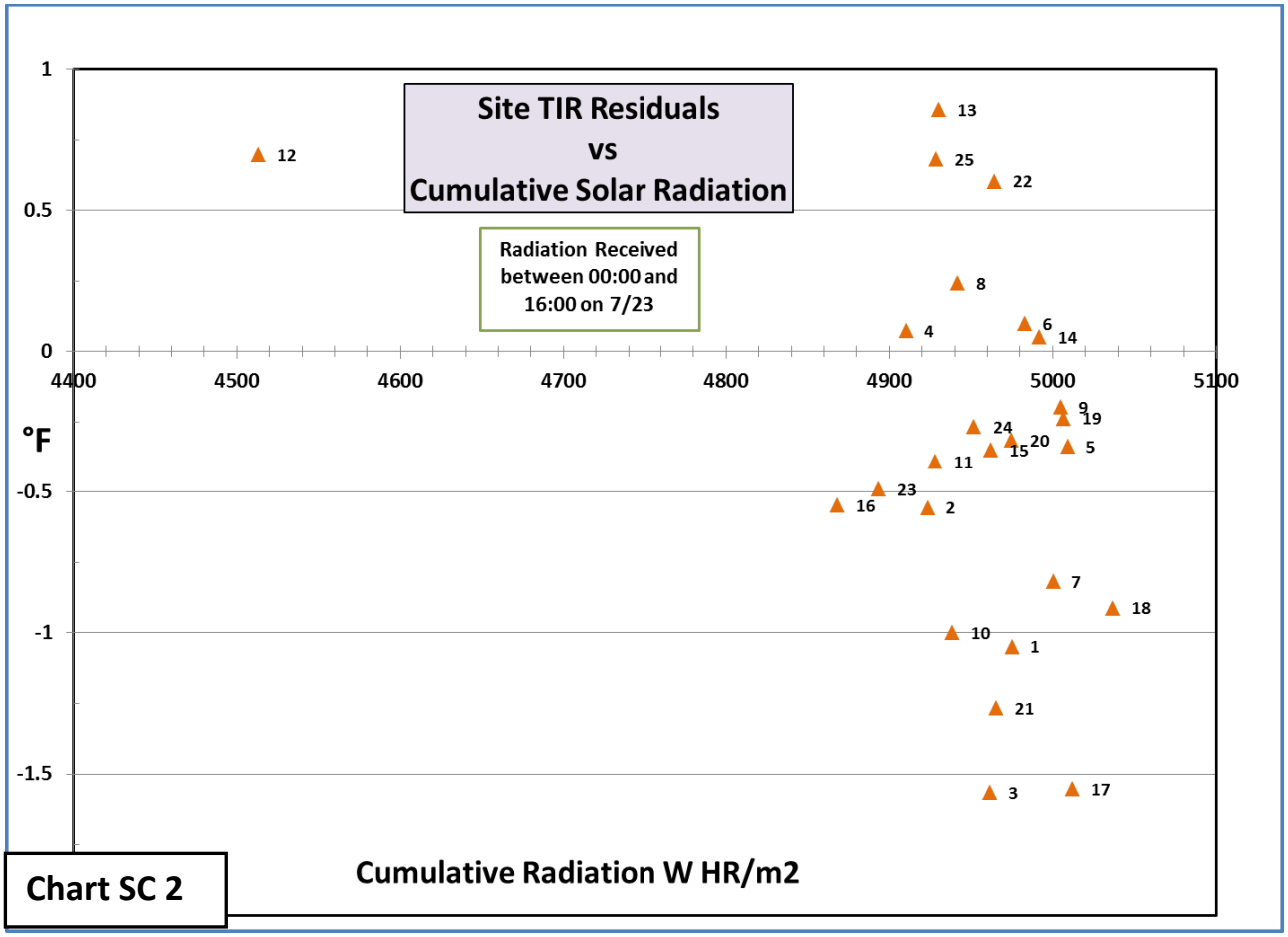


Chart SC 2

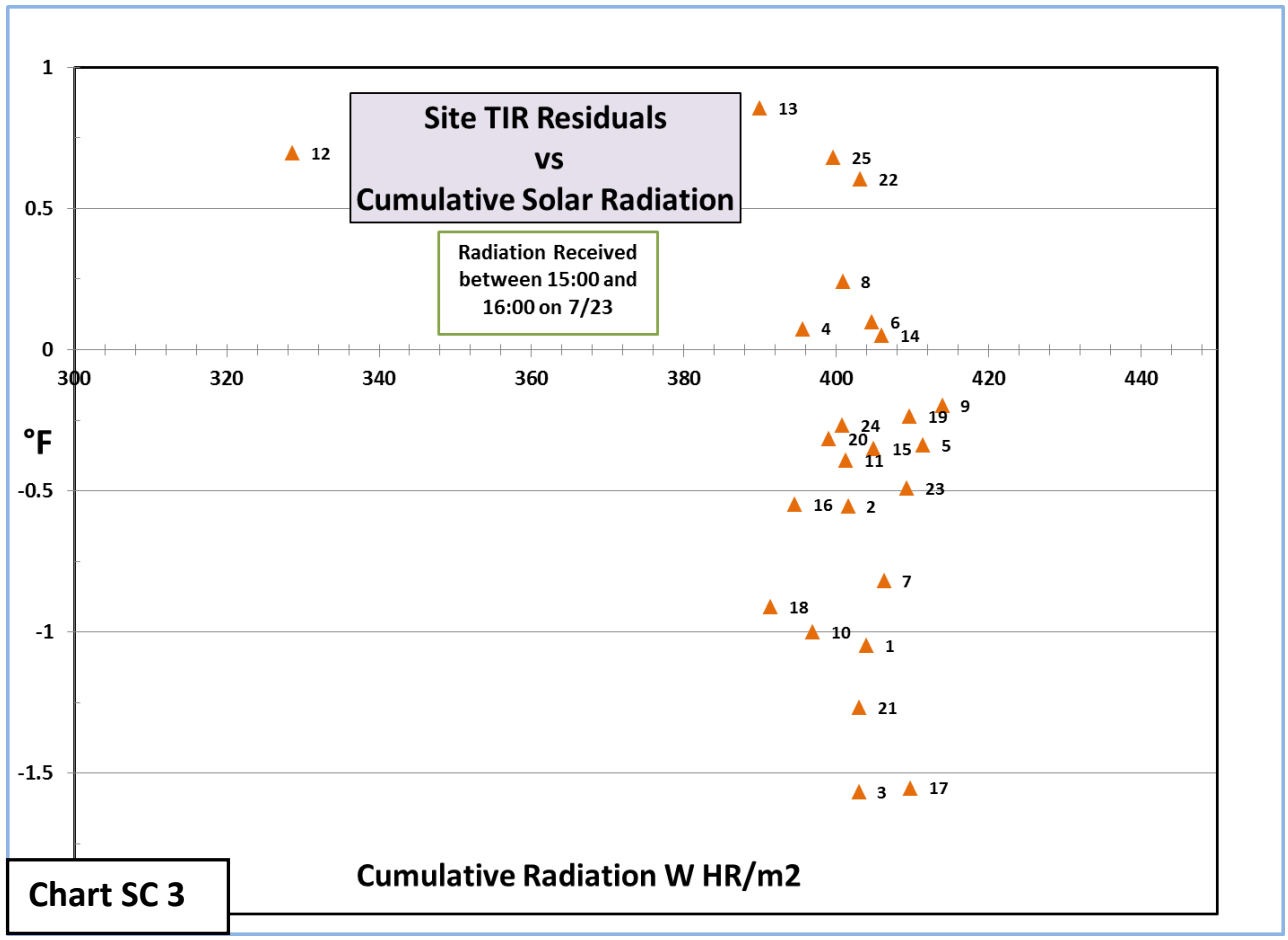


Chart SC 3

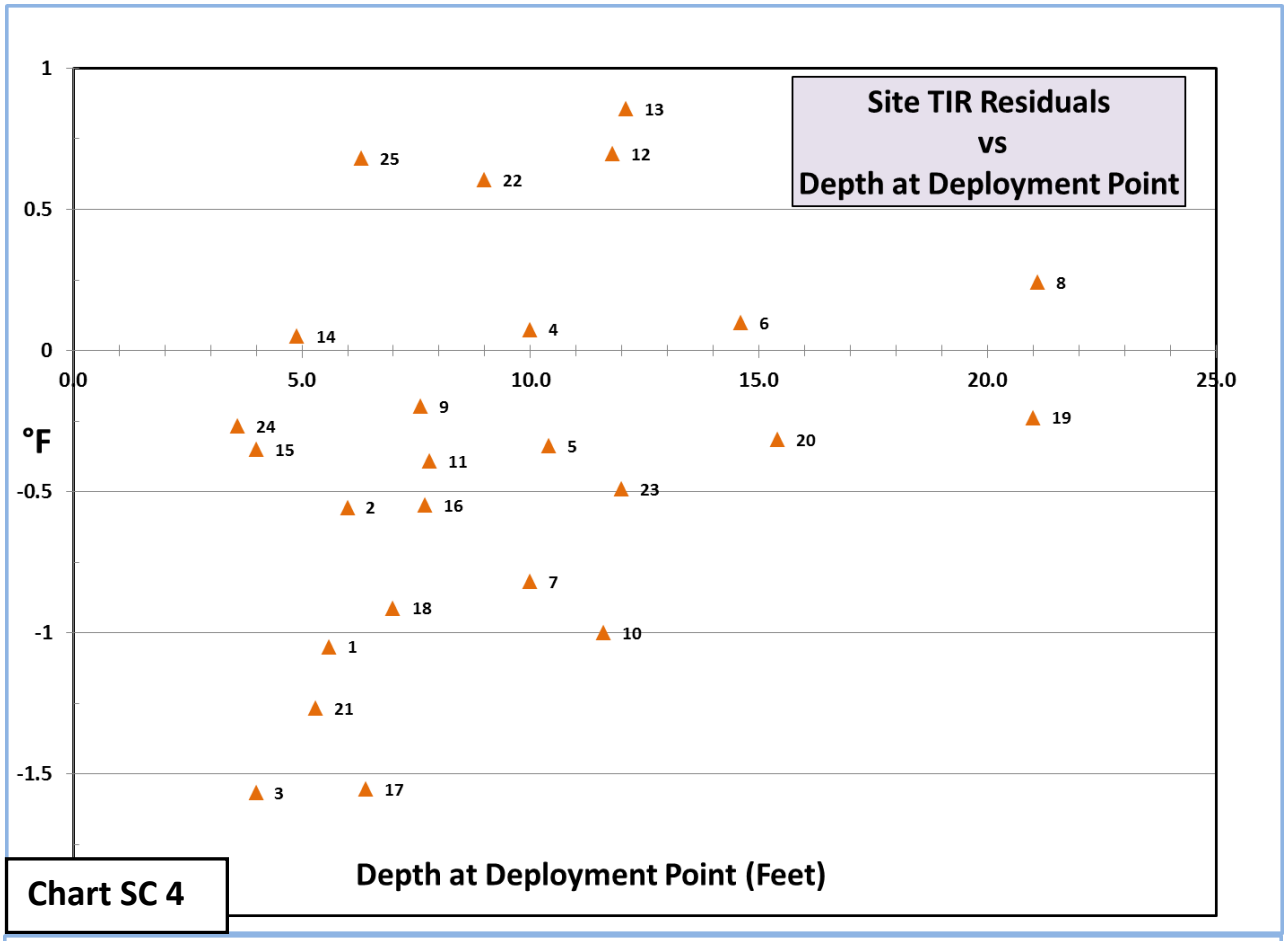


Chart SC 4

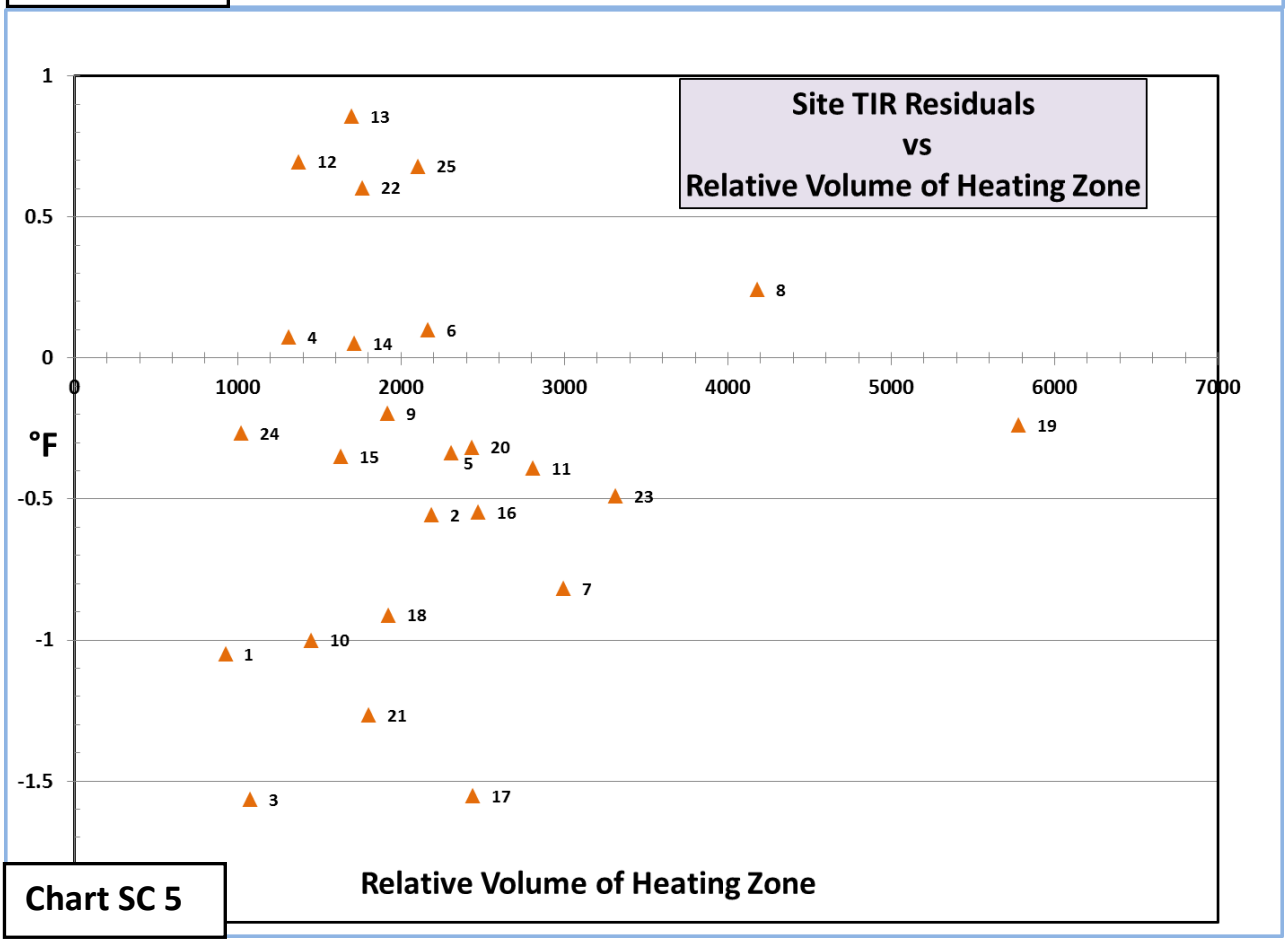


Chart SC 5

Chart SC 6

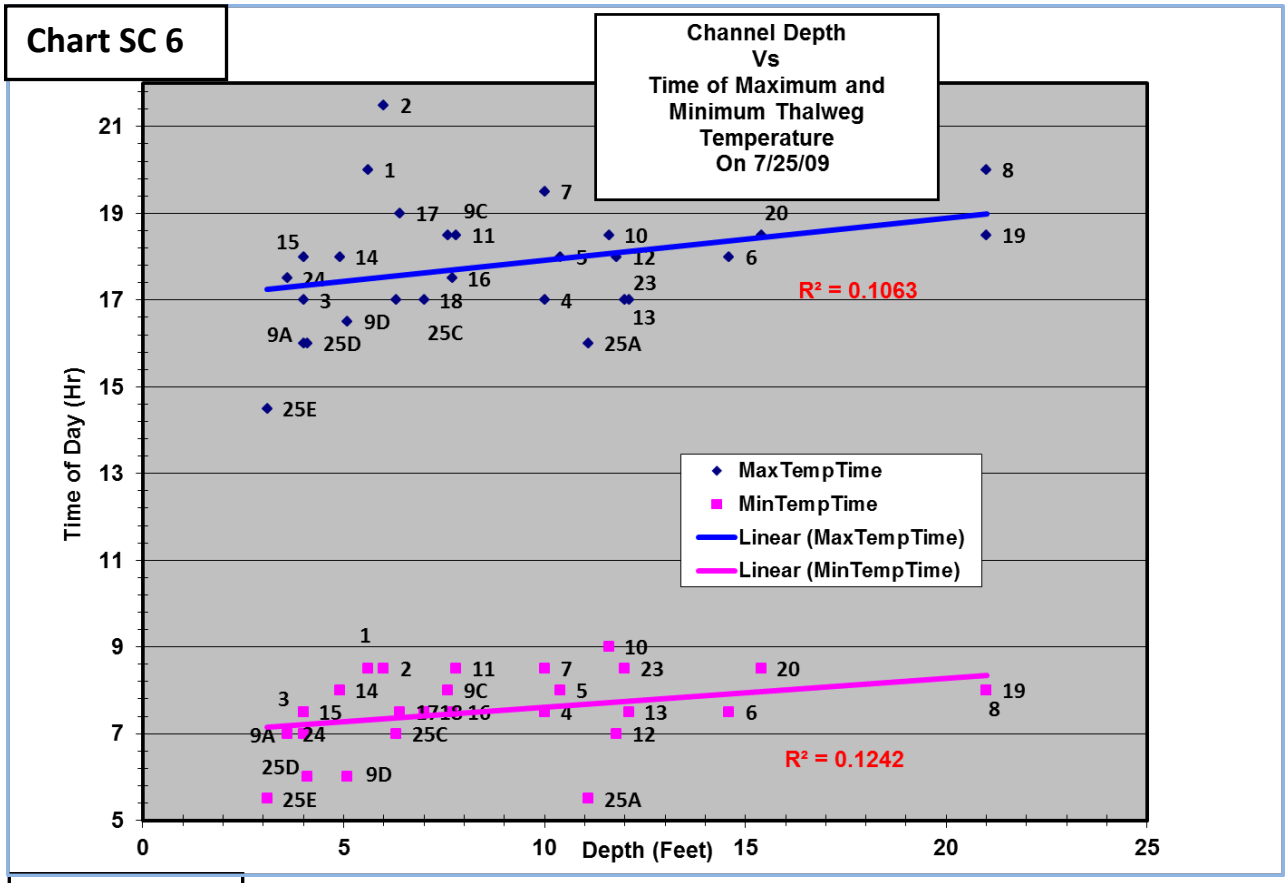


Chart SC 6
Channel Depth
Vs
Time of Maximum and
Minimum Thalweg
Temperature
On 7/25/09
Time of Day (Hr)
Depth (Feet)
MaxTempTime
MinTempTime
Linear (MaxTempTime)
Linear (MinTempTime)
R² = 0.1063
R² = 0.1242

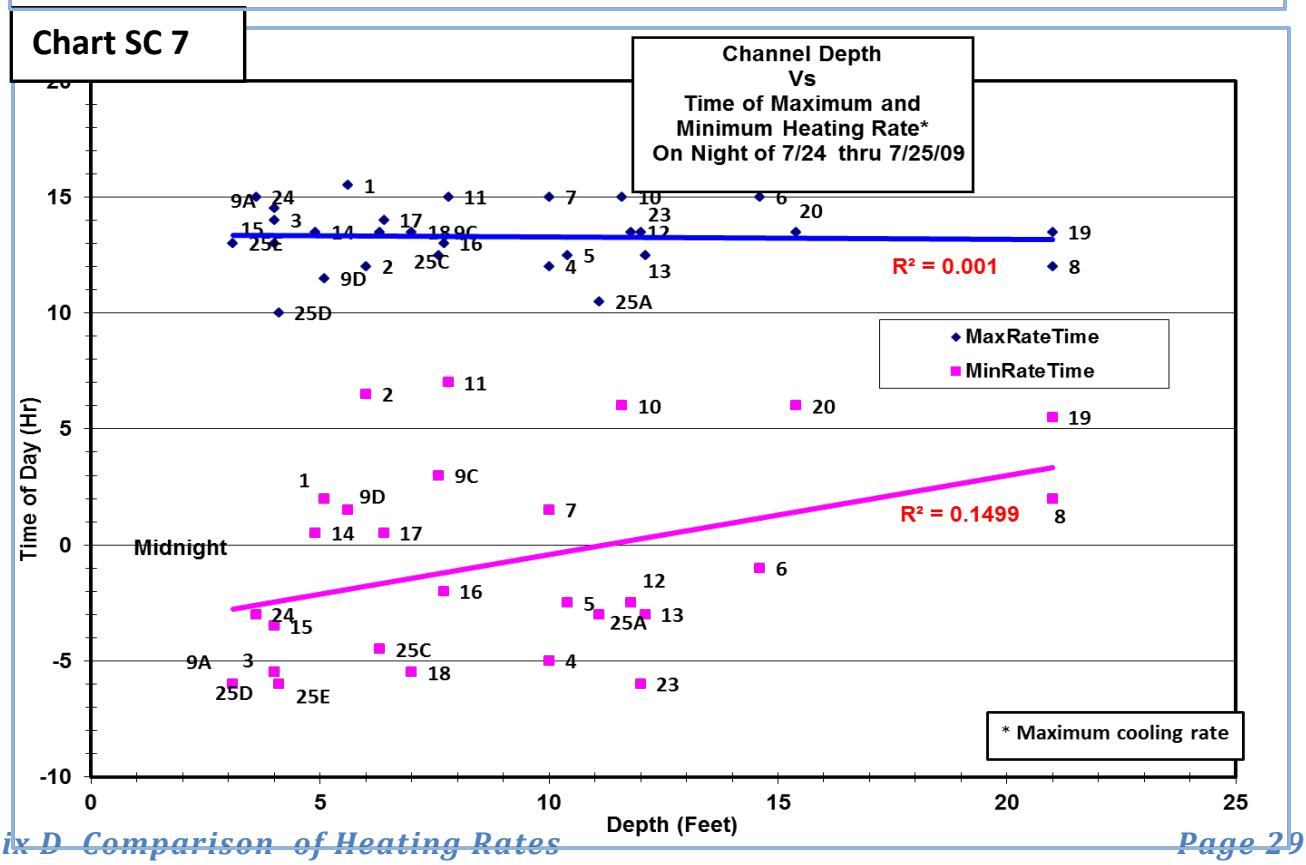


Chart SC 7
Channel Depth
Vs
Time of Maximum and
Minimum Heating Rate*
On Night of 7/24 thru 7/25/09
Time of Day (Hr)
Depth (Feet)
Midnight
MaxRateTime
MinRateTime
R² = 0.001
R² = 0.1499
* Maximum cooling rate

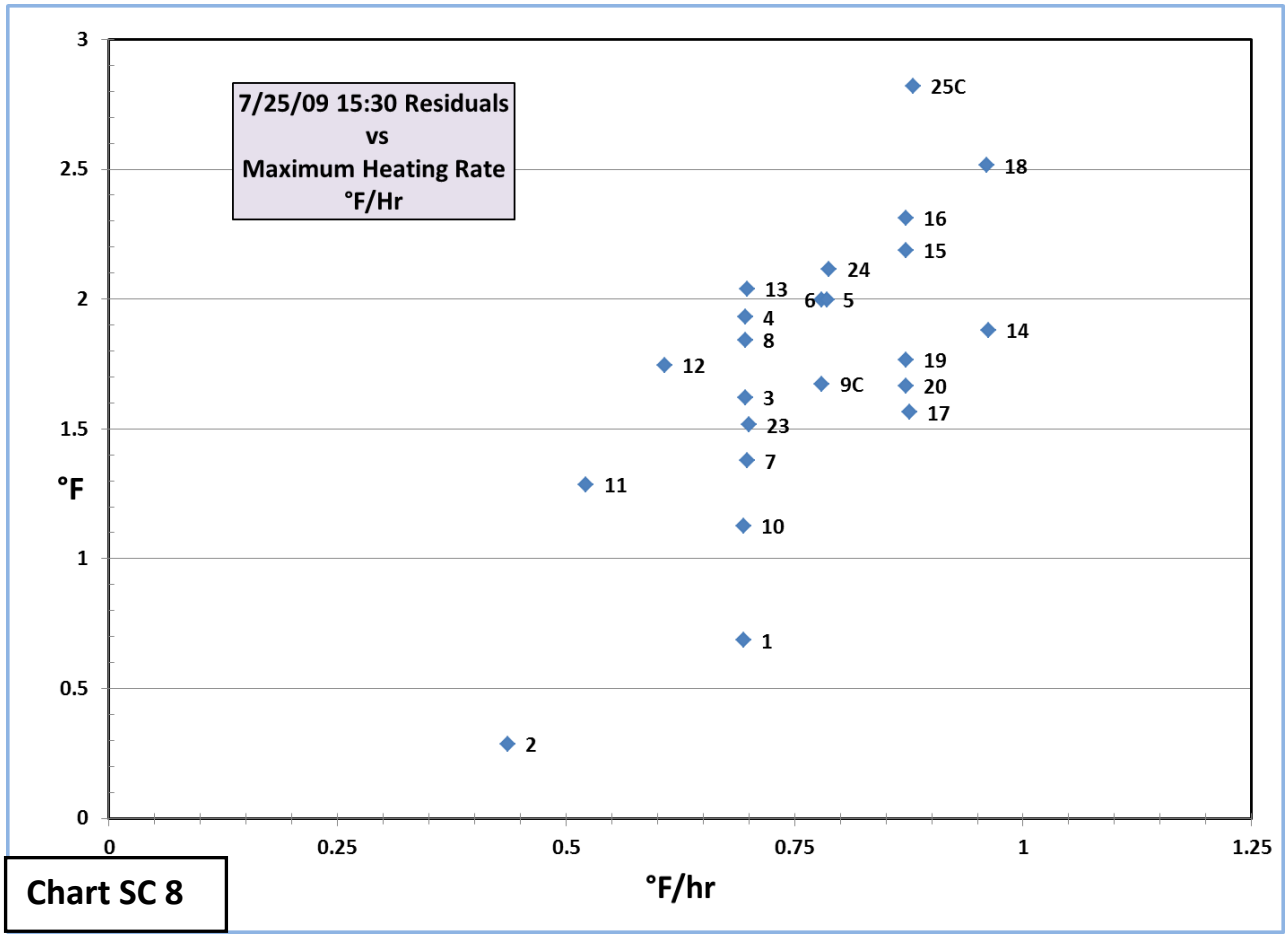
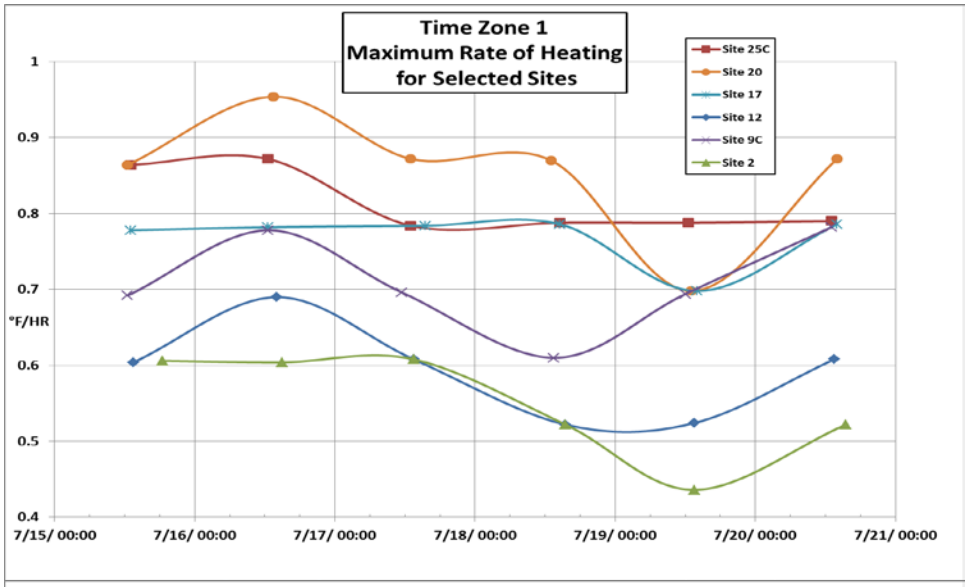
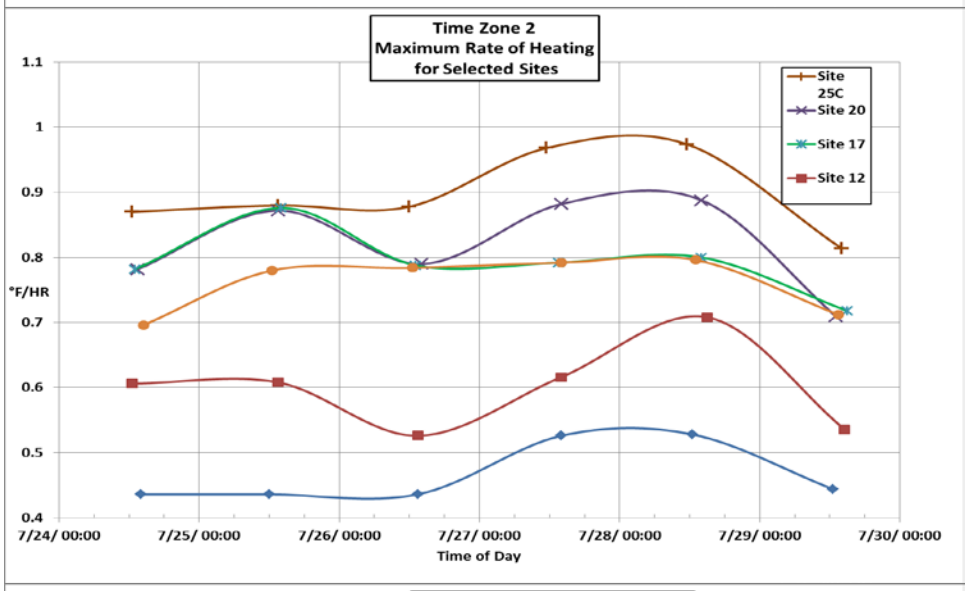
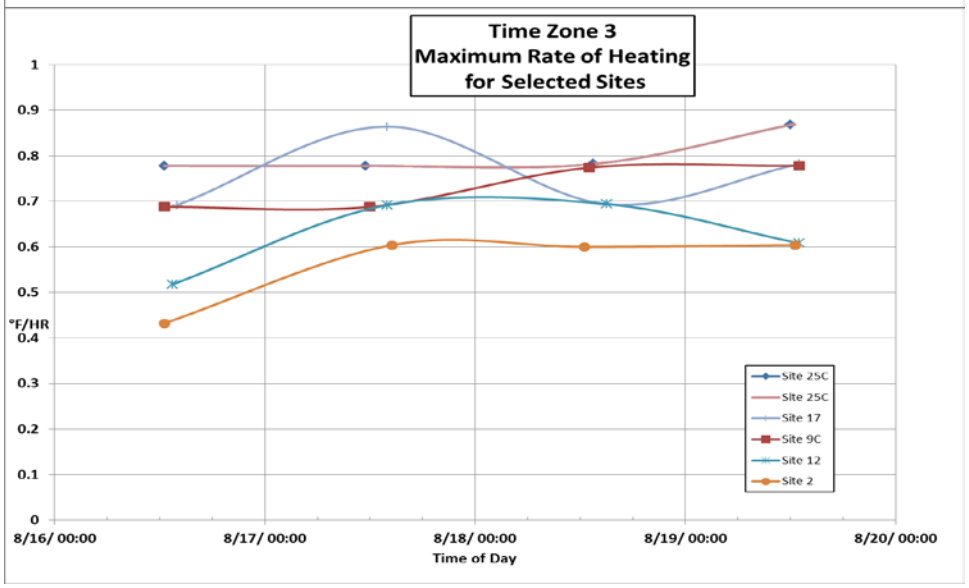

7/25/09 15:30 Residuals
vs
Maximum Heating Rate
°F/Hr
25C
18
16
15
24
13
6
5
4
8
14
12
19
9C
20
3
17
23
7
11
10
1
2
°F
°F/hr
0
0.5
1
1.5
2
2.5
3
0
0.25
0.5
0.75
1
1.25

Chart SC 8


Time Zone 1
Maximum Rate of Heating
for Selected Sites
Site 25C
Site 20
Site 17
Site 12
Site 9C
Site 2
°F/HR
1
0.9
0.8
0.7
0.6
0.5
0.4
7/15/ 00:00
7/16/ 00:00
7/17/ 00:00
7/18/ 00:00
7/19/ 00:00
7/20/ 00:00
7/21/ 00:00


Time Zone 2
Maximum Rate of Heating
for Selected Sites
Site 25C
Site 20
Site 17
Site 12
°F/HR
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
7/24/ 00:00
7/25/ 00:00
7/26/ 00:00
7/27/ 00:00
7/28/ 00:00
7/29/ 00:00
7/30/ 00:00
Time of Day


Time Zone 3
Maximum Rate of Heating
for Selected Sites
Site 25C
Site 25C
Site 17
Site 9C
Site 12
Site 2
°F/HR
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
8/16/ 00:00
8/17/ 00:00
8/18/ 00:00
8/19/ 00:00
8/20/ 00:00
Time of Day