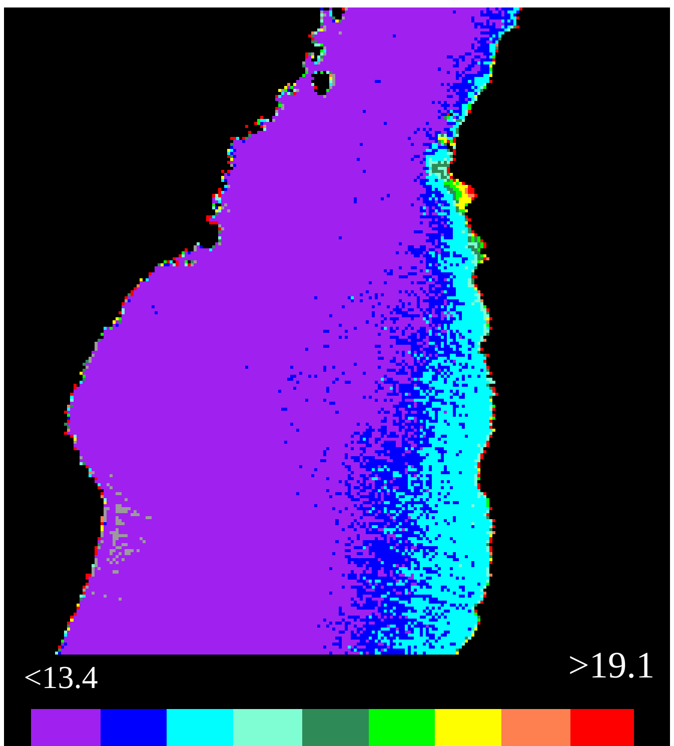
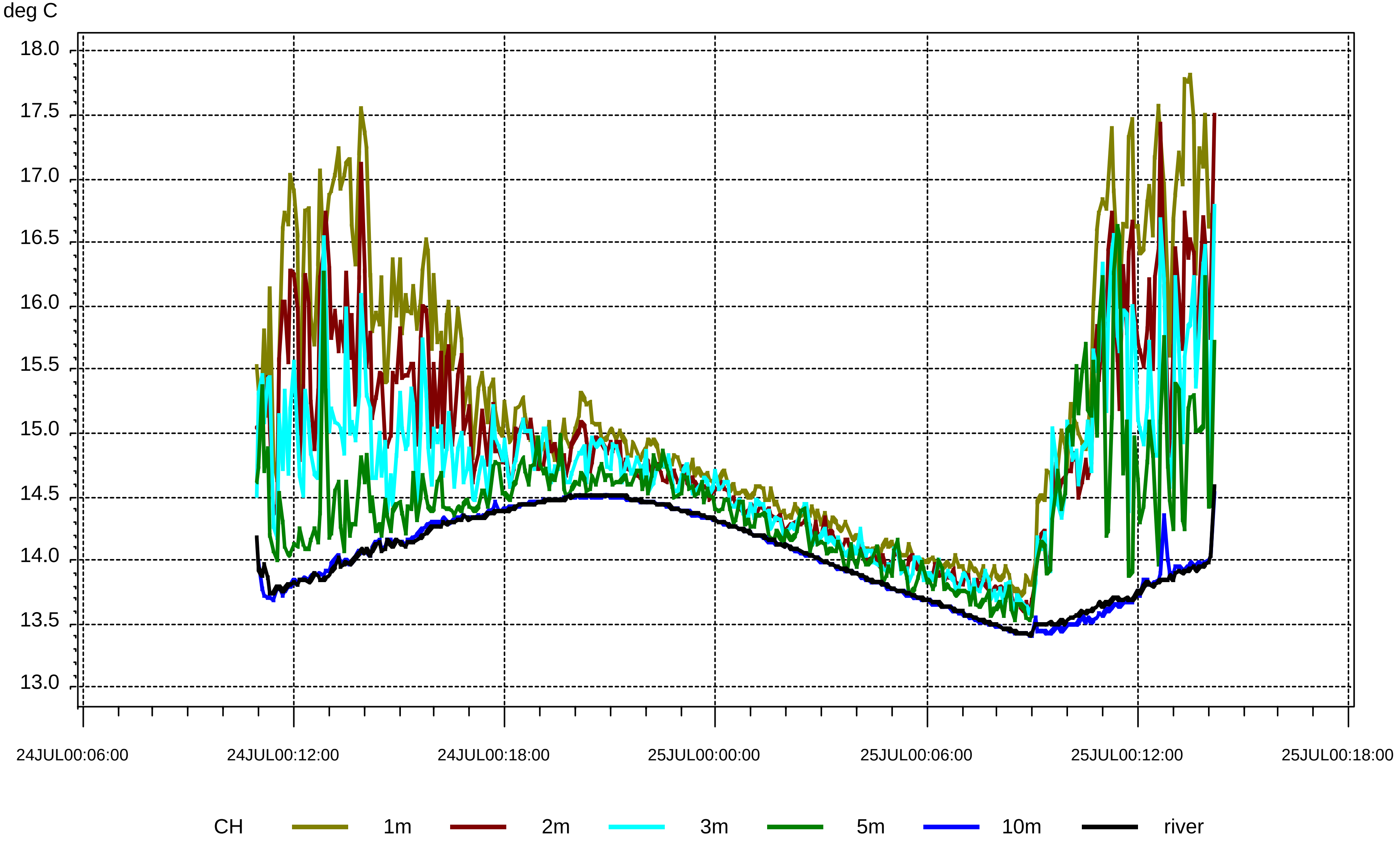
Gradients in Nearshore Water Temperature Aug-Oct, 2004

Matt Kaplinski and Josh Korman



Bill Vernieu, GCMRC, 2000 LSSF

m10 RM 64.6L



deg C
18.0
17.5
17.0
16.5
16.0
15.5
15.0
14.5
14.0
13.5
13.0
24JUL00:06:00
24JUL00:12:00
24JUL00:18:00
25JUL00:00:00
25JUL00:06:00
25JUL00:12:00
25JUL00:18:00
CH
1m
2m
3m
5m
10m
river

Hypotheses to Test for 2004 Nearshore Water Temperature Study

- Isolation of Nearshore Environment
  - Nearshore warming will vary with extent of hydraulic isolation (talus<low angle<backwater).
  - Higher fluctuations will decrease residence time in isolated environments and reduce nearshore warming
- Air-Water Temperature Gradient
  - Nearshore warming will be greatest when difference between water and air temperature is large (May-Aug).
  - Steadier flows that cause nearshore warming during summer months will have little effect during spring and fall when ambient conditions do not support nearshore warming.

‘Experimental Design’ of 2004 Study

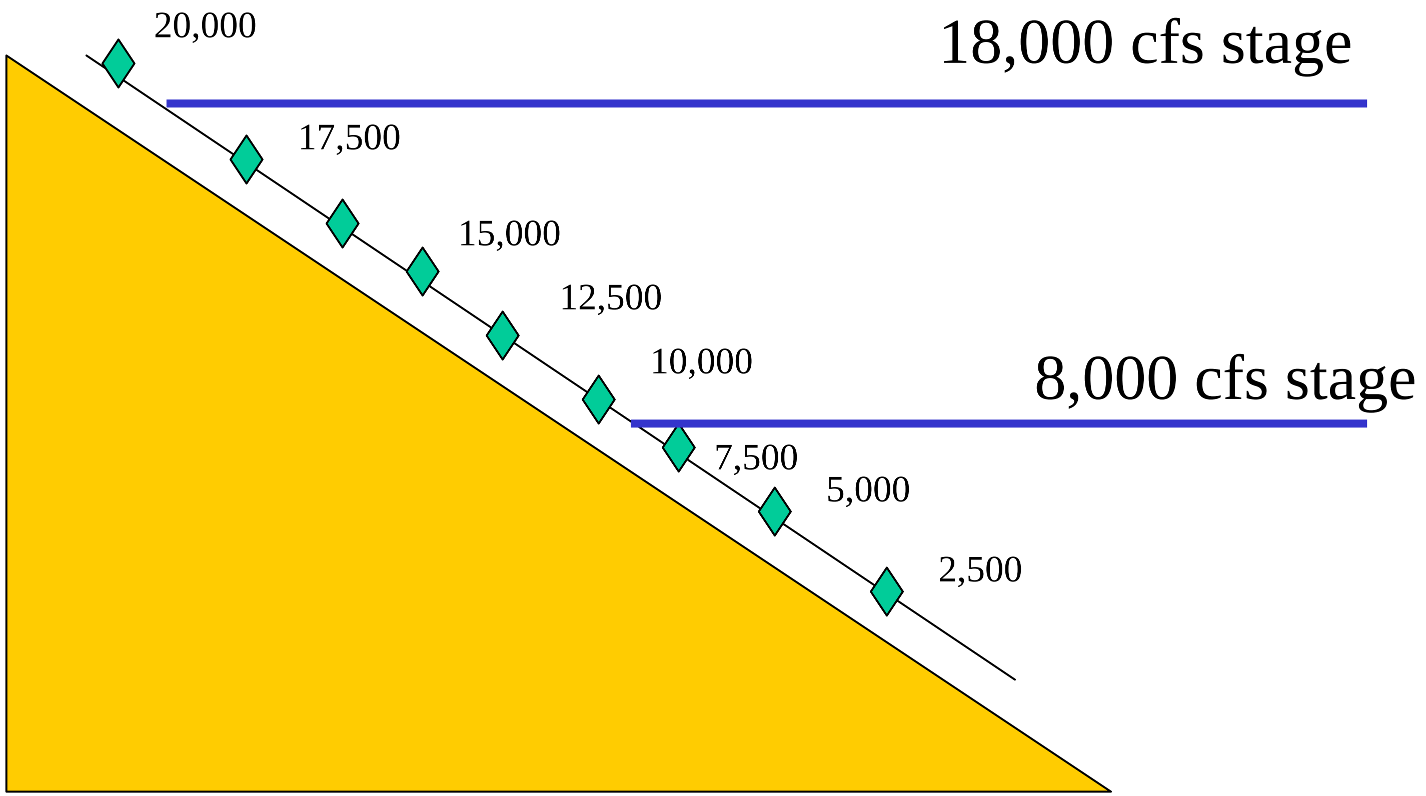
Period	Air Temperature and Solar Insolation	Daily Flow Fluctuations
Late-August	High	High (10-18 kcfs)
Early-September	High	Low (5-10 kcfs)
Late-October	Low	Low (5-10 kcfs)

Flow Effect: August vs. September
Ambient Effect: September vs. October

Methods

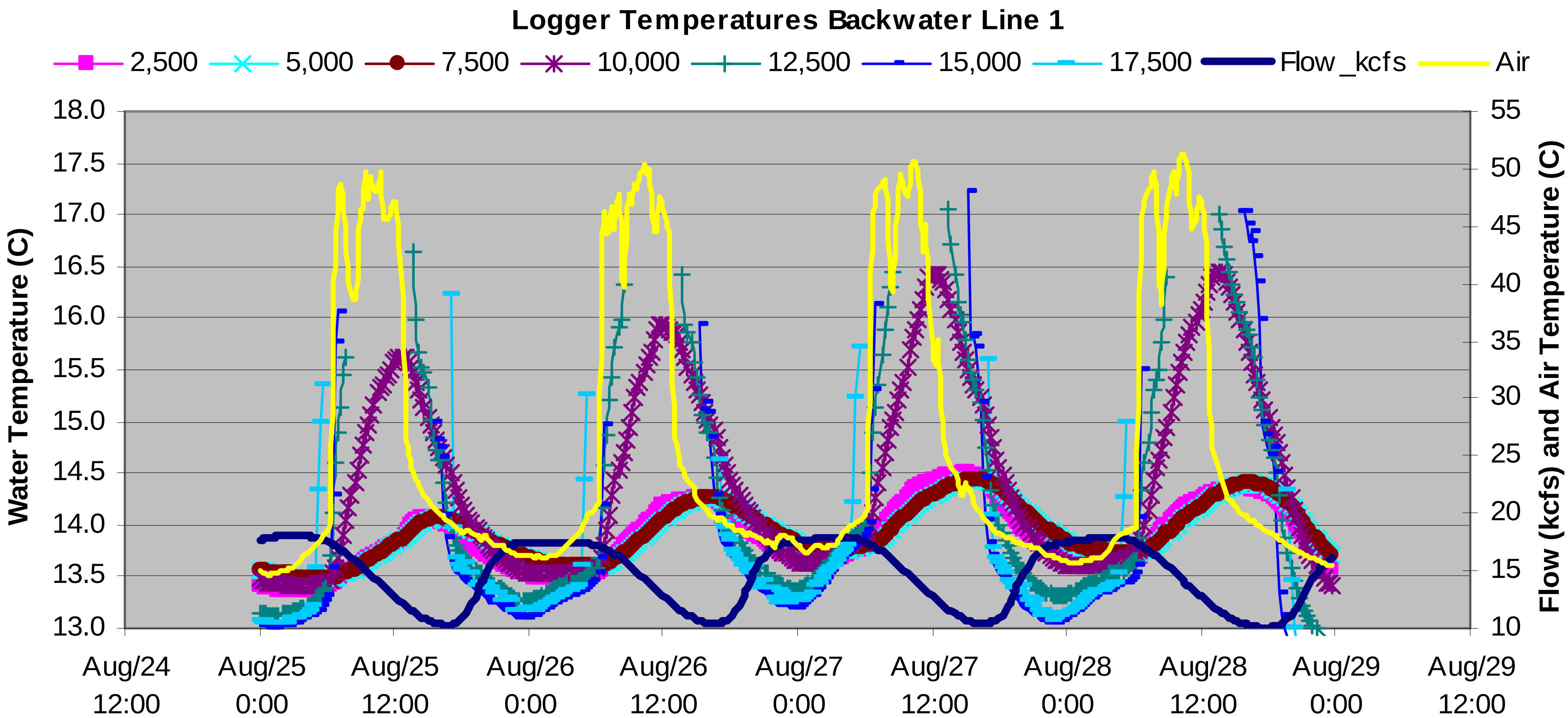
- Deployed string of temperature loggers from 2.5 – 20 kcfs in 2.5 kcfs increments (mid-Aug to late Oct.) on the bottom
- 3 Sites (Glen Canyon (-3.5 mile), Eminence (42.5), and Salt Mines (65 mile) – contrast in mainstem water temperatures
- 3 Habitat types (backwater, low angle sand or cobble, talus) – contrast in hydraulic isolation
- Replicate lines for each habitat type per site
- 8 loggers/line * 3 habitat types * 2 replicates * 3 sites = 144 loggers!
- Measured vertical gradient in water temperature over permanently inundated loggers for brief periods in Aug. and Sep. (Surface, – 25 cm, bottom)

Logger Line

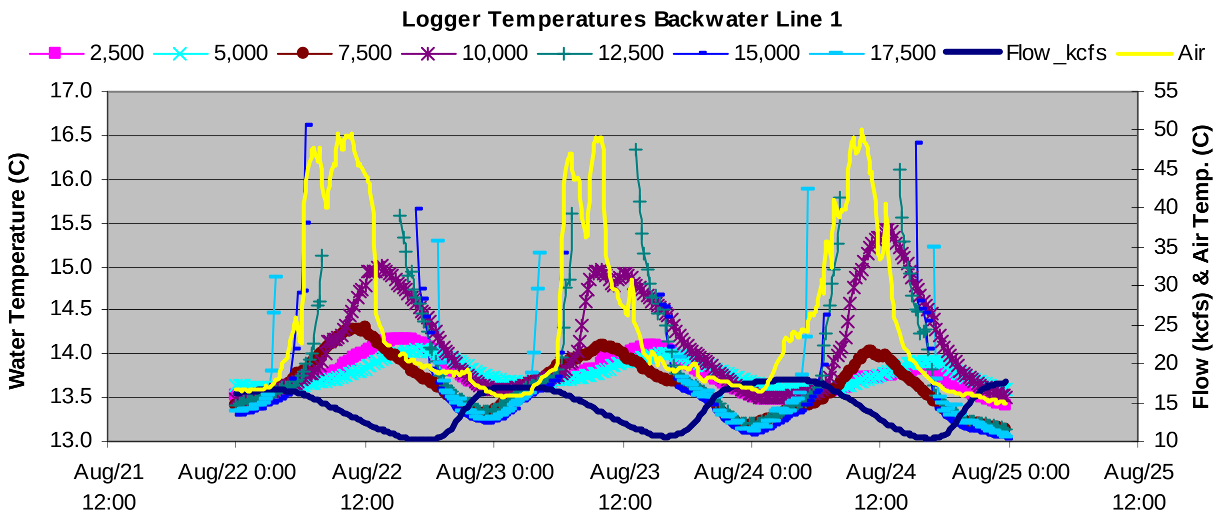

20,000
18,000 cfs stage
17,500
15,000
12,500
10,000
8,000 cfs stage
7,500
5,000
2,500

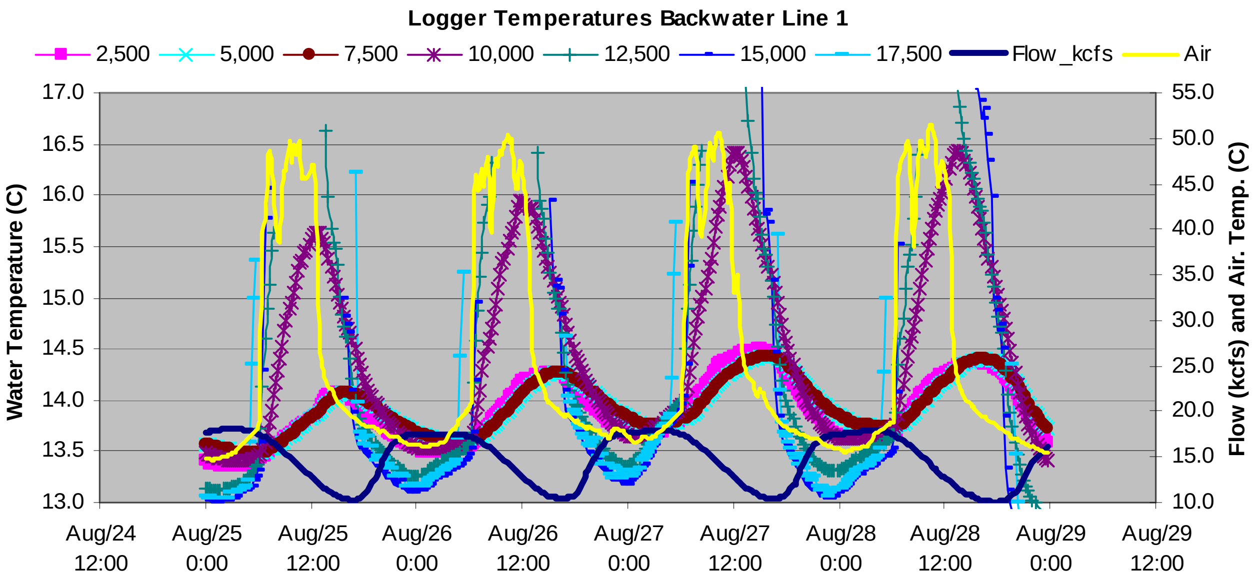


Eminence Backwater

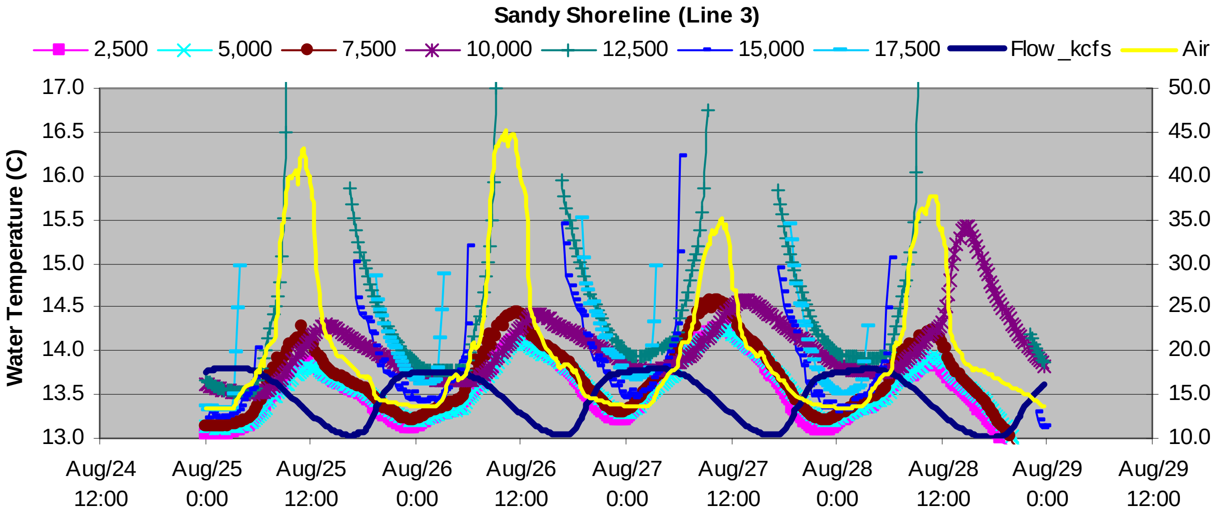


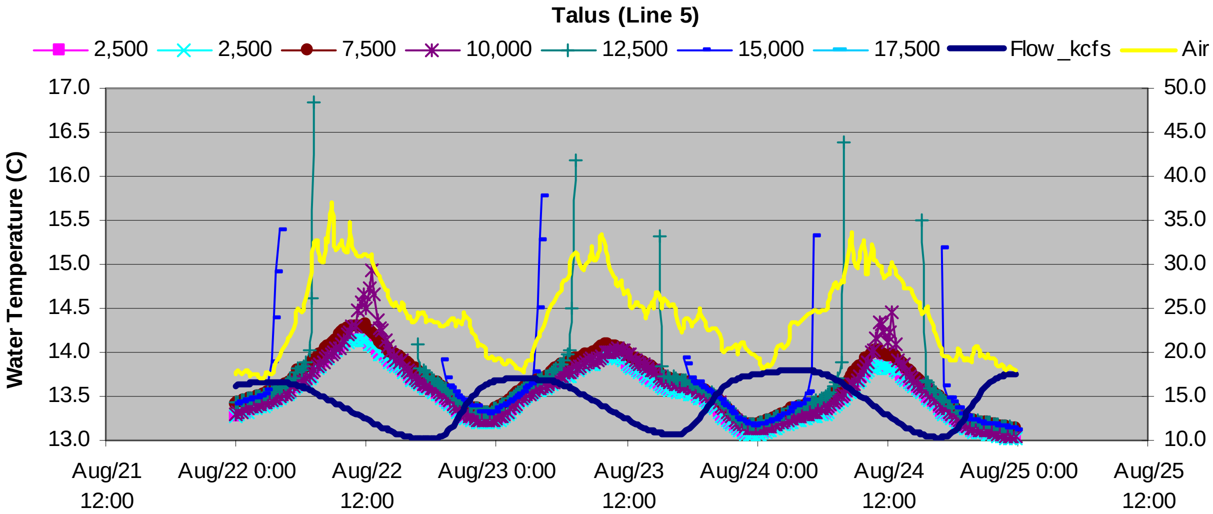
Eminence Backwater



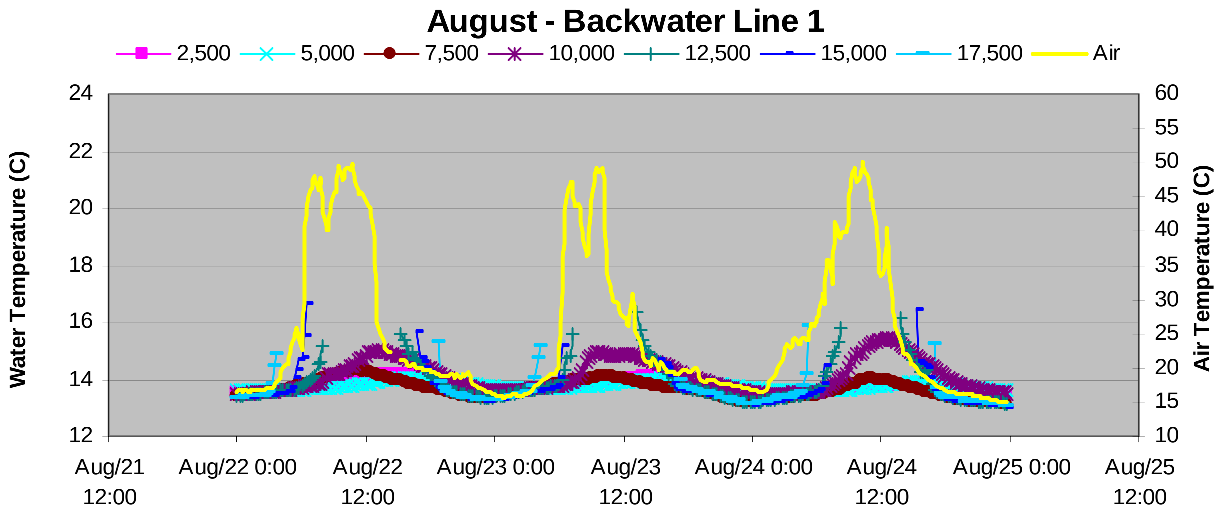


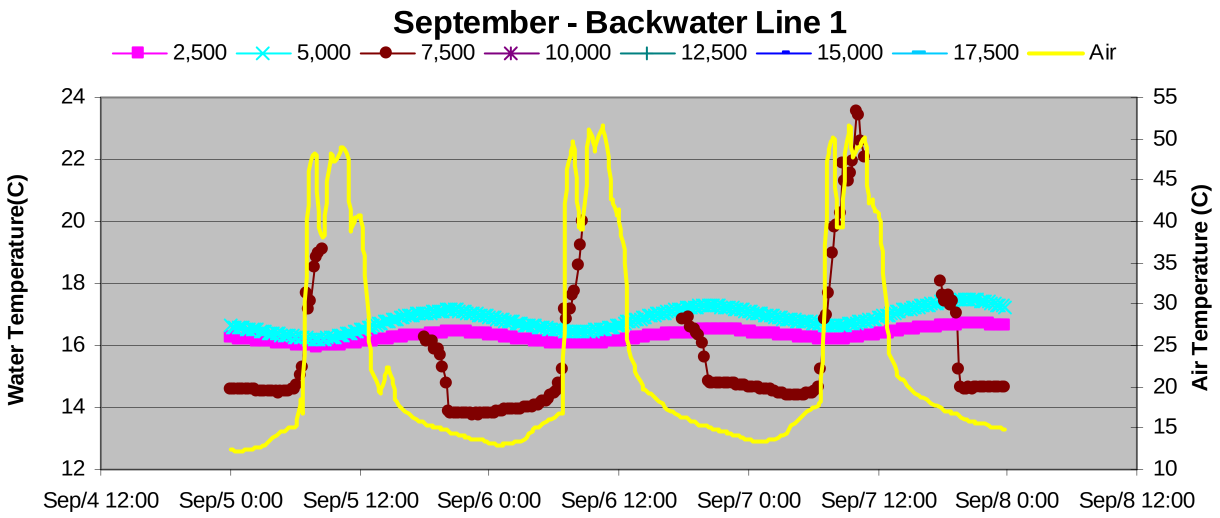
Eminence Shorelines (Low vs. Steep angle)





August vs. September Eminence Backwater





Conclusions

- In general nearshore-offshore warming under fluctuating flows was relatively small (0-2 C).
- Strong seasonal component to nearshore warming (Sept. vs. Oct). Greatest warming potential during early-summer months when discharge temperature is low and air temperature and solar insolation are high.
- More warming (relative to GCD release temp.) under 5-10 kcfs regime due to longer travel time.
- Strong effect of site isolation with backwaters showing greatest warming. Inconsequential warming in talus habitats.
- To test the effects of fluctuating flows on nearshore warming the best comparison would be Sunday vs. Weekday operations. Our monthly comparison confounded by seasonal and GCD release temperature effects.
- Calibrated thermal imaging probably best way to quantify warming due to high spatial variation.

Nearshore Warming Summary

	Permanent Inundation	Varial Zone
August	2.5 kcfs vs. 10 kcfs	2.5 kcfs vs. 17.5 kcfs
September & October	2.5 kcfs vs. 5 kcfs	2.5 kcfs vs. 10 ckfs

		Permanent Zone		Varial Zone		Air
Month	**Site**	**Avg.**	**Max**	**Avg.**	**Max**	**Avg.**
Aug	Backwater line-1	0.49	2.10	0.46	2.92	23.3
	Backwater line-2	0.62	2.91	0.98	6.69	
	Shoreline line-3	0.44	1.94	0.78	5.53	
	Talus line-4	-0.09	0.24	0.03	2.99	
	Talus line-5	0.08	1.34	0.24	3.91	
Sept	Backwater line-1	0.56	0.88	-0.12	9.20	22.6
	Backwater line-2	1.05	1.97	1.26	4.74	
	Shoreline line-3			0.40	4.76	
	Talus line-4			0.04	3.10	
	Talus line-5			0.20	5.26	
Oct	Backwater line-1	0.31	0.74	1.09	3.14	10.0
	Backwater line-2					
	Shoreline line-3			-0.15	1.70	
	Talus line-4			-0.40	1.87	
	Talus line-5	0.01	0.03	0.06	1.10	