East Fork Lewis River TMDL Update Meeting

Overview of Monitoring and Modeling Results

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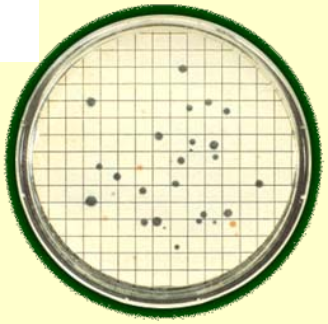
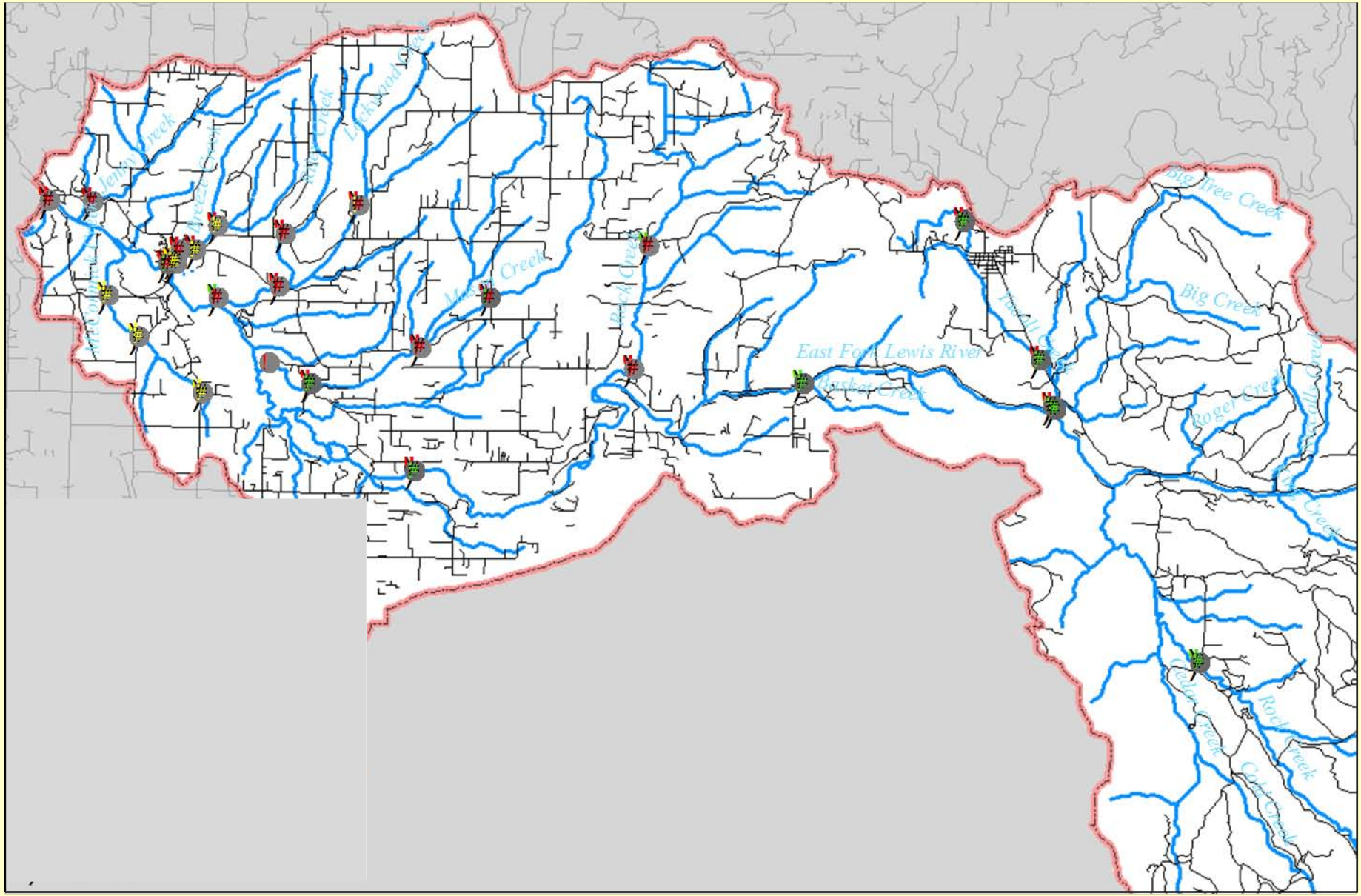
Purpose

- Fecal Coliform Bacteria TMDL
  - Review of available data
  - Comparison to water quality standards
  - Fecal Coliform Load Allocations
  - Next steps



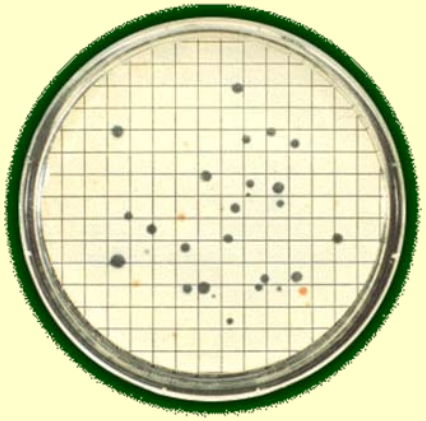
- Temperature TMDL
  - Review of available data
  - Comparison to water quality standards
  - Next Steps/Potential Outcomes

Bacteria Monitoring Locations



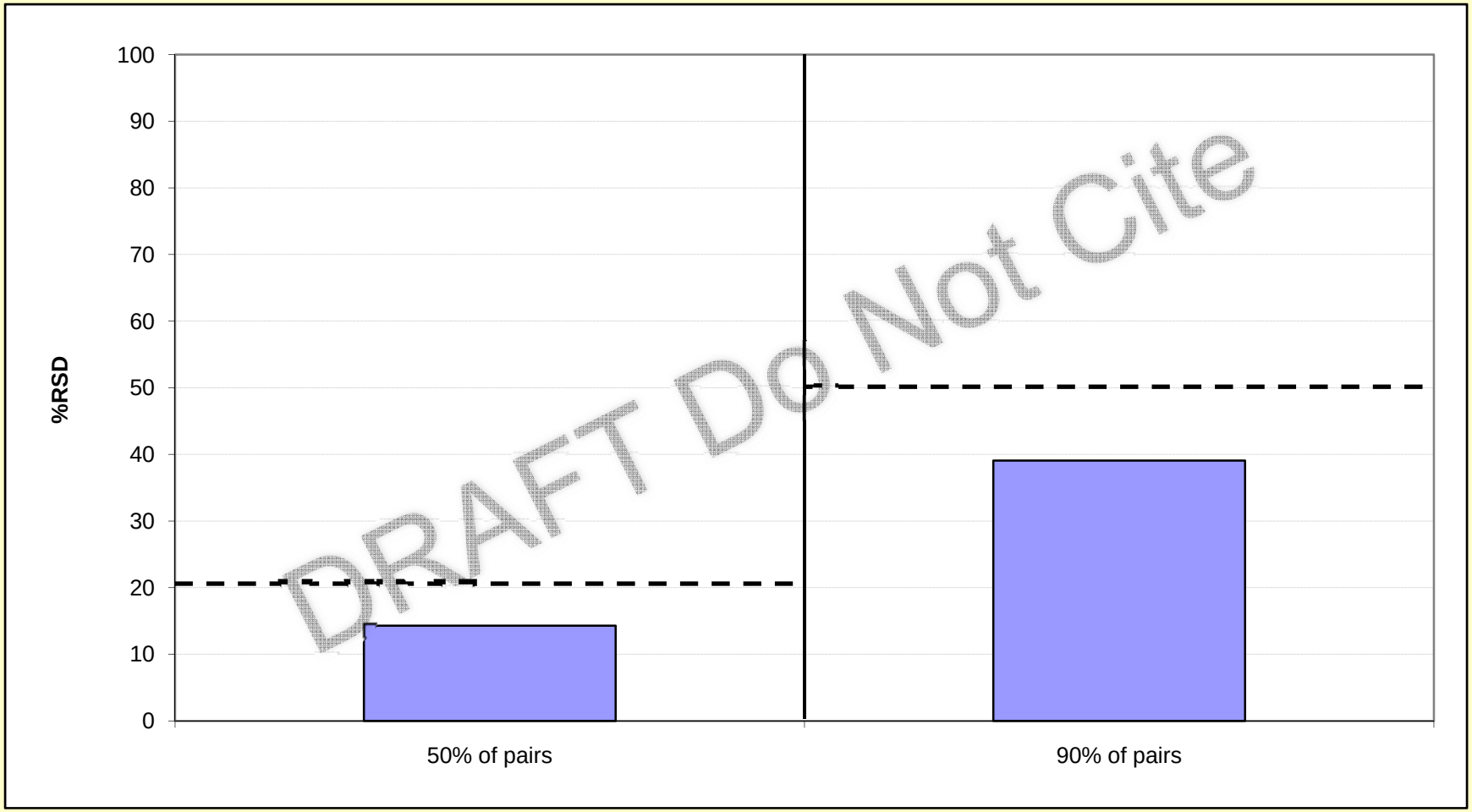
Available Fecal Coliform Bacteria Data

- Fecal coliform results from bi-weekly sampling runs from May 2005 through August 2006. Additional storm event sampled November 6 – 7, 2006.



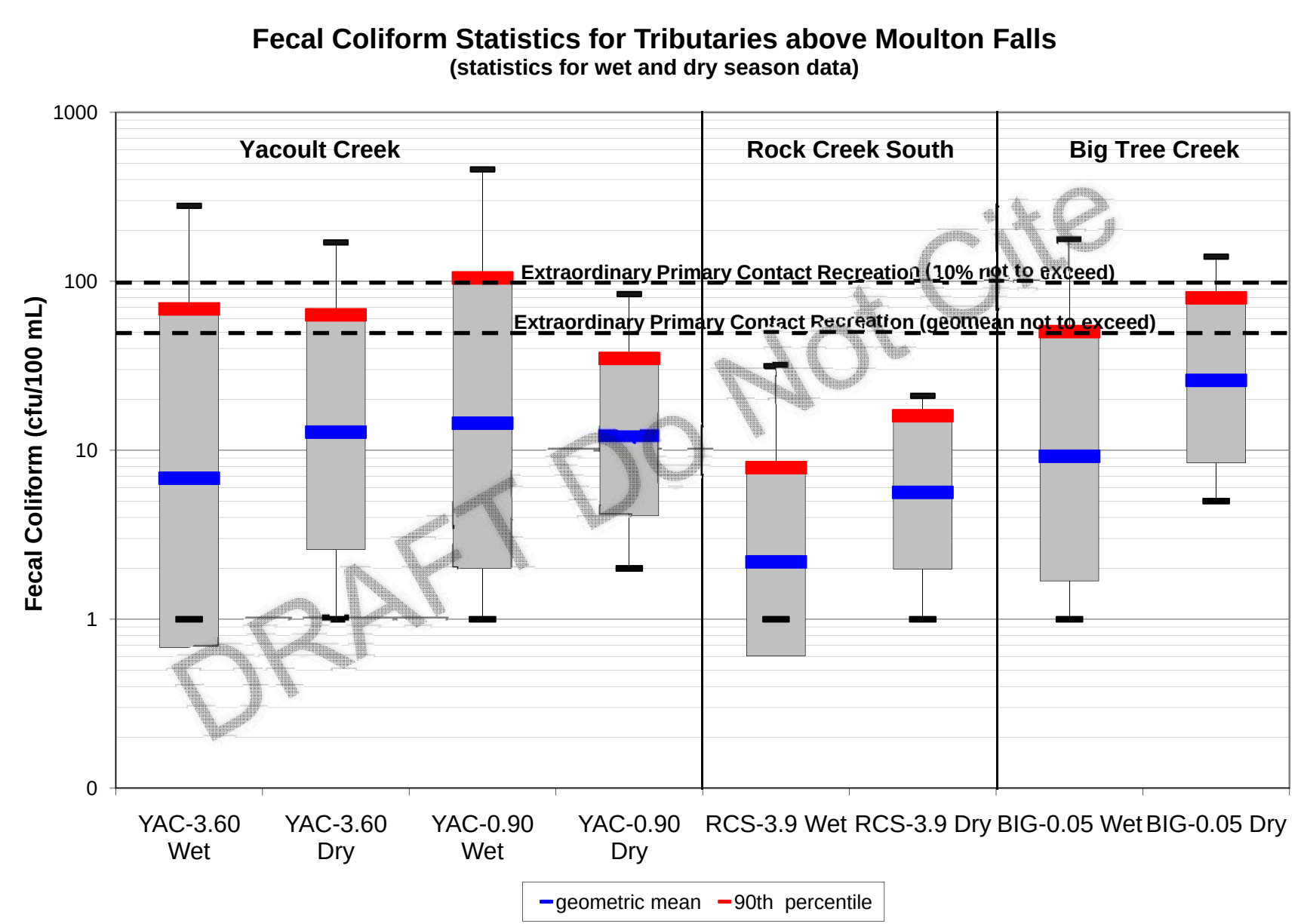
- Flow measurements from bi-weekly sampling runs from May 2005 through August 2006.

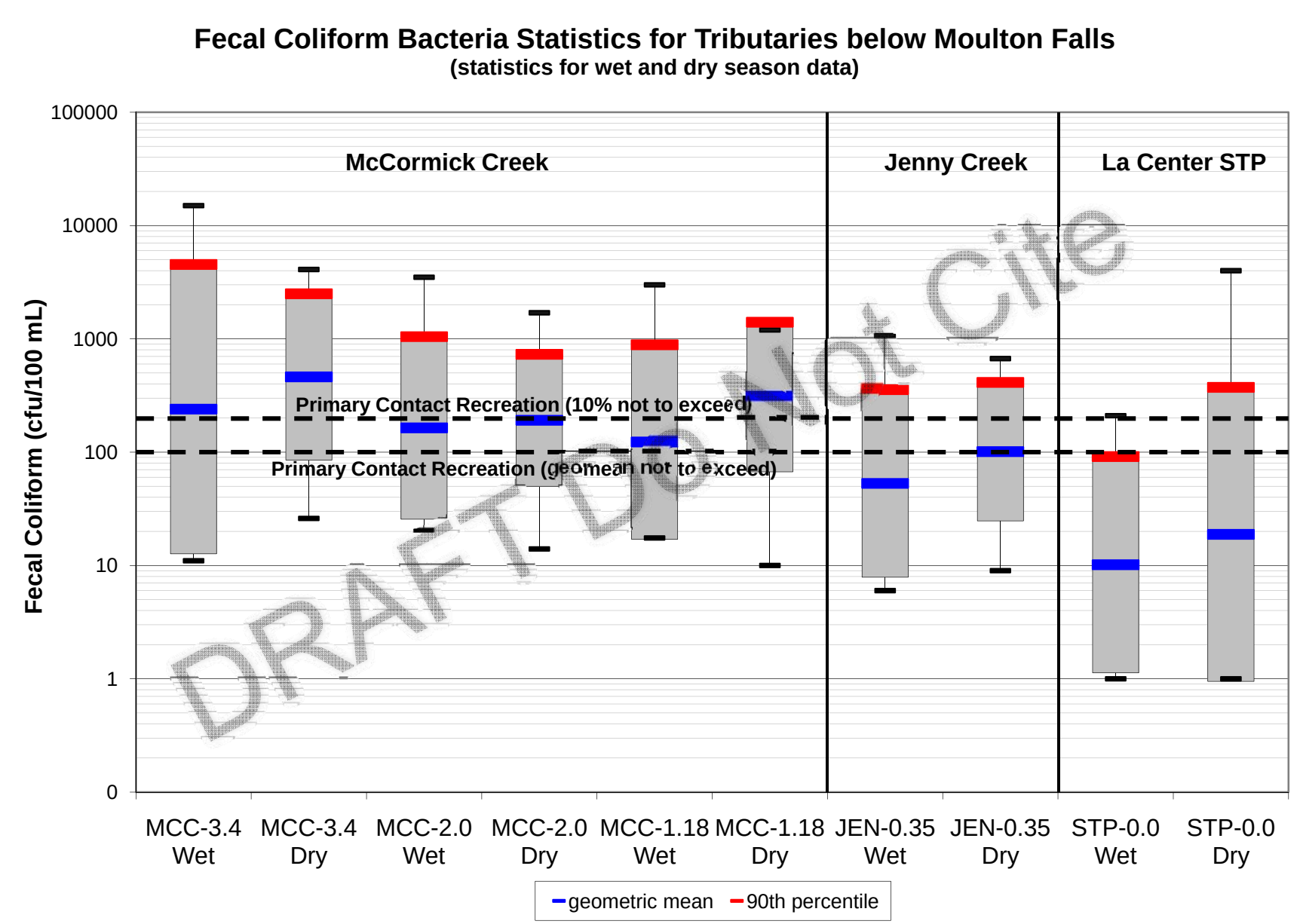
Percent RSD for QA samples (cfu/100 mL > 20) in East Fork Lewis River (2005)

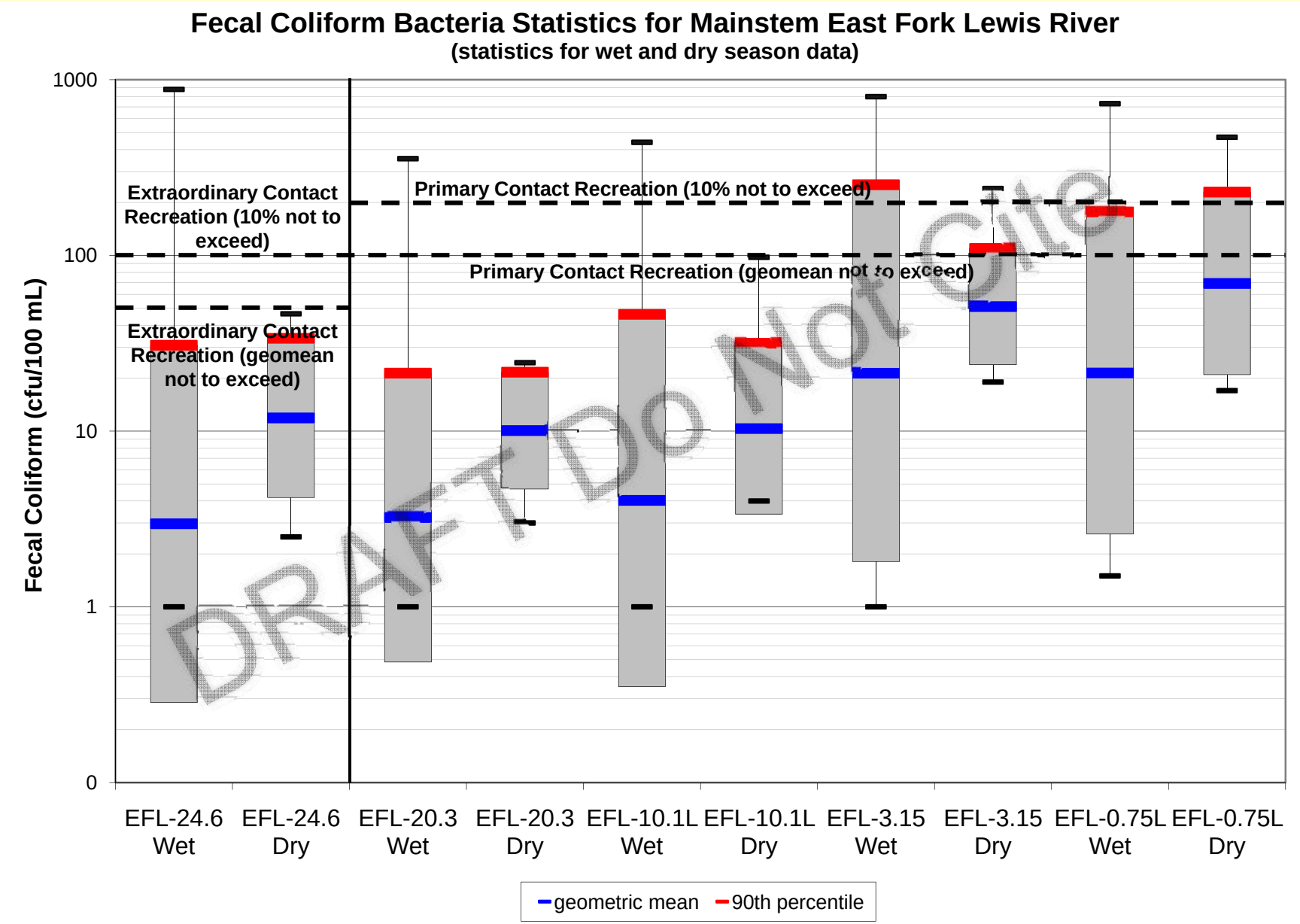


Bacteria Water Quality Criteria

Waterbody Reach	Recreation Uses	Bacteria Criteria
EFLR from mouth to Mason Creek	Primary Contact	geomean: 100 cfu/100mL
		10% not to exceed: 200 cfu/100mL
EFLR from Mason Creek to Moulton Falls, including tributaries	Primary Contact	geomean: 100 cfu/100mL
		10% not to exceed: 200 cfu/100mL
EFLR from Moulton Falls to headwaters	Extraordinary Primary Contact	geomean: 50 cfu/100mL
		10% not to exceed: 100 cfu/100mL


Fecal Coliform Statistics for Tributaries above Moulton Falls
(statistics for wet and dry season data)
Yacoult Creek
Rock Creek South
Big Tree Creek
Extraordinary Primary Contact Recreation (10% not to exceed)
Extraordinary Primary Contact Recreation (geomean not to exceed)
DRAFT Do Not Cite
Fecal Coliform (cfu/100 mL)
1000
100
10
1
0
YAC-3.60 Wet
YAC-3.60 Dry
YAC-0.90 Wet
YAC-0.90 Dry
RCS-3.9 Wet
RCS-3.9 Dry
BIG-0.05 Wet
BIG-0.05 Dry
geometric mean
90th percentile


Fecal Coliform Bacteria Statistics for Tributaries below Moulton Falls
(statistics for wet and dry season data)
Fecal Coliform (cfu/100 mL)
100000
10000
1000
100
10
1
0
McCormick Creek
Jenny Creek
La Center STP
Primary Contact Recreation (10% not to exceed)
Primary Contact Recreation (geomean not to exceed)
DRAFT Do Not Cite
MCC-3.4 Wet
MCC-3.4 Dry
MCC-2.0 Wet
MCC-2.0 Dry
MCC-1.18 Wet
MCC-1.18 Dry
JEN-0.35 Wet
JEN-0.35 Dry
STP-0.0 Wet
STP-0.0 Dry
geometric mean
90th percentile


Fecal Coliform Bacteria Statistics for Mainstem East Fork Lewis River
(statistics for wet and dry season data)
Fecal Coliform (cfu/100 mL)
1000
100
10
1
0
Extraordinary Contact Recreation (10% not to exceed)
Extraordinary Contact Recreation (geomean not to exceed)
Primary Contact Recreation (10% not to exceed)
Primary Contact Recreation (geomean not to exceed)
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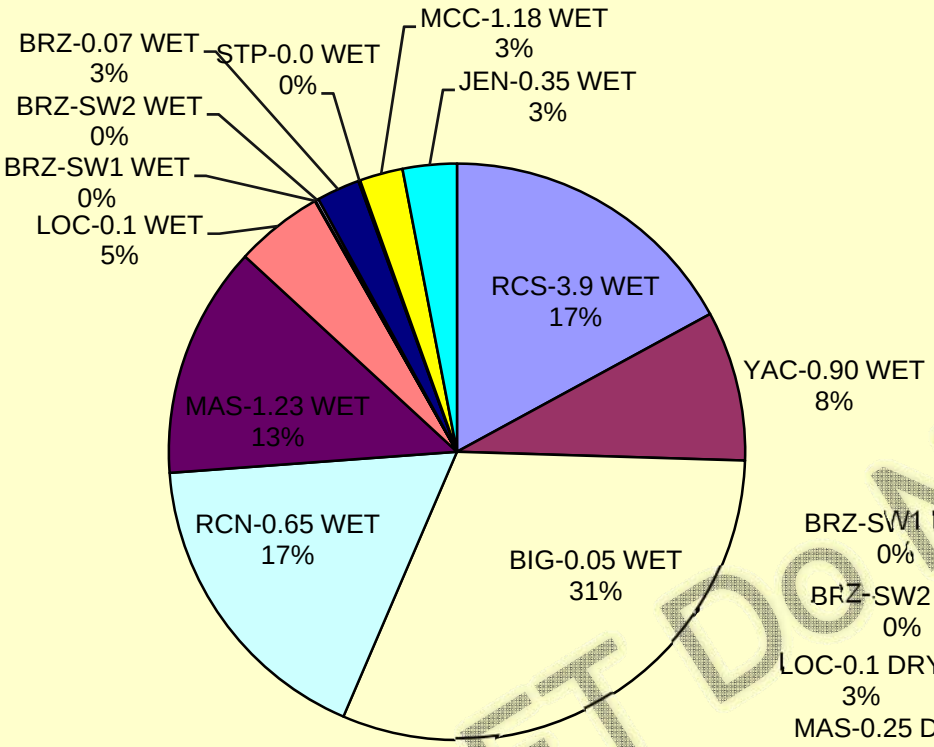
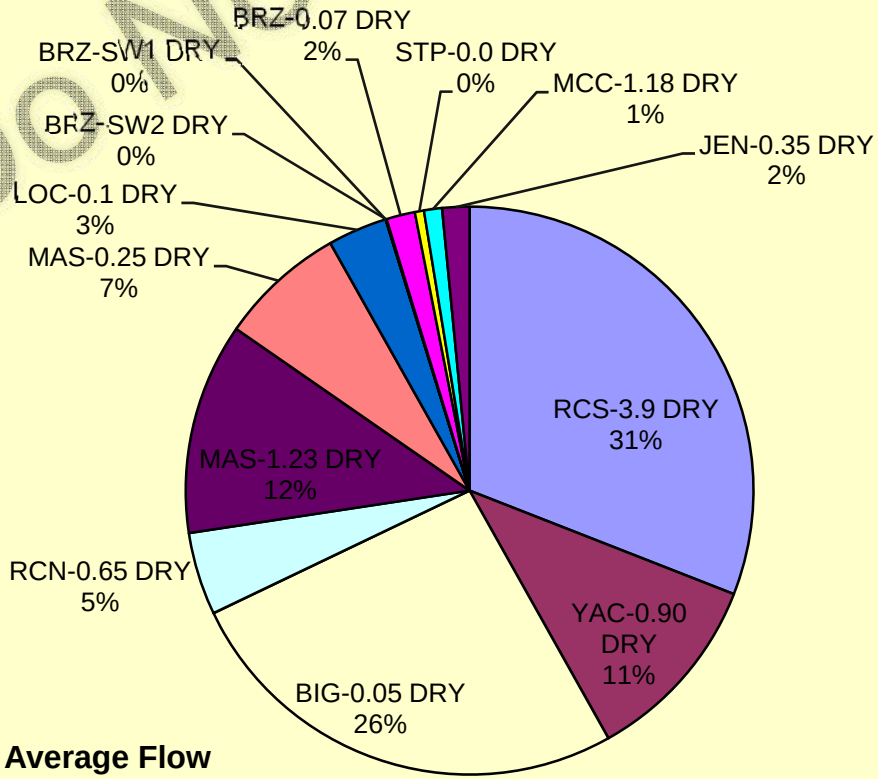
EFL-24.6 Wet
EFL-24.6 Dry
EFL-20.3 Wet
EFL-20.3 Dry
EFL-10.1L Wet
EFL-10.1L Dry
EFL-3.15 Wet
EFL-3.15 Dry
EFL-0.75L Wet
EFL-0.75L Dry
geometric mean
90th percentile

Wet Season Average Flow





Dry Season Average Flow

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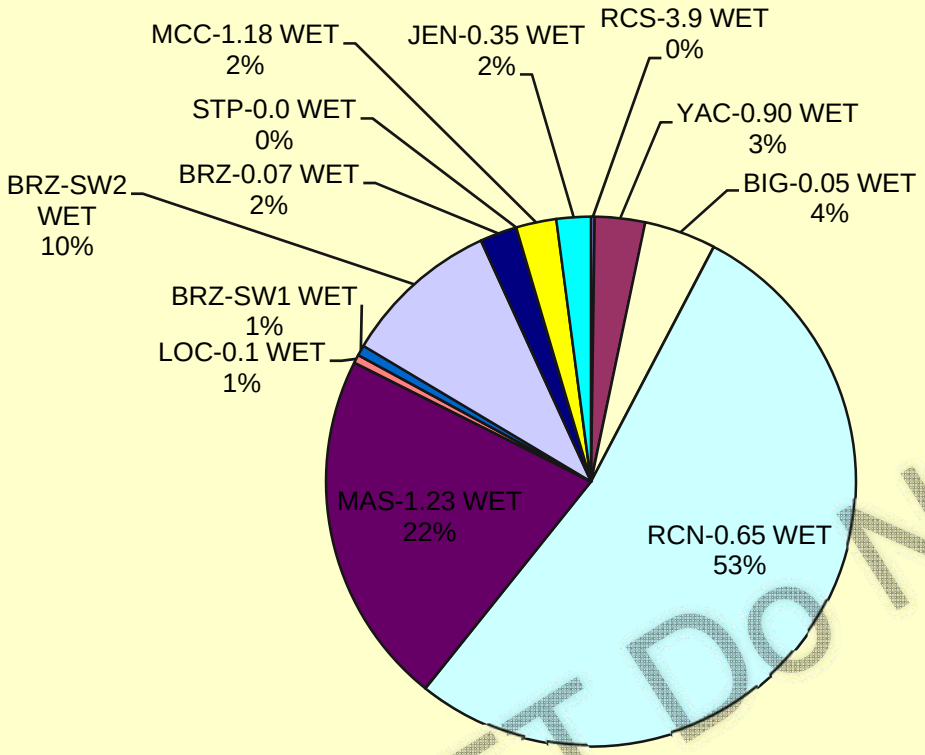
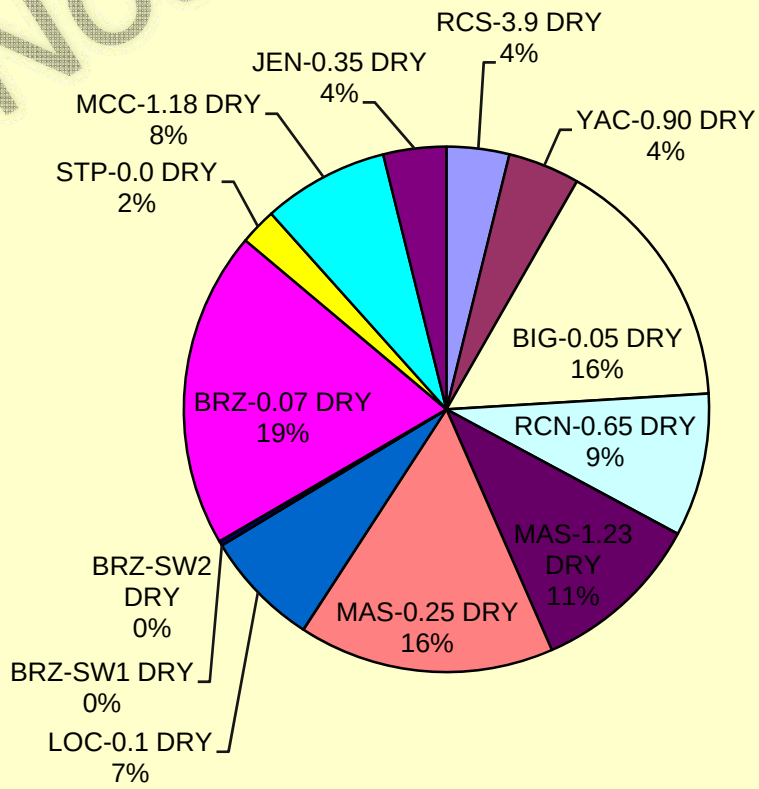


Wet Season Average Load (billion cfu/day)

Dry Season Average Load (billion cfu/day)



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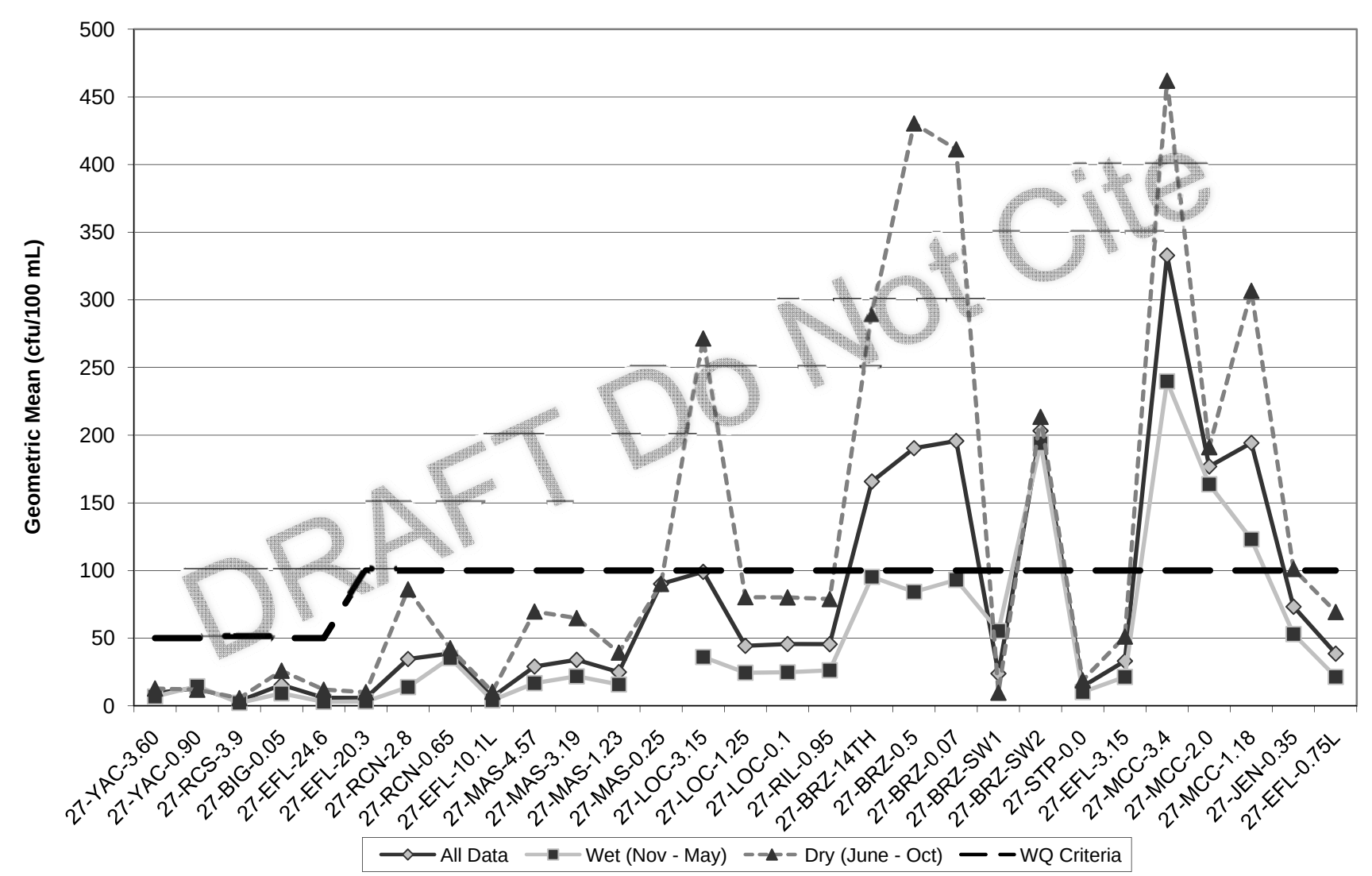
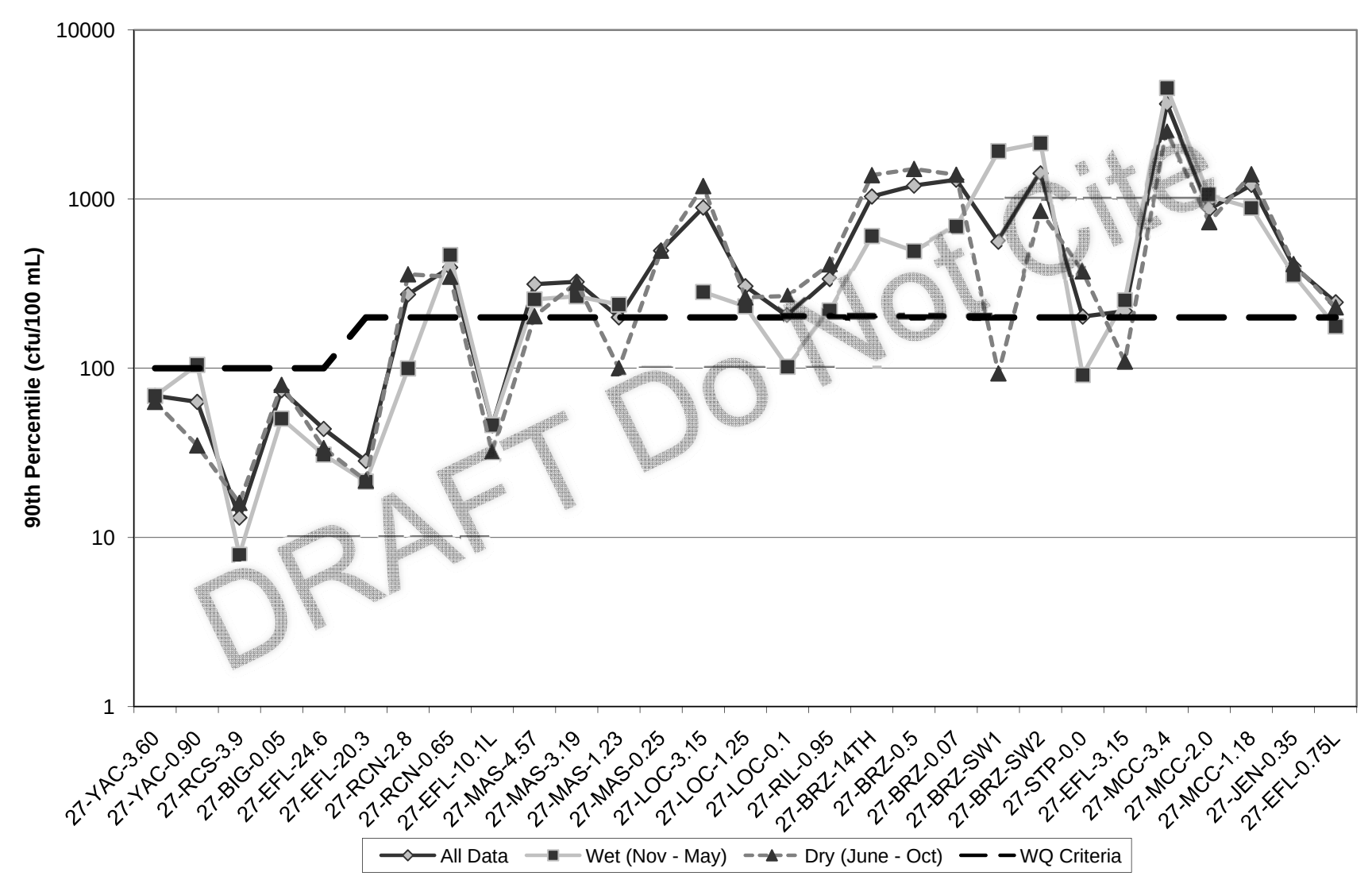
Geometric Mean Data compared to WQ Criteria

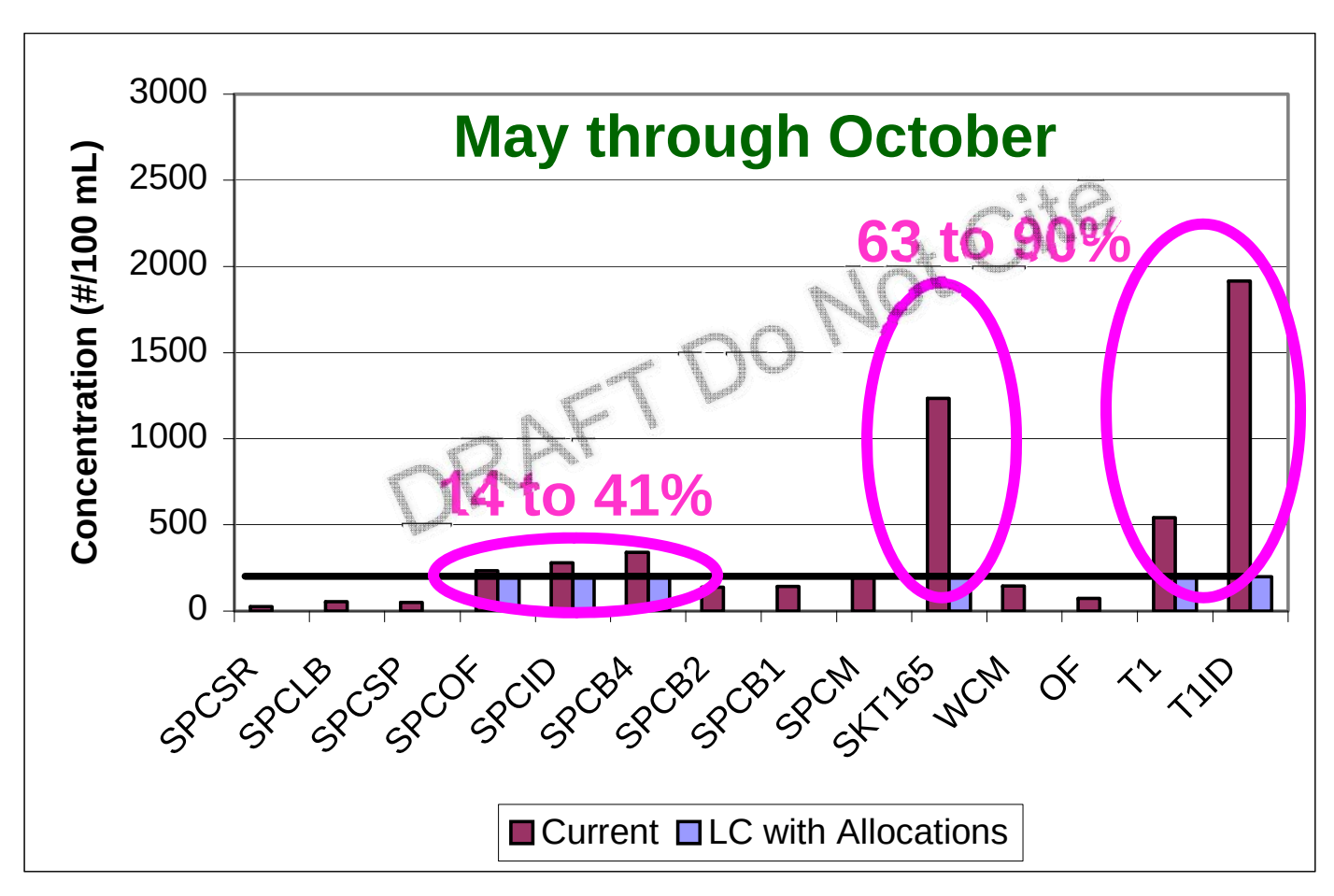


90th percentile Data compared to WQ Criteria



Fecal Coliform Rollback Analysis

- Method to calculate reduction factors necessary to meet both parts of the water quality standard



Load and Wasteload Allocations

- Load Allocations
  - Wet season (November – May) fecal coliform target
  - Dry season (June – October) fecal coliform target

- Wasteload Allocation
  - LaCenter WWTP fails to meet WQ criteria in dry season
  - Target geometric mean of 10 cfu/100 mL and 90th percentile of 200 cfu/100 mL to meet criteria

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Wet Season Load Allocation

Station ID	Description	FC Target Capacity (cfu/100 mL)	
		Geomean	90th Percentile
27-YAC-3.60	YACOLT CK @ CHILCOTE DR	50	100
27-YAC-0.90	YACOLT CK @ RAILROAD AVE	14	100
27-RCS-3.9	ROCK CK S @ DOLE VALLEY RD	50	100
27-BIG-0.05	BIG TREE CK @ LUCIA FALLS RD	50	100
27-EFL-24.6	EF LEWIS ABV BIG TREE CK	50	100
27-EFL-20.3	EF LEWIS @ USGS GAUGE	100	200
27-RCN-2.8	ROCK CK N @ NE GABRIEL RD	100	200
27-RCN-0.65	ROCK CK N @ HAMMOND RD	15	200
27-EFL-10.1L	EF LEWIS @ DAYBREAK- L BANK	100	200
27-MAS-4.57	MASON CK @ 102ND AVE NE	13	200
27-MAS-3.19	MASON CK @ JR ANDERSON RD	16	200
27-MAS-1.23	MASON CK @ MOORE RD	13	200
27-MAS-0.25	MASON CREEK N+R MOUTH	100	200
27-LOC-3.15	LOCKWOOD CK @ LESTER AVE	100	200
27-LOC-1.25	LOCKWOOD CK @ LOCKWOOD CK RD	21	200
27-LOC-0.1	LOCKWOOD CREEK NR MOUTH	100	200
27-RIL-0.95	RILEY CK @ JOHNSON RD	24	200
27-BRZ-14TH	TRIB TO BREEZE CK @ 14TH	31	200
27-BRZ-0.5	BREEZE CK OFF 4TH	34	200
27-BRZ-0.07	BREEZE CK @ MOUTH	27	200
27-BRZ-SW1	STORMWTR CULVERT NR CEDAR & 4TH	6	200
27-BRZ-SW2	STRMWTR DITCH TO BREEZE CK NR MOUTH	18	200
27-STP-0.0	LACENTER WWTP	100	200
27-EFL-3.15	EF LEWIS @ LACENTER RD	17	200
27-MCC-3.4	MCCORMICK CK @ NE 289TH	11	200
27-MCC-2.0	MCCORMICK CK @ NW SPENCER RD	31	200
27-MCC-1.18	MCCORMICK CK @ LACENTER RD	28	200
27-JEN-0.35	JENNY CK @ PACIFIC HWY	30	200
27-EFL-0.75L	EF LEWIS @ I-5 BRIDGE-L BANK	100	200

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Dry Season Load Allocation

Station ID	Description	FC Target Capacity (cfu/100 mL) Geomean	90th Percentile
27-YAC-3.60	YACOLT CK @ CHILCOTE DR	50	100
27-YAC-0.90	YACOLT CK @ RAILROAD AVE	50	100
27-RCS-3.9	ROCK CK S @ DOLE VALLEY RD	50	100
27-BIG-0.05	BIG TREE CK @ LUCIA FALLS RD	50	100
27-EFL-24.6	EF LEWIS ABV BIG TREE CK	50	100
27-EFL-20.3	EF LEWIS @ USGS GAUGE	100	200
27-RCN-2.8	ROCK CK N @ NE GABRIEL RD	48	200
27-RCN-0.65	ROCK CK N @ HAMMOND RD	24	200
27-EFL-10.1L	EF LEWIS @ DAYBREAK- L BANK	100	200
27-MAS-4.57	MASON CK @ 102ND AVE NE	100	200
27-MAS-3.19	MASON CK @ JR ANDERSON RD	40	200
27-MAS-1.23	MASON CK @ MOORE RD	100	200
27-MAS-0.25	MASON CREEK N+R MOUTH	36	200
27-LOC-3.15	LOCKWOOD CK @ LESTER AVE	45	200
27-LOC-1.25	LOCKWOOD CK @ LOCKWOOD CK RD	61	200
27-LOC-0.1	LOCKWOOD CREEK NR MOUTH	60	200
27-RIL-0.95	RILEY CK @ JOHNSON RD	38	200
27-BRZ-14TH	TRIB TO BREEZE CK @ 14TH	42	200
27-BRZ-0.5	BREEZE CK OFF 4TH	57	200
27-BRZ-0.07	BREEZE CK @ MOUTH	59	200
27-BRZ-SW1	STORMWTR CULVERT NR CEDAR & 4TH	100	200
27-BRZ-SW2	STRMWTR DITCH TO BREEZE CK NR MOUTH	50	200
27-STP-0.0	LACENTER WWTP	10	200
27-EFL-3.15	EF LEWIS @ LACENTER RD	100	200
27-MCC-3.4	MCCORMICK CK @ NE 289TH	37	200
27-MCC-2.0	MCCORMICK CK @ NW SPENCER RD	52	200
27-MCC-1.18	MCCORMICK CK @ LACENTER RD	44	200
27-JEN-0.35	JENNY CK @ PACIFIC HWY	49	200
27-EFL-0.75L	EF LEWIS @ I-5 BRIDGE-L BANK	60	200

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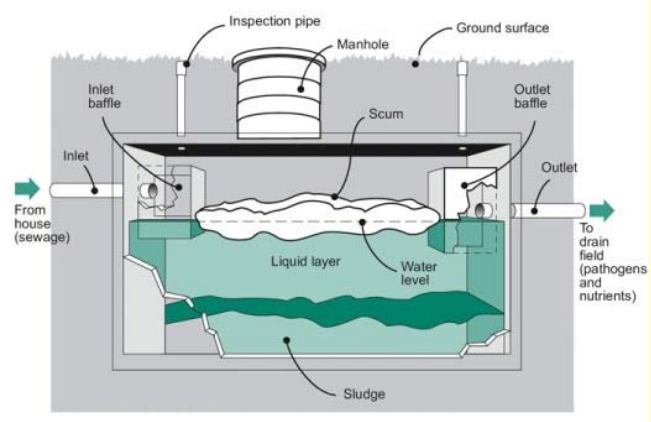
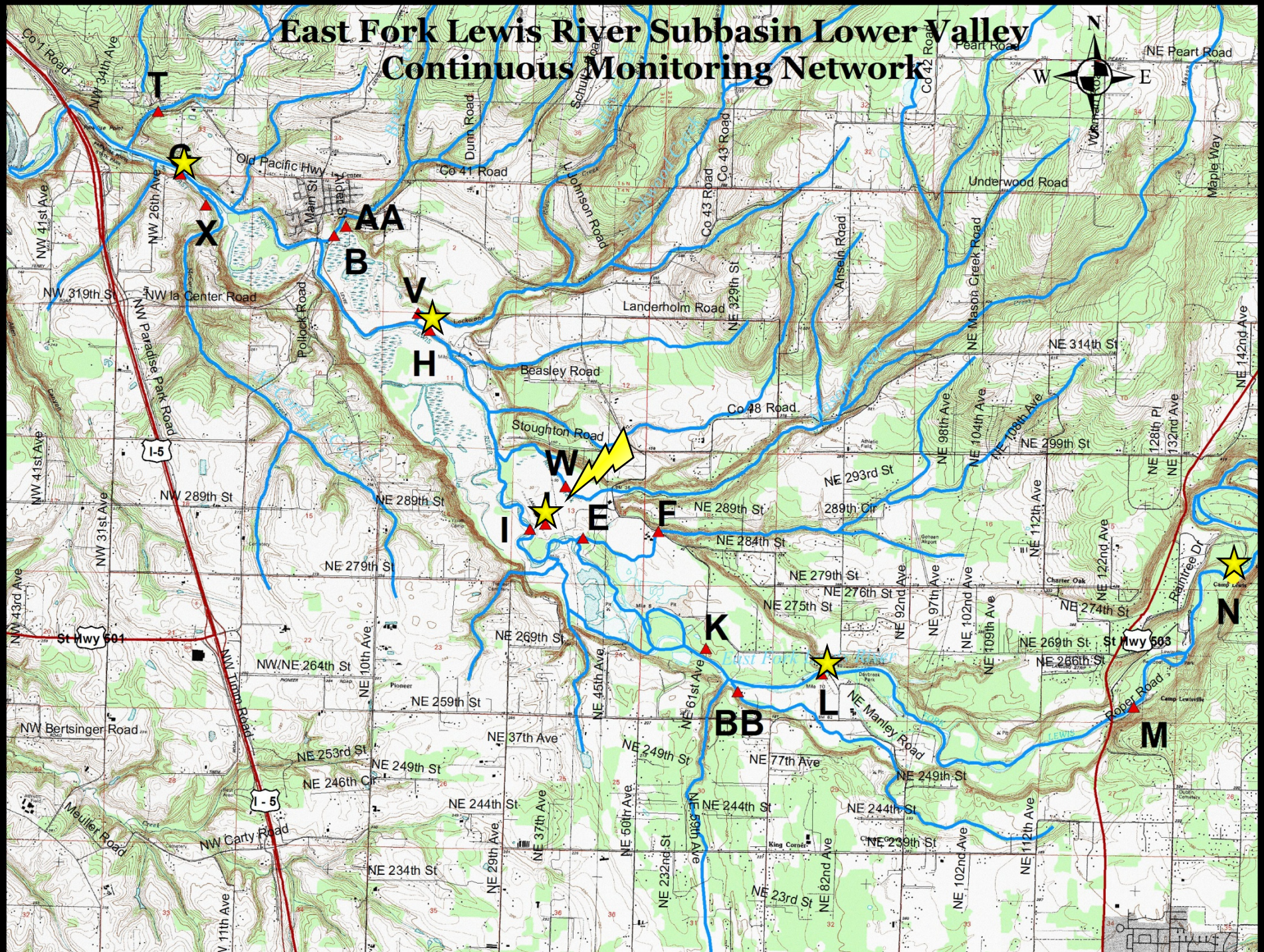
Potential Management Strategies

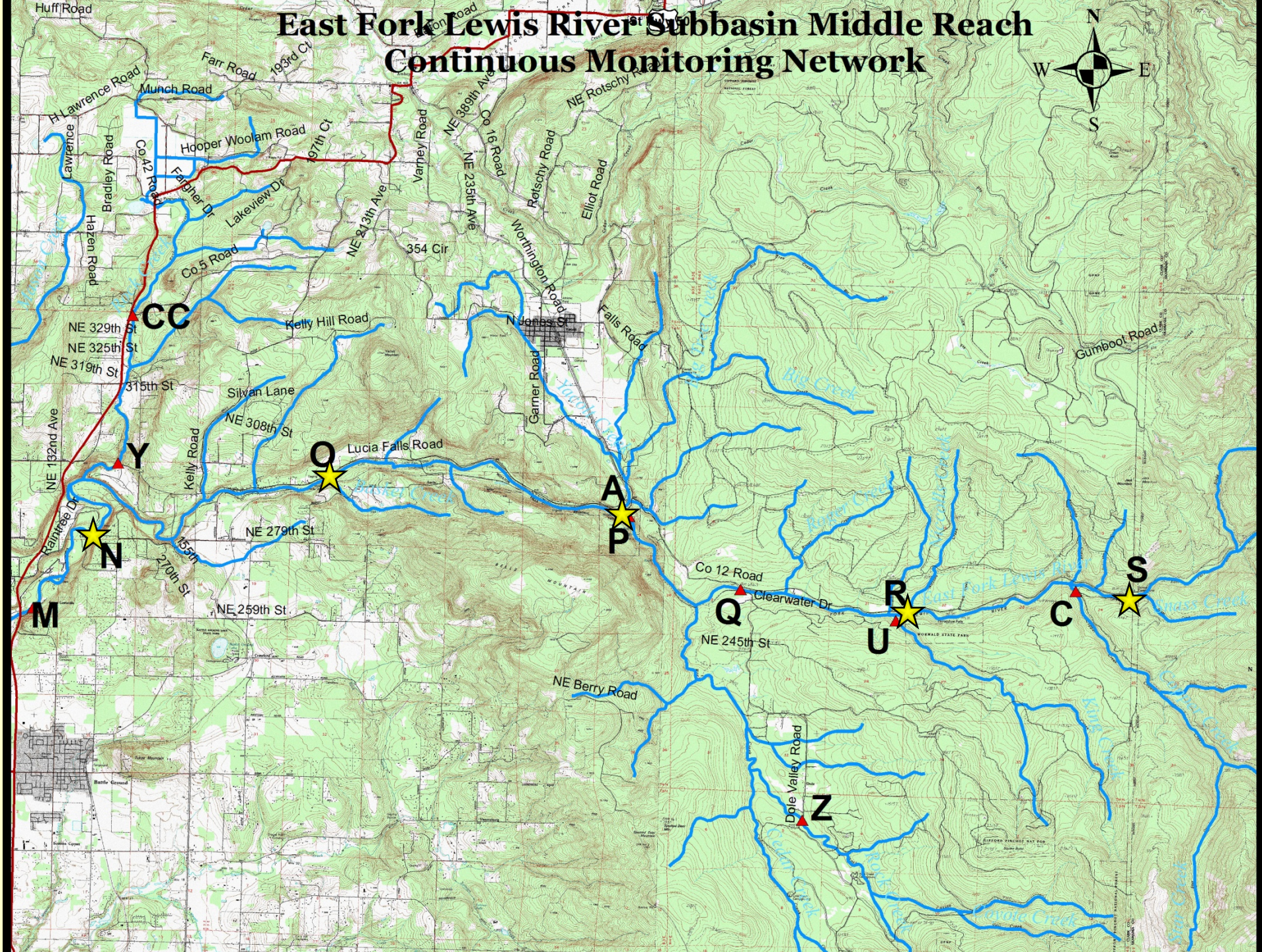
- Activities to reduce storm water and sediment loading to surface waters from upland
- Investigate on-site sewage treatment systems
- Activities to reduce loads from recreational activities, such as swimming and boating
- Exclude livestock from waterways and wet areas year-round



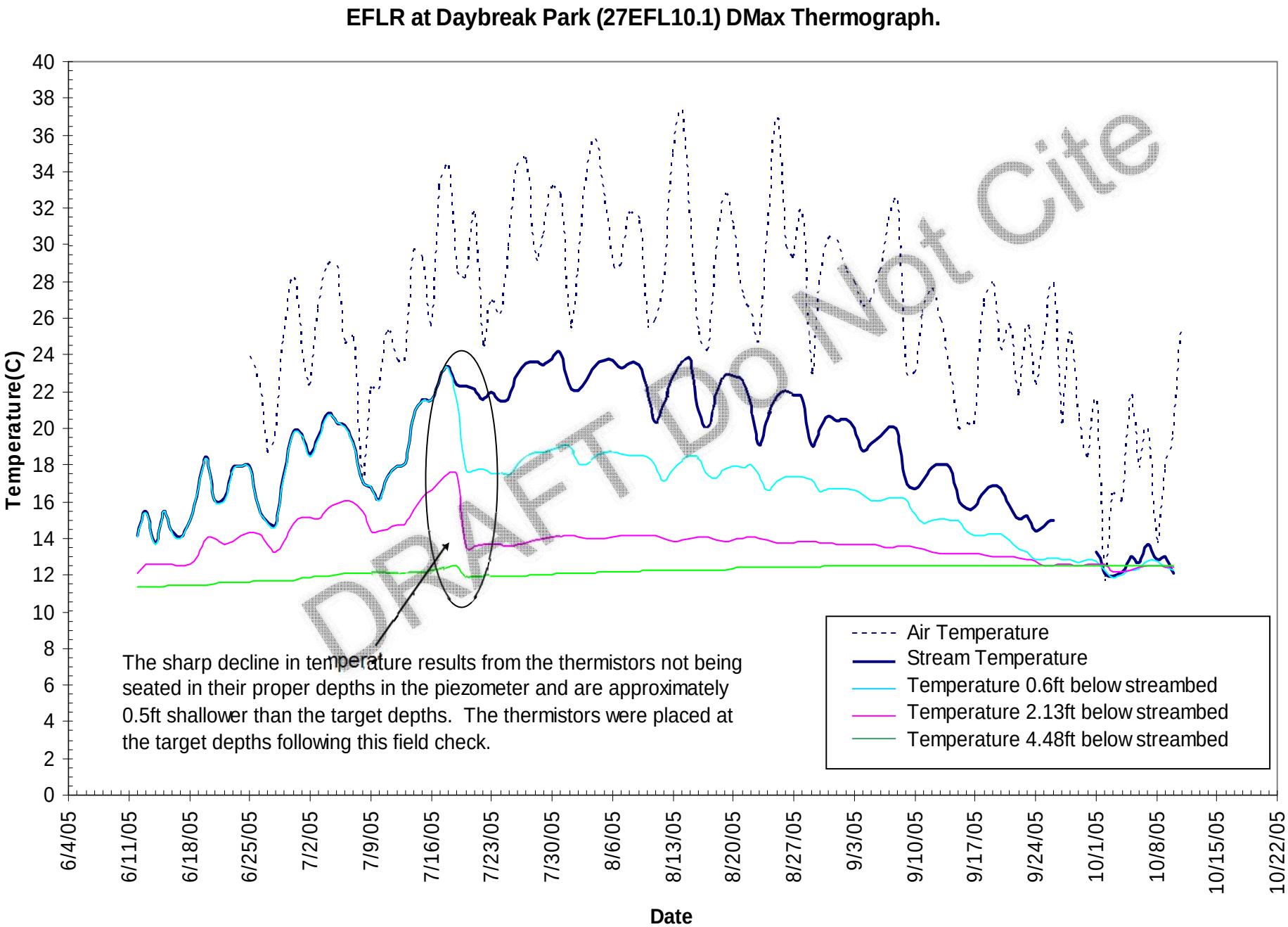
East Fork Lewis River Subbasin Lower Valley Continuous Monitoring Network



East Fork Lewis River Subbasin Middle Reach Continuous Monitoring Network



Continuous Temperature Data


EFLR at Daybreak Park (27EFL10.1) DMax Thermograph.
Temperature(C)
Date
Air Temperature
Stream Temperature
Temperature 0.6ft below streambed
Temperature 2.13ft below streambed
Temperature 4.48ft below streambed
The sharp decline in temperature results from the thermistors not being seated in their proper depths in the piezometer and are approximately 0.5ft shallower than the target depths. The thermistors were placed at the target depths following this field check.
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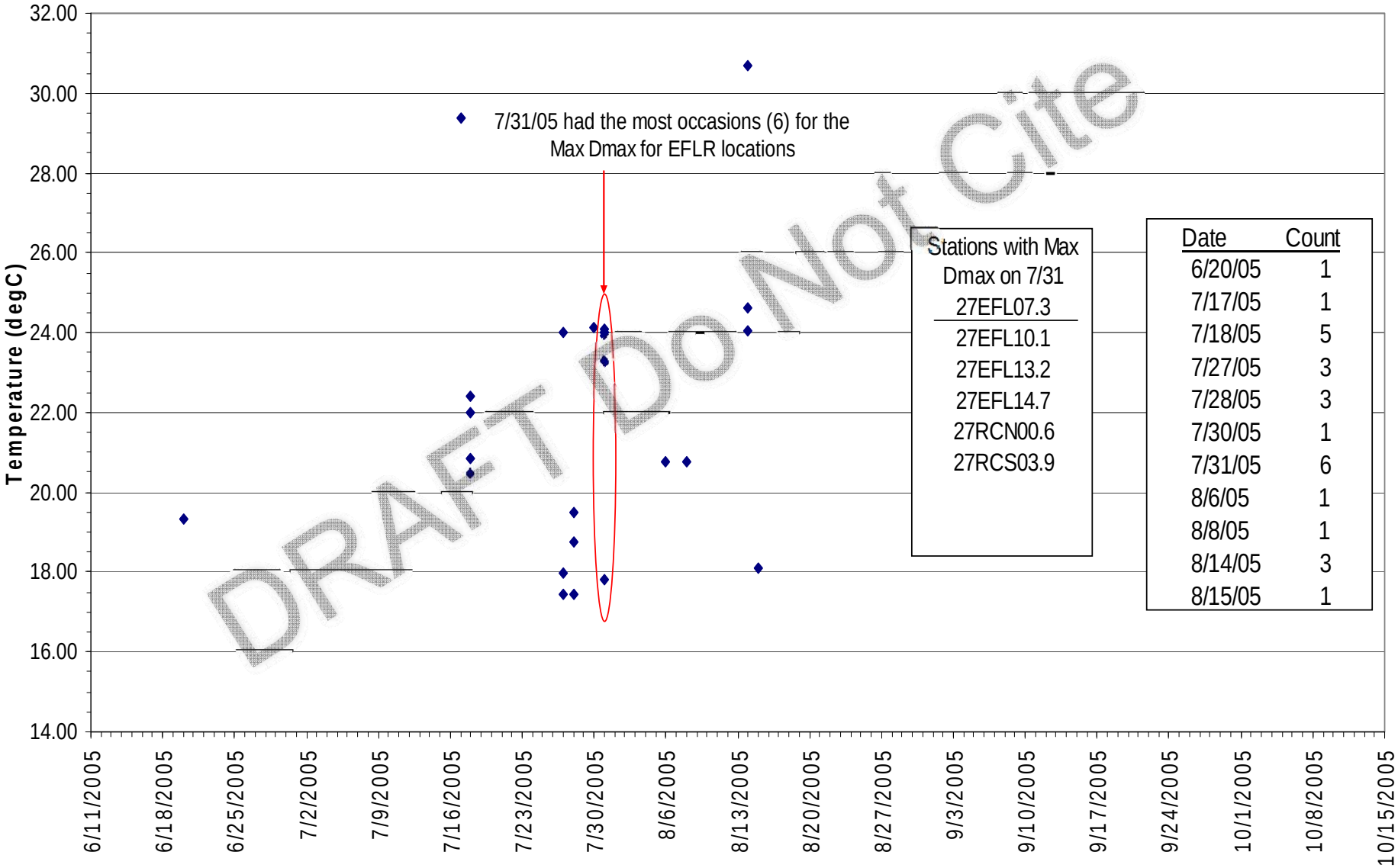
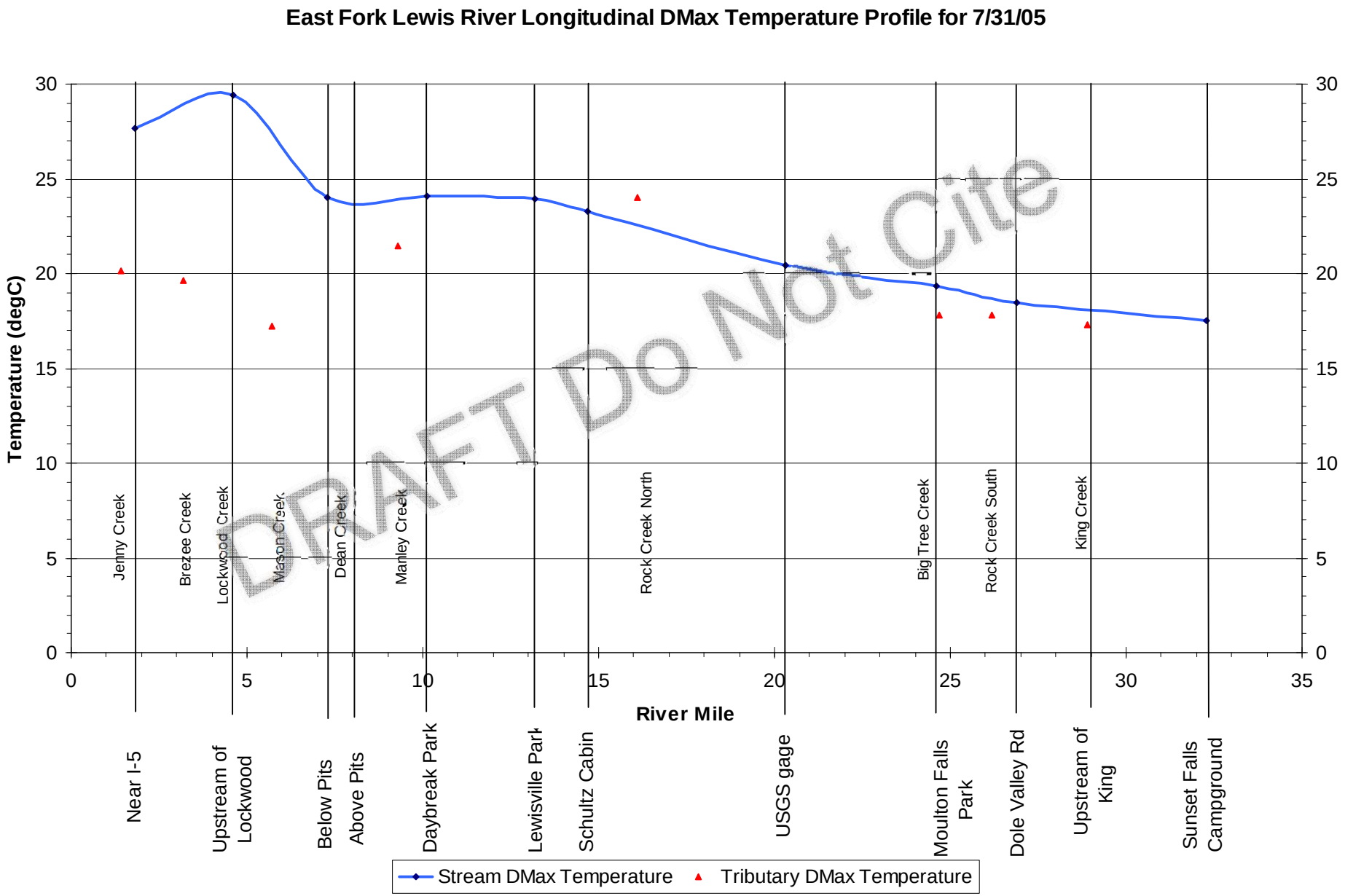
Estimation of the Critical Period using the Maximum Dmax Instream Temperatures for all Monitoring Stations in the East Fork Lewis TMDL




East Fork Lewis River Longitudinal DMax Temperature Profile for 7/31/05
Temperature (degC)
River Mile
0
5
10
15
20
25
30
35
Jenny Creek
Brezee Creek
Lockwood Creek
Mason Creek
Dean Creek
Manley Creek
Rock Creek North
Big Tree Creek
Rock Creek South
King Creek
Near I-5
Upstream of Lockwood
Below Pits
Above Pits
Daybreak Park
Lewisville Park
Schultz Cabin
USGS gage
Moulton Falls Park
Dole Valley Rd
Upstream of King
Sunset Falls Campground
Stream DMax Temperature
Tributary DMax Temperature
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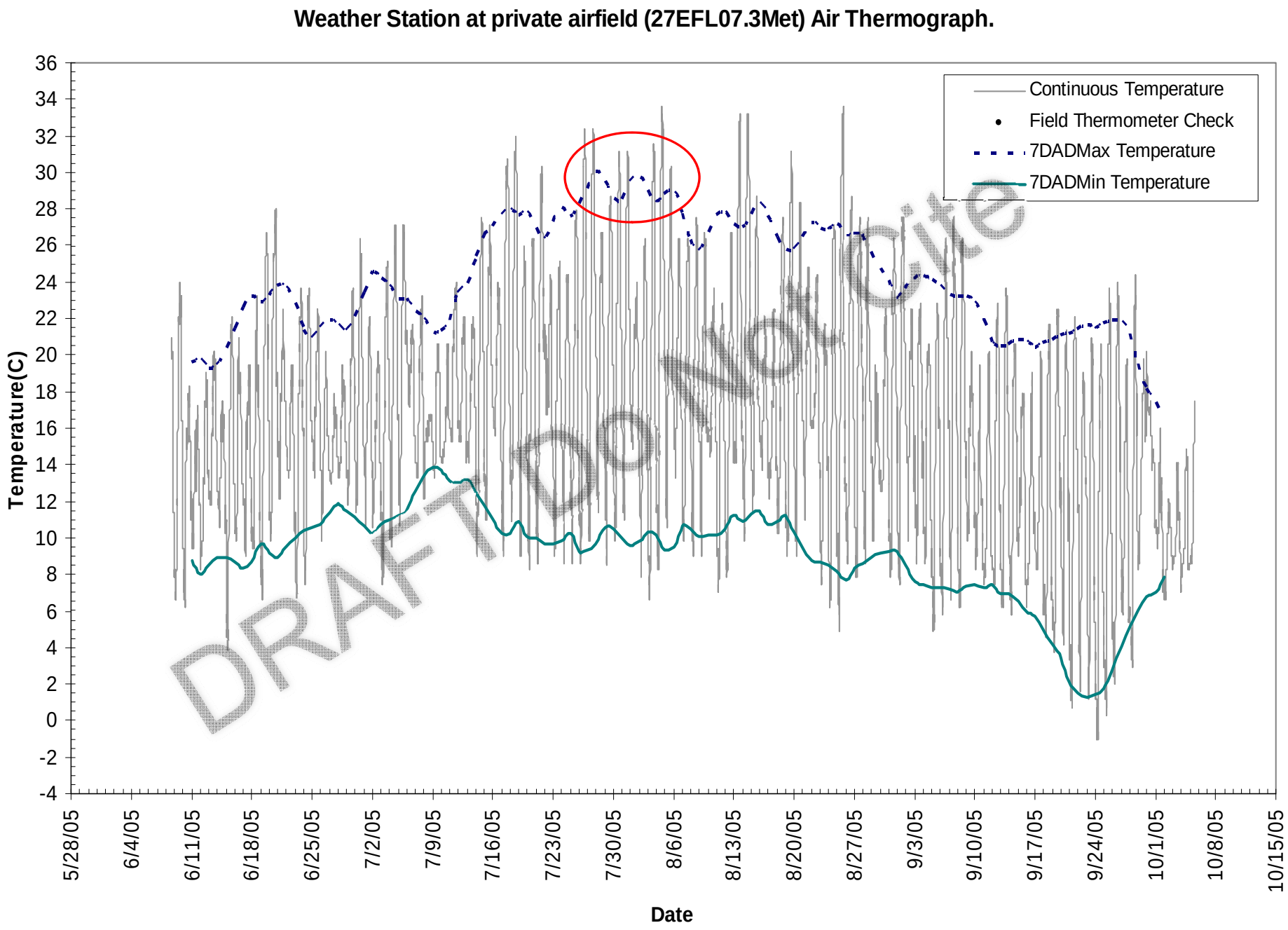
Weather Station at private airfield (27EFL07.3Met) Air Thermograph.
Continuous Temperature
Field Thermometer Check
7DADMax Temperature
7DADMin Temperature
Temperature(C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
5/28/05
6/4/05
6/11/05
6/18/05
6/25/05
7/2/05
7/9/05
7/16/05
7/23/05
7/30/05
8/6/05
8/13/05
8/20/05
8/27/05
9/3/05
9/10/05
9/17/05
9/24/05
10/1/05
10/8/05
10/15/05
Date
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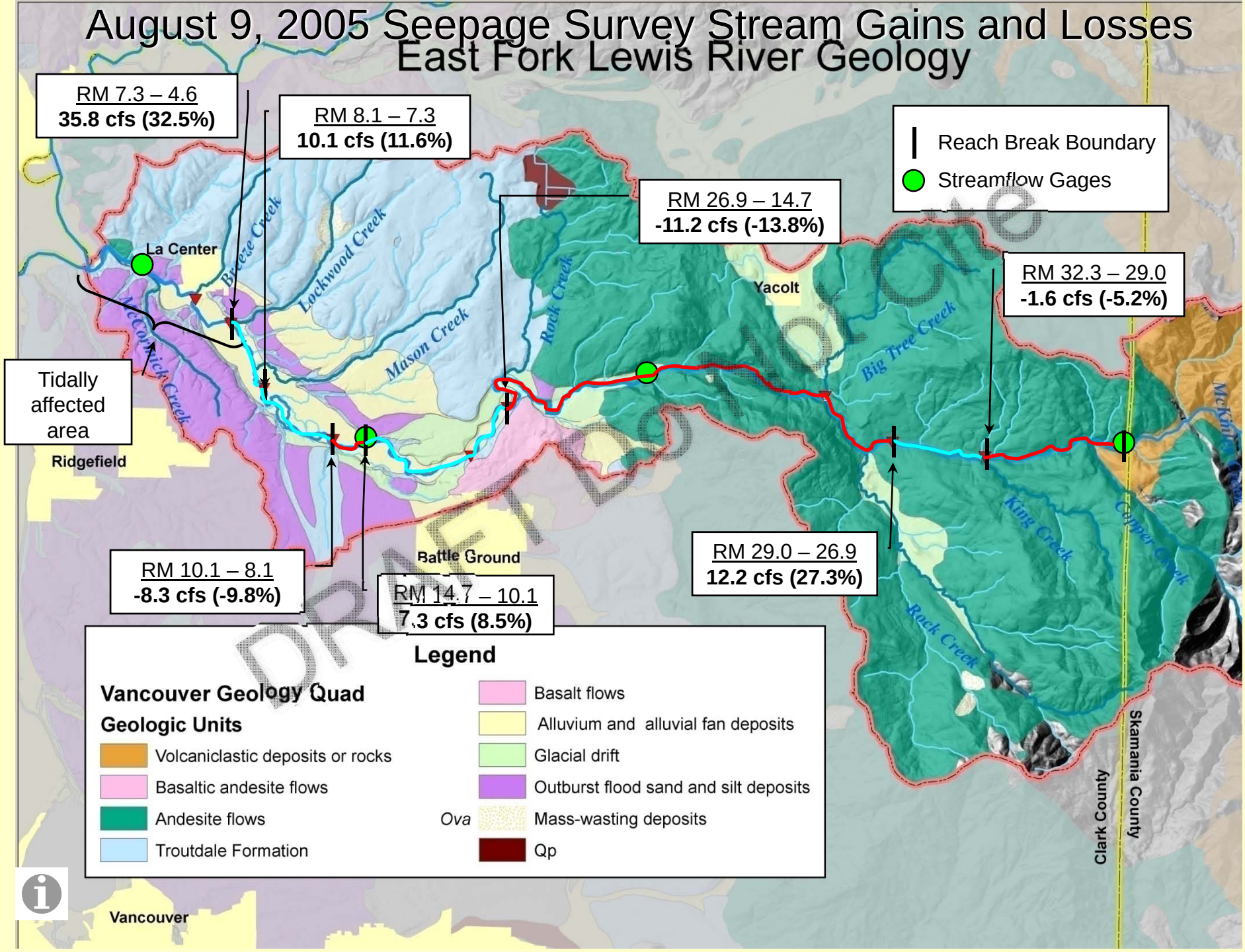
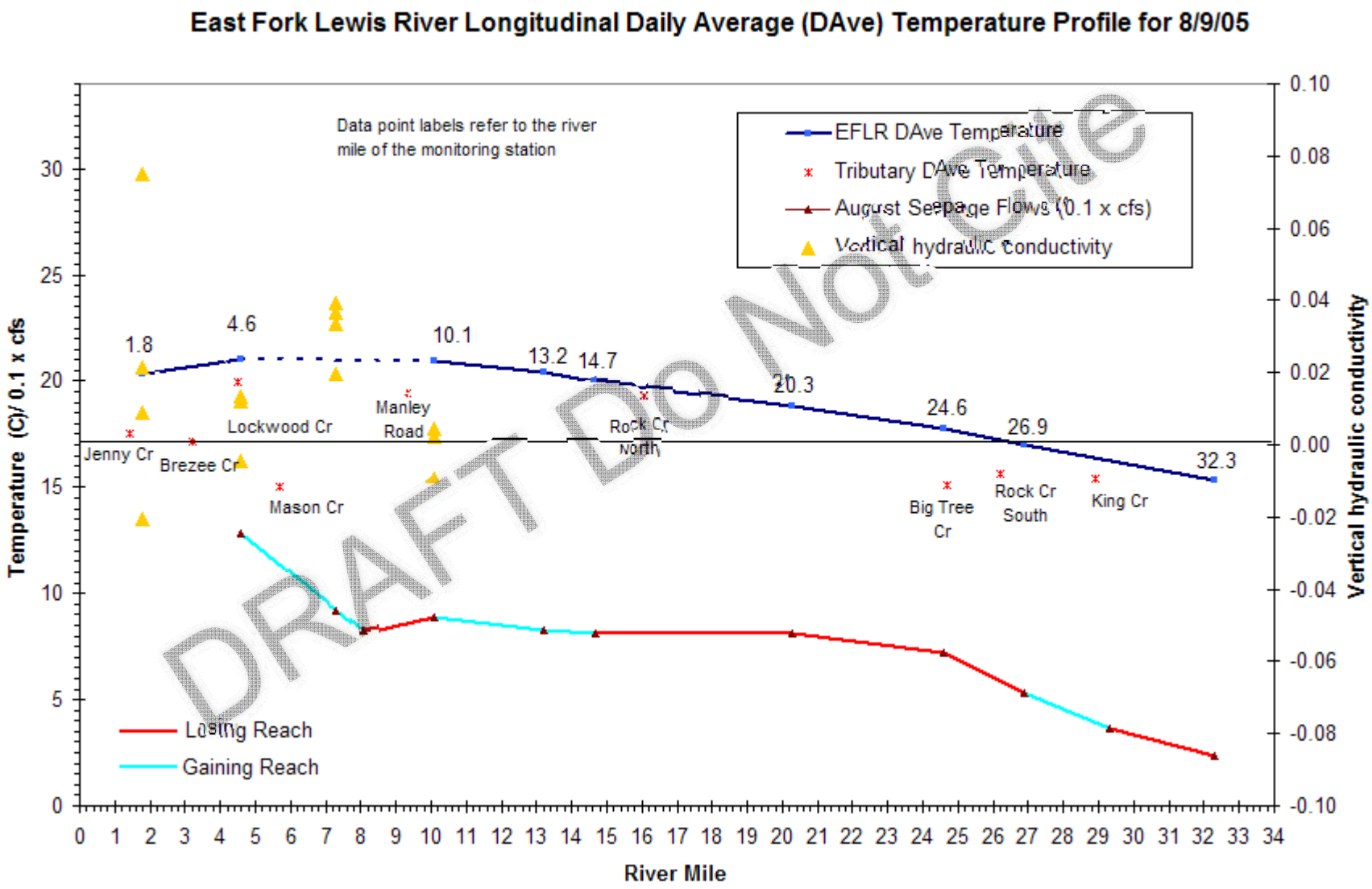
Streamflow and Preliminary Groundwater Results

August 9, 2005 Seepage Survey Stream Gains and Losses
East Fork Lewis River Geology




East Fork Lewis River Longitudinal Daily Average (DAve) Temperature Profile for 8/9/05
Data point labels refer to the river mile of the monitoring station
EFLR DAve Temperature
Tributary DAve Temperature
August Seepage Flows (0.1 x cfs)
Vertical hydraulic conductivity
1.8
4.6
10.1
13.2
14.7
20.3
24.6
26.9
32.3
Jenny Cr
Brezee Cr
Lockwood Cr
Mason Cr
Manley Road
Rock Cr North
Big Tree Cr
Rock Cr South
King Cr
Losing Reach
Gaining Reach
Temperature (C)/ 0.1 x cfs
Vertical hydraulic conductivity
River Mile
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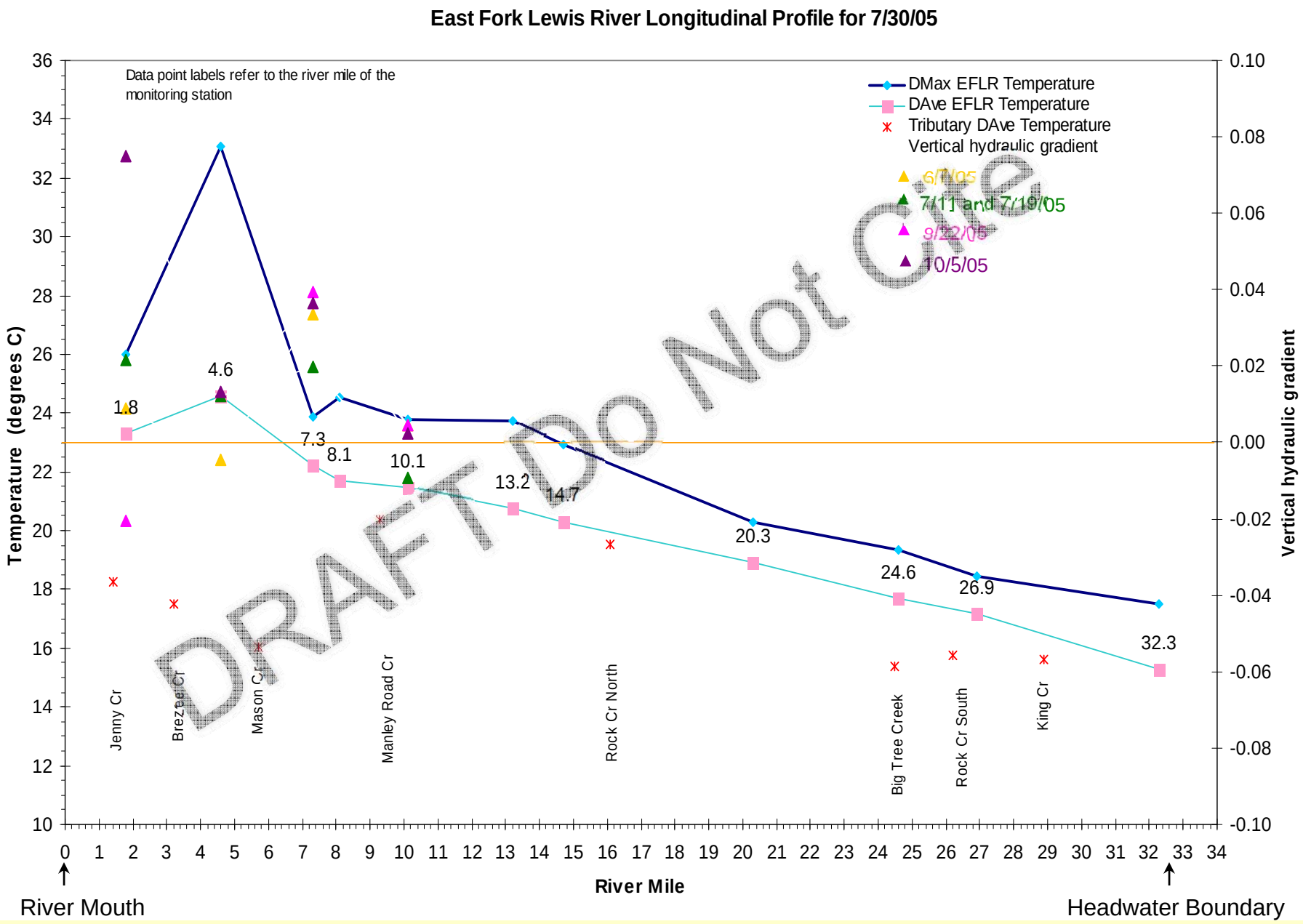
East Fork Lewis River Longitudinal Profile for 7/30/05
Data point labels refer to the river mile of the monitoring station
DMax EFLR Temperature
DAve EFLR Temperature
Tributary DAve Temperature
Vertical hydraulic gradient
6/7/05
7/11 and 7/19/05
9/22/05
10/5/05
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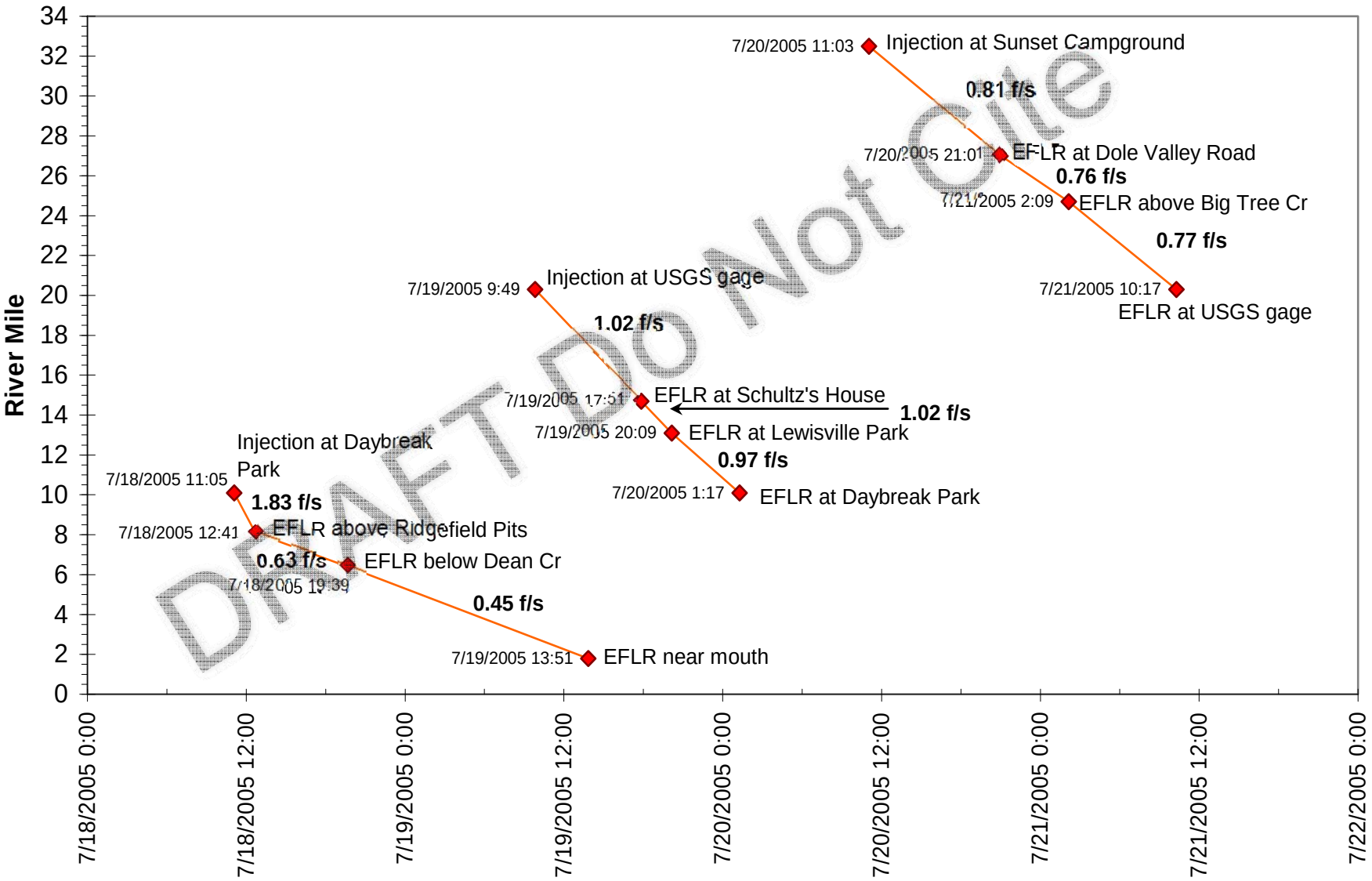
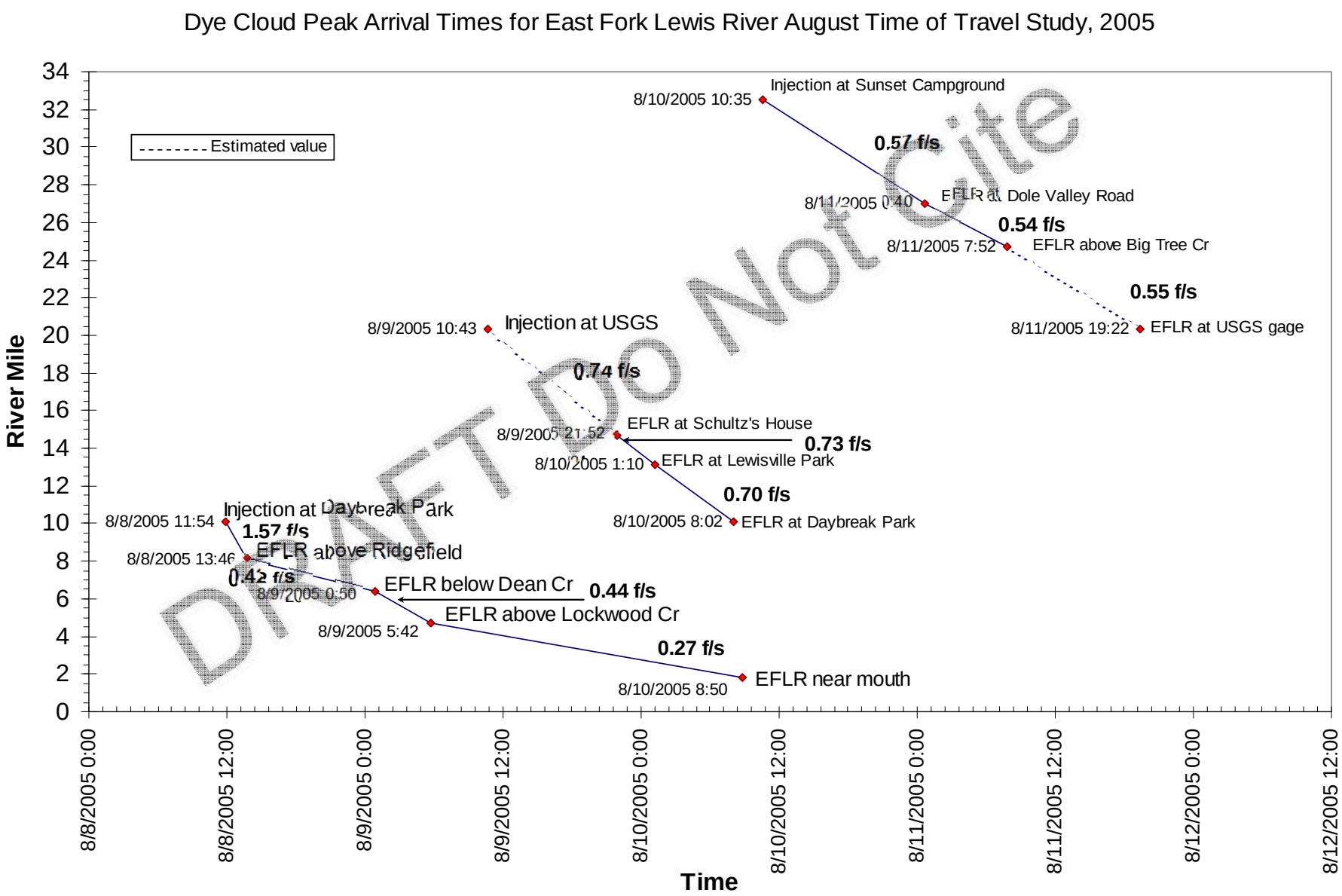
Temperature (degrees C)
Vertical hydraulic gradient
River Mile
River Mouth
Headwater Boundary
1.8
4.6
7.3
8.1
10.1
13.2
14.7
20.3
24.6
26.9
32.3
Jenny Cr
Brezee Cr
Mason Cr
Manley Road Cr
Rock Cr North
Big Tree Creek
Rock Cr South
King Cr

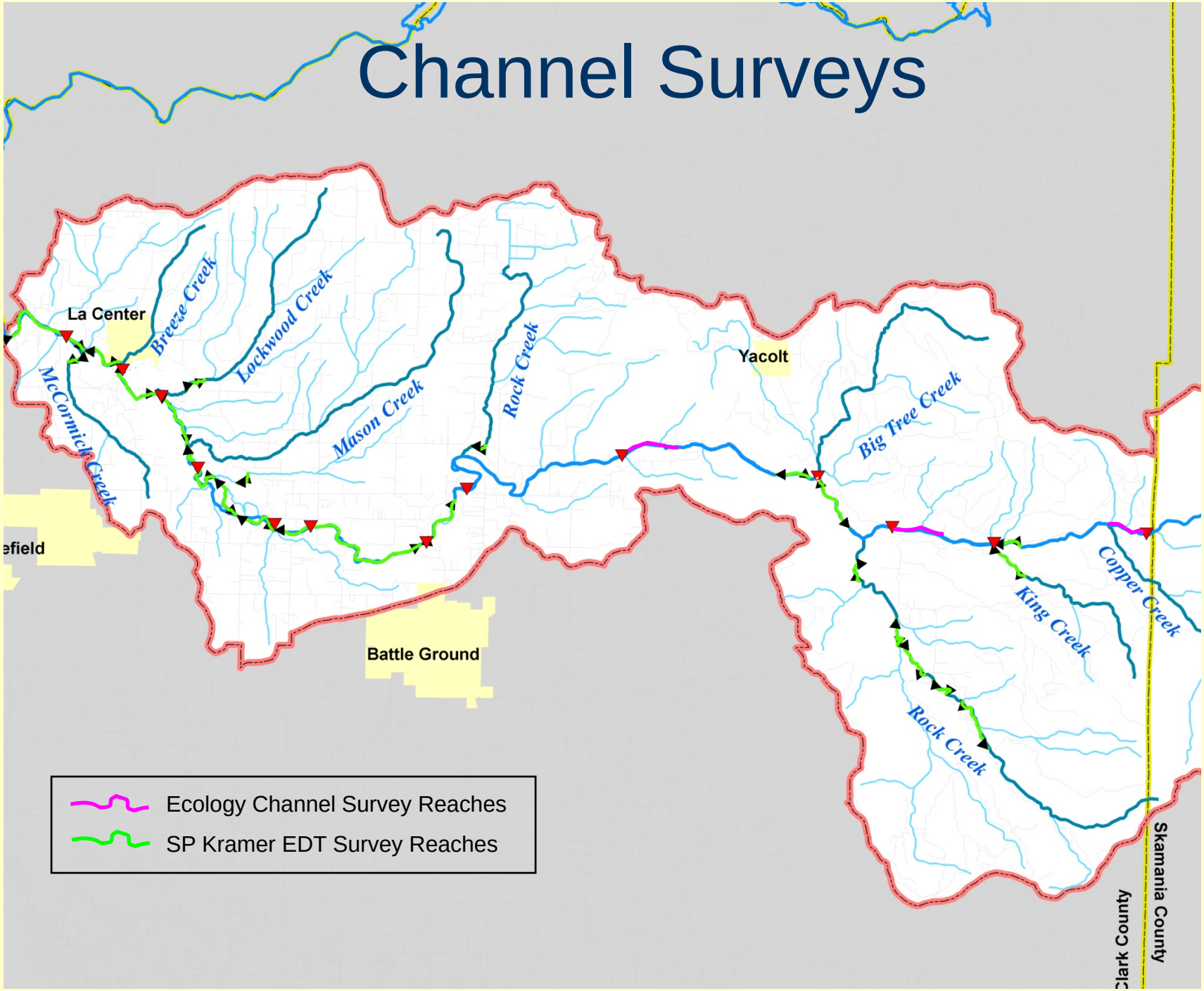
July Time of Travel Dye Study Results



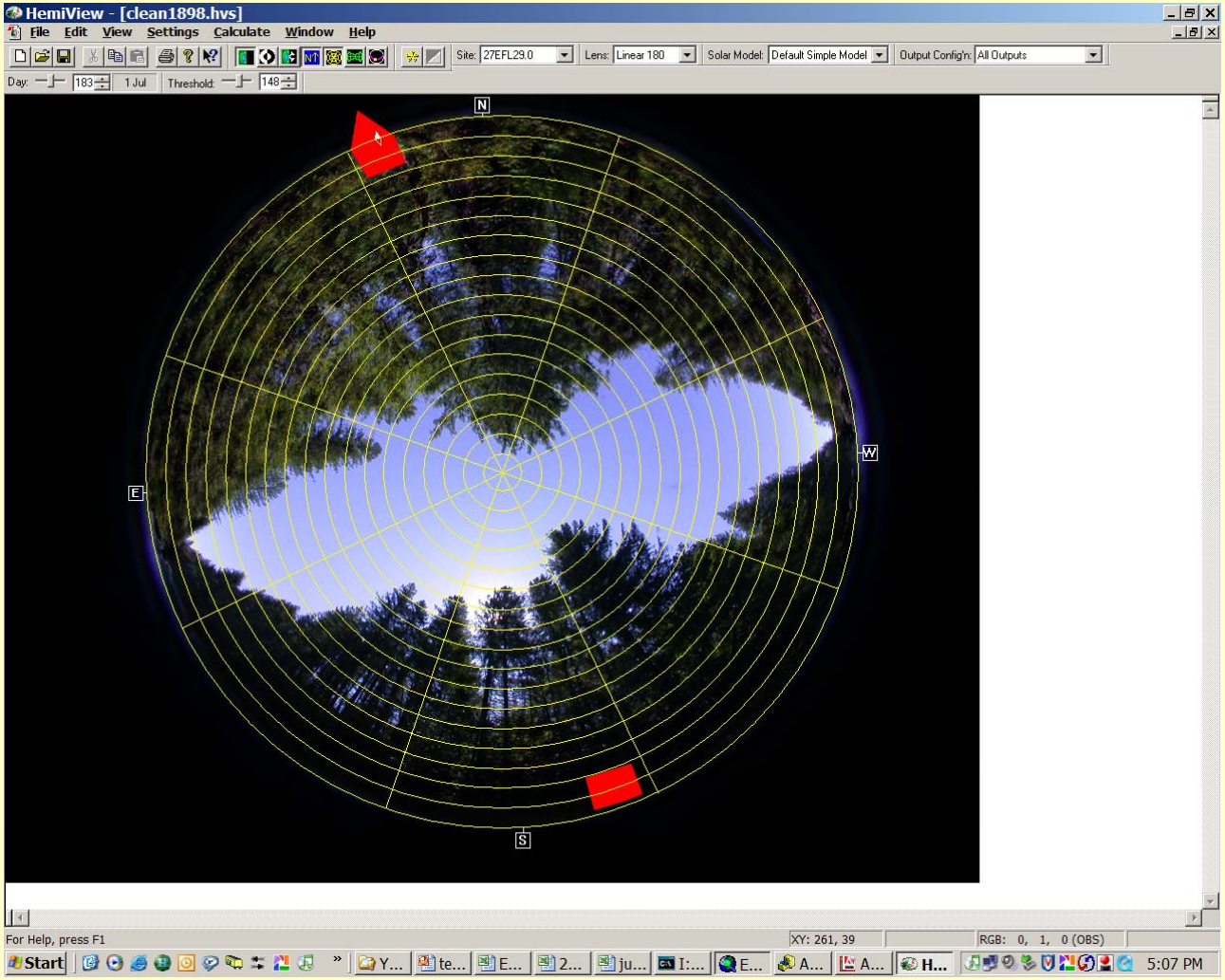
August Time of Travel Dye Study Results



Channel Surveys



Hemispherical Photography



- Pictures taken at representative locations for riparian vegetation types
- Pictures were processed using Hemiview software
- The picture at the left shows a grid that Hemiview uses to calculate canopy density similar to a densiometer.

Temperature Water Quality Criteria

Waterbody Reach	Aquatic Life Uses	Temperature Standard Highest 7 DADMax
EFLR from mouth to Mason Creek	Salmonid Spawning, Rearing, and Migration	17.5ºC (63.5ºF)
EFLR from Mason Creek to headwaters	Core Summer Habitat	16ºC (60.8ºF)

Core summer salmonid habitat. The key identifying characteristics of this use are summer (June 15 – September 15) salmonid spawning or emergence, or adult holding; use as important summer rearing habitat by one or more salmonids; or foraging by adult and sub-adult native char. Other common characteristic aquatic life uses for waters in this category include spawning outside of the summer season, rearing, and migration by salmonids.

Station ID	Description	Days 7DADM above WQ Criteria	Number of Days on Record	% WQ Standard Violated
16°C criteria				
27EFL29.0	EFLR abv King Cr	12	90	13%
27KNG00.0	King Cr near mouth	25	112	22%
27EFL26.9	EFLR at Dole Valley Rd	39	95	41%
27RCS03.9	Rock Cr S at Dole Valley Rd	34	112	30%
27EFL24.6	EFLR abv Moulton Falls	39	83	47%
27BIG00.0	Big Tree Cr at mouth	36	112	32%
27EFL20.3	EFLR at the USGS gage	58	113	51%
RCN050	Rock Cr North	80	131	61%
27RCN00.6	Rock Cr North	59	91	65%
27EFL14.7	EFLR at Shultz residence	62	75	83%
27EFL13.2	EFLR at Lewisville Park	60	90	67%
27D090	EF Lewis R nr Dollar Corner	43	49	88%
27EFL10.1	EFLR at Daybreak Park	92	120	77%
MAN010	Manley Cr	62	79	78%
27EFL08.1	EFLR abov Ridgefield pits	33	39	85%
27DEA00.8	Dean Cr at JA Moore Rd	91	114	80%
27DEA00.0	Dean Cr at mouth	22	28	79%
27EFL07.3	EFLR blw Dean Cr	49	73	67%
27MAS00.8	Mason Cr ds of Heitmann Cr	47	115	41%
17.5°C criteria				
27EFL04.6	EFLR abv Lockwood Cr	97	189	51%
27LOC00.0	Lockwood Creek at Mouth	32	65	49%
BRZ010	Brezee Cr	45	131	34%
27BRZ00.1	Brezee Cr near mouth	53	113	47%
27EFL01.8	EFLR at gage near mouth	100	127	79%
27JEN00.3	Jenny Creek at Pacific Hwy	50	112	45%

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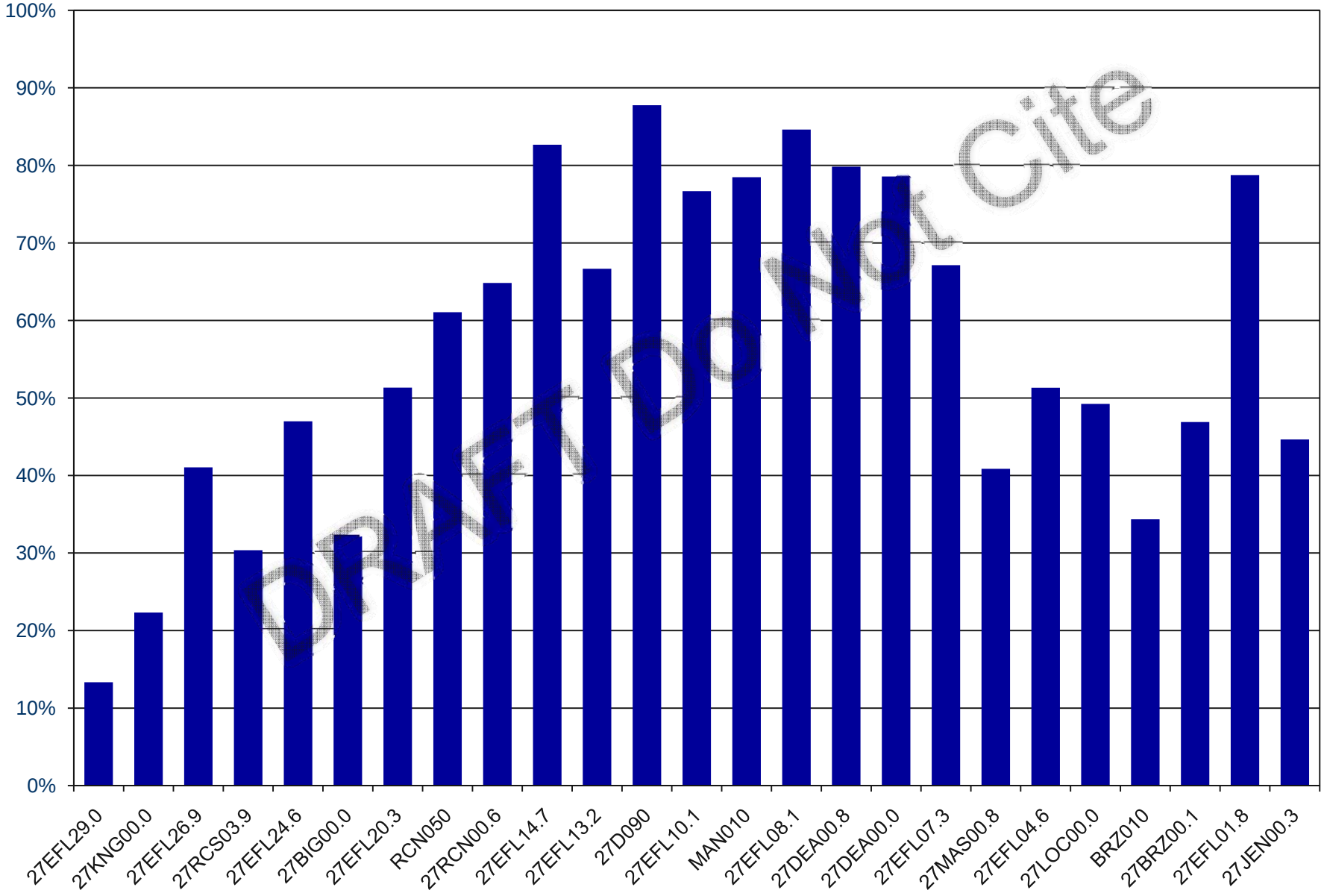
Percent of samples that exceed the temperature WQ criteria



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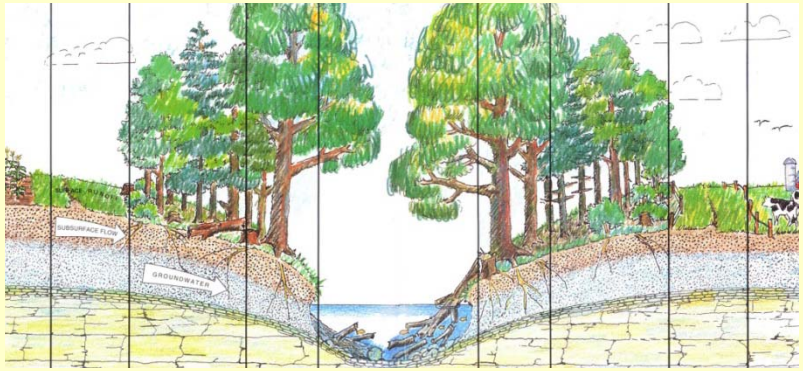
Models for Temperature TMDLs

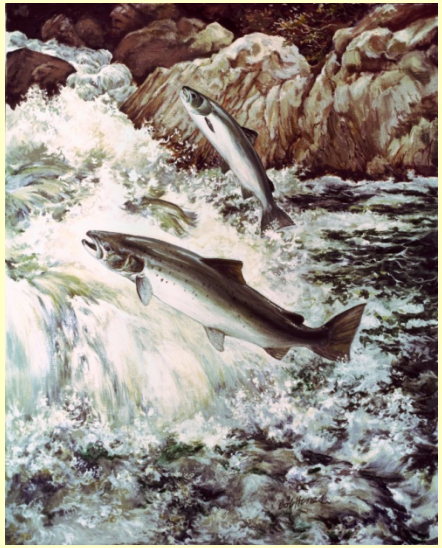
- Shade
  - A tool for estimating shade from riparian vegetation.

- QUAL2Kw
  - A modeling framework for simulating river and stream water quality.

Possible Management Strategies and Recommendations



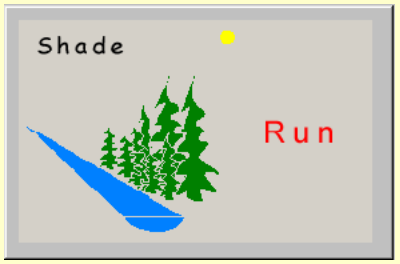
- Load Allocations
  - Effective shade (increase riparian vegetation)
- Wasteload Allocation
  - 0.3°C increase at mixing zone boundary
- Management activities that would reduce the loading of sediment to the surface waters from upland and channel erosion
- Activities to increase instream habitat
- Voluntary water conservation measures to increase instream flow



Next steps…

- Model temperature for mainstem East Fork Lewis River
- Develop Load and Wasteload Allocations for temperature
- Draft technical report for external review in fall 2009.

QUAL2Kw



Advisory Committee Process and Timeline

- September 2009 → December 2010 - Ecology and stakeholders use TMDL study results and other information to develop a cleanup strategy that must be approved by EPA
- 2011 - Ecology and stakeholders develop a detailed list of cleanup actions (who, what, when, where)
- 2012+ - Follow up to determine if strategy is working and make adjustments as needed

Thanks!

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