Upper Klamath and Lost Subbasins Temperature TMDL

Technical Update and TMDL Allocations Overview

Tribal Coordination Meeting

May 6, 2019

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Oregon Department of Environmental Quality

Agenda

Schedule

General Temperature TMDL Approach

Water Quality Standards, TMDL Approach, and Allocations
- Klamath River
- Lost River

Tributary Model Scenarios
- Jenny Creek
- Spencer Creek
- Miller Creek

TMDL Schedule

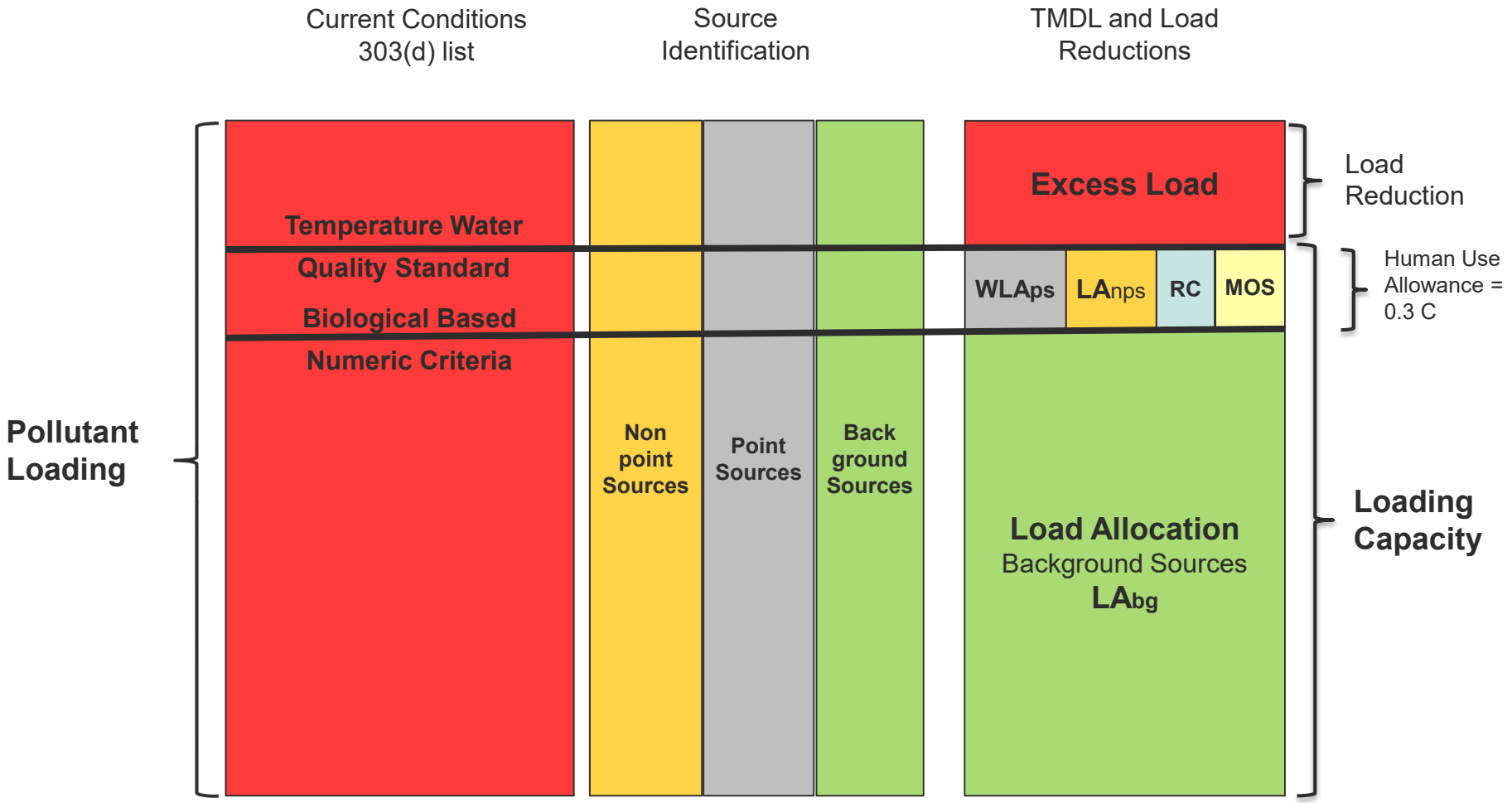
May 15, 2019: Public Comment Begins (60-Day)

July 15, 2019: Public Comment Ends

Sept. 30, 2019: EPA approval of TMDL

Typical Temperature TMDL

$$TMDL = WLA_{ps} + LA_{nps} + LA_{bg} + MOS + RC$$



Klamath River Temperature Criteria

Point Source Site Specific Criterion

- Upper Klamath Lake to Keno Dam
- Applies June 1 – September 30
- 0.3 deg-C warming at 25% mix = 0.075 deg-C warming at 100% mix

Cool Water Species Narrative

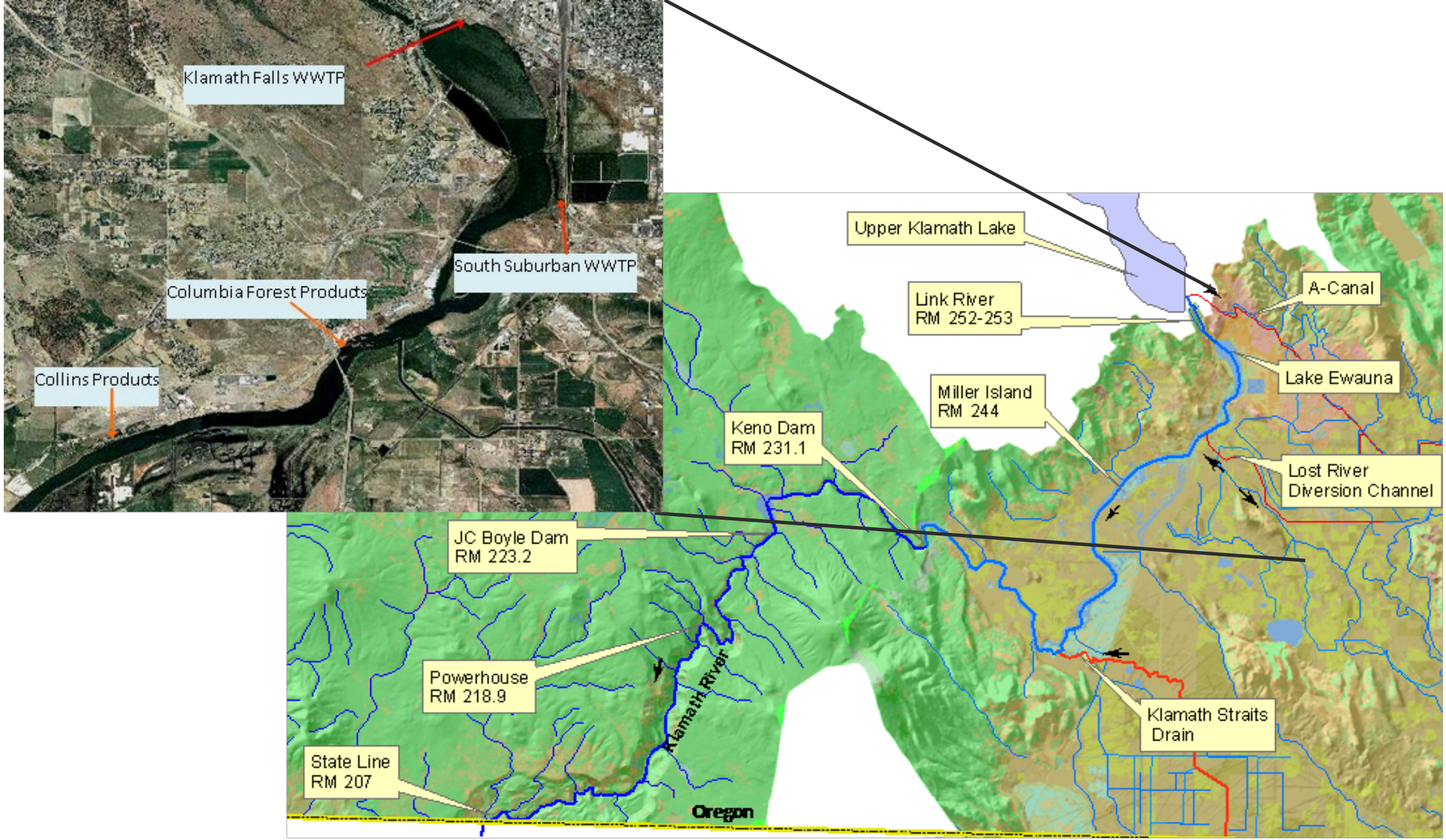
- Upper Klamath Lake to Keno Dam
- 28 deg-C Daily Maximum (all sources)

Redband and Lahontan Use

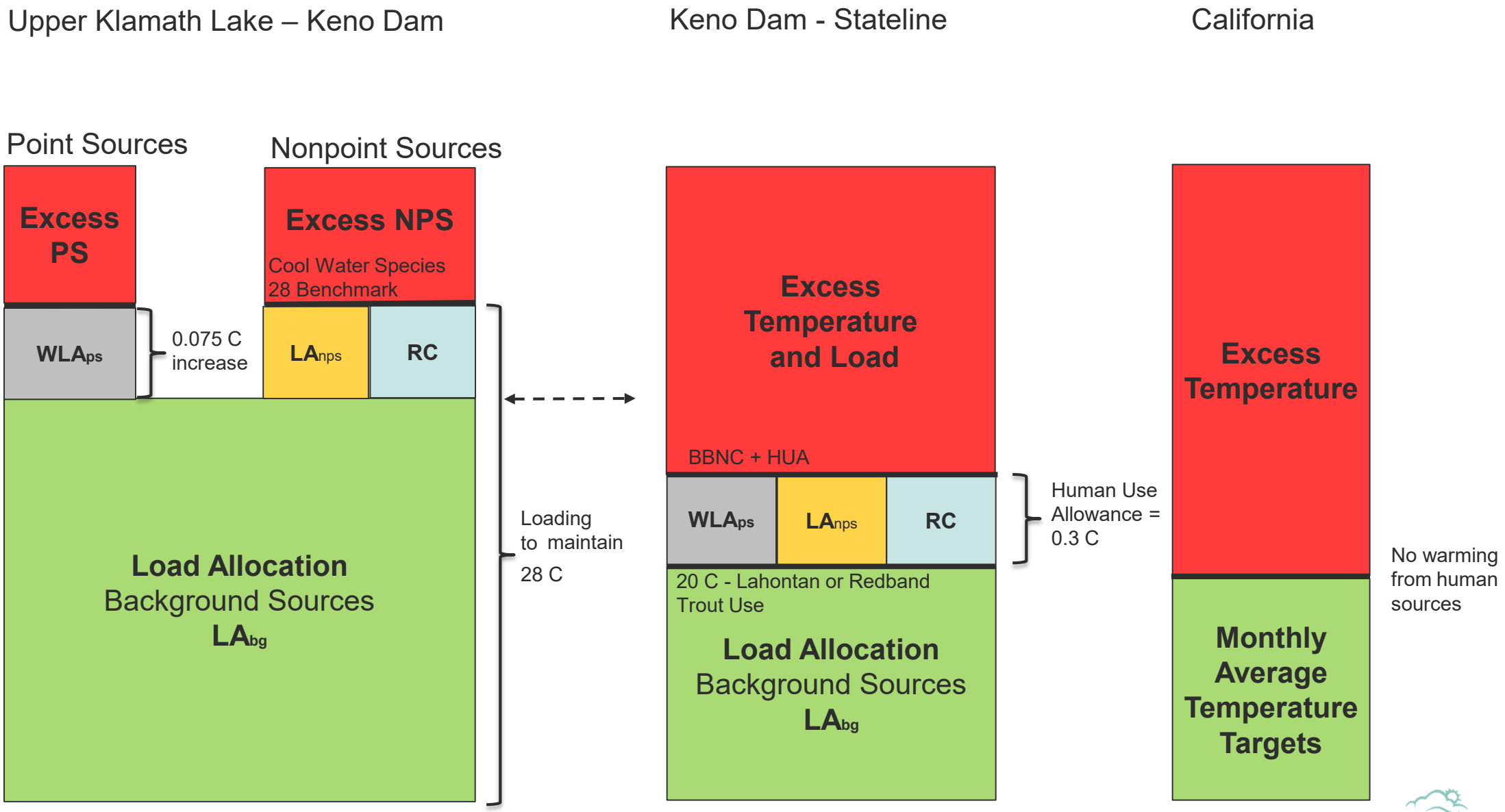
- Keno Dam to OR/CA Stateline
- 20 deg-C 7-Day Mean Daily Maximum
- 0.3 deg-C human use allowance

California Targets at Stateline

- Monthly average temperature targets (natural conditions)
- No warming from human sources (defined as <=0.04 deg-C)


Klamath Falls WWTP
South Suburban WWTP
Columbia Forest Products
Collins Products
Upper Klamath Lake
Link River
RM 252-253
A-Canal
Lake Ewauna
Miller Island
RM 244
Keno Dam
RM 231.1
Lost River
Diversion Channel
JC Boyle Dam
RM 223.2
Powerhouse
RM 218.9
Klamath River
Klamath Straits
Drain
State Line
RM 207
Oregon

Klamath River



Klamath River Source Reductions

- Klamath Falls WWTP
- South Suburban WWTP
- KSD
- LRDC
- Keno Dam
- J.C. Boyle Dam
- Natural Sources

Criteria Driving Reductions

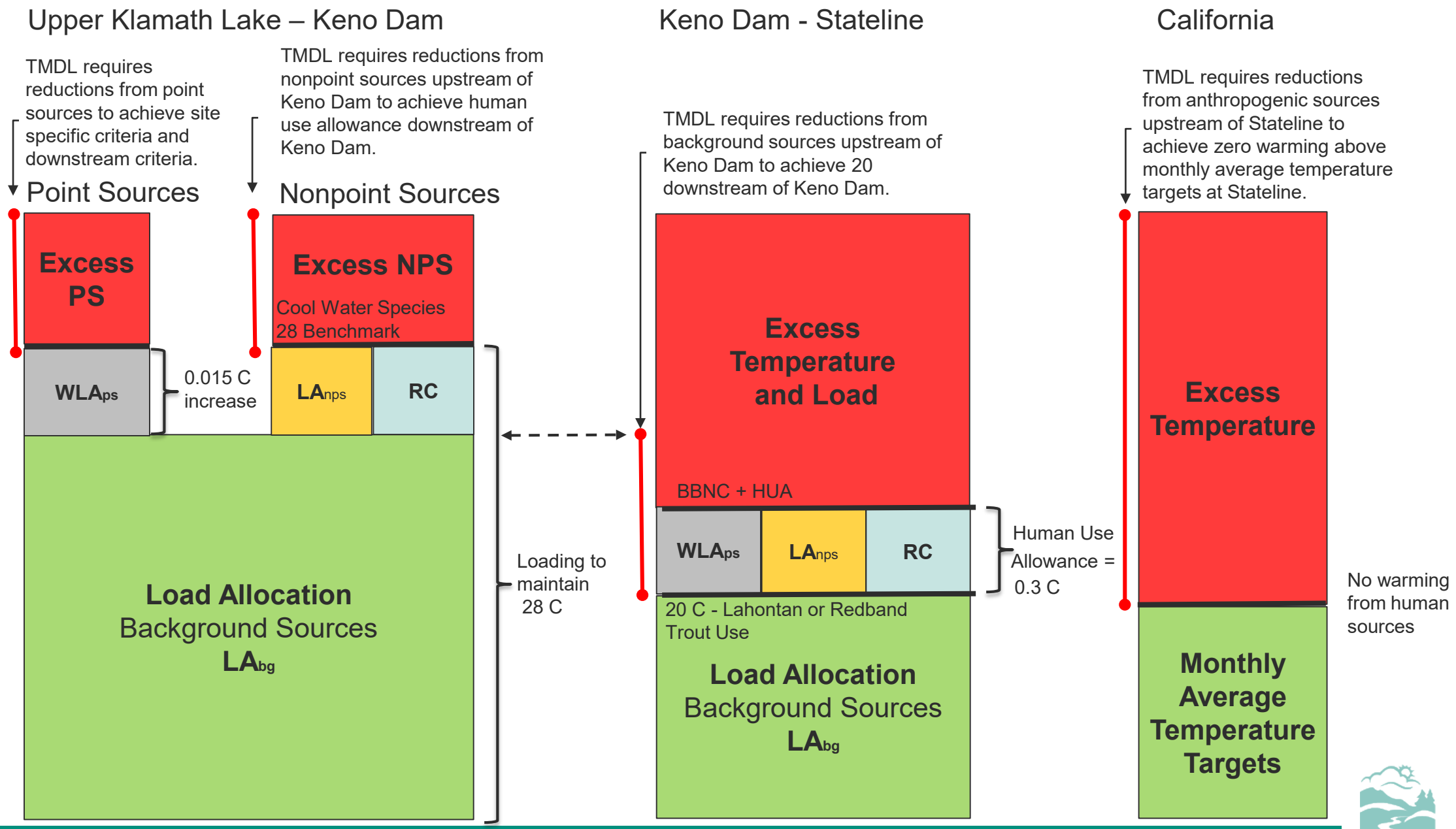
Point Sources
- Site Specific Criterion
- California Targets at Stateline

KSD and LRDC
- 0.3 deg-C Human Use Allowance
- California Targets at Stateline

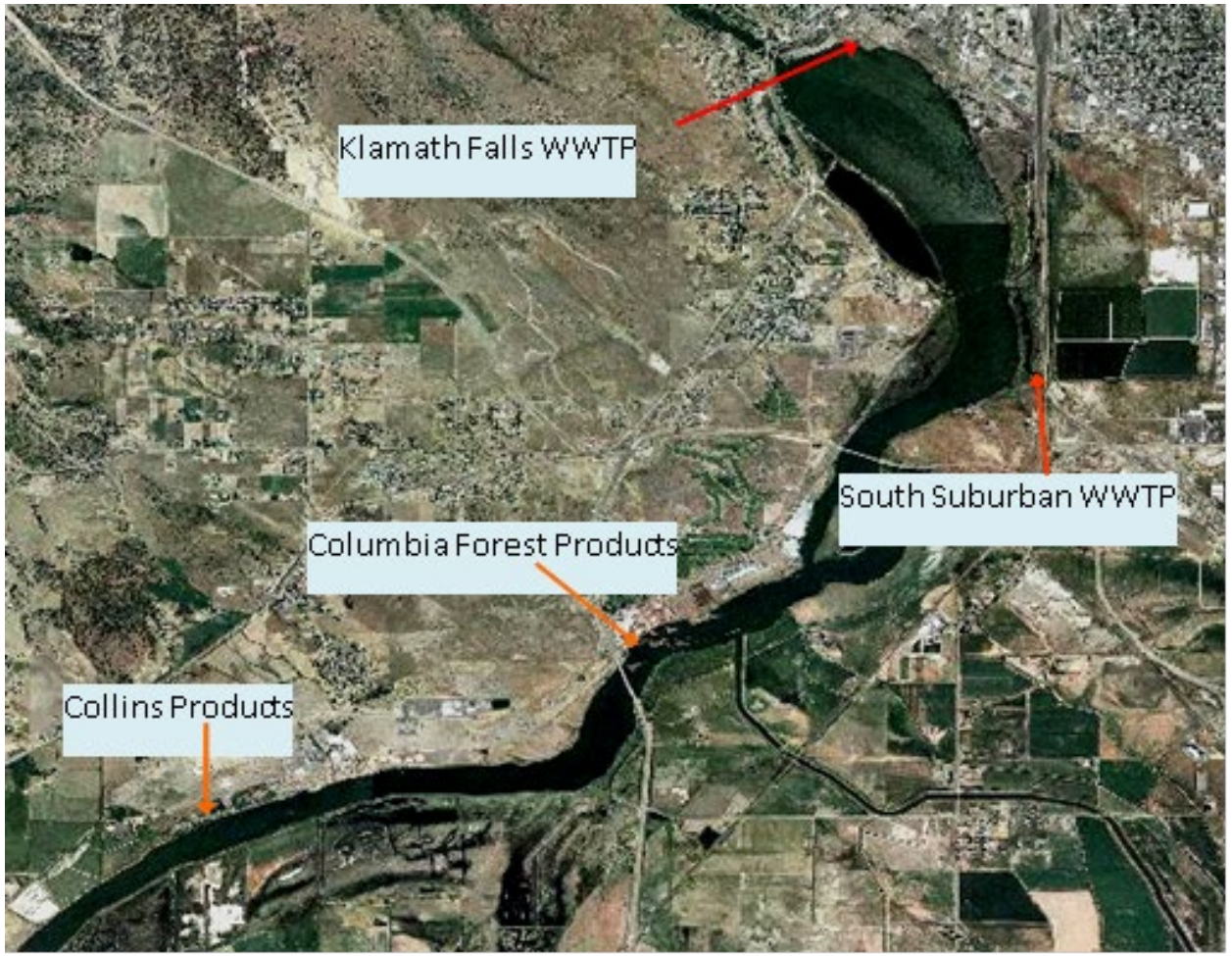
Keno and J.C. Boyle Dams
- 0.3 deg-C Human Use Allowance
- California Targets at Stateline

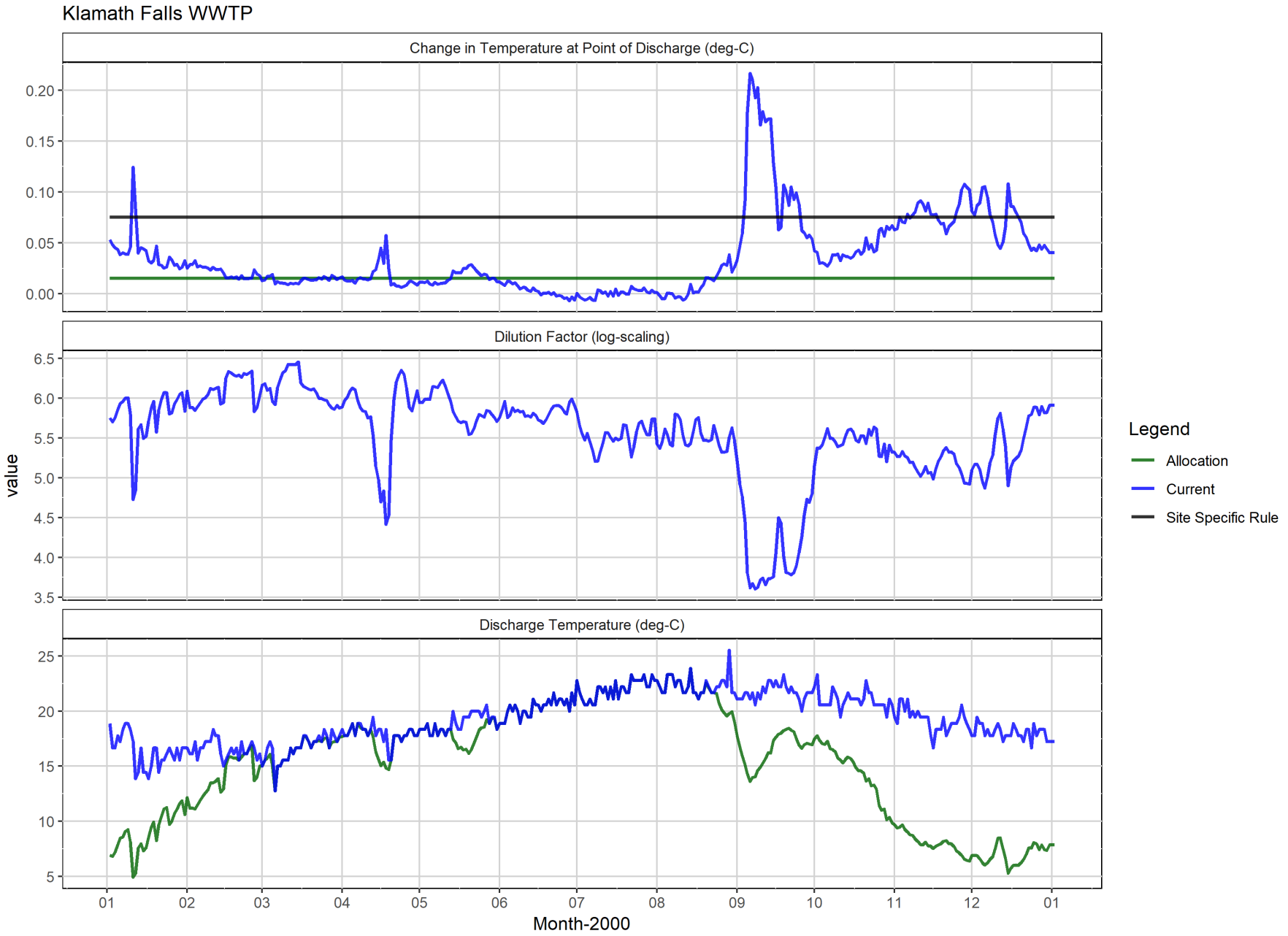
Natural Sources
- 20 deg-C Redband and Lahonton Trout use downstream of Keno Dam

Klamath River Source Reductions

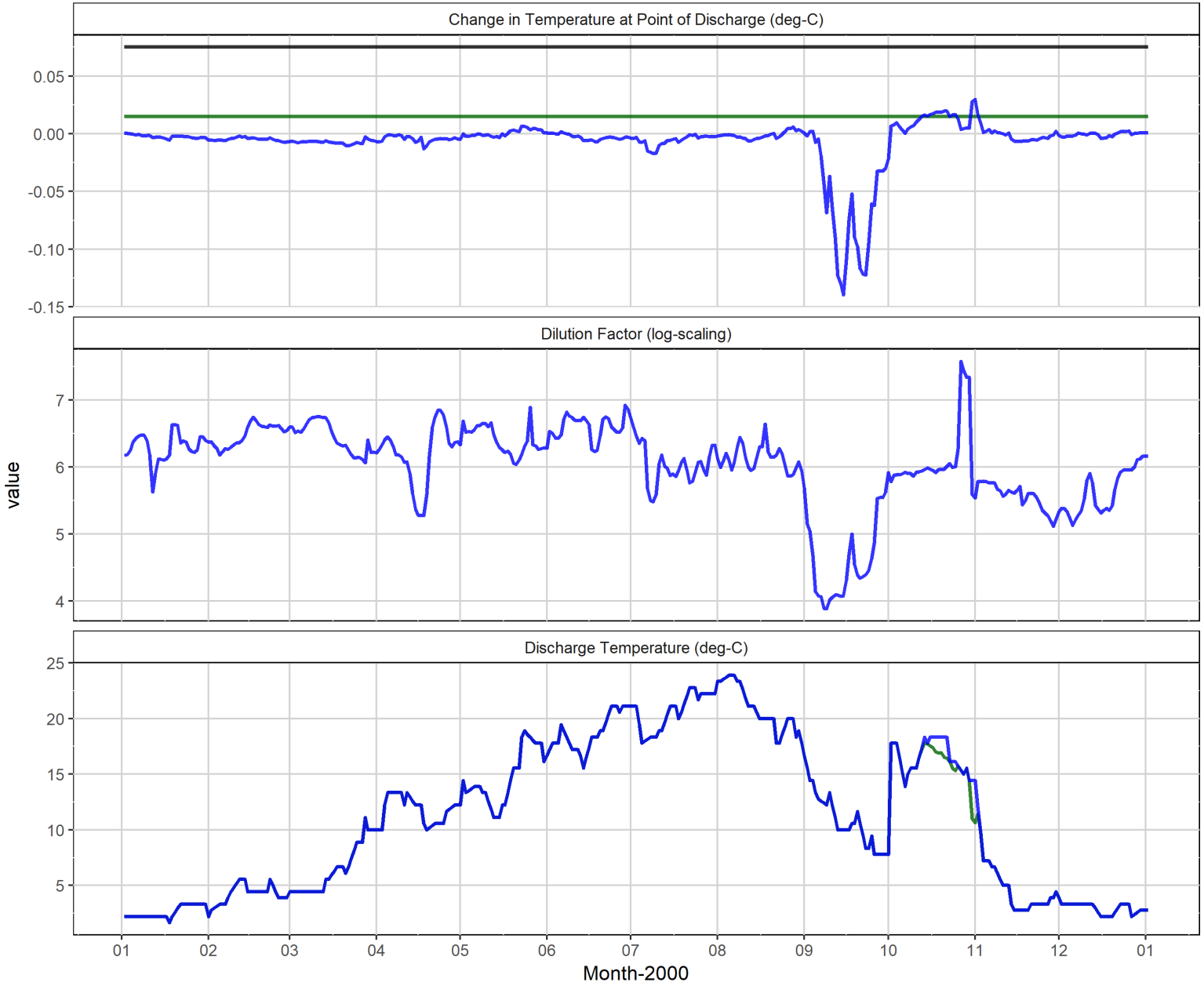


Point Source Warming and Allocations




Klamath Falls WWTP
Change in Temperature at Point of Discharge (deg-C)
0.20
0.15
0.10
0.05
0.00
Dilution Factor (log-scaling)
value
6.5
6.0
5.5
5.0
4.5
4.0
3.5
Discharge Temperature (deg-C)
25
20
15
10
5
01
02
03
04
05
06
07
08
09
10
11
12
01
Month-2000
Legend
Allocation
Current
Site Specific Rule

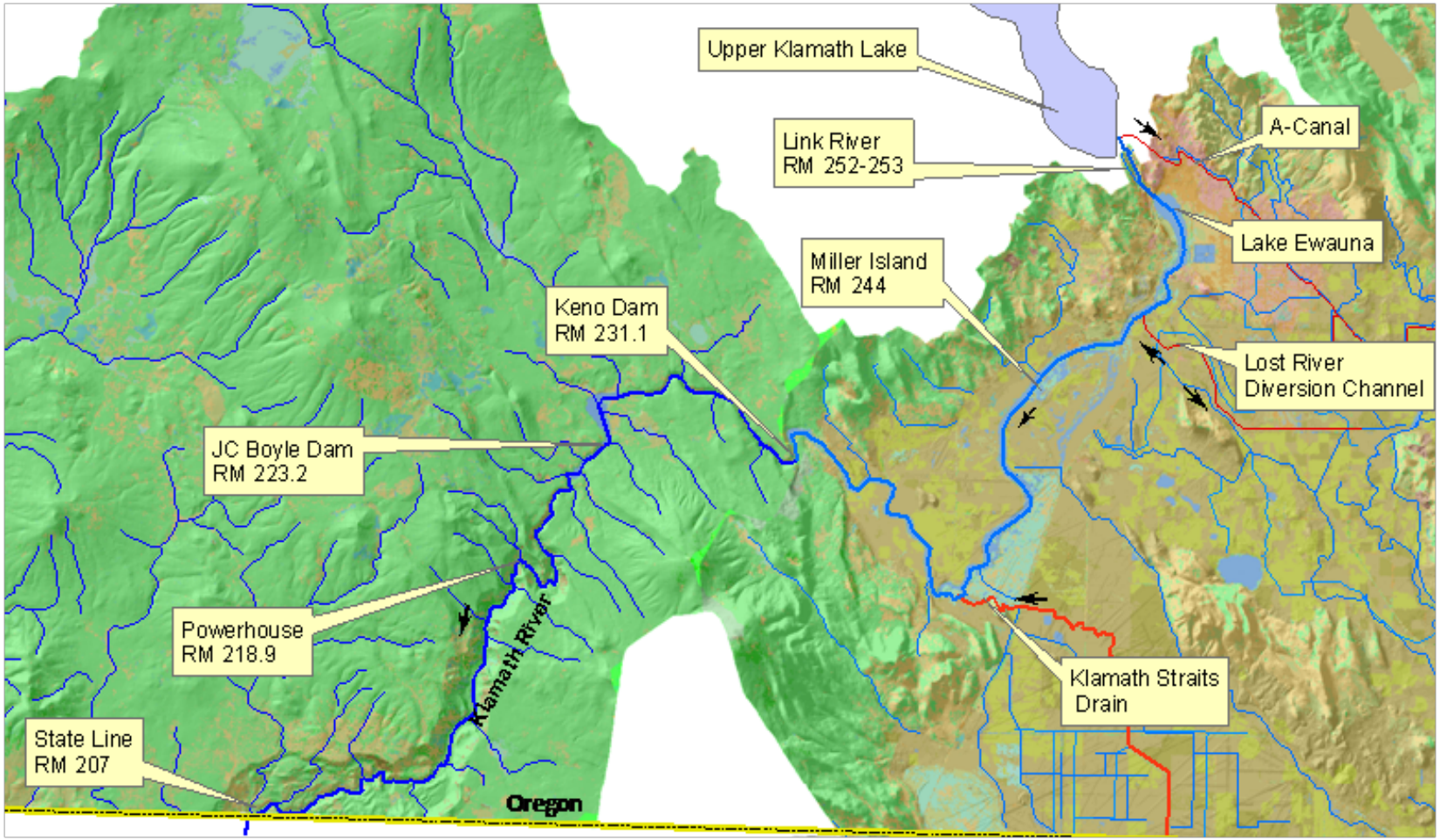
South Suburban WWTP



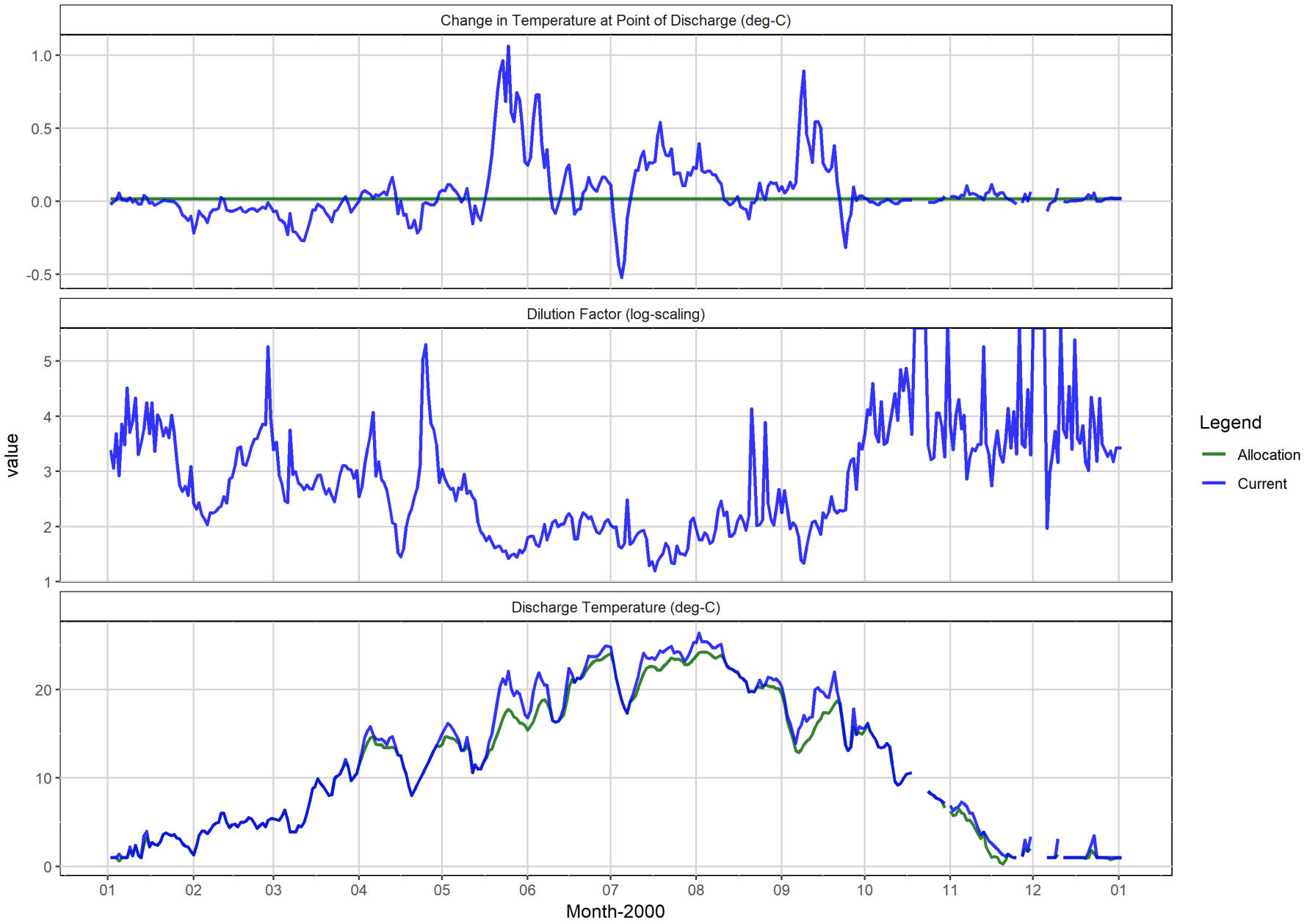
Legend

- Allocation
- Current
- Site Specific Rule

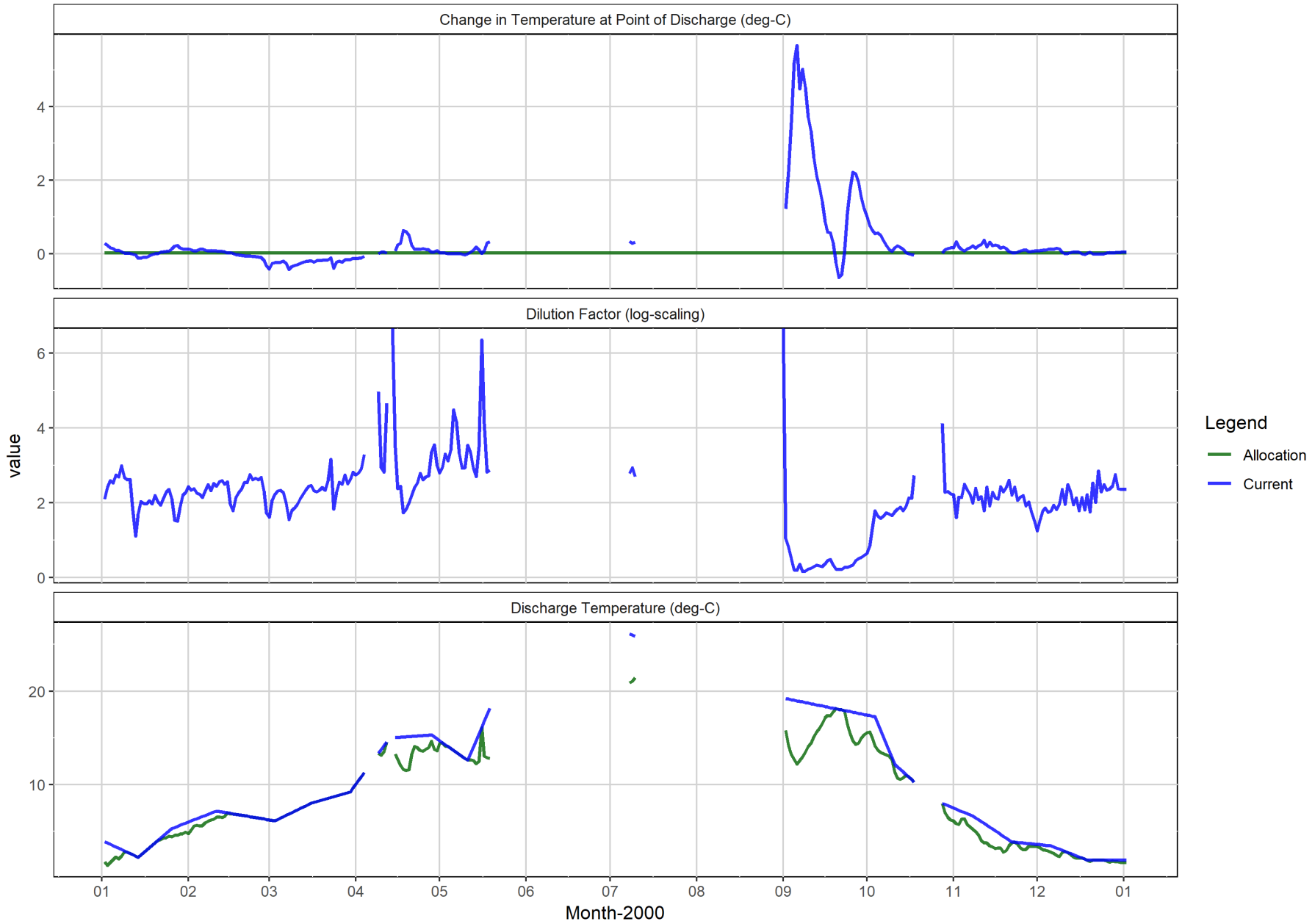
KSD and LRDC Warming and Allocations



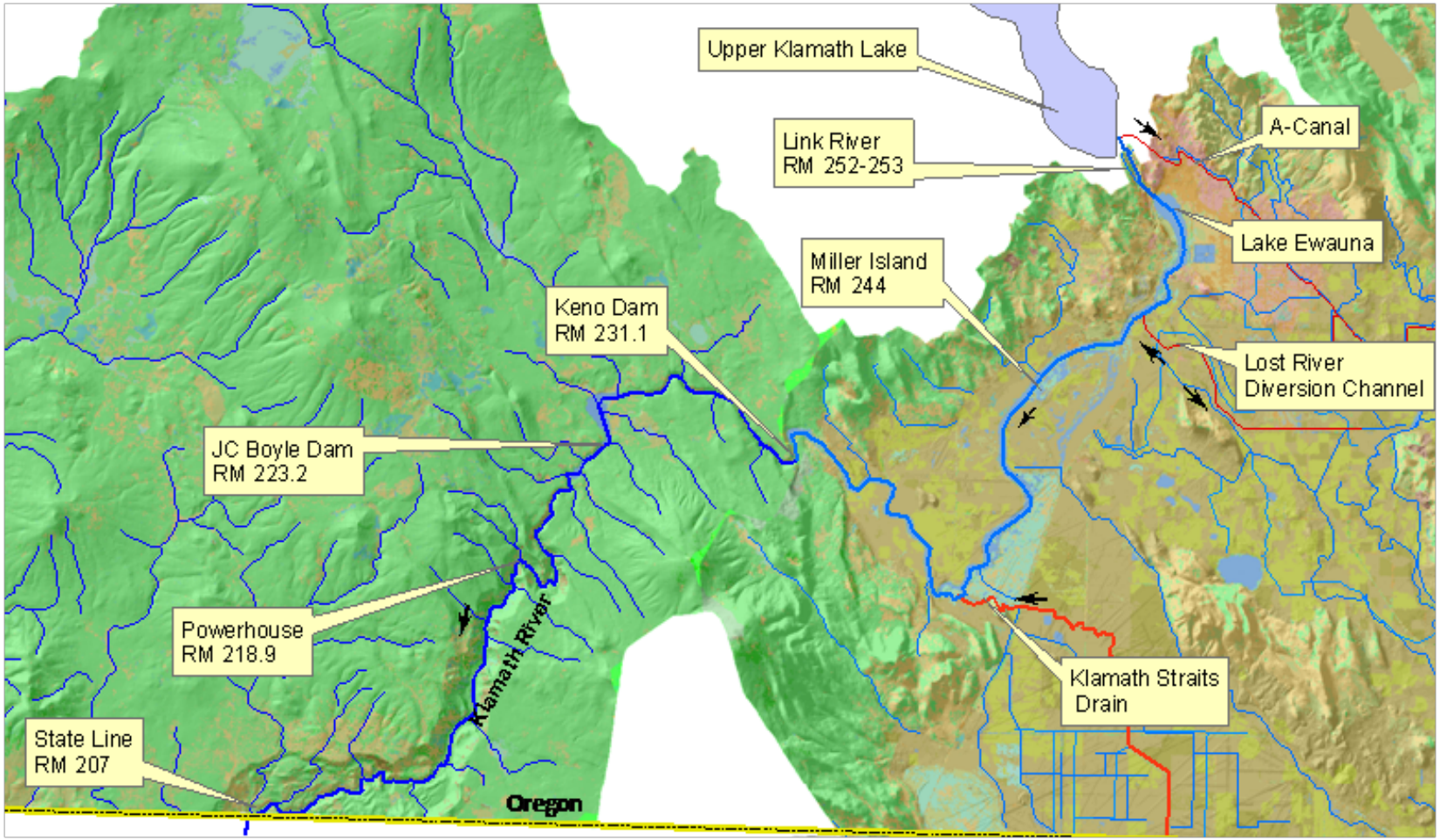
Klamath Straits Drain

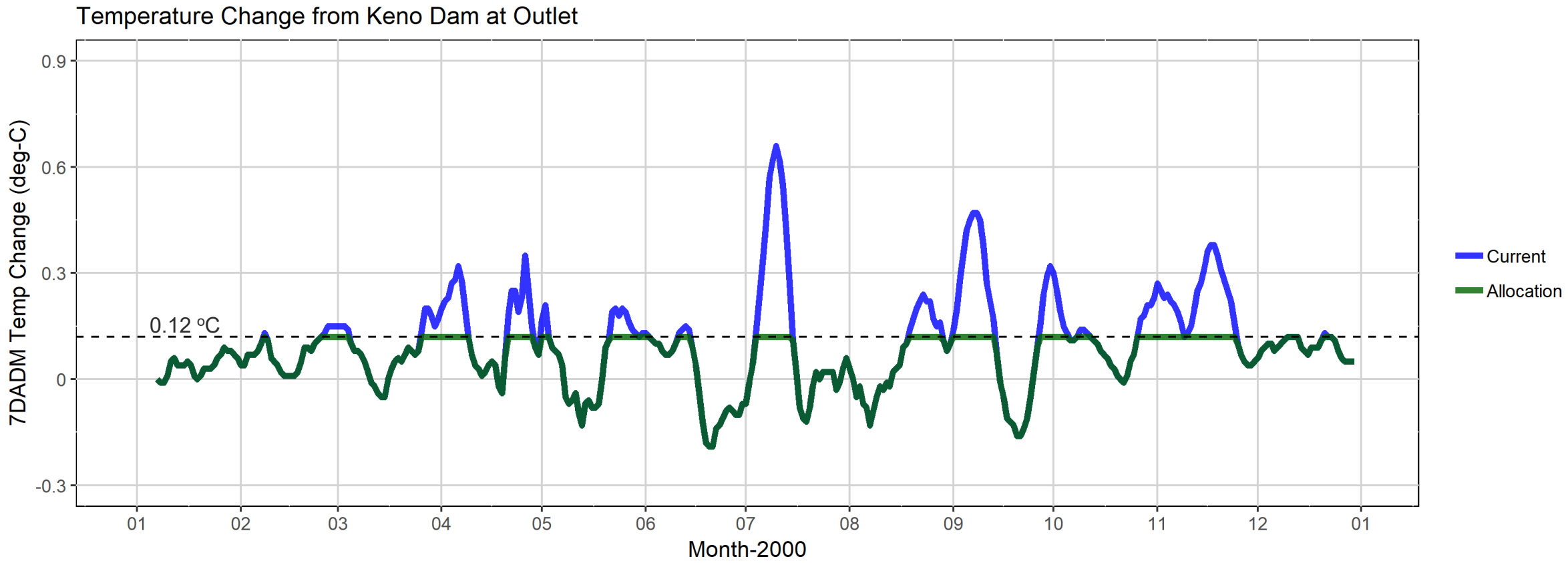


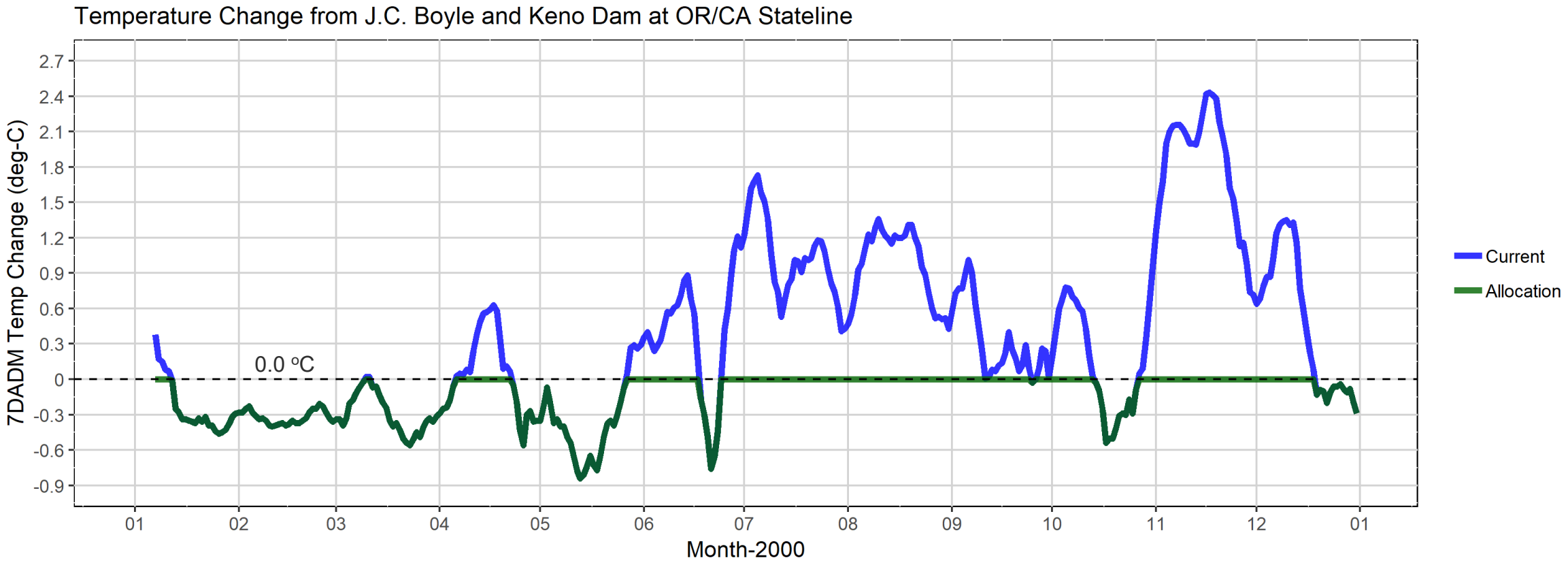
Lost River Diversion Channel

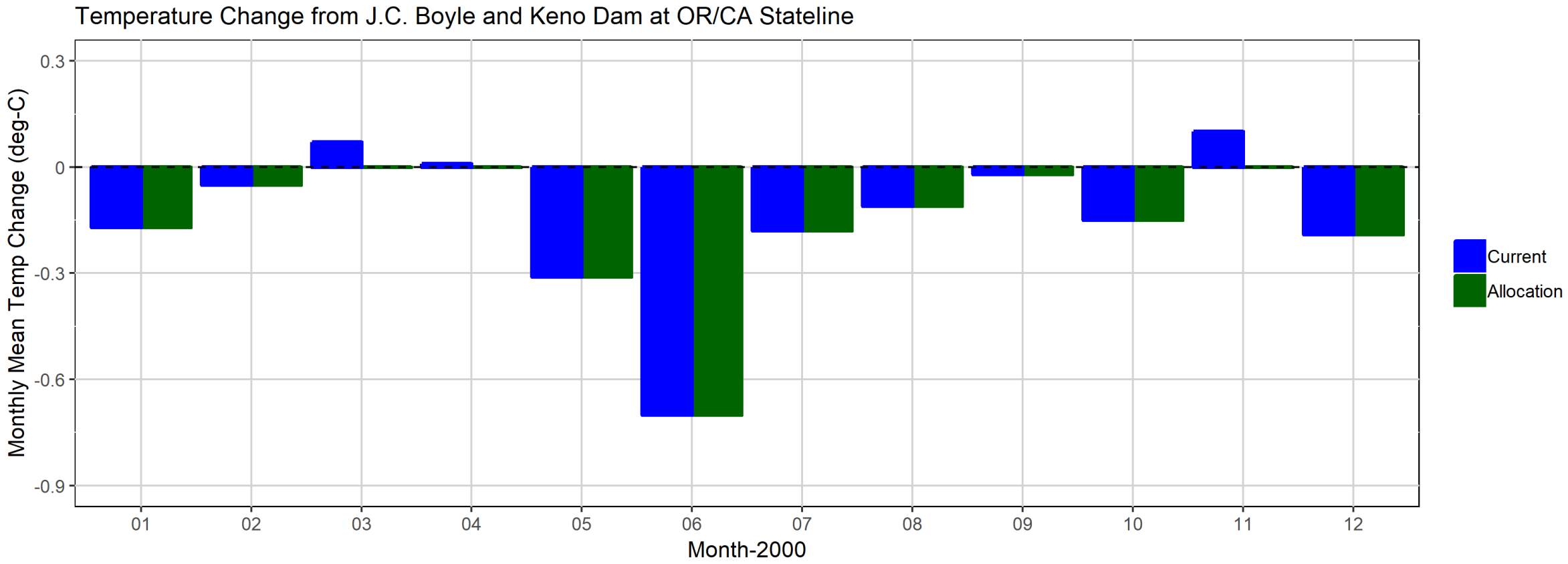


Keno and J.C. Boyle Dams Warming and Allocation

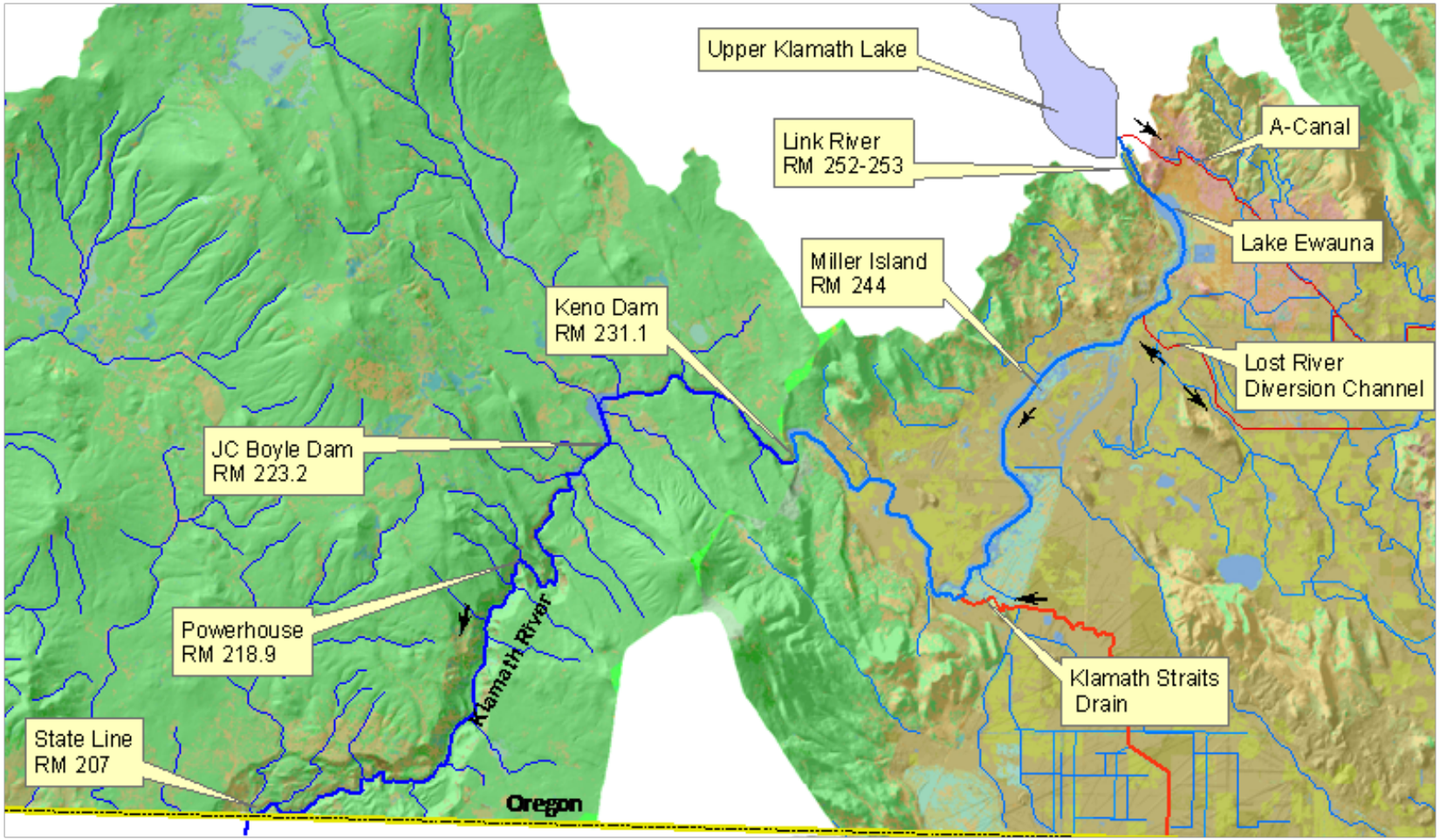


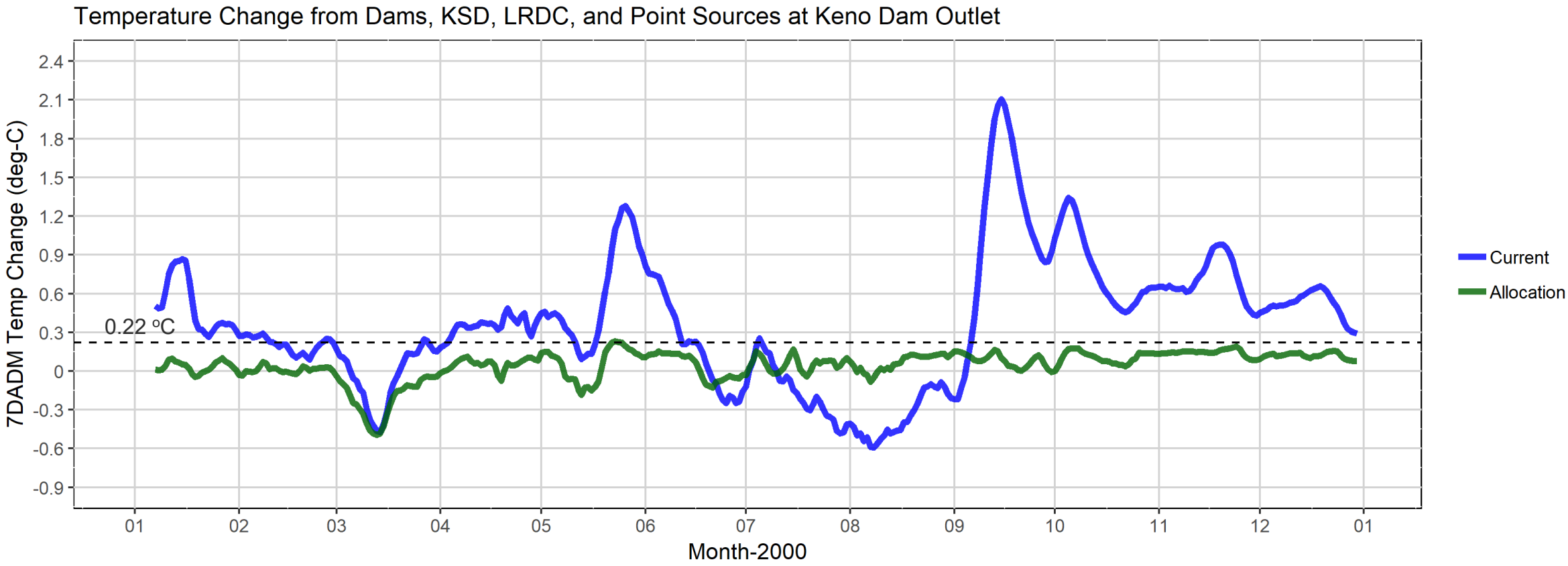

Temperature Change from Keno Dam at Outlet
7DADM Temp Change (deg-C)
0.9
0.6
0.3
0
-0.3
0.12 ºC
01
02
03
04
05
06
07
08
09
10
11
12
01
Month-2000
Current
Allocation

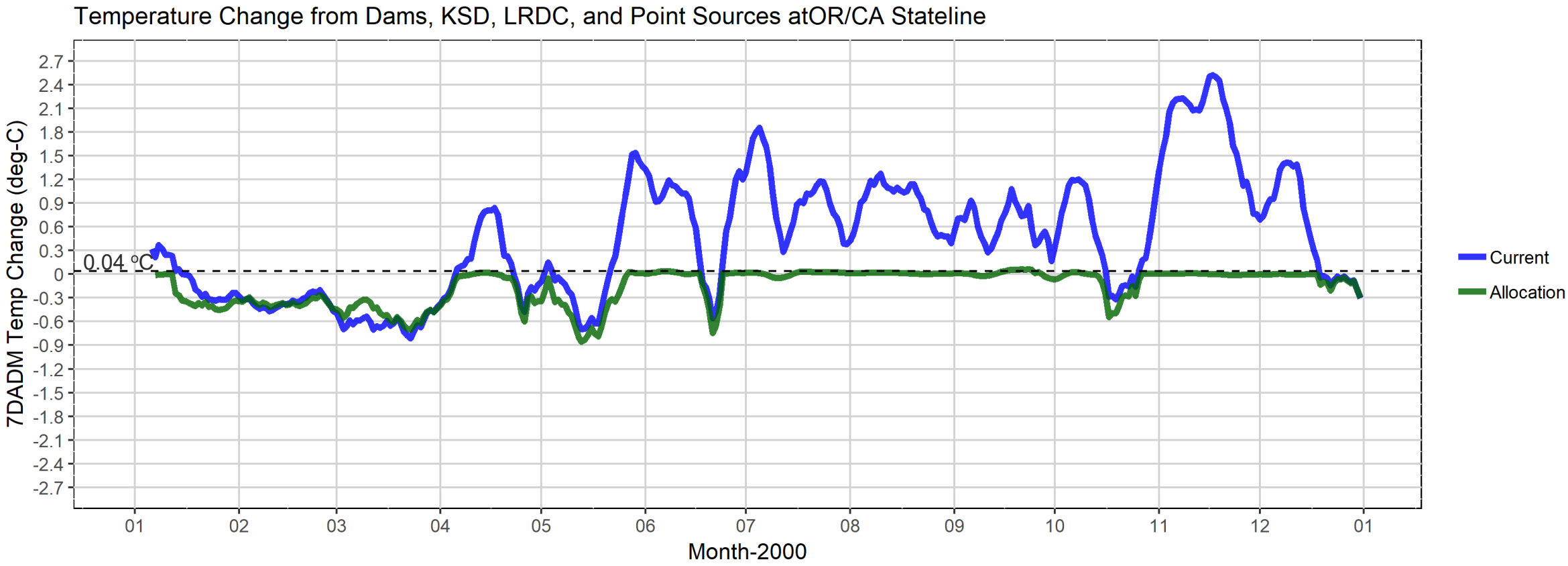

Temperature Change from J.C. Boyle and Keno Dam at OR/CA Stateline
7DADM Temp Change (deg-C)
2.7
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0
-0.3
-0.6
-0.9
0.0 °C
01
02
03
04
05
06
07
08
09
10
11
12
01
Month-2000
Current
Allocation

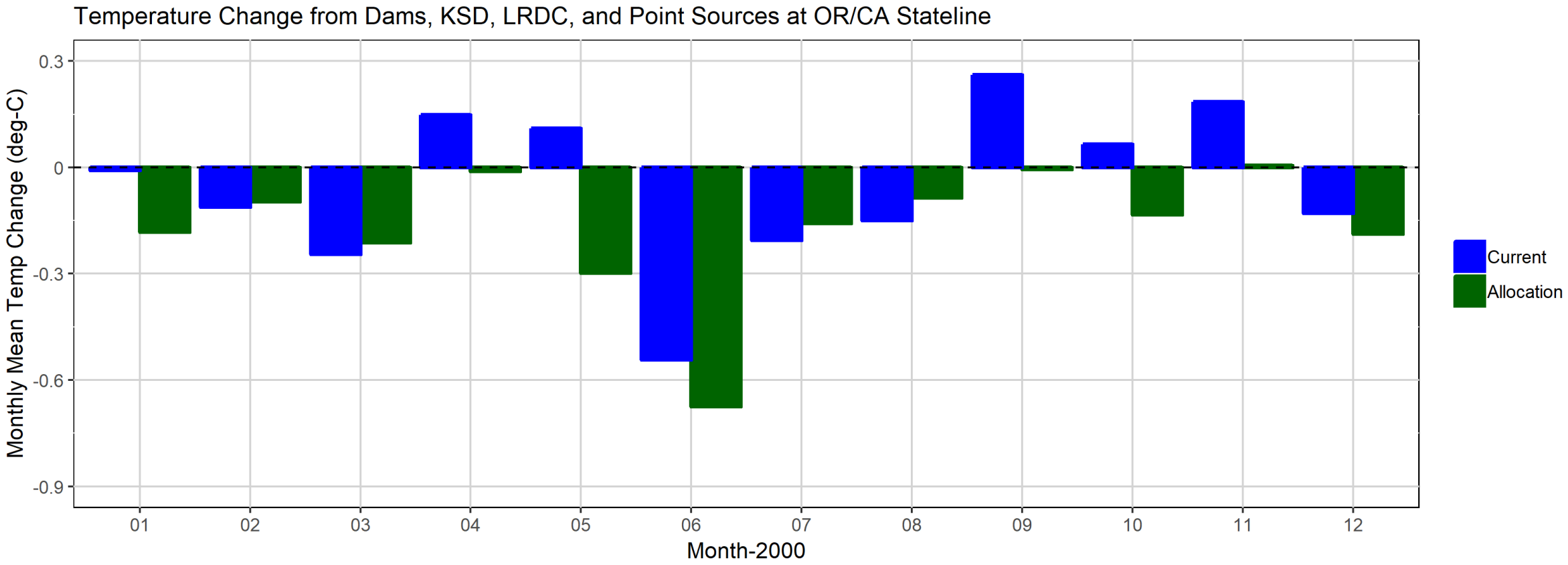

Temperature Change from J.C. Boyle and Keno Dam at OR/CA Stateline
Monthly Mean Temp Change (deg-C)
0.3
0
-0.3
-0.6
-0.9
01
02
03
04
05
06
07
08
09
10
11
12
Month-2000
Current
Allocation

Cumulative Source Warming and Allocation




Temperature Change from Dams, KSD, LRDC, and Point Sources at Keno Dam Outlet
7DADM Temp Change (deg-C)
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0
-0.3
-0.6
-0.9
0.22 °C
01
02
03
04
05
06
07
08
09
10
11
12
01
Month-2000
Current
Allocation


Temperature Change from Dams, KSD, LRDC, and Point Sources atOR/CA Stateline
7DADM Temp Change (deg-C)
2.7
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0
-0.3
-0.6
-0.9
-1.2
-1.5
-1.8
-2.1
-2.4
-2.7
0.04 °C
01
02
03
04
05
06
07
08
09
10
11
12
01
Month-2000
Current
Allocation


Temperature Change from Dams, KSD, LRDC, and Point Sources at OR/CA Stateline
Monthly Mean Temp Change (deg-C)
0.3
0
-0.3
-0.6
-0.9
01
02
03
04
05
06
07
08
09
10
11
12
Month-2000
Current
Allocation

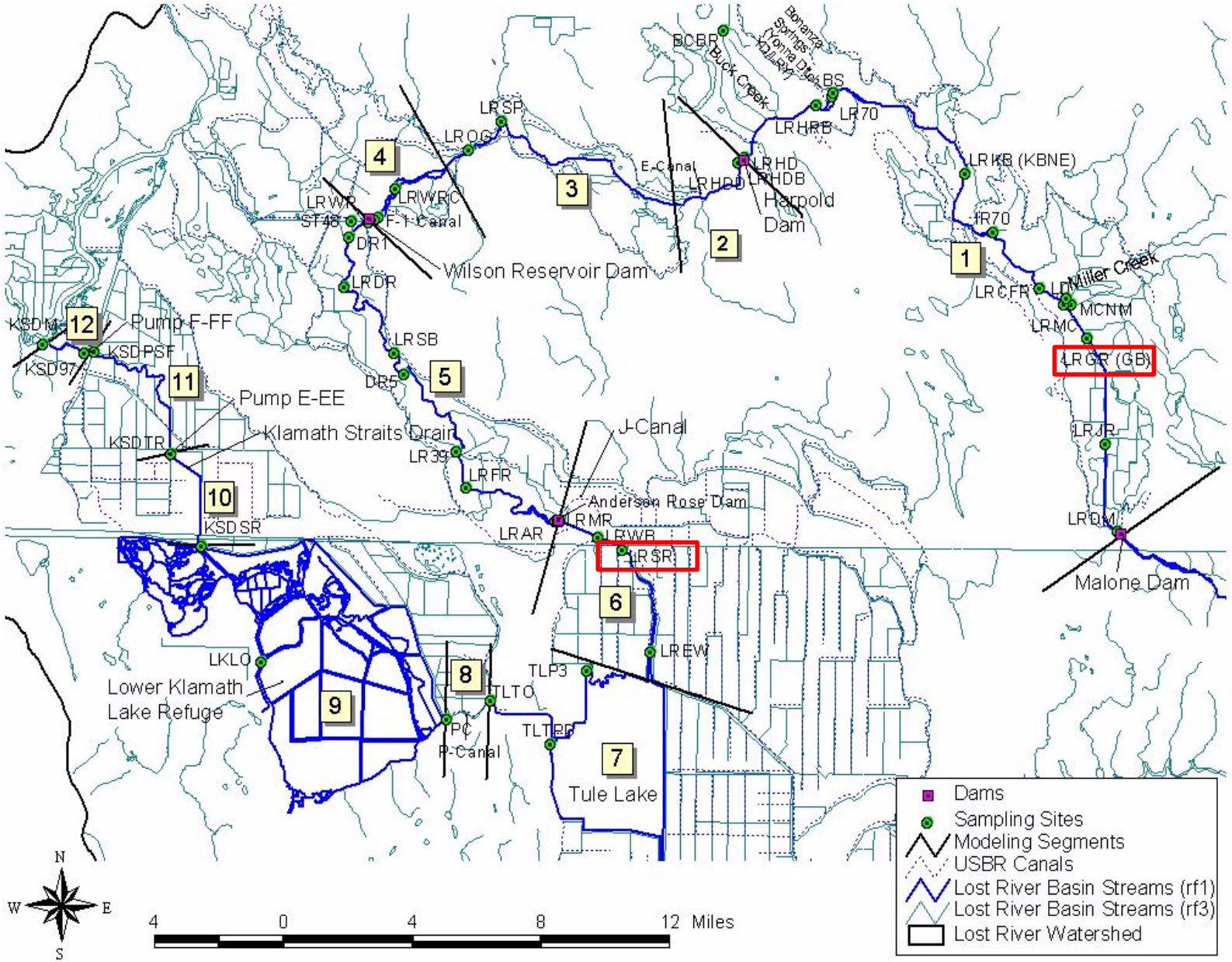
Lost River Temperature Criteria

Cool Water Species Narrative

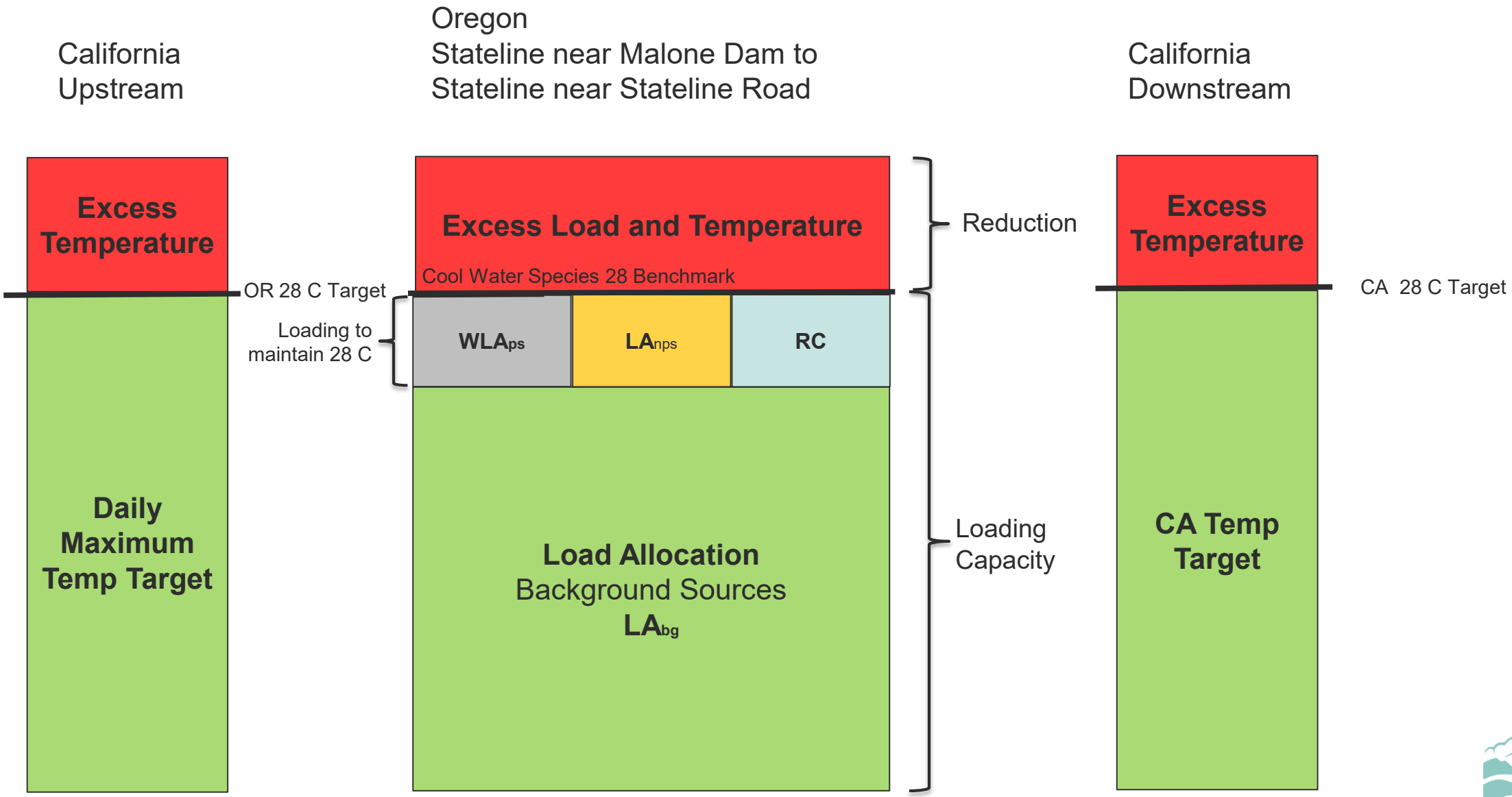
- OR/CA border (near Malone Dam) to OR/CA border (near State Line Road).
- 28 deg-C Daily Maximum

California Targets at Stateline

- 28 deg-C 7DADM


BCBR
Buck Creek
Bonanza Springs
Yonna Ditch
Ady Canyon
BS
LR70
LRHRB
LRKB (KBNE)
LRHD
LRHDB
E-Canal
Harpold Dam
LR70
LRCFR
LR
Miller Creek
MCNM
LRMC
LRGR (GB)
LRJR
LRDM
Malone Dam
LRSP
LROC
LRWR
LRWRC
ST48
F-1 Canal
DR1
Wilson Reservoir Dam
LRDR
LRSB
DR5
KSDM
KSDPSF
KSD97
Pump F-FF
Pump E-EE
Klamath Straits Drain
KSDTR
LR39
LRFR
J-Canal
Anderson Rose Dam
LRMR
LRAR
LRWB
LRSR
KSDSR
LREW
TLP3
TLTO
TLTPR
TPC
P-Canal
Tule Lake
LKLO
Lower Klamath Lake Refuge
1
2
3
4
5
6
7
8
9
10
11
12
N
W
E
S
4 0 4 8 12 Miles
Dams
Sampling Sites
Modeling Segments
USBR Canals
Lost River Basin Streams (rf1)
Lost River Basin Streams (rf3)
Lost River Watershed

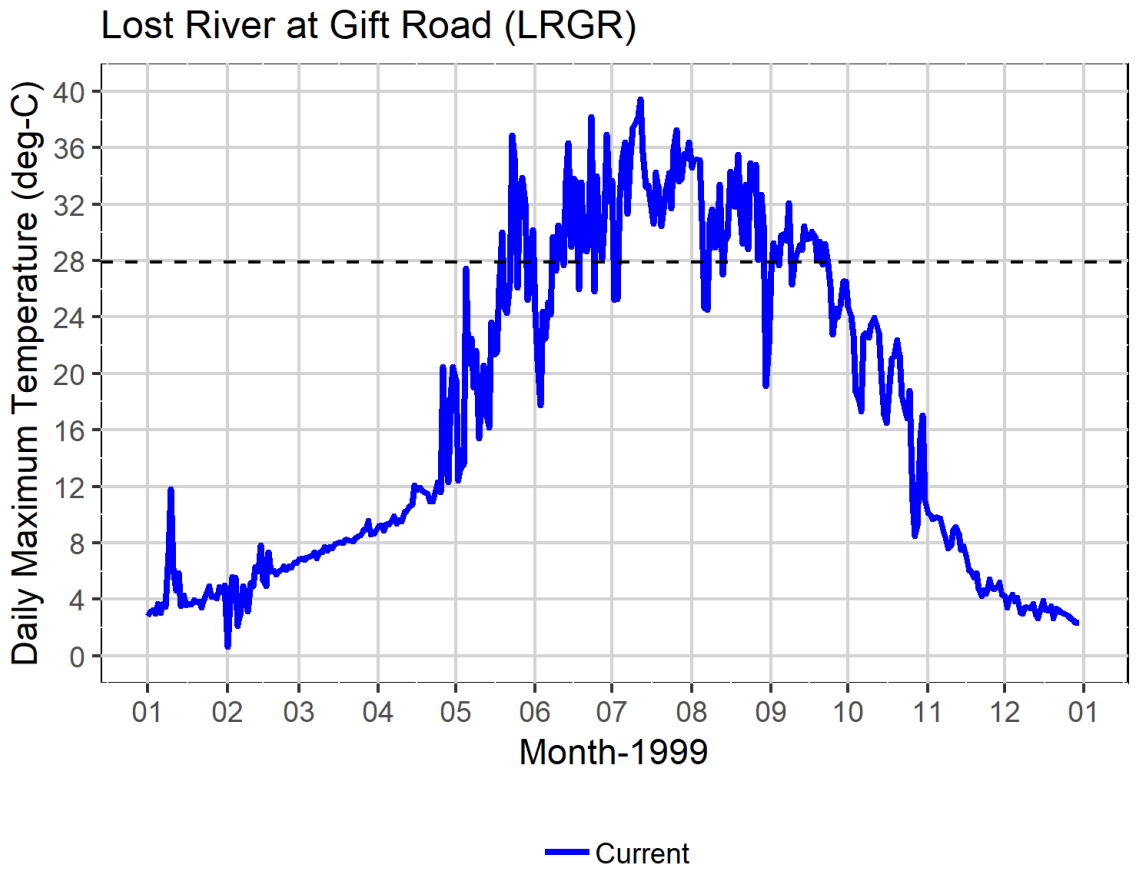
Lost River

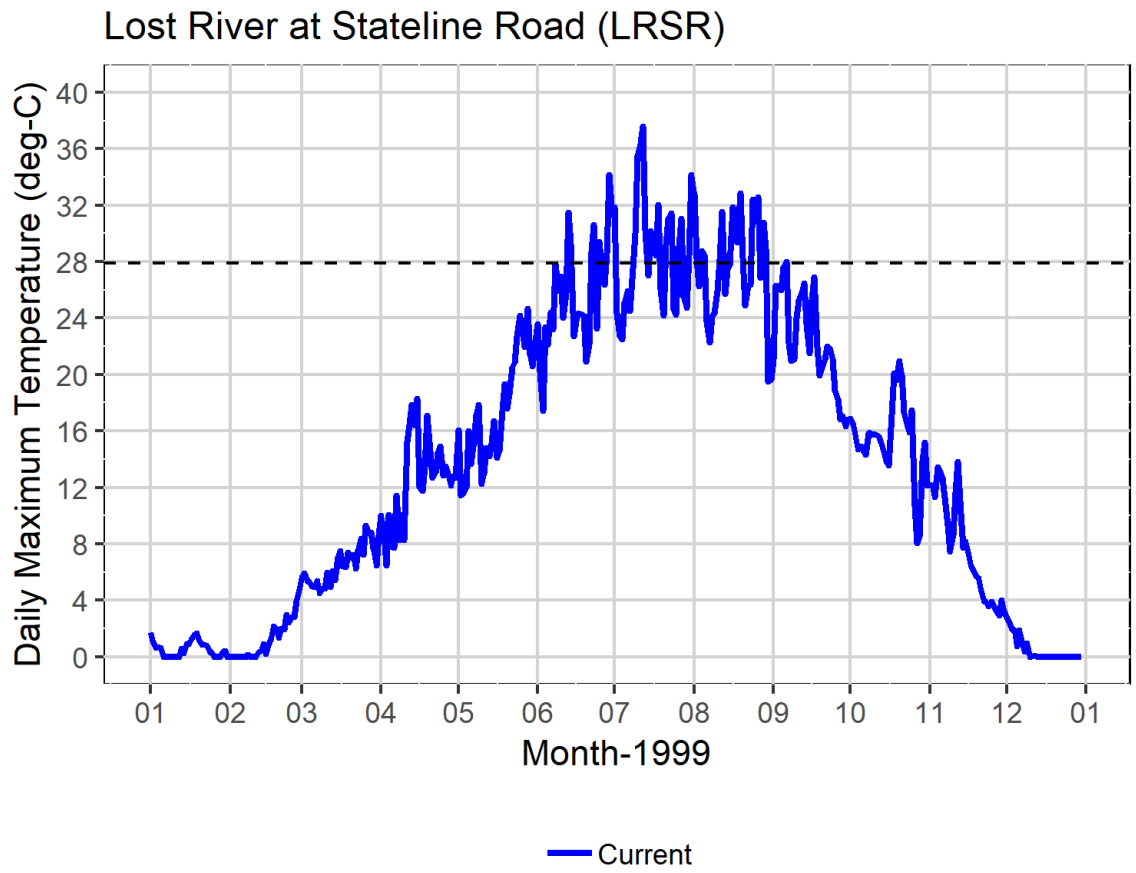

California
Upstream
Oregon
Stateline near Malone Dam to
Stateline near Stateline Road
California
Downstream
Excess Temperature
Excess Load and Temperature
Cool Water Species 28 Benchmark
Reduction
Excess Temperature
OR 28 C Target
CA 28 C Target
Loading to maintain 28 C
WLAps
LAnps
RC
Daily Maximum Temp Target
Load Allocation
Background Sources
LAbg
Loading Capacity
CA Temp Target

Sources

- Warming from loss of streamside vegetation
- Malone Diversion Dam
- Anderson Rose Dam

Current Temperatures

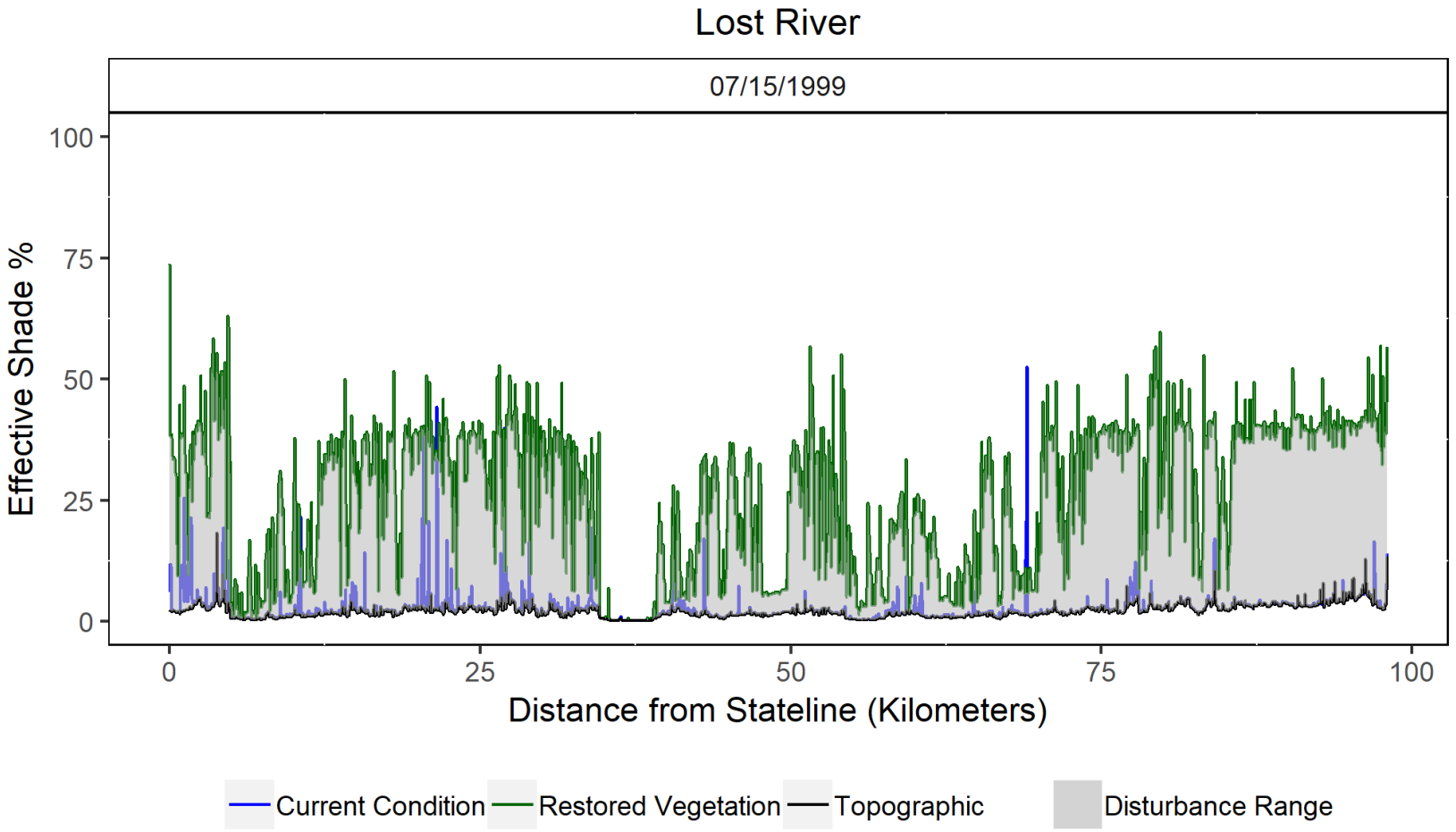




Lost River Restored Vegetation

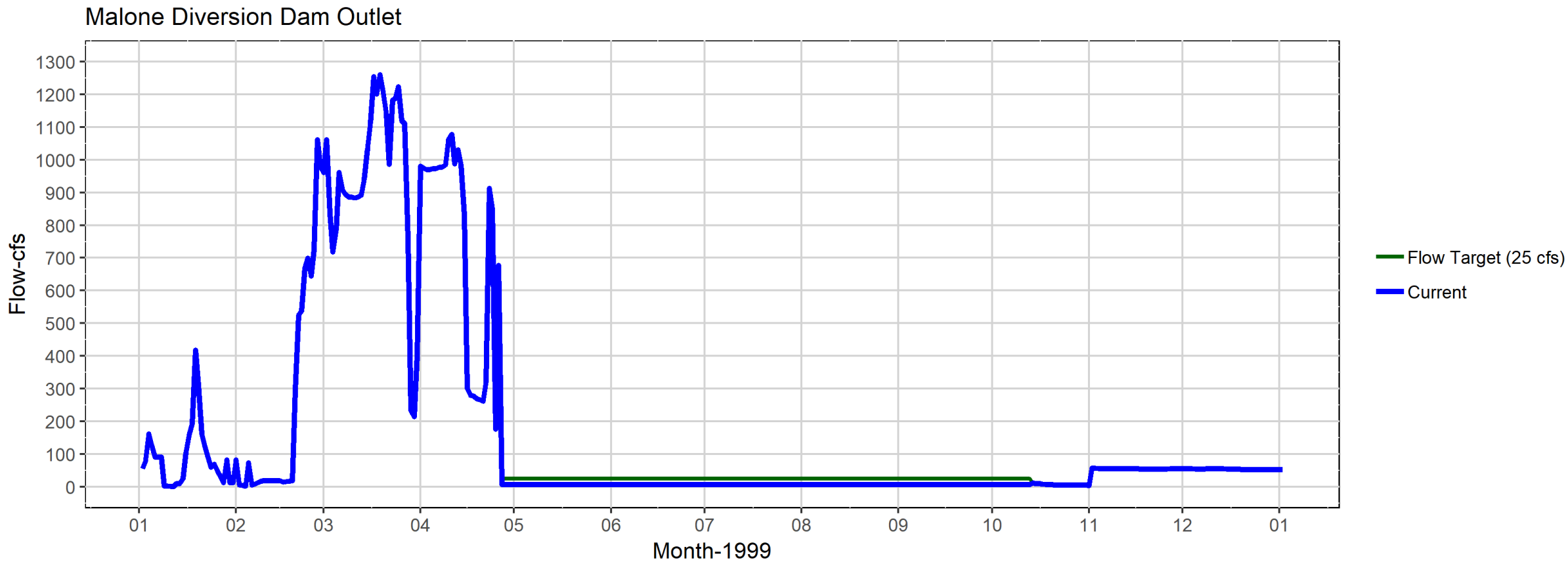
Location	Vegetation Type	Proportion in model	Height (m)	Density	Overhang (m)
Within 10-meters from stream channel	Cottonwood	0.60	36.5	70%	3.0
	Aspen	0.10	12	70%	3.0
	Willow	0.30	4.5	90%	3.0
	Composite Average	**1.00**	**24.5**	**76%**	**3.0**
Beyond 10-meters from stream channel	Cottonwood	0.25	36.5	70%	0.0
	Aspen	0.20	12	70%	0.0
	Willow	0.30	4.5	90%	0.0
	Sagebrush and or Native Grasses	0.20	0.9	100%	0.0
	Ponderosa Pine	0.05	30.5	10%	0.0
	Composite Average	**1.00**	**14.6**	**79%**	**0.0**

Restored Vegetation

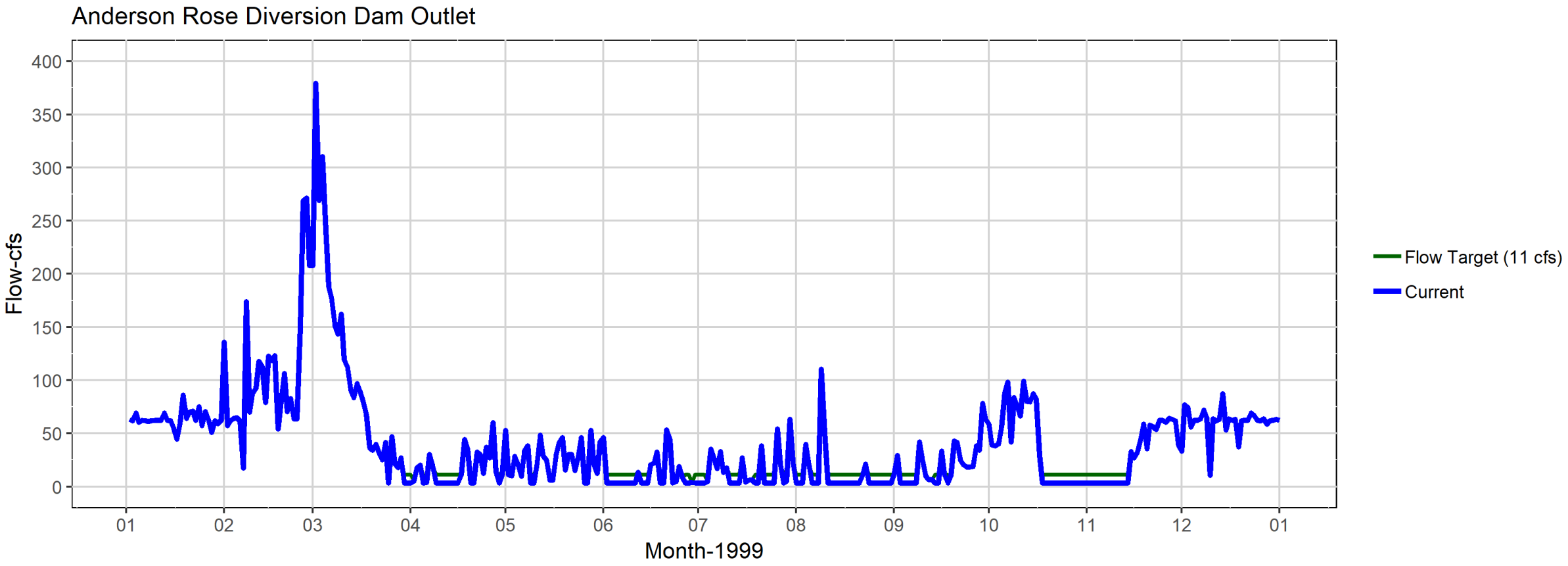


Extent	Mean Effective Shade Current Condition	Mean Effective Shade Restored Condition	Mean Effective Shade Deficit
Lost River in Oregon (Malone Dam to Stateline)	3%	26%	23%
Malone Dam to Harpold Dam	3%	30%	27%
Harpold Dam to Poe Valley Bridge (RM 27)	1%	12%	11%
Poe Valley Bridge (RM 27)-Wilson Reservoir	2%	20%	18%
Wilson Reservoir	0%	0%	0%
Wilson Dam to Anderson Rose Dam	3%	27%	24%
Anderson Rose Dam to Stateline	6%	37%	31%

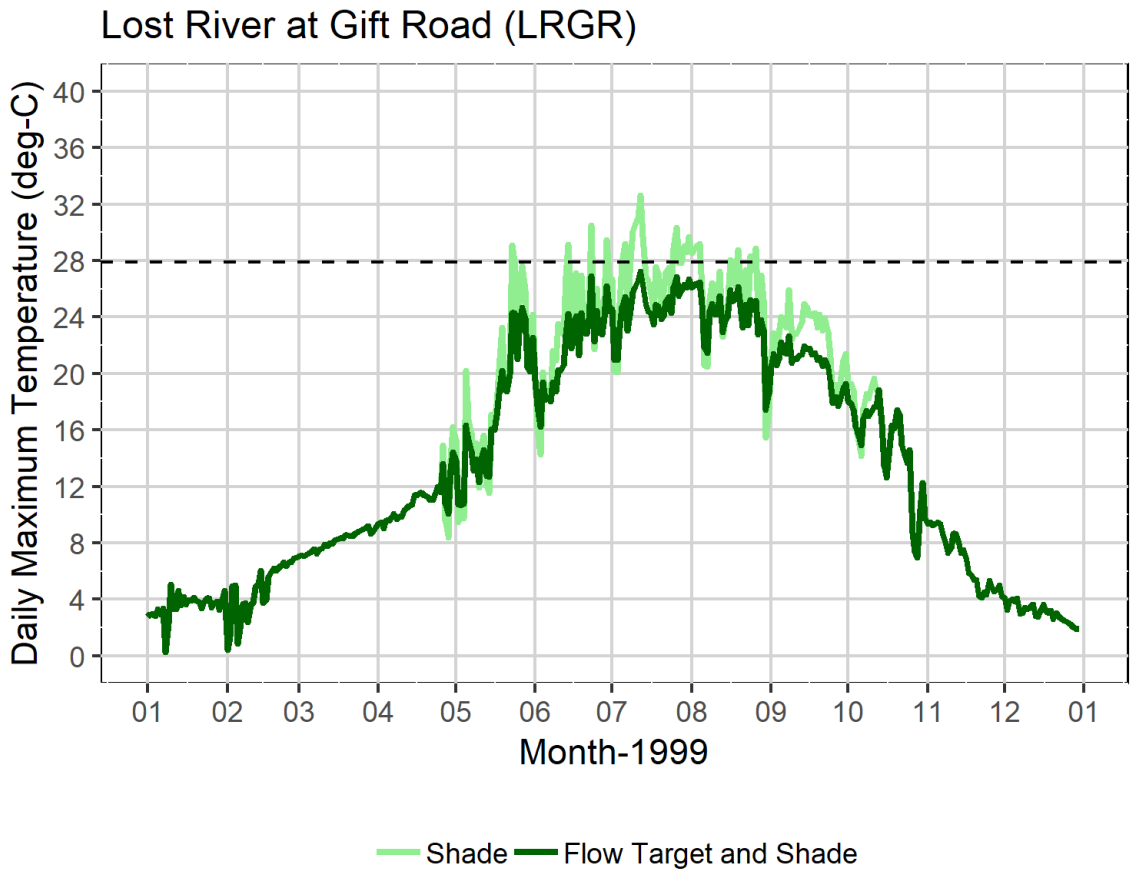
Flow below Malone Diversion Dam

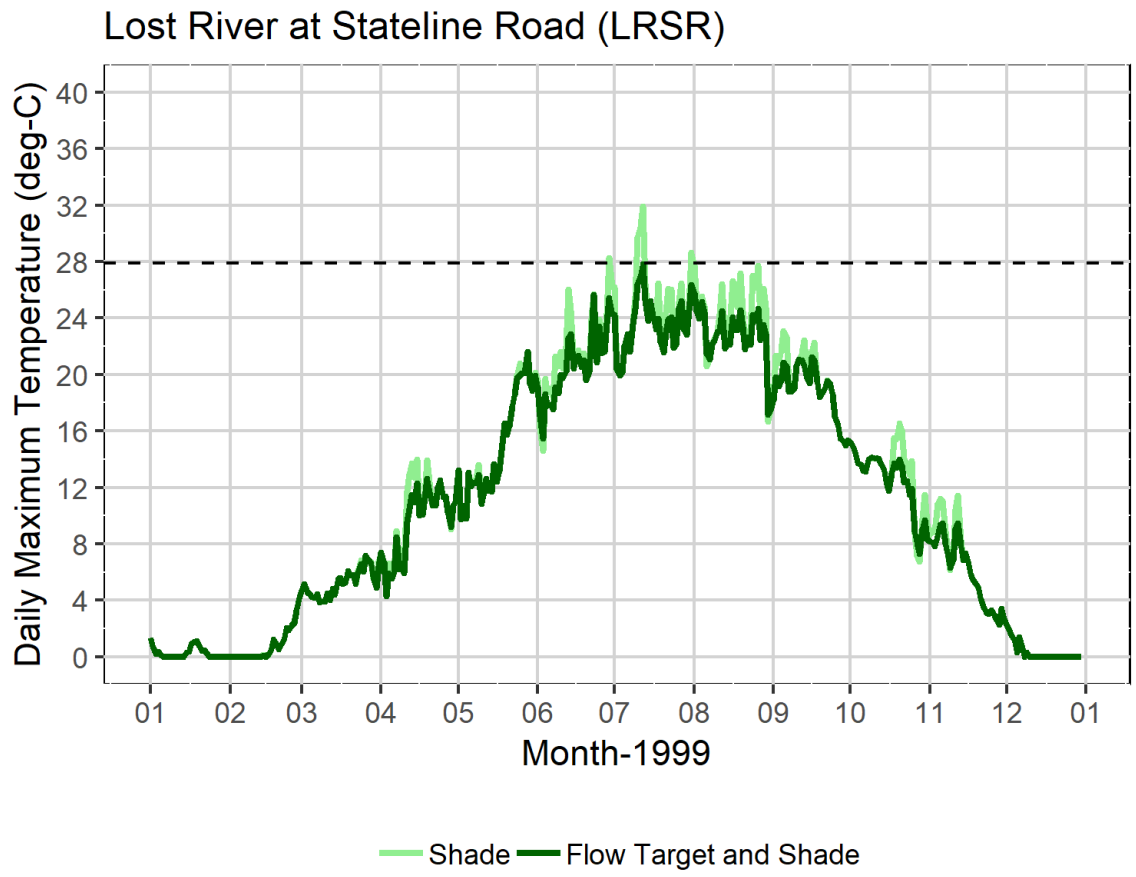


Flow below Anderson Rose Diversion Dam



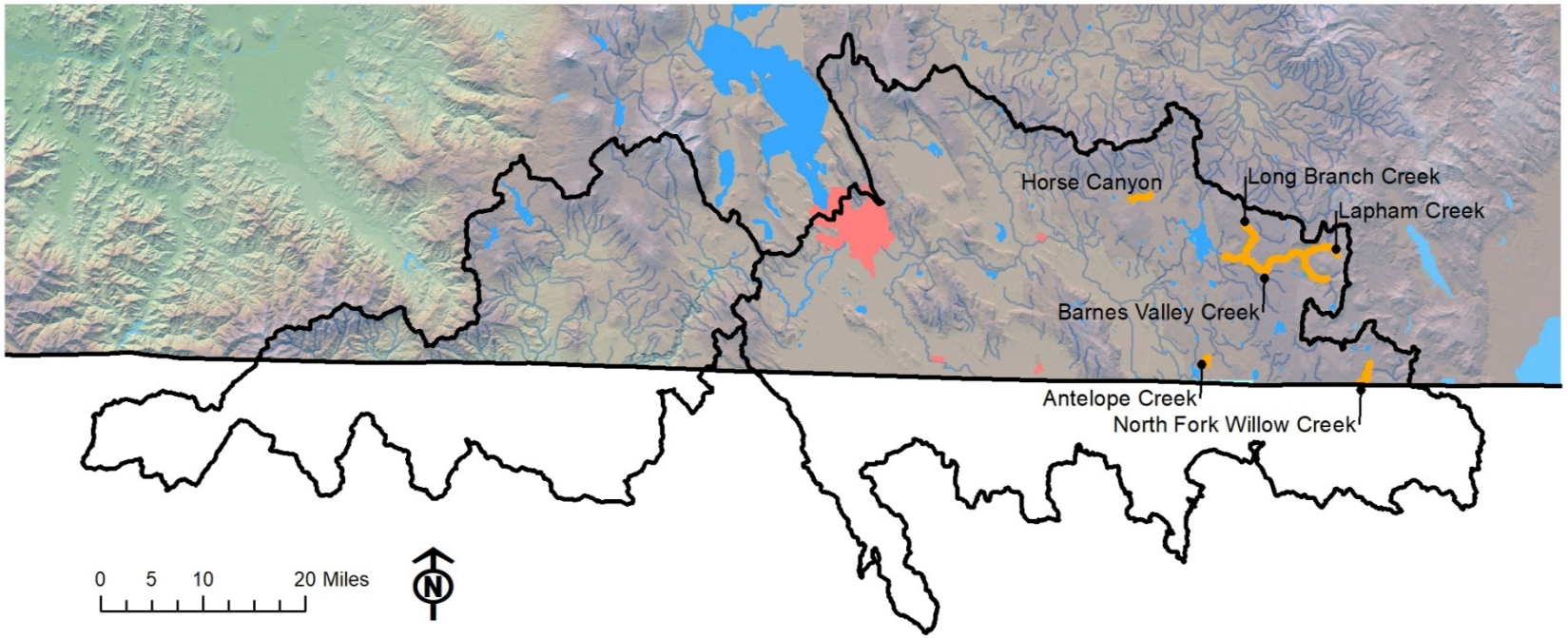
Scenario Temperatures





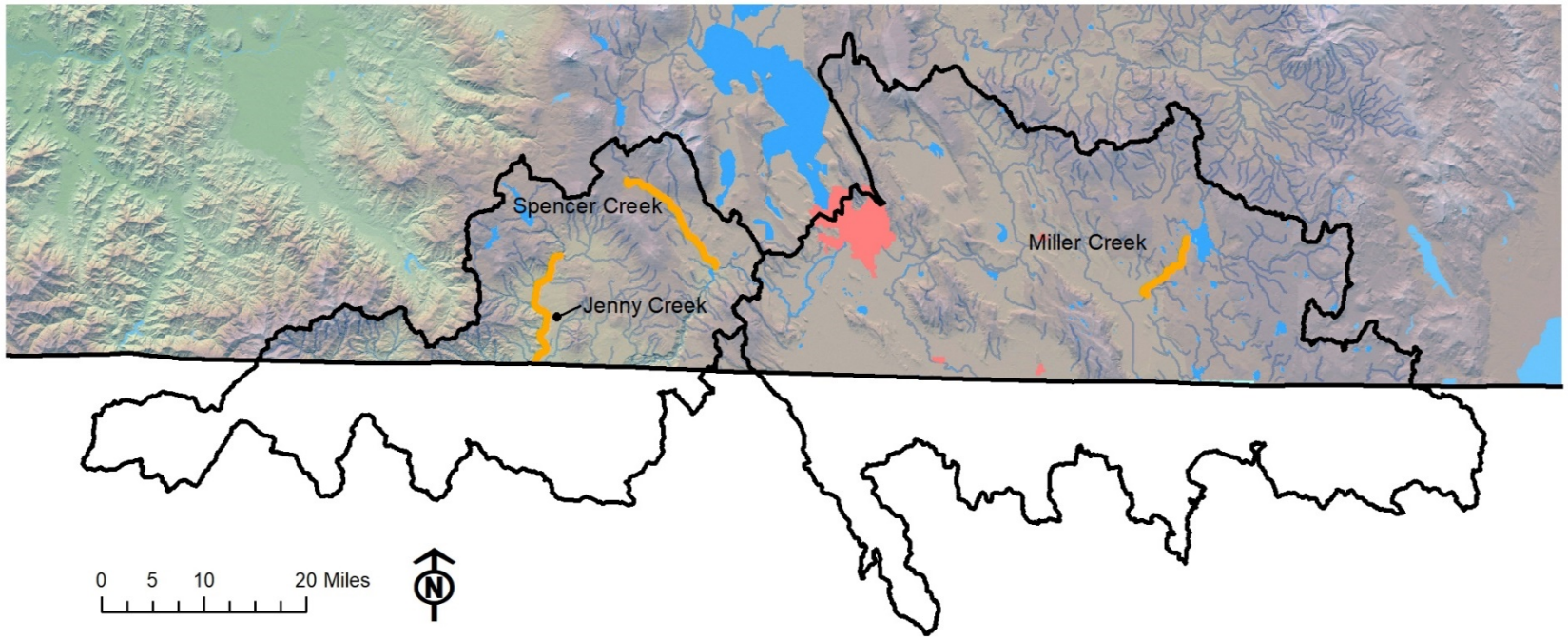
Tributary Solar Only Models

Model Output	Stream	Simulation Period	Simulation Extent
Solar Radiation and Effective Shade	Antelope Creek	July 15, 2005	1.77
	Barnes Valley Creek		23.9
	Horse Canyon		3.81
	Lapham Creek		7.44
	Long Branch		8.11
	North Fork Willow Creek		5.43



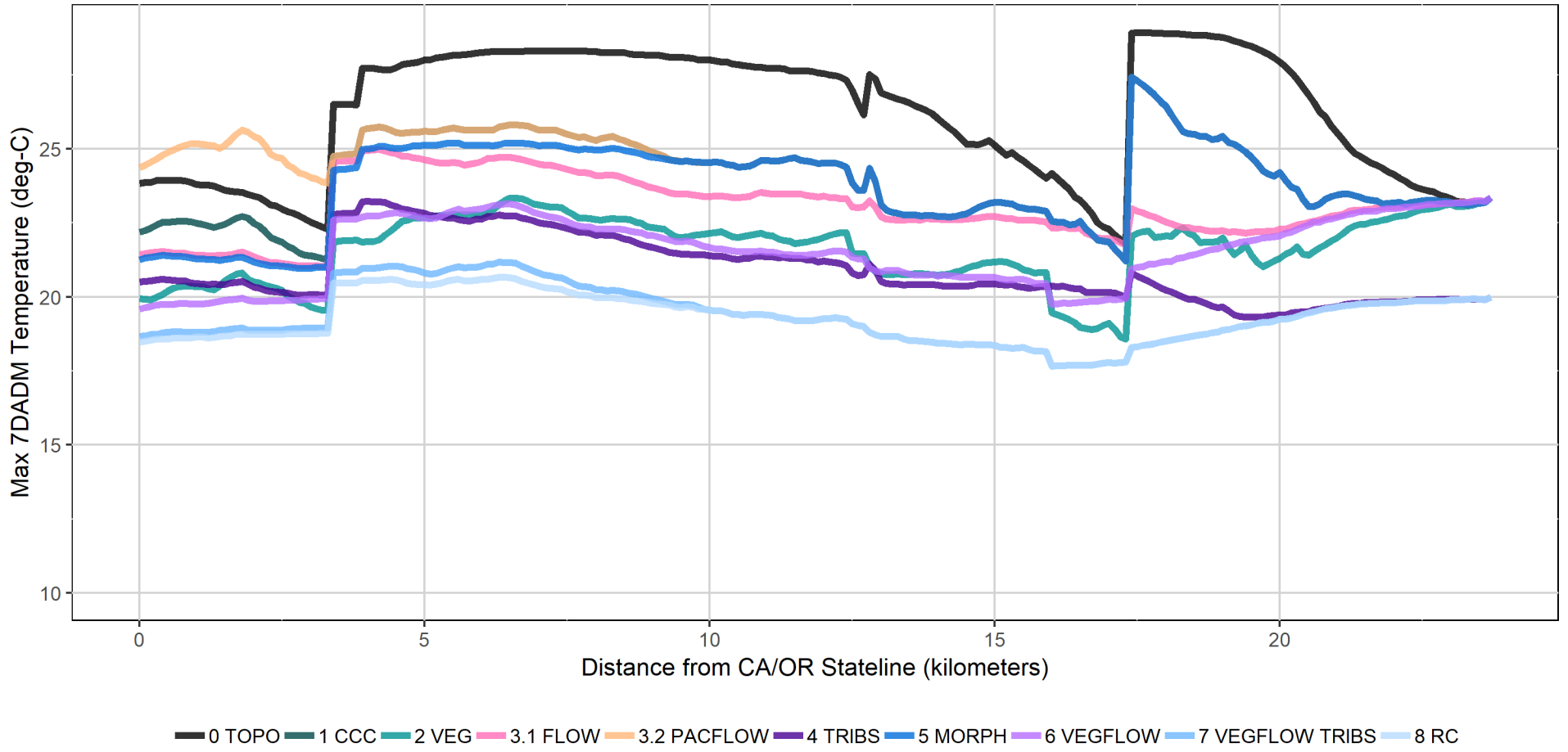
Tributary Temperature Models

Model Output	Stream	Simulation Period	Simulation Extent
Temperature	Jenny Creek	July 2001	Confluence with Johnson Creek to OR/CA border: 23.7 km
	Spencer Creek	July 2001	Headwaters to mouth: 25.2 km
	Miller Creek	July – Early August 2001	Gerber Reservoir to Pine Creek: 14.57 km

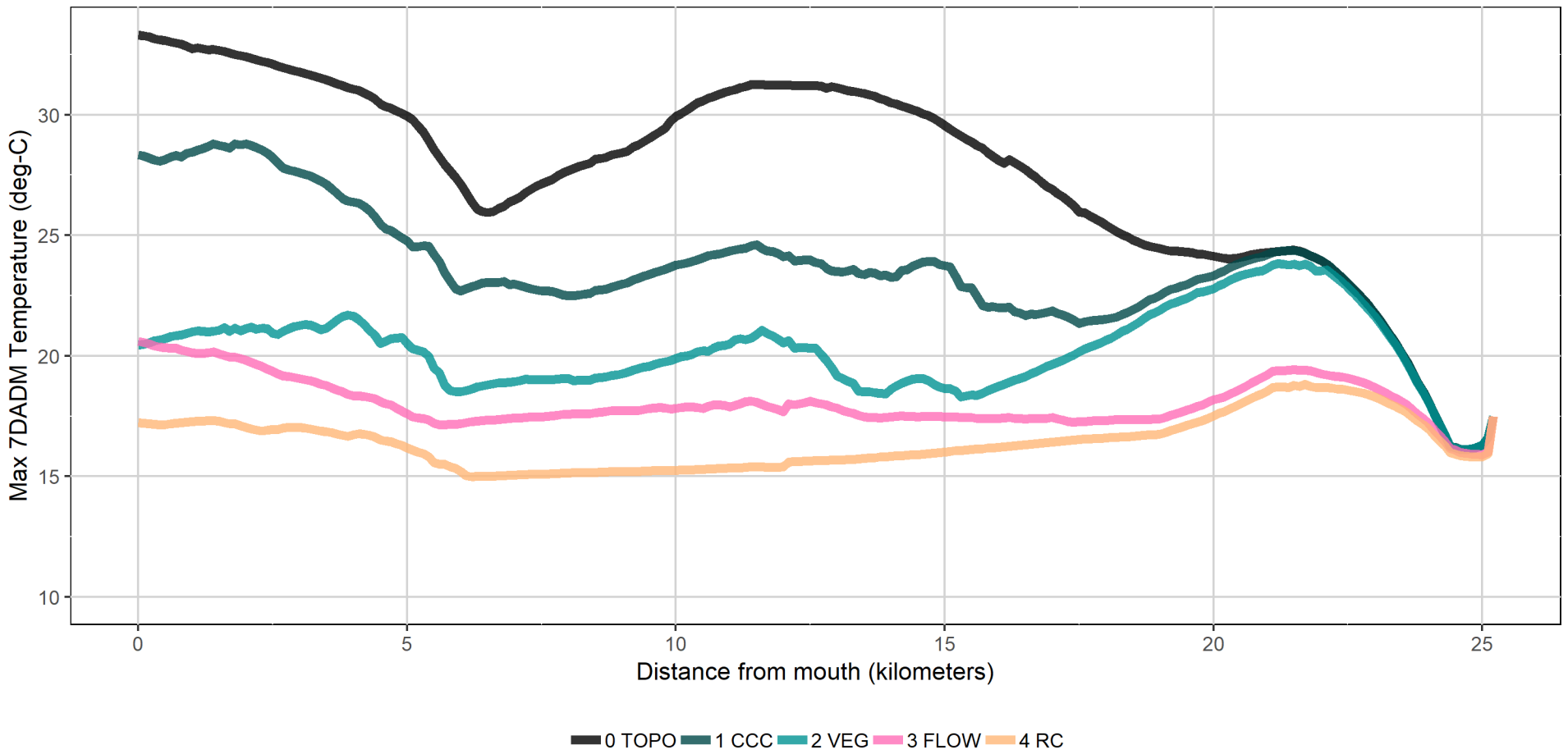


Model Scenario	Model Scenario Description	Jenny Creek	Spencer Creek	Miller Creek
Topographic TOPO	Same as Current Calibrated Conditions (CCC) except all vegetation is removed.	✓	✓	✓
Current Calibrated Conditions CCC	Current Calibrated Condition	✓	✓	✓
Restored Vegetation VEG	Restored Vegetation	✓	✓	✓
Natural Flow FLOW	Estimated natural flow. Water withdrawals from points of diversion are maintained as instream flow and the boundary condition flow was adjusted to reflect the natural flow	✓	✓	✓
PacCorp withdrawals PACFLOW	Flow from Spring Creek was reduced by five cfs and the stream temperature was increased by two degrees Celsius to reflect Pacificorp's current diversion. The diversion was not occurring during the 2001 model year.	✓		
Tributary Conditions TRIBS	Flows were adjusted to reflect the "FLOW" scenario in addition to cooler tributary and boundary condition temperatures.	✓		
Channel Morphology MORPH	Channel morphology changes were focused along 10 kilometers of Jenny Creek upstream from the CA/OR border where portions of the stream exceed the criterion. Along this reach the channel width-to-depth ratio was reduced from 8 to 4.	✓		
Restored Vegetation & Flow VEGFLOW	Incorporation of the Restored Vegetation (VEG) and Natural Flow (FLOW) scenarios.	✓	✓	✓
Restored Conditions RC	Incorporation of the Restored Vegetation (VEG), Natural Flow (FLOW), or Channel Morphology (MORPH) scenarios.	✓	✓	✓

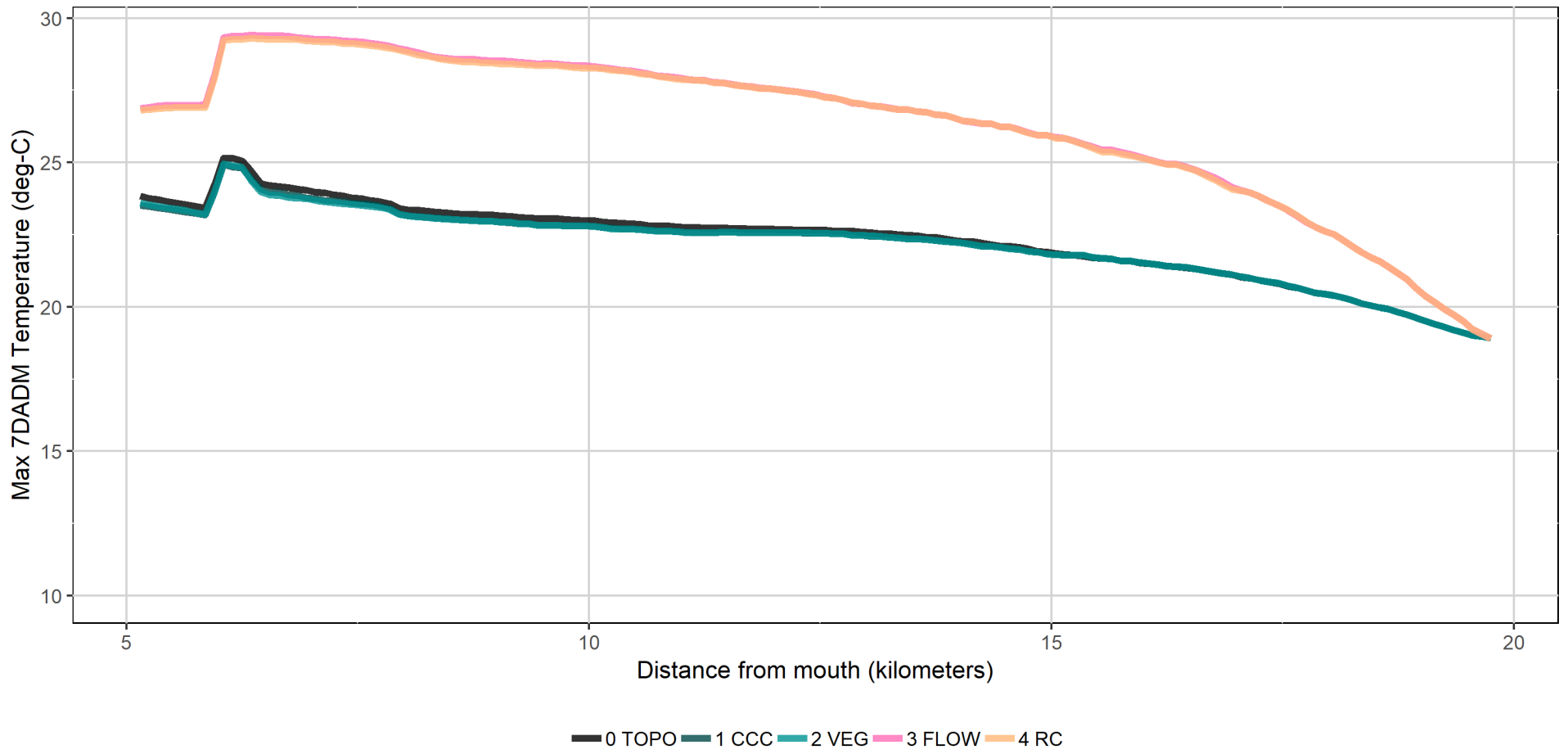
Jenny Creek Model Scenario Results



Spencer Creek Model Scenario Results



Miller Creek Model Scenario Results



Tributary Allocations

Effective Shade Targets

Cumulative Warming Allocations <= 0.3°C

- Vegetation Management Agencies: 0.0°C
- Dam and Reservoir Operations: 0.0°C
- Water withdrawals, Discrete NPS, and Existing Infrastructure: 0.2°C*
- Reserve Capacity 0.1°C

* Tributaries flowing into CA: 0.0°C

Contact Information

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Acknowledgements:

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