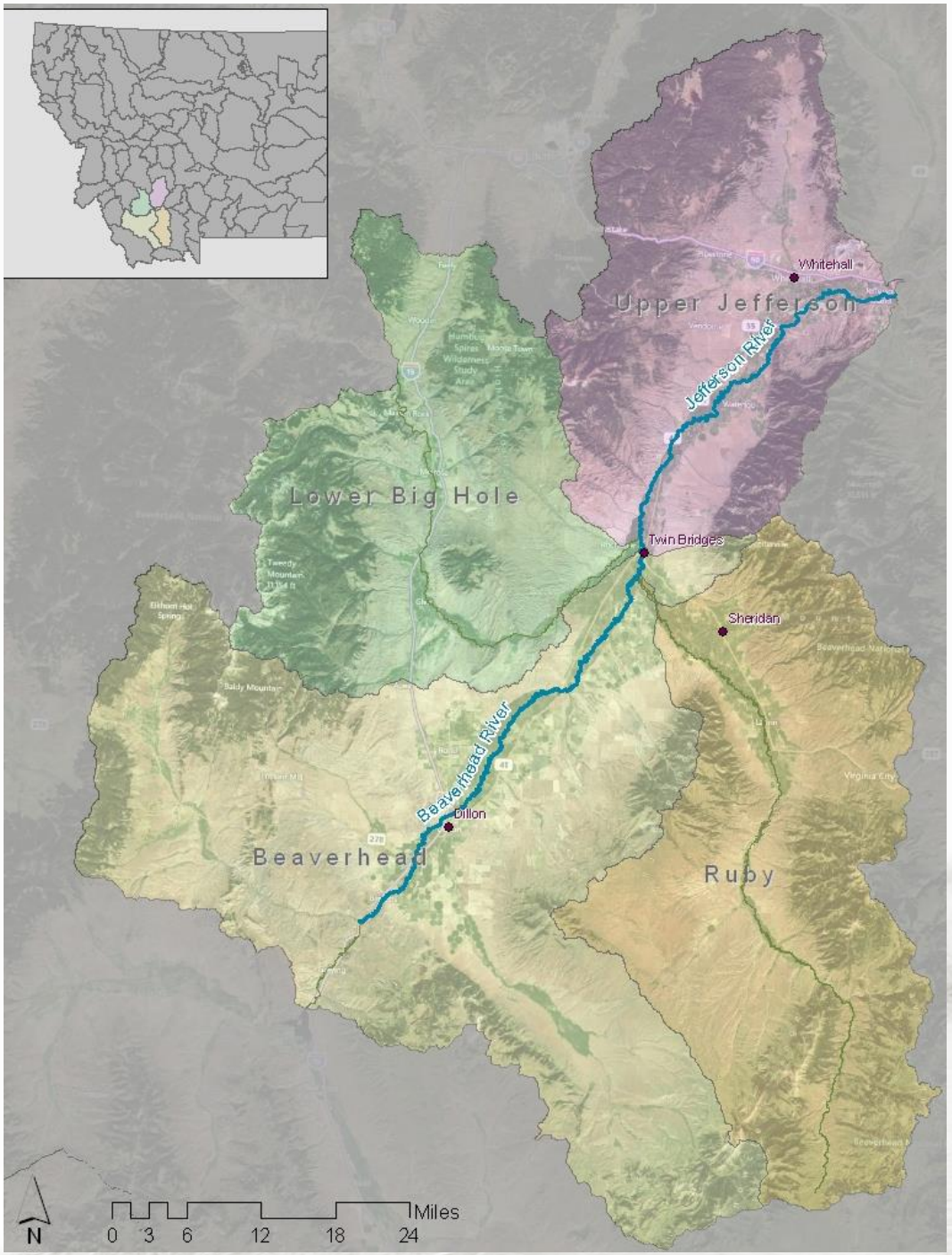
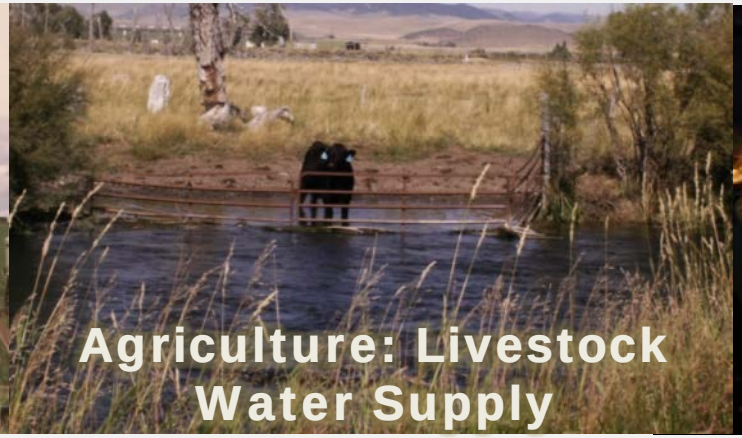


Beaverhead-Jefferson Temperature Document

Kristy Fortman
Montana DEQ

Why do we write TMDLs?

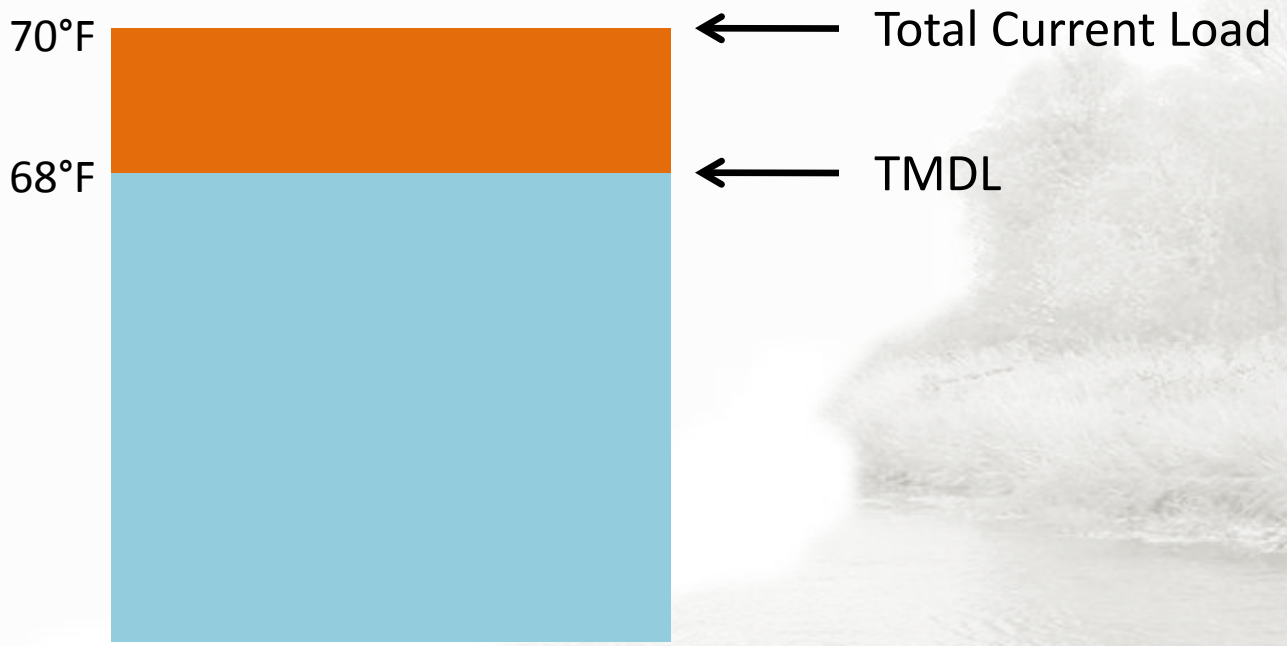
Water quality planning tool and Clean Water Act requires states to assess water quality



Support beneficial uses

What is a TMDL?

Total **M**aximum **D**aily **L**oad is the amount of a pollutant that a stream can receive from all sources and still meet water quality standards



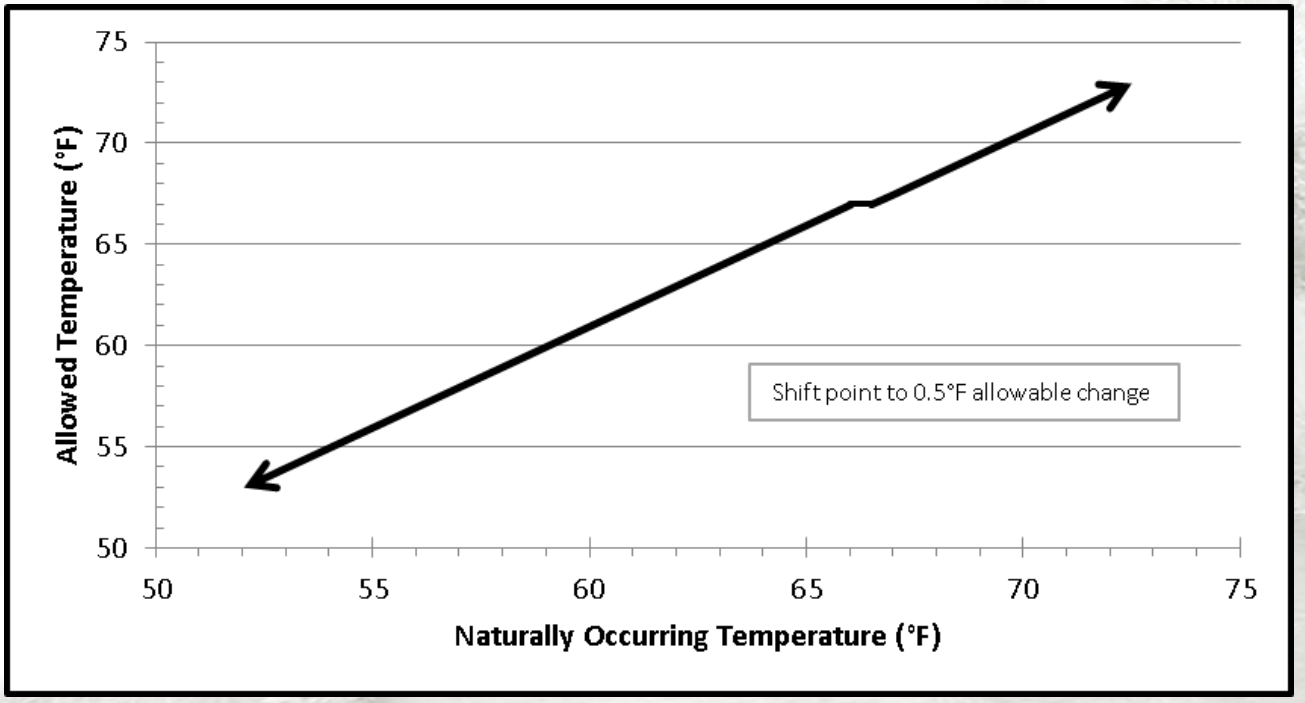
Temperature TMDLs

High levels of thermal loading may increase in-stream temperatures to levels that harm fish and other aquatic life populations.

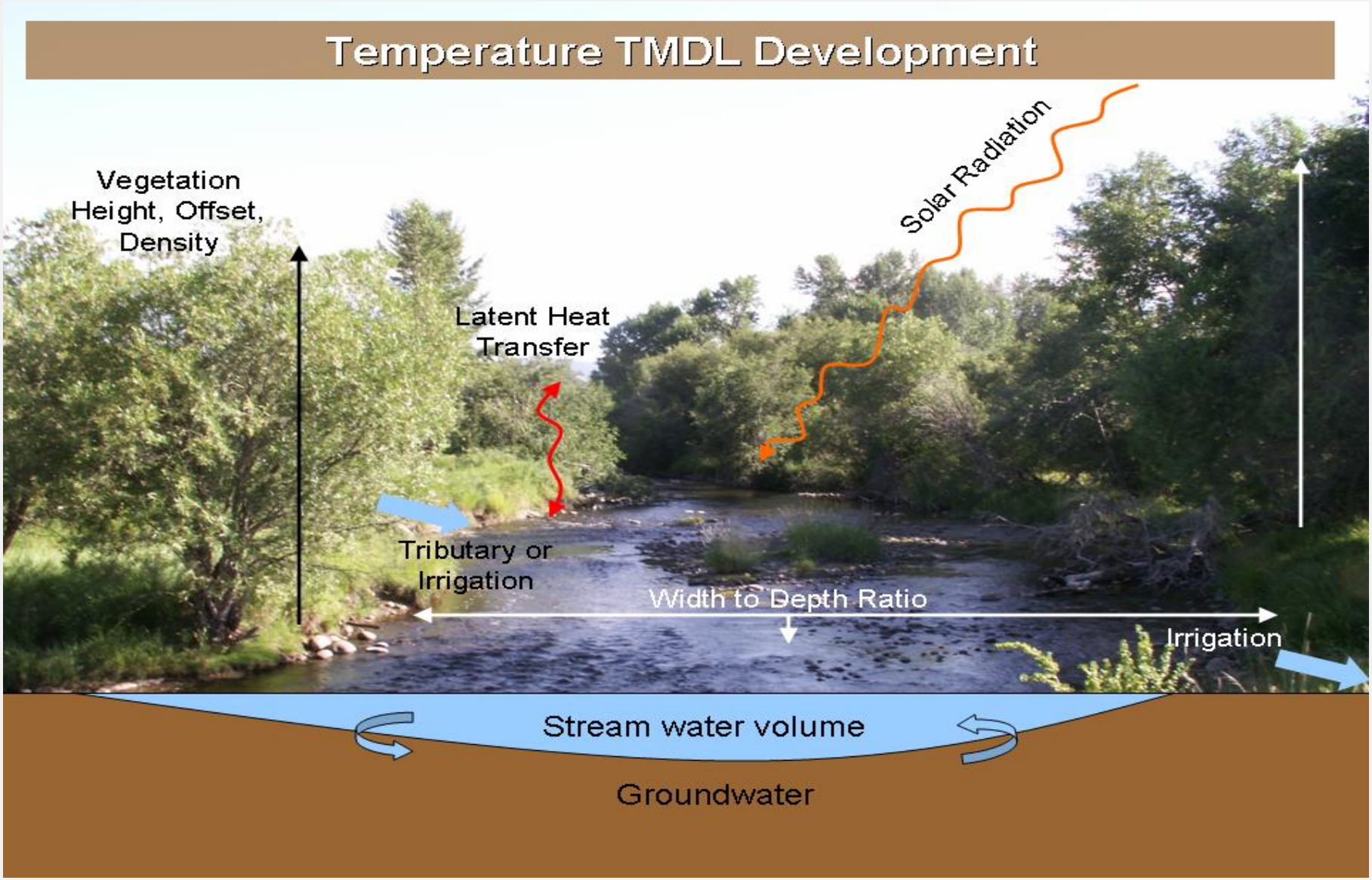
Temperature standard

17.30.623(2)(e)

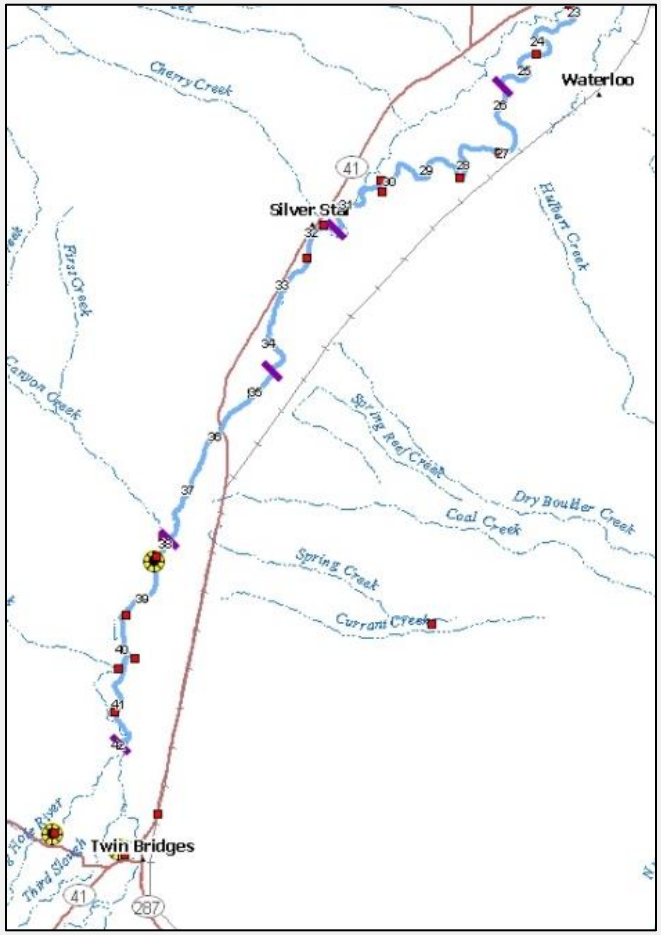
A 1 ^{O}F maximum increase above naturally occurring water temperature is allowed within the range of 32 ^{O}F to 66 ^{O}F; within the naturally occurring range of 66 to 66.5 ^{O}F, no discharge is allowed which will cause the water temperature to exceed 67 ^{O}F; and where the naturally occurring water temperature is 66.5 ^{O}F or greater, the maximum allowable increase in water temperature is 0.5 ^{O}F.

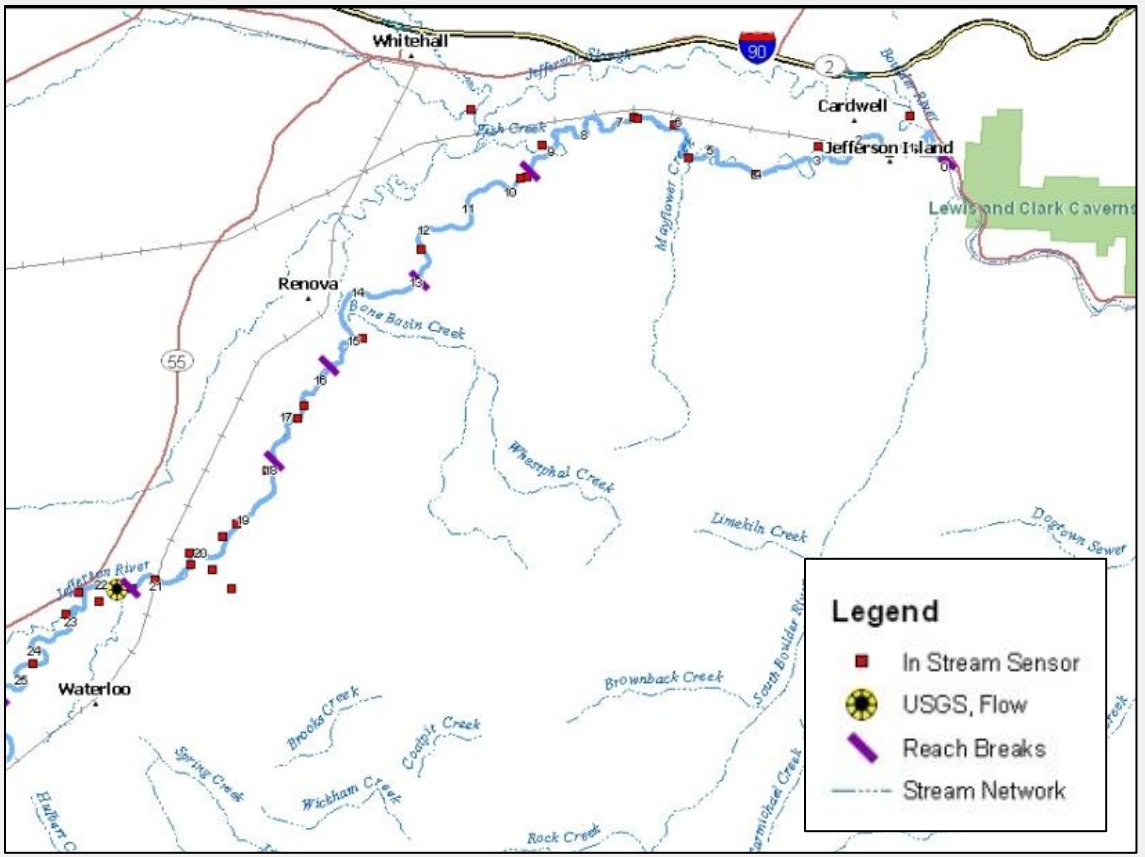


Instream temperature parameters



Jefferson River Data Collection





Field Data - 2009

- Continuous temperature monitoring – 49 sites
- Stream flow -63 sites
- Morphology – 5 sites
- Shade/ riparian condition – 24 sites
- Meteorological conditions

Jefferson River Temperature Targets

Target Parameter	Target Value
Primary Target	
Allowable Human-Caused Temperature Change	If the naturally occurring temperature is less than 66°F, the maximum allowable increase is 1°F. Within the naturally occurring temperature range of 66–66.5°F, the allowable increase cannot exceed 67°F. If the naturally occurring temperature is greater than 66.5°F, the maximum allowable increase is 0.5°F.
Temperature-Influencing Targets	
Riparian Health – Shade	Mixed low and high level vegetation with an average daily effective shade ranging between 16-21% (an average height of around 25.5 ft., overhang of around 1.5 ft., and density of 42%)
Instream flow (water use management)	15% reduction in diverted flow from voluntary reductions during low flow conditions – conserved water should be allowed to flow down the upper Jefferson River (any voluntary water savings and subsequent instream flow augmentation must be done in a way that protects water rights)
Reduce headwater temperatures	Decrease headwater temperature using the naturally occurring maximum temperature from the three headwaters streams (Ruby River at mouth= 66.70°F, Beaverhead River at mouth = 72.29°F, Big Hole River at mouth = 77.00°F).
Wastewater Treatment Facilities	No more than a 1.0°F increase when the receiving water is cooler than 66.5°F, no increase above 67°F when the receiving water is 66 – 66.5°F and no more than a 0.5°F increase under conditions where the receiving water is greater than 66.5°F

Jefferson River Temperature Targets

Existing conditions and comparison to targets

Target Parameter		Existing Condition	Target Value
Allowable Human-Caused Temperature Change		Max Δ >0.5°F	Δ of <0.5°F (under current maximum temperatures)
Effective Shade		15%	16-21%
Water Use		Drought management plan in place	15% water savings from improved irrigation delivery and application efficiencies (any voluntary water savings and subsequent in stream flow augmentation must be done in a way that protects water rights)
HEADWATER TEMPERATURE	**Ruby River**	69.96°F ($T_{max\ at\ mouth}$)	66.70°F ($T_{max\ at\ mouth}$)
	Beaverhead River	72.86°F ($T_{max\ at\ mouth}$)	72.29°F ($T_{max\ at\ mouth}$)
	Big Hole River	78.06°F ($T_{max\ at\ mouth}$)	77.00°F ($T_{max\ at\ mouth}$)

Jefferson River Source Assessment: QUAL2K

Water Quality (QUAL2K) Model

Uses temperature data from hottest period of the monitoring record (Aug 20th-22nd, 2009) to simulate water temperature change through the system.

Allows scenarios to be conducted to see affects of some parameters on water temperatures.

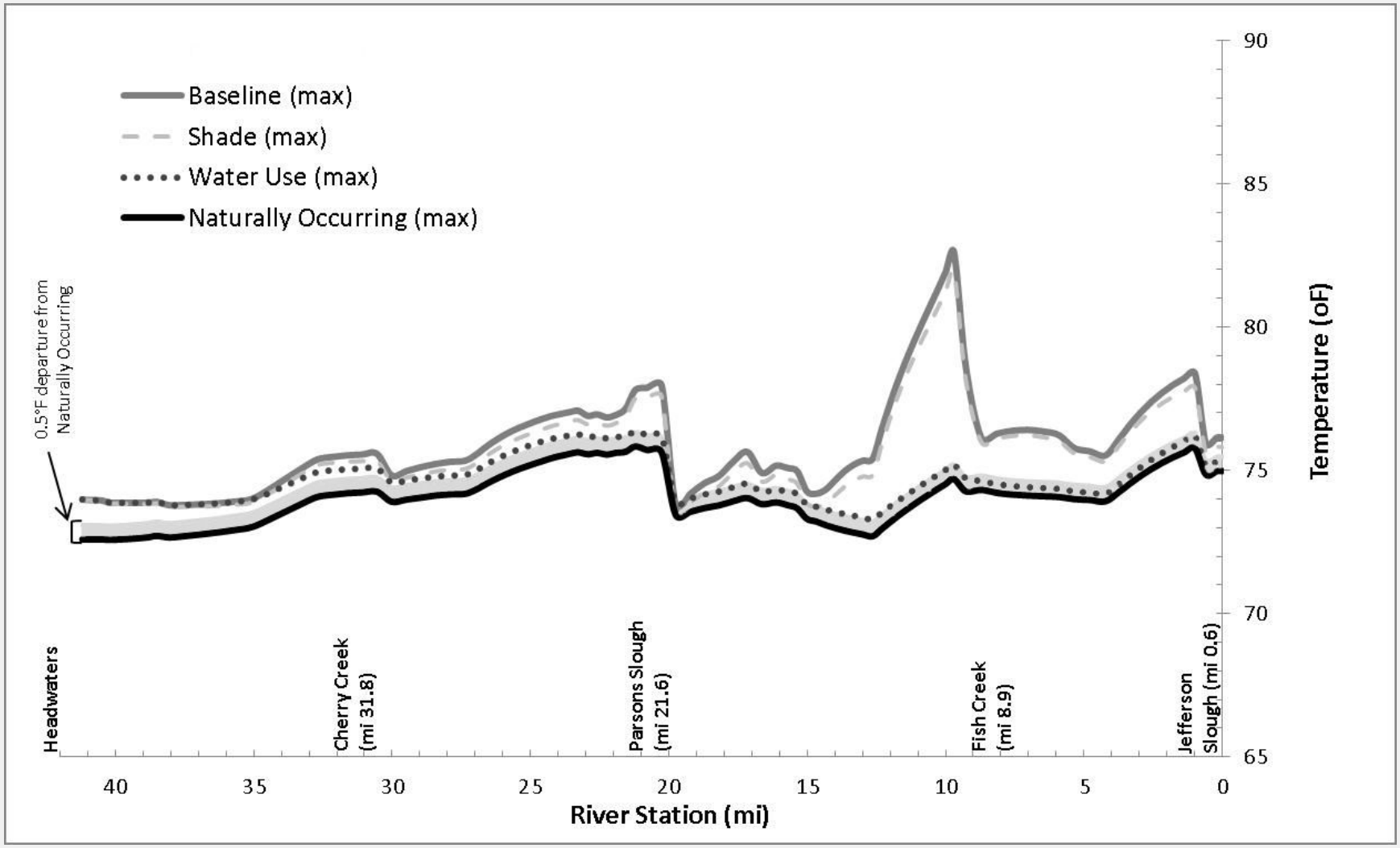
Jefferson River Source Assessment: QUAL2K

QUAL2K Scenario Development

Scenario	Inputs
Existing conditions (calibration)	Using measured data
Existing conditions with low flow	7Q10 water year
Full potential shade	Shade increased in each reach depending on the vegetation
Improved water management practices	Increased instream flow
Naturally occurring condition	Decrease headwater temperatures, increase shade, and improvement in water management practices

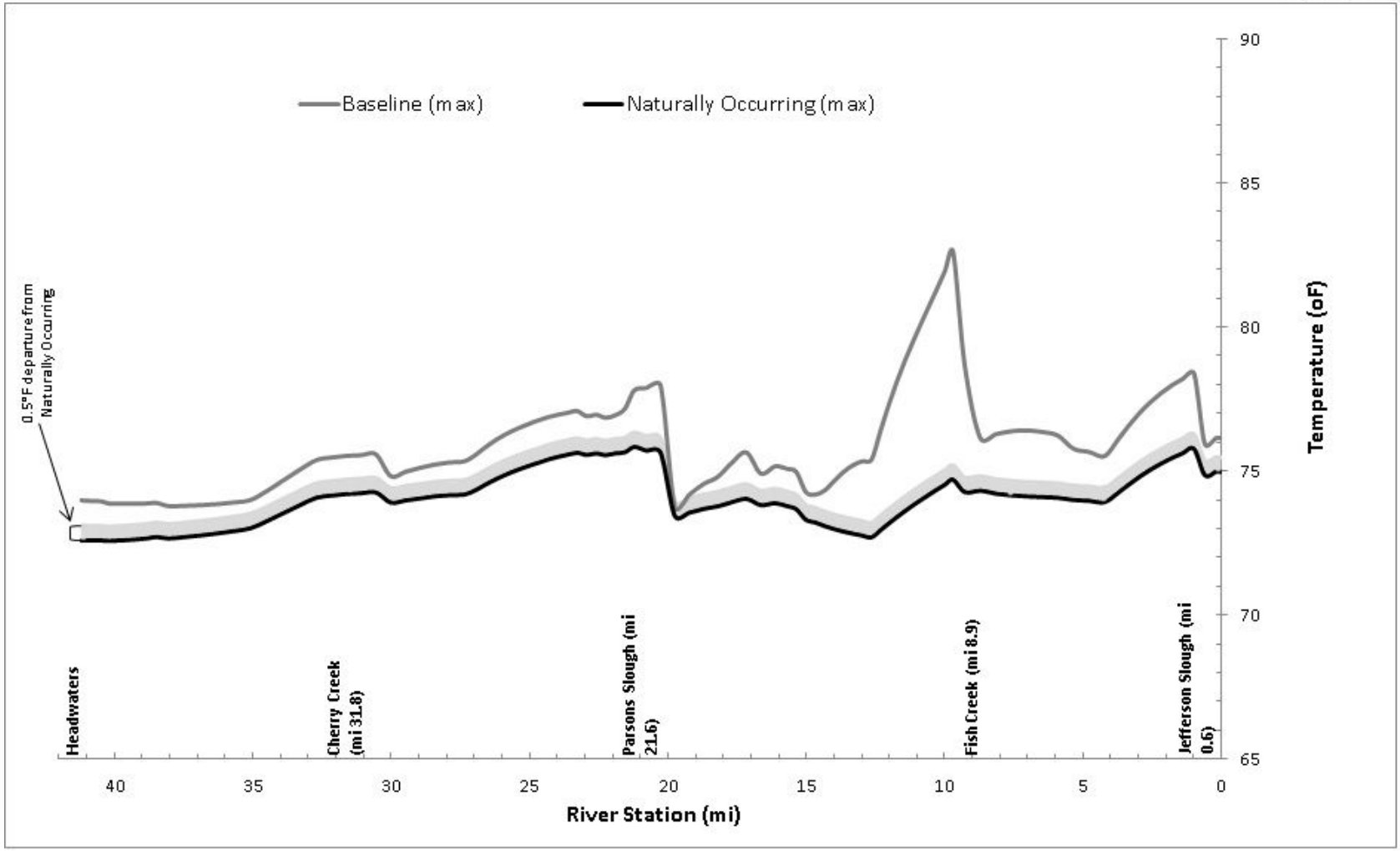
Jefferson River Source Assessment: QUAL2K

QUAL2K Scenario Results



Jefferson River Source Assessment: QUAL2K

QUAL2K Naturally Occurring Scenario Results



Jefferson River TMDLs and Allocations

Example instantaneous and daily load allocations

- Flow of 101 cfs, modeled 7Q10 flow), just above Jefferson Slough between August 20-22 (the modeled time period)
- Modeled naturally occurring average temperature of 67.53°F (just above Jefferson Slough).

The example TMDL is therefore:

$TMDL_{(instantaneous)}$ = ((67.53 + 0.5) - 32)*(5/9) *101 * 28.3 =57,214 kcal/s

Converted to a daily load the TMDL is:

TMDL = 57,214 kcal/s * 86,400 s/day = 4,943,258,352 kcal/day

To continue with the example at a naturally occurring temperature of 67.53°F and flow of 101 cfs:

$LA_{(instantaneous)}$ = (67.53- 32)*(5/9) * 101 * 28.3 = 56,420 kcal/s

Converted to a daily load the LA is:

LA = 56,420 kcal/s * 86,400 s/day = 4,874,659,152 kcal/day

The resulting example explicit MOS at 101 cfs is:

$MOS_{(instantaneous)}$ = 57,214 kcal/s – 56,420 kcal/s = 794 kcal/s

Converted to a daily load the MOS is:

MOS = 794 kcal/s * 86,400 s/day = 68,599,200 kcal/day

Jefferson River TMDLs and Allocations

Example instantaneous and daily load allocations

Category	Temperature (°F)	Flow (cfs)	Temperature change from baseline (°F)	Allocation (instantaneous load in kcal/s)	Allocation (daily load in kcal/day)
Nonpoint sources and background (LA)	67.53	101	0.00	56,420	4,874,659,152
Explicit MOS	NA	NA	0.50	794	68,599,200
Total	NA	101	0.50	57,214**	4,943,258,352**

**These values reflect the TMDL expressed as instantaneous (kcal/s) and daily (kcal/day) loads

Jefferson River Document

Document completion steps

- Public comment period (Ends August 7th)
- Response to comments and completion of final document
- Submit to EPA for approval
- Approved plan ready for stakeholder implementation

Jefferson River Implementation

QUESTIONS?

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