

Boulder Elkhorn TMDLs for Sediment, Temperature and Nutrients



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Temperature TMDLs

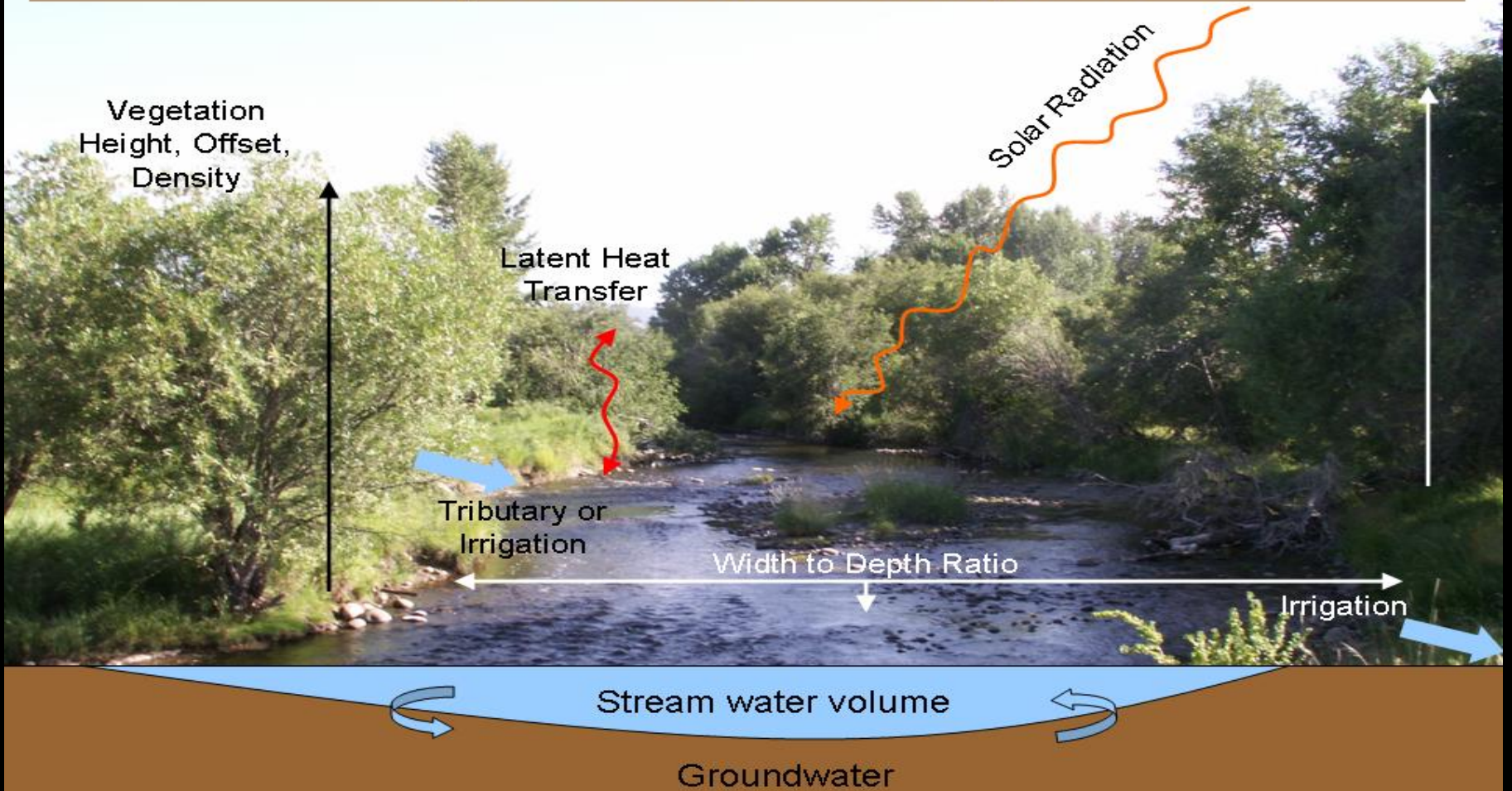
High levels of thermal loading may increase in-stream temperatures to levels that harm fish and other aquatic life populations .



In western Montana, temperature impairment listings are associated with fish and aquatic life designated uses.

Temperature TMDLs

Temperature TMDL Development



Applicable Standards for Temperature

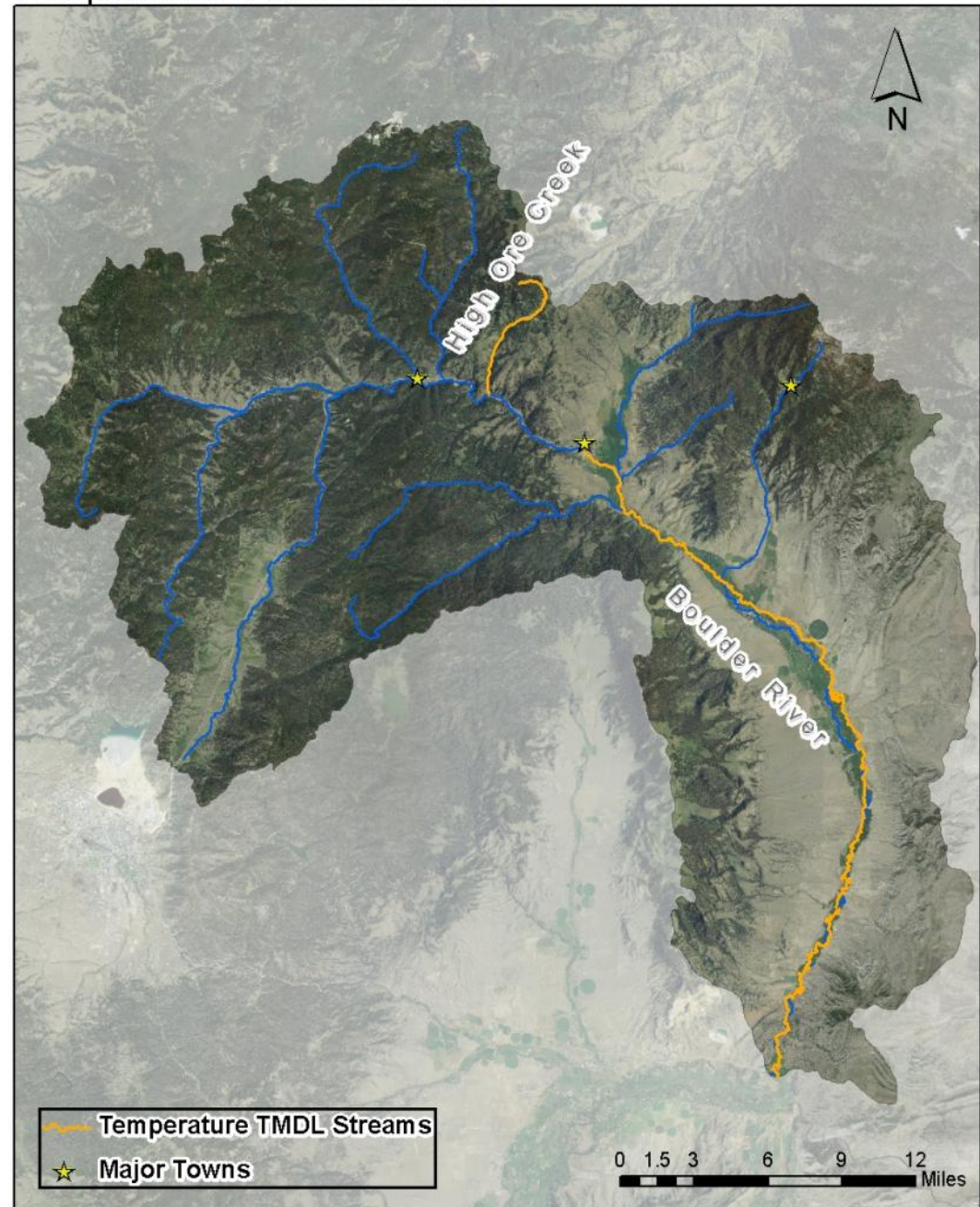
- 17.30.623(2)(e) A 1 °F maximum increase above naturally occurring water temperature is allowed within the range of 32 °F to 66 °F; within the naturally occurring range of 66 to 66.5 °F, no discharge is allowed which will cause the water temperature to exceed 67 °F; and where the naturally occurring water temperature is 66.5 °F or greater, the maximum allowable increase in water temperature is 0.5 °F.

Applicable Standards for Temperature: Key Definitions

- 17.30.602(19) “Naturally occurring” means conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil, and water conservation practices have been applied.
- 17.30.602(25) “Reasonable land, soil, and water conservation practices” means methods, measures, or practices that protect present and reasonably anticipated beneficial uses. These practices include but are not limited to structural and nonstructural controls and operation and maintenance procedures. Appropriate practices may be applied before, during, or after pollution-producing activities.

Temperature TMDL Streams

- Boulder River (City of Boulder to the mouth)
- High Ore Creek



Boulder River Source Assessment

Field Data

- Data Loggers
- Solar Pathfinder Shade
- Stream Flow

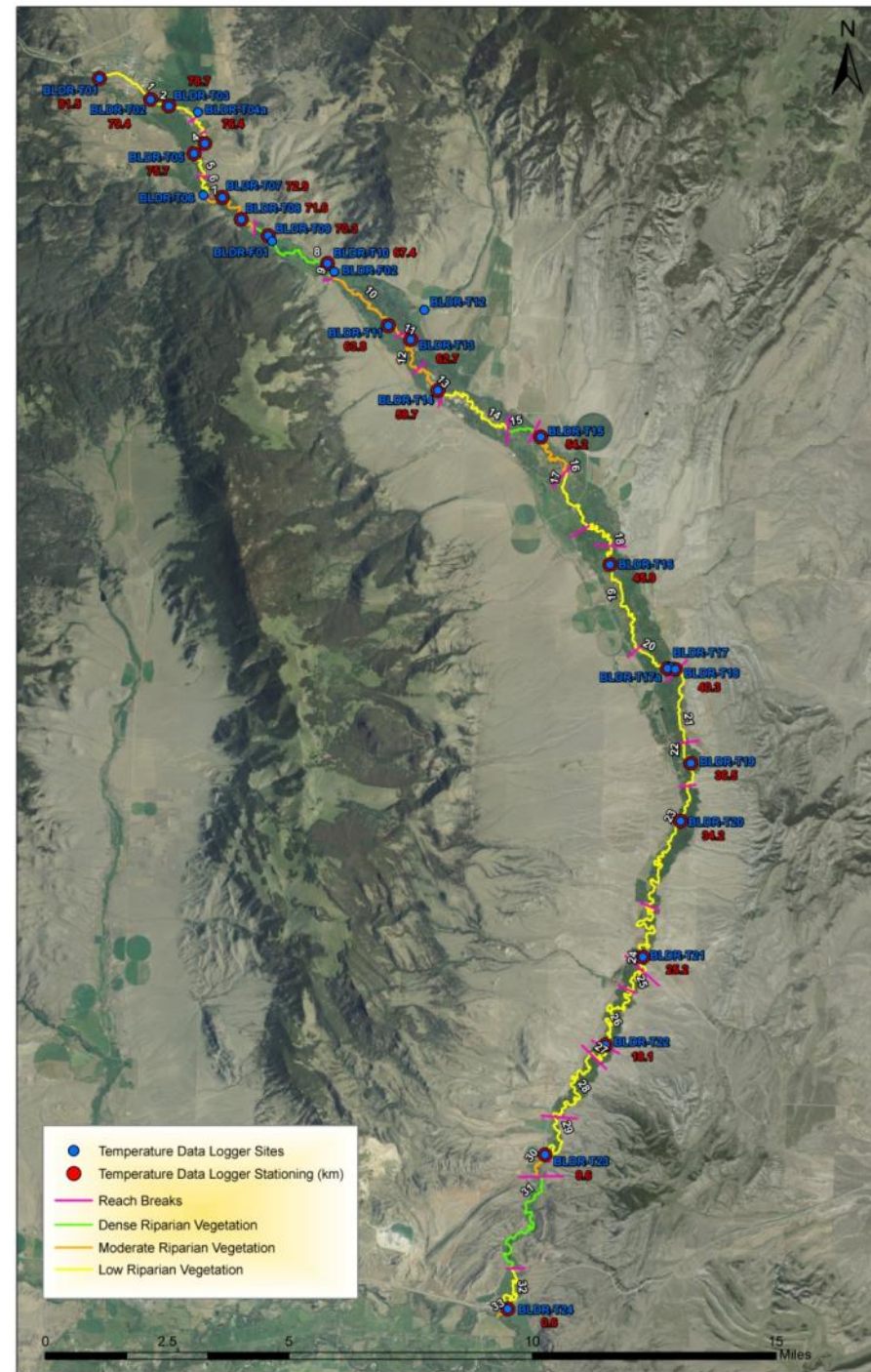
Riparian Vegetation Reach Type	Baseline (Existing Conditions) Scenario			Shade Scenario 1 (Reference Shade)*			Shade Scenario 2**		
	Number of Reaches	Length (Miles)	Percent	Number of Reaches	Length (Miles)	Percent	Number of Reaches	Length (Miles)	Percent
Dense Riparian	4	6.6	13%	33	50.7	100%	12	15.6	31%
Moderate Riparian	8	9.0	18%	0	0.0	0%	21	35.1	69%
Low Riparian	21	35.1	69%	0	0.0	0%	0	0.0	0%

* Also applied in the Natural Condition Scenario.
 ** Also applied in the Naturally Occurring Scenario.

QUAL2K Model

Uses temperature data from hottest period of the monitoring record to simulate water temperature change through the system.

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



Boulder River Source Assessment: QUAL2K

Existing Conditions – used the field data and riparian assessment categories to simulate conditions over a period of hot, summer-time weather

Figure 2-2. Boulder River Temperature Data, July 24th-26th, 2010.

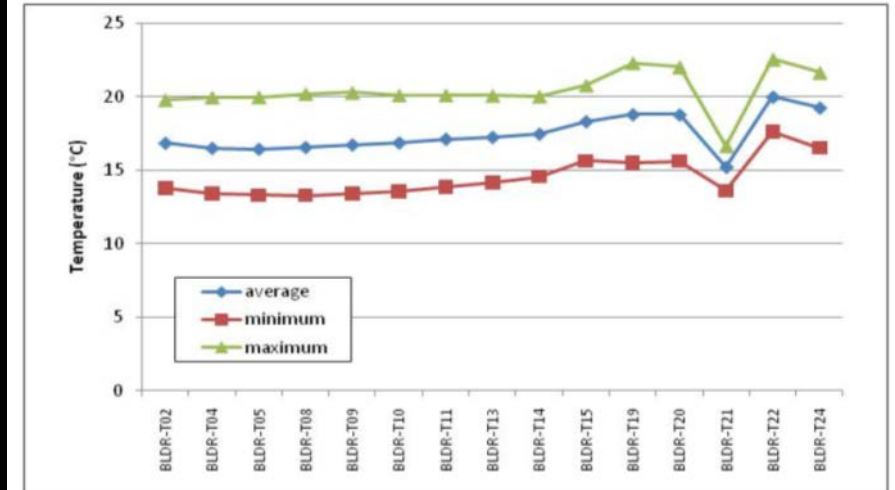
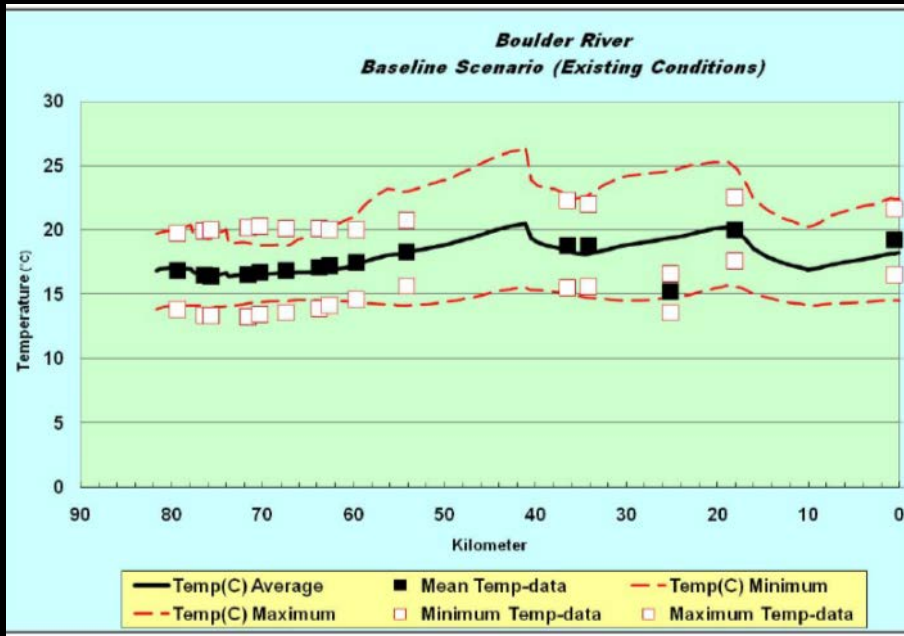
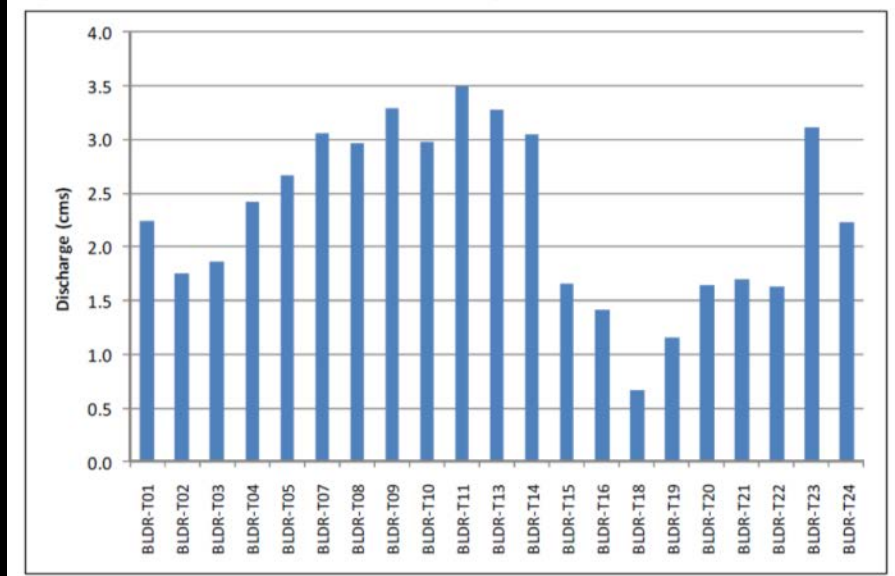


Figure 2-3. Boulder River Streamflow Data, August 4th-6th, 2010.



Boulder River Source Assessment: QUAL2K Scenarios

TMDL ANALYSIS SCENARIOS

Shade Scenario 2 – Riparian conditions improved by one category (low -> moderate; moderate -> dense)

Showed departure from existing conditions of 0.7 – 2.7 °F.

*Naturally Occurring – Shade Scenario 2 and 15% less water withdrawal
Showed departure from existing conditions of 0.7 – 3.6 °F.

Data Logger Site	Q2K Existing Conditions			Q2K Naturally Occurring Scenario			Departure from Existing Conditions	Departure from Existing Conditions
	Distance (km)	Maximum Temperature (°C)	Maximum Temperature (°F)	Distance (km)	Maximum Temperature (°C)	Maximum Temperature (°F)		
BLDR-T02	79.1	20.1	68.1	79.1	20.1	68.1	0.0	0.0
BLDR-T04	76.3	19.5	67.1	76.3	19.2	66.5	-0.4	-0.7
BLDR-T05	75.6	19.4	66.8	75.6	19.0	66.1	-0.4	-0.7
BLDR-T08	71.4	19.0	66.2	71.4	18.6	65.4	-0.4	-0.8
BLDR-T09	70.4	18.8	65.9	70.4	18.5	65.4	-0.3	-0.5
BLDR-T10	67.4	18.8	65.9	67.4	19.0	66.2	0.2	0.3
BLDR-T11	63.7	20.0	67.9	63.7	19.3	66.7	-0.7	-1.2
BLDR-T13	62.7	20.1	68.3	62.7	19.4	66.9	-0.8	-1.4
BLDR-T14	59.8	21.0	69.9	59.8	20.0	68.0	-1.1	-1.9
BLDR-T15	54.1	23.0	73.4	54.1	21.8	71.2	-1.2	-2.2
BLDR-T19	36.5	22.8	73.0	36.5	21.8	71.2	-1.0	-1.8
BLDR-T20	34.5	22.5	72.6	34.5	21.5	70.7	-1.0	-1.9
BLDR-T22	18.8	25.3	77.5	18.8	23.3	73.9	-2.0	-3.6
BLDR-T24	1.0	22.5	72.5	1.0	20.6	69.1	-1.8	-3.3

Grey highlighted values indicate that the model scenario predicts a potential decrease in temperature greater than 0.5°F.

Boulder River Targets

Riparian Health – Shade: Minimum of 22% average effective shade at a given sample site

Width to Depth Ratio – Average <30 at a given sample site

Increase Streamflow – Improvement of water-use resulting in 15% less reduction in summer water withdrawal

Allowable Temperature Increase from Point Sources – (Numeric standard) No more than 0.5 degrees F under conditions where the receiving water is greater than 66.5, or 1.0 when the receiving water is cooler than 66.5.

Boulder River TMDL and Allocations

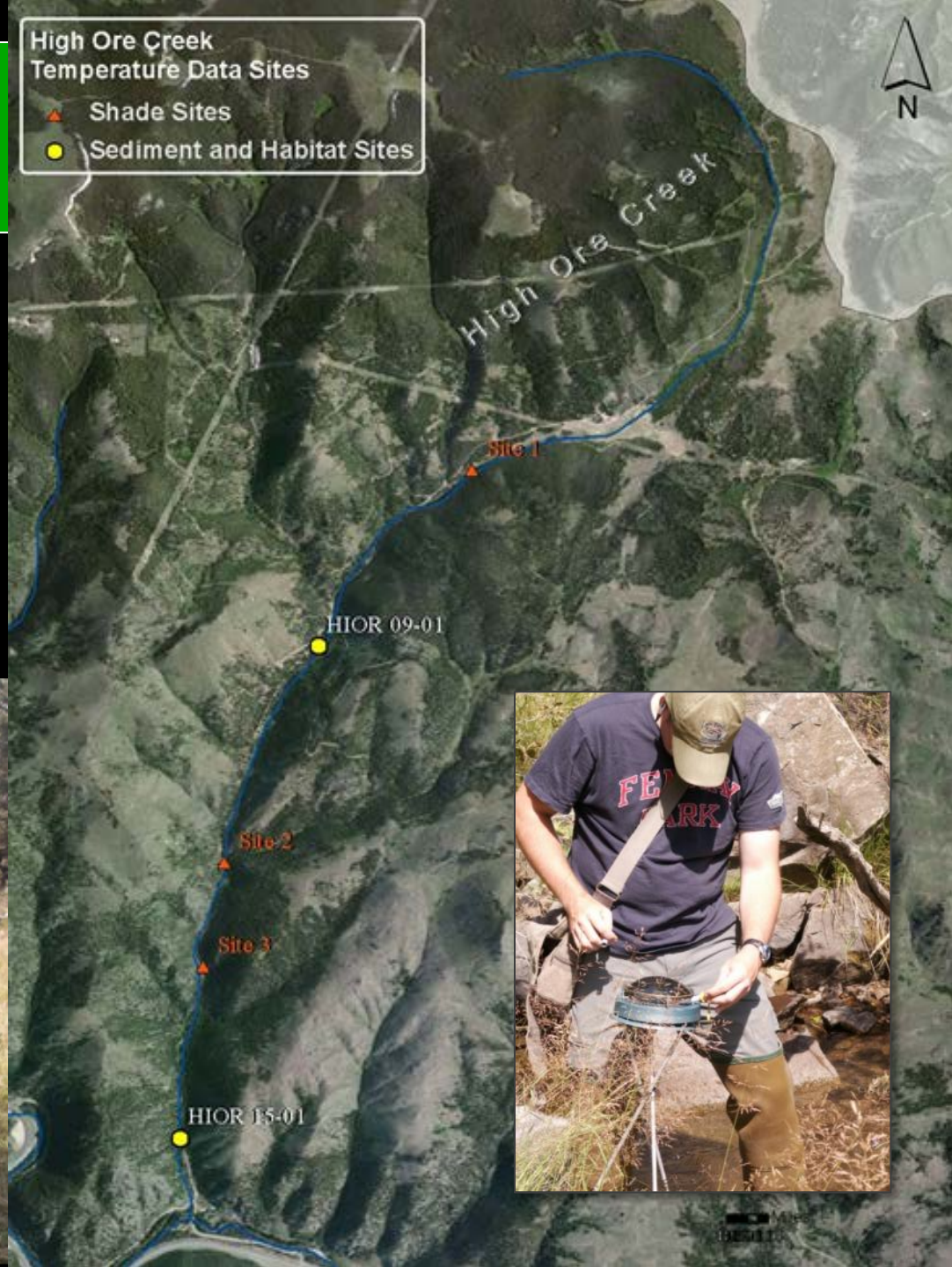
In lieu of expressing allocations based on quantified temperatures or thermal loads, the TMDL and allocations are expressed via conditions that, if met, would comply with the temperature standard. In this case, these conditions are essentially a reiteration of the targets:

- Maintain or improve riparian conditions to provide a minimum of 22% effective shade
- Maintain or improve stream morphology conditions to a minimum of <30 width-to-depth ratio
- Reduce inefficient use or conveyance of water from the Boulder River where practical and possible
- No discharges in exceedance of the temperature standard conditions

High Ore Creek Source Assessment

Field Data Only

- Limited Temperatures & Stream Flows
- Solar Pathfinder Shade
- Channel Measurements
- DEQ & BLM Data



High Ore Creek Targets

Riparian Health – Shade: Minimum of 70% average effective shade at a given sample site

Width to Depth Ratio – Average <18 at a given low gradient sample site; average <13 at higher gradient (slopes >2%) sample site

Increase Streamflow – Improvement of water-use resulting in 15% less reduction in summer water withdrawal (if any water-use exists)

Allowable Temperature Increase from Point Sources – (Numeric standard) No more than 0.5 degrees F under conditions where the receiving water is greater than 66.5, or 1.0 when the receiving water is cooler than 66.5.

High Ore Creek TMDL and Allocations

In lieu of expressing allocations based on quantified temperatures or thermal loads, the TMDL and allocations are expressed via conditions that, if met, would comply with the temperature standard. In this case, these conditions are essentially a reiteration of the targets:

- Maintain or improve riparian conditions to provide a minimum of 70% effective shade
- Maintain or improve to stream morphology conditions to a minimum of <13 width-to-depth ratio for higher gradient sites
- Maintain or improve to stream morphology conditions to a minimum of <18 width-to-depth ratio for lower gradient sites