Recommendation Report Regarding the Flow/Habitat Relationship of the

Canyon Reservoir Tailrace Trout Fishery

Background

In 2010, Guadalupe River Trout Unlimited (GRTU) funded a study assessing habitat quality and quantity in response to flow on the Canyon Reservoir Tailrace. This study was completed in 2015, culminating into a master's thesis entitled "Habitat Suitability and Availability for Rainbow Trout (*Oncorhynchus mykiss*) in the Canyon Reservoir Tailrace and Evaluation of Side Scan Sonar for Habitat Mapping in a Semi-wadable River (Cummings 2015).

In 2015, Trungale Engineering and Science was contracted to establish a temperature model of the Canyon Reservoir Tailrace to provide data for amending the GRTU flow agreement with the Guadalupe-Blanco River Authority (Trungale 2015). The resulting model utilized water temperature monitoring data from 1997 to 2014 along with discharge rates to predict how water temperatures throughout the tailrace respond to changes in releases from Canyon Reservoir. This study was used to compliment the findings from the habitat study in assessing how flow rates affect habitat and temperature on the tailrace.

Executive Summary and Conclusions

- Current flow agreement provides 90% maximum weighted usable area (WUA) and 80% optimal habitat in the study area (Table 1).
- Habitat is not likely the primary factor limiting trout survival although some improvements can be made.
- Most areas of the tailrace that were unsuitable for adult trout at low flows (<80 cfs) were due to insufficient depth (<0.2 m), (Figures 1-3).
- Based on temperature modeling by Joe Trungale, 150 cfs was determined to be the flow at which most of the 10-mile stretch below Canyon Dam would be thermally suitable for trout throughout the summer.

Habitat Improvement Recommendations

1. Proper assessment, planning, and preparation must occur before habitat improvement is decided on and implemented.
2. The addition of instream cover and structures to increase depth could improve habitat suitability for adult trout.

3. Riparian vegetation and bank placed materials could stabilize streambanks where erosion is problematic, as well as provide shading, nutrients, macroinvertebrate habitat, and overhead cover for fish.

4. Monitoring and maintenance should be part of any habitat improvement plan.

5. Cooperation with landowners and river authorities can limit the amount of large woody debris removed from the river.

6. Consultation with stream restoration experts, landowners, river authorities, and cooperators to guide habitat improvement projects is strongly recommended.

Instream Flow Recommendations

1. A flow rate of 140 cfs could be considered a minimum rate to maintain habitat quantity and quality for adult trout. This reflects the new prescribed flow rate of 150 cfs through critical summer months.

2. A flow rate of 20 cfs could be considered a critical minimum flow rate during drought. This retains about 70% maximum WUA and 70% optimal habitat for the study area.

3. A flow rate of 470 cfs would maximize optimal habitat. However, this flow is unlikely to be maintained and can prevent wading in many areas of the tailrace.

4. Discharges higher than 470 cfs reduce optimal habitat due to unsuitable velocities for adult trout.

Temperature

1. Summer water temperature is likely the primary factor limiting trout survival on the tailrace and determines how much physical habitat is usable by trout.

2. Summer water temperatures have been shown to cause extensive trout mortality in the tailrace (Magnelia 2004, 2007).

3. Summer water temperatures periodically exceed tolerance limits at 7.42 miles downstream of Canyon Dam (Ponderosa Crossing) and frequently exceed tolerance limits 10.42 miles downstream (3rd Crossing), (Trungale 2015).

4. Even during prescribed releases, summer water temperatures beyond 7.42 miles downstream of Canyon Dam can exceed optimal levels, so consistent oversummer survival in these areas should not be expected.

5. Stockings and regulations beyond 3rd Crossing could be modified to reflect the realities of the thermal regime.

Challenges

1. The tailrace experiences high discharge events that can damage habitat structures.

2. Projects should not interfere with the multiple recreational users on the river.

3. Private property along the river will require coordination with landowners for access and potential changes to land use practices.

References

Cummings, G.A. 2015. Habitat suitability and availability for rainbow trout *Oncorhynchus mykiss* in the Canyon Reservoir Tailrace and evaluation of side scan sonar for habitat mapping in a semi-wadable river. Texas State University, San Marcos, TX. 136 pp.

Magnelia, S.J. 2004. Summary of 1987-2001 data from the Canyon Reservoir Tailrace with implications for establishment of a put-grow-and-take rainbow trout fishery. Texas Parks and Wildlife Department, Management Data Series No. 215. Austin, TX. 47 pp.

Magnelia, S.J. 2007. Survival of rainbow trout fingerlings stocked into the special regulation zone of the Canyon Reservoir Tailrace. Texas Parks and Wildlife Department Management Data Series No. 247. Austin, TX. 27 pp.

Trungale Engineering & Science. 2015. Flow-temperature relationships in the Guadalupe River downstream of Canyon Reservoir. Prepared for Guadalupe River Trout Unlimited. 15 pp.

Table 1. Adult trout habitat/flow statistics for the Canyon Reservoir Tailrace.

Discharge (cms)	Discharge (cfs)	WUA (m^2)	% Max WUA	Optimal Habitat (m^2)	% of study area
0.57	20	162592.14	68.69	146263.71	70.65
1.13	40	175245.75	74.04	160744.81	72.82
1.70	60	189118.49	79.90	175113.86	75.47
2.27	80	197099.81	83.27	184435.85	77.75
2.83	100	203389.15	85.93	190607.12	78.43
3.40	120	208369.82	88.03	195968.02	79.43
3.96	140	212550.08	89.80	200953.29	80.34
4.53	160	215880.52	91.21	205179.50	80.99
5.10	180	218463.67	92.30	208537.49	81.17
5.66	200	220418.65	93.12	211098.12	81.20
6.80	240	224216.41	94.73	215940.97	81.56
7.36	260	226023.31	95.49	217902.30	81.43
9.63	340	231216.71	97.69	223475.81	81.24
11.33	400	233588.33	98.69	225733.90	80.93
13.31	470	235614.07	99.54	227398.31	80.50
16.43	580	236693.42	100.00	227288.59	79.37
22.66	800	233232.61	98.54	220755.68	75.43

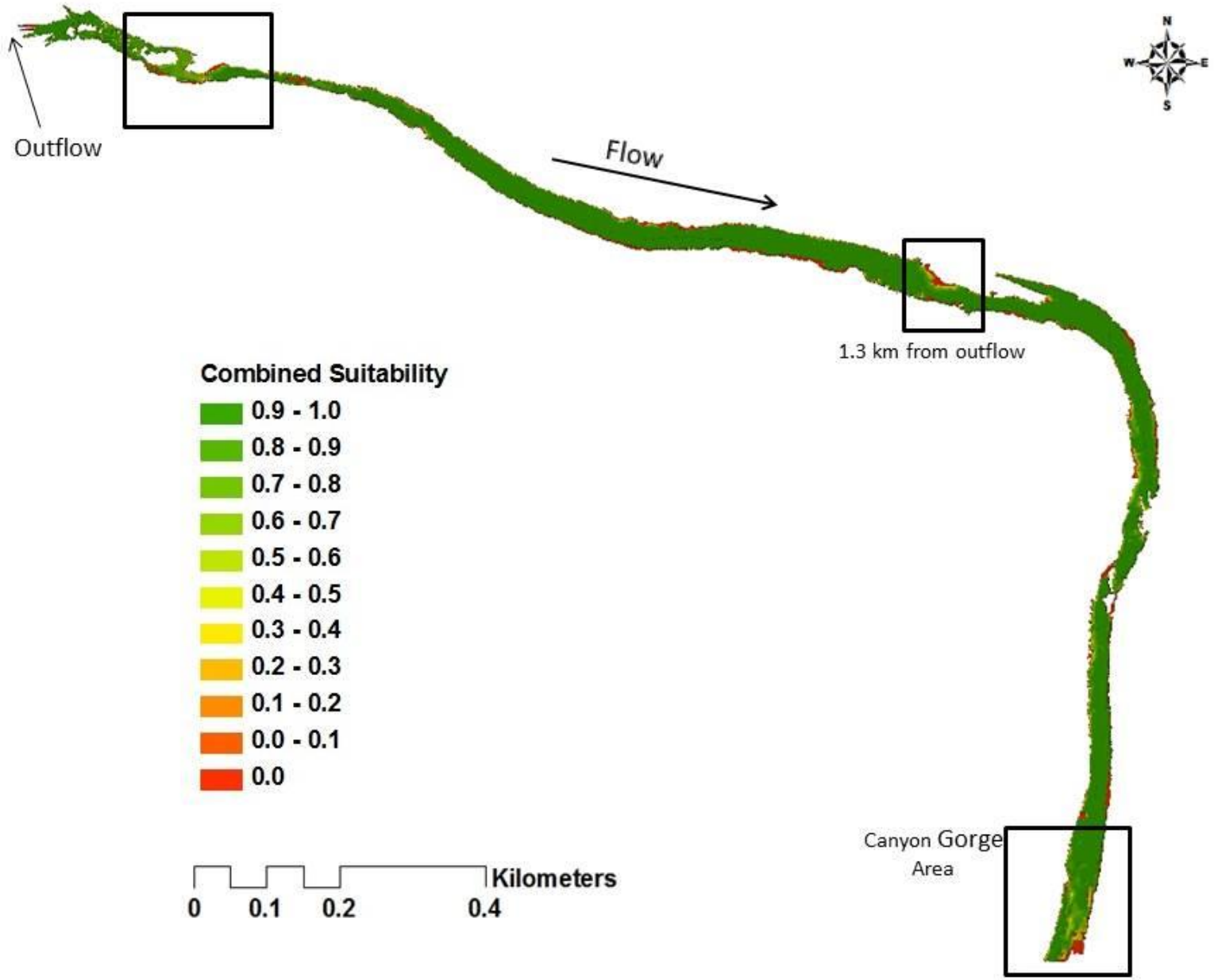

Figure 1. Habitat suitability map for study section one at 60 cfs. Boxes indicate areas of low suitability for adult trout.

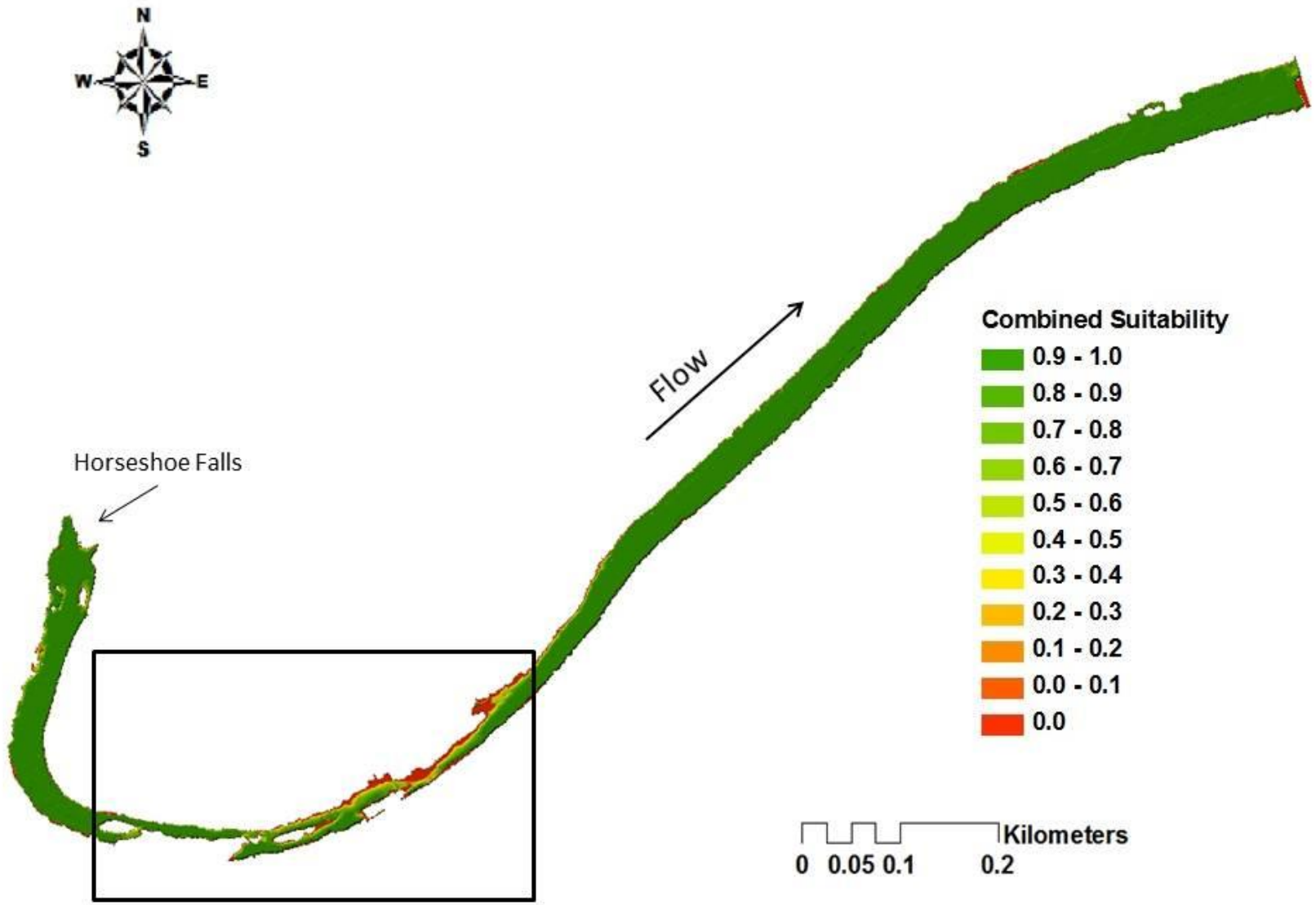

Figure 2. Habitat suitability map for study section two at 60 cfs. Box indicates area of low suitability for adult trout.

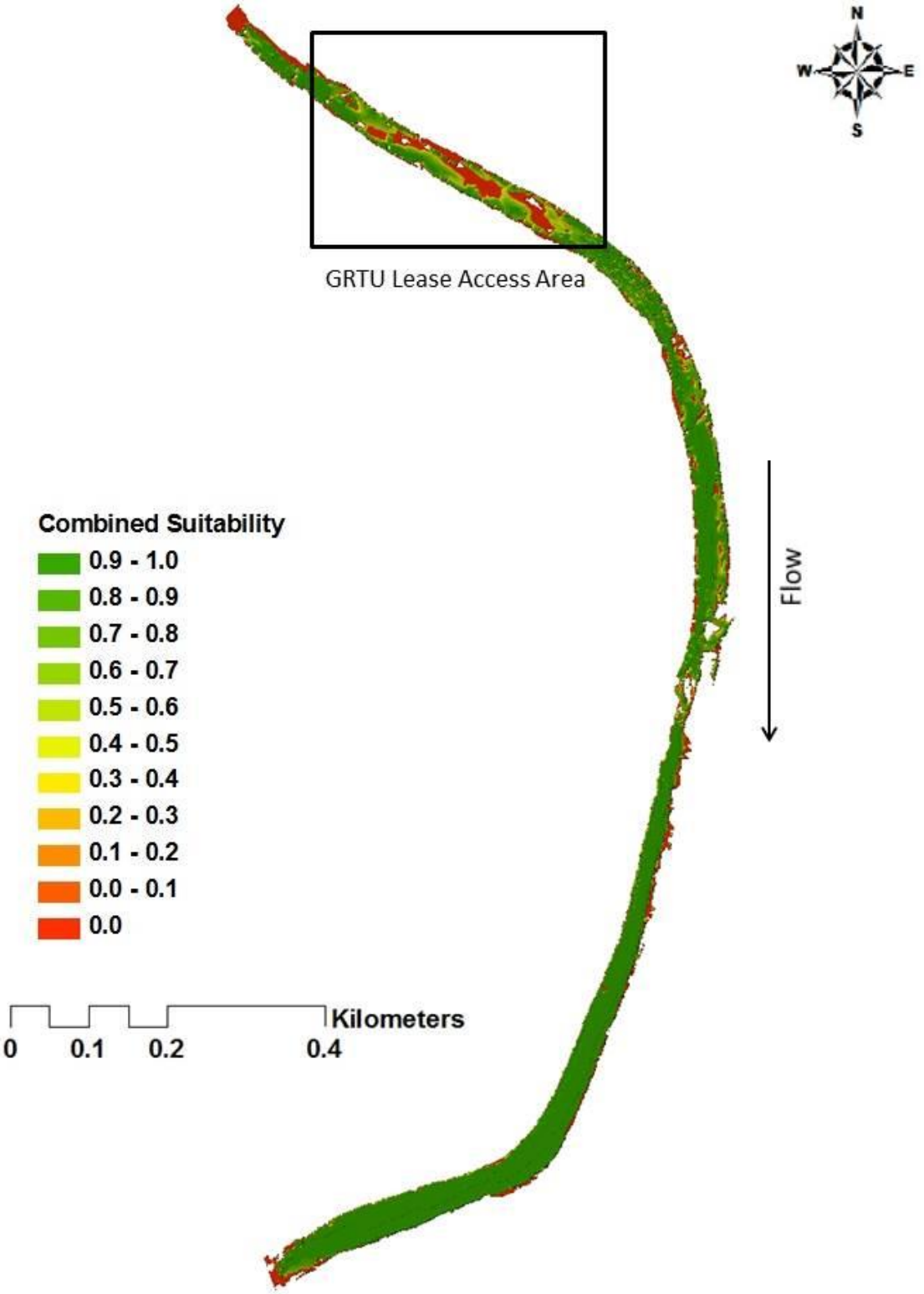

Figure 3. Habitat suitability map for study section three at 60 cfs. Box indicates area of low suitability for adult trout.