United States Department of the Interior
FISH AND WILDLIFE SERVICE
UTAH FIELD OFFICE
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WEST VALLEY CITY, UTAH 84119

April 13, 2010

In Reply Refer To
FWS/R6
ES/UT
09-TA-0217

Mr. Brent Gardner
Alpha Engineering Company
43 South 100 East, Suite 100
St. George, Utah 84770

RE: Tusher Wash Diversion Analysis, Grand and Emery Counties, Utah

Dear Mr. Gardner:

We are involved in early discussions with local stakeholders concerning the rehabilitation of the Tusher Wash Diversion (Diversion), which spans the Green River upstream of the town of Green River, Utah. Possible modifications to the structure include updates to an existing hydropower facility (screenings and fish 'friendly' rudders), construction of an additional hydropower facility (requiring additional diversions of water), raising the height of the Diversion, and addition of a fish passage structure. Because you are contracted to investigate the engineering design of some of these possibilities, we are providing you with a description of items that must be addressed if these projects move forward. This letter is a follow-up to a recent call we had with you on March 30, 2010.

Importance of the Green River to endangered fish recovery

As you know, four federally endangered species inhabit the Green River: bonytail (*Gila elegans*); Colorado pikeminnow (*Ptychocheilus lucius*); humpback chub (*Gila cypha*); and razorback sucker (*Xyrauchen texanus*). Portions of the Green River provide critical habitat to all four species; the entire length of the Green River and its 100 year floodplain is designated as critical habitat for at least one species between the Yampa River confluence and the Colorado River confluence (Appendix A)[1]. The Diversion is located in critical habitat for the Colorado pikeminnow and razorback sucker, and directly downstream of Desolation Canyon, designated critical habitat for the bonytail and humpback chub.

The Green River Basin, and particularly the mainstem Green River, is vital to the recovery of these species and maintaining self-sustaining populations in the Green River is a recovery goal for all four species (U.S. Fish and Wildlife Service 2002a, 2002b, 2002c, 2002d). Currently, the Green River Basin harbors:

- the largest, most productive, and most robust population of the Colorado pikeminnow;
- two known, active spawning locations of the Colorado pikeminnow;

[1] For a detailed description of the critical habitat reaches, please see the Federal Register: 59 FR 13374

- two known population centers of humpback chub;
- two known, active spawning locations of the razorback sucker; and
- populations of stocked individuals of all four species;

These four species are adapted to desert river hydrology (characterized by large spring peaks of snow-melt runoff and low, relatively stable base flows) and long, unimpeded stretches of river in the Colorado River Basin. Razorback sucker and Colorado pikeminnow migrate to established spawning areas to reproduce (U.S. Fish and Wildlife Service 2002b, 2002d). Individuals travel long distances to reach these sites (745 river kilometers round-trip on record for Colorado pikeminnow) (U.S. Fish and Wildlife Service 2002b). Colorado pikeminnow spawn in two principal sites: Gray Canyon in the lower Green River; and the lower Yampa River (U.S. Fish and Wildlife Service 2002b). Known spawning sites for razorback sucker are located in the lower Yampa River and in the Green River near Escalante Ranch, but other, less-used sites are probable (U.S. Fish and Wildlife Service 2002d). Maintaining connectivity between population centers and spawning sites is vital to reaching the de-listing goals of self-sufficient populations.

The Upper Colorado River Endangered Fish Recovery Program (Recovery Program), in conjunction with the Utah Division of Wildlife Resources, monitors populations of these species in the Green River. Populations of adult Colorado pikeminnow in Desolation Canyon and the lower Green River declined in the early 2000s, but began to slowly rebound by the end of the decade (Table 1) (Bestgen et al. 2005; Bestgen et al. 2010). Humpback chub monitoring in Desolation Canyon has shown reduced catch rates when comparing early (2001-2003) to late (2006-2007) sampling in the decade (Table 1) (Jackson and Hudson 2005, personal communication Paul Badame UDWR 2010). Larval drift indicates that razorback sucker reproduction occurs upstream of the Diversion each year, but that larval abundance is declining (Bestgen et al. 2002). Although a stocking program is being implemented to re-establish populations of Bonytail in the Upper Colorado Basin, they remain so rare that it is currently not possible to conduct population estimates.

River Reach	Species	2001	2002	2003	2006	2007	2008
Desolation-Gray Canyon	Humpback chub (> 200 mm)	1254	2612	937	410	204	[A]
		738-2697	1477-8509	636-1520	305-595	153-298	
	Colorado pikeminnow (> 400 mm)	699	757	621	519	484	1296
		507-963	504-1166	423-942	350-813	307-793	669-2580
Lower Green River	Colorado pikeminnow (> 400 mm)	355	261	227	791	604	467
		270-496	184-388	154-352	617-1025	476-783	301-752

Table 1. Population estimates for adult humpback chub and Colorado pikeminnow in the vicinity of Tusher Wash Diversion. [A] No sampling for humpback chub took place in 2008.

These population estimates indicate a downward trend in the abundance of Colorado pikeminnow and humpback chub. This is a concern because the Green River populations have always been viewed as the foundations for recovery of both species.

Considerations for the Tusher Wash Diversion rehabilitation

In the course of designing any future modifications to the Tusher Wash Diversion, it is important to consider how the modifications may impact the endangered fish species and how the impacts may be avoided, minimized, or mitigated. We foresee the following considerations as being important for any modification design:

1. *Fish Passage* – Providing safe, effective fish passage for both up- and downstream movements year-round;
2. *Limiting Fish Mortality* – Avoiding impacts whenever feasible through effective planning and minimizing mortality (when unavoidable) to individuals by protecting against fish entrainment into irrigation and hydropower facilities; and
3. *Maintaining Habitat* – Maintaining suitable habitat in the project vicinity, by providing adequate hydrological, thermal, and chemical conditions.

Fish Passage

It is critical to species recovery that Tusher Wash Diversion does not act as a barrier to natural fish movement. As described earlier, adult razorback sucker and Colorado pikeminnow make annual migrations to established spawning locations. Individuals that reside below Tusher Wash Diversion must be able to reach these spawning sites, which occur upstream from the diversion. Individuals that reside below the diversion make important contributions to the population's reproductive success and genetic diversity. If these individuals are prevented from reaching spawning locations, the population's reproduction and genetic exchange will be reduced.

Designing fish passage for native, warm-water fishes requires special design criteria because these species are not equipped with strong burst speeds or jumping abilities. Therefore, fish-ladders (or other structures designed for salmonids) will not work for these species. Fish passage design must take into account Colorado pikeminnow and razorback sucker swimming ability. In addition, designs must analyze flows available inter- and intra-annually, to ensure that flows will be available year round to operate the facility. Typically, designs such as roughened channels and vertical slot fish-ways are considered for passage of these warm-water fishes. We can provide more information about fish passage designs upon request.

Limiting fish mortality

Water intake structures have the potential to harm endangered Colorado River fishes of all ages and sizes through mortality, injury or displacement. This is especially true for pumps and hydropower facilities, which create an increased threat of mortality. However, installing intake cover fish screens reduces entrainment for non-larval individuals.

Because of the number of intake structures on the Green River, management actions indentified in the recovery goals for the listed fish species include minimizing entrainment of adults and sub-adults in diversion canals. We follow the 1997 National Marine Fisheries Service's 'Fish Screening for Anadromous Salmonids' which require fish screen mesh openings of no greater than 3/32 inch and approach velocities of no greater than 0.33 feet per second (fps)[2] when screening these types of facilities.

However, no amount of screening can completely prevent entrainment of larval fish. Endangered larval fish are very small (<0.5 inches total length) and incapable of directed swimming from the time of hatching through the first 2-4 weeks of their life. Depending on the water year, larval fish may be present

[2] This is for structure in the river, requirements are different if structures are in a canal.

in the Green River from as early as April 1 to as late as August 31 (earlier in dry years; later in wet years). Because known spawning locations occur upstream of the diversion site, larval fish must pass the Tusher Wash Diversion.

The most effective way to minimize entrainment is through project design that allows for adequate bypass flows and for pumps to be turned off, if present. However, this also has the largest impact on project operations. Therefore, the Service asked researchers to determine what time of day larval fish are most abundant in the water column. Recent data analysis by the Colorado State University Larval Fish Lab indicated that the highest abundance of larval fish was found at midnight, by nearly an order of magnitude. As a result, the Service recommends that projects not operate during the midnight hours (10 pm to 2 am) during the known larval fish drift period.

We are currently in talks with Reclamation, the Recovery Program, and other stakeholders to determine how to screen the existing facilities on the west side of the river. Discussions have included 'fish-friendly' rudders for the hydropower facility. Decisions about acceptable mortality from hydropower facility operations (both overall and per size class) have not yet been made, so we cannot provide detailed guidance on hydropower screenings at this time.

Maintaining habitat

It is important that suitable habitat for endangered fish species is maintained in the vicinity of the Diversion. In fact, because this stretch of river is designated critical habitat for two listed species, a project can not adversely modify the habitat. We have specific habitat criteria, called primary constituent elements (PCEs) for the designated critical habitat in the Green River.

Water, physical habitat, and the biological environment are the PCEs of critical habitat. This includes a quantity of water of sufficient quality that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. In addition, oxbows, backwaters, and other areas in the 100-year floodplain, when inundated, provide access to spawning, nursery, feeding, and rearing habitats. Food supply, predation, and competition are important elements of the biological environment.

Habitat in the vicinity of the project would need to remain suitable for endangered fish. For this project, habitat condition is largely controlled by flows in the river channel. Habitat conditions regulated by flows that must be considered include, but are not limited to:

- Adequate water depth for fish movement, both over the diversion through a passage facility and local movement across the river channel; and
- Suitable chemical conditions, such as temperature, dissolved oxygen, and pollution levels.

Proposed projects

Some design possibilities for the structure include raising the diversion, increasing the hydrologic head, and creating a new hydropower facility. This new hydropower facility could be either on the east or west bank of the river, and would require a new water right of approximately 500 cubic feet per second (cfs).

We are concerned that the new depletion, combined with the existing hydropower facility's depletion (700 cfs), will eventually result in dry damming the Green River at the Diversion. In fact, in water year 2002, we determined that these two facilities would utilize all of Green River's flow for 82 days[3], including a two month consecutive period. While we understand that 2002 was an extremely dry year, there is concern about non-drought years as well. In 2008, an 'average' year (Bureau of Reclamation 2009), there were 44 days in which the Green River at Green River, Utah had flows less than 1200 cfs.

Dry damming the river will result in significant entrainment issues and effectively remove habitat from that portion of the river. While the diversions for hydropower will be returned to the river downstream, the entire portion of the river between the Diversion and the hydropower facility offer habitat insufficient for fish. Operation of this facility must occur under conditions that do not remove this portion of habitat in the Green River. Analyses must be conducted to clearly identify the flows necessary to provide adequate habitat for the endangered fish (ie: allowing 10 cfs to pass the structure would not likely provide useable habitat).

Conclusion

We hope this letter provides a basis for future design research and analysis. However, it is important to note that this letter does not convey any final decisions or analyses about project impacts. We simply intended to provide you with a basis for understanding and remedying the possible impacts to federally listed fish in the project vicinity. Thank you for the opportunity to comment on this project. If you have any questions or need further information please contact Paul Abate or Kevin McAbee at (801) 975-3330 extension 130, or 143, respectively.

Sincerely,

Larry Crist
Utah Field Supervisor

cc: UDWR – SLC; Attn: Walt Donaldson
UDWR – Moab; Attn: Paul Badame
Upper Colorado River Endangered Fish Recovery Program; Attn: Tom Chart

[3] Based on readings from the USGS's Green River at Green River, Utah gauge.

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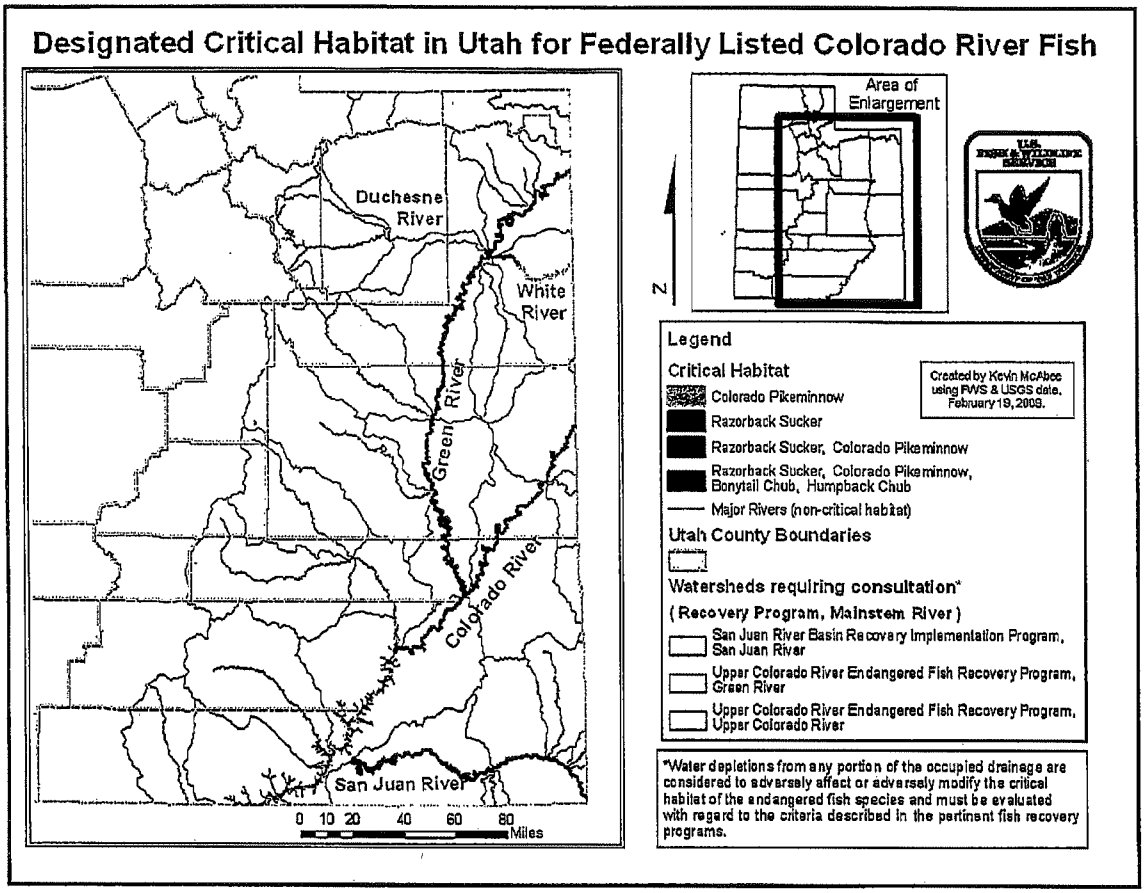
Appendix A


Designated Critical Habitat in Utah for Federally Listed Colorado River Fish
Duchesne River
White River
Green River
Colorado River
San Juan River
0 10 20 40 60 80
Miles
Area of Enlargement
N
Legend
Critical Habitat
Colorado Pikeminnow
Razorback Sucker
Razorback Sucker, Colorado Pikeminnow
Razorback Sucker, Colorado Pikeminnow, Bonytail Chub, Humpback Chub
Major Rivers (non-critical habitat)
Utah County Boundaries
Watersheds requiring consultation*
(Recovery Program, Mainstem River)
San Juan River Basin Recovery Implementation Program, San Juan River
Upper Colorado River Endangered Fish Recovery Program, Green River
Upper Colorado River Endangered Fish Recovery Program, Upper Colorado River
Created by Kevin McAbee using FWS & USGS data, February 19, 2009.
*Water depletions from any portion of the occupied drainage are considered to adversely affect or adversely modify the critical habitat of the endangered fish species and must be evaluated with regard to the criteria described in the pertinent fish recovery programs.