

Quarterly Report for SPR-677

Evaluation of Measures to Promote Desert Bighorn Sheep Highway Permeability on US 93 Before and During Highway Reconstruction

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*Photo courtesy of FNF Construction

EXECUTIVE SUMMARY

U.S. Highway 93 Project Description

Desert bighorn sheep populations may be fragmented and isolated by anthropogenic influences such as highways, fences, railroads, agricultural developments, canals, and housing developments (Leslie and Douglas 1979, Gionfriddo and Krausman 1986, Rodriguez et al. 1996, McKinney and Smith 2007). Traditional management techniques such as habitat protection and improvement and maintenance of dispersal corridors are

important in conservation of bighorn sheep populations (Schwartz et al. 1986). However, Beier and Loe (1992) suggested preservation of natural wildlife movement corridors and creation of wildlife movement corridors in areas formerly unobstructed might afford inadequate preservation of connectivity in the absence of appropriate scientific foundations. Though wildlife passage structures have been widely used in North America to enhance permeability and reduce wildlife-vehicle collisions for a range of wildlife species, limited information exists on the efficacy of passage structures in promoting permeability for desert bighorn sheep populations.

U.S. Highway 93 (US 93) is the primary transportation route between Phoenix and Las Vegas, Nevada, and has been congressionally designated as one leg of the CANAMEX (Canada to Mexico) Trade Corridor upon which commercial, as well as non-commercial traffic is projected to increase dramatically in the future. US 93 currently crosses at Hoover Dam (Milepost [MP] 0) on the Colorado River 70 miles northwest of Kingman, Arizona, and 20 miles southeast of Las Vegas. The proposed study area extends between US 93 MP 0 and 17. Construction of a new US 93 highway alignment has been ongoing since 2003 between MP 0 and 2 to bypass Hoover Dam to address traffic volume congestion and security issues; this project will be completed in late 2010. US 93 traffic volumes on the new bridge over the Colorado River as part of the Hoover Dam bypass project were forecast at 9,300 AADT in 1997 and are anticipated to increase to 16,400 by 2017 (Source Appendix A; Hoover Dam Bypass EIS; ADOT). US 93 from MP 2-17 will be reconstructed from a 2-lane to a 4-lane divided highway with a standard median width (108 ft centerline to centerline), scheduled to commence in December 2008.

The sheep population on the proposed study area is a sub-unit of the largest extant desert bighorn sheep population in Arizona, encompassing the Black Mountains, and has served as a source herd for numerous reintroductions of bighorn into several sites in Arizona and the Southwest. Elevations within the study area range from 637 ft at the Colorado River to 4,957 ft on Mount Wilson. This topography is well suited for desert bighorn sheep and includes rugged mountainous terrain with steep talus slopes and cliffs to dry washes among rolling hills (Cunningham and Hanna 1992). The sheep population here provides the public with wildlife watching opportunities within the study site and along the Colorado River, as well as providing recreational opportunity to those who hunt sheep in the area. Desert bighorn sheep have been a focal species of concern during all planning efforts for the reconstruction of US 93.

Cunningham and Hanna (1992) conducted an intensive 2-year assessment of desert bighorn movements and habitat uses in the Black Mountains adjacent to the US 93 corridor, primarily in the area around MP 0-2. The information from this study was used to develop and refine alternatives for both the Hoover Dam bypass project and reconstruction of US 93 between MP 2-17.

As planning progressed for the reconstruction of US 93 and the preferred alignment alternative was selected, McKinney and Smith (2007) conducted an assessment of bighorn sheep trans-highway movements relative to the proposed reconstruction plans.

They focused on identifying potential locations for future passage structures to enhance highway permeability for sheep and to reduce the incidence of wildlife-vehicle collisions.

They documented 5 continuous, linear, elevated guidelines corresponding to ridgelines where sheep concentrated their movements and crossings; 82% of the sheep crossings between MP 2-17 occurred at 3 of these locations for which McKinney and Smith (2007) recommended passage structures (underpasses or overpasses) to promote highway permeability and ensure genetic heterogeneity and vigor of the desert bighorn sheep population.

The Arizona Department of Transportation (ADOT) commissioned a Technical Advisory Committee to address the recommendations for promoting desert bighorn sheep permeability. Their findings, reflecting the recommendations of McKinney and Smith (2007) were incorporated into the 2008 Preliminary Bridge Selection Report for US 93 MP 0-17.

Like the tremendous commitment ADOT and the Federal Highway Administration (FHWA) made to incorporating wildlife passages into the internationally-acclaimed State Route 260 project, they have made a tremendous commitment to promoting desert bighorn sheep permeability across US 93. To date, few wildlife overpasses (<5) have been constructed in the U.S., with none targeting use by bighorn sheep. With the tremendous commitment to promote bighorn permeability and the heretofore untested efficacy of overpasses to promote bighorn sheep permeability and connectivity, a scientifically-based research evaluation is warranted.

RESEARCH OBJECTIVES

With the extensive desert bighorn sheep research conducted along US 93 by Cunningham and Hanna (1992) and McKinney and Smith (2007), our proposed research focuses on evaluating the effectiveness of the proposed US 93 wildlife overpasses and bridges in promoting desert bighorn permeability. However, to *quantitatively* and *objectively* evaluate the efficacy of the planned passage structures, a comparison of before and after-construction desert bighorn sheep permeability must be accomplished using passage rates as calculated by Dodd et al. (2007a).

McKinney and Smith's (2007) assessment used a GPS collar programming schedule of 5 hours between fixes to optimize the frequency of fixes and maximizing battery life for their 2-year assessment. As such, their study was not designed to yield information sufficient to calculate desert bighorn sheep passage rates as done by Dodd et al. (2007a, b). Though meeting their research objectives, including the primary one of determining the best locations for sheep passage structures, McKinney and Smith's (2007) study provided limited insights into pre-construction desert bighorn permeability across US 93 between MP 0-17. This research project scope of work addresses monitoring before and during-overpass structures construction.

The specific objectives and associated procedures of our first phase of US 93 research include:

- 1) Assess desert bighorn sheep movement and highway crossing patterns and distribution relative to US 93, and assess permeability (passage rates) across the highway corridor before and during construction.
- 2) Investigate the spatial and temporal relationships of desert bighorn sheep highway crossing and distribution patterns to vehicular traffic volume before and during construction.
- 3) Investigate wildlife-vehicle collision patterns along US 93 before and during construction.
- 4) Assess the impact of US 93 highway construction activities on desert bighorn sheep movements and behavioral patterns and develop mitigation strategies to minimize these impacts.

Post-construction monitoring will be implemented upon the conclusion of construction for at least a 3 year period to determine if the overpasses are reducing desert bighorn-vehicle collisions and promoting desert bighorn permeability and to continue any on-going management recommendations.

Objective 1. Assess desert bighorn sheep movement and highway crossing patterns and distribution relative to US 93, and assess permeability (passage rates) across the highway corridor.

- This is the primary objective of this research project and we will rely on the application of GPS telemetry. We will employ methodologies developed and reported by Dodd et al. (2007a) to assess movements, distribution, and measure desert bighorn sheep permeability.
- Arizona Desert Bighorn Sheep Society (ADBSS) approved the use of special tag funds through the Habitat Partnership Committee process to allow for the purchase of satellite collars in fall 2008. These collars not only allow for the retrieval of data on a daily basis, but also do not require the extensive flight time necessary for data retrieval and welfare checks. These collars, purchased in anticipation of the ADOT-AGFD agreement, also provided the opportunity to collar sheep prior to the December harvest and avoid capturing too close to lambing season. Had these collars not been purchased, captures would not have taken place until almost summer, missing out on movements associated with many construction activities. These collars allow for ADOT and AGFD to use the funding for this research project to collar sheep again in 2010 and will provide continuity into the highly anticipated post-construction phase (proposal submitted to ADOT). AGFD with the help of ADOT, NPS and several volunteers from the ADBSS successfully collared 30 sheep

within 2 days, an extremely difficult task that could not have been completed without these partners, since then 10 more sheep have been collared.

- Twelve of 40 sheep have crossed US 93 since October 2008 with six of these sheep crossing near milepost 5.1 in the vicinity of a planned wildlife overpass and sheep-proof fencing. AGFD, ADOT, FHWA and NPS met in early 2009 to discuss the necessity of 7' fencing in areas where sheep could be intercepted and forced to the new wildlife overpasses. Evidence showing the ability of sheep to easily jump a 5' fence (originally planned for a majority of the project) combined with previous ADOT/AGFD research pointing to the importance of appropriate fencing in success of wildlife crossing structures and the use of GPS data obtained from the current satellite collars led to the conclusion that the extent of 7' fencing should be increased to achieve maximum success. ADOT, NPS and FHWA approved this component and are currently implementing the new fencing into construction in a true adaptive management approach, pointing to the willingness of ADOT and FHWA to continue to adapt and maintain their role as a wildlife friendly Agency. ADOT is world renowned in their efforts to reduce wildlife-vehicle collisions while simultaneously maintaining permeability for wildlife across roadways.

Desert bighorn sheep movement patterns since the capture in November have been similar in many respects to those reported in McKinney and Smith (2007; figure 2). Sheep activity at the overpass sites is regularly documented by ADOT and FNF construction personnel (Figure 1)

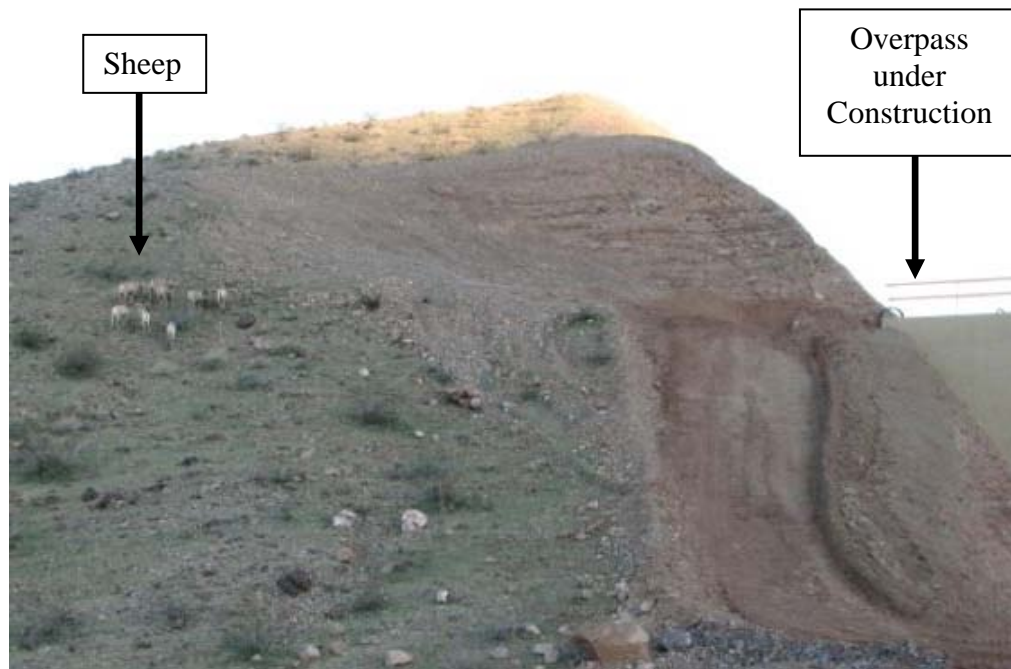


Figure 1. Sheep waiting for the opportunity to cross at MP 12.2 overpass. (Photo courtesy of FNF Construction).

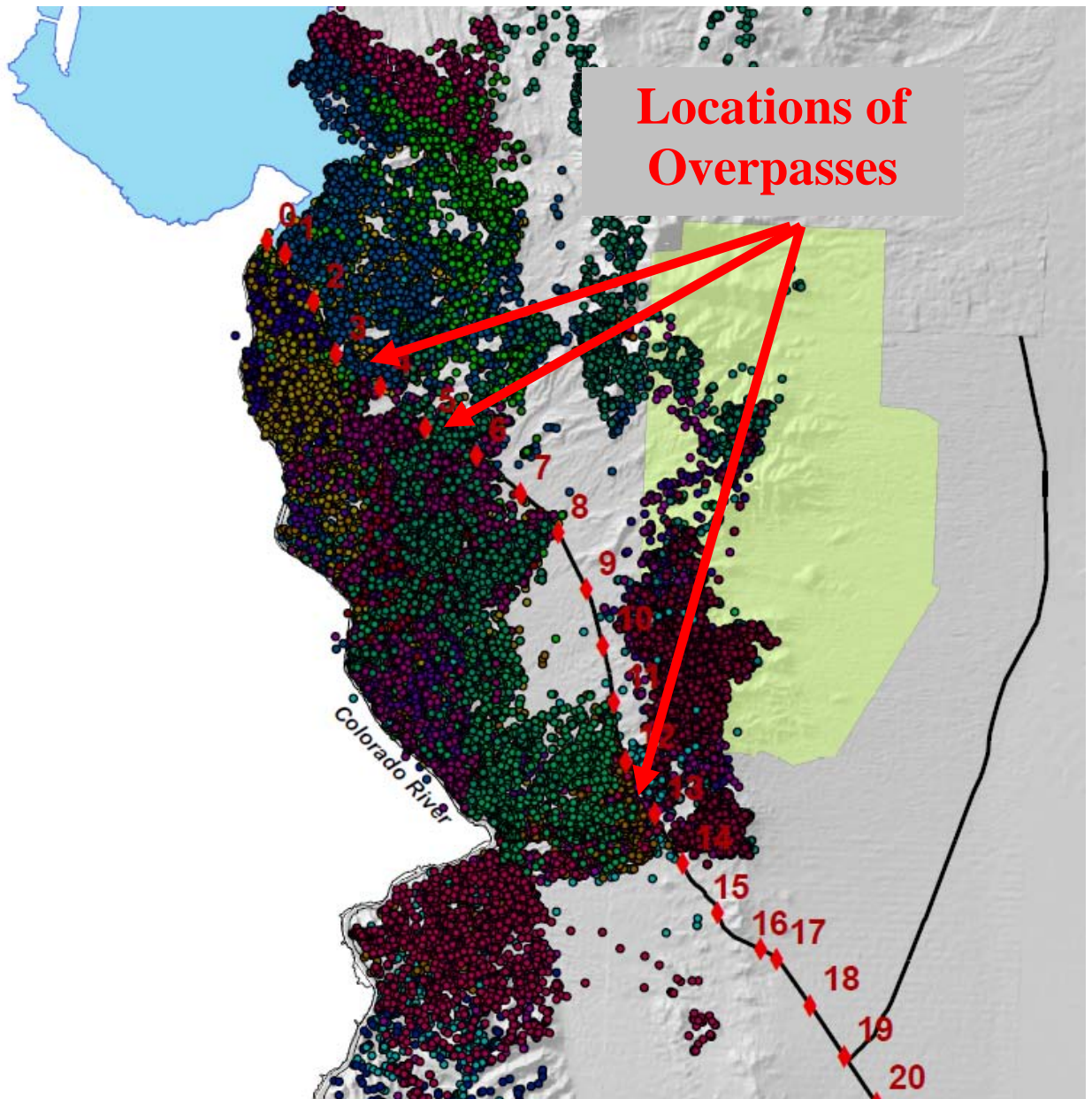


Figure 2. Desert bighorn sheep movements since October 2008 and the location of the overpasses under construction along US 93, each color represents individual sheep and each dot is a location taken every 2 hours for 2 years, providing approximately 7,000 GPS locations/ month.

- To date, thirteen collars have been recovered from the project. One sheep died of unknown causes on Mt. Wilson in early spring 2009 while the other nine dropped prematurely due to faulty release mechanisms. These ten collars were replaced during a quick capture on September 30 and October 1, 2009. Three additional collars have been recovered since this capture due to premature drops or torn collar material. The next major capture to place 30 more collars on sheep with ADOT ATRC monies will occur in 2010 where we will replace collars on sheep that are providing data adjacent to the highway and collar new sheep in place of those that are not providing useful highway movement data.

Objective 2. Investigate the spatial and temporal relationships of desert bighorn sheep highway crossing and distribution patterns to vehicular traffic volume.

- In winter 2008-2009 ADOT TPD installed a permanent traffic counter just beyond the southern boundary of the project area. Traffic data is being collected on an hourly basis and loaded into an overall database that can be linked to sheep movements to evaluate effects of traffic volumes on their movements and distribution. This will also allow for a baseline comparison to data obtained following completion of the project and the opening of US 93 to heavy truck traffic.

Objective 3. Investigate wildlife-vehicle collision patterns along US 93.

- In the during-construction phases of the US 93 upgrade, three ewes and one ram were killed by vehicles between October 2008 and January 2010. One ewe mortality occurred in October 2008 (milepost 2.3) where construction was completed and traffic is still active on the original road alignment and sheep-proof fencing ends nearby. A second ewe was killed at milepost 12.2 in spring 2009 at the exact location a wildlife overpass will be constructed. The third ewe was hit at milepost 2.5 in August. The ram was struck by a vehicle at MP 2.2 on January 6, 2010 (Fig. 3) This is near the transition of the first completed phase of construction (MP 0-2) and the current project (MP 2-17). Once completed, fencing will link the underpasses in phase 1 to the overpass at MP 3.3 virtually eliminating the potential for similar losses along this stretch. Appropriate fencing is essential to the success of the sheep crossings. Collisions are lower than historically documented by Cunningham and Hanna (1992) likely due to the rerouting of semis and slower speeds caused by construction activities. Without overpasses and fencing, collisions with sheep would increase sharply once heavy truck traffic resumed and sheep movements from east to west would be completely hindered, this project will significantly reduce this effect.



Figure 3. Desert bighorn sheep ram killed by a vehicle at MP 2.2 in January 2010. This is near the transition of the first completed phase of construction (MP 0-2) and the current project (MP 2-17). Once completed, fencing will link the underpasses in phase 1 to the overpass at MP 3.3 virtually eliminating the potential for similar losses along this stretch.

Objective 4. Assess the impact of US 93 highway construction activities on desert bighorn sheep movements and behavioral patterns and develop mitigation strategies to minimize these impacts, if necessary.

- We are collecting information, when provided by ADOT, on construction activities, location and their dates. AGFD personnel also document this activity when possible. This information is being entered into a database that will be linked to the sheep movement data obtained from the satellite collars to evaluate effects of various construction activities on their movements.
- Blasting activity and location is being provided by ADOT and will be used to evaluate sheep movements once all GPS and blasting information is obtained.
- Construction has id underway for all wildlife bridges (Fig. 4 and 5) and will likely be the first completed of the 3 overpasses. ROW fencing installation is almost complete aside from where fences tie into bridges, overpasses and culverts.



Figure 4. Side view of construction of sheep overpass at MP 12.2.



Figure 5. Sheep view of construction of sheep overpass at MP 12.2.

- AGFD attends occasional progress meetings and works regularly with ADOT, NPS and FNF to appropriately locate fencing to simultaneously minimize visual impacts while maximizing the effectiveness of the fence by placing it in areas where sheep cannot easily jump it due to escarpments. AGFD will be on hand to help ensure location of appropriate jump-outs and insights to making the overpasses as effective as possible.

PROJECT BUDGET

- With the approval of special tag funds provided by the ADBSS (\$137,000) to allow for the use of more expensive satellite collars, we are currently awaiting another round of satellite collar that are in the process of being completed. Collars are ordered and captures will take place in 2010.

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