2020 Biennial Adaptive Management Report

Prepared for:
Desert Conservation Program, Clark County, Nevada

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Acronyms and Abbreviations

AMMP	Adaptive Management and Monitoring Plan
AMP	Adaptive Management Program
AMR	Adaptive Management Report
Alta	Alta Science & Engineering, Inc.
BCCE	Boulder City Conservation Easement
BGO	Biological Goal and Objective
DCP	Desert Conservation Program
ECO	Enduring Conservation Outcomes
ESA	Endangered Species Act
MOA	Memorandum of Agreement
MSHCP	Multiple Species Habitat Conservation Plan
OHV	Off Highway Vehicle
Permit	Incidental Take Permit #TE34927-0
Permittees	Clark County; cities of Boulder City, Henderson, Las Vegas, Mesquite, and North Las Vegas; and Nevada Department of Transportation
PIE	Public information, education, and outreach
USFWS	United States Fish and Wildlife Service

Section 1 Introduction and background

This Biennial Adaptive Management Report (AMR) describes the analysis and subsequent recommendations from the Science Advisor Panel's review in accordance with the Clark County Multiple Species Habitat Conservation Plan (MSHCP) and associated Biological Opinion (USFWS 2000).

Clark County coordinates compliance with Incidental Take Permit #TE34927-0 (Permit) issued by the United States Fish and Wildlife Service (USFWS) in 2001, in accordance with Section 10(a)(1)(B) of the Endangered Species Act (ESA). The current Permit expires in February 2031. Permittees include Clark County; the cities of Boulder City, Henderson, Las Vegas, Mesquite, and North Las Vegas; and the Nevada Department of Transportation (Permittees). Clark County serves as the Plan Administrator for the MSHCP on behalf of the other Permittees, with the Desert Conservation Program (DCP) representing Clark County in this role. Compliance with the Permit requires implementation of the MSHCP and Implementing Agreement (Clark County 2000, USFWS et al. 2000).

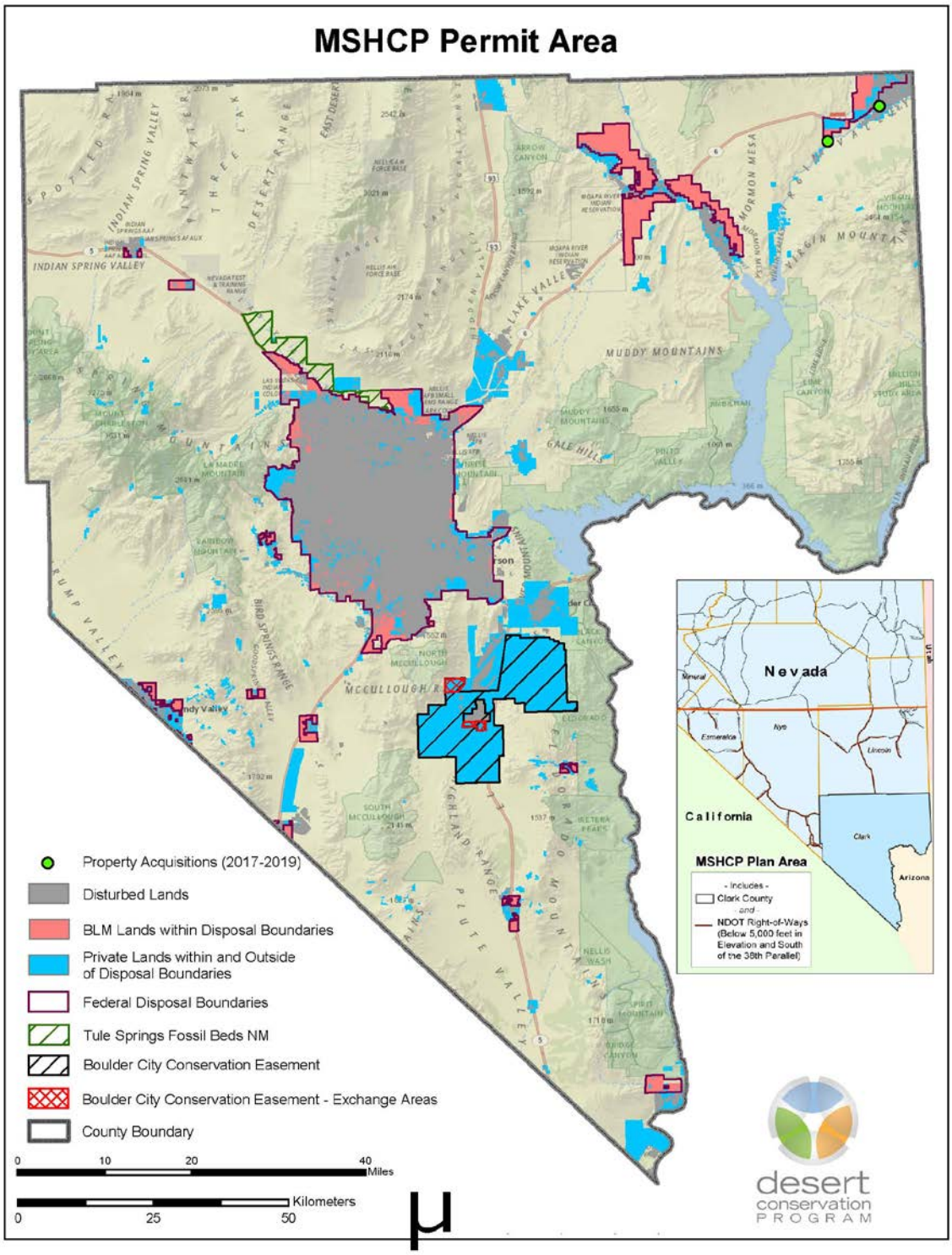
The MSHCP and Permit consists of 78 species categorized as "covered" species, which includes 15 reptiles and amphibians, 8 birds, 4 mammals, 10 invertebrates, and 41 plants (USFWS 2001). Covered species include both listed and non-listed species under the ESA and are those species for which sufficient information was known and where management prescriptions could be implemented and supported by the Permit. At the time the MSHCP was finalized in 2000, the desert tortoise (*Gopherus agassizii*) and the southwestern willow flycatcher (*Empidonax traillii extimus*) were the only species listed under the ESA as threatened and endangered, respectively. Since 2000, after the MSHCP was finalized, the Mount Charleston blue butterfly (*Icaricia shasta charlestonensis*) and the western population of the yellow-billed cuckoo (*Coccyzus americanus*) have been listed as endangered and threatened, respectively.

The MSHCP plan area includes Clark County, as well as lands in Nye, Lincoln, Mineral, and Esmeralda counties that lie below the 38th parallel, are less than 5,000 feet in elevation, and are in association with Nevada Department of Transportation activities (Figure 1). The Permit originally allowed for the incidental take of MSHCP-covered species from 145,000 acres within the plan area, which has since increased by 22,650 acres (due to the credit provided by the creation of the Tule Springs Fossil Beds National Monument) for a total of 167,650 acres. The area in which the MSHCP allows incidental take is a portion of the plan area, referred to as the "permit area", and includes (Figure 1):

- Non-federal lands in Clark County; and
- Any federal lands within Clark County that may be designated by a federal agency for disposal and eventual transfer to non-federal ownership (i.e., Federal Disposal Boundaries).

Additional introductory information, such as the history (including the background of the Adaptive Management Program [AMP]), function, and the proposed future amendment of the MSHCP and Permit is detailed in the 2016 Biennial AMR (Enduring Conservation Outcomes [ECO] 2016).

Figure 1. MSHCP permit area and plan area (inset)



Boulder City Conservation Easement and the Tule Springs Fossil Beds National Monument areas within the permit area are precluded from future development. Property acquisitions for riparian reserve system lands during this biennium are included for reference.

1.1 Purpose

The MSHCP and Permit required the development of a science-based adaptive management process, the AMP. Consequently, a Memorandum of Agreement (MOA) was prepared to describe the AMP, including specific goals and guiding principles to the AMP (Clark County 2000, USFWS 2001 and 2002). The AMP is designed to provide an objective, quantitative evaluation of the effectiveness of management actions in attaining program goals through the interpretation of inventory, monitoring, and research goals (USFWS 2000). The AMP thus provides objective data and analysis upon which to base management decisions, and a framework to evaluate those management decisions (USFWS 2000). The AMP is required to have an objective, science-based adaptive management contractor (i.e., Science Advisor Panel) to provide an independent assessment of MSHCP implementation. The Biennial AMR is the product of that independent assessment. The independent review is accomplished by obtaining information on recent projects, reports, and datasets, and performing the following four assessments (USFWS 2000):

1. Analyze all land-use trends in Clark County to ensure that take and habitat disturbance are balanced with conservation (Section 2).
2. Track habitat loss by ecosystem (Section 3).
3. Evaluate the effectiveness of management actions at meeting MSHCP goals of conservation and recovery (Section 4).
4. Monitor population trends and ecosystem health (Section 5).

The purpose of this Biennial AMR is to document the Science Advisor Panel's analyses, findings, and subsequent recommendations of the above four items to improve the DCP's AMP and the MSHCP implementation.

1.2 Previous Biennial AMR

Prior to this Biennial AMR, the most recent report was completed in 2018 and included data from 2001 through 2017 (Alta 2018). This Biennial AMR summarizes recommendations from the 2018 report and narrative from the DCP to evaluate how recommendations have been implemented (Appendix A). This Biennial AMR also summarizes new recommendations to assist the DCP in the upcoming biennium.

1.2.1 Summary of 2018 Biennial AMR recommendations

The 2018 Biennial AMR included 9 recommendations that were intended for DCP implementation, and DCP staff comments for each are located in Appendix A. It is the Science Advisor Panel's opinion that (based on the responses from the DCP), all recommendations have been or are being implemented successfully.

The 2018 Biennial AMR also included 5 recommendations that were intended for the Science Advisor Panel to implement during preparations and analysis of the 2020 Biennial AMR. Those recommendations are also included in Appendix A with Science Advisor Panel responses and discussion.

1.3 Significant updates since the 2018 Biennial AMR

Since the Biennial AMR in 2018 the following significant updates to the DCP workflow and details of the MSHCP have been implemented:

- The DCP is continuing to initiate monitoring and other elements described in the Adaptive Management and Monitoring Plan (AMMP).
- New riparian properties have been acquired as described in the most recent update to the Riparian Reserve Unit Management Plan; DCP is currently looking at acquiring additional new riparian properties.
- A land exchange was conducted between Clark County and the City of Boulder City. Boulder City acquired 1,145 acres to expand the Energy Zone in the Boulder City Conservation Easement. In exchange, Boulder City transferred 1,927 acres of equal or higher habitat value for desert tortoise to the northwest portion of the Easement, resulting in a 1:1.7 acre ratio increase in the Easement.

1.3.1 Adaptive management and monitoring plan

An AMMP was developed based on the 2016 Biological Goals and Objectives (BGOs). It provides the technical direction for collecting and assessing monitoring data, determining the success of the conservation actions in achieving the BGOs, and maintaining or enhancing populations of MSHCP-covered species and their habitats through an adaptive management process. The incorporation of relevant and quantitative data and information obtained through systematic and consistent monitoring is a fundamental component of the AMMP. This information is used to periodically evaluate conservation success, with an emphasis on learning from past actions and making necessary changes. The AMMP applies to the entire suite of conservation actions conducted under the MSHCP to formalize adaptive management of the entire conservation program. Adaptive management of individual projects can also be important, but is not directly described in the main body of the AMMP; guidance is provided in Appendix B of the AMMP. Understanding the process and timing of adaptive management tasks will serve to streamline DCP workflow and maximize effectiveness toward permit requirements and biological goals.

A portion of the AMMP describes the evaluation timeline for both analyzing monitoring data and the adaptive management process (TerraGraphics 2017):

- The adaptive management evaluation process is a regular, systematic, recurring process to be performed every four years. This 2020 AMR includes the first iteration of the adaptive management evaluation process, including statistical analysis of available data (Section 5 and Appendix B).
- The adaptive management action process occurs when necessary, beginning at the four-year evaluation interval and continuing until the actions have met their stated goals.
- Analysis of monitoring data for reporting purposes can occur at any time as individual projects dictate, but at a minimum should be conducted every two years as part of the Biennial AMR to serve as a benchmark for conservation progress. Additionally, a more in-depth analysis should take place as part of the adaptive management evaluation and is included here in Section 5 and Appendix B (see first bullet).
- Quantification and reporting of project-level progress that leads to the achievement of BGOs should be part of the adaptive management evaluation (see first bullet).

Integration of concepts and analyses from the AMMP into DCP workflow should occur at an intentional pace. Here in the 2020 AMR we present the first iteration of the adaptive management evaluation process to provide preliminary results for species and habitats with sufficient data for statistical analysis (Section 5 and Appendix B).

Section 2 Land use trends in Clark County – analysis and discussion

The first assessment tool of the AMR states "*Analyze all land-use trends in Clark County to ensure that take and habitat disturbance is balanced with conservation"* (USFWS 2000). Land use trends measure the change from a current land use to a different one. The Science Advisor Panel is particularly interested in the change from a natural habitat to a human land use, which represents a habitat loss for a covered species. In the MSHCP, permitted acres (i.e., the number of acres which are permitted to undergo land use change) and habitat loss are the primary measures of "take" for 78 covered species (Clark County 2000).

The original MSHCP allowed for 145,000 acres to be developed between 2001 and 2031. The establishment of the Tule Springs Fossil Beds National Monument provided an amendment to the MSHCP, which allowed for an additional 22,650 acres of development within the original MSHCP timeframe. As acres are permitted for development, each of the Permittees provide monthly updates on expended permitted acres which are summarized in Quarterly Administrator Update reports. The Science Advisor Panel's assessment used data from March 2017 through March 2019, provided by DCP staff (DCP 2019). The Science Advisor Panel assumes the data from the Permittees are accurate, complete, and current. Because mitigation fees are required to be paid prior to disturbing any habitat, the acres of actual habitat loss are expected to be less than expended permitted acres. Expended permitted acres are used to track the remaining permitted acres available for development under the MSHCP.

Habitat loss is determined from the total number of acres developed and acts as a surrogate for assessing impacts on covered species, with the assumption that any disturbed habitat results in habitat loss for covered species. Habitat loss is measured at the extent of non-federal lands and federal disposal areas within the county. Non-federal lands include lands in private, municipal (city and county), and state ownership.

This section summarizes the number of acres permitted and habitat loss that have occurred since the last assessment from 2018 (Alta 2018) and cumulatively since the initiation of the MSHCP in 2001. Overall, the assessment is structured by two questions regarding habitat loss (ECO 2010). These assessment questions are discussed in the sub-section below and are:

- How many acres have been permitted for habitat loss?
- How many total acres of habitat loss have occurred?

2.1 Assessment of general habitat loss

The reported number of expended permitted acres was compared to county-wide aerial imagery collected in early March 2019 to determine actual habitat loss to date versus permitted disturbance acres to date (see ECO 2016 for a detailed description of the aerial imagery and spatial analysis). The results presented in this sub-section pertain to actual habitat loss, assuming that all development equates to habitat loss. Habitat loss discussed in this sub-section is irrespective of ecosystem. Habitat loss from currently undeveloped permitted acreage, if developed in the future, will be captured in the 2022 Biennial AMR.

As of March 2019, a total of 103,917 acres have been permitted under the MSHCP, including 15,000 municipal acres that were exempted from the original MSHCP. This is 62.0% of the total permitted acres under the amended MSHCP (including the Tule Springs Fossil Beds National Monument; 167,650 acres total). Also, as of March 2017, a total of 103,585 acres of habitat have been developed (i.e., actual habitat loss; Table 1; Figure 2). This is 61.8% of the

amended allowed acreage. From March 2017 to March 2019, 6,336 acres of development occurred, which is a habitat loss of 0.1% of all land in Clark County (Table 1, Figure 3a). This is in contrast to the 5,489 acres of habitat lost to development in the previous biennium (Alta 2018). Habitat loss from 2017-2019 was 47.9% less than the average habitat loss across all previous bienniums (6,336 acres versus 12,156 acres, on average; based on the overall total acreage developed between 2001 and 2017). Habitat loss from 2017-2019 was 2.2% of the total amount of developed land in Clark County (Figure 3b). Habitat loss was 3.8% of the total amended permitted acres (Figure 3c).

Current and historic rates of habitat loss can be used to project potential future rates of loss. From 2001 to 2019 the average amount of development per biennium was 10,389 acres. At this rate, the remaining 63,733 acres permittable for development under the current MSHCP would be developed in 6.1 years from March 2019, or approximately year 2025. However, several recent bienniums have not experienced such high rates of development. With the average 6,093 acres of development per biennium from 2015 to 2019, the remaining acres permittable for development would be developed in 10.5 years from March 2019, or approximately year 2029. For reference the current Permit is valid until February 2031. It must be noted that these calculations are for informational purposes only and do not represent projections of actual future rates of development. Actual development has been highly variable over time and is expected to continue as such in the future.

Table 1. Total area, development area (habitat loss), and percent habitat loss prior to 2001, 2001-2017, and 2017-2019 in Clark County, Nevada

Total acres in Clark County	Acres developed (habitat loss) within each time period[1] (% total acres[2] / % permitted acres[3])			Cumulative developed acres (% total acres / % permitted acres)
	Prior 2001	2001-2017	2017-2019	
5,159,738	180,754 (3.5% / NA[4])	97,249 (1.9% / 58.0%)	6,336 (0.1% / 3.8%)	284,339 (5.5% / 61.8%[5])

[1] Based on aerial imagery. The total developed acres are fewer than the number of acres permitted for development.
[2]Percent of total acres in Clark County developed within time period.
[3]Percent of MSHCP-permitted acres developed within time period.
[4]Not Applicable, as MSHCP began in 2001.
[5]Cumulative percent of expended permitted acres developed is based on acres developed since the permit began in 2001 (103,585 acres).

Figure 2. Map of ecosystems, habitat loss, and federal disposal boundaries within the MSHCP permit area

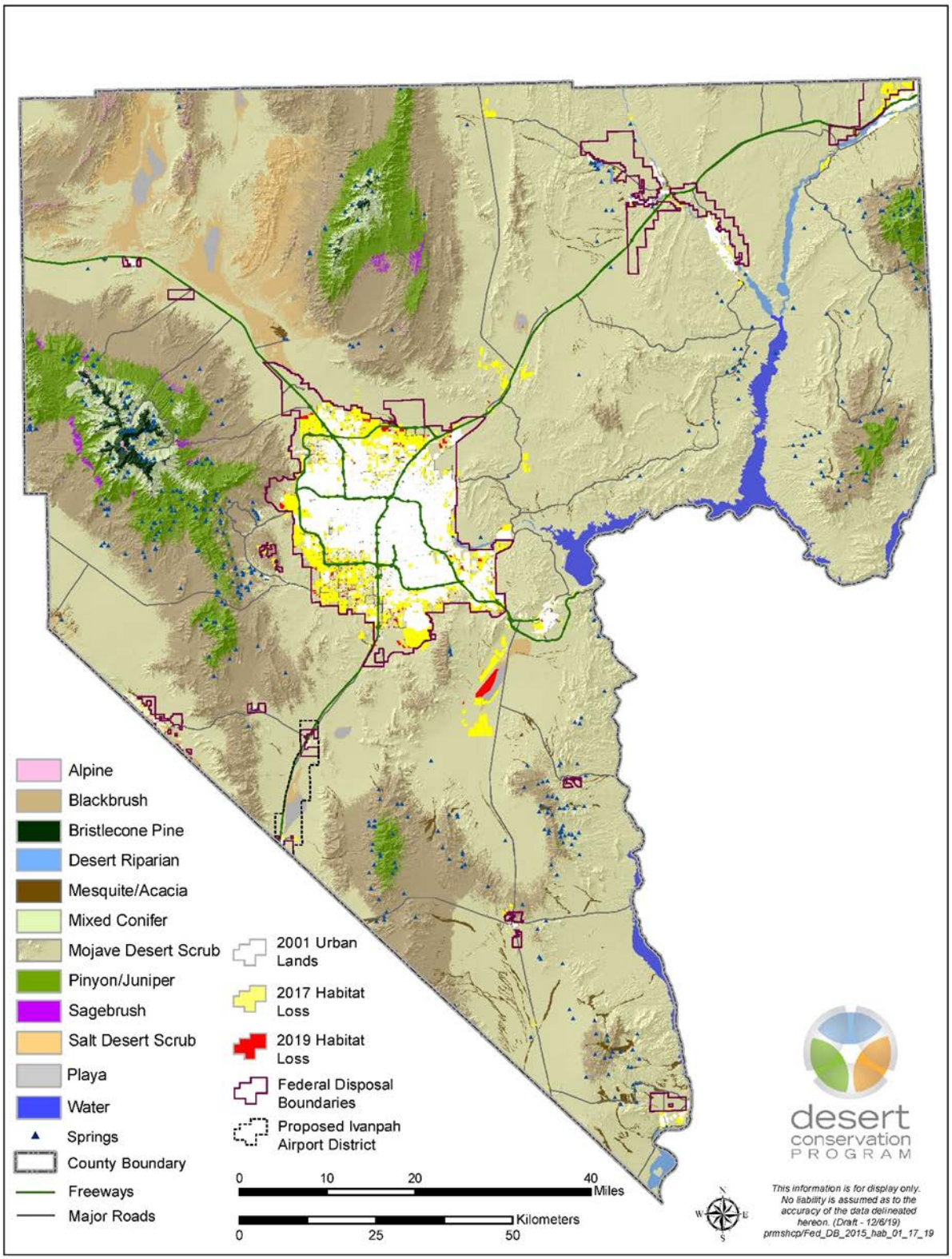
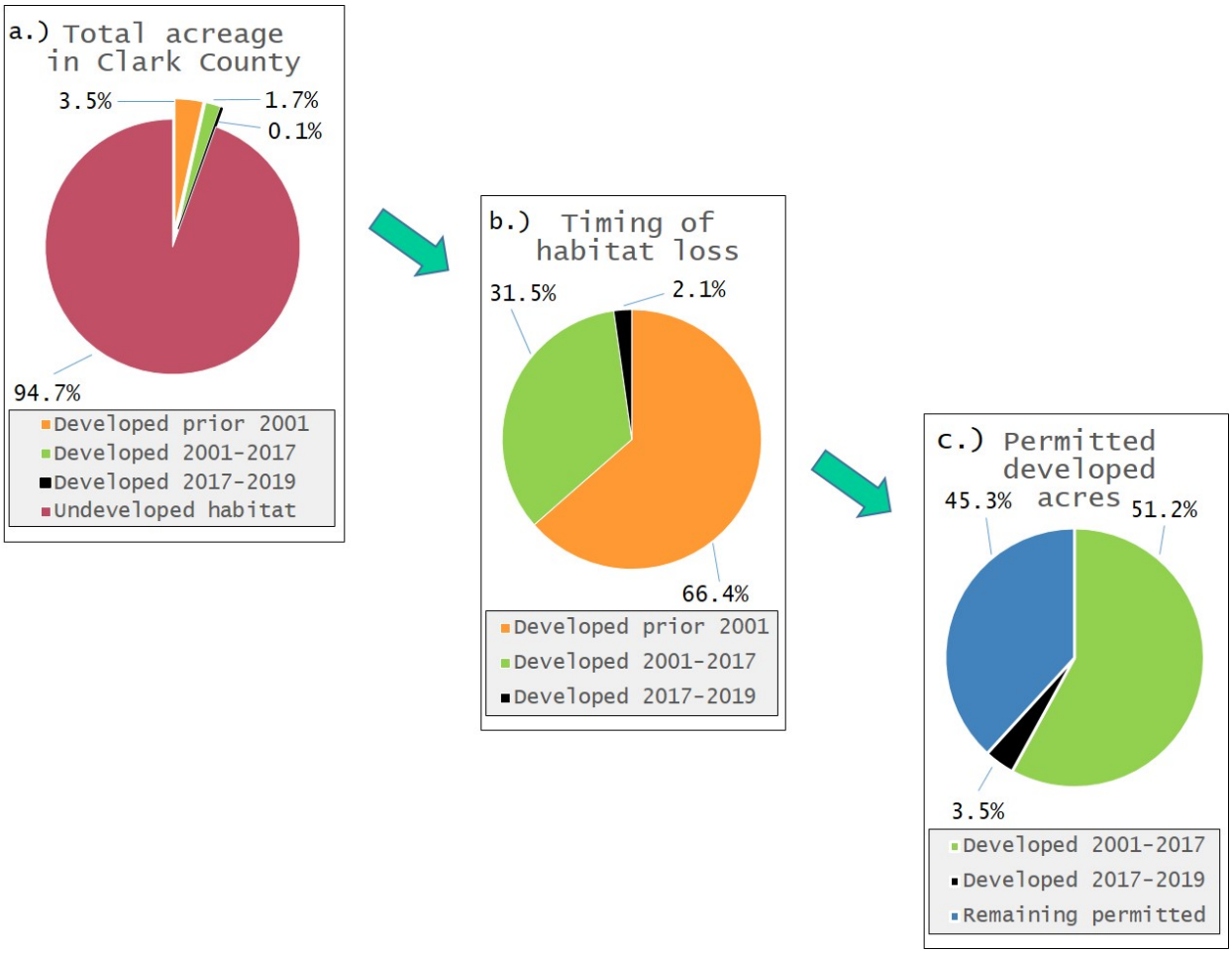


Figure 3. Percent habitat loss as a function of total habitat, time period, and development pace of permitting acreage



(a) Habitat loss, by time period, compared to total habitat (i.e, total acreage) within Clark County.
(b) Distribution of habitat loss by time period.
(c) Proportion of total amended permitted acres developed per time period.
Note: Each color among pie charts represents the same calculated acreage and time period (e.g., orange slices are the amount of habitat developed prior to 2001 [180,754 ac] in both [a] and [b]).

2.2 Conclusions and recommendations for land use trend analysis

Based on the Science Advisor Panel's assessment of land use trends (i.e., general habitat loss), conclusions are:

- General habitat loss is commensurate with what is expected given the percent of habitat loss at this point in the timeline of the MSHCP. However, annual rates of habitat take have varied tremendously over the duration of the MSHCP and may increase or decrease with changing economic conditions in the region.
- In a general sense, current conservation actions are balancing habitat take (USFWS 2000) because the Permit conditions are being met.

These conclusions are consistent with the 2018 AMR conclusions.

The Science Advisor Panel does not have any specific recommendations for the DCP to implement in this section.

Section 3 Habitat loss by ecosystem – analysis and discussion

The second assessment tool of the AMR states "*Track habitat loss by ecosystem*" (USFWS 2000). In addition to tracking total habitat loss, the DCP tracks habitat loss by ecosystems (i.e., habitat types) as an assessment of development impacts (i.e., "take") on 78 covered species. There are 12 ecosystems described for Clark County, although not all ecosystems are impacted by development due to land ownership and land use patterns (Figure 2). Information describing each ecosystem was detailed in the 2016 Biennial AMR (ECO 2016). Table 2 summarizes acres of habitat that have been developed (i.e., habitat loss) in the most recent biennium (i.e., 2017-2019) and over the life of the Permit (i.e., since 2001). Table 2 also categorizes acres by ecosystem relative to that ecosystem's prevalence throughout Clark County. It is noted that DCP re-calculated the development layers since the last AMR to leverage access to better aerial imagery and therefore improve the accuracy of calculating habitat loss. The numbers presented here are considered more accurate than those in previous AMR's. Further, at the time of writing this AMR, the acreages of total development and ecosystem-specific development provided by DCP do not perfectly match up. DCP is working on identifying the source of the discrepancy. Therefore, for interpretation, the ecosystem-specific acreage estimates should be treated as close to, but not exactly, accurate.

In the most recent biennium (2017-2019), a total of 6,360 acres of classified ecosystem types were developed, the majority of which were Mojave Desert Scrub (4,867 acres; 76.5% of development this biennium). Other ecosystems that were developed included Blackbrush, Salt Desert Scrub, Mesquite/Acacia, Desert Riparian, and Playa. No other ecosystems lost acreage in the recent biennium, although several had existing developed acres (Table 2). Notably, considerably more Salt Desert Scrub was developed in this biennium than in the previous biennium (1,205 acres vs. 254 acres, respectively).

Table 2. Habitat loss by ecosystem during 2017-2019 and since 2001. These percentages are based on the total area of each ecosystem in Clark County, Nevada

Ecosystem[1]	Total acres (% of Clark County[2])	Developed acres (i.e., Habitat Loss)			
		Prior 2001[3]	*2001 -2017*	*2017 -2019[4]*	*Cumulative since Permit began (2001-2019) (% of ecosystem type[5])*
Blackbrush	1,027,144 (19.9%)	1	621	6	627 (0.06%)
Desert Riparian	27,717 (0.5%)	3,005	541	19	560 (2.02%)
Mesquite/Acacia	50,008 (1.0%)	5,546	1,943	242	2,185 (4.37%)
Mixed Conifer	67,556 (1.3%)	31	7	0	7 (0.01%)
Mojave Desert Scrub	3,377,939 (65.5%)	165,412	87,170	4,867	92,037 (2.72%)
Pinyon/Juniper	286,400 (5.6%)	36	6	0	6 (<0.01%)
Sagebrush	11,632 (0.2%)	0	3	0	3 (0.03%)
Salt Desert Scrub	204,329 (4.0%)	6,723	6,773	1,205	7,978 (3.90%)
Playa	19180 (0.4%)	0	48	21	69 (0.36%)
Total	5,159,738	180,754	97,222	6,360	103,582 (2.00%)

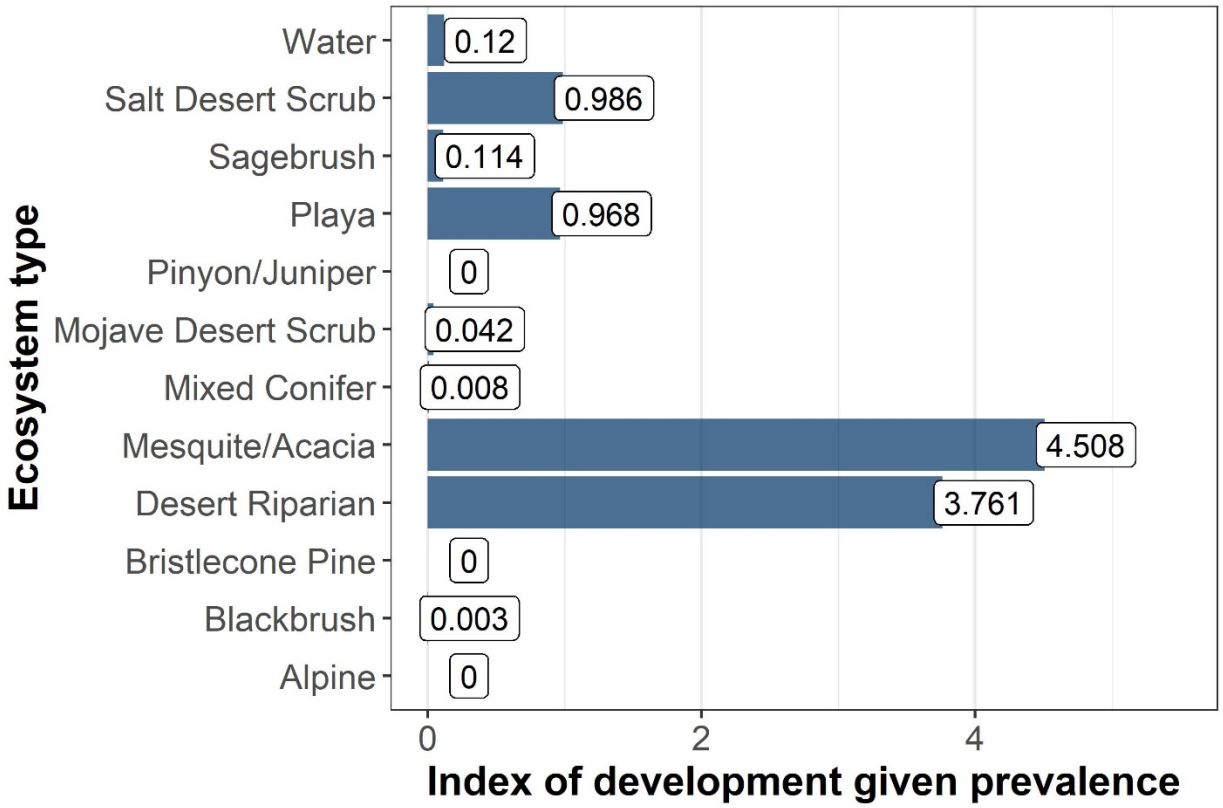
[1]Exlcudes 'Alpine', 'Bristlecone Pine', and 'Water', as these ecosystems total 1.7% of Clark County. 'Alpine' and 'Bristlecone Pine' have had 0 acres developed, and, based on the more accurate re-calculation of developed areas, 110 acres of 'Water' were developed prior to 2015. 'Water' can be developed due to the resolution and classification errors in the Heaton et al. (2011) ecosystem model.
[2]Percent of Clark County comprised of each ecosystem. Calculation is for the entirety of Clark County, including federal land, and therefore reflects ecosystem acreages for the larger county-encompassed landscape.
[3]Existing development before Permit began.
[4] Habitat loss in acres. Note the discrepancy in total habitat loss in the 2017-2019 biennium presented here compared to Section 2, due to undetermined discrepancies in calculations provided by DCP.
[5] Cumulative percent developed rounded to nearest 0.01%.

In addition to quantifying the absolute area of habitat loss for each ecosystem, the Science Advisor Panel calculated an index of the acreage loss in proportion to the total existing area of each ecosystem (i.e., prevalence, Figure 4). This assessment can determine if specific ecosystems are being lost at a disproportionately higher rate than they occur, which could lead to specific recommendations for conservation actions (see Section 4 below). For example, a disproportionately high rate of loss of the Mesquite/Acacia ecosystem would indicate a need for conservation actions targeted at protecting or enhancing remaining Mesquite/Acacia habitats.

To illustrate the calculations performed to create Figure 4, the amount of all Desert Riparian that has been developed since the Permit began (2001 – 2019) is 2.02% whereas the acreage of all of Clark County that is Desert Riparian ecosystem is 0.54%. Therefore, Desert Riparian has been developed at a rate disproportionately higher than expected. Loss of Desert Riparian by an index factor is 3.761 (i.e., 0.0202 / 0.0054 ≈ 3.761). This index does not have a naturally interpretable unit of measurement, but can be compared across ecosystem types to identify relatively high rates of development of relatively rare ecosystem types.

The disproportional loss analysis (Figure 4) found that over the life of the Permit, both the Desert Riparian and Mesquite/Acacia habitats have been developed at considerably higher rates given their general low prevalence within Clark County, suggesting that these ecosystems may need a specific focus in terms of conservation actions (see Section 4 for analysis of this need). On the other hand, these ecosystems represented a small amount of the total habitat loss to date (2001 through 2019), with 88.9% of developed acres occurring in Mojave Desert Scrub (Table 2). The Mojave Desert Scrub may warrant conservation attention because of this large proportion undergoing development. However, Mojave Desert Scrub is also the most abundant ecosystem within Clark County (comprising 65.5% of total land in Clark County; Table 2) and the total amount of development in Mojave Desert Scrub is proportionally small relative to its occurrence (0.042;Figure 4). Therefore, it is not at risk relative to its occurrence. The other interpretation is that the disproportionate developments of Desert Riparian and Mesquite/Acacia are of concern precisely because of their relative rarity in Clark County (0.5% and 1.0% of land area, respectively; Table 2).

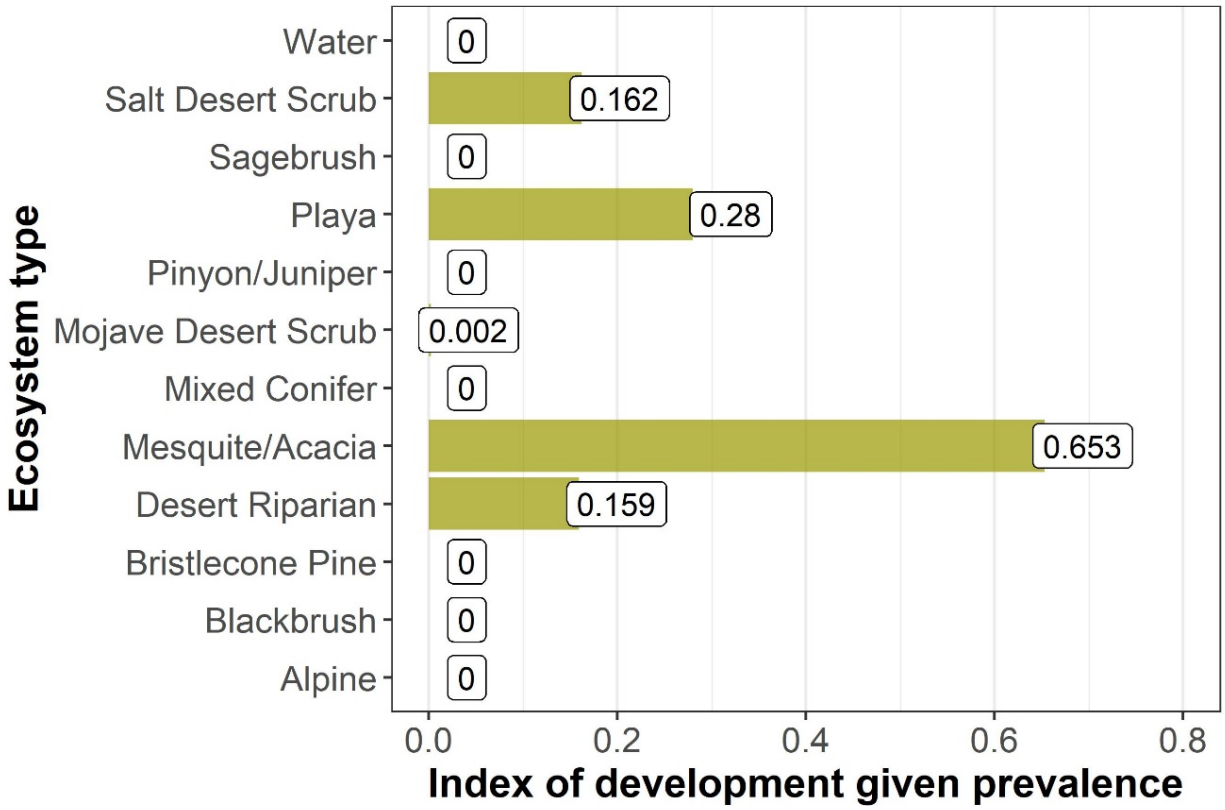
Figure 4. Index of disproportional habitat loss since the Permit began (2001-2019) as a function of the amount of each ecosystem in Clark County, Nevada



Values indicate the rate at which an ecosystem is being developed relative to its occurrence to visualize disproportionate disturbance in ecosystem types with low prevalence. Values calculated as proportion of ecosystem lost to development divided by proportion of Clark County comprised by that ecosystem type.

Disproportional loss analysis of recent development only (2017-2019) also showed a disproportionately high loss if Mesquite/Acacia, as well as lesser disproportionate losses of Playa, Salt Desert Scrub, and Desert Riparian (Figure 5).

Figure 5. Index of disproportional habitat loss during the 2017-2019 biennium in Clark County, Nevada



Values calculated as proportion of ecosystem lost to development divided by proportion of Clark County comprised by that ecosystem type.

These examples highlight that there are multiple factors to balance when assessing whether the rate of disturbance to an ecosystem warrants additional conservation action. At the level of Clark County and over the life of the Permit to-date (2001-2019), the Desert Riparian and Mesquite/Acacia ecosystems warrant conservation attention because of their proportionally high historic rate of development, whereas Mojave Desert Scrub warrants conservation attention because of its high overall amount of development. Recent development also resulted in disproportionately high loss of Mesquite/Acacia habitat, and, to a lesser extent, Playa, Salt Desert Scrub, and Desert Riparian.

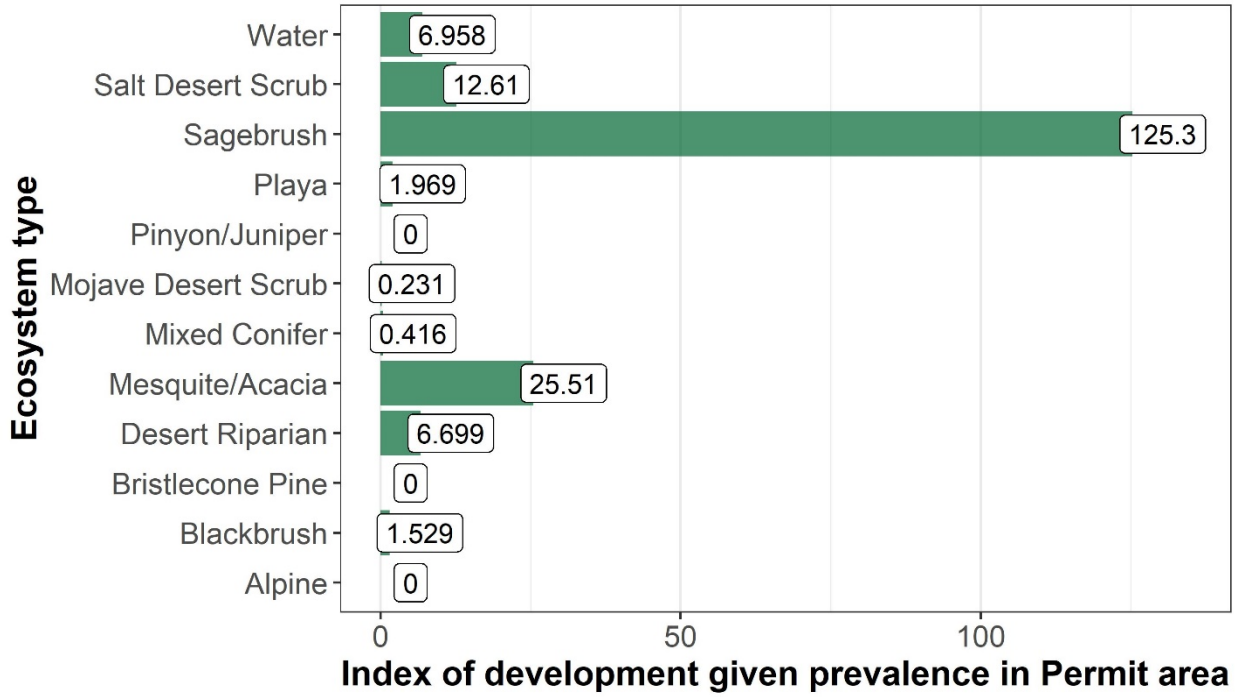
At the landscape level, the proportion of habitat loss in relation to ecosystem prevalence across the entirety of Clark County over all time periods is valuable (Figure 4). However, the MSHCP permit area, in which incidental take is allowed, does not cover the entirety of Clark County (see Section 1). An alternative relevant metric to track loss of ecosystem acreage is to focus on the areas that have been or could be developed under the MSHCP and to do so specific to the most recent biennium. This provides information on the proportionality of ecosystem loss relative to the total amount that could be lost under the MSHCP.

Using aerial imagery of existing disturbed acreage, property ownership GIS layers, and current federal designation of disposal boundaries, DCP staff calculated that 647,107 acres have been developed, or are potentially available to be developed under the MSHCP, as of March 2019 (i.e., private land or federal disposal lands not covered under conservation agreements; Figure 1). These are lands that, if developed, would fall under the administration of the MSHCP,

although the total acreage of these lands that can ultimately be developed is limited by the Permit to 167,650 acres. As part of biennial tracking of habitat loss specific to ecosystem, the Science Advisor Panel calculated the proportion of undeveloped acreage by ecosystem in 2001 and calculated the index of disproportionate loss over the life of the Permit (2001-2019). A second Permit-area disproportionate loss looked only at recent development (March 2017 – March 2019) compared to undeveloped ecosystem acreage as of March 2017 (this analysis focuses on the most recent AMR biennium and only the acres that could potentially be developed under the MSHCP). We note that development numbers were provided to the Science Advisor Panel by DCP staff and that total developed acreages in the county-wide analysis above do not match developed acreages in the MSHCP-wide analysis presented here. The DCP was not able to reconcile the different numbers, and it is expected that they will be resolved prior to the next AMR.

Over the life of the MSHCP, Sagebrush habitat has had the most disproportionate loss, primarily because it has such a low prevalence within portions of Clark County that could potentially be developed under the MSHCP (Figure 6). Following Sagebrush, Mesquite/Acacia, Salt Desert Scrub, and Desert Riparian have also shown disproportionately high rates of development.

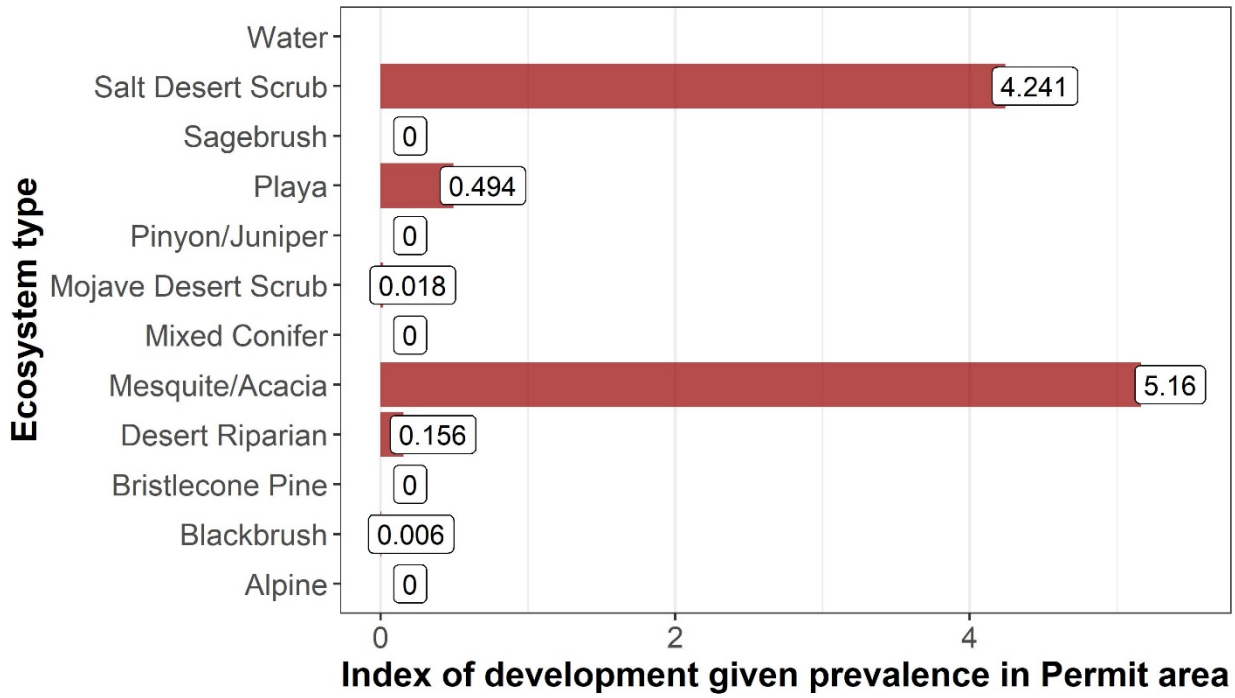
Figure 6. Long term habitat loss by ecosystem (2001-2019), proportional to its occurrence on acreage that could potentially be developed under the MSHCP (i.e., the Permit area)



Values calculated as proportion of ecosystem lost to development divided by proportion of the MSHCP Permit area comprised by that ecosystem type.

In contrast, during the most recent biennium (2017-2019), Sagebrush was not developed at all (Table 2) and therefore did not indicate disproportionate loss (Figure 7). Instead, Mesquite/Acacia and Salt Desert Scrub showed the most disproportionate loss. This agrees with the county-wide disproportionality loss results due to the low prevalence and comparatively high development of these ecosystem types at both the county-wide level and the potentially-developable land within the purview of the MSHCP.

Figure 7. Recent biennium habitat loss by ecosystem (2017-2019), proportional to its occurrence on acreage that could potentially be developed under the MSHCP (i.e., the Permit area) as of March, 2017



Values calculated as proportion of ecosystem lost to development divided by proportion of the MSHCP Permit area comprised by that ecosystem type.

3.1 Conclusions and recommendations for habitat loss by ecosystem analysis

Based on the Science Advisor Panel's assessment of habitat loss categorized by ecosystem, conclusions are:

- Mesquite/Acacia, Salt Desert Scrub, and Desert Riparian ecosystem types are rare both within the county (total 5.5%) and within the Permit area (total 6.5%), yet these ecosystem types were disproportionately highly developed both since 2001 and since 2017. We recommend conservation projects that focus on these ecosystem types to best counteract their relatively high rates of development.
- Aside from disproportionate development of rare ecosystem types, the majority of habitat loss was Mojave Desert Scrub. We recommend continued conservation projects that address the larger loss of this common ecosystem type.
- We recognize challenges associated with identifying and conserving Mesquite/Acacia ecosystems and land ownership challenges associated with conserving Salt Desert Scrub and Desert Riparian ecosystems. Nonetheless, these ecosystems are rapidly being developed in Clark County.

The following are recommendations from the Science Advisor Panel that are intended for DCP implementation:

- Develop conservation actions for those ecosystems undergoing the highest total loss and the highest proportional loss since both metrics could be important to the conservation and management of covered species.
    - Target future conservation actions specific to Desert Riparian, Mesquite/Acacia, Salt Desert Scrub, and Playa ecosystems due to their low prevalence and high historic and recent relative rate of development.
    - Target future conservation actions to Mojave Desert Scrub ecosystems due to the total high rate of habitat loss. Management of the Boulder City Conservation Easement (BCCE) and associated Mojave Desert Scrub restoration projects may already be sufficient to offset habitat loss.
- Reconcile developed acreages via GIS processing and analysis (e.g., snap to the same raster extent and resolution, snap vector boundaries, etc.). Two sets of numbers were provided to the Science Advisor Panel, especially highlighting an increase in total developed Mojave Desert Scrub acres when looking at a subset of the county compared to the whole county, which should not be possible.

These recommendations are similar to those made in the 2018 AMR and are still relevant.

Section 4 Effectiveness of management actions – analysis and discussion

The third assessment tool in the AMR states "Evaluate the effectiveness of management actions at meeting MSHCP goals of conservation and recovery" (USFWS 2000). Herein, the management actions are the various projects the DCP implements and manages (see Biennium Progress Reports for project descriptions, budgets, and timelines; Clark County 2019). To evaluate the effectiveness of project-based management actions, the Science Advisor Panel reviewed the project list and noted which BGO's were being addressed by each project. Tabulating the BGOs across multiple projects provided a simple metric to quantify outcomes to help assess the entire program and identify where gaps may exist. This analysis is anticipated to differ for each Biennial AMR, as it is dependent on the administered projects at that time and the adaptive management tools utilized by the DCP. Furthermore, this analysis will become increasingly quantitative with each AMR as concepts from the 2016 BGO and 2017 AMMP are further integrated into the DCP workflow.

The 2018 AMR indicated the AMMP B1 worksheets were to be implemented at the start of each project to document project expectations and outcomes with respect to the BGOs, and act as an evaluation tool at the conclusion of the project. The DCP continues to transition to this new process, and furthermore, the B1 worksheets have been reformatted for 2020 to better guide the tracking of BGOs at the project-level. The updated worksheet is anticipated to more directly link and quantify the project objectives with the BGOs, and the 2022 Biennium AMR will reflect this update.

The biological goals are summarized below (see TerraGraphics 2017 for complete description and corresponding biological objectives):

Riparian Goals:

Goal R1. Maintain or expand habitat on riparian reserve lands;

Goal R2. Maintain stable or increasing populations of T&E listed species on riparian reserve lands;

Goal R3. Foster community engagement;

Goal R4. Promote ecological resilience;

Desert Goals:

Goal D1. Maintain or expand habitat on desert upland reserve system lands;

Goal D2. Maintain stable or increasing populations of T&E listed species on desert reserve lands;

Goal D3. Foster community engagement; and

Goal D4. Promote ecological resilience.

To facilitate this assessment, the DCP provided the Science Advisor Panel with a list of master projects which included narratives describing each project, sub-project, and accomplishments (Clark County 2019). All projects and sub-projects were assigned by the DCP to one of seven categories, summarized below and in Table 3.

1. **AMP**. Components include contracting an independent Science Advisor Panel and design and implementation of research projects. Specific projects in this analysis include those for desert upland areas (submitting two papers for peer-reviewed publication, range-wide desert tortoise monitoring, occupancy sampling, predation studies, connectivity study, forage study, evaluation of drones for tortoise detection, and species and habitat monitoring in desert upland areas for birds, bats, and small mammals), and riparian reserve units (projects include surveys for birds, bats, small mammals, surveys for federally listed birds, and avian point-count surveys). There were 20 projects in this category that were assessed for addressing the biological goals; all 8 biological goals were addressed with the great majority of projects addressing goals R2, D1, and D2.
2. **BCCE projects** include property management and conservation, and research projects to benefit covered species. Specific projects in this category include weed surveys, fencing, site rehabilitation and cleanup, kiosk and signage, cultural resource survey, and law enforcement. A total of 15 projects were assessed in meeting the biological goals; all projects addressed biological goals D1, D2, D3 and/or D4.
3. **Conservation projects** include general funding of conservation actions to provide for conservation and recovery of covered species which may include research, habitat protection, or species inventory. Specific projects include fencing installation and maintenance at the Tule Spring Fossil Beds National Monument, installation of bat gates, Tule Springs Cultural Resource survey, and relict leopard frog conservation efforts. Four projects in this category addressed goals D1, D2, and D3.
4. **Public information, education, and outreach (PIE) projects** aim to inform the public about the MSHCP and include programs to encourage people to respect and protect the desert. Specific projects include Mojave Max appearances and branding, Off Highway Vehicle (OHV) outreach and education, and creating a Bearpoppy viewing ramada at the Springs Preserve. There were 6 projects assessed in this category which addressed goals D1, D2, and D3.
5. **Program administration and permit compliance** encompasses all aspects of implementing the MSHCP and complying with the incidental take permit. Specific projects include the MSHCP permit amendment, species distribution modeling, a habitat suitability model and species account summary for Joshua tree, a climate change workshop geared towards incorporating climate change in a Habitat Conservation Plan, acquisition of supplies, data analysis, legal services, and consultants. The 5 assessed projects in this category addressed all 8 biological goals.

6. **Riparian reserves projects** focus on acquiring private lands in desert riparian habitats to conserve habitat for riparian birds covered by the MSHCP. Specific projects include Muddy River restoration, design, vegetation clearing, habitat restoration, Virgin River restoration, Mormon Mesa restoration, fence and gate maintenance, weed management and removal, water rights consulting, and property acquisition. There were 14 riparian projects that addressed biological goals R1, R2, R3, and R4.
7. **Wild desert tortoise assistance projects** include operation of the wild desert tortoise assistance line, implementation of a translocation program, maintenance of tortoise exclusion fencing, tortoise monitoring, and research projects. Specific projects that were assessed here include wild desert tortoise hotline, telemetry on the BCCE, tortoise monitoring, and a pet tortoise sterilization clinic. There were 5 assessed projects that addressed goals D2 and D3.

Projects vary in magnitude (both in effort and in monetary scale), duration, and overall potential impact in achieving BGOs. There were 69 master projects and 261 sub-projects, of which 96 were classified based on the Biological Goal to which they contributed (e.g. many sub- projects were for supply acquisition, or services that were administrative in nature, and were thereby excluded from analysis) (Table 3 and Appendix C).

Table 3. Categories of projects tallied by which biological goals they support

Project Category	Number of projects and sub-projects assessed	R1	R2	R3	R4	D1	D2	D3	D4
AMP	20	4	6	3	3	13	12	5	8
BCCE	15	-	-	-	-	12	6	5	-
Conservation	4	-	-	-	-	1	1	3	-
PIE	6	-	-	-	-	2	1	6	-
Administration	5	3	3	1	3	4	3	1	3
Riparian	14	14	1	1	3	-	-	-	-
Wild desert tortoise	5	-	-	-	-	-	4	3	-

4.1 Conclusions and recommendations for management action effectiveness

Based on the Science Advisor Panel's assessment of management action effectiveness, conclusions are:

- Overall, the assessment of the effectiveness of the DCP's management actions is positive because all biological goals have projects that are either recently completed and/or are in progress.
- Classification of projects was conducted post-hoc and was based on information provided by the DCP (as it was for the 2018 AMR). For future implementation of concepts from the AMMP, each project should be cross-referenced with its applicable BGOs during project inception and should be validated during project close-out (TerraGraphics 2017). This will provide more consistent (and quantitative) data on which BGOs are applicable to each project and will be based on DCP staff's knowledge of each project.

The following are recommendations from the Science Advisor Panel that are intended for DCP implementation:

Implement all effectiveness worksheets, which are expected to be updated in 2020 (Appendix B of the AMMP). By doing so, and collating in a spreadsheet, direct quantitative assessment within the next Biennial AMR will be possible.

Section 5 Species status and population trends – analysis and discussion

The final assessment tool in the AMR states "*Monitor population trends and ecosystem health"* (USFWS 2000). The MSHCP directs the DCP to monitor the status and trends of covered species and their habitat to prevent loss or fragmentation of habitat for the benefit of stabilizing or increasing population numbers within Clark County (Clark County 2000, USFWS 2002). No quantitative goals were established at the initiation of the MSHCP; however, goals were to be developed over time through surveys, monitoring, and adaptive management.

Monitoring the status of populations and the habitats of MSHCP-covered species provides information on the benefits of conservation actions conducted by the DCP as part the MSHCP implementation. Additionally, monitoring can serve as a safeguard against failing to detect MSHCP-covered species population declines in spite of successful implementation of the MSHCP.

The recently completed AMMP outlines the rationale and general methodology for monitoring species' status and population trends for all MSHCP-covered species (TerraGraphics 2017). Monitoring will be used to record and evaluate species' population and habitat trends, and potentially to demonstrate the impact of conservation actions on the populations of MSHCP-covered species. Furthermore, the AMMP outlines how monitoring data will be used to conduct the new program-level adaptive management process. The adaptive management process for population and habitat of MSHCP-covered species is to be completed every 4 years and is separate from the Biennial AMR (see Section 1.3.1). The AMMP also requires all monitoring data to be synthesized and disseminated in the Biennial AMR.

This AMR contains the first adaptive management evaluation process outlined in the AMMP (Appendix B). Because this process is only to be conducted every four years, the 2022 AMR will not contain a full analysis of species status and population trends. Instead, the 2022 AMR will present graphs and tables expanding on the data presented in Appendix B. This will serve as a public update on species status and population trends in between the complete statistical analysis on species status and population trends contained in this 2020 AMR and as will be part of the 2024 AMR.

5.1 Adaptive management evaluation process

The evaluation of species status and trends is detailed in the AMMP with the required final output being a table stating whether each population and habitat trend is achieving targets or meeting triggers. Detailed write-up on input data, statistical methods, and full results are provided in Appendix B. Here, the output tables on targets and triggers is presented for reference (Table 4).

The AMMP specifies 24 species populations and two habitats that require monitoring and assessment of trends to determine whether those populations and habitats are stable, increasing, or declining. Data were available for statistical analysis for six species: desert tortoise, desert iguana, leopard lizard, blue grosbeak, phainopepla, and Arizona Bell's vireo. Surveys were also conducted for Great Basin collared lizard, yellow-billed cuckoo, southwestern willow flycatcher, summer tanager, and vermillion flycatcher, although sample sizes of observed

individuals were too low to allow for statistical analysis. However, data were quantitatively summarized for yellow-billed cuckoo and southwestern willow flycatcher to provide some level of analysis. Data on bats have been collected but have not been processed to present here. Data on desert upland plants have not been collected due to a lack of knowledge on the location of extant populations of most of those plants, although DCP is currently initiating a project to improve this knowledge. The types of data needed to measure and monitor riparian and desert upland habitat quality will be determined at a workshop in November 2020 and after that will be collected.

For five of the six species with sufficient quantitative data for statistical analysis, plus the quantitative assessment of yellow-billed cuckoo and southwestern willow flycatcher, populations were stable or increasing. The exception was phainopepla, which appeared potentially to be decreasing. However, the lack of statistical significance in the apparent decline meant that the statistical conclusion of phainopepla trends was 'no trend'. Therefore, phainopepla were also determined to be achieving the target of 'stable or increasing populations'. It is expected that by the next adaptive management evaluation there will be considerably more data for analysis for all species populations and habitats, in that there will be high statistical power to detect stable, increasing, or decreasing trends in the eight species that already have multiple years of data collection.

The judgement as to whether data were sufficient to make determinations of 'stable populations' was difficult. Ultimately, it highlighted the challenge of "proving" stability, which requires subjective determinations of what constitutes a stable population. This challenge is exacerbated by the fact that failing to detect a positive or negative trend is not evidence that no trend exists. This challenge could be overcome by revising the AMMP to focus on statistical analysis for triggers being met, with the ultimate conclusions being a yes or no. In this case, there is no need to 'prove' stability, only to prove population declines.

Table 4. Targets and trigger results for species populations and habitat trends specified in the AMMP. Detailed methods and results are presented in Appendix B

Monitoring survey	Covered species group	Species	Target	Target achieved?	Trigger	Trigger met?
Occupancy sampling	Desert upland reptiles	**Desert tortoise**	Stable or increasing populations across desert upland reserve lands during the assessment period	YES	Decreasing populations across desert upland reserve lands during the assessment period	NO
		Great Basin collared lizard		N/A		N/A
		Desert iguana		YES		NO
		Large-spotted leopard lizard		YES		NO
Federal protocol	-	**Yellow-billed cuckoo**	Stable or increasing populations across riparian reserve lands during the assessment period	YES	Decreasing populations across riparian reserve lands during the assessment period	NO
Federal protocol	-	**Southwestern willow flycatcher**	Stable or increasing populations across riparian reserve lands during the assessment period	YES	Decreasing populations across riparian reserve lands during the assessment period	NO
Point count	Riparian birds	Blue grosbeak	Stable or increasing populations across riparian reserve lands during the assessment period	YES	Decreasing populations across riparian reserve lands during the assessment period	NO
		Phainopepla		YES		NO
		Summer tanager		N/A		N/A
		Vermillion flycatcher		N/A		N/A
		Arizona Bell's vireo		YES		NO
Passive acoustic occupancy	Bats	Silver-haired bat	Stable or increasing populations across reserve lands during the assessment period	N/A	Decreasing populations across reserve lands during the assessment period	N/A
		Long-eared myotis		N/A		N/A
		Long-legged myotis		N/A		N/A
Species-specific	Desert upland plants	Sticky ringstem	Stable or increasing populations across reserve lands during the assessment period	N/A	Decreasing populations across reserve lands during the assessment period	N/A
		Las Vegas bearpoppy		N/A		N/A
		White bearpoppy		N/A		N/A
		Rosy king sandwort		N/A		N/A
		Threecorner milkvetch		N/A		N/A
		Alkali mariposa lily		N/A		N/A
		Blue Diamond cholla		N/A		N/A
		Forked (Pahrump Valley) buckwheat		N/A		N/A
		Sticky buckwheat		N/A		N/A
		White-margined beardtongue		N/A		N/A
TBD	Riparian	Habitat quality	Stable or increasing habitat quality across riparian reserve lands during the assessment period	N/A	Decreasing habitat quality across riparian reserve lands during the assessment period	N/A
TBD	Desert upland	Habitat quality	Stable or increasing habitat quality across desert upland reserve lands during the assessment period	N/A	Decreasing habitat quality across desert upland reserve lands during the assessment period	N/A

5.2 Conclusions and recommendations for species status and trends analysis

Based on the analysis of the available species population data, all populations were determined to be stable or increasing. The adaptive management action process does not need to be enacted. Additional conclusions are:

- The next adaptive management evaluation process will be performed in conjunction with the 2024 AMR.
- The 2022 AMR must display species population and habitat data without requiring statistical analysis (e.g., updating the tables and graphs in Attachment A of Appendix B [the Species and Habitat Monitoring Criteria analysis]).

The following are recommendations from the Science Advisor Panel that are intended for DCP implementation:

- Prior to the next adaptive management evaluation process, the Science Advisor Panel and DCP should discuss the targets and triggers metric to resolve the statistical and practical difficulty of attempting to ascertain 'population stability'. One potential solution would be to only assess whether triggers are being met to identify population declines, with the lack of a statistically significant population decline being sufficient population performance.
- The remaining species populations and habitats should have monitoring plans developed and enacted as soon as is feasible.
- The DCP should consider starting monitoring and reporting for species that are expected to be of management or conservation concern in the future, for example due to Permit amendment or future state or federal listing status.

Section 6 Summary of conclusions and recommendations

This Biennial AMR describes the independent analysis and subsequent conclusions and recommendations from the Science Advisor Panel's assessment of land use trends, habitat loss by ecosystem, the effectiveness of management actions at meeting MSHCP goals, and population trends and ecosystem health (see Table 5 for a summary).

Table 5. Summary of conclusions for all assessments performed by the Science Advisor Panel for the 2020 Biennial AMR

Assessment section	Summary of conclusions
Section 2—Analyze all land-use trends in Clark County to ensure that take and habitat disturbance are balanced with conservation.	General habitat loss is commensurate with what is expected given the timeline of the Permit and in a general sense, current conservation actions reflect a focus that is appropriate given the rates and patterns of habitat take.
Section 3—Track habitat loss by ecosystem.	Mesquite/Acacia, Desert Riparian, Salt Desert Scrub, and Mojave Desert Scrub ecosystems may warrant conservation attention because of either their total habitat loss or proportionally high historic rate of development.

Assessment section	Summary of conclusions
Section 4—Evaluate the effectiveness of management actions at meeting MSHCP goals of conservation and recovery	All biological goals have projects that are either recently completed and/or are in progress.
Section 5—Monitor population trends and ecosystem health.	All species with sufficient data for statistical trend analysis were determined to have stable or increasing trends. Targets were achieved for those eight species. The next adaptive management evaluation in the 2024 AMR will leverage considerably more monitoring information as monitoring programs are developed and implemented.

Recommendations for each assessment are described in their corresponding sections and are summarized in Table 6, below.

Table 6. Summary of recommendations for all assessments performed by the Science Advisor Panel for the 2020 Biennial AMR

Assessment section	Summary of recommendations
Section 2—Analyze all land-use trends in Clark County to ensure that take and habitat disturbance are balanced with conservation.	The Science Advisor Panel does not have any specific recommendations for the DCP to implement in this section.
Section 3—Track habitat loss by ecosystem.	Develop conservation actions for ecosystems undergoing the highest total habitat loss and the highest proportional habitat loss since both metrics could be important to the conservation and management of covered species. These include: o Desert Riparian, Mesquite/Acacia, Salt Desert Scrub, and Playa ecosystems due to their low prevalence and high historic and recent relative rate of development. o Mojave Desert Scrub ecosystems due to the total high rate of habitat loss. Reconcile developed acreages via GIS processing and analysis. Two sets of numbers were provided to the Science Advisor Panel, especially highlighting an increase in total developed Mojave Desert Scrub acres when looking at a subset of the County compared to the whole County, which should not be possible.

Assessment section	Summary of recommendations
Section 4—Evaluate the effectiveness of management actions at meeting MSHCP goals of conservation and recovery	Implement all effectiveness worksheets, which are expected to be updated in 2020 (Appendix B of the AMMP). By doing so, and collating in a spreadsheet, direct quantitative assessment within the next Biennial AMR will be possible..
Section 5—Monitor population trends and ecosystem health.	Prior to the next adaptive management evaluation process, the Science Advisor Panel and DCP should discuss the targets and triggers metric to resolve the statistical and practical difficulty of attempting to ascertain 'population stability'. One potential solution would be to only assess whether triggers are being met to identify population declines, with the lack of a statistically significant population decline being sufficient population performance. The remaining species populations and habitats should have monitoring plans developed and enacted as soon as is feasible. The DCP should consider starting monitoring and reporting for species that are expected to be of management or conservation concern in the future, for example due to Permit amendment or future state or federal listing status.

The Science Advisor Panel's overall appraisal, based on the above four primary assessments (summarized in Table 5 and Table 6), is that the DCP is successfully implementing the current MSHCP. In addition, the updates and improvements in tracking, program-level analysis, and reporting is expected to allow for more quantitative rigor in future assessments.

Section 7 References

Alta Science and Engineering, Inc. 2018. 2018 Biennial Adaptive Management Report. December 15, 2017.

Clark County. 2000. Final Clark County Multiple Species Habitat Conservation Plan and Environmental Impact Statement for Issuance of a Permit to Allow Incidental Take of 79 Species in Clark County, Nevada. Prepared by RECON for the Desert Conservation Program. September 2000.

Clark County 2019. 2017-2019 Biennium Progress Report. November 2019. http://www.clarkcountynv.gov/airquality/dcp/Documents/Library/dcp%20reports/2019/2019-2021_IPB%20Report_Final.pdf

Desert Conservation Program (DCP). 2019. Quarterly Administrator Update, January – March 2019. 11 pp.

Enduring Conservation Outcomes (ECO). 2010. Final Adaptive Management Report, Clark County Multiple Species Habitat Conservation Plan. June 15, 2010.

ECO. 2016. 2016 Adaptive Management Report, Clark County Multiple Species Habitat Conservation Plan. December 18, 2015.

Heaton, J. S., X. Miao, K. Von Seckendorff Hoff, D. Charlet, P. Cashman, J. Trexler, A. Grimmer, R. Patil. 2011. Final Report 2005-UNR-578. Report to Clark County MSHCP 2005-UNR-578:D27

TerraGraphics Environmental Engineering, Inc. 2017. Adaptive Management and Monitoring Plan. Prepared for Clark County DCP. January 9, 2017.

U.S. Fish and Wildlife Service (USFWS). 2000. Intra-Service Biological Opinion and Conference Opinion on Issuance of an Incidental Take Permit to Clark County, Nevada for a Multiple Species Habitat Conservation Plan. File No. 1-5-00-FW-575. November 19, 2000.

USFWS. 2001. Federal Fish and Wildlife Permit Number TE034927-0. Clark County MSHCP Permittees. Effective January 9, 2001.

USFWS. 2002. Memorandum of Agreement among United States Bureau of Land Management, National Park Service, Unites States Department of Agriculture-Forest Service, United States Fish and Wildlife Service (Refuges), United States Fish and Wildlife Service (Ecological Services) and Clark County, Nevada in its Capacity as Administrator of the Desert Conservation Program Regarding Adaptive Management of the Clark County Multiple Species Habitat Conservation Plan. December 12, 2002.

USFWS, BLM, USFS, NPS, NDOW, NDF, NDSP, NDOT, Clark County, and the cities of Las Vegas, North Las Vegas, Boulder City, Henderson, and Mesquite. 2000. Clark County Multiple Species Habitat Conservation Plan Implementing Agreement. November 2000.

Appendix A
Summary of Recommendations from Previous Biennial AMR

desert conservation PROGRAM

Response to Recommendations From 2018 AMR

Alta Science & Engineering, Inc.

Desert Conservation Program (DCP)

Comment Number	Document Section, Page and Paragraph	Recommendation text from 2018 AMR	DCP comments; description of how recommendation has been addressed
1	Sec 3.1, Page 14, Paragraph 2, Bullet 1	"Develop conservation actions for those ecosystems undergoing the highest total loss and the highest proportional loss since both metrics could be important to the conservation and management of covered species. -Target future conservation actions specific to Desert Riparian, Mesquite/Acacia, and Playa ecosystems due to their low prevalence and high historic and recent relative rate of development. -Target future conservation actions to Mojave Desert Scrub ecosystems due to the total high rate of habitat loss. Management of the Boulder City Conservation Easement (BCCE) and associated Mojave Desert Scrub restoration projects may already be sufficient to offset habitat loss."	Over the last two years the county has completed one acre of mesquite restoration on the muddy river. We are also in different phases of restoration across the muddy and virgin river to restore approximately 30-50 acres of desert riparian and another approximately 24 acres of mesquite/acacia. We have been working with BLM to try and initiate restoration activities on the BCCE within the right-of-ways but it has been taking an extremely long time to obtain the necessary approvals. that project will hopefully start in 2020
2	Sec 3.1, Page 14, Paragraph 2, Bullet 2	"Assess available data and tools that may be used to update the ecosystem map every five years."	DCP has begun a complete overhaul of the ecosystems map to a more detailed US National Vegetation Classification System. This will be completed in multiple phases and will replace the old ecosystems maps for
3	Sec 3.1, Page 14, Paragraph 2, Bullet 3	"Conduct an accuracy assessment of any future ecosystem mapping analyses to determine the uncertainty inherent in the calculations of ecosystem loss, rate of loss, and proportion of loss."	We will be conducting an accuracy assessment with the new ecosystems map project.
4	Sec 4.1, Page 18, Paragraph 2, Bullet 1	"Implement all effectiveness worksheets (Appendix B of the AMMP). By doing so, and collating in a spreadsheet, direct quantitative assessment within the next Biennial AMR will be possible. This recommendation is likely already being implemented; however, the Science Advisor Panel stresses its	This is currently in progress and should be completed before the next AMR

Desert Conservation Program (DCP)

Comment Number	Document Section, Page and Paragraph	Recommendation text from 2018 AMR	DCP comments; description of how recommendation has been addressed
5	Sec 4.1, Page 18, Paragraph 2, Bullet 2	"When the Science Advisor Panel is providing recommendations during the Implementation Plan and Budget (IPB) process, they should link projects and/or concepts to specific recommendations from the most recent Biennial AMR. For example, this Biennial AMR recommends specific conservation focus on Mesquite/Acacia and Playa habitats. This provides direction and	*The SAP thinks this comment was mis-categorized in the 2018 AMR. It was placed in the subsection for DCP implementation, but is directed at the SAP*.
6	Sec 5.3, Page 21, Paragraph 2, Bullet 1	"Calculate population growth rates for desert tortoise and riparian bird populations when sufficient data have been collected."	For species where there were enough detections trends were stable or increasing as shown in the appendix to this AMR
7	Sec 5.3, Page 22, Paragraph 2, Bullet 2	"Identify a fragmentation metric(s) to monitor fragmentation in order to address the general goal of "allow no net unmitigated loss or fragmentation of habitat…" listed in Section 2.1.6 of the MSHCP (Clark County 2000)."	This is being completed by the science advisor for inclusion in this AMR
8	Sec 6.1, Page 23, Paragraph 1, Listed item 1 Paragraph 2 Bullets 1-2	"Integrating the BGOs and AMMP into current workflow is a task that is not explicitly addressed in a proposed project or upcoming deliverable. The Science Advisor Panel recommends a planning level task that includes both: -Detailing the current DCP workflow, which generally includes mapping the steps and processes from beginning to end—ranging from project selection (e.g., the IPB) to key data entry and retention for individual projects, to reporting and feedback loops; and -Reorganizing the workflow (if necessary) to explicitly include data needs described in the AMMP for both the Biennial AMR and the more in-depth quadrennial report. The AMMP describes the types of data required, but does not provide specifics on data fields, etc., or how the data will be stored to accommodate common analysis between projects.	I think the current process of completing the AMR/AMMP will shed more light on the kind of information that is necessary to have called out in future reporting and thus will be more easily incorporated into the projects workflow.
9	Sec 6.1, Page 23, Paragraph 1, Listed item 2 Paragraph 1	"The Science Advisor Panel recommends that DCP continue to do the monitoring that is needed to conduct the analyses included in this report, including continuing to monitor habitat loss by evaluating total loss and rate of loss (Section 2), continuing to monitor habitat loss by ecosystem by evaluating total loss, rate of loss, and proportion of loss (Section 3), continuing to evaluate ecosystem loss within the county and within the MSHCP area (Section 3), continuing to monitor the desert tortoise and riparian bird	We have continued to do all those things

Science Advisory Panel (SAP)

Comment Number	Document Section, Page and Paragraph	Recommendation text from 2018 AMR	SAP comments; description of how recommendation has been addressed
1	Sec 2.2, Page 9, Paragraph 2, Bullet 1	"As part of analysis during the next Biennial AMR, the Science Advisor Panel should consider calculating habitat loss across similar time periods (i.e., each 2 years to correspond to the Biennial AMR) to make direct comparisons regarding the rate of habitat loss between 2-year time periods."	Developed acres has varied widely from biennium to biennium, making any individual biennium largely uninformative for projecting future development. Nonetheless, the 2020 AMR now include projections of development based on the average development rate across all bienniums and the recent development rate from the past two bienniums.
2	Sec 2.2, Page 9, Paragraph 2, Bullet 2	"As part of analysis during the next Biennial AMR, the Science Advisor Panel should consider projecting the rate of future expended permitted acres for the entire MSHCP period. This could forecast when all permitted acres will be developed."	This action was incorporated in Section 2 of the 2020 AMR.
3	Sec 2.2, Page 9, Paragraph 2, Bullet 3	"As part of analysis during the next Biennial AMR, the Science Advisor Panel should consider evaluating habitat quality of remaining habitat, with regards to the survival of covered species, as data on habitat quality becomes available."	There are no data available to quantify habitat quality. This will be a topic at the habitat monitoring workshop that is scheduled for Nov 2020.
4	Sec 5.3, Page 21, Paragraph 2, Bullet 1	"Calculate population growth rates for desert tortoise and riparian bird populations when sufficient data have been collected."	The adaptive management evaluation appendix to the 2020 AMR contained statistical analysis of population trends for desert tortoise, Great Basin collared lizard, leopard lizard, blue grosbeak, phainopepla, and Arizona Bell's vireo. A quantitative summary of population trends was calculated for yellow-billed cuckoo and southwestern willow flycatcher. All other species either had too few detections for statistical analysis or monitoring data are not yet available/collected.
5	Sec 5.3, Page 22, Paragraph 2, Bullet 2	"Identify a fragmentation metric(s) to monitor fragmentation in order to address the general goal of “allow no net unmitigated loss or fragmentation of habitat…” listed in Section 2.1.6 of the MSHCP (Clark County 2000)."	Basic fragmentation metrics are calculated in the Attachment B of Appendix B of this document. This will be a topic at the habitat monitoring workshop that is scheduled for Nov 2020.

Appendix B
Adaptive Management Evaluation

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M E M O R A N D U M

To: Scott Cambrin, Clark County Desert Conservation Program, Las Vegas, Nevada

From: Tarita Harju, Alta Science & Engineering, Inc., Kellogg, Idaho
Seth Harju, Heron Ecological, Kingston, Idaho

Date: February 7, 2020

Job Code: 2017-ALTA-1730A, D42, WAF 007

Subject: **2020 Adaptive Management Evaluation - Final**
(Adaptive Management Monitoring Plan Table 4)

Section 1 Introduction

The Adaptive Management and Monitoring Plan (AMMP; TerraGraphics 2017) was developed based on the 2016 Biological Goals and Objectives (BGOs). It provides the technical direction for collecting and assessing monitoring data, determining the success of the conservation actions in achieving the BGOs, and maintaining or enhancing populations of Multiple Species Habitat Conservation Plan (MSHCP)-covered species and their habitats through an adaptive management process. The incorporation of relevant and quantitative data and information obtained through systematic and consistent monitoring is a fundamental component of the AMMP. This information is used to periodically evaluate achievement of criteria set forth in the AMMP, with an emphasis on learning from past actions and making necessary changes. The following excerpt from the AMMP lists the evaluation timeline for both analyzing monitoring data and the adaptive management process (TerraGraphics 2017):

- The adaptive management evaluation process is a regular, systematic, recurring process to be performed every four years.
- The adaptive management action process occurs when necessary, beginning at the four-year evaluation interval and continuing until the actions have met their stated goals.
- Analysis of monitoring data for reporting purposes can occur at any time as individual projects dictate, but at a minimum should be conducted every two years as part of the Biennial AMR to serve as a benchmark for conservation progress. Additionally, a more in-depth analysis should take place as part of the adaptive management evaluation (see first bullet).
- Quantification and reporting of project-level progress that leads to the achievement of BGOs should be part of the adaptive management evaluation (see first bullet).

This memorandum describes the analysis and results of the first Adaptive Management (AM) Evaluation, to be conducted every four years (as described in the bullets above). Integration of concepts and analyses from the AMMP into DCP workflow are occurring at an intentional pace. For example, projects are ongoing and begin at various times; therefore, it is unreasonable to expect that all projects have the required data for the AM Evaluation at this first four-year benchmark. This evaluation is considered a baseline evaluation and we anticipate modifications to the criteria that are evaluated, as well as to the methods and analysis used in evaluation.

There are two sets of criteria included in the AMMP and both are evaluated in this memorandum:

- BGO performance periods and performance criteria (Section 2, below).
- Species and habitat monitoring criteria (Section 3, below).

Section 2 Evaluation of BGO performance periods and criteria

The BGOs and the AMMP were initially drafted in 2016 and the AMMP was not finalized until January of 2017. Evaluation of the BGO performance periods and criteria focuses on 2017 – 2019; however, data and/or projects that began prior to 2017 may be discussed if information was readily available. The AMMP is a living document and is intended to be modified as the need arises. BGOs and associated performance periods and criteria, as they were originally written in the AMMP, were especially intended to be modified over time. They are an initial mechanism to quantitatively evaluate DCP actions and determine BGO achievement. For several of the BGO evaluations in the sub-sections below, we suggest reviewing the performance periods and/or performance criteria to ensure they are applicable and have a clear interpretation/intent.

Consolidating and scaling up quantitative data from the project-level to a program-level AM Evaluation is challenging and DCP is working to find an efficient tracking mechanism. The AMMP includes one tool for this task—the "Effectiveness Monitoring for Individual Conservation Projects", B1-Worksheet (Appendix B of the AMMP; TerraGraphics 2017). The Science Advisor Panel and DCP Staff have tested the B1-Worksheet on projects at several stages—from project inception to near completion—and a second version of the B1-Worksheet will be tested in 2020. Ideally, project level achievement, as it relates to each BGO, would be reported using a consistent template (such as the B1-Worksheet) and the every-four-year AM Evaluation would review the worksheets to determine if BGO performance periods and criteria are being achieved overall on a program level. In lieu of having a seamless mechanism in place to scale project-level results up, this AM Evaluation relies on readily available data, progress reports, and informal interviews with key DCP staff.

The 2016 BGOs are listed in Table 1 and each has a separate sub-section for its evaluation.

Table 1. 2016 Biological Goals and Objectives (BGOs)

Goal R 1: Maintain, improve, and expand habitat for the MSHCP-covered species on riparian reserve system lands
Objective R 1.1: *Monitor MSHCP-covered species occupancy*
Objective R 1.2: *Maintain and/or increase suitable breeding habitat for MSHCP-covered birds*
Objective R 1.3: *Incorporate elements of natural riparian processes into restoration design and implementation*
Objective R 1.4: *Inventory, remove, and control invasive and non-native plant species*
Objective R 1.5: *Reduce habitat fragmentation and/or improve connectivity and habitat quality through restoration design and implementation*
Objective R 1.6: *Acquire riparian property at an equivalent rate as take*
Goal R 2: Maintain stable or increasing populations of federally-listed threatened and endangered (T&E) species on riparian reserve system lands
Objective R 2.1: *Monitor and adaptively manage for breeding bird populations*
Goal R 3: Foster community and stakeholder engagement to benefit covered species
Objective R 3.1: *Collaborate with other stakeholders on project/mitigation work (e.g., agencies, permittees)*
Objective R 3.2: *Promote responsible recreation (e.g., signage, education)*
Goal R 4: Promote ecological resiliency on riparian reserve system lands
Objective R 4.1: *Identify critical uncertainties and address these through planning and adaptive management, when feasible (land use changes, catastrophic events–fire, climate change)*
Objective R 4.2: *Identify critical connectivity corridors for covered species, prioritize acquisition and/or conservation where feasible*
Goal D 1: Maintain, improve, and expand habitat for MSHCP-covered species on desert upland reserve system lands
Objective D 1.1: *Monitor MSHCP-covered species occupancy*
Objective D 1.2: *Maintain existing intact functioning habitat and restore degraded habitat (D 1.1 determines degree of habitat functionality)*
Objective D 1.3*: Protect and conserve habitat for covered plants and physically protect plants with specific requirements*
Objective D 1.4: *Inventory, remove, and control invasive and non-native plant species*
Objective D 1.5: *Reduce habitat fragmentation and/or improve connectivity through restoration design and implementation*
Goal D 2: Maintain stable or increasing populations of Federal T&E-listed species on desert upland reserve system lands
Objective D 2.1: *Monitor and adaptively manage for desert tortoise populations*
Objective D 2.2: *Augment populations through translocation programs when appropriate*

Table 1. 2016 Biological Goals and Objectives (BGOs)

Goal D 3: Foster community and stakeholder engagement to benefit covered species
Objective D 3.1: *Collaborate with other stakeholders on project/mitigation work (e.g., agencies, permittees)*
Objective D 3.2: *Promote responsible recreation (e.g., signage, education)*
Objective D 3.3: *Provide law enforcement within reserve system*
Objective D 3.4: *Educate project proponents and construction personnel about procedures for reporting desert tortoises that occur on project sites and provide a mechanism for collection and relocation of tortoises in collaboration with USFWS*
Goal D 4: Promote ecological resiliency on desert upland reserve system lands
Objective D 4.1: *Identify critical uncertainties and address these through planning and adaptive management, when feasible (land use changes, catastrophic events–fire, climate change)*
Objective D 4.2: *Identify critical connectivity corridors for covered species, prioritize conservation and/or acquisition of corridors, and increase permeability for species movement where feasible*

R1.1. Monitor MSHCP-covered species occupancy

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Monitor MSHCP-covered species occupancy in suitable habitat every _1_ year(s). Evaluate progress towards objective using AM framework every _4_ years.	Demonstrate that MSHCP-covered species are monitored every _1_ year(s).

The AMMP describes MSHCP-covered species monitoring (Section 2.5 of the AMMP; TerrraGraphics 2017). Species that are recommended for monitoring are listed in Table 5 of the AMMP (TerraGraphics 2017), and excerpted as Table 1 in the *Evaluation of Species and Habitat Monitoring Criteria* (Attachment A). The riparian species recommended for monitoring include seven avian species and three species of bats (the bat species are listed as using both upland and riparian habitat in the AMMP). All riparian avian species had monitoring data collected in 2017, 2018, and 2019 (Attachment A), and acoustic bat monitoring began in 2018 and continued in 2019. Bats were not monitored in 2017, however, a one-year lag between the completion of the AMMP in January 2017 and commencing on-the-ground monitoring is acceptable. Acoustic bat monitoring is included in the 2019-2021 Implementation Plan and Budget (IPB; Clark County 2018) and the frequency of monitoring in the future will be determined by the 2018-2019 monitoring data.

Performance Period(s)	Performance Criteria	Conclusions	
Monitor MSHCP-covered species occupancy in suitable habitat every _1_ year(s). Evaluate progress towards objective using AM framework every _4_ years.	Demonstrate that MSHCP-covered species are monitored every _1_ year(s).	✓	All avian species have been monitored annually since 2017. Monitoring for bats began in 2018 and will be conducted annually.

R1.2. Maintain and/or increase suitable breeding habitat for MSHCP-covered birds

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Monitor changes in suitable breeding habitat across riparian reserve lands every _2_ year(s). Evaluate progress towards objective using AM framework every _4_ years.	Demonstrate stable or increasing acreage of suitable breeding habitat across riparian reserve lands for all MSHCP-covered birds. Demonstrate stable or increasing patch size of suitable breeding habitat across riparian reserve lands for all MSHCP-covered birds.

There is currently no measure for habitat being collected (Attachment A). Detailed topographic information (LiDAR) and high resolution aerial photography were acquired in 2019 and are planned to be used to establish baseline condition of vegetation communities and structure as a basis for habitat monitoring, which can commence after baseline is established.

Since the AMMP was finalized in January of 2017, 317.83 acres of riparian reserve unit land has been acquired (BGO R1.6, below). With these acquisitions, it is reasonable to assume that the suitable breeding habitat for MSHCP-covered birds has not decreased (i.e., any theoretical decrease in suitable breeding habitat on existing reserve lands would have been compensated for by the acquisition of new land). Additionally, to the knowledge of DCP staff, there has been no development or destruction of suitable breeding habitat since 2016. DCP staff visit the reserve units regularly (where accessible) and apprise themselves of any changing land conditions.

Performance Period(s)	Performance Criteria	Conclusions	
Monitor changes in suitable breeding habitat across riparian reserve lands every _2_ year(s). Evaluate progress towards objective using AM framework every _4_ years.	Demonstrate stable or increasing acreage of suitable breeding habitat across riparian reserve lands for all MSHCP-covered birds.	✓	Since habitat is not being monitored yet, the performance period "*monitor changes…every 2 years*" is not being met. However, it is reasonable to assume that the performance criteria are being met because of the 317 acre reserve unit acquisition since 2017.
	Demonstrate stable or increasing patch size of suitable breeding habitat across riparian reserve lands for all MSHCP-covered birds.	✓	

R1.3. Incorporate elements of natural riparian processes into restoration design and implementation

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Evaluate progress towards objective using AM framework every 4 years.	Riparian restoration projects [and/or] plans demonstrably include elements of natural riparian processes as appropriate. Riparian restoration projects demonstrate functionality after 6 years or as established during project initiation.

This BGO has two criteria—the first criteria can be achieved by implementation and/or through planning documents. In future evaluations, any projects that are a result of a planning document will be assessed for follow-though with the implementation of natural riparian processes. The second criteria can only be fully achieved after an on-the-ground project has reached full efficacy. Project-level monitoring after implementation but before the project reaches full efficacy may be used as an interim measure of achievement. For the current evaluation, no on-the-ground projects have reached full efficacy and we did not have access to post-implementation project data for an interim assessment (note: post-implementation monitoring data/success is not a requirement of this criterion).

The 2017-2019 Biennium Progress Report (Clark County 2019a) was the primary resource used to evaluate whether riparian projects met the first criterion of "…*demonstrably include elements of natural riparian processes*". This criterion can be met either by implementation projects or through planning documents. Its intention is that if a project could include natural riparian processes (such as using native plants, considering hydrologic conditions required for germination and/or survival, etc.), that it does.

The following riparian projects appear to include elements of natural riparian processes based on language in the 2017-2019 Biennium Progress Report (Clark County 2019a):

Riparian Project 2—Integrated Watershed Plan for the Lower Virgin River.

Riparian Project 3—Muddy River Restoration, Parcels A-E (restoration of approximately 25 acres).

Riparian Project 4—Muddy River Restoration, Parcel E (non-native vegetation removal and planting native riparian species, includes continued monitoring).

Riparian Project 5—Muddy River Restoration, Parcels G-I (includes a Muddy River restoration plan that includes language such as "planting zone map" and "increase connectivity to the riparian zone…".

Riparian Project 6—Virgin River Restoration (includes the Virgin River restoration plan for Mormon Mesa, Phase I, and the Mormon Mesa restoration project that specifies mastication of non-native tamarisk simultaneous with care being taken to not damage or remove native riparian species.)

None of the projects reviewed in the 2017-2019 Biennium Progress Report clearly excluded natural riparian processes.

In addition to the projects listed above, the *Riparian Reserves Management Plan* (Clark County 2019b) includes the following language in its Management Action Descriptions, #1.2 "…incorporate natural riparian processes wherever possible".

During future evaluations, both criteria for this objective should be able to rely on project effectiveness worksheets (B-1 worksheets) to gauge the level of achievement.

Performance Period(s)	Performance Criteria	Conclusions	
Evaluate progress towards objective using AM framework every 4 years	Riparian restoration projects [and/or] plans demonstrably include elements of natural riparian processes as appropriate.	✓	Seven out of seven projects reviewed incorporated natural riparian processes.
	Riparian restoration projects demonstrate functionality after 6 years or as established during project initiation.	NA	Cannot evaluate at this time. No projects have reached full efficacy that were initiated in 2017 or later.

R1.4. Inventory, remove, and control invasive and non-native plant species

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
For locations where non-native and invasive species have been treated, monitor every 1 year until 2 consecutive years indicate no remaining individuals. Then monitor every 4 years, at a minimum. For locations where non-native and invasive species are located but not treated, monitor every 1 year(s) to ensure no expansion into surrounding area. Evaluate progress towards objective using AM framework every 4 years.	Demonstrate effective control or reduction (as appropriate) of invasive and non-native species at treated locations across riparian reserve lands. Demonstrate reduction of invasive species across riparian reserve lands.

This BGO has two performance periods and two criteria, none of which have formal tracking mechanisms. The DCPs primary contract for weed control is with the National Park Service. The National Park Service treats weeds on the reserve units similarly to how they do on their own land—this cooperative approach appears to be very effective at controlling weeds, but does not lend itself to tracking the presence and treatment of non-native species as specified for the performance periods and criteria. Additionally, the performance period specifying "monitor every 1 year until 2 consecutive years indicate no remaining individuals…" may not accurately be able to track whether a non-native patch is eradicated. The varying hydrologic conditions each year may mean that a prolific weed in one year is scarce the next year and vice-versa.

The following is a summary of information gleaned from NPS annual report (NPS 2018a).

Weed surveys and project activities are conducted on nine Muddy River parcels (Muddy River Reserve Units A, B, C, D, E, F, G, H, and I). Treatment of non-native plants are completed in a prioritized manner based on the targeted species listed from the Southern Nevada Cooperative

Weed Management Area (SNCWMA). Surveys are conducted systematically using a grid pattern to cover each property. Survey and subsequent treatment is conducted twice per year; once in the winter and once in the spring/summer. Multiple surveys each year are designed to detect a variety of species that may emerge during weather patterns related to the seasons.

The report supplied by NPS shows survey and treatment data for 2015, 2016, and 2018 (skipping 2017), however, the methods section indicates that a survey was conducted in 2017. The 2015-2018 survey and treatment data show that in general, a similar gross-acreage of weeds are still present; however, the species of weeds vary year to year and the area they infest overlap each other, which could be a combined result of the previous years' treatments and weather patterns. Several species surveyed and treated in 2016 were not present in 2018, indicating control/reduction, as required in the BGO performance criteria.

The NPS also controls non-native plants on the Virgin River Property and we assume similar methods / approach is implemented (a final report and/or data was not readily available at the time of this evaluation, but information provided in the 2017-2019 Biennium Progress Report [Clark County 2019a] indicates similar activities are conducted).

<table>
<tr><th>Performance Period(s)</th><th>Performance Criteria</th><th colspan="2">Conclusions</th></tr>
<tr><td rowspan="2">For locations where non-native and invasive species have been treated, monitor every 1 year until 2 consecutive years indicate no remaining individuals. Then monitor every 4 years, at a minimum.

For locations where non-native and invasive species are located but not treated, monitor every 1 year(s) to ensure no expansion into surrounding area.

Evaluate progress towards objective using AM framework every 4 years.</td><td>Demonstrate effective control or reduction (as appropriate) of invasive and non-native species at treated locations across riparian reserve lands.</td><td>✓</td><td rowspan="2">NPS weed control activities appear to be effective and thorough; however, a formal tracking mechanism is not set up to evaluate either performance period (as they are worded here) and the reports submitted by NPS do not specifically address the criteria as they are written (See recommendations below).</td></tr>
<tr><td>Demonstrate reduction of invasive species across riparian reserve lands.</td><td>✓</td></tr>
</table>

Recommendations for future evaluations:

As discussed above, the benefits from having a cooperative weed program with NPS are significant; however, the data and reporting received on the projects do not align with the language in the BGO performance criteria. Suggestions include either reframing the criteria to be more practical and fit the on-the-ground activities, or modify the reporting procedures for the project. The Science Advisor Panel and DCP staff should review the GIS data that NPS provides annually to determine how best it can be used to evaluate the criteria. A combination of both reframing the criteria and obtaining additional data and/or information may be appropriate. Possible suggestions for the NPS project include:

- NPS could keep track of a running table by species (similar to what is already in the report), but add a new column for each year to track the status of each species/infestation each year (it would contain notes such as "species xyz was not observed in 2020", or "the specific area this weed was observed last year was not surveyed because….." For example, Tamarix (on the BCCE) was treated in 2016 and

2018, but not 2017 even though it was detected in 2017. Information on why it was not treated would be helpful.

R1.5. Reduce habitat fragmentation and/or improve connectivity and habitat quality through restoration design and implementation

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Monitor riparian reserve units every 4 years. Evaluate progress towards objective using AM framework every 4 years.	Riparian restoration projects demonstrably reduce fragmentation/increase connectivity when feasible and as identified during project initiation. Demonstrate upward trend in habitat connectivity and downward trend in habitat fragmentation across riparian reserve lands.

Assessing whether restoration activities have improved habitat fragmentation/connectivity and habitat quality is dependent on a comparison to baseline metric(s). Several past, ongoing, or future projects may improve fragmentation/connectivity and habitat quality on reserve units, but the BGO evaluation cannot be complete without an overall comparison. Calculating habitat fragmentation is nested in the AMMP under habitat monitoring (Section 2.6.3 of the AMMP).

For the purposes of this BGO analysis, habitat fragmentation was calculated using FragStats for each reserve unit, as well as for the river corridors directly adjacent to the reserve unit parcels. The fragmentation analysis is discussed in Attachment B.

In addition to calculating the baseline fragmentation metrics, projects that may affect habitat fragmentation and connectivity were considered in this evaluation. A brief summary of these findings include:

- Non-native plant treatments by the NPS and other non-native plant removal projects, such as the Mormon Mesa tamarisk mastication project (Clark County 2019a) can be assumed to either maintain or increase habitat connectivity (in the absence of fine-scale pre-project monitoring data).
- The Muddy River Restoration of Parcels A-E, positioned between lands outside the reserve system, aims to restore approximately 25 acres and reconnect floodplain. Similar to the non-native plant treatments, we can assume that if the project is successful, it will increase habitat connectivity.

As the projects listed above (and other projects similar in nature) progress and conclusions can be drawn regarding their success, they should be used to evaluate this BGO's criteria.

Performance Period(s)	Performance Criteria		Conclusions
Monitor riparian reserve units every _4_ years. Evaluate progress towards objective using AM framework every _4_ years.	Riparian restoration projects demonstrably reduce fragmentation/increase connectivity when feasible and as identified during project initiation.	⊙	Habitat is not being monitored on the riparian reserve units yet and a baseline fragmentation analysis was conducted as part of this evaluation; therefore, the performance period "*monitor…every 4 years*" is not being met, but we anticipate it will be met for the next evaluation in 2024. Without baseline data for projects, we cannot formally evaluate either criteria. However, the projects that we have knowledge of (non-native plant removals and the Muddy River restoration project), should theoretically either maintain existing connectivity or increase connectivity.
	Demonstrate upward trend in habitat connectivity and downward trend in habitat fragmentation across riparian reserve lands.	⊙	

Recommendation for performance period / criteria review:

The language for the first criterion isn't clear and/or is repetitive. Specifically, the phrase "when feasible and as identified during project initiation" should be reviewed.

R1.6. Acquire riparian property at an equivalent rate as take (i.e., habitat conversion)

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Evaluate progress towards objective using AM framework every _4_ years.	Demonstrate acquisition of riparian habitat and function at an equivalent rate as take over life of Permit.

The criteria for this BGO is written as one criterion, but is separated into two for the purposes of this evaluation—one criterion to evaluate riparian habitat and a separate criterion to evaluate riparian function. Currently there is no measure of habitat function and that criterion cannot be evaluated. We anticipate that measuring and monitoring habitat function will be included in the upcoming November 2020 Habitat Monitoring Workshop.

Since 2016, a total of 317.83 acres of riparian habitat have been acquired and the total riparian reserve unit acreage is 486.53 acres (Clark County 2019b). A total of 560 acres of riparian habitat have been developed since the Permit began in 2001 (Section 3 of the 2020 AMR), indicating 73.47 more acres have been developed than are included in the riparian reserve units. In addition to this deficit, the fragmentation analysis (Attachment B) indicates that several

of the parcels included in the riparian reserve units consist of <50% of the desert riparian ecosystem type.

Performance Period(s)	Performance Criteria	Conclusions	
Evaluate progress towards objective using AM framework every 4 years.	Demonstrate acquisition of riparian habitat at an equivalent rate as take over life of Permit.	✗	Riparian habitat take exceeds the riparian reserve unit acreage by 73.47 acres.
	Demonstrate acquisition of riparian function at an equivalent rate as take over life of Permit.	**NA**	There is no data available to evaluate this criterion.

Recommendations for future evaluations:

Demonstrating acquisition of riparian function at an equivalent rate as take is challenging because habitat function of developed lands cannot be determined and there are no habitat functionality measures currently in place for riparian reserve lands. We recommend re-wording or removing this criterion.

R2.1. Monitor and adaptively manage for breeding bird populations

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Monitor T&E breeding bird populations in all suitable habitat every 1 year(s). Evaluate progress towards objective using AM framework every 4 years.	Demonstrate stable or increasing T&E breeding bird populations across riparian reserve lands.

All avian species have been monitored since 2017. The Evaluation of Species and Habitat Monitoring Criteria memorandum (Attachment A) describes monitoring activities for breeding bird populations and includes analysis of population trends. The AMMP established targets and triggers for species population trends (Table 5 in the AMMP and Table 2 in Attachment A). Essentially, a species will either achieve the 'target' if its population appears to be stable or increasing (or, there is lack of evidence that the population is decreasing), or, it will meet the trigger if the monitoring data indicate the population is decreasing. All MSHCP-covered birds achieved the target and there was no evidence of decreasing population trends. Sufficient data was not available to conduct a statistical analyses using the monitoring data and these conclusions are qualitative. We anticipate sufficient data will be available for the next evaluation.

Performance Period(s)	Performance Criteria	Conclusions	
Monitor T&E breeding bird populations in all suitable habitat every _1_ year(s). Evaluate progress towards objective using AM framework every _4_ years.	Demonstrate stable or increasing T&E breeding bird populations across riparian reserve lands.	✓	The performance period of monitoring annually is achieved and all MSCHP-covered bird species appear to have stable or increasing population trends, based on a qualitative assessment (Attachment A).

R3.1. Collaborate with other stakeholders on project/mitigation work

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Evaluate progress towards objective using AM framework every _4_ years.	Demonstrate a stable or increasing number of collaborators.

Data used to evaluate DCP achievement of the criterion was a list of collaborators that DCP have engaged with since 2016 (Wright, personal communication 2019 [Tarita Harju has email—9/24/19]. The list of collaborators includes:

- Virgin River Coalition (facilitated by The Nature Conservancy)
- NPS
- BLM
- USGS
- USFWS
- Nevada Division of Forestry
- Nevada Division of Wildlife
- Nevada Division of State Lands
- Nevada Division of Environmental Protection
- Nevada Division of Mines
- Southern Nevada Water Authority
- Clark County Regional Flood Control District
- Private landowners

The list of collaborators provided here are intended to be used as a baseline metric to be compared to in four years during the next BGO evaluation.

Performance Period(s)	Performance Criteria	Conclusion	
Evaluate progress towards objective using AM framework every 4 years.	Demonstrate a stable or increasing number of collaborators.	✓	Criterion met. The current list of collaborators will be used as a baseline metric for future evaluations.

Recommendations for future evaluations:

Nuances to each collaboration cannot be captured in the current criterion. Because the nature and depth of collaboration varies with each entity, it may be possible in the future that the overall number of collaborators decrease, but the effectiveness of sustained partnerships outweigh that perceived "cost". The Science Advisor Panel does not have a clear recommendation to change the language of the criteria, but urge future analyses to include a narrative behind whether or not this criterion is being met.

R3.2. Promote responsible recreation (e.g., signage, education)

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Evaluate progress towards objective using AM framework every 4 years.	Sign repair is completed within 60 days of damage reported. Demonstrate a stable or decreasing number of negative law enforcement encounters per unit effort. Demonstrate a stable or increasing number of public engagement, such as presentations and brochure distribution.

This objective is paired with objective D3.2 to illustrate the importance of responsible recreation in both the upland reserve lands and the riparian reserve lands. The objective is intended to provide the DCP with a mechanism to evaluate recreation on the riparian lands if and when it is regularly recreated on. As the properties are used now, they receive very little to no recreation use and therefore have no regular signage or law enforcement presence.

Performance Period(s)	Performance Criteria	Conclusion	
Evaluate progress towards objective using AM framework every 4 years.	Sign repair is completed within 60 days of damage reported. Demonstrate a stable or decreasing number of negative law enforcement encounters per unit effort. Demonstrate a stable or increasing number of public engagement, such as presentations and brochure distribution.	**NA**	See discussion; if law enforcement is implemented in the future, these criteria will become relevant and will be evaluated.

Recommendations for future evaluations:

The Science Advisor Panel feels that this objective is not applicable to the current use of the riparian reserve lands, based on the information provided above regarding land use and law enforcement. If a law enforcement presence is required in the future, this objective and its associated criteria should be evaluated, but we recommend excluding it from evaluation until it is relevant.

R4.1. Identify critical uncertainties and address these through planning and adaptive management, when feasible

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Evaluate progress towards objective using AM framework every 4 years.	An analysis of critical uncertainties at the scale of the riparian reserve lands is conducted every 4 year(s) and as determined on a project-by-project basis during project initiation. Riparian projects demonstrably identify and address critical uncertainties during planning and implementation.

The criteria for this objective is written as two criterions, but is split into three for the evaluation table below.

Data used to evaluate DCP achievement of the criteria were two-fold: 1) program-level information, such as that found in the Riparian Reserve Unit Management Plan was used to evaluate if an analysis of critical uncertainties are conducted every four years, and 2) project-level information that was readily available was used to determine if critical uncertainties are determined during project initiation and whether projects are identifying and addressing critical uncertainties during planning and implementation.

The Riparian Reserve Units Management Plan includes a section on Stressors and is updated every two years. The 2019 Riparian Reserve Units Management Plan includes the following stressors:

- Non-native and Invasive Species
- Altered Local and Regional Aquifers and Altered Surface Flow
- Fire
- Livestock Trespass
- Development
- Infrastructure
- Agriculture
- Climate Change

The 2015 and 2017 Riparian Reserve Unit Management Plans were compared to the 2019 Plan to help determine if critical review is taking place. Both the 2015 and 2017 documents included the same stressors (labeled “threats” in the 2015 management plan), but the section overall shows substantial updates for each successive management plan. These changes indicate critical review is occurring even if the list of stressors remains the same. The discussion for each stressor generally includes planning and management strategies to minimize the relative

risk of each stressor; for example the Livestock Trespass section states "*Reducing or eliminating this threat can occur by installing barriers to prevent entry by trespass livestock, but may be costly to install and maintain*".

There are several individual projects and or elements from specific projects that address these criteria as well, including:

- Non-native plant treatments on all riparian reserve units (Clark County 2019a).
- Tamarisk mastication at the Virgin River – Riverside reserve unit was used to create a firebreak.
- Water rights analysis and permit preparation
- Cattle barriers were installed and maintained at the Virgin River – Mormon Mesa reserve unit.

Performance Period(s)	Performance Criteria	Conclusions	
Evaluate progress towards objective using AM framework every 4 years.	An analysis of critical uncertainties at the scale of the riparian reserve lands is conducted every 4 year(s).	✓	Criterion met. The Riparian Management Plan critically reviews stressors every two years.
	An analysis of critical uncertainties at the scale of the riparian reserve lands is conducted as determined on a project-by-project basis during project initiation.	✓	Criterion met. We've interpreted this criterion to include projects that address the critical uncertainties listed in the Riparian Management Plan.
	Riparian projects demonstrably identify and address critical uncertainties during planning and implementation.	**NA**	We do not have data available to evaluate this criterion and are unclear of its meaning.

Recommendations for future evaluations:

Language for the first criterion required the evaluation of two different scales of data (a broader scale for the riparian reserve units as a whole, and a finer scale on a project-by-project basis). These two scales should be separated for evaluation purposes. In addition, the language in second and third criteria are not clear how they differ from each other. The third criterion "riparian projects demonstrably identify and address critical uncertainties during planning and implementation" may have been intended to represent the question "what are the biggest risks with this specific project", which would be much more specific uncertainties than those for the program overall (e.g., climate change). We recommend reviewing all three criteria and either clarifying language and/or removing the second criterion of "an analysis of critical uncertainties at the scale of the riparian reserve lands is conducted as determined on a project-by-project basis during project initiation."

R4.2. Identify critical connectivity corridors for covered species, prioritize acquisition and/or conservation where feasible

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Conduct comprehensive connectivity analysis of critical connectivity corridors for covered species at scale of riparian reserve lands every 4 year(s) and when a land acquisition project is being considered. Evaluate progress towards objective using AM framework every 4 years.	An analysis of critical connectivity corridors for covered species at the scale of the riparian reserve lands is conducted every 4 year(s). Acquisition and conservation activities demonstrably consider connectivity enhancement during planning and implementation.

Data is not available to evaluate the first performance criterion; baseline data is expected in the near future from recent projects and we anticipate that it can be used for the next evaluation.

The property acquisition matrix was used to evaluate the second performance criterion. The matrix is used when any riparian properties are under consideration for purchasing by the DCP (Table 2). It includes several criteria that incorporate habitat connectivity or enhancement. Matrix criteria that incorporate the underlying value of habitat connectivity or enhancement are denoted with a "►" in the table of matrix criteria, below:

Table 2. Riparian Property Acquisition Matrix

Environmental Criteria	
Species Evaluation (2 points for affirmative, 0 points for negative)	
	Are SWFL currently present at the site?
	Is there existing SWFL habitat on the site?
	Is there SWFL occurrence data on desired land (occurrence data)
►	Habitat or potential habitat on the property (NNHP SWFL)
►	Habitat or potential habitat on the property (BOR SWFL) (wifl hab distr nad 83)
►	Habitat or potential habitat on the property (NPS SWFL model)
►	Do other covered riparian birds occur at the site? If yes, complete species evaluation for each covered bird species.
Proximity to Sensitive Lands (1 point for affirmative, 0 for negative)	
►	Does the desired property abut or is it adjacent to federal, state or conserved lands?
►	Does the desired property abut or is it adjacent to known or potential habitat for SWFL?
Restoration Potential (1 point for affirmative, 0 for negative)	
	Are plans in place or easily established for leveraging funds, projects to benefit habitat or species?
	Does the desired property boundary border the Virgin or Muddy River?
	Is there standing water at the site?
	Is there access to water at the site via irrigation district or other means?
	Does the desired property support native riparian trees or other native riparian wetland plants?

Environmental Criteria	
Level of Disturbance (1 point for affirmative, 0 for negative)	
	Are noxious weeds absent that will require treatment, such as tamarisk, tall whitetop?
	Is minimal restoration needed?
	Is the desired property absent of infrastructure that may require removal, such as roads, chemical tanks, out buildings, septic tanks, fences?
Administrative Criteria	
Ease of Management no (1) yes (0)	
	Are lands difficult to access due to legal issues, safety or other reasons?
	Are lands difficult to access due to difficult terrain?
►	Are there known land use practices, such as grazing, occurring on adjacent land that will negatively affect the habitat or species?
	Does the property need a fence to keep out cattle?
	Are agreements needed for water with irrigation districts or others?
Complexity of Land Acquisition Process no (1) yes (0)	
	Are there existing structures?
	Is an environmental assessment likely needed due to underground storage tanks or other reasons?
	Will the desired property require further parceling?
	Will an additional private survey need to be conducted?
	Is the property held in limbo due to the cadastral survey?
Potential for Degradation of Habitat if not Purchased for Conservation no (1) yes (0)	
	Is habitat in identified flood scour zone?
	Is the habitat reasonably protected from degradation from existing or potential future land practices?

In addition to the property acquisition matrix addressing connectivity, several projects were identified in the 2017-2019 Biennium Progress Report (Clark County 2019a) that consider connectivity corridors, either through planning or implementation:

- Non-native plant treatments
- The Muddy River Restoration of Parcels A-E
- Acquisition of LiDAR data on the Muddy River and Virgin Rivers.

Performance Period(s)	Performance Criteria	Conclusions	
Conduct comprehensive connectivity analysis of critical connectivity corridors for covered species at scale of riparian reserve lands every _4_ year(s) and when a land acquisition project is being considered.	An analysis of critical connectivity corridors for covered species at the scale of the riparian reserve lands is conducted every _4_ year(s).	✓	Data is not available to evaluate this criterion, but a current project will provide baseline data for it.
Evaluate progress towards objective using AM framework every _4_ years.	Acquisition and conservation activities demonstrably consider connectivity enhancement during planning and implementation.	✓	The Riparian Property Acquisition Matrix incorporates habitat connectivity and enhancement, as do several specific projects.

D1.1. Monitor MSHCP-covered species occupancy

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Monitor MSHCP-covered species occupancy in suitable habitat every _1_ year(s). Evaluate progress towards objective using AM framework after _4_ years.	Demonstrate that MSHCP-covered species are monitored every _1_ year(s).

Upland MSHCP-covered species that are recommended for monitoring include reptiles, plants, and bats (the bat species are listed as using both upland and riparian habitat). The plant species will be surveyed for in 2020 but are currently not known to occur within the reserve system. Monitoring has been conducted for the desert tortoise annually since 2013 and other reptile species have been recorded during the desert tortoise monitoring since 2015. Bat monitoring began in 2018, creating a one-year lag between the completion of the AMMP in January 2017 and commencing on-the-ground monitoring, but this timeline is acceptable for implementing a new monitoring program. Acoustic bat monitoring is included in the 2019-2021 IPB (Clark County 2018). The frequency of monitoring in the future will be determined by the 2018-2019 monitoring data.

Performance Period(s)	Performance Criteria	Conclusions	
Monitor MSHCP-covered species occupancy in suitable habitat every _1_ year(s). Evaluate progress towards objective using AM framework after _4_ years	Demonstrate that MSHCP-covered species are monitored every _1_ year(s).	✓	All reptile species have been monitored annually since 2015. Monitoring for bats began in 2018 and will be conducted annually.

D1.2 Maintain existing intact functioning habitat and restore degraded habitat

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Monitoring restoration projects annually for at least 5 years. Evaluate progress towards objective using AM framework every 4 years.	Demonstrate stable or increasing acreage of high-functioning habitat within the desert upland reserve.

There are no upland restoration projects since 2017 that contribute to this BGO and therefore the performance period stating "Monitoring restoration projects annually for at least 5 years" cannot be evaluated.

Data to evaluate the criterion, as outlined in Section 2.6.2 of the AMMP, does not currently exist. LiDAR data collected in 2015 is available, but there is no analysis using those data to address this criterion.

Qualitative conclusions can still be drawn for this criterion in the absence of baseline data. The following discussion points from the November 2019 Quarterly Meeting support the idea that we can draw conclusions regarding high-functioning habitat on the reserve unit system without having an exact acreage and consistent monitoring plan for it:

- The DCP can influence habitat only on their durable lands (i.e., the reserve land system).
- Management goals/actions on all reserve unit lands emphasize conservation and there is no development or activities allowed on the lands that would 1) increase habitat fragmentation, or 2) result in habitat loss.

We can assume that habitat quality will remain unchanged unless one of the following occurs:

1) A failed restoration project degraded habitat instead of improved it. To our knowledge, this situation has not occurred. Or,
2) Unauthorized activities occurred that resulted in habitat degradation. The DCP has measures in place, such as the presence of law enforcement and a public education program, to decrease the likelihood of unauthorized activities. These are discussed with BGO D3.2, BGO D3.3, and BGO D3.4. DCP staff have no knowledge of activities severe enough to deter tortoise use. Or,
3) Severe weather events and/or directional trends in climate change. Alone, or in combination, prolonged drought, intense rainfall events, and high winds can reduce vegetation cover, cause soil erosion, and lead to plant and animal mortality. Climate change will result in changes in maximum and minimum temperatures, the diurnal temperature range, and annual and seasonal precipitation amounts. These changes may degrade 'high-functioning' habitat. DCP staff have no knowledge of any occurrences of severe weather events that would result in detectable habitat degradation, and there is no baseline data to evaluate any ongoing habitat degradation resulting from climate change.

Performance Period(s)	Performance Criteria	Conclusions	
Monitoring restoration projects annually for at least 5 years. Evaluate progress towards objective using AM framework after 4 years.	Demonstrate stable or increasing acreage of high-functioning habitat within the desert upland reserve.	⊙	There have been no projects to evaluate in the performance period. Data is not available to evaluate achievement of the criteria; however, we can qualitatively report that high-functioning habitat in the reserve unit did not decrease in acreage.

D1.3. Protect and conserve habitat for covered plants

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Evaluate progress towards objective using AM framework every 4 years.	Demonstrate that known habitat for covered plant species is protected and conserved. Demonstrate that known covered plant species are physically protected.

There are currently no known locations of MSHCP-covered plants on reserve system lands. If any are located on reserve system lands in the future, their habitat will be protected and conserved.

Performance Period(s)	Performance Criteria	Conclusions	
Evaluate progress towards objective using AM framework every 4 years.	Demonstrate that known habitat for covered plant species is protected and conserved.	**NA**	There are currently no known locations of MSHCP-covered plants on reserve system lands.
	Demonstrate that known covered plant species are physically protected.	**NA**	There are currently no known locations of MSHCP-covered plants on reserve system lands.

Recommendations for future evaluations:

The Science Advisor Panel feels that this objective is not applicable at this time because there are no known locations of MSHCP-covered plants on reserve system lands. If any are located on reserve system lands in the future, this objective and its associated criteria should be evaluated, but we recommend excluding it from evaluation until it is applicable.

D1.4. Inventory, remove, and control invasive and non-native plant species

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
For locations where non-native and invasive species have been treated, monitor every 1 year until 2 consecutive years indicate no remaining individuals. Then monitor every 4 years, at a minimum. For locations where non-native and invasive species are located but not treated, monitor every 1 year(s) to ensure no expansion into surrounding area. Evaluate progress towards objective using AM framework every 4 years.	Demonstrate effective control or reduction (as appropriate) of invasive and non-native species at treated locations across desert upland reserve lands. Demonstrate reduction of invasive species across desert upland reserve lands.

It has two performance periods and two criteria, none of which have formal tracking mechanisms. The DCPs primary contract for weed control is with the National Park Service. The National Park Service treats weeds on the reserve units similarly to how they do on their own land—this cooperative approach appears to be very effective at controlling weeds, but does not lend itself to tracking the presence and treatment of non-native species as specified for the performance periods and criteria. Additionally, the performance period specifying "monitor every 1 year until 2 consecutive years indicate no remaining individuals…" may not accurately be able to track whether a non-native patch is eradicated. The varying hydrologic conditions each year may mean that a prolific weed in one year is scarce the next year and vice-versa.

The following is a summary of information gleaned from NPS Final Reports (NPS 2016, NPS 2017, and NPS 2018b).

Weed surveys are conducted along Boulder City Conservation Easement (BCCE) travel routes and targeted treatments of priority weeds are conducted. Surveys are conducted twice a year during the winter and during spring/summer. If a weed infestation is identified along the travel route, the survey continues beyond the travel corridor buffer (10 meter buffer) to determine the extent. In general, the same travel routes are surveyed year after year.

Weed species, infested acres, and treated acres are included in each annual report, which, when combined with the survey maps provides evidence that biannual monitoring and treatment is occurring and that locations continuing to support priority weeds are treated year after year. This frequency of monitoring and treatment meets the BGO performance period of annual monitoring and treatment.

The annual reports state that the surveys are conducted twice per year to "detect a variety of species that may emerge during weather patterns related to the seasons". Any specific species may be more or less prevalent in different years, depending on weather and seasonal conditions. For this reason, the acres of infested and treated may not be indicative of whether the species is expanding or decreasing.

Performance Period(s)	Performance Criteria	Conclusions	
For locations where non-native and invasive species have been treated, monitor every 1 year until 2 consecutive years indicate no remaining individuals. Then monitor every 4 years, at a minimum For locations where nonnative and invasive species are located but not treated, monitor every 1 year(s) to ensure no expansion into surrounding area. Evaluate progress towards objective using AM framework every 4 years.	Demonstrate effective control or reduction (as appropriate) of invasive and non-native species at treated locations across desert upland reserve lands.	✓	NPS weed control activities appear to be effective and thorough; however a formal tracking mechanism is not set-up to evaluate either performance period as they are written here, and the reports submitted by NPS do not specifically address the criteria as they are written. (See recommendations).
	Demonstrate reduction of invasive species across desert upland reserve lands.	✓	

Recommendations for future evaluations:

The following are the same recommendations as for BGO R1.4.

The benefits from having a cooperative weed program with NPS are significant; however, the data and reporting received on the projects do not align with the language in the BGO performance criteria. Suggestions include either reframing the criteria to be more practical and fit the on-the-ground activities, or modify the reporting procedures for the project. The Science Advisor Panel and DCP staff should review the GIS data that NPS provides annually to determine how best it can be used to evaluate the criteria. A combination of both reframing the criteria and obtaining additional data and/or information may be appropriate. Possible suggestions for the NPS project include:

- NPS could keep track of a running table by species (similar to what is already in the report), but add a new column for each year to track the status of each species/infestation each year (it would contain notes such as "species xyz was not observed in 2020", or "the specific area this weed was observed last year was not surveyed because….." For example, Tamarix (on desert upland reserve lands) was treated in 2016 and 2018, but not 2017 even though it was detected in 2017. Information on why it was not treated would be helpful.

D1.5. Reduce habitat fragmentation and/or improve connectivity through restoration design and implementation

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Evaluate progress towards objective using AM framework every 4 years	Desert upland restoration projects demonstrably reduce fragmentation/increase connectivity when feasible and as identified during project initiation Demonstrate upward trend in habitat connectivity and downward trend in habitat fragmentation across desert upland reserve lands

Discussion points for R1.5 are relevant here, especially the need for baseline metrics, without which an overall evaluation of the criteria cannot be completed. For the purposes of this BGO analysis, habitat fragmentation was calculated using FragStats for the BCCE. The fragmentation analysis is discussed in Attachment B.

Apart from the fragmentation analysis, there haven't been any desert upland restoration projects since the AMMP was finalized in January 2017.

Performance Period(s)	Performance Criteria	Conclusions	
Evaluate progress towards objective using AM framework every 4 years	Desert upland restoration projects demonstrably reduce fragmentation/increase connectivity when feasible and as identified during project initiation	**NA**	There have been no desert upland restoration projects since 2017 and therefore no data/projects to evaluate.
	Demonstrate upward trend in habitat connectivity and downward trend in habitat fragmentation across desert upland reserve lands	✓	A baseline fragmentation analysis was conducted as part of this evaluation and we anticipate comparisons can be made in the 2024 AM Evaluation to address this criterion.

D2.1. Monitor and adaptively manage for desert tortoise populations

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Monitor desert tortoise populations in all suitable habitat every 1 year(s). Evaluate progress towards objective using AM framework every 4 years.	Demonstrate stable or increasing desert tortoise populations across desert upland reserve lands.

The desert tortoise has been monitored annually since 2013 and the analysis required to evaluate the criteria is included in the Evaluation of Species and Habitat Monitoring Criteria memorandum (Attachment A). The AMMP established targets and triggers for species population trends (Table 5 in the AMMP and Table 2 in Attachment A). Essentially, a species will either achieve the 'target' if its population appears to be stable or increasing (or, there is lack of evidence that the population is decreasing), or, it will meet the trigger if the monitoring data

indicate the population is decreasing. The desert tortoise achieved the target, and the analysis indicated there is no apparent trend in the monitoring data.

Performance Period(s)	Performance Criteria	Conclusions	
Monitor desert tortoise populations in all suitable habitat every 1 year(s).	Demonstrate stable or increasing desert tortoise populations across desert upland reserve lands.	✓	The performance period of monitoring annually is achieved and the analysis indicated there is no apparent upward or downward trend for the desert tortoise population.
Evaluate progress towards objective using AM framework every 4 years.			

D2.2. Augment populations through translocation programs

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Evaluate progress towards objective using AM framework every 4 years.	Demonstrate positive contribution of translocated desert tortoise populations to the overall desert tortoise population across desert upland reserve lands.

Analysis for this BGO's criterion is provided in the Analysis of Augmented Tortoise Populations memorandum (Attachment C). The analysis concluded that the criterion was achieved through the transportation and release of tortoises into the resident Eldorado Valley tortoise population. The analysis showed translocated tortoises survived over the five year study period, although survival was lower than for resident tortoises. Additionally, resident tortoise survival appeared unaffected by the translocation effort, indicating the translocated tortoises did not negatively impact the resident portion of the population.

Performance Period(s)	Performance Criteria	Conclusions	
Evaluate progress towards objective using AM framework every 4 years.	Demonstrate positive contribution of translocated desert tortoise populations to the overall desert tortoise population across desert upland reserve lands.	✓	The criterion is achieved because translocated tortoises survived over the five year study period and resident tortoise survival appeared unaffected by the translocation effort.

D3.1. Collaborate with other stakeholders on project/mitigation work

The performance period and criteria for objective D3.1 is provided in the table below:

Performance Period(s)	Performance Criteria
Evaluate progress towards objective using AM framework every 4 years.	Demonstrate a stable or increasing number of collaborators.

Data used to evaluate DCP achievement of the criterion was a list of collaborators that DCP have engaged with since 2016. A baseline list of collaborators had not been established; therefore, this initial evaluation reports the baseline data. DCP staff reviewed their list of projects and internal responsibilities from 2016-2019 and provided the following list of collaborators for desert upland work:

- USFWS
- City of Boulder City
- Great Basin Institute
- USGS
- BLM
- Boulder City Police Department
- College of Southern Nevada

Each of these entities partner with the DCP in some fashion and/or combine funds with other partners to make their DCP-cooperative projects successful. The above list will be used as baseline data with which to compare to the number of collaborators during the next assessment in four years.

Performance Period(s)	Performance Criteria	Conclusions	
Evaluate progress towards objective using AM framework every 4 years.	Demonstrate a stable or increasing number of collaborators.	✓	Criterion met. The current list of collaborators will be used as a baseline metric for future evaluations.

D3.2. Promote responsible recreation (e.g., signage, education)

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Evaluate progress towards objective using AM framework every 4 years.	Sign repair is completed within 60 days of damage reported. Demonstrate a stable or decreasing number of negative law enforcement encounters per unit effort.

This BGO includes two criteria. There is no formal data available to gauge achievement of the first criterion "sign repair is completed within 60 days of damage reported"; however DCP staff report that when sign damage is documented, its repair is expedited.

Data for the second criterion is provided by the Boulder City Police Department (Attachment D) and a detailed discussion is included with BGO D3.3, below. This criterion is redundant with the criterion for BGO D3.3.

Performance Period(s)	Performance Criteria	Conclusions	
Evaluate progress towards objective using AM framework every 4 years.	Sign repair is completed within 60 days of damage reported.	✓	There is no formal data available to gauge achievement; however, DCP staff report expedient sign repair. (See recommendations)
	Demonstrate a stable or decreasing number of negative law enforcement encounters per unit effort.	✗	See discussion for BGO D3.3, below (redundant criterion).

Recommendations for future evaluations:

The Science Advisor Panel and DCP staff generally agree that the performance criteria selected for this BGO are not particularly effective and meaningful gauges of whether responsible recreation is promoted adequately. To start the discussion of more applicable criteria, the group suggested using OHV registrations and other efforts such as working with mappers (e.g., Google Maps) to correctly symbolize open vs. closed roads on the BCCE.

Additionally, we recommend formally tracking data for the criteria (i.e., if timely sign repair remains one of the criteria, we strongly recommend tracking the number of repairs required and the number of days until it is fixed). A site visit datasheet could be used to record activities and condition for each visit.

D3.3. Provide law enforcement within reserve system

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Evaluate progress towards objective using AM framework every 1 year(s).	Demonstrate a stable or decreasing number of negative law enforcement encounters per unit effort. Demonstrate a stable or increasing number of positive law enforcement encounters.

Data used to evaluate the criteria were the number of encounters and effort spent each month at the BCCE from September 2016 – August 2019 by Boulder City law enforcement (Attachment D). These data are graphically displayed in Figure 1.

These data show there is generally a decrease in the number of contacts from June to September each year. The number of negative encounters, including warnings and citations, are generally very low. There has only been 1 citation since 2016 and 41 warnings. The single citation and over half the warnings were documented between April and June, 2019. A qualitative review of the encounters (Figure 1 and Attachment D) do not show obvious increasing or decreasing trends for either positive or negative encounters.

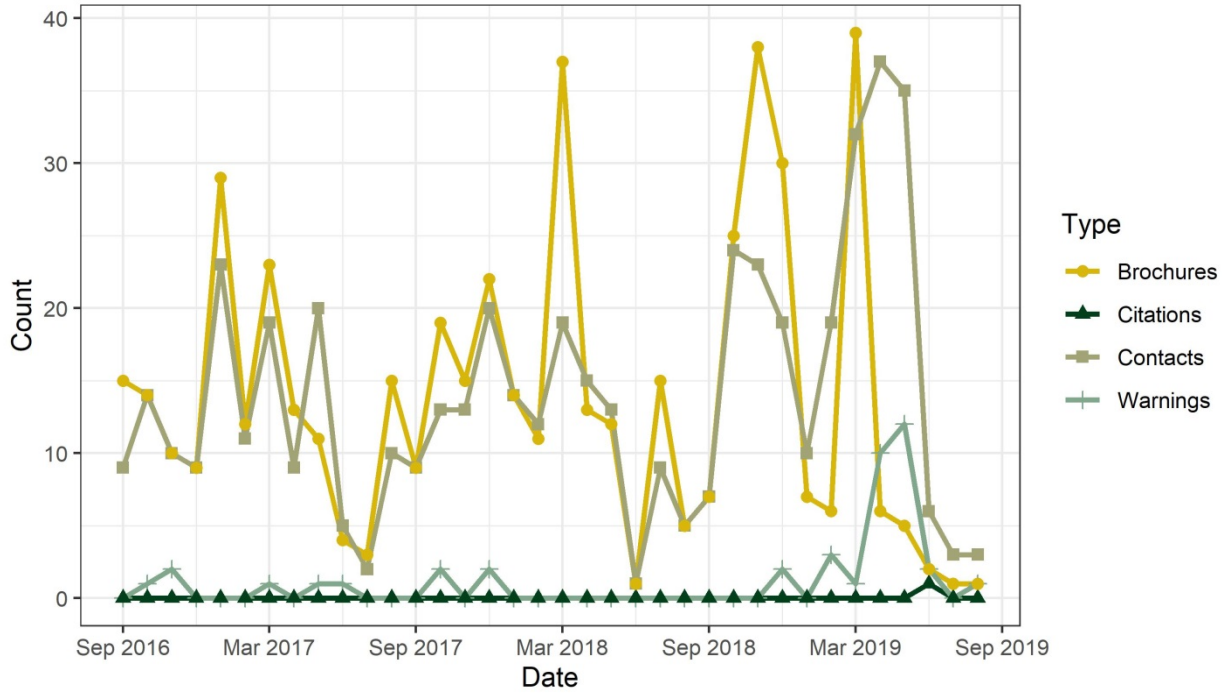
Changing conditions or circumstances may influence law enforcement counts and subsequent interpretation. Law enforcement effort and encounters in 2019 differ from other years in that they drove less per unit effort (the number of miles driven per hour of their presence is lower), there is an unexplained increase in warnings during April and May 2019 (the April – May 2019 warnings account for over half of all warnings since 2016), and fewer brochures were handed

out. These differences may be due to changing recreational use or pressure, or may be due to changing law enforcement staff and/or availability. Without additional information, it appears that 2019 saw an increase in negative law enforcement encounters. DCP staff were not aware of increased unauthorized use or other recreation-based problems on the BCCE in 2019; therefore, we anticipate the 2019 encounters are an anomaly and recommend DCP staff monitor the future law enforcement counts closely.

Other observations that will benefit from additional context include:

- The number of contacts is routinely lower than the number of brochures handed out. Does the brochure count include multiple brochures handed out to large groups but the group contact is counted as one contact?
- It is unclear how to separate positive from negative encounters. For example, does the number of contacts include all contacts, including the warnings and citations? Or does the number of contacts represent positive encounters only? Also, are brochures handed out during positive encounters only?

Figure 1. Boulder City Police Department Counts of Contacts, Warnings, Citations and Brochures handed out at the BCCE from September 2016 – August 2019.



Performance Period(s)	Performance Criteria	Conclusions	
Evaluate progress towards objective using AM framework every 1 year(s).	Demonstrate a stable or decreasing number of negative law enforcement encounters per unit effort.	✗	Criterion not met. Without additional context, the 2019 negative encounters are far higher than other years.
	Demonstrate a stable or increasing number of positive law enforcement encounters.	⊙	Overall, no trend is apparent over time for either the number of contacts or brochures. It is unclear which of the contacts (contacts and/or brochures) include both positive and negative encounters versus positive-only encounters.

Recommendations for future evaluations:

We recommend requesting additional context and information from the Boulder City Police Department to accompany their status report. For example, it is unclear which types of contacts are positive or negative, and there doesn't appear to be a mechanism to discuss or review abnormalities in the number of contacts (i.e., is a new officer being trained and is expected to be proficient in 3 months? Was there one isolated day or weekend with an unusual amount of unauthorized activities? If so, was it large enough to warrant counter-measures and/or is there reason to suspect it indicates a change in use?). The aim of these criteria should not be to encourage fewer or only-positive contacts, but without additional information these criteria are at risk of doing just that.

The performance criterion "demonstrate a stable or decreasing number of negative law enforcement encounters per unit effort" is identical to one of the criteria for BGO D3.2. Redundant criteria for BGOs may be warranted, but we recommend reviewing the two BGOs (D3.2 and D3.3) in tandem to determine the most informative and practical measures of achievement.

D3.4. Educate project proponents and construction personnel…in collaboration with USFWS

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Evaluate progress towards objective using AM framework every 4 years.	Demonstrate that desert tortoise reporting procedures are communicated to proponents and construction personnel for each project occurring on tortoise habitat. Demonstrate engagement with contractors (e.g., biological consultants, researchers) to ensure they are aware of reporting and tortoise disposition procedures when working desert upland reserve lands.

This objective has two criteria, the first of which focuses on communication with construction personnel as they are considered the most likely people encountering desert tortoises during development activities. The second criterion has a similar communication intent but is directed at communication to other scientists and professionals intentionally working in desert tortoise habitat.

The first criterion is largely met by DCP participation in the air quality dust classes. These classes are consistently held at the Clark County building (onsite) twice per month from January to September (in some years, classes were also held in October to December). These classes were held prior to the Final AMMP being completed in January 2017.

The air quality dust class is required for construction personnel to obtain their dust permit. The DCP has a 15 minute presentation at the beginning of all onsite dust classes. The presentation consists of a 10 minute video which covers the proper procedures of what to do when you find a tortoise on a construction site and how to notify the DCP. The video is followed by a small question and answer period where the workers can ask follow up questions of the DCP staff attending the class. Data is provided in Table 3, below to provide perspective on the number people reached through this effort. These data may be used in future analyses to help determine continued effectiveness of the outreach effort. Context should be applied when comparing these numbers in the future; for example, the number of attendees is expected to fluctuate with the rate of development.

Table 3. Dust class attendance for classes that included a desert tortoise presentation

	2016	2017	2019
January	102	69	105
February	118	131	111
March	127	102	2
April	122	123	122
May	123	132	129
June	2	118	122
July	81	107	116
August	92	110	119
September	91	111	116
October	60	104	NA
November	40	No Classes	NA
December	67	No Classes	NA
Total	**1025**	**1107**	**942**

NOTE: In 2018, no attendee count data was retained, but classes were held consistently twice per month from January – September.

The second criterion does not have any specific actions or projects supported by the DCP that directly meet it.

Performance Period(s)	Performance Criteria	Conclusions	
Evaluate progress towards objective using AM framework every 4 years.	Demonstrate that desert tortoise reporting procedures are communicated to proponents and construction personnel for each project occurring on tortoise habitat.	✓	Criterion met. The air quality dust classes are reaching the targeted audience and conveying the desired information. Classes are well attended and held consistently.
	Demonstrate engagement with contractors (e.g., biological consultants, researchers) to ensure they are aware of reporting and tortoise disposition procedures when working desert upland reserve lands.	**NA**	Criterion not met, but see the recommendation to remove it.

Recommendations for future evaluations:

The Science Advisor Panel recommends reviewing the criterion "demonstrate engagement with contractors (e.g., biological consultants, researchers) to ensure they are aware of reporting and tortoise disposition procedures when working desert upland reserve lands" for its cost-benefit of achieving the intent of the MSHCP. The Science Advisor Panel's general opinion is that although it is crucial that professionals intentionally working in desert tortoise habitat understand the proper reporting and disposition procedures, it is not currently a major contributor to desert tortoise health or species status. Professionals working directly with desert tortoises are required to obtain a federal permit, and training for the permit covers all material relevant to reporting and disposition procedures. Any addition that the DCP could add to this training would

likely not be substantial. We recommend removing the second criterion and revisiting the idea in the future if desert tortoise certification changes.

D4.1. Identify critical uncertainties and address these through planning and adaptive management, when feasible

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Conduct comprehensive uncertainty analysis every 4 year(s). Evaluate progress towards objective using AM framework every 4 years.	An analysis of critical uncertainties at the scale of the desert upland reserve lands is conducted every 4 year(s) and when a new project is initiated. Desert upland projects demonstrably identify and address critical uncertainties during planning and implementation.

The criteria for this objective is written as two criteria, but is split into three for the evaluation table, below.

Data used to evaluate DCP achievement of the criteria were two-fold (and of the same nature as data used for BGO R4.1): 1) program-level information, such as that found in the BCCE Management Plan was used to evaluate if an analysis of critical uncertainties are conducted every four years, and 2) project-level information that was readily available was used to determine if critical uncertainties are determined during project initiation and whether projects are identifying and addressing critical uncertainties during planning and implementation.

The BCCE Management Plan includes a section on ecological resiliency and includes relevant ecological stressors (with discussion) that are paired with the DCPs ability to influence each one, as follows (Clark County 2019c):

- Climate change: DCP ability to influence— low to none.
- Fire: DCP ability to influence— low to moderate.
- Invasive species: DCP ability to influence— low to moderate.
- Development: DCP ability to influence— moderate to high (discussion of this category includes the indirect introduction of predators)
- Transportation: DCP ability to influence— moderate to high.
- Recreation: DCP ability to influence— moderate to high.

The ecological resiliency section shows significant updates from the 2015 and 2017 BCCE Management Plans, indicating critical review every two years is occurring.

There are several individual projects and or elements from specific projects that address these criteria as well, including the 2017-2019 Biennium Progress Report (Clark County 2019a):

- Non-native plant treatments (BGO D1.4).
- BCCE Law Enforcement (BGO D3.3)
- Effects of exotic forage on desert tortoise
- Desert tortoise predation studies

- Desert tortoise genetic connectivity modeling

Performance Period(s)	Performance Criteria	Conclusions	
Evaluate progress towards objective using AM framework every 4 years.	An analysis of critical uncertainties at the scale of the desert upland reserve lands is conducted every 4 year(s).	✓	Criterion met. The BCCE Management Plan critically reviews stressors every 2 years.
	An analysis of critical uncertainties at the scale of the desert upland lands is conducted as determined on a project-by-project basis during project initiation.	✓	Criterion met. We've interpreted this criterion to include projects that address the critical uncertainties listed in the BCCE Management Plan.
	Desert upland projects demonstrably identify and address critical uncertainties during planning and implementation.	**NA**	We do not have knowledge available to evaluate this criterion and are unclear of its meaning.

Recommendations for future evaluations:

The following are the same recommendations as for the Riparian BGO R4.1.

Language for the first criterion required the evaluation of two different scales of data (a broader scale for the riparian reserve units as a whole, and a finer scale on a project-by-project basis). These two scales should be separated for evaluation purposes. In addition, the language in second and third criteria are not clear how they differ from each other. The third criterion "riparian projects demonstrably identify and address critical uncertainties during planning and implementation" may have been intended to represent the question "what are the biggest risks with this specific project", which would be much more specific uncertainties than those for the program overall (e.g., climate change). We recommend reviewing all three criteria and either clarifying language and/or removing the second criterion of "an analysis of critical uncertainties at the scale of the riparian reserve lands is conducted as determined on a project-by-project basis during project initiation."

D4.2. Identify critical connectivity corridors for covered species, prioritize conservation ...increase permeability for species movement where feasible

The performance period(s) and associated criteria are listed in the table below:

Performance Period(s)	Performance Criteria
Conduct comprehensive connectivity analysis of critical connectivity corridors for covered species at scale of desert upland reserve lands every 4 year(s) or when a land acquisition project is being considered. Evaluate progress towards objective using AM framework every 4 years.	An analysis of critical connectivity corridors for covered species at the scale of the desert upland reserve lands is conducted every 4 year(s). Acquisition and conservation activities demonstrably consider connectivity enhancement during planning and implementation.

Data is not available to evaluate the first performance criterion; baseline data is expected in the near future from recent projects and we anticipate that it can be used for the next evaluation.

Specific data is also not available to evaluate the second criterion which is focused on acquisition and conservation activities. There is no set of criteria or matrix for property acquisition similar to that for riparian properties (BGO R4.2) and no acquisition has occurred since 2017. The 2017-2019 Biennium Progress Report (Clark County 2019a) was used to identify specific projects that consider connectivity corridors, either through planning or implementation:

- Non-native plant treatments (BGO D1.4, above).
- Desert tortoise culvert projects to facilitate movement
- BCCE restoration

Performance Period(s)	Performance Criteria	Conclusions	
Conduct comprehensive connectivity analysis of critical connectivity corridors for covered species at scale of desert upland reserve lands every _4_ year(s) or when a land acquisition project is being considered.	An analysis of critical connectivity corridors for covered species at the scale of the desert upland reserve lands is conducted every _4_ year(s).	⊙	Data is not available to evaluate this criterion.
Evaluate progress towards objective using AM framework every _4_ years.	Acquisition and conservation activities demonstrably consider connectivity enhancement during planning and implementation.	✓	Criterion met. Several projects include the concept of connectivity enhancement and no acquisition has occurred since 2017.

Recommendations for future evaluations:

The use of the word "corridor" in the first criterion caused several members of the Science Advisor Panel and DCP staff to question the overall intent of the criterion, and the BGO. We recommend reviewing this criterion and rephrasing to include more specific wording.

2.1 Summary of BGO performance periods and criteria evaluation

A total of 41 criteria derived from 24 biological objectives were evaluated. Of these:

- Twenty-four criteria are being met and received a "✓" in its conclusions table.
- Five criteria received a "⊙" because it is unclear whether they are being met, generally due to lack of data.
- Nine criteria were assigned "NA" and include discussion regarding why they are not currently relevant or applicable to the DCP at this time, as well as reasons and/or a description of when they may be relevant again. And,
- Three criteria are not being met and received a "✗". Discussion and recommendations for meeting the criteria in the future are included in each corresponding section.

All criteria that did not receive a "✓" (✓ = criteria met), are included in Attachment E with a summary of the criteria's conclusion. Additionally, all recommendations, regardless of whether the criteria were met, are summarized in Attachment E. If all criteria for a BGO were met and there were no recommendations, the BGO is not included in Attachment E.

Section 3 Evaluation of species and habitat monitoring criteria

A stand-alone report was prepared that describes the statistical analysis and results for the evaluation of species and habitat monitoring criteria (Attachment A). MSHCP-covered species and habitat monitoring are described in Section 2.5 and 2.6 of the AMMP, respectively and the associated criteria are established in Section 3.3.2 and Table 5 of the AMMP (TerraGraphics 2017).

Twenty-four individual species (including four reptiles, seven birds, three bats, and ten plants) and two vegetation communities are included for monitoring and subsequent analysis as part of each four-year AM Evaluation (Table 5 of the AMMP, TerraGraphics 2017). It is assumed that MSHCP-covered species not specifically named in this list will be covered by the general riparian and desert upland habitat quality serving as a proxy for monitoring of individual species' populations. Criteria set forth in Table 5 of the AMMP provide a mechanism for monitoring and evaluating the status and trends of MSHCP-covered species and their habitats. This will ensure that if species are faring poorly, then future conservation actions and projects may be directed to determine if and how the species populations and their habitats can be improved. The AMMP established targets and triggers for species population and habitat trends (Table 5 in the AMMP). Essentially, a species or habitat will either achieve the 'target' if (a) its population or habitat quality, respectively, is stable or increasing, or, (b) it will meet the trigger if the monitoring data indicate the population or habitat quality is decreasing.

The AMMP was finalized in January 2017 and is being implemented at an intentional pace. With this in mind, some of the sampling designs outlined in the AMMP have not been fully developed and implemented as on-the-ground monitoring projects. Other data from recently implemented sampling designs have been collected but not yet processed, and other data have been collected and processed but for an insufficient number of years to allow for statistical estimation of indicator trend as specified in the AMMP and Table 5 therein. The evaluation in Attachment A details statistical analyses that have been completed and provides suggestions for the next AM Evaluation when additional, and longer-term, data will be available.

Monitoring surveys have been started for the reptiles, birds, and bats. However, the bat acoustic monitoring data have not yet been processed and are therefore not part of this evaluation. The plant species will be surveyed in spring of 2020 across Clark County but are currently not known to occur within reserve system lands. Methods to quantify and monitor riparian and desert upland habitat quality are anticipated to be developed as part of the November 2020 Habitat Monitoring Workshop. Therefore, based on current availability of data, only the reptile and bird species were analyzed for this AM Evaluation. A formal statistical analysis was conducted for all reptile and bird species; however, small sample sizes prohibited clear result interpretation for all species except the desert tortoise.

Summary results are included in Table 4, below (identical to Table 2 in Attachment A). Results for the desert tortoise population trend indicated that a stable trend model was best supported by the data and that the target was met. Qualitative determinations were made regarding the population trend for desert iguana, leopard lizard, yellow-billed cuckoo, southwestern willow flycatcher, Arizona Bell's vireo, blue grosbeak, and phainopepla. In all cases, the limited data available qualitatively indicate that the target is being met. All qualitative determinations of targets being met were based on data, and the lack of any statistically significant trend served as the primary basis for a determination of stable occupancy rates and densities. All other species listed in Table 4 did not have sufficient monitoring data to conduct a statistical or qualitative trend analysis.

Table 4. Results from species and habitat criteria evaluation

Monitoring survey	Covered species group	Species	Target	Target achieved?	Trigger	Trigger met?
Occupancy sampling	Desert upland reptiles	Desert tortoise	Stable or increasing populations across desert upland reserve lands during the assessment period	YES	Decreasing populations across desert upland reserve lands during the assessment period	NO
		Great Basin collared lizard		N/A		N/A
		Desert iguana		YES		NO
		Large-spotted leopard lizard		YES		NO
Federal protocol	-	Yellow-billed cuckoo	Stable or increasing populations across riparian reserve lands during the assessment period	YES	Decreasing populations across riparian reserve lands during the assessment period	NO
Federal protocol	-	Southwestern willow flycatcher	Stable or increasing populations across riparian reserve lands during the assessment period	YES	Decreasing populations across riparian reserve lands during the assessment period	NO
Point count	Riparian birds	Blue grosbeak	Stable or increasing populations across riparian reserve lands during the assessment period	YES	Decreasing populations across riparian reserve lands during the assessment period	NO
		Phainopepla		YES		NO
		Summer tanager		N/A		N/A
		Vermillion flycatcher		N/A		N/A
		Arizona Bell's vireo		YES		NO
Passive acoustic occupancy	Bats	Silver-haired bat	Stable or increasing populations across reserve lands during the assessment period	N/A	Decreasing populations across reserve lands during the assessment period	N/A
		Long-eared myotis		N/A		N/A
		Long-legged myotis		N/A		N/A
Species-specific	Desert upland plants	Sticky ringstem	Stable or increasing populations across reserve lands during the assessment period	N/A	Decreasing populations across reserve lands during the assessment period	N/A
		Las Vegas bearpoppy		N/A		N/A
		White bearpoppy		N/A		N/A
		Rosy king sandwort		N/A		N/A
		Threecorner milkvetch		N/A		N/A
		Alkali mariposa lily		N/A		N/A
		Blue Diamond cholla		N/A		N/A
		Forked (Pahrump Valley) buckwheat		N/A		N/A
		Sticky buckwheat		N/A		N/A
		White-margined beardtongue		N/A		N/A
TBD	Riparian	Habitat quality	Stable or increasing habitat quality across riparian reserve lands during the assessment period	N/A	Decreasing habitat quality across riparian reserve lands during the assessment period	N/A
TBD	Desert upland	Habitat quality	Stable or increasing habitat quality across desert upland reserve lands during the assessment period	N/A	Decreasing habitat quality across desert upland reserve lands during the assessment period	N/A

Section 4 References

Clark County 2018. Implementation Plan and Budget 2019- 2021, Final Report. December 2018. http://www.clarkcountynv.gov/airquality/dcp/Documents/Library/dcp%20reports/2019/2019-2021_IPB%20Report_Final.pdf

Clark County 2019a. 2017-2019 Biennium Progress Report. November 2019. http://www.clarkcountynv.gov/airquality/dcp/Documents/Library/dcp%20reports/2019/2019-2021_IPB%20Report_Final.pdf

Clark County 2019b. Riparian Reserves Management Plan. Version 1.2. April 2019.

Clark County 2019c. Boulder City Conservation Easement Management Plan. Version 3.4. February 2019.

National Park Service (NPS) 2016. Boulder City Conservation Easement Weed Sentry - 2016 Final Report. Prepared for the Desert Conservation Program. Clark County DCP Project Number 2007-NPS-714K. November 4, 2016.

NPS 2017. Boulder City Conservation Easement Weed Sentry - 2017 Final Report. Prepared for the Desert Conservation Program. Clark County DCP Project Number 2011-NPS-910R.

NPS 2018a. Final Report, Muddy River Weed Management. Prepared for the Desert Conservation Program. Project Number 2015-NPS-1520B.

NPS 2018b. Boulder City Conservation Easement Weed Sentry - 2018 Final Report. Prepared for the Desert Conservation Program. Clark County DCP Project Number 2017-NPS-1710B.

TerraGraphics 2017. Adaptive Management and Monitoring Plan. Prepared by the Science Advisor Panel for the Desert Conservation Program. January 9, 2017.

Wright 2019. Personal communication, September 24, 2019 email.

Attachment A
Evaluation of Species and Habitat Monitoring Criteria

Clark County Desert Conservation Program

Evaluation of Species and Habitat Monitoring Criteria – *Analysis for the Adaptive Management Evaluation (AMMP Table 5 Analysis)*

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Synopsis:

This report represents the statistical analysis and results of currently available data to complete Table 5 of the Adaptive Management and Monitoring Plan (AMMP; cite YYYY). This is the first year that the AMMP has been implemented and is therefore a partial implementation. Some of the sampling designs to collect data for Table 5 have not been developed, some data have been collected but not yet processed, and some data have been collected and processed but for an insufficient number of years to allow for statistical estimation of indicator trend as specified in the AMMP and Table 5 therein. Nonetheless, this report details statistical analyses that have been completed and provides suggestions for the next implementation of the AMMP when additional, and longer-term, data will be available. Description of the goal of the AMMP and its associated content will not be presented here, as these results are intended to be inserted into the draft Biennial Adaptive Management Report and AMMP document.

Introduction

Table 5 in the AMMP lists 24 individual species and two vegetation communities to be monitored and analyzed as part of each four-year implementation of the AMMP process (reproduced as Table 1 below). These species were selected based on inclusion as a covered species in the Multiple Species Habitat Conservation Plan (MSHCP; cite YYYY), status as a state or federally-listed species, and likelihood of prevalence to allow eventual statistical estimation of population trend. For MSHCP-covered species not included in Table 5 of the AMMP, it is assumed that general riparian and desert upland habitat quality will serve as a proxy for monitoring of individual species' populations. Table 5 is part of the adaptive management process of the AMMP. The ultimate goal of Table 5 is to provide a mechanism for monitoring and evaluating the status and trends of MSHCP-covered species and their habitats. This will ensure that if species are faring poorly, then future conservation actions and projects may be directed to determine if and how the species populations and their habitats can be improved.

The AMMP was written and finalized in December, 2016. Therefore, given the state of knowledge of the distribution of some species in Table 5, the complexity of developing a sampling framework for habitat quality, and the timeline of funding of DCP projects, data are not available for all of the species and habitats listed in Table 5. The goal of this report and associated methods are to start the AMMP process, albeit partially, and to provide a framework and baseline results for the full AMMP analysis four years hence.

Methods

The AMMP specifically calls for population monitoring for four reptiles, seven birds, three bats, ten plants, and two habitat associations. Monitoring surveys have been started for the reptiles, birds, and bats. However, the bat acoustic monitoring data have not yet been processed and are therefore not part of this analysis. The plant species will be surveyed for in spring of 2020 across Clark County, but are currently not known to occur within reserve system lands. Methods to quantify and monitor riparian and desert upland habitat quality will be developed as part of a workshop with the Desert Conservation Program and the Science Advisor Panel in 2020. Therefore, based on current availability of data, only the reptile and bird species were analyzed in this report.

Table 5 in the AMMP (Table 1) evaluates species' population and habitat trends as either achieving desired targets or meeting undesired triggers. Targets are defined as "stable or increasing" and triggers are defined as "decreasing" trends. Standard statistical tests are based on evaluating support within a data set for rejecting a null hypothesis. In the case of trend analysis, a stable trend was defined as a lack of either an increasing or decreasing trend. Based on the short number of years that monitoring data have been collected, only strong population trends were expected to be detected in the statistical analysis.

Reptiles

Occupancy monitoring surveys for desert tortoise (*Gopherus agasizii*) were conducted from 2013 through 2018, providing six years of data for trend analysis. Other reptile species were incidentally observed and recorded during the desert tortoise surveys from 2015 through 2018. Dynamic occupancy models were used to analyze the desert tortoise occupancy data (MacKenzie et al. 2003). Dynamic occupancy models allow for modeling trends in the proportion of sampling sites where a species is present and explicitly incorporates imperfect detection. Imperfect detection is where, when a species is truly present at a site, it may not be

observed during any given single visit. A fully-parameterized dynamic occupancy model was fit to each species' occupancy data using the 'unmarked' package in Program R. This allowed for the most independence in estimated yearly occupancy rates by allowing colonization (the rate at which unoccupied sites become occupied), extinction (the rate at which occupied sites become unoccupied), and detection probability (the probability of detecting the species given true presence) to vary independently from year to year. These rates were then used to derive estimated annual occupancy rates.

Table 1. Excerpted Table 5 from the Adaptive Management and Monitoring Plan (AMMP 2016).

Monitoring survey	Covered species group	Species	Target	Target achieved?	Trigger	Trigger met?
Occupancy sampling	Desert upland reptiles[a]	**Desert tortoise**	Stable or increasing populations across desert upland reserve lands during the assessment period		Decreasing populations across desert upland reserve lands during the assessment period	
		Great Basin collared lizard				
		Desert iguana				
		Large-spotted leopard lizard				
Federal protocol	-	**Yellow-billed cuckoo**	Stable or increasing populations across riparian reserve lands during the assessment period		Decreasing populations across riparian reserve lands during the assessment period	
Federal protocol	-	**Southwestern willow flycatcher**	Stable or increasing populations across riparian reserve lands during the assessment period		Decreasing populations across riparian reserve lands during the assessment period	
Point count	Riparian birds	Blue grosbeak	Stable or increasing populations across riparian reserve lands during the assessment period		Decreasing populations across riparian reserve lands during the assessment period	
		Phainopepla				
		Summer tanager				
		Vermillion flycatcher				
		Arizona Bell's vireo				
Passive acoustic occupancy	Bats	Silver-haired bat	Stable or increasing populations across reserve lands during the assessment period		Decreasing populations across reserve lands during the assessment period	
		Long-eared myotis				
		Long-legged myotis				
Species-specific	Desert upland plants	Sticky ringstem	Stable or increasing populations across reserve lands during the assessment period		Decreasing populations across reserve lands during the assessment period	
		Las Vegas bearpoppy				
		White bearpoppy				
		Rosy king sandwort				
		Threecorner milkvetch				
		Alkali mariposa lily				
		Blue Diamond cholla				
		Forked (Pahrump Valley) buckwheat				
		Sticky buckwheat				
		White-margined beardtongue				
TBD[b]	Riparian	Habitat quality	Stable or increasing habitat quality across riparian reserve lands during the assessment period		Decreasing habitat quality across riparian reserve lands during the assessment period	
TBD[b]	Desert upland	Habitat quality[c]	Stable or increasing habitat quality across desert upland reserve lands during the assessment period		Decreasing habitat quality across desert upland reserve lands during the assessment period	

Note: Species in **bold** are indicator species and must be surveyed sufficiently for statistical analysis of status and trend.

[a]Other MSHCP-listed reptile species will be covered using 'desert upland habitat quality' as a surrogate.

[b]To be decided: Appendix A outlines possible approaches; specific monitoring methods to be determined prior to initial survey.

[c]Desert upland habitat quality also serves as surrogate for peregrine falcon and nine cryptic reptile species.

Constant intercept (i.e., no trend), simple linear, and quadratic regressions were then performed on the annual occupancy rate estimates to test for a statistical trend over time. Trend models were compared using sample size-corrected Akaike's Information Criterion (AICc). Desert tortoise apparent annual occupancy rates are known to vary dramatically over time due to interannual variations in aboveground activity rates and therefore are often unavailable for detection (Harju and Cambrin 2019). However, after a sufficient number of years, trend detection should be possible in spite of interannual sampling noise.

Avian

Surveys for yellow-billed cuckoo (*Coccyzus americanus*) and southwestern willow flycatcher (*Empidonax traillii extimus*) were conducted following established federal survey protocols specific to each species. Protocol surveys included 4-5 visits within a breeding season to conduct callback surveys and visual point count surveys. As new reserve unit properties were acquired within this window, not all survey units were surveyed in each year. To standardize for unequal survey areas and unequal time spent in each unit (due to survey effort or unit size), detections of individuals were standardized by the number of hours expended surveying each unit.

Point count surveys for all other avian species were conducted at riparian reserve units in 2017, 2018, and 2019 and at the Boulder City Conservation Easement in 2018 and 2019. Surveys were 10 minutes in duration and survey stations were visited three times each year. Each avian species observed was recorded along with estimated distance from the survey point. Trends in occupancy rates of five non-listed avian species listed in Table 5 of the AMMP were analyzed using dynamic occupancy models and species detection/non-detection data using the 'unmarked' package in Program R. A fully-parameterized dynamic occupancy model was fit to each species' occupancy data using the 'unmarked' package in Program R. This allowed for the most independence in estimated yearly occupancy rates by allowing colonization (the rate at which unoccupied sites become occupied), extinction (the rate at which occupied sites become unoccupied), and detection probability (the probability of detecting the species given true presence) to vary independently from year to year. These rates were then used to derive estimated annual occupancy rates. Constant intercept (i.e., no trend), simple linear, and quadratic regressions were then performed on the annual occupancy rate estimates to test for a statistical trend over time. Trend models were compared using sample size-corrected Akaike's Information Criterion (AICc).

Trends in detection-corrected avian densities of the same five non-listed avian species from Table 5 of the AMMP were analyzed using point count distance sampling in the 'unmarked' package in Program R. Distance sampling for point counts uses the distance between the survey point and the individual observed birds to model imperfect detection as a function of distance (Dénes et al. 2015). For each species, Akaike's Information Criterion (AIC) was used to select the distance decay function that best approximated imperfect detection of that species based on half normal, hazard, exponential, and uniform decay functions. Distance detection probabilities were allowed to vary independently each year for each species to most accurately specify the distance decay function.

Results

Reptiles

A total of 2,130 reptile occupancy surveys were conducted between 2013 and 2018. During these surveys, a desert tortoise was observed within the survey plot 125 times. Other reptile species were less common, with 65 desert iguanas (*Dipsosaurus dorsalis*), 43 leopard lizard (*Gambelia wislizenii*), and only two Great Basin collared lizards (*Crotaphytus bicinctores*) observed between 2015 and 2018.

Detection probability of live desert tortoises was highly variable among years, with the lowest detection probability of 0.097 in 2015 and 0.338 in 2013 (Figure 1). Apparent occupancy rate of desert tortoise varied over the six years of data, ranging from a low of 0.131 in 2013 to a high of 0.541 in 2015 (Figure 2). Three models were tested for trend analysis, a constant no-trend model, a linear trend model, and a quadratic trend model. Despite a seemingly quadratic trend in apparent occupancy over the six years, after correcting for overfitting of small sample sizes, AICc values indicated that the no-trend model was considerably better than either a linear trend model (ΔAICc = 8.94) or a quadratic trend model (ΔAICc = 31.23).

Figure 1. Annual detection probabilities for live desert tortoises during occupancy surveys on the Boulder City Conservation Easement, Nevada. Detection probability defined as the probability of detecting a tortoise on a single survey, given that the site was truly occupied within that year. Error whiskers are 95% confidence intervals.

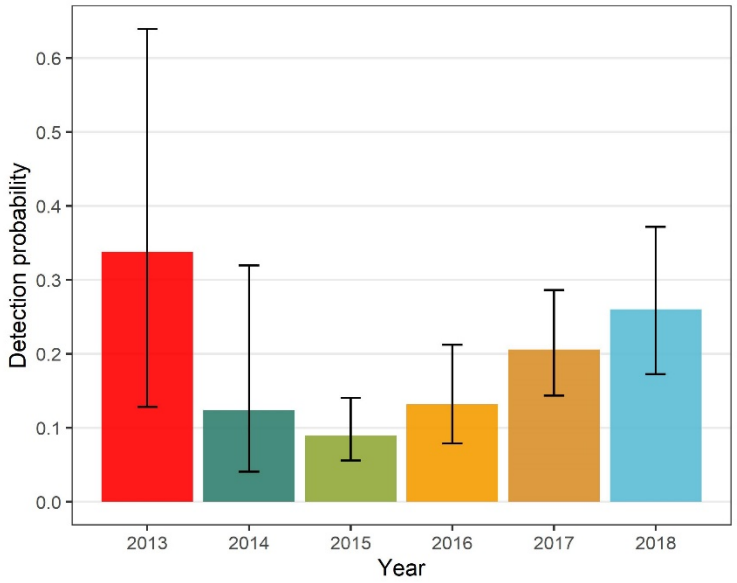
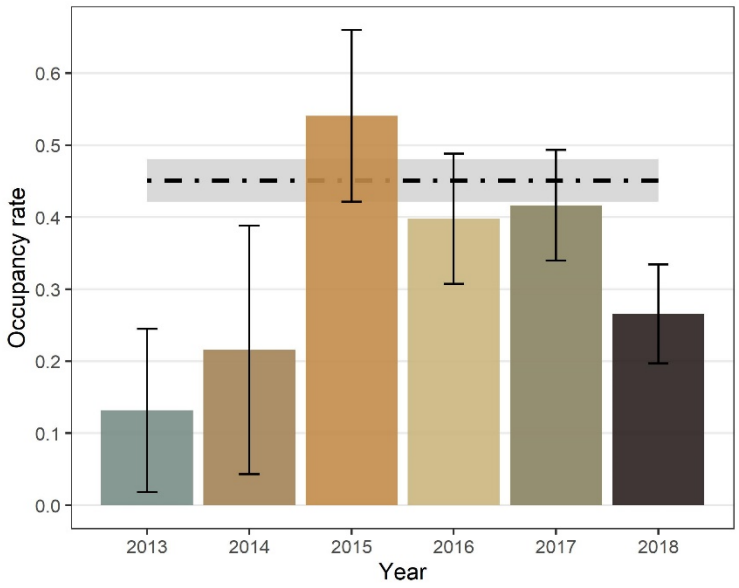
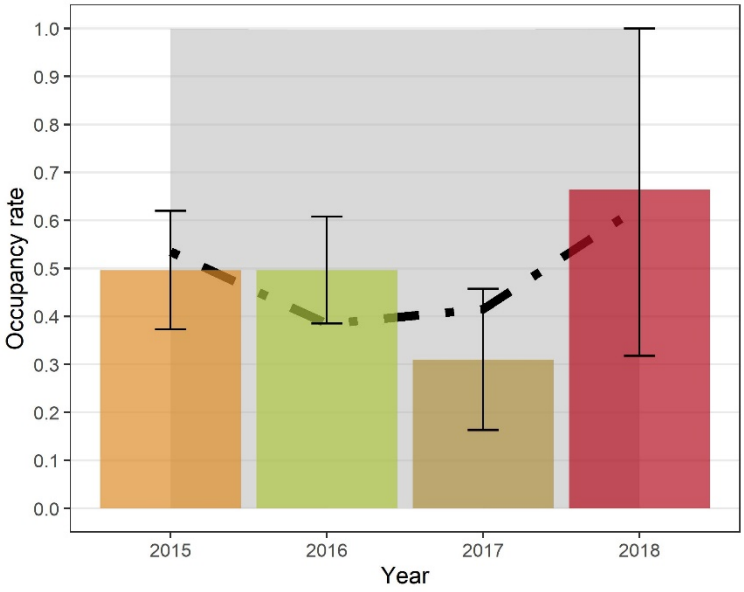


Figure 2. Estimated annual occupancy rates of desert tortoises on the Boulder City Conservation Easement, Nevada, derived from a fully-parameterized dynamic occupancy model. Vertical bars are year-specific area-wide occupancy rate estimates (error bars are +/- one standard error). Horizontal dashed line is the trend estimate from the best model (i.e., no trend, with gray 95% confidence interval band).



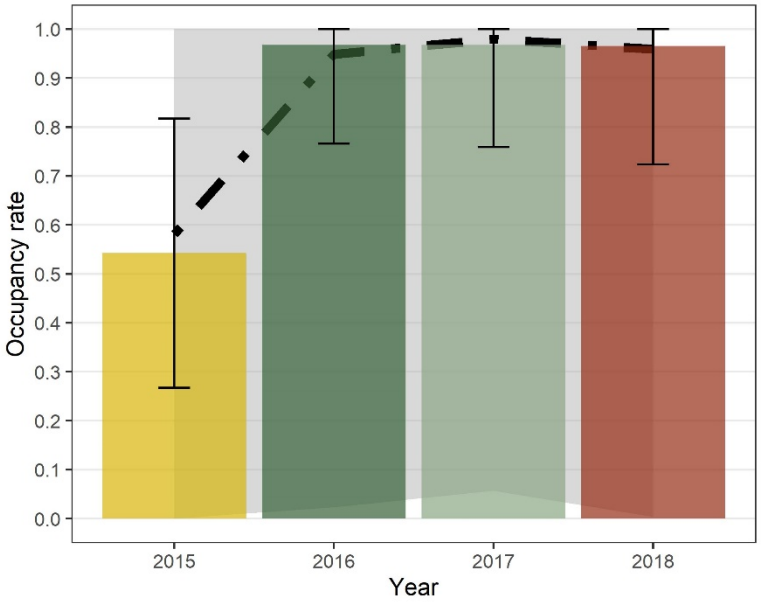
Detection probabilities for desert iguana were extremely low, ranging from 0.004 to 0.110. Occupancy rates of desert iguana from 2015 through 2018 were fairly even, with a slight drop in 2017 and an uptick in 2018 (Figure 3). The quadratic trend model performed best and fit the occupancy trend considerably better than a no-trend model (ΔAICc = 51.46) or a linear trend model (ΔAICc = Inf). However, due to small sample size, the 95% confidence intervals for the quadratic trend essentially covered the range from 0.00 to 1.00 occupancy rates in all years (Figure 3). Therefore a statistical trend was not detectable, but based on the pattern of point estimates and the trend model selection results it was determined that a qualitative conclusion of stable or increasing population trends can be made.

Figure 3. Estimated annual occupancy rates of desert iguanas on the Boulder City Conservation Easement, Nevada, derived from a fully-parameterized dynamic occupancy model. Vertical bars are year-specific area-wide occupancy rate estimates (error bars are +/- one standard error). Horizontal dashed line is the trend estimate from the best model (i.e., quadratic trend, with gray 95% confidence interval band).



Detection probabilities for leopard lizard were also extremely low, ranging from 0.015 to 0.044. Estimated occupancy rates of leopard lizard implied a large increase in area occupied after 2015 (Figure 4). The quadratic trend model performed best and fit the occupancy trend considerably better than a no-trend model (ΔAICc = 58.86) or a linear trend model (ΔAICc = Inf). However, due to small sample size, the 95% confidence intervals for the quadratic trend essentially covered the range from 0.00 to 1.00 occupancy rates in all years (Figure 4). Therefore a statistical trend was not detectable, but based on the pattern of point estimates and the trend model selection results, it was determined that a qualitative conclusion of stable or increasing population trends can be made. The two solitary observations reported for the Great Basin collared lizard prevented analysis of occupancy trends for that species.

Figure 4. Estimated annual occupancy rates of leopard lizards on the Boulder City Conservation Easement, Nevada, derived from a fully-parameterized dynamic occupancy model. Vertical bars are year-specific area-wide occupancy rate estimates (error bars are +/- one standard error). Horizontal dashed line is the trend estimate from the best model (i.e., quadratic trend, with gray 95% confidence interval band).



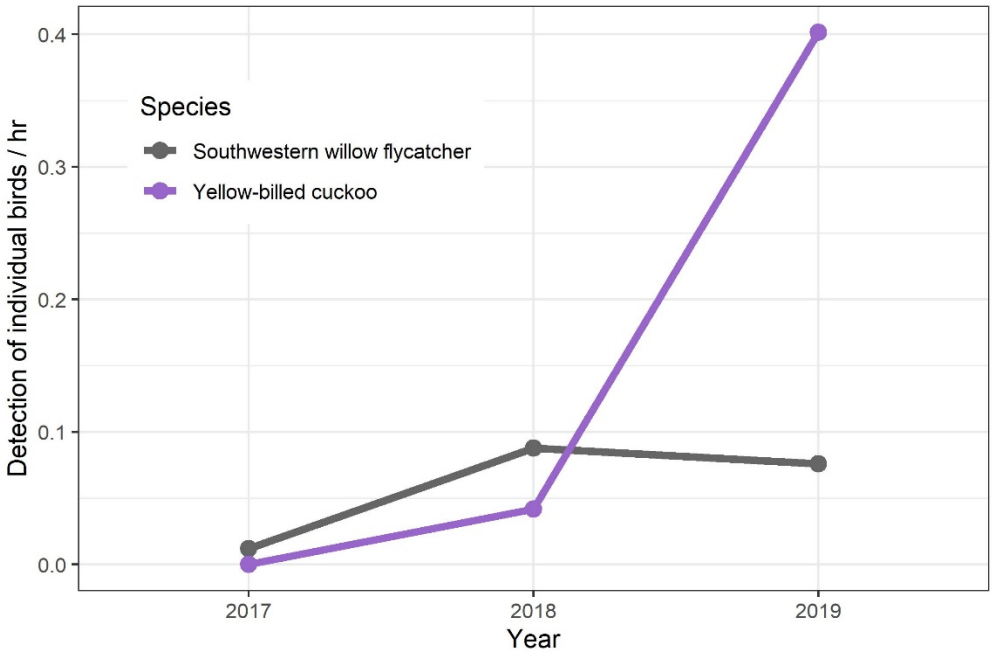
Avian

Protocol surveys for yellow-billed cuckoos and southwestern willow flycatchers took place at multiple riparian reserve units each year from 2017-2019. Observations of yellow-billed cuckoo and southwestern willow flycatcher were too few to permit statistical analysis and therefore raw data are presented here. There were zero cuckoos detected in 2017, 1 individual in 2018, and 13 detections in 2019. There was also one cuckoo nest detected in 2019. There was one southwestern willow flycatcher individual and one territory detected in 2017 and five individuals and six nests detected in 2018. There were five individual flycatchers, three pairs, four territories, and five nests detected in 2019. Individual birds detected per hour of survey effort increased from 2017 to 2019 for both yellow-billed cuckoos and southwestern willow flycatchers (Figure 5). Based on raw and standardized survey results for both species, populations of both species appear stable or increasing on riparian reserve units.

Detections of the non-federally listed bird species in Table 5 of the AMMP (Table 1 here) were not equal among species. In 2017, 2018, and 2019, Arizona Bell's vireo (*Vireo bellii*) had 204 detections during point count surveys in riparian reserve units, blue grosbeak (*Passerina caerulea*) had 59 detections, phainopepla (*Phainopepla nitens*) had 41 detections, vermillion flycatcher (*Pyrocephalus rubinus*) had 21 detections, and summer tanager (*Piranga rubra*) had four detections.

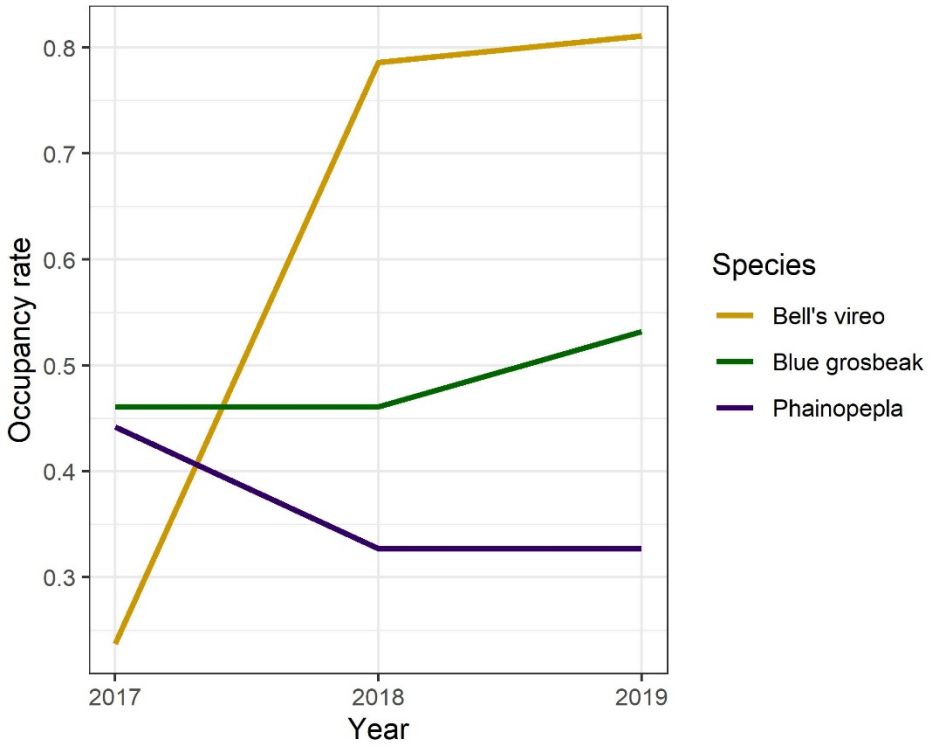
Occupancy rates of Arizona Bell's vireo on riparian reserve units appeared to be increasing from 2017 through 2019, although this trend was not statistically significant ($p = 0.309$) suggesting stable trends of Arizona Bell's vireo occupancy given the short time frame of the analysis (Figure 6). Detection rates of any Arizona Bell's vireo during a single survey was moderately high, ranging from 0.629 to 0.820. For the distance sampling density analysis, Arizona Bell's vireo distance detection probability was best explained by a hazard decay function (ΔAIC of next-best function = 13.04). After accounting for year-specific variation in distance detection probability, density was fairly constant over the three years, with similar point estimates ranging from 0.323 to 0.527 birds / hectare with broadly overlapping 95% confidence intervals (Figure 7). Qualitatively these data suggested stable densities of Arizona Bell's vireo.

Figure 5. Number of individual birds detected per hour of survey effort to account for unequal reserve unit sizes and unequal survey effort across units and years.



Occupancy rates of blue grosbeak on riparian reserve units appeared stable from 2017 through 2019, and the small estimated positive trend was not statistically significant ($p = 0.331$) suggesting stable trends of blue grosbeak occupancy given the short time frame of the analysis (Figure 6). Detection rates of any blue grosbeak during a single survey were low to moderate, ranging from 0.224 to 0.581. For the distance sampling density analysis, blue grosbeak distance detection probability was best explained by a half normal decay function (ΔAIC of next-best function = 3.29). Density point estimates were stable across the three years, ranging from 0.39 to 0.49 birds / hectare, albeit with very wide and overlapping 95% confidence intervals (Figure 7). Wide confidence intervals prevented statistical trend estimation, but qualitatively these results suggest stable blue grosbeak population densities on riparian reserve units.

Figure 6. Estimated occupancy rates for Arizona bell's vireo, blue grosbeak, and phainopepla on Desert Conservation Program riparian reserve units in Clark County, NV from 2017 through 2019.



Occupancy rates of phainopepla on riparian reserve units appeared to decline from 2017 through 2019, but the estimated negative trend was not statistically significant ($p = 0.334$) suggesting stable trends of phainopepla occupancy given the short time frame of the analysis (Figure 6). Detection rates of any phainopepla during a single survey were low, ranging from 0.115 to 0.228. For the distance sampling density analysis, phainopepla distance detection probability was best explained by a hazard decay function (ΔAIC of next-best function = 25.24). Density point estimates appeared higher in 2018 and 2019 than in 2017 (41.42 and 43.51 compared to 3.55 birds / hectare, respectively), although 95% confidence intervals in bird density were implausibly wide in 2018 and 2019 due to small sample sizes (Figure 7). Wide confidence intervals prevented statistical trend estimation, but qualitatively these results suggest stable phainopepla population densities on riparian reserve units.

Approximately 40 detections are necessary to parameterize distance decay functions for detection probability, so density modeling of vermillion flycatcher and summer tanager were not possible for this dataset due to insufficient sample sizes. For point count surveys in 2018 and 2019 on the Boulder City Conservation Easement, the only species of these five that was detected was phainopepla, with one detection. This sample size was also too small for density estimation on the Boulder City Conservation Easement.

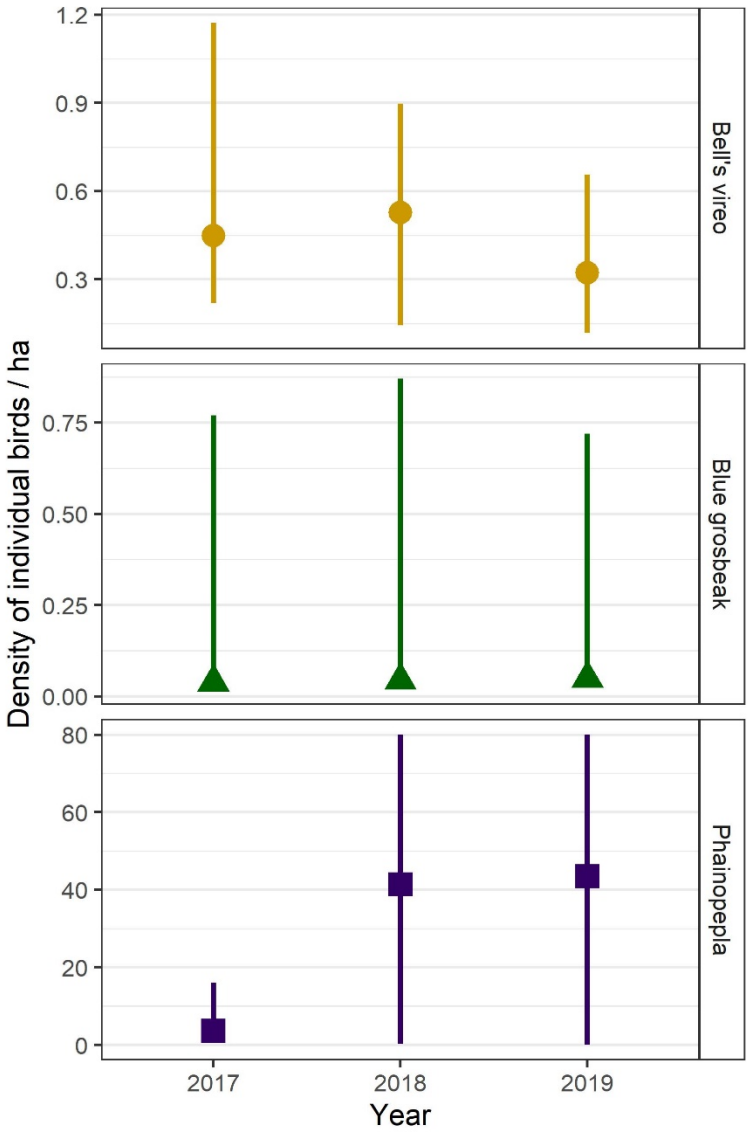


Figure 7. Avian density estimates for three species on Desert Conservation Program riparian reserve units in Clark County, Nevada. Error bars are 95% confidence intervals. Note that the displayed y-axis for phainopepla was truncated for clarity; confidence intervals for 2018 and 2019 extended implausibly high due to low sample sizes in these years.

Discussion

The primary goals of the AMMP were to guide and ensure regular monitoring of MSHCP-covered species and their habitats and to provide a mechanism for identifying potential corrective conservation actions if species and habitats fare poorly on reserve lands. Table 5 of the AMMP provides the mechanism for objectively determining when greater attention is warranted on declining species or habitat quality. This mechanism is achieved via quantitative analysis of species and habitat trends and subsequent completion of Table 5. Here, Table 5 of the AMMP has been completed to the fullest extent possible given currently-collected data (Table 2 below).

Determination of whether the target was met was statistically possible for desert tortoise because of the longer period over which data have been collected and the clear statistical determination that a stable trend model was best supported by the data. Qualitative

determinations have been made that targets are being met for desert iguana, leopard lizard, yellow-billed cuckoo, southwestern willow flycatcher, Arizona Bell's vireo, blue grosbeak, and phainopepla. All qualitative determinations of targets being met were based on data, with the lack of any statistically significant trend serving as the basis for a determination of stable occupancy rates and densities. It is expected that sufficient data for these species will be available at the next AMMP evaluation to conduct statistical trend analyses. It should be noted that for the remainder of species and habitats in Table 5 of the AMMP, it was not possible to conduct statistical or qualitative trend analysis. It is expected that sufficient data for either statistical or qualitative trend analysis will be available at the next AMMP evaluation. It is strongly encouraged that future statistical trend analyses adopt or modify the analytical approaches provided here to ensure consistency, comparability, and the explicit incorporation of imperfect detection of wildlife species.

Table 2. Completed Table 5 from the Adaptive Management and Monitoring Plan (AMMP 2016). Note that meeting of most targets or triggers could not be quantifiably determined due to a lack of specific data at this time (e.g., N/A).

Monitoring survey	Covered species group	Species	Target	Target achieved?	Trigger	Trigger met?
Occupancy sampling	Desert upland reptiles	**Desert tortoise**	Stable or increasing populations across desert upland reserve lands during the assessment period	YES	Decreasing populations across desert upland reserve lands during the assessment period	NO
		Great Basin collared lizard		N/A		N/A
		Desert iguana		YES		NO
		Large-spotted leopard lizard		YES		NO
Federal protocol	-	**Yellow-billed cuckoo**	Stable or increasing populations across riparian reserve lands during the assessment period	YES	Decreasing populations across riparian reserve lands during the assessment period	NO
Federal protocol	-	**Southwestern willow flycatcher**	Stable or increasing populations across riparian reserve lands during the assessment period	YES	Decreasing populations across riparian reserve lands during the assessment period	NO
Point count	Riparian birds	Blue grosbeak	Stable or increasing populations across riparian reserve lands during the assessment period	YES	Decreasing populations across riparian reserve lands during the assessment period	NO
		Phainopepla		YES		NO
		Summer tanager		N/A		N/A
		Vermillion flycatcher		N/A		N/A
		Arizona Bell's vireo		YES		NO
Passive acoustic occupancy	Bats	Silver-haired bat	Stable or increasing populations across reserve lands during the assessment period	N/A	Decreasing populations across reserve lands during the assessment period	N/A
		Long-eared myotis		N/A		N/A
		Long-legged myotis		N/A		N/A
Species-specific	Desert upland plants	Sticky ringstem	Stable or increasing populations across reserve lands during the assessment period	N/A	Decreasing populations across reserve lands during the assessment period	N/A
		Las Vegas bearpoppy		N/A		N/A
		White bearpoppy		N/A		N/A
		Rosy king sandwort		N/A		N/A
		Threecorner milkvetch		N/A		N/A
		Alkali mariposa lily		N/A		N/A
		Blue Diamond cholla		N/A		N/A
		Forked (Pahrump Valley) buckwheat		N/A		N/A
		Sticky buckwheat		N/A		N/A
		White-margined beardtongue		N/A		N/A
TBD	Riparian	Habitat quality	Stable or increasing habitat quality across riparian reserve lands during the assessment period	N/A	Decreasing habitat quality across riparian reserve lands during the assessment period	N/A
TBD	Desert upland	Habitat quality	Stable or increasing habitat quality across desert upland reserve lands during the assessment period	N/A	Decreasing habitat quality across desert upland reserve lands during the assessment period	N/A

Literature cited

Adaptive Management and Monitoring Plan (AMMP). 2016. Prepared by TerraGraphics Environmental Engineering, Inc. for Clark County Desert Conservation Program.

Clark County. 2000. Final Clark County Multiple Species Habitat Conservation Plan and Environmental Impact Statement for Issuance of a Permit to Allow Incidental Take of 79 Species in Clark County, Nevada.

Dénes, F.V., L.F. Silveira, and S.R. Beissinger. 2015. Estimating abundance of unmarked animal populations: accounting for imperfect detection and other sources of zero inflation. Methods in Ecology and Evolution 6:543-556.

Harju, S.M., and S.M. Cambrin. 2019. Identifying habitat correlates of latent occupancy when apparent annual occupancy is confounded with availability for detection. Biological Conservation 238:108246.

MacKenzie, D.I., J.D. Nichols, J.E. Hines, M.G. Knutson, and A.B. Franklin. 2003. Estimating site occupancy, colonization, and local extinction when a species is detected imperfectly. Ecology 84:2200-2207.

Attachment B
Analysis of Habitat Fragmentation/Connectivity

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M E M O R A N D U M

To: Scott Cambrin, Clark County Desert Conservation Program, Las Vegas, NV

From: Tarita Harju, Alta, Kellogg, ID

Date: February 7, 2020

Job Code: 2017-ALTA-1730A – D41

Subject: **Analysis of Habitat Fragmentation / Connectivity - Final**

Section 1 Introduction

This memorandum describes baseline fragmentation and connectivity analyses that were conducted to support the 2020 Adaptive Management Report (AMR). Several technical documents and the MSHCP specifically discuss or list habitat fragmentation in the context of quantifying and reducing it.

1.1 Need for analysis

The Adaptive Management and Monitoring Plan (AMMP) discusses habitat fragmentation and connectivity, including an outline of suggested analyses in Section 2.6.3 (TerraGraphics 2017). Specifically, the AMMP states that:

- Baseline connectivity and fragmentation metrics should be calculated for each reserve unit in order to prioritize and assess effects of invasive species removal, habitat restoration, and land acquisition projects.
- Landscape metrics should be (re)calculated for reserve units at least every four years to monitor changes in habitat fragmentation and connectivity.
- [Fragmentation metrics could also be calculated] at smaller scales (e.g., parcel, subunit) within reserve units to evaluate species-specific objectives
- [Fragmentation metrics could also be calculated] at broader scales to prioritize acquisition of new parcels that may increase connectivity.

The 2018 AMR included the recommendation to "*Identify a fragmentation metric(s) to monitor fragmentation in order to address the general goal of "*allow no net unmitigated loss or fragmentation of habitat…*" listed in Section 2.1.6 of the MSHCP (Clark County 2000)*", with the intention that the recommendation be addressed in the 2020 AMR.

The 2016 Biological Goals and Objectives (BGOs) include fragmentation and connectivity both directly and indirectly in several objectives, the most prominent being BGOs R1.5 and D1.5, which are "*Reduce habitat fragmentation and/or improve connectivity and habitat quality through restoration design and implementation*" (TerraGraphics 2016).

In summary, quantifying fragmentation is been repeatedly identified as a necessary part of reserve management, adaptive management, and is an explicit requirement in the MSHCP.

1.2 Fragmentation and connectivity

Habitat fragmentation is the splitting up of habitat into smaller, disconnected parcels (Turner et al. 2001). Habitat fragmentation can lead to habitat loss, habitat isolation, change in habitat quality, and greater edge effects (Van Dyke 2010). Habitat connectivity is the spatial continuity of habitat across a landscape (Turner et al. 2001, Crooks and Sanjayan 2006). Typically, as habitat fragmentation increases, habitat connectivity decreases, but connectivity is only achieved if individuals (i.e. plants or birds) move between connected habitat patches and is dependent on the scale, species, and ecological process being assessed (Crooks and Sanjayan 2006, Van Dyke 2010).

The spatial extent for assessing habitat fragmentation across a landscape depends on the habitat use and needs of each species, but usually can be assessed for a species home range and within its range-wide or regional distribution (e.g., what fragment size and degree of connectivity constitutes a mosaic of habitat that is meaningful to the species of interest?). Currently within Clark County there are 78 MSHCP-covered species and preferred habitat requirements vary considerably (e.g., the habitat requirements for a desert tortoise vary significantly from that of the yellow-billed cuckoo). To address the variability of habitat requirements for multiple species, the AMMP uses an indicator species approach (i.e., a species whose status is assumed to reflect the status of other species with which it shares the community; Van Dyke 2010) to monitor and adaptively manage for all 78 species (Section 2.5 of the AMMP, TerraGraphics 2017).

In addition to the landscape scale that is relevant to each species, the DCP must also consider the total areal extent of their durable lands (i.e., the Reserve System Lands, totaling 86,926 acres). Although information regarding habitat and anthropogenic uses across Clark County affects MSHCP-covered species, the DCP can only guarantee the durability of conservation-based projects on their Reserve System Lands. Fragmentation analyses may include areas beyond the Reserve System Lands, but the social-political context and rate of development are considerable factors when determining the spatial extent at which DCP can affect the MSHCP-cover species.

Section 1.1 lists several documents that encourage or require a fragmentation analysis at varying spatial extents, spatial resolutions, and for varying purposes. These analyses are highly dependent upon selecting an appropriate landscape extent and identifying which fragmentation metrics are meaningful and can be impacted by DCP conservation projects. For these reasons, we have only conducted a cursory baseline fragmentation analysis using the program FragStats (McGarigal et al. 2012). We anticipate the results and discussion provided here will facilitate discussion to identify appropriate spatial extents and fragmentation metrics at the November 2020 Habitat Monitoring Workshop.

Section 2 Limitations and challenges with existing technical documents describing fragmentation analyses

This section aims to review the language and proposed/recommended fragmentation analyses, and 1) specify what parts may or may not be achievable at this time and why, and 2) provide further recommendation regarding how and/or when it may be realistic to perform proposed analyses.

2.1 AMMP fragmentation discussion and analyses

The following is the same list of analyses provided in the introduction of this memorandum. We list limitations and challenges below each excerpt from the AMMP.

1. *Baseline connectivity and fragmentation metrics should be calculated for each reserve unit in order to prioritize and assess effects of invasive species removal, habitat restoration, and land acquisition projects*.

   Limitations/challenges:

   a) Baseline fragmentation metrics can be calculated for current Reserve System Lands and will be calculated for any additional Reserve System Lands acquired by Clark County. Fragmentation metrics averaged across all Reserve System Lands will change as lands are added to the reserve system, but will not necessarily be reflective of management or restoration work done by the DCP. The spatial extent and resolution of data available for newly acquired land may differ from established Reserve System Lands and may influence which baseline fragmentation metrics can be calculated.

   b) Several spatial extents and spatial resolutions of data are referenced in the excerpt from the AMMP—the fine resolution data required to assess effects of invasive species removal may be different from coarse resolution data used to prioritize land acquisition projects. Currently, the DCP has acquired coarse resolution data, such as ecosystem type data, that spans Clark County, but has only acquired finer resolution data for specific projects. The priority and timing of collecting fine resolution habitat data will be a topic at the November 2020 Habitat Monitoring Workshop.

2. *Landscape metrics should be (re)calculated for reserve units at least every four years to monitor changes in habitat fragmentation and connectivity*.

   Limitations/challenges:

   a) Data sources and quality are expected to change over time and may make comparability to older datasets challenging. We will preserve the data used to calculate baseline metrics but anticipate that in four years, the DCP will have a dataset with updated boundaries for ecosystem types, using data collected at a higher spatial resolution, and produced from different algorithms. We will need to be thoughtful about making comparisons between these different data sets.

   b) The limitation discussed in 1(a), above is also applicable.

3. *Fragmentation metrics could also be [calculated] at smaller scales (e.g., parcel, subunit) within reserve units to evaluate species-specific objectives*

   Limitations/challenges:

   a) The idea of nesting a parcel or subunit within a larger unit for fragmentation analysis is not intuitive for the Riparian Reserve System because several of the parcels are already spatially isolated. The DCP acquires land by the parcel and these parcels are not necessarily contiguous with existing Reserve System. The appropriate spatial extent and resolution for monitoring landscape fragmentation metrics should be determined prior to baseline analysis and monitoring.

   b) Fragmentation and connectivity metrics that are based on species-specific objectives will be a discussion topic at the November 2020 Habitat Monitoring

Workshop. Related topics that need clarification, planning, and/or research to effectively determine which metrics should be calculated for which species' habitat include:

i. Appropriate buffer sizes/home ranges for each MSHCP-listed species and/or multiple species that may occur in the same general area. How well do these buffers or home ranges overlay with existing DCP data? For example, avian and bat home ranges may be more complex to conceptually apply to static Reserve System Lands.

ii. Which metrics should be calculated for each species separately versus combining the requirements/preferences of multiple species together? For example, seven avian species are MSHCP-listed that may occur in riparian habitats and they have different habitat requirements.

iii. What spatial extent and resolution of data is required for species-specific metrics? How obtainable/realistic is it to acquire fine-resolution data at the spatial extent relevant to the species (e.g., the home range of a bird) versus collecting fine-resolution data only on Reserve System Lands?

4. *Fragmentation metrics [could also be calculated] at broader scales to prioritize acquisition of new parcels that may increase connectivity.*

Limitations/challenges:

a) We assume that any analysis informing connectivity at the landscape level uses coarse-resolution data such as the existing ecosystem type data, and it is not practical to factor in other data such as presence of invasive species and/or habitat quality at such a coarse resolution. However, finer resolution factors should be considered, and presumably are considered, during parcel acquisition.

b) The property acquisition matrix currently used to evaluate and rank potential acquisitions includes environmental criteria that address proximity to protected lands (federal, state, or otherwise conserved lands), proximity to MSHCP-covered species habitat, the presence of noxious weeds, and the ability of the property to support native riparian plants. These criteria, although not specifically naming connectivity, are clearly factoring in variables meaningful and relevant to landscape connectivity. We see this as recognition that the DCP already factors in connectivity and habitat quality in their acquisition decisions. The DCP's method of evaluating a property for acquisition requires on-site evaluation, which may be more informative than a fine- or coarse-scale fragmentation analysis.

c) A coarse-scale fragmentation analysis identifying areas likely to increase connectivity (and /or, increase habitat diversity for the maximum number of MSHCP-listed species) would be useful.

2.2 2018 AMR Recommendation for Fragmentation Analysis

The 2018 AMR included the recommendation to "*Identify a fragmentation metric(s) to monitor fragmentation in order to address the general goal of "*allow no net unmitigated loss or fragmentation of habitat…*" listed in Section 2.1.6 of the MSHCP (Clark County 2000).*", with the recommendation that it be addressed in the 2020 AMR by the Science Advisor Panel.

Limitation/Challenges:

The specific decision of which metric(s) to use in monitoring to ensure the language in the MSHCP is upheld is entwined with discussion of spatial extent, spatial resolution, and habitat quality, both of which will be included in the November 2020 Habitat Monitoring Workshop. The FragStats analysis presented here provides several baseline metrics that are intended for discussion and decision making regarding the most appropriate long-term metrics to track.

In lieu of having a specific fragmentation metric to report addressing "no net unmitigated loss or fragmentation of habitat…" for the 2020 AMR, the Science Advisor Panel and DCP discussed options at the November 2019 Quarterly Meeting. The following discussion points from that meeting are relevant here:

- The DCP can influence habitat loss and fragmentation only on their durable lands (i.e., the Reserve System Lands).
- Management goals/actions on all Reserve System Lands emphasize conservation and there is no development or activities allowed on the lands that would 1) increase habitat fragmentation, or 2) result in habitat loss.
- Projects implemented by the DCP are conservation-based and include habitat restoration when practical.

With the above three bullets in mind, we concluded at the November 2019 Quarterly Meeting that for all Reserve System Lands, the extent of habitat loss and fragmentation can be assumed to remain the same as when the property was acquired, or decrease with the completion of restoration projects. The only exceptions to this would be:

1) A failed restoration project that degraded habitat instead of improving it. To our knowledge, this situation has not occurred during any restoration project
2) Unauthorized activities that result in habitat degradation. The DCP has measures in place, such as the presence of law enforcement and a public education program, to decrease the likelihood of unauthorized activities. Additionally, the coarse resolution of existing disturbance data would likely not detect degradation caused by unauthorized activities (e.g., the finest resolution data available for the baseline fragmentation analysis was paved and unpaved roads in the BCCE; if recreation activities resulted in an unauthorized trail, its presence would likely not be identified as a road).

2.3 2016 BGOs that incorporate Fragmentation and Connectivity

The 2016 BGOs include fragmentation and connectivity both directly and indirectly in several objectives, the most prominent being BGOs R1.5 and D1.5, which are "*Reduce habitat fragmentation and/or improve connectivity and habitat quality through restoration design and implementation*" (TerraGraphics 2016).

Limitation/Challenges:

Similar to the second limitation described for the AMMP (Section 2.1, 1.a), the DCP currently does not have fine-resolution data across all the Reserve System Lands, rather it is collected on a project-by-project and as-needed basis. The need for collecting data prior to implementing restoration is expected to be discussed at the November 2020 Habitat Monitoring Workshop.

Section 3 Methods/ Parameters used in FragStats analysis

Methods and decisions made in performing the FragStats analysis using geographic information system (GIS) are described in detail to facilitate replication. We anticipate that an outcome from the November 2020 Habitat Monitoring Workshop will be to recalculate fragmentation metrics using varying spatial extents, different data that has a finer resolution, and/or to focus on similar, but different metrics from those presented in the Results Section (Section 4, below). The GIS data and processes used to produce the rasters in GeoTIFF grid (.tif) format for input in FragStats are included as Attachment A.

3.1 Data Preparation

Data used in the FragStats analysis included the following DCP-provided GIS layers:

- Reserve System Land boundaries
- developed land (calculated each biennium)
- ecosystem type
- roads
- USGS NHD streams layer (Attachment A).

Data were overlain for each both the Upland and Riparian Reserve System Lands in GIS using the following parameters and then was converted to a raster in TIFF (.tif) format.

1. Riparian Reserve System. The Reserve System Lands are located on the Muddy River and the Virgin River. Parcels were processed together if they were contiguous. No buffer was applied to parcels because the majority of the home ranges of the MSHCP-covered species that may occur in riparian areas (seven avian species, three bats, and one plant species) are indistinct and highly variable given seasonal habitat use and migration patterns (an appropriate buffer strategy for avian species is expected to be included in the November 2020 Habitat Monitoring Workshop). In lieu of a static buffer around each parcel, we built a buffer based on the river corridor (i.e. approximate riparian area) in the immediate vicinity of each parcel (termed “corridor-based” for the purposes of this analysis)
    a. Muddy River – Parcel Based. All parcels (MR-A through MR-I) were processed at the same time with no buffer around each parcel, as explained above. The landscape area in-between parcels are considered background for the purposes of this analysis.
    b. Muddy River – Corridor Based. The NHD stream dataset (recommended by DCP GIS staff) was used to approximate stream location. The analysis buffer width was chosen based on subjective averaging of the floodplain width as estimated on an aerial image combined with averaging the width of the desert riparian ecosystem type (assuming the desert riparian ecosystem type roughly approximates the riparian area). This resulted in a 418 m wide buffer (209 m on either side of the stream line) applied to the stream line 800 m (½ mile) upstream and downstream from the furthest upstream and downstream parcel edges, respectively (Figure 1).
    c. Virgin River – Parcel Based. Reserve System parcels on the Virgin River span a greater geographic area than those on the Muddy River. The parcels were

processed together if they were contiguous within each of the following groupings:

i. Mesquite West parcel 1-A

ii. Bunkerville parcels 2-A, 2-B, 2-C, 2-D, 2-E,2-F, and 2-G

iii. Bunkerville parcels 2-H and 2-I

iv. Riverside parcels 3-A and 3-B

v. Mormon Mesa parcel 5-A

d. Virgin River – Corridor Based. The NHD stream dataset was used to approximate stream location and the methods for applying the buffer were the same as for the Muddy River – Corridor Based .tif (bullet "b", above). The riparian area and floodplain appeared to vary widely between sites, so we used a single buffer width as a coarse baseline measure. Different buffers based on species- or habitat-based objectives may be appropriate for future analyses. The buffer width was 418 m wide (209 m on either side of the stream line) and was applied to the stream line ½ mile upstream and downstream from the furthest upstream and downstream parcel edges, respectively (Figures 2-4). Parcels were grouped as listed here:

i. Mesquite West and Bunkerville parcels (parcels 1-A and 2-A through 2-I).

ii. Riverside parcels 3-A and 3-B

iii. Mormon Mesa parcel 5-A

2. Upland Reserve System. The BCCE is the only Upland Reserve System unit and is contiguous, with the exception of Highway 95 bisecting it. A 357m buffer was applied around the edges of the BCCE and is based on the 40 ha home range of the desert tortoise (S. Cambrin, personal communication). Consistent with the AMMP, we used the desert tortoise as a proxy for the multitude of MSHCP-covered species that may occur on the BCCE.

The groupings listed above resulted in 11 .tif rasters that were imported and analyzed using FragStats (McGarigal et al. 2012). Information provided in the bullets above are abbreviated in Table 1.

Table 1. List of FragStats input rasters

Reserve System / Area		Raster / Model Name (.tif)	Type	Buffer	Notes
BCCE		BCCE	Parcel/Reserve based	357 meters	Buffer sized for desert tortoise home range of 40 hectares
Virgin River - separated by contiguity	Riverside Parcels	Parcels 3-A and 3-B	Parcel/Reserve based	None	No buffer due to mobility of MSHCP-covered species (includes seven birds, three bats and one plant)
		Virgin River 3	Virgin River NHD Stream layer - River Corridor based	209 m wide; 1/2 mile upstream and downstream from furthest parcel lines	
	Mesquite West and Bunkerville Parcels	Parcels 2-A through 2-G	Parcel/Reserve based	None	No buffer due to mobility of MSHCP-covered species (includes seven birds, three bats and one plant)
		Parcels 2-H and 2-I	Parcel/Reserve based	None	No buffer due to mobility of MSHCP-covered species (includes seven birds, three bats and one plant)
		Parcel 1-A	Parcel/Reserve based	None	
		Virgin River 1 & 2	Virgin River NHD Stream layer - River Corridor based	209 meters wide; 1/2 mile upstream and downstream from furthest parcel lines	Buffer is based on the NHD stream line and the stream length from Parcel 1-A to Parcel 2-I.
	Mormon Mesa Parcel	Parcel 5-A	Parcel/Reserve based	None	
		Virgin River 5	Virgin River NHD Stream layer - River Corridor based	209 meters wide; 1/2 mile upstream and downstream from furthest parcel lines	Buffer is based on the NHD stream line and parcel 5-A
Muddy River		All Parcels	Parcel/Reserve based (all parcels in same raster)	None	
		Muddy River	Muddy River NHD Stream layer - River Corridor based	209 meters wide; 1/2 mile upstream and downstream from furthest parcel lines	Buffer is based on the NHD stream line and the stream length between all Muddy River parcels.

3.2 FragStats Options

The fragmentation analysis was performed using FragStats v4.2.1 (McGarigal 2015). FragStats performs patch-, class-, and landscape-level calculations for the following metrics:

- Area and edge metrics
- Shape metrics
- Core area metrics
- Contrast metrics
- Aggregation metrics
- Diversity metrics

In total, FragStats can produce 251 metrics and statistics for each model (i.e. .tif raster). Our intent with this analysis is to provide baseline metrics to be compared with data in future years, as well as start the discussion of which metrics are informative and relevant for the DCP's Reserve System Lands. To this end, we selected several basic metrics for calculation and anticipate that as habitat monitoring and species-specific habitat objectives are formalized, the suite of calculated metrics will be updated. We have retained a digital copy of the .tif rasters and complete versions of FragStats output for future comparisons and re-analysis (digital copy of .tif rasters and full FragStats calculations were provided to DCP staff with deliverable submission). We do not recommend interpretation of all possible FragStats metrics, but rather we suggest identifying specific fragmentation and connectivity questions or objectives and then selecting the relevant metrics.

Additional inputs for FragStats calculations, besides the .tif rasters described in Section 3.1, include class descriptors and edge contrast weights (Table 2; Attachment A includes actual text that is saved as .fcd and a .fsq files, respectively, for import into FragStats). Edge contrast weights can be unique between each ecosystem and disturbance type, depending on analysis needs and species- or habitat-specific objectives. For our baseline analysis, we selected generic weights that treated all raster cells of ecosystem types equally (weight of 0.2) and all disturbance types as equal to each other but negatively impactful compared to the ecosystem types (weight of 0.9).

Table 2. Class descriptors and edge weight contrasts used in FragStats analysis

Class Descriptors		Edge Contrast Weight
Code	Ecosystem / Disturbance Type	
1	Alpine	NA
2	Blackbrush	0.2
3	Bristlecone Pine	NA
4	Desert Riparian	0.2
5	Mesquite Acacia	0.2
6	Mixed Conifer	NA
7	Mojave Desert Scrub	0.2
8	Pinyon Juniper	NA
9	Sagebrush	NA

Class Descriptors		Edge Contrast Weight
Code	Ecosystem / Disturbance Type	
10	Salt Desert Scrub	0.2
12	Water	NA
13	Playa	0.2
50	Disturbed	0.9
60	Roads	0.9
70	NHD Streams	0.2

NA = Ecosystem Type was in data provided by DCP that covered entire Clark County area, but was not within the areas processed for FragStats Analysis (i.e., they were not present on the Reserve System Lands or their buffers.).

Section 4 Results

Data presented in Tables 3-6 are a selection of class-level FragStats metrics and Table 7 is a selection of landscape-level FragStats metrics intended for baseline comparisons only. Patch-level metrics are calculated for each individual patch and are included in the digital results provided to DCP staff, but are not summarized here because of their limited interpretability.

Reserve System maps (Figures 1-5) should be referenced when interpreting FragStats results. The following are basic observations and interpretations of the FragStats output (Table 3-6):

- Most Riparian Reserve System land contains only two ecosystem types: desert riparian and Mojave desert scrub. Exceptions to this include parcels 3-A and 3-B (Virgin River – Riverside parcels) that also contain <1 hectare of mesquite acacia (in addition to the desert riparian and Mojave desert scrub), and parcel 1-A (Virgin River – Mesquite West parcel) that contains 100% desert riparian habitat.
- The Virgin River Reserve System is comprised of primarily desert riparian habitat (ranging from 39% to 91% of the parcel); whereas the Muddy River Reserve System is almost 75% Mojave desert scrub habitat.
- The Muddy River Reserve System has far less desert riparian habitat (assumably the preferred habitat for a riparian Reserve) when compared to the Muddy River corridor model; only 23% of the Muddy River Reserve System is desert riparian habitat compared to over 50% in the river corridor model. For additional comparison, river corridor models for the Virgin River have a similar composition to the reserve/parcel-based models.
- The BCCE is dominated by Mojave desert scrub (89% of the landscape). All other habitats each comprise less than 2% of the landscape.
- The average Euclidean distance to the nearest patch in the BCCE is generally similar (ranging from 60-meters to 84-meters) for all habitat types with more than one patch present even though the habitat composition is weighted heavily in favor of Mojave desert scrub (see bullet immediately above).
- Patch size in proportion to the overall landscape and density (including patch index) is relatively smaller on the BCCE than for the Riparian Reserve System, indicating more disturbance breaks up the ecosystem type on the BCCE. Figure 5 shows the numerous roads in BCCE that break up otherwise contiguous patches of Mojave desert scrub.

Discussion of FragStats output is limited because we do not want to draw conclusions that are highly confounded. The following general observations were gleaned from reviewing results for all Reserve System Lands and stand out as limitations that should be addressed or noted as caveats each time a fragmentation analysis is performed:

- Many of the reserve units contain fewer than five distinct habitat patches and several ecosystem types only have one patch in a given reserve unit or parcel. In these cases, interpreting results such as shape, aggregation, and edge contrast are no more informative than viewing the figures. However, viewing an image does not provide a quantitative metric by which to compare to in the future. Baseline results presented in this memorandum are informative to the extent that they may help detect changes during future analyses.
- The shape and size of the analysis area have a high degree of influence on results. If results are not interpreted in the context of the map/figure, the reader may draw erroneous conclusions. Below is one example of FragStats results appearing noteworthy, but upon closer examination in the context of the analysis extent, it is considered extraneous:
    - Mesquite acacia on Virgin River – Riverside property (parcels 3-A and 3-B). The shape metric = 1, which should mean the habitat class is a square with no irregularity. When Figure 3 is consulted, we see that mesquite acacia comprises very little of the area and is typically 1 cell x 1 cell where it occurs. This result is influenced by cell size and its small prevalence on the landscape rather than its true patch shape. Overall, this is an indication that spatial extent and spatial resolution has a large impact on resulting metrics.

Table 3. Output from FragStats – Baseline metrics for the Muddy River - Riparian Reserve System

Metric		FragStats Code	Muddy River				
			All Parcels, No Buffer		River-based, 1/2 mile buffer upstream and downstream		
			Mojave Desert Scrub	Desert Riparian	Desert Riparian	Mojave Desert Scrub	Mesquite Acacia
General Area and Shape Metrics	Total Area (ha)	CA / TA	33	10	113	47	12
	Mean (Standard Deviation [SD])	AREA_MN	7(4)	1(2)	10(17)	5(6)	4(6)
	Percentage of landscape	PLAND	72	23	51	22	6
	Number of Patches	NP	5	9	11	9	3
	Patch Density (index)	PD	10.91	19.65	5.02	4.11	1.37
	Largest Patch Index (percent)	LPI	29	16	26	9	5
	Total Edge (m)	TE	2,010	1,500	17,400	8,520	1,620
	Edge Density (m/ha)	ED	43.88	32.74	79.43	38.89	7.40
	Shape (no units) Mean (SD)	SHAPE_MN	1.29(0.13)	1.17(0.14)	1.72(0.69)	1.60(0.46)	1.33(0.24)
Aggregation Metrics	Euclidean Nearest Neighbor (m) Mean (SD)	ENN_MN	277(262)	124(119)	87(54)	162(78)	962(1265)
	Clumpiness Index	CLUMPY	0.68	0.80	0.73	0.77	0.92
	Landscape Division Index	DIVISION	0.86	0.97	0.91	0.99	1.00
	Landscape Shape Index (LSI)	LSI	2.62	2.50	5.49	4.96	1.83
	Normalized LSI	NLSI	0.17	0.16	<1	<1	<1
Contrast Metrics	Contrast Weighted Edge Density (m/ha)	CWED	20	12	79	35	5
	Total Edge Contract Index (%)	TECI	15	16	74	57	40
	Edge Contract Index (%) Mean (SD)	ECON_MN	20(15)	23(16)	87(18)	60(16)	51(11)

Table 4. Output from FragStats – Baseline metrics for the Virgin River – Mesquite West and Bunkerville - Riparian Reserve System

Metric		FragStats Code	Virgin River- Mesquite West and Bunkerville							
			VR Parcel 1A	VR Parcels 2A-2G		VR Parcels 2H-2I		River-based - 1/2 mile buffer upstream and downstream		
			Desert Riparian	Desert Riparian	Mojave Desert Scrub	Desert Riparian	Mojave Desert Scrub	Desert Riparian	Mojave Desert Scrub	Mesquite Acacia
General Area and Shape Metrics	Total Area (ha)	CA / TA	3	34	1	37	1	206	17	<1
	Mean (Standard Deviation [SD])	AREA_MN	1(<1)	6(9)	<1(<1)	12(16)	<1(<1)	21(48)	2(3)	<1(<1)
	Percentage of landscape	PLAND	71	55	1	91	1	74	6	<1
	Number of Patches	NP	2	6	2	3	2	10	11	2
	Patch Density (index)	PD	49.38	9.82	3.27	7.33	4.88	3.58	3.94	0.72
	Largest Patch Index (percent)	LPI	44	39	1	85	1	59	3	<1
	Total Edge (m)	TE	600	3,090	420	1,770	390	23,460	5,340	180
	Edge Density (m/ha)	ED	148.15	50.56	6.87	43.22	9.52	83.98	19.12	0.64
	Shape (no units) Mean (SD)	SHAPE_MN	1.67(0.33)	1.30(0.22)	1.08(0.08)	1.23(0.17)	1.13(0.13)	1.78(1.14)	1.36(0.45)	1.17(0.17)
Aggregation Metrics	Euclidean Nearest Neighbor (m) Mean (SD)	ENN_MN	60(0)	131(72)	60(0)	60(0)	573(0)	68(15)	284(278)	67(0)
	Clumpiness Index	CLUMPY	0.07	0.81	0.84	0.59	0.57	0.58	0.71	-1.00
	Landscape Division Index	DIVISION	0.73	0.83	1.00	0.27	1.00	0.65	1.00	1.00
	Landscape Shape Index (LSI)	LSI	2.17	2.54	1.29	1.73	1.60	6.20	4.46	1.50
	Normalized LSI	NLSI	0.42	0.09	0.15	0.30	0.43	0.27	0.28	1.00
Contrast Metrics	Contrast Weighted Edge Density (m/ha)	CWED	30	23	4	17	4	26	7	<1
	Total Edge Contract Index (%)	TECI	8	23	47	17	34	20	26	10
	Edge Contract Index (%) Mean (SD)	ECON_MN	8(<1)	28(16)	50(5)	18(7)	38(17)	36(16)	33(16)	10(0)

Table 5. Output from FragStats – Baseline metrics for the Virgin River – Riverside and Mormon Mesa - Riparian Reserve System

Metric		FragStats Code	Virgin River - Riverside						Virgin River - Mormon Mesa			
			VR Parcels 3A-3B			River-based - 1/2 mile buffer upstream and downstream			VR Parcel 5A		River-based - 1/2 mile buffer upstream and downstream	
			Desert Riparian	Mojave Desert Scrub	Mesquite Acacia	Desert Riparian	Mojave Desert Scrub	Mesquite Acacia	Desert Riparian	Mojave Desert Scrub	Desert Riparian	Mojave Desert Scrub
General Areas and Shape Metrics	Total Area (ha)	CA / TA	21	14	1	57	34	<1	28	5	77	2
	Mean (Standard Deviation [SD])	AREA_MN	4(6)	1(1)	<1(<1)	7(6)	2(2)	<1(NA)	28(NA)	5(NA)	39(NA)	2(NA)
	Percentage of landscape	PLAND	39	26	1	47	28	<1	84	16	90	2
	Number of Patches	NP	5	22	3	8	19	1	1	1	2	1
	Patch Density (index)	PD	9.03	39.75	5.42	6.63	15.74	0.83	3.01	3.01	2.31	1.16
	Largest Patch Index (percent)	LPI	27	9	<1	15	7	<1	84	16	46	2
	Total Edge (m)	TE	6,990	5,820	480	12,480	10,830	240	510	510	5,490	480
	Edge Density (m/ha)	ED	126.29	105.15	8.67	103.41	89.73	1.99	15.36	15.36	63.41	5.54
	Shape (no units) Mean (SD)	SHAPE_MN	1.75(1.00)	1.19(0.25)	1.00(0.00)	1.62(0.72)	1.41(0.60)	1.00(NA)	1.11(NA)	1.19(NA)	2.17(0.08)	1.78(NA)
Aggregation Metrics	Euclidean Nearest Neighbor (m) Mean (SD)	ENN_MN	60(0)	75(29)	393(380)	60(0)	79(30)	N/A	N/A	N/A	60(0)	N/A
	Clumpiness Index	CLUMPY	0.61	0.54	0.42	0.70	0.61	1.00	0.96	0.97	0.30	0.72
	Landscape Division Index	DIVISION	0.92	0.99	1.00	0.95	0.99	1.00	0.30	0.97	0.60	1.00
	Landscape Shape Index (LSI)	LSI	4.39	4.88	1.80	4.78	6.08	1.00	1.11	1.19	3.08	1.78
	Normalized LSI	NLSI	0.24	0.34	0.57	0.16	0.28	0.00	0.03	0.03	0.51	0.28
Contrast Metrics	Contrast Weighted Edge Density (m/ha)	CWED	58	58	4	32	49	1	3	3	13	1
	Total Edge Contract Index (%)	TECI	39	42	41	26	41	46	4	9	10	10
	Edge Contract Index (%) Mean (SD)	ECON_MN	30(11)	43(18)	42(9)	30(14)	41(20)	46(NA)	4(NA)	9(NA)	10(1)	10(NA)

Table 6. Output from FragStats – Baseline metrics for the BCCE - Upland Reserve System

Metric		FragStats Code	BCCE (with 357 m buffer)				
			Salt Desert Scrub	Mojave Desert Scrub	Mesquite Acacia	Playa	Blackbrush
General Area and Shape Metrics	Total Area (ha)	CA / TA	687	36887	303	52	0.18
	Mean (Standard Deviation [SD])	AREA_MN	11 (43)	86 (408)	2(6)	52(NA)	0.18 (NA)
	Percentage of landscape	PLAND	2	89	1	<1	<1
	Number of Patches	NP	60	431	185	1	1
	Patch Density (index)	PD	0.14	1.04	0.45	0.00	0.00
	Largest Patch Index (percent)	LPI	1	13	<1	<1	<1
	Total Edge (m)	TE	83,130	1,263,660	111,090	3,540	120
	Edge Density (m/ha)	ED	2.00	30.43	2.68	0.09	0.00
	Shape (no units) Mean (SD)	SHAPE_MN	1.40 (0.55)	1.56 (0.73)	1.39(0.53)	2.33(NA)	1.33 (NA)
Aggregation Metrics	Euclidean Nearest Neighbor (m) Mean (SD)	ENN_MN	61 (4)	60 (2)	84(69)	N/A	N/A
	Clumpiness Index	CLUMPY	0.91	0.76	0.73	0.94	-1.00
	Landscape Division Index	DIVISION	1.00	0.96	1.00	1.00	1.00
	Landscape Shape Index (LSI)	LSI	8.50	17.93	16.10	2.33	1.33
	Normalized LSI	NLSI	0.09	0.21	0.27	0.06	1.00
Contrast Metrics	Contrast Weighted Edge Density (m/ha)	CWED	1	26	1	<1	<1
	Total Edge Contract Index (%)	TECI	61	77	41	29	10
	Edge Contract Index (%) Mean (SD)	ECON_MN	73 (22)	84 (14)	39(19)	29(NA)	10 (NA)

Table 7. Output from FragStats - Baseline landscape metrics for all Reserve System Lands.

Metric / FragStats Code		Muddy River	Virgin River	BCCE
Richness	Patch Richness / PR	4	6	8
	Patch Richness Density / PRD	8.73	3.11	0.02
	Relative Patch Richness (%) / RPR	8	12	16
Diversity	Shannon's Diversity Index / SHDI	0.75	1.14	0.49
	Simpson's Diversity Index / SIDI	0.43	0.56	0.21
	Modified Simpson's Diversity Index / MSIDI	0.57	0.82	0.23
Evenness	Shannon's Evenness Index / SHEI	0.54	0.64	0.24
	Simpson's Evenness Index / SIEI	0.58	0.67	0.24
	Modified Simpson's Evenness Index / MSIEI	0.41	0.46	0.11

Despite the limitations discussed above, the baseline metrics presented in Tables 3-7 provide informative data that can be referenced and compared to results from future analyses. In addition, the discussion of each metric (or set of metrics) can help solidify goals for desired future conditions. Which metrics does DCP want to see increase over time and which do they want to decrease? For example, the Muddy River Reserve System lands are dominated by a non-riparian ecosystem type (Mojave desert scrub). While this is likely due to parcel shape and not a product of DCP management objectives or preferences, we should consider management actions that can be implemented to improve either riparian habitat or decrease fragmentation in the area? (Note, these types of management actions may well be occurring already. It is included here for discussion purposes.)

Discussion points throughout this memorandum emphasize the importance of 1) formulating clear objectives that lead to identifying meaningful FragStats metrics, 2) selecting a relevant spatial extent and spatial resolution for analysis which may differ across the Reserve System Lands and for different species, and 3) obtaining and analyzing data at an ecologically and managerially meaningful spatial extent and resolution (i.e., fine resolution data is required to answer fine resolution objectives). Discussion points throughout this memorandum should be referred to during the November 2020 Habitat Monitoring Workshop.

Section 5 References

Clark County. 2000. Final Clark County Multiple Species Habitat Conservation Plan and Environmental Impact Statement for Issuance of a Permit to Allow Incidental Take of 79 Species in Clark County, Nevada. Prepared by RECON for the Desert Conservation Program. September 2000.

Crooks, K. and M. Sanjayan. 2006. Connectivity Conservation. Cambridge University Press, Cambridge, UK. 712 p.

McGarigal, K., S.A. Cushman, and E. Ene. 2012. FragStats v4: Spatial Pattern Analysis Program for Categorical and Continuous Maps. Computer software program produced by the authors at the University of Massachusetts, Amherst. Available at the following web site: http://www.umass.edu/landeco/research/fragstats/fragstats.html

McGarigal. 2015. FragStats Help, Version 4.2. 21 April 2015. https://www.umass.edu/landeco/research/fragstats/documents/fragstats.help.4.2.pdf

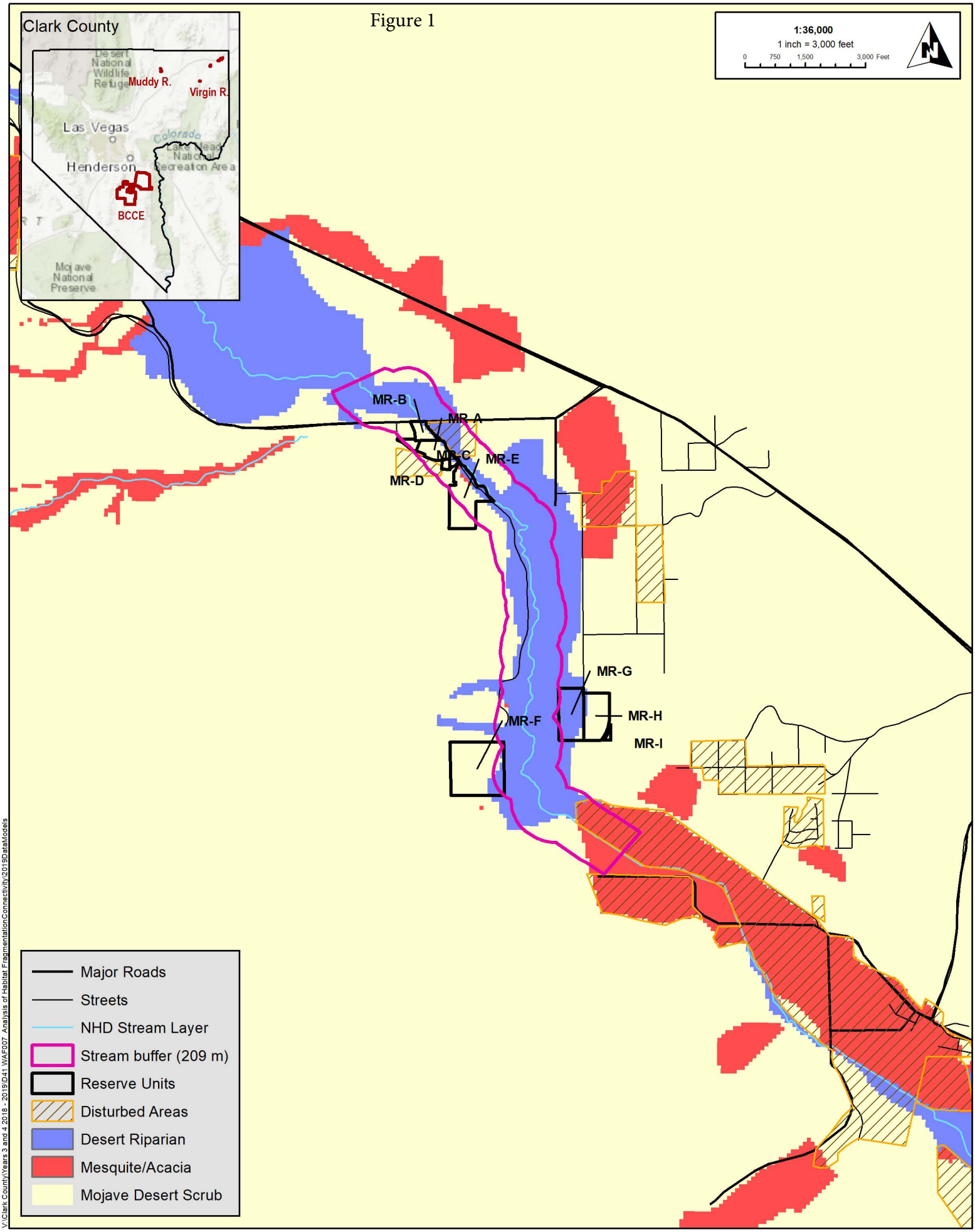
TerraGraphics Environmental Engineering, Inc. (TerraGraphics). 2016. Biological Goals and Objectives for the Clark County, NV Multiple Species Habitat Conservation Plan - Final. Prepared for Clark County DCP. June 22, 2016.

TerraGraphics 2017. Adaptive Management and Monitoring Plan. Prepared by the Science Advisor Panel for the Desert Conservation Program. January 9, 2017.

Turner, M.G., R. H Gardner, and R. V. O'Neill. 2001. Landscape Ecology in Theory and Practice. Spring-Verlag New York, Inc. New York, NY, USA. 401 p.

Van Dyke, F. 2010. Conservation Biology, 2nd edition. Springer, New York, NY, USA. 477 p.

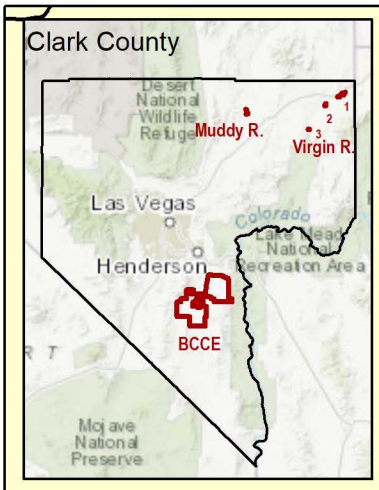
Figure 1



V:\Clark County\Years 3 and 4 2018 - 2019\D41 WAF007 Analysis of Habitat Fragmentation Connectivity\2019\Data\Models

Alta Science & Engineering, Inc.	Print Date: Jan 17, 2020	Requestor: T. Harju	Analysis of Habitat Fragmentation/Connectivity Muddy River Reserve MR-A through MR-I	This map was produced using information obtained from several different sources that have not been independently verified. These sources have also not provided information on the precision and accuracy of the data. Information on this map is not a substitute for survey data.
	Project Number: 18022-66-20	Project Manager: T. Harju		
		Cartographer: J. Gilley		

Figure 2



1:36,000
1 inch = 3,000 feet
0 750 1,500 3,000 Feet

1-A
2-A
2-B
2-C
2-D
2-E
2-F
2-G
2-H
2-I

- Major Roads
- Streets
- NHD Stream Layer
- Stream buffer (209 m)
- Reserve Units
- Disturbed Areas
- Desert Riparian
- Mesquite/Acacia
- Mojave Desert Scrub

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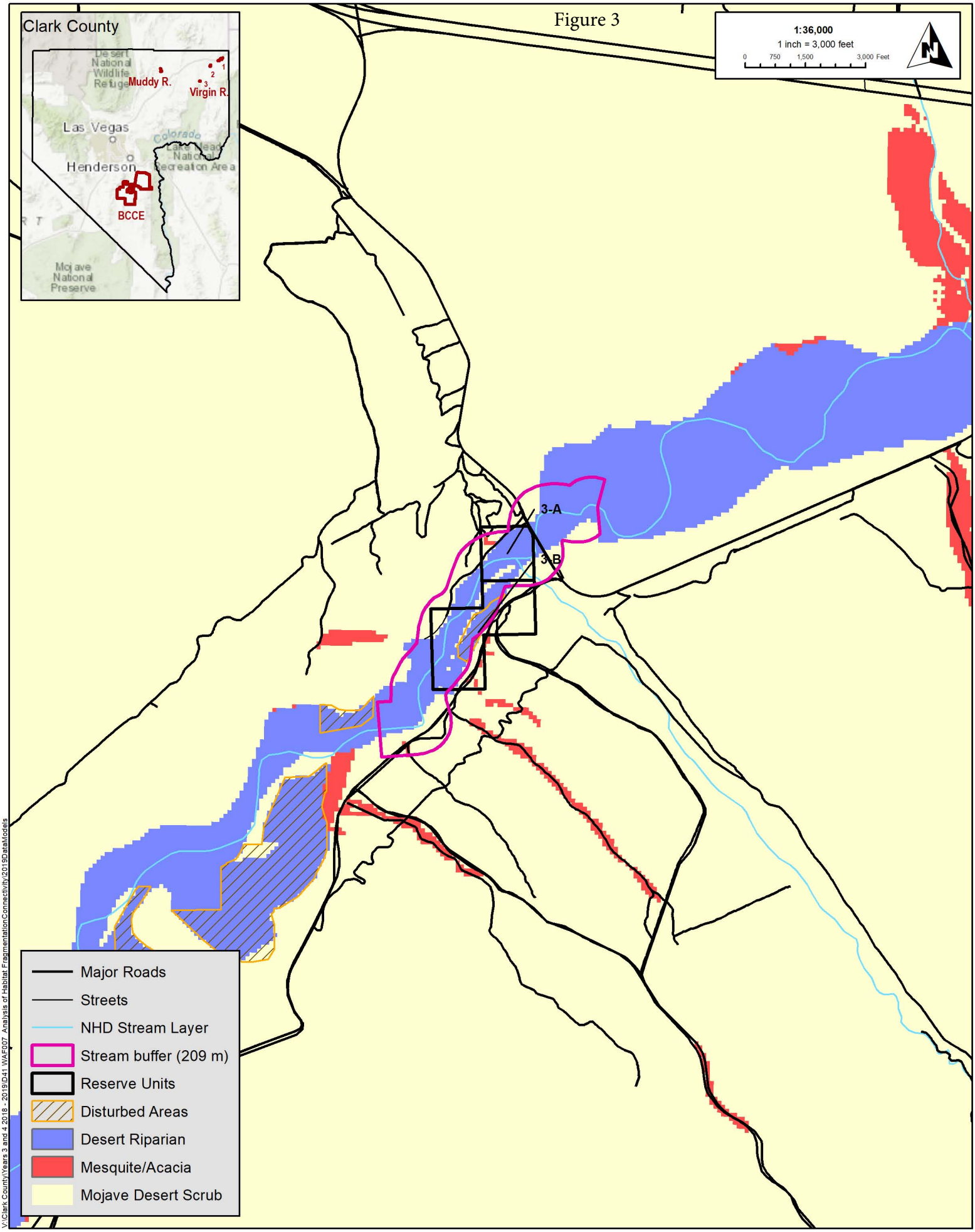
Alta Science & Engineering, Inc.	Print Date: Jan 17, 2020	Requestor: T. Harju	Analysis of Habitat Fragmentation/Connectivity Virgin River Reserve Map 3: 1-A, 2-A through 2-I	This map was produced using information obtained from several different sources that have not been independently verified. These sources have also not provided information on the precision and accuracy of the data. Information on this map is not a substitute for survey data.
	Project Number: 18022-66-20	Project Manager: T. Harju		
		Cartographer: J. Gilley		

Figure 3



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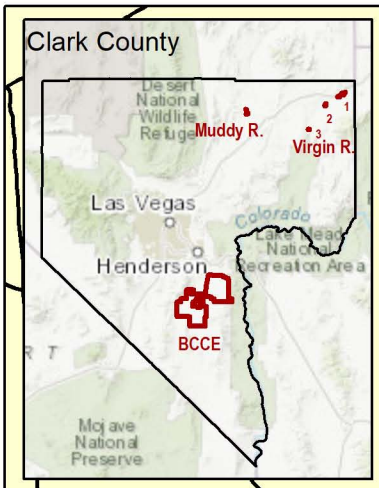
Alta Science & Engineering, Inc.	Print Date: Jan 17, 2020 Project Number: 18022-66-20	Requestor: T. Harju Project Manager: T. Harju Cartographer: J. Gilley	**Analysis of Habitat Fragmentation/Connectivity** **Virgin River Reserve** **Map 2: 3-A, 3-B**	This map was produced using information obtained from several different sources that have not been independently verified. These sources have also not provided information on the precision and accuracy of the data. Information on this map is not a substitute for survey data.

Figure 4



1:36,000
1 inch = 3,000 feet
0 750 1,500 3,000 Feet

5-A

- Major Roads
- Streets
- NHD Stream Layer
- Stream buffer (209 m)
- Reserve Units
- Desert Riparian
- Mesquite/Acacia
- Mojave Desert Scrub

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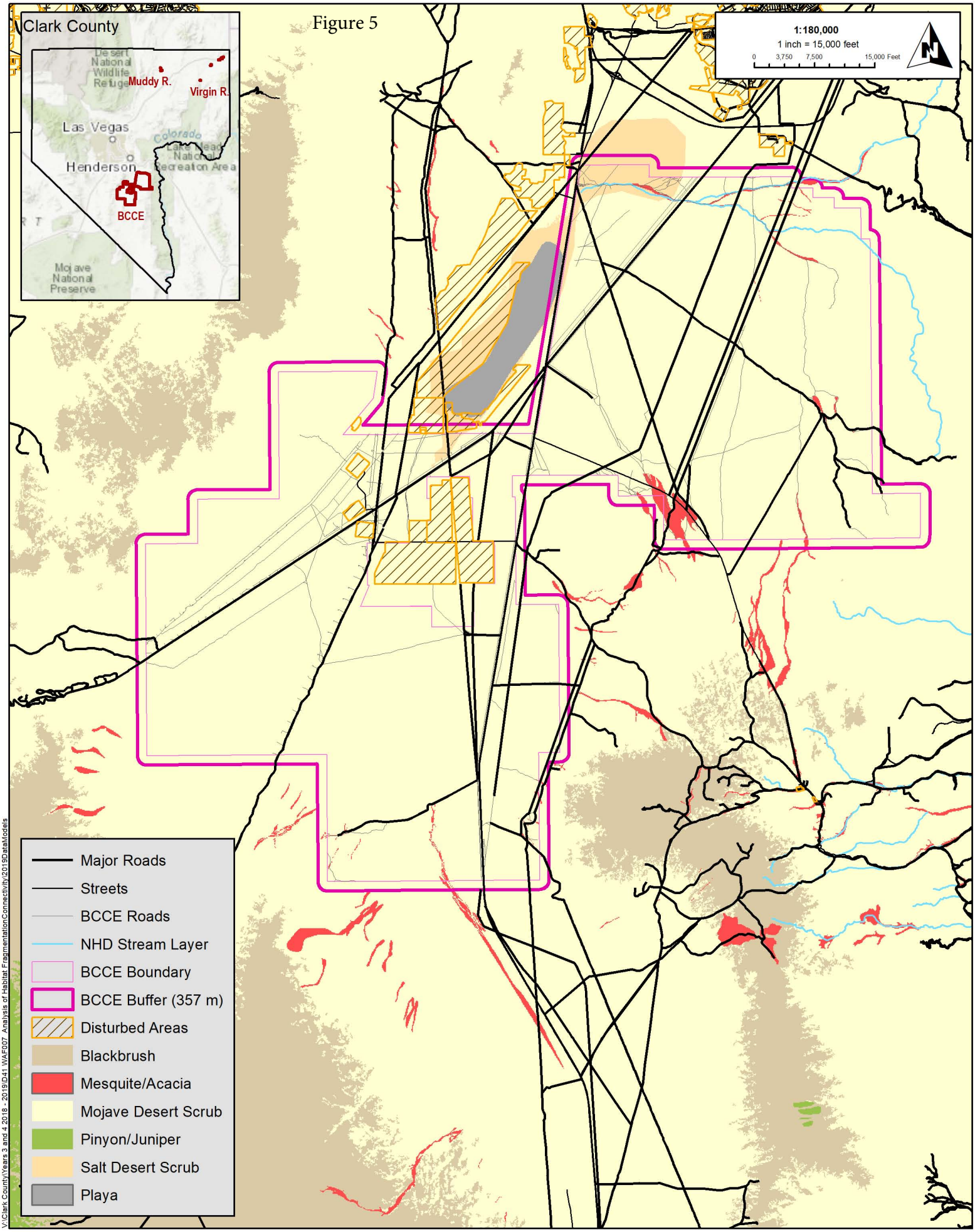
Alta Science & Engineering, Inc.

Print Date	Jan 17, 2020
Project Number	18022-66-20
Requestor	T. Harju
Project Manager	T. Harju
Cartographer	J. Gilley

Analysis of Habitat Fragmentation/Connectivity
Virgin River Reserve
Map 3: 5-A

This map was produced using information obtained from several different sources that have not been independently verified. These sources have also not provided information on the precision and accuracy of the data. Information on this map is not a substitute for survey data.

Figure 5



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Alta Science & Engineering, Inc.	Print Date: Jan 17, 2020	Requestor: T. Harju	Analysis of Habitat Fragmentation/Connectivity BCCE Reserve	This map was produced using information obtained from several different sources that have not been independently verified. These sources have also not provided information on the precision and accuracy of the data. Information on this map is not a substitute for survey data.
	Project Number: 18022-66-20	Project Manager: T. Harju		
		Cartographer: J. Gilley		

Attachment A
GIS Processing Instructions and Additional Input Information for FragStats Analysis

GIS Processing Instructions and Additional Input Information for FragStats Analysis

The following GIS data were used in preparation of the .tif files that were inputs to FragStats

Shorthand Name	File name	Source	Notes
Permit Disturbance	Disturbed2019_spr_priv_fed.shp	DCP	Calculated every biennium by DCP; based on imagery described in the AMR.
Ecosystem Type	D21_Final_Model_target_2_playa1.tif	DCP	20XX Ecosystem Type data from xxxxx.
BCCE Roads	BCCE_rds.shp	DCP	
Other Roads????	sclmajor_l.shp streets_l.shp	DCP	
NHD Streams	NHDFlowline.shp NHDFlowline2.shp NHDFlowline3.shp NHDFlowline4.shp NHDFlowline5.shp	USGS	https://www.usgs.gov/core-science-systems/ngp/national-hydrography
BCCE Boundary	BCCE_2019.shp	DCP	
Riparian Reserve Unit Boundaries (Muddy River and Virgin River)	CC_Reserves_2019.shp	DCP	

GIS Processing Instructions:

1. Buffer all reserve unit polygons to desired buffer
2. Prepare disturbed layers
    a. Check that all layers are in UTM Zone 11N meters before beginning
        i. Convert the projection if they are not
    b. Clip all disturbance layers using the buffer layers
    c. Add a column called Code and populate it with
        i. 50 for disturbed area
        ii. 60 for roads
        iii. 70 for NHD streams filtered to just those with a GNIS ID.
    d. Convert layers from polygons or polylines to raster:
        i. Use the Code field for raster values
        ii. Set 30 cell size (or whatever size matches the ecosystem layer)
    e. Measure your cell sizes to check your work before merging
3. Clip ecosystem layer with buffer layer
4. Use Mosaic to new raster tool to combine disturbed layer with ecosystem layer keeping ecosystem values and replacing them only where disturbed (50) cells fall.
    a. Set output to .tif
    b. Set raster to 8 bit signed

    c. Set bands to 1
    d. Use Mosaic Operator Maximum
5. Export layer as a .tif
    a. No compression.
6. Additional steps for the stream corridor buffers:
    a. Measure desired stream length upstream and downstream from corresponding parcel edges.
    b. Buffer width is from the stream line, not the parcels.
    c. Trim the ends of the buffer back to the end of the river line segment and perpendicular to the river line.
    d. Even though the stream was used to buffer, it still needs to be included in the ecosystem/disturbance layer (code 70).

Class Descriptor text that is saved as a .fcd for import into FragStats

ID,Name,Enabled,IsBackground
1,Alpine,true,false
2,Blackbrush,true,false
3,BristleconePine,true,false
4,DesertRiparian,true,false
5,MesquiteAcacia,true,false
6,MixedConifer,true,false
7,MojaveDesertScrub,true,false
8,PinyonJuniper,true,false
9,Sagebrush,true,false
10,SaltDesertScrub,true,false
12,Water,true,false
13,Playa,true,false
50,Disturbed,false,false
60,Roads,false,false
70,NHDStreams,false,false
88,NoData,false,false

Edge Weight Contrast text that is saved as a .fsq for import into FragStats

FSQ_TABLE
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Attachment C
Analysis of Augmented Tortoise Populations

Clark County Desert Conservation Program

Analysis of Augmented Tortoise Populations –
Analysis for the ***Adaptive Management Evaluation, BGO D2.2***

Prepared by
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Introduction

One of the goals of the Adaptive Management and Monitoring Plan (AMMP) is to evaluate whether conservation actions are achieving the Biological Goals and Objectives of the Clark County Desert Conservation Program (DCP; AMMP 2016, DCP 2016). Biological goals are "the broad, guiding principles for the operating conservation actions of the MSHCP [Multiple Species Habitat Conservation Plan]" (AMMP 2016). Goals are general in nature and in and of themselves are only achievable through more specific, targeted objectives. Biological objectives have been identified for the MSHCP biological goals (AMMP 2016). In particular, goal 'D 2 Maintain stable or increasing populations of Federal T&E-listed species on desert upland reserve system lands' has two associated objectives, including 'Objective D 2.2: Augment population through translocation programs when appropriate'. To this end, the DCP partnered with the U.S. Fish and Wildlife Service to release translocated Mojave desert tortoises (*Gopherus agasizii*) into the Eldorado Valley to augment the resident population of desert tortoises beginning in September, 2014 (DCP 2013).

Here, the biological objective D 2.2 was assessed via statistical analysis of the efficacy of the desert tortoise translocation project on the Boulder City Conservation Easement. The goal of

the analysis was to quantify survival rates for resident versus translocated tortoises to determine if translocated tortoises were surviving post-translocation and whether resident tortoises showed a precipitous decline in survival after the translocated tortoises were released into the population.

Methods

Kaplan-Meier survival analysis was used to model survival of translocated and resident desert tortoises from September, 2014, the beginning of translocation, through June, 2019, the most recent data provided to the Science Advisor Panel for this analysis. Some individuals were released during subsequent translocation events and thus not monitored from the beginning of the study (termed 'staggered entry'). Much of the data involved right-censored tortoises, which are individuals who were alive the last time they were seen. The true fate of these individuals may be that they died sometime after last seen or that they are still alive. For this analysis, all right-censored tortoises due to dropped transmitters judged in the field to have died were classified as dead. All tortoises not judged in the field to have died (e.g., no evidence of predation or mortality) were assumed for analytical purposes to be have been alive at last sighting. While the inclusion of these assumptions may bias true survival estimates (e.g., if tortoises were not found again *because* they had died), any potential bias was assumed to be equal across both translocated and resident tortoise groups. Field notes provided along with the survival data were used to differentiate between presumed alive and presumed dead fates. Tortoises were classified as adults or juveniles depending on whether midline carapace length was above or below 180 mm, respectively.

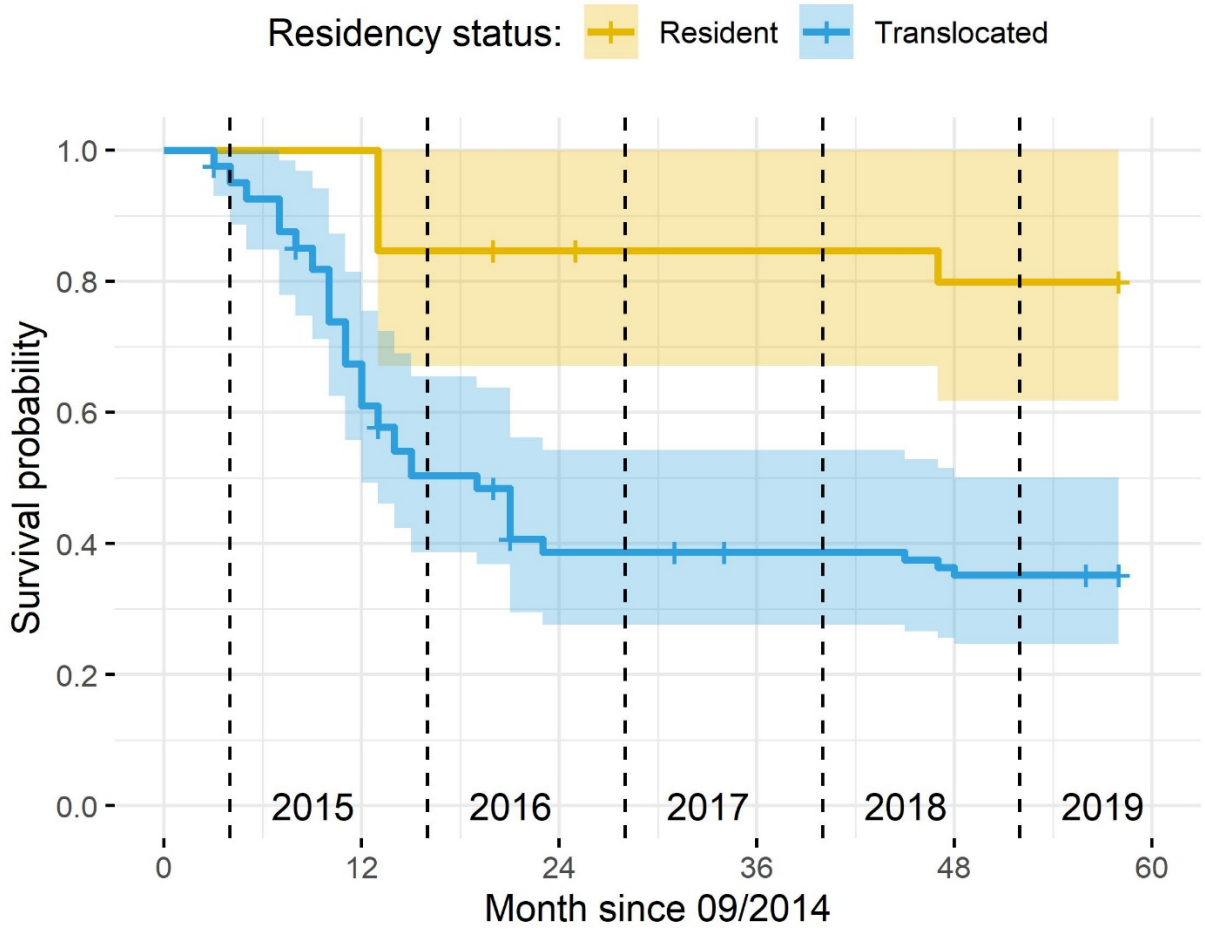
The Kaplan-Meier analysis was performed using the 'survival' package in Program R. The unit interval for time was calculated as month first seen and month last seen, with fate being last seen alive or (presumed) dead. Two tortoises died within the same month as release. Their survival was reclassified as lasting one month instead of zero months to allow inclusion within the analysis. This choice was made to retain these two short-lived individuals rather than excluding them from the analysis and biasing positively the population-level survival rate. Only radio-telemetered tortoises were included in the analysis (e.g., mark-encounter tortoises were excluded).

Results

The dataset consisted of 102 individual tortoises (22 resident adults, 60 translocated adults, and 20 translocated juveniles), 39 of which were recorded mortalities during the study and 63 of which were alive at last sighting. The first translocated tortoises were released September, 2014 and the last tortoises were released September, 2017. The first recorded mortality was in October, 2014 and the last was in August, 2018. The last date a tortoise was observed alive was June, 2019, the most recent data provided to the Science Advisor Panel for this analysis.

Both resident and translocated tortoises died during the study, although translocated tortoises survived at notably lower rates than resident tortoises (Figure 1). For most of the five year period, month-specific confidence intervals did not overlap between the two residency groups, showing that survival was significantly higher for resident versus translocated tortoises (Figure 1). The majority of mortality for both residency groups occurred during 2015, and after summer of 2016 survival was fairly constant for both groups. Survival rates at the end of the study period were 0.352 (95% CI 0.247 – 0.501) for translocated tortoises and 0.799 (95% CI 0.618 – 1.00) for resident tortoises.

Figure 1. Survival curves for resident and translocated Mojave desert tortoises in the Boulder City Conservation Easement, Eldorado Valley, Nevada. Initial release date (Month 0) was September, 2014. Horizontal solid lines are survival probability, shaded ribbons are 95% confidence intervals. Cross marks along the survival curves mark right-censoring (i.e., a month when a tortoise was last seen alive and not seen subsequently). Vertical dashed lines mark January of each labeled year for reference. Table below the graph is the number of tortoises in each residency group alive at each referenced month. Numbers at risk do not decrease monotonically because of staggered entry of radio-telemetered tortoises into the analysis.



Discussion

The Eldorado Valley translocation study in the Boulder City Conservation Easement intended to augment the local resident population of desert tortoises via translocation efforts. One simple metric to evaluate whether the translocation project had failed to augment the local population would be that all translocated tortoises died shortly after translocation. In this

scenario, the translocation project would have failed to contribute any individuals to the population. Clearly, this scenario did not happen, as survival rate of translocated tortoises was estimated to be 0.352 five years after the beginning of the translocation project. A second simple metric to evaluate whether the translocation project had failed to augment the local population would be that survival of resident tortoises declined precipitously after translocation began, presumably because of competition for limiting resources. Again, this scenario clearly did not happen. Resident tortoises had few mortalities, resulting in a near 80% survival rate over a five year period. This equates to a roughly 96% annual survival rate, which is both high and well within the range established for Mojave desert tortoise in most years (e.g., Lovich et al. 2014).

The D 2.2 objective, "Augment population through translocation programs when appropriate" (DCP 2016) was achieved through the transportation and release of tortoises into the resident Eldorado Valley tortoise population. The analysis showed translocated tortoises survived over the five year study period, although survival was lower than for resident tortoises. Additionally, resident tortoise survival appeared unaffected by the translocation effort, indicating the translocated tortoises did not negatively impact the resident portion of the population.

Literature cited

Adaptive Management and Monitoring Plan (AMMP). 2016. Prepared by TerraGraphics Environmental Engineering, Inc. for Clark County Desert Conservation Program.

Desert Conservation Program (DCP). 2013. Desert tortoise pre- and post-translocation monitoring plan. Prepared by Enduring Conservation Outcomes for Clark County Desert Conservation Program.

DCP. 2016. Biological Goals and Objectives for the Clark County, NV Multiple Species Habitat Conservation Plan – Final. Prepared by the Science Advisor Panel for the DCP.

Lovich, J.E., C.B. Yackulic, J. Freilich, M. Agha, M. Austin, K.P. Meyer, T.R. Arundel, J. Hansen, M.S. Vamstad, and S.A. Root. 2014. Climatic variation and tortoise survival: has a desert species met its match? Biological Conservation 169:214-224.

Attachment D

Boulder City Police Department – BCCE Data

Boulder City Police Department - BCCE Presence
September 2016 - August 2019

Year	Month	Hours	Miles	Contacts	Warn	Citations	Brochures	Miles / Hour
2016	Sep	128	1429	9	0	0	15	11.16
2016	Oct	144	1664	14	1	0	14	11.56
2016	Nov	125	1388	10	2	0	10	11.10
2016	Dec	136	1548	9	0	0	9	11.38
2017	Jan	144	1676	23	0	0	29	11.64
2017	Feb	129	1448	11	0	0	12	11.22
2017	Mar	128	1432	19	1	0	23	11.19
2017	Apr	144	1,615	9	0	0	13	11.22
2017	May	106	1279	20	1	0	11	12.07
2017	Jun	127	1536	5	1	0	4	12.09
2017	Jul	133	1601	2	0	0	3	12.04
2017	Aug	135	1639	10	0	0	15	12.14
2017	Sep	105	1461	9	0	0	9	13.91
2017	Oct	96	1278	13	2	0	19	13.31
2017	Nov	75	972	13	0	0	15	12.96
2017	Dec	113	1185	20	2	0	22	10.49
2018	Jan	150	1685	14	0	0	14	11.23
2018	Feb	110	1261	12	0	0	11	11.46
2018	Mar	142	1604	19	0	0	37	11.30
2018	Apr	117	1382	15	0	0	13	11.81
2018	May	102	1200	13	0	0	12	11.76
2018	Jun	90	1069	1	0	0	1	11.88
2018	Jul	113	1328	9	0	0	15	11.75
2018	Aug	108	1233	5	0	0	5	11.42
2018	Sep	92	1120	7	0	0	7	12.17
2018	Oct	114	1314	24	0	0	25	11.53
2018	Nov	105	1189	23	0	0	38	11.32
2018	Dec	113	1323	19	2	0	30	11.71
2019	Jan	124	1154	10	0	0	7	9.31
2019	Feb	98	751	19	3	0	6	7.66
2019	Mar	139	1366	32	1	0	39	9.83
2019	Apr	132	1235	37	10	0	6	9.36
2019	May	152	1323	35	12	0	5	8.70
2019	Jun	105	1045	6	2	1	2	9.95
2019	Jul	159	1632	3	0	0	1	10.26
2019	Aug	152	943	3	1	0	1	6.20
TOTAL		**4385**	**48308**	**502**	**41**	**1**	**498**	

Attachment E
Adaptive Management Evaluation – Summary of Conclusions for Criteria Not Being Met and Recommendations for All Criteria, if Present

Adaptive Management Evaluation - Summary of Conclusions for Criteria Not Being Met and Recommendations for All Criteria, if Present.

R1.4 Inventory, Remove, and Control Invasive and Non-Native Plant Species		
Criteria for this BGO were met, but there are recommendations. **Recommendations:** The data and reporting received on relevant projects do not align with the language in the criteria. Suggestions include either reframing the criteria to be more practical and fit the on-the-ground activities, or modify the reporting procedures for the project. The Science Advisor Panel and DCP staff should review the GIS data that NPS provides annually to determine how best it can be used to evaluate the criteria. See Section R1.4 for additional information.		
R1.5 Reduce Habitat Fragmentation and/or Improve Connectivity		
Performance Criteria	**Met?**	**Conclusions**
Riparian restoration projects demonstrably reduce fragmentation/increase connectivity when feasible and as identified during project initiation.	⊙	Habitat is not being monitored yet and a baseline fragmentation analysis was conducted as part of this evaluation; therefore, the performance period "monitor…every 4 years" is not being met, but is being initiated.
Demonstrate upward trend in habitat connectivity and downward trend in habitat fragmentation across riparian reserve lands.	⊙	Without baseline data for projects, we cannot formally evaluate either criteria. However, the projects that we have knowledge of, should theoretically either maintain existing connectivity or increase connectivity.
Recommendations: The language for the first criterion isn't clear and/or is repetitive. Specifically, the phrase "when feasible and as identified during project initiation" should be reviewed.		
R1.6 Acquire Riparian Property at an Equivalent Rate as Take		
Performance Criteria	**Met?**	**Conclusions**
Demonstrate acquisition of riparian habitat at an equivalent rate as take over life of Permit.	✗	Riparian habitat take exceeds the riparian reserve unit acreage by 73.47 acres.
Demonstrate acquisition of riparian function at an equivalent rate as take over life of Permit.	**NA**	There is no data available to evaluate this criterion.
Recommendations: Demonstrating acquisition of riparian function at an equivalent rate as take is challenging because habitat function of developed lands cannot be determined and there are no habitat functionality measures currently in place for riparian reserve lands. We recommend re-wording or removing this criterion.		
R3.1 Collaborate With Other Stakeholders on Project/Mitigation Work		
Criteria for this BGO were met, but there are recommendations. **Recommendations:** Nuances to each collaboration cannot be captured in the current criterion. Because the nature and depth of collaboration varies with each entity, it may be possible in the future that the overall number of collaborators decrease, but the effectiveness of sustained partnerships outweigh that perceived "cost". If the language is not changed, we urge future analyses to include a narrative behind whether or not this criterion is being met.		
R3.2 Promote Responsible Recreation		
Performance Criteria	**Met?**	**Conclusions**
•Sign repair is completed within 60 days of damage reported. •Demonstrate a stable or decreasing number of negative law enforcement encounters per unit effort. •Demonstrate a stable or increasing number of public engagement, such as presentations and brochure distribution.	**NA**	See discussion; if law enforcement is implemented in the future, these criteria will become relevant and will be evaluated.
Recommendations: The Science Advisor Panel feels that this objective is not applicable to the current use of the riparian reserve lands. If a law enforcement presence is required in the future, this objective and its associated criteria should be evaluated, but we recommend excluding it from evaluation until it is relevant.		

R4.1 Identify Critical Uncertainties and Address these through Planning		
Performance Criteria	**Met?**	**Conclusions**
Riparian projects demonstrably identify and address critical uncertainties during planning and implementation.	**NA**	We do not have data available to evaluate this criterion and are unclear of its meaning.
Recommendations: The third criterion "riparian projects demonstrably identify and address critical uncertainties during planning and implementation" may have been intended to represent the question "what are the biggest risks with this specific project", which would be much more specific uncertainties than those for the program overall (e.g., climate change). We recommend reviewing all three criteria and either clarifying language and/or removing the second criterion of "an analysis of critical uncertainties at the scale of the riparian reserve lands is conducted as determined on a project-by-project basis during project initiation."		
D1.2 Maintain Existing Intact Functioning Habitat and Restore Degraded Habitat		
Performance Criteria	**Met?**	**Conclusions**
Demonstrate stable or increasing acreage of high-functioning habitat within the desert upland reserve.	⊙	There have been no projects to evaluate in the performance period. Data is not available to evaluate achievement of the criteria; however, we can qualitatively report that high-functioning habitat in the reserve unit did not decrease in acreage.
No recommendations provided for this BGO.		
D1.3 Protect and Conserve Habitat for Covered Plants		
Performance Criteria	**Met?**	**Conclusions**
Demonstrate that known habitat for covered plant species is protected and conserved.	**NA**	There are currently no known locations of MSHCP-covered plants on reserve system lands.
Demonstrate that known covered plant species are physically protected.	**NA**	There are currently no known locations of MSHCP-covered plants on reserve system lands.
Recommendations: The Science Advisor Panel feels that this objective is not applicable at this time because there are no known locations of MSHCP-covered plants on reserve system lands. If any are located on reserve system lands in the future, this objective and its associated criteria should be evaluated, but we recommend excluding it from evaluation until it is applicable.		
D1.4 Inventory, Remove, and Control Invasive and Non-Native Plant Species		
Criteria for this BGO were met, but there are recommendations. **Recommendations:** Recommendations are identical those in R1.4. They are not repeated here to conserve space.		
D1.5 Reduce Habitat Fragmentation and/or Improve Connectivity		
Performance Criteria	**Met?**	**Conclusions**
Desert upland restoration projects demonstrably reduce fragmentation/ increase connectivity when feasible and as identified during project initiation	**NA**	There have been no desert upland restoration projects since 2017 and therefore no data/projects to evaluate.
Recommendations: Discussion points for R1.5 are relevant here, especially the need for baseline metrics, without which an overall evaluation of the criteria cannot be completed. Apart from the fragmentation analysis (Attachment B), there haven't been any desert upland restoration projects since the AMMP was finalized in 2017.		
D3.2 Promote Responsible Recreation		
Performance Criteria	**Met?**	**Conclusions**
Demonstrate a stable or decreasing number of negative law enforcement encounters per unit effort.	✗	See discussion for BGO D3.3, below (redundant criterion).
Recommendations: The Science Advisor Panel and DCP staff generally agree that the performance criteria selected for this BGO are not particularly effective and meaningful gauges of whether responsible recreation is promoted adequately. We recommend formally tracking data for the criteria Additional information is in Section D3.2		

D3.3 Provide Law Enforcement within Reserve System		
Performance Criteria	**Met?**	**Conclusions**
Demonstrate a stable or decreasing number of negative law enforcement encounters per unit effort.	✗	Criterion not met. Without additional context, the 2019 negative encounters are far higher than other years.
Demonstrate a stable or increasing number of positive law enforcement encounters.	⊙	Overall, no trend is apparent over time for either the number of contacts or brochures. It is unclear which of the contacts (contacts and/or brochures) include both positive and negative encounters versus positive-only encounters.
Recommendations: We recommend requesting additional context and information from the Boulder City Police Department to accompany their status report (examples given in Section D3.3). The aim of these criteria should not be to encourage fewer or only-positive contacts, but without additional information these criteria are at risk of doing just that. The performance criterion "demonstrate a stable or decreasing number of negative law enforcement encounters per unit effort" is identical to one of the criteria for BGO D3.2. Redundant criteria for BGOs may be warranted, but we recommend reviewing the two BGOs (D3.2 and D3.3).		
D3.4 Educate Project Proponents and Construction Personnel		
Performance Criteria	**Met?**	**Conclusions**
Demonstrate engagement with contractors (e.g., biological consultants...) to ensure they are aware of reporting and tortoise disposition procedures when working desert upland reserve lands.	**NA**	Criterion not met, but see the recommendation to remove it.
Recommendations: The Science Advisor Panel recommends reviewing the criterion "demonstrate engagement with contractors..." for its cost-benefit of achieving the intent of the MSHCP. The Science Advisor Panel's general opinion is that although it is crucial that professionals intentionally working in desert tortoise habitat understand the proper reporting and disposition procedures, it is not currently a major contributor to desert tortoise health or species status. Professionals working directly with desert tortoises are required to obtain a federal permit, and training for the permit covers all material relevant to reporting and disposition procedures. We recommend removing the second criterion and revisiting the idea in the future if desert tortoise certification changes.		
D4.1 Identify Critical Uncertainties and Address the through Planning and Adaptive Management		
Performance Criteria	**Met?**	**Conclusions**
Desert upland projects demonstrably identify and address critical uncertainties during planning and implementation.	**NA**	We do not have knowledge available to evaluate this criterion and are unclear of its meaning.
Recommendations: The third criterion, "riparian projects demonstrably identify and address critical uncertainties during planning and implementation" may have been intended to represent the question "what are the biggest risks with this specific project", which would be much more specific uncertainties than those for the program overall (e.g., climate change). We recommend reviewing all three criteria and either clarifying language and/or removing the second criterion of "an analysis of critical uncertainties at the scale of the riparian reserve lands is conducted as determined on a project-by-project basis during project initiation."		
D4.2 Identify Critical Connectivity Corridors for Covered Species		
Performance Criteria	**Met?**	**Conclusions**
An analysis of critical connectivity corridors for covered species at the scale of the desert upland reserve lands is conducted every 4 year(s).	⊙	Data is not available to evaluate this criterion.
Recommendations: The use of the word "corridor" in the first criterion caused several members of the Science Advisor Panel and DCP staff to question the overall intent of the criterion, and the BGO. We recommend reviewing this criterion and rephrasing to include more specific wording.		

Appendix C
Current Projects Linked to BGOs

Project Number	Master Project/Contract Title	Lead Agency/Contractor	DCP Project	Category	Status (based on contract dates using 7/31/19 cutoff)	Report Reference	R1	R2	R3	R4	D1	D2	D3	D4
714	***Boulder City Conservation Easement Management Plan***	***Desert Conservation Program***		***Master Project***	***Complete***		*Not assessed*							
714K	BCCE Weed Survey	National Park Service	BCCE Management	Start Date Before 2016			*Not assessed*							
719	***DT Pickup Service, Transfer & Holding***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
719AA	BCCE DT Telemetry and Health Assessments	Great Basin Institute	Translocation	Split Project	In Progress	Wild DT Project 2	0	0	0	0	0	1	0	0
719X	DT Telemetry on the BCCE Yr 1 (funded w/1450B)	Great Basin Institute	Translocation	Start Date Before 2016		Wild DT Project 3	*Not assessed*							
722	***Management of Acquired Land & Water Rights***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
722K	Muddy River Grading Plan	Louis Berger Engineering	Muddy River Restoration, Parcels A-E	DNF	Complete	Riparian Project 3	1	0	0	1	0	0	0	0
801	***Adaptive Management Program***	***Desert Conservation Program***		***Master Project***	***Complete***		*Not assessed*							
801J	Occupancy Covaritate Creation	Terraspectra Geomatics	Desert Tortoise Occupancy Sampling	DNF	Complete		*Not assessed*							
802	***BCCE Management, Maintenance & Law Enforcement***	***Desert Conservation Program***		***Master Project***	***Complete***		*Not assessed*							
802M	DCP Branding Project	Robertson + Partners	Branding	Start Date Before 2016			*Not assessed*							
803	***DT Hotline and Pick-Up Service***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
803D	BCCE DT Predation Study - Phase 2	Conservation Science Research	Desert Tortoise Predation Studies	Start Date Before 2016			*Not assessed*							
803E	Hotline and Processing of Wild DTs	Knight & Leavitt Assoc	Wild Desert Tortoise Assistance Hotline	Start Date Before 2016		Wild DT Project 1	*Not assessed*							
803F	DT Health Assess and Pickup Svc Support	Ecocentric, LLC	Wild Desert Tortoise Assistance Hotline	DNF	In Progress	Wild DT Project 1	0	0	0	0	0	1	1	0
804	***Desert Tortoise Fencing S10***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
804F	Energy Zone Fencing (w/1442 & 1525)	Muller Construction	BCCE Energy Zone Fencing	No Reason to Exclude	Complete	BCCE Project 3	0	0	0	0	1	0	0	0
804G	SW Gas Civil Plans Revisions	John Jones Landscape Architect	BCCE Energy Zone Fencing	No Reason to Exclude	Complete		*Not assessed*							
804H	Fencing Materials	American Fence Company	Boundary Fence for the Tule Springs Fossil Beds National Monument	Supplies Acquisition			*Not assessed*							
804J	DT Combo Fencing Engineering Details	John Jones Landscape Architect, PLLC	Boundary Fence for the Tule Springs Fossil Beds National Monument	No Reason to Exclude	Complete	Cons Project 1	0	0	0	0	1	1	0	0

Project Number	Master Project/Contract Title	Lead Agency/Contractor	DCP Project	Category	Status (based on contract dates using 7/31/19 cutoff)	Report Reference	R1	R2	R3	R4	D1	D2	D3	D4
805	***Manage Acquired Properties and Water Rights***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
805Q	Water Rights Consulting	Michael Buschelman Consulting	Management of Water Rights	Start Date Before 2016			*Not assessed*							
805AD	Muddy River Grading Plan (w/722&1445)	Louis Berger Engineering	Muddy River Restoration, Parcels A-E	DNF	In Progress	Riparian Project 3	*Not assessed*							
805AE	Water Rights Consulting (w/1445)	Farr West Engineering	Management of Water Rights	No Reason to Exclude	In Progress	Riparian Project 8	*Not assessed*							
805AF	MR Vegetation Clearing (w/1520P & 1720D)	Eagle View Contractors, Inc.	Muddy River Restoration, Parcel E	No Reason to Exclude	Complete	Riparian Project 4	1	0	0	0	0	0	0	0
807	***OHV Education***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
807D	OHV Registration Program Marketing	Radioactive Productions (MXT Media)	OHV Education	No Reason to Exclude	Complete	PIE	0	0	0	0	0	0	1	0
807E	OHV Education - Story Map	Map Photo Write	OHV Education		Complete		*Not assessed*							
807F	OHV Registration Program Marketing	MXT Media	OHV Education	No Reason to Exclude	Complete		*Not assessed*							
807G	Acquisition of Learn to the Max Staff Shirts	Logo Apparel	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
807H	DT Aware & Invasive Spec Ed for OHV Comm	MXT Media	OHV Education	No Reason to Exclude	In Progress	PIE	0	0	0	0	1	1	1	0
809	***Restoration of DT & Gypsum Habitat***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**BCCE**	0	0	0	0	1	1	0	1
809L	Supplies Acquisition	Forestry Suppliers	BCCE Management	Supplies Acquisition			*Not assessed*							
809M	BCCE Cultural Resource Survey	SWCA Environmental Consultants	BCCE Restoration	No Reason to Exclude	In Progress	BCCE	0	0	0	0	0	0	1	0
811	***Desert Tortoise Monitoring***	***Desert Conservation Program***		***Master Project***	***Complete***		*Not assessed*							
811J	Vegetation Data for DT Occ Cov Mon Project II	Knight & Leavitt Associates	Desert Tortoise Occupancy Sampling	DNF	Complete	BCCE	0	0	0	0	1	1	0	0
811K	LiDAR/Aerial Imagery Data Analysis	The University of Texas at Austin	Desert Tortoise Occupancy Sampling	DNF	Complete	BCCE	0	0	0	0	1	0	0	0
901	***Permit Amendment Transition***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
901B	Covered Species Analysis Support	Southwest Ecology, LLC	Permit Amendment	No Reason to Exclude	Complete	Prog Admin Project 2	1	1	0	0	1	1	0	0
901D	DCP Branding Project	Robertson + Partners	Branding	No Reason to Exclude	Complete		*Not assessed*							
901E	DT Culvert Engineering Specifications	John Jones Landscape Architect	BCCE Energy Zone Fencing	Start Date Before 2016			*Not assessed*							
901F	Science Advisor (w/1410 & 1411)	Terragraphics	Independent Science Advisor	No Reason to Exclude	Complete	AMP Project 1	1	1	1	1	1	1	1	1
901G	Legal Services for DCP (w/1014)	Ebbin Moser & Skaggs, LLP	Permit Amendment	No Reason to Exclude	Complete	Prog Admin Project 2	*Not assessed*							
901H	HCP Consultant for the MSHCP Amend 3/1460	WRA Environmental Consultants	Permit Amendment	No Reason to Exclude	In Progress	Prog Admin Project 2	*Not assessed*							

Project Number	Master Project/Contract Title	Lead Agency/Contractor	DCP Project	Category	Status (based on contract dates using 7/31/19 cutoff)	Report Reference	R1	R2	R3	R4	D1	D2	D3	D4
910	***BCCE Mgmt,Maint & LE 11-13***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
910B	BCCE Site Rehabilitation & Cleanup	Nevada Division of Forestry	BCCE Management	Start Date Before 2016			*Not assessed*							
910M	BCCE Informative Video	Radioactive Productions	BCCE Outreach	DNF	Complete		*Not assessed*							
910R	BCCE Weed Survey	National Park Service (NPS)	BCCE Management	No Reason to Exclude	Complete	BCCE Project 1	*Not assessed*							
910S	BCCE Restore & Repair	Muller Construction	BCCE Management	No Reason to Exclude	Complete	BCCE Project 1	*Not assessed*							
910T	BCCE Limited Use Signs	Pictographics	BCCE Management	Supplies Acquisition		BCCE Project 1	*Not assessed*							
910U	BCCE Kiosk Signs - 3 Locations	KVO Industries	BCCE Outreach	No Reason to Exclude	Complete	BCCE Project 4	0	0	0	0	0	0	1	0
910V	BCCE Gabion Sign Attachment Specifications	John Jones Landscape Architect, PLLC	BCCE Outreach	Supplies Acquisition		BCCE Project 4	*Not assessed*							
910W	BCCE Gabions Constructed in Three Locations	Maile Concrete	BCCE Outreach	No Reason to Exclude	Complete	BCCE Project 4	*Not assessed*							
910X	Limited Use & Authorized Road Signage	Pictographics	BCCE Management	Supplies Acquisition		BCCE Project 1	*Not assessed*							
910Y	No Shooting Signage	702 Graphics	BCCE Management	Supplies Acquisition		BCCE Project 1	*Not assessed*							
910Z	Route G Desert Tortoise Guard	Maile Concrete	BCCE Management	No Reason to Exclude	Complete	BCCE Project 1	0	0	0	0	1	0	0	0
916	***Information & Education 11-13***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
916Q	Mojave Max Mascot Appearances	Steve-N-Kids	Mojave Max Education Program	Start Date Before 2016		PIE Project 1	0	0	0	0	0	0	1	0
916ZC	Mojave Max Assemble Application	Zee Designs	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
916ZD	Acquisition of Sunshades	Jackson Media Works	General Outreach	Supplies Acquisition		PIE Project 5	*Not assessed*							
916ZE	Acquisition of Mojave Max Trail Camera	B & H Photo	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
916ZF	Acquisition of Learn to the Max Shirts	Logo Apparel	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
916ZG	Acquisition of Mojave Max Cut-Outs	Paper Zombies	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
916ZH	Acquisition of Name Badges	Abbott Trophies, LLC	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
916ZJ	Acquisition of Tortoise Erasers	Skyhigh Marketing	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
916ZK	Acquisition of Mood Rulers	Morgan Specialties, Inc.	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							

Project Number	Master Project/Contract Title	Lead Agency/Contractor	DCP Project	Category	Status (based on contract dates using 7/31/19 cutoff)	Report Reference	R1	R2	R3	R4	D1	D2	D3	D4
916ZL	Acquisition of MoMax Patches	Las Vegas Tactical, LLC	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
916ZM	Gfx Design for MoMax Brochure (w/1515)	Paper Zombies	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
917	***Riparian Property Acquisition 11-13***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
917EC	Boundary Surveys and Parceling for VR Props	Stanley Consultants, Inc.	Riparian Property Acquisition	No Reason to Exclude	Complete		*Not assessed*							
917BC	Appraisal Report for APN 002-26-501-009	Anderson Valuation Group	Riparian Property Acquisition	No Reason to Exclude	Complete		*Not assessed*							
917DC	Appraisal Rpt for APN 002-26-301-004 & 005	Anderson Valuation Group	Riparian Property Acquisition	No Reason to Exclude	Complete		*Not assessed*							
917GC	Appraisal Rpt for APN 001-19-201-009	Anderson Valuation Group	Riparian Property Acquisition	No Reason to Exclude	Complete		*Not assessed*							
917KA	Appraisal Rpt for APN 034-00-001-013 & 019	Anderson Valuation Group	Riparian Property Acquisition	No Reason to Exclude	Complete		*Not assessed*							
917LA	Appraisal Rpt for APN 034-00-001-014, 021 & 39	Anderson Valuation Group	Riparian Property Acquisition	No Reason to Exclude	Complete		*Not assessed*							
917CC	Appraisal Rpt for APN 002-27-801-002	Anderson Valuation Group	Riparian Property Acquisition	No Reason to Exclude	Complete		*Not assessed*							
917FC	Appraisal Rpt for APN 002-26-401-001	Anderson Valuation Group	Riparian Property Acquisition	No Reason to Exclude	Complete		*Not assessed*							
917MA	Appraisal Rpt for APN 002-25-501-13, 002-25-601-031, 002-27-801-002	Anderson Valuation Group	Riparian Property Acquisition	No Reason to Exclude	Complete		*Not assessed*							
917AC	Boundary Surveys and Parceling for VR Props	Stanley Consultants, Inc.	Riparian Property Acquisition	No Reason to Exclude	Complete	Riparian Project 7	*Not assessed*							
917BD	Parceling for APN 002-26-501-009	Stanley Consultants, Inc.	Riparian Property Acquisition	No Reason to Exclude	In Progress	Riparian Project 7	*Not assessed*							
917DD	Appraisal Report for APN 002-26-301-002	Anderson Valuation Group	Riparian Property Acquisition	No Reason to Exclude	Complete	Riparian Project 7	*Not assessed*							
917DE	Parceling for Virgin River Properties	Stanley Consultants, Inc.	Riparian Property Acquisition	No Reason to Exclude	Complete	Riparian Project 7	*Not assessed*							
917K	DRB Holdings, LLC Land Acquisition		Riparian Property Acquisition	No Reason to Exclude	In Progress	Riparian Project 7	*Not assessed*							
917L	Happy Good Fortune, LLC Land Acquisition		Riparian Property Acquisition	No Reason to Exclude	In Progress	Riparian Project 7	*Not assessed*							

Project Number	Master Project/Contract Title	Lead Agency/Contractor	DCP Project	Category	Status (based on contract dates using 7/31/19 cutoff)	Report Reference	R1	R2	R3	R4	D1	D2	D3	D4
917M	Bunkerville Compound, LLC Land Acquisition		Riparian Property Acquisition	No Reason to Exclude	In Progress	Riparian Project 7	*Not assessed*							
917MB	Parceling for Bunkerville Property	Stanley Consultants, Inc.	Riparian Property Acquisition	No Reason to Exclude	In Progress	Riparian Project 7	*Not assessed*							
917MC	Phase I Env. Site Assessment of Bunkerville Parcel	Converse Consultants, Inc	Riparian Property Acquisition	No Reason to Exclude	Complete	Riparian Project 7	*Not assessed*							
917NA	Parceling for Virgin River Properties	Stanley Consultants, Inc.	Riparian Property Acquisition	No Reason to Exclude	Complete	Riparian Project 7	1	0	0	0	0	0	0	0
1012	***Desert Tortoise Monitoring***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1012D	DT Occupancy Sampling Crews II	Knight & Leavitt Assoc	Desert Tortoise Occupancy Sampling	No Reason to Exclude	Complete	AMP Project 4	0	0	0	0	1	1	0	0
1014	***Permit Amendment Transition***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1014J	Legal Services for DCP	Ebbin Moser & Skaggs, LLP	Permit Amendment	No Reason to Exclude	In Progress	Prog Admin Project 2	*Not assessed*							
1405	***MSHCP Fee Consolidation***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1410	***Adaptive Management Program-Baseline***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**AMP**	1	1	1	1	1	1	1	1
1410B	Science Advisor Panel for the DCP	Terragraphics	Independent Science Advisor	No Reason to Exclude	In Progress		*Not assessed*							
1410C	Science Advisor Panel for the DCP	Alta Sciences & Engineering, Inc.	Independent Science Advisor	No Reason to Exclude	In Progress	AMP Project 1	*Not assessed*							
1411	***Adaptive Management Program-DT Modeling***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**AMP**	0	0	0	0	1	1	1	1
1411A	Science Advisor (W/1410 & 901)	Terragraphics	Independent Science Advisor	No Reason to Exclude	In Progress	AMP Project 1	*Not assessed*							
1412	***Adaptive Management Program-DT Monitoring***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1412A	Eldorado DT Monitoring Year 2	Great Basin Institute	Translocation	Start Date Before 2016			*Not assessed*							
1412C	Occupancy Covariate	Terraspectra Geomatic	Desert Tortoise Occupancy Sampling	DNF	Complete		*Not assessed*							
1412D	BCCE DT Telemetry and Health Assessments	Great Basin Institute	Translocation	Counted with Other	In Progress	Wild DT Project 2	*Not assessed*							
1420	***BCCE Management***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1420E	BCCE Law Enforcement (partial with 1510A)	City of Boulder City	BCCE Management	Start Date Before 2016		BCCE Project 1	*Not assessed*							
1420F	Reserves Maintenance & Tools	American Express	BCCE Management	Supplies Acquisition			*Not assessed*							
1420G	Acquisition of Signs for the BCCE	Berntsen International, Inc	BCCE Management	Supplies Acquisition			*Not assessed*							
1420H	BCCE 25 mph Decals for Route Signage	Signarama	BCCE Management	Supplies Acquisition			*Not assessed*							
1420J	Reserves Maintenance & Tools FY18	American Express	BCCE Management	Supplies Acquisition		BCCE Project 1	*Not assessed*							

Project Number	Master Project/Contract Title	Lead Agency/Contractor	DCP Project	Category	Status (based on contract dates using 7/31/19 cutoff)	Report Reference	R1	R2	R3	R4	D1	D2	D3	D4
1420K	Slow Signage for Eldorado Valley Drive	SmartSign	BCCE Management	Supplies Acquisition		BCCE Project 1	*Not assessed*							
1420L	Route G Desert Tortoise Guard	Maile Concrete	BCCE Management	No Reason to Exclude	Complete	BCCE Project 1	*Not assessed*							
1420M	Reserves maintenance & Tools FY19	American Express	BCCE Management	Supplies Acquisition		BCCE Project 1	*Not assessed*							
1420N	Acquisition of Dead End Sign	Pictographics	BCCE Management	Supplies Acquisition		BCCE Project 1	*Not assessed*							
1420P	Rekey Two Locks at 4701 W. Russell Road	ABC Locksmiths	BCCE Management	Supplies Acquisition		BCCE Project 1	*Not assessed*							
1420Q	Acquisition of Dead End Sign	Pictographics	BCCE Management	Supplies Acquisition		BCCE Project 1	*Not assessed*							
1420R	Route E Flooding Signage	Signarama	BCCE Management	Supplies Acquisition		BCCE Project 1	*Not assessed*							
1420S	Acquisition of GPS Logger for BCPD Patrols	LandAirSea Systems	BCCE Management	Supplies Acquisition		BCCE Project 1	*Not assessed*							
1420T	GNSS Receiver Rental	Frontier Precision	BCCE Management	Supplies Acquisition		BCCE Project 1	*Not assessed*							
1421	***BCCE Restoration***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**AMP**	0	0	0	0	1	0	0	0
1421A	DCP Branding Project	Robertson + Partners	Branding	Start Date Before 2016			*Not assessed*							
1421B	BCCE DT Predation Study -Phase 2 Amendment	Conservation Science Research & Consulting	Desert Tortoise Predation Studies	No Reason to Exclude	Complete	AMP Project 5	0	0	0	0	1	1	0	0
1440	***Other Property Management***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**Riparian**	1	0	0	0	0	0	0	0
1440C	Water Rights Permit Fees	Nevada Division of Water Resources	Management of Water Rights	DNF	Complete		*Not assessed*							
1442	***Fencing***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1442A	Energy Zone Fencing (w/804 & 1525)	Muller Construction	BCCE Energy Zone Fencing	No Reason to Exclude	Complete	BCCE Project 3	*Not assessed*							
1445	***Riparian Property Management***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1445C	Muddy River Grading Plan (w/722&805)	Louis Berger Engineering	Muddy River Restoration, Parcels A-E	DNF	In Progress	Riparian Project 3	*Not assessed*							
1445E	Water Rights Consulting (w/805)	Farr West Engineering	Management of Water Rights		In Progress	Riparian Project 8	*Not assessed*							
1445F	Lower Virgin River Integrated Watershed Plan	The Nature Conservancy (TNC) of Nevada	Virgin River Integrated Watershed Plan	No Reason to Exclude	Complete	Riparian Project 2	1	1	1	1	0	0	0	0
1445G	Acquisition of Field Supplies	Forestry Suppliers	Management of the Riparian Reserve Units	Supplies Acquisition			*Not assessed*							
1445H	Riparian Rsv Units Prop Maint (w/1520)	Eagle View Contractors, Inc.	Management of the Riparian Reserve Units	No Reason to Exclude	Complete	Riparian Project 1	1	0	0	0	0	0	0	0

Project Number	Master Project/Contract Title	Lead Agency/Contractor	DCP Project	Category	Status (based on contract dates using 7/31/19 cutoff)	Report Reference	R1	R2	R3	R4	D1	D2	D3	D4
1446	***Riparian Prop Restoration - Phase II***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1446C	Muddy River Restoration Plan	Fred Phillips Consulting, LLC	Muddy River Restoration, Parcel E	DNF	Complete		*Not assessed*							
1446D	Muddy River Habitat Restoration	National Park Service (NPS)	Muddy River Restoration, Parcel E	No Reason to Exclude	In Progress	Riparian Project 4	1	0	0	1	0	0	0	0
1450	***USFWS DT Translocation-S10***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**Wild Dt**	0	0	0	0	0	1	0	0
1450B	Desert Tortoise Telemetry on the BCCE	Great Basin Institute	Translocation	Start Date Before 2016			*Not assessed*							
1451	***USFWS DT Translocation-SNPLMA***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1451A	Eldorado Desert Tortoise Monitoring (Year 1 & 2)	Great Basin Institute	Translocation	Start Date Before 2016			*Not assessed*							
1455	***Wild Desert Tortoise Assistance***	***Desert Conservation Program***		***Master Project***	***Complete***		*Not assessed*							
1455D	BCCE DT Telemetry and Health Assessments	Great Basin Institute	Translocation	No Reason to Exclude	In Progress	Wild DT Project 2	*Not assessed*							
1460	***Permit Amendment***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**Prog Admin**	1	1	1	1	1	1	1	1
1460A	HCP Consultant for the MSHCP Amend w/901	WRA Environmental Consultants	Permit Amendment	No Reason to Exclude	In Progress	Prog Admin Project 2	*Not assessed*							
1460B	Economic Analysis of a Regional HCP	Applied Analysis	Permit Amendment	No Reason to Exclude	Complete	Prog Admin Project 2	*Not assessed*							
1460C	Facilitate Climate Change Workshop	Adaptation Insight	Permit Amendment	No Reason to Exclude	Complete	Prog Admin Project 2	0	0	0	1	0	0	0	1
1460D	Joshua Tree Habitat Model	Southwest Ecology, LLC	Permit Amendment	No Reason to Exclude	Complete	Prog Admin Project 2	0	0	0	0	1	0	0	0
1460E	Species Distribution Modeling, Phase II	University of Nevada Reno (UNR) - BRRC	Permit Amendment	No Reason to Exclude	In Progress	Prog Admin Project 2	1	1	0	1	1	1	0	1
1500	***MSHCP Administration 15-17***	***Desert Conservation Program - Master Project***		***Master Project***	***Complete***		*Not assessed*							
1500AA	Acquisition of Jeep Rubicon	Sahara Chrysler Jeep Dodge Ram	MSHCP Administration	Supplies Acquisition			*Not assessed*							
1500AB	Acquisition of Computers & Monitors	Dell Marketing LP	MSHCP Administration	Supplies Acquisition			*Not assessed*							
1500AC	Acquisition of Adobe Creative Cloud	SHI International Corp	MSHCP Administration	Supplies Acquisition			*Not assessed*							
1500AD	Acquisition of VLA Project 2016	Dell Marketing LP	MSHCP Administration	Supplies Acquisition			*Not assessed*							
1500AE	Acquisition of Desktop Printer	CDW Government, Inc	MSHCP Administration	Supplies Acquisition			*Not assessed*							
1500AF	Fujitsu Scanner Maintenance	Graphic Imaging Services, Inc.	MSHCP Administration	Supplies Acquisition			*Not assessed*							
1500T	Office Supplies - FY17	Staples	MSHCP Administration	Supplies Acquisition			*Not assessed*							
1500U	Document Shredding & Container - FY17	Opportunity Village	MSHCP Administration	Supplies Acquisition			*Not assessed*							
1500V	Uniform Apparel - FY17	Logo Apparel	MSHCP Administration	Supplies Acquisition			*Not assessed*							
1500W	Safety shoes - FY17	Red Wing Shoes of America	MSHCP Administration	Supplies Acquisition			*Not assessed*							

Project Number	Master Project/Contract Title	Lead Agency/Contractor	DCP Project	Category	Status (based on contract dates using 7/31/19 cutoff)	Report Reference	R1	R2	R3	R4	D1	D2	D3	D4
1500X	First Aid & Safety Supplies - FY17	Cintas First Aid & Safety	MSHCP Administration	Supplies Acquisition			*Not assessed*							
1500Y	Wet-hose Contract for Unleaded	Rebel Oil Company, Inc	MSHCP Administration	Supplies Acquisition			*Not assessed*							
1500Z	Wet-hose Contract for Unleaded Fuel	Rebel Oil Company, Inc	MSHCP Administration	Supplies Acquisition			*Not assessed*							
1510	***BCCE MGMT & LAW ENFORCEMENT***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**BCCE**	0	0	0	0	1	1	1	0
1510A	BCCE Law Enforcement (partial with 1420E)	City of Boulder City	BCCE Management	Start Date Before 2016		BCCE Project 1	*Not assessed*							
1515	***INFORMATION, EDUCATION & OUTREACH***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1515A	Mojave Max Education Program	RRCIA (So NV Conservancy)	Mojave Max Education Program	Start Date Before 2016		PIE Project 1	*Not assessed*							
1515C	DCP Branding Project (w/901D)	Robertson + Partners	Branding	Supplies Acquisition		PIE Project 2	*Not assessed*							
1515G	Mojave Max Secure Server License	Zee Designs	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
1515H	Mojave Max Contest Portal	Zee Designs	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
1515J	2017 Mojave Max Website Support	Zee Designs	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
1515K	Live Video Feed	Zee Designs	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
1515L	Assembly Application	Zee Designs	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
1515M	Mojave Max Assemble Application	Zee Designs	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
1515N	Acquisition of Lip Moisturizer Balls	Skyhigh Marketing	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
1515P	Acquisition of Temporary Tattoos	Giftco	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
1515Q	Acquisition of LED Flashlights	Skyhigh Marketing	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
1515R	Acquisition of Tortoise Paper Clips	Morgan Specialties, Inc.	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
1515S	Acquisition of Learn to the Max Patches	AB Limited Worldwide	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
1515T	Mojave Max Verification Page	Zee Designs	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							

Project Number	Master Project/Contract Title	Lead Agency/Contractor	DCP Project	Category	Status (based on contract dates using 7/31/19 cutoff)	Report Reference	R1	R2	R3	R4	D1	D2	D3	D4
1515U	Incr Archiving Time on Mojave Max	Earthcam, Inc.	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
1515V	Acquisition of Learn to the Max Conf	Logo Fusion USA, Inc.	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
1515W	Mojave Max Website Support Services	Robertson + Partners	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1515X	Acquisition of Learn to the Max	Logo Fusion USA, Inc.	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
1515Y	Mojave Max Assembly Power-Point Presentation	Robertson + Partners	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1515Z	Acquisition of Tortoise Costumes	Alinco, Inc	Mojave Max Education Program	Supplies Acquisition			*Not assessed*							
1515AA	Repair Hole from Camera Removal	Muller Construction	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1515AB	Gfx Design for MoMax Brochure (w/916)	Paper Zombies	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1515AC	Mojave Max Education Program (w/1715)	Outside Las Vegas Foundation	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1520	***RIPARIAN PROPERTY MANAGEMENT***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1520B	Muddy River Weed Management	National Park Service (NPS)	Management of the Riparian Reserve Units	Start Date Before 2016		Riparian Project 1	1	0	0	0	0	0	0	0
1520G	Muddy River Pump Diagnostic	Whitney's Water Systems, Inc	Management of the Riparian Reserve Units	DNF	Complete		*Not assessed*							
1520H	VR Baseline Conditions Assessment	Stillwater Sciences	Virgin River Restoration	DNF	Complete		*Not assessed*							
1520J	Riparian Property Maintenance	L.J. McCormick Enterprises Inc	Management of the Riparian Reserve Units	No Reason to Exclude	Complete	Riparian Project 1	*Not assessed*							
1520K	Muddy River Pump	Whitney's Water Systems, Inc	Management of the Riparian Reserve Units	DNF	Complete		*Not assessed*							
1520L	Backflow Test and Repair	Whitney's Water Systems, Inc	Management of the Riparian Reserve Units	DNF	Complete		*Not assessed*							
1520M	Riparian Rsv Units Prop Maint (w/1445)	Eagle View Contractors, Inc.	Management of the Riparian Reserve Units	No Reason to Exclude	Complete	Riparian Project 1	*Not assessed*							
1520N	Muddy River Reserve Unit Gate Signs	Pictographics	Management of the Riparian Reserve Units	Supplies Acquisition		Riparian Project 1	*Not assessed*							
1520P	MR Vegetation Clearing (w/805 & 1720)	Eagle View Contractors, Inc.	Muddy River Restoration, Parcel E	No Reason to Exclude	Complete	Riparian Project 4	*Not assessed*							

Project Number	Master Project/Contract Title	Lead Agency/Contractor	DCP Project	Category	Status (based on contract dates using 7/31/19 cutoff)	Report Reference	R1	R2	R3	R4	D1	D2	D3	D4
1521	***RIPARIAN RESTORATION RSV UNITS & WATER RIGHTS***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1521A	VR Baseline Conditions Assessment	Stillwater Sciences	Virgin River Restoration	DNF	Complete		*Not assessed*							
1521B	VR Rest Plan -Mormon Mesa Ph 1	SWCA Environmental Consultants	Virgin River Restoration	No Reason to Exclude	Complete	Riparian Project 6	*Not assessed*							
1521C	Mormon Mesa Restoration Services	Great Basin Institute	Virgin River Restoration	No Reason to Exclude	Complete	Riparian Project 6	1	0	0	0	0	0	0	0
1521D	Herbicide Acquisition for Mormon Mesa Restoration	Helena Chemical Company	Virgin River Restoration	Supplies Acquisition		Riparian Project 6	*Not assessed*							
1521E	Virgin River Riparian Restoration	Nevada Division of Forestry (NDF) - Carson City	Virgin River Restoration	No Reason to Exclude	In Progress	Riparian Project 6	1	0	0	0	0	0	0	0
1521F	Herbicide Acquisition	Helena Chemical Company	Virgin River Restoration	Supplies Acquisition		Riparian Project 6	*Not assessed*							
1521Z	Mormon Mesa Restoration Project	Nevada Division of Forestry (NDF) - Las Vegas	Virgin River Restoration	No Reason to Exclude	Complete	Riparian Project 6	1	0	0	0	0	0	0	0
1525	***Wildlife Fencing***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1525A	Energy Zone Fencing (w/804 & 1442)	Muller Construction	BCCE Energy Zone Fencing	No Reason to Exclude	Complete	BCCE Project 3	*Not assessed*							
1525B	Tule Springs Cultural Resource Survey	HRA, Inc	Boundary Fence for the Tule Springs Fossil Beds National Monument	No Reason to Exclude	Complete	Cons Project 1	0	0	0	0	0	0	1	0
1530	***SOUTH LOOP TRAIL RESTORATION***	***Desert Conservation Program***		***Master Project***	***Complete***		*Not assessed*							
1530A	South Loop Trail Restoration	Great Basin Institute	Changed Circumstances: South Loop Trail Restoration for the Endangered Mount Charleston Blue Butterfly	DNF	Complete		*Not assessed*							
1535	***RIPARIAN RSV UNITS BASELINE BIRD SURVEYS***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1535A	Federally Listed Bird Surveys	SWCA Environmental Consultants	Species Monitoring and Habitat Monitoring	No Reason to Exclude	Complete	AMP Project 3	*Not assessed*							
1535B	Point Count Surveys on Riparian Properties	SWCA Environmental Consultants	Species Monitoring and Habitat Monitoring	No Reason to Exclude	Complete	AMP Project 3	*Not assessed*							
1535C	Avian Surveys on Riparian Props (w/1730)	SWCA Environmental Consultants	Species Monitoring and Habitat Monitoring	No Reason to Exclude	Complete	AMP Project 3	0	1	0	0	0	0	0	0

Project Number	Master Project/Contract Title	Lead Agency/Contractor	DCP Project	Category	Status (based on contract dates using 7/31/19 cutoff)	Report Reference	R1	R2	R3	R4	D1	D2	D3	D4
1540	***DESERT TORTOISE MONITORING***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1540A	Desert Tortoise Range-Wide Monitoring	Great Basin Institute	Species Monitoring – Desert Tortoise	DNF	Complete		*Not assessed*							
1540B	DT Monitoring Data Management	US Fish & Wildlife Service	Species Monitoring – Desert Tortoise	DNF	Complete		*Not assessed*							
1540C	Desert Tortoise Range-Wide Mon (w/1541B)	Great Basin Institute	Species Monitoring – Desert Tortoise	No Reason to Exclude	In Progress	AMP Project 2	0	0	0	0	0	1	0	0
1540D	BCCE DT Telemetry and Health Assessments	Great Basin Institute	Translocation	No Reason to Exclude	In Progress	Wild DT Project 2	*Not assessed*							
1541	***DESERT TORTOISE MONITORING-SNPLMA***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1541A	DT Monitoring Data Management Year 2-5	US Fish & Wildlife Service (USFWS) -Las Vegas	Species Monitoring – Desert Tortoise	No Reason to Exclude	In Progress	AMP Project 2	0	0	0	0	0	1	0	0
1541B	Desert Tortoise Range-Wide Monitoring	Great Basin Institute	Species Monitoring – Desert Tortoise	No Reason to Exclude	In Progress	AMP Project 2	*Not assessed*							
1545	***Post-translocation DT Monitoring***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1545A	DT Telemetry on the BCCE (Yr 2 & 3)	Great Basin Institute	Translocation	Start Date Before 2016		Wild DT Project 2	*Not assessed*							
1545B	BCCE DT Telemetry and Health Assessments	Great Basin Institute	Translocation	No Reason to Exclude	In Progress	Wild DT Project 2	*Not assessed*							
1550	***Relict Leopard From Consv Planning & Imp***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1550A	Relict Leopard Frog Consv Plan and Impl	University of Nevada (UNLV) - Board of Regents	Relict Leopard Frog Conservation	No Reason to Exclude	In Progress	Cons Project 2	0	0	0	0	0	0	1	0
1555	***DT STERILIZATION CLINICS & OUTREACH***	***Desert Conservation Program***		***Master Project***	***Complete***		*Not assessed*							
1555B	Tortoise Sterilization Clinic	US Fish & Wildlife Service	Tortoise Sterilization	DNF	Complete		*Not assessed*							
1560	***TEMP HOLDING FACILITY FOR DISPLACED DT***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**Wild DT**	0	0	0	0	0	1	1	0
1570	***Restoration on the Clark County Muddy River Riparian Reserve Unit***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1570B	Muddy River Restoration Plan	Fred Phillips Consulting, LLC	Muddy River Restoration, Parcels G-I	No Reason to Exclude	Complete	Riparian Project 5	1	0	0	0	0	0	0	0
1580	***Tortoise Connectivity***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1580A	Desert Tortoise Connectivity Modeling	University of Nevada Reno (UNR) - BRRC	Desert Tortoise Habitat Connectivity Study	No Reason to Exclude	In Progress	AMP Project 5	0	0	0	0	1	1	0	1
1700	***MSHCP ADMINISTRATION 17-19***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1700A	2015-2017 BPR Editing and Printing	Jackson Media Works	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							
1700B	Office Supplies - Admin FY18	Staples	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							

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1700C	First Aid & Safety Supplies FY18	Cintas First Aid & Safety	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							
1700D	Uniform Apparel - FY18	Logo Apparel	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							
1700E	Document Shredding and Container FY18	Opportunity Village	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							
1700F	Lot 4 - Safety Shoes for Staff FY18	Red Wing Shoes of America	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							
1700G	Acquisition of DCP Storage Cabinets	Haworth, Inc	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							
1700H	Design Option Drawings	Faciliteq	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							
1700J	Acquisition of Computers	Dell Marketing LP	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							
1700K	Office Supplies - Admin FY19	Staples	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							
1700L	First Aid & Safety Supplies FY19	Cintas First Aid & Safety	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							
1700M	Uniform Apparel FY19	Logo Apparel	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							
1700N	Document Shredding and Container FY19	Opportunity Village	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							
1700P	Lot 4 -Safety Shoes for Staff FY19	Red Wing Shoes of America	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							
1700Q	Acquisition of Replacement Laptop	Dell Marketing LP	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							
1700R	Acquisition of Plotter	Monsen Engineering	MSHCP Administration	Supplies Acquisition		Prog Admin Project 1	*Not assessed*							
1710	***BCCE Management and Law Enforcement***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1710A	Law Enforcement for the BCCE	Boulder City Conservation Easement Law Enforcement	BCCE Management	No Reason to Exclude	In Progress	BCCE Project 1	*Not assessed*							
1710B	BCCE Weed Survey	National Park Service (NPS)	BCCE Management	No Reason to Exclude	In Progress	BCCE Project 1	0	0	0	0	1	0	0	0
1710C	BCCE Maintenance	Turf Tech, Inc.	BCCE Management	No Reason to Exclude	In Progress	BCCE Project 1	0	0	0	0	1	0	0	0
1715	***Public Information, Education, and Outreach***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1715A	Mojave Max Education Program	Outside Las Vegas Foundation	Mojave Max Education Program	No Reason to Exclude	In Progress	PIE Project 1	0	0	0	0	0	0	1	0
1715B	Acquisition of Lip Moisturizer Balls	Skyhigh Marketing	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715C	Acquisition of Ear Buds	Skyhigh Marketing	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715D	Acquisition of Tortoise Paper Clips	Skyhigh Marketing	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715E	Acquisition of Plastic Conference Bags	Morgan Specialties, Inc.	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							

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1715F	Acquisition of Beeswax Lip Balm	Logo Fusion USA, Inc.	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715G	Acquisition of Fidget Spinners	Logo Fusion USA, Inc.	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715H	Acquisition of DT Stress Balls	Bluetrack, Inc	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715J	Acquisition of Learn to the Max Patches	AB UnLimited Worldwide	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715K	Acquisition of flower Highlighters	AB UnLimited Worldwide	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715L	Acquisition of Learn to the Max Tote Bags	AB UnLimited Worldwide	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715M	Acquisition of Learn to the Max Crayon Sets	AB UnLimited Worldwide	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715N	Educational Classroom Resources	Acorn Naturalists	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715P	Acquisition of DCP Pens	Logo Fusion USA, Inc.	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715Q	Acquisition of Natural Beeswax Lip Balm	My Promos&Apparel	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715R	Acquisition of Mojave Max Sunglasses	Skyhigh Marketing	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715S	Graphics Design for DCP Pamphlets	MYS Project and Brand Management	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715T	Acquisition of Mo Max Stress Balls	Bluetrack, Inc	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1715U	DCP Graphics Design	Paper Zombies	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1720	***Riparian Properties Baseline Mgmt***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1720A	Virgin River Weed Management	National Park Service (NPS)	Management of the Riparian Reserve Units	No Reason to Exclude	In Progress	Riparian Project 1	1	0	0	0	0	0	0	0
1720C	Field Supplies for Riparian Reserves	Forestry Suppliers	Management of the Riparian Reserve Units	Supplies Acquisition		Riparian Project 1	*Not assessed*							
1720D	MR Vegetation Clearing (w/1520P & 805AF)	Eagle View Contractors, Inc.	Muddy River Restoration, Parcel E	No Reason to Exclude	Complete	Riparian Project 4	*Not assessed*							

Project Number	Master Project/Contract Title	Lead Agency/Contractor	DCP Project	Category	Status (based on contract dates using 7/31/19 cutoff)	Report Reference	R1	R2	R3	R4	D1	D2	D3	D4
1725	***Fencing Installation and Maintenance***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1730	***Adaptive Management Program***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**AMP**	1	1	1	1	1	1	1	1
1730A	Science Advisor Panel for the DCP	Alta Sciences & Engineering, Inc.	Independent Science Advisor	No Reason to Exclude	In Progress	AMP Project 1	*Not assessed*							
1730B	VR and MR Property LiDAR Acquisition	Southern NV Water Authority (SNWA)	Species Monitoring and Habitat Monitoring	No Reason to Exclude	Complete	AMP Project 3	1	0	0	0	0	0	0	0
1730C	Desert Upland Baseline Bird Surveys	SWCA Environmental Consultants	Species Monitoring and Habitat Monitoring	No Reason to Exclude	Complete	AMP Project 3	0	0	0	0	1	0	0	1
1730D	Desert Upland Baseline Sm Mammal Surveys	Newfields	Species Monitoring and Habitat Monitoring	No Reason to Exclude	Complete	AMP Project 3	0	0	0	0	1	0	0	1
1730E	Avian Surveys on Riparian Props (w/1535)	SWCA Environmental Consultants	Species Monitoring and Habitat Monitoring	No Reason to Exclude	Complete	AMP Project 3	*Not assessed*							
1730G	Acquisition of Telescoping Poles	Forestry Suppliers	Species Monitoring and Habitat Monitoring	Supplies Acquisition		AMP Project 3	*Not assessed*							
1730H	Acquisition of Acoustic Analysis Software	Wildlife Acoustics, Inc.	Species Monitoring and Habitat Monitoring	Supplies Acquisition		AMP Project 3	*Not assessed*							
1730J	Effects of Exotic Forage on Mojave DT	US Geological Survey (USGS) - Western Eco Rsrch Ctr	Desert Tortoise Forage Study	No Reason to Exclude	In Progress	AMP Project 7	0	0	0	0	1	1	0	0
1730K	Avian Species Surveys	SWCA Environmental Consultants	Species Monitoring and Habitat Monitoring	No Reason to Exclude	In Progress	AMP Project 3	0	1	0	0	0	0	0	0
1730M	Desert Upland Small Mammal Surveys II	BEC Environmental, Inc.	Species Monitoring and Habitat Monitoring	No Reason to Exclude	In Progress	AMP Project 3	0	0	0	0	1	0	0	1
1735	***Current Status and Conservation Knowledge Reports for State-listed Plants***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**AMP**	0	1	0	0	0	1	0	0
1740	***Desert Tortoise Translocation - S10***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**BCCE**	0	0	0	0	0	1	0	0
1740A	DT Telemetry on the BCCE (Yr4)	Great Basin Institute	Translocation	No Reason to Exclude	Complete	Wild DT Project 2	*Not assessed*							
1740B	BCCE DT Telemetry and Health Assessments	Great Basin Institute	Translocation	No Reason to Exclude	In Progress	Wild DT Project 2	*Not assessed*							
1741	***Desert Tortoise Translocation - SNPLMA***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1745	***BCCE Restorations***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**BCCE**	0	0	0	0	1	0	0	0
1750	***Riparian Reserve Units Restoration***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							

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1750A	Virgin River Drone Imagery	SWCA Environmental Consultants	Virgin River Restoration	No Reason to Exclude	Complete	Riparian Project 6	1	0	0	0	0	0	0	0
1755	***Rare Plant Surveys***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**BCCE**	0	0	0	0	1	0	0	0
1760	***Evaluating Desert Tortoise Habitat Restoration - SNPLMA***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**BCCE**	0	0	0	0	1	1	0	0
1765	***Assessment of Desert Tortoise Guard Design***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1770	***To the Max Campaign***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1770A	DCP Branding Project	Robertson + Partners	Branding	No Reason to Exclude	Complete	PIE Project 2	*Not assessed*							
1770B	Removal of Mojave Max Camera	Earthcam, Inc.	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1770C	Avian Species Photographs	Brian Small Photo	General Outreach	Supplies Acquisition		PIE Project 5	*Not assessed*							
1770D	Acq of MoMax Contest Winner Trophies	A1 Trophies & Awards	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1770E	Artwork to Revise Mojave Max Collateral	Paper Zombies	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1770F	MoMax Website Hosting and Support	Robertson + Partners	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1770G	Acquisition of Learn to the Max Name Badges	Abbott Trophies, LLC	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1770H	Advertising for Desert Tortoise License Plate	Robertson + Partners	General Outreach	Supplies Acquisition		PIE Project 5	*Not assessed*							
1770J	Acquisition of Neck Buffs	Logo Fusion USA, Inc.	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1770K	Acquisition of Mood Rulers	AB UnLimited Worldwide	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1770L	Acquisition of Journals with Pens	AB UnLimited Worldwide	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1770M	Acquisition of Mojave Max Slide Puzzle	Skyhigh Marketing	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1770N	Graphics Design for MM Emergence Tees	Paper Zombies	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1770P	Acquisition of Lip Balm Balls	Skyhigh Marketing	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							
1770Q	Acquisition of Table Throw	Logo Fusion USA, Inc.	Mojave Max Education Program	Supplies Acquisition		PIE Project 1	*Not assessed*							

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1775	***OHV Registration Program Marketing***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1775A	OHV Marketing	MXT Media	OHV Education	No Reason to Exclude	Complete	PIE Project 3	*Not assessed*							
1780	***Tule Springs Fossil Beds National Monument Boundary Fencing***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***		*Not assessed*							
1785	***Pilot Project for Drone Detection of Desert Tortoises***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**BCCE**	0	0	0	0	1	1	0	0
1785A	Eval Drone-Based Auto DT Detectability	Brainlike, Inc.	Evaluation of Drones for Detection of Desert Tortoises	No Reason to Exclude	Complete	AMP Project 8	*Not assessed*							
1785B	Viable Process for Surveying DT using Drones	Brainlike, Inc.	Evaluation of Drones for Detection of Desert Tortoises	No Reason to Exclude	Complete	AMP Project 8	*Not assessed*							
1787	***Desert Tortoise Sterilization Clinic***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**Wild DT**	0	0	0	0	0	0	1	0
1787A	Pet Desert Tortoise Sterilization Workshop	Oquendo Center	Tortoise Sterilization	No Reason to Exclude	Complete	Wild DT Project 3	*Not assessed*							
1790	***LVSP, Bearpoppy Habitat & Public Education***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**PIE**	0	0	0	0	0	0	1	0
1790A	LV Bearpoppy Fencing, Ramada & Trail	Las Vegas Valley Water District	Las Vegas Springs Preserve Bearpoppy Habitat	No Reason to Exclude	Complete	PIE Project 4	0	0	0	0	1	0	1	0
1792	***Arden Mine Complex Restoration and Bat Gate Installation***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**AMP**	0	0	0	0	0	0	1	0
1792A	Acquisition of Bat Detectors	Titley Scientific, LLC	Species Monitoring and Habitat Monitoring	Supplies Acquisition		AMP Project 3	*Not assessed*							
1792B	Acquisition of Bat Monitoring Equipment	Forestry Suppliers	Species Monitoring and Habitat Monitoring	Supplies Acquisition		AMP Project 3	*Not assessed*							
1792C	Gold Butte AML Closures	Nevada Department of Minerals	Installation of Bat Gates	No Reason to Exclude	In Progress	Cons Project 3	0	0	0	0	0	0	1	0
1795	***Desert Tortoise Predator-Prey Dynamics***	***Desert Conservation Program - Master Project***		***Master Project***	***In Progress***	**AMP**	0	0	0	0	1	1	0	0
1795A	Desert Tortoise Predator-Prey Dynamics	US Geological Survey (USGS) - Western Eco Rsrch Ctr	Desert Tortoise Predation Studies	No Reason to Exclude	In Progress	AMP Project 5	*Not assessed*							