

**ZEBRA-TAILED LIZARD MONITORING AT
DIAMOND CREEK ON THE HUALAPAI RESERVATION**

2018 ANNUAL REPORT

Grant #R15AP00060

Submitted to:

Bureau of Reclamation
Upper Colorado Region
125 State St., Rm 6107
Salt Lake City, UT 84138

Prepared by:

Hualapai Department of Cultural Resources
P.O. Box 310
Peach Springs, AZ 86434

September, 2018

Introduction

The zebra-tailed lizard (ZTL; *Callisaurus draconoides*) is a characteristic, relatively common Mohave and Sonoran Desert species that occurs throughout the lower elevation deserts of the Southwest (Brennon and Holycross 2006). ZTL are a medium-sized, insectivorous iguanid lizard (Figure 1) that prefers sandy desert habitats, which are often dominated by creosote-bush (*Larrea tridentata*; Figure 2). Female ZTL lay 2-8 eggs in summer in sandy, friable soils; however, this species may be multivoltine. Although widespread, isolated populations may occur in sand dune refugia.

Prior to 1983, zebra-tailed lizards were persistent residents of the sand dune area along the Colorado River in Grand Canyon at the Diamond Creek confluence on the Hualapai Indian Reservation (Tomko 1976; Miller et al. 1981; Figure 3). With the flooding that occurred (approximately 100,000 cfs) on the Colorado River in Grand Canyon in 1983-4 due to unexpectedly high runoff from the Rocky Mountains, river access at Diamond Creek for river rafters was restricted to the dune area, and river traffic drove over the dunes. Off-road vehicular impacts are well-known to negatively affect diurnal reptile species, such as desert tortoise and ZTL (Busack and Bury 1974; Webb and Wilshire 1983). Repeated censuses for ZTL at the mouth of Diamond Creek from the late 1980's through 2010 consistently failed to reveal any of these conspicuous, diurnal lizards, and the population was considered extirpated there (Stevens et al. 2011; Stevens 2012). However, ZTL, were still extant in the middle and upper Peach Springs Canyon, several miles south of the Diamond Creek dunes.

Analysis of missing and at-risk species in the Colorado River ecosystem downstream from Glen Canyon Dam identified ZTL as having high potential for restoration (Stevens et al. 2011). In an effort to re-establish ZTL on the dunes at Diamond Creek, the Bureau of Reclamation, Upper Colorado Region, working through the Glen Canyon Dam Adaptive Management Program, funded a translocation effort working with the Hualapai Tribe and Stevens Ecological Consulting, LLC in 2012.

Following the translocation effort in 2012, monthly surveys (April-October) have been performed annually from 2012 to 2018. This report provides survey results from the 2018 surveys and reviews prior years' survey results and discusses trends in the population status of zebra-tailed lizards at Diamond Creek on the Hualapai Reservation.

On August 9 and 10, 2016, there was a large monsoon flood in Peach Springs Canyon that flowed across the Diamond Creek campground and down the wash east of the dune area. This flood deposited fine grain sediments and silt in the campground area and caused a large erosion event in the wash. Surveys following the flood in 2016 found less than one-half the number of zebra-tails compared to prior to the flood (Hualapai Tribe 2016). There was concern that the flood had a significant impact to the zebra-tail population at Diamond Creek and that further translocations may be necessary in 2017 or 2018.



Figure 1. A male Zebra-tailed lizard at the Diamond Creek dunes in 2015 (Photo by D. Dupree). Males are identified by the blue/black markings on the sides/underbellies behind the front limbs and a distinctly banded tail.



Fig. 2: A photograph of the top of the Diamond Creek dunes in 2015 (Photo by D. DuPree). Vegetation on the dunes is dominated by creosote bush. The Diamond Creek campground can be seen in the background.

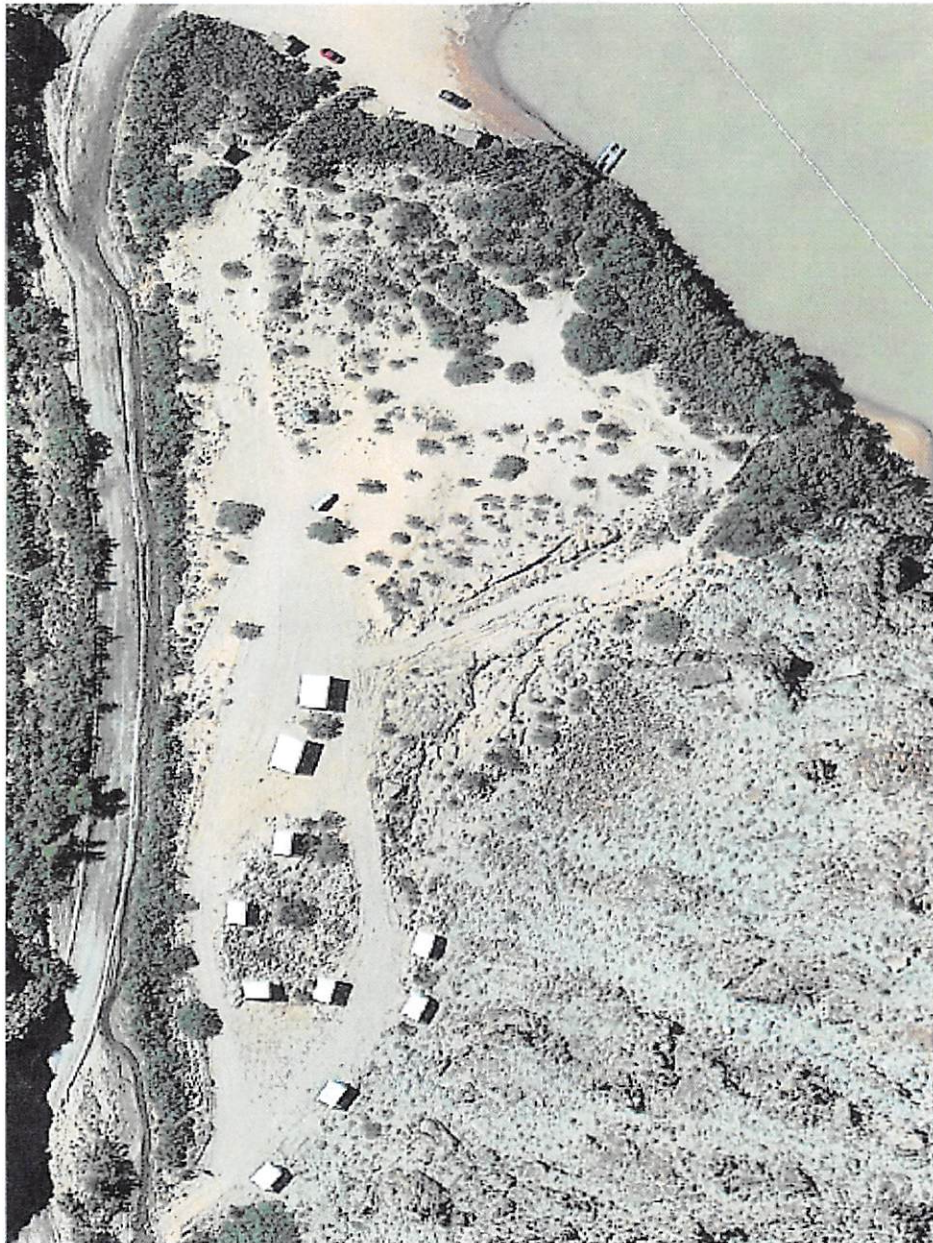


Figure 3. Aerial photograph of the Diamond Creek area of the Hualapai Reservation where the zebra-tailed lizards were released in 2012 and surveyed for subsequently. The dune habitats are in the upper center of the photograph. Lizards have also been found throughout much of the terrestrial areas including the wash habitat to the east of the dunes and in the campground/ramada areas during all of the surveys. As mentioned above, the 2016 flood caused significant erosion in the eastern wash at Diamond Creek. Zebra-tailed lizards have begun to return to the wash area since the 2016 flood (Hualapai Tribe 2017, this report).

Methods

Details of the capture and translocation activities performed in 2012 can be found in the 2013 Annual Report, Bureau of Reclamation, Salt Lake City, Utah. This report will provide information on the 2018 survey activities and results and compare these data with previous years' data.

In 2018, from April through September, surveys for zebra-tailed lizards were performed at monthly intervals. Dr. Kerry Christensen of the Hualapai Department of Cultural Resources performed the zebra-tail surveys at the Diamond Creek area by walking around and through the dune area and adjacent dirt habitats on foot (Figure 3). Mr. Winkie Crook and Ms. Jessica Orozco, biologists from the Hualapai Department of Natural Resources participated in the September 2018 zebra-tail survey and will continue this work in the future.

The surveys lasted approximately 60 minutes each. We recorded information on behavior, distance to vegetation and vegetation type as well as location when a zebra-tailed lizard was encountered. Determinations of adult versus juvenile versus baby lizards is based on size; babies are less than 3.5 inches, juveniles 3.5 to 5.0 inches and adults are longer than 5.0 inches. Photographs of adult male, adult female, juvenile and baby zebra-tailed lizards are provided in Figures 4-7.

Locations of all lizards encountered during the survey, including zebra-tailed lizards were plotted on an aerial photograph of the dune area (Figure 8). The Project Manager transposed the field aerial photographs to a computer generated version of the aerial photograph with the lizard locations (Figure 8).



Figure 4. A photograph of a male zebra-tailed lizard with the blue/black patch on the sides and the distinctly banded tail.



Figure 5. A photograph of an adult female zebra-tail lizard (Photo by D. Dupree). Note the lack of a blue/black patch on the side and less defined banding of the tail compared to males.



Figure 6. A photograph of a juvenile zebra-tailed lizard (center of photograph). This juvenile is about $2/3$ the size of an adult. It is hard to visualize the relative size difference without an object for scale.



Figure 7. A photograph of a baby zebra-tailed lizard (center of photo) born in 2018. Total length of this individual is less than 3.0 inches. This is the smallest baby zebra-tailed lizard baby observed since the beginning of this project.

Results

A good number of zebra-tailed lizards were observed in all of the monthly surveys (Table 1). The September survey had three observers (compared to a single observer in all the other surveys) and also found the most zebra-tailed lizards of all the surveys including two of the three babies observed in 2018 (Table 1).

Table 1 shows that a good number of zebra-tailed lizards were observed on all of the 2018 surveys. These data also show that there was one baby observed in April which is very unusual as previous years' surveys did not observe baby lizards until July (Hualapai Tribe 2016). The 14 zebra-tailed lizards observed in September was, in fact, not the record number of observations. Fifteen zebra-tailed lizards were observed during the September, 2015 survey of which four were juveniles and three babies.

Table 1. Summary of the 2018 Diamond Creek zebra-tailed lizard monitoring results.

Date	# of ztl located/ survey	# juveniles	# Babies	Mean dist. To veg. (m)	Vegetation type(s)
4/18/18	7	4	0	0.84	Creosote, tamarisk, brittle bush
5/30/18*	7	1	0	1.86	Creosote, mesquite, brittle bush
6/19/18	7	2	1	2.0	Creosote, brittle bush, mesquite, cat claw
7/30/18	6	3	0	1.5	Creosote, mesquite, arrowweed
8/29/18	8	3	0	1.14	Creosote, brittle bush, mesquite
9/10/18	11	1	2	0.85	Creosote, brittle bush, mesquite
Average	7.67	2.33	0.5	1.37	

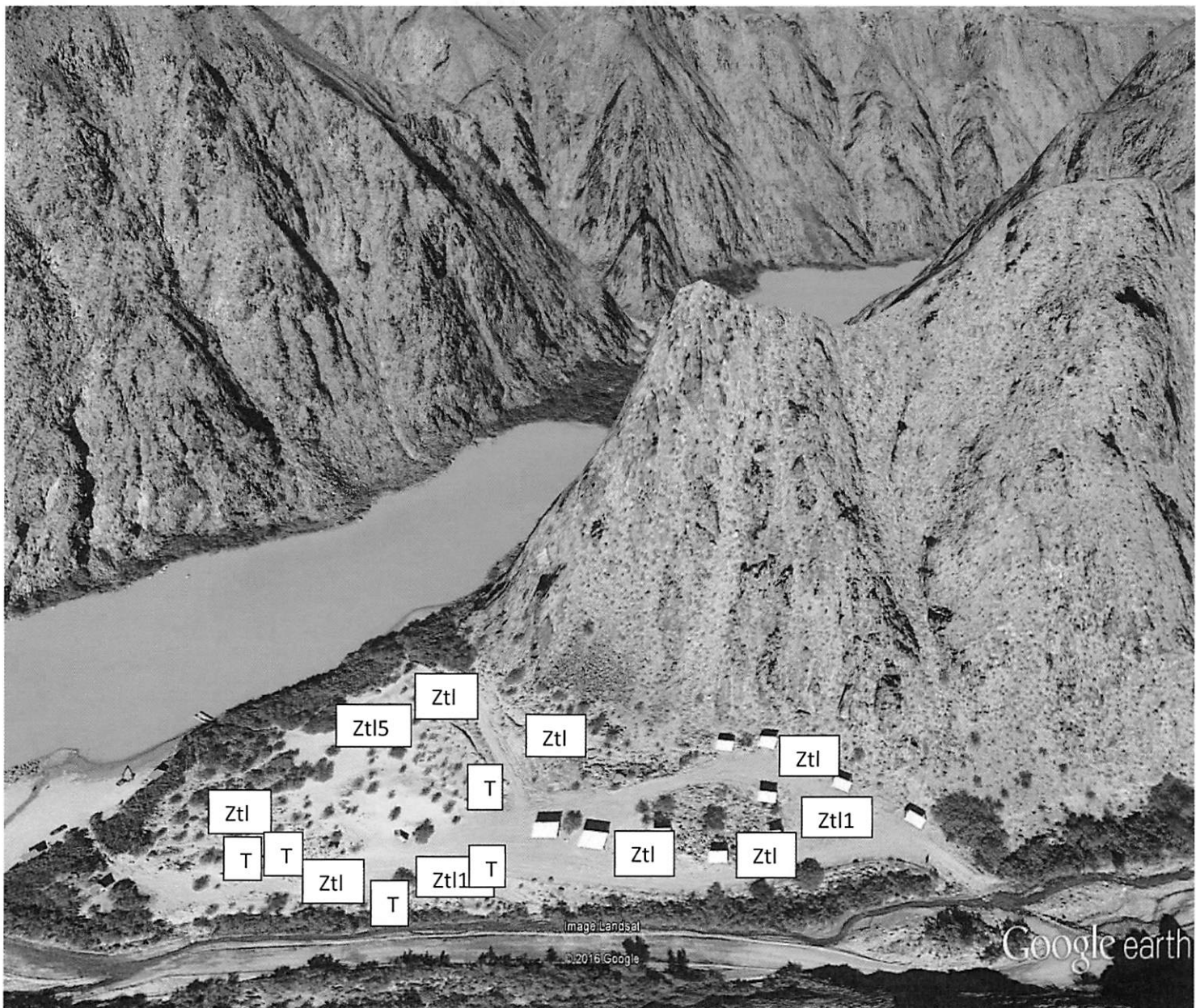
*Unusual amount of foot and truck traffic in the campground and on the dune area during this survey.

Table 2 provides a comparison of the average numbers of zebra-tailed lizards observed per year since initiation of the project in 2012. A good number of zebra-tailed lizards were observed in 2018 compared to all the other years with slightly fewer in 2018 compared to 2016 and 2017 (Table 2). Of note is that more juveniles were observed in 2018 than 2016 or 2017. Another interesting statistic is that fewer babies were observed in 2018 compared to the three previous years.

Table 2. A summary of the results of zebra-tailed lizard surveys from 2012 to 2017.

Year	Mean # of ZTL located	Mean # Juveniles	Mean # Babies	Mean distance to vegetation
2012	4.0	0.6	0.0	1.2
2013	3.5	1.0	0.0	1.3
2014	5.6	2.4	0.13 (3 total)	2.0
2015	11.3	2.7	1.70 (10 total)	0.9
2016	7.8	1.33	1.0 (6 total)	0.87
2017	8.7	0.83	1.2 (7 total)	1.59
2018	7.67	2.33	0.5 (3 total)	1.37

Figure 8. The locations of lizards (zebra-tail, whiptails and tree lizards) observed on the September, 2018 survey. Zebra-tail lizards are denoted by ZTL, whiptails by W and tree lizards by T.



The results of the 2018 zebra-tailed lizard surveys show that the zebra-tail lizard population at Diamond Creek on the Hualapai Reservation remains in a fairly stable state. In addition, while relatively few babies were found in 2018 compared to previous years, the lizards are continuing to reproduce. It is notable that the smallest baby zebra-tail that has ever been observed was found during the last survey in September suggesting that the zebra-tailed lizard population may be reproducing later in the year in 2018 compared to other years. A follow-up survey later in September is warranted to see if more babies can be found.

Continued surveys in 2019 and beyond will provide additional information as to the range of natural variation in the zebra-tailed lizard population at Diamond Creek and allow us to make more-informed management decisions in the future. At this time, it does not seem necessary to translocate additional zebra-tail individuals to Diamond Creek in 2019. We will continue to work with Reclamation, Stevens Ecological Services and other interested entities within and outside of the Glen Canyon Dam Adaptive Management Program to monitor and manage zebra-tailed lizards at Diamond Creek and evaluate potential translocations in the future.

References Cited

- Brennon, T.C. and A.T. Holycross. 2005. A Field Guide to Amphibians and Reptiles of Maricopa County. Arizona Game and Fish Department, Phoenix.
- Busack, S. D. and R. B. Bury. 1974. Some effects of off-road vehicles and sheep grazing on lizard populations in the Mojave Desert. *Biological Conservation* 6:179–183.
- Hualapai Tribe. 2016. Zebra-tailed lizard monitoring at Diamond Creek on the Hualapai Reservation. 2016 Annual Report. Bureau of Reclamation, Salt Lake City, Utah.
- Miller, D.W., R.A Young, T.W. Gatlin, and J.A. Richardson 1982 Amphibians and Reptiles of the Grand Canyon Monograph Number 4, Grand Canyon Natural History Association, Grand Canyon.
- Stevens, L.E. et al.. 2011. Assessment of taxa of management concern in the Colorado River ecosystem, Glen and Grand Canyons, Arizona, USA: habitat needs, availability and ecosystem roles, final report 8 July 2011. Report to the Bureau of Reclamation Glen Canyon Dam Adaptive Management Program, Salt Lake City.
- Stevens, L.E.2012. The biogeographic significance of a large, deep canyon: Grand Canyon of the Colorado River, Southwestern USA. Pp. 169-208 in Stevens, L.E., editor. *Global Advances in Biogeography*. InTech Publications, Rijeka. ISBN: 978-953-51-0454-4 .
- Tomko, D. 1976. Reptiles and amphibians of the Colorado River corridor, Grand Canyon. Museum of Northern Arizona, Flagstaff.
- Webb, R. H. and H. G. Wilshire, editors. 1983. *Environmental Effects of Off-Road Vehicles. Impacts and Management in Arid Regions*. Springer-Verlag, Inc., New York.

APPENDIX A

2017 Zebra-tailed Lizard Completed Survey Forms and Associated Aerial Photographs

Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen Date 4/18/18

Start: 10:20 AM Finish 11:20 AM

Temperature: 72-74°F RH 24-22% Wind: 5.0-10.0 mph

1st encounter: Behavior: Juvenile next to road, no tail

Distance to vegetation: 0.5 m Vegetation Type creosote bush

2nd encounter: Behavior: Adult female in wash

Distance to vegetation: 1.0 m Vegetation Type creosote bush

3rd encounter: Behavior: Juvenile on dune

Distance to vegetation: 0.30 m Vegetation Type Mesquite

4th encounter: Behavior: Adult female sunning on rock on west edge of dune

Distance to vegetation: 3.0 m Vegetation Type creosote bush

5th encounter: Behavior: Juvenile at edge of creosote bush

Distance to vegetation: 0.0 m Vegetation Type creosote bush

6th encounter: Behavior: Adult next to road, ran into brittle bush

Distance to vegetation: 0.1 m Vegetation Type brittle bush

7th encounter: Behavior: Juvenile crossing road entrance to campground

Distance to vegetation: 1.0 m Vegetation Type tamarisk

8th encounter: Behavior: _____

Distance to vegetation: _____ Vegetation Type _____

Comments: some ants active, ranger truck drove around the camp ground – probably disturbed some lizards. Good numbers of tree lizards and whiptails. One, large and dark desert spiny lizard (*Sceloporus magister*) towards river

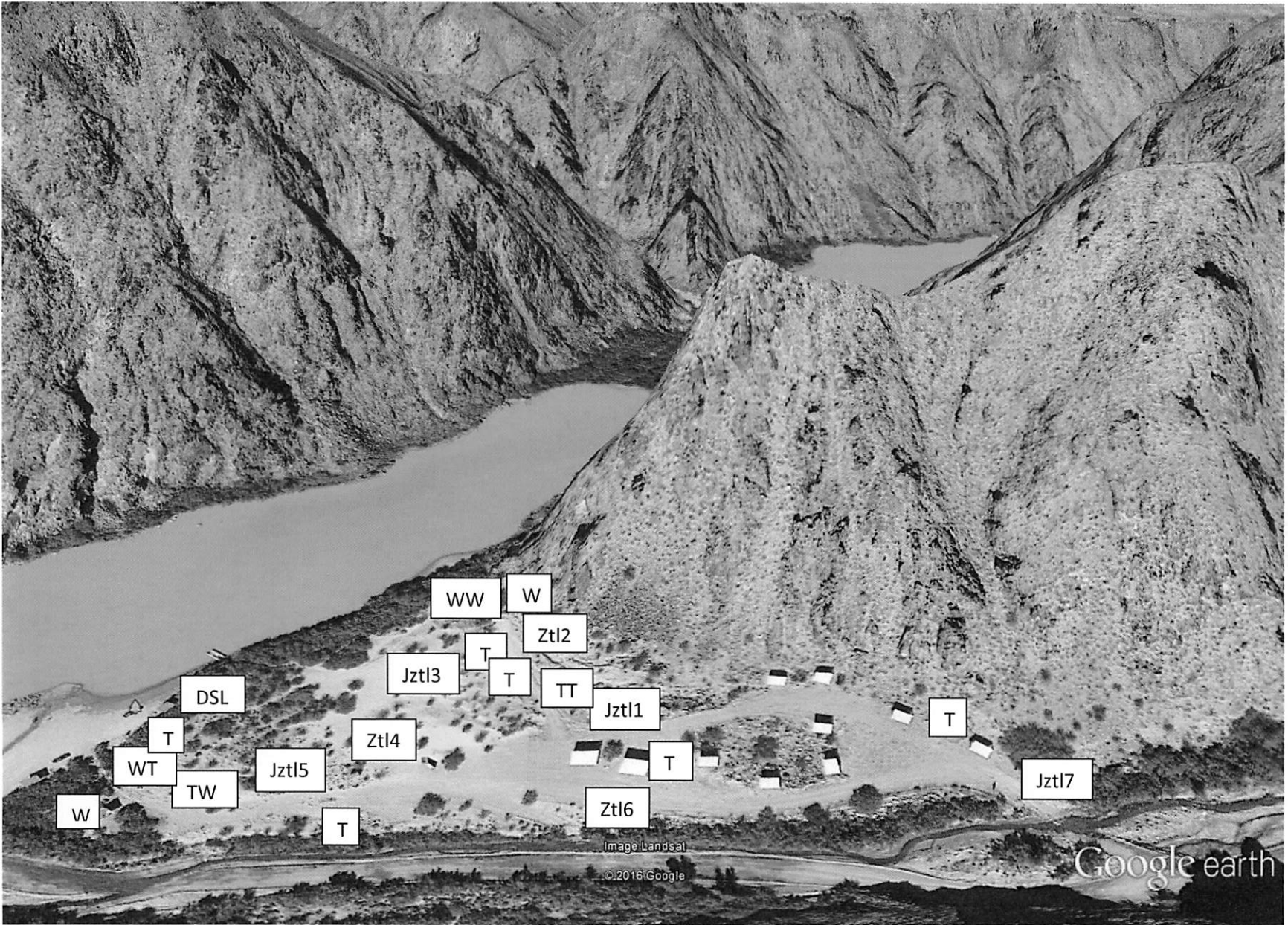


Image Landsat
©2016 Google

Google earth

Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen Date May 30, 2018

Start: 9:30 AM Finish 10:30 AM

Temperature: 90 – 98° F RH 28 – 22 % Wind: 2 – 3 mph

1st encounter: Behavior: Adult female in road

Distance to vegetation: 3.0m Vegetation Type mesquite

2nd encounter: Behavior: Adult female near ramada #2

Distance to vegetation: 1.0m Vegetation Type creosote

3rd encounter: Behavior: Adult on edge of road, ran under mesquite

Distance to vegetation: 1.5m Vegetation Type mesquite

4th encounter: Behavior: adult female at east edge of dune

Distance to vegetation: 1.0m Vegetation Type creosote

5th encounter: Behavior: adult female at top of dune

Distance to vegetation: 1.5m Vegetation Type creosote

6th encounter: Behavior: Juvenile/adult male with faint markings next to road

Distance to vegetation: 1.0m Vegetation Type mesquite

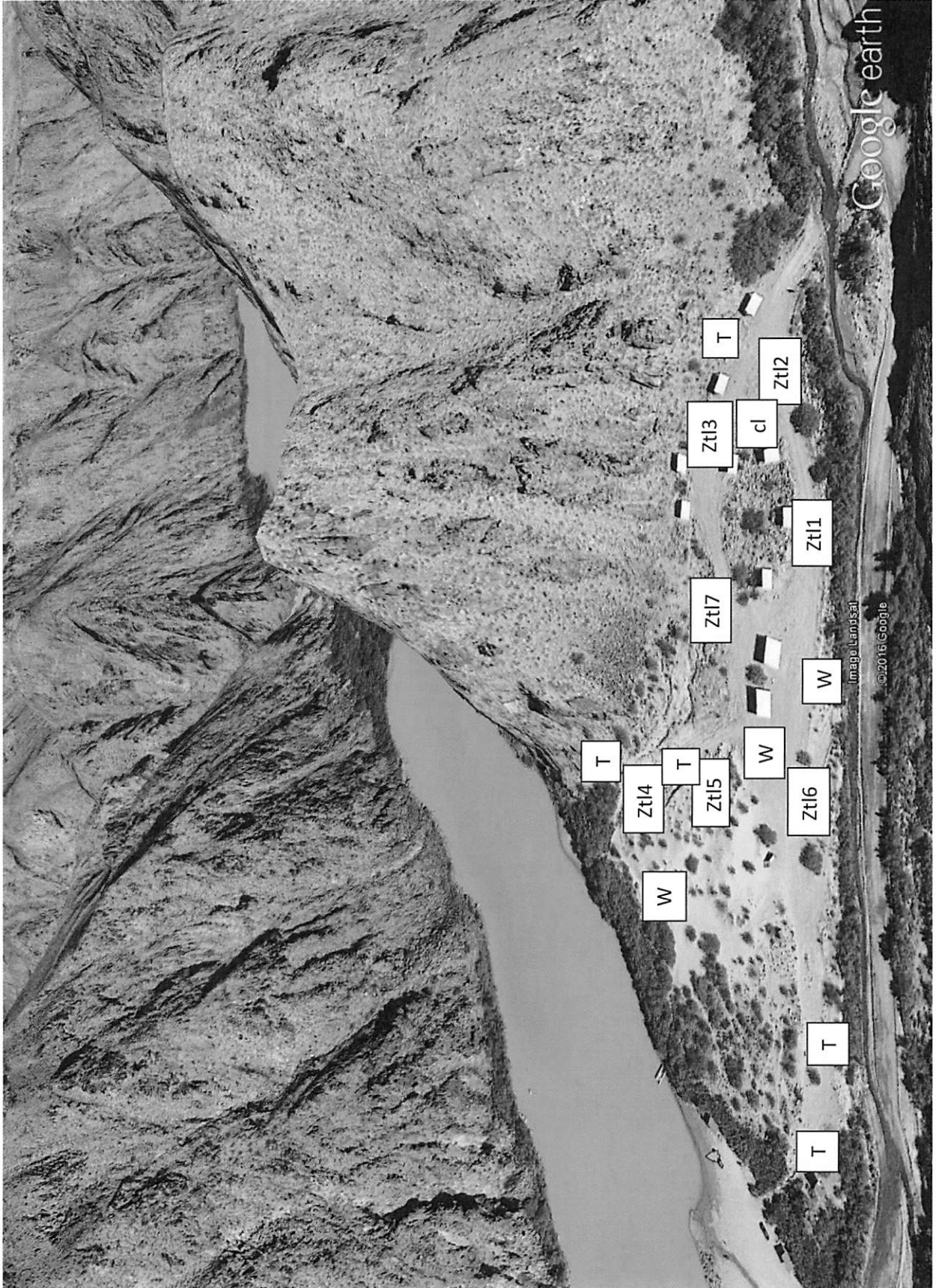
7th encounter: Behavior: adult in road, ran approx. 25 meters

Distance to vegetation: 4.0m Vegetation Type brittle bush

8th encounter: Behavior: _____

Distance to vegetation: _____ Vegetation Type _____

Comments: Lots of visitors including three Grand Canyon Youth vans in the campground with approx. 45 youth carrying river gear from vans to upstream beach. Lots of foot traffic between the beach and the porta-potties. Very hot.



Google earth

Image Landsat
©2016 Google

Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen Date 6/19/18

Start: 9:00 AM Finish 9:55 AM

Temperature: 81-88°F RH 34-22% Wind: 0-1 mph

1st encounter: Behavior: in vegetation next to road

Distance to vegetation: 1.0m Vegetation Type brittle bush

2nd encounter: Behavior: Adult female in open

Distance to vegetation: 1.0 m Vegetation Type mesquite

3rd encounter: Behavior: Adult male on west side of dune

Distance to vegetation: 2.0m Vegetation Type creosote bush

4th encounter: Behavior: Juvenile in the rocks

Distance to vegetation: 1.0m Vegetation Type cat claw acacia

5th encounter: Behavior: Juvenile in the open

Distance to vegetation: 4.0m Vegetation Type creosote bush

6th encounter: Behavior: Adult female next to road

Distance to vegetation: 4.0m Vegetation Type mesquite

7th encounter: Behavior: Baby at edge of wash

Distance to vegetation: 1.0m Vegetation Type brittle bush

8th encounter: Behavior: _____

Distance to vegetation: _____ Vegetation Type _____

Comments: Lots of human traffic around and on the dune area



W

W

Bzt17

Zt12

W

T

Zt11

T

Zt15

Zt13

Zt16

W

Zt14

Google earth

Image Landsat ©2016 Google

Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen Date 7/30/18

Start: 9:35 AM Finish 10:20 AM

Temperature: 95-100° F RH 45-40 % Wind: 3-4 mph

1st encounter: Behavior: Juvenile ran through ramada #2

Distance to vegetation: 1.5 m Vegetation Type brittle bush

2nd encounter: Behavior: Adult female NW edge of dune

Distance to vegetation: 2.0 m Vegetation Type mesquite

3rd encounter: Behavior: Adult female N edge of dune

Distance to vegetation: 3.0 m Vegetation Type arrowweed

4th encounter: Behavior: Juvenile at NE edge of dune

Distance to vegetation: 1.0 m Vegetation Type arrowweed

5th encounter: Behavior: Juvenile near porta potties

Distance to vegetation: 1.0 m Vegetation Type creosote bush

6th encounter: Behavior: Adult female in rocks ran under mesquite tree

Distance to vegetation: 0.5m Vegetation Type mesquite

7th encounter: Behavior: _____

Distance to vegetation: _____ Vegetation Type _____

8th encounter: Behavior: _____

Distance to vegetation: _____ Vegetation Type _____

Comments: very hot and humid. Not much foot traffic. Only one tree lizard and one whiptail seen besides the zebra-tails.



Google earth

Image Landsat
©2016 Google

Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen Date 8/29/18

Start: 9:00 AM Finish 10:00 AM

Temperature: 80-90°F RH 35-27% Wind: 0-3.0 mph

1st encounter: Behavior: juvenile on east side of dune

Distance to vegetation: 3.0 m Vegetation Type mesquite

2nd encounter: Behavior: juvenile at northeast corner of dune

Distance to vegetation: 0.5 m Vegetation Type creosote bush

3rd encounter: Behavior: adult female in rocks

Distance to vegetation: 0.5 m Vegetation Type creosote bush

4th encounter: Behavior: juvenile in rocks

Distance to vegetation: 0.5 m Vegetation Type creosote bush

5th encounter: Behavior: adult female next to path to restroom

Distance to vegetation: 1.0 m Vegetation Type creosote bush

6th encounter: Behavior: adult female at top of wash

Distance to vegetation: 1.5 m Vegetation Type sand verbena

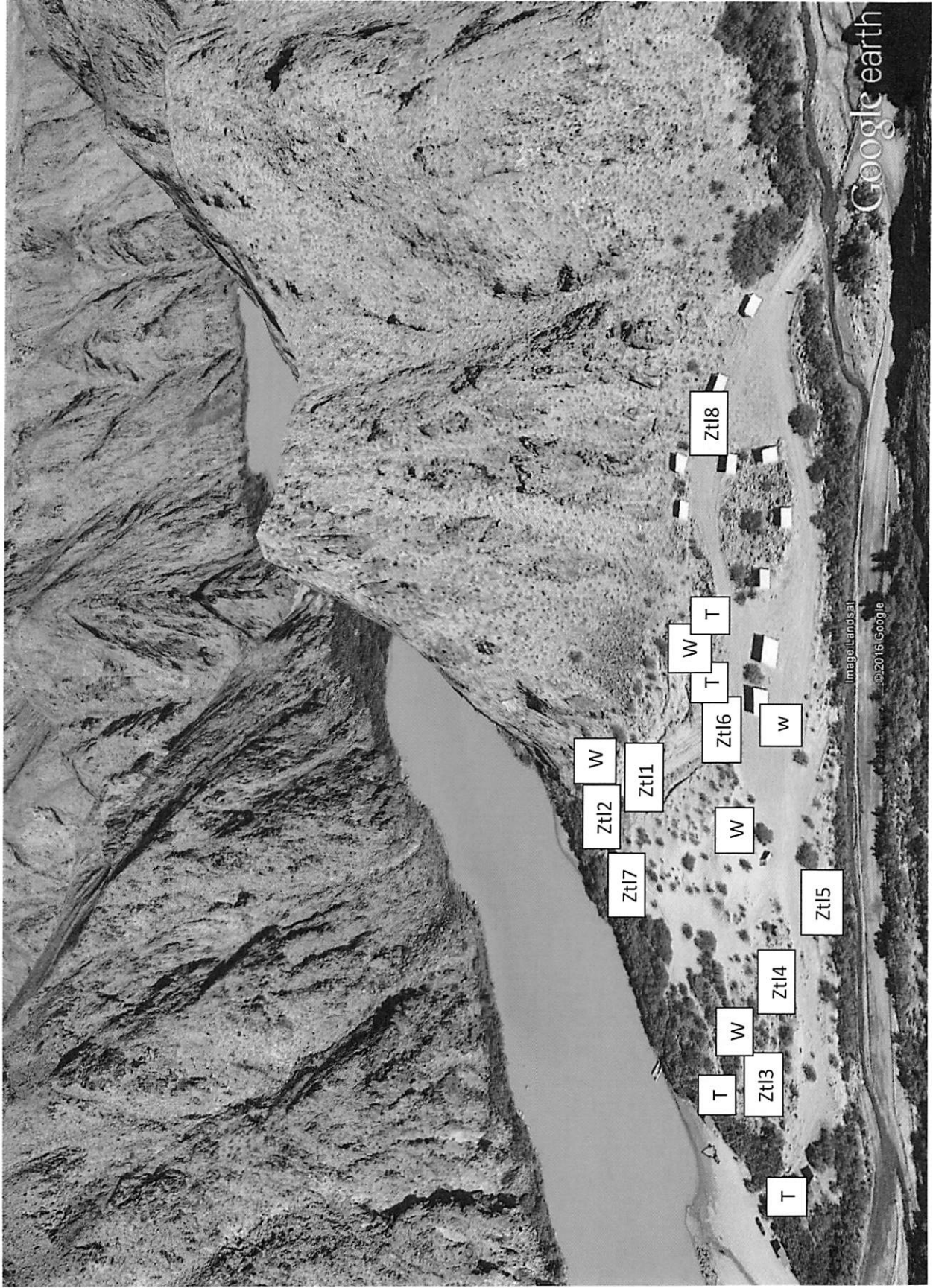
7th encounter: Behavior: adult female at north end of dune

Distance to vegetation: 0.1 m Vegetation Type creosote bush

8th encounter: Behavior: adult female next to ramada #2

Distance to vegetation: 2.0 m Vegetation Type brittle bush

Comments: partly cloudy, little to no foot traffic



Google earth

Image Landsat
©2016 Google

Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen, Winkie Crook, Jessica Orozco Date 9/10/18

Start: 9:45 AM Finish 10:35 AM

Temperature: 84-94°F RH 40-35 % Wind: 2-3 mph

1st encounter: Behavior: Adult female between ramadas 2 and 3

Distance to vegetation: 0.1 meters Vegetation Type brittle bush

2nd encounter: Behavior: sunning on a rock, ran under mesquite tree

Distance to vegetation: 0.5 m Vegetation Type mesquite

3rd encounter: Behavior: Adult male in the open

Distance to vegetation: 2.0 m Vegetation Type creosote bush

4th encounter: Behavior: Adult female in the east wash

Distance to vegetation: 0.1 m Vegetation Type mesquite

5th encounter: Behavior: two adults together on west side of dune

Distance to vegetation: 1.0 m Vegetation Type creosote bush

6th encounter: Behavior: juvenile on west side of dune

Distance to vegetation: 0.1 m Vegetation Type creosote bush

7th encounter: Behavior: Adult male under a desert senna bush

Distance to vegetation: 0.0 m Vegetation Type *Senna covesii*

8th encounter: Behavior: Baby in open, ran under creosote bush; approx.. 2 inches in size

Distance to vegetation: 0.1 m Vegetation Type creosote bush

9th encounter: Behavior: Adult male sunning on rock

Distance to vegetation: 0.2 m Vegetation Type creosote bush

10th encounter: Behavior: Baby on a rock

Distance to vegetation: 0.3 m Vegetation Type creosote bush

11th encounter: Behavior: Adult female in the open

Distance to vegetation: 5.0 m Vegetation Type mesquite

Comments: Not too much human traffic. Definitely helps to have more than one person on the survey.

