



Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Lower Colorado River Riparian Bird Surveys

2012 Annual Report



March 2013

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Lower Colorado River Multi-Species Conservation Program

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ACRONYMS AND ABBREVIATIONS

CRIT	Colorado River Indian Tribe
CVCA	Cibola Valley Conservation Area
DS	Double Sampling (software program)
EI	enhanced intensive
FPC	Fred Phillips Consulting, LLC
GBBO	Great Basin Bird Observatory
GIS	Geographic Information System
GPS	Global Positioning System
H	herbaceous
ha	hectare(s)
LCR	lower Colorado River
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
LW	low woody
m	meter(s)
NPN	National Phenology Network
NWR	National Wildlife Refuge
PVER	Palo Verde Ecological Reserve
Reclamation	Bureau of Reclamation
SE	standard error
TW	tall woody
U	unsuitable
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
YEW	Yuma East Wetlands

Symbols

°F	degrees Fahrenheit
%	percent

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ABSTRACT

This report summarizes the results of 2012 field surveys that were completed as part of the Lower Colorado River Multi-Species Conservation Program's (LCR MSCP) Riparian Bird Survey Project. The first component of this project was to conduct system-wide monitoring of riparian birds. For this component, we completed rapid area searches on 80 plots selected using a stratified random sampling approach as well as intensive area searches on a subset of 8 of these plots. As part of the same project component, we also completed rapid area searches on 71 plots within habitat creation sites and intensive area searches on a subset of 4 of these plots. The rapid and intensive area search data were then analyzed using a double-sampling approach to generate an estimate for the total number of territories of five LCR MSCP covered species within the project area, the gila woodpecker (*Melanerpes uropygialis*), vermilion flycatcher (*Pyrocephalus rubinus*), Arizona bell's vireo (*Vireo bellii arizonae*), Sonoran yellow warbler (*Dendroica petechia sonorana*), and summer tanager (*Piranga rubra*), and also for the most common, territorial riparian landbird species. We found 189 species within the system-wide project area, with over one-half being classified as migrants or other non-breeding populations. Bell's vireo, yellow warbler, and gila woodpecker were the most abundant of the LCR MSCP covered species, and summer tanager, vermilion flycatcher, and gilded flicker were present in small numbers. In the habitat creation sites, we detected a total of 137 species, including yellow warbler and bell's vireo as the most abundant covered species that were breeding, and summer tanager and vermilion flycatcher breeding in small numbers.

Another component of the project objectives was to test the assumptions of the double-sampling design. To do this, we conducted a second season of a triple-sampling effort (rapid area search, intensive area search, and enhanced intensive [EI] area search) on nine randomly-selected plots. Thirty-five diurnal landbird species were detected during the second year of this project component. Of these, 10 species (43 percent [%]) had triple-sampling detection rates that were within 20% of the detection rates generated by using double-sampling data alone (rapid and intensive area searches). Five species detected this year were not detected on the EI surveys as breeders in 2011. For the remaining 20 species, the differences between triple-sampling and double-sampling detection rates were greater than 20%. The species that showed the largest discrepancies were those that breed early, often breed multiple times per season, or have poorly defined territorial behaviors.

For the final component of the 2012 project objectives, we collected a second year of standardized LCR MSCP habitat monitoring data, including biotic and abiotic variables, which will be used to refine habitat models for the four most abundant LCR MSCP covered bird species in future years.

INTRODUCTION

The Bureau of Reclamation (Reclamation) has been conducting bird surveys within the Lower Colorado Region since 2002. In 2007, the U.S. Geological Survey (USGS) designed and implemented a bird sampling plan for Reclamation that would produce density and trend estimates for six of the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) covered riparian birds and other non-covered birds within the riparian habitat of the LCR MSCP planning area (Bart et al. 2010). We, Great Basin Bird Observatory (GBBO), continued this project from 2008 through 2010 during which time we continued rapid and intensive effort surveys and refined field protocols (GBBO 2008, 2009, 2010). Using data from the first 4 years of the project, we calculated population densities for six of the LCR MSCP birds, the gila woodpecker (*Melanerpes uropygialis*), vermilion flycatcher (*Pyrocephalus rubinus*), gilded flicker (*Colaptes chrysoides*), Arizona bell's vireo (*Vireo bellii arizonae*), Sonoran yellow warbler (*Dendroica petechia sonorana*), and summer tanager (*Piranga rubra*) as well as other riparian obligate birds (GBBO 2008, 2009, 2010). We collected habitat data for these six covered LCR MSCP species (GBBO 2009, 2010). From this study, we and our USGS collaborators produced several products, including a final sampling design (USGS), a field protocol (GBBO), the Double Sampling (DS) software program to analyze the data (USGS with GBBO), Geographic Information System (GIS) tools for sampling design (USGS), preliminary habitat models (GBBO), and preliminary population estimates (Bart et al. 2010; GBBO 2008, 2009, 2010). The final study design for the LCR Riparian Bird Survey Project, "*A Sampling Plan for Riparian Birds of the Lower Colorado River*" (Bart et al. 2010), along with all previous annual reports on this project from GBBO and USGS, are available on the LCR MSCP Web site (www.lcrmscp.gov).

In 2011, we continued the original two-part component of the project, (Component 1) monitoring riparian birds using the system-wide and habitat creation site sampling plans, and added three new components to the project: (Component 2) obtaining a 1-year baseline bird populations size estimate on a pre-development site in the Laguna Division Conservation Area, (Component 3) testing assumptions of the double-sampling method, and (Component 4) collecting data that lead to additional species-specific bird habitat models for four LCR MSCP covered birds. In 2012, we continued collecting data for project Components 1, 3, and 4. Component 2, the pre-development surveys at the Laguna Division Conservation Area, was a 1-year project that was completed in 2011.

The overarching goals of this project continue to be: (1) provide a baseline for monitoring long-term population trends of obligate riparian birds throughout the lower Colorado River (LCR), including LCR MSCP habitat creation sites; (2) estimate population sizes of obligate riparian birds; and (3) define habitat requirements of LCR MSCP covered species.

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System-wide monitoring of the LCR MSCP's riparian birds emphasizes six species covered under the program (hereafter called covered species), including gilded flicker, gila woodpecker, vermilion flycatcher, Arizona bell's vireo, Sonoran yellow warbler, and summer tanager. The other LCR MSCP covered bird species, including southwestern willow flycatcher (*Empidonax traillii extimus*), elf owl (*Micrathene whitneyi*), western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), black rail (*Laterallus jamaicensis*), Virginia rail (*Rallus limicola*), and Yuma clapper rail (*Rallus longirostris yumanensis*) are monitored separately using species-specific protocols and are therefore not covered in this report, except for incidental detections.

The project area for system-wide bird monitoring includes the Colorado River from Separation Point, upstream of Lake Mead, to the Southerly International Boundary with Mexico. In 2012, we were once again granted access to survey the habitat creation sites located within the Colorado River Indian Tribe's 'Ahakhav Tribal Preserve. With the exception of 2010, these sites have been surveyed all other years of the project. The project area also includes portions of the Bill Williams and Virgin Rivers as well as LCR MSCP habitat creation sites within the historic flood plain of the Colorado River's main stem.

In this annual report, we provide an abridged description of methods that have been previously provided in more detail in GBBO (2010) and Bart et al. (2010). In addition, we summarize the results of the project tasks covered in 2012 and refer the reader to previous annual reports on this project (GBBO 2008–2011) for results from previous surveys.

COMPONENT 1: POPULATION ESTIMATES OF AVIAN SPECIES WITHIN THE LCR MSCP BOUNDARIES AND ON HABITAT CREATION SITES

Introduction

As in past years, we conducted area search surveys in the LCR Riparian Bird Survey Project area and habitat conservation areas to obtain population size estimates, trends, and distribution for the six covered bird species (gila woodpecker, gilded flicker, vermilion flycatcher, summer tanager, Arizona bell's vireo, and Sonoran yellow warbler) as well as for non-covered species, with the exception of the following species for which only presence/absence data were gathered in 2012: white-winged dove, mourning dove, Eurasian collared-dove, brown-headed cowbird, European starling, Gambel's quail, greater roadrunner, red-winged blackbird, great-tailed grackle, and house finch. We generated population estimates using the avian double-sampling survey method developed for the LCR MSCP bird monitoring program in 2007–2010 (Bart and Manning 2008; GBBO 2009, 2010; Bart et al. 2010).

The rationale and methods for population monitoring based on double-sampling that we used in this project were developed in the first 3 years of riparian area search monitoring for the LCR MSCP project (Bart and Manning 2008; Bart et al. 2010; GBBO 2010). The double-sampling method requires both rapid and intensive area searches, which are described in more detail in the next section and in GBBO (2010).

Methods

Study Area and Sampling Plan

Our study area spans the main stem of the LCR from Separation Canyon (just upstream of Lake Mead) to the Southerly International Boundary, just south of Yuma (attachment 1a). The USGS surveyed the section extending from Separation Canyon to Lake Mead in 2007; however, since 2007, because of inaccessibility due to fluctuating water levels, we have excluded that area from our surveys.

To roughly delineate vegetation types that are important for the covered species, we originally defined potentially suitable habitat patches as “good/fair/poor” and further as “tall/low” (plus “unsuitable” and “marsh”) (for more details on the original stratification, see Bart 2007). This stratification was done so that we could adjust survey effort distribution in order to optimize survey effectiveness for covered species (Bart et al. 2010). Our original habitat stratification was

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based on combined vegetation classes from the Anderson-Ohmart vegetation classification system that was originally used to map vegetation types throughout the project area (table 1).

Table 1.—Codes of dominant vegetation type (from Anderson and Ohmart 1976; Bart 2007)

Code	Description
AG	Agriculture
ATW	Atriplex
AW	Arrowweed
CW	Cottonwood-willow
HM	Honey mesquite
SC	Salt cedar
SH	Salt cedar-honey mesquite
SM	Salt cedar-screwbean mesquite
OW	Open water
SOW	Structured open water
BW	Backwater
UD	Undeveloped bare ground
NC	No classification

During the first stratification (Bart 2007), survey plots were delineated to divide the entire project area into approximately 9-hectare (ha) plots and each were assigned to the habitat type that covered the majority of the plot. It is important to note that other habitat types may be present in any plot that is designated to one habitat type. For instance, an “unsuitable” plot may have in a *minority* of its area highly suitable habitat for a covered species, thus explaining survey results that indicate that a small portion of a covered species’ population occurs in “unsuitable” plots.

In the spring of 2010, we revised the sampling design to create a new plots layer. This new layer largely retained the original grid delineation of approximately 9-ha plots. We were able to resolve several issues by creating the new plots layer, including achieving a better fit with the LCR MSCP project boundary, addressing more appropriately the amount of non-riparian habitat, and creating plots of optimal size to maximize survey effort. Historically, the Colorado River flood plain was mostly covered by riparian habitat, but today, much of that historic flood plain area is covered by upland habitats due to river management. To

update the sampling plot grid, we first clipped the old plots layer to fit the project’s current LCR MSCP boundary, and second, we reduced some plot sizes to better reflect the survey area that can effectively be covered in an area search.

The original habitat stratification was further updated in 2010 when we (1) revised the names of most habitat categories (so as not to presume suitability for covered species) and (2) combined the original six strata (unsuitable, good-tall, good-low, fair, poor, marsh) to create just four habitat strata: tall woody (TW), low woody (LW), herbaceous (H), and unsuitable (U). We selected habitat strata in an effort to keep the tall and medium woody and the low woody cover types separate (tall and low woody), combine various herbaceous vegetation types into herbaceous, and to combine all other habitat strata into unsuitable. In table 2, we provide the crosswalk from the original Anderson and Ohmart (1976) vegetation types to the habitat strata used for re-stratification in 2010. Further details on habitat strata and plot assignments can be found in Bart et al. (2010).

Table 2.—Crosswalk of 2010 habitat strata (also used in 2011) with Anderson and Ohmart (1976), from Bart et al. (2010)

Type (Bart et al.)	Habitats (Anderson and Ohmart)	
Tall woody (TW)	CW-1	CW-3
	CW-2	
Low woody (LW)	CR-0	SC-5
	CW-4	SC-6
	CW-5	SH-1
	CW-6	SH-3
	HM-3	SH-4
	HM-4	SH-5
	HM-5	SH-6
	HM-6	SM-3
	SC-1	SM-4
	SC-2	SM-5
	SC-3	SM-6
	SC-4	
Herbaceous (H)	AG-0	MA-3
	ATX-0	MA-4
	AW-0	MA-5
	MA-1	MA-6
	MA-2	MA-7
Unsuitable (U)	BW-0	UD-0
	NC-0	

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Furthermore, the project area was originally divided into 13 geographic regions, resulting in the following breakdown of area by the revised habitat strata (table 3; further description of regions below). The geographic regions of the original sampling plan were retained in 2011 and 2012 without changes. The area of each habitat stratum by region is needed for estimating system-wide population sizes for the purpose of this report. In table 4, we report the number of available plots by habitat strata and region in the 2010 plots layer (hereafter, 2010 plot delineation), which we continued to use in 2011 and 2012.

Table 3.—Area, in hectares, of each habitat stratum per region from the 2010 plot delineation in the LCR MSCP project area

Geographic regions	Habitat strata				Total
	Herbaceous	Low woody	Tall woody	Unsuitable	
1	11.81	2,723.45	637.67	1,197.44	4,570.38
2	145.82	1,927.66	67.04	453.53	2,594.05
3	0.00	7,684.46	0.00	8,056.50	15,740.96
5	40.30	6,027.48	82.17	6,612.92	12,762.88
6	762.51	2,953.16	241.71	661.76	4,619.14
7	72.83	2,789.73	475.81	4,414.66	7,753.03
8	27.00	2,392.52	19.30	8,252.11	10,690.92
9	107.41	9,350.29	124.15	15,363.48	24,945.34
10	157.67	5,605.03	48.85	3,387.81	9,199.36
11	620.64	2,862.68	151.57	438.74	4,073.63
12	234.85	2,829.05	621.69	6,045.60	9,731.18
13	0.00	1,443.74	588.69	3,879.52	5,911.95
Total	2,180.84	48,589.25	3,058.66	5,8764.05	112,592.80

In 2012, we did not combine the herbaceous and unsuitable plots into one stratum as we had done before. Over the past 2 years, we realized that the plots categorized as herbaceous are mostly covered by cattail/bulrush marsh. This habitat type should therefore be treated separately from the plots categorized as “unsuitable.” The unsuitable category has a range of habitats that sometimes includes some good bird habitat and sometimes barren areas, such as a parking lot. Due to the variation in cover, the “unsuitable” category results can be challenging to interpret. In addition, plot changes from the 2010 layer resulted in Region 4 consisting of only 25 plots, which is the reason we continue to combine Regions 4 and 5 for plot selection and statistical analyses (J. Bart, personal communication).

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Table 4.—Number of plots available by region and habitat stratum based on the 2010 plot delineation of the LCR MSCP project area

Geographic regions	Habitat strata				Total
	Herbaceous	Low woody	Tall woody	Unsuitable	
1	1	298	66	109	474
2	14	212	7	41	274
3	0	844	0	656	1500
5	3	650	10	463	1,126
6	70	319	24	54	467
7	6	301	50	337	694
8	3	249	2	439	693
9	9	995	10	925	1,939
10	16	614	5	198	833
11	51	291	15	31	388
12	22	291	56	309	678
13	0	160	61	204	425
Total	195	5,224	306	3,766	9,491

Plot Selection: System-wide Surveys Rapid Area Search Plots

For the 2012 system-wide area searches, we randomly selected a total of 80 ~9-ha plots from the 2010 plot delineation, covering four habitat strata (low woody, tall woody, herbaceous, and unsuitable) in eight geographic regions (table 5 and attachments 1b–u). The region was not used to stratify the random site selection in 2012 because, based on plot selections in previous years, we expected a random selection to provide sufficient coverage across available regions. As in 2010 and 2011, several regions were purposely excluded from sampling in 2012, including Regions 1 (access problems), 2 (outside the LCR MSCP project area), 3 (lack of riparian vegetation and fluctuating lake levels), 9 (permit unattainable), and 13 (border safety concerns).

We used a stratified random plot selection, with strata defined by habitat, to select the 2012 plots. Using the same method as in 2011, we separated the plots into Excel spreadsheets by the three habitat strata that describe each plot's dominant vegetation type (low woody, tall woody, herbaceous, and unsuitable). In each sheet, we created a column of random numbers, sorted the plots by the random number column, and then selected from the beginning of the list. We weighted the number of plots per stratum toward woody habitats for more intensive survey coverage of covered species, resulting in an initial selection of 35 low woody, 25 tall woody, 10 herbaceous, and 10 unsuitable plots (table 6).

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Table 5.—List of all regions in the LCR MSCP study area, whether they were included in the 2012 plot selection, and reasons for exclusion

Region #	Region name	Included in 2011 plot selection?	Reasons for exclusion
1	Separation Canyon to Lake Mead	No	Not accessible
2	Virgin River	No	Outside LCR MSCP project area
3	Lake Mead	No	Fluctuating water levels
4	Hoover Dam to Davis Dam	Yes	Added to Region 5 in 2010
5	Davis Dam to Bill Williams River (excluding Havasu National Wildlife Refuge [NWR])	Yes	
6	Havasus NWR (excluding Bill Williams unit)	Yes	
7	Bill Williams unit of the Havasu NWR	Yes	
8	Bill Williams unit to Cibola, excluding the Colorado Reservation	Yes	
9	Colorado River Indian Tribe Land	No	Permits unattainable for system-wide plots in Region 9
10	Cibola NWR	Yes	
11	Imperial NWR	Yes	
12	Colorado River from the Imperial NWR to Yuma	Yes	
13	Yuma to Southerly International Boundary	No	Border safety concerns

If randomly selected plots were inaccessible, we used the same sequential list to select alternate plots in the same habitat and region. If no alternate plots were available within the same region, then the closest region with the same habitat type was used as an alternate. We used alternate plots when the selected plots were farther than 2 kilometers from the nearest road, trail, or waterway; if private landowners denied us access to the site; if plots were inhabited by squatters; or because plots contained wetlands that were inaccessible by boat or foot or were otherwise unsafe. In 2012, 10 plots were replaced with alternates in the same region and stratum due to a combination of the above reasons.

Habitat Creation Site Plot Selection

Rapid Area Search Plots

When the project began in 2007, double-sampling with rapid and intensive area searches was done on habitat creation sites (J. Bart, personal communication). However, after these data were analyzed, it was found that the total acreage of

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Table 6.—Number of system-wide area search plots per region and habitat stratum surveyed in 2012

Region #	Region Name	Low woody	Tall woody	Herbaceous	Unsuitable	Total
1	Separation Canyon to Lake Mead	0	0	0	0	0
2	Virgin River	0	0	0	0	0
3	Lake Mead	0	0	0	0	0
4+5	Hoover Dam to Bill Williams River (excluding Havasu National Wildlife Refuge [NWR])	4	2	0	1	7
6	Havasu NWR (excluding Bill Williams unit)	5	4	3	0	12
7	Bill Williams unit of the Havasu NWR	7	7	0	4	18
8	Bill Williams unit to Cibola excluding the Colorado Reservation	5	0	0	1	6
9	Colorado River Indian Reservation 'Ahakhav Tribal Preserve	0	0	0	0	0
10	Cibola NWR	5	0	0	4	9
11	Imperial NWR	5	3	2	0	10
12	Colorado River from the Imperial NWR to Yuma	4	9	2	3	18
13	Yuma to Southerly International Boundary	0	0	0	0	0
	Total	35	25	7	13	80

habitat creation was too small at that time to provide accurate population size estimates based on the double-sampling method. Therefore, during the LCR MSCP bird surveys of 2008–2010, we surveyed all post-development habitat conservation areas (= habitat creation sites) plots using the intensive area search method to obtain a complete baseline inventory, while pre-development plots were covered with rapid area searches (GBBO 2010). An overview map of all habitat creation sites is provided in attachment 1v, and plot maps for each of the habitat creation sites are provided in attachments 1w–aa.

Beginning in 2011, we implemented a double-sampling protocol for habitat creation sites to provide monitoring for the rapidly increasing total area (200–400 acres per year) of these sites, which necessitated a sampling plan rather than continued complete coverage using intensive surveys. In 2011, we surveyed all of the habitat conservation area survey plots currently delineated by Reclamation (n = 60) with the rapid area search method. With the added acreage in 2012, we expanded our coverage of the habitat conservation area survey plots to the additional plots delineated by Reclamation (total n = 71) with the rapid area search method (except Beal A and D plots, which were not surveyed in 2012 due

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to a misunderstanding among field technicians). A subset (n = 4) of the 71 plots was randomly selected for intensive area searches, mirroring the approach of system-wide sampling (J. Bart, personal communication). Three additional plots compose the Yuma East Wetlands (YEW) habitat creation project, and those sites were surveyed with intensive area searches by Fred Phillips Consulting, LLC (FPC), in 2012.

In habitat creation sites, we collected data using the same methods used for the system-wide intensive area searches. All habitat creation sites were larger than typical system-wide area search plots, so we subdivided the sites into plots that were a reasonable size to be surveyed in one morning (5–18 ha). We worked closely with the Reclamation GIS expert to prepare this plots layer in spring 2011 and to add the new plots to it in 2012. We classified the plots into the same four woodland habitat strata as we used for the system-wide plots, and the herbaceous or unsuitable strata were empty. The habitat creation site plots are summarized in table 7.

Table 7.—Habitat creation sites, number of plots, habitat type, and area surveyed using rapid area searches in 2012

(Asterisks [*] indicate projects not officially part of the LCR MSCP. The Yuma East Wetlands Conservation Area was surveyed by Fred Phillips Consulting, LLC in 2012.)

Habitat creation project	# of survey plots in 2012	Low woody (ha)	Tall woody (ha)	Total
'Ahakhav Tribal Preserve ¹	5	4.99	51.69	56.68
Beal Lake Conservation Area	4	0.00	41.61	41.61
Cibola National Wildlife Refuge Unit 1	13	38.75	72.28	111.03
Cibola Valley Conservation Area	23	125.20	108.40	233.60
Palo Verde Ecological Reserve	26	107.10	174.94	282.03
Yuma East Wetlands Conservation Area ¹	3	²	²	²
Total	74	276.04	448.92	724.95

¹ Project not officially part of the LCR MSCP.

² Acreage currently not available.

Intensive Area Search Plots, System-Wide and Habitat Creation Sites

We surveyed a total of 12 plots with the intensive area search method in 2012, 8 of which were randomly selected from the 2012 pool of system-wide plots for rapid area searches and 4 of which were randomly selected from the habitat creation site plots (table 8).

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Table 8.—Summary of Component 1 plots that were surveyed using the intensive area search method in 2012

(Asterisks [*] indicate projects not officially part of the LCR MSCP. Plots are listed in numerical order.)

Plots surveyed with intensive method in 2012	System-wide intensive (n = 8)	Habitat creation site intensive (n = 4)
2867	X	
2883	X	
5799	X	
7334	X	
9015	X	
9124	X	
9304	X	
9323	X	
'Ahakhav Tribal Preserve* Plot C		X
Cibola Valley Conservation Area Phase 3 Plot C		X
Cibola Valley Conservation Area Phase 3 Plot D		X
Beal Lake Conservation Area Plot B		X
Yuma East Wetlands		X

Avian Monitoring Methods

To monitor birds of the lower Colorado River in system-wide and in habitat creation plots, we conducted rapid and intensive area searches. Our goal for the rapid area search effort was to obtain the most accurate possible estimate of breeding territories while optimizing the balance between geographic survey coverage and survey effort. Our goal for the intensive area search effort was to find and document all territories present on each plot. By combining these two approaches, using double-sampling in a random subset of system-wide survey plots, we can also use the data to calculate detection ratios and density of breeding birds in the study area. Further information for this approach can be reviewed in GBBO (2008) and Bart et al. (2010).

Rapid area searches for this project employ the same field methods as intensive area searches, but the reduced number of visits (two, compared with eight in intensive area searches) prevents a similarly accurate measure of total breeding densities, as some breeding birds may be missed during both visits. Intensive area searches involved accurate delineation of breeding territories of all birds present on the plot using the cumulative knowledge from eight visits. We counted

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separately the non-breeding birds (known migrants or resident LCR birds using but not breeding in the plot or birds that breed outside the plot but foraged in the plot post-breeding) from breeders.

To conduct area searches, we used a combination of a hand-held Global Positioning System (GPS) unit (Garmin Etrex Legend H and Garmin GPSMap 60CSx) and an aerial photo of the plot overlaid with a 50-meter (m) Universal Transverse Mercator (UTM) grid (attachments 2a–c). We systematically grid-searched the plot walking at a slow enough pace to stop and record all bird sightings, locations, and breeding evidence on and around the plot. We passed within at least 50 m of every point within the plot to ensure that all sections of the plot were adequately covered. We surveyed one plot per morning (with the exception of some of the habitat creation sites where we surveyed two plots per morning due to the early stages of vegetation and low breeding bird densities), and all visits of the same effort (rapid, intensive, and enhanced intensive) to an individual plot were done by the same independent surveyor.

We conducted all area searches, except two, between April 2 and June 13, 2012. Two surveys had to be completed in early July 2012 due to high winds that caused repeated cancelations of kayak survey plots on Lake Mohave. All surveys began at sunrise and ended no later than noon in order to minimize surveys during high temperatures (> 100 degrees Fahrenheit) and periods of low bird activity. The period of time we spent for each survey visit depended on difficulty of terrain, vegetation density, and the amount of bird activity, with plots that were easy to hike with low bird densities taking less time (2–3 hours), and plots that had dense vegetation and high bird activity taking more time (up to 5 or 6 hours). Whether the survey was a rapid or an intensive area search, our goal was to identify and record data on all birds present within the plot on each visit. During each visit, for both rapid and intensive area searches, we spent enough time observing birds and collecting location and breeding behavior data on the plot to detect as close as possible 100 percent (%) of all individual birds present on the plot during that visit. During each area search visit, bird locations were mapped and behaviors recorded as accurately as possible in order to estimate the number of territories at the end of the season using cumulative territory observations.

We recorded all bird sightings and territory boundaries directly on to a gray-scale aerial photograph with a 50-m UTM grid, which also included imagery of the immediate surroundings of the plot (between 20 and 100 m, depending on plot shape). We also recorded birds near the edge or just outside the plot on the map in order to prevent double counting of birds and to assess if those birds were also using the plot. At the end of the season, we classified birds that were on the edge, and with partial territories in the plot, by approximating how much of the territory was within the plot to the nearest 25% (resulting in 0%, 25%, 50%, 75%, or 100% of a territory in a plot).

We marked all observed breeding evidence on the map using shorthand codes (adapted from Bibby et al. 2000), and our knowledge of breeding status was recorded explicitly on the data sheet (table 9 and attachment 2d). If we observed confirmed breeding evidence on at least one visit, the bird was determined a breeder. If we detected an adult bird of a species known to breed in the area on the same territory over multiple visits (at least three consecutive visits), even if the only breeding evidence we observed was singing, it was generally determined a “breeder,” and it was thus included in the total number of breeding territories regardless of direct evidence of nesting. On rapid area search plots, some breeding evidence was necessary for classifying an individual as a breeder. Exceptions to this rule were repeated sightings of yellow-billed cuckoo and willow flycatcher, both of which breed later than most other landbirds in the project area and are known to occur as migrants in the study area, and these two species were therefore never determined to be breeders in this study. These species are surveyed separately for the LCR MSCP using single-species survey protocols that could not be included in this study (McLeod and Koronkiewicz 2010; Halterman et al. 2009). Other exceptions included birds that defend territories during stopover migration on the lower Colorado River, such as the yellow warbler. Yellow warblers both breed and migrate through the lower Colorado River each spring, so special consideration was given to this species when determining breeding status on a plot. Table 9 illustrates how we ranked breeders (confirmed breeding or possible/probable breeding on three consecutive visits) and non-breeders (observed only or possible/probable breeding on less than three consecutive visits) based on behavioral cues at each visit.

Table 9.—Behavioral information collected to determine breeding status during area searches

Categories	Behavior
Observed	Seen or heard only
Possible	Singing
	Pair seen or heard together
	Territorial display
Probable	Pair in suitable nesting habitat
	Courtship and/or mate guarding
	Agitated behavior
	Nest building
Confirmed	Carrying nest material
	Prolonged distraction behavior
	Occupied nest
	Food carrying
	Dependent young present
	Fecal sac carrying
	Nest with eggs
Nest with young	

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If we observed a flock, its location was circled on the survey map, and the number of individuals was recorded on the data sheet. We recorded birds at the site of first detection as either a pair, male, female, individual of unknown sex/age, juvenile, flyover (i.e., flying over but not landing in the plot), or incidental (i.e., detected in the plot's general area, but not in the plot—same as a casual observation). For non-territorial and colonial breeders (listed in the introduction), we recorded individuals and their observed breeding behaviors as one entry per species per visit in the Access database. In previous years, at the end of the season, the number of non-territorial birds using the plot was estimated by averaging the number of possible breeders over each visit the species was detected during the season. We therefore note that their final numbers are approximations of the number of breeding individuals. In 2012, due to the changes in data entry and the evolving Access database, we chose to provide only presence/absence information for non-territorial breeding birds. Before the 2013 field season, we will work with Reclamation to edit the Access database so that there is a place to enter breeding pair estimates for these species.

Rapid Area Searches

In their implementation, rapid and intensive area searches differed primarily in the amount of data that we recorded for species that are not covered by the LCR MSCP and by the number of visits to the plot. Rapid area searches occurred in two visits spaced by at least 3 weeks, with the first round of visits in early April through mid-May and the second round in mid-May through mid-June 2012.

If we found one of the six covered species during a rapid area search, we mapped several locations where the bird/pair/family group was observed and worked hard to document breeding evidence during each survey. Locations were digitized in ArcGIS at the end of the season. To digitize the locations, we brought scanned territory maps into GIS and georeferenced them for each of the six covered species. Each surveyor digitized the territories that they had delineated themselves in the field. To record locations of the birds in GIS, the surveyors created a point shapefile with the following attributes: surveyor, date the bird was observed, species, territory code that they assigned to that species, and survey type. Using their georeferenced map, the surveyor could visualize where to place a dot corresponding to an observation point for the bird (see attachment 8).

For all non-covered species, we focused our efforts on getting a complete count, avoiding double counts, recording breeding evidence (see table 9), and determining the percentage of their territory that was inside the plot. In rapid area searches, we delineated territories of covered species to the best of our ability during the two visits. For some species, we were only able to obtain one or two locations. We automatically classified all species known only as migrants in the project area (e.g., Wilson's warbler, *Wilsonia pusilla*) as non-breeders. If we found a bird that is known to breed in the project area in the same location and displayed possible, probable, or confirmed breeding behaviors on both visits, we

determined it to be a “breeder.” In some cases, we could not determine the breeding status of a bird in just two visits, in which case we classified it as a non-breeder. Extensive training of and communication with the field surveyors continued throughout the survey season to evaluate bird observations and breeding evidence data to determine breeding status of recorded birds. In addition, detailed reference materials (e.g., Nevada Breeding Bird Atlas, Arizona Breeding Bird Atlas, Birds of the Lower Colorado River, and The Birds of North America Accounts) were provided during training to aid the field crews’ understanding of breeding bird behaviors.

In 2012, field data collection methods were the same as in previous years, but data entry methods changed to accommodate Reclamation’s new data management system. In the field, data are collected on a map with a 50-m grid of the plot and the gray-scale aerial photography in the background (attachment 2c). Within several hours of completing a survey, surveyors transferred the survey data from the field map (attachment 2d) to Reclamation’s Access database for this project. In this database, the raw data from each plot visit, including specific records on each breeding and presumed non-breeding species, are entered and immediately checked for accuracy (see attachment 3 for data entry protocol). For each pair of a LCR MSCP covered species that was ranked at least as a possible breeder, locations, dates, and territory codes from each survey were transferred onto a master copy of the plot map for each species. Surveyors continued to add observations to the master copy of the maps throughout the season to accumulate locations of individuals. At the end of the field season, after surveyors completed all surveys of the plot, their cumulative knowledge from the surveys was used to enter the final number of breeding pairs per species for each plot in both the field data sheets and a summary table in the database (attachment 2e).

Intensive Area Searches

We conducted weekly intensive area searches for a total of eight visits to each intensive area search plot during the breeding season. We delineated territories for all territorial species (LCR MSCP covered and non-covered) to the extent possible within the plot, but with primary focus on covered species and other territorial riparian-obligate birds. Our knowledge of territory locations from previous visits was used in a cumulative manner to arrive at a total territory count at the end of the season (as described above for rapid area searches). For this, we used the observation territory maps from previous visits to confirm known territory locations and territory boundaries and to add previously undetected, or poorly delineated, territories with each visit. During intensive area searches, we could determine the breeding status of individuals with much greater accuracy than was possible in rapid area searches because of the increased number of visits and decreased time between visits to the plot. We used our data from all eight visits to determine how many breeding territories were active on the plot during the whole survey period and which individuals were only passing through the plot but not breeding.

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During each visit, we recorded the highest ranking breeding evidence (confirmed, followed by probable, followed by possible) for breeding status (see table 9). At the end of the eight surveys, we defined a bird as a “breeder” on that plot if confirmed breeding evidence was recorded during any visit or if probable or possible breeding evidence was recorded during three or more consecutive visits. Therefore, we emphasize that our definition of a “breeder” in this project does not automatically imply that positive nesting evidence was recorded, but rather that a breeding attempt most likely took place in the delineated territory during our surveys. Also at the end of the season, we determined the final locations and layouts of breeding territories within the plot based on all visits (attachment 2g). For this, we combined all maps drafted during intensive area searches into final maps of territories by species using the cumulative data from all visits. In 2011 and 2012, we also entered these final territory maps for covered species (and many non-covered species) into ArcGIS as shapefiles by species and plot in order to provide a digital format for future comparisons.

The protocol for transferring data from the intensive area search data format to Reclamation’s new Access database is similar as for the rapid area search data. In the field, intensive data are collected on a map with a 50-m grid of the plot and the gray-scale aerial photography in the background (attachment 2c). Within several hours of completing a survey, surveyors transferred the survey data from the field map (attachment 2d) to Reclamation’s Access database for this project. In this database, the raw data from each plot visit, including specific records on each breeding and presumed non-breeding species, are entered and immediately checked for accuracy (see attachment 3 for data entry protocol). For each pair of a LCR MSCP covered species that was ranked at least as a possible breeder, locations, dates, and territory codes from each survey were transferred onto a master copy of the plot map for each species. Surveyors continued to add observations to the master copy of the maps throughout the season to accumulate locations of individuals. At the end of the field season, after surveyors completed all surveys of the plot, their cumulative knowledge from the surveys was used to enter the final number of breeding pairs per species for each plot in both the field data sheets and a summary table in the database (attachment 2f).

All bird data collected during the 2012 field season were entered during the field season. We then combined each surveyor’s Access and Excel databases into one Excel workbook and one Access database for the whole field season. To ensure that the data were entered completely and correctly (quality assurance), GBBO staff checked 100% of field data sheets for all rapid, intensive, and enhanced intensive (EI) plots, including Excel and Access summary data, immediately after the end of the field season. The data were proofed by comparing Excel summary data sheets to the summary data in the Access database. In addition, over 10% of all daily survey data were proofed by comparing the daily survey map to the species summary map, the Access database, and the ArcGIS data file. In these tens of thousands of rows of data checked, our error rate was < 1%. All errors found were corrected in the final Access database and GIS files.

Double-Sampling

All rapid bird survey techniques may result in biased estimates of species that differ in their detectability. For instance, densities of birds that have a soft song, vocalize rarely, behave secretively, or show strong seasonal changes in detectability may be systematically underestimated in rapid survey techniques such as point counts, belt transects, and single rapid area searches. In addition, birds that are temporarily undetectable, such as those sitting quietly on a nest or having departed the area for long foraging bouts, may be missed entirely by the surveyor. To quantify this bias, intensive and rapid area searches can be used in a double-sampling approach. For this, a surveyor other than the one conducting intensive area searches visits the intensive area search plot to conduct a standard rapid area search without any prior knowledge of the plot and its birds. Using the detections during the rapid area search and the actual number of territories present on the plot, as determined in the intensive area search effort, the detection ratio of each species present can be estimated. Details on how detection ratios are derived can be reviewed in Bart and Earnst (2002) and Bart (2007).

Population Size Analyses

For all intensive area searches, we summarized the data in two ways by (1) reporting the total number of breeding territories based on end-of-season summaries of all breeders and (2) listing species that were either migrants or residents that were not confirmed to be breeding within the plot, by species. We only included flyovers and incidental sightings in summary species lists, and they were excluded from all quantitative analyses in this report. We summarized rapid area search data by number of territories and number of birds with no confirmed breeding evidence (resident non-breeding birds and migrants).

Detection ratios can be calculated using the methods of Thompson (2002), revised by Bart and Earnst (2002). A detailed explanation of the mathematical formulas is provided in Bart (2007). We only included breeders in our calculations of detection ratio and the resulting population size estimate, which were expressed in total number of breeding territories of a species. To automate detection ratio calculation for double-sampling using rapid and intensive area searches, USGS (J. Bart, personal communication) wrote the DS program (Bart and Hartley 2010), which we used for all detection ratio calculations and population size estimation for system-wide surveys and habitat creation sites. For this report, we used the 2012 survey data and the DS program to estimate system-wide territory numbers of the covered species and of the 10 most abundant species, excluding colonial nesters and other non-territorial species. Since not all regions were surveyed in the system-wide effort (see “Study Area and Sampling Plan,” above), the overall population size estimate by species should be considered a minimum population size estimate for the LCR MSCP project area.

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For population size estimates, we first removed all non-territorial species (red-winged blackbird, brown-headed cowbird, mourning dove, white-winged dove, Gambel's quail, European starling, great-tailed grackle, Eurasian collared-dove, house finch, and greater roadrunner). Although we included these species, as well as shorebirds, waterbirds, and raptors in our report tables, we did not include them in the detection ratio calculations because it is often impossible to determine breeding status and territory location of these species during our area searches due to their large home ranges (some raptors), clustered occurrences (shorebirds), or secretive nature (shorebirds and several waterbirds). The only species we used in the detection ratio calculations were therefore moderately common or common territorial passerines and the six LCR MSCP covered species (40 species total). For these, we performed two separate calculations, one for system-wide plots and another for habitat creation plots. The resulting overall detection ratios were 0.80 for system-wide plots (standard error [SE] = 0.097) and 0.78 for habitat creation site plots (SE = 0.117). These were then used to calculate overall population size estimates for each system-wide and habitat creation site populations using the DS program.

To perform the calculations that generate population size estimates, we used the calculated detection ratio and the results in the "estimates 2" tab in the results file exported by DS. First we separated the results into different Excel sheet tabs by habitat type. Next, for each species/region/habitat type combination, we calculated the density of pairs per region and habitat by multiplying the density by the stratum area. Finally, we used a series of pivot tables in Microsoft Excel to build the report tables with our density calculations for each species by region and habitat strata.

Results

Overall Species Richness Patterns

We detected a total of 192 species of birds in all system-wide and habitat creation site surveys along the LCR in 2012 (attachment 4). Of the 192 species, approximately one-half were species that use the LCR project area only during migration or wintering (attachment 4). We detected all of the covered species in at least one site. The highest concentrations of covered species were recorded in the Bill Williams River riparian areas and in the habitat creation sites. We also recorded clapper rail, yellow-billed cuckoo, and willow flycatcher, but since these species are monitored separately from this effort, we do not discuss them in detail in this report. We recorded 189 species in system-wide surveys, compared with 137 species on habitat creation sites (attachment 4).

System-wide Surveys

System-wide Rapid Area Searches

On 80 system-wide rapid area search plots surveyed in 2012 (see attachment 5 for a list of all plots surveyed), we recorded 161 species. Of these, we classified 76 species as territorial breeders (table 10), 11 species as non-territorial breeders, and 126 species as migrants or non-breeders (table 11). The number of breeding territories varied widely among species, with the most abundant species being either riparian-associated or generalist species. Approximately one-half of the breeding birds were of a species that were not strictly territorial (and thus excluded from the DS analyses), and some of these species were also the most numerous system-wide, including white-winged dove, mourning dove, great-tailed grackle, brown-headed cowbird, and yellow-headed and red-winged blackbirds. Additional non-territorial, breeding birds included Gambel's quail, greater roadrunner, Eurasian collared-dove, European starling, and house finch. The most common territorial species included song sparrow, common yellowthroat, yellow-breasted chat, Lucy's warbler, and Bewick's wren (table 10). We saw three willow flycatcher pairs that could be potential breeders, and Reclamation distributed this information to the southwestern willow flycatcher survey crew so they could confirm breeding and subspecies.

We found the most common breeders of the covered species to be the Sonoran yellow warbler (185.25 territories) followed by Arizona bell's vireo (67.25 territories), gila woodpecker (34 territories), and summer tanager (28.25 territories). No breeding vermilion flycatchers were detected on any of the 80 plots. One breeding gilded flicker was detected with a partial (25%) territory in one plot at the Bill Williams River, southwest of Alamo Dam (plot #3320). The majority of this territory was located in adjacent upland habitat featuring large saguaro cactuses, and neither a nest nor a mate was observed during the two surveys.

System-wide Intensive Area Searches

During system-wide intensive area searches (n = 8 plots) in 2012, we recorded and mapped 371.75 breeding territories of 31 species (table 12 and attachment 6 for a list of the 2012 intensive area search plots). Additionally, we detected non-territorial and colonial species breeding that made up 23% of the breeding birds (approximately 85 breeding pairs), including white-winged dove (~36 pairs), mourning dove (~21 pairs), Gambel's quail (~6 pairs), brown-headed cowbird (~14 pairs), house finch (~5 pairs), and greater roadrunner (~3 pairs).

We found breeding evidence for four of the covered species, Sonoran yellow warbler (22.5 territories), Arizona bell's vireo (5 territories), gila woodpecker (3.25 territories), and summer tanager (2.75 territories; table 12). A total of 112 additional species that were classified as migrants or non-breeders was also detected on the eight plots throughout the season (table 13).

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Table 10.—Total number of breeding territories, by species, determined by the surveyors in the 80 system-wide rapid area search plots in 2012

(The number of territories in each plot was determined by the surveyor after the second survey. Species are listed in descending order of abundance. Partial territories are represented in decimals [see “Methods” for details].)

Species	Number of territories
Song sparrow	995.5
Common yellowthroat	569.75
Yellow-breasted chat	419
Lucy's warbler	222.25
Bewick's wren	213.5
Abert's towhee	198
Verdin	188.5
Sonoran yellow warbler ¹	185.25
Black-tailed gnatcatcher	169.25
Marsh wren	150.5
Ash-throated flycatcher	73.5
Arizona bell's vireo ¹	67.25
Black-chinned hummingbird	67.25
Ladder-backed woodpecker	63.5
American coot	56.25
Anna's hummingbird	41.75
Virginia rail	34.5
Gila woodpecker ¹	34
Blue grosbeak	32.25
Crissal thrasher	32.25
Common gallinule	31.75
Summer tanager ¹	28.25
Phainopepla	26.75
Yuma clapper rail ¹	26.25
California black rail	25.5
Lesser nighthawk	25.25
Pied-billed grebe	24
Least bittern	21.25
Bullock's oriole	20.5
Lesser goldfinch	20.5
Brown-crested flycatcher	17
Horned lark	15.5
Canyon wren	1.25
Green heron	10.75

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Table 10.—Total number of breeding territories, by species, determined by the surveyors in the 80 system-wide rapid area search plots in 2012

(The number of territories in each plot was determined by the surveyor after the second survey. Species are listed in descending order of abundance. Partial territories are represented in decimals [see “Methods” for details].)

Species	Number of territories
Unidentified hummingbird	10.25
Great egret	8
Great blue heron	6
Northern mockingbird	6
Western kingbird	6
Costa's hummingbird	5.25
Black phoebe	4.25
Killdeer	4.25
Say's phoebe	4
Great horned owl	1.75
Western least bittern	1.5
Northern rough-winged swallow	1.25
Black-crowned night-heron	1
Cactus wren	1
Clark's grebe	1
Common ground-dove	1
Common poorwill	1
Cooper's hawk	1
Loggerhead shrike	1
Long-eared owl	1
Turkey vulture	1
Western grebe	1
Western screech owl	1
White-throated swift	1
Common raven	0.75
Elf owl ¹	0.75
Western meadowlark	0.5
American kestrel	0.25
Burrowing owl	0.25
Gilded flicker*	0.25
Red-tailed hawk	0.25

¹ LCR MSCP covered species.

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Table 11.—Detected but not confirmed breeding during system-wide rapid area searches in 80 plots in 2012
(Species that were just observed flying over plots, but not landing in them, are identified with a ^ . Species known to be only migrants through the lower Colorado River area are identified with a * . Incidental sightings that were not from inside or above the plot are not included.)

Species	Detected, not confirmed breeding in system-wide rapid area searches, 2012
Abert's towhee	x
American bittern	x
American coot	x
American kestrel	x
American redstart	x*
American robin	x*
Anna's hummingbird	x^
Arizona bell's vireo ¹	x
Bald eagle	x^
Barn swallow	x*
Bewick's wren	x
Black phoebe	x
Black-crowned night-heron	x
Black-headed grosbeak	x*
Black-necked stilt	x
Black-tailed gnatcatcher	x
Black-throated gray warbler	x*
Blue grosbeak	x
Blue-gray gnatcatcher	x
Brewer's sparrow	x*
Brown-crested flycatcher	x
Brown-headed cowbird	x
Bullock's oriole	x
Cactus wren	x
Canada goose	x^
Caspian tern	x^*
Cassin's vireo	x*
Cattle egret	x^
Cedar waxwing	x*
Chipping sparrow	x*
Clark's grebe	x
Cliff swallow	x

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Table 11.—Detected but not confirmed breeding during system-wide rapid area searches in 80 plots in 2012
(Species that were just observed flying over plots, but not landing in them, are identified with a ^ . Species known to be only migrants through the lower Colorado River area are identified with a * . Incidental sightings that were not from inside or above the plot are not included.)

Species	Detected, not confirmed breeding in system-wide rapid area searches, 2012
Common gallinule	x
Common goldeneye	x*
Common ground-dove	x
Common raven	x
Cooper's hawk	x
Double-crested cormorant	x
Dusky flycatcher	x*
Eurasian collared-dove	x^
European starling	x^
Gambel's quail	x
Gambel's white-crowned sparrow	x*
Gila woodpecker ¹	x
Gray flycatcher	x*
Great blue heron	x
Great egret	x
Greater roadrunner	x
Greater yellowlegs	x*
Great-tailed grackle	x
Green heron	x^
Green-tailed towhee	x*
Hammond's flycatcher	x*
Hermit thrush	x*
Hermit warbler	x*
Horned lark	x
House finch	x
House wren	x
Killdeer	x
Lazuli bunting	x
Least sandpiper	x*
Lesser goldfinch	x
Lesser nighthawk	x^
Lincoln's sparrow	x*

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Table 11.—Detected but not confirmed breeding during system-wide rapid area searches in 80 plots in 2012
(Species that were just observed flying over plots, but not landing in them, are identified with a ^. Species known to be only migrants through the lower Colorado River area are identified with a *. Incidental sightings that were not from inside or above the plot are not included.)

Species	Detected, not confirmed breeding in system-wide rapid area searches, 2012
Loggerhead shrike	x
Long-billed curlew	x ^{^*}
Long-billed dowitcher	x [*]
Lucy's warbler	x
Macgillivray's warbler	x [*]
Mallard	x
Mountain white-crowned sparrow	x [*]
Mourning dove	x
Nashville warbler	x [*]
Neotropic cormorant	x ^{^*}
Northern harrier	x
Northern mockingbird	x
Northern parula	x [*]
Northern rough-winged swallow	x
Olive-sided flycatcher	x [*]
Orange-crowned warbler	x [*]
Osprey	x
Pacific-slope flycatcher	x [*]
Peregrine falcon	x [^]
Phainopepla	x
Prairie falcon	x [^]
Redhead	x [*]
Red-tailed hawk	x [^]
Red-winged blackbird	x
Ring-billed gull	x ^{^*}
Ruby-crowned kinglet	x [*]
Rufous hummingbird	x [*]
Savannah sparrow	x [*]
Say's phoebe	x
Sharp-shinned hawk	x
Snow goose	x ^{^*}
Snowy egret	x

Lower Colorado River Riparian Bird Surveys, 2012

Table 11.—Detected but not confirmed breeding during system-wide rapid area searches in 80 plots in 2012
(Species that were just observed flying over plots, but not landing in them, are identified with a ^. Species known to be only migrants through the lower Colorado River area are identified with a *. Incidental sightings that were not from inside or above the plot are not included.)

Species	Detected, not confirmed breeding in system-wide rapid area searches, 2012
Song sparrow	x
Sonoran yellow warbler*	x
Sora	x
Spotted sandpiper	x*
Summer tanager*	x^
Swainson's thrush	x*
Swainson's hawk	x^*
Townsend's warbler	x*
Tree swallow	x*
Turkey vulture	x
Verdin	x
Vesper sparrow	x*
Violet-green swallow	x*
Warbling vireo	x*
"Western" flycatcher	x*
Western kingbird	x
Western tanager	x*
Western wood-pewee	x*
White-crowned sparrow	x*
White-faced ibis	x*
White-throated swift	x
White-winged dove	x
Willow flycatcher ²	x
Wilson's warbler	x*
Wilson's phalarope	x^*
Wilson's snipe	x*
Yellow-breasted chat	x^
Yellow-headed blackbird	x
Yellow-rumped (Audubon's) warbler	x*
Yellow-rumped (Myrtle's) warbler	x*

¹LCR MSCP covered species.

²Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated.

Lower Colorado River Riparian Bird Surveys, 2012

Table 12.—Total number of breeding territories by species detected during system-wide intensive area searches in 2012
(Listed in descending order of abundance. Territorial species only.)

Species	Number of territories
Song sparrow	72.75
Common yellowthroat	39.5
Lucy's warbler	36.25
Abert's towhee	28.25
Bewick's wren	26
Sonoran yellow warbler ¹	25.25
Yellow-breasted chat	25
Black-tailed gnatcatcher	21.5
Marsh wren	17.5
Verdin	15.5
American coot	12
Least bittern	8
Anna's hummingbird	6.75
Crissal thrasher	6.75
Arizona bell's vireo ¹	6
Blue grosbeak	5.25
Lesser nighthawk	4.5
Ladder-backed woodpecker	4.25
Ash-throated flycatcher	3.25
Black-chinned hummingbird	3
Common gallinule	3
House sparrow	3
Gila woodpecker ¹	2.5
Summer tanager ¹	2.5
Western kingbird	2.5
Pied-billed grebe	2
Brown-crested flycatcher	1.75
Black rail ¹	1
Yuma clapper rail ¹	1
Lesser goldfinch	1
Sora	1
Virginia rail	1
Canyon wren	0.5
Killdeer	0.5
Phainopepla	0.5
Say's phoebe	0.5
Common ground-dove	0.25
Total	391.75

¹ LCR MSCP covered species.

Lower Colorado River Riparian Bird Surveys, 2012

Table 13.—Species detected but not confirmed breeding on the intensive system-wide area search plots in 2012 (n = 8)
 (Species that were just observed flying over plots, but not landing in them, are identified with a ^. Species known to be only migrants through the lower Colorado River area are identified with a *.
 Incidental sightings that were not from inside or above the plot are not included.)

Species	Detected, not confirmed breeding in system-wide intensive area searches, 2012
Abert's towhee	x
American coot	x
American kestrel	x
American pipit	x*
American robin	x*
Anna's hummingbird	x
Bald eagle	x^
Bank swallow	x^*
Barn swallow	x^*
Black phoebe	x
Black-chinned hummingbird	x
Black-crowned night-heron	x
Black-headed grosbeak	x*
Black-necked stilt	x^
Black-throated gray warbler	x*
Black-throated sparrow	x
Blue grosbeak	x
Blue-gray gnatcatcher	x
Brewer's sparrow	x*
Brown-headed cowbird	x
Bullock's oriole	x
Canada goose	x^
Canyon wren	x
Caspian tern	x^*
Cassin's vireo	x*
Cattle egret	x^
Cedar waxwing	x^*
Chipping sparrow	x*
Cliff swallow	x

Lower Colorado River Riparian Bird Surveys, 2012

Table 13.—Species detected but not confirmed breeding on the intensive system-wide area search plots in 2012 (n = 8)
 (Species that were just observed flying over plots, but not landing in them, are identified with a ^. Species known to be only migrants through the lower Colorado River area are identified with a *.
 Incidental sightings that were not from inside or above the plot are not included.)

Species	Detected, not confirmed breeding in system-wide intensive area searches, 2012
Common black-hawk	x
Common raven	x
Common yellowthroat	x
Cooper's hawk	x
Cordilleran flycatcher	x*
Crissal thrasher	x
Double-crested cormorant	x^
Dusky flycatcher	x*
Eurasian collared-dove	x^
European starling	x^
Gadwall	x^*
Gambel's quail	x
Gambel's white-crowned sparrow	x*
Gray flycatcher	x*
Great blue heron	x
Great egret	x
Great-tailed grackle	x
Green heron	x^
Green-tailed towhee	x*
Hammond's flycatcher	x*
Hermit thrush	x*
Hermit warbler	x*
House finch	x^
House wren	x
Killdeer	x
Ladder-backed woodpecker	x^
Lawrence's goldfinch	x^
Lazuli bunting	x
Least sandpiper	x^*

Lower Colorado River Riparian Bird Surveys, 2012

Table 13.—Species detected but not confirmed breeding on the intensive system-wide area search plots in 2012 (n = 8)
 (Species that were just observed flying over plots, but not landing in them, are identified with a ^. Species known to be only migrants through the lower Colorado River area are identified with a *.
 Incidental sightings that were not from inside or above the plot are not included.)

Species	Detected, not confirmed breeding in system-wide intensive area searches, 2012
Lesser goldfinch	x
Lesser nighthawk	x^
Lincoln's sparrow	x*
Long-billed curlew	x^*
Macgillivray's warbler	x*
Mallard	x^
Mountain white-crowned sparrow	x*
Mourning dove	x
Nashville warbler	x*
Northern rough-winged swallow	x
Olive-sided flycatcher	x*
Orange-crowned warbler	x*
Osprey	x
Pacific-slope flycatcher	x*
Peregrine falcon	x^
Phainopepla	x
Plumbeous vireo	x*
Prairie falcon	x^
Red-shafted northern flicker	x*
Red-tailed hawk	x
Red-winged blackbird	x
Ruby-crowned kinglet	x*
Rufous hummingbird	x*
Say's phoebe	x
Sharp-shinned hawk	x
Snowy egret	x
Song sparrow	x
Sonoran yellow warbler ¹	x
Spotted towhee	x*

Lower Colorado River Riparian Bird Surveys, 2012

Table 13.—Species detected but not confirmed breeding on the intensive system-wide area search plots in 2012 (n = 8)
 (Species that were just observed flying over plots, but not landing in them, are identified with a ^. Species known to be only migrants through the lower Colorado River area are identified with a *.
 Incidental sightings that were not from inside or above the plot are not included.)

Species	Detected, not confirmed breeding in system-wide intensive area searches, 2012
Swainson's thrush	x*
Swainson's hawk	x*
Townsend's warbler	x*
Tree swallow	x*
Tropical kingbird	x^
Turkey vulture	x
Vaux's swift	x^*
Verdin	x
Violet-green swallow	x^*
Warbling vireo	x*
Western flycatcher	x*
Western kingbird	x
Western tanager	x*
Western wood-pewee	x*
White-crowned sparrow	x*
White-faced ibis	x^*
White-throated swift	x
White-winged dove	x
Willow flycatcher ²	x
Wilson's warbler	x*
Wilson's snipe	x
Yellow-headed blackbird	x^
Yellow-rumped (Audubon's) warbler	x*
Yellow-rumped (Myrtle's) warbler	x*
Zone-tailed hawk	x*

¹ LCR MSCP covered species.

² Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated.

Habitat Creation Sites: Rapid Area Searches

During rapid area searches on habitat creation sites in 2012 (n = 71 plots), we recorded a total of 123 species, 58 of which were classified as breeders (see attachment 5 for a list of all habitat creation plots surveyed in 2012). We also classified four of the six covered species, including Sonoran yellow warbler, Arizona bell's vireo, summer tanager, and vermilion flycatcher, as breeders in habitat creation sites. Gila woodpecker and gilded flicker were not detected in our 2012 surveys of these sites (see attachment 4 for a complete list of detected species).

Over the course of the field season, we detected 65 species that we classified as non-breeders or migrants in habitat creation plots and 41 species that were found both breeding and not breeding in habitat creation sites. Interesting species included dickcissel, indigo bunting, and white-tailed kite, which were only observed on habitat creation plots and not detected during system-wide surveys. All species of migrants and non-breeders are listed in attachment 7A and 7B.

Beal Lake Riparian Habitat Conservation Area

In 2012, we monitored two of the four Beal Lake plots (Beal B and C, attachment 1w) with rapid area searches. We detected more than 75 breeding territories (table 14) and 31 non-breeding species in these plots (attachment 7a). We found Arizona bell's vireo to be the most abundant breeder of all covered species, with 11 territories in Beal B and C. We also found Sonoran yellow warbler nesting in Beal B and C and summer tanager territories in Beal C. Non-territorial breeding species included mourning and white-winged doves (common), brown-headed cowbird, Gambel's quail, and greater roadrunner. We also suspected black phoebe and lesser goldfinch to be breeding at Beal, but were unable to confirm nesting in these plots.

Colorado River Indian Tribe (CRIT 9 'Ahakhav Tribal Preserve) Habitat Creation Site

Five plots in the Colorado River Indian Tribe (CRIT) 9 'Ahakhav Tribal Preserve habitat creation site (attachment 1x) were covered with rapid area searches in 2012, resulting in more than 55 breeding territories (table 15) and 41 species of non-breeders (attachment 7a). In these plots, we confirmed breeding of two covered species, vermilion flycatcher in plots A, B, C, and D, and summer tanager in plots B and C. No other covered species was detected on the CRIT 9 'Ahakhav Tribal Preserve in 2012.

The most common species we found breeding at CRIT 9 'Ahakhav Tribal Preserve were non-territorial species including mourning and white-winged doves, brown-headed cowbird, Gambel's quail, house finch, and great-tailed grackle. Crissal Thrashers were detected and suspected to be breeding, but breeding could not be confirmed.

Lower Colorado River Riparian Bird Surveys, 2012

Table 14.—Number of breeding territories detected at Beal Lake during rapid area search plots in 2012 (Listed in descending order of abundance. Beal A and D were not surveyed this year. Non-territorial species are not listed.)

Species	C1502 (Beal B)	C1503 (Beal C)	Total
Arizona bell's vireo ¹	4	7	11
Abert's towhee	3.5	6.5	10
Yellow-breasted chat	4	5.25	9.25
Black-tailed gnatcatcher	1.75	6	7.75
Lucy's warbler	0.75	6.75	7.5
Common yellowthroat	3.75	3.5	7.25
Sonoran yellow warbler ¹	2.5	4.5	7
Anna's hummingbird	2	2	4
Verdin	0	3	3
Crissal thrasher	0.75	1.5	2.25
Bullock's oriole	0	1.5	1.5
Ladder-backed woodpecker	0	1.25	1.25
Summer tanager ¹	0	0.75	0.75
Great horned owl	0.5	0	0.5
Ash-throated flycatcher	0	0.25	0.25
Brown-crested flycatcher	0.25	0	0.25
Total	23.75	49.75	73.5

¹ LCR MSCP covered species.

Palo Verde Ecological Reserve

In rapid area searches of 26 plots at Palo Verde Ecological Reserve (PVER) (attachment 1y), we detected more than 260 breeding territories (table 16) and 72 species of migrants and other non-breeders (attachment 7a). We found Sonoran yellow warbler breeding in plots that were in planting Phases 4 and 5. No other covered species were found breeding at PVER this year. In 2012, the PVER sites again had an active northern harrier territory, with both parents vigorously defending their nest. This territory was also active in each of the previous 4 years. Non-territorial breeding species, all common on this site, included mourning and white-winged doves, brown-headed cowbird, red-winged blackbird, Gambel's quail, and house finch. Several greater roadrunner pairs also had partial territories in PVER plots. Several species, including Arizona bell's vireo, white-tailed kite, Bewick's wren, great blue heron, snowy and great egrets, killdeer, and lesser goldfinch, were detected and suspected to be breeding, but breeding could not be confirmed.

Lower Colorado River Riparian Bird Surveys, 2012

Table 15.—Number of breeding territories of territorial species detected at Colorado River Indian Tribe sites (CRIT 9 'Ahakhav Tribal Preserve) during rapid area search plots in 2012

(Listed in descending order of abundance)

Species	C2101 (CRIT 9 Plot A)	C2102 (CRIT 9 Plot B)	C2103 (CRIT 9 Plot C)	C2104 (CRIT 9 Plot D)	C2105 (CRIT 9 Plot E)	Total
Anna's hummingbird	0.5	0.75	4.25	2.75	2.5	10.75
Abert's towhee	1.5	1	2.25	2.75	0.5	8
Lucy's warbler	1.75	0.5	0	3.5	0	5.75
Bullock's oriole	0.5	0.75	2	1.5	0	4.75
Verdin	1.25	1	1	1.5	0	4.75
Ladder-backed woodpecker	0.5	0.75	1.75	0.75	0.75	4.5
Vermilion flycatcher ¹	1.5	0.75	0.75	1	0	4
Ash-throated flycatcher	0.5	0	1	0.5	0	2
Western kingbird	0	1	0	0.25	0.5	1.75
Black-tailed gnatcatcher	0.5	0	0	1	0	1.5
Great horned owl	0	0	0.5	1	0	1.5
Lesser goldfinch	0	0	1	0.5	0	1.5
Summer tanager ¹	0	0.25	0.5	0	0	0.75
Barn owl	0	0	0.5	0	0	0.5
Black phoebe	0	0	0	0	0.5	0.5
Black-chinned hummingbird	0	0	0.5	0	0	0.5
Tropical kingbird	0	0	0	0.25	0	0.25
Total	8.5	6.75	16	17.25	4.75	53.25

¹ LCR MSCP covered species.

Cibola Valley Conservation Area

In 23 rapid area search plots at Cibola Valley Conservation Area (CVCA) attachment 1z), we documented more than 200 breeding territories (table 17) and a total of 72 species of migrants and other non-breeders (attachment 7a) in 2012. We found Sonoran yellow warbler and summer tanager breeding in CVCA planting Phase 1 plots, but the most abundant breeding species at CVCA overall were non-territorial species including mourning and white-winged doves, brown-headed cowbird, house finch, red-winged blackbird, and Gambel's quail. Other non-territorial species, including Eurasian collared-dove, European starling, and greater roadrunner, were also found breeding at CVCA in small numbers. Several species, including Costa's hummingbird, Bewick's wren, western meadowlark, lesser nighthawk, loggerhead shrike, and phainopepla, were detected and suspected to be breeding, but breeding was not confirmed.

Lower Colorado River Riparian Bird Surveys, 2012

Table 16.—Number of breeding territories of territorial species detected at Palo Verde Ecological Reserve during rapid area search plots in 2012
(Listed in descending order of abundance)

Species	Number of territories						
	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	PVER total
Common yellowthroat	6	1.75	1	4.5	26.25	22.25	61.75
Blue grosbeak	3	3.25	10.25	12.25	21	6.75	56.5
Song sparrow	6	8	0	14.5	9.5	0.5	38.5
Abert's towhee	3.75	5.25	4.25	7.75	9.25	0.75	31
Western kingbird	0	12.75	3.5	5	4.25	1	26.5
Bullock's oriole	1.75	3.5	1.25	2	3.25	0	11.75
Black-chinned hummingbird	1.5	4.5	2	0.5	1.75	0	10.25
Yellow-breasted chat	0	0	0	3.25	4	0	7.25
Sonoran yellow warbler ¹	0	0	0	3	1	0	4
Black-tailed gnatcatcher	0	0	0	2	1	0	3
Lucy's warbler	0	0	1	1	1	0	3
Northern mockingbird	0	0.5	0.25	2	0	0	2.75
Barn owl	1	0	1	0	0	0	2
Crissal thrasher	0	0	0.25	0.75	1	0	2
Anna's hummingbird	0	0	1	0	0	0	1
Ash-throated flycatcher	0	0	0	0	1	0	1
Verdin	0	0	0	0	1	0	1
Costa's hummingbird	0	0	0.5	0	0	0	0.5
Great horned owl	0.5	0	0	0	0	0	0.5
Indigo bunting	0	0	0	0	0.25	0	0.25
Ladder-backed woodpecker	0	0	0	0.25	0	0	0.25
Northern harrier	0	0	0.25	0	0	0	0.25
Total	23.5	39.5	26.5	58.75	85.5	31.25	265

¹ LCR MSCP covered species.

Lower Colorado River Riparian Bird Surveys, 2012

Table 17.—Number of breeding territories of territorial species detected in Cibola Valley Conservation Area during rapid area search plots in 2012
(Listed in descending order of abundance)

Species	Number of territories						
	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Total CVCA
Abert's towhee	18.25	5.75	8.25	15.75	7	6.25	61.25
Blue grosbeak	7.75	3	4.5	7.25	2.25	3.5	28.25
Western kingbird	3.75	8.25	10	1.5	0	0	23.5
Black-tailed gnatcatcher	0	0	2.5	7.25	4	0.25	14
Bullock's oriole	5.25	3	2.5	0.5	0.5	0.25	12
Verdin	0	0	2.75	3.25	2.75	0.5	9.25
Black-chinned hummingbird	5.5	3	0	0	0	0	8.5
Common yellowthroat	0.25	1	0	0	0	5.25	6.5
Crissal thrasher	0	0	1.25	1.75	1.25	1.25	5.5
Ladder-backed woodpecker	1.5	1.25	2	0.25	0	0	5
Indigo bunting	4	0	0	0	0	0	4
Song sparrow	0	4	0	0	0	0	4
Great horned owl	2.5	1.25	0	0	0	0	3.75
Lesser goldfinch	1	0	0	2	0	0	3
Sonoran yellow warbler ¹	3	0	0	0	0	0	3
Ash-throated flycatcher	0.5	0	1	0.5	0.75	0	2.75
Horned lark	0	0	0	1	0	1.75	2.75
Anna's hummingbird	2	0	0	0	0	0	2
Summer tanager ¹	1.5	0	0	0	0	0	1.5
Northern mockingbird	0	0.25	0	0.75	0	0.25	1.25
Loggerhead shrike	0	0	0	0.5	0	0	0.5
Cooper's hawk	0.25	0	0	0	0	0	0.25
Lucy's warbler	0	0	0	0.25	0	0	0.25
Total	57	30.75	34.75	42.5	18.5	19.25	202.75

¹ LCR MSCP covered species.

Cibola Farm Unit 1 Site

The rapid area search plots covered in 2012 at the Cibola Farm Unit 1 site included Nature Trail, Mass Planting, Research 3, CW north, Cottonwood Genetics, and Crane Roost plots (attachment 1aa). In these plots, we documented over 184 breeding territories (table 18) and a total of 65 species of migrants and other non-breeders (attachment 7a). Sonoran yellow warbler territories were found in both Nature Trail plots and the Cottonwood Genetics area. Arizona bell's vireo was found breeding at the south end of the Nature Trail plot. We also detected summer tanagers in Unit 1, which were classified as non-breeders, where nesting was suspected but could not be confirmed. Several other species were also detected and suspected to be nesting, including barn owl, Costa's hummingbird, Lawrence's and lesser goldfinches, loggerhead shrike, and phainopepla. The most common species classified as breeders in Cibola Farm Unit 1 were non-territorial species including mourning and white-winged doves, brown-headed cowbird, and red-winged blackbird. Other non-territorial species were found breeding in small numbers, including house finch, European starling, Gambel's quail, Eurasian collared-dove, great-tailed grackle, yellow-headed blackbird, and greater roadrunner.

Yuma East Wetlands

In the spring of 2012, FPC began area searches for surveying the YEW habitat creation site using methods similar to our intensive area searches (attachment 1bb). Reclamation provided us with these data and requested that we include the results in this report. In FPC's three plots at YEW, surveyors detected more than 52 breeding territories (table 19) and 62 species of migrants and other non-breeders (attachment 7b). Breeding was not confirmed for any LCR MSCP covered bird species in these plots. Non-territorial breeding species were present and included mourning and white-winged doves (1 pair of each species in plot 4703), brown-headed cowbird (breeding in all plots with 5–11 pairs per plot), and house finch (1 pair in plot 4701).

Habitat Creation Sites: Intensive Area Searches

Intensive area searches were conducted on four habitat creation site plots, Beal Plot B, CVCA Phase 3 Plots C and D, and CRIT 9 Plot C. During these surveys, we detected 67 bird species, including 20 species classified as breeders in almost 77 territories (table 20) and 50 species classified as non-breeders and migrants (table 21). We found four covered species breeding in these plots: Sonoran yellow warbler and Arizona bell's vireo at Beal Plot B and summer tanager and vermilion flycatcher at CRIT 9 'Ahakhav Tribal Preserve Plot C.

Lower Colorado River Riparian Bird Surveys, 2012

Table 18.—Number of breeding territories of territorial species detected in Cibola Farm Unit 1 during rapid area search plots in 2012
(Listed in descending order of abundance)

Species	Number of territories													Total
	C2701 (Mass Planting)	C2702 (Research 3)	C2703 (Cottonwood Genetics B)	C2704 (Cottonwood Genetics A)	C2705 (NTS)	C2706 (NTN)	C2707 (CW North)	C2720 (Crane Roost C)	C2721 (Crane Roost B)	C2722 (Crane Roost A)	C2723 (Crane Roost F)	C2724 (Crane Roost E)	C2725 (Crane Roost D)	
Abert's towhee	1.3	3	2	3.8	9.5	4.8	4	1.8	2.3	3.3	0.5	0.5	2	39
Blue grosbeak	0.3	1.8	3	0.5	3	0	1.5	3	1	1	4	1.3	1.8	22
Western kingbird	3.8	3	2	1.5	3.5	1.5	2	0	0	2	1	0.5	0	21
Song sparrow	0	0.3	0	0	0	0	0	0	0.5	9.5	0.8	0	3	14
Bullock's oriole	0.3	0.3	3.3	1.8	2	1.8	2	0	0	1.3	0	0	0.8	13
Verdin	0	1	0	0	3.5	3	0.5	1	0	2.5	0	0	1.5	13
Common yellowthroat	0	1	1.8	2.5	1.5	0	0	0	0	2.5	0	0	1.5	11
Anna's hummingbird	0	0	0	0	1.8	5	0	0	0	0	0	0.5	0	7.3
Yellow-breasted chat	0	0	0	0	0	0	0	0	0	3	0	0	2	5
Black-tailed gnatcatcher	0	0	0	0	0.5	2.8	0.5	0	0	0	0	0	1	4.8
Ash-throated flycatcher	1	0	0	0	0	1.3	0	0	0.3	0.5	0.3	0.8	0.5	4.5
Ladder-backed woodpecker	0	0	0	0.5	1	1	0	0	0.3	0	0	1	0	3.8
Sonoran yellow warbler ¹	0	0	0.8	0	0.3	2	0	0	0	0	0	0	0	3
Crissal thrasher	0	0	0.5	0	0.8	0.5	0	0	0	0.5	0		0.5	2.8
Black-chinned hummingbird	0	0	0	1	0	0	1	0	0	0.5	0	0	0	2.5
Lucy's warbler	0	0	0	0	0	2	0	0	0	0	0	0	0	2
Killdeer	0	0	0	0	0	0	0	0	0	0	1.8	0	0	1.8
Great horned owl	1	0	0	0	0	0.5	0	0	0	0	0	0	0	1.5
Arizona bell's vireo ¹	0	0	0	0	1	0	0	0	0	0	0	0	0	1
White-tailed kite	0	0	0.8	0	0	0	0	0	0	0	0	0	0	0.8
Green heron	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0.3
Northern mockingbird	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0.3
Northern rough-winged swallow	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0.3
Total	7.5	10	14	12	28	26	12	6.3	4.3	27	8.3	4.5	15	184

¹ LCR MSCP covered species.

Lower Colorado River Riparian Bird Surveys, 2012

Table 19.—Number of breeding territories of territorial species detected at Yuma East Wetlands during intensive area search plots by Fred Phillips Consulting, LLC in 2012
(Listed in alphabetical order)

Species	Plot 4701	Plot 4702	Plot 4703	Total
Abert's towhee	2.5	1	2	5.5
Anna's hummingbird	0	1	1	2
Black-tailed gnatcatcher	1	0	0	1
Blue grosbeak	0	1	0	1
Common yellowthroat	0	1	0	1
Song sparrow	1	0	0	1
Verdin	6.75	5	2.75	14.5
Total	11.25	9	5.75	26

Approximately 50% of the breeding birds on these plots were non-territorial species, such as white-winged and mourning doves, brown-headed cowbird, red-winged blackbird, Gambel's quail, and house finch, which are not included in our population size estimates,. Of the territorial species included in breeding population estimates, Abert's towhee was the most common, followed by blue grosbeak, Anna's hummingbird, Bullock's oriole, and black-tailed gnatcatcher.

Overall Population Size Estimates

In 2012, we included only territorial breeding species in detection ratio calculations using DS. However, our data indicate that non-territorial breeding species usually make up more than one-half of the breeding bird abundance in the lower Colorado River project area, and omitting them from our DS analyses had a powerful effect on overall detection ratios, which were lowered by approximately 0.1 when excluding all non-territorial breeding species. We therefore also performed DS analyses on data from previous years with non-territorial breeders excluded, and detection rates were similarly lowered for those years. These results suggest very high detection rates in lower Colorado River non-territorial breeding species, which our field observations support in that these species tend to be among the most easily confirmed during a survey.

System-wide Population Size Estimates

Using the DS program for analyzing data from system-wide random plots, we obtained an overall detection ratio of 0.80 for territorial riparian landbird species. With this detection ratio, the 2012 system-wide minimum population size estimates for LCR MSCP covered species resulted in almost 1,100 Arizona bell's vireo territories, more than 700 Sonoran yellow warbler territories, more than

Lower Colorado River Riparian Bird Surveys, 2012

Table 20.—Total number of breeding territories by species detected during intensive area searches at a subset of four habitat creation sites in 2012

(Listed in descending order of abundance. Territorial species only.)

Species	Number of territories				Total
	C1502 (Beal Plot B)	C2103 (CRIT 9 Plot C)	C2509 (CVCA Phase 3 Plot D)	C2510 (CVCA Phase 3 Plot C)	
Abert's towhee	7.5	3.75	7.5	2.75	21.5
Blue grosbeak	0	0	4.75	2	6.75
Anna's hummingbird	1.75	4	0	0	5.75
Bullock's oriole	0.25	2.5	1	2	5.75
Arizona bell's vireo ¹	5.5	0	0	0	5.5
Black-tailed gnatcatcher	4	0	1.5	0	5.5
Yellow-breasted chat	3.5	0	1	0	4.5
Western kingbird	0	0.75	1	2	3.75
Verdin	0	1	2	0	3
Sonoran yellow warbler ¹	2.75	0	0	0	2.75
Ladder-backed woodpecker	0.5	1.75	0	0	2.25
Lucy's warbler	1.5	0	0	0	1.5
Summer tanager ¹	0	1.5	0	0	1.5
Crissal thrasher	0.5	0	1	0	1.5
Ash-throated flycatcher	0	1.25	0	0	1.25
Black-chinned hummingbird	0	0	1	0	1
Common yellowthroat	0	0	1	0	1
Great horned owl	0	0.75	0	0	0.75
Brown-crested flycatcher	0.5	00	0	0	0.5
Vermilion flycatcher ¹	0	0.25	0	0	0.25
Total	28.25	17.5	21.75	8.75	76.25

¹ LCR MSCP covered species.

400 gila woodpecker territories, almost 200 summer tanager territories, and just over 20 gilded flicker territories (table 22). Since we only detected one gilded flicker in 2012, the population estimate for gilded flickers is almost certainly inflated and more likely represents the availability of the “tall woody” habitat types present at the one detection site. Tall woody habitat is available elsewhere in the project area, but we have not detected gilded flickers in most of these sites over the past several years. Vermilion flycatchers were not detected as breeders during system-wide surveys this year, so we do not have a 2012 population size estimate for this species.

Lower Colorado River Riparian Bird Surveys, 2012

Table 21.—Species detected but not confirmed breeding during intensive area searches at a subset of four habitat creation sites in 2012

(Species that were just observed flying over plots, but not landing in them, are identified with a ^. Species known to be only migrants through the lower Colorado River area are identified with a *. Incidental sightings that were not from inside or above the plot are not included. Listed in alphabetical order.)

Species	C152 (Beal B)	C213 (CRIT C)	C259 (CVCA 3C)	C251 (CVCA 3D)
American robin	x^*	x^*		
Barn swallow			x^*	x^*
Black-crowned night heron	x^			
Black-headed grosbeak		x^*		
Brewer's sparrow			x^*	
Brown-headed cowbird	x^		x^	x^
Cliff swallow			x^	x^
Common raven		x^	x^	x^
Cordilleran flycatcher				x^*
Double-crested cormorant	x^			
Eurasian collared-dove	x^			
Gray flycatcher		x^*		
Great blue heron	x^			
Great egret	x^			
Great-tailed grackle	x^	x^		
Green heron	x^			
Green-tailed towhee			x^*	
House wren			x^	
Killdeer		x^		
Lesser goldfinch				x^
Lesser nighthawk	x^			
Lincoln's sparrow			x^*	
Lucy's warbler		x^		
Macgillivray's warbler			x^*	
Northern rough-winged swallow	x^			
Olive-sided flycatcher			x^*	
Orange-crowned warbler	x^*		x^*	x^*

Lower Colorado River Riparian Bird Surveys, 2012

Table 21.—Species detected but not confirmed breeding during intensive area searches at a subset of four habitat creation sites in 2012

(Species that were just observed flying over plots, but not landing in them, are identified with a ^. Species known to be only migrants through the lower Colorado River area are identified with a *. Incidental sightings that were not from inside or above the plot are not included. Listed in alphabetical order.)

Species	C152 (Beal B)	C213 (CRIT C)	C259 (CVCA 3C)	C251 (CVCA 3D)
Osprey		x^		
Phainopepla				x^
Red-winged blackbird	x^		x^	x^
Ruby-crowned kinglet			x^*	x^*
Savannah sparrow			x^*	
Swainson's hawk				x^*
Townsend's warbler		x^*		x^*
Tree swallow	x^*		x^*	x^*
Turkey vulture	x^	x^		
Unidentified <i>Empidonax</i> flycatcher		x^*		
Unknown yellow-rumped warbler	x^*	x^*		
Vaux's swift			x^*	
Warbling vireo			x^*	x^*
"Western" flycatcher	x^*		x^*	x^*
Western kingbird				x^
Western tanager		x^*	x^*	
Western wood-pewee	x^*			x^*
White-crowned sparrow	x^*	x^*	x^*	x^*
White-faced ibis	x^*	x^*		
White-winged dove	x^		x^	
Willow flycatcher ²	x^		x^	x^
Wilson's warbler	x^*	x^*	x^*	x^*
Yellow-rumped (Audubon's) warbler	x^*	x^*	x^*	x^*

¹ LCR MSCP covered species.

² Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated.

Lower Colorado River Riparian Bird Surveys, 2012

Table 22.—Estimated number of territories of covered species, by habitat-region combinations, based on system-wide surveys completed in 2012
(For details on strata definitions, see “Methods.” Regions 4 and 5 are combined here due to changes in the 2010 plots layer. Dashes indicate that no plots were surveyed in that habitat-region combination during 2012.)

Region	Habitat	Arizona bell's vireo	Sonoran yellow warbler	Gila woodpecker	Summer tanager	Gilded flicker	Vermilion flycatcher
5	Tall woody	15	15	0	0	0	0
5	Low woody	0	0	0	0	0	0
5	Herbaceous	–	–	–	–	–	–
5	Unsuitable	0	0	0	0	0	0
6	Tall woody	0	8	4	0	0	0
6	Low woody	0	0	0	0	0	0
6	Herbaceous	14	0	0	0	0	0
6	Unsuitable	–	–	–	–	–	–
7	Tall woody	36	124	15	23	0	0
7	Low woody	444	484	188	99	0	0
7	Herbaceous	–	–	–	–	–	–
7	Unsuitable	546	84	84	42	21	0
8	Tall woody	-	-	-	-	-	-
8	Low woody	0	0	35	0	0	0
8	Herbaceous	–	–	–	–	–	–
8	Unsuitable	0	0	0	0	0	0
10	Tall woody	–	–	–	–	–	–
10	Low woody	0	0	0	0	0	0
10	Herbaceous	–	–	–	–	–	–
10	Unsuitable	0	0	0	0	0	0
11	Tall woody	0	1	1	1	0	0
11	Low woody	10	0	59	20	0	0
11	Herbaceous	0	0	7	14	0	0
11	Unsuitable	–	–	–	–	–	–
12	Tall woody	0	0	3	0	0	0

Table 22.—Estimated number of territories of covered species, by habitat-region combinations, based on system-wide surveys completed in 2012
(For details on strata definitions, see “Methods.” Regions 4 and 5 are combined here due to changes in the 2010 plots layer. Dashes indicate that no plots were surveyed in that habitat-region combination during 2012.)

Region	Habitat	Arizona bell's vireo	Sonoran yellow warbler	Gila woodpecker	Summer tanager	Gilded flicker	Vermilion flycatcher
12	Low woody	0	0	0	0	0	0
12	Herbaceous	4	0	8	0	0	0
12	Unsuitable	0	0	0	0	0	0
	Total	1,069	717	402	199	21	0

As in previous years, we found that the Arizona bell’s vireo had the highest estimated population size system-wide of all covered species, and it occurred in 7 of the 22 habitat-region combinations surveyed. We recorded yellow warbler as the second most abundant of the covered species, occurring in six habitat-region combinations. Vermilion flycatcher and gilded flicker had the lowest population size estimates and also occurred in the lowest number of habitat-region combinations (zero and one, respectively), and the remaining covered species were moderately rare, with summer tanager in 6 and gila woodpecker in 10 habitat-region combinations. As in 2011, our surveys showed that Region 7 (Bill Williams River National Wildlife Refuge [NWR]) had the largest number of covered species of all system-wide regions, followed by Region 11 (Imperial NWR; see table 22).

For the 10 most abundant territorial species detected system-wide in 2012, we estimated population sizes using the same methods as for covered species. Based on our data, the most abundant species were common yellowthroat, song sparrow, and Abert’s towhee, with more than 11,000 territories estimated for each, followed by Lucy’s warbler, black-tailed gnatcatcher, and verdin (table 23). Red-winged blackbird, white-winged and mourning doves, European starling, Gambel’s quail, and brown-headed cowbird may have been even more numerous, but we did not include them in our analysis due to their relative lack of territoriality or clustered distribution. We determined that the 10 most abundant

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Table 23.—Estimated number of breeding pairs of 10 of the most abundant species breeding along the lower Colorado River, by habitat-region combination, based on system-wide surveys completed in 2012 (For details on strata definitions, see “Methods.” Regions 4 and 5 are combined here due to changes in the 2010 plots layer. Dashes indicate that no plots were surveyed in that habitat-region combination during 2012.)

Region	Habitat	Common yellowthroat	Song sparrow	Abert's towhee	Lucy's warbler	Black-tailed gnatcatcher	Verdin	Marsh wren	Yellow-breasted chat	Black-chinned hummingbird	Ash-throated flycatcher
5	Tall woody	28	36	0	22	9	10	1	9	0	3
5	Low woody	1,269	476	1,825	2,301	1,031	912	0	317	159	238
5	Herbaceous	–	–	–	–	–	–	–	–	–	–
5	Unsuitable	0	0	1,253	696	1,114	835	0	0	0	0
6	Tall woody	58	33	15	10	19	10	3	26	6	5
6	Low woody	329	376	549	675	549	110	596	376	63	157
6	Herbaceous	506	115	22	36	32	0	287	22	0	7
6	Unsuitable	–	–	–	–	–	–	–	–	–	–
7	Tall woody	141	536	40	41	9	20	0	303	12	14
7	Low woody	1,935	5,182	572	1,106	434	661	39	1,816	217	306
7	Herbaceous	–	–	–	–	–	–	–	–	–	–
7	Unsuitable	231	735	483	567	441	567	0	252	42	357
8	Tall woody	–	–	–	–	–	–	–	–	–	–
8	Low woody	105	0	840	928	1,103	385	0	0	140	298
8	Herbaceous	–	–	–	–	–	–	–	–	–	–
8	Unsuitable	502	0	1,255	0	502	1,380	0	0	1004	0
10	Tall woody	–	–	–	–	–	–	–	–	–	–
10	Low woody	797	399	2,745	3,100	2,834	886	0	266	664	620
10	Herbaceous	–	–	–	–	–	–	–	–	–	–
10	Unsuitable	1,425	110	0	0	0	0	2,111	82	0	0
11	Tall woody	24	13	4	1	3	7	4	3	0	1
11	Low woody	1,780	1,879	325	364	285	462	944	728	167	148
11	Herbaceous	669	195	21	14	7	21	1,170	98	21	14

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Table 23.—Estimated number of breeding pairs of 10 of the most abundant species breeding along the lower Colorado River, by habitat-region combination, based on system-wide surveys completed in 2012

(For details on strata definitions, see “Methods.” Regions 4 and 5 are combined here due to changes in the 2010 plots layer. Dashes indicate that no plots were surveyed in that habitat-region combination during 2012.)

Region	Habitat	Common yellowthroat	Song sparrow	Abert's towhee	Lucy's warbler	Black-tailed gnatcatcher	Verdin	Marsh wren	Yellow-breasted chat	Black-chinned hummingbird	Ash-throated flycatcher
11	Unsuitable	–	–	–	–	–	–	–	–	–	–
12	Tall woody	95	46	22	3	21	45	10	7	14	7
12	Low woody	1,004	897	619	513	534	1,217	0	85	278	171
12	Herbaceous	242	73	27	0	38	42	246	19	8	0
12	Unsuitable	1,979	677	573	0	208	1,198	0	313	313	156
	Total	13,121	11,778	11,189	10,375	9,175	8,770	5,412	4,722	3,106	2,500

riparian species were also relatively widespread throughout the project area, with detections in most habitat-region combinations, and especially throughout the low woody habitat stratum.

Habitat Creation Site Population Size Estimates

Based on DS analyses of our data from habitat creation site plots, we determined an overall detection ratio of 0.78 (SE = 0.117) for territorial riparian species. Of the four covered species detected in habitat creation sites, Sonoran yellow warbler was the most abundant, with an estimated total of 19 territories (table 24). This is in contrast to our results from the system-wide surveys, in which Arizona bell's vireo was the most abundant of the covered species. As in 2011, Abert's towhee, blue grosbeak, and common yellowthroat were the three most abundant of the non-covered territorial species, with more than 100 territories each in habitat creation sites (table 25).

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Table 24.—Estimated number of breeding pairs of covered species breeding in habitat creation sites along the lower Colorado River, by site, based on double-sampling surveys completed in 2012

(For details on habitat strata definitions, see “Methods.”)

Region	Habitat	Sonoran yellow warbler	Arizona bell's vireo	Vermilion flycatcher	Summer tanager
'Ahakhav Tribal Preserve	Low woody	0	0	1.93	0
'Ahakhav Tribal Preserve	Tall woody	0	0	3.22	0.97
Beal Lake Conservation Area	Low woody	–	–	–	–
Beal Lake Conservation Area	Tall woody	6.54	10.28	0	0.7
Cibola National Wildlife Refuge Unit 1	Low woody	0	0	0	0
Cibola National Wildlife Refuge Unit 1	Tall woody	3.86	1.29	0	0
Cibola Valley Conservation Area	Low woody	0	0	0	0
Cibola Valley Conservation Area	Tall woody	3.86	0	0	1.93
Palo Verde Ecological Reserve	Low woody	0	0	0	0
Palo Verde Ecological Reserve	Tall woody	5.15	0	0	0
	Total	19.41	11.57	5.15	3.6

Discussion

Species Richness Patterns

Upon review of the species lists and other survey results, Arizona bell’s vireo, Sonoran yellow warbler, and gila woodpecker continue to be regularly found throughout the project area, while the summer tanager and vermilion flycatcher remain uncommon breeders with a spotty distribution in the study area. We found that two types of sites continue to be hotspots for covered species: (1) the Bill Williams River region and (2) the habitat creation sites. While the habitat creation sites may not feature several species of old-growth riparian gallery forest, such as gila woodpecker and gilded flicker, we found that they are already attracting some species, such as summer tanager, ash-throated flycatcher, ladder-backed woodpecker, and Lucy’s warbler, that are associated with the mid-successional woodland habitats targeted by the LCR MSCP’s habitat creation efforts (attachment 4; also see “Results” for Component 1 above).

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Table 25.—Estimated number of breeding pairs of the most common riparian species breeding in habitat creation sites along the lower Colorado River, by habitat type, based on double-sampling surveys completed in 2012
(For details on habitat strata definitions, see “Methods.”)

Region	Habitat	Abert's towhee	Blue grosbeak	Common yellowthroat	Western kingbird	Song sparrow	Bullock's oriole	Verdin	Black-tailed gnatcatcher	Anna's hummingbird	Black-chinned hummingbird
'Ahakhav Tribal Preserve	Low woody	1.93	0	0	0	0	0.64	1.61	0.64	0.64	0
'Ahakhav Tribal Preserve	Tall woody	8.36	0	0	2.25	0	5.47	4.50	1.29	13.19	0.64
Beal Lake Conservation Area	Low woody	–	–	–	–	–	–	–	–	–	–
Beal Lake Conservation Area	Tall woody	9.35	0	6.78	0	0	1.40	2.80	7.24	3.74	0
Cibola National Wildlife Refuge Unit 1	Low woody	6.43	11.90	0	1.93	1.61	0	1.29	0	0.64	0
Cibola National Wildlife Refuge Unit 1	Tall woody	43.11	16.41	13.83	24.77	16.41	17.05	15.44	6.11	8.69	3.22
Cibola Valley Conservation Area	Low woody	37.32	16.73	6.76	1.93	0	1.61	8.36	14.80	0	0
Cibola Valley Conservation Area	Tall woody	41.50	19.63	1.61	28.31	5.15	13.83	3.54	3.22	2.57	10.94
Palo Verde Ecological Reserve	Low woody	7.72	12.55	31.21	4.18	4.50	1.61	0	2.57	0	1.29
Palo Verde Ecological Reserve	Tall woody	32.17	58.88	46.97	29.92	45.04	13.51	1.29	1.29	1.29	11.90
	Total	187.91	136.09	107.16	93.30	72.71	55.13	38.84	37.16	30.76	27.99

System-wide Surveys

Our population size estimates for several LCR MSCP covered species (Arizona bell's vireo and Sonoran yellow warbler) were overall slightly lower in 2012 than in 2011, which may be due to the random plot selection representing a lower proportion of their total population or environmental factors such as annual variation in migration arrival times, reproductive schedule, or population variation. Gila woodpecker and summer tanager population size estimates, on the other hand, were nearly the same in 2011 and 2012. Upon review of the 2010 plot delineation, most of the available system-wide survey plots fall into the low woody (55%) and unsuitable (40%) habitat categories, while few plots fall into the tall woody (3%) and herbaceous (2%) categories (see table 4). We believe that this reflects (or at least approximates) the true distribution of these habitat types in the LCR MSCP project area even though plots classified as one habitat type can also have small patches of other habitats. At the very least, we can conclude that large (> 5–10 ha) patches of tall woody are rare along the main stem of the river, which explains the relative rarity of “old-growth” bird species such as summer tanager and gilded flicker. Tall woodland-associated species such as Arizona bell's vireo and Sonoran yellow warbler also readily nest in riparian shrub habitats and, therefore, may fair better overall despite the relative lack of tall woodlands. Together, our findings suggest that big benefits can be achieved for covered species if cover by tall woodlands is increased overall through habitat creation.

Our system-wide surveys showed that the LCR corridor is occupied by a large diversity of breeding birds and migrants. Our protocols tend to err on the side of classifying a bird as a presumed non-breeder if insufficient evidence of nesting was found during the surveys, so our population estimates that are based on observed territory numbers need to be viewed as minimum breeding population size estimates.

Reflecting both the wide variety of habitat types and habitat quality present system-wide, we found abundances to be greatest in generalist species, such as mourning and white-winged doves, brown-headed cowbird, and great-tailed grackle (all of which were excluded from our population size estimates), as well as in riparian specialist species such as Abert's towhee, yellow-breasted chat, song sparrow, and common yellowthroat. The system-wide distribution of all covered species indicates that even the fairly common ones, Arizona bell's vireo and Sonoran yellow warbler, were clearly more abundant in some habitat-region combinations than in others. Based on general metapopulation dynamics, the more geographically connected and widespread subpopulations become, the greater local and regional stability is found in bird populations (Kuvlesky et al. 2007).

Unlike our surveys in previous years, the 2012 surveys resulted in one gilded flicker territory record. As we stated in previous annual reports, this species is currently very rare and likely absent from most riparian areas of the LCR. Where it occurred, we found their territory centers to be just outside the riparian corridor, and the territory detected in 2012 was no exception. One territorial individual was detected adjacent to the riparian corridor south of Alamo Dam off the Bill Williams River, leaving us, again, with the intriguing impression that the riparian habitats may play at least some role in their territory selection. Because this is a very rare species, we continue to recommend that survey techniques, such as call playback or species-specific opportunistic discovery surveys to increase detection rates, be explored along the entire project area. Also, targeting sites historically occupied by gilded flickers, as opposed to random locations on the river, may provide additional detections and a more complete understanding of the species' current status.

Habitat Creation Sites

This was the second year of implementing the double-sampling protocol at habitat creation sites of the LCR MSCP. Due to the large amount of habitat created by spring of 2012, survey coverage was switched to a sampling approach that included rapid and intensive area searches, mirroring the double-sampling approach used for system-wide surveys.

Similar to our findings for 2008–2011 (GBBO 2010, 2011), the habitat creation sites that were older than 2 years supported breeding populations of four of the six covered species: bell's vireo, yellow warbler, vermilion flycatcher and summer tanager. Gila woodpecker and gilded flicker were not detected in habitat creation sites most likely because the sites are still too young to produce sufficient numbers of trees that are large enough for woodpecker cavities or to produce enough decadent vegetation with snags. We believe that continued monitoring of the habitat creation sites will be particularly useful to determine whether or not populations of riparian bird species associated with old-growth forests can be restored, specifically given how uncommon tall woody vegetation is in the current landscape of the LCR.

In 2012, several old-growth associated species had at least partial territories in the habitat creation plots; for instance, we found ladder-backed woodpecker and ash-throated flycatcher territories in all five habitat creation sites in 2012. At Beal, we also recorded a partial territory of a brown-crested flycatcher pair. Other cavity nesters have begun to set up breeding territories in habitat creation sites, as well, with Lucy's warblers being a common breeder in all five sites.

We also recorded raptor species at habitat creation sites, including short-eared owl, white-tailed kite, and northern harrier, which were associated with the riparian shrub habitat type classified as low woody. We also observed great horned owl and barn owl breeding in some habitat creation sites.

In 2012, we also collected tree/shrub phenology data on a volunteer basis for the project. We believe that much of the bird breeding and migration timing and activity are a result of tree and shrub phenology. As part of the contracted work, we are already collecting valuable data on the migrants using the Colorado River system as a flyway and stopover location. Research has shown that neotropical migrants use visual cues to choose locations where they are likely to find food and shelter during stopovers. Vegetative phenology, including leaf out, flowering, and fruiting, may be a cue migrants use to predict food availability (i.e., insects). We collaborated with the National Phenology Network (NPN) Nature's Notebook program to collect data on common riparian trees and shrubs on all intensively surveyed plots (Components 1 and 3). Several desert riparian species were not part of the program, so we worked with NPN staff to add them to Nature's Notebook. We also collected phenology data on yellow warblers in an attempt to further examine effects of phenology on our survey results.

COMPONENT 3: TESTING THE ASSUMPTIONS OF THE DOUBLE-SAMPLING METHOD

Introduction

The double-sampling method that was developed for LCR MSCP riparian bird surveys (Bart et al. 2010; GBBO 2010) is based on three important assumptions:

- Random selection of intensive area search plots from the random set of rapid area search plots
- Uniformity in the implementation of rapid and intensive area searches
- Unbiased estimates of bird numbers during intensive area searches

There is no reason to doubt that the first two assumptions of random and uniform sampling are met in the current implementation of the LCR MSCP monitoring plan. The goal was therefore to test the third assumption that unbiased estimates of bird numbers are obtained during the intensive surveys. Factors that could bias these estimates, or may differentially affect detection probability during intensive area searches, include (see also Farnsworth et al. 2005):

- Secretive species that are difficult to detect
- Density of vegetation
- Density of birds

In order to quantify if, and how many, birds are missed during standard intensive surveys, we performed a third, even more intensive survey effort on a set of plots. For the purpose of this project, we refer to this approach as a “triple-sampling” or “enhanced intensive” method.

In 2012, we selected a set of triple-sampling plots that we surveyed with three different types of area searches within the field season: (1) the standard rapid area search, (2) the standard intensive area search, and (3) an enhanced intensive (EI) area search, which is described in more detail below. In brief, the EI area search allowed us significantly more time to devote to delineating territories and detecting less conspicuous individuals than is possible during our standard intensive area search. For each plot, we conducted these three types of area searches using three independent surveyors, with stringent controls established to ensure that no communication occurred between surveyors regarding their findings during the field season. After 3 years of data collection, we will compare the results of the three types of searches across multiple plots that exhibit variation in vegetation and population density. We will provide a quantitative estimate of the potential biases associated with our intensive and rapid area search methods, as well as determine biases associated with each species.

Using the triple-sampling method, we are also able to gather additional life history data for the four more common covered species, gila woodpecker, summer tanager, Arizona bell’s vireo, and Sonoran yellow warbler, as well as other riparian-obligate bird species. We have found that gilded flickers and vermilion flycatchers are present on very few, if any, LCR MSCP plots in a given year, and we may not generate enough data to include these two species in our final analysis.

The 3-year goals for this component of the project include the following:

- Evaluate the assumption that unbiased estimates are being obtained during intensive area searches
- Estimate the average error rate being made during intensive area search surveys and determine if differences in error rates exist between species or habitats
- Suggest improvements to the intensive area search survey methods to achieve higher accuracy, if any are needed

After 3 years of data collection, the following outputs can be generated:

- A quantitative assessment of the assumption that intensive area searches generate, to the best of our ability, unbiased estimates of bird numbers

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- A detection probability for standard intensive area searches for the four more common covered species, possibly for the two rarer covered species, and for additional riparian-obligate species
- Detailed suggestions to improve the double-sampling area search protocol to achieve greater accuracy
- Details on breeding phenology, territory use, and seasonal behaviors of high-priority species that will be valuable in refining riparian bird monitoring methods for the LCR MSCP project area, with regional applications

For this report, we conducted a preliminary data analysis using the 2012 data from rapid, intensive, and EI surveys to estimate any biases based on the second year of surveys.

Methods

Plot Selection

To select our triple-sampling plots, we used a new ArcGIS plot layer created in 2011. This new “EI layer” was based on the knowledge GBBO acquired during surveys and data analyses in previous years (2008–2010) regarding the actual distributions, areas of concentration, and habitat requirements of the covered species. This triple-sampling (EI) layer is comprised of some of the most difficult habitats to survey on the river that are composed of mostly tall woody vegetation and dense understory. Because the covered species are concentrated in these habitat types, the EI layer by no means represents the landscapes of much of the current LCR corridor.

Prior to EI plot selection, we divided the entire layer for EI plots into two strata that represented a “medium” and “hard” ranking for access and logistical difficulty. The layer does not have any “easy” plots. Plots were assigned to these two strata using aerial photography, habitat type, and our previous knowledge of the study area. To select triple-sampling plots in 2012, we first examined the eight plots already selected for intensive area searches as part of the system-wide monitoring effort in Component 1. If up to two of these plots were located in the new EI layer, they were automatically included in the triple-sampling effort. This was done to ensure that some random coverage of the entire LCR MSCP study area is associated with the Component 3 effort. Once we assigned two of the system-wide intensive plots to triple-sampling, we randomly selected additional plots for the triple-sampling effort from the EI layer (adding up to four in the “medium” and four in the “hard” categories, to reach a total of eight plots).

Because the selection of triple-sampling plots is not fully random for the system-wide sampling area, we did not use these plots for system-wide population size estimates and did not analyze them using the DS program. We only used them for testing the assumption of the double-sampling effort that unbiased counts can be achieved in standard intensive area searches. In addition, we added one plot selected in 2011 that was not surveyed that year, resulting in a total of nine EI plots surveyed in 2012. Attachments 6 and 7 present summaries of all plots selected for each of the project components, including the triple-sampling effort.

Survey Techniques

As in 2011, the triple-sampling plots received rapid, standard intensive, and EI area searches, using independent observers for each survey type on a given plot. Each of these surveyors conducted rapid and intensive area searches in other plots, and some surveyors conducted all three survey types to ensure consistency in survey methods. We further ensured that surveyors were alternated among survey types in order to reduce observer bias.

Survey methods used for this project component were the same as those used for the double-sampling component. For a given plot, the rapid, intensive, and EI observers were not allowed to communicate their findings for the entire course of the field season. No plot received more than one type of area search on a given day (i.e., there was never more than one surveyor on the plot per day). The surveys were scheduled as regularly as possible given the constraints of our field season, with rapid surveys occurring once in the first month of the season and again in the second month, intensive surveys were approximately once a week for 8 weeks (8 visits), and EI surveys were approximately twice a week for 8 weeks (16 visits).

For the EI area searches, we delineated every territory within a plot with the highest level of precision possible. On each visit, the surveyor recorded one or multiple bird locations of all observed individuals. Similar to the standard intensive surveys, an individual/pair was classified as a breeder if the individual or pair was seen exhibiting some breeding behavior for 3 consecutive weeks or if the individual or pair was observed in the same territory on at least six consecutive visits. These extra days allowed the surveyor to range outside the plot boundary for better territory delineation, focus on particular birds or species that have territories that are difficult to determine (such as gila woodpecker and summer tanager), map multiple singing perches, and make any other adjustments to ensure that all bird territories fully or partially located within the plot were completely delineated. As with other area searches, we were limited by the amount of time that birds were active on a given day (mornings until it got very hot). In densely vegetated plots, surveyors were limited to identifying and mapping mostly by sound. Overall, the methods for all area search efforts in this project are similar, but increasingly more mapping time is spent by standard intensive and EI surveyors.

Data Analysis

All EI data were entered into an Access database that was created by Reclamation in 2012. The data were entered using the same data standards described in Component 1. We processed the data in task-specific triple-sampling Excel data sheets and Access queries created for this project component.

We compared the EI data to the standard intensive area search data collected on the same plots to calculate species-specific estimates of the error rates associated with standard intensive area searches. We calculated the ratio of the average number of territories determined by the intensive surveyor compared to the average number of territories determined by the EI surveyor at the end of the season. We also conducted a paired t-test comparing the number of territories, by species, among the standard intensive and EI data to determine whether any differences were statistically significant. The goal of these analyses was to determine whether the additional visits during EI surveys resulted in a different estimate of absolute breeding densities.

In addition to examining overall detection rates with EI data (see table 24), we also examined the change in detected territories throughout the survey season for all three survey types in greater detail. For this, we plotted the number of territories detected during each individual visit (for each of 2 rapid, 8 standard intensive, and 16 EI visits) and the final number of territories reported by each survey type with number of days into the survey season, starting with April 2, 2012. This additional analysis was done for two covered species, the summer tanager and yellow warbler, and for one of the most common riparian-obligate species, the song sparrow.

Results

The percentages presented in this section as detection ratios are the ratio of the average total number of territories reported by the standard intensive surveyor over that reported by the EI surveyor. If the percentage is 100%, it means that standard intensive and EI surveyors obtained the same average number of territories in EI plots in 2012. If the percentage is less than 100%, then the standard intensive survey missed some of the territories that the EI survey detected. If the percentage is greater than 100%, then the standard intensive surveys recorded more breeding territories than the EI surveys could confirm.

The results of the triple-sampling effort varied by species (see tables 23 and 24). Several species showed relatively low discrepancies (75–100%) between EI and standard intensive area searches, including the covered species Sonoran yellow warbler, Arizona bell's vireo, and gila woodpecker, as well as several of the common riparian species, including yellow-breasted chat, black-tailed gnatcatcher, verdin, Bewick's wren, Lucy's warbler, Abert's towhee, and Bullock's oriole. Cryptic species had low detection rates (< 50%) when

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comparing the two methods, including lesser nighthawk and black rail. Some flycatcher species, including western kingbird and ash-throated flycatcher, were overestimated during standard intensive surveys (> 120%) (table 26).

Table 26.—Two-tailed t-test results comparing enhanced and standard intensive results of territory estimates for territorial breeding species found in at least two of the EI plots in 2012, using 0.01 confidence intervals

(The mean is the average number of breeding territories, by species, in the intensive (INT) and EI plots where the species was detected as a breeder. Observation is the sample size of plots, out of nine total in 2012, in which the species was observed breeding by both the intensive and EI surveyors. Alpha was set at 10% or 0.01.)

Species	Survey type	Mean	SD	Observations (Plots)	P (T ≤ t) two-tailed	t critical two-tailed
Abert's towhee	EI	3.03	1.89	9	1	3.36
	INT	3.03	2.08	9		
American coot	EI	0.13	0.18	2	0.26	63.66
	INT	1	0.71	2		
Anna's hummingbird	EI	1.67	1.25	6	0.94	4.03
	INT	1.71	1.86	6		
Arizona bell's vireo	EI	3.25	3.03	4	0.84	5.84
	INT	3.19	2.54	4		
Ash-throated flycatcher	EI	1.06	0.56	8	0.17	3.5
	INT	1.47	0.65	8		
Bewick's wren	EI	8.56	4.71	4	0.58	5.84
	INT	7.56	5.43	4		
Black-chinned hummingbird	EI	1.47	1.28	8	0.76	3.5
	INT	1.31	1.19	8		
Black-tailed gnatcatcher	EI	2.39	1.57	7	0.37	3.71
	INT	1.79	0.83	7		
Blue grosbeak	EI	0.75	0.71	7	1	3.71
	INT	0.75	0.69	7		
Brown-crested flycatcher	EI	0.69	0.55	4	0.9	5.84
	INT	0.63	1.09	4		
Bullock's oriole	EI	0.92	1.01	6	1	4.03
	INT	0.92	0.56	6		
California black rail	EI	2.5	2.35	4	0.26	5.84
	INT	0.94	0.77	4		
Canyon wren	EI	0.25	0.35	2	0.5	63.66
	INT	0.75	0.35	2		
Common yellowthroat	EI	8.08	7	9	0.09	3.36
	INT	5.67	4.47	9		

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Table 26.—Two-tailed t-test results comparing enhanced and standard intensive results of territory estimates for territorial breeding species found in at least two of the EI plots in 2012, using 0.01 confidence intervals

(The mean is the average number of breeding territories, by species, in the intensive (INT) and EI plots where the species was detected as a breeder. Observation is the sample size of plots, out of nine total in 2012, in which the species was observed breeding by both the intensive and EI surveyors. Alpha was set at 10% or 0.01.)

Species	Survey type	Mean	SD	Observations (Plots)	P (T ≤ t) two-tailed	t critical two-tailed
Crissal thrasher	EI	0.75	0.61	4	0.51	5.84
	INT	0.5	0.35	4		
Gila woodpecker	EI	0.89	0.56	7	0.51	3.71
	INT	0.79	0.47	7		
Green heron	EI	0.31	0.38	4	0.55	5.84
	INT	0.56	0.43	4		
Ladder-backed woodpecker	EI	0.97	0.38	9	0.32	3.36
	INT	1.19	0.73	9		
Lesser goldfinch	EI	1.83	2.55	3	0.51	9.92
	INT	0.92	0.88	3		
Lesser nighthawk	EI	0.63	0.53	2	0.3	63.66
	INT	0.13	0.18	2		
Lucy's warbler	EI	3.33	2.39	6	0.87	4.03
	INT	3.13	2.18	6		
Song sparrow	EI	23.46	27.77	7	0.32	3.71
	INT	16.43	16.89	7		
Sonoran yellow warbler	EI	8.1	9.86	5	0.62	4.6
	INT	6.75	5.94	5		
Summer tanager	EI	1.33	0.88	6	0.14	4.03
	INT	0.96	0.58	6		
Verdin	EI	3.43	2.63	7	0.31	3.71
	INT	2.86	2.57	7		
Virginia rail	EI	3.88	0.18	2	0.34	63.66
	INT	2	1.41	2		
Western kingbird	EI	1.88	1.59	2	0.91	63.66
	INT	2	2.83	2		
Yellow-breasted chat	EI	8.69	9.04	8	0.45	3.5
	INT	6.91	6.43	8		

In 2012, we also began to analyze the triple-sampling data by calculating mean, variance, and standard deviation by species between the standard intensive and EI data and by performing a paired t-test. No significant differences in detection rates among the two survey methods were found for any of the tested species using a 99% confidence level or $\alpha = 0.01$ (table 27).

Finally, we also examined seasonal effects on the number of territories reported by each survey type. On figure 1, we show the summer tanager results from the three survey types on plot #8223. The results show that the EI surveyor reported consistent numbers of breeding summer tanagers throughout the survey season when they were detected. The surveyor conducting standard intensive area searches reported breeding pair numbers that varied more than the EI surveyor's throughout the season, but both surveyors reported the same number of final breeding territories at the end of the season. In addition, both intensive and EI surveyors documented the arrival of summer tanagers on the plot within 2 days of each other. The surveyor conducting rapid area searches did not detect summer tanagers on their first survey early in the season (although the species had likely just arrived on the plot), but he/she detected the same number of breeding pairs on the second visit as did the EI surveyor throughout most of the season. The zero entry for the rapid area search total number of territories at the end of the season was a result of our conservative guidelines for determining breeding status in rapid area searches (see "Methods").

In the second example, we examined results from the three survey methods for yellow warbler in plot #8223 (figure 2). Yellow warblers are present in significant numbers for both breeding and migration stopover throughout the study area. Migrating yellow warblers, like breeding pairs, are known to sing, defend territories, and copulate during migration stopovers. It is therefore nearly impossible to tell a migrant from a breeder early in the season (April and early May) unless breeding evidence is observed at that time. We thus rely on repeated surveys of individuals maintaining a territory for weeks at a time as well as confirmed breeding evidence such as nest building, food carrying, or dependent young to classify a breeding pair.

In our analysis, the EI surveyor reported a low number of yellow warbler breeding pairs early in the season and increasing numbers in the first month that then leveled out in the second month of surveys (figure 2). The standard intensive surveyor reported consistent territory numbers during the first 2 months and a drop in the last month similar to that reported by the EI surveyor. The rapid area search surveyor reported lower numbers than either intensive method in both rapid surveys, but ultimately reported a similar total number of territories at the end of the season compared with the intensive surveyor.

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Table 27.—Ratio of the average number of territories determined by intensive area searches compared to the average number of territories determined by enhanced intensive area searches at the end of the season, 2011 and 2012
(Species in alphabetical order)

Species	Percentage of territories detected on intensive surveys that were also detected on EI surveys 2011	Percentage of territories detected on intensive surveys that were also detected on EI surveys 2012
Abert's towhee	73	100
American coot	80	800
Anna's hummingbird	143	103
Arizona bell's vireo ¹	85	98
Ash-throated flycatcher	146	138
Bewick's wren	123	88
Black phoebe	100	No data
California black rail ¹	57	38
Black-chinned hummingbird	89	89
Black-tailed gnatcatcher	89	75
Blue grosbeak	117	100
Brown-crested flycatcher	132	91
Bullock's oriole	91	100
Canyon wren	120	300
Common yellowthroat	75	70
Crissal thrasher	47	67
Elf owl	No data	200
Gila woodpecker ¹	75	88
Great blue heron	No data	300
Great egret	No data	500
Great horned owl	100	No data
Green heron	No data	180
Ladder-backed woodpecker	75	123
Lawrence's goldfinch	50	No data
Least bittern ¹	20	No data
Lesser goldfinch	54	50
Lesser nighthawk	67	20
Lucy's warbler	72	94
Marsh wren	33	58
Phainopepla	143	74
Pied-billed grebe	40	100
Song sparrow	98	70
Sonoran yellow warbler ¹	78	83
Summer tanager ¹	48	72
Verdin	68	83
Vermilion flycatcher ¹	163	No data
Virginia rail	100	52
Western kingbird	106	120
Yellow-breasted chat	76	79
Yuma clapper rail ¹	200	100

¹ LCR MSCP covered species.

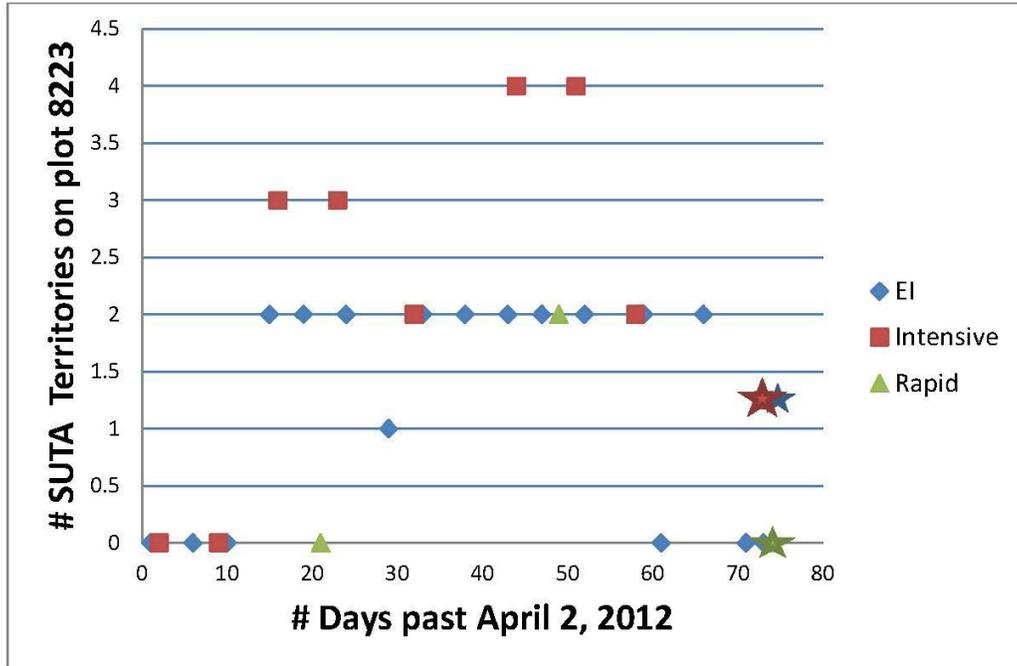


Figure 1.—Comparison of estimated numbers of summer tanager territories using three different survey methods (rapid, standard intensive, enhanced intensive area searches) on plot #8223 in 2012.

(The colored star signifies the final number of breeding territories determined by each survey effort at the end of the season. In some cases, the final number of territories is higher than individual surveys numbers because not all territories were detected on each individual survey.)

In our last example, the song sparrow, varying numbers of territories were recorded on plot #2861 by all three surveyors early in the season (figure 3). The EI surveyor reported, similar to the previous examples, consistent territory numbers detected per survey throughout the season. The standard intensive surveyor also became relatively consistent in the reported number of territories per survey throughout the season after the first few surveys. The rapid surveyor reported consistently higher numbers of territories on both surveys, resulting in a higher final territory estimate at the end of the season. The very high breeding densities of song sparrows in our study area (as many as 20 pairs using a 300 m x 300 m plot) creates very difficult survey conditions for any surveyor, which suggests that very high-density breeding populations need more intensive methods than moderate-density populations.

Discussion

For Component 3 of the project, we presented preliminary results based on the second year of a 3-year study. As the first 2 years of data indicate, the results

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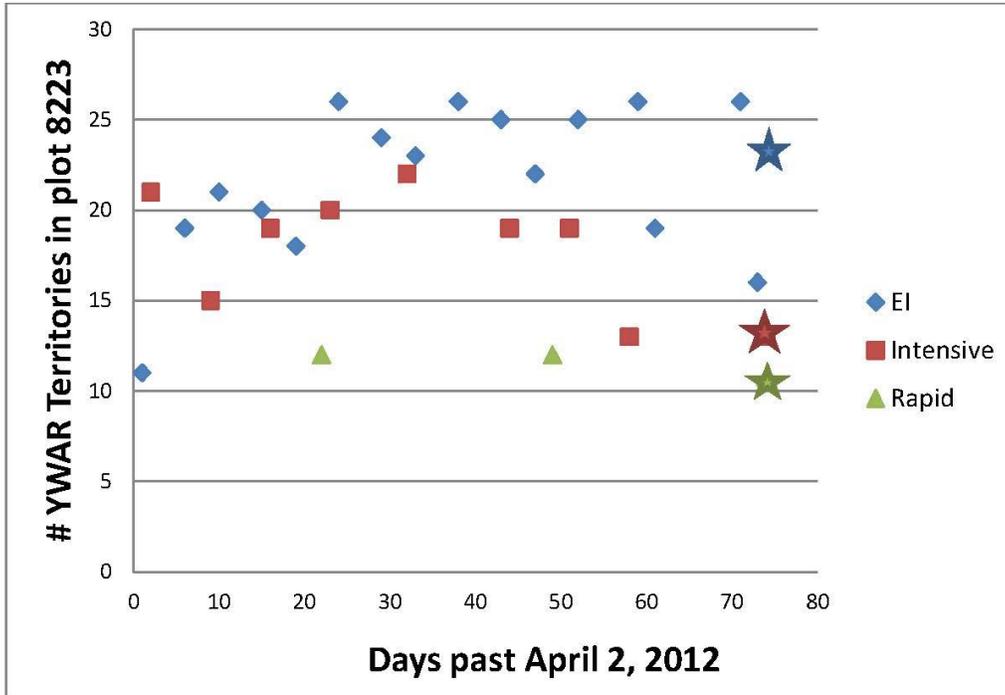


Figure 2.—Comparison of estimated numbers of Sonoran yellow warbler territories using three different survey methods (rapid, standard intensive, enhanced intensive area searches) in plot #8223 in 2012.
 (The colored star signifies the final number of breeding territories determined by each survey effort at the end of the season. In some cases, the final number of territories is higher than individual surveys numbers because not all territories were detected on each individual survey.)

appear to be somewhat sensitive to variation among years and sample sizes, and thus, we expect for these results to be preliminary until we add data from the last year and analyze all years together.

The second year of triple-sampling plots indicated higher concentrations of covered species in the 2012 plots than in the 2011 plots. When taking the data from the first 2 years of triple-sampling for 40 species, then 33% (compared to 43% in 2011) of the 40 species had detection ratios that fell within 20% (above or below) of 100% detection when comparing the EI surveys to standard intensive surveys (see table 27). Many species were detected at similar rates using the EI and standard intensive methods, including Sonoran yellow warbler, gila woodpecker, black-chinned hummingbird, Arizona bell’s vireo, blue grosbeak, and Bullock’s oriole (see table 24). Some of the species with the greatest discrepancies between standard intensive and EI survey methods included secretive marshbirds and waterbirds, such as black and Virginia rails and American coot, and the crepuscular lesser nighthawk. If these species were

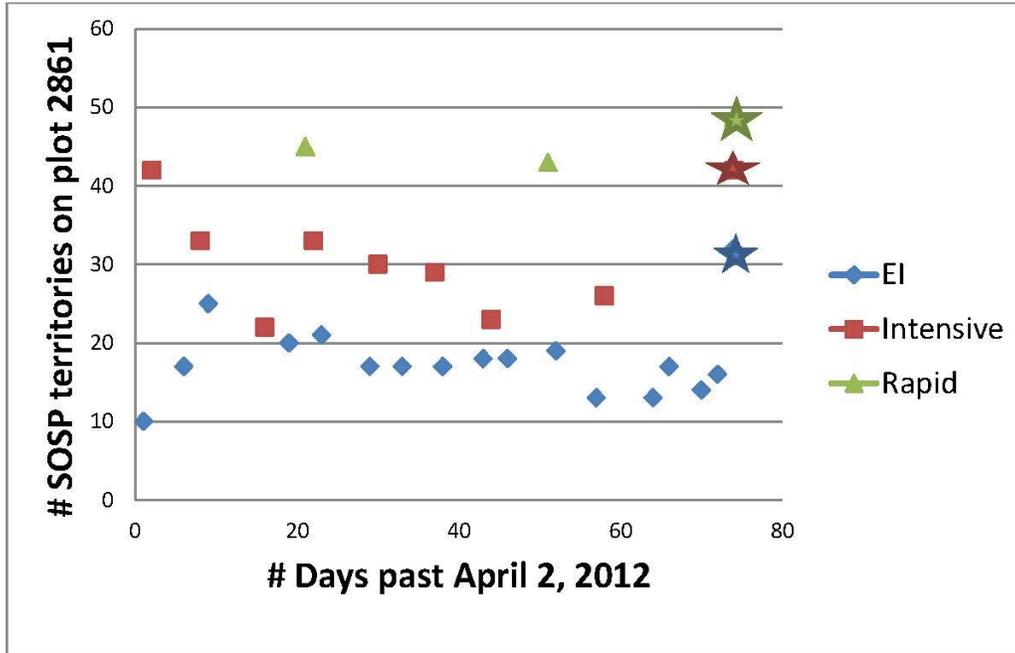


Figure 3.—Comparison of estimated numbers of song sparrow territories using three different survey methods (rapid, standard intensive, enhanced intensive area searches) in plot #2861 in 2012.

(The colored star signifies the final number of breeding territories determined by each survey effort at the end of the season. In some cases, the final number of territories is higher than individual surveys numbers because not all territories were detected on each individual survey.)

focal species, they would likely be surveyed using field protocols specifically designed to detect their presence, which are different from the field methods used in this project that target diurnal, territorial landbirds.

The landbirds with the greatest discrepancies among the results of the two intensive methods included species such as lesser goldfinch, marsh wren, canyon wren, and several species of flycatchers (see table 26). This suggests that the triple-sampling effort is an important element for refining detection ratio estimates for certain landbirds. The reasons for such discrepancies are likely related to (1) migration status of the species and individuals present in the plot, (2) species-specific territorial habits and singing phenology, or (3) habitat use patterns that make them particularly difficult species for territory delineation. For instance, marsh wrens are affected by water levels because their nests are built just above the water. Entire plots of marsh habitat may come and go over several days with fluctuating water levels, so depending on the timing of a given survey, marsh wrens may be challenging to detect. Crissal thrashers also continue to be challenging because they are among the earliest of breeders and therefore likely to be less vocal during our surveys, and they have relatively large territories that are difficult to map in dense vegetation cover. Finally, because thrashers are usually

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present in low numbers, an error that might only affect a half-territory on a plot may be enough to cause a significant difference between the two survey types.

In 2011, we saw large discrepancies between the two intensive survey methods in early breeders and local residents such as crissal thrasher, goldfinches, verdin, Lucy's warbler, and marsh wren. These species also often attempt multiple nests in one breeding season, which may already be underway by the time the regular landbird breeding surveys begin. Such species are difficult to fully address in a multi-species monitoring program that is designed to capture the majority of landbird populations, which nest after mid-April in this region. In an attempt to better cover these early-nesting species, we started surveys in early April instead of mid-April in 2012. We found that the EI and standard intensive area searches produced similar numbers of breeding territories for crissal thrashers, Lucy's warblers, marsh wrens, and verdin this year, where their breeding season was better captured than previously (see table 24). The continuing challenge of a long-term landbird monitoring program will be to optimize data collection for the species that are of greatest interest to population monitoring, while estimating the sources of errors for these and all lower-priority species that are also monitored as part of a multi-species protocol.

Another change that we made in 2012 was to use the information from last year's effort to improve pre-season field crew training. In particular, we improved our survey and training methods for summer tanagers, which standard intensive area searches tended to underestimate, and for flycatchers, which tended to be overestimated. Summer tanagers are known to vocalize only during early stages of mating and nesting, and they are mostly silent during incubation and brood-rearing. In the middle of their nesting season, they are therefore difficult to detect in plots with very dense vegetation because visual detection and the ability to follow individuals and closely examine potential nesting trees are compromised. Summer tanagers are also rare enough in the project area that even a moderate number of overlooked territories may result in a significantly lower population estimate than true population size. In hopes of improving detections of summer tanagers by our field crew, we emphasized their specific natural history pattern during crew training and added practice in songs, calls, and chip notes of male and female summer tanagers. We also encouraged surveyors to spend additional time mapping the territories of this species. We attribute the increasingly similar results of EI and standard intensive surveys in 2012 to these refinements in training methods.

Several species of flycatchers, including ash-throated flycatcher, brown-crested flycatcher, and western kingbird, were overestimated by standard intensive area searches when compared to EI area searches (see table 27). We used this information in crew training to further stress the importance of accurate mapping and territory delineation of these species. We know that these flycatchers have large territories, and individuals are often difficult to track through plots due to dense vegetation. In addition to more intensive crew training, the field crew

supervisor reviewed each surveyor's data in the first few weeks of the field season and addressed any evidence of overestimation of these species in first-time surveyors with additional training. Despite these efforts, we saw improvement only in brown-crested flycatcher detection rates in 2012 when comparing the two intensive methods (see table 27). We will continue to explore ways to improve surveying for these species during the third year of this study.

As discussed in GBBO (2011), the plots selected for the triple-sampling effort were originally some of the most challenging plots we usually survey, and they are not representative of most of the LCR MSCP project area. This was done in order to increase survey coverage for covered species, which tend to occur in their highest concentrations in plots that are very difficult to survey. Therefore, we attributed much of the discrepancies between the intensive survey and EI survey types to the inherent logistical difficulties of surveying very difficult plots. For instance, the detection ratios reported for the system-wide bird monitoring component of the project showed very little discrepancy between rapid and intensive surveys at habitat creation sites, which are easy to thoroughly cover during area searches. A larger discrepancy between rapid and intensive area searches was reported in system-wide surveys, which typically consist of plots with varying difficulties. We therefore suspect that the triple-sampling effort may have shown extreme results in the first year of data collection because these plots featured extremely dense vegetation and thus overall lower detection rates than average LCR MSCP plots. We anticipate that this method will show greater similarity in results between the two intensive survey methods in the relatively open habitat types that predominate most of the riparian corridor of the Colorado River.

In 2013, after analyzing the third year of triple-sampling surveys and combining all three years into a comprehensive analysis, we will develop recommendations about modifications to the double-sampling method that will further improve the effectiveness and efficiency of the LCR MSCP Riparian Bird Survey Project. When planning for the future of this bird monitoring, our recommendations will need to be considered along with logistics, funding, timing, and other factors. We will also compare the "medium" and "hard" EI plots to see if detections were significantly different between those two strata.

LITERATURE CITED

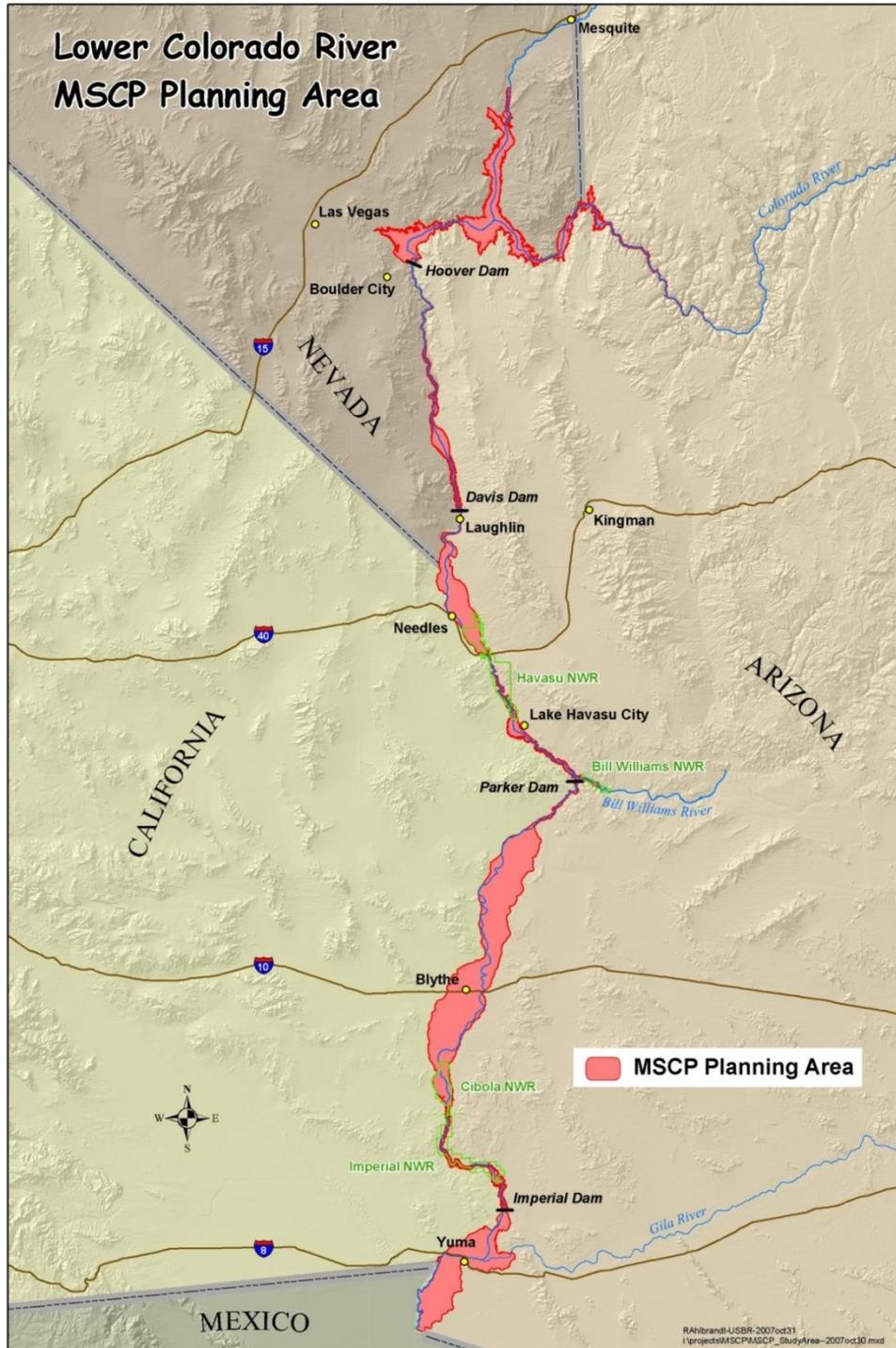
- Anderson, B.W. and R.D. Ohmart. 1976. Vegetation type maps of the lower Colorado River from Davis Dam to the southerly international boundary: U.S. Department of the Interior, Bureau of Reclamation, Boulder City, Nevada.
- Bart, J. 2007. Lower Colorado River Riparian Bird Surveys. Unpublished report submitted to the Bureau of Reclamation, Lower Colorado Region, May 2008.
- Bart, J. and S.L. Earnst. 2002. Double sampling to estimate density and population trends in birds. *Auk* 119:36–45.
- Bart, J. and A. Manning. 2008. Lower Colorado River Riparian Bird Surveys 2007. Unpublished report submitted to the Bureau of Reclamation, Lower Colorado Region, May 2008.
- Bart, J. and D. Hartley. 2010. DS - software for analyzing data collected using double-sampling: User manual for program DS. In review.
- Bart, J., L. Dunn, and A. Leist. 2010. A sampling plan for riparian birds of the Lower Colorado River—Final Report: U.S. Geological Survey Open-File Report 2010–1158. 20 p.
- Bibby, C.J., N.D. Burgess, D.A. Hill, and S.H. Mustoe. 2000. *Bird Census Techniques*, 2nd ed. Academic Press, London.
- Bureau of Reclamation. 2006. Lower Colorado River Multi-Species Conservation Program. <http://www.lcrmscp.gov>
- _____. 2008. Species Accounts for the lower Colorado River Multi-Species Conservation Program. http://www.lcrmscp.gov/reports/2008/species_accounts_sep08.pdf
- Farnsworth, George L, J.D. Nichols, J.R. Sauer, S.G. Fancy, K.H. Pollock, S.A. Shriner and T.R. Simons. 2005. *Statistical Approaches to the Analysis of Point Count Data: A little extra information can go a long way*. USDA Forest Service Gen. Tech. Rep. PSW-GTR-191.
- Great Basin Bird Observatory (GBBO). 2008. Annual report on the Lower Colorado River riparian bird surveys. Unpublished report submitted to the Bureau of Reclamation, Lower Colorado Region, October 2008.

- _____. 2009. Annual report on the lower Colorado River riparian bird surveys. Unpublished report submitted to the Bureau of Reclamation, Lower Colorado Region, October 2009.
- _____. 2010. Summary report on the Lower Colorado River Riparian Bird Surveys, 2008–2010. Unpublished report submitted to the Bureau of Reclamation, Lower Colorado Region, December 2010.
- Halterman, M.D., E.T. Rose, S.E. McNeil, and D. Tracy. 2009. Yellow-billed Cuckoo distribution, abundance and habitat use on the lower Colorado River and tributaries, 2008 annual report. Bureau of Reclamation, Lower Colorado River Multi-Species Conservation Program, Boulder City, NV.
- Kuvlesky, W.P., Jr., L.A. Brennan, B.M. Ballard, and T.M. Langschied. 2007. Avian Ecology at the Landscape Scale in South Texas: Applying Metapopulation Theory to Grassland Bird Conservation. *In: Wildlife Science: linking ecological theory and management implications.* T.E. Fulbright and D. G. Hewitt (eds). Boca Raton, Taylor and Francis:21–42.
- McLeod, M.A. and T.J. Koronkiewicz. 2010. Southwestern willow flycatcher surveys, demography, and ecology along the Lower Colorado River and tributaries, 2009. Annual report submitted to the Bureau of Reclamation, Boulder city, NV, by SWCA Environmental Consultants, Flagstaff, AZ. 165 p.
- Thompson, W.L. 2002. Towards reliable bird surveys: accounting for individuals present but not detected. *Auk* 119:18–25.

ATTACHMENT 1

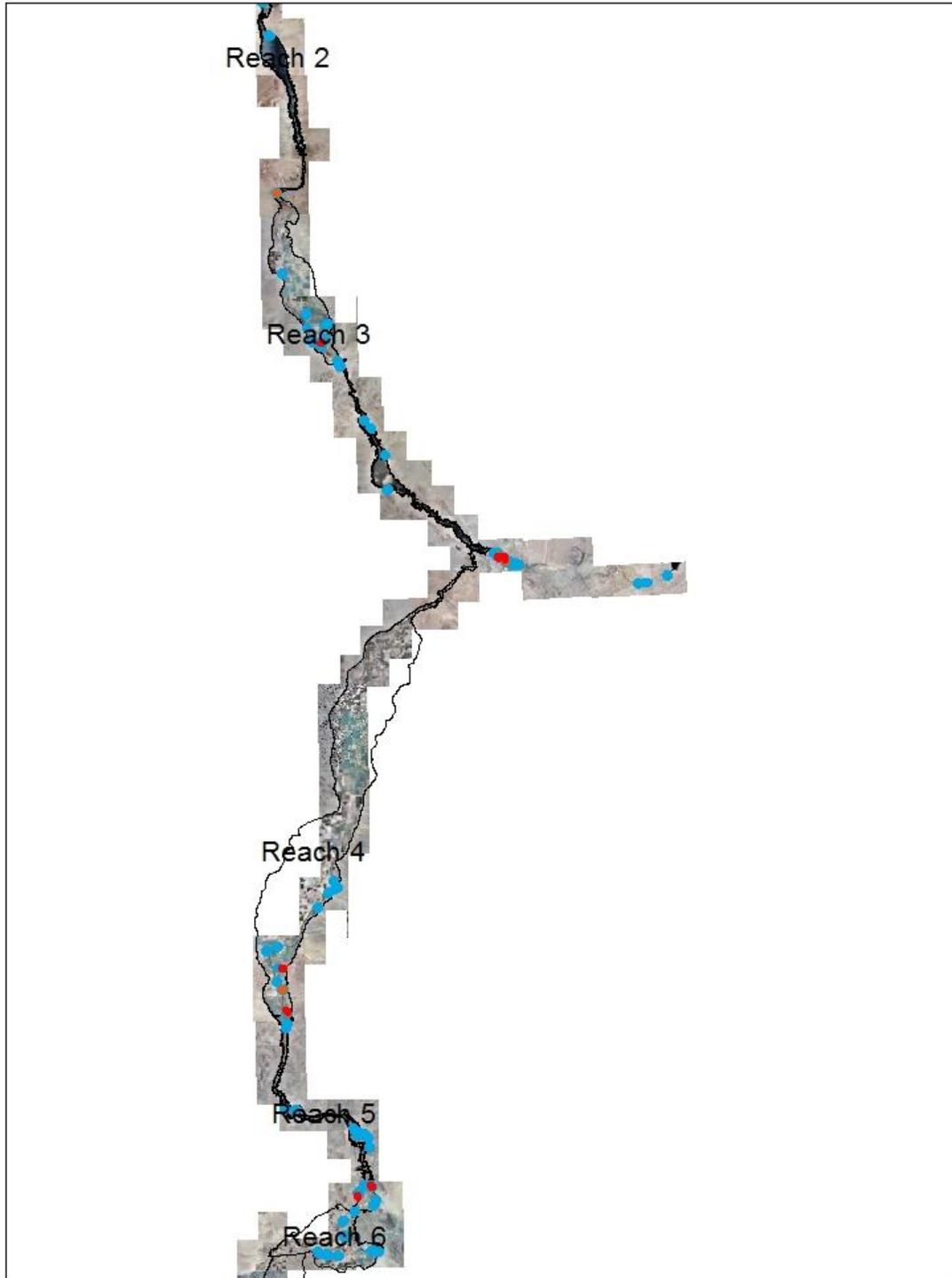
System-wide and Habitat Creation Plot Maps, 2012

Attachment 1a



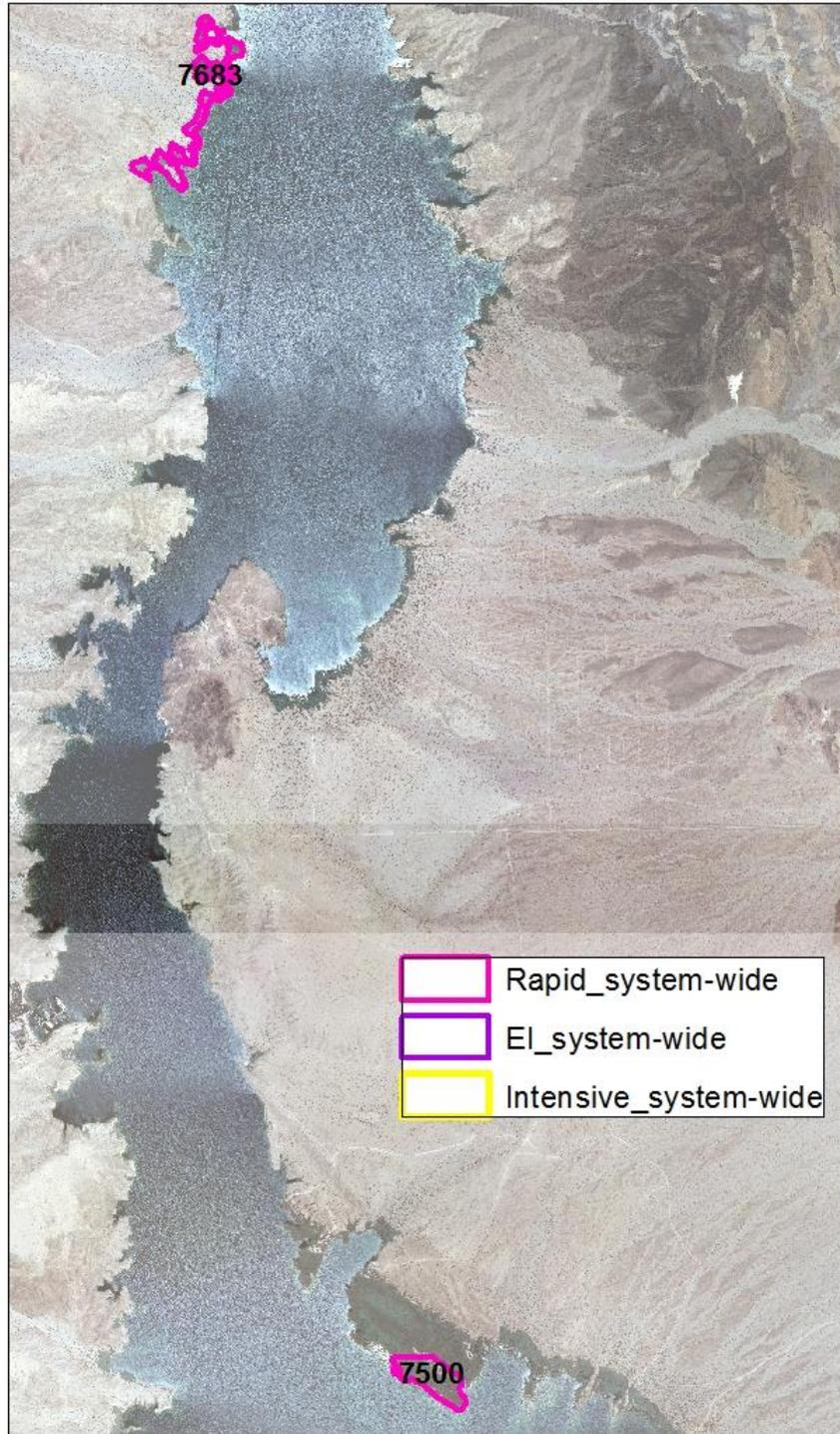
Map of the Lower Colorado River Multi-Species Conservation Program study area for system-wide bird surveys (in pink). Map provided by the Bureau of Reclamation, Lower Colorado River Region.

Attachment 1b



Overview of system-wide plots surveyed in 2011 (rapid plots in pink, intensive plots in purple, and enhanced intensive plots in blue) with the Lower Colorado River Multi-Species Conservation Program reach boundary layer (reach boundary provided by the Bureau of Reclamation, Lower Colorado River Region, 2002).

Attachment 1c



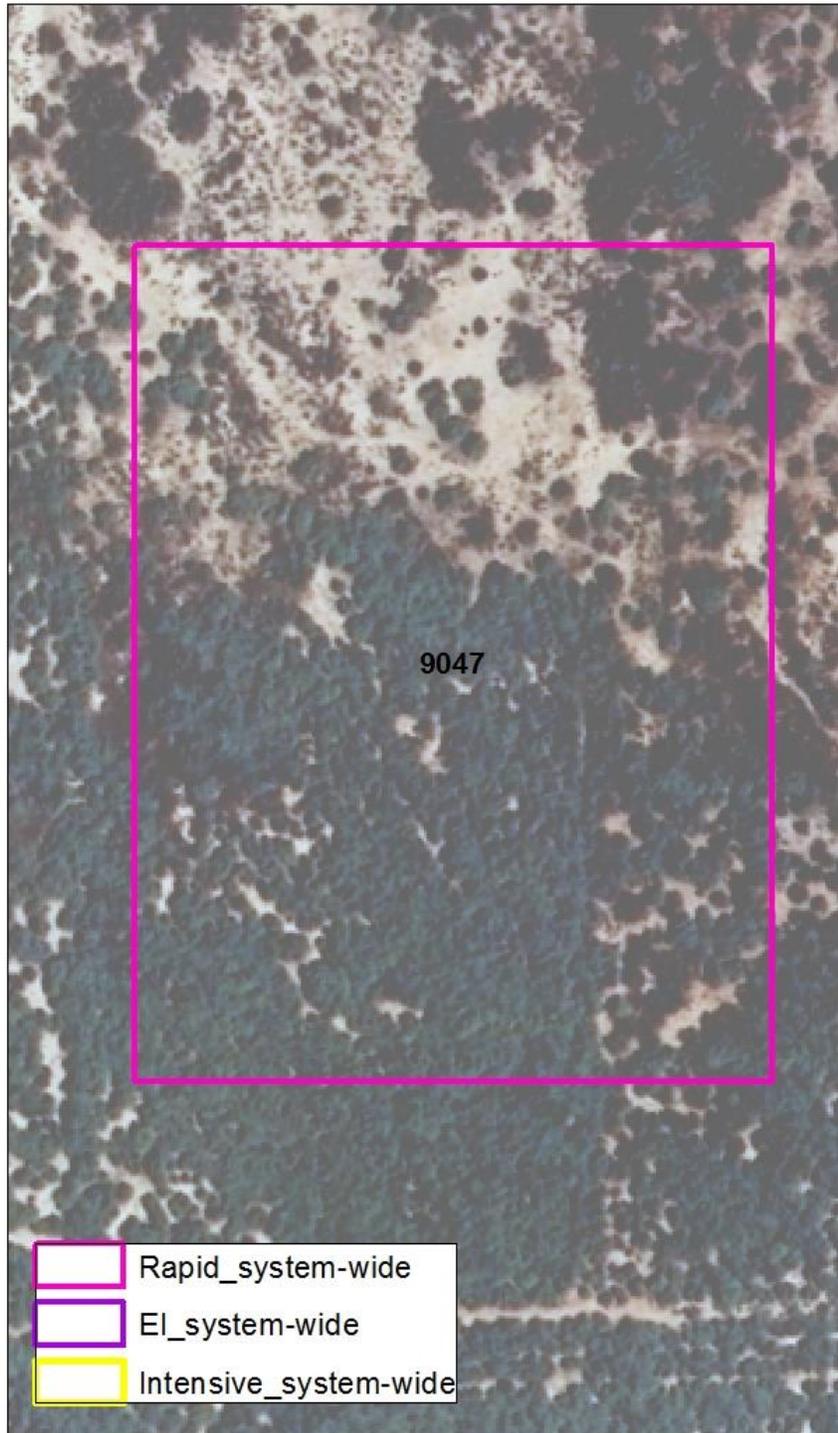
Regional map of system-wide plots surveyed in 2012: Region 5 North (Davis Dam to Bill Williams River [excluding Havasu National Wildlife Refuge]) Lake Mohave plots. Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1d



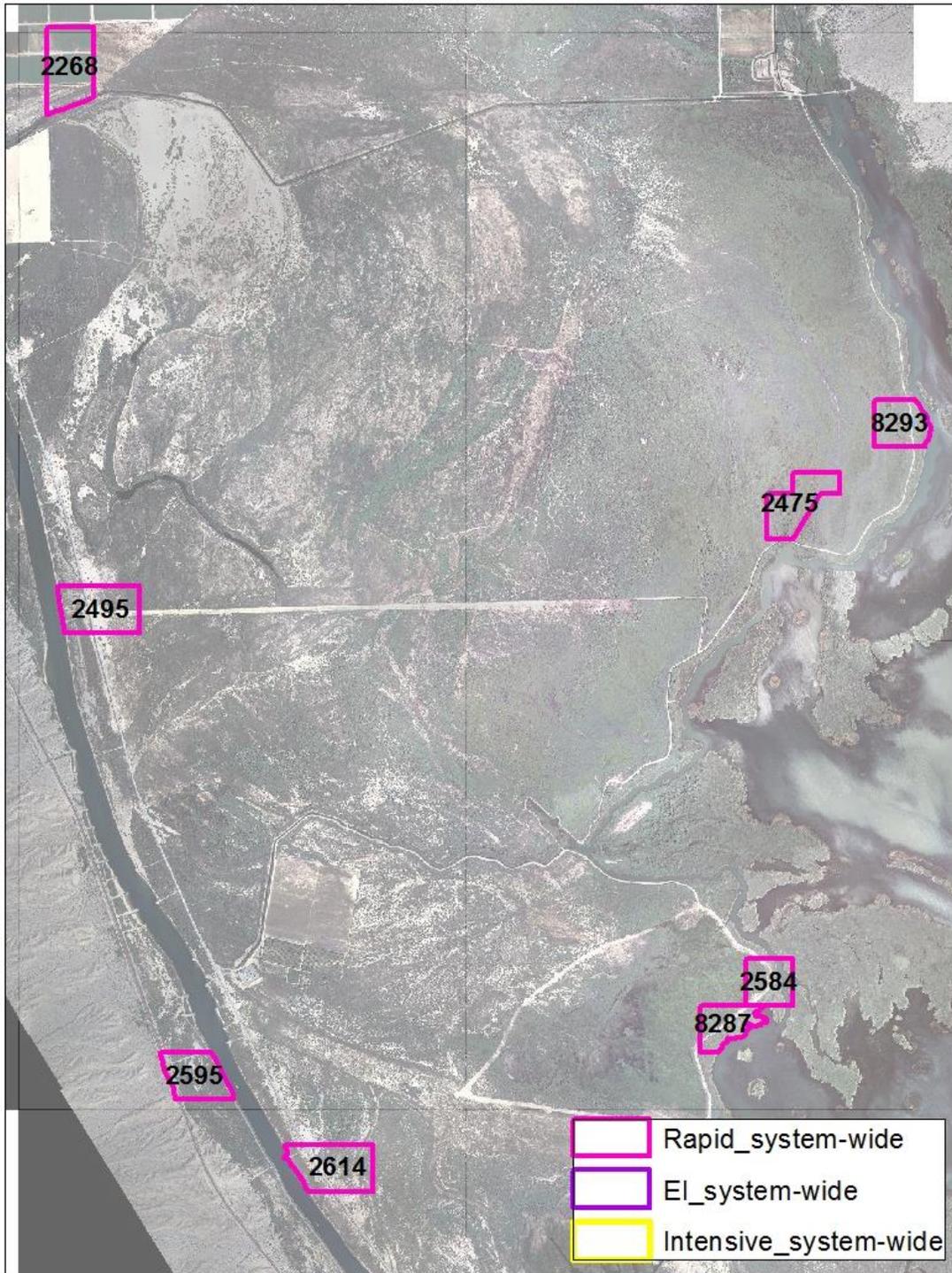
Regional map of system-wide plots surveyed in 2012: Region 5 North (Davis Dam to Bill Williams River [excluding Havasu National Wildlife Refuge]) Big Bend State Park plot. Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1e



Regional map of system-wide plots surveyed in 2012: Region 5 North (Davis Dam to Bill Williams River [excluding Havasu National Wildlife Refuge]) Ft. Mohave plot. Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1f



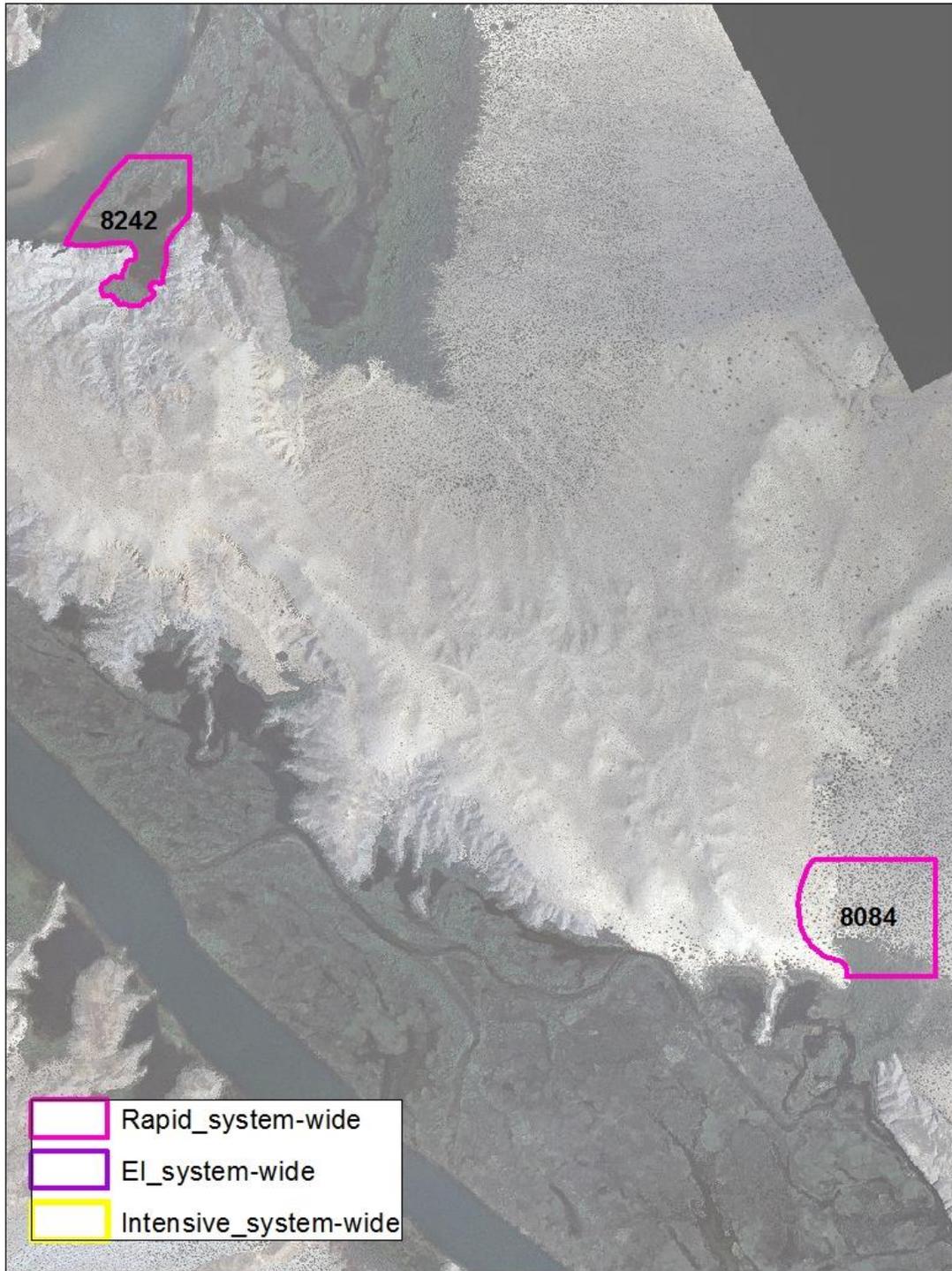
Regional map of system-wide plots surveyed in 2012: Region 6 South (Havasu National Wildlife Refuge [excluding Bill Williams unit]) Havasu National Wildlife Refuge plots. Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1g



Regional map of system-wide plots surveyed in 2012: Region 6 South (Havasú National Wildlife Refuge [excluding Bill Williams unit]) Havasú National Wildlife Refuge plots. Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1h



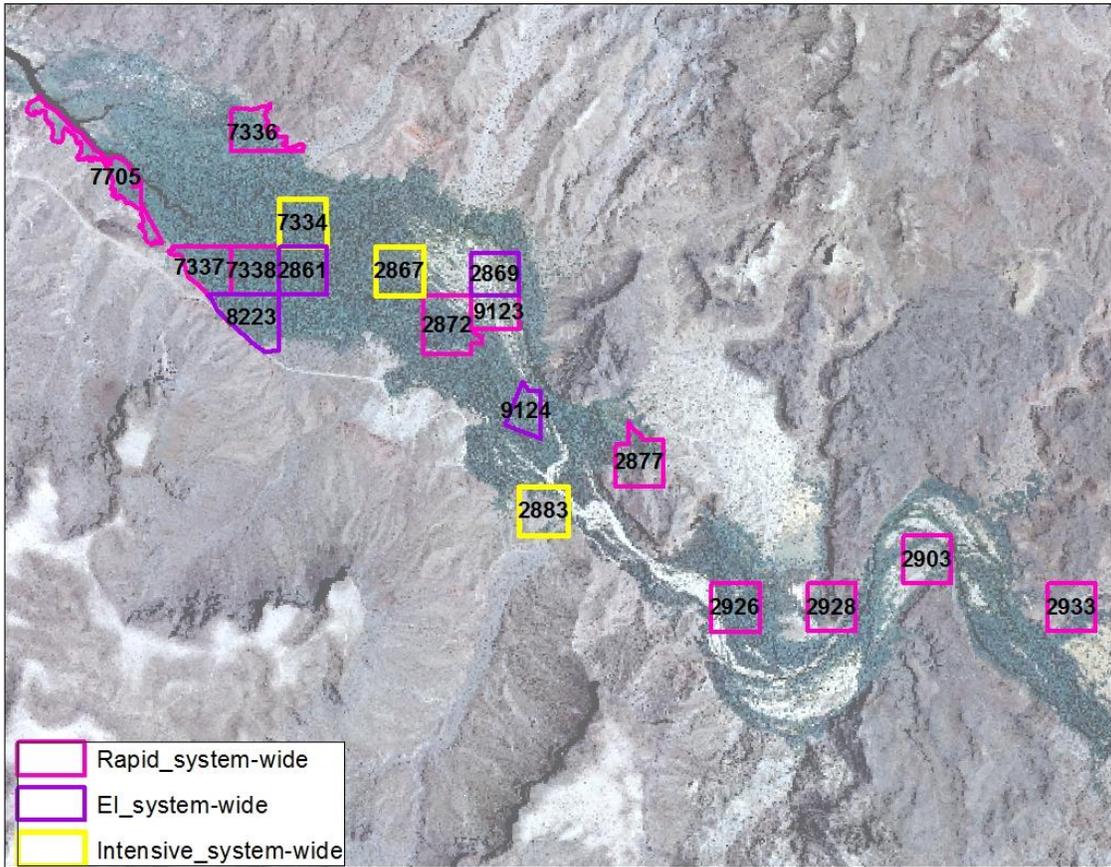
Regional map of system-wide plots surveyed in 2012: Region 6 South (Havasu National Wildlife Refuge [excluding Bill Williams unit]) Havasu National Wildlife Refuge Topock Gorge plots. Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1i



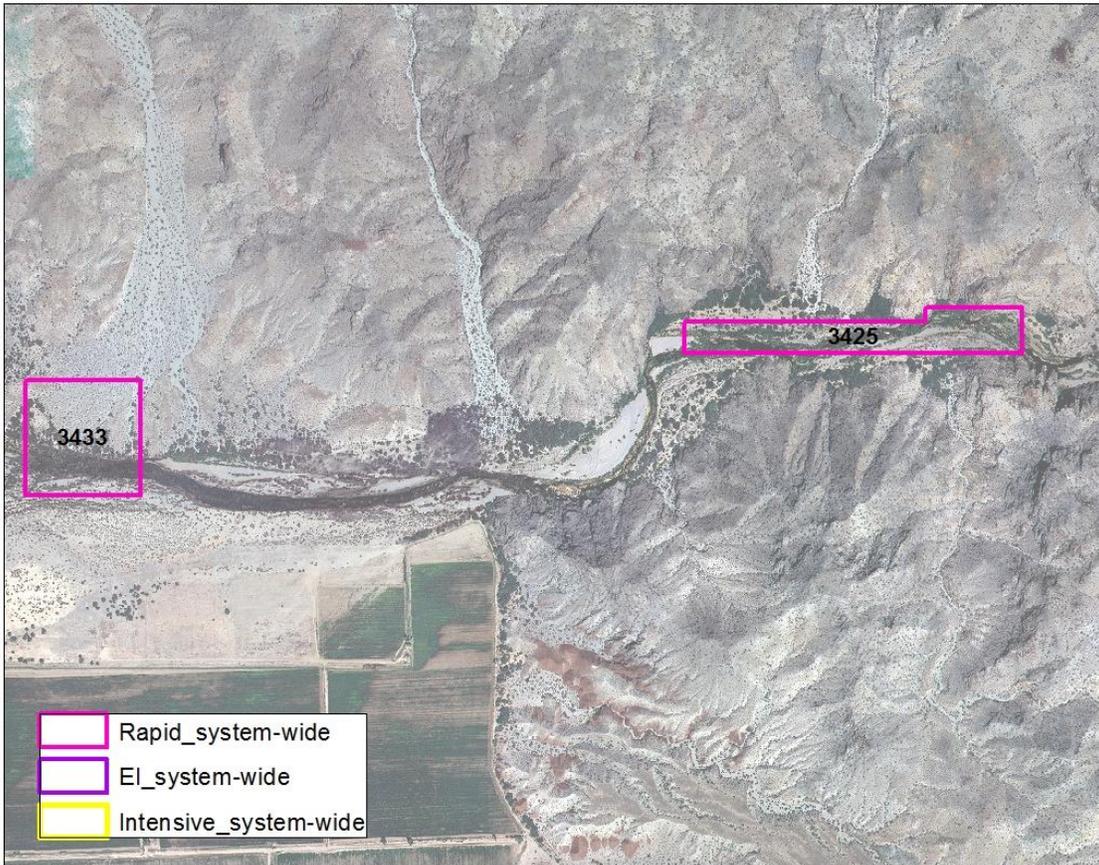
Regional map of system-wide plots surveyed in 2012: Region 6 South (Havasu National Wildlife Refuge [excluding Bill Williams unit]) Lake Havasu plots. Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1j



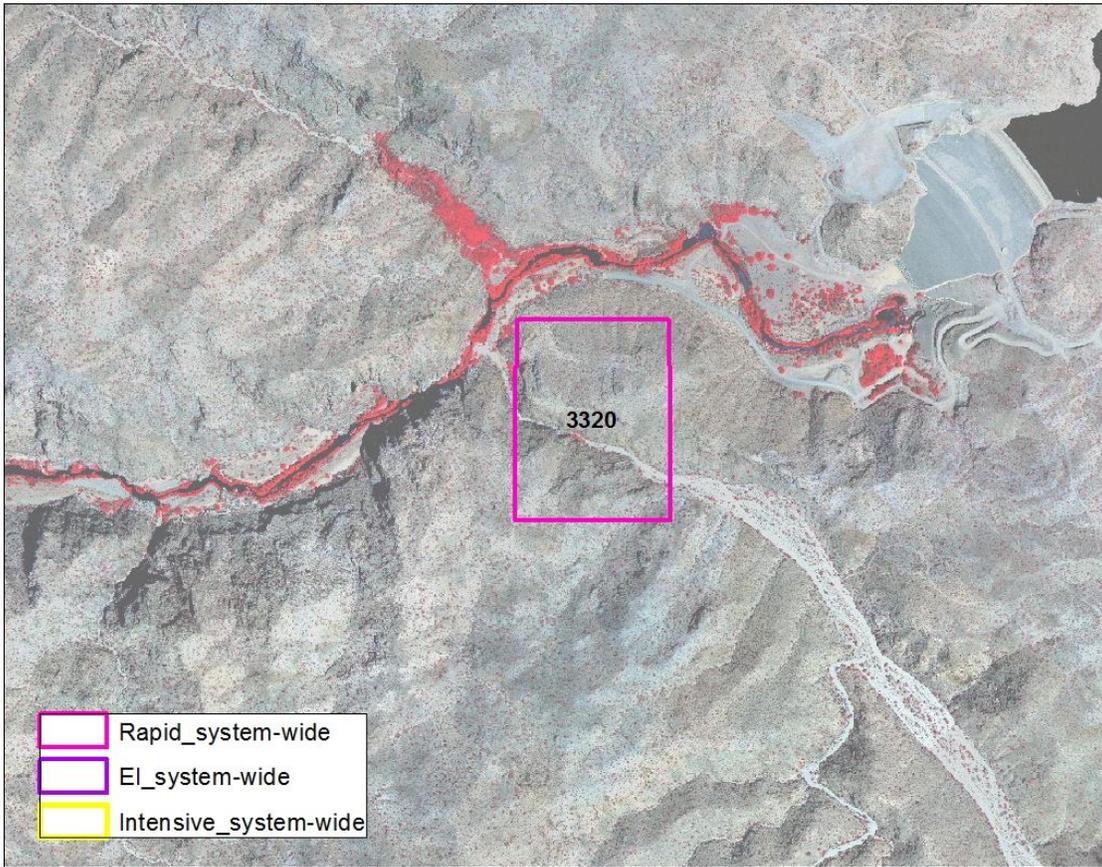
Regional map of system-wide plots surveyed in 2012: Region 7 West (Bill Williams unit of the Havasu National Wildlife Refuge) Bill Williams River National Wildlife Refuge plots. Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1k



Regional map of system-wide plots surveyed in 2012: Region 7 (Bill Williams unit of the Havasu National Wildlife Refuge) Lincoln Ranch plots. Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 11



Regional map of system-wide plots surveyed in 2012: Region (Bill Williams unit of the Havasu National Wildlife Refuge) 7 Alamo Dam plot. Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1m



Regional map of system-wide plots surveyed in 2012: Region 8 Central (Bill Williams unit to Cibola excluding the Colorado Reservation) south of Blythe plots. Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1n



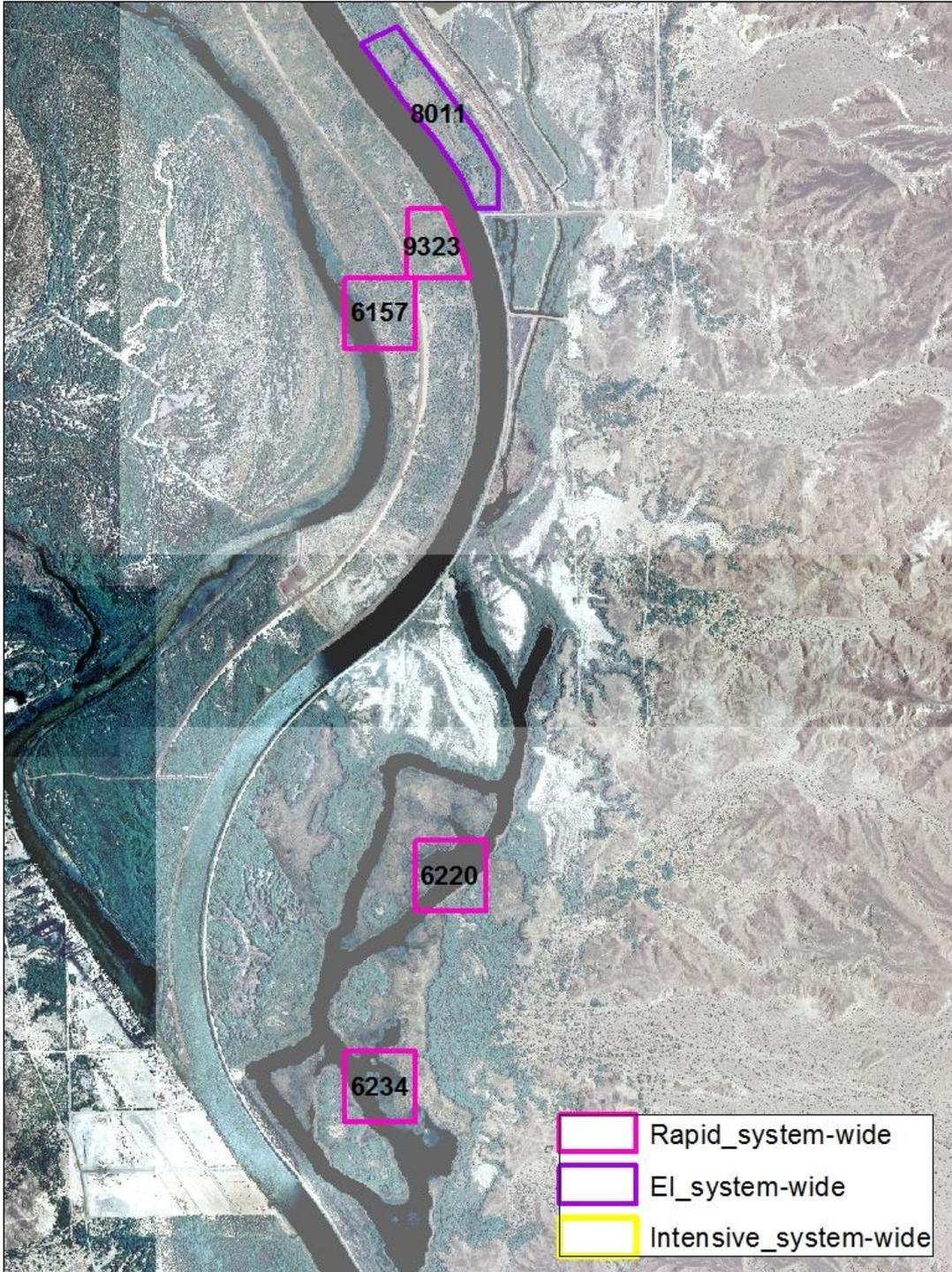
Regional map of system-wide plots surveyed in 2012: Region 8 Central (Bill Williams unit to Cibola excluding the Colorado Reservation) south of Blythe plots. Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1o



Regional map of system-wide plots surveyed in 2012: Region 10 North (Cibola National Wildlife Refuge). Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1p



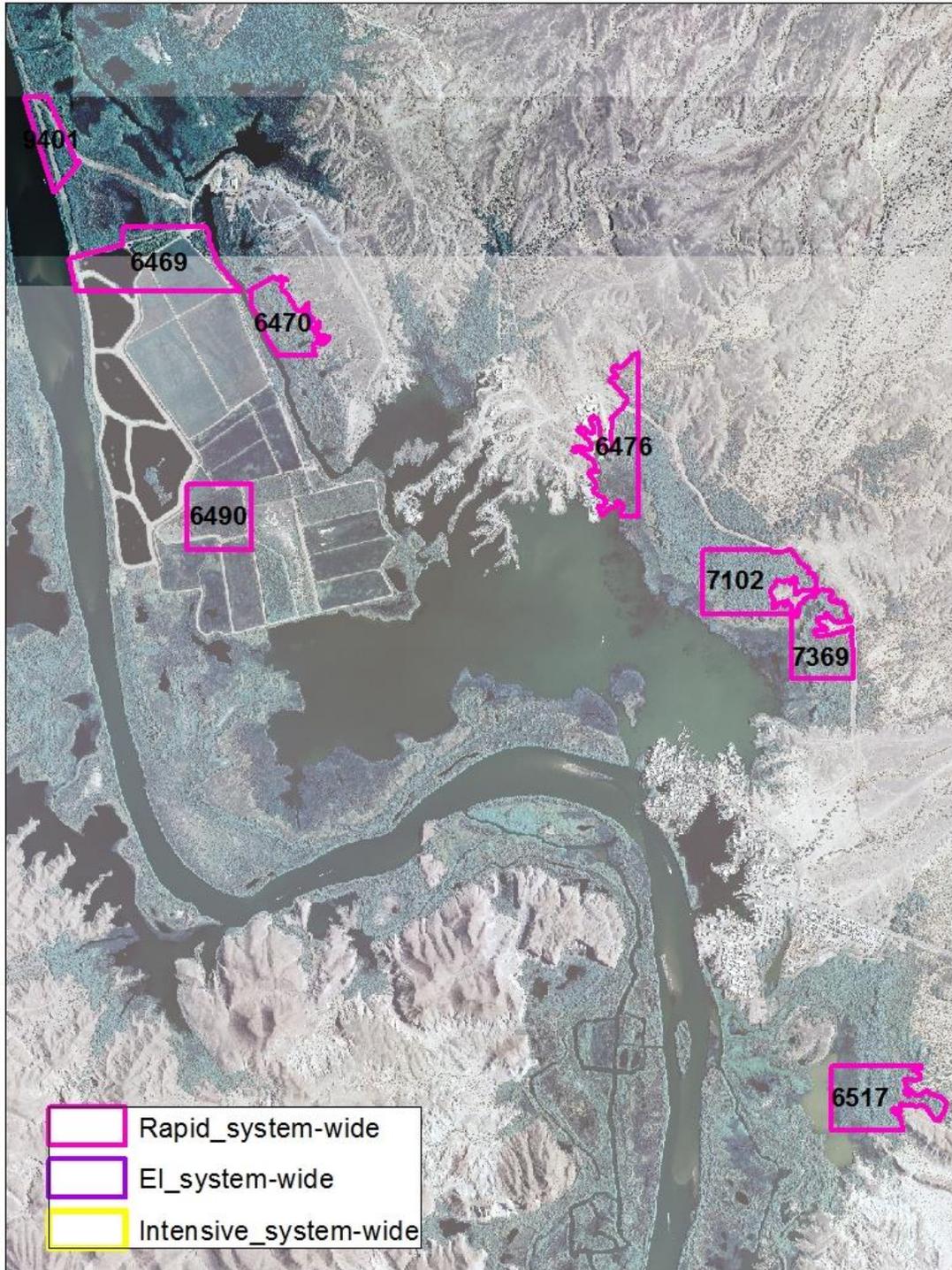
Regional map of system-wide plots surveyed in 2012: Region 10 South (Cibola National Wildlife Refuge). Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1q



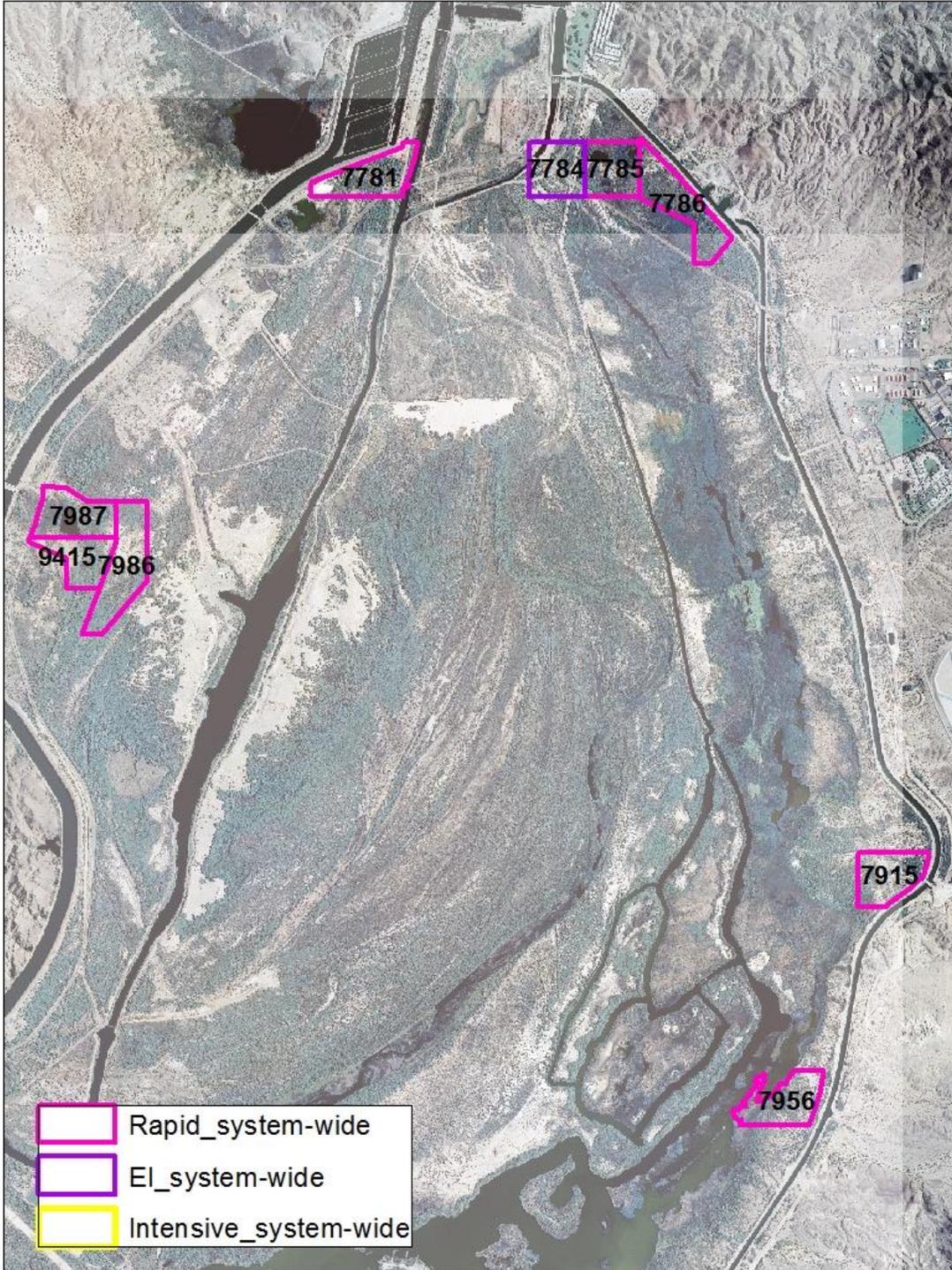
Regional map of system-wide plots surveyed in 2012: Region 11 (Imperial National Wildlife Refuge) North. Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1r



Regional map of system-wide plots surveyed in 2012: Region 11 (Imperial National Wildlife Refuge) North. Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1s



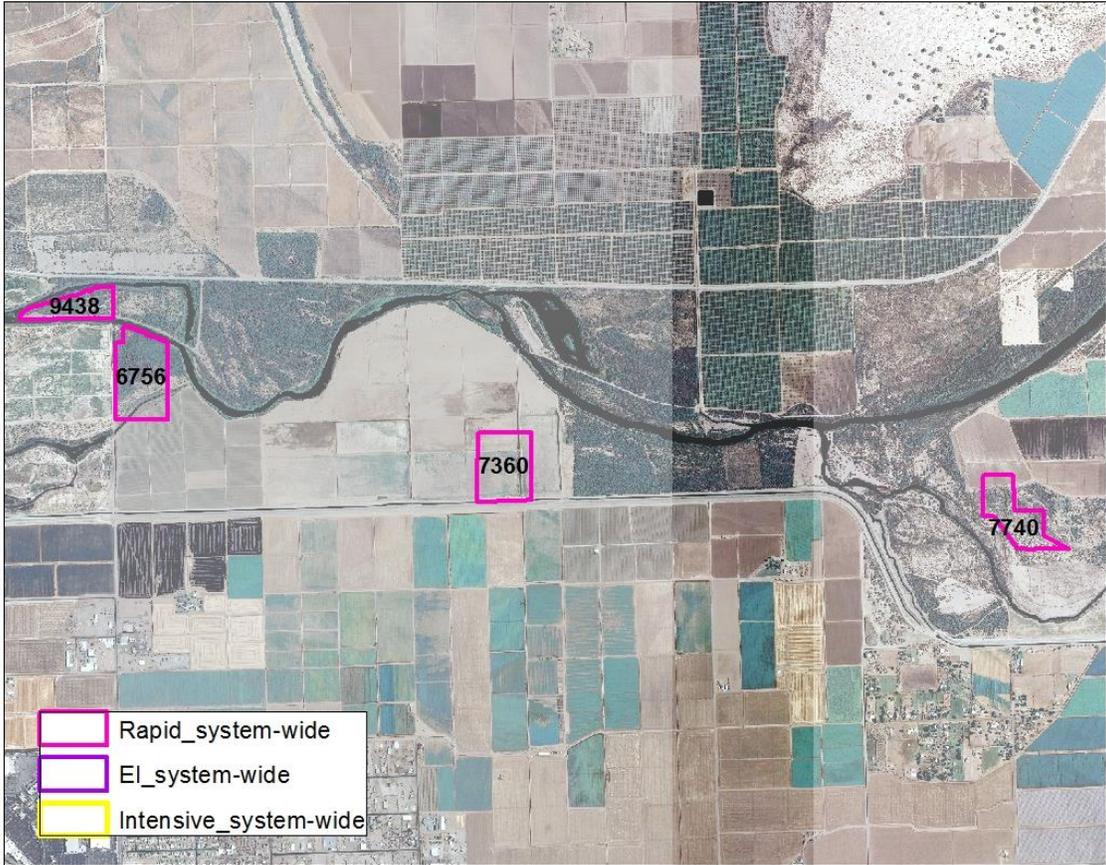
Regional map of system-wide plots surveyed in 2012: Region 12 North (Colorado River from the Imperial National Wildlife Refuge to Yuma). Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1t



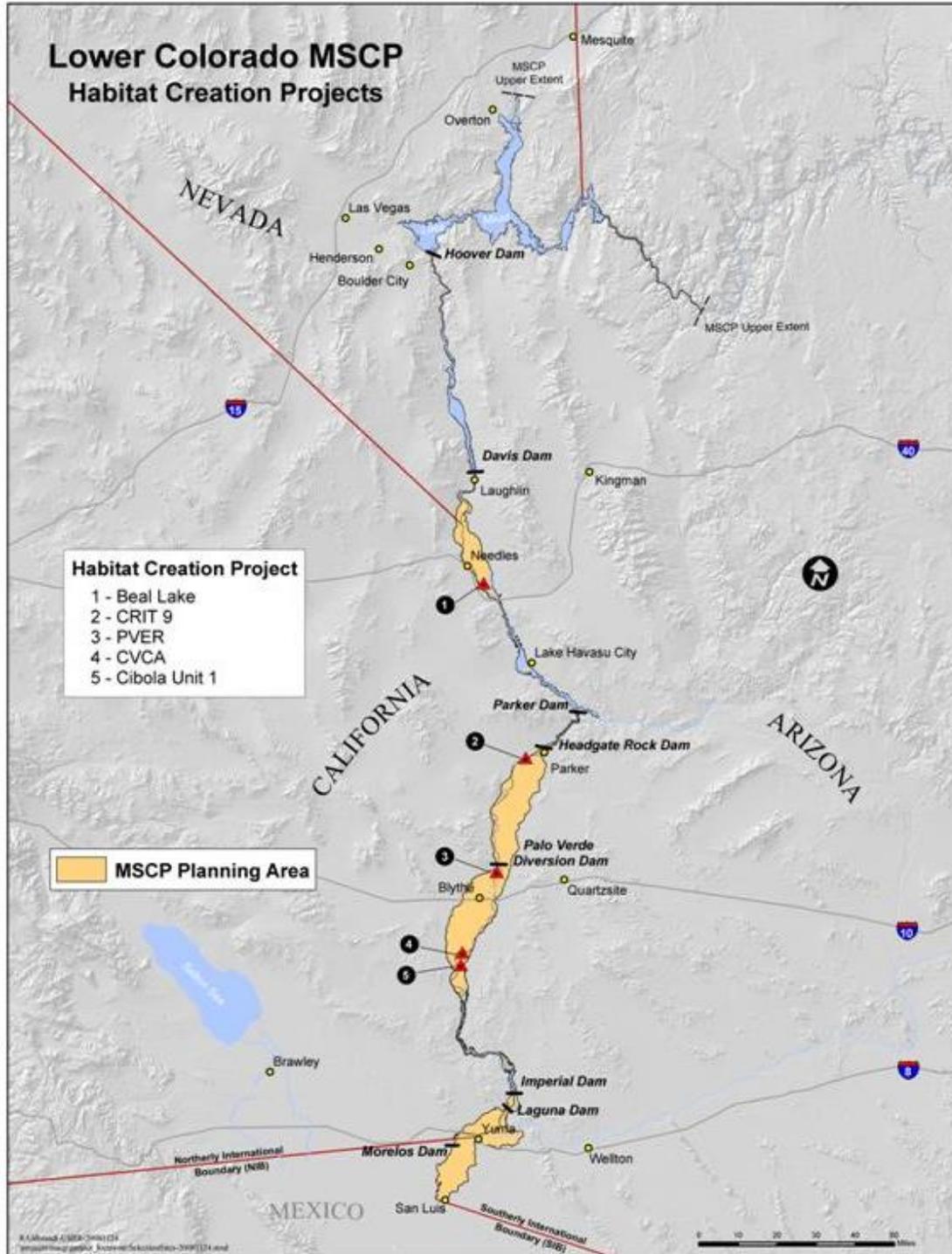
Regional map of system-wide plots surveyed in 2012: Region 12 North (Colorado River from the Imperial National Wildlife Refuge to Yuma). Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1u



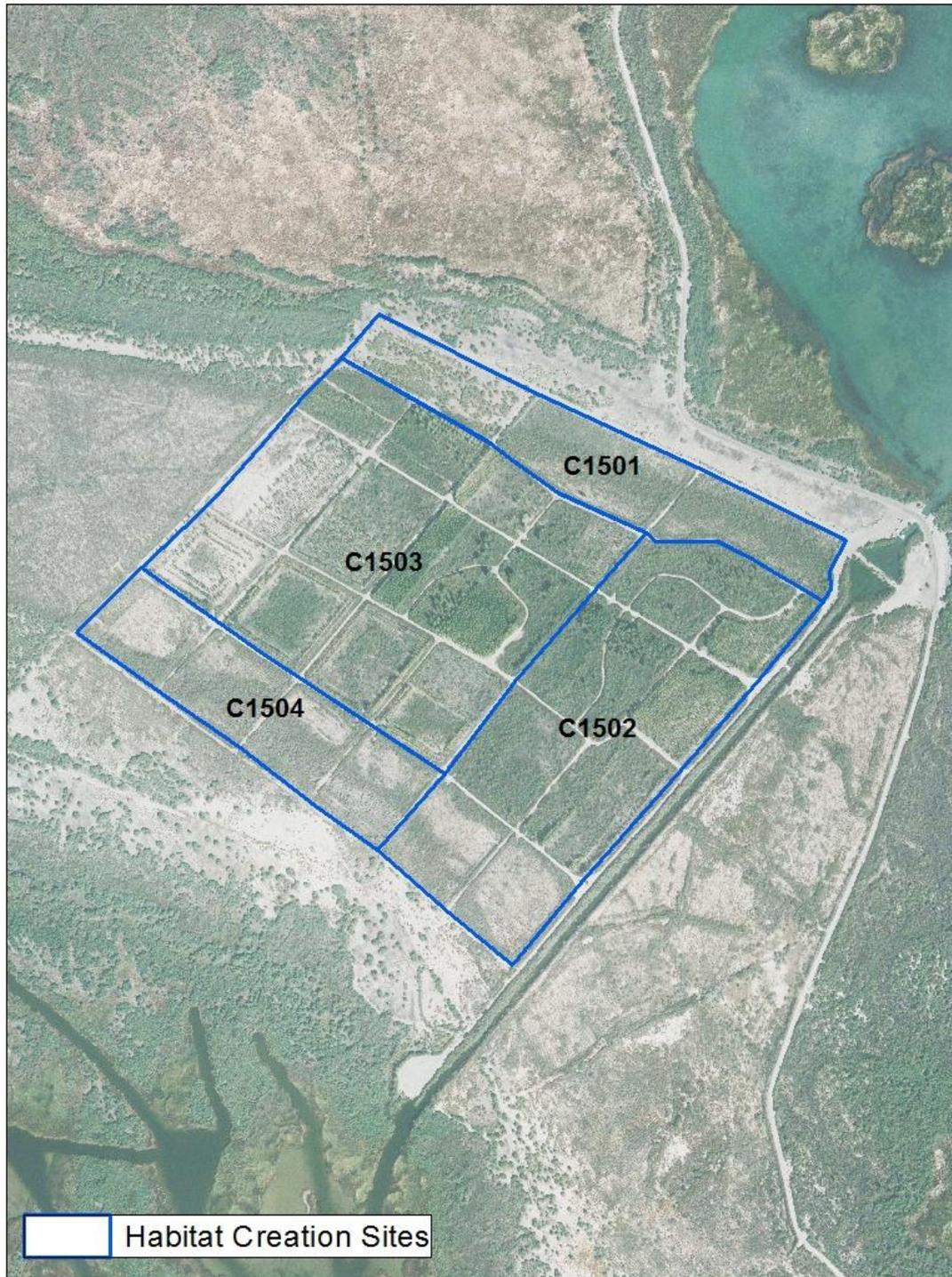
Regional map of system-wide plots surveyed in 2012: Region 12 South (Colorado River from the Imperial National Wildlife Refuge to Yuma). Rapid plots are outlined in pink, intensive plots in yellow, and enhanced intensive plots in purple.

Attachment 1v



Overview of habitat creation sites of the Lower Colorado River Multi-Species Conservation Program in 2012. Map provided by the Bureau of Reclamation, Lower Colorado River Region.

Attachment 1w



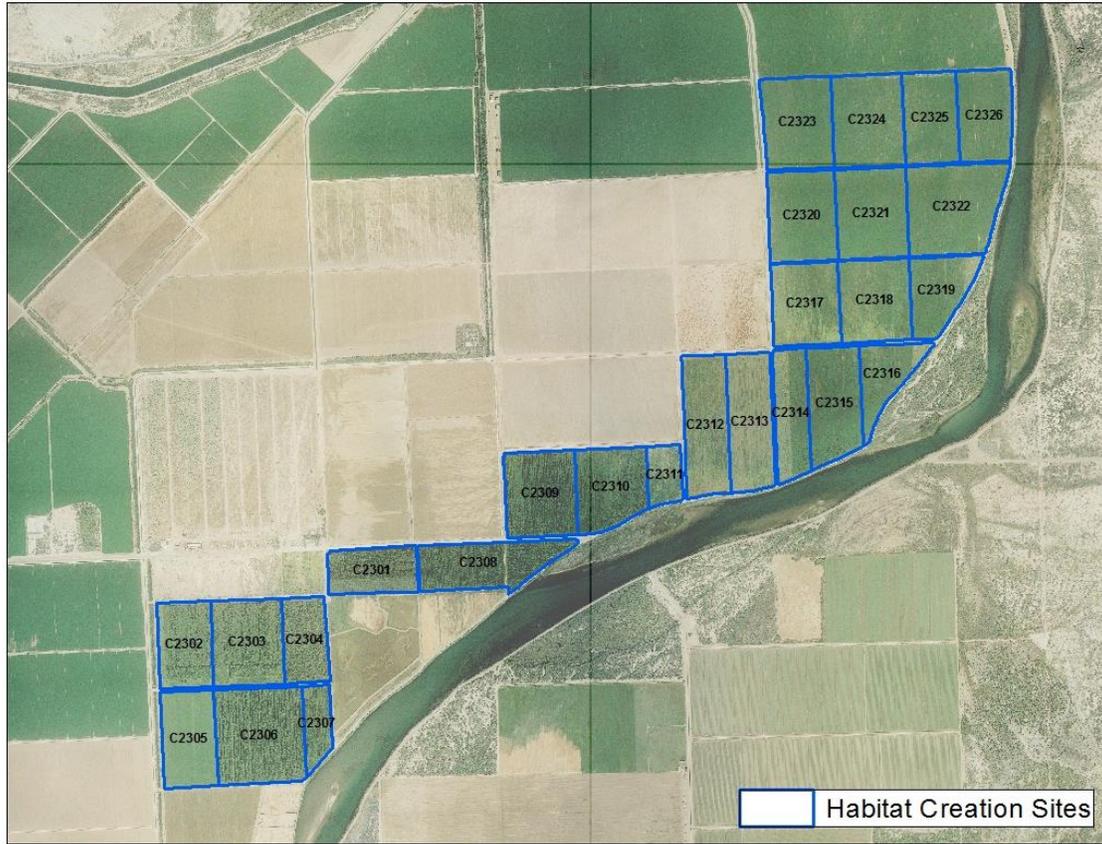
Overview of Beal Lake habitat creation site and four riparian bird survey plots, 2012.

Attachment 1x



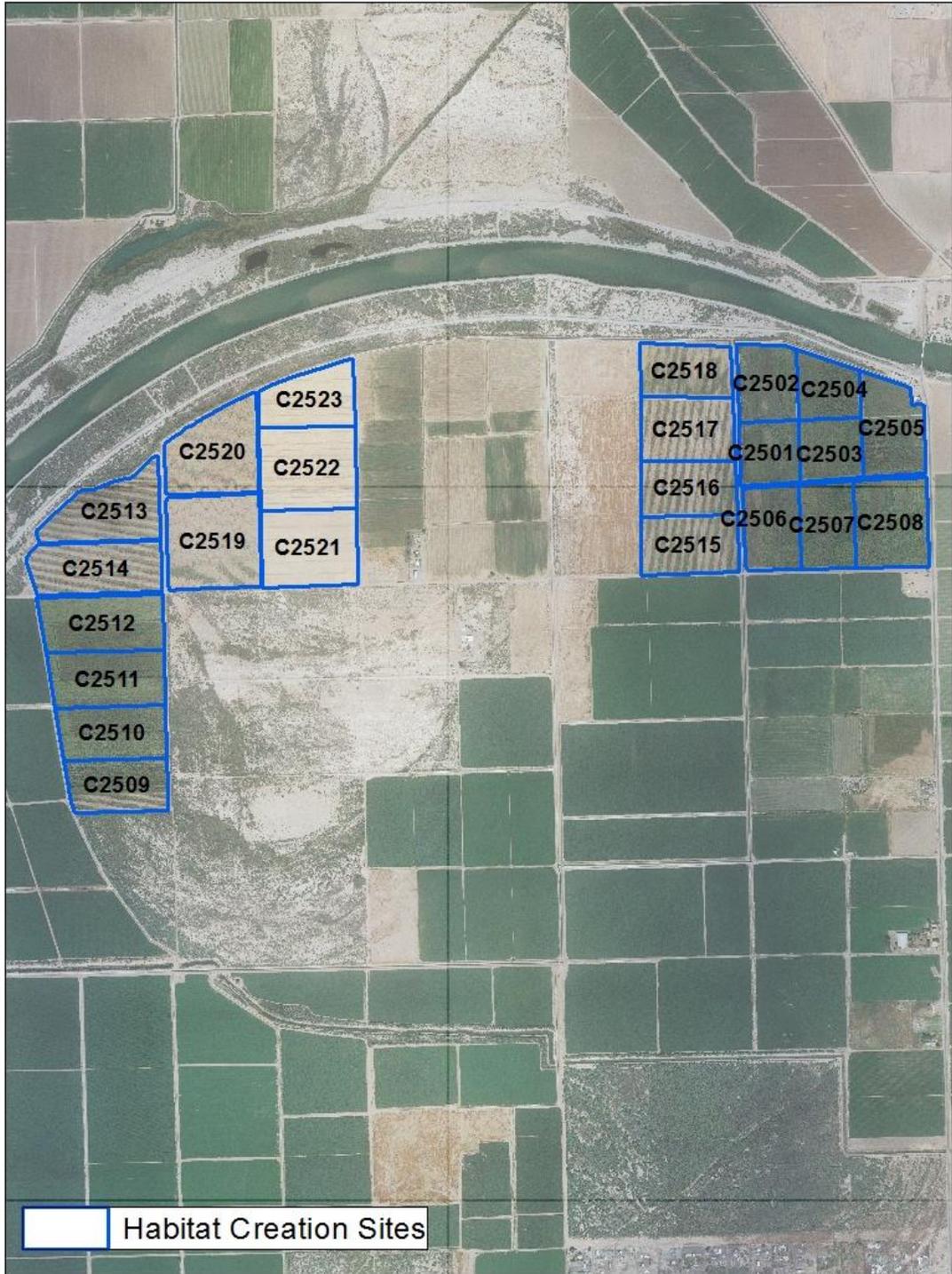
Overview of Colorado River Indian Tribes habitat creation site and five riparian bird survey plots, 2012.

Attachment 1y



Overview of Palo Verde Ecological Reserve habitat creation site with 5 phases and 26 riparian bird survey plots, 2012.

Attachment 1z



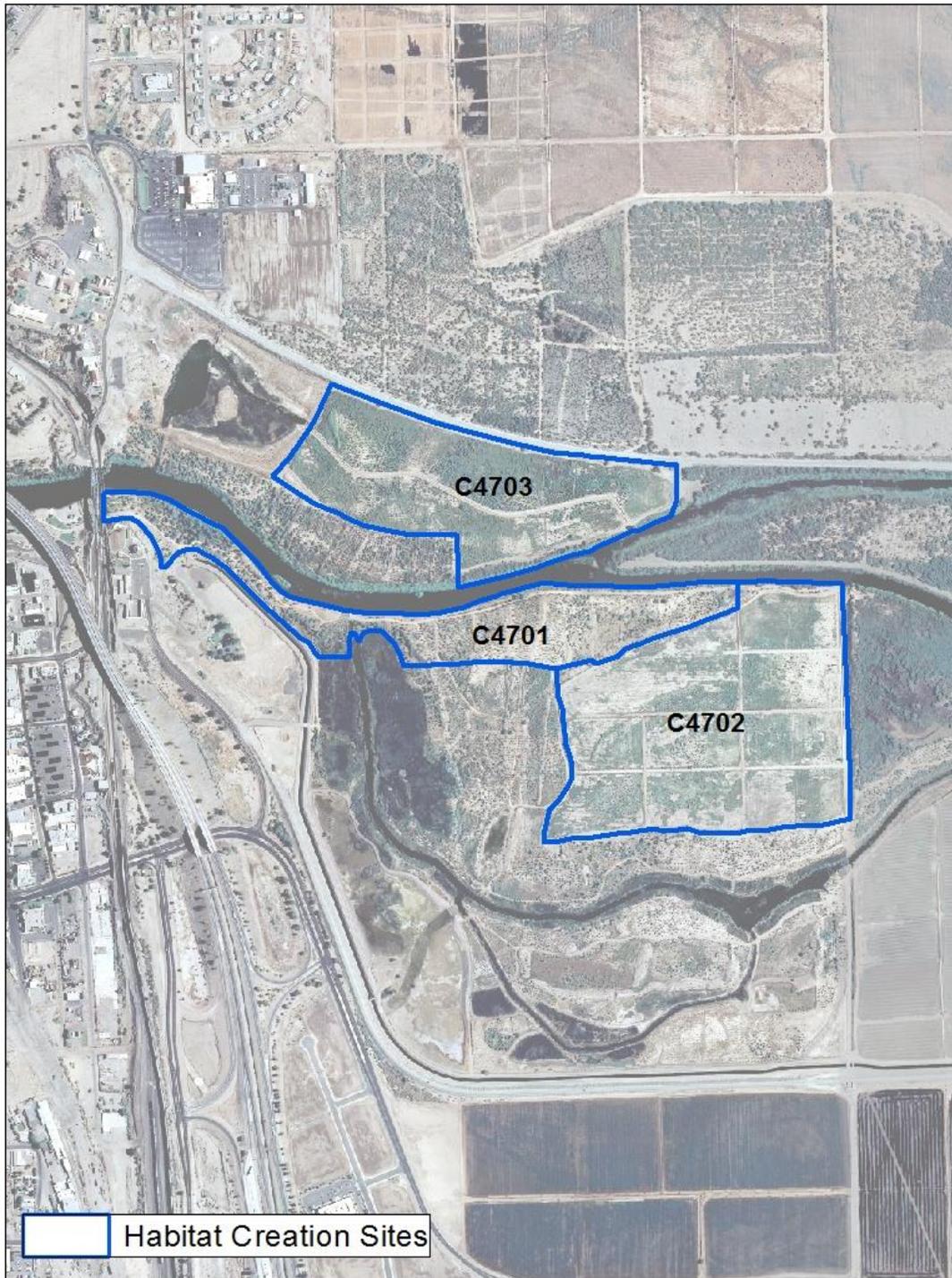
Overview of Cibola Valley Conservation Area habitat creation site with 5 phases and 23 riparian bird survey plots, 2012.

Attachment 1aa



Overview of Cibola Farm Unit 1 habitat creation sites with 13 riparian bird survey plots, 2012.

Attachment 1bb

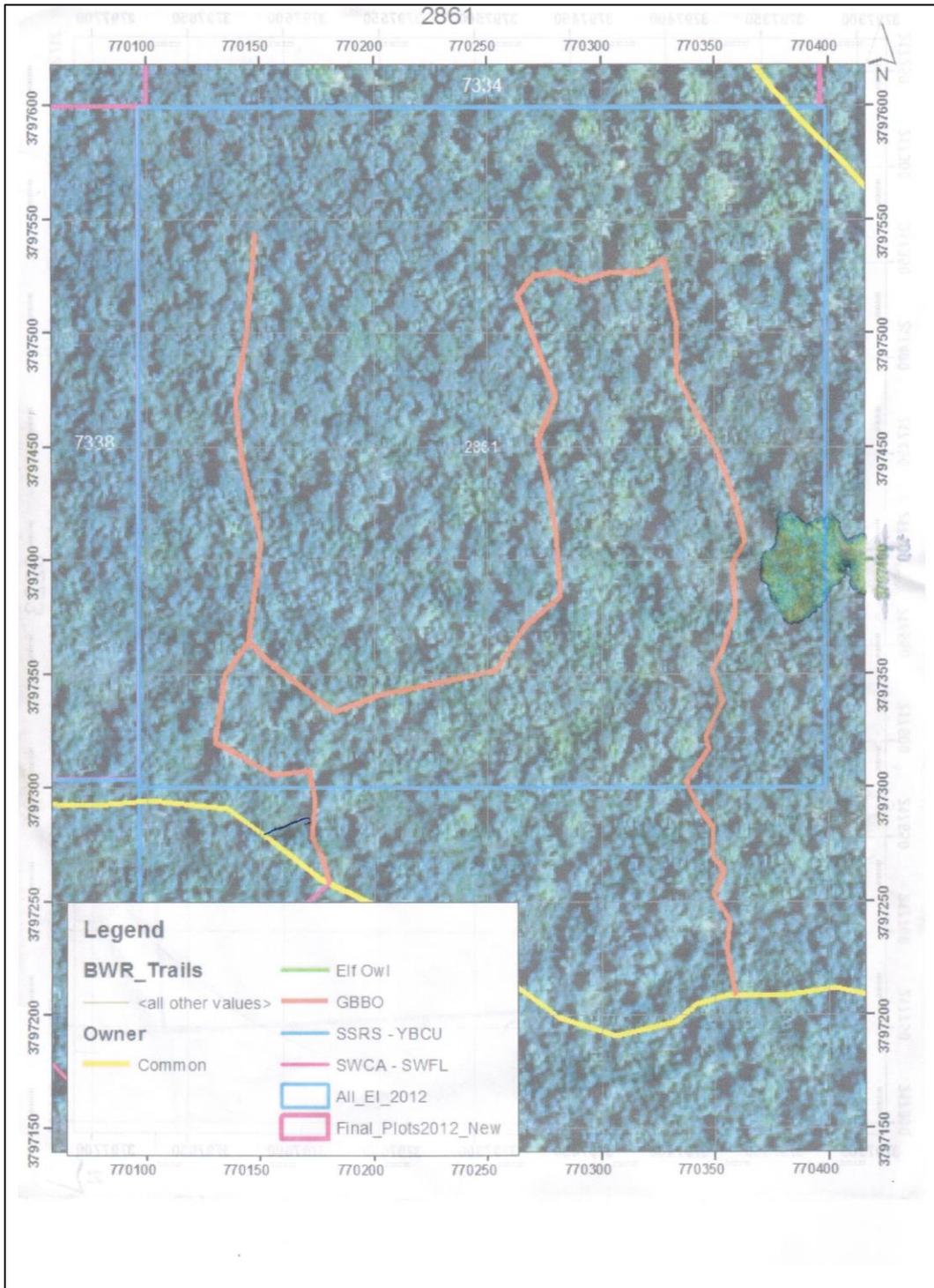


Overview of Yuma East Wetlands habitat creation sites with three riparian bird survey plots surveyed by Fred Phillips Consulting, LLC in 2012.

ATTACHMENT 2

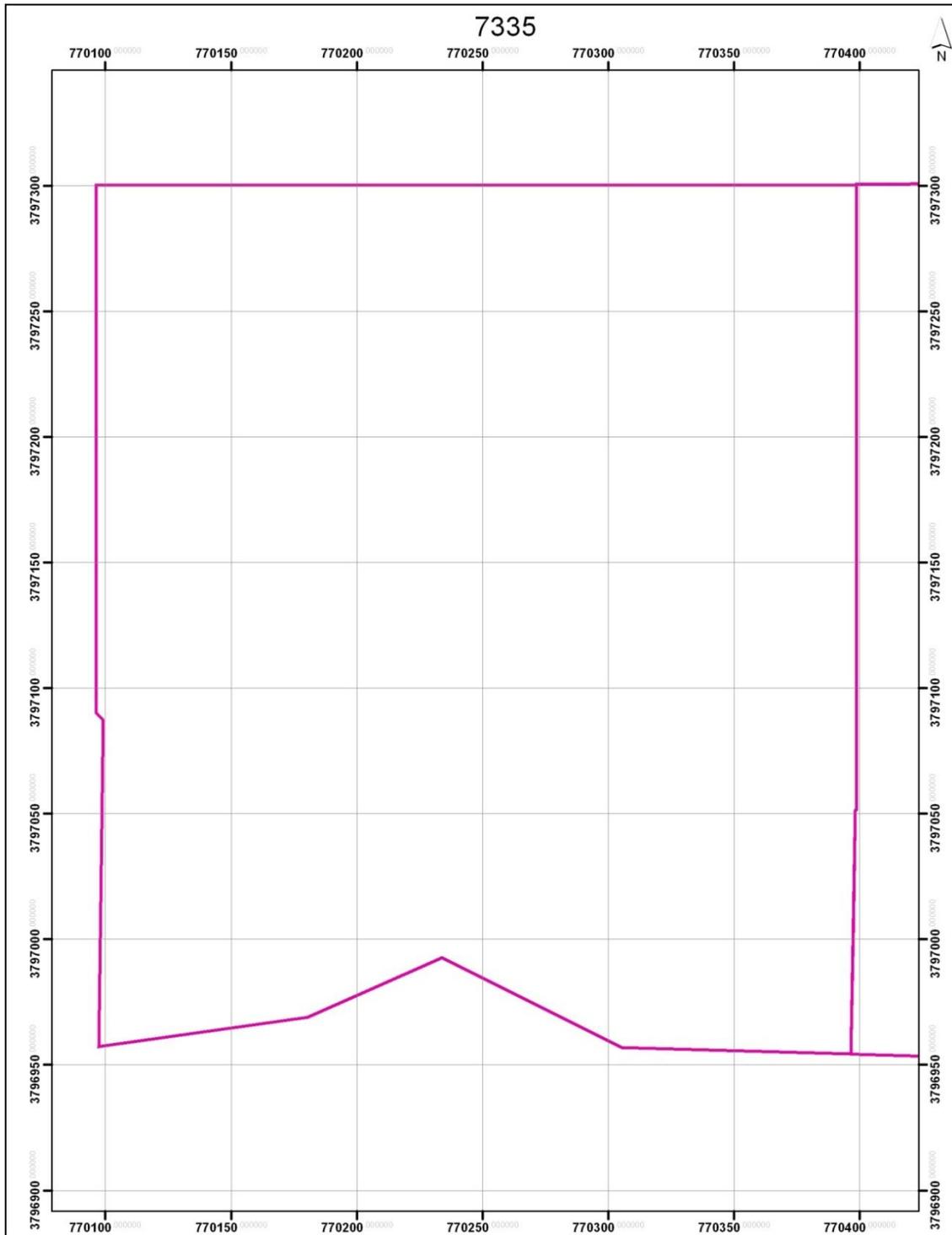
Sample Plot Maps

Attachment 2a



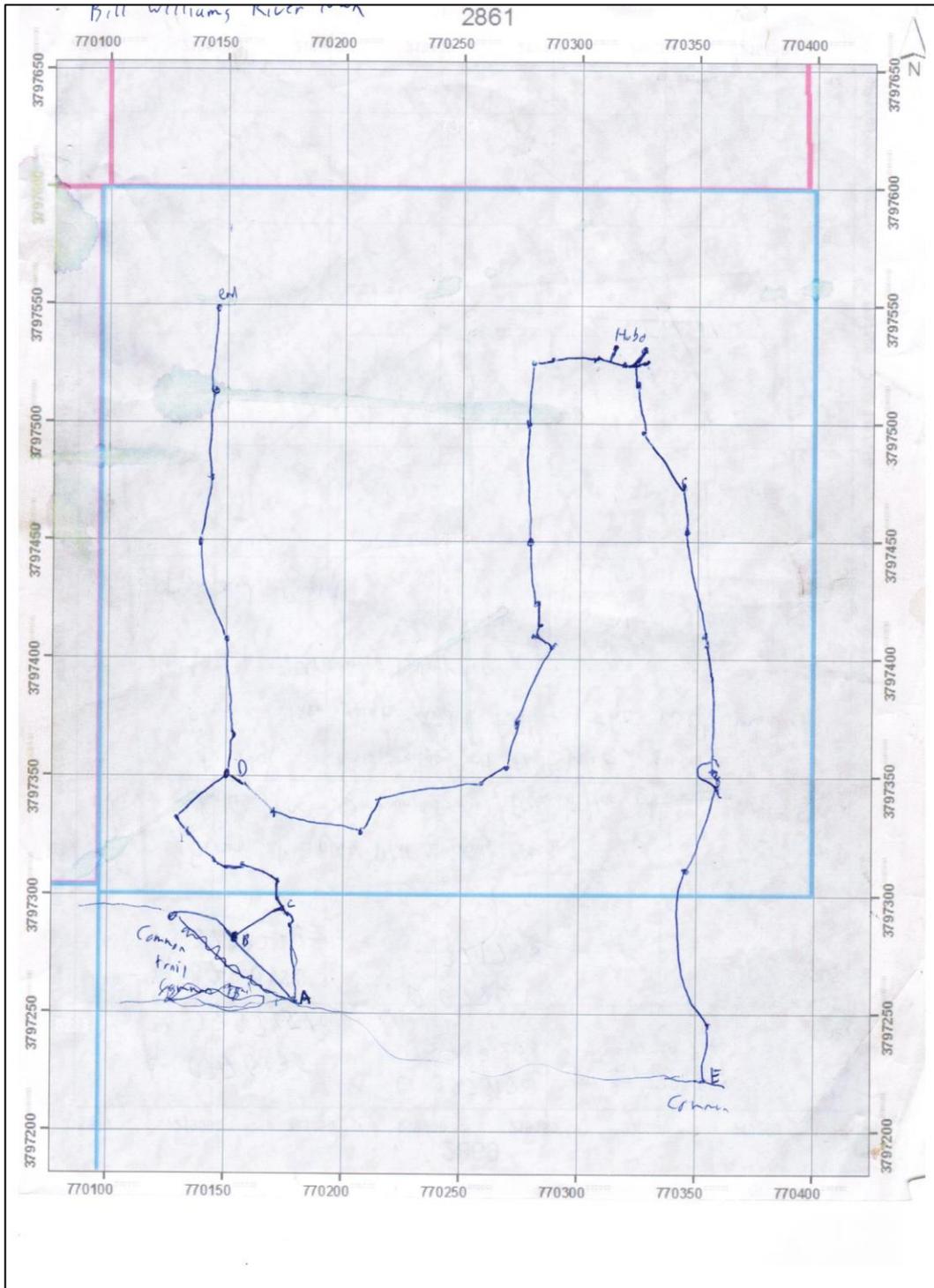
Example of a system-wide bird monitoring plot.

Attachment 2b



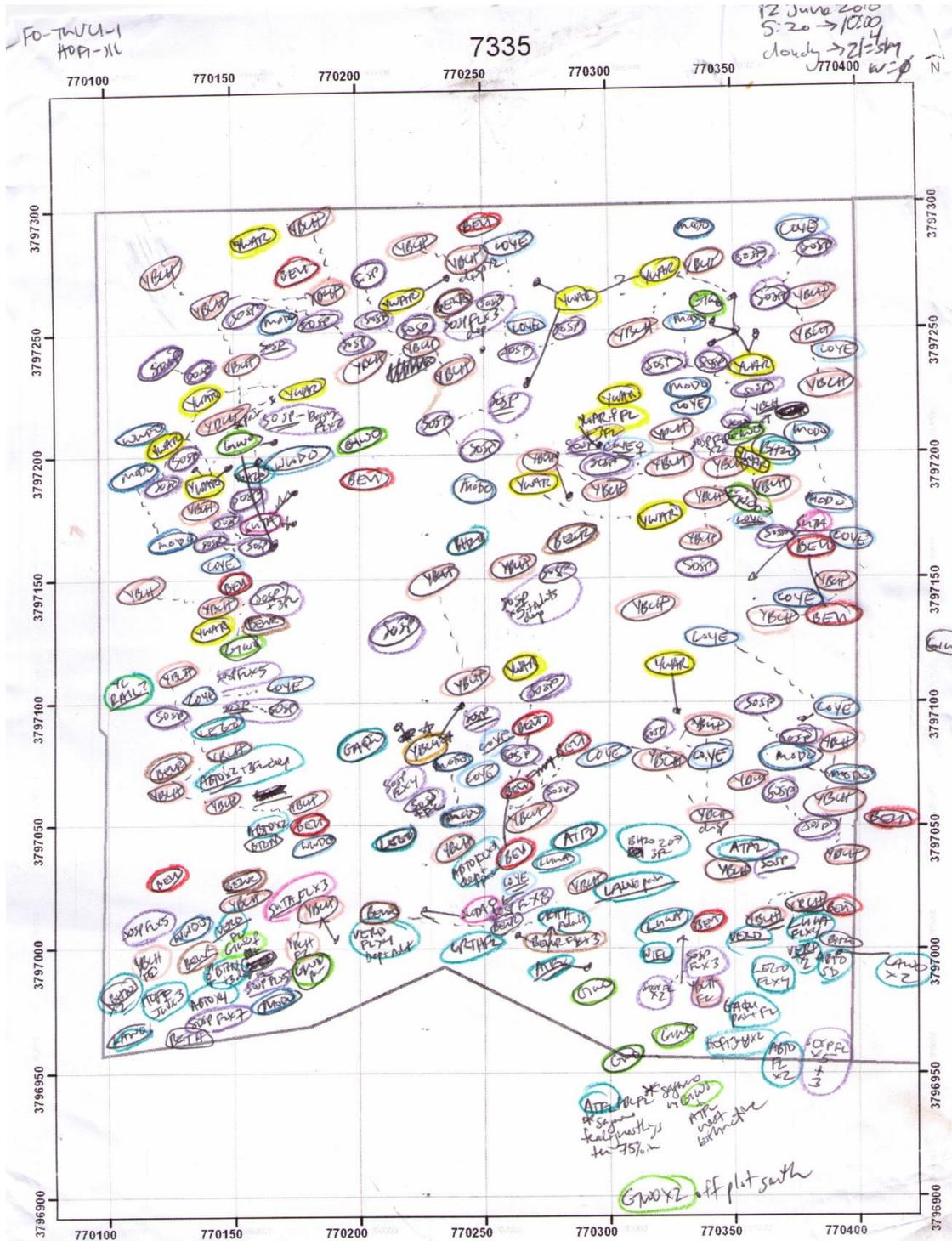
Example of a grid bird survey plot (when no aerial photo coverage is available).

Attachment 2c



Example of a bird survey plot map with grid, including gray-scale imagery for reference.

Attachment 2d



Example of a filled-out bird survey plot map from a rapid area search.

Attachment 2e

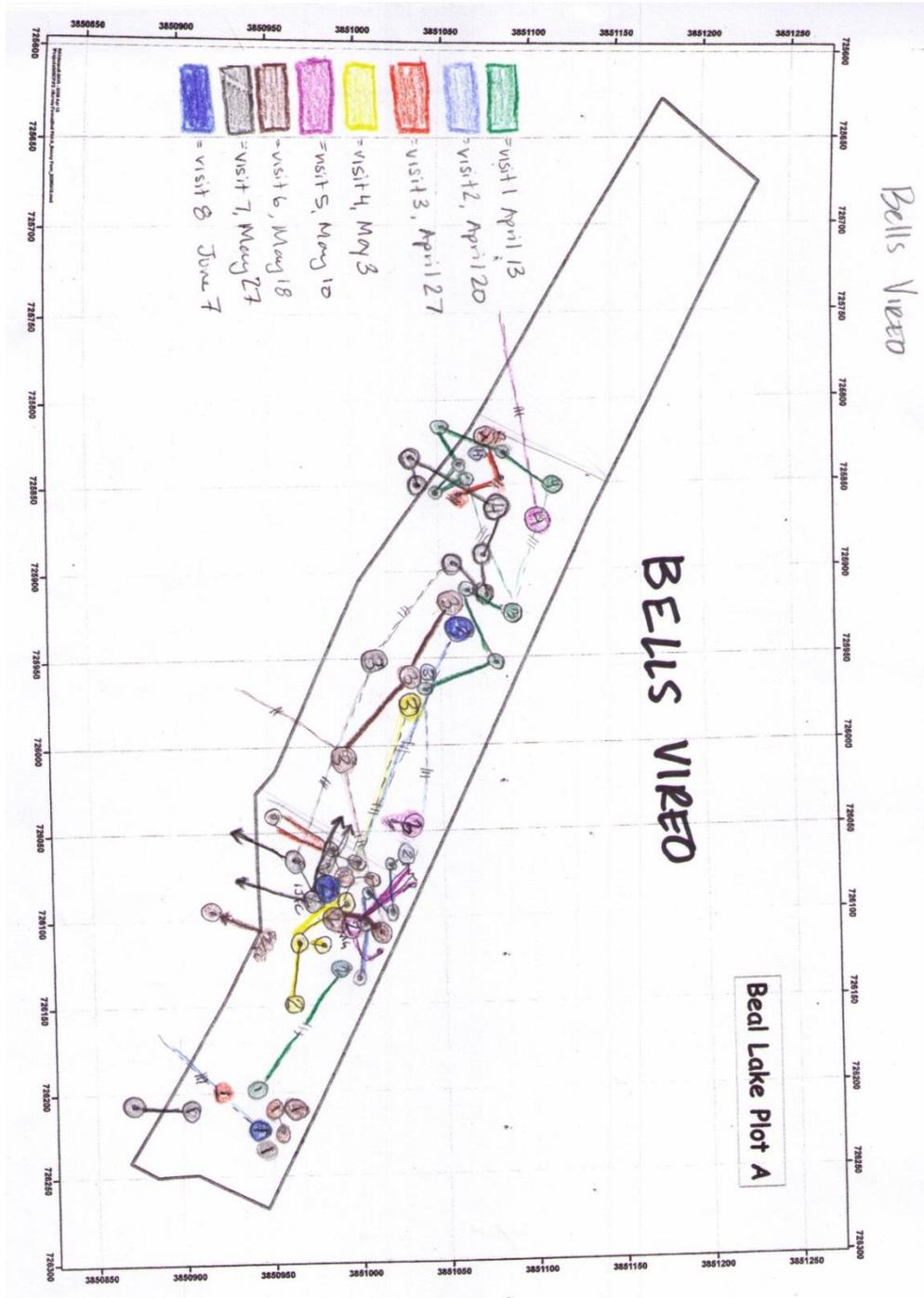
Rapid Area Search End-of-Season Summary Sheet 2010
(send to GBBO, 1755 E. Plumb Ln #256, Reno, NV 89502)

Plot Name: 7225 - Topack Year: 2010
 UTM's of Plot Corner: 1735450 13831950
 Surveyor Name(s): John Diener

Full Species Name	Number of Territories in Plot (decimals o.k. for partial territories)	Avg. Date of Incubation Peak (first and second brood, approximate based on survey data)	Peak Date for Sightings of Non-breeding Individuals (if applicable)
Abercrombie's Towhee	4.5		Will fill in later with all data
Black-tailed Gnatcatcher	4		
Common Yellowthroat	3.75		
Marsh Wren	.75		
Least Bittern	.50		
Green Heron	.50		
Northern Mockingbird	.50		
Yellow-breasted Chat	1		
Verdin	2.5		
Gambel's Quail	4		
Ladder-backed Woodpecker	1		
Pied-billed Grebe	1		
Ash-throated Flycatcher	.50		
American Coot	2		
White-winged Dove	1		
Great-tailed Grackle	2		
Brown-headed Cowbird	3		
Mourning Dove	3		
Lesser Night Hawk	0		
Great Egret	0		
Red-winged Blackbird	0		
American Kestrel	0		
House Finch	1.5		
Turkey Vulture	0		
Clark's Grebe	.5		
UNK Western Grebe	.5		
Song Sparrow	1		
Lazuli Bunting	0		
Phainopepla	1		
Black-throated Sparrow	.50		

Example of a filled-out rapid area search end-of-season summary data sheet (first page). All species found in the plot over both rapid surveys during the season are listed on this sheet, and the number of partial territories is tallied for use in the Double Sampling program. If a bird was not found breeding in the plot, or if it was a flyover, it is listed on the data sheet with a zero in the territories column. The "Avg. Date of Incubation Peak" and the "Peak Date for Sightings of Non-breeding Individuals" are only filled out if the surveyor has that information from their rapid surveys.

Attachment 2g



Example of a species territory map (Arizona bell's vireo) compiled at the end of an intensive survey effort for each species on the plot.

ATTACHMENT 3

Protocol for Access Database Data Entry, 2012

Data Entry Directions, 2012, with New Access Database

1. Open database in Microsoft Access 2007 or 2010.
2. There will be a security warning bar across the top of the window – click on the options button, then the button for “enable this content” and press enter.
3. Now you can begin using the database.
4. Click on the top button for “surveys”
 - This is where you will add each of the plots that you are surveying this season.
 - This only needs to be done once for each plot – after the 1st time, you will be able to select your plot from a list.
 - Click the add button.
 - A new screen titled “surveyor-survey editor” will pop up.
 - The 1st 2 boxes are grayed out – meaning that you will not enter anything in them, and the program will auto-fill them later.
 - Next, select the type of survey you will be doing on this plot – will it be rapid (RAP), intensive (INT), or EI enhanced intensive (ENH)? Remember, this is the type of survey YOU are doing on the plot (not is it an EI overall or not).
 - Next, select your name from the surveyor drop-down.
 - Next, hit the collection button to find your plot: Selection = S + your plot number. Just click once on the plot and you will have selected it.
 - Next, enter the beginning date: Beg date = the 1st date that you survey the plot.
 - Next, enter the end date – for this year, we will use June 15 for all plots.
 - Notes are for any notes about the plot as a whole during the whole season, such as a fire on the plot, a construction project, etc.
 - Finally, make sure that all you have entered is correct and save and leave the window.
 - You will see all of your plots now in the surveyor-surveys window.
5. Click on the 2nd button for “events.”
 - Here you will add basic information about your survey of a plot on a certain date.
 - Under surveyor-survey, select the plot that you have surveyed.
 - Enter the date that you conducted the survey (should be the same date that you are doing the data entry).
 - Enter the sky and wind codes using the drop-downs.
 - Enter the time in (start time of your survey) and time out (end time of your survey). You can right-click in the white box for these to see the clock – this is the fastest method of entering the time; otherwise, you need to enter it with a colon.

- Finally, make sure that all you have entered is correct and save and leave the window.
6. Next, enter the non-breeders on the 4th button.
 - Press the add button to enter new data.
 - Press the species button to enter the species. Select a species by clicking on the blue box to the left of the species name.
 - Next, use the drop-down to select your plot and the correct date for the “surveyor-event.”
 - Next, enter the number of males, females, unknown sex, independent young, flyovers, and incidentals. Each individual should be in only one of these six categories (e.g., we are not sexing young, flyovers, or incidentals).
 - If you have notes for yourself about that species for that survey, enter them here.
 - Check your work and save.
 - Repeat these above instructions for each non-breeding species you recorded for your plot.
 7. Finally, you will enter your pairs under the “pairs” button. We have asked that this button name be changed to “potential breeders.”
 - Click to add a new male/pair/family group that is a potential breeder on the plot.
 - You will have already highlighted all of one species on your field map with one color, numbered the male/pair/family groups, and started your species map at this point (see area search protocol for detailed instructions).
 - Click the species button to add the species. Remember to click the blue box to the left of the species name to select it.
 - Select the correct survey-event (plot and date) from the drop-down.
 - DO NOT do the “territory in” or breeding check box until the end of the season.
 - Check your work and save.
 - REMEMBER – It is critical that you enter the male/pair/family groups in the same order as you numbered them on your maps since at this point the database will auto-number the male/pair/family groups you just entered.
 8. Click on the pair you just entered.
 9. Next, click the details button in the surveyor-pairs window to add the breeding information about the male/pair/family group you just entered.
 - Click the add button to add new information on that pair from today’s survey.
 - Select the correct survey-event (plot and date) from the drop-down.
 - Add the number of birds you saw associated with that male/pair/family group (use the TAB key to make it easier).

- Next, click on the attribute button to add observed behaviors. Please add all the behaviors that you observed on that survey and press the save button.
- Add any notes to yourself about that male/pair/family group on that date only.
- Check what you have entered and press done when you are finished.

ATTACHMENT 4

Comprehensive Species List from Avian Surveys Conducted
along the Lower Colorado River in 2012

Listed in alphabetic order of common name. Scientific names available in Great Basin Bird Observatory 2010, 2011.

Species	Rapid				Intensive				Enhanced intensive (EI)				Flyovers: All sites
	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	
Abert's towhee	✓		✓	✓	✓		✓	✓			✓	✓	
American avocet	✓								✓				✓
American bittern	✓	✓	✓										✓
American coot	✓		✓		✓		✓				✓		
American goldfinch							✓		✓				✓
American kestrel	✓	✓	✓		✓				✓				✓
American pipit					✓	✓							✓
American redstart	✓												
American robin	✓	✓			✓	✓				✓			
American wigeon									✓				✓
Anna's hummingbird	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Arizona bell's vireo	✓	✓	✓	✓			✓	✓			✓	✓	
Ash-throated flycatcher	✓	✓	✓	✓			✓	✓			✓	✓	
Bald eagle	✓		✓		✓				✓				✓
Baltimore oriole			✓										
Bank swallow		✓			✓				✓				✓
Barn owl		✓		✓				✓					✓
Barn swallow	✓	✓			✓	✓			✓	✓			✓
Belted kingfisher		✓	✓						✓				✓

Species	Rapid				Intensive				Enhanced intensive (EI)				Flyovers: All sites
	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	
Bewick's wren	✓		✓	✓			✓				✓		
Black phoebe	✓		✓	✓	✓		✓		✓		✓		
Black-chinned hummingbird	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	
Black-crowned night-heron	✓		✓		✓	✓			✓				✓
Black-headed grosbeak	✓	✓			✓	✓			✓	✓			✓
Black-necked stilt	✓				✓				✓				✓
Black-tailed gnatcatcher	✓		✓	✓			✓	✓			✓	✓	
Black-throated gray warbler	✓	✓			✓				✓	✓			
Black-throated sparrow			✓		✓		✓						
Blue grosbeak	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓
Blue-gray gnatcatcher	✓				✓	✓							
Brewer's sparrow	✓	✓			✓	✓			✓				
Brewer's blackbird		✓				✓							✓
Brown-crested flycatcher	✓		✓	✓			✓	✓			✓	✓	
Brown-headed cowbird	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bullock's oriole	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Burrowing owl			✓										
Cactus wren	✓		✓								✓		
California black rail	✓		✓				✓				✓		
California gull									✓				✓
Canada goose	✓				✓								✓

Species	Rapid				Intensive				Enhanced intensive (EI)				Flyovers: All sites
	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	
Canyon wren	✓		✓		✓		✓		✓		✓		
Caspian tern	✓	✓			✓				✓				✓
Cassin's vireo	✓	✓			✓	✓			✓	✓			
Cassin's kingbird							✓		✓				
Cattle egret	✓				✓				✓				✓
Cedar waxwing	✓				✓				✓	✓			✓
Chipping sparrow	✓	✓			✓	✓			✓	✓			✓
Clark's grebe	✓		✓										
Cliff swallow	✓	✓	✓		✓	✓			✓	✓			✓
Common black-hawk					✓								
Common gallinule	✓		✓				✓		✓		✓		
Common goldeneye	✓												
Common ground-dove	✓	✓	✓	✓							✓		✓
Common loon									✓				✓
Common poorwill			✓				✓		✓		✓		
Common raven	✓	✓	✓	✓	✓	✓	✓		✓	✓			✓
Common yellowthroat			✓	✓	✓	✓	✓	✓	✓		✓	✓	
Cooper's hawk	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓
Cordilleran flycatcher					✓	✓							
Costa's hummingbird		✓	✓	✓			✓		✓	✓			✓
Crissal thrasher			✓	✓	✓		✓	✓			✓	✓	

Species	Rapid				Intensive				Enhanced intensive (EI)				Flyovers: All sites
	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	
Dickcissel				✓									
Double-crested cormorant	✓	✓	✓		✓	✓			✓				✓
Dusky flycatcher	✓				✓					✓			
Eared grebe			✓										
Elf owl							✓				✓		
Eurasian collared-dove	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
European starling	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Gadwall					✓		✓						✓
Gambel's quail	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓
Gambel's white-crowned sparrow	✓	✓			✓				✓				
Gila woodpecker	✓		✓				✓				✓	✓	✓
Gilded flicker			✓										
Gray flycatcher	✓				✓	✓			✓	✓			
Gray vireo									✓				
Great blue heron	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
Great egret	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
Great horned owl	✓		✓	✓	✓	✓	✓	✓	✓			✓	
Greater roadrunner	✓		✓	✓	✓		✓	✓			✓		
Greater yellowlegs	✓					✓							✓
Great-tailed grackle	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Green heron	✓		✓	✓	✓	✓	✓		✓		✓		✓

Species	Rapid				Intensive				Enhanced intensive (EI)				Flyovers: All sites
	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	
Green-tailed towhee	✓	✓			✓	✓			✓				
Hammond's flycatcher	✓	✓			✓				✓	✓			
Hermit thrush	✓	✓			✓				✓				
Hermit warbler	✓	✓			✓				✓	✓			
Hooded oriole			✓										
Horned lark	✓	✓	✓	✓			✓			✓			✓
House finch	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
House wren	✓	✓	✓		✓	✓	✓		✓			✓	
Indigo bunting				✓				✓				✓	
Killdeer	✓	✓	✓	✓	✓	✓			✓	✓	✓		✓
Ladder-backed woodpecker			✓	✓	✓		✓	✓	✓		✓	✓	✓
Lawrence's goldfinch		✓		✓	✓		✓			✓		✓	✓
Lazuli bunting	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
Least bittern			✓				✓				✓		
Least sandpiper	✓				✓				✓				✓
Lesser goldfinch	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lesser nighthawk	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
Lesser scaup	✓		✓										
Lincoln's sparrow	✓	✓			✓	✓			✓	✓			
Loggerhead shrike	✓	✓	✓	✓			✓		✓		✓	✓	
Long-billed curlew	✓	✓			✓	✓			✓				✓

Species	Rapid				Intensive				Enhanced intensive (EI)				Flyovers: All sites
	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	
Long-billed dowitcher	✓												✓
Long-eared owl			✓										
Lucy's warbler	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Macgillivray's warbler	✓	✓			✓	✓			✓	✓			
Mallard	✓		✓		✓		✓		✓		✓		✓
Marbled godwit									✓				✓
Marsh wren			✓				✓				✓		
Merlin									✓				
Mountain white-crowned sparrow	✓	✓			✓				✓				
Mourning dove	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Nashville warbler	✓	✓			✓	✓			✓	✓			
Neotropic cormorant	✓												✓
Northern harrier	✓	✓		✓			✓						✓
Northern mockingbird	✓	✓	✓	✓			✓						✓
Northern parula	✓	✓								✓			
Northern rough-winged swallow	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
Northern shoveler									✓				✓
Olive-sided flycatcher	✓	✓			✓	✓			✓	✓			
Orange-crowned warbler	✓	✓			✓	✓	✓		✓	✓			✓
Osprey	✓	✓			✓	✓			✓				✓
Pacific-slope flycatcher	✓	✓			✓	✓			✓	✓			

Species	Rapid				Intensive				Enhanced intensive (EI)				Flyovers: All sites
	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	
Peregrine falcon	✓	✓			✓				✓				✓
Phainopepla	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓
Pied-billed grebe	✓		✓				✓				✓		
Plumbeous vireo		✓			✓	✓				✓			
Prairie falcon	✓				✓								✓
Red-breasted merganser									✓				✓
Redhead	✓	✓											✓
Red-shafted northern flicker					✓	✓							
Red-tailed hawk	✓	✓	✓		✓		✓		✓				✓
Red-winged blackbird	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ring-billed gull	✓												✓
Rock pigeon		✓											✓
Rock wren							✓						
Ruby-crowned kinglet	✓	✓			✓	✓			✓	✓			
Ruddy duck			✓										
Rufous hummingbird	✓				✓								
Savannah sparrow	✓	✓				✓							
Say's phoebe	✓		✓		✓		✓		✓		✓	✓	✓
Sharp-shinned hawk	✓	✓			✓	✓			✓				✓
Snow goose	✓												✓
Snowy egret	✓	✓			✓				✓	✓			✓

Species	Rapid				Intensive				Enhanced intensive (EI)				Flyovers: All sites
	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	
Solitary sandpiper						✓							
Song sparrow	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	
Sonoran yellow warbler	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	
Sora	✓						✓		✓		✓		
Southwestern willow flycatcher		✓					✓						
Spotted sandpiper	✓		✓										
Spotted towhee					✓								
Summer tanager	✓	✓	✓	✓			✓	✓	✓		✓	✓	✓
Swainson's thrush	✓	✓			✓	✓			✓	✓			
Swainson's hawk	✓	✓			✓	✓				✓			✓
Townsend's warbler	✓	✓			✓	✓			✓	✓			
Tree swallow	✓	✓			✓	✓			✓	✓			✓
Tropical kingbird				✓	✓								✓
Turkey vulture	✓	✓	✓		✓	✓			✓	✓			✓
Unidentified <i>accipiter</i> hawk						✓							
Unidentified <i>empidonax</i> flycatcher	✓	✓	✓		✓	✓			✓	✓			
Unidentified hummingbird			✓	✓			✓	✓	✓		✓		✓
Unidentified swallow	✓	✓			✓	✓			✓				✓
Unknown yellow-rumped warbler	✓	✓			✓	✓			✓				✓
Vaux's swift		✓			✓	✓			✓				✓
Verdin	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓

Species	Rapid				Intensive				Enhanced intensive (EI)				Flyovers: All sites
	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	
Vermilion flycatcher		✓	✓	✓				✓			✓		✓
Vesper sparrow	✓	✓											
Violet-green swallow	✓	✓			✓	✓	✓		✓	✓	✓		✓
Virginia rail			✓			✓	✓				✓		
Warbling vireo	✓	✓			✓	✓			✓	✓			
Western bluebird									✓				
“Western” flycatcher	✓	✓			✓	✓			✓	✓			
Western grebe			✓										
Western kingbird	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Western least bittern			✓										
Western meadowlark			✓	✓									
Western screech owl											✓		
Western tanager	✓	✓	✓		✓	✓			✓	✓			✓
Western wood-pewee	✓	✓			✓	✓			✓	✓			
Whimbrel		✓											
White-crowned sparrow	✓	✓			✓	✓			✓	✓			
White-faced ibis	✓	✓			✓	✓			✓	✓			✓
White-tailed kite		✓		✓		✓							✓
White-throated swift	✓		✓		✓				✓				✓
White-winged dove	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Willow flycatcher	✓	✓			✓	✓			✓	✓	✓	✓	

Species	Rapid				Intensive				Enhanced intensive (EI)				Flyovers: All sites
	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	System-wide	Habitat conservation	
Wilson's warbler	✓	✓			✓	✓	✓		✓	✓			✓
Wilson's phalarope	✓												✓
Wilson's snipe	✓				✓						✓		✓
Yellow-breasted chat	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓
Yellow-beaded blackbird	✓	✓	✓	✓	✓	✓			✓	✓			✓
Yellow-rumped (Audubon's) warbler	✓	✓			✓	✓			✓	✓			✓
Yellow-rumped (Myrtle's) warbler	✓	✓			✓				✓				
Yuma clapper rail			✓				✓				✓		
Zone-tailed hawk					✓								

ATTACHMENT 5

List of All Area Search Plots Surveyed for Project
Components 1 and 3 in 2012

“x” indicates plots surveyed in 2012. Asterisks (*) indicate plots slated for survey but not completed in 2012 due to access issues (these plots will be surveyed in 2013).

Plot/section	System-wide plots (n = 80)	Habitat creation plots (n = 71)	Intensive area search	Enhanced intensive area search
C1501		*		
C1502		x	Yes – habitat creation	
C1503		x	Yes – for Component 3 only	Yes
C1504		*		
C2101		x		
C2102		x		
C2103		x	Yes – habitat creation	
C2104		x		
C2105		x		
C2301		x		
C2302		x		
C2303		x		
C2304		x		
C2305		x		
C2306		x		
C2307		x		
C2308		x		
C2309		x		
C2310		x		
C2311		x		
C2312		x		
C2313		x		
C2314		x		
C2315		x		
C2316		x		
C2317		x		
C2318		x		
C2319		x		
C2320		x		
C2321		x		
C2322		x		
C2323		x		

Plot/section	System-wide plots (n = 80)	Habitat creation plots (n = 71)	Intensive area search	Enhanced intensive area search
C2324		x		
C2325		x		
C2326		x		
C2501		x		
C2502		x		
C2503		x		
C2504		x		
C2505		x		
C2506		x		
C2507		x		
C2508		x		
C2509		x	Yes – habitat creation	
C2510		x	Yes – habitat creation	
C2511		x		
C2512		x		
C2513		x		
C2514		x		
C2515		x		
C2516		x		
C2517		x		
C2518		x		
C2519		x		
C2520		x		
C2521		x		
C2522		x		
C2523		x		
C2701		x		
C2702		x		
C2703		x		
C2704		x		
C2705		x		
C2706		x	Yes – for Component 3 only	Yes
C2707		x		
C2720		x		
C2721		x		
C2722		x		

Plot/section	System-wide plots (n = 80)	Habitat creation plots (n = 71)	Intensive area search	Enhanced intensive area search
C2723		x		
C2724		x		
C2725		x		
C4701			Yes – by Fred Phillips Consulting, LLC	
C4702			Yes – by Fred Phillips Consulting, LLC	
C4703			Yes – by Fred Phillips Consulting, LLC	
S2268	x			
S2475	x			
S2495	x			
S2584	x			
S2595	x			
S2614	x			
S2648	x			
S2763	x			
S2861			Yes – for Component 3 only	Yes
S2867	x		Yes – system-wide	
S2869			Yes – for Component 3 only	Yes
S2872	x			
S2877	x			
S2883	x		Yes – system-wide	
S2903	x			
S2926	x			
S2928	x			
S2933	x			
S3320	x			
S3425	x			
S3433	x			
S5242	x			
S5257	x			
S5261	x			
S5278	x			
S5326	x			
S5415	x			
S5572	x			

Plot/section	System-wide plots (n = 80)	Habitat creation plots (n = 71)	Intensive area search	Enhanced intensive area search
S5799	x		Yes – system-wide	
S6157	x			
S6220	x			
S6234	x			
S6349	x			
S6469	x			
S6470	x			
S6476	x			
S6490	x			
S6517	x			
S6589	x			
S6593	x			
S6750	x			
S6756	x			
S6990	x			
S7102	x			
S7334	x		Yes – system-wide	
S7336	x			
S7337	x			
S7338	x			
S7369	x			
S7500	x			
S7683	x			
S7705	x			
S7740	x			
S7781	x			
S7785	x			
S7786	x		Yes – for Component 3 only	Yes
S7838	x			
S7915	x			
S7956	x			
S7986	x			
S7987	x			
S8011			Yes – for Component 3 only	Yes
S8031	x			
S8084	x			

Plot/section	System-wide plots (n = 80)	Habitat creation plots (n = 71)	Intensive area search	Enhanced intensive area search
S8223			Yes – for Component 3 only	Yes
S8242	x			
S8253	x			
S8262	x			
S8287	x			
S8293	x			
S8568	x			
S8581	x			
S8684	x			
S9015	x		Yes – system-wide	
S9047	x			
S9123	x			
S9124	x		Yes – system-wide and Component 3	Yes
S9291	x			
S9304	x		Yes – system-wide	
S9323	x		Yes – system-wide	
S9382	x			
S9401	x			
S9413			Yes – for Component 3 only	Yes
S9415	x			
S9438	x			

ATTACHMENT 6

Table of all the Plots Surveyed in 2012 Using the
Standard Intensive Area Search Method

Plot number	Enhanced intensive (n = 9)	System-wide standard intensive (n = 8)	Habitat creation standard intensive (n = 4)
S9413	Yes		
S9323		Yes	
S9304		Yes	
S9124	Yes	Yes	
S9015		Yes	
S8223	Yes		
S8011	Yes		
S7786	Yes		
S7334		Yes	
S5799		Yes	
S2883		Yes	
S2869	Yes		
S2867		Yes	
S2861	Yes		
Cibola Valley Conservation Area: C2510			Yes
Cibola Valley Conservation Area: C2509			Yes
Cibola National Wildlife Refuge Unit 1: C2706	Yes		
Beal Lake Conservation Area: C1503	Yes		
Beal Lake Conservation Area: C1502			Yes
Ahakhav Tribal Preserve: C2103			Yes

ATTACHMENT 7A

Non-breeding Tables for Habitat Creation Sites

Species that were just observed flying over plots, but not landing in them, are identified with a ^. Species known to be only migrants through the lower Colorado River area are identified with a *. Listed in alphabetical order.

Species	'Ahakhav Tribal Preserve	Beal Lake Conservation Area	Cibola National Wildlife Refuge Unit 1	Cibola Valley Conservation Area	Palo Verde Ecological Reserve
American bittern					x^
American kestrel				x^	x^
American robin	x*			x*	x*
Anna's hummingbird		x			
Arizona bell's vireo		x			
Ash-throated flycatcher	x				
Bank swallow			x*		
Barn owl	x^				
Barn swallow		x^*	x*	x^*	x^*
Belted kingfisher					x^
Black-chinned hummingbird					x
Black-headed grosbeak	x*	x*	x*	x*	x*
Black-throated gray warbler			x*	x*	
Blue grosbeak			x	x	x
Brewer's sparrow	x*	x*	x*	x*	x*
Brewer's blackbird			x	x^	
Brown-headed cowbird	x^	x	x	x^	x^
Bullock's oriole		x		x	x^
Caspian tern					x^*
Cassin's vireo			x*	x*	x*

Species	'Ahakhav Tribal Preserve	Beal Lake Conservation Area	Cibola National Wildlife Refuge Unit 1	Cibola Valley Conservation Area	Palo Verde Ecological Reserve
Chipping sparrow	x*		x*	x*	x*
Cliff swallow	x^	x^	x	x^	x^
Common ground-dove				x^	x
Common raven				x^	x^
Cooper's hawk			x	x^	x^
Costa's hummingbird				x^	
Double-crested cormorant	x^		x	x^	x^
Eurasian collared-dove				x^	x^
European starling	x^		x	x^	x^
Gambel's white-crowned sparrow		x*			
Great blue heron			x	x^	x
Great egret	x^		x	x^	x^
Great-tailed grackle	x^	x^	x	x^	x^
Green-tailed towhee	x*		x*	x*	x*
Hammond's flycatcher		x*			
Hermit thrush			x*	x*	
Hermit warbler			x*	x*	x*
Horned lark				x	
House finch	x^		x	x^	x^
House wren			x		x
Killdeer			x	x^	x^
Lawrence's goldfinch				x^	x^

Species	'Ahakhav Tribal Preserve	Beal Lake Conservation Area	Cibola National Wildlife Refuge Unit 1	Cibola Valley Conservation Area	Palo Verde Ecological Reserve
Lazuli bunting	x	x	x	x	x
Lesser goldfinch	x^		x	x	x
Lesser nighthawk			x	x^	x^
Lincoln's sparrow	x*	x*	x*	x*	x*
Loggerhead shrike				x	
Long-billed curlew			x*		x^*
Lucy's warbler			x	x	x
Macgillivray's warbler	x*	x*	x*	x*	x*
Mountain white-crowned sparrow				x*	
Mourning dove	x^	x	x	x^	x^
Nashville warbler	x*		x*	x*	x*
Northern harrier				x^	x^
Northern mockingbird				x^	
Northern parula				x*	
Northern rough-winged swallow	x^	x^	x	x^	x^
Olive-sided flycatcher			x*		x*
Orange-crowned warbler	x*	x*	x*	x*	x*
Osprey					x^
Pacific-slope flycatcher	x*	x*	x*	x*	x*
Peregrine falcon	x				
Phainopepla			x	x^	
Plumbeous vireo					x*

Species	'Ahakhav Tribal Preserve	Beal Lake Conservation Area	Cibola National Wildlife Refuge Unit 1	Cibola Valley Conservation Area	Palo Verde Ecological Reserve
Redhead					x^*
Red-tailed hawk	x			x^	x^
Red-winged blackbird	x^	x^	x	x^	x^
Rock pigeon	x^				
Ruby-crowned kinglet	x*	x*		x*	x*
Savannah sparrow			x*		
Sharp-shinned hawk			x	x^	x
Snowy egret				x^	
Song sparrow			x		
Sonoran yellow warbler ¹			x	x	x
Swainson's thrush			x*	x*	x*
Swainson's hawk			x*		x^*
Townsend's warbler			x*	x*	x*
Tree swallow	x^*	x^*	x*	x^*	x^*
Turkey vulture	x		x	x^	x^
Vaux's swift		x^*			
Verdin	x^	x		x	
Vermilion flycatcher ¹	x^				
Vesper sparrow			x*		
Violet-green swallow			x*	x^*	
Warbling vireo	x*	x*	x*	x*	x*
"Western" flycatcher	x*	x*	x*	x*	x*

Species	'Ahakhav Tribal Preserve	Beal Lake Conservation Area	Cibola National Wildlife Refuge Unit 1	Cibola Valley Conservation Area	Palo Verde Ecological Reserve
Western kingbird	x	x^	x	x^	x^
Western tanager		x	x	x	x
Western wood-pewee	x*	x*	x*	x*	x*
Whimbrel			x*		
White-crowned sparrow	x*	x*	x*	x*	x*
White-faced Ibis			x*	x^*	x^*
White-tailed Kite			x		x^
White-winged dove	x^		x	x^	x^
Willow flycatcher ²			x	x	x
Wilson's warbler	x*	x*	x*	x*	x*
Yellow-breasted chat	x				
Yellow-headed blackbird			x	x^	x^
Yellow-rumped (Audubon's) warbler	x^*	x*	x*	x*	x*
Yellow-rumped (Myrtle's) warbler			x*		x*

¹ Lower Colorado River Multi-Species Conservation Program covered species.

² Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated.

ATTACHMENT 7B

Species Detected but Not Confirmed Breeding during Intensive Area Searches at Yuma East Wetlands in 2012 by Fred Phillips Consulting, LLC Surveyors

Note: Flyovers are included in this list, but incidental birds that were not in or above the plot during the survey are not included.

Species that were just observed flying over plots, but not landing in them, are identified with a ^. Species known to be only migrants through the lower Colorado River area are identified with a *. Listed in alphabetical order.

Species	Yuma East Wetlands plots		
	Plot 4701	Plot 4702	Plot 4703
Abert's towhee	x	x	x
American coot	x		
American kestrel	x^		
Anna's hummingbird	x	x	x
Audubon's warbler	x*	x*	
Ash-throated flycatcher	x	x	x
Black-chinned hummingbird	x	x	
Black-crowned night-heron	x		
Black phoebe	x		
Black-necked stilt	x	x	x^
Black-tailed gnatcatcher	x	x	x
Blue grosbeak		x	x
Brewer's sparrow	x*	x*	
Brown-headed cowbird	x^	x^	x^
Bullock's oriole	x	x	
Cliff swallow	x	x	x
Chipping sparrow		x	
Common yellowthroat	x	x	x
Crissal thrasher	x	x	x
Eurasian collared-dove	x	x	x
Gambel's quail	x	x	x
Gila woodpecker ¹	x		
Great egret	x		
Greater roadrunner	x		x
Great-tailed grackle	x		x
Green heron	x	x	
Hermit thrush	x*		
Hooded oriole			x
House finch	x	x	x
Indigo bunting	x		
Killdeer	x	x	

Species	Yuma East Wetlands plots		
	Plot 4701	Plot 4702	Plot 4703
Ladder-backed woodpecker	x	x	x
Lazuli bunting	x		x
Lesser goldfinch	x	x	
Lesser nighthawk	x		
Loggerhead shrike	x	x	
Macgillivray's warbler	x*	x*	x*
Mourning dove	x	x	x
Nashville warbler	x*	x*	x*
Northern mockingbird	x	x	x
Northern rough-winged swallow	x		x
Northern harrier		x	
Orange-crowned warbler	x*	x*	x*
Pacific-slope flycatcher	x*	x*	x*
Red-winged blackbird	x	x	x^
Rock pigeon	x		
Song sparrow	x	x	
Swainson's thrush	x*		x*
Townsend's warbler	x*	x*	x*
Tree swallow	x*		
Verdin	x	x	x
Warbling vireo	x*	x*	x*
"Western" flycatcher	x*	x*	x*
Western kingbird	x		
Western tanager	x*		x*
Western wood-pewee	x*		x*
White-crowned sparrow			x*
White-faced ibis		x^*	x^*
White-winged dove	x	x	x
Willow flycatcher ¹	x	x	x
Wilson's warbler	x*	x*	x*
Yellow warbler ²	x		

¹ Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated.

² Lower Colorado River Multi-Species Conservation Program covered species.

ATTACHMENT 8

Map Showing Species Digitizing in Geographic Information System

Red dots are observations added to the shapefile based on the background imagery of the georeferenced species map.

