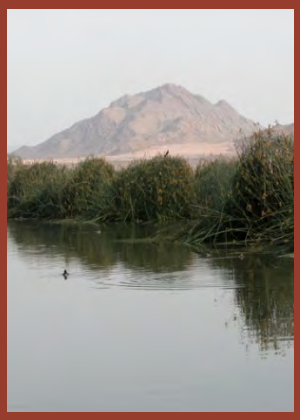

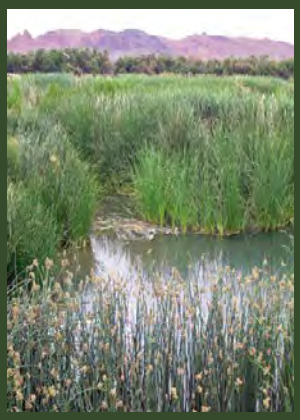

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Marsh Bird Monitoring, including Yuma Ridgway's Rail, along Las Vegas Wash, Clark County, Nevada, 2007-2016

January 2017

SOUTHERN NEVADA WATER AUTHORITY

Las Vegas Wash Coordination Committee

Marsh Bird Monitoring, including Yuma Ridgway's Rail, along Las Vegas Wash, Clark County, Nevada, 2007-2016

SOUTHERN NEVADA WATER AUTHORITY
Las Vegas Wash Project Coordination Team

Prepared for:

U.S. Fish and Wildlife Service
Southern Nevada Field Office

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January 2017

EXECUTIVE SUMMARY

The Las Vegas Wash Coordination Committee (LVWCC), a 29-member stakeholder group, is working to stabilize and enhance the Las Vegas Wash (Wash), the channel that drains flows from the Las Vegas Valley to Lake Mead at Las Vegas Bay. The Wash also flows through the 2,900-acre Clark County Wetlands Park (Wetlands Park). Activities associated with the stabilization program and park development include wetland revegetation and expansion. As a result of informal Section 7 consultation with the U.S. Fish and Wildlife Service regarding the project, the Southern Nevada Water Authority, the lead agency of the LVWCC, began annual surveys to determine the occurrence of Yuma Ridgway's rail (*Rallus obsoletus yumanensis*; formerly known as the Yuma clapper rail [*R. longirostris yumanensis*]) within the Wetlands Park. Surveys were conducted by permitted consultants nearly annually from 2000 through 2007 (McKernan and Braden 2001, 2002; SWCA 2002, 2003, 2005, 2006, 2007, 2008). Conway (2005, 2009) developed a protocol for conducting marsh bird monitoring surveys that includes calling for Ridgway's rail. The U.S. Fish and Wildlife Service accepted this protocol as the new official Yuma Ridgway's rail survey protocol in 2006. The survey protocol enables compliance obligations regarding the Ridgway's rail to be met, while also providing information on the status, abundance and distribution of other sensitive species that may benefit from wetland revegetation efforts. The Las Vegas Wash Project Coordination Team began conducting surveys using the new protocol in 2007 (Van Dooremolen 2010a). Yuma Ridgway's rail could not be surveyed for the first year because the necessary federal permit was not in place. The species was added to the survey in 2008. This report presents results from the 2016 monitoring season and a review of ten years of marsh bird surveys in the study area.

Six species were targeted during the surveys: American bittern, least bittern, black rail, Ridgway's rail, Virginia rail, and sora. Detections of pied-billed grebe, common gallinule, and American coot (referred to as non-target species) were also recorded. Surveys were conducted along three survey routes (Routes 2-4) comprising 26 points in 2016. In the ten-year period, the species detected each year remained largely the same: least bittern, Virginia rail, sora and the three non-target species, with American bittern recorded in just two years. No black rail were detected. Yuma Ridgway's rail was not identified during the surveys, but an individual was detected during other work in both 2015 and 2016, though not in the breeding season. Sora was the most abundant of the target species every year, and American coot was the most abundant, by far, of all species recorded. The numbers of individuals detected of target and non-target species varied from year to year. In 2016, abundances were down and below ten-year averages for all species but the American coot, and this pattern applied across all routes with only a few exceptions, possibly due, at least in part, to changes in habitat quality from flooding and management actions. Habitat quality on Routes 2 and 3 was fair to good, but the Mitigation Wetlands (Route 4) still continue to offer the highest quality emergent wetland habitat in the study area, and the highest quality potentially suitable nesting habitat for Yuma Ridgway's rail. Least bittern, Virginia rail, and the non-target species were confirmed nesting within the study area in the ten-year period. No nesting was documented for American bittern, black rail, Yuma Ridgway's rail, or sora.

Annual marsh bird surveys along the Wash should continue in order to comply with informal Section 7 consultation measures regarding Yuma Ridgway's rail.

ACKNOWLEDGEMENTS

I thank Nicholas Rice and Timothy Ricks for assisting with surveys, and I thank the Las Vegas Wash Coordination Committee for their continued support for wildlife monitoring and the implementation of the Las Vegas Wash Comprehensive Adaptive Management Plan and the Las Vegas Wash Wildlife Management Plan. These activities have been conducted by Deborah Van Dooremolen under permit no. TE-148556-3 (expires May 24, 2018), Nicholas Rice under permit no. TE-64580A-2 (expires May 26, 2021) and Timothy Ricks under permit no. TE-67397A-2 (expires May 30, 2021) as issued by the U.S. Fish and Wildlife Service, Sacramento, California.

Marsh Bird Monitoring, including Yuma Ridgway's Rail, along Las Vegas Wash, Clark County, Nevada, 2007-2016

Table of Contents

Page No.

Page No.

List of Tables

List of Figures

List of Appendices

1.0 BACKGROUND

The Las Vegas Wash (Wash) is the primary drainage channel for the Las Vegas Valley, carrying flows, including highly treated wastewater, urban runoff, shallow groundwater, and storm runoff, through the 2,900-acre Clark County Wetlands Park (Wetlands Park) to Lake Mead at Las Vegas Bay (Figure 1). Although originally an ephemeral stream, the Wash began supporting perennial flows in the 1950s when the discharge of treated wastewater into the channel was initiated. At first these perennial flows created a lush wetland along the channel. However, the volume of flows in the Wash continued to increase with the increasing urban population, and erosion began to drain the wetlands and carry thousands of tons of sediment to Lake Mead. By the late 1990s, headcutting had deeply incised the channel and reduced the wetlands by approximately 90% from their peak extent, leaving less than 200 acres.

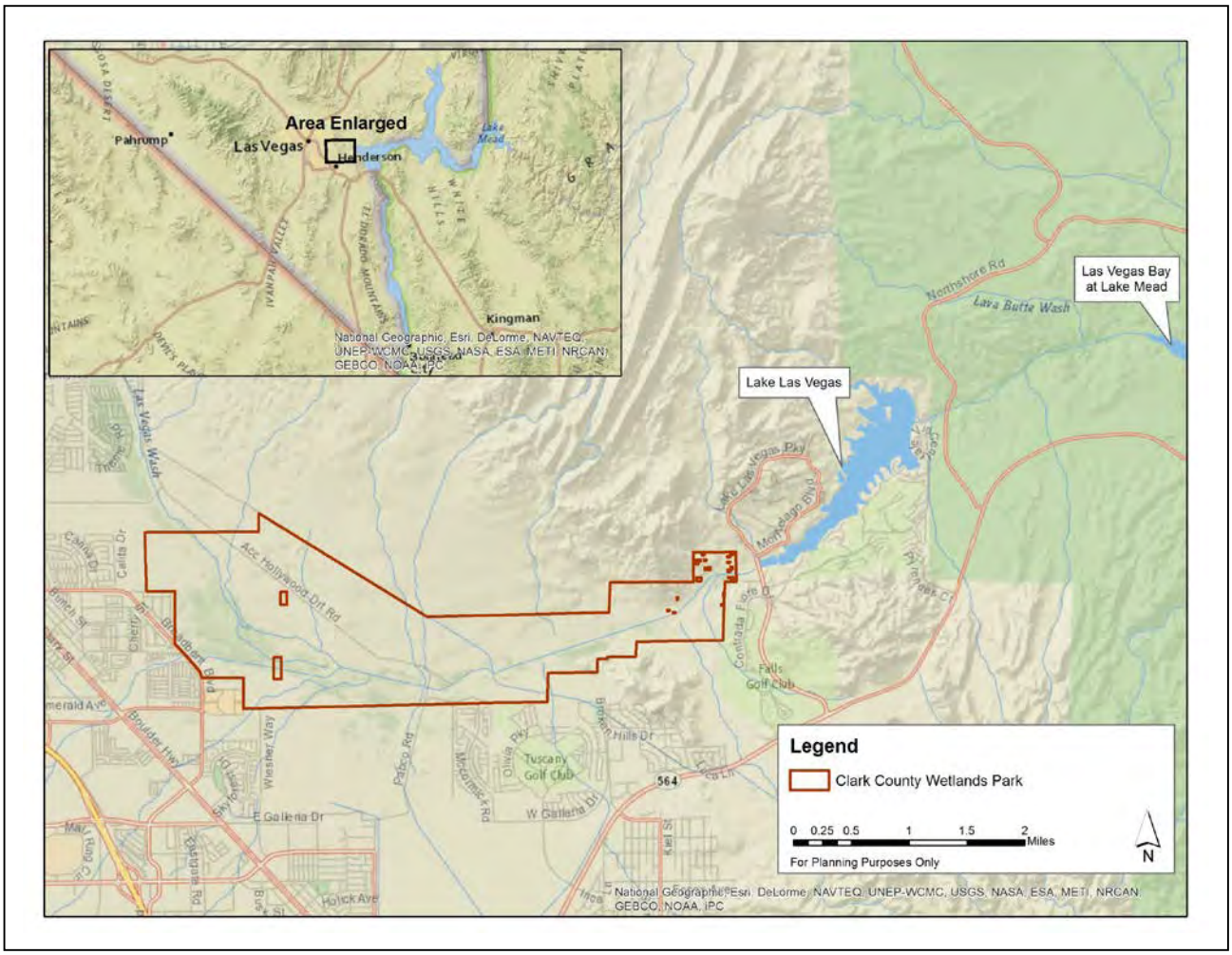

Figure 1. Las Vegas Wash location and general study area map.

In 1998, the Las Vegas Wash Coordination Committee (LVWCC), a now 29-member community stakeholder group, was created to address the degradation of the Wash. The group developed and is implementing the Las Vegas Wash Comprehensive Adaptive Management Plan (LVWCC 2000) to stabilize the Wash and restore its ecological functions. Stabilization and

enhancement activities, which include the construction of 21 erosion control structures (weirs) and extensive revegetation, will help deter further erosion and reduce the amount of sediment being deposited in Lake Mead; 19 weirs were in place by spring 2016.

The LVWCC is increasing wetland habitat along the channel by planting bulrush (*Schoenoplectus* spp.) in the impoundments of the weirs and along the weir faces; cattails (*Typha domingensis*) and common reed (*Phragmites australis*) volunteer from upstream sources. Emergent vegetation can also be found in the constructed wetland ponds in the Wetlands Park Nature Preserve (Nature Preserve). Clark County has created additional wetland habitat within the Wetlands Park in the form of the in-lieu fee mitigation wetlands (Mitigation Wetlands; Figure 2), first constructed in 2009. The increase in wetland habitat along the Wash and throughout the Wetlands Park could have a positive impact on secretive marsh birds (e.g., rails and bitterns), including the federally endangered Yuma Ridgway's rail (*Rallus obsoletus yumanensis*). (Note: This species was known as the Yuma clapper rail [*R. longirostris yumanensis*] until it was reclassified as a different species by Chesser et al. [2014]; for simplicity, all references below have been updated with the new species name).

The Yuma Ridgway's rail is largely restricted to the lower Colorado River watershed and the Salton Sea, inhabiting freshwater and brackish water wetlands (Anderson and Ohmart 1985). Home range size varies seasonally and is greatest during winter and post-breeding (Eddleman 1989, Conway et al. 1993). Eddleman (1989) reported a mean annual home range size of more than 17 acres, while Conway et al. (1993) reported mean annual home range size to be 30 acres. Sites occupied by Yuma Ridgway's rail have a higher percent cover of shallow water (Eddleman 1989). Density of emergent vegetation has also been reported as an important habitat variable, although findings differ. Anderson and Ohmart (1985) found that Yuma Ridgway's rail typically reached their highest numbers year-round in the densest stands of emergent vegetation, while Conway et al. (1993) found low stem densities to be an important component. Species preferences also vary. Conway et al. (1993) found that cattails and bulrush are preferred, although Yuma Ridgway's rails have also been detected in wetlands dominated by common reed, salt cedar (*Tamarix ramosissima*), and willow (*Salix* spp.; Eddleman 1989, Hinojosa-Huerta et al. 2001). Differences in preferred density and species of emergent vegetation among different geographic locations may relate to densities of crayfish, the most abundantly consumed prey item of the Yuma Ridgway's rail (Anderson and Ohmart 1985). Habitat use also changes throughout the year, thus Conway et al. (1993) suggest that maintaining shallow, open water areas with stands of emergent vegetation at different successional stages would best support Ridgway's rails year-round.

Alcorn (1988) reported that eight Ridgway's rails were observed in the Las Vegas Sewage disposal drainage ditch on September 6, 1959, and that a lone individual was observed in the same location a few weeks later (the site of the detections is believed to be the present-day City of Las Vegas Water Pollution Control Facility discharge channel, located approximately 1.5 miles upstream of the Wetlands Park boundary; Figure 2). A Yuma Ridgway's rail was also detected along the Wash, within the Wetlands Park, on May 28 and June 18, 1998, in a wet, salt cedar-dominated area upstream of Pabco Road Weir (Southwest Wetlands Consortium 1998; Figure 2). As a result of informal Section 7 consultation with the U.S. Fish and Wildlife Service on the proposed development of the Wetlands Park and associated erosion control structures, the

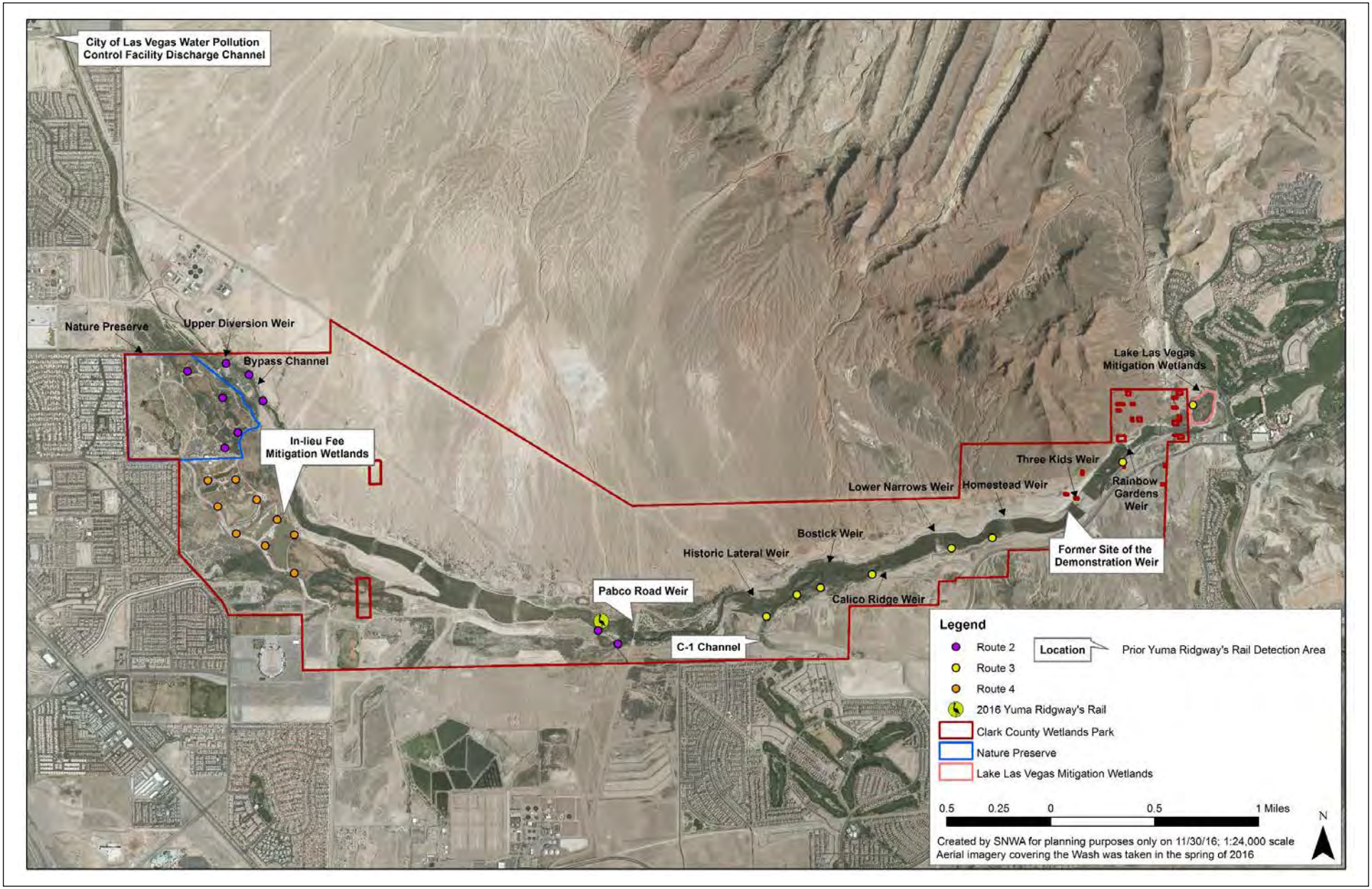

Figure 2. Prior Yuma Ridgway's rail detection areas, survey route locations of interest, and 2016 marsh bird monitoring points and Yuma Ridgway's rail detection location.

Southern Nevada Water Authority (SNWA), the lead agency of the LVWCC, began annual surveys to determine the occurrence of Yuma Ridgway's rail within the Wetlands Park.

SNWA contracted with permitted consultants to perform these surveys from 2000 to 2004 and 2006 to 2007. No Yuma Ridgway's rails were detected from 2000 to 2004, nor in 2007 (McKernan and Braden 2001, 2002; SWCA 2002, 2003, 2005, 2008). A Yuma Ridgway's rail was detected on May 23, 2005, during surveys for other species. It was calling from emergent habitat in the impoundment of the Demonstration Weir, which has since been demolished and replaced by the Three Kids Weir (SWCA 2006; Figure 2). On June 4 and June 7, 2006, also during surveys for other species, another Ridgway's rail was detected in the marsh along the C-1 Channel near where it discharges to the Wash (SWCA 2007; Figure 2). While the location where the bird was detected was lined with rock and concrete in subsequent years, emergents and other wetland vegetation have returned. Just last year, a Yuma Ridgway's rail was seen at the Mitigation Wetlands (Route 4) during aquatic bird counts on August 19 (Van Dooremolen 2015). The bird was observed foraging in the same location on several different mornings through September 3.

Conway (2005, 2009) developed a protocol for conducting marsh bird monitoring surveys that includes calling for Ridgway's rail. The U.S. Fish and Wildlife Service accepted this protocol as the new official Yuma Ridgway's rail survey protocol in 2006. The survey protocol enables compliance obligations regarding the Ridgway's rail to be met, while also providing information on the status, abundance, and distribution of other sensitive species such as the least bittern (*Ixobrychus exilis*) and black rail (*Laterallus jamaicensis*), which are covered on the Lower Colorado River Multi-Species Conservation Program and may benefit from wetland revegetation efforts. Consequently, in 2007, the Las Vegas Wash Project Coordination Team (Wash Team; the implementation team of the LVWCC) initiated a marsh bird monitoring study along the Wash and within the Wetlands Park (Van Dooremolen 2010a, 2010b, 2012, 2013, 2014a, 2014b, 2015). Yuma Ridgway's rail could not be surveyed for the first year because the necessary federal permit was not in place; therefore, the species was not added to the survey until 2008. This report presents results from the 2016 monitoring season and a review of ten years of marsh bird surveys in the study area.

2.0 METHODS

2.1 Description of Survey Routes

Three routes totaling 26 points were surveyed in 2016 (Figure 2). GPS coordinates of the points are included in Appendix A.

Route 2 included nine points in 2016: four within the constructed wetlands ponds at the Nature Preserve, one in the Upper Diversion Weir impoundment, two along the bypass channel, and two along the Wash upstream of Pabco Road Weir (Figure 2). The Nature Preserve ponds (3-acre lower pond [Vern's Pond], 1.5-acre middle pond complex, and 1.5-acre upper pond) have varying amounts of open water and the vegetation is composed of cattails, California and hardstem bulrush (*S. californicus* and *S. acutus*), common reed, sandbar willow (*S. exigua*), Goodding willow (*S. gooddingii*) and cottonwood (*Populus fremontii*). The Upper Diversion Weir point covers the 3.5-acre cattail complex in the impoundment. The bypass channel points include three acres of emergent marsh dominated by bulrush and cattails, with some sandbar and

Goodding willow, and other woody riparian species. The points at Pabco Road Weir cover approximately six acres of wetland habitat, with two points upstream of the weir. The emergent habitat is dominated by cattails and common reed. The riparian component of the habitat recovered somewhat from the prior year; the willows and cottonwoods that had been cleared in preparation for the construction of Sunrise Mountain Weir (currently on hold) resprouted several feet. The water upstream of the weir is slow-moving and includes a small backwater pond and wetlands created by the City of Henderson Water Reclamation Facility outfall channel.

Route 3 included eight points (approximately 45 acres of habitat; Figure 2) in 2016. The route begins in the small backwater wetland at the discharge of the C-1 Channel into the Wash (at the toe of Historic Lateral Weir) and continues downstream to end in the Lake Las Vegas mitigation wetlands, an off-channel wetland located on City of Henderson property just east of the Wetlands Park boundary. It includes points sampling the impoundments of Bostick, Calico Ridge, Homestead (new in 2016) and Rainbow Gardens weirs, as well as the toe of Lower Narrows Weir (Figure 2). All of these locations have banks and islands covered in cattails, bulrush, and common reed. The oldest of them, Bostick and Calico Ridge, also have mature Goodding willow with lesser amounts of sandbar willow, cottonwood and other riparian vegetation. The large sandbar in the Rainbow Gardens Weir impoundment that was dominated by riparian and wetland vegetation was removed in October 2015, opening up aquatic habitat and leaving only a small amount of emergent vegetation at the site. The area around the C-1 Channel point was still flooded as a result of repairs to the Historic Lateral Weir in the winter of 2014, requiring the movement of the monitoring station further up the channel.

Route 4 included nine points (approximately 60 acres of habitat; Figure 2) in 2016. The route is located in the Mitigation Wetlands created by Clark County. Two points were established on the smaller wetland cells, six on the larger cells, and one immediately to the southeast, covering habitat flooded by Duck Creek and the west channel, which carries overflows from Duck Creek and the Mitigation Wetlands. The smaller cells are dominated by dense stands of cattails and common reed, with the closest open water approximately 150 feet or more from the points. The larger cells are dominated by open water; cattails, bulrush, and common reed of varying width grow along the banks and in a few stands in the interior. Open water is deep in the smaller cells (greater than three feet), but mostly shallow in the larger cells, which contain only narrow zones of deeper water. The habitat at the point immediately adjacent to the Mitigation Wetlands consists primarily of cattails, flooded tamarisk, and common reed.

Along each route, survey points were established a minimum of 656 feet apart. Although Conway (2005, 2009) recommends a separation of 1,312 feet, the Wash does not contain enough emergent marsh to allow for such wide spacing while still maintaining a sufficient number of points per route. Conway (2005, 2009) does allow for tighter spacing in such circumstances but warns of the risk of double-counting individuals.

2.2 Survey Protocol

Surveys were performed using the North American marsh bird monitoring protocol developed by Conway (2005, 2009). Trained observers conducted the surveys during the breeding season from April through mid-May. Four surveys of each route were conducted (the protocol requires three) and each route was surveyed on a separate day. Two observers conducted each survey,

including at least one of the following permitted individuals: Deborah Van Dooremolen-TE-148556-3, Nicholas Rice-TE-64580A-2, and Timothy Ricks-TE-67397A-2. Surveys began one half hour before sunrise and concluded by 9 a.m. Although Conway (2005, 2009) specifies that the survey route be run in the same direction every time, each route was run in reverse every other survey to ensure that most points were surveyed during the earliest morning hours (the time of peak marsh bird vocalization). Surveys were not conducted if wind reached or exceeded 12 miles per hour, as measured by the Beaufort wind scale, for more than two points (see Appendix B for weather conditions on survey days).

At each point, surveys began with a five-minute period of passive listening followed by broadcasting the vocalizations of each target species in succession to elicit a response. Target species for the Wash survey included American bittern (*Botaurus lentiginosus*), least bittern, black rail, Ridgway's rail, Virginia rail (*R. limicola*), and sora (*Porzana carolina*). Each species' vocalizations were broadcast for 30 seconds, followed by 30 seconds of silence to listen for responses, for a total of one minute per species. Species' vocalizations were broadcast in succession from most sensitive (i.e., likely to be deterred from responding by hearing the call of another species) to least sensitive: black rail, least bittern, sora, Virginia rail, Ridgway's rail, and American bittern. Vocalizations were broadcast using MP3 players with portable speakers. The observers recorded all target species heard and/or seen during the survey, making a separate record for each bird and noting each minute of the survey period in which it was heard calling and/or seen. Individuals were also recorded if they were heard or seen at the point immediately before or after the survey. Detections of three other marsh bird species that were not targeted through the broadcast were also recorded, including pied-billed grebe (*Podilymbus podiceps*), common gallinule (*Gallinula galeata*), and American coot (*Fulica americana*). Given the sheer numbers of coots present at some points, observers often counted them either before or after the survey. Other data collected include the call type heard, the distance and direction to each detected bird, and whether the bird was detected at a previous point. The background noise level was also recorded at each point. Noise designated as loud or intense meant that at least some species could not be heard beyond approximately 165 or 80 feet, respectively.

The observers compared data after the survey was completed at each point in order to rectify any differences in detections.

2.3 Data Analysis

Points had to be surveyed a minimum of three times under appropriate conditions (wind below 12 miles per hour, no loud or intense noise, etc.) to be used in the analysis. Detections of target and non-target species were summarized by route and date to provide an overall picture of when and where birds were detected. However, since multiple detections could be made of the same bird over the course of a survey season, the number of unique individuals per species along each route was also estimated. This number was calculated as the sum of the maximum number of birds of the species that were detected at each point during the season. Whether or not a bird was counted as a unique individual was determined by the following criteria. If one or more individuals of a species were detected at the same point on more than one survey, they were considered to be the same individual(s). If an individual had been detected at a previous point during a survey, the second survey detection was not counted. If an individual was detected at a point within 656 feet of a location where an individual had been detected on a prior survey, and

the individual was calling from approximately the same direction where the other bird had been detected, it was considered to be the previously detected bird and was not counted as a new individual. This yielded an estimate of the number of individuals detected, i.e., the abundance, of each species. (Note: The above assumes that individuals inhabit a relatively small, defined area, a home range, throughout the survey season. Thus a Virginia rail detected at Point 1 during the second and third surveys on Route 4 would be considered a unique individual, and a Virginia rail detected at Point 6 on the same route in the fourth survey would be considered a unique individual. This assumption works well for species such as the Virginia rail and sora that inhabit smaller home ranges but could not be applied to the Yuma Ridgway's rail, which has not yet been detected during these surveys.)

For each route, the total number of individuals detected of each species, the total number of individuals detected of target species, and the total number of individuals detected regardless of species, were divided by the number of points the route contained, yielding a per point abundance for each. Then for the study area as a whole, the total number of individuals detected of each species, the total number of individuals detected of target species, and the total number of individuals detected regardless of species, were divided by the total number of points surveyed to yield the total abundance per point for each. Per point abundance (commonly referred to simply as abundance in the text) provides for a more accurate comparison between routes and between years because the number of points surveyed has varied over time. However, it should also be noted that, with the exception of American coot, the number of individuals detected on each route is typically small enough that the loss or addition of just one or two individuals can have a noticeable impact on this metric.

Abundance data were compared with results from the previous year and with an average of all ten years of surveys (seven for the Mitigation Wetlands) to look for changes. Charts of abundance for each species from 2007 through 2016 were also created to show trends and variations over time.

As stated in Section 2.1, the recommended spacing of points is 1,312 feet. Broadcasting from points with tighter spacing may impact bird behavior, calling them in from more distant points (Conway 2009). Since spacing for this study is half of the recommended distance, it is possible that some individuals were double-counted.

3.0 RESULTS AND DISCUSSION

Results are presented and discussed from both a species and a route perspective and a breeding status update is provided for both target and non-target species.

3.1 Species

Of the target species, least bittern, Virginia rail, and sora were detected in 2016 (Table 1). At least one individual of each species was detected on all routes with the exception of Virginia rail, which was not detected on Route 2. At least one individual of each non-target species was detected on all routes. Common gallinule and American coot were also identified during all survey replicates on each route (Table 1).

Route	No. of Points	Date	LEBI	VIRA	SORA	PBGR	COGA	AMCO	Grand Total
2	9	4/4/2016	1		7	2	4	19	33
		4/18/2016				3	3	11	17
		5/2/2016				1	4	9	14
		5/16/2016	1				5	7	13
2 Total			2	0	7	6	16	46	77
3	8	4/5/2016		1	1	1	6	155	164
		4/19/2016	1		1		6	68	76
		5/3/2016		2	2		9	35	48
		5/17/2016					5	19	24
3 Total			1	3	4	1	26	277	312
4	9	4/6/2016		1	7	2	2	8	20
		4/20/2016	1		2	1	4	55	63
		5/4/2016	1	2	1	1	3	53	61
		5/18/2016		1			5	47	53
4 Total			2	4	10	4	14	163	197
Grand Total	26		5	7	21	11	56	486	586

Table 1. Total 2016 detections for each species by route and date for the 26 points surveyed. LEBI=Least Bittern, VIRA=Virginia Rail, SORA=Sora, PBGR=Pied-billed Grebe, COGA=Common Gallinule, AMCO=American Coot.

Sora was the most abundant of the target species with 0.65 individuals per point (Table 2). American coot was the most abundant of all species with 9.77 birds per point, while common gallinule was a distant second at 1.00 birds per point (Table 2).

Least bittern, Virginia rail, and sora have been identified in all ten survey years, as have the three non-target species (Table 2, Figures 3-5). Sora has been the most abundant of the target species every year, just as American coot has been the most abundant, by far, of all species recorded. American bittern has only been detected twice during the surveys, and just on Route 4. As in all prior years of this study, no Yuma Ridgway's rail or black rail were detected during the surveys. However, a Yuma Ridgway's rail was heard by Great Basin Bird Observatory staff on Route 2, less than 200 feet from one of the monitoring points, during vegetation surveys for the avian point count study on October 20 (UTMs: E-681115, N-3995671; Datum-NAD83, Zone 11N). The bird kekked when the field crew entered a patch of common reed on the north bank of the Wash above Pabco Road Weir (Figure 2). A follow-up visit by a permitted Wash Team biologist on November 3 failed to detect the bird; call playback was used after 30 minutes of passive listening. There was no response. This marks the second consecutive year with a Ridgway's rail detection, although, as with all prior detections of the species, they were made during other surveys and not during official protocol monitoring.

The abundances of all species have exhibited variation over the ten years of surveys, with none increasing or decreasing for more than three consecutive years (Table 2, Figures 3-5). While no species has an obvious overall increasing or decreasing trend, there are some notable similarities in trends among species. From 2011 onward, least bittern and sora show a similar abundance pattern, peaking in 2012, declining the following year, rising again in 2014 and then declining for the past two years (Virginia rail and American coot mimic much, but not all, of this pattern).

			Target Species (TS) abundance (per point)					Non-target Species abundance (per point)			
Year	**Route**	**No. of Points**	**AMBI**	**LEBI**	**VIRA**	**SORA**	**Total TS**	**PBGR**	**COGA**	**AMCO**	**Grand Total**
2007	1	9	0 (0.00)	1 (0.11)	4 (0.44)	7 (0.78)	12 (1.33)	1 (0.11)	1 (0.11)	15 (1.67)	29 (3.22)
	2	8	0 (0.00)	4 (0.50)	2 (0.25)	5 (0.63)	11 (1.38)	7 (0.88)	14 (1.75)	81 (10.13)	113 (14.13)
	3	7	0 (0.00)	4 (0.57)	1 (0.14)	2 (0.29)	7 (1.00)	4 (0.57)	13 (1.86)	68 (9.71)	92 (13.14)
2007 Total		24	0 (0.00)	9 (0.38)	7 (0.29)	14 (0.58)	30 (1.25)	12 (0.50)	28 (1.17)	164 (6.83)	234 (9.75)
2008	1	9	0 (0.00)	0 (0.00)	4 (0.44)	6 (0.67)	10 (1.11)	1 (0.11)	1 (0.11)	20 (2.22)	32 (3.56)
	2	8	0 (0.00)	2 (0.25)	0 (0.00)	5 (0.63)	7 (0.88)	4 (0.50)	15 (1.88)	41 (5.13)	67 (8.38)
	3	9	0 (0.00)	9 (1.00)	1 (0.11)	5 (0.56)	15 (1.67)	5 (0.56)	12 (1.33)	151 (16.78)	183 (20.33)
2008 Total		26	0 (0.00)	11 (0.42)	5 (0.19)	16 (0.62)	32 (1.23)	10 (0.38)	28 (1.08)	212 (8.15)	282 (10.85)
2009	1	9	0 (0.00)	2 (0.22)	2 (0.22)	5 (0.56)	9 (1.00)	0 (0.00)	0 (0.00)	4 (0.44)	13 (1.44)
	2	8	0 (0.00)	2 (0.25)	0 (0.00)	6 (0.75)	8 (1.00)	4 (0.50)	11 (1.38)	46 (5.75)	69 (8.63)
	3	8	0 (0.00)	2 (0.25)	2 (0.25)	5 (0.63)	9 (1.13)	4 (0.50)	13 (1.63)	97 (12.13)	123 (15.38)
2009 Total		25	0 (0.00)	6 (0.24)	4 (0.16)	16 (0.64)	26 (1.04)	8 (0.32)	24 (0.96)	147 (5.88)	205 (8.20)
2010	1	3	0 (0.00)	0 (0.00)	2 (0.67)	3 (1.00)	5 (1.67)	0 (0.00)	0 (0.00)	0 (0.00)	5 (1.67)
	2	9	0 (0.00)	2 (0.22)	2 (0.22)	7 (0.78)	11 (1.22)	3 (0.33)	11 (1.22)	28 (3.11)	53 (5.89)
	3	6	0 (0.00)	2 (0.33)	0 (0.00)	3 (0.50)	5 (0.83)	1 (0.17)	10 (1.67)	50 (8.33)	66 (11.00)
	4	3	1 (0.33)	0 (0.00)	3 (1.00)	3 (1.00)	7 (2.33)	0 (0.00)	2 (0.67)	3 (1.00)	12 (4.00)
2010 Total		21	1 (0.05)	4 (0.19)	7 (0.33)	16 (0.76)	28 (1.33)	4 (0.19)	23 (1.10)	81 (3.86)	136 (6.48)
2011	2	9	0 (0.00)	4 (0.44)	0 (0.00)	5 (0.56)	9 (1.00)	5 (0.56)	11 (1.22)	54 (6.00)	79 (8.78)
	3	6	0 (0.00)	2 (0.33)	2 (0.33)	2 (0.33)	6 (1.00)	2 (0.33)	8 (1.33)	65 (10.83)	81 (13.50)
	4	9	0 (0.00)	2 (0.22)	11 (1.22)	9 (1.00)	22 (2.44)	7 (0.78)	9 (1.00)	56 (6.22)	94 (10.44)
2011 Total		24	0 (0.00)	8 (0.33)	13 (0.54)	16 (0.67)	37 (1.54)	14 (0.58)	28 (1.17)	175 (7.29)	254 (10.58)
2012	2	9	0 (0.00)	5 (0.56)	1 (0.11)	8 (0.89)	14 (1.56)	5 (0.56)	14 (1.56)	32 (3.56)	65 (7.22)
	3	9	0 (0.00)	4 (0.44)	3 (0.33)	13 (1.44)	20 (2.22)	2 (0.22)	16 (1.78)	184 (20.44)	222 (24.67)
	4	9	0 (0.00)	6 (0.67)	13 (1.44)	14 (1.56)	33 (3.67)	6 (0.67)	10 (1.11)	36 (4.00)	85 (9.44)
2012 Total		27	0 (0.00)	15 (0.56)	17 (0.63)	35 (1.30)	67 (2.48)	13 (0.48)	40 (1.48)	252 (9.33)	372 (13.78)
2013	2	9	0 (0.00)	3 (0.33)	1 (0.11)	5 (0.56)	9 (1.00)	3 (0.33)	15 (1.67)	71 (7.89)	98 (10.89)
	3	9	0 (0.00)	1 (0.11)	2 (0.22)	5 (0.56)	8 (0.89)	0 (0.00)	8 (0.89)	48 (5.33)	64 (7.11)
	4	9	0 (0.00)	3 (0.33)	7 (0.78)	12 (1.33)	22 (2.44)	5 (0.56)	10 (1.11)	59 (6.56)	96 (10.67)
2013 Total		27	0 (0.00)	7 (0.26)	10 (0.37)	22 (0.81)	39 (1.44)	8 (0.30)	33 (1.22)	178 (6.59)	258 (9.56)
2014	2	9	0 (0.00)	5 (0.56)	0 (0.00)	11 (1.22)	16 (1.78)	5 (0.56)	16 (1.78)	45 (5.00)	82 (9.11)
	3	7	0 (0.00)	2 (0.29)	1 (0.14)	4 (0.57)	7 (1.00)	1 (0.14)	3 (0.43)	140 (20.00)	151 (21.57)
	4	9	0 (0.00)	5 (0.56)	5 (0.56)	16 (1.78)	26 (2.89)	3 (0.33)	13 (1.44)	33 (3.67)	75 (8.33)
2014 Total		25	0 (0.00)	12 (0.48)	6 (0.24)	31 (1.24)	49 (1.96)	9 (0.36)	32 (1.28)	218 (8.72)	308 (12.32)
2015	2	9	0 (0.00)	4 (0.44)	1 (0.11)	7 (0.78)	12 (1.33)	6 (0.67)	17 (1.89)	24 (2.67)	59 (6.56)
	3	7	0 (0.00)	2 (0.29)	3 (0.43)	5 (0.71)	10 (1.43)	2 (0.29)	12 (1.71)	98 (14.00)	122 (17.43)
	4	9	1 (0.11)	3 (0.33)	5 (0.56)	6 (0.67)	15 (1.67)	4 (0.44)	10 (1.11)	40 (4.44)	69 (7.67)
2015 Total		25	1 (0.04)	9 (0.36)	9 (0.36)	18 (0.72)	37 (1.48)	12 (0.48)	39 (1.56)	162 (6.48)	250 (10.00)
2016	2	9	0 (0.00)	2 (0.22)	0 (0.00)	7 (0.78)	9 (1.00)	4 (0.44)	7 (0.78)	23 (2.56)	43 (4.78)
	3	8	0 (0.00)	1 (0.13)	2 (0.25)	3 (0.38)	6 (0.75)	1 (0.13)	12 (1.5)	155 (19.38)	174 (21.75)
	4	9	0 (0.00)	2 (0.22)	3 (0.33)	7 (0.78)	12 (1.33)	4 (0.44)	7 (0.78)	76 (8.33)	99 (11.00)
2016 Total		26	0 (0.00)	5 (0.19)	5 (0.19)	17 (0.65)	27 (1.04)	9 (0.35)	26 (1.00)	254 (9.77)	316 (12.15)

Table 2. Total and per point abundances by year and route for 2007-2016. AMBI=American Bittern, LEBI=Least Bittern, VIRA= Virginia Rail, SORA=Sora, PBGR=Pied-billed Grebe, COGA=Common Gallinule, AMCO=American Coot.

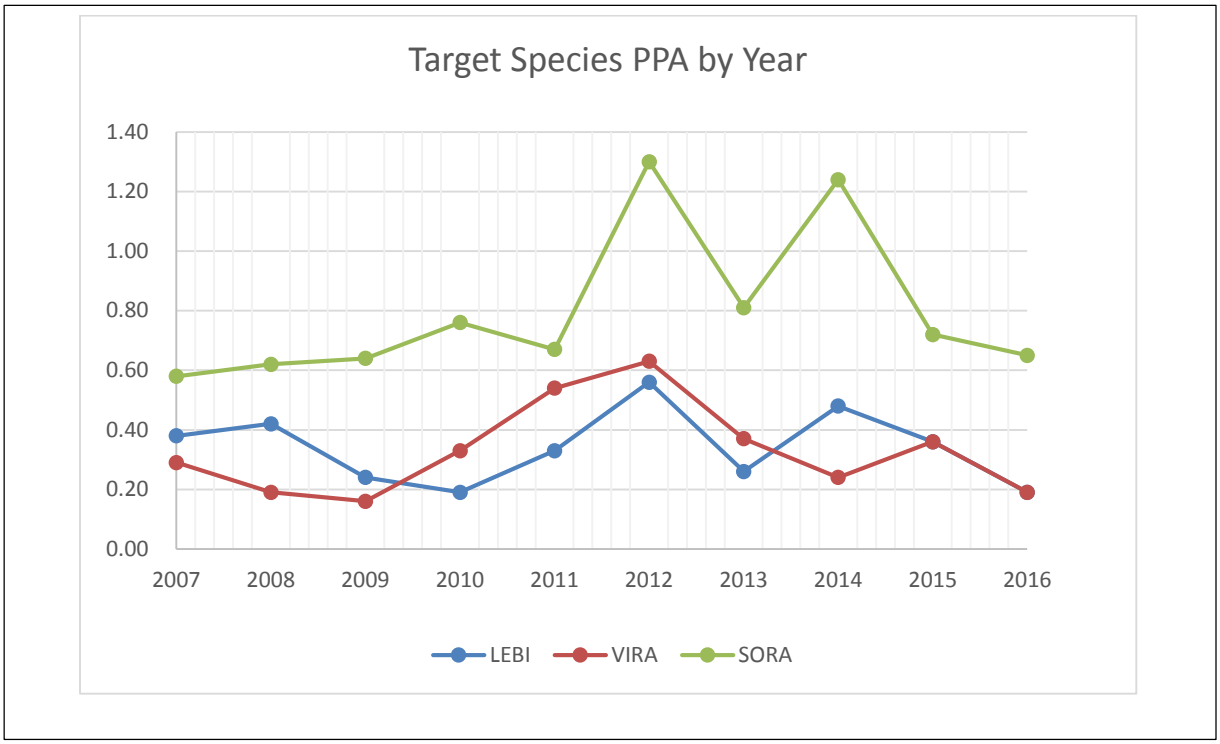

Figure 3. Target species per point abundances (PPA) by year, 2007-2016. LEBI=Least Bittern, VIRA= Virginia Rail, SORA=Sora.

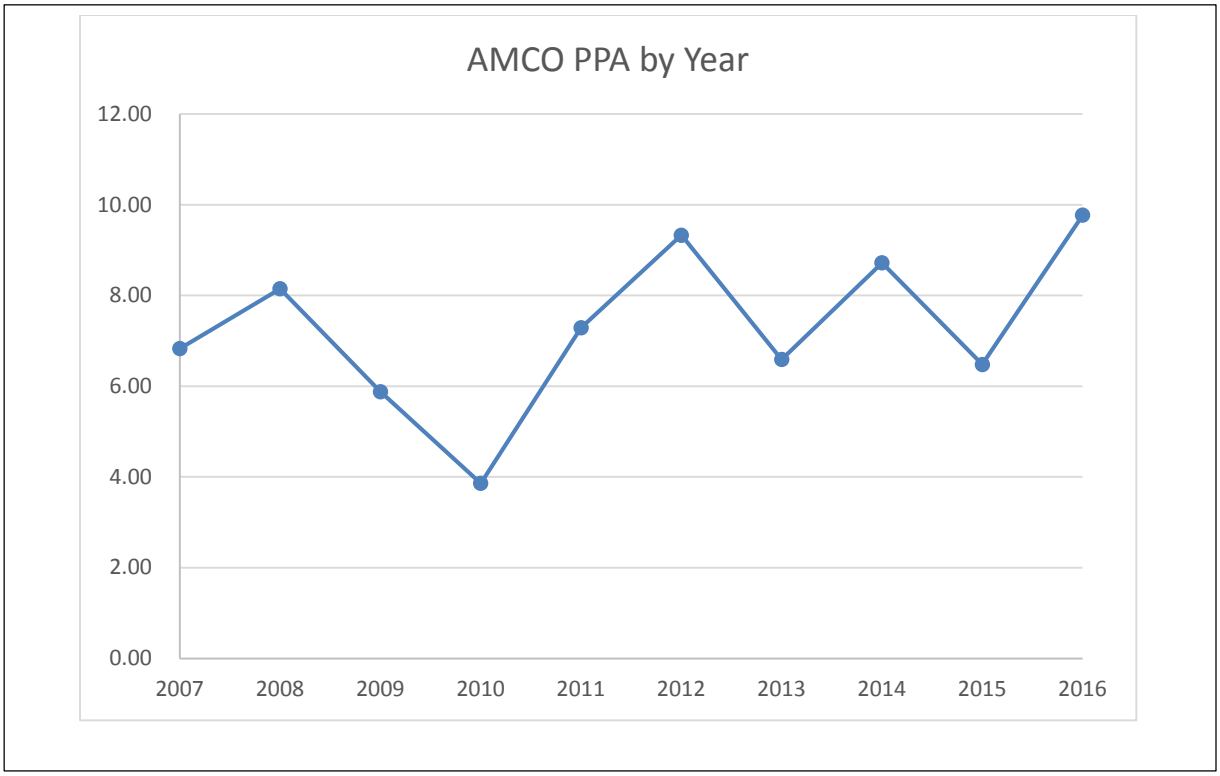

Figure 4. American coot (AMCO) per point abundance (PPA) by year, 2007-2016.

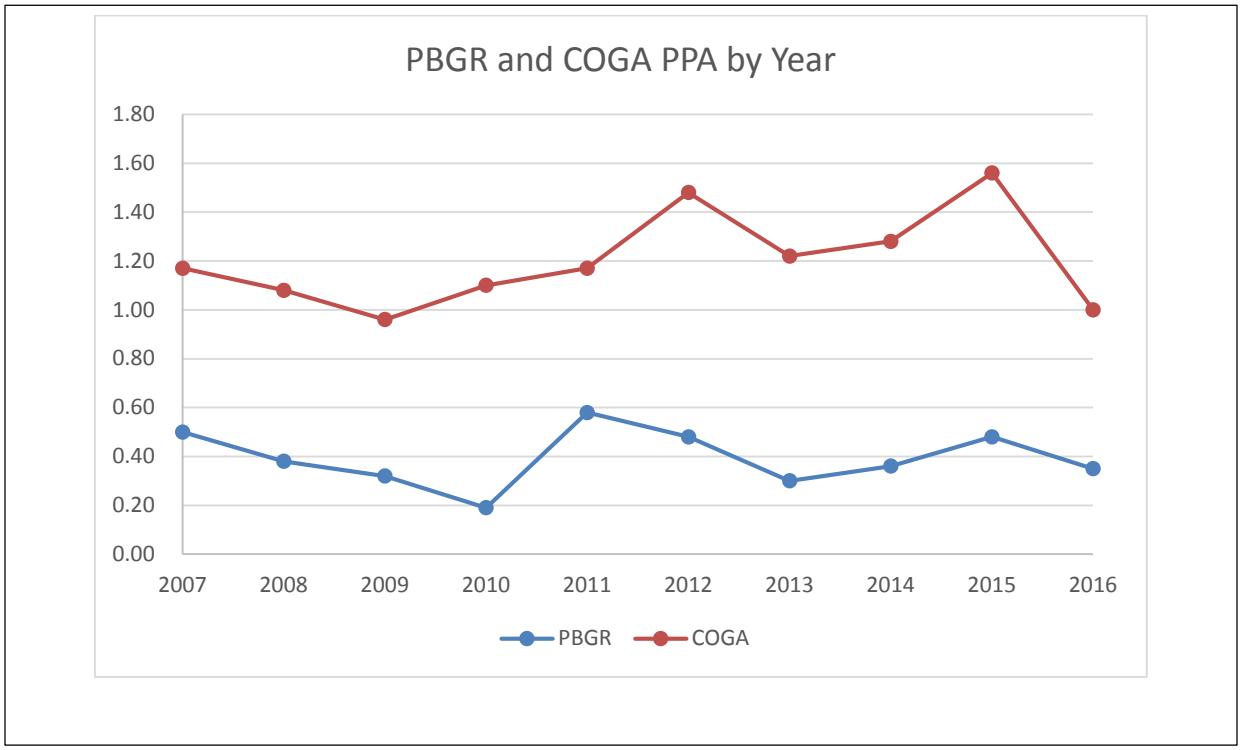

Figure 5. Pied-billed grebe (PBGR) and common gallinule (COGA) per point abundances (PPA) by year, 2007-2016.

The range of this trend is of note because 2011 was the first year of the current route composition. Route 1, which was located upstream of the Wetlands Park, was discontinued and the Mitigation Wetlands (Route 4) were mature enough to warrant a full route (three points were surveyed at the site in 2010, however, all but one changed in 2011; Table 2). Likewise, no points have changed on Routes 2 and 4 since 2011, although a few have changed on Route 3 due to habitat loss and creation. Also of note is the similar abundance pattern of pied-billed grebe and common gallinule over the ten-year period (Figure 5).

These similarities in trends indicate that forces that impact species abundance from year to year often have overarching, as well as species-specific, effects. This is intuitive, as all are marsh dependent species but have differences in status and habitat use. For example, while Virginia rail, pied-billed grebe and common gallinule are year-round residents in the study area, least bittern, sora, and American coot migrate or have a migratory component to their populations. Given this lens, the abundance pattern of Virginia rail (Figure 3) has strong similarities to that of pied-billed grebe and common gallinule (Figure 5), possibly indicating effects to year-round residents.

Most notably, the abundances of all species but American coot declined from 2015 to 2016, and all but the coot were below their ten-year averages, most substantially so (Table 3, Figures 3-5). While none established new lows, several were at or near their lowest abundance for the life of the surveys. Declines may be related to habitat impacts from flooding and management actions, further described under Section 3.2 below.

3.2 Routes

3.2.1 Route 2

In 2016, Route 2 shared the highest abundances of least bittern, sora and pied-billed grebe with Route 4 (Table 3), and with zero detections, had the lowest abundance of Virginia rail. With the exception of sora, abundances were down from the previous year, even for American coot, and well below average.

Route	Year	AMBI	LEBI	VIRA	SORA	Total TS	PBGR	COGA	AMCO	Grand Total
2	2015	0.00	0.44	0.11	0.78	1.33	0.67	1.89	2.67	6.56
	2016	0.00	0.22	0.00	0.78	1.00	0.44	0.78	2.56	4.78
	10Y AVG	**0.00**	**0.38**	**0.08**	**0.76**	**1.22**	**0.53**	**1.51**	**5.18**	**8.44**
3	2015	0.00	0.29	0.43	0.71	1.43	0.29	1.71	14.00	17.43
	2016	0.00	0.13	0.25	0.38	0.75	0.13	1.50	19.38	21.75
	10Y AVG	**0.00**	**0.37**	**0.22**	**0.60**	**1.19**	**0.29**	**1.41**	**13.69**	**16.59**
4	2015	0.11	0.33	0.56	0.67	1.67	0.44	1.11	4.44	7.67
	2016	0.00	0.22	0.33	0.78	1.33	0.44	0.78	8.33	11.00
	7Y AVG	**0.06**	**0.33**	**0.84**	**1.16**	**2.40**	**0.46**	**1.03**	**4.89**	**8.79**
Total	2015	0.04	0.36	0.36	0.72	1.48	0.48	1.56	6.48	10.00
	2016	0.00	0.19	0.19	0.65	1.04	0.35	1.00	9.77	12.15
	10Y AVG	**0.01**	**0.33**	**0.34**	**0.80**	**1.48**	**0.38**	**1.18**	**7.33**	**10.38**

Table 3. Per point abundances for each species for each route and overall for 2015 and 2016 with study averages. Overall averages include data from Route 1, which was surveyed from 2007 through 2010. AMBI=American Bittern, LEBI=Least Bittern, VIRA= Virginia Rail, SORA=Sora, TS=Target Species, PBGR=Pied-billed Grebe, COGA=Common Gallinule, AMCO=American Coot.

Over the ten-year period, Route 2 had somewhat higher average abundances of least bittern, pied-billed grebe and common gallinule than the other routes, suggesting a preference for the habitat there. Conversely, the route had substantially lower average Virginia rail abundance, with 5 of 10 survey seasons having no detections (Tables 2 and 3). This indicates that Route 2 provides less desirable habitat for the species than the other routes.

Habitat quality was fair to good in 2016, a decrease from 2015. Flooding from record rainfall in April negatively impacted habitat in the Upper Diversion Weir impoundment, flattening a large area of cattails and depositing sediment and trash. Also, cattails in the Nature Preserve continued to age and expand, closing off portions of the ponds, reducing open water. This may have impacted results. Clark County's last widespread cattail management occurred in 2014.

The route did host the October 2016 detection of Yuma Ridgway's rail noted under Section 3.1 in the portion on the Wash above Pabco Road Weir. The vegetation in that area had been cleared in the winter of 2015 in anticipation of weir construction that was later delayed. The emergents at the site had fully regrown by spring of 2016. The area where the bird was found is dominated by common reed and has a small backwater.

3.2.2 Route 3

Route 3 had the highest abundances of American coot and common gallinule in 2016 (Table 3). The route had the lowest abundances of least bittern and sora, resulting in the low for total target species abundance, as well. While Virginia rail numbers were higher than Route 2, they were still low at just two individuals (0.25 per point), and only one least bittern was detected along the route in 2016, a low only matched in 2013 (Table 2). Abundances followed the overall pattern of year over year declines and below average values for all species but the coot, with the exception of Virginia rail and common gallinule, whose abundances remained above their ten-year averages (Table 3). All three target species declined by more than 40% from 2015.

Route 3 had nearly double the average abundance of the other routes for American coot over the ten-year period with 16.59 birds per point (Table 3), indicating a strong preference for the stabilized habitat along the Wash. However, very few, if any, coots appear to actually nest on the Wash. High numbers are identified during the first survey of the season and then typically decline 85% or more by the last survey (see Table 1 for an example of this pattern from 2016), and no nesting behavior or independent young have been observed. This suggests that the majority of the birds are from the overwintering population that departs to nest elsewhere in the area or migrate to other breeding grounds.

Overall, habitat quality in 2016 was fair to good, as in the prior year. However, there were changes to habitat quality at some of the points. The marsh at the toe of the Lower Narrows Weir continued to improve and the habitat in the Homestead Weir impoundment (just downstream) matured enough to merit a monitoring point. However, although offering diverse, expansive emergent habitat, neither point yielded a target species detection in 2016, despite Lower Narrows providing three in 2015. (Note: Two least bittern were detected at the Lower Narrows point and two Virginia rail were detected at the Homestead point during other surveys in the fall of 2016). The clearing and removal of the sandbar above Rainbow Gardens Weir degraded habitat quality at the site, although likely just temporarily. The weir maintenance crew was unable to remove all of the marsh, and it expanded throughout the survey season. Sediment aggregated to it, beginning to reform the sandbar. The remnant emergent habitat also became a strainer for the debris and trash carried by the April storm flows. The clearing of the site did appear to positively impact coot numbers, with more than 50 counted at the site in the first survey, likely drawn by the increase in aquatic habitat. Finally, habitat quality at the Lake Las Vegas mitigation wetlands degraded in 2016. While it appeared that property managers had cleared some cattails, increasing open water slightly, water levels were lower and the water appeared stagnant. Common reed expanded and riparian trees showed signs of stress.

The changes to habitat at some of the points may have affected results, and the flooding in April, which is normally a dry month in the valley, may have had farther reaching impacts than storm debris deposition. Provisional data from U.S. Geological Survey gage 09419700, located on the Wash at Pabco Road Weir (Figure 2), show flows peaking above 8,000 cubic feet per second (cfs) during the first storm of the month on April 9-10 (they normally range from approximately 200 to 400 cfs). Additional storms on April 28 and 30, had flows peaking above 1,000 cfs and near 4,000 cfs, respectively. It is possible that flows at these elevated velocities impacted territory establishment and nesting behavior, negatively affecting detections.

3.2.3 Route 4

Route 4 had the highest abundance of Virginia rail and of total target species in 2016. Interestingly, as stated under Section 3.2.1, the route shared the same higher abundance values for least bittern, sora and pied-billed grebe, and also had the same lower abundance of common gallinule as Route 2 (Table 3). Sora abundance increased from 2015 and pied-billed grebe abundance remained the same, but otherwise abundance values declined and were below average for all species but the American coot. The decline in total target species abundance represents the second consecutive year of decreases (Table 2). Also, while Virginia rail abundance declined across all routes, the decrease on Route 4 is of particular note. The route originally averaged 1.00 or more birds per point, but since peaking in 2012 has declined to just 0.33 birds per point in 2016 (Table 2). Once accounting for at least 70% of all detections of the species, abundance along the route declined to near parity with Route 3 in 2016 (Table 2). Still, Route 4 had substantially higher average abundance of Virginia rail, sora and total target species for the seven-year period that surveys have occurred at the site, and the only detections for American bittern in the ten-year study period (Tables 2 and 3). This indicates a preference for the habitats available at the Mitigation Wetlands and the area inundated by Duck Creek and the west channel (although just one point, the latter habitat has hosted an average of 3.57 individuals since 2010, typically composed of Virginia rail and sora, but occasionally least bittern, as well).

Water level changes in spring may have contributed to the year over year declines of some species along the route. Water levels were kept low in two of the large cells in late winter to attract shorebirds and wading birds. Then in early spring, project managers raised the water level in those cells, seeking to create levels low enough to attract migrating shorebirds but expansive enough to dissuade ground-nesting birds from nesting in the interior of the cells. Water levels at the site are difficult to manage, so this necessitated changing flows in and out of two of the smaller cells, as well. Then April was far wetter than normal, with several storms sending inches of rain to the valley, flooding the Duck Creek area and the larger cells. As a result, the water level in the emergent vegetation increased substantially in a short period of time.

Even though numbers were down, the Mitigation Wetlands still continue to offer the highest quality emergent wetland habitat in the study area, and the highest quality potentially suitable nesting habitat for Yuma Ridgway's rail. The site meets many of the habitat conditions outlined under Section 1.0 and hosted a Ridgway's rail from August 19 through September 3, 2015. Recent activities may further improve habitat quality on the site. In fall, vegetation enhancement and management began at the larger cells. Common reed was removed from select areas along the banks and a diversity of riparian and wetland vegetation was planted both in the cleared areas and in the interior of the cells. This should help Clark County meet their U.S. Army Corps of Engineers permit for the project.

3.3 Breeding Status Update

The protocol used for marsh bird monitoring is intended to document breeding birds. With ten years of surveys now complete, a review of the breeding status of each species is appropriate (the subject was first addressed by Van Dooremolen [2010a]). Information, unless otherwise noted, is based on personal observations by the author.

Least bittern has now been documented with dependent young at the Nature Preserve and the Mitigation Wetlands, in addition to prior confirmation of nesting along the Wash, near Bostick Weir (Figure 2). Virginia rail was also confirmed nesting at a new site in the project area with two broods of chicks observed near the point sampling the Duck Creek/west channel area (Route 4) during other surveys; it had also been previously documented as nesting at Bostick Weir.

The non-target species have all been documented as breeding within the project area. Pied-billed grebe nesting has been confirmed by other field work along the Wash and at the Mitigation Wetlands. Common gallinule nesting is ubiquitous, with chicks observed along at least one route nearly every year. American coot has only been confirmed to nest at the Nature Preserve since this study began, although chicks were reported at the Mitigation Wetlands during aquatic bird counts. Coot nesting did occur on the Wash in 2003 and 2005, as eggs were collected from the species for the bioassessment monitoring program. However, no nests were found in the 2007 sampling and no nesting behavior or chicks have been observed on the channel since.

Despite being the most abundant target species every year, sora breeding still has not been confirmed, with most, if not all, birds departing by the fourth survey and no nesting behavior or dependent young documented. In eight years of biweekly monitoring, the avian point count study has only recorded sora in the study area once between May 3 and July 30 (on June 3, 2007), and in seven years of monthly aquatic bird counts at the Mitigation Wetlands, the species was never identified between May 12 and July 21. The species was originally included as a target species because the study area is on the border of its breeding range, but it appears to be a winter resident and migrant.

American bittern nesting also has not been confirmed in the study area. Both detections during these surveys were visuals; the species was not heard singing to solicit a mate. One was detected on May 3, 2010, the other on April 1, 2015, the former representing the only known May detection in the study area; American bittern has also been detected during the avian point counts and aquatic bird counts, but only from mid-September to mid-April. This supports the conclusion that this species, like sora, is a winter resident and migrant, and not breeding in the study area. It was originally included as a target species because Alcorn (1988) reports that Chuck Lawson, who conducted extensive bird research in the project area, suspected that the species was breeding in the Wash back in the 1970s.

With no detections over the course of the study, black rail is not presumed to be breeding in the study area. Although the Wash is distant from known breeding populations, the rail was included as a target species because of detections along the Virgin River (Braden et al. 2007) and an unconfirmed detection that was reported at the Mitigation Wetlands on September 24, 2009 (NVBirds listserv posting on September 28, 2009).

Finally, after ten years of surveys under this study and several prior years of focused surveys, Yuma Ridgway's rail has yet to be confirmed as breeding within the project area. The last detection to occur in breeding season months was in June 2006, and the few recent detections have been in late summer and fall. The closest known breeding population is on the Muddy River near the Overton Wildlife Management Area (C. Klinger pers. comm.), about 40 miles northeast of the Wash.

4.0 RECOMMENDATIONS

Annual variations in the abundances of individual bird species are common. Additional years of monitoring will provide more information on the target and non-target species in the study area. Also, annual monitoring for Yuma Ridgway's rail is necessary to comply with informal Section 7 consultation measures. Thus, it is recommended that marsh bird monitoring continue in 2017. Also, few new birds have been detected during the fourth survey over the ten-year period and the protocol only requires three, so it is recommended that the fourth survey be discontinued moving forward. Finally, there are several species that are targeted by these surveys that are not currently known to nest in the study area. With the exception of the Ridgway's rail, these could be removed from the study. However, such a change could have unintended consequences for the species that remain. Each target species that is removed from the call broadcast sequence reduces the time spent at each point by one minute, decreasing the amount of time in which detections can be made. Therefore, careful consideration should be made before changing any target species.

5.0 LITERATURE CITED

Alcorn, J. R. 1988. *The Birds of Nevada*. Fallon, Nevada: Fairview West Publishing.

Anderson, B.W., and R.D. Ohmart. 1985. Habitat use by clapper rails in the lower Colorado River valley. Condor 87: 116-126.

Braden, G.T., A. Miller, and L. Crew. 2007. The status of Yuma clapper rail and yellow-billed cuckoo along portions of the Virgin River and Muddy River in Southern Nevada: 2006 Final. Final report to the Southern Nevada Water Authority, Las Vegas, prepared by San Bernardino County Museum, Redlands, California.

Chesser, R.T., R.C. Banks, C. Cicero, J.L. Dunn, A.W. Kratter, I.J. Lovette, A.G. Navarro-Siguenza, P.C. Rasmussen, J.V. Remsen, Jr., J.D. Rising, D.F. Stotz, and K. Winker. 2014. Fifty-fifth supplement to the American Ornithologists' Union *Check-list to North American Birds*. The Auk 131: CSi-CSxv.

Conway, C.J, W.R. Eddleman, S.H. Anderson, and L.R. Hanebury. 1993. Seasonal changes in Yuma clapper rail vocalization rate and habitat use. Journal of Wildlife Management 57:282-290.

Conway, C.J. 2005. Standardized North American marsh bird monitoring protocols. Wildlife Research Report #2005-4, U.S. Geological Survey, Arizona Cooperative Fish and Wildlife Research Unit, Tucson, Arizona.

Conway, C.J. 2009. Standardized North American marsh bird monitoring protocols, version 2009-2. Wildlife Research Report #2009-2, U.S. Geological Survey, Arizona Cooperative Fish and Wildlife Research Unit, Tucson, Arizona.

Eddleman, W.R. 1989. Biology of Yuma clapper rail in the southwestern U.S. and northwestern Mexico. Final Rep. Intra-Agency Agreement No. 4-AA-30-02060, U.S. Bureau of Reclamation, Yuma Project Office, Yuma, Arizona. 127pp.

Hinojosa-Huerta, O., S. DeStefano, and W.W. Shaw. 2001. Distribution and abundance of the Yuma clapper rail (Rallus longirostris yumanensis) in the Colorado River delta, Mexico. Journal of Arid Environments 49: 171-182.

LVWCC (Las Vegas Wash Coordination Committee). 2000. Las Vegas Wash Comprehensive Adaptive Management Plan. Las Vegas Wash Project Coordination Team, Southern Nevada Water Authority, Las Vegas, Nevada.

McKernan, R. L., and G. T. Braden. 2001. The status of Yuma clapper rail and yellow-billed cuckoo along portions of Virgin River, Muddy River, and Las Vegas Wash, Southern Nevada, 2000. Final report to the U.S. Fish and Wildlife Service and Southern Nevada Water Authority, Las Vegas, NV, prepared by San Bernardino County Museum, Redlands, California.

McKernan, R. L., and G. T. Braden. 2002. The status of Yuma clapper rail and yellow-billed cuckoo along portions of Virgin River, Muddy River, and Las Vegas Wash, Southern Nevada, 2001. Final report to the U.S. Fish and Wildlife Service and Southern Nevada Water Authority, Las Vegas, NV, prepared by San Bernardino County Museum, Redlands, California.

Southwest Wetlands Consortium. 1998. A survey for southwestern willow flycatchers along Las Vegas Wash, Clark County Wetlands Park, Nevada. Final report to the Clark County Department of Parks and Recreation, Las Vegas, NV, prepared by SWCA Environmental Consultants, Salt Lake City.

SWCA. 2002. Survey for Yuma clapper rails, yellow-billed cuckoos and southwestern willow flycatchers along Las Vegas Wash, Clark County, Nevada. Prepared by SWCA Environmental Consultants, Salt Lake City. Final report prepared for the Southern Nevada Water Authority, Las Vegas, NV.

SWCA. 2003. Survey for Yuma clapper rails, yellow-billed cuckoos and southwestern willow flycatchers along Las Vegas Wash, Clark County, Nevada. Prepared by SWCA Environmental Consultants, Salt Lake City. Final report prepared for the Southern Nevada Water Authority, Las Vegas, NV.

SWCA. 2005. [2004] Survey for Yuma clapper rails, yellow-billed cuckoos and southwestern willow flycatchers along Las Vegas Wash, Clark County, Nevada. Prepared by SWCA Environmental Consultants, Salt Lake City. Final report prepared for the Southern Nevada Water Authority, Las Vegas, NV.

SWCA. 2006. Survey for southwestern willow flycatchers in 2005 along Las Vegas Wash, Clark County, Nevada. Prepared by SWCA Environmental Consultants, Salt Lake City. Final report prepared for the Southern Nevada Water Authority, Las Vegas, NV.

SWCA. 2007. 2006 survey for Yuma clapper rails and southwestern willow flycatchers along Las Vegas Wash, Clark County, Nevada. Prepared by SWCA Environmental Consultants, Salt Lake City. Final report prepared for the Southern Nevada Water Authority, Las Vegas, NV.

SWCA. 2008. 2007 survey for Yuma clapper rails and southwestern willow flycatchers along Las Vegas Wash, Clark County, Nevada. Prepared by SWCA Environmental

Consultants, Salt Lake City. Final report prepared for the Southern Nevada Water Authority, Las Vegas, NV.

Van Dooremolen, D. 2010a. Marsh bird monitoring, including Yuma clapper rail, along Las Vegas Wash, Clark County, Nevada, 2007-2009. Final report prepared for the U.S. Fish and Wildlife Service, Southern Nevada Field Office, Las Vegas, NV, and Las Vegas Wash Coordination Committee, Las Vegas, NV. http://www.lvwash.org/assets/pdf/resources_ecoresearch_marshmonitoring.pdf

Van Dooremolen, D. 2010b. Marsh bird monitoring, including Yuma clapper rail, along Las Vegas Wash, Clark County, Nevada, 2010. Final report prepared for the U.S. Fish and Wildlife Service, Southern Nevada Field Office, Las Vegas, NV, and Las Vegas Wash Coordination Committee, Las Vegas, NV. http://www.lvwash.org/assets/pdf/resources_ecoresearch_yuma10.pdf

Van Dooremolen, D. 2012. Marsh bird monitoring, including Yuma clapper rail, along Las Vegas Wash, Clark County, Nevada, 2011. Final report prepared for the U.S. Fish and Wildlife Service, Southern Nevada Field Office, Las Vegas, NV, and Las Vegas Wash Coordination Committee, Las Vegas, NV. http://www.lvwash.org/assets/pdf/resources_ecoresearch_yuma11.pdf

Van Dooremolen, D. 2013. Marsh bird monitoring, including Yuma clapper rail, along Las Vegas Wash, Clark County, Nevada, 2012. Final report prepared for the U.S. Fish and Wildlife Service, Southern Nevada Field Office, Las Vegas, NV, and Las Vegas Wash Coordination Committee, Las Vegas, NV. http://www.lvwash.org/assets/pdf/resources_ecoresearch_yuma12.pdf

Van Dooremolen, D. 2014a. Marsh bird monitoring, including Yuma clapper rail, along Las Vegas Wash, Clark County, Nevada, 2013. Final report prepared for the U.S. Fish and Wildlife Service, Southern Nevada Field Office, Las Vegas, NV, and Las Vegas Wash Coordination Committee, Las Vegas, NV. http://www.lvwash.org/assets/pdf/resources_ecoresearch_march_bird_monitor.pdf

Van Dooremolen, D. 2014b. Marsh bird monitoring, including Yuma clapper rail, along Las Vegas Wash, Clark County, Nevada, 2014. Final report prepared for the U.S. Fish and Wildlife Service, Southern Nevada Field Office, Las Vegas, NV, and Las Vegas Wash Coordination Committee, Las Vegas, NV. http://www.lvwash.org/assets/pdf/resources_ecoresearch_yuma14.pdf

Van Dooremolen, D. 2015. Marsh bird monitoring, including Yuma clapper rail, along Las Vegas Wash, Clark County, Nevada, 2015. Final report prepared for the U.S. Fish and Wildlife Service, Southern Nevada Field Office, Las Vegas, NV, and Las Vegas Wash Coordination Committee, Las Vegas, NV. http://www.lvwash.org/assets/pdf/resources_ecoresearch_yuma15.pdf

Appendix A

GPS Coordinates for 2016
Marsh Bird Monitoring Points

Route	Point	Eastings	Northings	Location (Primary)	Comments
2	1	678178	3996968	Nature Preserve, Vern's Pond	
2	1.5	678276	3997090	Nature Preserve, Vern's Pond	
2	2	678155	3997357	Nature Preserve, Middle Ponds	
2	3	677879	3997558	Nature Preserve, Upper Pond	
2	4.5	678178	3997623	Wash, Upper Diversion Weir	
2	4.6	678357	3997540	Wash, Bypass Channel	
2	4.7	678468	3997338	Wash, Bypass Channel	
2	5	681090	3995598	Wash, Upstream of Pabco Road Weir	
2	6	681245	3995496	Wash, Upstream of Pabco Road Weir	
3	1.5A	682393	3995724	Wash, C-1 Channel	~80 feet SSE up the C-1 Channel due to changed hydrology
3	2	682626	3995895	Wash, Bostick Impoundment	
3	3	682808	3995954	Wash, Bostick Impoundment	
3	4.5	683207	3996062	Wash, Calico Ridge Weir Impoundment	
3	4.55	683820	3996274	Wash, Toe of Lower Narrows Weir	Added in 2014 to cover marsh below Lower Narrows Weir
3	4.56	684134	3996360	Wash, Head of Homestead Weir	Added in 2016 to cover marsh above Homestead Weir
3	7	685136	3996960	Wash, Rainbow Gardens Weir Impoundment	
3	8	685673	3997411	Lake Las Vegas Mitigation Wetlands	
4	0.5	678726	3996304	Mitigation Wetlands, Cell 6	
4	1	678730	3996008	Duck Creek and West Channel	
4	2.5	678502	3996216	Mitigation Wetlands, Cell 6	
4	3.5	678591	3996420	Mitigation Wetlands, Cell 5	
4	4	678276	3996306	Mitigation Wetlands, Cell 5	
4	5	678130	3996515	Mitigation Wetlands, Cell 4	
4	6	678051	3996715	Mitigation Wetlands, Cell 1	
4	7	678266	3996725	Mitigation Wetlands, Cell 3	
4	8	678431	3996573	Mitigation Wetlands, Cell 4	

Appendix B

2016 Survey Weather Conditions

Date	Route #	Temperature (Start/ Finish) - Fahrenheit	Sky (Start/Finish)	Beaufort (Start/Finish)
4/4/2016	2	58/72	partly cloudy/partly cloudy	0 (<1 mph)/0 (<1 mph)
4/5/2016	3	60/74	clear skies/clear skies	0 (<1 mph)/0 (<1 mph)
4/6/2016	4	64/75	partly cloudy/partly cloudy	0 (<1 mph)/3 (8-12 mph)
4/18/2016	2	58/70	clear skies/clear skies	0 (<1 mph)/0 (<1 mph)
4/19/2016	3	52/73	clear skies/clear skies	0 (<1 mph)/0 (<1 mph)
4/20/2016	4	56/71	clear skies/clear skies	0 (<1 mph)/0 (<1 mph)
5/2/2016	2	56/73	clear skies/clear skies	0 (<1 mph)/0 (<1 mph)
5/3/2016	3	61/75	clear skies/clear skies	0 (<1 mph)/1 (1-3 mph)
5/4/2016	4	65/79	clear skies/partly cloudy	0 (<1 mph)/0 (<1 mph)
5/16/2016	2	66/82	partly cloudy/partly cloudy	0 (<1 mph)/0 (<1 mph)
5/17/2016	3	68/70	cloudy/cloudy	0 (<1 mph)/2 (4-7 mph)
5/18/2016	4	62/74	clear skies/clear skies	0 (<1 mph)/0 (<1 mph)