



Las Vegas Wash Vegetation Monitoring Report, 2023

November 2024



SOUTHERN NEVADA
WATER AUTHORITY®



LVWCC

**Las Vegas Wash
Vegetation Monitoring Report, 2023**

**SOUTHERN NEVADA WATER AUTHORITY
Las Vegas Wash Project Coordination Team**

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Las Vegas Wash Coordination Committee

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November 2024

ABSTRACT

For more than 20 years, revegetation efforts along the Las Vegas Wash have been a primary component in helping to meet the goals of the Las Vegas Wash Coordination Committee. Monitoring for this report took place from August through October 2023. Approximately 299 acres of revegetation across 77 sites were surveyed in the field. The remaining 81 sites (51.3%) were monitored for total cover using ArcGIS. Sites ranging in age from 2 to 23 growing seasons had total cover, noxious species cover, species richness, and Wetland Prevalence Index documented. Of the 77 sites monitored in the field, 51 (66.2%) had the same cover as they did in the previous monitoring season, 20 (26%) increased in cover, and six (7.8%) decreased in cover. Now that the Las Vegas Wash Long-Term Revegetation Management Plan is being implemented, no new sites were added as planting events occur at previously established sites. Most older sites have matured to a point that vegetative cover does not change much between growing seasons. Beginning in the fall of 2025, vegetation monitoring will transition into long-term management. A brief introduction into the new protocol is described in the recommendations section.

ACKNOWLEDGMENTS

I would like to thank all of those who have helped make the Las Vegas Wash revegetation program a success. Specifically, I would like to thank David Syzdek, Adrienne Reschman, Linda Shapiro, and Aaron Ambos for their assistance in monitoring revegetation sites. Thank you to Tamra O'Halloran and Megan Singleton for their updates to the vegetation monitoring app. A special thank you goes to Jason Eckberg for his guidance, expertise, and help throughout the monitoring season and especially while writing this report. Thank you, Keiba Crear, for being a central figure in advocating for monitoring and management. Additional appreciation goes to the many people who reviewed this document and provided valuable comments. Finally, I would like to thank the members of the Las Vegas Wash Coordination Committee and Research and Environmental Monitoring Study Team for continuing to support this program and the implementation of the Las Vegas Wash Comprehensive Adaptive Management Plan.

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1.0 INTRODUCTION

1.1 Background

In 1997, a citizens advisory committee was assembled by the Southern Nevada Water Authority (SNWA) to evaluate water quality issues in the Las Vegas Wash (Wash), Las Vegas Bay, and Lake Mead (Figure 1). From this, the Las Vegas Wash Coordination Committee (LVWCC), a 28-member stakeholder group consisting of federal, state, and local agencies; the University of Nevada, Las Vegas; private businesses; environmental groups; and citizens, was formed. In 2000, the LVWCC created the Las Vegas Wash Comprehensive Adaptive Management Plan (CAMP; LVWCC 2000) to help guide stabilization and enhancement efforts along the Wash. On-the-ground activities have been carried out since then to implement the goals of the CAMP, including constructing erosion control structures (weirs) in the stream channel and armoring the banks with rock. Wetland, riparian, and upland vegetation has been planted to help further protect the Wash from erosion, as well as to improve the functional attributes of the ecosystem.

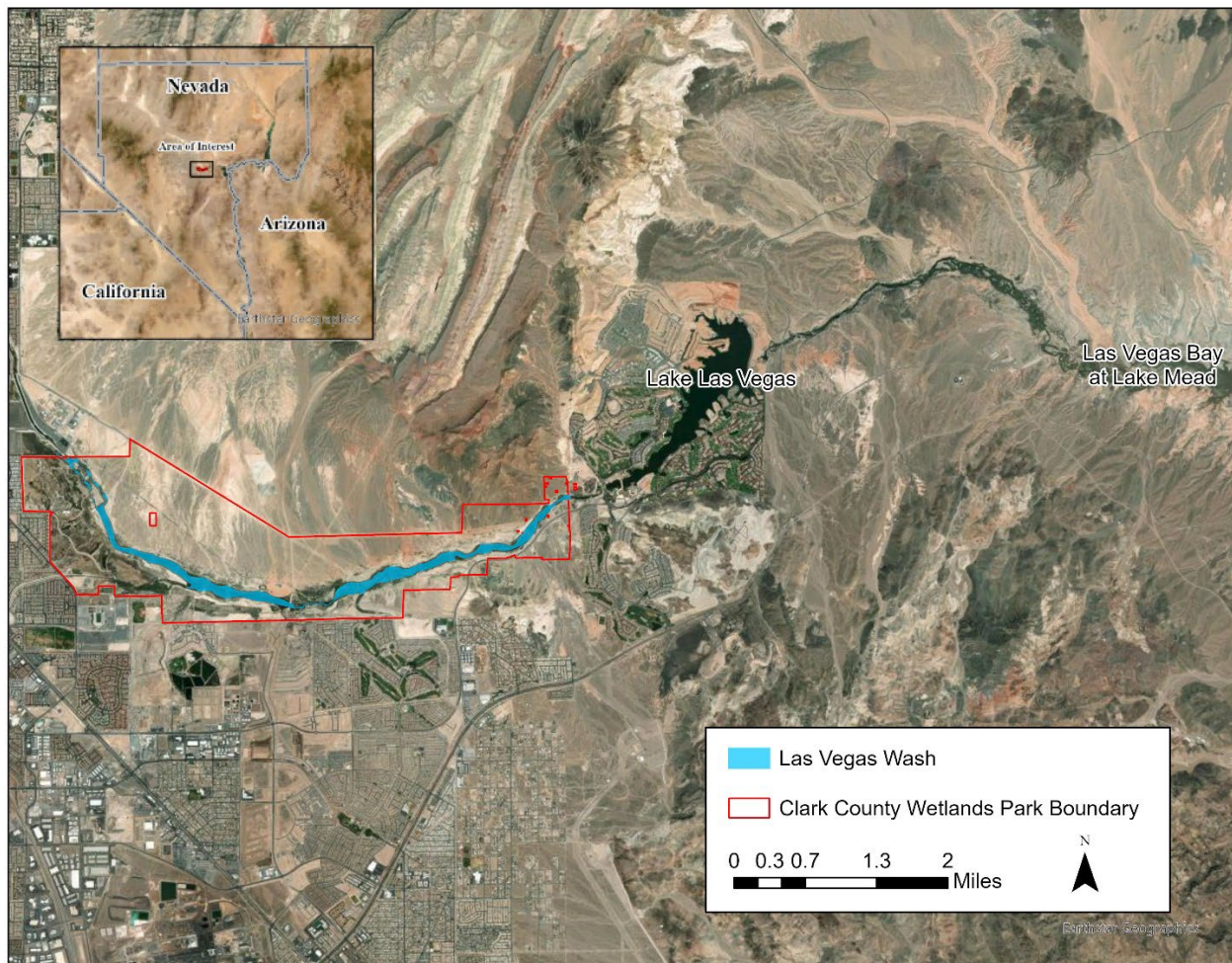


Figure 1. Las Vegas Wash location and general study area map.

Over the past 25 years, the main goal of the revegetation program was to help stabilize and enhance the Wash. This was achieved by planting tens of thousands of native plants across several hundred

acres along the channel. These plants act as soil anchors during flood events, binding their roots to soil particles on the surface, subsurface, and in the deep subsurface horizon. In addition, it has been documented that a variety of wildlife species benefit from these revegetation efforts (Great Basin Bird Observatory 2024, Lantow 2020, Van Dooremolen et al. 2024).

At the time the erosion control project began, few native plants were found along the Wash's banks, especially wetland and riparian species (LVWCC 2000). Salt cedar (*Tamarix ramosissima*; a.k.a., tamarisk), an exotic species, had successfully established in the area and become the dominant species. At its peak, salt cedar covered approximately 1,500 acres along the channel. The plants used to restore the Wash to a natural-type condition include a variety of species native to upland, wetland, and riparian areas in the region.

1.2 Purpose and Scope

This report documents the status of SNWA's revegetation efforts along the Wash by reporting 2023 data as part of a comprehensive vegetation monitoring program. Vegetation monitoring results from 2002 through 2022 have been previously documented (SNWA 2005, Eckberg and Shanahan 2008, Eckberg 2014A, Eckberg 2014B, Eckberg 2015, Eckberg 2016, Eckberg 2018, Eckberg 2019A, Eckberg 2019B, Eckberg 2020, Eckberg 2022, Lantow 2023, Lantow 2024); therefore, they are not described in detail in this report. Since 2003, monitoring activities have been conducted on progressively larger land areas. Approximately 38 acres were monitored in 2003 and about 612 acres were monitored in 2023. All revegetation sites are located within or bordering the Clark County Wetlands Park (Figure 2).

1.3 Need for Revegetation and Vegetation Monitoring

Revegetation projects along the Wash are conducted to meet permitting requirements and because of their environmental benefits. Clean Water Act (CWA) Section 404 permits issued by the U.S. Army Corps of Engineers (Corps) to SNWA for erosion control projects occurring in jurisdictional waters of the U.S. required revegetation as compensatory mitigation for wetlands impacted. Section 404 of the CWA established a program to regulate the discharge of dredged or fill material into waters of the U.S. This includes wetlands associated with Wash erosion control projects. Section 404 permits required that revegetation projects are monitored for success; consequently, several performance indicators are monitored so performance criteria can be achieved. The primary criterion is that mitigation areas provide the functional attributes of a natural wetland system.

The Nevada Division of Environmental Protection (NDEP), which derives duties through state and federal implementing regulations (i.e., Chapter 445A of the Nevada Revised Statutes and Section 402 of the CWA), also requires revegetation to occur for Wash construction projects. NDEP issued general stormwater permits for Wash construction activities, and permits require that final site stabilization is achieved. Vegetative cover serves as a form of final stabilization, defined by NDEP as "...perennial vegetative cover with a density of 70% of the native background vegetative cover...establishing at least 70% of the natural cover of the native vegetation...e.g., if the native vegetation covers 50% of the ground, 70% of 50% would require 35% total cover."

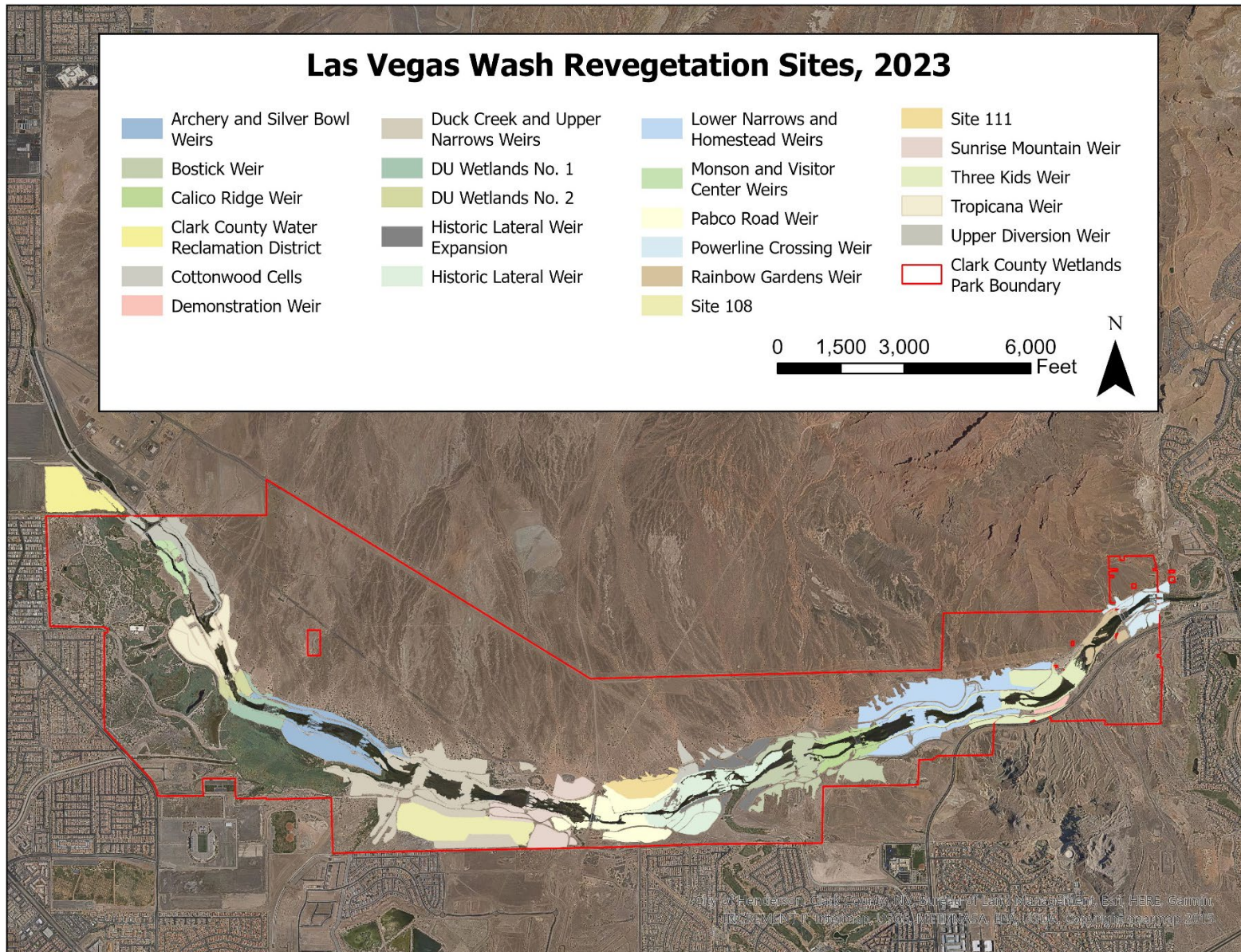


Figure 2. Location of the 2023 Las Vegas Wash revegetation sites.

In addition to permit-required revegetation, SNWA has received multiple federal, state, and local grants to help fund the erosion control program as well as ecological enhancements along the Wash. Granting agencies, such as the Bureau of Reclamation (BOR), require that revegetation projects are successful; therefore, specific criteria are measured during monitoring to ensure compliance with these requirements. For program consistency, all revegetation sites are monitored annually for the same criteria and with the same general methodology.

Also, stakeholders such as the LVWCC and Las Vegas Valley Watershed Advisory Committee (LVVWAC) need to be kept aware of the status of projects along the Wash including the revegetation program. Many stakeholder meetings were held to establish the goals of the Wash program and providing regular updates ensures members are informed of progress. In addition, the LVVWAC, which provides funding and oversight for the LVWCC's activities, needs to know how funds are spent and that efforts are successful.

Finally, data from past revegetation efforts along the Wash informs future decisions. Information on which species are regularly successful and which ones rarely survive without substantial human intervention helps project managers decide what species should be used in future restoration efforts. This increases revegetation project success and helps ensure funds are used effectively.

1.4 Program Funding

Beginning July 2022, the Wash program transitioned from capital construction to the Las Vegas Wash Long-Term Operating Plan (LTOP; LVWCC 2020). The LTOP lays out 36 actions to sustain program assets, including revegetation, and is funded by LVVWAC member agencies. State and federal grants continue to be important components of the budget for revegetation activities.

1.5 Typical Revegetation Establishment Activities

1.5.1 Planning

Most revegetation sites along the Wash were established in association with the construction of weirs. Plant selection and irrigation design were done in conjunction with the engineering plans for the site. Hydroseed was included in the construction of the erosion control structures. Hydroseeding represented the final step in the construction process and the initial step in most revegetation projects. Species were specifically selected to be most successful on each weir site. Procedures were described in construction plans to include tackifier, mulch, and fertilizer along with the seeds themselves.

1.5.2 Plant Procurement

After plants are selected, procurement activities take place in order to have material in time for planting at the sizes needed to have a successful restoration site. Plants are either ordered from government or commercial nurseries or grown by the Las Vegas Wash Project Coordination Team (Wash Team). Local and regional nurseries, such as the Nevada Division of Forestry and Mountain States Wholesale Nursery, have provided most of the plants for this work. Plants grown by the Wash Team involve collecting seed or cuttings, establishing the seedlings, transplanting them into

larger containers, irrigating them, and delivering them back to the Wash for final planting. With revegetation activities taking place for more than 20 years, there are now sufficient native species established along the Wash to procure seeds and cuttings without going to surrogate areas. Plant propagation for the Wash Team takes place at the SNWA-owned and -operated Warm Springs Natural Area propagation facility in Moapa, NV.

1.5.3 Invasive and Other Undesirable Species Removal

Prior to revegetation efforts, most of the sites described in this report were covered in part or entirely by salt cedar, an invasive species that is prolific, spreads easily, and can encroach on revegetation sites if removal does not take place. Some other invasive species that are found on sites and require constant monitoring are tall whitetop (*Lepidium latifolium*), silverleaf nightshade (*Solanum elaeagnifolium*), giant reed (*Arundo donax*), Malta starthistle (*Centaurea melitensis*), and johnsongrass (*Sorghum halepense*). Without their removal, the native species used in revegetation would not be able to grow, germinate, and become self-sustaining. Consequently, considerable effort is given to surveying sites for encroachment, identifying invasive species, and planning for their removal as soon as possible.

Other species that are closely monitored because of their ability to grow vigorously and outcompete revegetated plants are common reed (*Phragmites australis*) and quailbush (*Atriplex lentiformis*). Quailbush is a native species and the Wash has both native and non-native common reed as well as hybrids of the two (Saltonstall et al. 2016). The goal with these species is not to completely remove them, since this is likely unattainable, but to selectively thin them so that other vegetation has time and space to establish and create a species-rich environment.

1.5.4 Irrigation

Non-wetland revegetation sites along the Wash require irrigation for the first 1–3 growing seasons to become established. Sites are irrigated with infrastructure components that are easily moved to new sites as they are planted. Irrigation water is pumped out of the Wash using gasoline- or biodiesel-powered pumps to a single mainline and then to multiple lateral lines that are fitted with drip irrigation tubing. Past efforts included spray irrigation.

Over the years, the sizes of the sites that are irrigated have ranged from under one acre to almost 60 acres. Regular checks and maintenance of irrigation system components are critical to ensure the water is reaching the plants. On average, southern Nevada gets less than five inches of rain annually, so a break in the irrigation system could be detrimental to the plants' health and the overall success of the site. Irrigation maintenance includes fixing leaks, tightening connections, and fixing or replacing broken pipes or emitters.

1.5.5 Trash Removal

Trash along the Wash is prevalent and caused by flood events, wind, and illegal dumping. South Hollywood Blvd., located just north of the Wash is a common place for illegal dumping and when flood events occur this trash is likely to end up in the Wash. If this trash or trash moved from other parts of the valley by wind or during flood events ends up at a newly planted revegetation site, it

can hinder the site's success. Following storm events, sites should be assessed to ensure there is no trash that could hinder plant growth and site success.

1.5.6 Herbivore Control

Fencing was installed on some revegetation sites to help reduce the damage caused by beavers and rabbits. Some sites have a single fence that goes around the site's entirety while other sites have individual fences for each plant. Both situations require continual inspection for damage, repairs, and adjustments to the spacing of the fences to reduce plant damage. Once a site is considered fully established, the fencing is typically removed. Only a few locations at the Wash still have fencing; these sites should be inspected, and if deemed appropriate, all fencing should be removed.

1.5.7 Long-Term Management

The Las Vegas Wash Long-Term Revegetation Management Plan (RMP; Eckberg 2019C) was created to help identify activities that would improve revegetation sites along the Wash after initial establishment. Initial establishment activities were completed in the spring of 2022.

In general, the RMP focuses on how to improve the ecological function of revegetation sites including diversifying plant structure types and species, increasing wildlife benefits in the form of food and shelter, and removing undesirable species and trash from the sites.

2.0 MATERIALS AND METHODS

Monitoring was conducted between August and October 2023, following the same guidelines as previous years (Eckberg and Shanahan 2009). As of August 2023, there were 82 wetland and 76 non-wetland revegetation sites. Many larger sites were broken up into multiple monitoring areas (Table 1). These smaller monitoring areas have their information combined using a weighted average of cover statistics, with acreage as the weight, to properly combine sites of different sizes.

ArcGIS was used to monitor 81 of the 158 total revegetation sites in 2023 for total cover; these sites did not have data collected regarding species richness, individual species cover, or Wetland Prevalence Index (WPI). Sites are only monitored using ArcGIS if they meet specific criteria as laid out in Eckberg and Shanahan (2009) or if on-the-ground obstacles prevent in-person monitoring.

Major Site	Acreage		No. of Monitoring Areas	
	2022	2023	2022	2023
Archery and Silver Bowl Weirs	38.6	38.4	9	9
Bostick Weir	44.6	45.6	15	17
Calico Ridge Weir	14.9	14.7	11	11
Clark County Water Reclamation District	29.5	29.7	1	1
Cottonwood Cells	8.3	8.5	9	9
Demonstration Weir	2.3	2.3	2	2
Duck Creek Confluence and Upper Narrows Weirs	86.3	85.3	13	13
DU Wetlands No. 1 Weir	13.5	13.3	5	5
DU Wetlands No. 2 Weir	6.3	6.2	5	5
Historic Lateral Weir	39.7	42.4	14	14
Historic Lateral Expansion	13.1	13.1	6	6
Lower Narrows and Homestead Weirs	71.4	71.4	8	8
Monson and Visitor Center Weirs	8.5	8.3	4	4
Pabco Road Weir	39.5	39.2	18	18
Powerline Crossing Weir	14.1	14.0	17	17
Rainbow Gardens Weir	8.3	8.4	8	8
Site 108	39.4	39.4	59	59
Site 111	14.9	14.9	26	26
Sunrise Mountain Weir	33.6	33.7	8	8
Three Kids Weir	34.7	34.7	8	8
Tropicana Weir	29.4	29.6	6	6
Upper Diversion Weir	24.2	19.1	24	24
TOTAL	615.1	612.2	276	278

Table 1. Change in cumulative acreage monitored and number of monitoring areas from 2022 to 2023.

3.0 RESULTS AND DISCUSSION

The following subsections describe monitoring results for each site and for groupings of sites. From 2022 to 2023, the number of areas monitored increased by two while the acreage decreased by just under 3 acres (Table 1). The total areas and acreage include sites monitored in the field as well as with ArcGIS.

Cumulatively, there have been 122.9 acres of wetlands created above those required by mitigation permits (Table 2), including 3.16 acres associated with the Cottonwood Cells, which were fully funded by grants from the BOR, and 5.99 acres created at Clark County Water Reclamation District (CCWRD), which had its permit held by the property owners. Some individual project results show the wetlands created do not meet the required acreage (Table 2). For these instances, multiple projects were combined to meet the required acreage. Federally funded projects are not eligible for use as mitigation of wetlands impacted in accordance with permits issued by the Corps.

Mitigation Project	Mitigation Permit Number	Mitigation Required (acres)	Wetland Area Created (acres)
Archery and Silver Bowl Weirs	SPK-2011-00796-SG	0 ^c	8.72
Bostick Weir	200125114	7.88	15.85
Calico Ridge Weir	200450004	3.80	5.76
Clark County Water Reclamation District	SPK-2009-00227-SG	6.79	5.99^a
Cottonwood Cells	N/A	—	3.16^b
Demonstration Weir	199825148	0.90	0.55
Duck Creek Confluence and Upper Narrows Weirs	SPK-2009-00042	1.33	21.79
DU Wetlands No. 1 Weir	SPK-2010-00285-SG	1.22	3.98
DU Wetlands No. 2 Weir	2007-1961-SG	0.05	1.62
Historic Lateral Weir	199825148	4.90	22.72
Historic Lateral Expansion	SPK-2014-01108	0 ^c	0.42
Lower Narrows and Homestead Weirs	SPK-2008-01417-SG	6.25	14.30
Monson and Visitor Center Weirs	200250111	4.81	1.61
Pabco Road Weir	199725375	2.20	8.62
Powerline Crossing Weir	200450454	4.87	2.90
Rainbow Gardens Weir	200250054	1.00	4.88
Sunrise Mountain Weir	SPK-2014-01108	0 ^c	4.81
Three Kids Weir	SPK-2012-01138-SG	0 ^c	18.08
Tropicana Weir	SPK-2016-00293	0 ^c	22.62
Upper Diversion Weir	200550514	0.01	7.59
Bank Protection Projects	—	7.06	—
TOTAL		53.07	175.97

^a Permit held by Clark County Water Reclamation District and not eligible for Wash wetland mitigation.

^b Federally funded revegetation not eligible for wetland mitigation.

^c Permits authorized under Nationwide Permit Number #27 after 2012 have no mitigation requirement.

Table 2. Mitigation requirements and wetland areas established as of October 2023.

3.1 Archery and Silver Bowl Weirs

The Archery and Silver Bowl weirs were simultaneously completed in 2015 (Table 3, Figure 3). The revegetation for these weirs was also conducted simultaneously and there is no separation between the two weirs for revegetation sites (Figure 3). Seven of the nine revegetation sites were monitored in the field in 2023. Archery Weir (AW) and Silver Bowl Weir (SBW) were monitored using ArcGIS, and the acreage and total cover for each site was recorded.

Total cover for seven of the nine sites remained the same as documented in 2022. Archery Silver Bowl North (ASBN) and Archery Silver Bowl South 2 (ASBS2) both increased in total cover. However, these sites saw a decrease in cover from 2021 to 2022 when monitored using ArcGIS. Seeing this pattern suggests that total cover is likely underestimated when using ArcGIS at these sites. There is a high probability that this is a result of the inability to identify the main species present, desert saltbush (*Atriplex polycarpa*), with aerial imagery. At these sites, desert saltbush made up 62.5% and 87.5% of the total cover, respectively, in 2023.

The two weir sites, AW and SBW, had all of the vegetation removed from the face of the weirs in 2019 as part of final benchmarking of the weirs to return them to their original lines and grades. Since then, both sites have seen increases in acreage most years. AW increased in acreage from 1.34 in 2022 to 1.42 in 2023. SBW increased from 1.91 acres in 2022 to 1.93 acres in 2023. These results demonstrate that, while the required maintenance activity of removing vegetation from the weirs has an immediate large impact, the recovery is also swift.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
ASBN	8	6.48	non-wet	75–100%	2.5%	20	3.70
ASBNB	8	2.87	wet	75–100%	15%	11	2.19
ASBNUB	8	1.59	non-wet	75–100%	0.5%	8	3.44
ASBS1	8	11.41	non-wet	75–100%	0.1%	4	3.97
ASBS2	8	8.60	non-wet	75–100%	0.0%	3	3.97
ASBSB	8	2.50	wet	75–100%	15%	10	1.73
ASBSUB	8	1.59	non-wet	75–100%	0.0%	5	3.98
AW	7	1.42	wet	75–100%	nm	nm	nm
SBW	7	1.93	wet	75–100%	nm	nm	nm

¹ASBN= Archery Silver Bowl North, ASBNB= Archery Silver Bowl North Bank, ASBNUB= Archery Silver Bowl North Upper Bank, ASBS1= Archery Silver Bowl South 1, ASBS2= Archery Silver Bowl South 2, ASBSB= Archery Silver Bowl South Bank, ASBSUB= Archery Silver Bowl South Upper Bank, AW=Archery Weir, SBW=Silver Bowl Weir

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps' 1987 Wetland Delineation Manual. "wet" = wetland and "non-wet" = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 3. Vegetation monitoring results for Archery and Silver Bowl weirs revegetation sites in 2023.

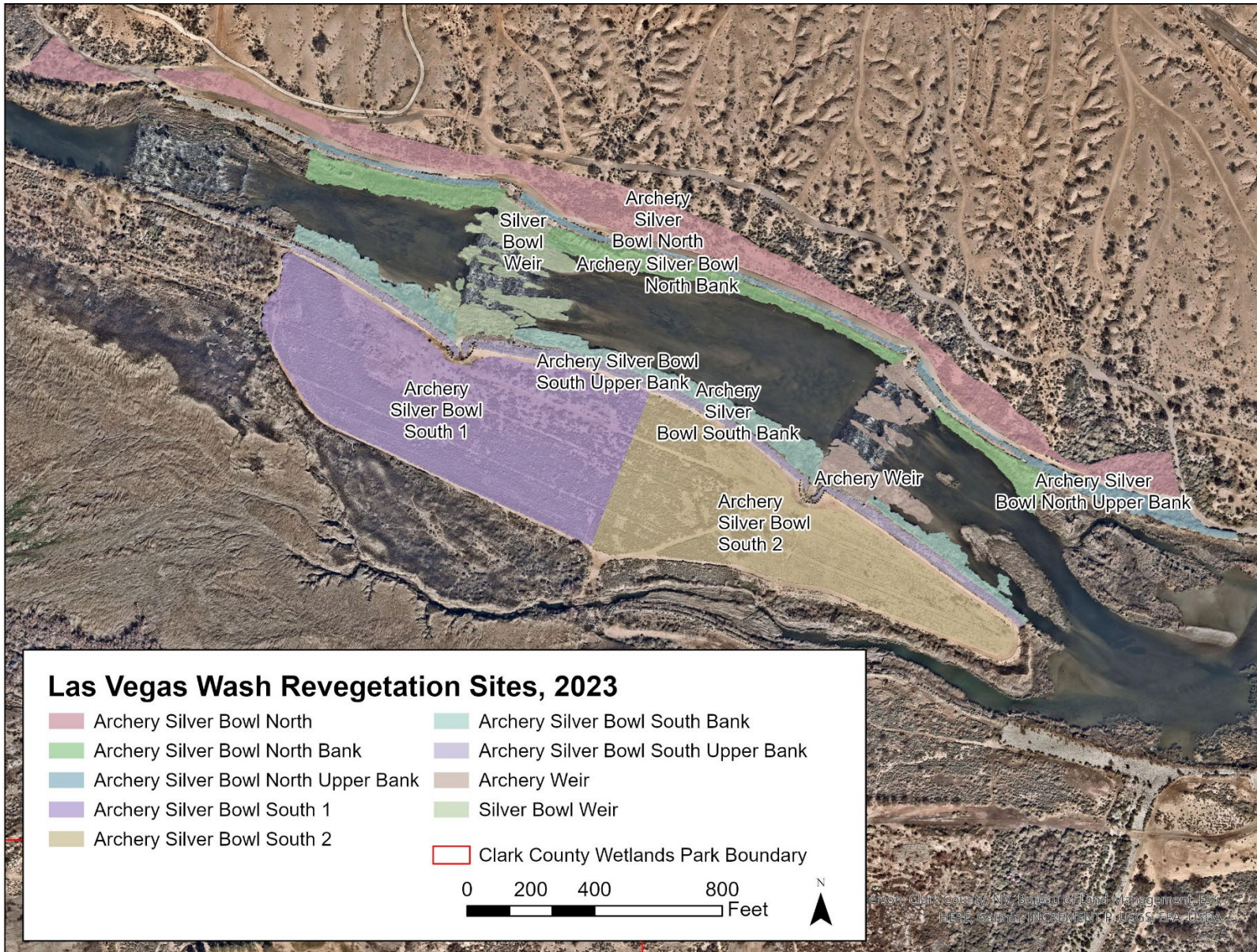


Figure 3. Aerial photograph of 2023 delineated Archery and Silver Bowl weirs revegetation sites.

3.2 Bostick Weir

Nine of the 14 revegetation sites at the Bostick Weir were monitored in the field in 2023 (Table 4, Figure 4). Most of the sites were in the 19th or 20th growing season and are considered well established. The only relatively young site is Bostick South Tamarisk (BST) which was in its eighth growing season. Measuring about 21 acres, BST is a very large site when compared to most other Wash revegetation sites, and therefore was divided into three monitoring areas, increasing the total number of monitoring areas for Bostick Weir from 17 to 19. Breaking this site up into smaller monitoring areas allows project managers to better understand whether this site is a good candidate for enhancement under the RMP. This site was placed on the candidate list in 2021 (Lantow 2023) but has since been removed following additional monitoring. Results from this year’s surveys show BST has a total cover of 66.8% comprised of 26 species.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
B	20	7.43	wet	75–100%	2.5%	27	2.12
BI	20	3.34	wet	75–100%	nm	nm	nm
BN	20	0.86	non-wet	50–75%	0.0%	5	4.44
BS	19	1.21	non-wet	75–100%	nm	nm	nm
BST	8	21.01	non-wet	66.8%	8.8%	26	4.54
DBN	20	0.48	non-wet	50–75%	0.0%	5	4.25
DBS	19	0.22	non-wet	50–75%	0.0%	5	4.56
DBSE	19	0.65	wet	75–100%	nm	nm	nm
UBN	20	0.56	non-wet	75–100%	nm	nm	nm
UBNB	19	2.26	wet	75–100%	nm	nm	nm
UBNE	19	0.67	wet	75–100%	2.5%	6	2.03
UBS	20	2.54	non-wet	75–100%	1.0%	17	2.75
UBS	20	2.07	wet	75–100%	2.6%	10	2.10
UBSB	19	1.71	non-wet	75–100%	0.0%	7	3.51

¹B=Bostick, BI=Bostick Islands, BN=Bostick North, BS=Bostick South, BST=Bostick South Tamarisk, DBN=Downstream Bostick North, DBS=Downstream Bostick South, DBSE=Downstream Bostick South Emergent, UBN=Upstream Bostick North, UBNB=Upstream Bostick North Bank, UBNE=Upstream Bostick North Emergent, UBS=Upstream Bostick South, UBSB=Upstream Bostick South Bank

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual.

“wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 4. Vegetation monitoring results for Bostick Weir revegetation sites in 2023.

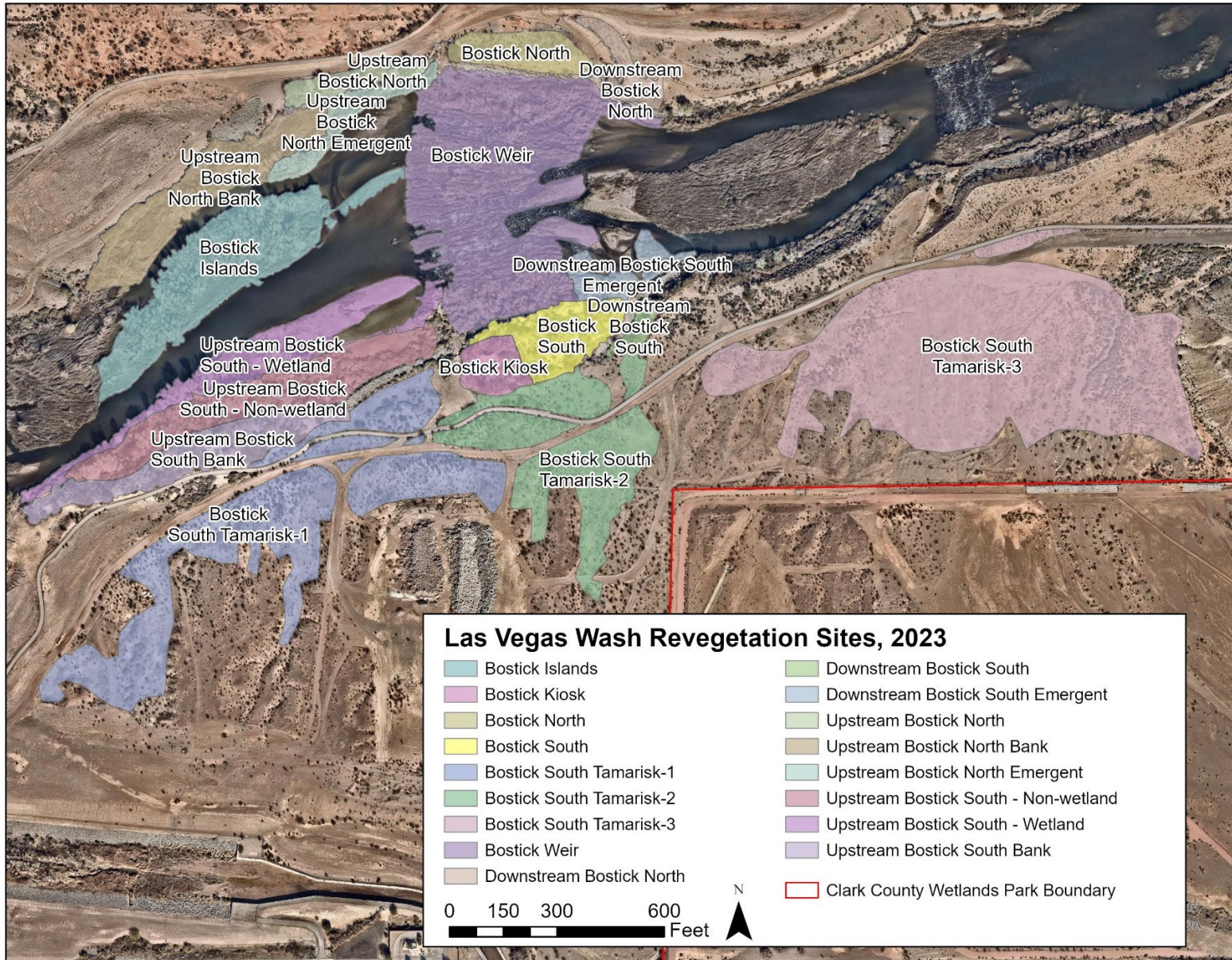


Figure 4. Aerial photograph of 2023 delineated Bostick Weir revegetation sites.

The total cover of all sites remained the same as the previous year except for Downstream Bostick North (DBN). DBN saw an increase in total cover, improving from 25–50% in 2021 and 2022 to 50–75% in 2023. When surveyed in the field in 2023, 5 plant species were identified, and honey mesquite (*Neltuma glandulosa* var. *torreyana*) made up more than half of the total cover. Therefore, although this site increased in cover, it remains a good candidate for enhancement under the RMP to help improve diversity.

3.3 Calico Ridge Weir

Two of the 10 revegetation sites related to this weir were monitored in the field in 2023 (Table 5, Figure 5). The weir is a two-stage weir, with a typical rock rip-rap section in the center of the Wash channel and two higher elevation components to the north and south. These two higher elevation portions are slightly above the water table and passively filled in with wetland vegetation soon after construction was completed. This site is known as Calico (C) for vegetation monitoring and is broken up into two monitoring areas: north and south. The center channel has typically not had vegetation, likely due to the higher velocities in the narrower section. Calico Ridge Weir (CRW) had 0.02 acres of wetlands, which is the same size that was recorded during 2022 (Table 5, Figure 5).

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
C	19	1.24	wet	75–100%	nm	nm	nm
CRW	19	0.02	wet	75–100%	nm	nm	nm
DCN	19	0.65	non-wet	25–50%	0.0%	7	4.37
DCS	19	2.30	non-wet	25–50%	nm	nm	nm
DCS	19	0.71	wet	75–100%	nm	nm	nm
UCE	19	3.56	wet	75–100%	0.1%	5	1.97
UCN	19	1.91	non-wet	5–25%	nm	nm	nm
UCN	19	0.62	wet	75–100%	nm	nm	nm
UCS	19	2.89	non-wet	25–50%	nm	nm	nm
UCS	19	0.82	wet	75–100%	nm	nm	nm

¹C=Calico, CRW=Calico Ridge Weir, DCN=Downstream Calico North, DCS=Downstream Calico South, UCE=Upstream Calico Emergent, UCN=Upstream Calico North, UCS=Upstream Calico South

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. WPI≤2.0 = wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland
nm = this attribute was not monitored

Table 5. Vegetation monitoring results for Calico Ridge Weir revegetation sites in 2023.

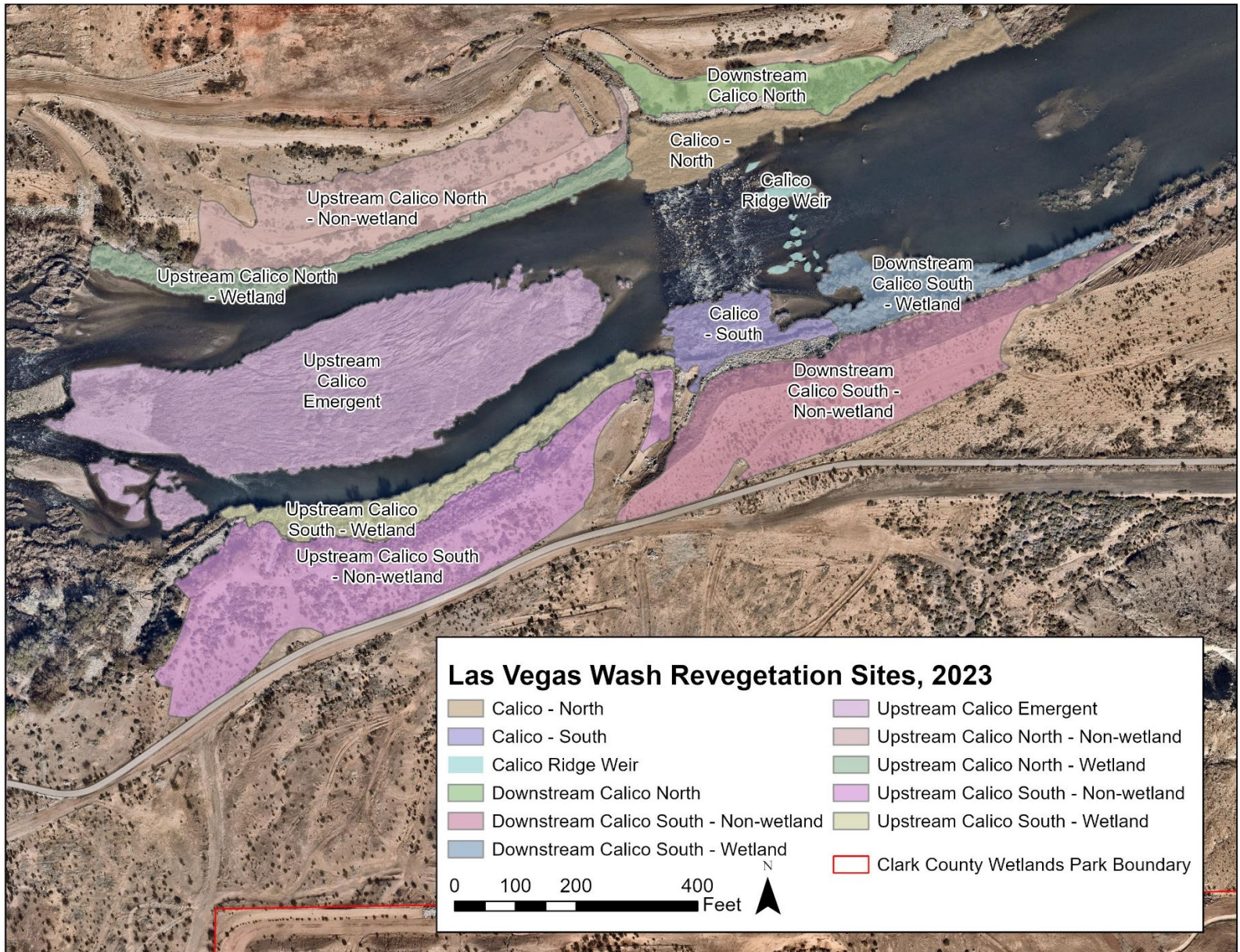


Figure 5. Aerial photograph of 2023 delineated Calico Ridge Weir revegetation sites.

All 10 sites are in their 19th growing season (Table 5, Figure 5), so most do not vary year to year. Of the sites surveyed in the field in 2023, Downstream Calico North (DCN) saw a decrease in total cover from 50–75% in 2021 and 2022 to 25–50% in 2023. Looking at the data in more detail, there was only a 2.6% difference in species cover recorded during field surveys in 2021 and 2023, therefore the higher total cover for this site was likely an overestimate.

Additional sites that showed a change in total cover were Upstream Calico North – Non-wetland (UCN-N) and Upstream Calico South – Non-wetland (UCS-N). UCN-N decreased in total cover from 25–50% to 5–25%, and UCS-N decreased from 75–100% to 25–50%. Both sites were monitored using ArcGIS, and it is likely that these percentages are low due to the inability to identify plant species while using ArcGIS, resulting in inaccurate total cover percentages.

3.4 Clark County Water Reclamation District

The CCWRD revegetation site (Table 6, Figure 6) was monitored with ArcGIS in 2023 for the fifth year in a row and will likely continue to be monitored this way. In 2020, it was determined that access was difficult to any interior area of the site. Although vegetation is visible along the perimeter, that vegetation would not be an accurate representation of the entire site.

If funding is available, removing weeds such as salt cedar, which has reestablished on the site, as well as larger undesirable species such as quailbush, would be priority. Removing these plants should allow for better access to the interior of the site. Measuring the total cover of the site using ArcGIS shows it remained at 75–100% for the seventh year in a row. While there is a wetland component to the site used for mitigation for Corps permits (Table 2), there is no distinction on the ground. Therefore, the site is monitored as a single monitoring area.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
CCWRD	14	29.71	both	75–100%	nm	nm	nm

¹CCWRD=Clark County Water Reclamation District

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 6. Monitoring results for the Clark County Water Reclamation District revegetation site in 2023.



Figure 6. Aerial photograph of 2023 delineated Clark County Water Reclamation District revegetation site.

3.5 Cottonwood Cells

All revegetation sites at the Cottonwood Cells were monitored in the field in 2023 (Table 7, Figure 7). Sites range in age from 11 to 22 growing seasons. Four of the seven sites had the same total cover as in 2022, while Cottonwood Cell 2 (CC2) decreased and Cottonwood Cell North (CCN) and Cottonwood Cell North Stockpile (CCNS) both increased. Comparing this to the previous field-monitored year (2021), results show that total cover of all three sites stayed the same. Therefore, using ArcGIS to monitor these sites may result in inaccurate total cover percentages.

CCN is made up of three monitoring areas: CCN-1 saw an increase in cover, CCN-2 saw a decrease, and CCN-3 remained the same. Total cover for CCN is shown as a whole number as opposed to a range like the other sites. This percentage is calculated by taking the weighted average of all three monitoring areas. CCNS showed an increase in total cover from 5–25% recorded in 2022 using ArcGIS to 50–75% recorded in the field in 2023. These changes in total cover suggest that the aerial imagery is unable to adequately show some of the vegetation on these upland sites.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
CC1	22	0.98	wet	75–100%	2.5%	19	2.69
CC2	19	0.54	wet	50–75%	2.5%	7	2.10
CC3	12	1.15	wet	75–100%	0.5%	15	2.60
CC3-2	11	0.40	wet	75–100%	2.5%	9	3.97
CC3-B	11	0.32	wet	75–100%	2.5%	7	2.10
CCN	12	4.38	non-wet	84.0%	0.1%	16	2.14
CCNS	12	0.77	non-wet	50–75%	0.1%	7	4.07

¹CC1=Cottonwood Cell 1, CC2=Cottonwood Cell 2, CC3=Cottonwood Cell 3, CC3-2=Cottonwood Cell 3-2, CC3-B=Cottonwood Cell 3 - Bank, CCN=Cottonwood Cell North, CCNS=Cottonwood Cell North Stockpiles

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 7. Vegetation monitoring results for Cottonwood Cells revegetation sites in 2023.

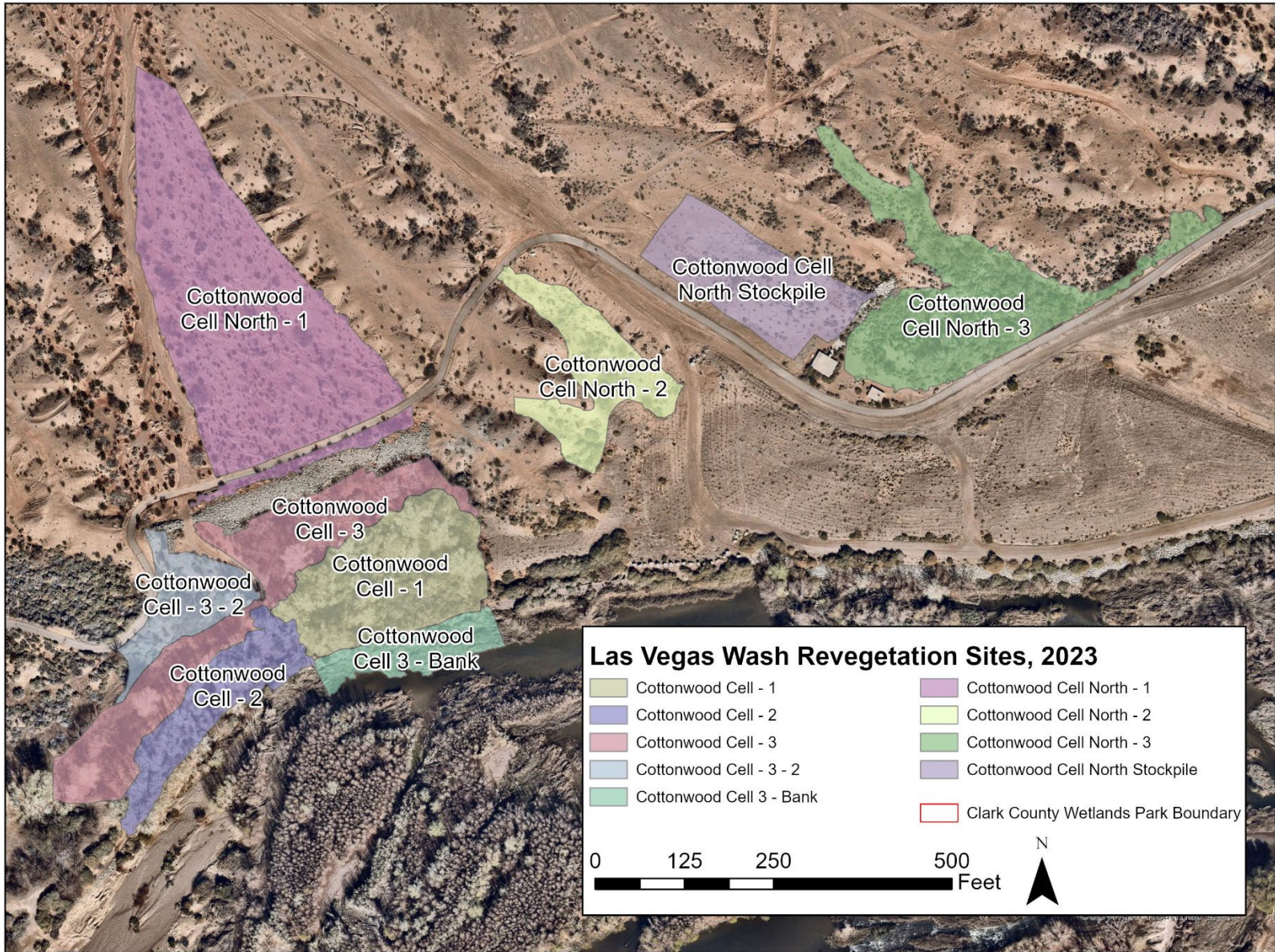


Figure 7. Aerial photograph of 2023 delineated Cottonwood Cells revegetation sites.

3.6 Demonstration Weir

The two sites at the Demonstration Weir were monitored using ArcGIS in 2023 and their total cover did not change (Table 8, Figure 8). Upstream Demonstration South – Wetland (UDS-W) and Upstream Demonstration South – Non-wetland (UDS-N) are in their 21st growing season so this is expected.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
UDS	21	1.77	non-wet	50–75%	nm	nm	nm
UDS	21	0.55	wet	75–100%	nm	nm	nm

¹UDS=Upstream Demonstration South

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland
nm = this attribute was not monitored

Table 8. Vegetation monitoring results for Demonstration Weir revegetation sites in 2023.

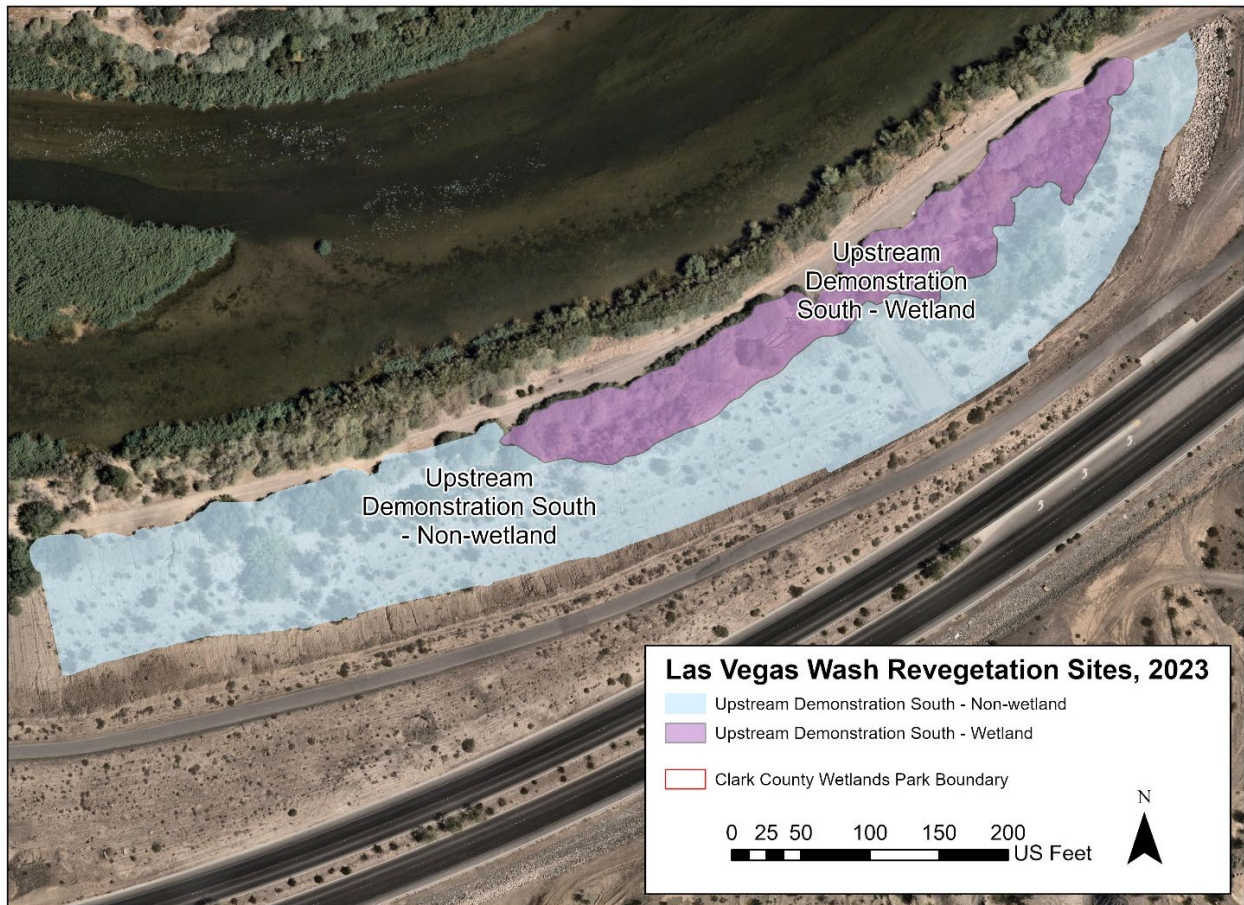


Figure 8. Aerial photograph of 2023 delineated Demonstration Weir revegetation sites.

3.7 Duck Creek Confluence and Upper Narrows Weirs

All sites at the Duck Creek Confluence and Upper Narrows weirs experience little change from year to year and range from their eighth to 11th growing season (Table 9, Figures 9). Duck Creek Upper Narrows Emergent (DCUNE) was the only site monitored in the field in 2023. The only noticeable change at DCUNE was a slight increase in noxious species cover. DCUNE went from 2.6% noxious species cover in 2021 to 7.8% in 2023. Salt cedar was the sole species accounting for this percentage. Although still relatively low, if it continues to increase then the site will be a good candidate for invasive and other undesirable species removal under the RMP. All other sites were monitored using ArcGIS and showed no changes in total cover. Duck Creek Upper Narrows South Fill (DCUNSF) continues to be at 1–5% total cover and is a good candidate for enhancement under the RMP.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DCUNE	11	10.26	wet	75–100%	7.8%	20	2.07
DCUNN	10	14.86	non-wet	75–100%	nm	nm	nm
DCUNNR	10	1.52	non-wet	75–100%	nm	nm	nm
DCUNNS	10	1.31	non-wet	5–25%	nm	nm	nm
DCUNS-1	10	9.53	non-wet	75–100%	nm	nm	nm
DCUNS-2	9	10.60	non-wet	50–75%	nm	nm	nm
DCUNS-3	9	10.58	non-wet	75–100%	nm	nm	nm
DCUNSF	8	11.47	non-wet	1–5%	nm	nm	nm
DCUNSR	9	3.08	non-wet	75–100%	nm	nm	nm
DCCS	9	1.41	wet	75–100%	nm	nm	nm
DCCW	10	3.93	wet	75–100%	nm	nm	nm
UDCCI	10	3.11	wet	75–100%	nm	nm	nm
UNW	10	3.59	wet	75–100%	nm	nm	nm

¹DCUNE=Duck Creek Upper Narrows Emergent, DCUNN=Duck Creek Upper Narrows North, DCUNNR=Duck Creek Upper Narrows North Riparian, DCUNNS=Duck Creek Upper Narrows North Stockpile, DCUNS-1=Duck Creek Upper Narrows South 1, DCUNS-2=Duck Creek Upper Narrows South 2, DCUNS-3=Duck Creek Upper Narrows South 3, DCUNSF= Duck Creek Upper Narrows South Fill, DCUNSR= Duck Creek Upper Narrows South Riparian, DCCS= Duck Creek Channel South, DCCW=Duck Creek Confluence Weir, UDCCI=Upstream Duck Creek Confluence Channel, UNW=Upper Narrows Weir

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland
nm = this attribute was not monitored

Table 9. Vegetation monitoring results for Duck Creek Confluence and Upper Narrows weirs revegetation sites in 2023.

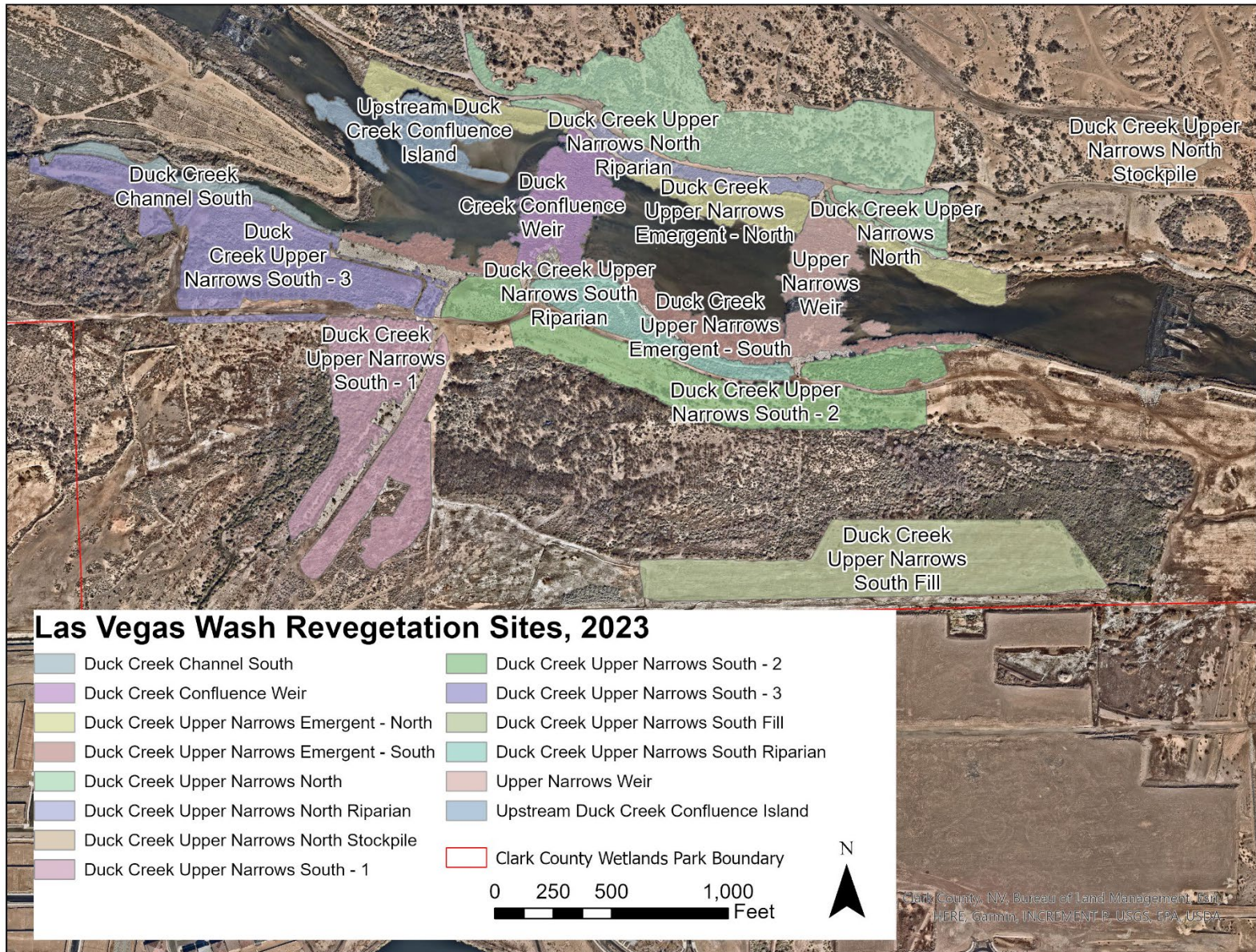


Figure 9. Aerial photograph of 2023 delineated Duck Creek Confluence and Upper Narrows weirs revegetation sites.

3.8 DU Wetlands No. 1 Weir

All sites except DU Wetlands No. 1 Weir (DU1W) were monitored in the field in 2023 (Table 10, Figures 10 and 11). Total cover for sites remained the same except for DU Wetlands No. 1 South (DU1S) which increased from 50–75% recorded using ArcGIS in 2022 to 75–100% recorded in the field in 2023. Total cover recorded in the field in 2021 was the same as 2023. This is likely another example of ArcGIS being unable to accurately identify total cover of a site.

After removal of the vegetation from DU1W in 2019, the site grew in acreage and was measured at 1.40 acres of passively established vegetation in 2023. DU Wetlands No. 1 Emergent (DU1E).

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DU1E	11	2.58	wet	75–100%	0.9	19	2.04
DU1S	11	7.97	non-wet	75–100%	2.5	13	3.59
DU1T	8	1.32	non-wet	50–75%	2.5	10	2.76
DU1W	11	1.40	wet	75–100%	nm	nm	nm

¹DU1E=DU Wetlands No. 1 Emergent, DU1S=DU Wetlands No. 1 South, DU1T=DU Wetlands No. 1 Tamarisk, DU1W=DU Wetlands No. 1 Weir

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. WPI≤2.0 = wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland
nm = this attribute was not monitored

Table 10. Vegetation monitoring results for DU Wetlands No. 1 Weir revegetation sites in 2023.



Figure 10. Vegetation at DU Wetlands No. 1 Weir Emergent.

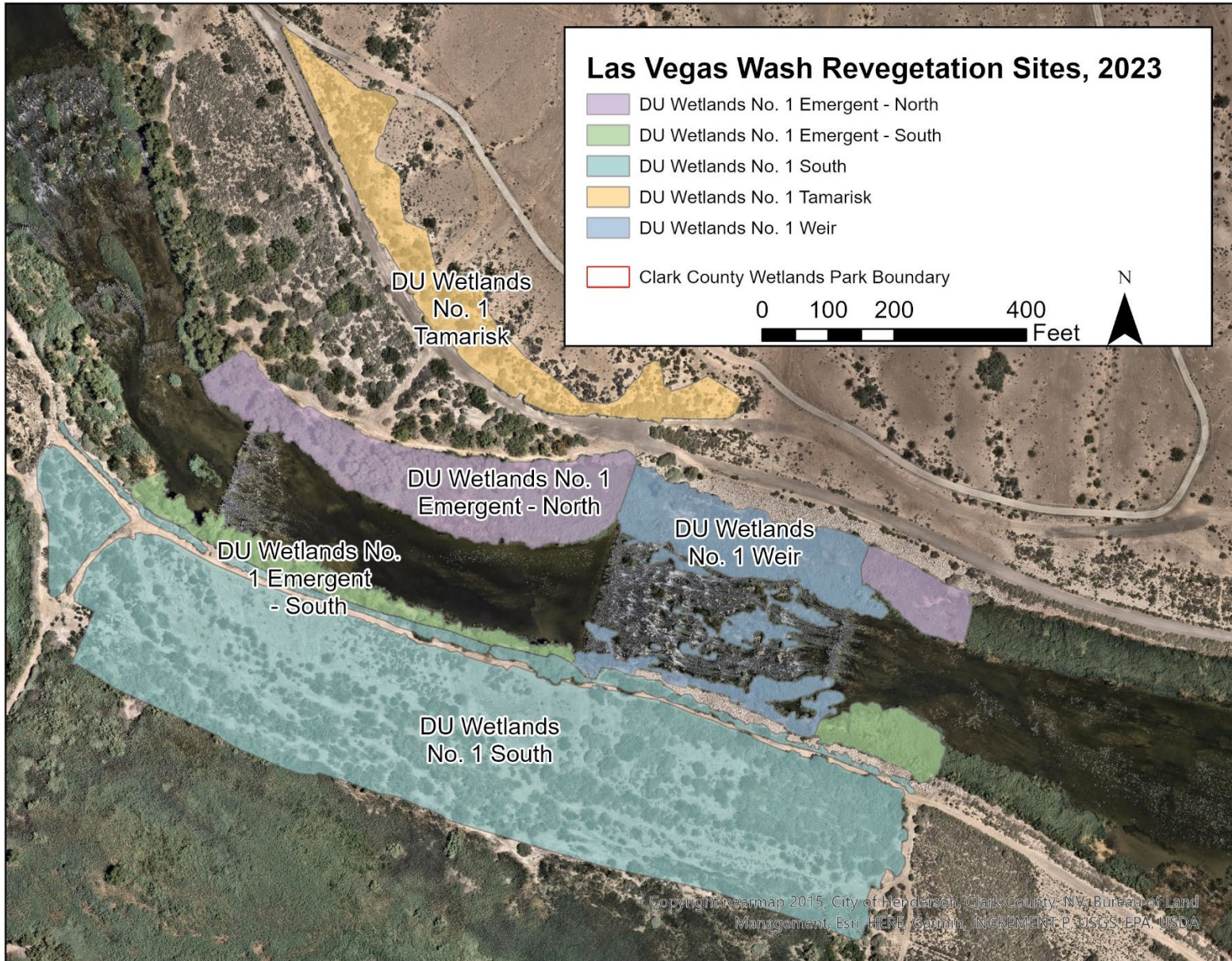


Figure 11. Aerial photograph of 2023 delineated DU Wetlands No. 1 Weir revegetation sites.

3.9 DU Wetlands No. 2 Weir

Two of the four revegetation sites at the DU Wetlands No. 2 Weir were monitored in the field in 2023 while the other two were monitored using ArcGIS (Table 11, Figures 12 and 13). DU Wetlands No. 2 South (DU2S) decreased in cover from 75–100% to 50–75%. Looking at past results, every year this site was monitored in the field since 2017, the total cover was 75–100%. Therefore, these results are likely due to the inability to identify all plant species using ArcGIS which results in lower total cover percentages. All other sites had the same total cover as recorded in 2022.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DU2E	14	1.41	wet	75–100%	0.2%	15	2.12
DU2N	14	3.05	non-wet	75–100%	2.5%	11	3.19
DU2S	14	1.56	non-wet	50–75%	nm	nm	nm
DU2W	14	0.21	wet	75–100%	nm	nm	nm

¹DU2E=DU Wetlands No. 2 Emergent, DU2N=DU Wetlands No. 2 North, DU2S=DU Wetlands No. 2 South, DU2W=DU Wetlands No. 2 Weir

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps' 1987 Wetland Delineation Manual. "wet" = wetland and "non-wet" = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 11. Vegetation monitoring results for DU Wetlands No. 2 Weir revegetation sites in 2023.

Both DU Wetlands No. 2 Emergent (DU2E) and DU Wetlands No. 2 North (DU2N) decreased in noxious species cover. DU2E went from 9.7% to 0.2% and DU2N went from 15% to 2.5%. Since both sites now have low percentages of noxious species, they are currently not good candidates for invasive and other undesirable species removal under the RMP. However, DU2N had extensive dead vegetation and would be a good candidate for enhancement under the RMP (Figure 12).



Figure 12. Photo of DU Wetlands No. 2 North showing large amounts of dead vegetation.

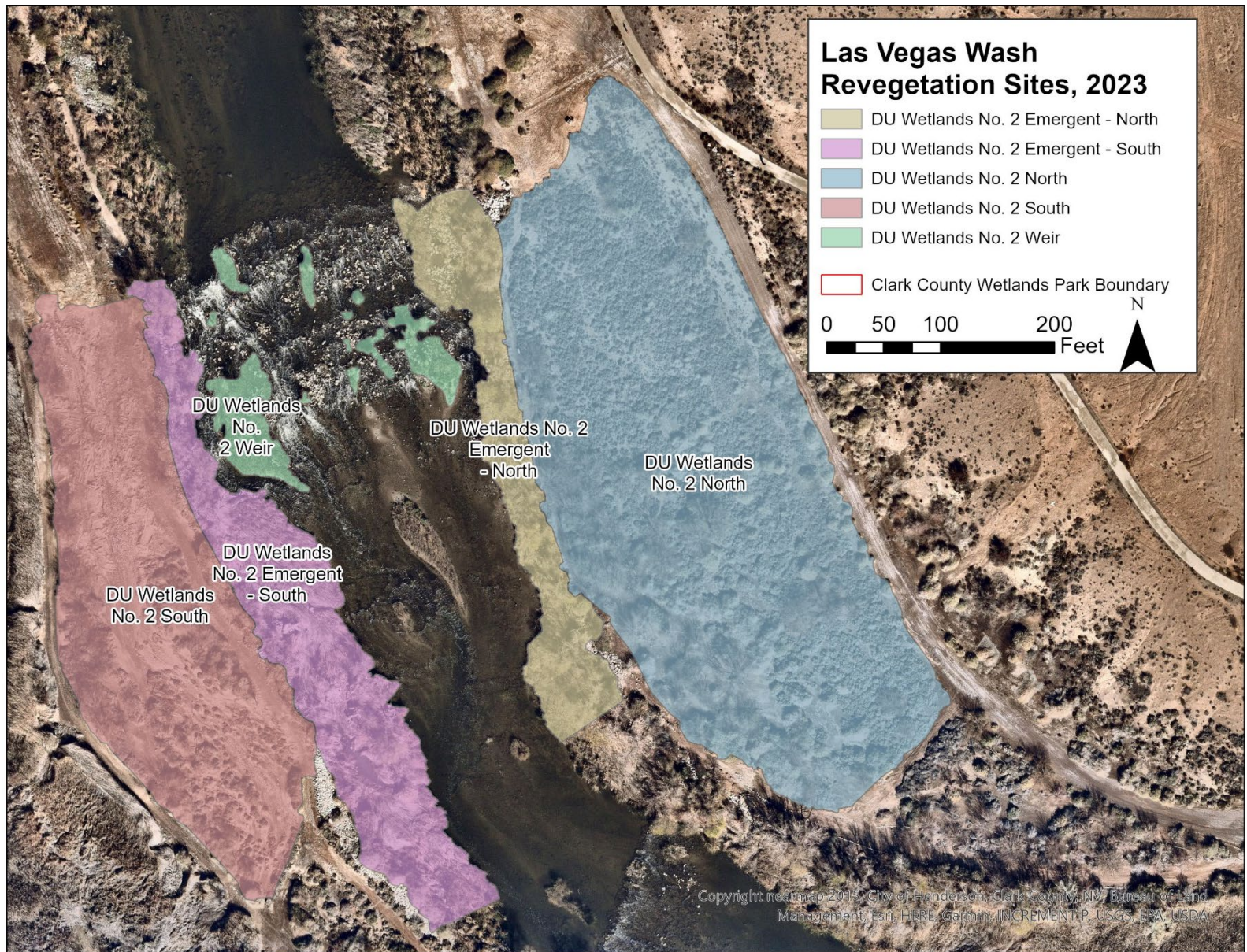


Figure 13. Aerial photograph of 2023 delineated DU Wetlands No. 2 Weir revegetation sites.

3.10 Historic Lateral Weir

Nine of 12 sites at Historic Lateral Weir were monitored in the field in 2023 (Table 12, Figure 14). Downstream Historic Lateral Passive Wetland (DHLPW) grew from 4.35 to 7.66 acres. Total coverage of all sites remained the same or increased since 2022. Upstream Historic Lateral South Upper Plateau (UHLSUP) cover increased from 50–75% recorded in 2019–2022 to 75–100% in 2023. This is a result of increasing diversity and plant growth. Upstream Historic Lateral South Upper Plateau 2 (UHLSUP2) cover increased by almost 35% from 2022 when total cover was determined using ArcGIS. However, results show only a 5% increase from field surveys conducted in 2021. Therefore, it is likely that this site has actually experienced little change in total cover over the years and that differences in cover were due to the inability to identify plant species while using ArcGIS, resulting in inaccurate total cover percentages.

Historic Lateral Weir Emergent – North (HLWE-N) saw a significant increase in noxious species cover, from 2.5% in 2022 to 15% in 2023. Upstream Historic Lateral North – Wetland (UHLN-W) and Upstream Historic Lateral North South (UHLNS) also saw increases in noxious species cover. All three sites should be considered good candidates for invasive and other undesirable species removal under the RMP.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DHLPW	23	7.66	wet	75–100%	nm	nm	nm
HLWE-N	4	0.94	wet	75–100%	15.0%	10	2.23
HLWE-S	4	0.51	wet	75–100%	0.5%	7	2.13
HLW	23	2.82	wet	75–100%	nm	nm	nm
UHLN	23	4.26	non-wet	75–100%	3.0%	24	2.40
UHLN	23	1.92	wet	75–100%	15.0%	20	2.22
UHLNS	23	1.62	wet	50–75%	7.5%	17	2.45
UHLPW	23	6.34	wet	75–100%	nm	nm	nm
UHLSB	23	1.24	non-wet	75–100%	0.1%	10	3.95
UHLSB	23	0.92	wet	75–100%	0.1%	13	2.30
UHLSUP	16	3.22	non-wet	75–100%	2.5%	13	4.73
UHLSUP2	13	10.96	non-wet	68.4%	0.3%	12	4.71

¹DHLPW=Downstream Historic Lateral Passive Wetlands, HLWE-N= Historic Lateral Weir Emergent North, HLWE-S=Historic Lateral Weir Emergent South, HLW=Historic Lateral Weir, UHLN=Upstream Historic Lateral North, UHLNS=Upstream Historic Lateral North South, UHLPW=Upstream Historic Lateral Passive Wetlands, UHLSB=Upstream Historic Lateral South Bank, UHLSUP=Upstream Historic Lateral South Upper Plateau, UHLSUP2=Upstream Historic Lateral South Upper Plateau 2

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland
nm = this attribute was not monitored

Table 12. Vegetation monitoring results for Historic Lateral Weir revegetation sites in 2023.

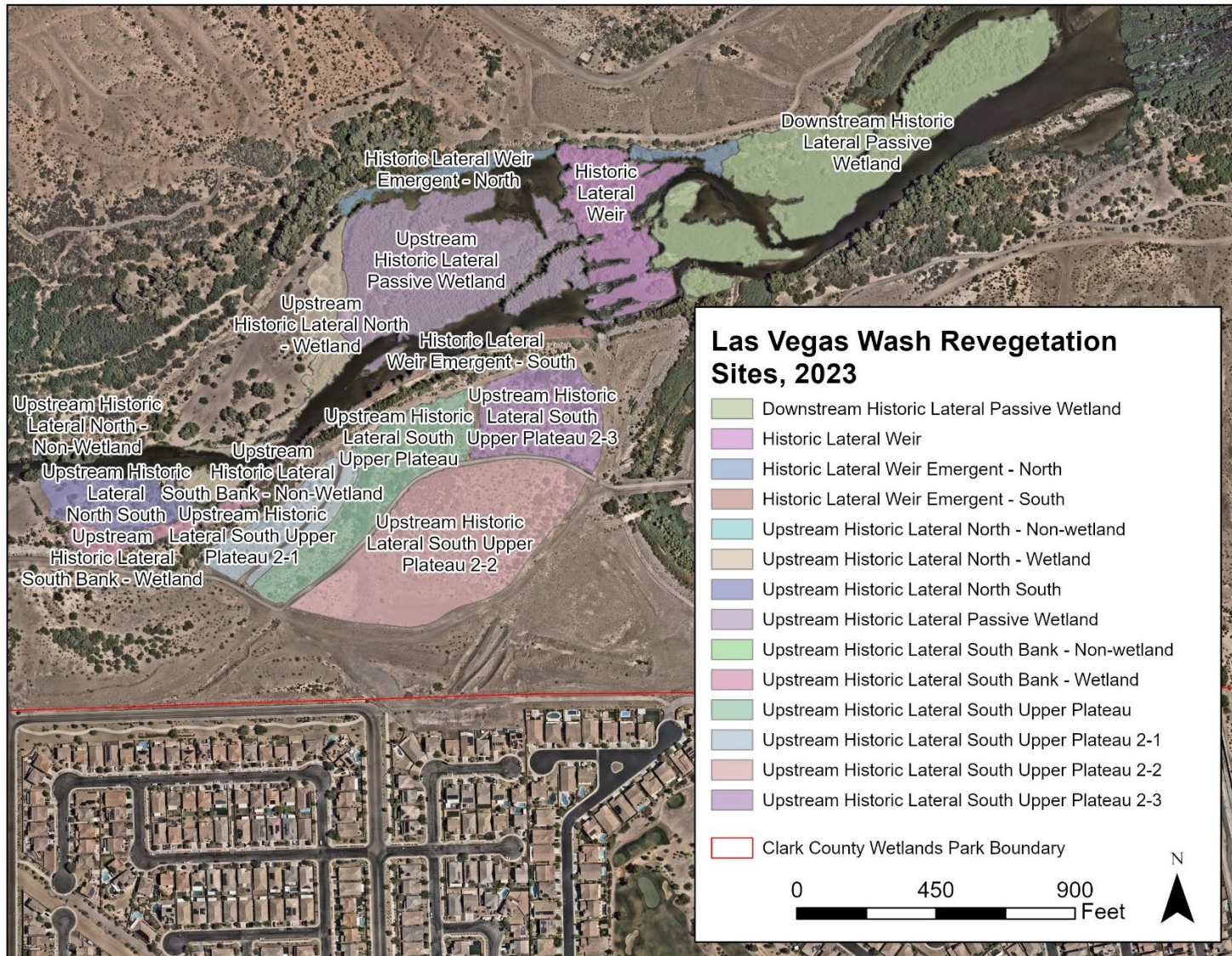


Figure 14. Aerial photograph of 2023 delineated Historic Lateral Weir revegetation sites.

3.11 Historic Lateral Weir Expansion

The three Historic Lateral Weir Expansion sites are in their fourth growing season, and all were surveyed in the field in 2023 (Table 13, Figure 15). Historic Lateral Expansion North (HLEN) was separated into four monitoring areas based on the stations volunteers were separated into during the fall 2019 Green-Up. Total cover for HLEN-2, HLEN-3, and HLEN-4 increased. Using a weighted average of the mid-point of each monitoring area’s total cover and acreage as the weight, HLEN had a total cover of 69.5% which is an increase of 28.2% since 2022. The dominant species on the site were alkali sacaton (*Sporobolus airoides*), desert globemallow (*Sphaeralcea ambigua* ssp. *rugosa*), brittlebush (*Encelia farinosa*), and desert saltbush, accounting for 86% of the total cover. Quailbush dominated the site in 2020 but has since been reduced to 7.2% total cover, showing that efforts to thin this native shrub have been working and allowing other native species to grow. Two noxious weeds were identified: salt cedar with a low cover of 0.3% and silver-leaf nightshade with a cover of 0.03%. Although noxious species are present, with such low numbers they currently do not pose a threat to this site.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
HLEN	4	9.73	non-wet	69.5%	0.3%	20	2.40
HLES	4	2.92	non-wet	46.4%	0.1%	24	2.53
HLES-T	4	0.42	wet	75–100%	0.0%	11	2.33

¹HLEN=Historic Lateral Expansion North, HLES=Historic Lateral Expansion South, HLES-T=Historic Lateral Expansion South Trench

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. WPI≤2.0 = wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland
nm = this attribute was not monitored

Table 13. Vegetation monitoring results for Historic Lateral Weir Expansion revegetation sites in 2023.

Historic Lateral Expansion South (HLES) was divided into five sections with four planted so far. The four planted areas were revegetated by Girl Scouts as part of achieving their Gold Star Award. The first area was planted in the fall of 2019; the other three were planted in fall of 2020. The fifth, unplanted area at HLES is intended to be used for additional Scout or small group plantings and does not count toward total acreage or total number of monitoring areas. HLES-1 continues to detract from the overall cover for this site, with a total cover of just 0.025% in 2023 (which is an increase from the 0.001% recorded in 2022). HLES-2, HLES-3, and HLES-4 had total covers of 62.5%, 62.5%, and 87.5%, respectively. Of these, HLES-3 changed from 2022, increasing from 37.5%. The total cover for HLES has increased over time, from 27.3% in 2021, to 41.6% in 2022, to 46.4% in 2023.

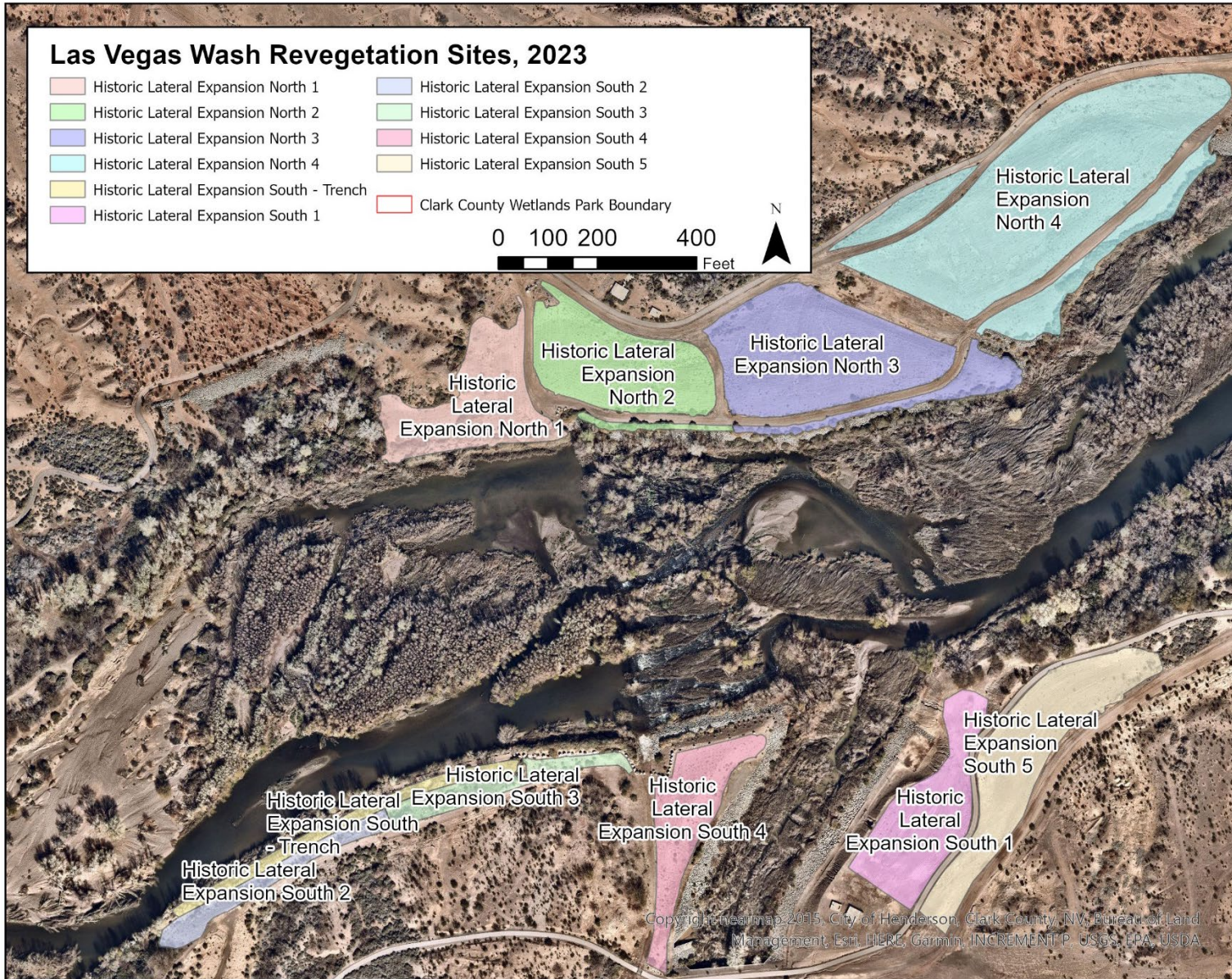


Figure 15. Aerial photograph of 2023 delineated Historic Lateral Weir Expansion revegetation sites.

The third revegetation site is Historic Lateral Expansion South Trench (HLES-T) and is the result of an engineering design only used here and at the Sunrise Mountain Weir. A large trench was dug outside of the Wash channel on the back side of the bank protection installed along the water. This trench is designed to allow for riparian trees and other vegetation to grow near the banks of the Wash without the risk of impeding flows. HLES-T remained at 75–100% cover for the fourth year in a row and was dominated by common reed and Fremont’s cottonwood (*Populus fremontii*). A total of 11 species passively established or remained following the first four growing seasons.

3.12 Lower Narrows and Homestead Weirs

Lower Narrows Homestead North (LNHN) and Lower Narrows Homestead South 3 (LNHS3) were the only sites monitored in the field in 2023 at the Lower Narrows and Homestead weirs (Table 14, Figure 16). Lower Narrows Homestead South 1 (LNHS1) saw a significant decrease in total cover from 2022 to 2023, going from 75–100% to 5–25%. Comparing results from the past several years, the total cover decreased each time when surveyed using ArcGIS. Therefore, this is likely another example of not being able to accurately identify plants while determining total cover using ArcGIS.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
HW	12	4.14	wet	75–100%	nm	nm	nm
LNW	12	3.61	wet	75–100%	nm	nm	nm
LNHE	12	6.54	wet	75–100%	nm	nm	nm
LNHN	12	40.92	non-wet	75–100%	0.1%	16	3.50
LNHS1	12	7.38	non-wet	5–25%	nm	nm	nm
LNHS2	11	6.61	non-wet	50–75%	nm	nm	nm
LNHS3	12	2.23	non-wet	25–50%	0.0%	7	4.21

¹HW=Homestead Weir, LNW=Lower Narrows Weir, LNHE=Lower Narrows Homestead Emergent, LNHN=Lower Narrows Homestead North, LNHS1=Lower Narrows Homestead South 1, LNHS2=Lower Narrows Homestead South 2, LNHS3=Lower Narrows Homestead South 3

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual.

“wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. WPI≤2.0 = wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland

nm = this attribute was not monitored

Table 14. Vegetation monitoring results for Lower Narrows and Homestead weirs revegetation sites in 2023.

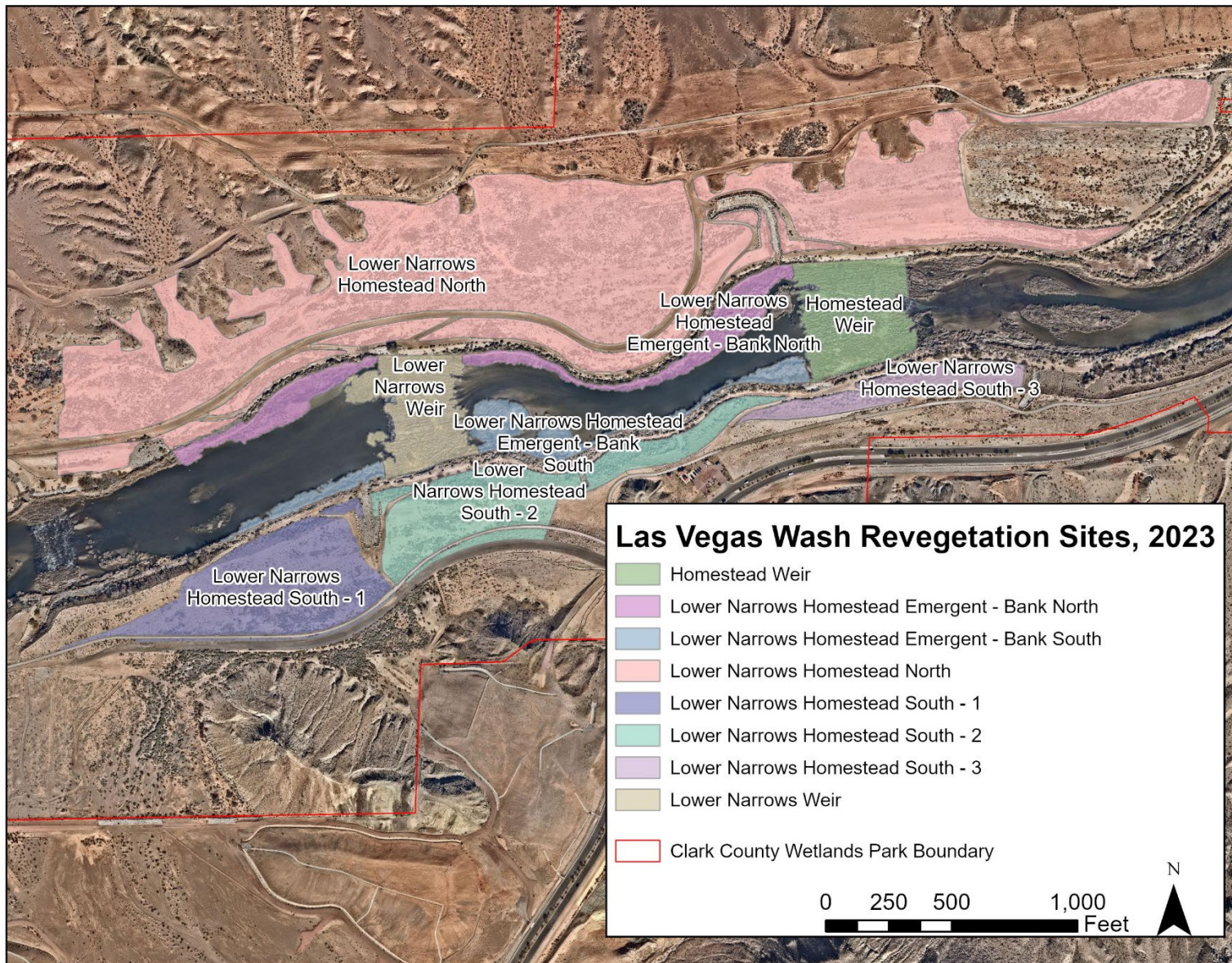


Figure 16. Aerial photograph of 2023 delineated Lower Narrows and Homestead weirs revegetation sites.

Field monitoring in 2022 showed LNHS1 and Lower Narrows Homestead South 2 (LNHS2) are dominated by one or two species. Under the RMP, these sites are considered good candidates for enhancement, and the spring 2024 and 2025 Green-Ups will take place at these locations, which should increase species diversity.

All sites monitored using ArcGIS in 2023 had the same total cover as recorded in 2022 except LNHS1 and Lower Narrows Homestead South 3 (LNHS3). LNHS3 increased from 5–25% in 2022 to 25–50% in 2023. Acreage for each site either remained the same or saw very minimal change from what was recorded in 2022.

3.13 Monson and Visitor Center Weirs

Two revegetation sites at the Monson and Visitor Center weirs were monitored in the field in 2023, and the other two were monitored using ArcGIS (Table 15, Figure 17). Like previous years, all sites had a total cover of 75–100%. Given the maturity of these sites, there is not much change in species or their covers from year to year.

Noxious plant cover for Downstream Monson South – Wetland (DMS-W) saw a slight decrease, from 45.5% in 2021 to 33% in 2023. The two main noxious species are salt cedar and johnsongrass, with 30% total cover. DMS-W is a good candidate for invasive and other undesirable species removal under the RMP.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DMN	21	3.73	non-wet	75–100%	nm	nm	nm
DMN	21	0.99	wet	75–100%	nm	nm	nm
DMS	21	2.92	non-wet	75–100%	0.5%	8	3.54
DMS	21	0.62	wet	75–100%	33.0%	21	2.65

¹DMN=Downstream Monson North, DMS=Downstream Monson South

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 15. Vegetation monitoring results for Monson and Visitor Center weirs revegetation sites in 2023.

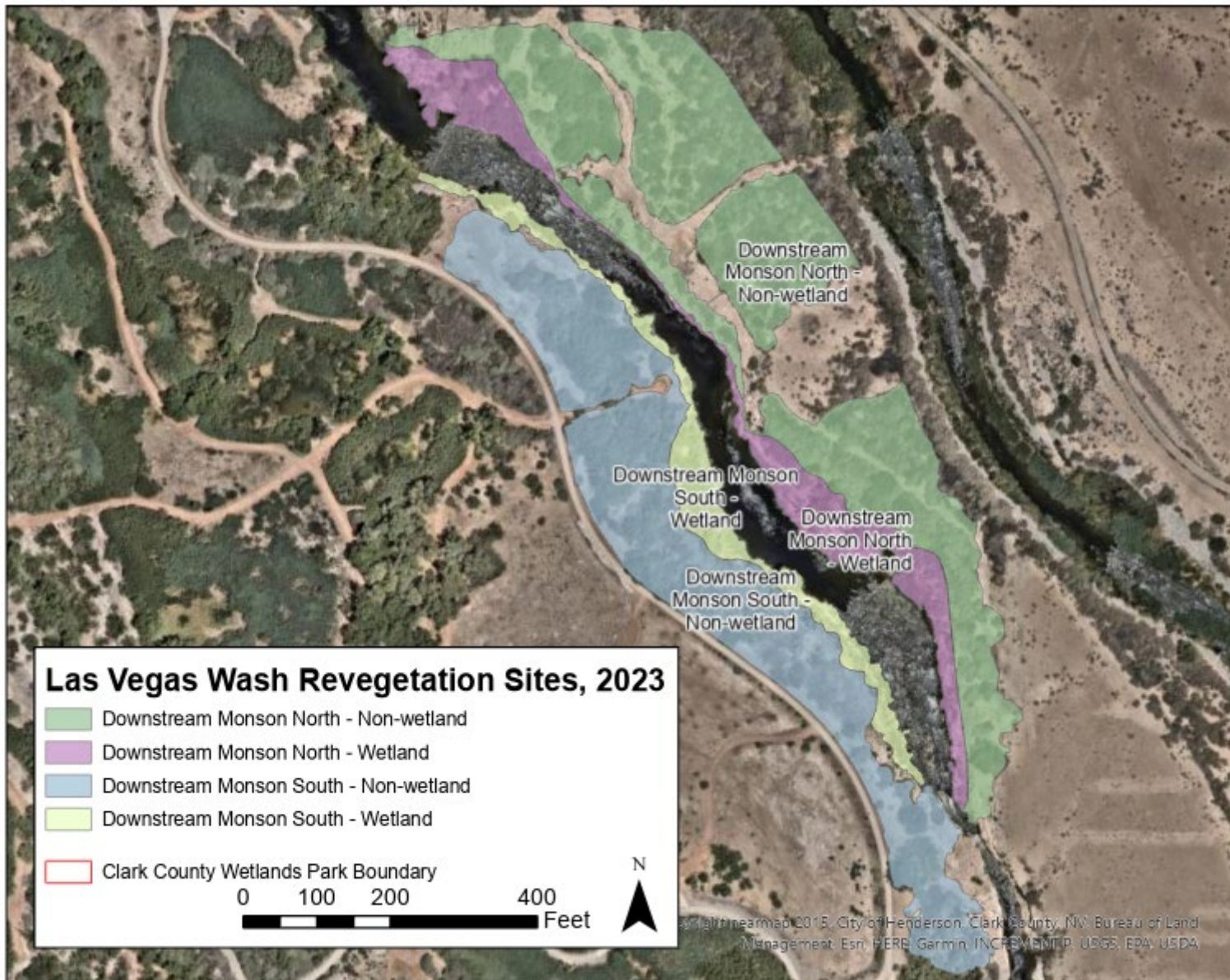


Figure 17. Aerial photograph of 2023 delineated Monson and Visitor Center weirs revegetation sites.

3.14 Pabco Road Weir

Four of the 15 revegetation sites associated with the Pabco Road Weir were monitored in the field in 2023 (Table 16, Figure 18). Upstream Pabco South (UPS) was the only site of the ones surveyed in the field that had a change in total cover. UPS went from 50–75% recorded every year since 2020 to 75–100% recorded in 2023. The increase in total cover was caused by two species, Goodding’s willow (*Salix gooddingii*), which increased from 0% to 15%, and salt heliotrope (*Heliotropium curassavicum*), which increased from 2.5% to 15%. Two sites monitored using ArcGIS saw a decrease in total cover. Downstream Pabco South Upper Plateau (DPSUP) and Downstream Pabco South Upper Plateau-3 (DPSUP-3) both went from 50–75% recorded in the field in 2022 to 25–50% recorded using ArcGIS in 2023. These results are likely another example of being unable to properly identify all plant species using ArcGIS. The Upstream Pabco Island (UPI) site was removed in early 2020 but had grown to 0.20 acres in 2023. Although Upstream Pabco North (UPN) was mostly removed in 2020, it measured at 2.58 acres of passively established wetlands in 2023. This site was originally planted in 2001 but continued to grow due to sediment deposition and began to impede water flow over the weir, resulting in the need to remove the vegetation.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DPI	23	1.22	wet	75–100%	nm	nm	nm
DPN	15	9.52	non-wet	75–100%	nm	nm	nm
DPNB	12	0.88	wet	75–100%	nm	nm	nm
DPS	23	3.75	wet	25–50%	nm	nm	nm
DPSUB	13	1.01	non-wet	5–25%	nm	nm	nm
DPSUP	13	9.56	non-wet	25–50%	nm	nm	nm
DPSUP-3	6	0.60	non-wet	25–50%	nm	nm	nm
PN	23	3.55	non-wet	50–75%	nm	nm	nm
PN	23	0.85	wet	75–100%	nm	nm	nm
PS	23	1.27	non-wet	75–100%	0.1%	10	3.9
PS	23	0.29	wet	75–100%	0.1%	7	2.39
UPI	23	0.20	wet	75–100%	nm	nm	nm
UPN	18	2.58	wet	75–100%	2.6%	15	1.85
UPS	22	1.65	wet	75–100%	3.1%	22	2.23
UPSUP	22	2.24	non-wet	75–100%	nm	nm	nm

¹DPI=Downstream Pabco Island, DPN=Downstream Pabco North, DPNB=Downstream Pabco North Bank, DPS=Downstream Pabco South, DPSUB=Downstream Pabco South Upper Bank, DPSUP=Downstream Pabco South Upper Plateau, DPSUP-3=Downstream Pabco South Upper Plateau-3 PN=Pabco North, PS=Pabco South, UPI=Upstream Pabco Island, UPN=Upstream Pabco North, UPS=Upstream Pabco South, UPSUP=Upstream Pabco South Upper Plateau

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. WPI≤2.0 = wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland nm = this attribute was not monitored

Table 16. Vegetation monitoring results for Pabco Road Weir revegetation sites in 2023.

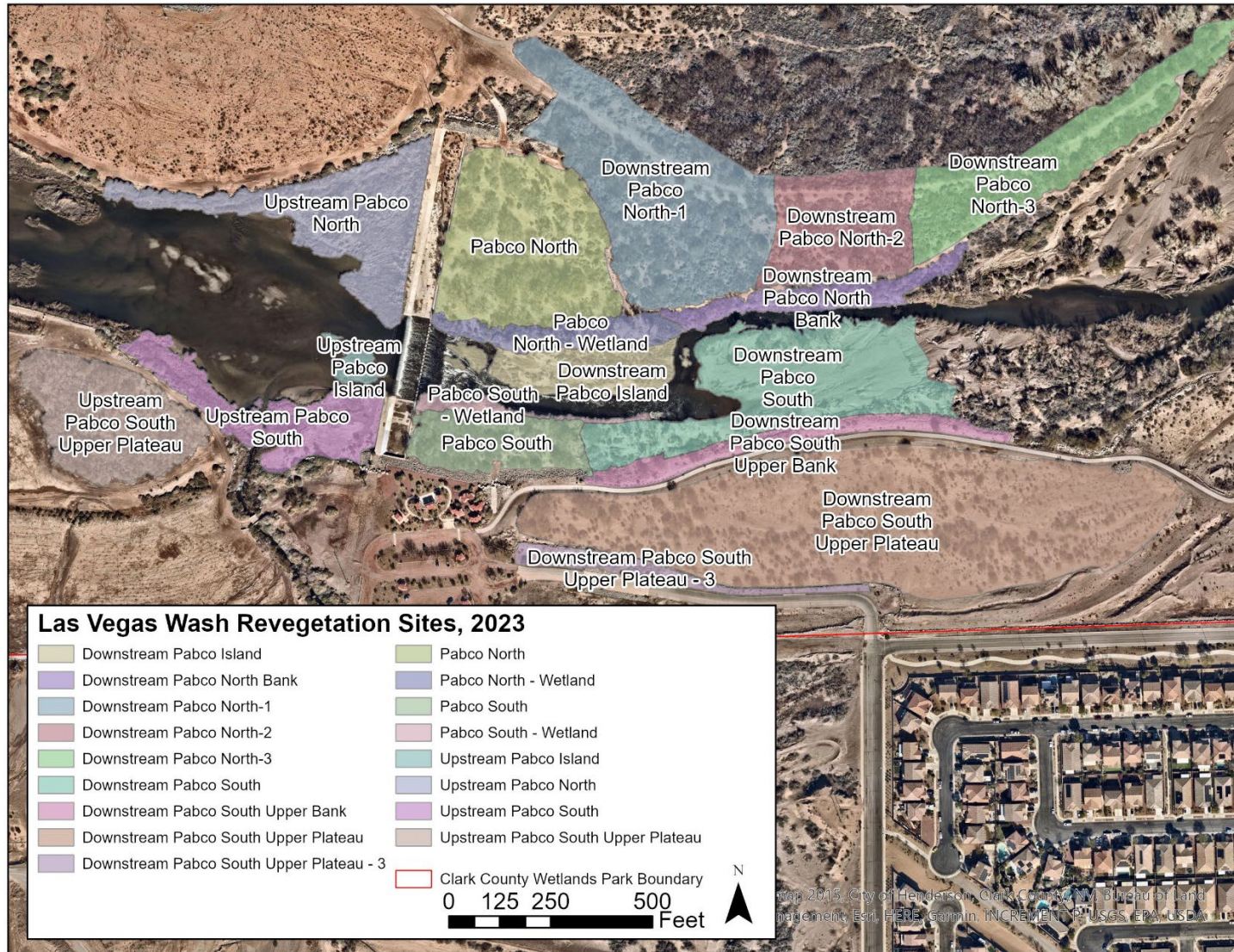


Figure 18. Aerial photograph of 2023 delineated Pabco Road Weir revegetation sites.

3.15 Powerline Crossing Weir

Nine of 11 revegetation sites at the Powerline Crossing Weir were monitored in the field in 2023 (Table 17, Figure 19). Total cover remained the same for all sites except for Powerline South Bank (PLSB) and Upstream Powerline North Plateau (UPLNP) which both increased. PLSB went from 50–75% total cover in 2020–2022 to 75–100% in 2023. The main contributor to this change was bush seepweed (*Suaeda nigra*) increasing from 25–50% to 50–75% cover. Total cover for UPLNP is shown as a whole number as opposed to a range like the other sites. This percentage is calculated by taking the weighted average of all five monitoring areas which make up this site. Three of the five monitoring areas at UPLNP increased in total cover while the other two remained the same.

Upstream Powerline South Plateau (UPLSP) was the spring 2023 Green-Up location. The goal of Green-Up events following the transition to the LTOP is to enhance current sites. This site increased in cover, from 60.7% in 2021 to 82.9% in 2023, and in diversity, from 8 species in 2021 to 21 species in 2023.

All sites are in their 17th growing season and therefore do not experience much change over the years. However, storms and Wash flows removed Upstream Powerline Island (UPLI) in its entirety in 2022 and it remained at 0 acres in 2023. Both Downstream Powerline North Bank (DPLNB) and Downstream Powerline South Bank (DPLSB) recorded high noxious plant cover in 2021 and 2023. Therefore, these sites are now considered good candidates for invasive and other undesirable species removal under the RMP.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DPLNB	17	0.32	wet	75–100%	37.5%	5	2.43
DPLSB	17	0.30	wet	75–100%	62.5%	3	2.62
PCW	17	0.22	wet	75–100%	nm	nm	nm
PLSB	17	0.59	non-wet	75–100%	0.0%	5	2.56
UPLI	17	0	n/a	n/a	n/a	n/a	n/a
UPLNB	17	0.67	non-wet	5–25%	0.0%	4	3.24
UPLNE	17	1.09	wet	75–100%	2.5%	10	2.29
UPLNP	17	3.94	non-wet	76.3%	0.0%	9	3.09
UPLNW	17	0.38	wet	75–100%	0.1%	4	2.00
UPLSB	17	0.60	wet	75–100%	2.5%	11	2.10
UPLSP	17	5.90	non-wet	82.9%	0.0%	21	3.63

¹DPLNB=Downstream Powerline North Bank, DPLSB=Downstream Powerline South Bank, PCW=Powerline Crossing Weir, PLSB=Powerline South Bank, UPLI=Upstream Powerline Island, UPLNB=Upstream Powerline North Bank, UPLNE=Upstream Powerline North Emergent, UPLNP=Upstream Powerline North Plateau, UPLNW=Upstream Powerline North Wetland, UPLSB=Upstream Powerline South Bank, UPLSP=Upstream Powerline South Plateau

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. WPI≤2.0 = wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland

nm = this attribute was not monitored

Table 17 . Vegetation monitoring results for Powerline Crossing Weir revegetation sites in 2023.

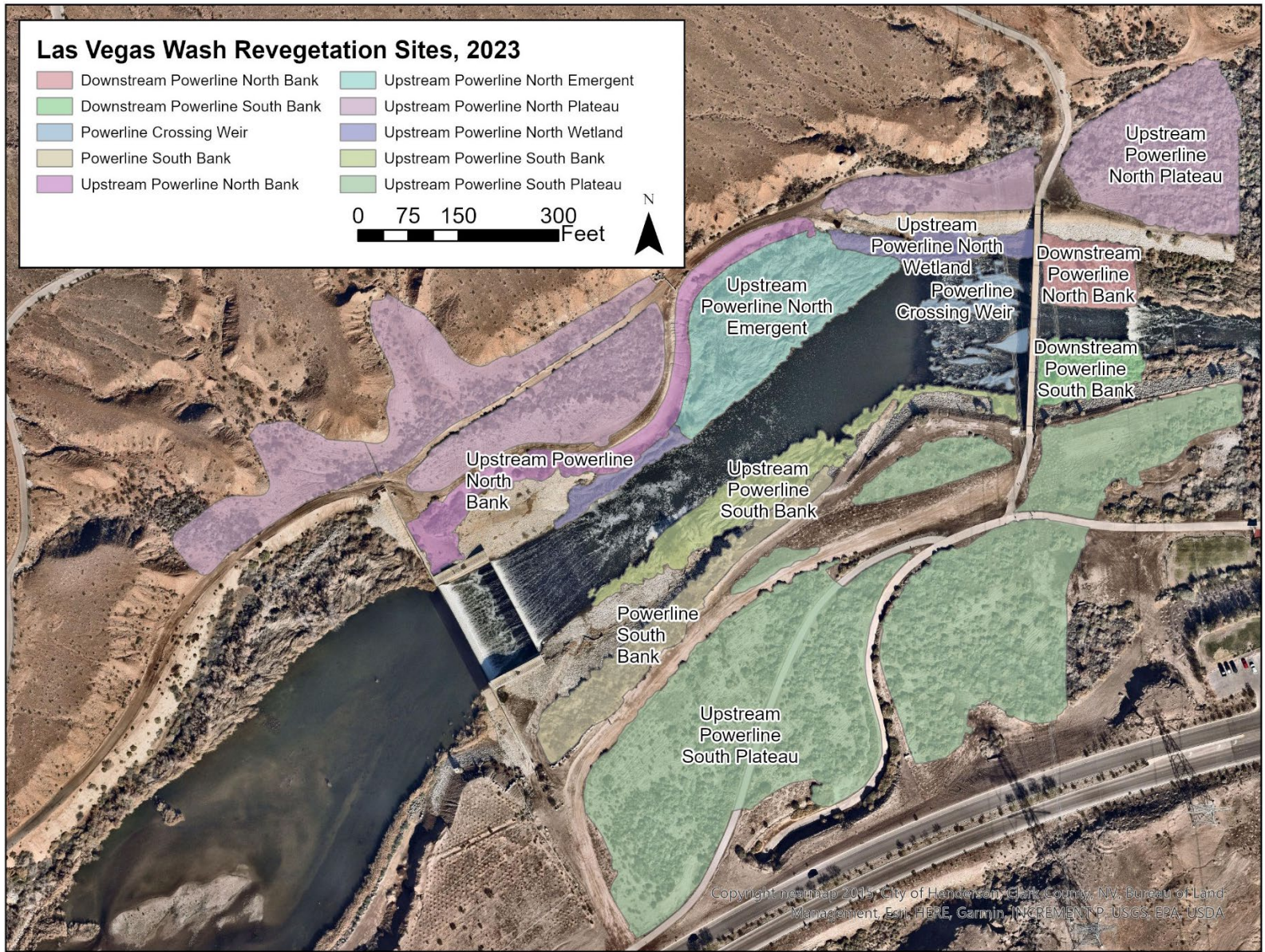


Figure 19. Aerial photograph of 2023 delineated Powerline Weir revegetation sites.

3.16 Rainbow Gardens Weir

Upstream Rainbow North Bank was the only site at Rainbow Gardens Weir that was surveyed in the field in 2023 (Table 18, Figure 20). Upstream Rainbow Island (URI) saw an increase in acreage from 1.93 in 2022 to 2.20 in 2023. Storms and Wash flows in 2022 removed Rainbow Islands (RI) in its entirety and it still has not reestablished. Therefore, no data was recorded for this site in 2023.

Upstream Rainbow South Bank 2 (URSB2) and Upstream Rainbow South Emergent (URSE) both recorded high percentages of noxious species cover when surveyed in the field in 2022 and remain good candidates for invasive and other undesirable species removal under the RMP.

Upstream Rainbow South Plateau (URSP) has recorded the same total cover since 2015 of 5–25%. This site was included in the spring 2023 Green-Up and results from this event should be noticeable in future monitoring. This site was not surveyed in the field in 2023 and total cover was determined using ArcGIS. The results show no increases in total cover, but this is likely due to the inability to identify the small plants installed during the Green-Up. This site will be monitored in the field for the next five years, with survivorship recorded for two consecutive years beginning in the fall of 2024.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
RI	19	0	n/a	n/a	n/a	n/a	n/a
URI	19	2.20	wet	75–100%	nm	nm	nm
URNB	14	1.63	non-wet	25–50%	2.5%	7	3.12
URNPW	19	2.29	wet	75–100%	nm	nm	nm
URSB1	18	0.02	non-wet	75–100%	nm	nm	nm
URSB2	16	0.45	non-wet	75–100%	nm	nm	nm
URSE	19	0.39	wet	75–100%	nm	nm	nm
URSP	18	1.39	non-wet	5–25%	nm	nm	nm

¹RI=Rainbow Islands, URI=Upstream Rainbow Island, URNB=Upstream Rainbow North Bank, URNPW=Upstream Rainbow North Passive Wetlands, URSB1=Upstream Rainbow South Bank 1, URSB2=Upstream Rainbow South Bank 2, URSE=Upstream Rainbow South Emergent, URSP=Upstream Rainbow South Plateau

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 18. Vegetation monitoring results for Rainbow Gardens Weir revegetation sites in 2023.

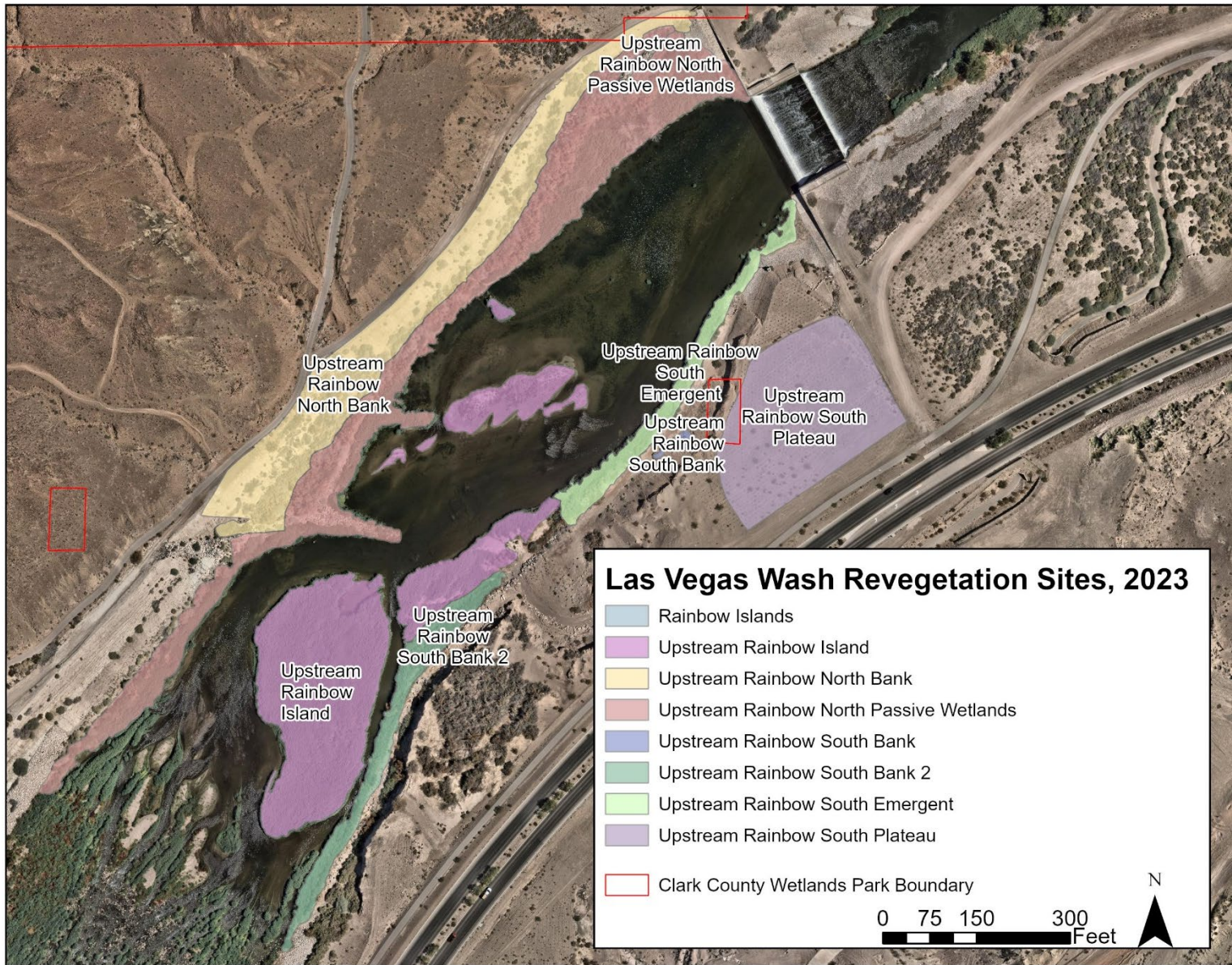


Figure 20. Aerial photograph of 2023 delineated Rainbow Gardens Weir revegetation sites.

3.17 Site 108

Site 108 was monitored using ArcGIS in 2023 (Table 19, Figure 21). This is still the largest contiguous revegetation site along the Wash, at 39.4 acres, despite being much larger at completion at nearly 60 acres. In the spring and fall of 2006, it was planted in phases through its four different grant-funding sources: NDEP, Nevada Division of State Parks (NDSP), and Southern Nevada Public Land Management Act (SNPLMA) Rounds IV and V. Because this is a large site, it is broken up into 59 monitoring areas, all less than 2 acres and most less than 1 acre in size.

Using a weighted average of the mid-point of each monitoring area’s total cover and acreage as the weight, the NDEP site showed the largest increase in total cover since last surveyed using ArcGIS in 2021, from 75.7% to 83.4%. All other sites had the same total cover since last surveyed using ArcGIS or saw an increase of no more than 2%.

Site 108 Funding Source	Growing Season ³	Acreage	Wetland Status ¹	Total Cover	Noxious Species Cover	Number of Species	WPI ²
NDEP	17	5.86	non-wet	83.4%	nm	nm	nm
NDSP	17	13.54	non-wet	85.0%	nm	nm	nm
SNPLMA IV	17	7.89	non-wet	87.5%	nm	nm	nm
SNPLMA V	17	12.11	non-wet	87.5%	nm	nm	nm
TOTAL	17	39.4	non-wet	85.9%	nm	nm	nm

¹NDEP=Nevada Division of Environmental Protection, NDSP=Nevada Division of State Parks, SNPLMAIV=Southern Nevada Public Land Management Act IV, SNPLMA V=Southern Nevada Public Land Management Act V

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

⁴Portions of funding areas SNPLMA IV and SNPLMA V were planted in the spring of 2006 and others in the fall of 2006
nm = this attribute was not monitored

Table 19. Vegetation monitoring results by funding source for the Site 108 revegetation site in 2023.

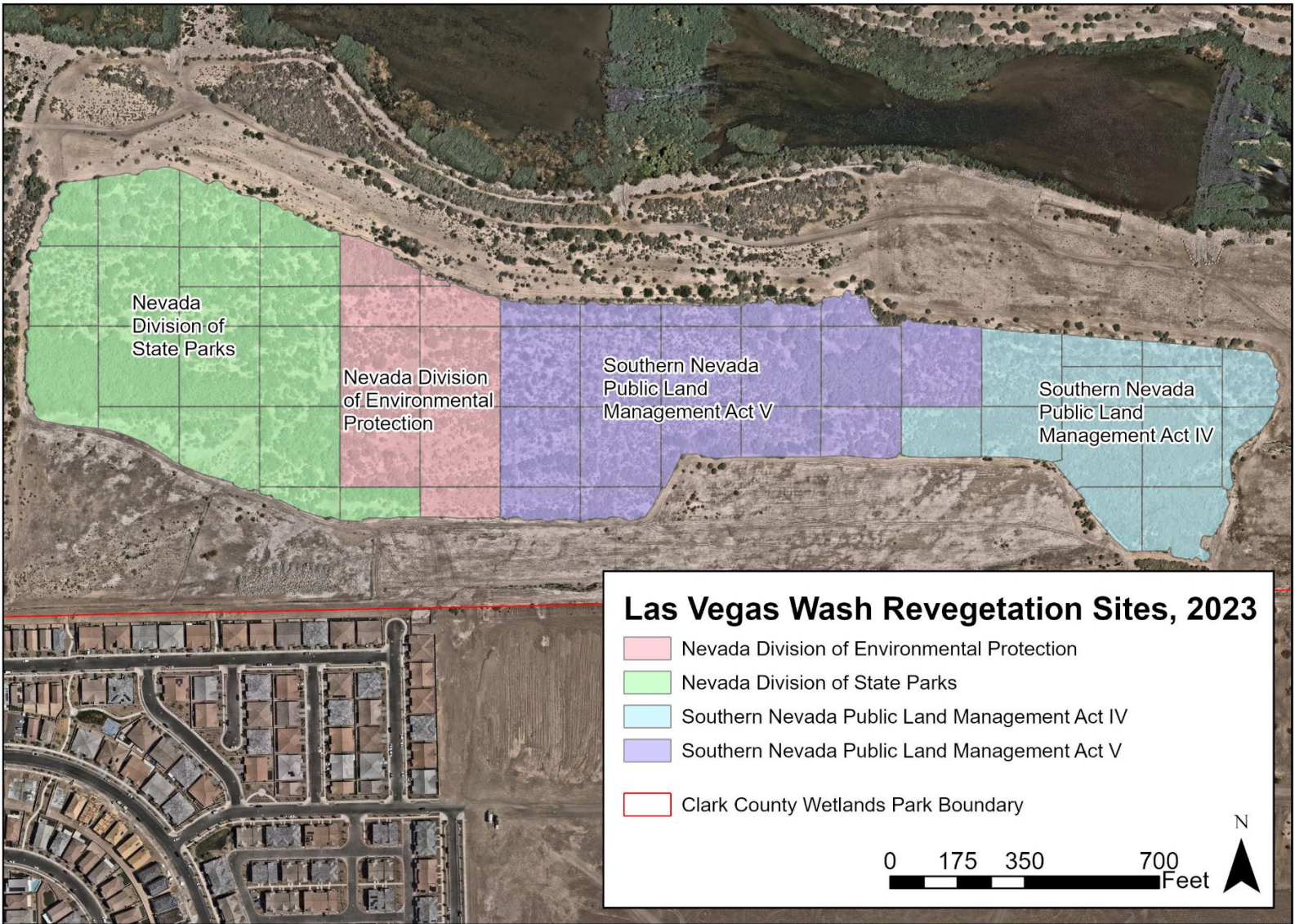


Figure 21. Aerial photograph of Site 108 with 2023 delineations based on funding source.

3.18 Site 111

Site 111 was planted as a single site, but due to being one of the larger revegetation sites along the Wash, it is broken up into 26 monitoring areas (Table 20, Figures 22 and 23). All areas were monitored using ArcGIS in 2023. This site is in its 16th growing season so there is not much change year to year. Total cover went from 81.4% measured using ArcGIS in 2021 to 78.7% in 2023.

Site Code	Growing Season	Acreage	Wetland Status ¹	Total Cover	Noxious Species Cover	Number of Species	WPI ²
S111	16	14.99	non-wet	78.7%	nm	nm	nm

¹Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps' 1987 Wetland Delineation Manual. "wet" = wetland and "non-wet" = non-wetland

²Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 20. Vegetation monitoring results for the Site 111 revegetation site in 2023.



Figure 22. Photo of monitoring area S111-24 which is a monitoring area within Site 111.

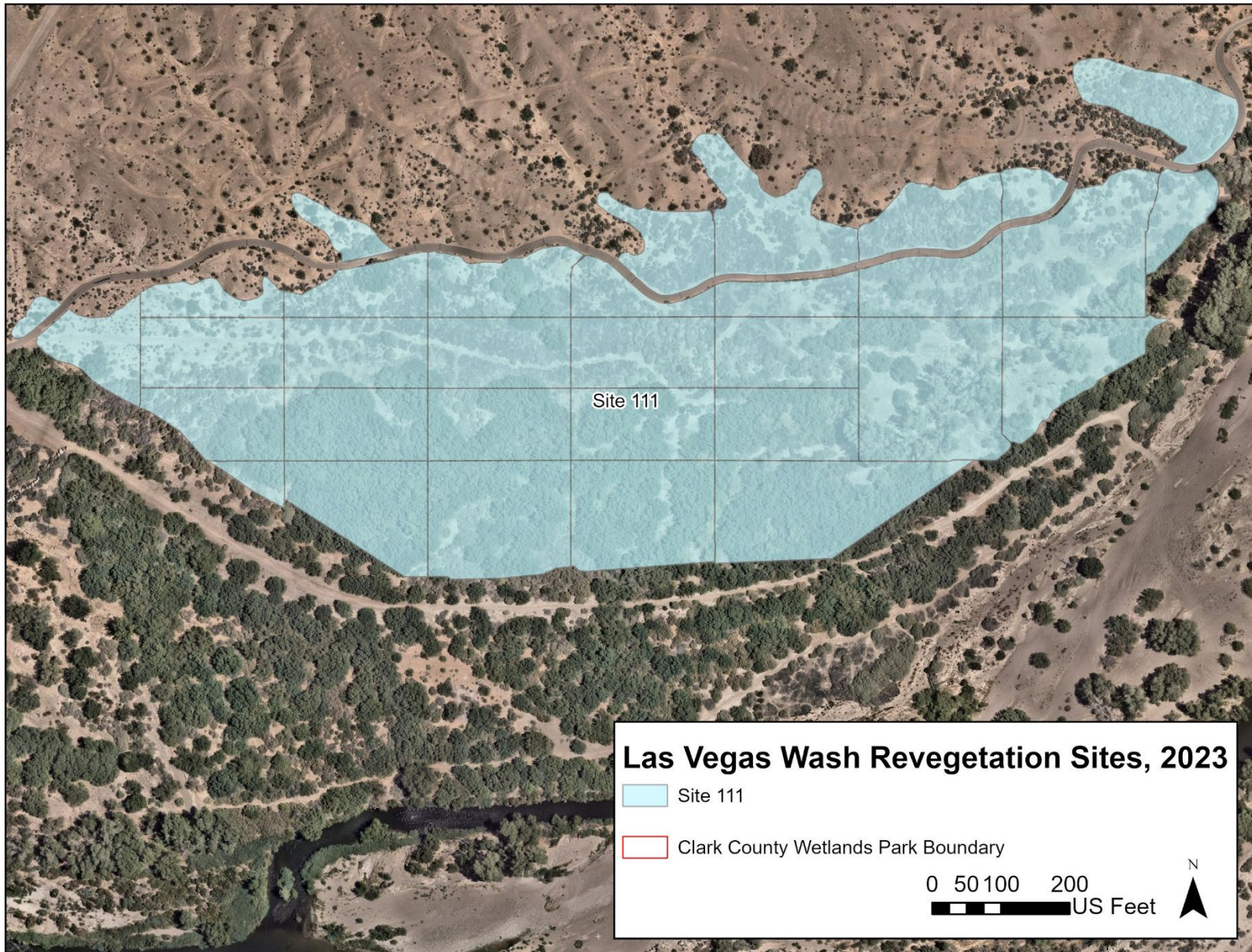


Figure 23. Aerial photograph of the 2023 delineated Site 111 revegetation site.

3.19 Sunrise Mountain Weir

Sunrise Mountain Weir’s sites are the newest of all sites monitored, ranging from two to four growing seasons. Six of the eight sites were monitored in the field in 2023 (Table 21, Figure 24). Sunrise Mountain North (SMN) was originally slated to be planted during the March 2020 Green-Up, but it was postponed until March 2022 due to COVID-19. SMN saw an increase in total cover from 25–50% in 2022 to 75–100% in 2023. This site is diverse with 28 species recorded in 2023. Of these species, four make up more than half of the total coverage for this site: brittlebush, honey mesquite, screwbean mesquite (*Strombocarpa pubescens*), and alkali sacaton each recorded coverage of 15%.

Sunrise Mountain Emergent-North (SME-N) and Sunrise Mountain South-1 (SMS-1) both saw an increase in species diversity. SME-N went from 11 to 16 and SMS-1 went from 10 to 18 species.

Sunrise Mountain South Trenches (SMT) continues to see an increase in noxious weed cover. Results from 2023 showed noxious species increasing from 37.5% cover in 2022 to 62.5% in 2023. Tamarisk is the noxious species found at this site. Seeing a consistent increase in tamarisk over the past several years shows that this site is a good candidate for invasive and other undesirable species removal under the RMP.

Sunrise Mountain South-2 (SMS-2) was planted as a Green-Up event in March 2022. In 2023, this site measured at 10.21 acres with a total cover of 50–75%, an increase from 25–50% in 2022. This is likely a result of the plants becoming larger and more established.

Site Code ¹	Growing Season	Acres	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
SME-N	4	1.39	wet	75–100%	2.5%	16	2.34
SME-S	4	0.80	wet	75–100%	15.1%	17	2.05
SMI	4	1.79	wet	75–100%	nm	nm	nm
SMS-1	3	8.88	non-wet	50–75%	0.6%	18	2.46
SMS-2	2	10.21	non-wet	50–75%	0.2%	26	2.34
SMN	3	9.11	non-wet	75–100%	0.5%	28	2.66
SMT	4	0.71	non-wet	75–100%	62.5%	8	2.98
SMW	4	0.83	wet	75–100%	nm	nm	nm

¹SME=Sunrise Mountain Emergent, SMI=Sunrise Mountain Islands, SMT=Sunrise Mountain Trenches, SMW=Sunrise Mountain Weir

³Wetland Prevalence Index (WPI) value. WPI≤2.0 = wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland

nm = this attribute was not monitored

Table 21. Vegetation monitoring results for the Sunrise Mountain Weir revegetation sites in 2023.

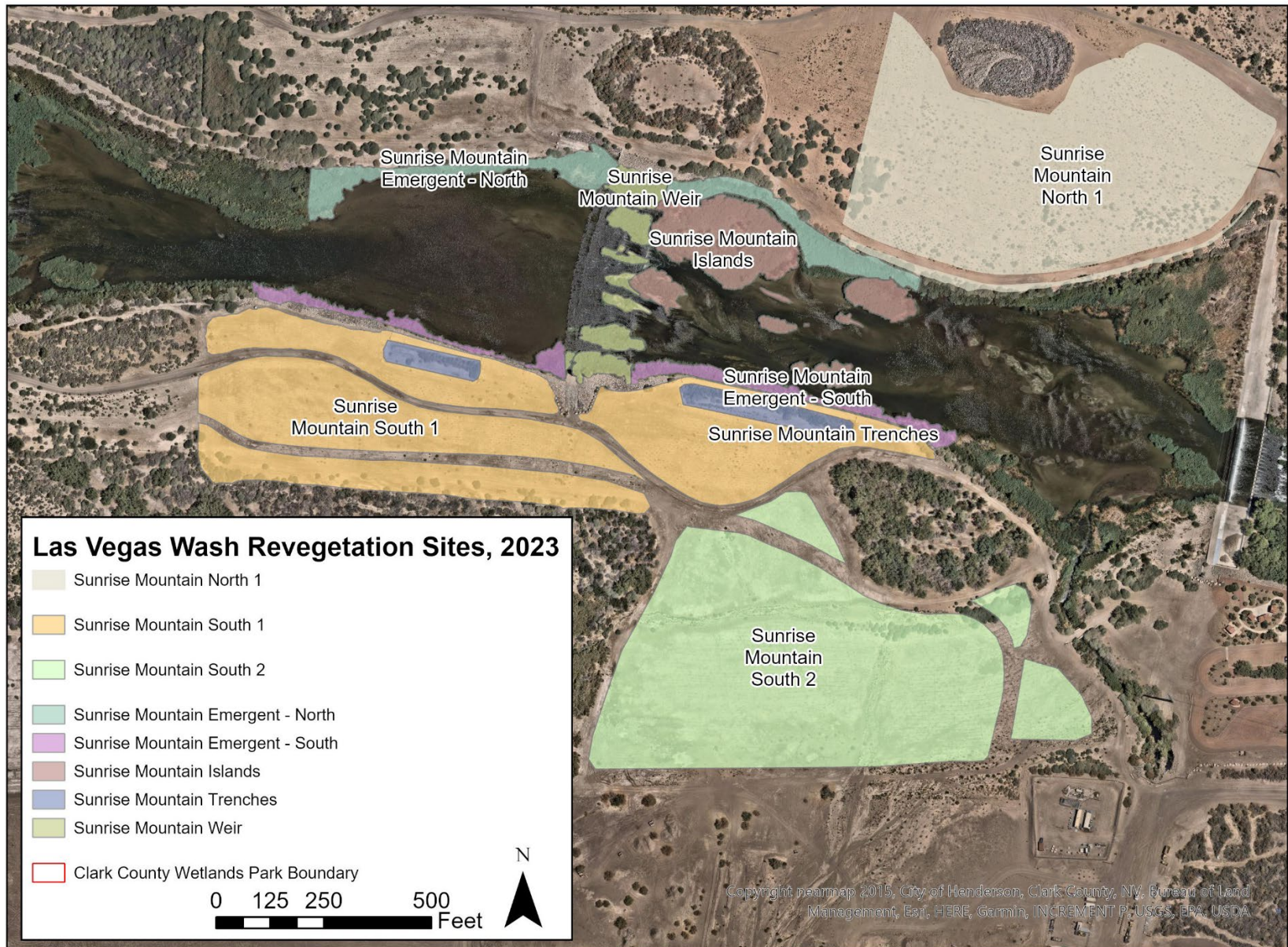


Figure 24. Aerial photograph of 2023 delineated Sunrise Mountain Weir revegetation sites.

3.20 Three Kids Weir

Six revegetation sites at the Three Kids Weir were monitored in the field in 2023 (Table 22, Figure 25). Lower Narrows Homestead Bank North (LNHB-N) increased in total cover from the previous year when surveyed using ArcGIS but was the same total cover from the previous year when surveyed in the field. This is again likely due to the inability to identify all species using ArcGIS, and therefore total cover estimates could be inaccurate.

Lower Narrows Homestead North 2 (LNHN2) was separated from LNHN at the Lower Narrows and Homestead weirs during construction of the Three Kids Weir and hydroseeded again after the Three Kids Weir was completed. LNHN2 saw a decrease in total cover from 50–75% in 2021 and 2022 to 25–50% in 2023. This site saw decreases in both fourwing saltbush (*Atriplex canescens* var. *canescens*) and desert saltbush cover.

Upstream Three Kids South (U3KS) is the lone Green-Up site associated with the Three Kids Weir and was planted in March 2017. This site was hydroseeded after weir construction, like LNHN2, but was also planted with approximately 4,000 container plants and irrigated for three growing seasons. Similar to LNHB-N, the site saw an increase in cover from the previous year when surveyed using ArcGIS but was the same total cover from the previous year when surveyed in the field. This is again likely due to the inability to identify all species using ArcGIS, and therefore total cover estimates could be inaccurate.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
LNHB-N	8	2.17	wet	75–100%	0.5%	21	2.78
LNHB-S	8	3.45	wet	75–100%	0.5%	20	3.58
LNHN2	7	9.60	non-wet	25–50%	0.5%	9	3.85
3KW	7	4.67	wet	75–100%	nm	nm	nm
U3KI	7	1.21	wet	75–100%	nm	nm	nm
U3KNB	8	4.81	wet	75–100%	2.5%	21	2.50
U3KS	7	7.03	non-wet	75–100%	0.0%	17	4.39
U3KSB	8	1.78	wet	75–100%	2.5%	11	2.05

¹LNHB-N=Lower Narrows Homestead Bank North, LNHB-S=Lower Homestead Bank South, LNHN2=Lower Narrows Homestead North 2, 3KW=Three Kids Weir, U3KI=Upstream Three Kids Island, U3KNB= Upstream Three Kids North Bank, U3KS=Upstream Three Kids South, U3KSB= Upstream Three Kids South Bank

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. WPI≤2.0 = wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland

nm = this attribute was not monitored

Table 22. Vegetation monitoring results for Three Kids Weir revegetation sites in 2023.

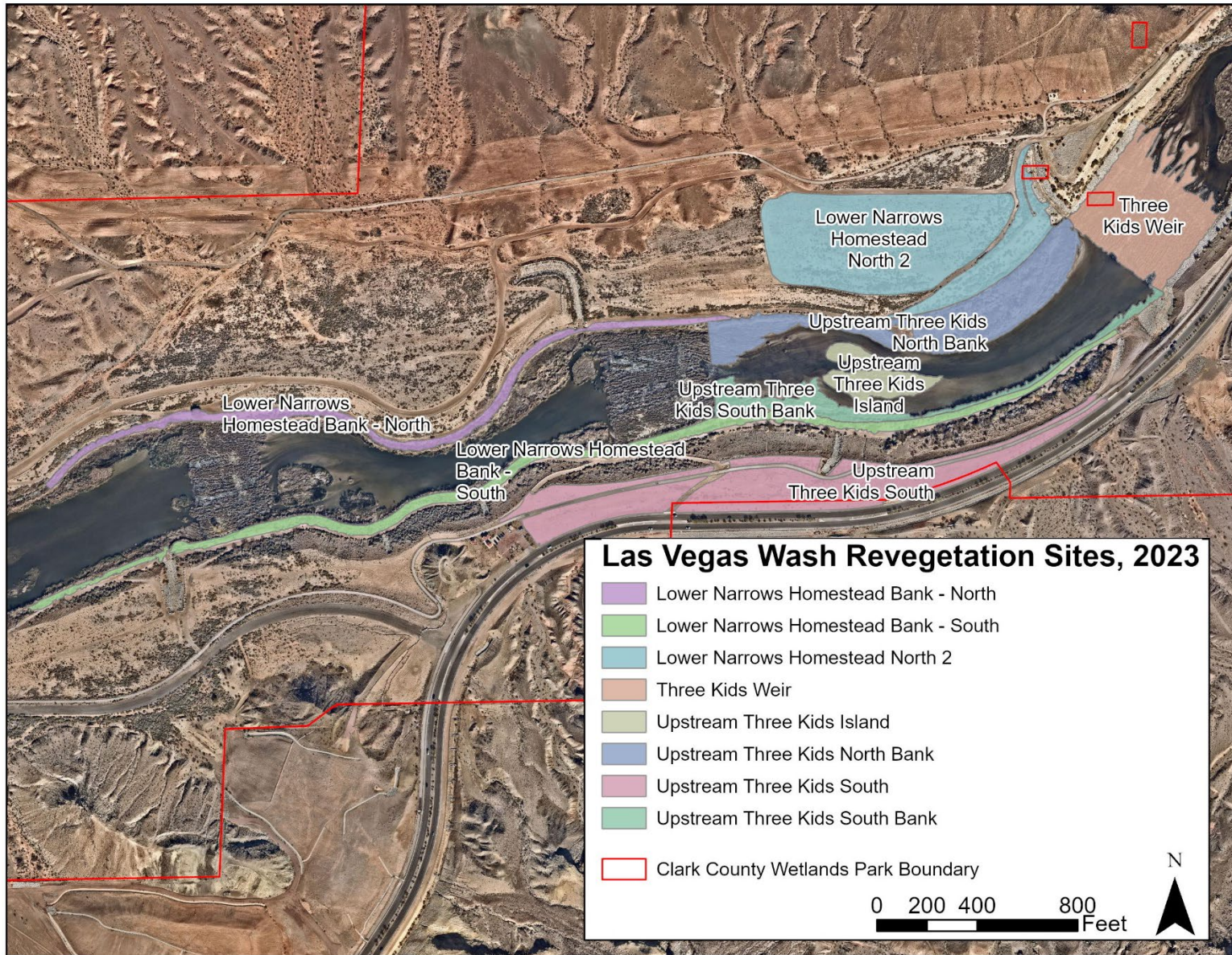


Figure 25. Aerial photograph of 2023 delineated Three Kids Weir revegetation sites.

3.21 Tropicana Weir

There are five sites associated with this weir, three of which were monitored in the field in 2023 (Table 23, Figure 26). These three sites were actively planted as Green-Up volunteer events: Tropicana West 1 (TW1) was the spring 2018 event, Tropicana West 2 (TW2) was the fall 2018 event, and Tropicana East (TE) was the spring 2019 event. The remaining two sites were passively created. Tropicana Weir (TW) is the vegetation growing on the weir itself and Tropicana Weir Emergent (TWE) is the vegetation growing on the Wash banks upstream and downstream of the weir. TWE is broken up into two monitoring areas; the cover value is a weighted average based on acreage.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
TE	5	7.02	non-wet	50-75%	0.1%	19	2.96
TW	4	2.47	wet	75-100%	nm	nm	nm
TW1	6	6.45	wet	75-100%	5.0%	15	2.21
TW2	5	10.70	wet	50-75%	1.0%	18	2.45
TWE	5	2.99	wet	87.5%	0.9%	21	1.87

¹TE=Tropicana East, TW=Tropicana Weir, TW1=Tropicana West 1, TW2=Tropicana West 2, TWE=Tropicana Weir Emergent

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps' 1987 Wetland Delineation Manual. "wet" = wetland and "non-wet" = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland
nm = this attribute was not monitored

Table 23. Vegetation monitoring results for Tropicana Weir revegetation sites in 2023.

TW was in its fourth growing season at the time of monitoring in 2023. Total cover stayed the same as in 2022 at 75–100%. For the sixth year in a row, TW1 had the maximum total cover value of 75–100%. Although total cover has remained the same, there has been a reduction in species richness over the years, from 37 species in 2018 to 15 species in 2023. A reduction in species richness is normal for Wash revegetation sites after each of the first few years of establishment. The wide-open spaces and frequent irrigation when first created allow for both native and non-native species to establish quickly. Once irrigation is reduced or ceases, many of these species are not able to survive. One of the non-native species that established on TW1 was bassia (*Bassia hyssopifolia*) which has since been removed from the site. It was the dominant species from 2019 through 2021, then it was reduced to 2.5% cover in 2022, and there was no bassia present in 2023. This result shows that the effort to reduce its abundance worked. TW2 was in its fifth growing season in 2023. This site had a total cover of 50–75% which is down from the previous year. Like at TW1, TW2's previously dominant species—bassia—has been significantly reduced and is now only 2.5% of the site's total cover. TW1's noxious species cover was reduced from 17.5% in 2022 to 5.0% in 2023, and TW2 had a significant decrease in noxious species cover, from 40% in 2022 to 1.0% in 2023. These reductions are positive and will hopefully continue, but noxious species monitoring should continue and removal efforts may need to be conducted again in the future if increases occur.

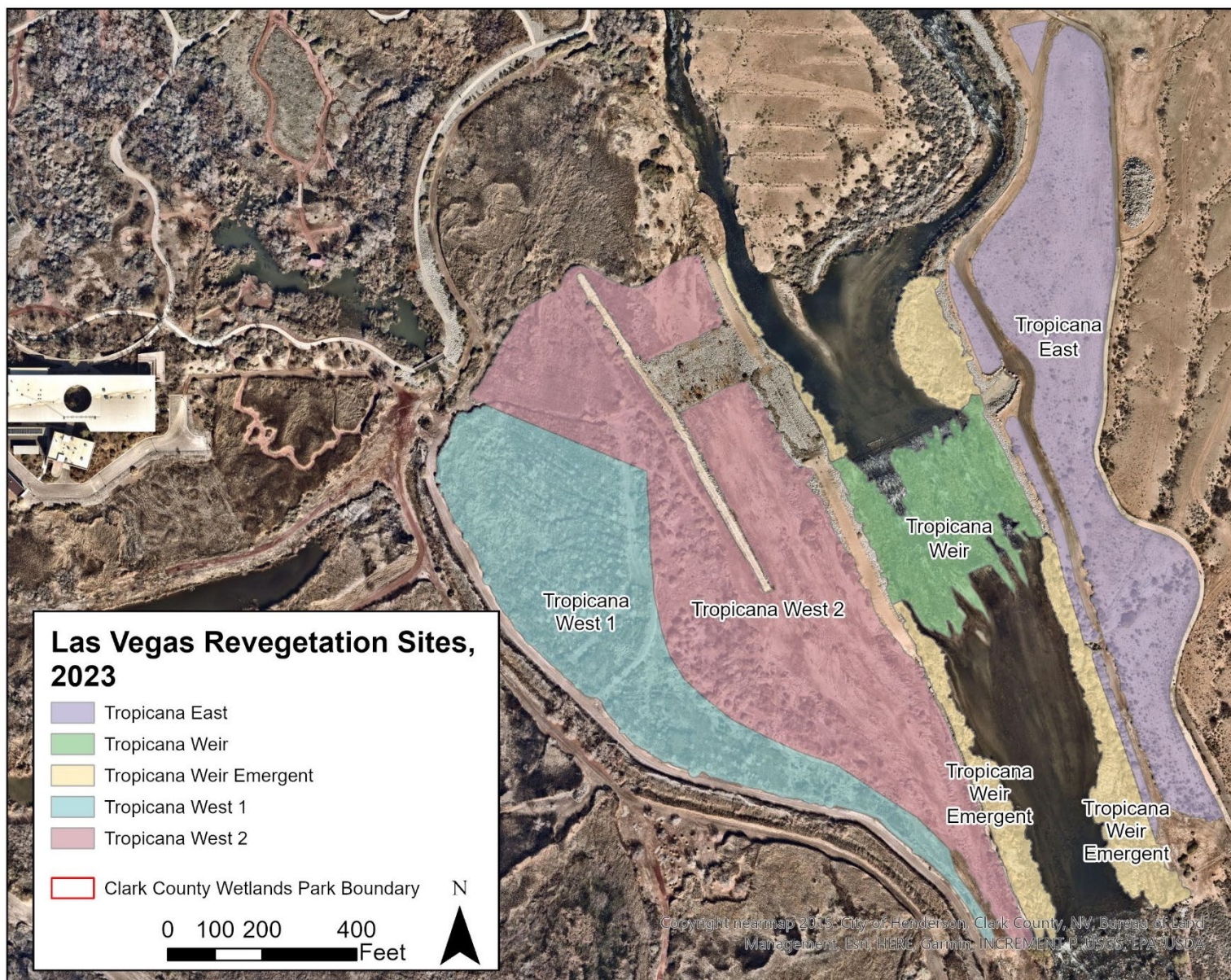


Figure 26. Aerial photograph of 2023 delineated Tropicana Weir revegetation sites.

On the other side of the Wash, TE was also monitored for the fifth time in 2023. There was an increase in total cover of bassia from 2020 to 2021, then a decrease from 2021 to 2022, and no bassia was present during 2023 surveys. This site saw a slight increase in number of species identified, from 16 in 2022 to 19 in 2023. Fluctuations in species richness are not unexpected because TE is only in its fifth growing season, and changes in species richness are likely to occur for the first several years. The total cover of the site decreased from 75–100% to 50–75%. One species—bush seepweed—contributed the most to this change, decreasing from 5–25% to 1–5%.

The TW site has both decreased and increased in acreage over its first four monitoring seasons. In 2020, there was 1.90 acres of vegetation passively created, which then decreased to 1.65 acres in 2021. In 2022 TW acreage began to increase going from 2.34 acres in 2022 to 2.47 acres in 2023. The passively established TWE site also has grown substantially since 2019 when it measured at 0.73 acres, increasing to 2.99 acres in 2023.

3.22 Upper Diversion Weir

All revegetation sites at the Upper Diversion Weir were monitored using ArcGIS in 2023 (Table 24, Figure 27). Upper Diversion Island (UDI) did not change in total cover from 2022. Upper Diversion Island Emergent (UDIE) saw an increase in cover from 25–50% in the field in 2022 to 75–100% using ArcGIS in 2023. This increase could be a result of being unable to accurately determine total cover using ArcGIS.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DUDE	15	3.29	wet	75–100%	nm	nm	nm
DUDN	15	10.10	non-wet	38.9%	nm	nm	nm
DUDS	15	1.30	wet	87.5%	nm	nm	nm
UDI	15	5.12	non-wet	75.4%	nm	nm	nm
UDIE	15	0.36	wet	75–100%	nm	nm	nm
UDIS	15	0.22	non-wet	75–100%	nm	nm	nm
UUDE	15	2.52	wet	75–100%	nm	nm	nm
UUDS	15	0.79	non-wet	75–100%	nm	nm	nm

¹DUDE=Downstream Upper Diversion Emergent, DUDN=Downstream Upper Diversion North, DUDS=Downstream Upper Diversion Shelves, UDI=Upper Diversion Island, UDIE=Upper Diversion Island Emergent, UDIS=Upstream Upper Diversion Island South, UUDE=Upstream Upper Diversion Emergent, UUDS=Upstream Upper Diversion South

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 24. Vegetation monitoring results for Upper Diversion Weir revegetation sites in 2023.

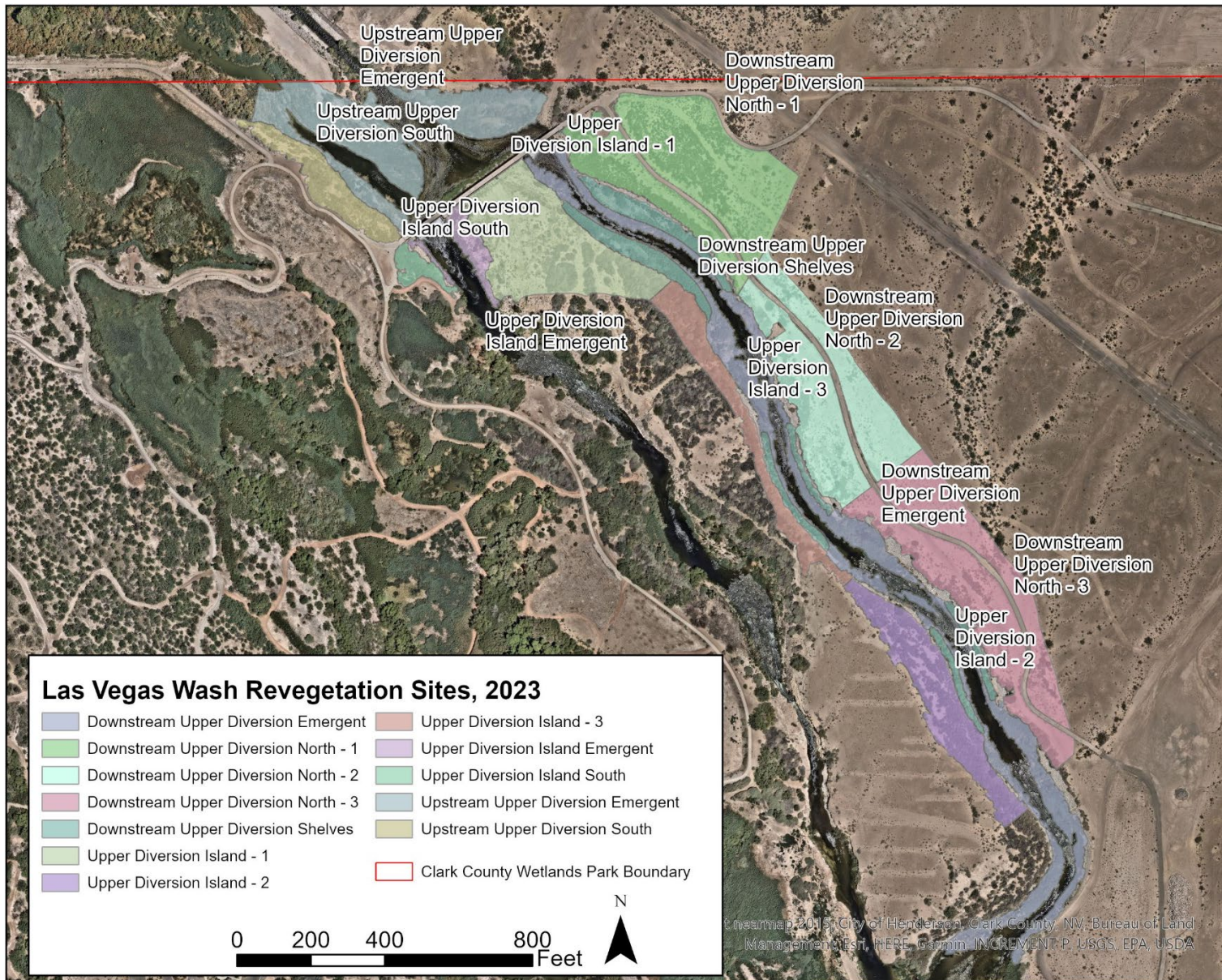


Figure 27. Aerial photograph of 2023 delineated Upper Diversion Weir revegetation sites.

Total cover at Downstream Upper Diversion North (DUDN; Figure 28) decreased slightly from 2022, to 38.9%. At less than 50% total cover on its recorded 10.10 acres in 2023, this site is a good candidate for enhancement under the RMP.



Figure 28. Photo of Downstream Upper Diversion North-2.

4.0 CONCLUSIONS

For comprehensive environmental programs such as the one along the Wash, there are various goals and multiple facets of each goal. This monitoring report is designed to describe how the Wash program is performing in relation to select quantitative measurements of native plant restoration. For the revegetation program as a whole and for individual sites, success occurs when there is an increase in native plant cover up to a self-sustaining level, high survivorship of planted plants, and ongoing control or reduction of noxious weeds. More difficult-to-measure goals include providing wildlife habitat and increasing the overall ecological health of the system. Wildlife surveys and the summation of other measurements, however, should indicate to managers and stakeholders whether these goals are being met as well.

Seventy-seven sites were monitored in the field in 2023. Of those sites, 51 (66.2%) had the same cover as they did in the previous monitoring season, 20 (26%) increased in cover, and six (7.8%) decreased in cover. ArcGIS was used to measure the total cover for the remaining 81 (51.3%) sites. Most older sites have matured to a point that vegetative cover does not change much between growing seasons.

Regular maintenance of weir structures includes removal of vegetation. Although this has an immediate large impact, the recovery is swift. Table 25 shows site acreage for each weir beginning

in 2018. The two weirs created after 2018—TW and SMW—show acreage beginning in 2020. Three Kids Weir, which was constructed in 2015, is currently the largest at 4.67 acres (Figure 29). No weirs were cleared during 2023, but plans are in place to resume this work in 2024. As SNWA continues with scheduled maintenance of the weirs, this table will be updated to reflect the years when vegetation was removed. Learning the immediate and long-term impacts of this maintenance will help with future planning. Additionally, understanding how quickly vegetation grows back can help determine the appropriate time between scheduled maintenance.

This report determined that, under the RMP, there are seven sites that are good candidates for enhancement, seven sites that are good candidates for invasive and other undesirable species removal, and one site that is a possible candidate for invasive and undesirable species removal following additional monitoring (Table 26). Combining the results from 2022 and 2023, there are a total of 11 sites that are candidates for enhancement, nine sites that are candidates for invasive and undesirable species removal, and five possible candidates for invasive and undesirable species removal following additional monitoring. It was determined that BST is no longer a good candidate for enhancement, and it has since been removed from the list. This table may change annually and will be used as a tool to guide future revegetation efforts along the Wash.

Beginning in July 2022, the Wash program transitioned from capital construction to the LTOP. With this change, Green-Up events are held just once a year in spring and enhance already-established sites. Sites that lack total cover and species diversity or have a high percentage of noxious species cover are considered priority sites for Green-Ups. This report represents the second year of monitoring after the LTOP transition and the final year using the current monitoring protocol. Moving forward, vegetation monitoring will follow a new method, the details of which can be found in Section 6.

Weir	Year					
	2018	2019	2020	2021	2022	2023
Archery Weir	0.71	0	1.16	1.11	1.34	1.42
Silver Bowl Weir	1.4	0	1.47	1.36	1.91	1.93
Bostick Weir	8.19	8.03	8.52	8.52	7.12	7.43
Calico Ridge Weir	0	0	0.08	0.08	0.02	0.02
Duck Creek Confluence Weir	3.32	2.93	3.88	3.99	3.95	3.93
Upper Narrows Weir	2.38	2.38	3.39	3.43	3.54	3.59
DU Wetlands No. 1 Weir	0.67	0	1.45	1.49	1.53	1.40
DU Wetlands No. 2 Weir	0.87	0.13	0.24	0.24	0.25	0.21
Historic Lateral Weir	0.42	1.07	2.95	3.05	3.07	2.82
Lower Narrows Weir	2.59	2.83	3.5	3.71	3.63	3.61
Homestead Weir	3.18	3.27	3.96	4.07	4.18	4.14
Powerline Crossing Weir	0.07	0.08	0.28	0.28	0.15	0.22
Sunrise Mountain Weir			0.53	0.58	0.73	0.83
Three Kids Weir	4.06	4.02	4.19	4.9	4.74	4.67
Tropicana Weir			1.69	1.65	2.34	2.47

Table 25. Changes in total acreage at each weir from 2018 through the present. Numbers that are bold represent years in which vegetation was removed.



Figure 29. Aerial image of Three Kids Weir which was constructed in 2015. This weir is currently the largest at 4.67 acres. Photo taken in 2020.

Site Code	Candidate for Enhancement	Candidate for Invasive and other Undesirable Species Removal	Possible Candidate for Enhancement Following Additional Monitoring	Possible Candidate for Invasive and Other Undesirable Species Removal Following Additional Monitoring
BN	X (2022)			
DBN	X			
DCS-N	X (2022)			
UCE	X (2022)			
DCUNE				X
DCUNNS	X (2022)			
DCUNSF	X			
DU2N	X			
HLWE-N		X		
UHLN-W		X		
UHLNS		X		
UHLN-W				X (2022)
LNHS1	X			
LNHS2	X			
DMS-W		X		
DPLNB		X		
DPLSB		X		
URSE		X (2022)		
URSB2		X (2022)		
URSP	X			
SME-S				X (2022)
SMT		X		
UDI				X (2022)
UUDS				X (2022)
DUDN	X			

Table 26. Vegetation sites that are good candidates for enhancement or invasive and other undesirable species removal following the Las Vegas Wash Long-Term Revegetation Management Plan. The sites that were added to the list following the 2022 surveys are shown in parentheses.

5.0 RECOMMENDATIONS

Annual monitoring of the vegetation has provided many years of data to compare. There are only a few sites where declines in total plant cover are notable. As with individual sites and even individual species, single-year increases or decreases are not of major concern to a large restoration project such as that occurring along the Wash.

The 2020 report recommended that LNHS1 and LNHS2 be closely monitored due to their lack of total cover. Both sites were planted as Green-Ups in 2011 and 2012. Although both sites have seen

an increase in total cover, they are both dominated by two species. To help enhance and diversify these sites, they were selected as the 2024 spring Green-Up location. This allowed for additional vegetation to be planted to improve overall cover and provide better habitat for wildlife. Results from this event should begin to show up in the fall 2024 monitoring.

Having 158 revegetation sites and 283 monitoring areas along the Wash, it is impossible to field survey all sites each year. Therefore, ArcGIS is used to determine total cover of the sites that are not field monitored. The current protocol has the monitoring lead determine total cover by doing a visual inspection of each monitoring area using aerial imagery in ArcGIS. This has proven to be a useful tool to allow staff to evaluate every site each year, but results suggest it may not be the most accurate. Furthermore, most sites are established and experience minimal changes each year, so surveying every site every year is no longer necessary. Section 6 details a new ArcGIS method that will be used for future monitoring.

The RMP was created in 2019 to identify activities that would improve revegetation sites along the Wash. It focuses on how to improve the ecological function of revegetation sites including diversifying plant structure types and species, increasing wildlife benefits in the form of food and shelter, and removing undesirable species and trash. Now that the RMP has been put into action, revisions should be made to the vegetation monitoring program to better address RMP goals. Section 6 details the updated monitoring protocol. The new plan will start in fall of 2024.

6.0 REVISED VEGETATION MONITORING PROTOCOL

In 2023, there were 158 revegetation sites and 283 monitoring areas. Following the 2023 survey season the number of total sites has been significantly reduced. Although acreage has not changed, this reduction was accomplished by merging sites together. Sites were merged if they have similar vegetation, WPI numbers, and are either next to or near one another. Sites that were grant funded will not be merged with other sites until after its fifth survey season. Most grants require five consecutive years of monitoring so keeping grant funded sites separate will allow for better tracking to ensure goals are met. Following the sites fifth survey season, these sites can be merged if deemed appropriate. The goal and purpose for reducing site numbers is to help simplify the survey process. Additional details and maps will be included in the 2024 annual report.

6.1 Weir and Drop Structure Monitoring

Permanent polygons for each weir including the apron, crest, and chute have been created in ArcGIS Pro following the Las Vegas Wash Facilities Inventory and Vegetation Management Plan (WSP 2019). These polygons also include all drop structures. Under the revised monitoring protocol, these sites will no longer vary year to year, and the total vegetative cover of each site will be calculated annually. In addition, there are several sites that have only been surveyed using ArcGIS in past years, and these sites will continue to be monitored this way unless it is determined

that they should be monitored in the field. Understanding the total vegetative cover of these sites will help guide management decisions and aid in determining when sites should be cleared to ensure vegetation is not impacting weir functionality.

To create a vegetative cover map of the Wash, the Wash Team will use high-resolution (resolution = 3 inches per pixel) aerial imagery and Light Detection and Ranging (LiDAR; resolution = 1 foot per pixel) data (Singleton, 2024). Aerial imagery will be acquired on a biennial basis between May and June during leaf-on conditions. The LiDAR data will be acquired on an as-needed basis also during leaf-on conditions. The LiDAR point cloud data will be processed into a canopy height model, joined with the aerial imagery, and a supervised classification will be performed to map trees, shrubs, and grasses along the Wash. The results will be polygons representing each tree, shrub, and grass. Finally, area calculation in ArcGIS Pro will be performed based on the fraction of vegetative cover per total site area.

Every third year, a visual survey of each weir will be conducted. This survey will determine the total woody vegetative cover on each structure. As described in Eckberg (2019), two species are of most concern on the weirs: Fremont's cottonwood and Goodding's willow. When present and possible, crews can be used to remove individuals of these species. However, if hand crews cannot reach the trees, or if the trees grow larger than hand tools can remove, large equipment will be needed from specialized contractors and agencies. Removal by hand crews is the preferred method. The large equipment method results in larger disturbance to surrounding vegetation, is more expensive, and typically results in weir repairs being needed, which can bring additional cost.

6.2 Wetland and Non-Wetland Site Updates

All sites along the Wash have a wetland designation of either wetland or non-wetland that was the result of a jurisdictional determination conducted according to the Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987). Each year, the WPI is calculated for each site which helps determine if the current wetland designation is accurate. The WPI is a weighted-average wetland indicator status of all, or nearly all, species at each site. The WPI has a range of 1–5, all sites that score ≤ 3.0 are considered wetland and sites that score 3.1–5 are considered non-wetland. Although the WPI is recorded each year, site statuses have not been re-evaluated since designation. Much has changed over the years, and some sites no longer have appropriate designations. Therefore, a complete assessment of all sites will be completed following fall 2024 sampling, and wetland designations will be updated as needed.

6.3 Timed Meander Surveys

The timed meander survey (TMS) method described here is designed to provide a qualitative assessment of plant community conditions. Many studies have used some version of this method successfully (MPCA, 2014; Bohnen and Galatowitsch, 2016). TMS consists of meandering around a site and recording all species that are present. Each survey begins with a base time of 20 minutes; once the base time elapses, if there are less than three new species identified within the final 10 minutes, then the survey concludes. If there are three or more new species identified, then an

additional 5 minutes will be added. Five-minute increments will be added until less than three species are recorded within a time increment. Sites that are larger than 25 acres will have two meanders completed; all other sites will have one. Each survey will record if any, and how many, additional 10-minute increments were added. The meander can stop before the base time expires if the entire site has been adequately surveyed in less than the allotted time. The timer will be paused when necessary to identify species or when moving from one area to the next within a site. Upon completion of the meander, the areal cover is estimated by cover class for all species and total site cover is recorded (Table 27).

Cover Class	Cover Class Range	Midpoint
7	>95–100%	97.5%
6	>75–95%	85
5	>50–75%	62.5%
4	>25–50%	37.5%
3	>5–25%	15%
2	>1–5%	3%
1	>0–1%	0.5%

Table 27. Cover classes, cover class ranges, and midpoint percentages that will be used to determine cover for all species identified within each site.

The vegetation monitoring app will have GPS capabilities to track the route taken for each site. At the start of each meander survey the tracking button will be switched to on. Staff will conduct the survey and once the survey is complete that button will be switched to of. From this, a map will be created that includes the route taken during each meander. This information will be placed in an appendix of each annual report and will be used to ensure the same route is not repeated each year.

All sites will be surveyed once every three years on a pre-determined rotation (Table 28). The data collected from these surveys will allow staff to determine total site cover, individual species cover, species richness, noxious species cover, and the WPI for each site. This new monitoring method will be used for all in-channel, bank, wetland, and non-wetland sites along the Wash.

	Year 1 (Beginning in 2024)	Year 2	Year 3	Annually
Meander Survey of Upland and Riparian Sites on the North Side	X			
Meander Survey of Upland and Riparian Sites on the South Side		X		
Meander Survey of all Bank and Wetland Sites			X	
Visual Survey of Weirs and Drop Structures			X	
Total Vegetative Cover of Weirs				X

Table 28. Survey schedule of sites along the Wash. This schedule repeats after the third year.

6.4 Data Retention

Grants have played a significant role in the Wash revegetation program, funding many of the sites in this report. SNWA is required to track grant-funded sites along with permitted areas in perpetuity. There is a legacy revegetation database that is associated with grants and permitted areas from 2003 through 2023. A new database will be created and updated annually with grants and permitted areas beginning in 2024. This database will lay out all information for each grant-funded site, permitted area, and its associated polygon(s) in ArcGIS. The legacy database will no longer be modified but can still be found in the Wash Team’s revegetation monitoring SharePoint folder for reference. Creating and maintaining the new database will help ensure that grant and permit requirements are met.

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