2017 Annual Habitat Monitoring Report
Salt River Ecosystem Restoration Project
Humboldt County, California

Prepared for the Humboldt County Resource Conservation District
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Summary

J.B. Lovelace & Associates assisted the Humboldt County Resource Conservation District by conducting the 2017 annual habitat monitoring effort for the Salt River Ecosystem Restoration Project (SRERP) near the Eel River estuary in Humboldt County, California. This watershed-scale habitat restoration project was initiated in 2013 and continues to be carried out in a series of phases throughout the Salt River corridor over the course of several years. Phases 1, Phase 2A (Lower), and Phase 2A (Middle) were completed prior to 2016, and restoration construction of Phase 2A (Upper) was completed in 2017. Implementation of this ambitious restoration project is expected to restore beneficial hydrological and ecological functions to the Salt River (a tributary to the Eel River) as well as to restore historically more abundant tidal and freshwater wetland habitats within the restoration area.

Following completion of each project phase, a suite of environmental parameters is assessed over the course of a 10-year monitoring period to evaluate progress toward the development of targeted conditions and to anticipate and address potential problems that may compromise the successful attainment of restoration goals. This 2017 annual habitat monitoring effort focused on restoration areas completed prior to the 2017 monitoring period (i.e., Phase 1 and Phase 2A) and involved the mapping and analysis of restored habitats, quantitative vegetation sampling to characterize developing herbaceous and woody riparian vegetation within specific habitats, and an assessment of the extent of invasive vegetation occurring throughout the SRERP area.

Results from the 2017 habitat monitoring effort demonstrate that the Salt River Ecosystem Restoration Project has met or exceeded the respective success criteria for this monitoring year in all regions of the project area addressed. Specifically, results from the habitat mapping and area analysis of riparian habitats in the Phase 1 and Phase 2A (Lower) restoration areas reflect negligible changes from results reported from those same habitats in 2016, and although specific minimum area (acreage) success thresholds only exist for final monitoring years, these habitat types assessed in the 2017 habitat monitoring effort currently meet or exceed those final thresholds.

Quantitative vegetation sampling results reflect the continued establishment and development of native vegetation in all habitats sampled in 2017, and relevant success thresholds for minimum cover of native vegetation were exceeded in every case. One encouraging example is the regionally rare native brackish marsh species, *Carex lyngbyei* (“Lyngbye’s sedge”). Known to occur in the lower reaches of the Salt River watershed, this species was also recently observed becoming established in the lower Phase 2A – Salt River Corridor restoration area during 2017.

Results from our quantitative sampling of replanted riparian habitats indicate that the establishment and development of woody riparian vegetation in the Phase 2A – (Lower) Salt River Corridor restoration area continues, including limited establishment of this vegetation type in both active channel and active bench habitats (i.e., “Salt River Channel Wetlands”). In contrast, our data also reflect somewhat mediocre rates of survivorship and development of woody riparian species in the replanted riparian habitats of the Phase 1 – Riverside Ranch Tidal Marsh restoration area.

Unfortunately, both quantitative sampling data and incidental observations collected during the 2017 habitat monitoring effort also confirm that the spread and establishment of invasive and otherwise undesirable vegetation continues. Invasive vegetation appears to be replacing non-native non-invasive vegetation throughout most sampled regions of the project area. While the estimated abundance of non-native non-invasive plant species has decreased in all sampled habitats except those in the middle Phase 2A restoration area, invasive species abundance has increased in every sampled habitat except the active bench regions of the middle Phase 2A area.

Less than two years from the first “final” assessment of the extent of invasive species in the SRERP restoration area (i.e., 2019 for Phase 2A [Lower] “salt river wetlands”), the mean estimated percent cover of invasive plant species exceeds eventual final (maximum) success criteria for this category of vegetation in all nine sampled habitats in 2017, which includes the following noxious and highly-invasive species (among others): *Spartina densiflora* (“dense-flowered cord grass”), *Cortaderia jubata* (“pampas grass”), *Cytisus scoparius* (“Scotch broom”), and *Senecio jacobaea* (“tansy ragwort”). The former two were previously known from the SRERP project area and continue to increase in abundance and distribution throughout the project footprint. The latter two were recently discovered in 2017 in the Phase 2A – Salt River Corridor reach.

Despite the continued favorable trajectory with respect to the development of projected habitats and native vegetation thus far, immediate and appropriate efforts are warranted to reduce and/or eradicate non-native and invasive vegetation documented during our 2017 fieldwork throughout the SRERP restoration area. If not adequately addressed, the continued establishment and development of such undesirable vegetation is likely to prevent the achievement of final success thresholds for monitoring years 5 and 10, thereby jeopardizing stated long-term restoration goals for the project. While these results indicate contrasting trends for the developing vegetation within the project footprint, if sufficient effort is dedicated to addressing invasive and other non-native plant species occurrences in a timely manner, all respective success thresholds can be met, thereby achieving the various goals of this restoration project.

1.0 Introduction

The Salt River Ecosystem Restoration Project (SRERP) is a phased watershed-scale habitat restoration project being implemented in the vicinity of the Eel River delta in coastal Humboldt County, California (Figure 1). Initiated in 2013, this collaborative effort is being coordinated by the Humboldt County Resource Conservation District (HCRCD) and involves numerous project partners. The primary focus of this restoration project is to restore beneficial fluvial, hydrological, and ecological functions to the Salt River (a tributary to the lower Eel River), as well as to restore historically more abundant adjacent coastal and floodplain wetland habitats. The project attempts to address compromised watershed functions resulting from historic channel alteration and excess sediment accretion throughout the Salt River watershed. Specific restoration goals include the reduction and management of upstream sediment sources, the facilitation of sediment transport through the system, and the creation of suitable conditions for the development and enhancement of ecologically important habitats such as tidal salt marsh, estuarine brackish, and freshwater wetlands. Accomplishing these goals is helping to reduce periodic flooding in the adjacent agricultural community during high-flow events, while simultaneously restoring regionally important coastal wetland habitats. During the summer of 2017 J.B. Lovelace & Associates participated in the restoration effort by assisting the HCRCD in the performance of required annual habitat monitoring tasks.

1.1 Regulatory Context & Monitoring Directives

Preparation for the SRERP involved an extensive planning and permitting process. As part of this process, the *Salt River Ecosystem Restoration Habitat Mitigation and Monitoring Plan* (HMMP) (H.T. Harvey & Associates with Winzler & Kelly 2012) was developed to guide the restoration effort and to provide an assessment framework with which to gauge its efficacy. This framework includes directives for implementing a 10-year, post-installation monitoring program, during which time various environmental parameters are to be measured and compared against success criteria to track progress towards achieving specific restoration goals, and to identify and address any problems that could prevent the realization of such goals. Implementation of this monitoring program is also a requirement included in the following project-related permits, certifications, and agreements:

- *Biological Opinion and Formal Consultation on the Salt River Ecosystem Restoration Project, Humboldt County, California: File No. AFWO-11B0097-11F0249* (U.S. Department of Interior-U.S. Fish & Wildlife Service 2011);
- *Section 404 General Permit for the Salt River Ecosystem Restoration Project No. 2010-00282N* (U.S. Army Corps of Engineers 2012);
- *Water Quality Certification for the Humboldt County RCD – Salt River Ecosystem Restoration Project, WDID No. 1B10106NHU* (North Coast Regional Water Quality Control Board 2011);

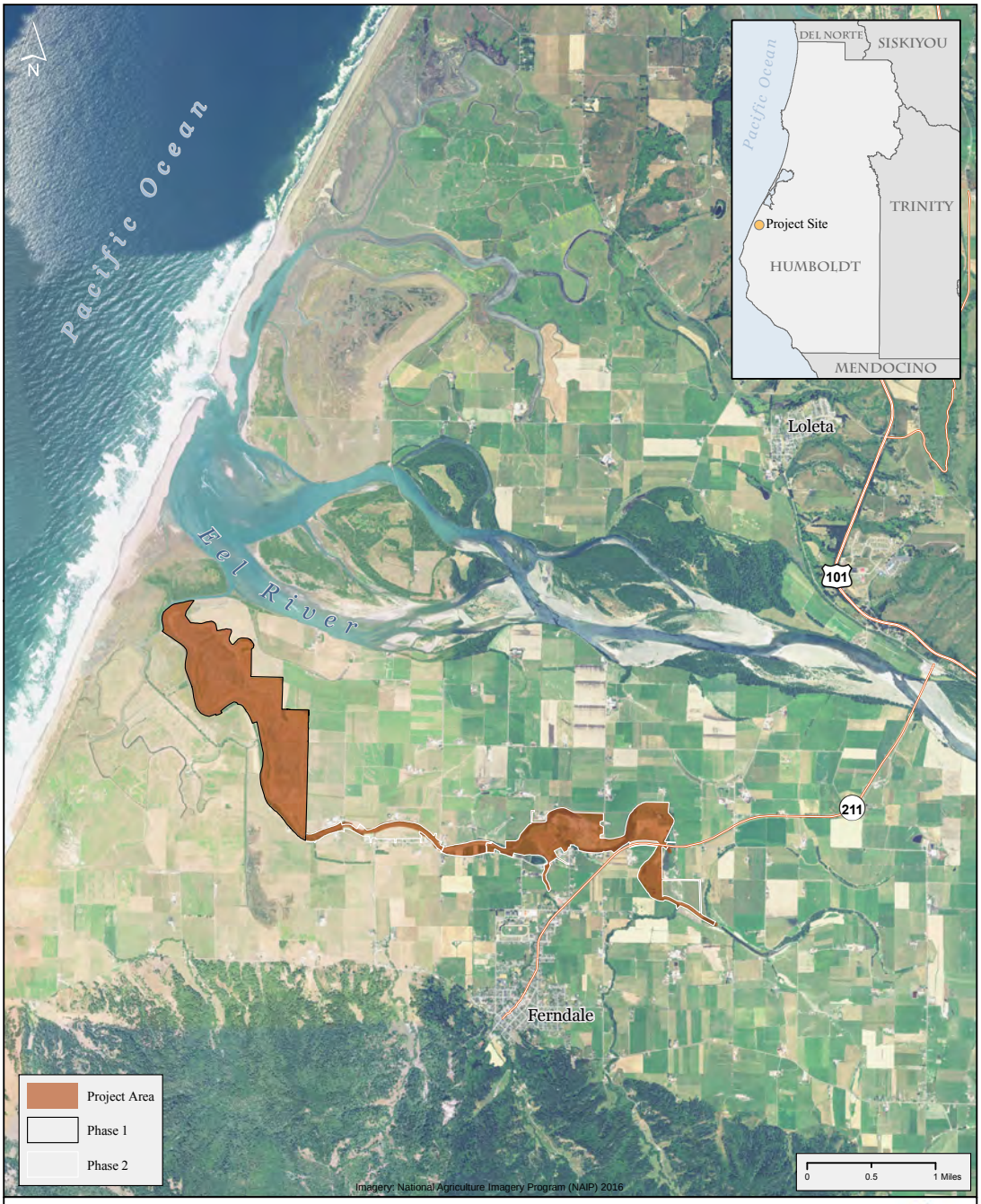

Figure 1. Salt River Ecosystem Restoration Project (SRERP) Vicinity
2017 Annual Quantitative Habitat Monitoring for the Salt River Ecosystem Restoration Project

- *Streambed Alteration Agreement Notification No. 1600-2011-0107-R1 Salt River, Francis Creek, Williams Creek, and Reas Creek* (California Department of Fish & Game 2012);
- *Humboldt County Resource Conservation District Conditional Use Permit Modification Case No. C-10-05M* for the Salt River Ecosystem Restoration Project (Humboldt County Department of Community Development Services 2011); and
- *Coastal Development Permit No. CDP-1-10-032* for the Salt River Ecosystem Restoration Project (California Coastal Commission 2012).

A quantitative assessment of the development of restored habitats and associated vegetation is an important component of this monitoring program, and is the focus of this annual habitat monitoring report.

1.2 Previous Monitoring & Reporting

The monitoring schedule provided in the HMMP prescribes specific monitoring requirements for the various combinations of restored habitats, vegetation parameters, and monitoring years (Table 1). Habitat monitoring efforts conducted during the first two monitoring years (i.e., 2014 and 2015) were performed by H.T. Harvey & Associates and are documented in *Salt River Ecosystem Restoration Project (Phase 1): Vegetation Monitoring for the High Marsh Ecotone (Year 1) Final Report* (H.T. Harvey & Associates 2014) and *2015 Quantitative Habitat Monitoring for the Salt River Ecosystem Restoration Project Final Report* (H.T. Harvey & Associates 2015). Habitat monitoring conducted in 2016 was performed by J.B. Lovelace & Associates, and this effort is described in *2016 Annual Habitat Monitoring Report for the Salt River Ecosystem Restoration Project* (J.B. Lovelace & Associates 2017). The current report provides documentation of the most recent (2017) habitat monitoring effort for the Salt River Ecosystem Restoration Project, and addresses the specific tasks (Table 1) identified for the current monitoring year, which consist of the following:

A. Habitat Area Analysis & Mapping

1. Phase 1 – Riverside Ranch Tidal Marsh Restoration Area:
    a. Replanted Riparian Forest
2. Phase 2A (Lower) – Salt River Corridor Restoration Area:
    a. Riparian Planting Zones

B. Vegetation Percent Cover Sampling

1. Phase 1 – Riverside Ranch Tidal Marsh Restoration Area:
    a. Replanted Riparian Forest
2. Phase 2A (Lower) – Salt River Corridor Restoration Area:
    a. Salt River Channel Wetlands
    b. Riparian Planting Zones
3. Phase 2A (Middle) – Salt River Corridor Restoration Area:
    a. Salt River Channel Wetlands
    b. Riparian Planting Zones

Table 1. SRERP Habitat Monitoring Schedule[1] for Phase 1 & Phase 2A. Bold text indicates the current monitoring year (2017).

			Monitoring Period & Schedule of Tasks[2]												
Phase		**Habitat Type**	2013	2014	2015	2016	**2017**	2018	2019	2020	2021	2022	2023	2024	2025
Phase 1		(Monitoring Year)		1	2	3	**4**	5	6	7	8	9	10		
		High Marsh Ecotone		BC	BC	BC	**C**	BC	C	BC	C	C	BC		
		"Tidal Salt & Brackish Marsh"		AC	C	ABC	**C**	ABC	C	ABC	C	C	ABC		
		(Monitoring Year)			1	2	**3**	4	5	6	7	8	9	10	
		Replanted Riparian Forest[3]			AC	BC	**ABCD**	C	ABCD	C	ABC	C	C	ABCD	
Phase 2A	**(Lower)**	(Monitoring Year)			1	2	**3**	4	5	6	7	8	9	10	
		"Salt River Channel Wetlands"[4]			BC	BC	**BC**	C	BC	C	C	C	C	C	
		Riparian Planting Zones[5]			AC	BC	**ABCD**	C	ABCD	C	ABC	C	C	ABCD	
	(Middle)	(Monitoring Year)				1	**2**	3	4	5	6	7	8	9	10
		"Salt River Channel Wetlands"[4]				BC	**BC**	BC	C	BC	C	C	C	C	C
		Riparian Planting Zones[5]				AC	**BC**	ABCD	C	ABCD	C	ABC	C	C	ABCD

[1] Adapted from Table 11 of the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012).
[2] A = Habitat area (acreage) assessment
B = Percent vegetative cover assessment
C = Non-native invasive vegetation assessment
D = Basal area assessment of replanted woody riparian vegetation
[3] Woody riparian revegetation efforts for Phase 1 were delayed until early 2015 due to unusually dry conditions (HCRCD 2015a).
[4] Includes both elements (i.e., active channel and active bench) of both brackish and freshwater channel wetlands.
[5] Includes both replanted riparian forest areas and active riparian berms.

C. Invasive Vegetation Assessment

1. SRERP Restoration Area-Wide

D. Replanted Woody Riparian Vegetation Basal Area Assessment

1. Phase 1 – Riverside Ranch Tidal Marsh Restoration Area:
    a. Replanted Riparian Forest
2. Phase 2A (Lower) – Salt River Corridor Restoration Area:
    a. Riparian Planting Zones

2.0 Project Description

The SRERP is being implemented in two phases over the course of several years, beginning in the lower portion of the watershed near the Salt River's confluence with the Eel River estuary, and progressing upstream to the vicinity of its confluence with Perry Slough near the toe of the coast range slope. The entire project area consists of approximately 7.7 miles of the Salt River channel and more than 800 acres of adjacent habitat. At the initiation of the 2017 habitat monitoring effort, the following phases and sub-phases of the restoration effort had been completed: Phase 1 and the first two sub-phases of Phase 2 (i.e., "Phase 2A [Lower]" and "Phase 2A [Middle]"). Restoration construction of the Phase 2A (Upper) and 2B (Lower) project reaches were not completed until late 2017, after the 2017 monitoring fieldwork, and is, therefore, not addressed in the current report.

Implementation of the SRERP involves extensive structural modifications to the Salt River channel system and adjacent floodplain wetland habitats in order to facilitate the enhancement of identified fluvial, hydrological, and ecological characteristics and functions. Extensive revegetation efforts follow completion of restoration construction activities in each phase and sub-phase of the project to stabilize disturbed soils and to re-establish suitable vegetative cover in the affected habitats. These efforts incorporate specific prescriptions for herbaceous and woody riparian species assemblages for each restoration area. These prescriptions were developed during the design phase of the project, and are provided in Tables 5-7 of the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012).

Herbaceous revegetation methods, which vary based on site conditions and desired species composition, include transplantation of propagated plant "plugs" as well as "hydroseeding," seed-drilling, and broadcasting seed application methods. Additionally, in restoration areas designated for the re-establishment of woody riparian vegetation, young shrubs, tree saplings, and live cuttings are planted during the dormant season following restoration construction. Specific methodologies and technical specifications for these revegetation efforts are described in:

- *Humboldt County Resource Conservation District Salt River Ecosystem Project Riverside Ranch (Phase 1) Tidal Marsh Restoration Seed Application Plan* (GHD 2012a);
- *Seed and Mulch Application Plans and Technical Specifications Riverside Ranch (Phase 1) Tidal Marsh Restoration Salt River Ecosystem Restoration Project* (GHD 2012b);
- *Salt River Ecosystem Restoration Project Salt River Channel & Riparian Floodplain Corridor – Lower Phase 2A Restoration Planting Plans* (GHD with H.T. Harvey & Associates October 2014);
- *Salt River Ecosystem Restoration Project Phase 1 Revegetation As-Built Documentation* (HCRCD 2015a)
- *Humboldt County Resource Conservation District Salt River Ecosystem Project Revegetation: Wetland Plug Planting Plans Phase Middle 2A* (HCRCD 2015b);
- *Humboldt County Resource Conservation District Salt River Ecosystem Project Phase Middle 2A Riparian Planting Plans* (HCRCD 2015c); and
- *Humboldt County Resource Conservation District Salt River Ecosystem Project Revegetation: Riparian Tree/Shrub Planting Plans Phase Middle 2A-R3* (HCRCD 2016a).

A general description of each of the project phases, respective revegetation efforts, restoration goals, and targeted or "projected" habitats for which 2017 monitoring requirements apply, is introduced here to provide supportive context for the 2017 habitat monitoring effort. A more encompassing project description for the entire SRERP can be found in the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012).

2.1 Phase 1 – Riverside Ranch Tidal Marsh Restoration

The first phase of the SRERP (Phase 1 – "Riverside Ranch Tidal Marsh Restoration Project") was implemented in 2013 on property acquired by the California Department of Fish and Wildlife, historically known as "Riverside Ranch." This ~440-acre Phase 1 restoration area, extends south (upstream) from its northern boundary near Salt River's confluence with Cutoff Slough and the Eel River, to the approximate location of the confluence between the Salt River and Reas Creek (Appendix A, Figures 1 & 2).

Phase 1 restoration increased the capacity of the Salt River channel through excavation and widening of much of its lower reach, and restored tidal connectivity throughout ~300 acres of the adjacent diked former tidelands by removing existing levees, excavating and grading reclaimed dairy pastureland, and developing a system of tributary channels throughout the Riverside Ranch restoration area. As part of Phase 1, a new 2.2 mile-long "setback levee" was also constructed around much of the eastern perimeter of the restored tidal habitat to prevent tidal inundation from extending beyond the restoration area, into adjacent agricultural pasturelands.

Approximately 2.5 miles of the Salt River channel and 2.8 miles of new and existing internal tributary channels were excavated and widened, and ~170,000 cubic yards of fill material was removed from reclaimed pastureland to achieve suitable topography, restoring tidal connectivity to these diked former tidelands. Restoration of tidal influence throughout this area has facilitated the development of important estuarine habitats historically more abundant throughout the region, such as tidal salt marsh and brackish wetlands, tidally influenced mudflats, and open water habitats, as well as associated and ecologically significant transitional zones or "ecotones."

2.1.1 Phase 1 Projected Habitats

One of the primary goals of the SRERP is the creation and/or enhancement of specific targeted habitat types projected to be established by the completion of the restoration-monitoring period. These "projected habitat types" are described in the HMMP and depictions of those projected habitats that are relevant to the current effort have been reproduced here in Appendix A, Figure 1. Some ambiguities inherent in the originally conceived habitat descriptions have been found to complicate assessments of restoration "success." In this current (2017) effort, we carry forward the approach towards classification of the different projected habitat types and regions of the SRERP restoration area introduced during the 2016 habitat monitoring period (J.B. Lovelace & Associates 2017), that was proposed in an attempt to facilitate more appropriate comparisons of observed results against success criteria. A complete description of this updated understanding of the SRERP projected habitats and can be found in J.B. Lovelace & Associates (2017), though relevant updated excerpts are provided below for regions of the SRERP restoration area considered during the 2017 habitat monitoring effort.

Phase 1: Riparian Habitats

In the context of vegetation, the term "riparian" is traditionally understood to be inclusive of all types of plant species associated with rivers or streams, regardless of a species' growth form or "habit" (e.g., herbaceous plants, woody shrubs, woody vines, trees, etc.). Use of this adjective in project-related documents for the SRERP, however, appears to refer only to the woody component (trees, shrubs, and/or woody vines) of riparian vegetation under consideration. In an attempt to avoid potential confusion (and consistent with the approach used in J.B. Lovelace & Associates 2017), the current 2017 monitoring report maintains such usage; hereafter, "riparian" is used to indicate habitats generally recognized as being classified as "forested wetlands" and/or "scrub-shrub wetlands" (Cowardin et al. 1979).

Implementation of Phase 1 necessitated the removal of some stands of pre-existing willow (*Salix* spp.)-dominated riparian forest, though portions of this existing habitat type were retained wherever possible. Following completion of construction, woody riparian species were also replanted throughout suitable "riparian planting zones" of the Phase 1 project area to achieve identified restoration goals and to compensate for the project-related loss of this valuable

habitat component. Suitable “riparian planting zones” consisted primarily of areas adjacent to the Salt River channel, and were typically contiguous with retained portions of pre-existing riparian forest. Due to exceptionally dry conditions occurring during the dormant planting season immediately following completion of construction (winter 2013/2014), replanting of Phase 1 woody riparian vegetation was instead delayed until the subsequent planting season in early 2015 (HCRCD 2015a). Riparian planting zones were also revegetated with suitable herbaceous species, following specifications provided in the aforementioned revegetation guidance documents.

2.2 Phase 2A – Salt River Corridor Restoration

The second phase of the SRERP (Phase 2) was initiated in 2014, following completion of Phase 1, and progressed upstream from the Phase 1 – Riverside Ranch restoration area. As of the 2017 habitat monitoring effort, the first two sub-phases of Phase 2 have been completed: “Phase 2A (Lower)” and “Phase 2A (Middle).” The distinction between “lower” and “middle” reaches reflects the progression of implementation of the respective restoration efforts, and the restoration goals and approach were consistent across both.

Phase 2A (Lower) was implemented in 2014. This restoration reach extends along the Salt River corridor, upstream from the southern-most limit of the Phase 1 project area, to a location approximately 200 feet upstream from the Dillon Road bridge crossing of the Salt River channel (Appendix A, Figures 1 & 3). The following year (2015), Phase 2A (Middle) restoration proceeded from the upstream terminus of Phase 2A (Lower) project reach, to a location approximately 0.4 linear miles upstream from the Dillon Road bridge, and ~1,000 feet northwest of the City of Ferndale’s wastewater treatment facility (Appendix A, Figures 1 & 4).

Restoration activities associated with these initial Phase 2 efforts focus on Salt River channel modifications and restoration of immediately adjacent habitat within the riparian corridor. Future design elements proposed for subsequent SRERP efforts further upstream include restoration of adjacent seasonal freshwater wetland habitats extending beyond the immediate riparian corridor (H.T. Harvey & Associates with Winzler & Kelly 2012). Salt River channel modifications involve excavation, widening, and recontouring to increase channel capacity, encourage conveyance of sediment through the system, and facilitate the development and maintenance of identified hydrologic and ecologic riparian habitat functions. Backwater alcoves, engineered log-jams, coarse woody debris, and other design features are also being incorporated into the channel during recontouring to increase channel morphological complexity and provide important habitat features for fish and other native aquatic species.

All disturbed portions of the Phase 2A project areas restored thus far were revegetated with appropriate species blends that correspond to five designated planting zones (i.e., brackish riparian forest, freshwater riparian forest, brackish active riparian berm, freshwater active riparian berm, and brackish marsh)

following completion of construction (GHD 2015; HCRCD 2016b). Revegetation efforts were consistent with the aforementioned guidance documents and involved hydroseeding and broadcast application methods for seed blends in autumn of 2015 and 2016 for Phases 2A (Lower) and (Middle), respectively. Revegetation of designated areas with woody species and "wetland plugs" occurred in winter and spring of 2014/2015 for Phase 2A (Lower), and 2015/2016 for (Phase 2A Middle).

2.2.1 Phase 2A Projected Habitats & Associated Habitat Components

Consistent with the first phase of the SRERP, Phase 2A restoration areas were designed, constructed, and revegetated with the intent to establish identified geomorphological and hydrological functions, and/or specific targeted or "projected" habitats. Different plant species assemblages were prescribed (H.T. Harvey & Associates with Winzler & Kelly 2012; GHD with H.T. Harvey & Associates October 2014; and HCRCD 2015b, 2015c, & 2016a) for various restoration "habitat components" throughout both reaches. These species compositions were developed based on a combination of restoration goals, various hydrological regimes, edaphic conditions, and/or other site-specific factors.

Projected habitat types within the Phase 2A Salt River restoration corridor identified in the HMMP include riparian habitats, "sediment management areas," and two distinct types of wetland systems contiguous with the wetted Salt River channel: "brackish marsh" and "freshwater channel" wetlands. For the purposes of the 2017 habitat monitoring effort (and consistent with the approach used in J.B. Lovelace & Associates 2017), we refer to portions of the Phase 2A Salt River corridor restoration area that are contiguous with the wetted Salt River channel, and are not otherwise classified as existing "riparian forest/scrub," "riparian planting zones," or "sediment management areas" to be part of the "Salt River channel wetland" system. This "Salt River channel wetland" system is composed of both "brackish marsh" and "freshwater" channel wetlands. Each of these habitats and relevant design components addressed in the 2017 habitat monitoring effort are identified and briefly described below.

Phase 2A: "Salt River Channel Wetlands"

The "Salt River channel wetland" system associated with the Phase 2A – Salt River corridor portion of the SRERP consists of estuarine, riverine, and palustrine emergent wetland habitats (Cowardin et al. 1979) that currently support predominantly herbaceous vegetation. Forested and scrub-shrub wetland habitats associated with Phase 2A are discussed separately in the "riparian habitats" section below. Specific features of these Salt River channel wetland habitats addressed in the 2017 habitat monitoring effort consist of active channel and active bench habitat components. A brief description of each component, as well as the hydrochemical gradient driving the transition from brackish marsh to freshwater wetland systems within the Phase 2A restoration area, follows.

Active Channel
The “active channel” represents the primary wetted Salt River channel that consistently conveys stream flow and sediment throughout the year. Although the immediate channel banks experience scouring during high-velocity flows, replanted and volunteer vegetation is established on the edges of the upper banks.

Active Bench
The “active bench” is a dynamic alluvial geomorphological feature extending from the edge of the active channel out to the upper reach of the Salt River corridor and adjacent Eel River floodplain. The active bench was designed to provide an interface between the active channel of the Salt River and the adjacent landscape, by accepting flows exceeding bankfull channel capacity during high-flow events, as well as receiving deposition of sediments transported from upstream sources. These wetland habitats provide for additional geomorphological diversity, sediment deposition, the establishment of wetland vegetation, low-velocity refugia for aquatic organisms during high-flow events, and foraging and breeding habitat for terrestrial wildlife and avian species during other times of the year.

Brackish Marsh & Freshwater Channel Wetland Habitats
Tidal influx and upstream freshwater contributions combine in the Phase 2A restoration area resulting in brackish hydrological conditions, particularly in the lower Phase 2A reach. Plant species tolerant of such intermediate water chemistry are expected to become established along the edges of the active Salt River channel and in adjacent active bench habitats exposed to tidal influence. With increasing distance upstream, and/or away from the active channel edge, the vegetation should transition into a plant community composed of species more typically adapted to freshwater conditions in response to this water chemistry gradient.

Tidal influence extends upstream in the Salt River active channel to a point approximately 600 feet upstream of the Dillon Road bridge (GHD with H.T. Harvey & Associates 2014), or ~400 feet upstream of the boundary between the “lower” and “middle” reaches of the Phase 2A restoration area. Beyond this point, the Salt River hydrological regime is understood to be a predominantly freshwater system. The actual transition between brackish and freshwater conditions of the adjacent active bench habitat is both variable and gradual due to variations in the geomorphology of the reconstructed channel, the dynamic nature of the associated hydrology, and the fact that the restored habitat is still in the early stages of development. Findings from the 2017 effort reflecting the current distribution of brackish and freshwater habitats are presented in Section 4.0 (below) and Appendix A.

Disambiguation of “Brackish Marsh”

The term “Brackish Marsh” has been used in the planning context of Phase 2 of the SRERP to refer to estuarine emergent wetland habitats expected to develop in the lower reach of the Phase 2A restoration area, including both aforementioned wetland design components associated with the Salt River channel (i.e., active channel and active bench). Consistent with that understanding, we apply the term “brackish marsh wetlands” to all estuarine emergent wetland habitats subject to brackish hydrological conditions, (whether in reference to such habitats in the Phase 1 restoration area or to Phase 2A Salt River channel wetlands [i.e., active channel and/or active bench]), not just the active channel edge of Phase 2A. For purposes of any comparisons of habitat monitoring results across monitoring years, H.T. Harvey & Associates’ (2015) use of “brackish marsh” corresponds specifically to the Phase 2A (Lower) “active channel” recognized in both J.B Lovelace & Associates (2017) and the current report.

Phase 2A: Riparian Habitats

Performance of the Phase 2A restoration activities necessitated the removal of some portions of pre-existing riparian forest, as had also occurred during Phase 1. This existing habitat was retained where possible, and woody riparian vegetation was replanted in suitable “riparian planting zones” during the subsequent dormant seasons for each project sub-phase to compensate for the loss of this habitat component as well as to achieve identified restoration goals. Riparian planting zones were also revegetated with suitable herbaceous species, following specifications provided in the aforementioned revegetation guidance documents.

Suitable Phase 2A riparian planting zones included both areas of “replanted riparian forest” along the upper riparian channel banks, contiguous with retained pre-existing riparian forest, as well as along the “active riparian berms.” “Active riparian berms” consist of linear, elevated channel edge design features that were constructed along specific portions of the interface between the edge of the active channel and the immediately adjacent active bench habitats. These active riparian berms serve as “natural” levees, provide bank stabilization, and are anticipated to eventually provide shading of the channel as well as underwater refugia for fish and other aquatic species.

Phase 2A: Sediment Management Areas

“Sediment management areas” are channel corridor restoration features designed to provide low-velocity locations for the deposition of transported sediments during high-flow events. Periodic removal of sediment from these areas is expected to address anticipated aggradation and to prevent channel occlusion. Given the anticipated periodic burial- and sediment removal-related disturbances in these sediment management areas, habitat-monitoring efforts are not required in these portions of the restoration area, and are not addressed further in this report.

3.0 Methods

Consistent with the schedule of monitoring requirements (Table 1) provided in the HMMP, the 2017 SRERP habitat monitoring effort consisted of three tasks: verification of habitat conditions to update maps of the distribution of specific habitats within respective portions of the SRERP project area, quantitative sampling within specific habitats to characterize the associated vegetation, and the documentation of invasive vegetation encountered during these efforts. Methods used to accomplish each of these tasks are described below. All fieldwork was performed by J.B. Lovelace & Associates' Principal Environmental Scientist and plant ecologist, Brett Lovelace, and all botanical taxonomic nomenclature presented in this effort is consistent with *The Jepson Manual: Vascular Plants of California, Second Edition* (Baldwin et al. 2012) or the *Jepson eFlora* (Jepson Flora Project 2017) where updated taxonomical classification was warranted.

3.1 Habitat Mapping & Area Analysis

Existing SRERP habitat GIS data, originally provided by the HCRCD and revised during the 2016 monitoring effort (J.B. Lovelace & Associates 2017), were refined where necessary in 2017 to develop updated habitat maps reflecting current site conditions. These refinements were made using ArcMap® (ESRI) geographic information system (GIS) desktop software and the most recent satellite imagery (Google Earth 2017 and National Agriculture Imagery Program [NAIP] 2016), and were based on observations made during fieldwork performed between August 4-11, 2017. Geographic field data were collected using a Trimble® Juno® global positioning system (GPS) device with ArcPad® software (ESRI). Habitat area (acreage) totals were calculated as part of this process, and the resulting maps are included in Appendix A as Figures 2-4.

The HMMP schedule of monitoring tasks (Table 1) only explicitly requires the analysis of habitat area (acreage) for Riparian Planting Zones in the Phase 1 and Phase 2A (Lower) project areas in 2017. Although the 2017 habitat mapping & area analysis effort focused on these specific habitat types, additional opportunistic observations of changes in the extent of other SRERP habitat types were also recorded where encountered. Habitat area success criteria established in the HMMP are included with respective 2017 habitat area analysis results in Table 6 for evaluation purposes. It is important to note that habitat area (acreage) success criteria provided in the HMMP for Phase 2 represent total "phase-wide" acreage thresholds (including upstream areas where restoration has not yet occurred), and do not reflect any partitioning into "sub-phase" quantities corresponding to the actual progression in which Phase 2A (Lower and Middle) restoration efforts were implemented. In the absence of sub-phase-specific success criteria, respective thresholds were proportionately scaled for each relevant Phase 2 sub-phase habitat using ArcMap® and appropriately truncated "projected habitat" GIS data created during the development of the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012).

3.2 Quantitative Vegetation Analysis

Two distinct quantitative sampling efforts were conducted in 2017 to analyze and characterize different aspects of the vegetation associated with specific habitats within the SRERP restoration area: vegetation percent cover sampling and replanted woody riparian vegetation basal area sampling. Both sampling efforts are described in detail below. Because some SRERP habitats (and associated monitoring task schedules) are partitioned due to project phasing (e.g., freshwater active bench habitat that extends through both Phase 2A [Lower] and Phase 2A [Middle] project areas, etc.), we adopt the convention of referring to partial, project phase-specific portions of a given habitat as their respective habitat type "sampling areas" (e.g., Phase 2A [Lower] active bench sampling area, Phase 2A [Middle] active bench sampling area, etc.). This allows for phase-specific portions of sampled habitats to be treated independently, to be tracked and evaluated based on respective monitoring schedules and success criteria, while minimizing the complexity of addressing various combinations of habitat types and monitoring schedule requirements. The primary drawback in this approach is reduced resolution when attempting to draw conclusions from results at the level of habitat variants (e.g., brackish vs. freshwater active berm habitat in the Phase 2A [Lower] restoration area, brackish vs. freshwater active channel habitat in the Phase 2A [Middle] reach, etc.). However, in light of the additional level of complexity inherent in tracking and evaluating each such iteration through "monitoring space," the aforementioned convention was determined to achieve the best compromise between simplicity and being most informative.

3.2.1 Vegetation Percent Cover Sampling

As was performed in the previous SRERP monitoring efforts, we collected vegetative percent cover data during August 4-9, 2017 to characterize the vegetation within habitats where this task was scheduled to occur during the current monitoring year. Specific habitat "sampling areas" where vegetation percent cover sampling was performed in 2017 were:

Phase 1 – Riverside Ranch Tidal Marsh Restoration Area

1. Replanted Riparian Forest

Phase 2A (Lower) – Salt River Corridor Restoration Area

Salt River Channel Wetlands

2. Active Channel
3. Active Bench

Riparian Planting Zones

4. Replanted Riparian Forest
5. Active Riparian Berm

Phase 2A (Middle) – Salt River Corridor Restoration Area

Salt River Channel Wetlands

6. Active Channel
7. Active Bench

Riparian Planting Zones

8. Replanted Riparian Forest
9. Active Riparian Berm

Sampling Design & Data Collection

We used a stratified, randomized sampling approach to characterize the abundance, species composition, and structural composition of existing vegetation in each vegetation sampling area. The goal of such a sampling approach is to sufficiently distribute the collection of vegetation data throughout sampling areas to provide the most accurate, quantitative characterization of the vegetative categories of interest throughout the site, while minimizing any pre-conceived bias on the part of the observer. Based on power analyses of 2016 SRERP vegetation sampling data (J.B. Lovelace & Associates 2017), we used a sample size (n=32) that was determined to be sufficient to detect a "medium" effect size of 0.5 standard deviations (following Cohen 1988) between the observed sample means and their respective success criteria using a two-sided *t*-test, and assuming both 95% confidence and a statistical power of 80%.

Using updated SRERP habitat GIS data and ArcMap® software, each phase and sub-phase of the restoration area was partitioned into ecologically distinct vegetation sampling areas of perceived relative homogeneity based on project reach, restoration habitat design components, revegetation prescriptions, and elevation strata. ArcMap® software was then used to randomly distribute 32 sampling plots throughout each of these sampling areas (Appendix A, Figures 5-7). Given that each sampling area is composed of multiple, geographically separated polygons, the 32 sample plots were randomly allocated throughout each sampling area, in quantities proportionate to the size (i.e., area) of each polygon. Geographic coordinates for each randomly assigned sample plot location were then appropriately corrected and uploaded to the aforementioned GPS unit for location during fieldwork. Once sample plots were located in the field, a $1m^2$ sampling frame, or "quadrat," constructed from ¼-inch diameter PVC was then used to visually estimate:

- (total) percent vegetative cover, and
- (absolute) percent cover of each species present.

In order to evaluate these data against the success criteria for specific vegetative parameters, each observed plant species was categorized as:

- native,
- non-native non-invasive,
- non-native invasive, or
- sterile "wheatgrass" hybrid (*Elymus* x *Triticum*);

as well as being:

- herbaceous (an herb),
- arborescent (a tree), or a
- shrub.

Table 2. Modified Braun-Blanquet (1928) Plant-Cover Abundance Scale.[1]

Cover Class	Range of Percent Cover	Median (%)
r	<1 (single individual)	0.1
+	<1 (sporadic or few)	0.5
1	1–5	3.0
2	>5–25	15.0
3	>25–50	37.5
4	>50–75	62.5
5	>75–95	85.5
6	>95-100	97.5

[1] Source: H.T. Harvey & Associates 2015.

Percent cover data collected for each species reflected that species' *absolute* cover, which is distinct from *relative* cover. *Absolute* cover quantifies the entire aerial projection of each species (or any other vegetative category of interest) within the sample frame, regardless of any canopy overlap between different species. When measuring absolute cover, resulting cumulative cover values for sampled locations that exceed 100% for a given sample are not uncommon (Barbour et al. 1998, etc.). Absolute cover data are generally considered to allow for a broader range of analytical applications. In contrast, *relative* cover values always represent a proportion between 0-100%, and can be less informative due to reduced precision in addressing areas of overlapping vegetative canopy.

In an attempt to minimize any observer-related variation between monitoring efforts, the same "modified" Braun-Blanquet (1928) cover-abundance scale (Table 2) used in previous monitoring efforts (H.T. Harvey & Associates 2014 & 2015; J.B. Lovelace & Associates 2017) was also used during the 2017 sampling fieldwork to assign a "cover class" to the visually estimated absolute percent cover for each species observed during sampling. Median percent cover values for the range associated with each cover class were then used in subsequent analyses. Although some precision is lost when using such a method, plant-cover abundance scales can be useful in long-term monitoring projects as they serve to reduce observer-based variation between observation periods.

The vegetation success criteria specified in the HMMP consist of minimum percent cover thresholds for native species and maximum percent cover thresholds for both non-native non-invasive and non-native invasive species for the various combinations of habitat type and monitoring year. These criteria are summarized below in Tables 3-5. Although no such "percent cover" success criteria are specified for vegetative structural composition (other than related criteria for riparian habitat acreage), a characterization of the structural type of sampled vegetation in riparian planting zones was requested during a meeting

Table 3. SRERP Native Vegetation Sampling Success Criteria.[1] Bold text indicates the current monitoring year (2017). Missing values indicate monitoring years for which no habitat monitoring tasks are required for respective habitats.

			Percent Cover Native Plant Species Success Criteria (≥)												
Phase		**SRERP Habitat Type**	2013	2014	2015	2016	**2017**	2018	2019	2020	2021	2022	2023	2024	2025
Phase 1		(Monitoring Year)		1	2	3	**4**	5	6	7	8	9	10		
		High Marsh Ecotone		5%	15%	30%	**–**	40%	–	50%	–	–	60%		
		Salt Marsh *sensu stricto*[2]		–	–	10%	**–**	30%	–	50%	–	–	60%		
		(Monitoring Year)			1	2	**3**	4	5	6	7	8	9	10	
		Replanted Riparian Forest[3]			–	15%	**30%**	–	40%	–	60%	–	–	80%	
Phase 2A	**(Lower)**	(Monitoring Year)			1	2	**3**	4	5	6	7	8	9	10	
		"Salt River Channel Wetlands"[4]			10%	20%	**30%**	–	50%						
		Riparian Planting Zones			–	15%	**30%**	–	40%	–	60%	–	–	80%	
	(Middle)	(Monitoring Year)				1	**2**	3	4	5	6	7	8	9	10
		"Salt River Channel Wetlands"[4]				10%	**20%**	30%	–	50%					
		Riparian Planting Zones				–	**15%**	30%	–	40%	–	60%	–	–	80%

[1] Adapted from Tables 8-10 of the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012).
[2] As per guidance provided in HCRCD's clarifying memorandum to the California Coastal Commission (HCRCD 2016c).
[3] Woody riparian revegetation efforts for Phase 1 were delayed until early 2015 due to unusually dry conditions (HCRCD 2015a).
[4] Includes both elements (i.e., active channel and active bench) of both brackish marsh and freshwater channel wetlands.

Table 4. SRERP Non-Native Non-Invasive Vegetation Sampling Success Criteria.[1] Bold text indicates the current monitoring year (2017). Missing values indicate monitoring years for which no success criteria have been specified (H.T. Harvey & Associates with Winzler & Kelly 2012).

			Percent Cover Non-Native Non-Invasive Plant Species Success Criteria												
Phase		**SRERP Habitat Type**	2013	2014	2015	2016	**2017**	2018	2019	2020	2021	2022	2023	2024	2025
Phase 1		(Monitoring Year)		1	2	3	**4**	5	6	7	8	9	10		
		High Marsh Ecotone		–	–	–	**–**	–	–	–	–	–	<15%		
		Salt Marsh *sensu stricto*[2]		–	–	–	**–**	–	–	–	–	–	<15%		
		(Monitoring Year)			1	2	**3**	4	5	6	7	8	9	10	
		Replanted Riparian Forest[3]			–	–	**–**	–	–	–	–	–	–	<15%	
Phase 2A	(Lower)	(Monitoring Year)			1	2	**3**	4	5	6	7	8	9	10	
		"Salt River Channel Wetlands"[4,5]			–	–	**–**	–	<15%						
		Riparian Planting Zones			–	–	**–**	–	–	–	–	–	–	<15%	
	(Middle)	(Monitoring Year)				1	**2**	3	4	5	6	7	8	9	10
		"Salt River Channel Wetlands" [4,5]				–	**–**	**–**	**–**	<15%					
		Riparian Planting Zones				–	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	<15%

[1] Adapted from the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012).
[2] As per guidance provided in HCRCD's clarifying memorandum to the California Coastal Commission (HCRCD 2016c).
[3] Woody riparian revegetation efforts for Phase 1 were delayed until early 2015 due to unusually dry conditions (HCRCD 2015a).
[4] Includes both elements (i.e., active channel and active bench) of both brackish marsh and freshwater channel wetlands.
[5] Although not explicitly specified in the HMMP, it is assumed that these criteria for non-native vegetation are intended for "Salt River channel wetlands," as they are for all other habitats where vegetation percent cover sampling is a requirement.

Table 5. SRERP Non-Native Invasive Vegetation Sampling Success Criteria.[1] Bold text indicates the current monitoring year (2017). Missing values indicate monitoring years for which no success criteria have been specified (H.T. Harvey & Associates with Winzler & Kelly 2012).

			Percent Cover Non-Native Invasive Plant Species Success Criteria												
Phase		**SRERP Habitat Type**	2013	2014	2015	2016	**2017**	2018	2019	2020	2021	2022	2023	2024	2025
Phase 1		(Monitoring Year)		1	2	3	**4**	5	6	7	8	9	10		
		High Marsh Ecotone		–	–	–	**–**	–	–	–	–	–	<5%		
		Salt Marsh *sensu stricto*[2]		–	–	–	**–**	–	–	–	–	–	<5%		
		(Monitoring Year)			1	2	**3**	4	5	6	7	8	9	10	
		Replanted Riparian Forest[3]			–	–	**–**	–	–	–	–	–	–	<5%	
Phase 2A	**(Lower)**	(Monitoring Year)			1	2	**3**	4	5	6	7	8	9	10	
		"Salt River Channel Wetlands" [4,5]			–	–	**–**	–	<5%						
		Riparian Planting Zones			–	–	**–**	–	–	–	–	–	–	<5%	
	(Middle)	(Monitoring Year)				1	**2**	3	4	5	6	7	8	9	10
		"Salt River Channel Wetlands" [4,5]				–	**–**	**–**	**–**	<5%					
		Riparian Planting Zones				–	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	<5%

[1] Adapted from the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012).
[2] As per guidance provided in HCRCD's clarifying memorandum to the California Coastal Commission (HCRCD 2016c).
[3] Woody riparian revegetation efforts for Phase 1 were delayed until early 2015 due to unusually dry conditions (HCRCD 2015a).
[4] Includes both elements (i.e., active channel and active bench) of both brackish marsh and freshwater channel wetlands.
[5] Although not explicitly specified in the HMMP, it is assumed that these criteria for non-native vegetation are intended for "Salt River channel wetlands," as they are for all other habitats where vegetation percent cover sampling is a requirement.

with project partners and the California Coastal Commission staff (HCRCD 2016c). During this same meeting it was also determined that quantitative vegetation sampling was not required within retained existing riparian habitat areas. This does not change the requirements established in the HMMP for monitoring the extent (acreage) of this habitat throughout the duration of the monitoring period.

Data Analysis

Statistical methods used to analyze percent cover data collected in the 2017 habitat monitoring effort consisted of: 1) non-parametric bootstrap analyses to evaluate the precision of mean percent cover estimates for the various vegetation categories of interest, and 2) power analyses to assess the adequacy of the sample size for each vegetation sampling area and to provide sample size recommendations for the subsequent monitoring year. To the extent possible, we attempted to maintain consistency with methods employed in previous monitoring efforts (H.T. Harvey & Associates 2014 and 2015; J.B. Lovelace & Associates 2017) to minimize any investigator-related discrepancies introduced in comparisons between results from different monitoring years.

At the sample plot level, absolute cover values for the various categories of interest (i.e., native, non-native non-invasive, invasive, and hybrid) were calculated from summed Braun-Blanquet cover class median percent cover values for each. These sample plot category totals were then pro-rated with respect to corresponding sample plot "total vegetative cover" values to yield a set of mean cover values ranging from 0−100%, which summed to equal the total vegetative cover percentage. These pro-rated sample plot means for the various categories were then used to calculate respective mean estimates for each sampling area. The same procedure was also used to produce mean percent cover estimates for the vegetative structural categories (i.e., herb, tree, and shrub) in riparian planting zones as well. All statistical analyses were performed using the statistical software program "R" (The R Foundation for Statistical Computing 2016) and specific methods used in the 2017 analyses of percent cover data are described below.

Nonparametric Bootstrap Analysis

Nonparametric bootstrap methods (Efron & Tibshirani 1993) were used to calculate 95% confidence intervals for observed mean percent cover estimates for each vegetative category of interest by applying the "BCa" approach (Efron 1987) to the pro-rated data described above. "Bootstrapping" provides a method of quantifying the uncertainty of an estimator (e.g., a sample mean, etc.) by repeatedly resampling (with replacement) the collected data at random. Each resampling event produces a corresponding sample mean, and the variability of these "bootstrap means" can be used to assess the uncertainty of the actual sample mean. In the present case, the BCa bootstrap was used to calculate confidence intervals for reported sample means. In this effort, we resampled each data set 100,000 times to produce confidence intervals for each combination of vegetative category of interest and sampled area.

Power Analyses

Power analyses were performed retrospectively to evaluate the adequacy of the 2017 sample size (n = 32) for each habitat area where vegetation sampling was conducted. They also serve to provide recommendations for initial sample sizes in subsequent vegetation sampling efforts in these habitats. Initial calculations revealed that the sample sizes used in the 2017 vegetation percent cover sampling efforts were sufficient to detect both an effect size of 0.5 standard deviations and/or a difference of 20% between the observed estimated means and respective success criteria. In fact, the latter effect size was slightly more conservative (being that it was calculated to represent 0.41 SD) than the "medium" effect size recommended following evaluation of 2016 sample data.

Based on these initial calculations, we ultimately performed power analysis calculations, assuming a two-sided *t*-test with 80% statistical power and a significance level of 0.05 (95% confidence) to be able to detect the more conservative effect size of a 20% difference between observed sample means and respective success criteria. In every instance, sample sizes associated with the 2017 sampling efforts for each sampled habitat type were determined to have exceeded the minimum quantities necessary to detect the aforementioned significant (and meaningful) differences between observed mean estimates of percent cover for the various vegetative categories of interest and their respective monitoring year success criteria.

3.2.2 Replanted Woody Riparian Vegetation Basal Area Assessment

As specified in the HMMP schedule of monitoring tasks (Table 1), we also initiated a quantitative sampling effort in 2017 to assess the structural development of woody riparian vegetation in SRERP habitats replanted with such species. The goal of this initial sampling was to establish the first baseline dataset for future comparison against results from subsequent years, thereby providing a means with which to evaluate the development of this vegetation component throughout respective 10-year monitoring periods for each SRERP phase and sub-phase. This woody riparian vegetation basal area sampling effort was performed during December 5-8, 2017.

Sampling Design & Data Collection

We utilized the same approach described above, for stratifying restoration sampling areas and creating random percent cover sampling plots (using ArcMap® GIS software and the Trimble GPS unit), to establish randomly-located basal area sampling plots throughout each of the three 2017 sampling areas of interest in the following quantities:

Phase 1 – Riverside Ranch Tidal Marsh Restoration Area:

1. Replanted Riparian Forest (n=30)

Phase 2A (Lower) – Salt River Corridor Restoration Area:

Riparian Planting Zones

2. Replanted Riparian Forest (n=21)
3. Active Riparian Berm (n=10)

Given that no prior basal area sampling has occurred in the SRERP habitat monitoring effort, initial sample sizes were chosen somewhat arbitrarily, but were based on the perceived appropriate balance of within-habitat variability, habitat area coverage, and cost-efficiency.

Once random basal area sampling plot center coordinates were determined, ArcMap® software was then used to create circular (10-meter radius) sampling plots around each plot center. These GIS data were then appropriately corrected and uploaded to the Trimble GPS device for location in the field. Upon arriving at each basal area sampling plot, the diameter-at-breast-height (DBH) (in millimeters), species, and geographic coordinates were recorded for all trees located within the plot that were ≥4.5 feet ("breast height") tall. Diameter measurements were obtained for all tree stems at 4.5 feet above ground level (on the uphill side, where relevant) using either metric calipers or a "diameter tape" depending on the size of the measured stem.

Following direction from HCRCD staff (Hansen pers. comm.), individual plants were considered to be a "tree" if they were a species whose vegetative "habit" is described in relevant botanical literature (e.g., Baldwin et al. 2012; etc.) as being a tree at maturity. This criterion included young flexible saplings and excluded some woody species whose habit is described as being a "shrub" at maturity (even if such woody individuals encountered were robust and tall enough to have a diameter-at-breast-height).

In instances where the circular plots extended outside of the boundaries of the targeted sampling habitats, the aforementioned data were only collected for trees within the area of overlap between the sampling plot and target habitat; all trees outside of the combined area of overlap were ignored. (This was common in the more narrow and sinuous habitat sampling areas along the riparian corridor in the Phase 2 – Salt River Corridor Restoration Area.) The actual coinciding sampled area of overlap between the sampling plot and target habitat was also calculated and recorded for each sampling plot using ArcMap® GIS software. In instances where basal area sampling plots extended into adjacent, retained "Existing Riparian Forest" habitat areas, no data were collected from trees in those retained habitats.

Data Analysis

All metric DBH measurements collected during fieldwork were subsequently converted to inches, and were then squared and multiplied by 0.005454 ("the forester's constant") to derive basal area values (measured in square-feet), otherwise expressed as:

$$\text{Basal area} = DBH^2 \times 0.005454$$

Resulting sampling plot measurements of both basal area and actual-plot-area-sampled were then summed to derive basal-area-per-unit-area-sampled totals for

each tree species in each sampled habitat. These measurements were then extrapolated to produce projected estimates of total habitat- and phase-wide basal area for each species using respective habitat areas (acreages) obtained from current SRERP GIS data. Tabulated values for the resulting projected basal area estimates are provided in Section 4.0 to characterize the current developmental status of this vegetation type in sampled habitats.

This approach was chosen to provide the perceived best method of accurately characterizing this aspect (i.e., basal area) of the development and structural complexity of woody riparian vegetation throughout the restoration area, while also facilitating future comparisons with subsequent sampling efforts throughout the duration of the SRERP monitoring period.

Simple cumulative basal area totals are dependent upon the extent and orientation of sampled habitats, as well as sampling plot location with respect to the targeted habitats. If, in subsequent comparisons between monitoring years, these artifacts of sampling design are not controlled for, possible future changes in the extent or orientation of sampled riparian habitats and/or sampling plot placement alone could result in variations in the actual extent of area surveyed, and consequently, in the availability of woody vegetation actually sampled. Such possible scenarios could result in differing cumulative basal area measurements between monitoring years simply due to artifacts of sampling design alone.

For these reasons, cumulative raw basal area measurements may not allow for parallel comparisons across monitoring years and, therefore, could limit the ability to draw meaningful conclusions about potential real changes in this vegetation type throughout the habitat monitoring period. Because our approach yields basal area estimates that are relativized and made proportionate to the actual area of sampled plots from which the original measurements were obtained, they have relatively broad utility in future comparisons across monitoring years.

3.3 Invasive Plant Species Assessment

Throughout the performance of habitat mapping and quantitative vegetation sampling fieldwork (i.e., August 2-11 and December 5-8, 2017), all encountered occurrences of invasive vegetation were documented using the aforementioned GPS device. The resulting geographic data were subsequently uploaded, appropriately corrected, and used to update relevant maps developed in the 2016 habitat monitoring effort (J.B. Lovelace & Associates 2017) using ArcMap® software and the most recent satellite imagery (NAIP 2016) to reflect the most current knowledge of the distribution and extent of invasive species occurring throughout the SRERP area. The resulting maps are included in Appendix A, Figures 12-16.

Where feasible, the distributions of discrete invasive species were mapped separately, and in the case of the highly invasive salt marsh species, *Spartina densiflora* (“dense-flowered cord grass”), *Spartina*-specific figures were created

to clearly depict updated observations of the distribution of this species throughout the SRERP restoration area (Appendix A, Figures 12-13). In some instances, the distributions of multiple co-occurring species overlapped to produce such complex mosaics that mapping separate species was not practical in the context of this effort. In such instances, the resulting combined species distribution mosaics were mapped as species "complexes." These "complexes" were assigned titles referencing the most dominant invasive species genera represented. These species complexes are included in respective figures (Appendix A), and the most well represented species associated with each complex are also indicated.

Our categorization of plant species as being native, non-native non-invasive, and invasive is consistent with that used in previous SRERP habitat monitoring efforts (H.T. Harvey & Associates 2014 & 2015; J.B. Lovelace & Associates 2017) in an attempt to maintain consistency throughout the duration of the entire SRERP monitoring period. Native plants are considered to be those "occurring naturally in an area, as neither a direct nor indirect consequence of human activity" (Baldwin et al. 2012). Non-native species are those introduced as a direct or indirect result of human activity. Non-native invasive plants are defined by Cal-IPC (2017) as non-native species threatening "wildlands" by displacing and/or hybridizing with native species and/or likely to "alter biological communities, or alter ecosystem processes."

Except as noted otherwise, our classification regards plant species encountered in the current habitat monitoring effort as being "invasive" if they are assigned a "high" invasive rating by the California Invasive Plant Council (Cal-IPC) (2017), are listed as "noxious weeds" by the California Department of Food & Agriculture (CDFA 2017), are listed as "federal noxious weeds" (USDA 2017), are considered invasive in the Humboldt County Weed Management Area (WMA) (2010), or otherwise warrant concern based on known or perceived potential for preventing the establishment of intended vegetation in the SRERP restoration area. Although some non-native plants detected in the current monitoring fieldwork regarded by the Cal-IPC (2017) as having "moderate" or "limited" invasive potential were considered invasive in the context of the SRERP restoration goals, it is also true that other species classified similarly were not considered problematic in the context of the current effort, based on local species observations.

We also include two native plant species in our treatment of invasive vegetation in this effort based on their potential for ecosystem-altering effects in this nascent, large-scale restoration project: *Phalaris arundinacea* ("reed canary grass") and *Typha latifolia* ("broad-leaved cattail"), although neither is listed as invasive by Cal-IPC (2017) or the Humboldt County Weed Management Area (2010). Although there is some ambiguity with respect to variation in the invasive potential of different populations of *P. arundinacea* (and the ability to distinguish between them in the field), both *P. arundinacea* and *Typha latifolia* are currently

considered to be native in California. However, up until relatively recently, *Phalaris arundinacea* was not regarded as being native to California, and was considered invasive in previous SRERP habitat monitoring efforts (H.T. Harvey and Associates 2014 & 2015; J.B. Lovelace & Associates 2017). Both species are considered by some sources (USDA 2017; etc.) to be invasive elsewhere due to their potential to alter ecosystem processes by becoming rapidly established and developing dense, monotypic stands which aggressively outcompete other species, and can result in sediment accretion and eventual channel occlusion and/or habitat conversion in some aquatic habitats.

4.0 Results

Results from the 2017 habitat monitoring effort demonstrate that the Salt River Ecosystem Restoration Project has met or exceeded the respective success criteria for this monitoring year in all phase and sub-phase portions of the project area (Tables 6-8). Baseline data collected in this most recent effort also reflect progress towards the successful development of woody riparian vegetation in the Phase 2A Salt River Corridor restoration area, but indicate that such vegetation is responding inconsistently in the Phase 1 – Riverside Ranch Tidal Marsh restoration area. Recent results indicate a continued favorable trajectory with respect to the development of projected habitats and native vegetation thus far, however, immediate and appropriate efforts are warranted to reduce and/or eradicate non-native and invasive vegetation also documented during our 2017 fieldwork. If not adequately addressed, the continued establishment and development of such undesirable vegetation is likely to prevent the achievement of final success thresholds for monitoring years 5 and 10, thereby jeopardizing stated long-term restoration goals for the project. Specific results for the habitat mapping and area analysis, quantitative vegetation sampling, and invasive vegetation assessment aspects of the 2017 monitoring effort are provided in respective sections below.

4.1 Results of Habitat Mapping & Area Analysis

Results from our 2017 habitat mapping and area analysis of riparian habitats in the Phase 1 and Phase 2A (Lower) restoration areas reflect negligible changes from results reported from those same habitats in 2016 (J.B. Lovelace & Associates 2017). Calculated area (acreage) totals and respective eventual final success criteria for each habitat type addressed in the 2017 habitat monitoring effort are summarized in Table 6 and are discussed below. The observed distribution and extent of each habitat type, and relevant associated restoration design components, are depicted in Appendix A (Figures 2-4).

4.1.1 Phase 1 – Riverside Ranch Tidal Marsh Restoration Area

Phase 1: Riparian Habitats

The total area of Phase 1 riparian habitats (43.3 acres) is approximately equivalent to the respective projected habitat extent (43.4 acres) specified in the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012). No substantial changes to this habitat were observed between 2016 and 2017 (Table 6).

4.1.2 Phase 2 – Salt River Corridor Restoration Area

Phase 2A (Lower): Riparian Habitats

The extent of existing riparian forest and riparian planting zone habitats that occur within the Phase 2A (Lower) restoration area have not changed substantially between 2016-2017. These habitats collectively total 22.01 acres, exceeding the extrapolated projected extent of this habitat (17.6 acres) by 25%. Respective acreages for each subordinate habitat component are provided in Table 6.

Table 6. SRERP Riparian Habitats. Summary of 2017 Observed Habitat Areas & Respective Success Criteria.

	Area (Acres)[1]			
			2017	
SRERP Habitat Type	**Projected[2]**	**Final Success Criteria[3]**	**Observed**	**% of Projected**
Phase 1 – Riverside Ranch Tidal Marsh Restoration Area				
Existing Riparian Forest	–	–	20.62	–
Replanted Riparian Forest	–	–	22.71	–
Phase 1 Riparian Habitat Total	**43.4**	**≥38.4**	**43.33**	**~100%**
Phase 2A (Lower) – Salt River Corridor Restoration Area				
Existing Riparian Forest	–	–	11.52	–
Riparian Planting Zones				
Replanted Riparian Forest	–	–	8.05	–
Active Riparian Berms	–	–	2.44	–
Phase 2A (Lower) Riparian Habitat Total	**17.6**	**≥15.8**	**22.01**	**125%**

[1] Missing values reflect "projected habitat" acreages, which were not specified in the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012) for the more narrowly defined habitat components identified during the 2017 habitat monitoring effort.

[2] "Projected Habitat" acreage quantities for those habitats either not recognized as discrete areas in H.T. Harvey & Associates with Winzler & Kelly (2012), or for partial portions of habitats which extend beyond phase and/or sub-phase boundaries, were extrapolated from "Projected Habitat" GIS data used in the development of the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012), and which are depicted in (Appendix A, Figure 1).

[3] Defined (H.T. Harvey & Associates with Winzler & Kelly 2012) as achieving ≥90% of Projected Habitat quantities in Monitoring Years 5-10.

4.2 Results of Quantitative Vegetation Analyses

4.2.1 Vegetation Percent Cover Sampling Results

Results from the 2017 vegetation percent cover sampling effort (Tables 7 & 8) exceed all relevant success criteria for minimum cover of native vegetation (Table 3) for the 2017 monitoring year. However, the continued increase in abundance of invasive plant species warrants the initiation of immediate and on-going management efforts to reduce and/or eliminate these occurrences if respective final success thresholds for monitoring years 5 and 10 are to be met.

The sampling area with the lowest percent cover values for both total and native vegetation throughout all habitats sampled during the 2017 effort was the active channel habitat in the Phase 2A (Lower) reach. The mean cover estimate for total vegetation within this sampling area was 78.4%. All other sampled areas exhibited total vegetative cover estimates in excess of 87%. Mean estimated cover of native vegetation within the Phase 2A (Lower) active channel sampling area was 40.2%, greater than the required 30% for that area during the current monitoring year. These observations indicate successful establishment of native vegetation throughout the sampled portions of the SRERP restoration area thus far.

Despite these encouraging results, both non-native non-invasive and invasive vegetation continue to exceed respective eventual final (maximum) cover thresholds (Tables 4 & 5) specified in the HMMP in many of the sampled areas in both Phase1 and Phase 2A restoration areas (Table 7). Observed percent cover of *non-native non-invasive* vegetation in the Phase 1 replanted riparian forest sampling area (i.e., $\overline{x}$ = 15.8%) was found to be approximately equivalent to the eventual final (maximum) success threshold for this vegetative category (i.e., <15% by monitoring year 5 for Salt River Channel Wetlands and monitoring year 10 for all other habitats [Table 4]). In the Phase 2A restoration areas, however, non-native non-invasive vegetation was found to be in excess of the eventual final maximum threshold in 4 of the 8 sampled habitats (i.e., Phase 2A [Lower] active channel [$\overline{x}$ = 18.3%] and active bench [$\overline{x}$ = 16.6%], and Phase 2A [Middle] active bench [$\overline{x}$ = 16.2%] and active riparian berm [$\overline{x}$ = 23.4%]) in 2017.

Similarly, mean estimated percent cover of *invasive* plant species currently exceeds eventual final (maximum) success criteria for this category of vegetation (i.e., <5% by monitoring year 5 for Salt River channel wetlands, and monitoring year 10 for all other habitats [Table 5]) in all nine of the habitats sampled in 2017. The lowest observed mean percent cover value of invasive vegetation in sampling results from this year was 6.4% in the active channel sampling area of the Phase 2A (Middle) reach, with the remaining percent cover values ranging from 11.4% in the Phase 2A (Middle) active riparian berm sampling area to 40.0% in the Phase 2A (Middle) replanted riparian forest.

The sterile “wheatgrass” hybrid (*Elymus* x *Triticum*) was only encountered in 3 restoration areas (i.e., Phase 2A [Lower] active riparian berm, and

Table 7. Summary of 2017 SRERP Quantitative Vegetation Percent Cover Sampling Results & Respective Success Criteria. Mean percent cover estimates are in bold and associated 95% confidence intervals follow in parentheses.

	Mean Percent Cover for Vegetation Categories of Interest								
	Total Vegetation[1]	Native Vegetation		Non-Native Non-Invasive Vegetation		Invasive Vegetation		Sterile Hybrid Wheatgrass[1]	
SRERP Habitat Sampling Area	Observed	Observed	2017 Success Criteria[2]	Observed	Final Success Criteria[3]	Observed	Final Success Criteria[3]	Observed	
Phase 1 – Riverside Ranch Tidal Marsh Restoration Area									
Replanted Riparian Forest (n=32)	**99.7** (97.8, 100.0)	**46.7** (34.3, 59.1)	≥30%	**15.8** (9.2, 26.5)	<15%	**37.2** (27.8, 47.3)	<5%	**0.0**	(NA)
Phase 2 – Salt River Corridor Restoration Area									
Phase 2A (Lower) – Salt River Channel Wetlands									
Active Channel (n=32)	**78.4** (70.6, 84.2)	**40.2** (30.6, 50.4)	≥30%	**18.3** (12.2, 25.8)	<15%	**20.0** (13.3, 28.8)	<5%	**0.0**	(NA)
Active Bench (n=32)	**88.8** (83.9, 92.3)	**55.9** (46.5, 65.8)	≥30%	**16.6** (10.7, 24.1)	<15%	**16.2** (9.9, 25.9)	<5%	**0.0**	(NA)
Phase 2A (Lower) – Riparian Planting Zones									
Replanted Riparian Forest (n=32)	**99.4** (97.8, 99.8)	**62.1** (49.9, 72.5)	≥30%	**7.3** (4.1, 15.0)	<15%	**30.0** (21.3, 40.7)	<5%	**0.0**	(NA)
Active Riparian Berm (n=32)	**96.7** (92.8, 98.4)	**64.3** (54.6, 73.0)	≥30%	**12.6** (8.0, 21.7)	<15%	**19.8** (13.7, 27.2)	<5%	**0.01**	(0.0, 0.04)
Phase 2A (Middle) – Salt River Channel Wetlands									
Active Channel (n=32)	**92.8** (88.1, 95.8)	**80.3** (71.8, 86.8)	≥20%	**6.1** (2.5, 12.5)	<15%	**6.4** (3.7, 10.2)	<5%	**0.0**	(NA)
Active Bench (n=32)	**87.3** (82.8, 91.3)	**59.0** (49.7, 67.8)	≥20%	**16.2** (9.8, 25.9)	<15%	**12.2** (8.4, 16.9)	<5%	**0.0**	(NA)
Phase 2A (Middle) – Riparian Planting Zones									
Replanted Riparian Forest (n=32)	**95.3** (89.0, 98.1)	**42.2** (32.4, 52.8)	≥15%	**13.1** (7.8, 20.8)	<15%	**40.0** (30.4, 50.4)	<5%	**0.05**	(0.0, 0.15)
Active Riparian Berm (n=32)	**93.6** (88.4, 96.4)	**58.3** (48.0, 68.2)	≥15%	**23.4** (16.0, 33.0)	<15%	**11.4** (6.9, 17.9)	<5%	**0.5**	(0.1, 1.9)

[1] No specific success criteria are indicated in the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012).

[2] Adapted from Tables 8-10 of the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012).

[3] Must be achieved by the final monitoring year for each respective habitat sampling area (i.e., Year 5 for Salt River Channel Wetlands or Year 10 for all others) (H.T. Harvey & Associates with Winzler & Kelly 2012).

Phase 2A [Middle] active riparian berm and replanted riparian forest) during the 2017 fieldwork, with maximum estimated mean cover (i.e., $\overline{x} = 0.5\%$) of this plant being documented in the active riparian berm sampling area in the middle Phase 2A reach (Table 7).

Additional descriptions of specific results from each sampled area follows. Mean estimates provided for total vegetative percent cover reflect total (absolute) vegetative cover. Mean estimates provided for all other vegetative categories of interest (i.e.; native, non-native non-invasive, invasive, and hybrid; as well as structural categories for riparian planting zones) represent relativized means based on respective total vegetative percent cover values calculated from transformed data as described in Section 3.2 (above), except where indicated otherwise. Dominant and/or representative species documented in sample plots within each area are listed in decreasing order of frequency and/or percent cover, and additional plant species composition and abundance data for invasive vegetation are presented in Figures 2-10, providing a finer scale of resolution to facilitate strategic vegetation maintenance and eradication efforts targeting this problematic vegetation category. Less frequently occurring species are omitted from these treatments, but a complete list of all plant species encountered in each sampling area during the 2017 vegetation sampling effort, and the associated original (untransformed) absolute mean cover values for each, are provided in Appendix B. The distributions of vegetation sampling plots for each sampled area are depicted in Appendix A, Figures 5-7. Although invasive species encountered in each sampling area are mentioned here for those areas in which they occur, additional treatment of invasive vegetation observed throughout the entire Phase 1 and Phase 2A restoration areas is provided in Section 4.3 below.

Phase 1 – Riverside Ranch Tidal Marsh Restoration Area

Phase 1 Riparian Planting Zones

Replanted Riparian Forest (n = 32)

Total estimated vegetative cover in the Phase 1 project area replanted with woody riparian species was 99.7% (Table 7). Our analysis of the varying contributions of different vegetative structural categories, or vegetative "habits," in this sampling area, however, reflect a low estimated percent cover ($\overline{x}$ = 0.3%) of tree species (Table 8; see also Appendix A, Figures 8-9). Instead, the majority of the vegetation was composed of herbaceous species ($\overline{x}$ = 91.2%), with some shrubs ($\overline{x}$ = 8.2%) (Table 8).

Mean estimated cover of native vegetation in this Phase 1 habitat type was 46.7%, exceeding the minimum success criterion of 30% for the third year of monitoring for this habitat. Dominant native herbaceous species encountered in the Phase 1 replanted riparian forest include *Deschampsia cespitosa* ("tufted hairgrass"), *Hordeum brachyantherum* ("meadow barley"), *Equisetum arvense* ("common horsetail), *Oenanthe sarmentosa* ("water parsley"), *Potentilla anserina* ssp. *pacifica* ("Pacific silverweed"), *Achillea millefolium* ("yarrow"), and

Table 8. Structural Composition of 2017 SRERP Riparian Planting Zone Vegetation. Mean percent cover estimates are in bold and associated 95% confidence intervals follow in parentheses. No specific success criteria exist for vegetative structural categories (H.T. Harvey & Associates with Winzler & Kelly 2012).

SRERP Habitat Sampling Areas	Mean Percent Cover of Vegetation Categories of Interest			
	Total	Herb	Shrub	Tree
Phase 1 – Riverside Ranch Tidal Marsh Restoration Area				
Replanted Riparian Forest (n=32)	**99.7** (97.8, 99.7)	**91.2** (78.2, 96.1)	**8.2** (3.4, 18.1)	**0.3** (0.0, 1.3)
Phase 2 – Salt River Corridor Restoration Area				
Phase 2A (Lower) – Salt River Channel Wetlands				
Active Channel (n=32)	**78.4** (70.6, 78.4)	**75.7** (68.4, 80.9)	**0.2** (0.0, 0.5)	**2.6** (0.9 , 5.7)
Active Bench (n=32)	**88.8** (83.9, 88.8)	**88.0** (83.5, 91.6)	**0.05** (0.0, 0.2)	**0.7** (0.07, 2.0)
Phase 2A (Lower) – Riparian Planting Zones				
Replanted Riparian Forest (n=32)	**99.4** (97.8, 99.4)	**70.0** (61.2, 77.6)	**11.2** (6.8, 17.6)	**18.2** (12.4 , 25.0)
Active Riparian Berm (n=32)	**96.7** (92.8, 96.7)	**87.9** (82.5, 92.1)	**1.9** (0.4, 5.5)	**6.9** (3.2 , 12.5)
Phase 2A (Middle) – Salt River Channel Wetlands				
Active Channel (n=32)	**92.8** (88.1, 92.8)	**90.3** (86.0, 93.6)	**0.8** (0.07 2.2)	**1.8** (0.7 , 3.5)
Active Bench (n=32)	**87.3** (82.8, 87.3)	**85.7** (81.1, 89.8)	**0.3** (0.0, 0.9)	**1.4** (0.6 , 2.6)
Phase 2A (Middle) – Riparian Planting Zones				
Replanted Riparian Forest (n=32)	**95.3** (89.0, 95.3)	**80.4** (71.6, 87.1)	**4.4** (2.1, 7.8)	**10.5** (5.5 , 17.7)
Active Riparian Berm (n=32)	**93.6** (88.4, 93.6)	**88.1** (82.0, 92.4)	**1.7** (0.0, 7.3)	**3.8** (1.8 , 7.5)

Alopecurus geniculatus (“water foxtail”). Native shrub species included *Rubus ursinus* (“California blackberry”), *Lonicera involucrata* ssp. *ledebourii* (“twinberry”), and *Morella californica* (“California wax myrtle”). Young native tree species consisted of *Salix lasiandra* var. *lasiandra* (“Pacific willow”) and *Picea sitchensis* (“Sitka spruce”).

The mean estimated percent cover of non-native non-invasive vegetation for this habitat was 15.8%, approximately equivalent to the final (maximum) success threshold (i.e., ≤15%). The observed species composition of this vegetative category in the Phase 1 replanted riparian forest consists primarily of *Festuca perennis* (“rye grass”), *Plantago lanceolata* (“English plantain”), *Rumex conglomeratus* (“clustered dock”), *Trifolium fragiferum* (“strawberry clover”), *Raphanus sativus* (“radish”), *Rumex crispus* (“curly dock”), and *Taraxacum officinale* (“common dandelion”), though other such species were also encountered less frequently. The sterile “wheatgrass” hybrid (*Elymus* x *Triticum*) was not encountered in this sampling area during vegetation sampling of this habitat component in 2017.

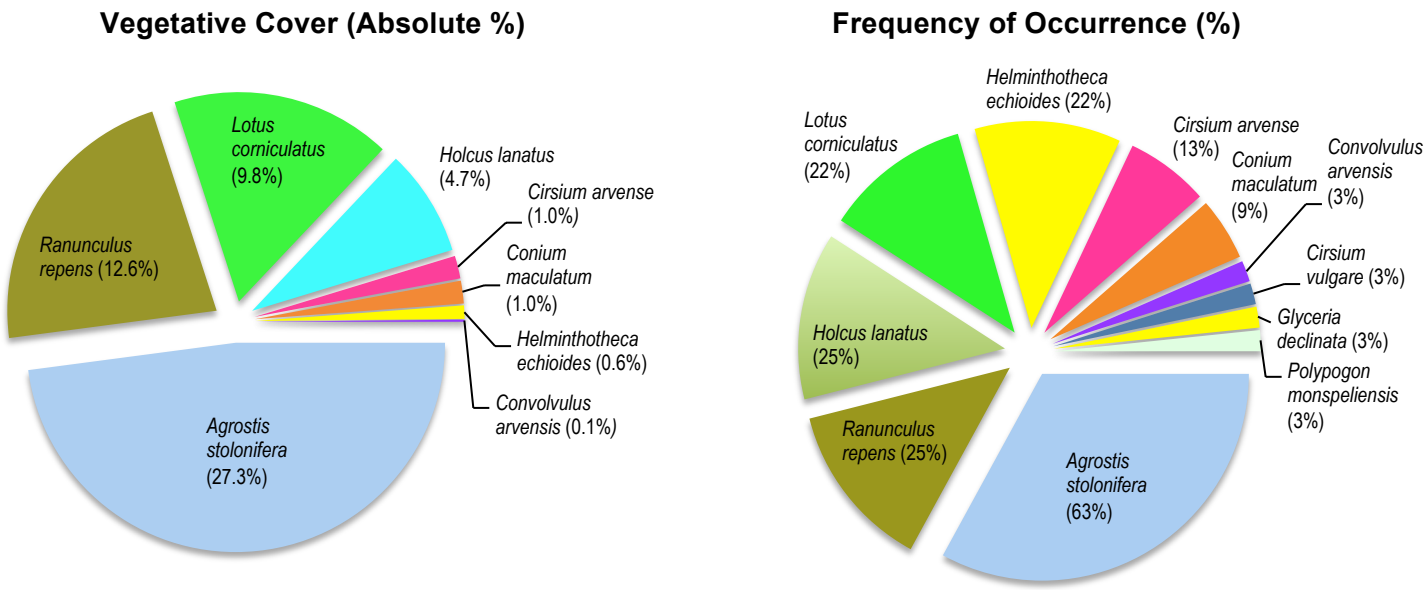

Figure 2. Invasive Vegetation Species Composition. Phase 1 – Riverside Ranch Tidal Marsh Restoration Area: Replanted Riparian Forest. Vegetative cover values indicate original mean estimated *absolute* percent cover of each species observed within sampling plots (n = 32) prior to transformation of data to yield an estimate of the *relative* cover of invasive species ($\overline{x}$ = 37.2%) throughout the sampling area. Frequency of occurrence values reflect the percentage of sampling plots in this sampling area, within which each species was detected.

Mean estimated invasive vegetative relative cover was 37.2%, substantially greater than the final (maximum) success criterion of 5%, and consisted of *Agrostis stolonifera* ("creeping bent"), *Ranunculus repens* ("creeping buttercup"),*Holcus lanatus* ("velvet grass"), *Lotus corniculatus* ("bird's-foot trefoil"), *Helminthotheca echioides* ("bristly ox-tongue"), *Cirsium arvense* ("Canada thistle"), *Conium maculatum* ("poison hemlock"), and *Convolvulus arvensis* ("bindweed") (Figure 2).

Phase 2 – Salt River Corridor Restoration Area

Phase 2A (Lower) Salt River Channel Wetlands

Phase 2A (Lower) Active Channel (n = 32)

The total estimated vegetative cover in the Phase 2A (Lower) active channel was 78.4%. Most of this vegetation was composed of herbaceous species ($\overline{x}$ = 75.7%), though some trees ($\overline{x}$ = 2.6%) and shrubs ($\overline{x}$ = 0.2%) are also becoming established in some locations (Table 8).

Mean estimated cover of native vegetation was 40.2%, exceeding the minimum success criterion of 30% for the third year of monitoring for this Phase 2 habitat. Dominant native herbaceous species documented in this dynamic habitat include

Deschampsia cespitosa (“tufted hairgrass”), *Salicornia pacifica* (“pickleweed”), *Grindelia stricta* var. *platyphylla* (“marsh gumplant”), *Scirpus microcarpus* (“panicled bulrush”), *Potentilla anserina* ssp. *pacifica* (“Pacific silverweed”), *Hordeum brachyantherum* (“meadow barley”), *Bolboschoenus maritimus* ssp. *paludosus* (“saltmarsh bulrush”), *Alopecurus geniculatus* (“water foxtail”), *Triglochin maritima* (“common arrow-grass”), *Juncus bufonius* (“toad rush”), *Equisetum arvense* (“common horsetail”), and *Stachys ajugoides* (“hedge nettle”). Native *Alnus rubra* (“red alder”), *Salix lasiolepis* (“arroyo willow”), *Salix lasiandra* var. *pacifica* (“Pacific willow”), and *Salix sitchensis* (“Sitka willow”) tree saplings were also observed becoming established in this channel habitat, as was the native “California blackberry,” *Rubus ursinus*.

The mean estimated percent cover of non-native non-invasive vegetation in the Phase 2A (Lower) active channel habitat in 2017 was 18.3%, exceeding the final (maximum) success criterion of 15%. Species in this vegetative category observed in the Phase 2A (Lower) active channel sampling area consisted of *Cotula coronopifolia* (“brass-buttons”), *Atriplex prostrata* (“fat-hen”), *Trifolium repens* (“white clover”), *Festuca perennis* (“rye grass”), and *Trifolium fragiferum* (“strawberry clover”), though other such species were also encountered to a lesser degree. The sterile “wheatgrass” hybrid (*Elymus* x *Triticum*) was not encountered in this sampling area during vegetation sampling of this habitat component in 2017.

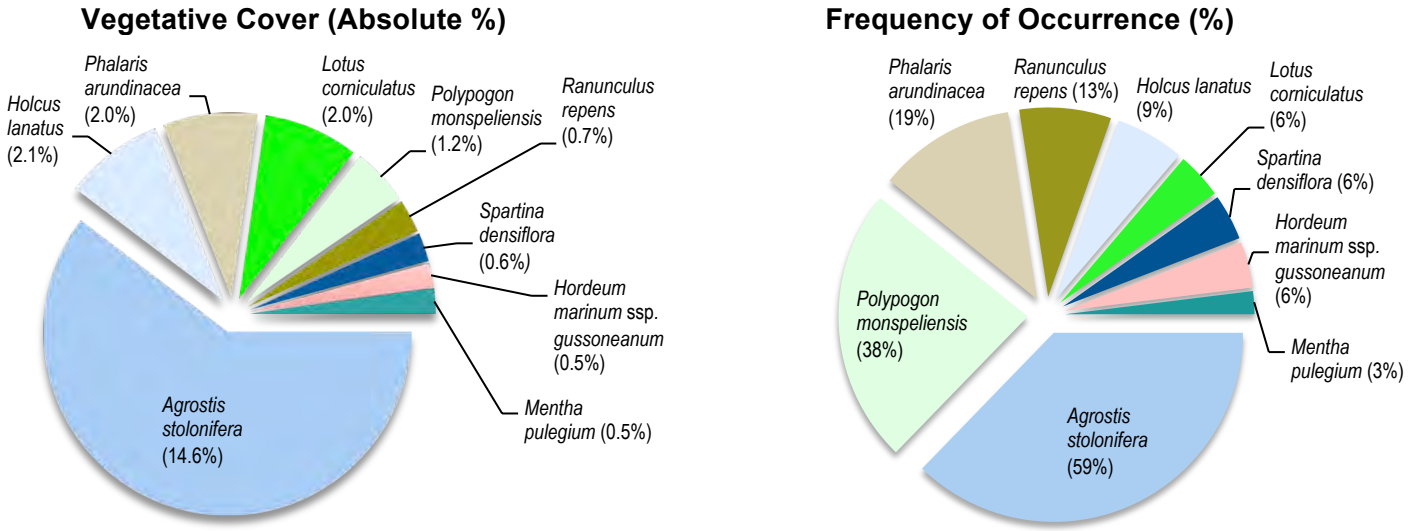

Figure 3. Invasive Vegetation Species Composition. Phase 2A (Lower) – Salt River Corridor Restoration Area: Active Channel. Vegetative cover values indicate original mean estimated *absolute* percent cover of each species observed within sampling plots (n = 32) prior to transformation of data to yield an estimate of the *relative* cover of invasive species ($\overline{x}$ = 20.0%) throughout the sampling area. Frequency of occurrence values reflect the percentage of sampling plots in this sampling area, within which each species was detected.

Mean estimated cover of invasive vegetation approximately doubled over the past year (from 10.2% reported in J.B. Lovelace & Associates 2017) to 20.0%, which is well above the final (maximum) success criterion of 5%. Invasive species observed along the Phase 2A (Lower) active channel edge during the 2017 effort included *Agrostis stolonifera* ("creeping bent"), *Polypogon monspeliensis* ("rabbitfoot grass"), *Phalaris arundinacea* ("reed canary grass"), *Ranunculus repens* ("creeping buttercup"), *Holcus lanatus* ("velvet grass"), *Lotus corniculatus* ("bird's-foot trefoil"), *Spartina densiflora* ("dense-flowered cord grass"), *Hordeum marinum* ssp. *gussoneanum* ("Mediterranean barley"), and *Mentha pulegium* ("pennyroyal") (Figure 3).

Phase 2A (Lower) Active Bench (n = 32)

Estimated mean total vegetative cover in the Phase 2A (Lower) active bench area was 88.8%. The vast majority of this plant community was composed of herbaceous species ($\overline{x}$ = 88.0%), though occasional tree saplings ($\overline{x}$ = 0.7%) and shrubs ($\overline{x}$ = 0.05%) were also encountered.

The mean estimated percent cover of native vegetation in this habitat was 55.9%, exceeding the minimum success criterion of 30% for this third year of monitoring for this area. Native vegetation included both woody and herbaceous components. Dominant native herbaceous plant species in this lower bench habitat consisted of *Deschampsia cespitosa* ("tufted hairgrass"), *Scirpus microcarpus* ("panicled bulrush"), *Bolboschoenus maritimus* ssp. *paludosus* ("saltmarsh bulrush"), *Salicornia pacifica* ("pickleweed"), *Grindelia stricta* var. *platyphylla* ("marsh gumplant"), *Juncus balticus* ssp. *ater* ("Baltic rush"), *Triglochin maritima* ("common arrow-grass"), *Oenanthe sarmentosa* ("water parsley"), *Carex lyngbyei* ("Lyngbye's sedge")[1], *Eleocharis macrostachya* ("spikerush"), and *Hordeum brachyantherum* ("meadow barley"). Native woody vegetation consisted of *Alnus rubra* ("red alder") and *Rubus ursinus* ("California blackberry").

Mean estimated cover of non-native non-invasive vegetation was 16.6%, slightly greater than the final (maximum) success criterion of 15%, and included *Cotula coronopifolia* ("brass-buttons"), *Atriplex prostrata* ("fat-hen"), *Festuca perennis* ("rye grass"), *Rumex conglomeratus* ("clustered dock"), and *Trifolium fragiferum* ("strawberry clover"). The sterile "wheatgrass" hybrid (*Elymus* x *Triticum*) was not encountered in this sampling area during vegetation sampling of this habitat component in 2017.

[1] *Carex lyngbyei* ("Lyngbye's sedge") is listed by the California Native Plant Society (CNPS 2017) as being "fairly endangered in California," but, "more common elsewhere" (i.e., CNPS' rare plant rank of 2B.2).

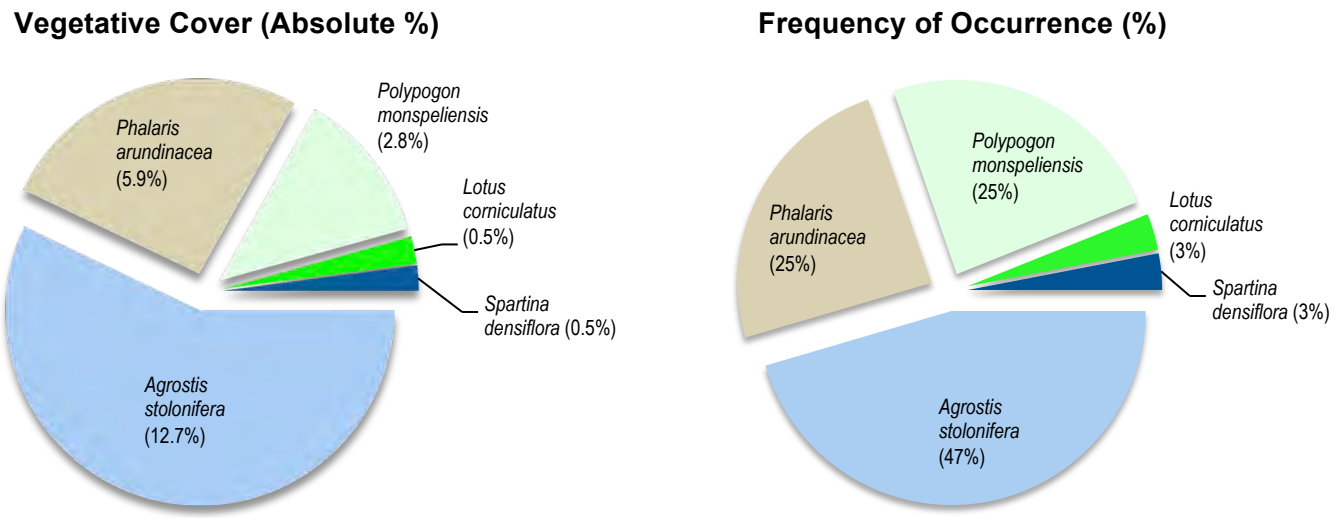

Figure 4. Invasive Vegetation Species Composition. Phase 2A (Lower) – Salt River Corridor Restoration Area: Active Bench. Vegetative cover values indicate original mean estimated *absolute* percent cover of each species observed within sampling plots (n = 32) prior to transformation of data to yield an estimate of the *relative* cover of invasive species ($\overline{x}$ = 16.2%) throughout the sampling area. Frequency of occurrence values reflect the percentage of sampling plots in this sampling area, within which each species was detected.

Mean estimated percent cover of invasive vegetation was 16.2%, exceeding the final (maximum) success criterion of 5%, and consisted primarily of *Agrostis stolonifera* ("creeping bent"), *Phalaris arundinacea* ("reed canary grass"), *Polypogon monspeliensis* ("rabbitfoot grass"), *Lotus corniculatus* ("bird's-foot trefoil"), and *Spartina densiflora* ("dense-flowered cord grass") (Figure 4).

Phase 2A (Lower) Riparian Planting Zones

Phase 2A (Lower) Replanted Riparian Forest (n = 32)

Total vegetative cover in the Phase 2A (Lower) replanted riparian forest sampling area was 99.4%. The bulk of this vegetation was composed of herbaceous species ($\overline{x}$ = 70.0%), though our sampling results also revealed a vigorous and developing riparian forest cohort, with both tree ($\overline{x}$ = 18.2%) and shrub ($\overline{x}$ = 11.2%) components (Table 8; see also Appendix A, Figures 10-11).
Mean estimated cover of native vegetation in this lower Phase 2A restoration area was 62.1%, exceeding the minimum success criterion of 30% for the third year of monitoring for this habitat. Dominant native herbaceous species included *Deschampsia cespitosa* ("tufted hairgrass"), *Scirpus microcarpus* ("panicled bulrush"), *Oenanthe sarmentosa* ("water parsley"), *Juncus balticus* ssp. *ater* ("Baltic rush"), *Potentilla anserina* ("Pacific silverweed"), *Epilobium ciliatum* ssp. *watsonii* ("Watson's willowherb"), *Equisetum arvense* ("common horsetail"), *Cyperus eragrostis* ("nutsedge"), *Grindelia stricta* var. *platyphylla* ("marsh

gumplant"), and *Stachys ajugoides* ("hedgenettle"). Native shrub species consisted of *Rubus ursinus* ("California blackberry"), *Rubus spectabilis* ("salmonberry"), *Rubus parviflorus* ("thimbleberry"), *Lonicera involucrata* ssp. *ledebourii* ("twinberry"), *Rosa californica* ("California rose"), and *Morella californica* ("California wax myrtle"). Establishing native tree species consisted of *Salix lasiolepis* ("arroyo willow"), *Alnus rubra* ("red alder), and *Picea sitchensis* ("Sitka spruce"), *Salix lasiandra* var. lasiandra ("Pacific willow"), and *Salix hookeriana* ("coastal willow").

The estimated mean cover of non-native non-invasive plant species in this habitat was 7.3%, less than the final (maximum) success threshold of 15%. The species composition of this vegetative category encountered here in this lower Phase 2A reach consisted primarily of *Festuca perennis* ("rye grass"), *Rumex conglomeratus* ("clustered dock"), and *Trifolium repens* ("white clover"), though other such species were also encountered to a lesser extent. The sterile "wheatgrass" hybrid (*Elymus* x *Triticum*) was not encountered in this sampling area during vegetation sampling of this habitat component in 2017.

Mean estimated cover of invasive vegetation was 30.0%, substantially greater than the final (maximum) success criterion of 5%, and consisted of *Phalaris arundinacea* ("reed canary grass"), *Agrostis stolonifera* ("creeping bent"),

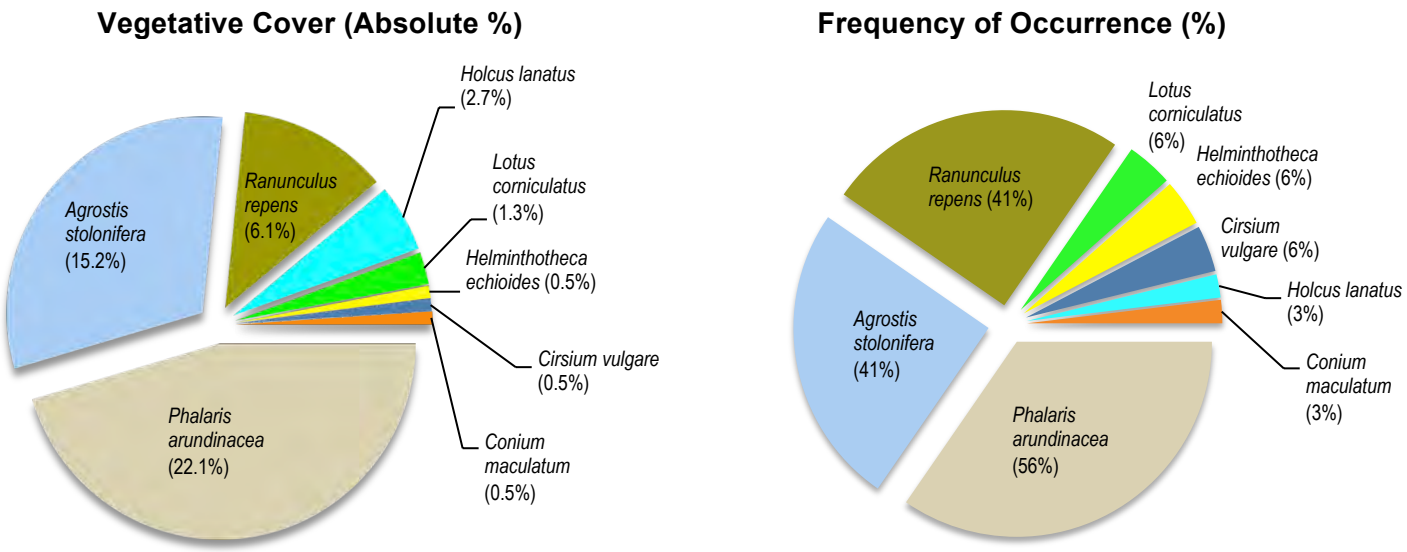

Figure 5. Invasive Vegetation Species Composition. Phase 2A (Lower) – Salt River Corridor Restoration Area: Replanted Riparian Forest. Vegetative cover values indicate original mean estimated *absolute* percent cover of each species observed within sampling plots (n = 32) prior to transformation of data to yield an estimate of the *relative* cover of invasive species ($\overline{x}$ = 30.0%) throughout the sampling area. Frequency of occurrence values reflect the percentage of sampling plots in this sampling area, within which each species was detected.

Ranunculus repens (“creeping buttercup”), *Lotus corniculatus* (“bird’s-foot trefoil”), *Helminthotheca echioides* (“bristly ox-tongue”), and *Cirsium vulgare* (“bull thistle”) (Figure 5).

Phase 2A (Lower) Active Riparian Berm (n = 32)

Estimated total vegetative cover of the Phase 2A (Lower) active riparian berm was 96.7%. The majority of this vegetation was composed of herbaceous species ($\bar{x}$ = 87.9%), though some trees ($\bar{x}$ = 6.9%) and shrubs ($\bar{x}$ = 1.9%) are becoming established in some locations (Table 8; see also Appendix A, Figures 10-11).

The mean estimate of native plant cover was 64.3%, exceeding the minimum success criterion of 30% for this third year of monitoring for this area. Native vegetation was composed primarily of herbaceous taxa such as *Deschampsia cespitosa* (“tufted hairgrass”), *Scirpus microcarpus* (“panicled bulrush”), *Hordeum brachyantherum* (“meadow barley”), *Grindelia stricta* var. *platyphylla* (“marsh gumplant”), *Oenanthe sarmentosa* (“water parsley”), *Juncus balticus* ssp. *ater* (“Baltic rush”), *Potentilla anserina* ssp. *pacifica* (“Pacific silverweed”), *Equisetum arvense* (“common horsetail”), *Juncus effusus* ssp. *pacificus* (“Pacific rush”), and *Stachys ajugoides* (“hedge-nettle”); though woody species such as *Alnus rubra* (“red alder”), *Picea sitchensis* (“Sitka spruce”), *Salix lasiolepis* (“arroyo willow”), *Salix sitchensis* (“Sitka willow”), *Rubus ursinus* (“California blackberry”), *Rubus spectabilis* (“salmonberry”), *Rosa californica* (“California rose”), *Ribes sanguineum* var. *glutinosum* (“red-flowering currant”), and *Physocarpus capitatus* (“Pacific ninebark”) were also observed to be establishing in this area as well.

The mean estimated percent cover of non-native non-invasive vegetation in the active riparian berm was 12.6%, less than the final (maximum) criterion of 15%, and the species composition included *Trifolium repens* (“white clover”), *Festuca perennis* (“rye grass”), *Trifolium fragiferum* (“strawberry clover”), *Plantago major* (“common plantain”), and *Rumex conglomeratus* (“clustered dock”), in addition to other less abundant species. Mean estimated percent cover of the sterile “wheatgrass” hybrid (*Elymus* x *Triticum*) in this habitat feature was 0.01%.

The mean estimated percent cover of invasive plant species observed in this restoration design feature was 19.8%, exceeding the final (maximum) success threshold, and consisted of *Phalaris arundinacea* (“reed canary grass”), *Agrostis stolonifera* (“creeping bent”), *Helminthotheca echioides* (“bristly ox-tongue”), *Lotus corniculatus* (“bird’s-foot trefoil”), *Ranunculus repens* (“creeping buttercup”), and *Holcus lanatus* (“velvet grass”) (Figure 6).

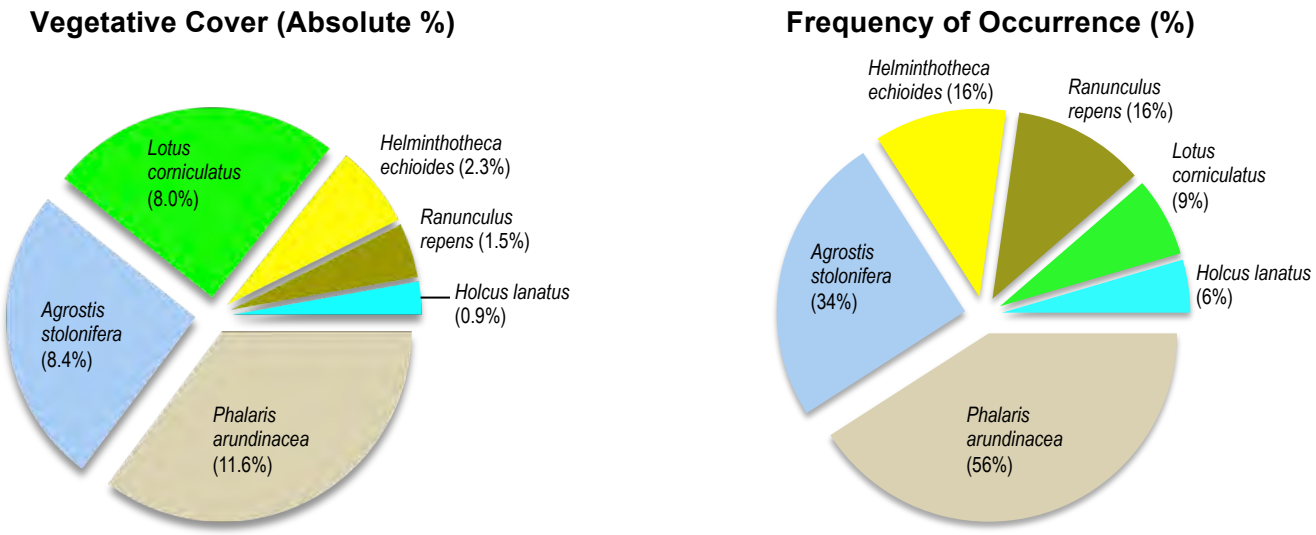

Figure 6. Invasive Vegetation Species Composition. Phase 2A (Lower) – Salt River Corridor Restoration Area: Active Riparian Berm. Vegetative cover values indicate original mean estimated *absolute* percent cover of each species observed within sampling plots (n = 32) prior to transformation of data to yield an estimate of the *relative* cover of invasive species ($\bar{x}$ = 19.8%) throughout the sampling area. Frequency of occurrence values reflect the percentage of sampling plots in this sampling area, within which each species was detected.

Phase 2A (Middle) Salt River Channel Wetlands

Phase 2A (Middle) Active Channel (n = 32)

Total vegetative cover in the Phase 2A (Middle) active channel sampling area was 92.8%. The majority of this vegetation was composed of herbaceous species ($\bar{x}$ = 90.3%), though the nascent establishment of some trees ($\bar{x}$ = 1.8%) and shrubs ($\bar{x}$ = 0.8%) is also occurring (Table 8).

Mean estimated cover of native vegetation was 80.3%, far exceeding the minimum success criterion of 20% for this second year of monitoring for this Phase 2 habitat. Dominant native species observed in this region of the active Salt River channel included *Scirpus microcarpus* (“panicled bulrush”), *Juncus balticus* ssp. *ater* (“Baltic rush”), *Cyperus eragrostis* (“nutsedge”), *Hordeum brachyantherum* (“meadow barley”), *Equisetum arvense* (“common horsetail”), *Potentilla anserina* ssp. *pacifica* (“Pacific silverweed”), *Deschampsia cespitosa* (“tufted hairgrass”), *Juncus effusus* ssp. *pacificus* (“Pacific rush”), *Oenanthe sarmentosa* (“water parsley”), *Schoenoplectus pungens* var. *longispicatus* (“common three-square bulrush”), *Juncus bufonius* (“toad rush”), *Gnaphalium palustre* (“western marsh cudweed”), and *Triglochin maritima* (“common arrow-grass”). Native woody species encountered in the Phase 2A (Middle) active channel sampling effort included *Alnus rubra* (“red alder”), *Salix sitchensis* (“Sitka

willow"), *Salix lasiolepis* ("arroyo willow"), *Salix lasiandra* var. *lasiandra* ("Pacific willow"), *Rubus ursinus* ("California blackberry"), and *Baccharis pilularis* ("coyote bush").

Mean estimated percent cover of non-native non-invasive vegetation in this habitat was 6.1% (less than the final [maximum] success threshold of 15%), and consisted primarily of *Trifolium repens* ("white clover"), *Atriplex prostrata* ("fat-hen"), and *Plantago major* ("common plantain"), though other similarly categorized species were also encountered to a lesser extent. The sterile "wheatgrass" hybrid (*Elymus* x *Triticum*) was not encountered in this sampling area during vegetation sampling of this habitat component in 2017.

Mean estimated cover of invasive vegetation was 6.4% (slightly greater than the final [maximum] success threshold of 5%), and consisted of *Agrostis stolonifera* ("creeping bent"), *Phalaris arundinacea* ("reed canary grass"), *Ranunculus repens* ("creeping buttercup"), and *Helminthotheca echioides* ("bristly ox-tongue") (Figure 7).

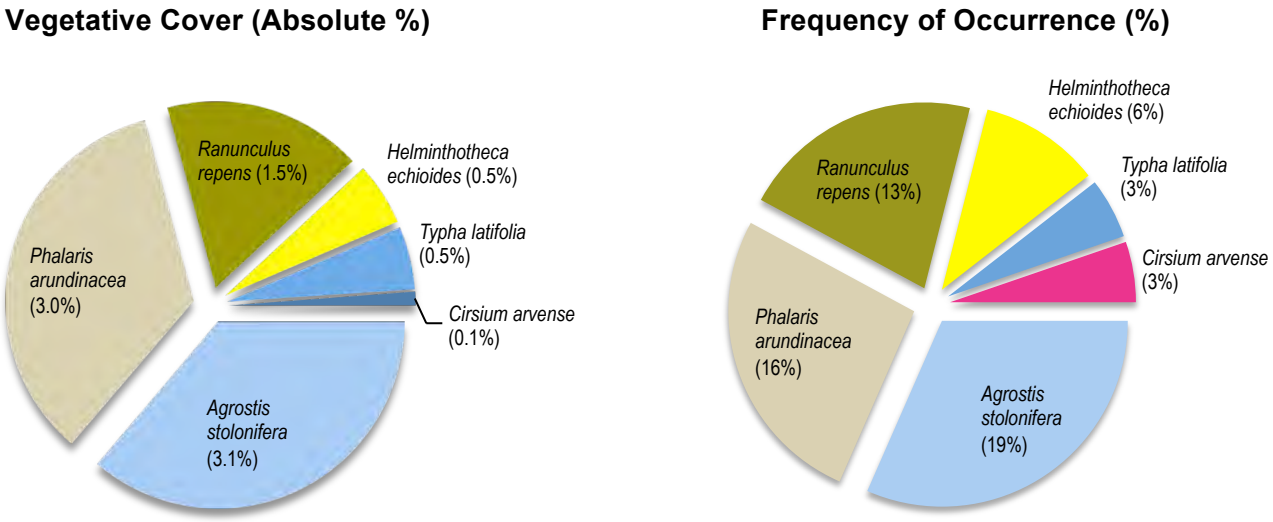

Figure 7. Invasive Vegetation Species Composition. Phase 2A (Middle) – Salt River Corridor Restoration Area: Active Channel. Vegetative cover values indicate original mean estimated *absolute* percent cover of each species observed within sampling plots (n = 32) prior to transformation of data to yield an estimate of the *relative* cover of invasive species ($\overline{x}$ = 6.4%) throughout the sampling area. Frequency of occurrence values reflect the percentage of sampling plots in this sampling area, within which each species was detected.

Phase 2A (Middle) Active Bench (n = 32)

The mean estimated total vegetative cover in the Phase 2A (Middle) active bench area was 87.3%. The majority of this vegetation was composed of herbaceous species ($\bar{x}$ = 85.7%), though some tree ($\bar{x}$ = 1.4%) and shrub ($\bar{x}$ = 0.3%) species were also encountered in some locations (Table 8).

The mean estimated percent cover of native vegetation in this habitat was 59.0%, exceeding the minimum success criterion of 20% for this second year of monitoring for this area. Native species consisted primarily of herbaceous taxa such as *Hordeum brachyantherum* ("meadow barley"), *Deschampsia cespitosa* ("tufted hairgrass"), *Scirpus microcarpus* ("panicled bulrush"), Oenanthe *sarmentosa* ("water parsley"), *Equisetum arvense* ("common horsetail"), *Juncus balticus* ssp. *ater* ("Baltic rush"), *Cyperus eragrostis* ("nutsedge"), *Alopecurus geniculatus* ("water foxtail"), *Potentilla anserina* ("Pacific silverweed"), and *Juncus effusus* ssp. *pacificus* ("Pacific rush"); though young *Salix lasiandra* ssp. *lasiandra* ("Pacific willow"), *Salix lasiolepis* ("arroyo willow"), and *Salix sitchensis* ("Sitka willow") saplings were also observed in this area during the recent sampling effort.

Mean estimated cover of non-native non-invasive vegetation was 16.2% (greater than the final [maximum] success threshold of 15%), and was composed of *Festuca perennis* ("rye grass"), *Trifolium fragiferum* ("strawberry clover"),

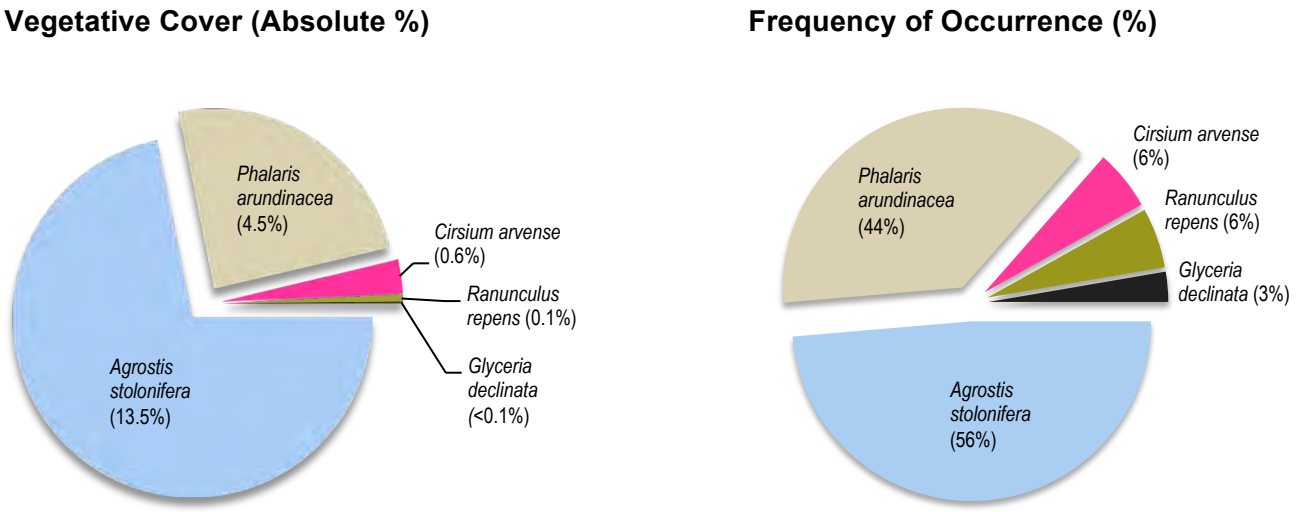

Figure 8. Invasive Vegetation Species Composition. Phase 2A (Middle) – Salt River Corridor Restoration Area: Active Bench. Vegetative cover values indicate original mean estimated *absolute* percent cover of each species observed within sampling plots (n = 32) prior to transformation of data to yield an estimate of the *relative* cover of invasive species ($\bar{x}$ = 12.2%) throughout the sampling area. Frequency of occurrence values reflect the percentage of sampling plots in this sampling area, within which each species was detected.

Trifolium repens (“white clover”), and *Aira caryophyllea* (“silver hair grass”). The sterile “wheatgrass” hybrid (*Elymus* x *Triticum*) was not encountered in this sampling area during vegetation sampling of this habitat component in 2017.

The mean estimated cover of invasive vegetation was 12.2%, exceeding the final [maximum] success threshold of 5%, and consisted primarily of *Agrostis stolonifera* (“creeping bent”), *Phalaris arundinacea* (“reed canary grass”), *Cirsium* arvense (“Canada thistle”), and *Ranunculus repens* (“creeping buttercup”) (Figure 8).

Phase 2A (Middle) Riparian Planting Zones

Phase 2A (Middle) Replanted Riparian Forest (n = 32)

Total vegetative cover in the Phase 2A (Lower) replanted riparian forest was 95.3%. The majority of the vegetation in this sampling area was composed of herbaceous species ($\overline{x}$ = 80.4%), though a developing woody riparian cohort of both tree ($\overline{x}$ = 10.5%) and shrub ($\overline{x}$ = 4.4%) components is also becoming established (Table 8).

Mean estimated cover of native vegetation in this lower Phase 2A restoration area was 42.2%, exceeding the minimum success criterion of 15% for this second year of monitoring for this habitat. Dominant native herbaceous species included *Hordeum brachyantherum* (“meadow barley”), *Oenanthe sarmentosa* (“water parsley”), *Deschampsia cespitosa* (“tufted hairgrass”), *Equisetum arvense* (“common horsetail”), *Elymus glaucus* (“wild rye”), *Scirpus microcarpus* (“panicled bulrush”), *Stachys ajugoides* (“hedgenettle”), *Potentilla anserina* (“Pacific silverweed”), *Cyperus eragrostis* (“nutsedge”), and *Epilobium ciliatum* ssp. *watsonii* (“Watson’s willowherb”). Native shrub species consisted of *Rubus ursinus* (“California blackberry”), *Rubus spectabilis* (“salmonberry”), *Lonicera involucrata* ssp. *ledebourii* (“twinberry”), and *Morella californica* (“California wax myrtle”). Establishing native tree species consisted of *Salix sitchensis* (“Sitka willow”), *Salix lasiolepis* (“arroyo willow”), *Salix lasiandra* var. *lasiandra* (“Pacific willow”), *Salix hookeriana* (“coastal willow”), *Populus trichocarpa* (“black cottonwood”), *Acer macrophyllum* (“big-leaf maple”), *Alnus rubra* (“red alder), and *Sequoia sempervirens* (“coast redwood”).

The estimated mean cover of non-native non-invasive plant species in this habitat was 13.1%, less than the final (maximum) success threshold of 15%. The species composition of this vegetative category encountered here in this lower Phase 2A reach consisted primarily of *Festuca perennis* (“rye grass”), *Trifolium repens* (“white clover”), *Rumex conglomeratus* (“clustered dock”), and *Trifolium fragiferum* (“strawberry clover”), though other such species were also encountered to a lesser extent. The mean estimated percent cover of the sterile “wheatgrass” hybrid (*Elymus* x *Triticum*) in this habitat feature was 0.05%.

Mean estimated cover of invasive vegetation was 40.0%, substantially greater than the final (maximum) success criterion of 5%, and consisted of *Phalaris*

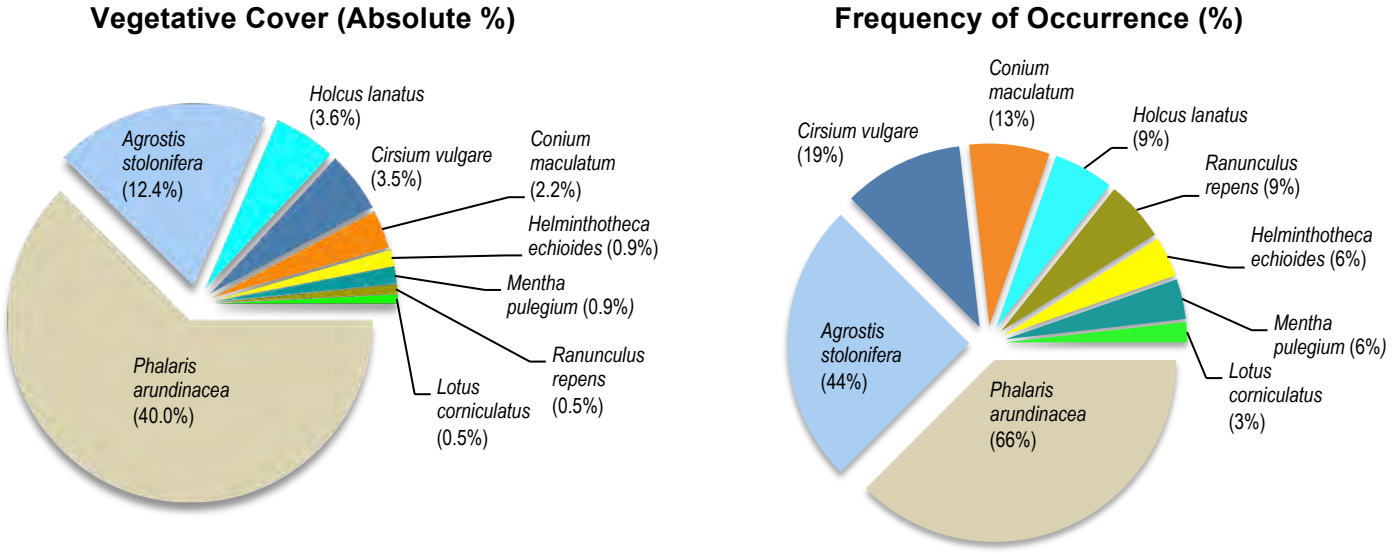

Figure 9. Invasive Vegetation Species Composition. Phase 2A (Middle) – Salt River Corridor Restoration Area: Replanted Riparian Forest. Vegetative cover values indicate original mean estimated *absolute* percent cover of each species observed within sampling plots (n = 32) prior to transformation of data to yield an estimate of the *relative* cover of invasive species ($\bar{x}$ = 40.0%) throughout the sampling area. Frequency of occurrence values reflect the percentage of sampling plots in this sampling area, within which each species was detected.

arundinacea ("reed canary grass"), *Agrostis stolonifera* ("creeping bent"), *Cirsium vulgare* ("bull thistle"), *Conium maculatum* ("poison hemlock"), *Holcus lanatus* ("velvet grass"), *Ranunculus repens* ("creeping buttercup"), *Helminthotheca echioides* ("bristly ox-tongue"), and *Mentha pulegium* ("pennyroyal") (Figure 9).

Phase 2A (Middle) Active Riparian Berm (n = 32)

Estimated total vegetative cover of the Phase 2A (Lower) active riparian berm was 93.6%. Although most of this vegetation was composed of herbaceous species ($\bar{x}$ = 88.1%), some establishing trees ($\bar{x}$ = 3.8%) and shrubs ($\bar{x}$ = 1.7%) were also encountered during recent sampling efforts (Table 8).

The mean estimated cover of native vegetation was 58.3% exceeding the minimum success criterion of 15% for this second year of monitoring for this area. Native vegetation was composed primarily of herbaceous taxa such as *Hordeum brachyantherum* ("meadow barley"), *Equisetum arvense* ("common horsetail"), *Deschampsia cespitosa* ("tufted hairgrass"), *Potentilla anserina* ssp. *pacifica* ("Pacific silverweed"), *Juncus balticus* ssp. *ater* ("Baltic rush"), *Oenanthe sarmentosa* ("water parsley"), *Scirpus microcarpus* ("panicled bulrush"), *Stachys ajugoides* ("hedge-nettle"), *Elymus glaucus* ("wild rye"), *Epilobium ciliatum* ssp. *watsonii* ("Watson's willowherb"), *Juncus effusus* ssp. *pacificus* ("Pacific rush"), *Cyperus eragrostis* ("nutsedge"), and *Gnaphalium palustre* ("western marsh

cudweed"); though woody species such as *Salix sitchensis* ("Sitka willow"), *Populus trichocarpa* ("black cottonwood"), *Alnus rubra* ("red alder"), *Picea sitchensis* ("Sitka spruce"), *Salix lasiolepis* ("arroyo willow"), *Salix lasiandra* var. *lasiandra* ("Pacific willow"), *Sequoia sempervirens* ("coast redwood"), *Morella californica* ("California wax myrtle"), and *Lonicera involucrata* ssp. *ledebourii* ("twinberry") were also observed to be establishing in this area as well.

The mean estimated percent cover of non-native non-invasive vegetation in the active riparian berm was 23.4%, exceeding the final (maximum) criterion of 15%, and the species composition included *Trifolium repens* ("white clover"), *Festuca perennis* ("rye grass"), *Trifolium dubium* ("little hop clover"), *Plantago major* ("common plantain"), *Trifolium fragiferum* ("strawberry clover"), *Hypochaeris radicata* ("hairy cat's-ears"), *Calystegia silvatica* ssp. *disjuncta* ("large bindweed"), and *Rumex conglomeratus* ("clustered dock"), in addition to other less abundant species. Mean estimated percent cover of the sterile "wheatgrass" hybrid (*Elymus* x *Triticum*) in this habitat feature was 0.5%.

Mean estimated cover of invasive plant species observed in this restoration design feature was 11.4% (greater than the final [maximum] success threshold), and consisted of *Phalaris arundinacea* ("reed canary grass"), *Helminthotheca echioides* ("bristly ox-tongue"), *Lotus corniculatus* ("bird's-foot trefoil"), *Ranunculus repens* ("creeping buttercup"), *Agrostis stolonifera* ("creeping bent"), *Cirsium vulgare* ("bull thistle"), and *Mentha pulegium* ("pennyroyal") (Figure 10).

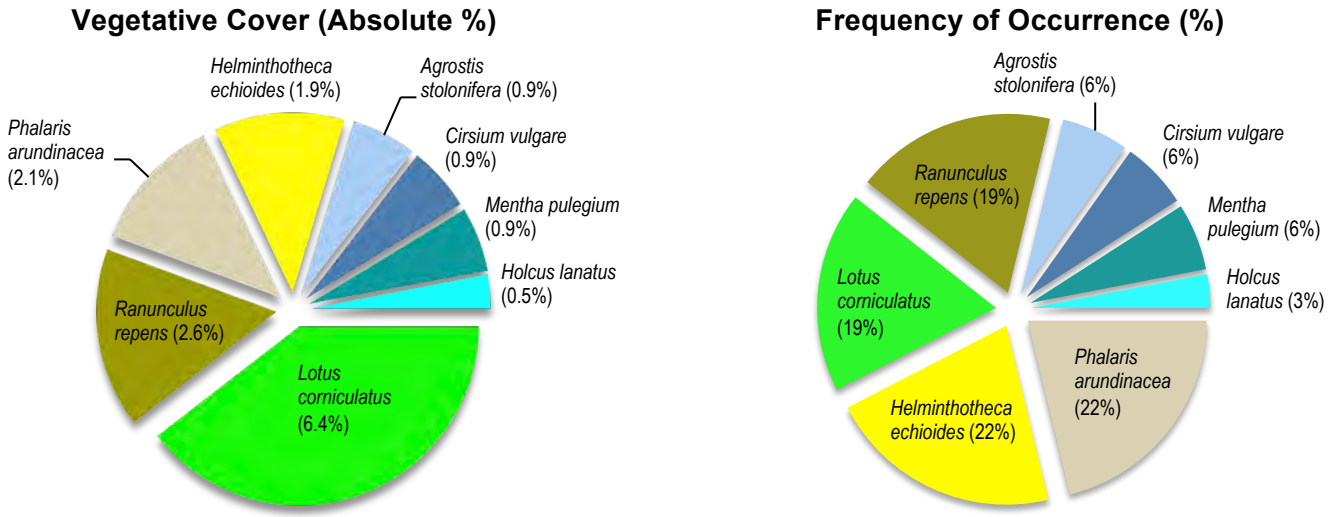

Figure 10. Invasive Vegetation Species Composition. Phase 2A (Middle) – Salt River Corridor Restoration Area: Active Riparian Berm. Vegetative cover values indicate original mean estimated *absolute* percent cover of each species observed within sampling plots (n = 32) prior to transformation of data to yield an estimate of the *relative* cover of invasive species ($\overline{x}$ = 11.4%) throughout the sampling area. Frequency of occurrence values reflect the percentage of sampling plots in this sampling area, within which each species was detected.

4.2.2 Replanted Woody Riparian Vegetation Basal Area Sampling Results

Results from our 2017 basal area sampling efforts reflect increasing vigorous growth and development of replanted woody riparian vegetation (and probably also volunteer recruitment) with increasing distance from the coastline (Table 9; Appendix A, Figures 8-11). Ultimately, we directly sampled ~11% (3.7 acres) of the total combined area (33.2 acres) of the three SRERP habitats addressed during the 2017 endeavor. Projected results for each sampled habitat are provided below and raw basal area measurements (not extrapolated to habitat- and/or phase-wide estimates) are provided in Appendix C.

Phase 1 – Riverside Ranch Tidal Marsh Restoration Area

Replanted Riparian Forest

We sampled (n = 30) approximately 10% (2.2 acres) of the Phase 1 replanted riparian forest habitat (22.7 acres) in 2017. Total projected basal area for this sampling area was 8.94 ft^2, which represents ~18% of the total projected basal area (51.17 ft^2) of all SRERP habitats addressed in this initial basal area sampling effort. The most significant basal area contributions were from *Salix lasiolepis* ("arroyo willow") and *Alnus rubra* ("red alder), with lesser amounts of *Picea sitchensis* ("Sitka spruce"), *Pinus contorta* ("shore pine"), *Salix lasiandra* var. lasiandra ("Pacific willow"), and *Salix hookeriana* ("coastal willow").

Phase 2A (Lower) – Salt River Corridor Restoration Area

Replanted Riparian Forest

In the Phase 2A (Lower) replanted riparian forest sampling area, we sampled (n = 21) approximately 13% (1.03 acres) of the total habitat area (8.05 acres). In contrast to the described results from the counterpart habitat in Phase 1, the projected total basal area for the replanted riparian forest in the Phase 2A (Lower) restoration area was 38.79 ft^2, representing ~76% of the total SRERP projected basal area (51.17 ft^2) in 2017. This is greater than four times the basal area observed in the Riverside Ranch restoration area, despite being only ~35% of the size. The greatest contributions to woody riparian basal area in the Phase 2A (Lower) replanted riparian forest were from *Alnus rubra* ("red alder) and *Salix lasiolepis* ("arroyo willow"), though *Salix hookeriana* ("coastal willow"), *Salix lasiandra* var. lasiandra ("Pacific willow"), *Picea sitchensis* ("Sitka spruce"), and *Salix sitchensis* ("Sitka willow") also contributed to a lesser extent.

Active Riparian Berm

In the active riparian berm habitat of the Phase 2A (Lower) restoration area, we sampled (n = 10) approximately 21% (0.51 acres) of the total habitat area (2.44 acres). The projected basal area for this restoration design feature was 3.44 ft^2, which represents ~7% of the total habitat area (33.2 acres) addressed in 2017. Most of this basal area was attributable to *Alnus rubra* ("red alder), though lesser contributions from *Picea sitchensis* ("Sitka spruce"), *Salix sitchensis* ("Sitka willow"), *Salix lasiandra* var. lasiandra ("Pacific willow"), and *Salix lasiolepis* ("arroyo willow") were also recorded.

Table 9. Summary of 2017 SRERP Replanted Woody Riparian Vegetation Basal Area Sampling Results. Basal area values represent projected totals for each tree species observed in each habitat sampled in 2017.

	(Projected*) Basal Area (ft^2)				
	Phase 1 – Riverside Ranch Tidal Marsh Restoration Area	**Phase 2A (Lower) – Salt River Corridor Restoration Area**			
Tree Species	**Replanted Riparian Forest (22.71 acres) (n = 30)**	**Replanted Riparian Forest (8.05 acres) (n = 21)**	**Active Riparian Berm (2.44 acres) (n = 10)**	**Total Phase 2A (Lower) (10.49 acres)**	**Total§ SRERP (33.2 acres)**
Alnus rubra (red alder)	0.2194	22.2287	3.3896	25.6183	25.8377
Salix lasiolepis (arroyo willow)	8.6172	15.5159	0.0006	15.5165	24.1338
Salix hookeriana (coastal willow)	0.0056	0.4891	0	0.4891	0.4946
Salix lasiandra (Pacific willow)	0.0147	0.3816	0.0027	0.3843	0.3990
Picea sitchensis (Sitka spruce)	0.0671	0.1524	0.0261	0.1785	0.2457
Salix sitchensis (Sitka willow)	0	0.0210	0.0193	0.0403	0.0403
Pinus contorta (shore pine)	0.0171	0	0	0	0.0171
Total	**8.9411**	**38.7887**	**3.4384**	**42.2270**	**51.1682**

* Projected total basal area values were derived from basal-area-per-unit-area-sampled measurements collected during 2017 quantitative vegetation sampling efforts, extrapolated to habitat- and phase-wide estimates based on respective habitat areas (acreages) obtained from current SRERP GIS data.

§ All SRERP restoration areas addressed during the 2017 basal area sampling effort

4.3 Invasive Plant Species Assessment

Results from the 2017 percent cover vegetation sampling effort discussed above provide quantitative estimates (Table 7) of the current abundance of invasive vegetation in SRERP habitats sampled during this most recent effort. Comparisons with results from previous vegetation percent cover sampling efforts for habitats where previous data exist (Figure 2), indicate increasing trends in the abundance of invasive vegetation in all sampled habitats, with the exception of the active bench habitat in the middle Phase 2A restoration reach, where an apparent slight decrease in invasive percent cover occurred between 2016-2017. Although no procedures were applied to test the significance of these "trends," and confidence in them is somewhat limited by the width of the various corresponding confidence intervals and the limited number of monitoring years for which data exist (n = 2, except for Phase 1 – high marsh ecotone and Phase 2A [Lower] – active channel, were n = 3), additional incidental observations made during our 2017 habitat mapping analysis and basal area sampling fieldwork corroborate these trends and indicate similar increases in invasive vegetation in regions of the SRERP project area where percent cover vegetation sampling did not occur in 2017. Recent observations include both increases in the extent and abundance of previously identified invasive plant occurrences (J.B. Lovelace & Associates 2017), as well as the identification of new occurrences, which reflect an increase in the establishment and abundance of invasive vegetation throughout the SRERP restoration area.

These recent observations are described below and the current distribution of invasive vegetation throughout the SRERP area is depicted in Appendix A, Figures 12-16). Where feasible, the distributions of single species were mapped discretely. Where the distributions of multiple co-occurring invasive species overlap, the resulting mosaics are indicated as species "complexes."

4.3.1 Phase 1 – Riverside Ranch Tidal Marsh Restoration Area

Invasive plant species occurrences documented within the Phase 1 restoration area during the 2016 habitat monitoring effort (J.B. Lovelace & Associates 2017) were relocated during our recent 2017 fieldwork, and either continue to persist as described in J.B. Lovelace & Associates (2017) or have increased in abundance and/or extent (Appendix A, Figures 12 & 14). Updated descriptions of invasive species occurrences observed in the Phase 1 restoration area in 2017 follow.

Spartina densiflora (Dense-Flowered Cord Grass)

The spread and establishment of the highly invasive salt marsh species, *Spartina densiflora* ("dense-flowered cord grass") documented throughout the Phase 1 restoration area in the 2014, 2015, and 2016 habitat monitoring efforts (H.T. Harvey & Associates 2014 & 2015; J.B. Lovelace & Associates 2017; respectively), continues. Although focused inspection of Salt Marsh habitat in the Riverside Ranch restoration area was not scheduled to occur in 2017 (Table 1), additional new occurrences of *S. densiflora* were observed incidentally, in a riparian bench swale on the eastern side of the Salt River channel, just south of

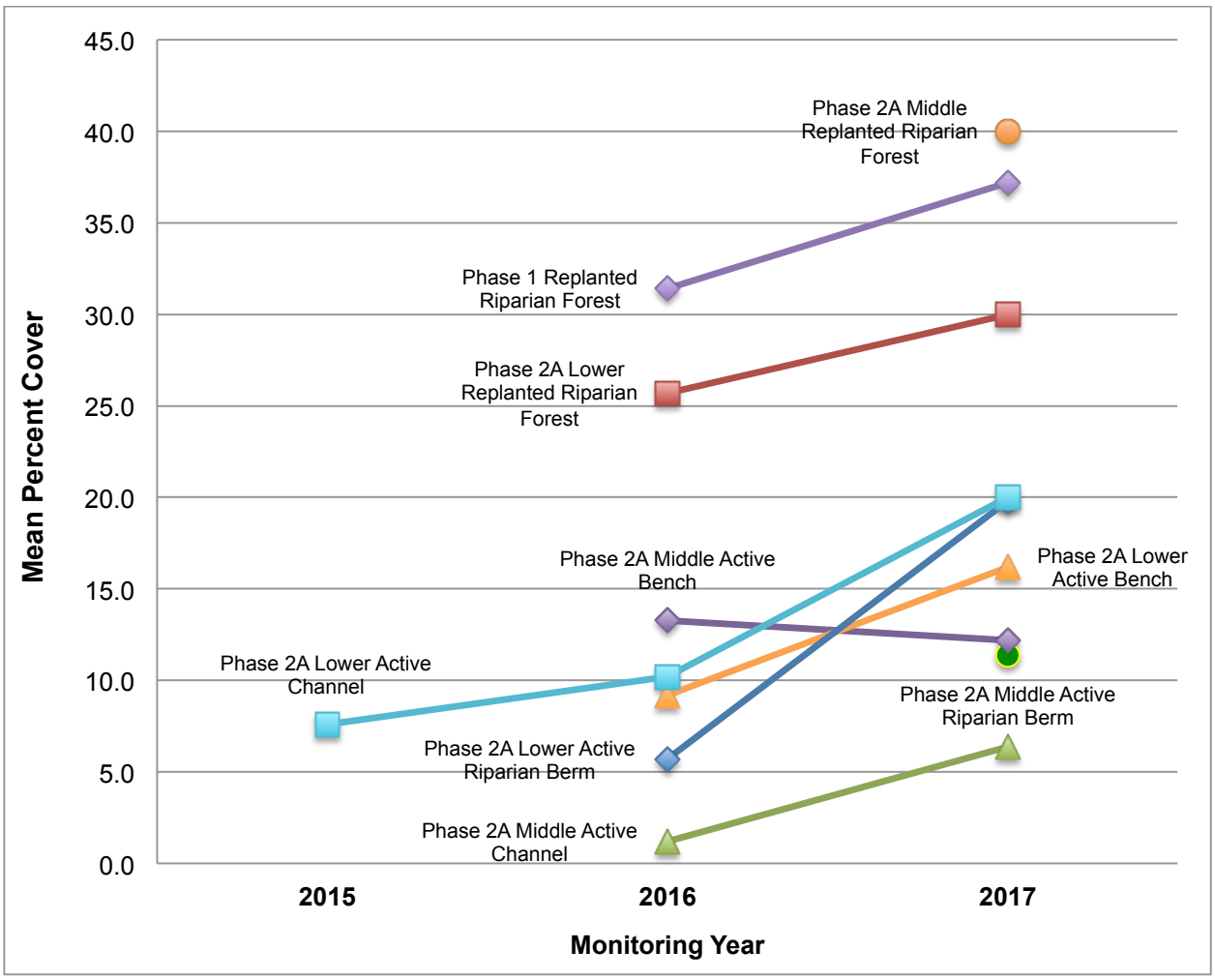

Figure 11. Estimated Mean Percent Cover of Invasive Species (2015-2017). Sources: H.T. Harvey & Associates (2015); J.B. Lovelace & Associates (2017); this current effort.

its confluence with Smith Creek (Appendix A, Figure 12) during the performance of other habitat monitoring tasks. As was described during the previous monitoring efforts (H.T. Harvey & Associates 2014 & 2015; J.B. Lovelace & Associates 2017) this species continues to become well established in tidal wetland and brackish riparian habitats throughout the Riverside Ranch restoration area and presents increasingly significant potential for failure to achieve the relevant restoration success criteria in the Phase 1 project area. This species is listed as "noxious" by the CDFA (2017).

Conium-Helminthotheca-Cirsium Complex

The 2.2-mile-long setback levee constructed along the eastern edge of the Phase 1 restoration area continues to support an extensive complex of invasive plant species (Appendix A, Figure 14), dominated by *Conium maculatum* ("poison hemlock"), *Helminthotheca echioides* ("bristly ox-tongue"), and *Cirsium vulgare* ("bull thistle"). Two additional invasive species, not identified in previous

SRERP monitoring efforts, *Silybum marianum* (“milk thistle”) and *Foeniculum vulgare* (“fennel”), were also found to be associated with this complex, growing adjacent to the access road that extends along the top of this levee. Additional limited occurrences of this invasive species complex still persist along the common boundary between brackish marsh, salt marsh, and riparian habitats on the north side of the “N1” channel, near its confluence with the Salt River.

Cortaderia jubata (Pampas Grass)

Additional, new occurrences of *Cortaderia jubata* (“pampas grass”) were also recently observed, both along the setback levee and in replanted riparian forest habitat near the edge of Salt River channel, south (downwind) of occurrences originally identified on the levee in 2016 (J.B. Lovelace & Associates 2017). These new occurrences of *C. jubata* indicate that previous suggestions (J.B. Lovelace & Associates 2017) about this design feature (i.e., the setback levee) becoming a significant source of invasive species propagules if left unmanaged, may indeed be accurate. *Cortaderia jubata* is listed as “noxious” by the CDFA (2017).

Polypogon monspeliensis (Rabbitfoot Grass)

Additional occurrences of *Polypogon monspeliensis* (“rabbitfoot grass”) were noted in 2017. These consist of a large occurrence that has become established on the tidal plain on the north side of the “S1 Channel,” near its confluence with the Salt River (Appendix A, Figure 14), as well as smaller occurrences at similar elevations in the High Marsh Ecotone habitat along the setback levee, north of those occurrences previously identified in 2016 (J.B. Lovelace & Associates 2017).

Agrostis-Holcus-Ranunculus Complex

Focused inspection of the brackish marsh habitat in the Riverside Ranch restoration area was not scheduled to occur in 2017 (Table 1), but incidental observations of this habitat made during the performance of other habitat monitoring tasks in 2017 revealed little to no deviations in the extent of the co-occurring *Agrostis-Holcus-Ranunculus* Complex from observations made in 2016 (J.B. Lovelace & Associates 2017). This complex forms the majority of the plant community in the brackish marsh wetland habitats within the Phase 1 restoration area, and although some native species also occur in these areas, the species composition is dominated by the invasive *Agrostis stolonifera* (“creeping bent”), *Holcus lanatus* (“velvet grass”), and *Ranunculus repens* (“creeping buttercup”). *Phalaris arundinacea* (“reed canary grass”) also occurs in some portions of brackish marsh habitat, though the extent of this species is indicated independently in Appendix A (Figure 14), with respect to brackish marsh habitat within the restored portions of the Phase 1 restoration area.

Phalaris-Agrostis Complex

An extensive invasive species complex dominated by *Phalaris arundinacea* (“reed canary grass”) and *Agrostis stolonifera* (“creeping bent”) was recently mapped along the northeastern edge of the setback levee in the Phase 1 – Riverside Ranch Tidal Marsh Restoration Area, within a peripheral portion of the

California Department of Fish & Wildlife-owned, “Riverside Ranch” property. Although not included in maps of invasive vegetation during the previous monitoring report (J.B. Lovelace & Associates 2017) due to its exclusion from the SRERP habitat monitoring effort, this complex is indicated in recently updated invasive species maps (Appendix A, Figure 14), as occupies a large portion of the Riverside Ranch property and is immediately adjacent to the restoration area. Though this area is intended to be grazed to provide short-grass Cackling Goose (*Branta hutchinsii*) habitat, this area is not being actively managed due to complications associated with grazing lease negotiations (Hansen pers. com.), allowing the aforementioned invasive species to flourish and persist in this area.

Mixed Herbaceous Invasive Complex

The riparian planting zones in the southern half of the Phase 1 restoration area, along the eastern bank of the Salt River channel, as well as in the adjacent disturbed agricultural habitat along the access road in the vicinity of the historic dairy infrastructure, continue to support some of the most abundant ($\overline{x}$ = 37.2% [cover]) assemblages of invasive vegetation in the SRERP restoration area (Table 7; Figure 2; Appendix A, Figure 14). The invasive species comprising this diverse assemblage consist (in varying proportions) of *Agrostis stolonifera* (“creeping bent”), *Ranunculus repens* (“creeping buttercup”), *Holcus lanatus* (“velvet grass”), *Lotus corniculatus* (“bird’s-foot trefoil”), *Helminthotheca echioides* (“bristly ox-tongue”), *Cirsium arvense* (“Canada thistle”), *Conium maculatum* (“poison hemlock”), *Convolvulus arvensis* (“bindweed”), *Phalaris arundinacea* (“reed canary grass”), *Cirsium vulgare* (“bull thistle”), *Glyceria declinata* (“low manna grass”), *Raphanus sativus* (“radish”), and *Dipsacus fullonum* (“wild teasel”).

Although eventual overstory shading by a developing riparian forest canopy is hoped to provide some degree of passive management of invasive and undesirable vegetation in these habitats, given the protracted period over which this is predicted to occur, substantial production and dispersal of invasive species propagules is likely during such a time period. Failure to implement adequate management efforts during the initial years of establishment and development of invasive species may allow for observed invasive vegetation to outcompete planted vegetation, preventing the ultimate realization of this restoration goal and requiring significant additional effort and expense.

Additional Observed Invasive Plant Species

Additional occurrences of *Rubus armeniacus* (“Himalayan blackberry”), *Cirsium arvense* (“Canada thistle”), *Helminthotheca echioides* (“bristly ox-tongue”), *Phalaris arundinacea* (“reed canary grass”), and *Hordeum marinum* ssp. *gussoneanum* (“Mediterranean barley”) documented during the 2016 habitat monitoring effort (J.B. Lovelace & Associates 2017) were also observed to still persist in the Phase 1 restoration area in 2017 (Appendix A, Figure 14).

Finally, *Parapholis strigosa* (“hairy sickle grass”), a species documented in 2016 (J.B. Lovelace & Associates 2017) in the Salt Marsh *sensu stricto* habitat, was

incidentally observed to be fairly abundant in this same habitat type during recent habitat monitoring efforts in 2017. This species is not described as being invasive in the aforementioned sources for invasive species information (Cal-IPC 2017; CDFA 2017; USDA 2017; Humboldt Weed Management Area 2010; etc.), however in discussions with other local experts it does appear that this non-native species has some potential to be invasive in local coastal habitats (Leppig pers. comm.) and should be considered and mapped appropriately in future SRERP monitoring efforts.

4.3.2 Phase 2A – Salt River Corridor Restoration Area

Invasive plant species previously identified within the Phase 2A restoration area continue to persist as described in J.B. Lovelace & Associates (2017) or have increased in abundance and/or extent (Appendix A, Figures 15-16) since the 2016 habitat monitoring effort, with the exception of the occurrence of *Glyceria declinata* ("low manna grass") in the middle Phase 2A restoration reach. The observed extent of *G. declinata* has noticeably contracted from the previous extent observed during 2016 (Appendix A, Figure 16). This contraction is probably at least partial explanation for the slight decrease in mean estimated percent cover of invasive vegetation in this sampling area between 2016 and 2017 (Figure 2). Increased competition from native vegetation is believed to have contributed to this change.

The majority of the invasive vegetation throughout the Phase 2A – Salt River corridor restoration area continues to consist a mixed assemblage of *Phalaris arundinacea* ("reed canary grass") and *Agrostis stolonifera* ("creeping bent"), which extends throughout the Phase 2A active channel, bench, and riparian berm habitats, as well as along the adjacent woody riparian fringe and in contiguous canopy gaps (Appendix A, Figures 15-16). Though the extent of this complex was not observed to have changed significantly over the past year, both the frequency of occurrence and estimated percent cover for both species increased in every Phase 2 sampling area where data were available for comparison (J.B. Lovelace & Associates 2017; Appendix B, herein), with the lone exception of *Phalaris arundinacea* ("reed canary grass") in the active bench habitat of the Phase 2A (Lower) reach. In this single habitat sampling area, although both frequency and estimated mean percent cover of *Agrostis stolonifera* ("creeping bent") increased, both measures of the abundance of *P. arundinacea* ("reed canary grass") decreased.

The highly invasive *Spartina densiflora* ("dense-flowered cord grass") has increased in abundance and has spread significantly further upstream in the brackish active channel and active bench habitats within the Phase 2A (Lower) restoration area in 2017 (Appendix A, Figure 13). *Polypogon monspeliensis* ("rabbitfoot grass"), and *Hordeum marinum* ssp. *gussoneanum* ("Mediterranean barley") have also spread further upstream in brackish active channel and active bench habitats within the Phase 2A (Lower) reach, with the latter species apparently becoming well established in the vicinity of disturbance by domestic grazing herbivores (i.e., goats) near the adjacent dairy ranch (Appendix A, Figure

15). *Typha latifolia* (“broad-leaved cattail”) has also become more abundant in the brackish active channel and active bench habitats of the Phase 2A (Lower) restoration area over the past year.

Little change was observed in the extent of the Mixed Herbaceous Invasive Complex identified in 2016 (J.B. Lovelace & Associates 2017), although the southern channel edge is eroding and sloughing off into the Salt River at this location, limiting the available surface area for establishment and persistence of vegetation. Despite that fact, the woody, and sometimes invasive *Pittosporum tenuiflorum* (“black matipo”) is escaping from adjacent agricultural landscape, into the Phase 2A (Lower) restoration area at this location (Appendix A, Figure 15). One discrete occurrence of *Helminthotheca echioides* (“bristly ox-tongue”), a component of this complex, was significant enough to be mapped as being distinct during our recent fieldwork.

Other invasive species observed escaping from adjacent developed landscape into the Phase 2A (Lower) restoration area included: *Crocosmia* x*crocosmiiflora* (“montbretia”), an additional occurrence of *Hedera helix* (“English ivy”) on the southern Salt River channel bank just upstream from the Dillon Road bridge, and *Cytisus scoparius* (“Scotch broom”) found becoming established in the narrow strip of replanted riparian forest on the southern side of the Salt River channel, just downstream of the Dillon Road bridge. *Cytisus scoparius* is listed as “noxious” by the CDFA (2017). *Cortaderia jubata* (“pampas grass”) was also observed to have proliferated within the Phase 2A (Lower) active bench and active riparian berm habitats since the 2016 effort, increasing from 2 occurrences in 2016 (J.B. Lovelace & Associates) to 9 occurrences detected during recent fieldwork.

As was recently observed in the lower Phase 2 restoration area, *Typha latifolia* (“broad-leaved cattail”) has also become more abundant in the active channel and active bench habitats of the Phase 2A (Middle) restoration area since the habitat monitoring effort in 2016. In addition to the *Phalaris-Agrostis* Complex previously mentioned as occurring throughout the Phase 2 – Salt River riparian corridor, the *Helminthotheca-Cirsium* Complex identified in the middle Phase 2A restoration area in 2016 (J.B. Lovelace & Associates 2017) was observed again in 2017, though development of the associated woody riparian vegetation may be exerting some competitive influence over the invasive herbaceous species. Finally, in addition to a new, discrete occurrence of *Dipsacus fullonum* (“wild teasel”) that was detected in the active riparian berm habitat, the invasive species, *Senecio jacobaea* (“tansy ragwort”) was also observed in both active riparian berm and replanted riparian forest habitats throughout the Phase 2A (Middle) restoration area during the 2017 habitat monitoring effort. The latter species is also listed as “noxious” by the CDFA (2017).

5.0 Discussion & Recommendations

Results presented herein for the 2017 habitat monitoring effort provide evidence of continued successful progress towards the attainment of some of the long-term restoration goals for the Salt River Ecosystem Restoration Project and reinforce the pressing need for appropriate invasive vegetation management actions to ensure that those goals are ultimately achieved. Roughly one-third of the way into the post-restoration monitoring period (one-fifth for the middle Phase 2A restoration area), all habitats addressed during the 2017 habitat monitoring effort reflect successful achievement of respective success criteria identified for both the extent of habitat area and the abundance (i.e., percent cover) of established native vegetation for the current monitoring year. At the same time, all SRERP habitats in which fieldwork occurred in 2017 currently support non-native and invasive vegetation at levels that will, in most cases, be difficult to reduce to the extent required (H.T. Harvey & Associates with Winzler & Kelly 2012) by respective "final" monitoring years (as early as 2019 for the lower Phase 2A restoration area [Tables 4 & 5]) unless immediate and extensive management efforts are initiated.

While there is good reason to be optimistic that the various final success criteria will ultimately be achieved, we recommend implementing strategies and methods to manage the increasing populations of invasive vegetation throughout the SRERP restoration area as soon as possible, and continuing to perform on-going monitoring efforts throughout the duration of the respective monitoring periods, to track and evaluate relative progress towards achieving the restoration goals of the project.

5.1 Habitat

Our observations confirm the continued development of projected habitats restored thus far, reflecting a favorable trajectory toward their persistence and the eventual realization of targeted conditions envisioned during the planning of the SRERP. No significant changes were observed in the extent of the habitats addressed during 2017, and all continue to exceed *final* minimum area success thresholds in this third monitoring year for Phase 1 and Phase 2A (Lower) restoration areas, and second monitoring year for the Phase 2A (Middle) restoration area. We recommend continued future performance of habitat mapping and area (acreage) analysis in respective monitoring years, consistent with the schedule of monitoring tasks described in the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012).

5.2 Vegetation

The development of vegetation throughout the SRERP restoration area continues to exhibit somewhat conflicting trajectories. Where a comparative analysis of quantitative sampling results across monitoring years (2014-2017) was possible, results from respective sampled areas reflect increasing establishment (i.e., total absolute percent cover) throughout. The same pattern was observed for the native component of the vegetation as well, with the exceptions of the active channel habitat in both Phase 2A (Lower and Middle)

restoration areas and the replanted riparian forest in the lower Phase 2A reach. In these habitats, varying decreases in estimated mean percent cover of native species were observed between 2016-2017. In the latter two habitats, the decreases are so slight, they are considered negligible, and within the context of respective confidence intervals, may simply indicate that the species composition in these habitats is beginning to achieve some degree of relative "stability."

That said, riparian processes and competitive pressures from non-native, invasive, and otherwise undesirable vegetation may be influencing the native vegetation in these habitats, and may partially explain the observed decreases. The active channel habitat is subject to dynamic fluvial and geologic forces (e.g., scouring, bank sloughing, etc.), which can remove vegetation and expose bare soil, both of which can also encourage the transport and establishment of pioneering non-native species (some of which may also prove to be invasive). The highly successful competitive tendencies of *Phalaris arundinacea* ("reed canary grass"), which is extensive throughout these and other habitats within the SRERP restoration area, may also be out-competing other, targeted native species within the restoration area. Despite the aforementioned exceptions in increasing native species abundance, all habitats sampled in 2017, not only satisfied respective success criteria for the current monitoring year, but all continue to be dominated by native plant species. Indeed, the observed establishment and expansion of *Carex lyngbyei* ("Lyngbye's sedge"), a rare native plant species of elevated conservation priority (CNPS 2017), into the lower Phase 2A brackish active channel and brackish active bench habitats in 2017 was a noteworthy and encouraging discovery.

Some disturbance to developing vegetation from domestic herbivores (i.e., cattle and goats) entering the restoration area from adjacent properties continues to occur in both the lower and middle reaches of the Phase 2A Salt River Corridor restoration area, though disturbances observed in 2017 appeared to be less impactful than those witnessed in 2016. Despite this apparent decrease between 2016-2017, livestock continue to have the potential to preclude the realization of final vegetation-related success criteria throughout the SRERP restoration area if allowed access. Effective livestock management practices and maintenance of perimeter fencing around private agricultural properties adjacent to the restoration area will continue to help prevent impacts to vegetation and water quality due to these domestic herbivores.

As of the 2017 habitat monitoring effort, the re-establishment of woody riparian vegetation appears to have been most successful in the Salt River Corridor restoration area (Phase 2A). In this region of the restoration area, quantitative percent cover data for 2016 (J.B. Lovelace & Associates 2017) and 2017, and basal area sampling results from 2017, all provide evidence of increasing abundance and structural development of native riparian trees and shrubs. The most well represented species in these areas are *Alnus rubra* ("red alder") and *Salix lasiolepis* ("arroyo willow"), followed by differing proportions of *Picea*

sitchensis (“Sitka spruce”) and other native willow species (*Salix* spp.), varying with restored habitat type. Our 2017 data, coupled with incidental field observations, also reflect limited nascent establishment of woody riparian vegetation in both active channel and active bench habitats (i.e., “Salt River Channel Wetlands”) throughout both partitions of the Phase 2A restoration area. While the majority of the riparian vegetation encountered in the Phase 2A restoration area is the result of extensive revegetation efforts following restoration habitat modification, it was also apparent that volunteer recruitment from *in situ* propagule sources is occurring and contributing to our results.

In contrast, the establishment and structural development of woody riparian vegetation in the Phase 1 – Riverside Ranch Tidal Marsh restoration area is both limited and variable. Vegetation percent cover sampling data from 2016 (J.B. Lovelace & Associates 2017) and 2017 do reflect an increase of 18% in the shrub component (primarily, *Rubus ursinus* [“California blackberry”]) over the past year, but also appear to indicate that the already limited abundance (i.e., percent cover) of trees decreased in this habitat during the same time period. Some young tree sapling mortality was documented in 2016 (J.B. Lovelace & Associates 2017), and both mortality and poor vigor were also observed in some regions of the Phase 1 replanted riparian forest more recently (pers. obs.).

Much of the replanted woody riparian vegetation in this habitat appears to be “stunted” and growing relatively slowly. Although proximity to the coastline (a surrogate for increased exposure to onshore winds and inclement weather, etc.) may be slowing the growth and development of these individuals somewhat, our observations of mortality and stunted growth also usually coincided with observations of dry and compacted surface soil, with (sometimes deep) cracking also occurring. In other regions of the Phase 1 replanted riparian forest, where increased survivorship and taller and more vigorous replanted individuals were encountered, surface soil conditions were generally observed to be more mesic, such as near the Salt River channel, or near transitional zones with adjacent brackish marsh habitats. The most abundant species encountered during basal area sampling of this habitat was, by an order of magnitude, *Salix lasiolepis* (“arroyo willow”). Lesser amounts of *Alnus rubra* (“red alder”), *Picea sitchensis* (“Sitka spruce”), *Salix lasiandra* var. *lasiandra* (“Pacific willow”), *Pinus contorta* (“shore pine”) and *Salix hookeriana* (“coastal willow”) were also documented.

Despite these observations of limited establishment and development, other factors are probably also contributing to what is believed by this author to be a somewhat artificially inflated decrease in the abundance of this vegetation type in this habitat. Given the highly variable response of the woody vegetation within this relatively expansive habitat area, we revisited our power analyses of the sample date from this habitat with respect to structural categories (i.e., proportion of herbaceous, shrub, and tree species), and confirmed that our sample size was indeed sufficient to account for within-habitat variability. However, the aforementioned “stunted” growth and short height (<4.5 feet tall) limits the

contributions of aerial cover of such individuals to collected percent cover data, and precludes many extant individuals from being included in the basal area sampling effort as well. For these reasons, some of the individuals that do still persist in this habitat are not yet of sufficient stature to be reflected in the results of associated quantitative sampling efforts.

It is anticipated that (assuming all other factors remain constant) future growth and development of this vegetation will result in it becoming more well-represented in quantitative sampling efforts. However, if an obvious increase in the abundance and development of woody riparian vegetation in the Phase 1 restoration area is not observed in the subsequent quantitative sampling efforts in this habitat (2019), replanting may become necessary, particularly as the riparian habitats in the Riverside Ranch Tidal Marsh restoration area are less likely to be as well subsidized by nearby propagule sources as in the Phase 2A restoration area (which are likely bolstering percent cover and basal area measurements of woody species in the latter).

5.2.1 Recommended Sample Size

We recommend continued quantitative vegetation sampling in subsequent monitoring years, as specified in the schedule of monitoring tasks described in the HMMP, using the same sample size (n) of 32 in the subsequent vegetation percent cover sampling effort. This sample size appears to adequately address the variability in the vegetation encountered thus far in the 2016 and 2017 quantitative sampling efforts, both based on assumptions proposed in the HMMP (H.T. Harvey & Associates with Winzler & Kelly 2012) as well as when applying a common "burden of proof" (i.e., Cohen's [1988] "medium" effect size, as described in J.B. Lovelace & Associates 2017) and more stringent level of confidence (i.e., 95%). It is important to recognize, however, that our suggested sample size is a "starting point," and its adequacy to address variability in future data sets should continue to be assessed retrospectively, during each habitat monitoring endeavor.

5.3 Invasive Plant Species

Invasive plant species are becoming more diverse and more abundant throughout the SRERP restoration area. Combined abundance (i.e., estimated mean percent cover) of invasive plant species has increased by at least 56% throughout the combined (sampled) Phase 1 and Phase 2A restoration areas between 2016-2017, and incidental observations made during recent 2017 fieldwork confirm the continued spread and establishment of invasive species elsewhere, in un-sampled portions of the project area as well. Included among these are two noxious (CDFA 2017) plant species reported in previous SRERP monitoring efforts (H.T. Harvey & Associates 2014 & 2015; J.B. Lovelace & Associates): *Spartina densiflora* ("dense-flowered cord grass") and *Cortaderia jubata* ("pampas grass"), which were both observed to have increased in distribution and abundance in both the Phase 1 and Phase 2A restoration areas between 2016-2017. Also detected in 2017 were two additional noxious (CDFA 2017) plants: *Cytisus scoparius* ("Scotch broom") and *Senecio jacobaea* ("tansy

ragwort"). These latter two were observed becoming established in the Phase 2A – Salt River Corridor restoration area.

As discussed previously (J.B. Lovelace & Associates 2017; this document), invasive and otherwise undesirable plant species pose real threats to the near- and long-term success of the Salt River Ecosystem Project given the extent to which such unfavorable vegetation continues to become established, particularly in light of the reported increasing trends in the establishment and development of such vegetation. To address this threat, we continue to recommend that immediate and aggressive invasive vegetation management efforts be initiated and repeated as necessary until future monitoring results demonstrate a sustained decreasing trend in the observed extent and abundance of invasive species throughout the SRERP restoration area to a level that will meet established respective success criteria. Such efforts should prioritize those species identified and discussed in Section 4.3. We also recommend continuing to conduct annual assessments to evaluate both the extent of invasive vegetation throughout the SRERP project area and the effectiveness of applied invasive species management efforts.

Significant off-site source populations of non-native and invasive species occur within the vicinity of the SRERP restoration area, and will continue to complicate non-native and invasive vegetation management efforts at the site through continued contribution of propagules unless these occurrences are also managed effectively. The most obvious of these include an extensive occurrence of *Spartina densiflora* ("dense-flowered cord grass") on the western bank of the lower Salt River channel that is part of a larger population found throughout the Eel River estuary (Grazul & Rowland 2011), and the large occurrence of the *Agrostis-Phalaris* Complex, which extends along the northeastern edge of the setback levee in the Phase 1 – Riverside Ranch Tidal Marsh Restoration Area.

The rate of plant reproduction is often exponential, particularly for successfully invasive "pioneering" species, and many reproduce both by sexual (e.g., seeds, etc.) and asexual methods (e.g., spreading by rhizomes, fragmentation, clonal reproduction, etc.). With every successful reproductive cycle, the invasive plant population potential increases by orders of magnitude. Coinciding with such increases, a proportionate level of effort and expense are required to adequately address such invasive vegetation.

For these reasons, sufficient invasive species management responses should be initiated as early as possible following detection, and should be appropriately implemented to manage the species being addressed. In order to be successful, management actions typically need to be repeated (i.e., multiple times each year, for successive years), sustained, and monitored to ensure that they are effective. Ill-conceived or incomplete attempts are frequently ineffective and ultimately do not result in a reduced need for continued efforts. Most often, early and

comprehensive responses result in more effective outcomes at reduced long-term expense to land managers, despite the extent of costs initially.

Where substantial occurrences of invasive species exist within the SRERP restoration area, efforts should continue despite the reduction and/or cessation of on-site propagule production, as *in situ* seed bank material continues to emerge and propagules from external sources arrive and establish. It is unlikely that all latent invasive species propagules in the existing seed bank will be exhausted by the end of the respective 10-year monitoring periods. However, with sustained and dedicated effort, invasive vegetation development, flower production, seed maturation, and subsequent dispersal can be greatly reduced to minimize both the establishment of new individuals and minimize further contributions to the seed bank at the site and in the surrounding landscape. Indeed, however much progress is made towards successful eradication of invasive vegetation in the Phase 1 and Phase 2A portions of the SRERP restoration area will likely ultimately translate into a reduced need (and expense) of future invasive vegetation management attention in upstream regions of the SRERP restoration area.

With continued time and the reduction in significant (restoration-related) soil disturbance events, there will also be fewer favorable opportunities for invasive seed germination and establishment. This reduction in disturbance regimes that favor invasive plant establishment, coupled with dedicated invasive species management efforts should contribute to reducing invasive species abundance throughout the SRERP area to below the final maximum success thresholds. The earliest "final" assessment periods for invasive vegetation in the SRERP come to bear in 2019 and 2020, in the Phase 2A (Lower) and (Middle) restoration areas (respectively). Given the amount of effort and time required to implement management strategies and gauge the resulting effects, such efforts should be initiated as soon as possible in order to achieve the desired results within the required time periods.

Effective invasive species management efforts require proper planning and must address various seasonal considerations. The typical phenology and reproductive biology for each targeted species should be evaluated to identify the best time(s) of year to implement appropriate management methods, as well as the number of repetitions during the species' development that management tasks should be performed to produce the desired results. Planning for management efforts should also take into consideration their potential impacts on other associated sensitive biological resources.

Invasive species management efforts should target specific species and minimize impacts to co-occurring native vegetation. Care should be taken in areas where special status plant species are known (i.e., *Carex lyngbyei*, "Lyngbye's sedge"), or have the potential (e.g., *Castilleja ambigua* ssp.

humboldtiensis, “Humboldt Bay owl’s-clover;” etc.), to occur in order to avoid causing adverse impacts to such species as a result of eradication efforts.

Invasive species management efforts should also incorporate a strategy to avoid causing adverse impacts to breeding birds. There is often substantial overlap between the optimum timing for invasive vegetation management efforts and the breeding season of resident and migratory bird species. Included among these are species with protective conservation status, for which suitable breeding habitat exists within the SRERP restoration area (pers. obs.). Appropriate planning can help minimize and/or avoid prevent invasive vegetation management-related impacts to breeding birds.

Non-native non-invasive vegetation also appears to present some challenge to eventual attainment of respective final success thresholds within some sampled areas. Consistent with the rationale described above, significant ground disturbance associated with vegetation management efforts would likely favor the establishment of invasive species. Such actions should, therefore, be avoided if possible during management of invasive and non-native non-invasive plant species. Ideally, the application of species-specific manual management methods (e.g., mowing, weed-whacking, etc.) would encourage native vegetation to outcompete non-native non-invasive vegetation to the extent that respective success thresholds are met. Continued sampling in respective habitats should be carried out as scheduled to assess the condition of this category of vegetation. Should it appear that success thresholds will not be met, supplemental planting of native species should also be considered.

5.4 Seasonal Considerations

Finally, due to a combination of logistical considerations, the floristically-sensitive portion of the 2017 fieldwork was performed comparatively late (August) for what is generally considered to be the “floristically appropriate” season for the region. Conducting botanical fieldwork outside of (or near the limits of) seasonally appropriate periods presents the risk of failing to accurately measure important vegetative variables of interest (e.g., percent cover, etc.) and/or of collecting data that, when compared across years, may provide inaccurate conclusions if data were collected during different periods within respective years. Indeed, performing fieldwork “too early” or “too late” may even result in the failure to detect some species altogether. Although complications may arise from comparisons of data collected during different timeframes, future habitat monitoring efforts for the SRERP should be conducted earlier in the floristic season (e.g., May-July), which will necessitate earlier initiation of solicitations to qualified entities for such work to be performed.

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Appendix A

Salt River Ecosystem Restoration Project Figures

Figure 1. SRERP Projected Habitat Types

Figure 2. SRERP Phase 1 – Riverside Ranch Tidal Marsh Restoration Area Habitats

Figure 3. SRERP Phase 2A (Lower) – Salt River Corridor Restoration Area Habitats

Figure 4. SRERP Phase 2A (Middle) – Salt River Corridor Restoration Area Habitats

Figure 5. SRERP Phase 1 – Riverside Ranch Tidal Marsh Restoration Area Quantitative Vegetation Sampling Plots

Figure 6. SRERP Phase 2A (Lower) – Salt River Corridor Restoration Area Quantitative Vegetation Sampling Plots

Figure 7. SRERP Phase 2A (Middle) – Salt River Corridor Restoration Area Quantitative Vegetation Sampling Plots

Figure 8. SRERP Phase 1 – Riverside Ranch Tidal Marsh Restoration Area (North) Replanted Woody Riparian Vegetation Basal Area Sampling Plots

Figure 9. SRERP Phase 1 – Riverside Ranch Tidal Marsh Restoration Area (South) Replanted Woody Riparian Vegetation Basal Area Sampling Plots

Figure 10. SRERP Phase 2A (Lower) – Salt River Corridor Restoration Area (West) Replanted Woody Riparian Vegetation Basal Area Sampling Plots

Figure 11. SRERP Phase 2A (Lower) – Salt River Corridor Restoration Area (East) Replanted Woody Riparian Vegetation Basal Area Sampling Plots

Figure 12. SRERP Phase 1 – Riverside Ranch Tidal Marsh Restoration Area Invasive *Spartina densiflora* (“dense-flowered cord grass”)

Figure 13. SRERP Phase 2A (Lower) – Salt River Corridor Restoration Area Invasive *Spartina densiflora* (“dense-flowered cord grass”)

Figure 14. SRERP Phase 1 – Riverside Ranch Tidal Marsh Restoration Area Invasive Plant Species

Figure 15. SRERP Phase 2A (Lower) – Salt River Corridor Restoration Area Invasive Plant Species

Figure 16. SRERP Phase 2A (Middle) – Salt River Corridor Restoration Area Invasive Plant Species

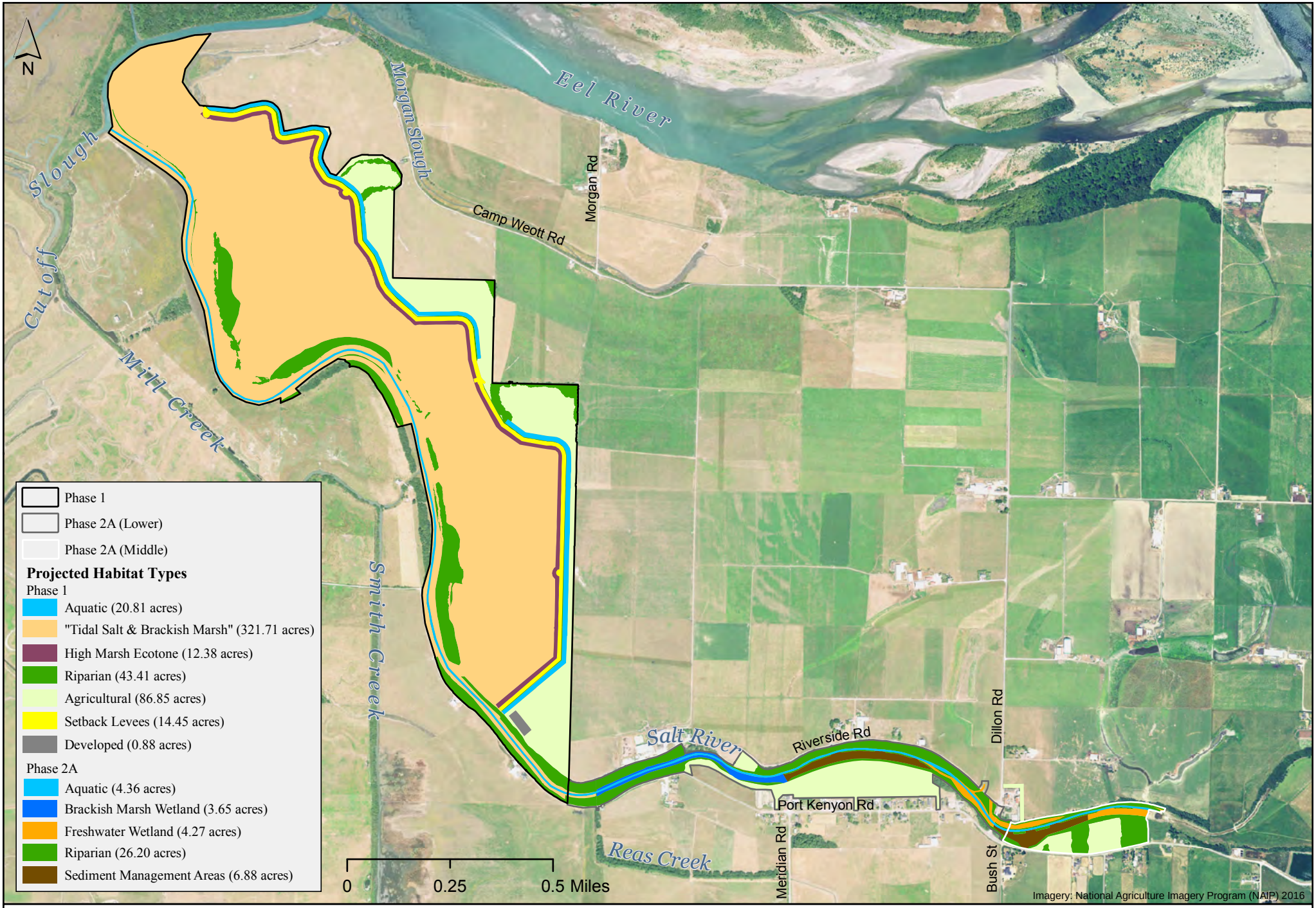

Figure 1. SRERP Projected Habitat Types (Adapted From: H.T. Harvey & Associates and Winzler & Kelly 2012)

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Salt River Ecosystem Restoration Project

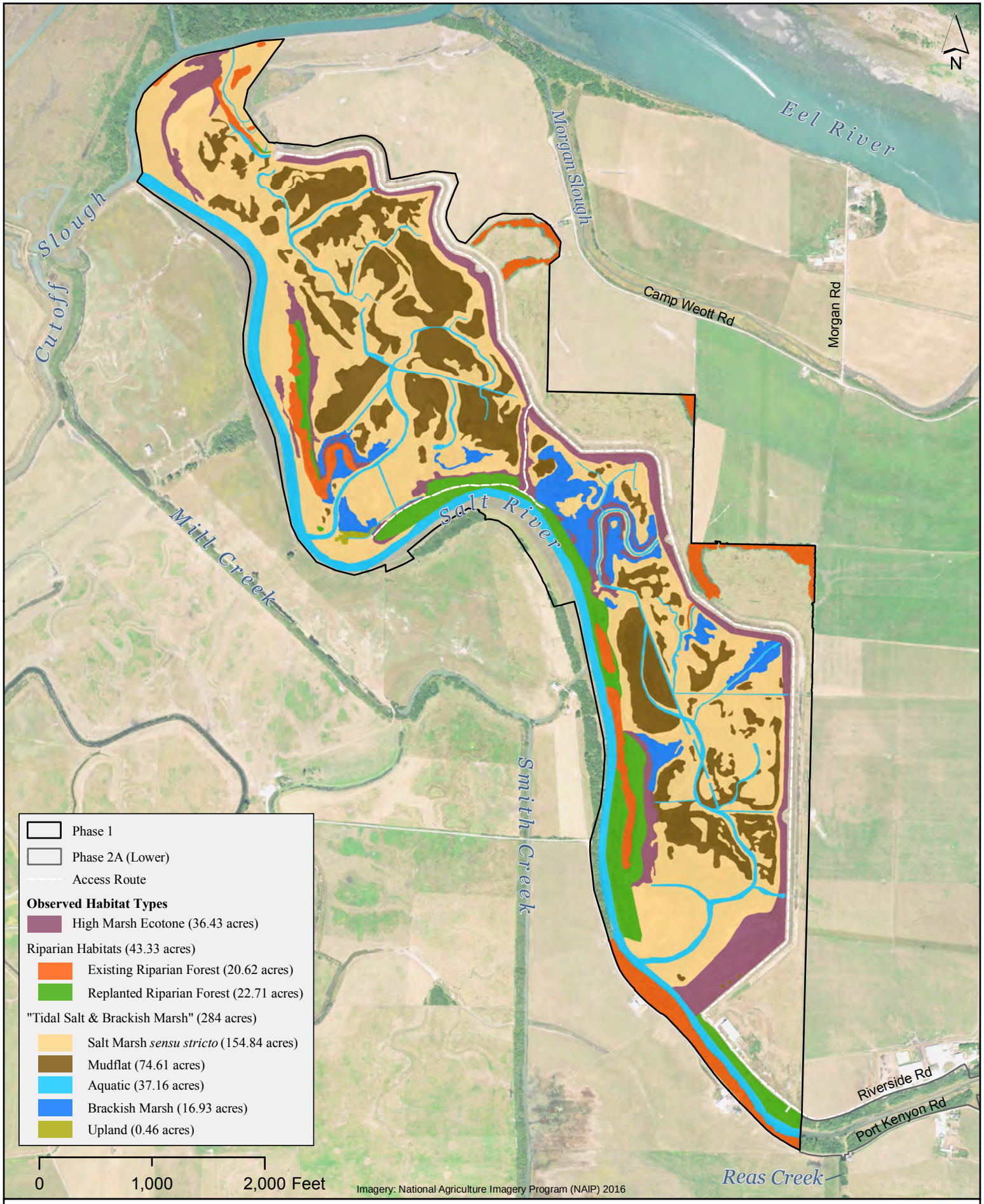

Figure 2. SRERP Phase 1 - Riverside Ranch Tidal Marsh Restoration Area Habitats

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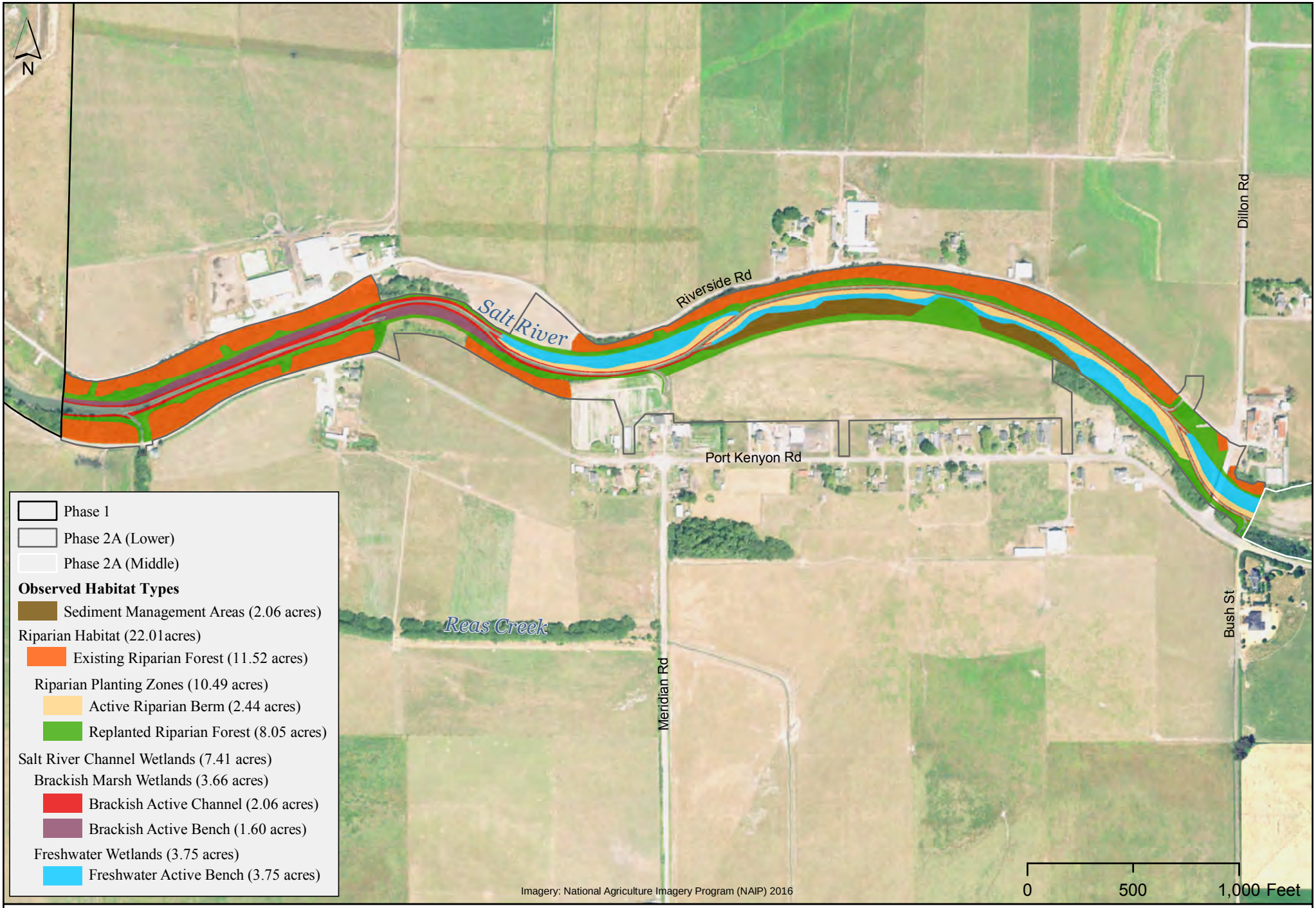

Figure 3. SRERP Phase 2A (Lower) - Salt River Corridor Restoration Area Habitats

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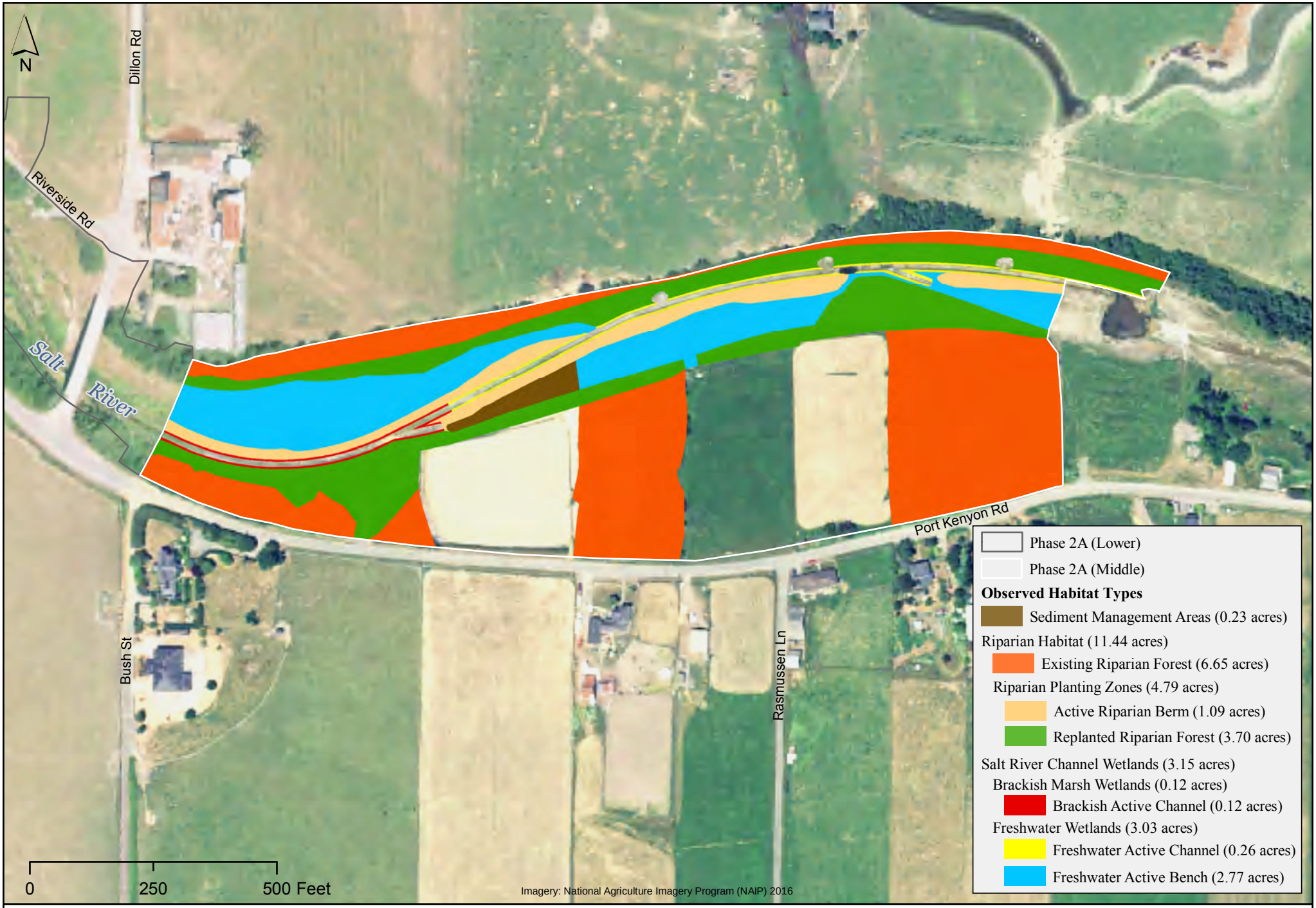

Figure 4. SRERP Phase 2A (Middle) – Salt River Corridor Restoration Area Habitats

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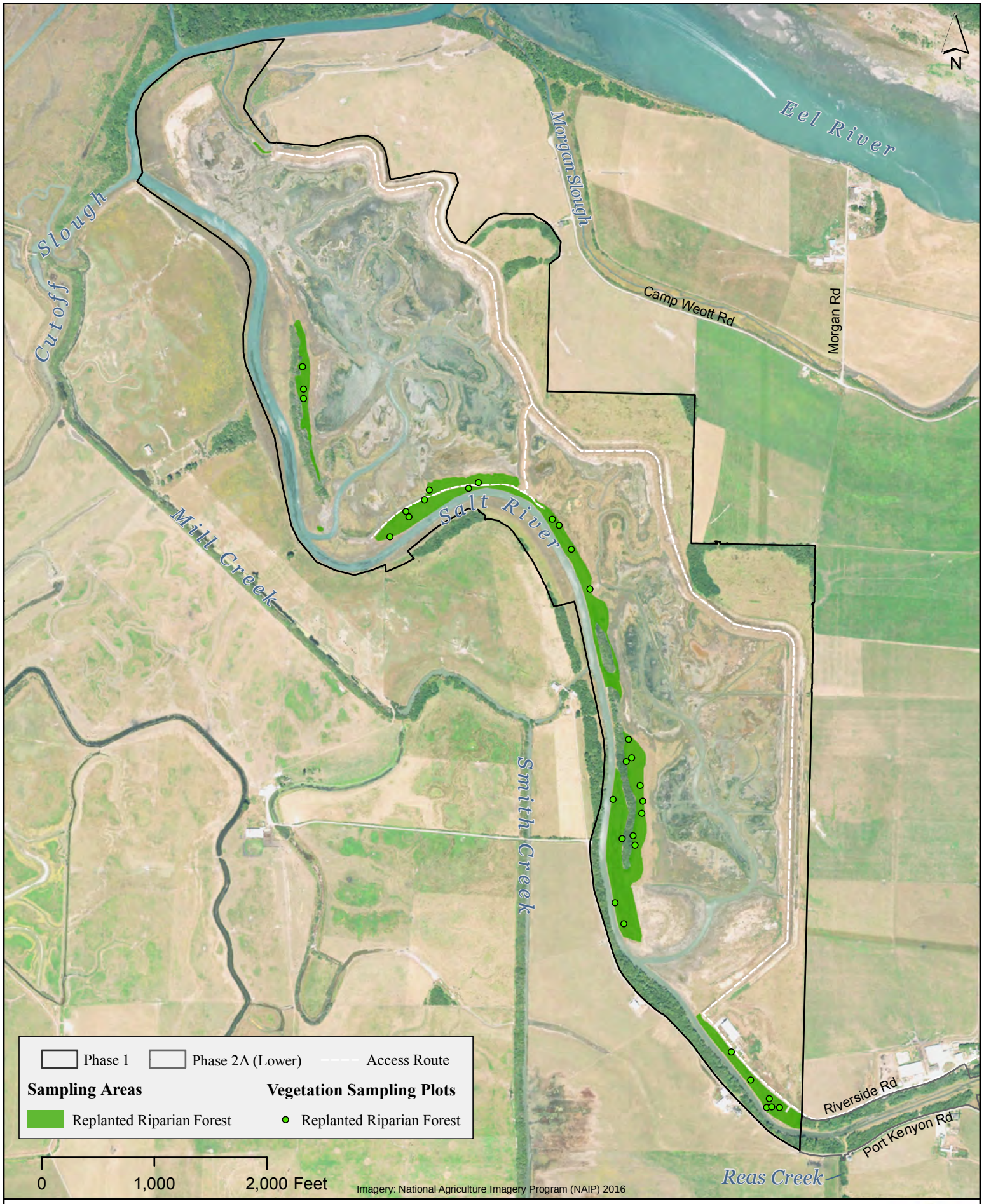

Figure 5. SRERP Phase 1 – Riverside Ranch Tidal Marsh Restoration Area Quantitative Vegetation Sampling Plots

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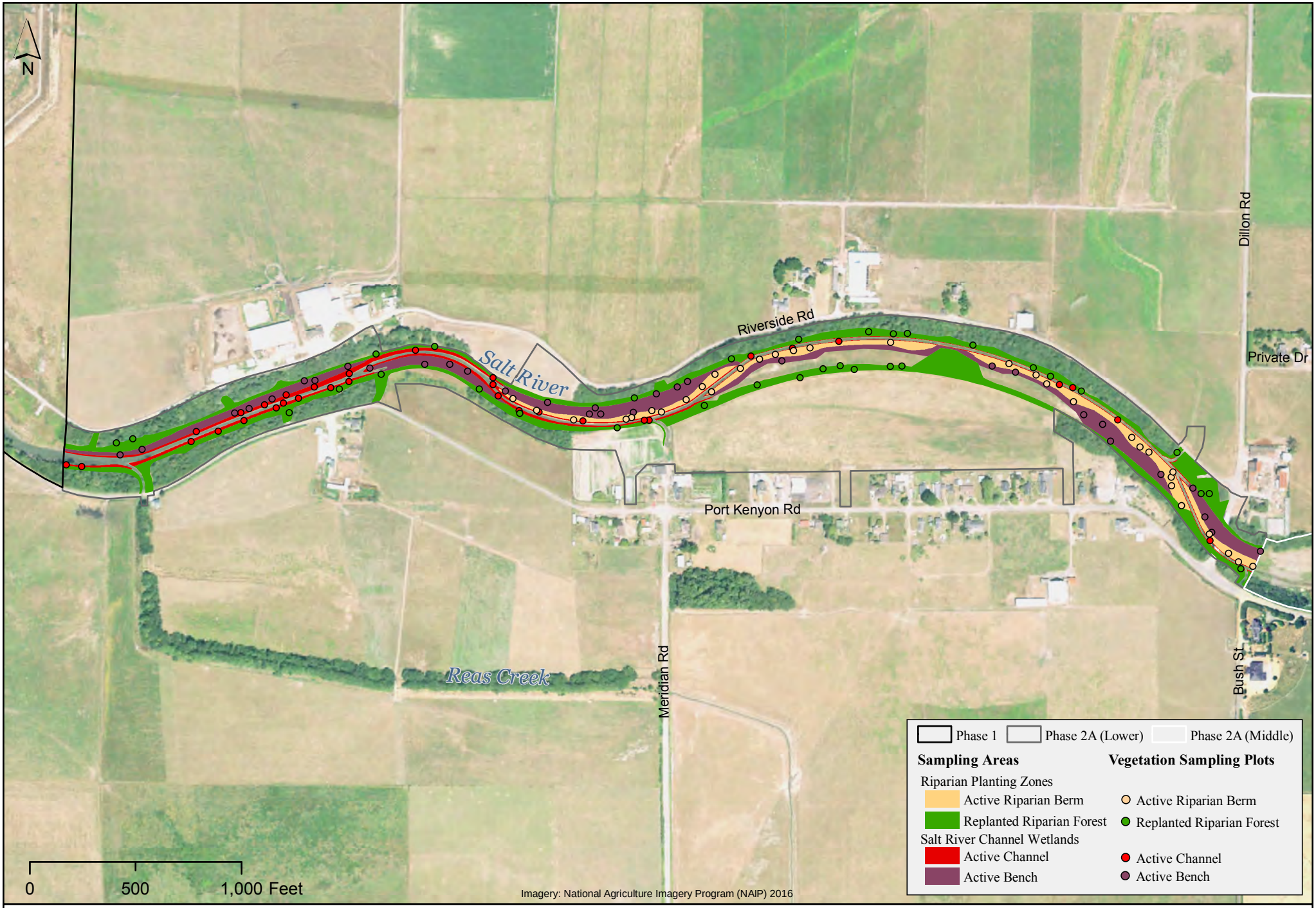

Figure 6. SRERP Phase 2A (Lower) – Salt River Corridor Restoration Area Quantitative Vegetation Sampling Plots

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Salt River Ecosystem Restoration Project

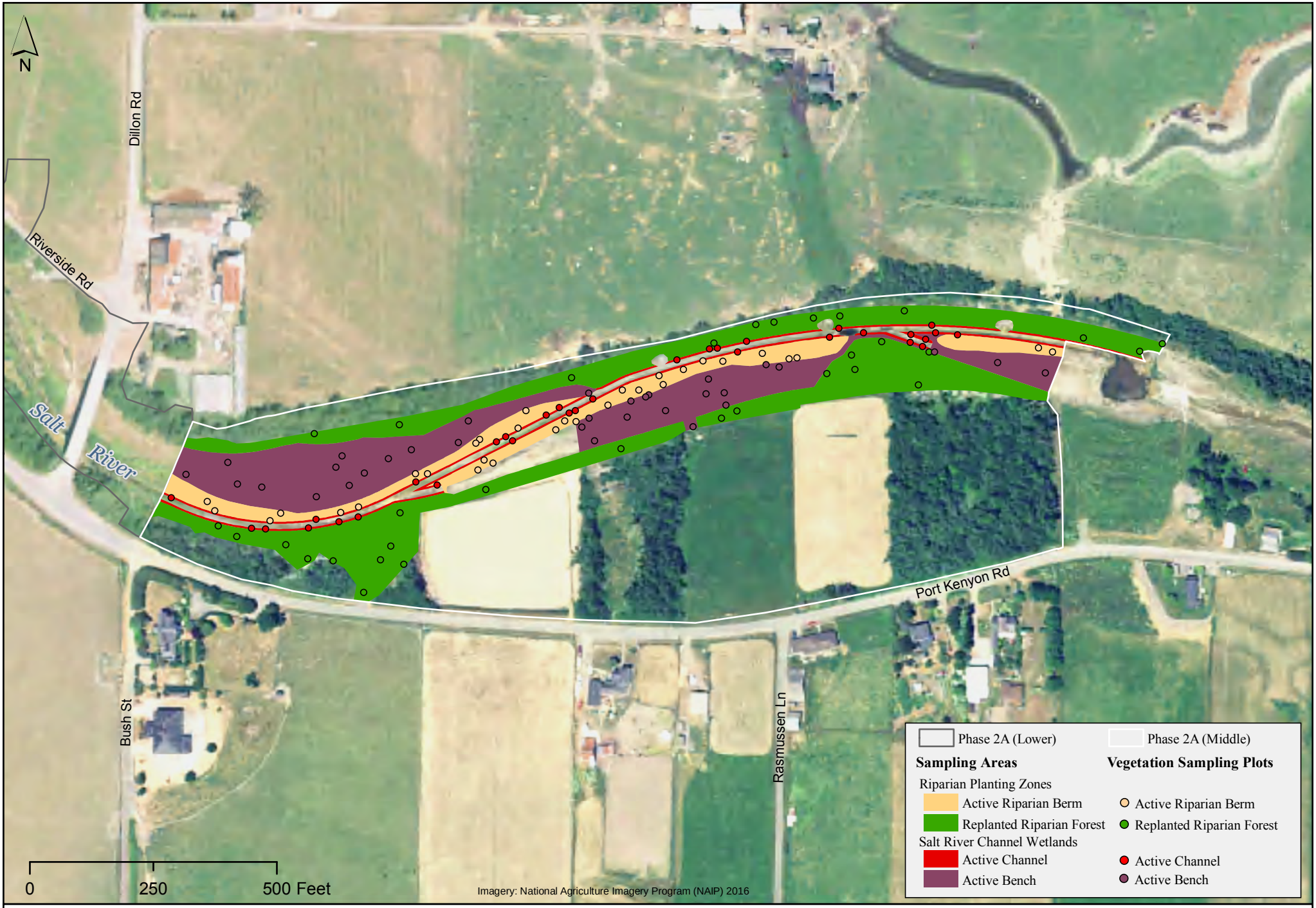

Figure 7. SRERP Phase 2A (Middle) – Salt River Corridor Restoration Area Quantitative Vegetation Sampling Plots

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Figure 8. SRERP Phase 1 – Riverside Ranch Tidal Marsh Restoration Area (North)
Replanted Woody Riparian Vegetation Basal Area Sampling Plots

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Figure 9. SRERP Phase 1 – Riverside Ranch Tidal Marsh Restoration Area (South)
Replanted Woody Riparian Vegetation Basal Area Sampling Plots

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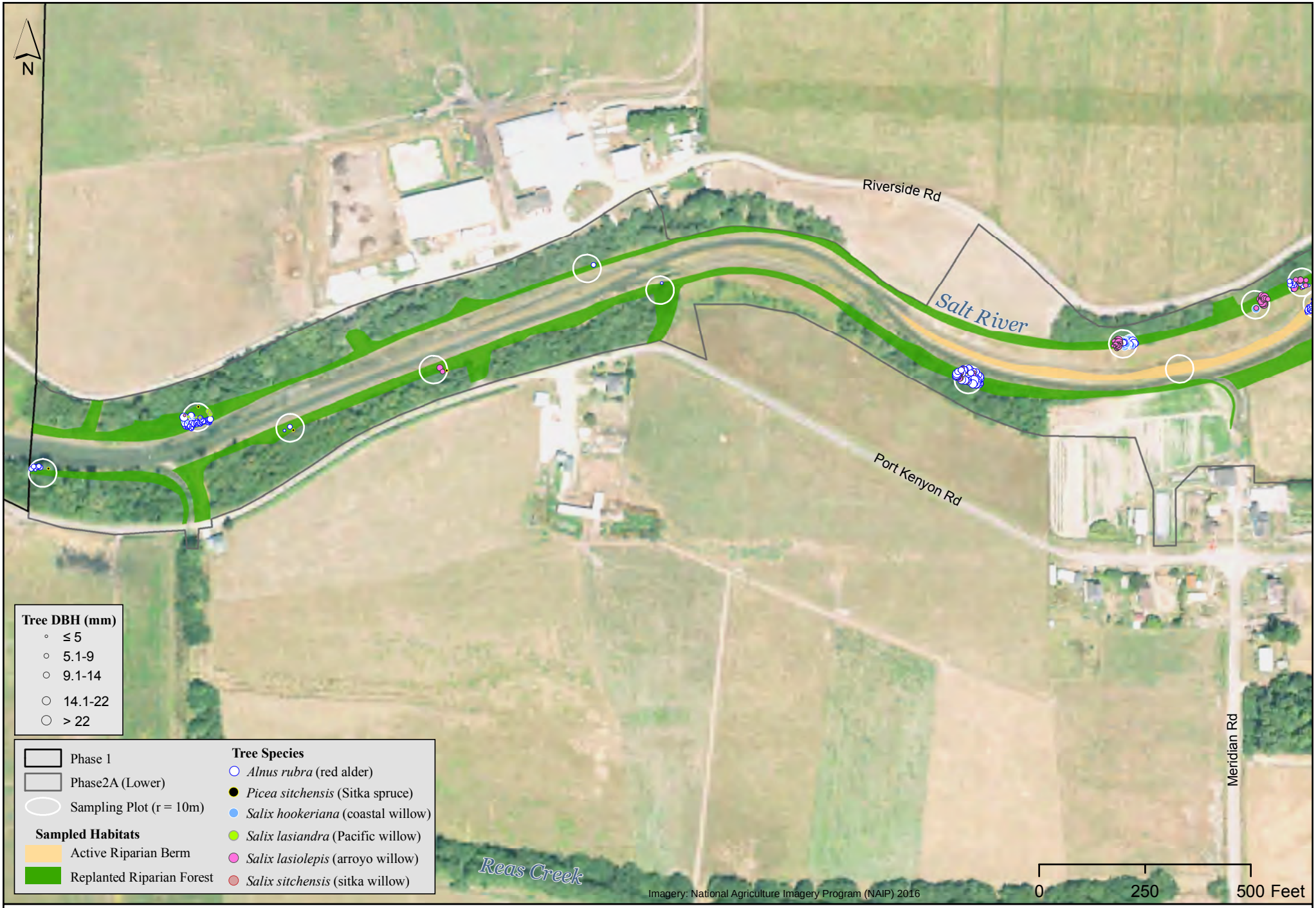

Figure 10. SRERP Phase 2A (Lower) – Salt River Corridor Restoration Area (West)
Replanted Woody Riparian Vegetation Basal Area Sampling Plots

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Figure 11. SRERP Phase 2A (Lower) – Salt River Corridor Restoration Area (East)
Replanted Woody Riparian Vegetation Basal Area Sampling Plots

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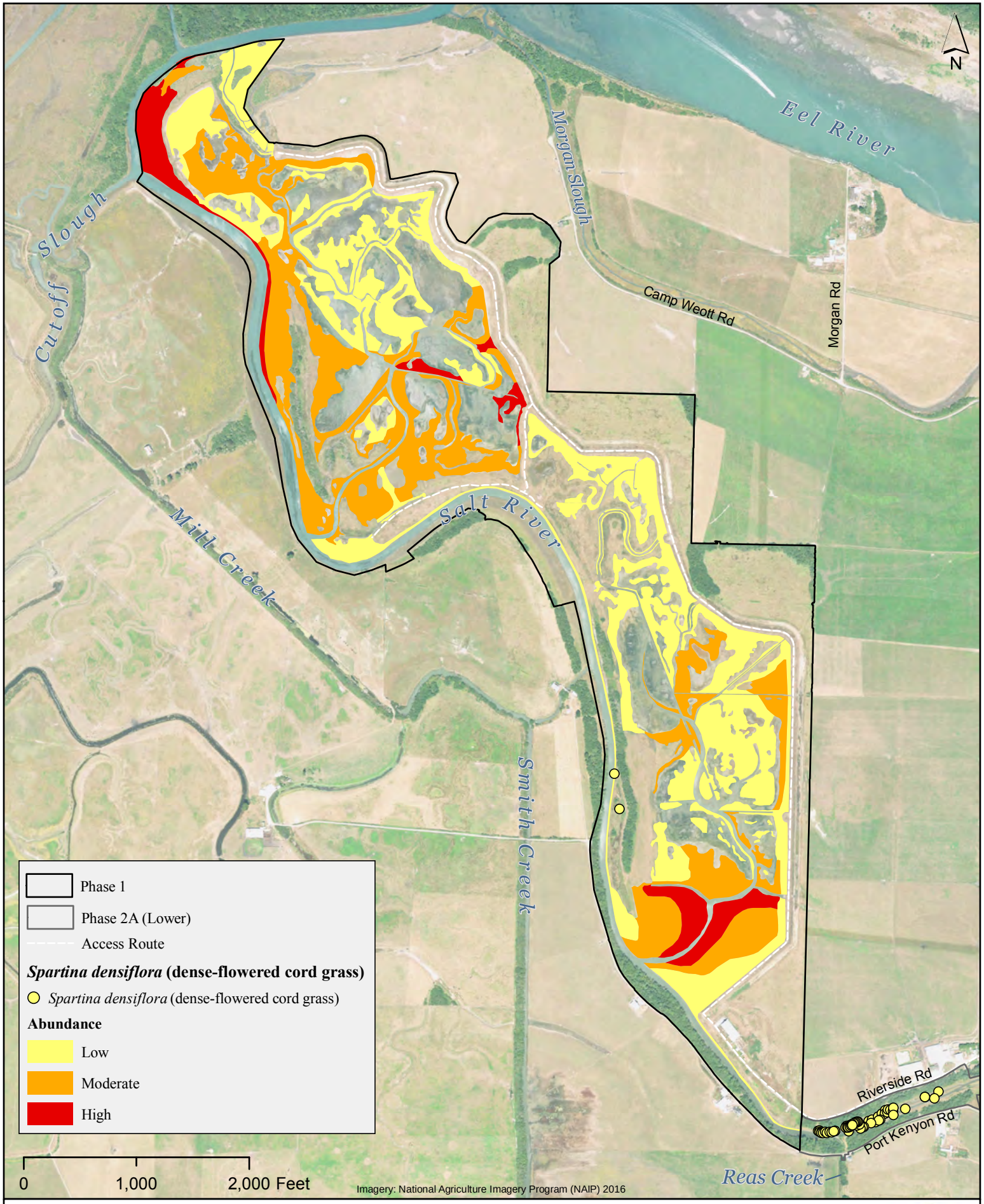

Figure 12. SRERP Phase 1 – Riverside Ranch Tidal Marsh Restoration Area
Invasive *Spartina densiflora* ("dense-flowered cord grass")

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Figure 13. SRERP Phase 2A (Lower) – Salt River Corridor Restoration Area
Invasive *Spartina densiflora* ("dense-flowered cord grass")
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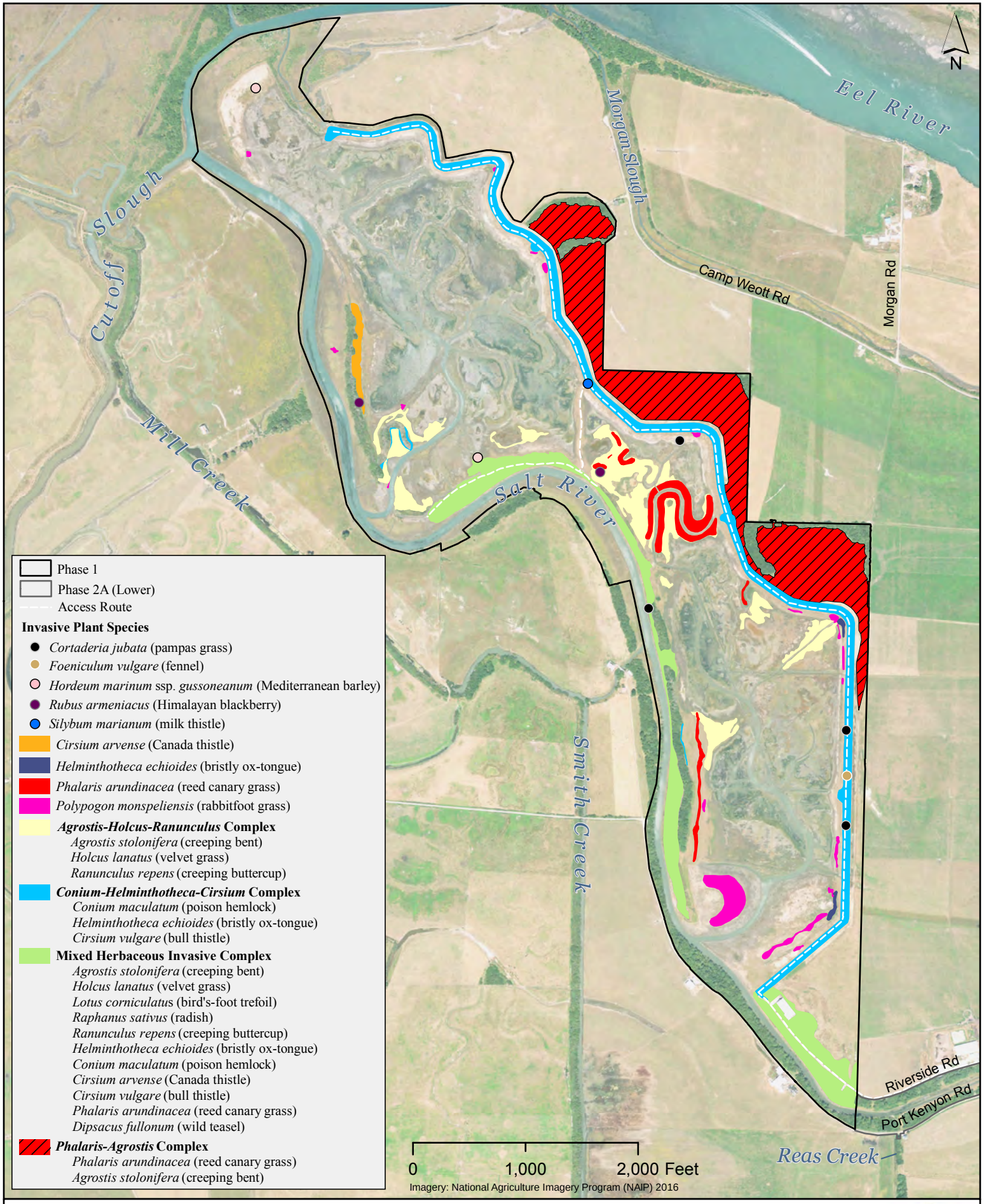

Figure 14. SRERP Phase 1 – Riverside Ranch Tidal Marsh Restoration Area Invasive Plant Species

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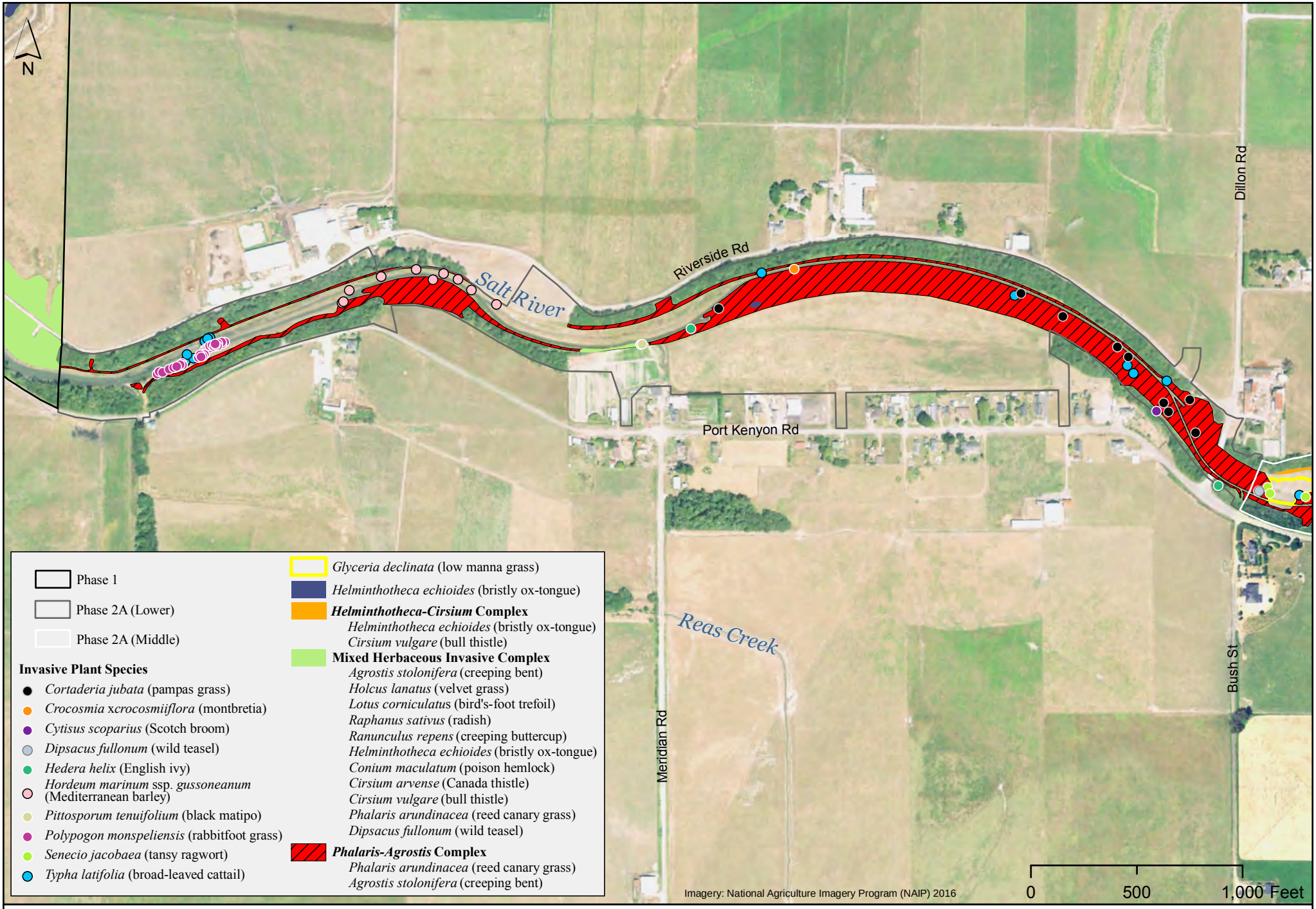

Figure 15. SRERP Phase 2A (Lower) – Salt River Corridor Restoration Area Invasive Plant Species

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Salt River Ecosystem Restoration Project

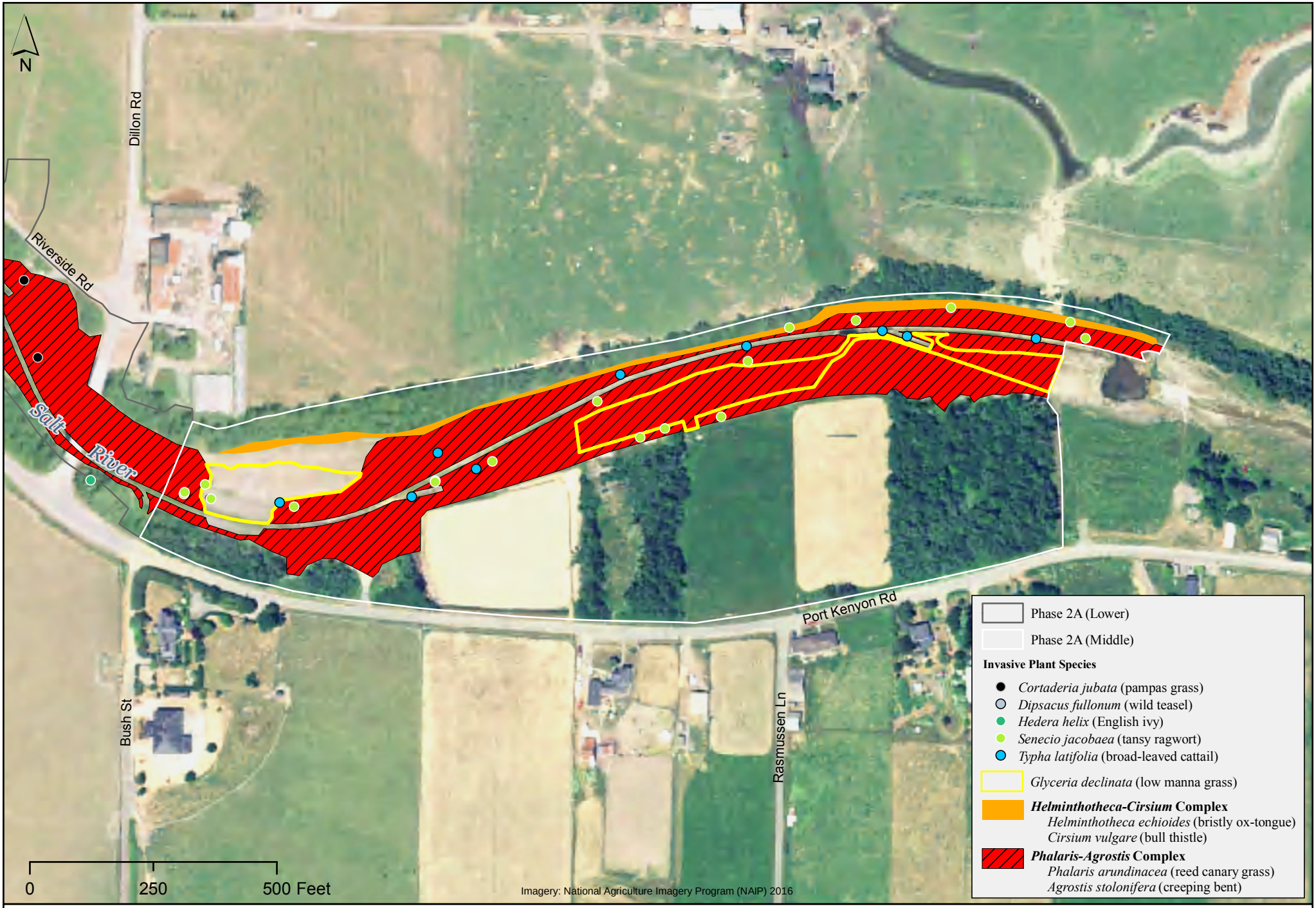

Figure 16. SRERP Phase 2A (Middle) – Salt River Corridor Restoration Area Invasive Plant Species

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Appendix B

SRERP Quantitative Vegetation Sampling Results

(Taxa in bold represent species with special status conservation protections.)

Phase 1 – Riverside Ranch Tidal Marsh Restoration Area: Replanted Riparian Forest

Species	Frequency (1.0 = 100%)	Absolute Cover ($\bar{x}$ % Cover)	SD
Native Species			
Herbaceous Species			
Deschampsia cespitosa	0.44	23.88	37.40
Hordeum brachyantherum	0.25	7.44	18.66
Equisetum arvense	0.16	6.73	19.36
Oenanthe sarmentosa	0.16	4.88	16.48
Potentilla anserina ssp. *pacifica*	0.09	2.52	11.27
Achillea millefolium	0.06	1.64	7.06
Alopecurus geniculatus	0.06	1.27	6.63
Rorippa curvisiliqua	0.03	1.17	6.63
Grindelia stricta	0.03	0.47	2.65
Salicornia pacifica	0.03	0.47	2.65
Shrub Species			
Rubus ursinus	0.25	10.67	24.20
Lonicera involucrata var. *ledebourii*	0.03	0.47	2.65
Morella californica	0.03	0.09	0.53
Tree Species			
Salix lasiandra var. *lasiandra*	0.03	0.47	2.65
Picea sitchensis	0.03	0.09	0.53
Non-Native Non-Invasive Species			
Herbaceous Species			
Festuca perennis	0.31	10.50	25.73
Plantago lanceolata	0.19	1.97	5.03
Rumex conglomeratus	0.16	0.77	2.74
Trifolium fragiferum	0.13	5.91	21.05
Raphanus sativus	0.09	1.41	4.44
Rumex crispus	0.09	0.48	2.65
Taraxacum officinale	0.06	0.02	0.09
Atriplex prostrata	0.03	0.47	2.65
Dactylis glomerata	0.03	0.47	2.65
Trifolium repens	0.03	0.47	2.65
Plantago major	0.03	0.09	0.53
Vicia hirsuta	0.03	0.09	0.53
Geranium dissectum	0.03	0.02	0.09
Invasive Species			
Herbaceous Species			
Agrostis stolonifera	0.63	27.34	32.44
Ranunculus repens	0.25	12.61	27.77
Holcus lanatus	0.25	4.70	10.21
Lotus corniculatus	0.22	9.80	24.23
Helminthotheca echioides	0.22	0.59	2.68
Cirsium arvense	0.13	1.03	3.70
Conium maculatum	0.09	1.03	3.70
Convolvulus arvensis	0.03	0.09	0.53
Cirsium vulgare	0.03	0.02	0.09
Glyceria declinata	0.03	0.00	0.02
Polypogon monspeliensis	0.03	0.00	0.02

Phase 2A (Lower) – Salt River Corridor Restoration Area: Active Channel

Species	Frequency (1.0 = 100%)	Absolute Cover ($\bar{x}$ % Cover)	SD
Native Species			
Herbaceous Species			
Deschampsia cespitosa	0.63	17.81	21.90
Salicornia pacifica	0.41	8.56	15.19
Grindelia stricta	0.31	2.22	7.02
Scirpus microcarpus	0.22	5.11	17.59
Potentilla anserina ssp. *pacifica*	0.19	1.91	5.03
Hordeum brachyantherum	0.13	0.59	2.68
Bolboschoenus maritimus ssp. *paludosus*	0.09	1.03	3.70
Alopecurus geniculatus	0.06	1.27	6.63
Triglochin maritima	0.06	1.19	6.63
Juncus bufonius	0.06	0.94	3.69
Equisetum arvense	0.06	0.56	2.69
Stachys ajugoides	0.06	0.19	0.74
Carex obnupta	0.03	0.47	2.65
Juncus balticus ssp. *ater*	0.03	0.47	2.65
Oenanthe sarmentosa	0.03	0.47	2.65
Veronica americana	0.03	0.47	2.65
Cyperus eragrostis	0.03	0.09	0.53
Spergularia marina	0.03	0.09	0.53
Distichlis spicata	0.03	0.00	0.02
Shrub Species			
Rubus ursinus	0.06	0.19	0.74
Tree Species			
Alnus rubra	0.09	2.11	7.44
Salix lasiolepis	0.06	0.56	2.69
Salix lasiandra var. *lasiandra*	0.03	0.47	2.65
Salix sitchensis	0.03	0.09	0.53
Non-Native Non-Invasive Species			
Herbaceous Species			
Cotula coronopifolia	0.50	9.38	17.22
Atriplex prostrata	0.25	0.71	2.71
Trifolium repens	0.22	7.22	18.25
Festuca perennis	0.16	1.05	3.70
Trifolium fragiferum	0.03	0.47	2.65
Plantago lanceolata	0.03	0.09	0.53
Plantago major	0.03	0.09	0.53
Rumex conglomeratus	0.03	0.09	0.53
Calystegia silvatica ssp. *disjuncta*	0.03	0.02	0.09
Rumex crispus	0.03	0.00	0.02
Invasive Species			
Herbaceous Species			
Agrostis stolonifera	0.59	14.63	23.15
Polypogon monspeliensis	0.38	1.21	3.69
Phalaris arundinacea	0.19	1.97	5.03
Ranunculus repens	0.13	0.66	2.72
Holcus lanatus	0.09	2.11	7.44

Phase 2A (Lower) – Salt River Corridor Restoration Area: Active Channel

Species	Frequency (1.0 = 100%)	Absolute Cover ($\bar{x}$ % Cover)	SD
Lotus corniculatus	0.06	1.96	11.05
Spartina densiflora	0.06	0.56	2.69
Hordeum marinum ssp. *gussoneanum*	0.06	0.47	2.65
Mentha pulegium	0.03	0.47	2.65

Phase 2A (Lower) – Salt River Corridor Restoration Area: Active Bench

Species	Frequency (1.0 = 100%)	Absolute Cover ($\bar{x}$ % Cover)	SD
Native Species			
Herbaceous Species			
Deschampsia cespitosa	0.63	21.75	30.00
Scirpus microcarpus	0.28	11.92	26.61
Bolboschoenus maritimus ssp. *paludosus*	0.25	9.08	20.67
Salicornia pacifica	0.25	4.03	11.78
Grindelia stricta	0.19	1.94	7.04
Juncus balticus ssp. *ater*	0.13	3.28	9.70
Triglochin maritima	0.13	3.28	9.70
Oenanthe sarmentosa	0.09	3.61	15.39
Carex lyngbyei	0.09	1.41	4.44
Eleocharis macrostachya	0.06	0.56	2.69
Hordeum brachyantherum	0.06	0.56	2.69
Alopecurus geniculatus	0.03	1.17	6.63
Distichlis spicata	0.03	1.17	6.63
Carex obnupta	0.03	0.47	2.65
Cyperus eragrostis	0.03	0.47	2.65
Potentilla anserina ssp. *pacifica*	0.03	0.47	2.65
Schoenoplectus pungens var. *longispicatus*	0.03	0.47	2.65
Spergularia marina	0.03	0.09	0.53
Triglochin striata	0.03	0.09	0.53
Epilobium ciliatum ssp. *watsonii*	0.03	0.02	0.09
Juncus bufonius	0.03	0.00	0.02
Shrub Species			
Rubus ursinus	0.03	0.09	0.53
Tree Species			
Alnus rubra	0.09	1.03	3.70
Non-Native Non-Invasive Species			
Herbaceous Species			
Cotula coronopifolia	0.38	12.53	22.32
Atriplex prostrata	0.25	0.81	2.73
Festuca perennis	0.09	0.95	3.69
Rumex conglomeratus	0.09	0.50	2.65
Trifolium fragiferum	0.06	2.34	9.22
Daucus carota	0.03	1.17	6.63
Hypochaeris radicata	0.03	0.47	2.65
Trifolium dubium	0.03	0.47	2.65
Trifolium pratense	0.03	0.47	2.65
Rumex crispus	0.03	0.09	0.53
Plantago lanceolata	0.03	0.02	0.09
Invasive Species			
Herbaceous Species			
Agrostis stolonifera	0.47	12.72	23.16
Phalaris arundinacea	0.25	5.89	15.67
Polypogon monspeliensis	0.25	2.80	11.24
Lotus corniculatus	0.03	0.47	2.65
Spartina densiflora	0.03	0.47	2.65

Phase 2A (Lower) – Salt River Corridor Restoration Area: Replanted Riparian Forest

Species	Frequency (1.0 = 100%)	Absolute Cover ($\bar{x}$ % Cover)	SD
Native Species			
Herbaceous Species			
Deschampsia cespitosa	0.53	14.89	23.23
Scirpus microcarpus	0.47	20.16	30.77
Oenanthe sarmentosa	0.47	5.16	6.83
Juncus balticus ssp. *ater*	0.31	7.98	16.60
Potentilla anserina ssp. *pacifica*	0.19	2.06	5.02
Epilobium ciliatum ssp. *watsonii*	0.19	0.77	2.74
Equisetum arvense	0.09	1.73	7.06
Cyperus eragrostis	0.06	1.64	7.06
Grindelia stricta	0.06	0.94	3.69
Stachys ajugoides	0.06	0.94	3.69
Shrub Species			
Rubus ursinus	0.44	13.13	19.86
Rubus spectabilis	0.13	1.03	3.70
Rubus parviflorus	0.06	2.05	11.04
Lonicera involucrata var. *ledebourii*	0.06	1.64	7.06
Rosa californica	0.03	1.17	6.63
Morella californica	0.03	0.09	0.53
Tree Species			
Salix lasiolepis	0.47	19.75	29.61
Alnus rubra	0.34	16.33	29.39
Picea sitchensis	0.09	1.03	3.70
Salix lasiandra var. *lasiandra*	0.06	0.56	2.69
Salix hookeriana	0.03	0.09	0.53
Non-Native Non-Invasive Species			
Herbaceous Species			
Festuca perennis	0.31	3.89	8.20
Rumex conglomeratus	0.19	3.47	9.66
Trifolium repens	0.06	0.94	3.69
Calystegia silvatica ssp. *disjuncta*	0.03	0.47	2.65
Cotula coronopifolia	0.03	0.47	2.65
Geranium dissectum	0.03	0.02	0.09
Plantago major	0.03	0.00	0.02
Rumex crispus	0.03	0.00	0.02
Invasive Species			
Herbaceous Species			
Phalaris arundinacea	0.56	22.11	29.55
Agrostis stolonifera	0.41	15.20	25.65
Ranunculus repens	0.41	6.08	12.13
Lotus corniculatus	0.06	1.27	6.63
Helminthotheca echioides	0.06	0.48	2.65
Cirsium vulgare	0.06	0.47	2.65
Holcus lanatus	0.03	2.67	15.11
Conium maculatum	0.03	0.47	2.65

Phase 2A (Lower) – Salt River Corridor Restoration Area: Active Riparian Berm

Species	Frequency (1.0 = 100%)	Absolute Cover ($\bar{x}$ % Cover)	SD
Native Species			
Herbaceous Species			
Deschampsia cespitosa	0.97	43.08	31.28
Scirpus microcarpus	0.28	15.97	31.86
Hordeum brachyantherum	0.22	2.53	5.50
Grindelia stricta	0.19	6.13	18.58
Oenanthe sarmentosa	0.16	1.97	5.03
Juncus balticus ssp. *ater*	0.13	2.61	11.26
Potentilla anserina ssp. *pacifica*	0.13	1.88	5.04
Equisetum arvense	0.09	3.61	15.39
Juncus effusus ssp. *pacificus*	0.06	0.94	3.69
Stachys ajugoides	0.06	0.94	3.69
Bromus carinatus	0.03	0.02	0.09
Shrub Species			
Rubus ursinus	0.06	0.19	0.74
Physocarpus capitatus	0.03	1.17	6.63
Rosa californica	0.03	1.17	6.63
Rubus spectabilis	0.03	0.47	2.65
Ribes sanguineum	0.03	0.09	0.53
Tree Species			
Alnus rubra	0.25	11.08	25.50
Picea sitchensis	0.06	1.64	7.06
Salix lasiolepis	0.03	0.47	2.65
Salix sitchensis	0.03	0.09	0.53
Non-Native Non-Invasive Species			
Herbaceous Species			
Trifolium repens	0.38	7.93	13.84
Festuca perennis	0.31	4.69	7.06
Trifolium fragiferum	0.22	4.02	11.79
Plantago major	0.19	0.77	2.74
Rumex conglomeratus	0.06	0.56	2.69
Calystegia silvatica ssp. *disjuncta*	0.03	0.47	2.65
Geranium dissectum	0.03	0.09	0.53
Plantago lanceolata	0.03	0.09	0.53
Raphanus sativus	0.03	0.09	0.53
Trifolium pratense	0.03	0.09	0.53
Hypochaeris radicata	0.03	0.02	0.09
Invasive Species			
Herbaceous Species			
Phalaris arundinacea	0.56	11.58	14.77
Agrostis stolonifera	0.34	8.41	17.31
Helminthotheca echioides	0.16	2.34	5.53
Ranunculus repens	0.16	1.52	4.44
Lotus corniculatus	0.09	8.02	25.32
Holcus lanatus	0.06	0.94	3.69

Phase 2A (Lower) – Salt River Corridor Restoration Area: Active Riparian Berm

Species	Frequency (1.0 = 100%)	Absolute Cover ($\bar{x}$ % Cover)	SD
Erosion Control Hybrid			
Herbaceous Species			
Elymus x *Triticum*	0.03	0.02	0.09

Phase 2A (Middle) – Salt River Corridor Restoration Area: Active Channel

Species	Frequency (1.0 = 100%)	Absolute Cover ($\bar{x}$ % Cover)	SD
Native Species			
Herbaceous Species			
Scirpus microcarpus	0.78	52.42	36.23
Juncus balticus ssp. *ater*	0.63	20.50	25.04
Cyperus eragrostis	0.53	9.38	10.43
Hordeum brachyantherum	0.44	5.77	8.81
Equisetum arvense	0.41	8.61	14.35
Potentilla anserina ssp. *pacifica*	0.41	4.92	8.52
Deschampsia cespitosa	0.16	1.59	4.44
Juncus effusus ssp. *pacificus*	0.13	1.50	4.44
Oenanthe sarmentosa	0.13	1.50	4.44
Schoenoplectus pungens var. *longispicatus*	0.13	1.13	3.71
Juncus bufonius	0.13	0.75	2.75
Gnaphalium palustre	0.06	0.19	0.74
Triglochin maritima	0.06	0.19	0.74
Bolboschoenus maritimus ssp. *paludosus*	0.03	0.09	0.53
Carex obnupta	0.03	0.09	0.53
Elymus glaucus	0.03	0.09	0.53
Epilobium ciliatum ssp. *watsonii*	0.03	0.00	0.02
Shrub Species			
Rubus ursinus	0.06	0.56	2.69
Baccharis pilularis	0.03	0.47	2.65
Tree Species			
Alnus rubra	0.09	1.03	3.70
Salix sitchensis	0.09	0.58	2.69
Salix lasiolepis	0.09	0.28	0.89
Salix lasiandra var. *lasiandra*	0.06	0.56	2.69
Non-Native Non-Invasive Species			
Herbaceous Species			
Trifolium repens	0.19	7.91	20.06
Atriplex prostrata	0.09	0.28	0.89
Plantago major	0.06	0.19	0.74
Plantago lanceolata	0.03	0.47	2.65
Rumex conglomeratus	0.03	0.09	0.53
Rumex crispus	0.03	0.09	0.53
Trifolium dubium	0.03	0.09	0.53
Invasive Species			
Herbaceous Species			
Agrostis stolonifera	0.19	3.14	8.03
Phalaris arundinacea	0.16	3.05	8.05
Ranunculus repens	0.13	1.50	4.44
Helminthotheca echioides	0.06	0.47	2.65
Typha latifolia	0.03	0.47	2.65
Cirsium arvense	0.03	0.09	0.53

Phase 2A (Middle) – Salt River Corridor Restoration Area: Active Bench

Species	Frequency (1.0 = 100%)	Absolute Cover ($\bar{x}$ % Cover)	SD
Native Species			
Herbaceous Species			
Hordeum brachyantherum	0.72	20.98	23.55
Deschampsia cespitosa	0.53	12.28	18.65
Scirpus microcarpus	0.38	22.89	36.84
Oenanthe sarmentosa	0.34	5.81	10.36
Equisetum arvense	0.28	4.44	12.91
Juncus balticus ssp. *ater*	0.19	5.33	14.22
Cyperus eragrostis	0.19	2.44	5.52
Alopecurus geniculatus	0.16	6.02	16.57
Potentilla anserina ssp. *pacifica*	0.13	1.88	5.04
Juncus effusus ssp. *pacificus*	0.06	0.94	3.69
Elymus glaucus	0.03	0.47	2.65
Epilobium ciliatum ssp. *watsonii*	0.03	0.47	2.65
Gnaphalium palustre	0.03	0.47	2.65
Juncus bufonius	0.03	0.02	0.09
Shrub Species			
Rubus ursinus	0.03	0.47	2.65
Tree Species			
Salix lasiandra var. *lasiandra*	0.16	0.84	2.77
Salix lasiolepis	0.13	0.75	2.75
Salix sitchensis	0.13	0.38	1.01
Non-Native Non-Invasive Species			
Herbaceous Species			
Festuca perennis	0.31	4.64	8.63
Trifolium fragiferum	0.25	8.36	22.32
Trifolium repens	0.16	8.94	25.13
Aira caryophyllea	0.09	2.81	9.48
Rumex conglomeratus	0.03	0.47	2.65
Vicia hirsuta	0.03	0.47	2.65
Veronica anagallis-aquatica	0.03	0.09	0.53
Invasive Species			
Herbaceous Species			
Agrostis stolonifera	0.56	13.55	18.97
Phalaris arundinacea	0.44	4.46	8.36
Cirsium arvense	0.06	0.56	2.69
Ranunculus repens	0.06	0.11	0.53
Glyceria declinata	0.03	0.02	0.09

Phase 2A (Middle) – Salt River Corridor Restoration Area: Replanted Riparian Forest

Species	Frequency (1.0 = 100%)	Absolute Cover ($\bar{x}$ % Cover)	SD
Native Species			
Herbaceous Species			
Hordeum brachyantherum	0.38	11.19	20.64
Oenanthe sarmentosa	0.38	6.66	10.52
Deschampsia cespitosa	0.38	5.95	9.04
Equisetum arvense	0.28	7.05	16.60
Elymus glaucus	0.16	1.22	3.72
Scirpus microcarpus	0.13	4.77	14.16
Stachys ajugoides	0.13	1.50	4.44
Potentilla anserina ssp. *pacifica*	0.09	2.11	7.44
Cyperus eragrostis	0.06	0.94	3.69
Epilobium ciliatum ssp. *watsonii*	0.06	0.56	2.69
Alisma triviale	0.03	0.47	2.65
Carex obnupta	0.03	0.47	2.65
Equisetum hyemale	0.03	0.47	2.65
Festuca rubra	0.03	0.47	2.65
Juncus balticus ssp. *ater*	0.03	0.47	2.65
Bromus carinatus	0.03	0.09	0.53
Juncus hesperius	0.03	0.09	0.53
Shrub Species			
Rubus ursinus	0.25	8.13	17.42
Rubus spectabilis	0.03	1.17	6.63
Lonicera involucrata var. *ledebourii*	0.03	0.09	0.53
Morella californica	0.03	0.09	0.53
Tree Species			
Salix sitchensis	0.19	7.58	23.22
Salix lasiolepis	0.16	11.14	27.40
Salix lasiandra var. *lasiandra*	0.06	0.56	2.69
Salix hookeriana	0.03	2.67	15.11
Populus trichocarpa	0.03	0.47	2.65
Acer macrophyllum	0.03	0.09	0.53
Alnus rubra	0.03	0.09	0.53
Sequoia sempervirens	0.03	0.09	0.53
Non-Native Non-Invasive Species			
Herbaceous Species			
Festuca perennis	0.34	6.89	11.75
Trifolium repens	0.28	8.94	19.99
Rumex conglomeratus	0.16	1.13	3.71
Trifolium fragiferum	0.06	0.48	2.65
Calystegia silvatica ssp. *disjuncta*	0.03	1.95	11.05
Invasive Species			
Herbaceous Species			
Phalaris arundinacea	0.66	40.04	41.86
Agrostis stolonifera	0.44	12.36	20.14
Cirsium vulgare	0.19	3.52	8.30
Conium maculatum	0.13	2.20	7.43
Holcus lanatus	0.09	3.59	12.86

Phase 2A (Middle) – Salt River Corridor Restoration Area: Replanted Riparian Forest

Species	Frequency (1.0 = 100%)	Absolute Cover ($\bar{x}$ % Cover)	SD
Ranunculus repens	0.09	0.50	2.65
Helminthotheca echioides	0.06	0.94	3.69
Mentha pulegium	0.06	0.94	3.69
Lotus corniculatus	0.03	0.47	2.65
Erosion Control Hybrid			
Herbaceous Species			
Elymus x *Triticum*	0.03	0.09	0.53

Phase 2A (Middle) – Salt River Corridor Restoration Area: Active Riparian Berm

Species	Frequency (1.0 = 100%)	Absolute Cover ($\bar{x}$ % Cover)	SD
Native Species			
Herbaceous Species			
Hordeum brachyantherum	0.88	19.23	15.57
Equisetum arvense	0.66	14.06	22.41
Deschampsia cespitosa	0.53	6.09	7.09
Potentilla anserina ssp. *pacifica*	0.47	5.78	8.80
Juncus balticus ssp. *ater*	0.28	9.66	23.65
Oenanthe sarmentosa	0.28	3.09	5.88
Scirpus microcarpus	0.25	13.92	28.94
Stachys ajugoides	0.19	1.69	4.44
Elymus glaucus	0.19	1.31	3.73
Epilobium ciliatum ssp. *watsonii*	0.16	0.23	0.74
Juncus effusus ssp. *pacificus*	0.09	1.41	4.44
Cyperus eragrostis	0.06	1.64	7.06
Gnaphalium palustre	0.06	0.11	0.53
Juncus hesperius	0.03	0.47	2.65
Shrub Species			
Morella californica	0.03	1.95	11.05
Lonicera involucrata var. *ledebourii*	0.03	0.47	2.65
Tree Species			
Salix sitchensis	0.16	1.22	3.72
Populus trichocarpa	0.06	2.34	9.22
Alnus rubra	0.06	0.56	2.69
Picea sitchensis	0.06	0.56	2.69
Salix lasiolepis	0.06	0.19	0.74
Salix lasiandra var. *lasiandra*	0.03	0.47	2.65
Sequoia sempervirens	0.03	0.47	2.65
Non-Native Non-Invasive Species			
Herbaceous Species			
Trifolium repens	0.47	18.27	28.57
Festuca perennis	0.13	2.98	11.47
Trifolium dubium	0.13	1.88	5.04
Plantago major	0.13	0.75	2.75
Trifolium fragiferum	0.09	6.95	22.56
Hypochaeris radicata	0.06	0.94	3.69
Calystegia silvatica ssp. *disjuncta*	0.06	0.56	2.69
Rumex conglomeratus	0.06	0.56	2.69
Vicia hirsuta	0.03	0.47	2.65
Plantago lanceolata	0.03	0.09	0.53
Veronica anagallis-aquatica	0.03	0.09	0.53
Invasive Species			
Herbaceous Species			
Phalaris arundinacea	0.22	2.07	5.02
Helminthotheca echioides	0.22	1.93	7.05
Lotus corniculatus	0.19	6.42	17.49
Ranunculus repens	0.19	2.61	7.75
Agrostis stolonifera	0.06	0.94	3.69

Phase 2A (Middle) – Salt River Corridor Restoration Area: Active Riparian Berm

Species	Frequency (1.0 = 100%)	Absolute Cover ($\bar{x}$ % Cover)	SD
Cirsium vulgare	0.06	0.94	3.69
Mentha pulegium	0.06	0.94	3.69
Holcus lanatus	0.03	0.47	2.65
Erosion Control Hybrid			
Herbaceous Species			
Elymus x *Triticum*	0.16	0.68	2.72

Appendix C

Summary Table of 2017 Replanted Woody Riparian Vegetation

Basal Area Sampling Measurements

Summary Table of 2017 SRERP Replanted Woody Riparian Vegetation Basal Area Sampling Measurements. Basal area values represent summed total basal area measurements for each tree species observed in each habitat sampled in 2017.

	Measured Basal Area (ft^2)				
	Phase 1 – Riverside Ranch Tidal Marsh Restoration Area	Phase 2A (Lower) – Salt River Corridor Restoration Area			
Tree Species	**Replanted Riparian Forest (22.71 acres) (n = 30)**	**Replanted Riparian Forest (8.05 acres) (n = 21)**	**Active Riparian Berm (2.44 acres) (n = 10)**	**Total Phase 2A (Lower) (10.49 acres)**	**Total[§] SRERP (33.2 acres)**
Alnus rubra (red alder)	0.0213	2.8357	0.7106	3.5463	3.5676
Salix lasiolepis (arroyo willow)	0.8358	1.9794	0.0001	1.9795	2.8153
Salix hookeriana (coastal willow)	0.0005	0.0624	0	0.0624	0.0629
Salix lasiandra (Pacific willow)	0.0014	0.0487	0.0006	0.0492	0.0507
Picea sitchensis (Sitka spruce)	0.0065	0.0194	0.0055	0.0249	0.0314
Salix sitchensis (Sitka willow)	0	0.0027	0.0040	0.0067	0.0067
Pinus contorta (shore pine)	0.0017	0	0	0	0.0017
Total	**0.8672**	**4.9483**	**0.7208**	**5.6691**	**6.5363**

[§] All SRERP restoration areas addressed during the 2017 basal area sampling effort