

2019 Annual Monitoring Report
Lower Spring Branch Creek and Suisun Hill Hollow Restoration Project
Rush Ranch Open Space Preserve
Suisun Marsh, Solano County, California



February 25, 2020

Regional Water Quality Control Board CIWQS Place ID 845722
California Department of Fish and Game 1600-2018-0102-R3
Bay Conservation and Development Commission M2018.005.00md
Delta Water Quality and Ecosystem Restoration Program
Grant Agreement P1596027
Prepared by

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Solano Archaeological Survey, Cultural Resources Technical Memorandum: Cultural Resources Monitoring – Lower Spring Branch Creek and Suisun Hill Hollow Restoration Project, Solano County, California

Annual Monitoring Report

Lower Spring Branch Creek and Suisun Hill Hollow Restoration Project

Rush Ranch Open Space Preserve

Suisun Marsh, Solano County, California

1.0 Introduction

The Lower Spring Branch Creek (LSBC) and Suisun Hill Hollow (SHH) Restoration Project is located at Rush Ranch, Suisun Marsh, Solano County (Figure 1). The project consisted of two discrete sites at Rush Ranch owned by Solano Land Trust (Figure 2). The LSBC site connects a seasonal drainage of LSBC to the tidal First Mallard Slough at the center of the Rush Ranch. The SHH site connects a seasonal drainage to Goat Island Marsh, a diked marsh in the northwest portion of Rush Ranch. Several regulatory agency agreements were issued for this project. This annual report covers requirements for all of these agreements, as follows:

- Regional Water Quality Control Board (RWQCB) CIWQS Place ID 845722
- California Department of Fish and Game (CDFW) 1600-2018-0102-R3
- Bay Conservation and Development Commission (BCDC) M2018.005.00md
- Delta Water Quality and Ecosystem Restoration Program Grant Agreement P1596027 administered by CDFW.

The project earthmoving and culvert installation construction by Hanford ARC was begun September 1, 2019 and completed November 23, 2019. Revegetation of disturbed areas was completed January 15, 2020. This monitoring report covers the construction monitoring as required by regulatory agencies, post construction monitoring; and compares data to prior years and performance criteria. It is based on the: *Final Agency Approved Adaptive Management and Monitoring Plan, Lower Spring Branch Creek and Suisun Hill Hollow Restoration Project, Rush Ranch Open Space Preserve; August 31, 2018; Prepared for Solano Land Trust by Siegel Environmental*, hereafter referred to as the AAMP.

2.0 Summary of 2019 Monitoring

Monitoring was performed in accordance with the AAMP pre-construction, construction and post-construction monitoring. A summary of the monitoring is included below and associated reports and other documents are attached.

2.1 Biological Monitoring

Pre-construction biological monitoring included a survey for rails, performed by CDFW biologists as part of greater Suisun Marsh survey; a survey for salt marsh harvest mouse (SMHM), conducted by LSA Inc approved biologists; and rare plant surveys conducted by SF Bay NERR biologists in conjunction with SLT staff. During construction a biological monitor from LSA was onsite for SMHM fencing, all vegetation removal and initial earthwork. No post-construction biological monitoring was performed in 2019.

Summary of wildlife monitoring results

LSA, Inc did not find any Salt Marsh Harvest Mouse (SMHM) during their survey and no SMHM were found during construction. LSA inspected silt fencing installed as erosion control and as a barrier to SMHM in construction areas (Figure 3). A memo report was issued by LSA dated January 15, 2020 attached, which certifies that no biological impacts occurred as a result of the construction.

CDFW conducted a California Ridgeway's Rail (RIRA) and California Black Rail in Suisun Marsh and reported it in *CDFW, 2019*, attached. Rush Ranch is located in the Cutoff Slough West area of the survey. The surveys were conducted in Mid-January through mid-April of 2019 using standard San Francisco Bay Secretive Marsh Bird Survey Protocols and Site-Specific Monitoring Protocols adopted by CDFW. The surveys were taken on transects established in 1984 throughout the region, with transects specifically at Rush Ranch (Spring Branch and First Mallard) shown in the report maps as Cutoff Slough West. No RIRA's were detected anywhere during the survey in 2019. Other species were detected in the Cutoff slough West area survey in 2019 and include Black Rail and Virginia Rail. A copy of the CDFW, 2019 report is attached.

Summary of rare plant monitoring

Two rare plants are found at Rush Ranch, Soft bird's beak (*Chloropyron molle* ssp. *molle*) and Suisun Thistle (*Cirsium hydrophilum* var. *hydrophilum*). SLT staff and SF Bay NERR botanist performed pre-construction surveys to locate these species within and around the construction zone. Soft bird's beak was found in essentially the same location in 2018 and 2019 (Figure 4) on the northern side of Lower Spring Branch Creek outside of the construction zone. The population was flagged prior to construction and noted as a no entry zone with construction crews. No Suisun thistle was found within or surrounding the construction zone. No rare plants were found at Suisun Hill Hollow.

2.2 Cultural Resource Monitoring

Cultural Monitoring at the site was prompted by CEQA mitigation measures and consultation with the Yoche Dehe Wintun Nation. Pre-construction cultural monitoring consisted of a site visit and review of existing records by Solano Archaeological Surveys (SAS) and the Yoche Dehe Wintun Nation monitors. At LSBC existing records noted a large bedrock mortar south and west of the construction site (fenced off and in public view) and one small bedrock mortar within a few hundred feet of the construction footprint on a hillside. During construction cultural resource monitors were present after vegetation clearing to walk the site and during initial earthwork activities along the south eastern side of the construction, nearest the small BRM. During routine monitoring and a vegetation clearing of the small BRM, SAS staff noted that the BRM was larger than mapped earlier and included a second small BRM, all of which were out of the construction area. SAS staff flagged the BRMS and a buffer and discussed the restrictions with the construction site supervisor. The SAS report is attached.

2.3 Fixed-point ground-based photo monitoring

Ground-based photo monitoring provides a record of physical and vegetation conditions over time. Fixed points for ground-based photo monitoring points were established at both the SHH and LSBC sites in November 2017 for permitting purposes and to establish a baseline. These same locations were revisited in November 2019, post-construction. (Attached photo comparison) Several focused photos on LSBC public access features and restoration sites were also added in 2019. The attached photo comparison shows the berm removal and fill placement areas of SHH. Seeding was completed in December 2019 in the SHH fill placement area of the former quarry.

At LSBC photo points focused on the L berm removal, new channel, and the new arch culvert. Several landscape views are provided for to be able to record vegetation change over time. In the future, photos will be taken at these same points and within the restoration areas in the summer when marsh vegetation is a peak biomass.

2.4 Aerial imagery –

Aerial imagery was captured using UVAs before and after construction at both LSBC and SHH restoration sites. Baseline imagery (Figures 5 & 6) was taken in May 2016 and November 2016, respectively. As built imagery (Figures 7 & 8) was taken November 2019.

2.5 Vegetation

Vegetation monitoring in tidal marsh and tidal marsh ecotone habitats (Figure 9) will be conducted using gradient directed transect (or gradsect) sampling techniques (Gillison and Brewer 1985) in accordance to the AMMP and with consultation from NERR.

The Grassland and grassland/upland ecotone restoration sites (Figure 10) in SHH will be monitored annually using permanent transects. Transects will be established using stratified random methods. A baseline from which to establish transects will be stretched across the length of the restored area. Transects will begin at a randomly selected point along that baseline, will run perpendicular to landscape slope, and will continue at regular intervals from that first established transect, with a minimum of three transects per restored area. Line point intercept (LPI) method will be used to obtain species composition and cover data. If species composition changes in such a way as to make LPI insufficient, a quadrat may be substituted for the LPI method.

2.6 Grazing Management and Monitoring

The Suisun Hill Hollow restoration site was grazed from August 1, 2019 through September 20, 2019, using 25 heifers. Grazing was used to reduce fuel loading and fire risk prior to equipment use. In future years, grazing may be shifted within the window of August 1st through January 31st depending on precipitation. Goals for livestock grazing include targeting invasive species, including medusahead ryegrass (*Taenatherum caput-medusae*) and Harding grass (*Phalaris aquatica*), which are both present

on the site. Grazing will be used to manage habitat for birds and other species. Burrowing owls and killdeer have been observed on site, and both require short vegetation. As grazing has been shown to be beneficial to vernal pools (Marty 2005; Marty 2015), grazing during the wet season is not anticipated to negatively impact the vernal pools on site.

The Lower Spring Branch Creek pasture will be grazed in fall of 2020 using mobile electric mesh fencing. Mobile electric fence will allow managers to keep livestock from the transition zone even as habitat transgression occurs. The upland areas are currently heavily invaded by medusahead ryegrass, which creates a suppressive thatch. Prescribed fire has been used to reduce medusahead ryegrass thatch on adjacent pastures, but is inappropriate so close to the marsh.

Both areas will be monitored as part of the overall grazing management of the property, including residual dry matter sampling and grazing monitoring. Additional transects may be established in the uplands of both sites to monitor species composition in areas adjacent to the restoration project.

2.7 Infrastructure

Function and stability of infrastructure were monitored by SLT staff (see attached LSBC SHH Infrastructure Monitoring Form). All structures were found to be functional and stable. Annual monitoring will continue using the aforementioned form. The form will ensure consistent monitoring across Solano Land Trust Staff, but monitoring will likely be conducted by the Project Manager or Field Operations Manager.

2.8 Public Access Infrastructure

The LSBC and SHH restoration sites are accessible to the public via the established trail system at Rush Ranch Open Space. Public access is available year round, seven days a week. Directional signage from the parking area and Ranch headquarters direct users onto the trails, and brochures with maps are available onsite in the Nature Center. Additional interpretive signage was installed as part of the project and is monitored annually as part of the infrastructure monitoring.

Guided public access is also available. Monthly tours are open to the public, and public school fieldtrips take elementary school children to the LSBC restoration site as often as twice weekly during fall and spring semesters. A summer STEM camp also utilizes the LSBC site.

2.9 Topographic monitoring

As-built topography data consists of digital elevation models (DEMs) constructed by Siegel Environmental (SE). An Unmanned Aerial Vehicle (UAV) was used on November 15, 2019 (prior to re-introducing tides to LSBC) to fly multiple overlapping images (effectively, stereo-pairs). Prior to the flight, SE set several ground control point targets (large black-and-white crosses) on the ground and surveyed them to NAVD88 using a Trimble R10 Real-Time Network GPS unit and referencing the survey to at least two on-site deep-seated benchmarks installed by the San Francisco Bay National Estuarine Research Reserve in 2016. For LSBC, SE also conducted on-the-ground elevation surveys on January 24, 2020 with the same Trimble R10 equipment and benchmark tie-ins to survey areas not completed at the time of the overflight (culvert and ranch road). On Jan 24, 2020 SE collected numerous elevation verification points in LSBC and SHH. DroneDeploy software was used to generate the initial DEM of

each area. Initial DEMs were imported into ArcMap 10.7.1, supplemented with the additional ground survey data for LSBC and breaklines that were established from aerial photography (channel banks, etc.).

Final DEMs were developed with elevations shown in half-foot increments (LSBC) and one-foot increments (SHH). Elevation verification points were used to assess the vertical accuracy of the final DEMs. Final maps produced show these final DEMs and integrate contour lines from earlier LiDAR-based DEMs outside the new DEM focus area to provide landscape context of the as-built elevation maps.

3.0 Monitoring Data Comparison

At this time, little data has been collected due to the short time period between completion of the project and submission of this annual report.

Earthwork has been completed, and topographical monitoring has been completed (Figures 12 & 13). As hydrologic connectivity to the marsh returns, further monitoring will be conducted to document change in topography over time.

Grazing in the SHH restoration site reduced medusahead ryegrass thatch and reduced vegetation height to desirable levels. The fence and water systems installed using project funds are fully functional and allow controlled grazing of the restoration area.

3.1 Status of Performance Measures

Performance measures have been met to the extent measurable given precipitation and time since completion/installation of project features. Lower than average precipitation resulted in no overland flow of freshwater from upland sources into LSBC. As such, it has not been possible to observe the residence time of stormwater in the system (PO – 2, Table 2.). Active revegetation efforts were completed in January of 2020. Insufficient time has passed for monitoring, which will be conducted in spring 2021. Observations of the plugged and seeded areas indicate germination and persistence of the plugs as of February 2020. An understanding of the true success of revegetation efforts will require time, and will be ascertained at the 5th year of the project (PO – 4, Table 2). Performance measures are listed in Table 2.

Table 1. Performance Objectives, Triggers, and Potential Adaptive Management Actions (from AMMP, 2018)

AAMP No.	Site	Criteria	Trigger	Potential Adaptive Management Actions	2019 progress
PO-1	LSBC	Tidal heights aligned between upper channel and First Mallard Slough at arch culvert.	More than 0.5 ft of reduction in tide height compared to tides at arch culvert	<ul style="list-style-type: none"> • Assess whether caused by channel blockage or undersized channel • Evaluate potential to clear blockage, enlarge channel 	No blockage observed. Criteria met so far.
PO-2	LSBC	Adequate combined downstream tidal and fluvial conveyance through the channel and across the high water overflow berm to reduce residence time of stormwater upstream of the ranch road by 25%.	Residence time of fluvial flows is >75% of pre-project conditions	Lower elevation of high water overflow berm or install weirs or culverts through the berm.	Not enough time to determine flows since construction. No flow from upstream since construction in 2019
PO-3	LSBC	Persistence of the tidal channel extended upstream of the ranch road crossing, allowing for natural geometry adjustments to conveyed flows	More than 0.5 ft of reduction in tide height compared to tides at arch culvert	<ul style="list-style-type: none"> • Assess degree of channel sedimentation • Evaluate potential to enlarge channel 	Tidal channel flows persistent since construction in 2019.
PO-4	LSBC	Revegetation of disturbed areas with predominantly (>25%) native vegetation cover by year-5 post-construction.	Non-native vegetation within disturbed areas exceeds 75% cover	Implement weed control program (weeding, herbicide, , etc.)	Active revegetation completed in January 2020. No monitoring results for 2019.

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PO-5	LSBC	Vegetation community composition within the tidal, seasonal, and ecotone habitats reflective of other locations at Rush Ranch by year-5 post-construction.	Significant difference in vegetation community composition	<ul style="list-style-type: none"> • Assess drivers (e.g., hydrologic, soils, invasives) • Evaluate potential to implement active native plant revegetation effort • Evaluate potential to address other drivers 	Active revegetation completed in January 2020. No monitoring results for 2019.
PO-9	LSBC	No major erosion or slumping along the high water overflow bench and public access path by year-5 post-construction.	Erosion or slumping along the high water overflow bench that threatens the integrity of the gravel access path	Repair eroded/slumped area and install appropriate erosion control measures (e.g., jute/coir netting) as-needed to control further erosion	No slumping or erosion observed since construction in 2019
PO-10	LSBC	No indications of culvert structural instability by year-5 post-construction	Signs of erosion around the culvert footings or wing-walls that an engineer determines could cause unsafe conditions	Repair culvert as-needed to alleviate the concern.	Culvert installed in November 2019. Structurally sound.
PO-11	LSBC	Interpretive sign intact and public access turnout being maintained by year-5 post construction	Sign no longer providing interpretive information, access turnout not accessible	<ul style="list-style-type: none"> • Repair sign • Clear vegetation in access turnout, fill potholes 	Sign in progress in 2019. To be installed in February 2020.

PO-12	LSBC	Cattle excluded from site during wet season	Cattle enter during wet season	<ul style="list-style-type: none"> • Inspect perimeter fencing for damage and repair • Review allowable use areas with grazing tenant 	No cattle observed in LSBC.
PO-13	SHH	Passage of storm flows downstream of the impoundment berm and reduced extent of ponding behind the berm in the first winter post-construction.	Storms flows not passing the impoundment berm after impoundment full, impoundment extent does not reduce compared to pre-project conditions	Reassess elevation of impoundment berm and consider lowering further if necessary	With only December 2019 to observe, so far the structure is functioning to criteria.
PO-14	SHH	No major erosion or slumping of the quarry slope layback area by year-5 post-construction	Erosion or slumping along the quarry slope layback area that threatens the integrity of the quarry	Repair eroded/slumped area and install appropriate erosion control measures (e.g., jute/coir netting) as-needed to control further erosion	NO observed slumping or erosion in layback area. Seed and straw installed December 2019.
PO-15	SHH	Development of predicted seasonal wetland, vernal pool, and impoundment habitats by year-5 post-construction.	Absence of intended habitats forming	Assess need to repair impoundment berm, assess need to conduct additional plantings, make adjustments as assessments indicate	No monitoring results to date

4.0 References

California Department of Fish and Wildlife (CDFW), 2019, *Annual Report, 2019, California Ridgeways's Rail and California Black Rail, Suisun Marsh, California*; Report to California Department of Water Resources, Agreement # 4600011215.

Gillison, A.N. & Brewer, K.R.W., 1985. The use of gradient directed transects or gradsects in natural resource surveys. *Journal of Environmental Management* 20, 103-127.

LSA, 2020, *Rush Ranch habitat restoration, Post- construction compliance report for submission to USFWS*, dated January 15, 2020, prepared for Solano Land Trust

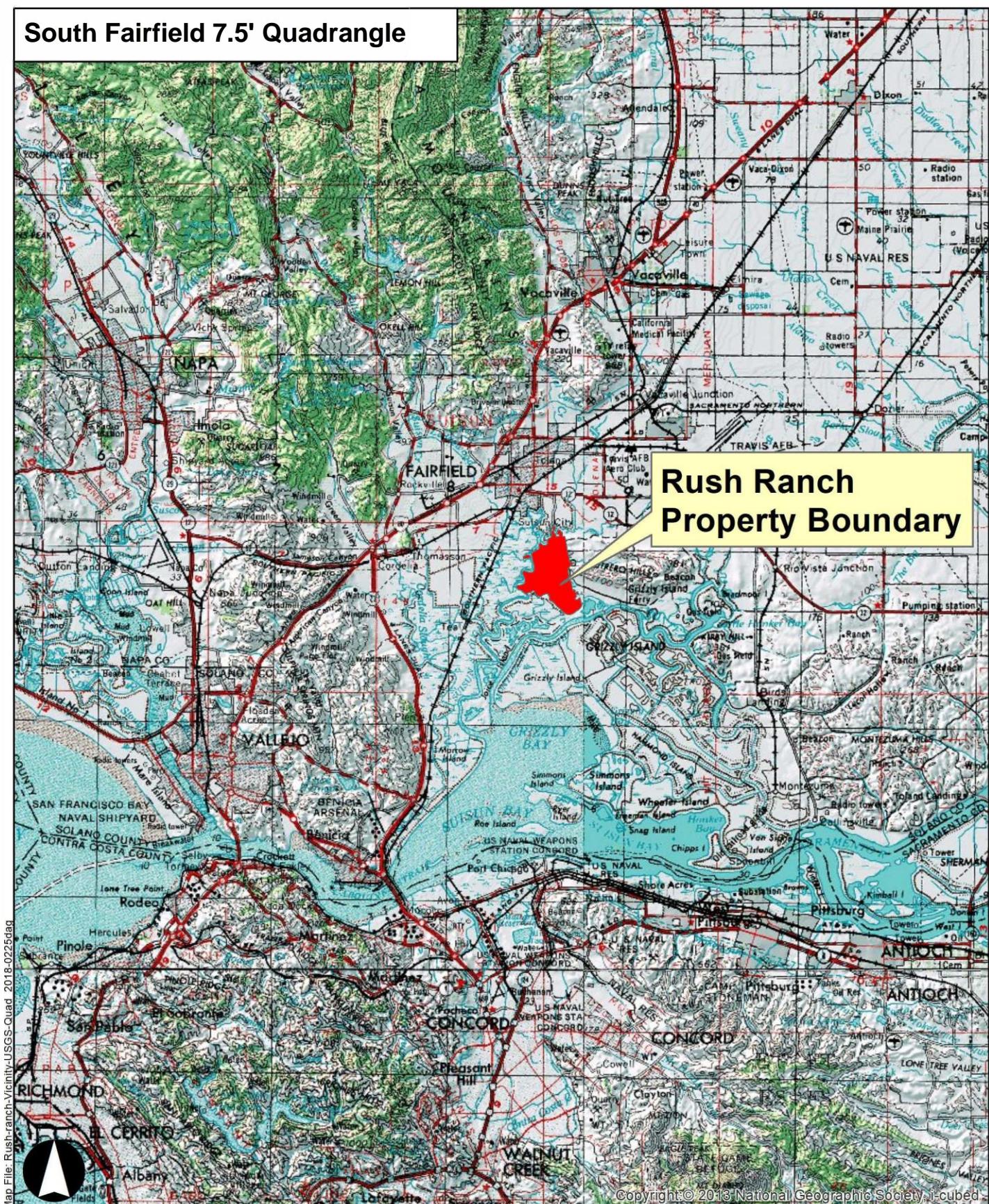
Marty, J. T., 2005. Effects of cattle grazing on diversity in ephemeral wetlands. *Conservation Biology* 1626–1632.

Marty, J. T., 2015. Loss of biodiversity and hydrologic function in seasonal wetlands persists over 10 years of livestock grazing removal. *Restoration Ecology*, Vol. 23, No. 5, pp. 548–554.

Siegel Environmental, 2018, (AMMP), *Final Agency Approved Adaptive Management and Monitoring Plan, Lower Spring Branch Creek and Suisun Hill Hollow Restoration Project, Rush Ranch Open Space Preserve, Suisun Marsh, Solano County, California*; dated August 31, 2018; Prepared for Solano Land Trust

Solano Archaeological Surveys (SAS), 2019, *Cultural Resources Monitoring – Lower Spring Branch Creek and Suisun Hill Hollow Restoration Project, Solano County, California. Cultural Resources Technical Memorandum*. Prepared for Solano Land Trust dated November 1, 2019

South Fairfield 7.5' Quadrangle



Data sources: RR Boundary (SLT, 2017), USGS Quads (ESRI 2017)

1 :300,000 (1" = 5 miles at letter size)

0 2.5 5 Miles

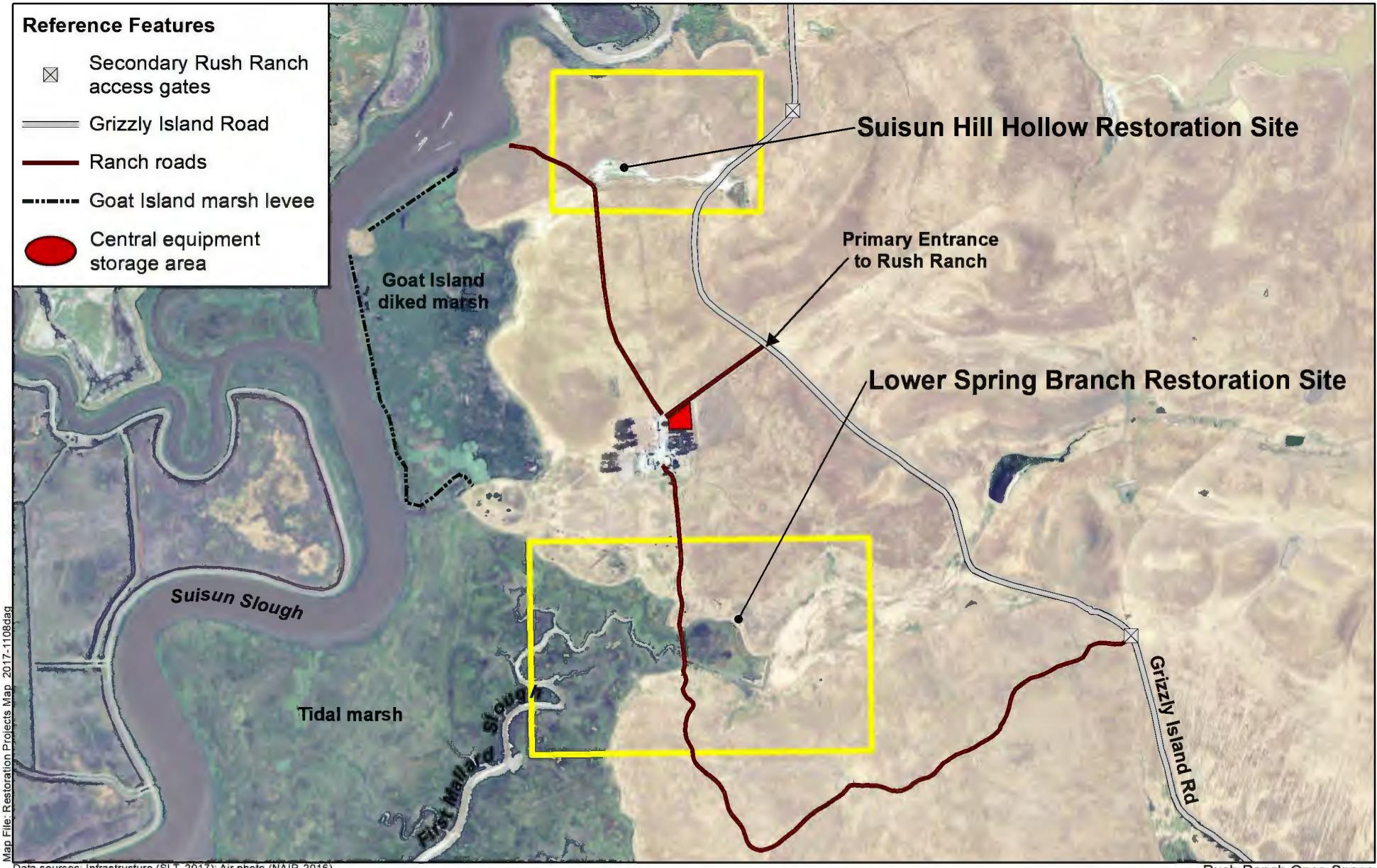
0 4 8 Kilometers

Rush Ranch Open Space
Solano County, CA



Figure 1

Project Vicinity - USGS 7.5' Quad Map



1:14,400 (1" = 1,200' at letter size)
0 600 1,200
ft
0 200 400
m



Rush Ranch Open Space
Solano County, CA

Figure 2
Restoration Projects Location Map



1:1,200 (1" = 100' at letter size)

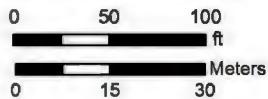


Figure 3
Mouse Exclusion and Silt Fence Alignment



0 50 100 200 Feet

Soft Bird's Beak at Lower Spring Branch Creek



Legend	
	Continuous Patches 2019
	Individuals 2019
	Continuous Patches 2018
	Individuals 2018
	Study Plots

Figure 4



Map File: air-photo-Nov-base SHH EL 2016-1227dag

Data sources: Air photo (Terravion, 2016)

Rush Ranch Open Space
Solano County, CA

1:600 (1" = 50' at Arch E size)

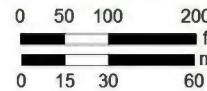


Figure 5
Suisun Hill Hollow
November 2016 Aerial Photograph



1:1,200 (1" = 100' at Arch E size)



0 100 200 400
ft
0 30 60 120
m

Rush Ranch Open Space
Solano County, CA

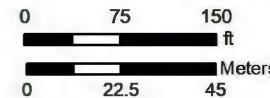
Figure 6
Lower Spring Branch Creek
May 2016 Aerial Photograph



Data sources: Air photo (EnviroDrones, 2019; Terravion, 2016);



1:1,800 (1" = 150' at letter size)



Rush Ranch Open Space
Solano County, CA

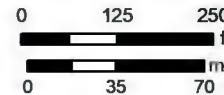
Figure 7
November 15, 2019 UAV Photograph - LSBC



Data sources: Air photo (Envirodrones, 2019; Terravion, 2017)

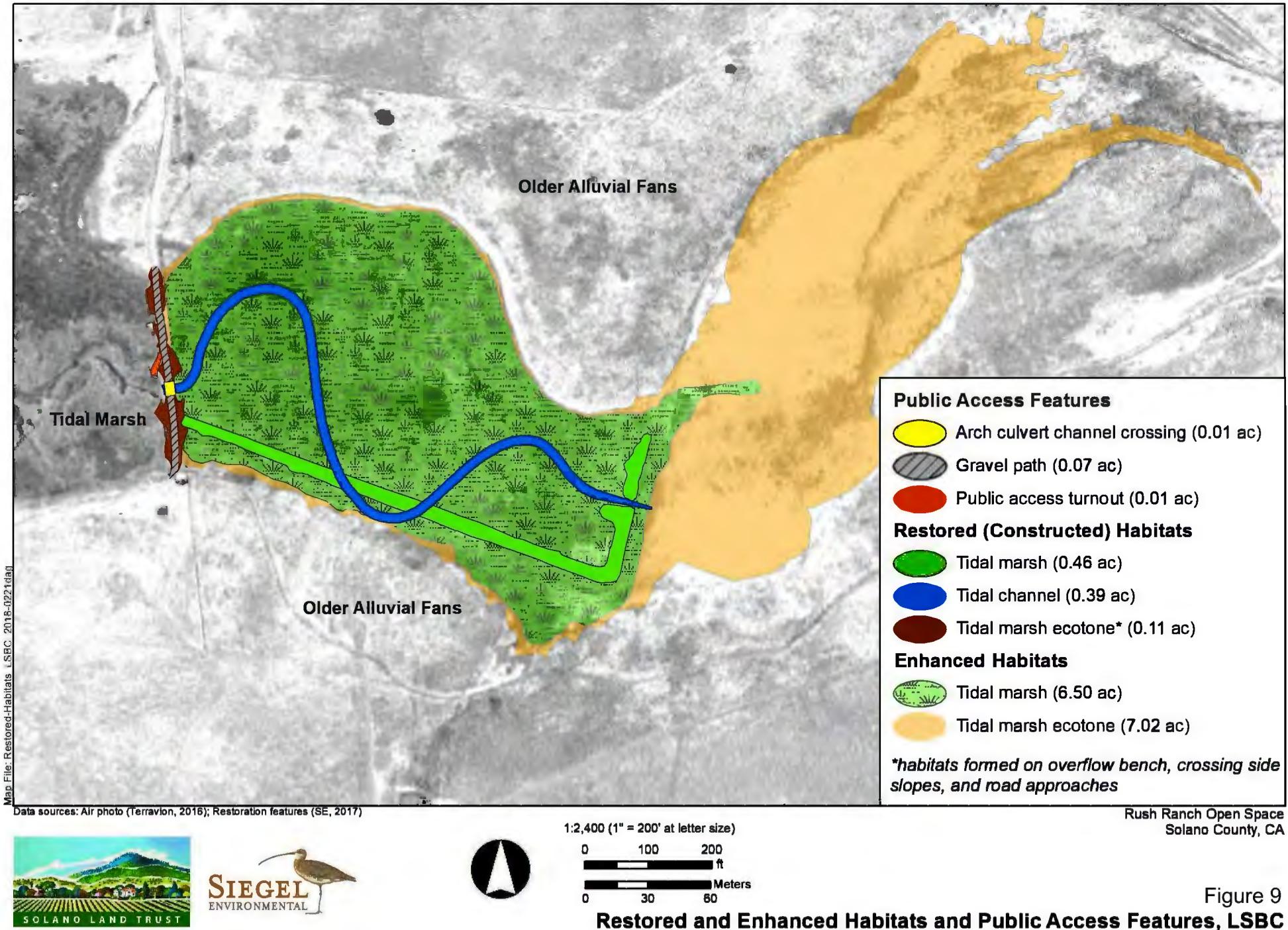


1:3,000 (1" = 250' at letter size)



Rush Ranch Open Space
Solano County, CA

Figure 8
November 15, 2019 UAV Photograph, SHH



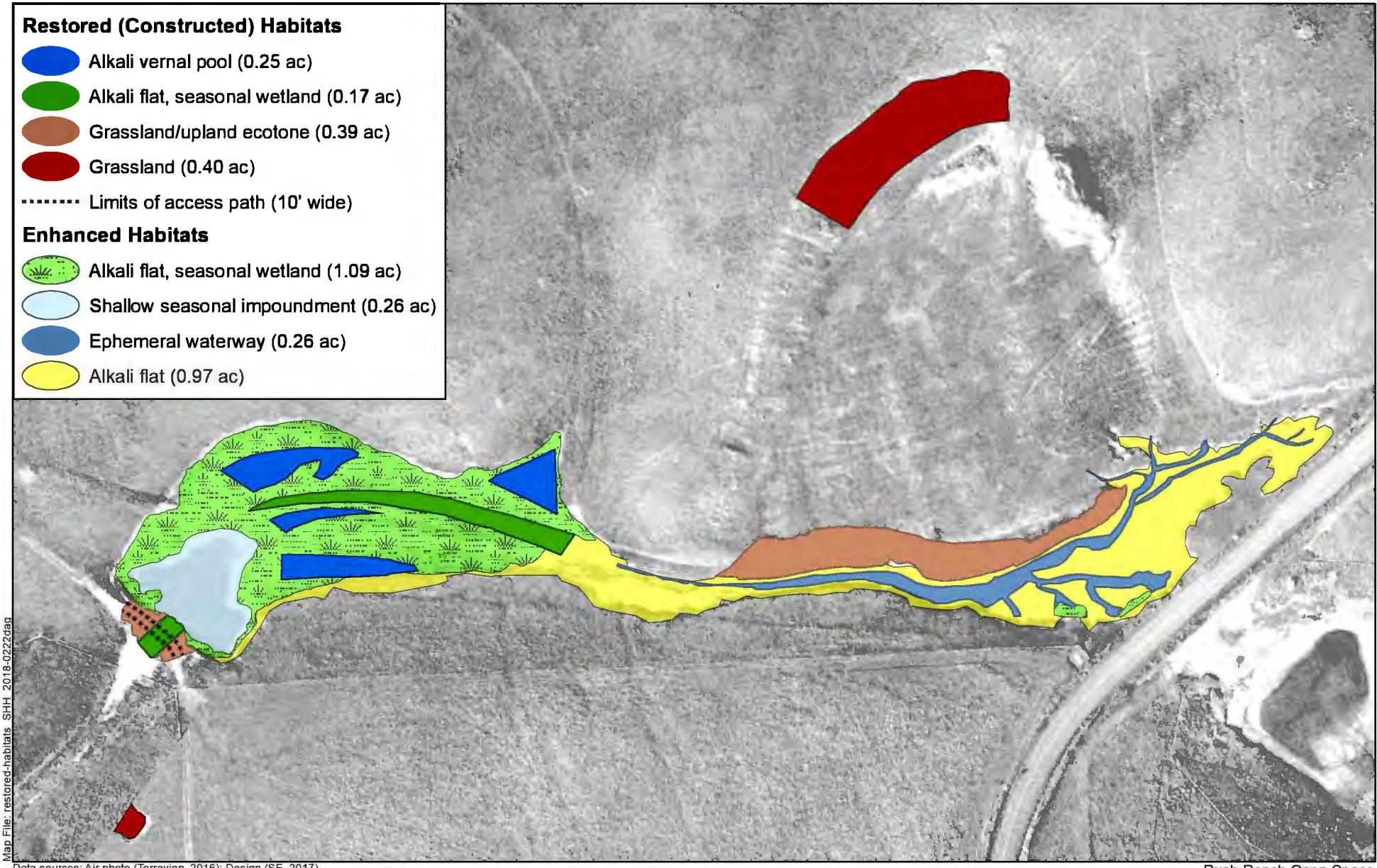


Figure 10
Restored and Enhanced Habitats, SHH



Red-tailed hawk Photo Credit Tom Muehleisen

Connecting Habitats

You are near a tidal marsh, a densely vegetated habitat that floods each day as the ocean's tide pushes into San Francisco Bay, Suisun Slough, and into the small creeks that wind through Rush Ranch's ancient marsh. In 2019, after many years of planning, the Solano Land Trust, partners, and grantors re-constructed parts of the creek to provide a watery connection between the upland hills and the marsh. You can look down on this new channel from the trail ahead. As you walk south, look closely at the wetlands and waters of Lower Spring Branch Creek and First Mallard Slough on both sides of the trail.



Aerial of Lower Spring Branch Creek during construction of new channel and backfilling. Photo Credit Bois Bishop



Early morning view of newly constructed tidal channel of Lower Spring Branch Creek. Photo Credit Tom Muehleisen

Restoration Benefits

Tidal plant and animal communities are spreading eastward up into the watershed. Higher tides from sea level rise will have room to spread. Seasonal rainfall runoff and tidal waters move plant debris, nutrients and fauna up and down the creek. The whole foodweb - from zooplankton, to fish, birds, other wildlife, and people benefit from these healthy habitats.



River Otter Photo Credit Tom Muehleisen

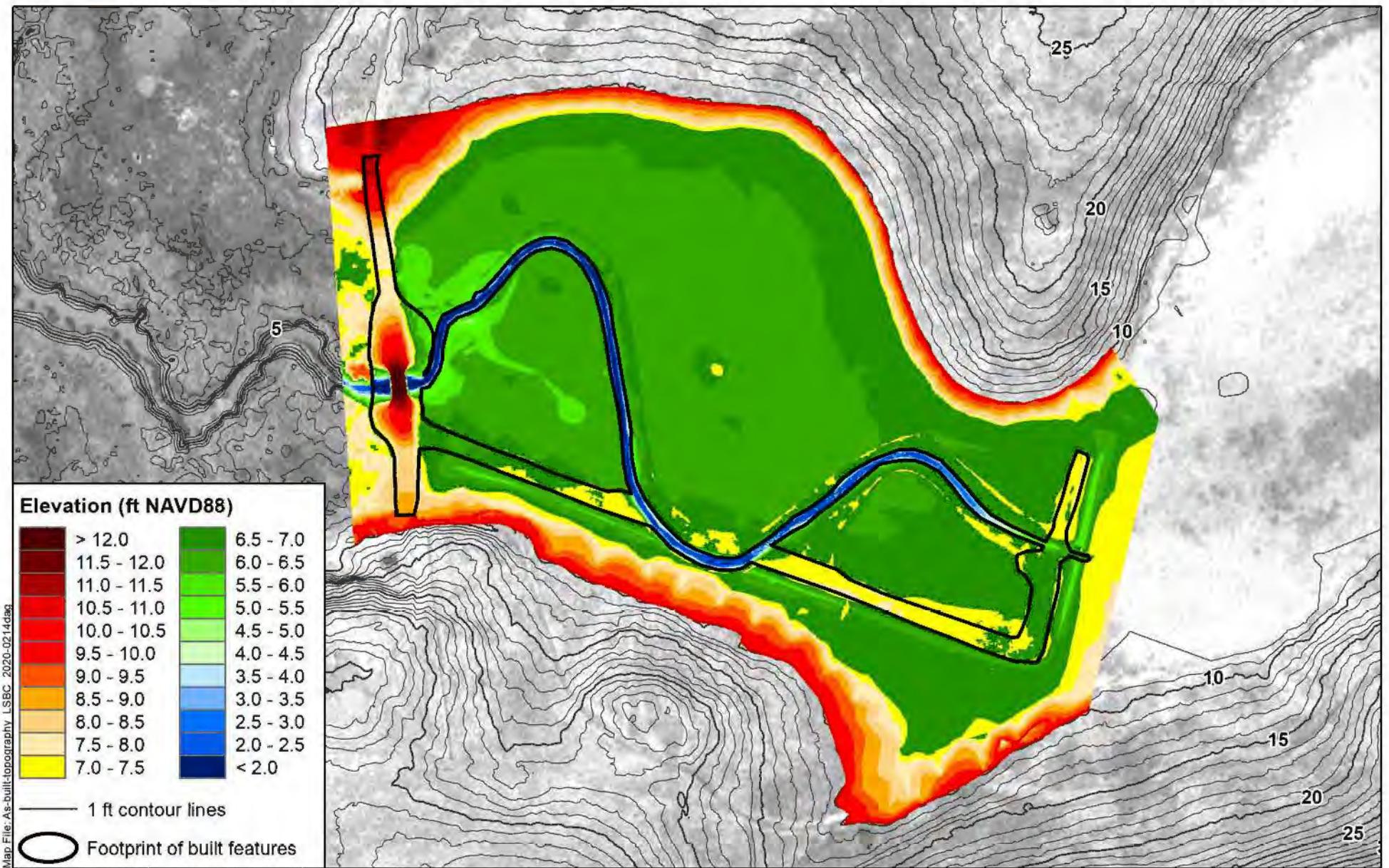
ACTION: Join Solano Land Trust to help protect, restore, and care for wetlands and natural areas in Solano County.
www.SolanoLandTrust.org

Funded by the Water Quality, Supply, and Infrastructure Improvement Act of 2014, the Delta Water Quality and Ecosystem Restoration Grant Program and its implementing agency, the California Department of Fish and Wildlife and Solano Orderly Growth Committee with in-kind contributions from Siegel Environmental and Hanford Applied Restoration and Conservation. Rush Ranch is a San Francisco Bay National Estuarine Research Reserve site.



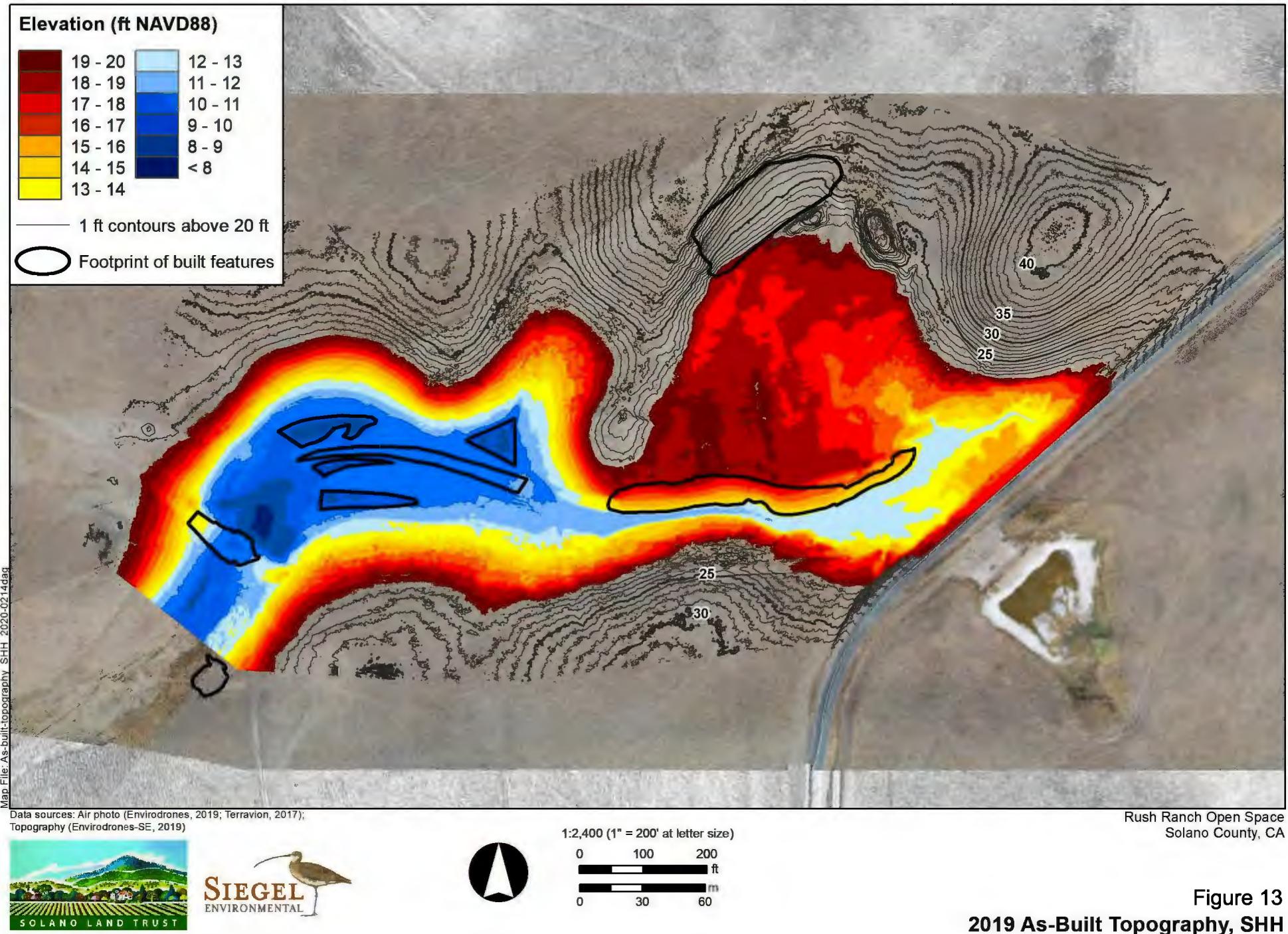
Rush Ranch Open Space
Solano County, CA

Figure 11
Interpretive Sign, Lower Spring Branch Creek



1:1,800 (1" = 150' at letter size)
 0 75 150 ft
 0 25 50 m

Figure 12
2019 As-Built Topography, LSBC



MEMORANDUM

DATE: January 15, 2020
To: Solano Land Trust
FROM: Steve Kohlmann, PhD.
SUBJECT: Rush Ranch habitat restoration, Post Construction Compliance report for submission to USFWS (Service File No. 08ESMF00-2012-F-0602 and 06FBDT00-2018-F-0316)

As part of the Formal Consultation on the Rush Ranch Habitat Restoration and Biological Opinion on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan (Service File No. 08ESMF00-2012- F-0602-2), the United States Fish and Wildlife Service has requested the following Reporting Requirement:

“The applicants shall submit a post-construction compliance report prepared by the on-site biologist to the San Francisco Bay-Delta Fish and Wildlife Office within sixty (60) calendar days of the date of the completion of construction activities. This report shall detail (i) dates that construction occurred; (ii) pertinent information concerning the success of the project in meeting the avoidance and minimization measures (i.e., Conservation Measures); (iii) an explanation of failure to meet such measures, if any; (iv) known project effects on the California clapper rail, salt marsh harvest mouse, California least tern, soft bird's-beak, Suisun thistle, and delta smelt if any; (v) occurrences of incidental take of these listed species, if any; (vi) documentation of employee environmental education; and (vii) other pertinent information.

This report contains the above requested information, based on LSA’s participation as the Service-approved on-site biological monitor.

1. Dates that construction occurred: The project started on September 1 with dewatering of the site, and concluded on November 22 with demobilization and site restoration. Worker training, site inspections, mowing/flushing and exclusion fence construction was initiated on 8/14/2019.
2. Success of Avoidance and Minimization measures: The required avoidance and minimization measures were implemented successfully. In particular, the exclusion fencing was maintained through the project’s duration and daily monitoring of the exclusion area occurred to prevent any covered species to be affected. The biological monitors did not

encounter rodents or rail species during the daily clearance of the work area; however, they frequently flushed passerine birds.

3. Failures: This was a challenging site to work in, mainly due to the high water level. Failures of the dewatering pump and sealing bladder caused the water level on-site to fluctuate. As a consequence, heavy equipment operating within the project site's footprint got stuck.
4. Known project effects on the California clapper rail, salt marsh harvest mouse, California least tern, soft bird's-beak, Suisun thistle, and delta smelt: No harm, injury, killing or other forms of take occurred of California clapper rails, salt marsh harvest mice, California least terns, and delta smelt resulting from project related activities. California least tern, Soft bird's-beak and Suisun thistle did not occur in the project area.
5. Documentation of employee environmental education: Worker environmental awareness training was provided by LSA's designated biologist on 8/14/19 and 9/3/19. Signature sheet attached.

Attachment: Signature sheet

RUSH RANCH

Lower Spring Branch Creek Suisun Hill Hollow Restoration

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CONTRACTOR TRAINING ATTENDANCE SHEET

Date: / /

Page of

Date: _____ Sensitive Species Trainer (s): J-e-r -- to ar MA _____

Lower Spring Branch Creek and Suisun Hill Hollow Infrastructure Monitoring Checklist

Monitor: Jasmine Westbrook

Date: 2/6/2020

Suisun Hill Hollow Site:

- **Walk the fence surrounding the SHH restoration site and monitor the following.** If answer is "no", describe issue and return to form to note date the concern was resolved.
 - o Gates functional, close and latch securely

Yes L No Description Date resolved

- o Fence is in good condition, wires are taught, no loose, broken, or missing wires

Yes No Description Date resolved

- o Water troughs functional, filling, not leaking or running over

Yes L No Description Date resolved

- o Trough pads functional, adequate to prevent undue compaction and erosion

Yes No Description Date resolved

- o Trail crossing is sound, w); igns of erosion, rutting, or washing out

Yes No Description Date resolved

Lower Spring Branch Creek and Suisun Hill Hollow Infrastructure Monitoring Checklist

Monitor: Jasmine L. Westbrook Date: 2/10/2020

Lower Spring Branch Creek Site:

- **Inspect the culvert/bridge** and monitor the following. If answer is "no", describe issue and return to form to note date the concern was resolved.

- o Bridge is sound, no signs of water cutting around the culvert, all uprights in good condition

Yes	No	Description	Date resolved
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- o Bridge safety railing is sound, complete and solid

Yes	No	Description	Date resolved
-----	----	-------------	---------------

- o Bridge/culvert is clear of debris, no obstruction of flow

Yes	No	Description	Date resolved
-----	----	-------------	---------------

- **Walk the LSBC spur trail** through the site and monitor the following. If answer is "no", describe issue and return to form to note date the concern was resolved.

- o Trail has been mowed and is reasonably free of high grass, weeds, or other vegetation that could impede visitor safety and enjoyment

Yes	No	Description	Date resolved
-----	----	-------------	---------------

- o Trail is sound with no to few erosive features

Yes	No	Description	Date resolved
-----	----	-------------	---------------

- o Trail surface is adequate for use with few tripping hazards

Yes	No	Description	Date resolved
-----	----	-------------	---------------

- o Trail markers and directional signage present and functional

Yes	No	Description	Date resolved
-----	----	-------------	---------------

- o Interpretive and educational signage present, legible, and free of vandalism

Yes	No	L	Description	Wt	tl	'aWJ	.	Date resolved	2/20/20LJD
-----	----	---	-------------	----	----	------	---	---------------	------------

install



CULTURAL RESOURCES TECHNICAL MEMORANDUM

DATE: November 1, 2019

TO: Solano Land Trust

FROM: Solano Archaeological Services (SAS)

SUBJECT: Cultural Resources Monitoring – Lower Spring Branch Creek and Suisun Hill Hollow Restoration Project, Solano County, California

INTRODUCTION

The Solano Land Trust (SLT) has completed a construction project at the Rush Ranch Open Space Preserve to restore form and function to the existing marsh's tidal reach (Project). Construction included lowering a berm to marsh grade, and excavation of a tidal channel. Solano Archaeological Services (SAS) provided archaeological monitoring for the restoration efforts, as well as updating site SAS-001 (UCDRR16-01) originally discovered by a U.C. Davis field school under Ph.D. candidate Roshanne Bakhtiary in 2016. SAS-001, consisting of a pre-contact milling station, lies adjacent to the restoration project footprint. Project permitting required compliance with the provisions of the California Environmental Quality Act (CEQA); the construction monitoring was conducted as a precautionary measure and not as required mitigation.

PROJECT LOCATION

Lower Spring Branch Creek and Suisun Hill Hollow Restoration Project area (project area) is located near the City of Suisun in Solano County, California, within SLT's Rush Ranch Open Space Preserve (Attachment A Figures 1-3). The Project area is depicted within Township 4 North, Range 1 West, Sections 7 and 12 of the Fairfield South, CA United States Geological Quadrangle 7.5' topographic map.

REGULATORY SETTING

CEQA requires that public agencies having authority to finance or approve public or private projects assess the effects of the projects on cultural resources. Cultural resources include buildings, sites, structures, objects, or districts, each of which may have historical, architectural, archaeological, cultural, or scientific significance. CEQA states that if a proposed project would result in an effect that may cause a substantial adverse change in the significance of a significant cultural resource (termed a "historical resource"), alternative plans or mitigation measures must be considered. Because only significant cultural resources need to be addressed, the significance of cultural resources must be determined before mitigation measures are developed.

CEQA §5024.1 (Public Resources Code §5024.1) and §15064.5 of the State CEQA Guidelines (14 California Code of Regulations [CCR] §15064.5) define a historical resource as "a resource listed or eligible for listing on the California Register of Historical Resources." A historical resource may be eligible for inclusion in the California Register of Historical Resources (CRHR) if it:

- Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;
- Is associated with the lives of persons important to our past;
- Embodies the distinctive characteristics of a type, period, region, or method of construction; represents the work of an important creative individual; or possesses high artistic values; or
- Has yielded, or may be likely to yield, information important to prehistory or history.

In addition, CEQA also distinguishes between two classes of archaeological resources: archaeological sites that meet the definition of a historical resource, and “unique archaeological resources.” An archaeological resource is considered “unique” if it:

- Is associated with an event or person of recognized significance in California or American history or of recognized scientific importance in prehistory;
- Can provide information that is of demonstrable public interest and is useful in addressing scientifically consequential and reasonable research questions;
- Has a special or particular quality such as oldest, best example, largest, or last surviving example of its kind;
- Is at least 100 years old and possesses substantial stratigraphic integrity; or
- Involves important research questions that historical research has shown can be answered only with archaeological methods (Public Resources Code §21083.2).

According to the State CEQA Guidelines, a project with an effect that may cause a substantial adverse change in the significance of a historical resource or a unique archaeological resource is a project that may have a significant effect on the environment (14 CCR §15064.5[b]). CEQA further states that a substantial adverse change in the significance of a resource means the physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of a historical resource would be materially impaired.

The State CEQA Guidelines (14 CCR §15064.5[e]) also require that excavation activities be stopped whenever human remains are uncovered, and that the county coroner be called in to assess the remains. If the county coroner determines that the remains are those of a Native American, the Native American Heritage Commission must be contacted within 24 hours, and the provisions for treating or disposing of the remains and any associated grave goods as described in CCR §15064.5 must be followed.

NATURAL AND CULTURAL SETTING

Existing Environment

The project site is located in Suisun Marsh east of Suisun Slough, North of Montezuma Slough, Grizzly Bay, and Suisun Bay, and west of Potrero Hills, approximately 0-40 feet above sea level. The property is relatively flat and lies in close proximity to a variety of drainages including Spring Branch Creek just north and First Mallard Branch River to the west. The juxtaposition of marsh, open grassland, and multiple water courses provided a variety of flora and fauna for aboriginal diet, including waterfowl, resident freshwater fishes, seasonal salmon runs, and a variety of nuts and seeds. In addition, the environmental and geological diversity would provide nearby access to a variety of raw materials for pre-contact inhabitants.

Pre-Contact Context

In the early 1970s, Fredrickson (1973, 1974) proposed a sequence of cultural manifestations or patterns for the central districts of the North Coast Ranges, placing them within a framework of cultural periods he believed were applicable to California as a whole. The following is a summary of these temporal periods with descriptions of the associated cultural patterns that have been identified for northern Solano County and the adjoining regions.

Paleo-Indian Period (10,000 B.C. to 6000 B.C.)

This period saw the first demonstrated entry and spread of humans into California with most known sites being situated along lakeshores. A developed milling tool technology may be present at this time. Social units were not heavily dependent upon the exchange of resources with trading activities having occurring on an ad hoc, individual basis.

Lower Archaic Period (6000 B.C. to 3000 B.C.)

The beginning of this period coincides with that of the middle Holocene climatic shift to more arid conditions that brought about the drying up of the pluvial lakes. Subsistence appears to have been focused more on plant foods although hunting clearly still provided for important food and raw material sources. Most tools were manufactured of local materials, and exchange remained on an ad hoc basis. Distinctive artifact types are large projectile points and the milling slab and hand stone.

Middle Archaic Period (3000 B.C. to 1000 B.C.)

This period begins at the end of mid-Holocene climatic conditions when weather patterns became similar to present-day conditions. Cultural change was likely brought about in response to these changes in climate and accompanying variation in available floral and faunal resources. Economic systems were more diversified and likely included the introduction of acorn processing technology. Hunting remained an important source of food and raw materials although reliance on plant foods appears to have predominated the subsistence system. Little evidence is present for development of regularized exchange relations. Typologically and technologically important artifacts characteristic of this period include the bowl mortar and pestle and the continued use of large projectile points.

Upper Archaic Period (1000 B.C. to A.D. 500)

A marked expansion of sociopolitical complexity marks this period with the development of status distinctions based upon material wealth. Group-oriented religions emerge, and there was a greater complexity of trade systems with evidence for regular, sustained exchanges between groups. Shell beads gained in significance as possible indicators of personal status and as important trade items. This period retained the large projectile points in different forms, but the milling slab and hand stone were replaced throughout most of California by the bowl mortar and pestle.

Emergent Period (A.D. 500 to 1800)

This period is distinguished by the advent of several technological and social changes. The bow and arrow were introduced, ultimately replacing the atlatl. Territorial boundaries between groups became well established and were well documented in early historic accounts. The exchange of goods between groups became more regularized and clamshell disk beads became a monetary unit of exchange. The mortar and pestle are the predominant milling implements utilized, and small arrow points replaced the larger projectile point forms more commonly associated with atlatls.

Ethnographic Setting

The project site is situated within the traditional ethnographic territory of the Patwin, who occupied a series of linguistically and culturally related tribelets who located in the lower Sacramento Valley west of the Sacramento River and north of Suisun Bay. The Patwin were politically organized into tribelets that consisted of one primary and several satellite villages. Each tribelet maintained its own autonomy and sense of territoriality. Villages were located along waterways, often near the juncture with another major topographic feature such as foothills or another waterway. Structures within these villages usually consisted of earth covered, semi subterranean structures with an elliptical or circular form (Kroeber 1932). All except the individual family dwellings were built with the assistance of everyone in the village.

Through the skilled use of the natural materials available within their range, the Patwin exploited a wide variety of edible resources. Netting and cordage was of particular importance in fishing and hunting activities and wild hemp, and milkweed provided particularly suitable fibers for the production of fishing nets and lines. Anadromous fish such as sturgeon and salmon were part of the staple Patwin diet (Johnson 1978:358) and were typically caught in large numbers using stone and wood weirs and cordage nets.

One of the more distinctive aspects of the Patwin culture was the Kuksu or “big-head” dances cult system, also found in other tribes through much of north central California. Within each cult were secret societies, each with its own series of dances and mythologies centered on animal figures such as Sede-Tsiak (Old Man Coyote) or Ketit (Peregrine Falcon). The Patwin were unique in possessing three secret societies. In the central California cult system, almost all groups possessed the Kuksu but the Patwin also had the “ghost dance” (way saltu) and Hesi societies (Kroeber 1932: 313). Each secret society engaged in specific spiritual activities. For example, the way saltu society stressed curing and shamanistic functions (Sturtevant 1959: 353–354, 364–365).

Historic Setting

Spanish explorers first entered what is now Solano County in 1775 crossing over the San Pablo Bay and landing on the shores of the Carquinez Straits. They named this area the “Puerto de la Asuncion de Nuestra Senora” meaning Port of our Heavenly Lady (later renamed by General Vallejo as Isla de la Yegua or Mare Island). The first Spanish contacts with Native Americans in this area were with the Patwin, and eventually the county was named after Chief Solano. Solano was one of California’s original 27 counties, founded on February 18, 1850 with Fairfield becoming the county seat on March 28, 1874 (Thompson and West 1878).

In 1835, General Mariano Guadalupe Vallejo was ordered by the Mexican government to colonize the Fairfield/Suisun area to protect interior Spanish interests from the Russians at Fort Ross. The lower part of the Sacramento Valley and Delta areas were then settled rapidly as the Mexican government granted large tracts of land and access to the region’s natural resources.

The discovery of gold in California incited a massive influx of settlers, including gold seekers and immigrants, from the United States and the rest of the world. The influx changed the demographics and cultural landscape of California overnight and increased interaction with and destruction of aboriginal populations including those in the Central Valley. During the Gold Rush, ranchers and farmers quickly discovered that selling their crops to miners was extremely profitable. Railroad tracks were laid to transport crops—playing an important part in the development of both towns and agriculture. In the late 1840s and 1850s, former gold seekers and pioneers began settling Solano County, where they raised livestock and cultivated fruit orchards, vineyards, wheat, barley, and oats. Produce and livestock were

transported overland by wagons to docks located at the numerous sloughs throughout the county, where they were then shipped to market.

BACKGROUND INFORMATION

Because this project consisted only of construction monitoring and updating records for one archaeological site (SAS-001/ UCDRR16-01), no background research was completed beyond reviewing a report documenting a previous survey conducted by the 2016 U.C. Davis field school (Bakhtiar 2018), which described UCDRR16-01 as an isolated find consisting of a single bedrock mortar (BRM) and a cupule located approximately 150 meters east of CA-SOL-346 (another pre-contact milling station).

CONSTRUCTION MONITORING/SITE RECORDATION

SAS archaeologists Susan Talcott, M.A., and Amy Wolpert, M.A. monitored SLT restoration construction from September 30-October 11, 2019. Two isolated, borderline historic-era bottles were identified, and one pre-contact site (SAS-001/ UCDRR16-01) was re-recorded and updated.

Isolated Bottles

The two isolated historic bottles consisted of the following:

1. Bottle 1: Dandy Flask with “*FEDERAL LAW FORBIDS SALE OR RE-USE OF THIS BOTTLE*” pre-dates 1964
2. Bottle 2: Gallo Flavor Guard Green Swirl wine bottle 1958-1990

No evidence of a historic deposit was noted.

SAS-001/ UCDRR16-01

SAS field crew expanded the boundaries and complexity of the site. In sum, three archaeological features were defined (Features A-C) and found to contain a total of eight BRMs and incipient mortars.

During the documentation of SAS-001/UCDRR16-01, SAS labeled each basaltic outcrop containing BRMs as a separate feature. Feature A consists of an outcrop measuring 1.2 meters (m) north-south, 0.66 m east-west, and approximately 20 centimeters (cm) high. Feature A included one BRM.

Feature B consists of a outcrop measuring 3.65 m north-south, 1.85 m east-west, and approximately 34 cm high. Feature B contained two BRMs.

Feature C consists of a outcrop measuring 2.99 m north-south, 1.65 m east-west, and approximately 10 cm high. Feature C contained three BRMs and two incipient mortars/degraded milling surfaces.

No artifacts were found in association with the three features. Department of Parks and Recreation site record forms may be found in Attachment B.

SUMMARY

The archaeological site SAS-001/UCDRR16-01 originally recorded in 2016 by the U.C. Davis field school was relocated and significantly updated, and two isolated historic-era bottles were identified without context. No new pre-contact archaeological resources were identified. No additional management is required.

REFERENCES

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- 2018 Archaeological Survey Report for the Solano Land Trust at Rush Ranch Open Space, Solano County, California. Submitted to the Solano Land Trust.
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- 1974 Cultural Diversity in Early Central California: A View from the North Coast Ranges. *Journal of California Anthropology* 1(1):41-53.
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- 1932 The Patwin and Their Neighbors. *University of California Publications in American Archaeology and Ethnology* 29(4):253-423.
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- 1983 *A Cultural Resource Survey of the Proposed Lynch Canyon Landfill Site, Southwestern Solano County, California*.

ATTACHMENT A

Figures

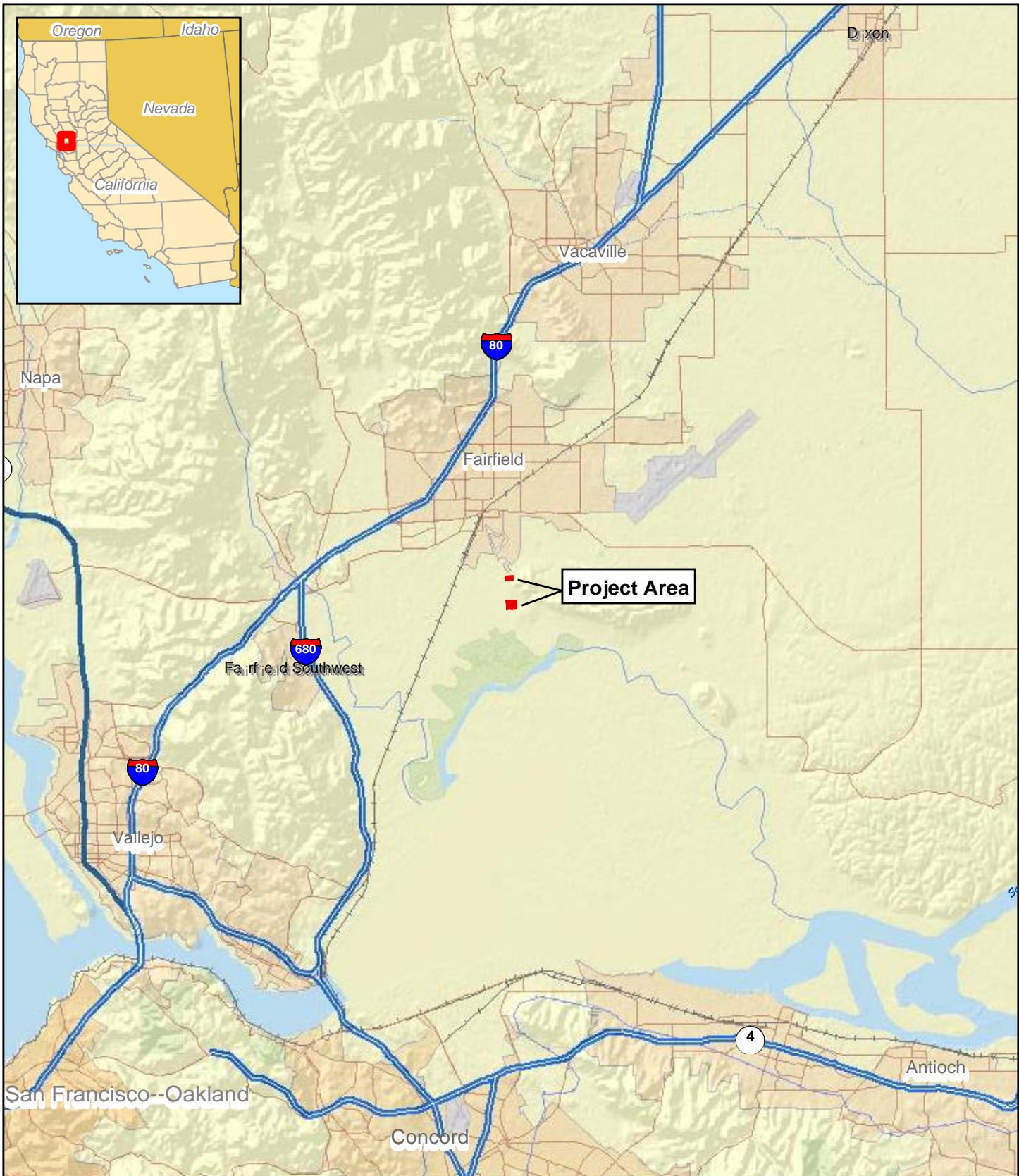


Figure 1. Project Vicinity Map.

■ Rush Ranch Project Area

Sources: USA Base Map [layer], Data and Maps [CD]. ESRI, 2006.



1:250,000

0 3 Miles
0 6 Kilometers





Figure 2. Project Location Map.

1:24,000

Rush Ranch Project Area

Wetlands Land Grant. (Presumed T4N, R11W,
Sections 6, 7; T4N, R2W, Sections 1, 12.)
Fairfield South 7.5' Series Quadrangle, USGS, 1980.

0.5

Miles

1

Kilometers





Figure 3. Project Area Map.

 Rush Ranch Project Area

Total Acreage = 106.80

1:8,000

0 500 Feet
250 Meters



ATTACHMENT B

Site Record Forms

**State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD**

**Primary #
HRI #
Trinomial
NRHP Status Code**

Other Listings Review Code	Reviewer	Date
---------------------------------------	-----------------	-------------

Page 1 of 9

*** Resource Name or #:** SAS-001/UCDRR16-01

P1. Other Identifier:

***P2. Location:** Not for Publication Unrestricted
 and (P2b and P2c or P2d. Attach a Location Map as necessary.)
***b USGS 7.5' Quad:** Fairfield South
 W ½ of the SW ¼ of Sec. 7 **M.D. B.M.**
c. Address: 3521 Grizzly Island Road **City:** Suisun City **Zip:** 94585
d. UTM: Zone: 10; 585,423 mE/ 4,228,855 mN **Datum:** NAD83 SAT Datum
e. Other Locational Data: Elevation: 20' asl

From the Rush Ranch Open Space Visitor Center located at 3521 Grizzly Island Road in Suisun City, follow the unnamed access road south past the antique farming equipment towards "Indian Grinding Rock". Continue south on this road for approximately 0.3 miles until the road forks just prior to a wood sign pointing west to "Indian Grinding Rock". The site is approximately 80 feet southeast of the fork and the east segment of access road continues southeast through the site.

***P3a. Description:** (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries)
 This site consists of three precontact bedrock milling station features located southeast of First Mallard Branch of Suisun Slough and south of the Rush Ranch Open Space Visitor Center. Locus 1 contains two highly weathered bedrock outcrops. The first outcrop (Feature A) contains one bedrock mortar cup (BRM #1) and was discovered in open grassland on the northern aspect of a nominal slope (0-10%). The second outcrop (Feature B) was ~4 meters east of Feature A and contained two bedrock mortar cups (BRM #2 and #3). Locus 2 contains one bedrock outcrop (Feature C). Feature C was discovered in open grassland on a nominal slope of 0-10%. The outcrop consists of weathered bedrock and contains three BRM cups (BRMs #4-#6) and two poorly defined milling surfaces/degraded BRMs (BRM #7 and #8). The site boundaries measure approximately 28 meters (N-S) by 95 meters (E-W). No artifacts were observed, but the area was covered with dense grass that hindered ground surface visibility (0-5%). The site has been partially disturbed by the construction of the access roads.

***P3b. Resource Attributes:** AP4. Bedrock milling feature

***P34. Resources Present:** Building Structure Object Site District Element of District Other (Isolates, etc.)

P5a.



P5b. Description of Photo:

Site overview, facing west, October 11, 2019.

***P6. Date Constructed/Age and Sources:**

Historic Prehistoric Both

***P7. Owner and Address:**

Solano Land Trust
 700 Main Street, Suite 210
 Suisun City, CA 94585

***P8. Recorded by:**

J. Coleman, S. Talcott, and A. Wolpert
 Solano Archaeological Services
 131 Sunset Ave., Ste. E 120
 Suisun, CA 94585

P9. Date Recorded: October 11, 2019

P10. Survey Type: Intensive pedestrian

***P11. Report Citation:** Coleman and Talcott, 2019, Monitoring Report for Rush Ranch Lower Spring Branch Creek - Suisun Hill Hollow Tidal Restoration Project, Solano County, California. Submitted to the Solano Land Trust by Solano Archaeological Services.

* Attachments: NONE Location Map Sketch Map Continuation Sheet Building, Structure, Object Record
 Archaeological Record District Record Linear Feature Record Milling Station Record Rock Art Record
 Artifact Record Photograph Record Other (List):

ARCHAEOLOGICAL SITE RECORD

Page 2 of 9

*Resource Name or #: SAS-001/UCDRR16-01

*A1. Dimensions: a. Length: 28 meters (N-S) × b. Width: 95 meters (E-W)

Method of Measurement: Paced Taped Visual estimate Other: Sub-meter accurate Trimble GeoX7 GPS device

Method of Determination (Check any that apply.): Artifacts Features Soil Vegetation Topography

Cut bank Animal burrow Excavation Property boundary Other (Explain):

Reliability of Determination: High Medium Low Explain: Six of the BRM's were discovered after clearing grass around exposed bedrock. There is also a large known bedrock outcrop "Indian Grinding Rock" west of the site at the base of the same hill. It is possible that the site extends beyond the recorded boundaries and additional BRM's are located along the hillside, but are obscured by existing vegetation and soil accumulation.

Limitations (Check any that apply): Restricted access Paved/built over Site limits incompletely defined

Disturbances Vegetation Other (Explain):

A2. Depth: None Unknown Method of Determination: Minor trowel scraping and raking near bedrock outcrops, but no subsurface testing was conducted.

*A3. Human Remains: Present Absent Possible Unknown (Explain): Human remains were not observed on the surface, but subsurface testing was not conducted.

*A4. Features (Number, briefly describe, indicate size, list associated cultural constituents, and show location of each feature on sketch map.):

Feature A: Bedrock outcrop measuring 1.2 meters long x 0.66 meters wide x 0.2 meters high. The outcrop contains one bedrock mortar cup (BRM 1). See Milling Station Records for measurements. No artifacts were found associated with Feature A. The bedrock is weathered and friable.

Feature B: Bedrock outcrop measuring 3.65 meters long x 1.85 meters wide x 0.34 meters high. The outcrop contains two bedrock mortar cups (BRM's 2-3). See Milling Station Records for measurements. No artifacts were found associated with Feature B. The bedrock is weathered and friable.

Feature C: Bedrock outcrop measuring 2.99 meters long x 1.65 meters wide x 0.1 meters high. The outcrop contains three bedrock mortar cups (BRM's 4-6) and two incipient mortar cups or degraded milling surfaces (BRM's 7-8). See Milling Station records for measurements. No artifacts were found associated with Feature C. This feature is part of a larger bedrock formation that is mostly covered with soil and grass. The bedrock is weathered and friable.

*A5. Cultural Constituents: None. No artifacts were observed in and around Features A-C or anywhere within the taped boundaries.

*A6. Were Specimens Collected? No Yes

*A7. Site Condition: Good Fair Poor (Describe disturbances.): The site is obscured by grasses and disturbed by access road grading.

*A8. Nearest Water (Type, distance, and direction.): Lower Spring Branch Creek approximately 50 meters to the north.

*A9. Elevation: 20 feet asl

A10. Environmental Setting: The site was located in open grassland on a nominal 0-10% slope with a northern aspect. The site lies directly on the hillside just south of Lower Spring Branch Creek and associated marshland.

A11. Historical Information: None

*A12. Age: Prehistoric Protohistoric 1542-1769 1769-1848 1848-1880 1880-1914 1914-1945
 Post 1945 Undetermined **Describe position in regional prehistoric chronology or factual historic dates if known:**

A13. Interpretations: The site could be part of a larger milling complex along the hillside.

A14. Remarks: The site should be tested for subsurface components.

A15. References: Coleman and Talcott, 2019, Monitoring Report for Rush Ranch Lower Spring Branch Creek - Suisun Hill Hollow Tidal Restoration Project, Solano County, California. Submitted to the Solano Land Trust by Solano Archaeological Services.

A16. Photographs: see Continuation Sheet

Original Media/Negatives Kept at: Solano Archaeological Services, 131 Sunset Avenue, Ste. E 120, Suisun, CA 94585

*A17. Form Prepared by: J. Coleman and S. Talcott **Date:** October 29, 2019

Affiliation and Address: Solano Archaeological Services, 131 Sunset Avenue, Ste. E 120, Suisun, CA 94585

State of California ↓ The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
CONTINUATION SHEET

Page 3 of 9

Primary #

HRI#

Trinomial

*Resource Name or #: SAS-001/UCDRR16-01

*Recorded by: J. Coleman, S. Talcott, and A. Wolpert

*Date: October 29, 2019

Continuation

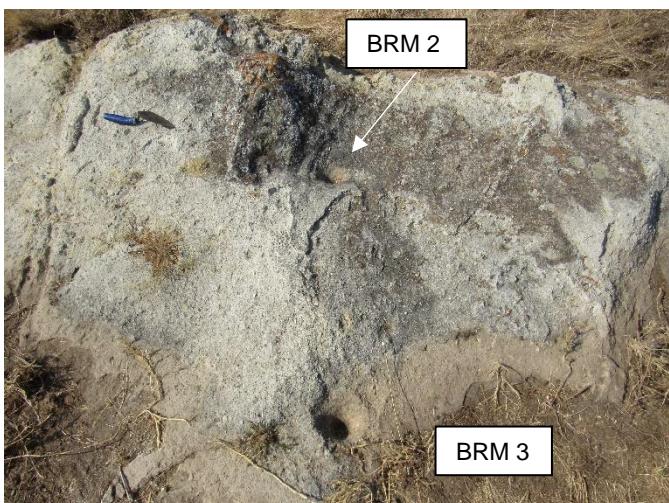
Update



SAS-001 Locus 1 Feature A BRM 1, facing east.



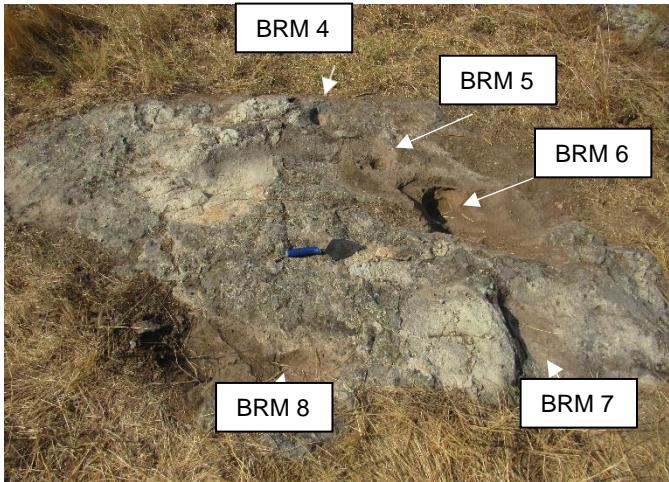
SAS-001 Locus 1 Feature A overview, facing north.



SAS-001 Locus 1 Feature B BRM's 2 and 3, facing west.



SAS-001 Locus 1 Feature A overview, facing north.



SAS-001 Locus 2 Feature C BRM's 4-8, facing west.



SAS-001 Locus 2 Feature C overview, facing north.

CONTINUATION SHEET

Primary # _____

HRI# _____

Trinomial: _____

Page 4 of 9

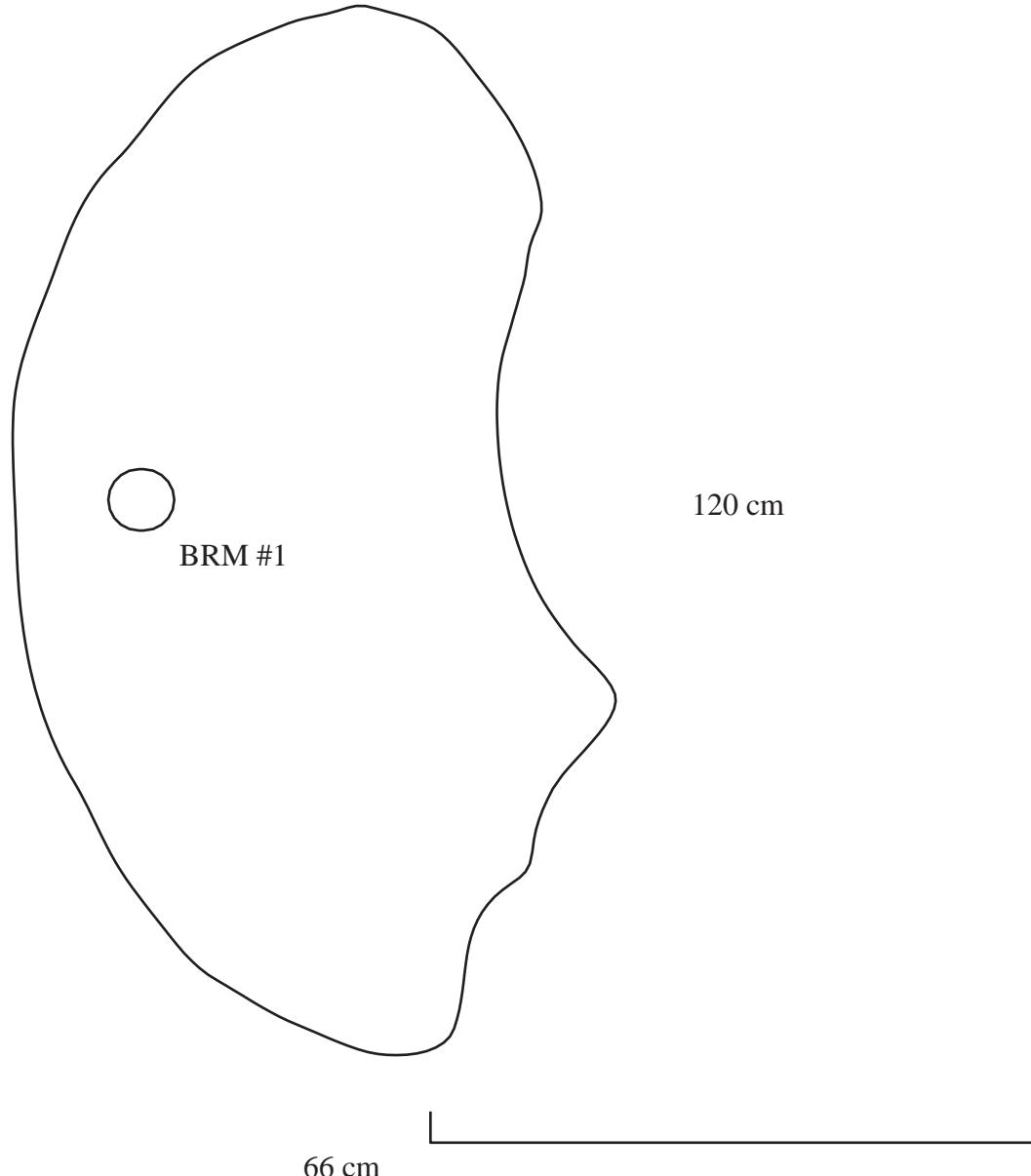
*Recorded by: J. Coleman, S. Talcott, and A. Wolpert

Date: October 29, 2019

*Resource Name or #: SAS-001/UCDRR16-01

Continuation Update

Feature A



Rush Ranch SAS-001 Locus 1

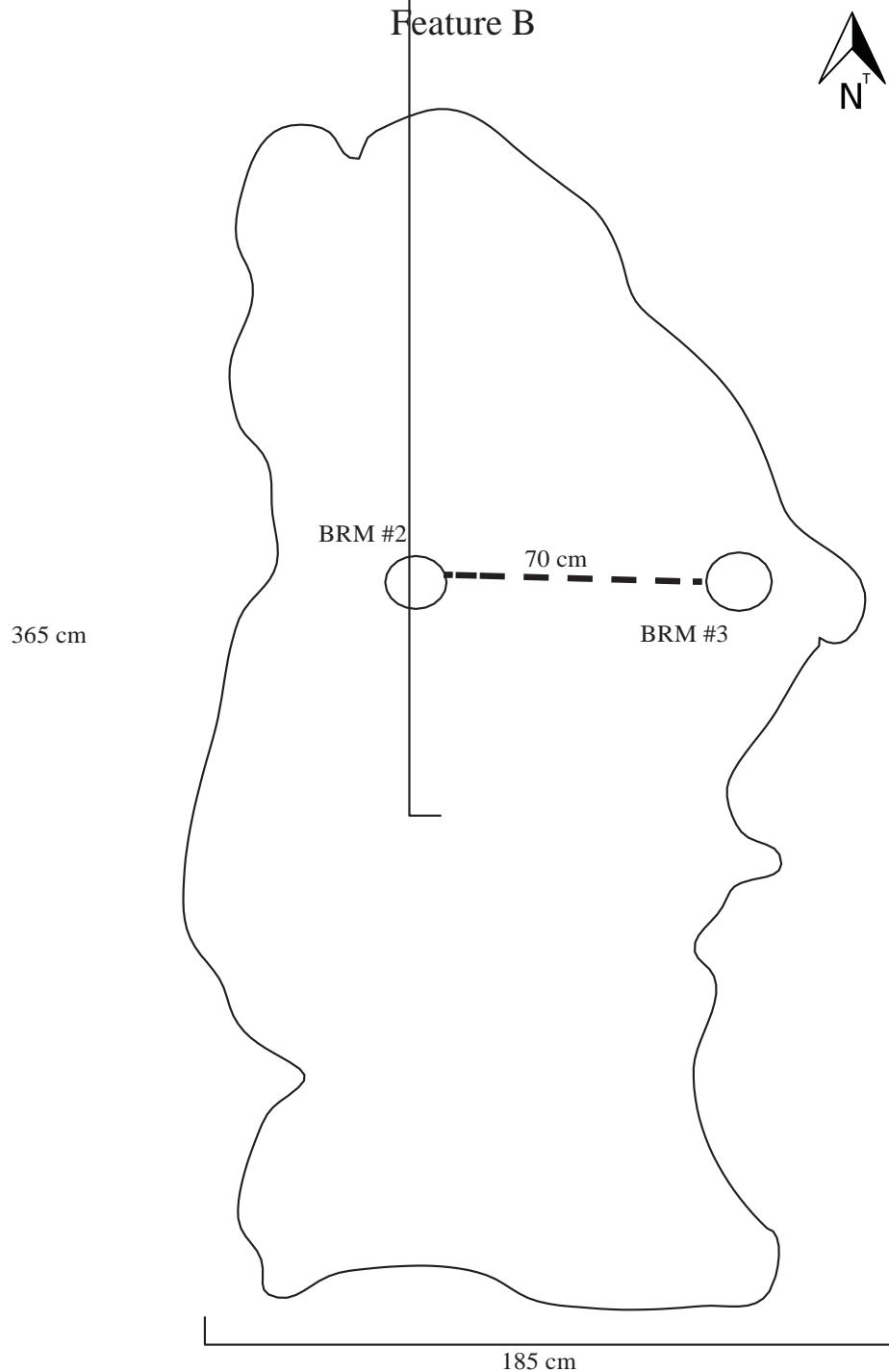
**State of California -- The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
CONTINUATION SHEET**

Page 5 of 9

*Recorded by: J. Coleman, S. Talcott, and A. Wolpert

Primary # _____
HRI# _____
Trinomial: _____

*Resource Name or #: SAS-001 / UCDRR16-01
Date: October 29, 2019 Continuation Update



Rush Ranch SAS-001 Locus 1

CONTINUATION SHEET

Primary # _____

HRI# _____

Trinomial: _____

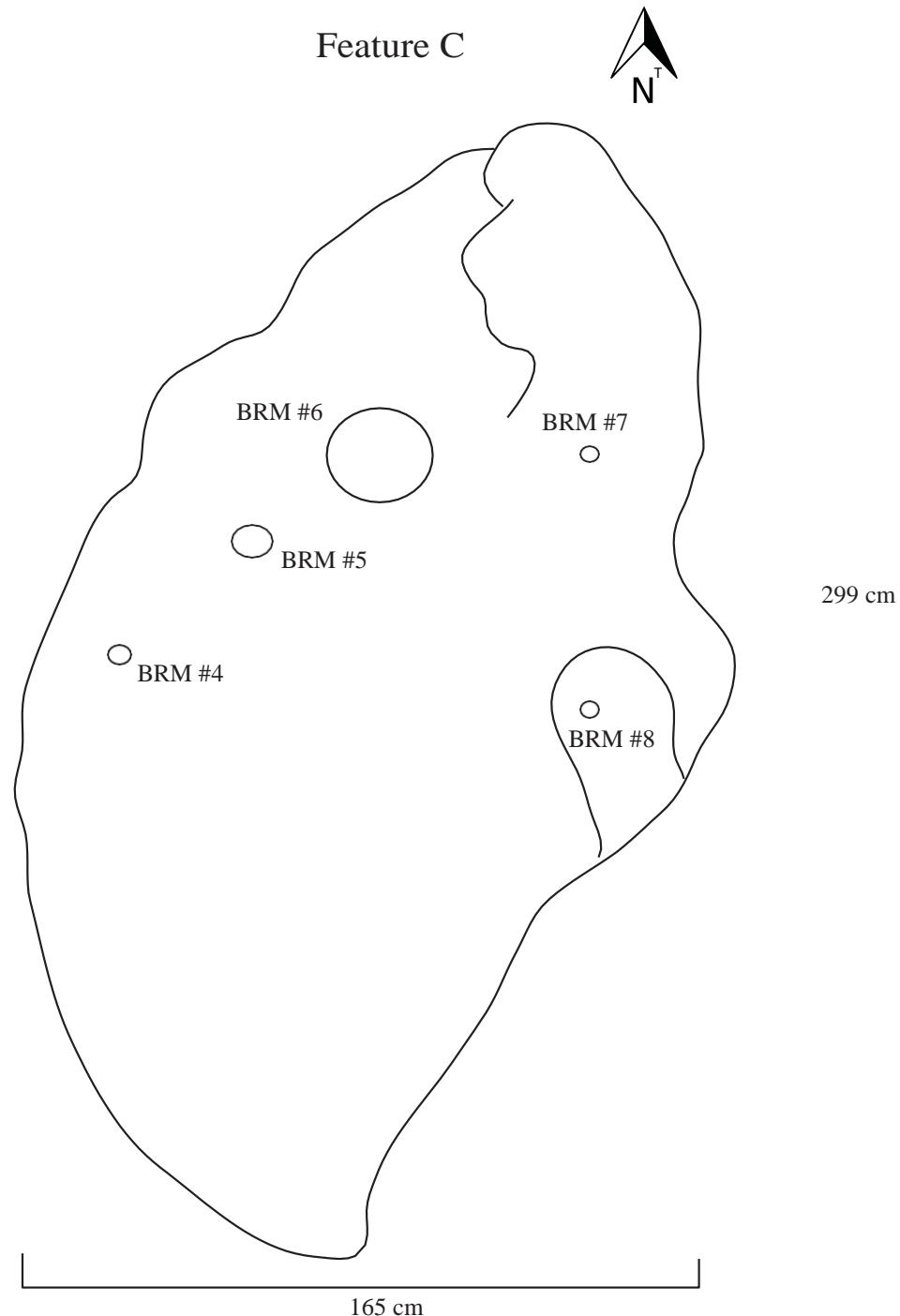
Page 6 of 9

*Resource Name or #: SAS-001/ UCDRR16-01

*Recorded by: J. Coleman, S. Talcott, and A. Wolpert

Date: October 29, 2019

Continuation Update



Rush Ranch SAS-001 Locus 2

**State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
MILLING STATION RECORD**

Primary # Trinomial

Page 7 of 9

Resource Name or #: SAS-001/UCDRR16-01

Form Prepared by: J. Coleman, S. Talcott, and A. Wolpert

Date: October 29, 2019

Feature	Outcrop Dimensions (m) and Orientation							Bedrock Type and Condition		
	Width	Length	Thickness	Orientation	Width	Length	Thickness	Height	Type	Condition
A	1.2	N-S	x	0.66	E-W	x	0.2	Height	Basalt	highly weathered and friable
B	3.65	N-S	x	1.85	E-W	x	0.34	Height	Basalt	highly weathered and friable
C	2.99	N-S	x	1.65	E-W	x	0.1	Height	Basalt	highly weathered and friable
		N-S	x		E-W	x		Height		
		N-S	x		E-W	x		Height		

Type Key:	Contents Key:
CO Conical mortar	PM Possible mortar
OM Oval mortar	MS Milling slick
SM Saucer mortar	BM Basin milling feature
Other:	S Filled with soil L Filled with leaves U Unexcavated Other: R Contains rock P Contains pestle M Contains mano

State of California--The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
SKETCH MAP

Primary #

HRI #

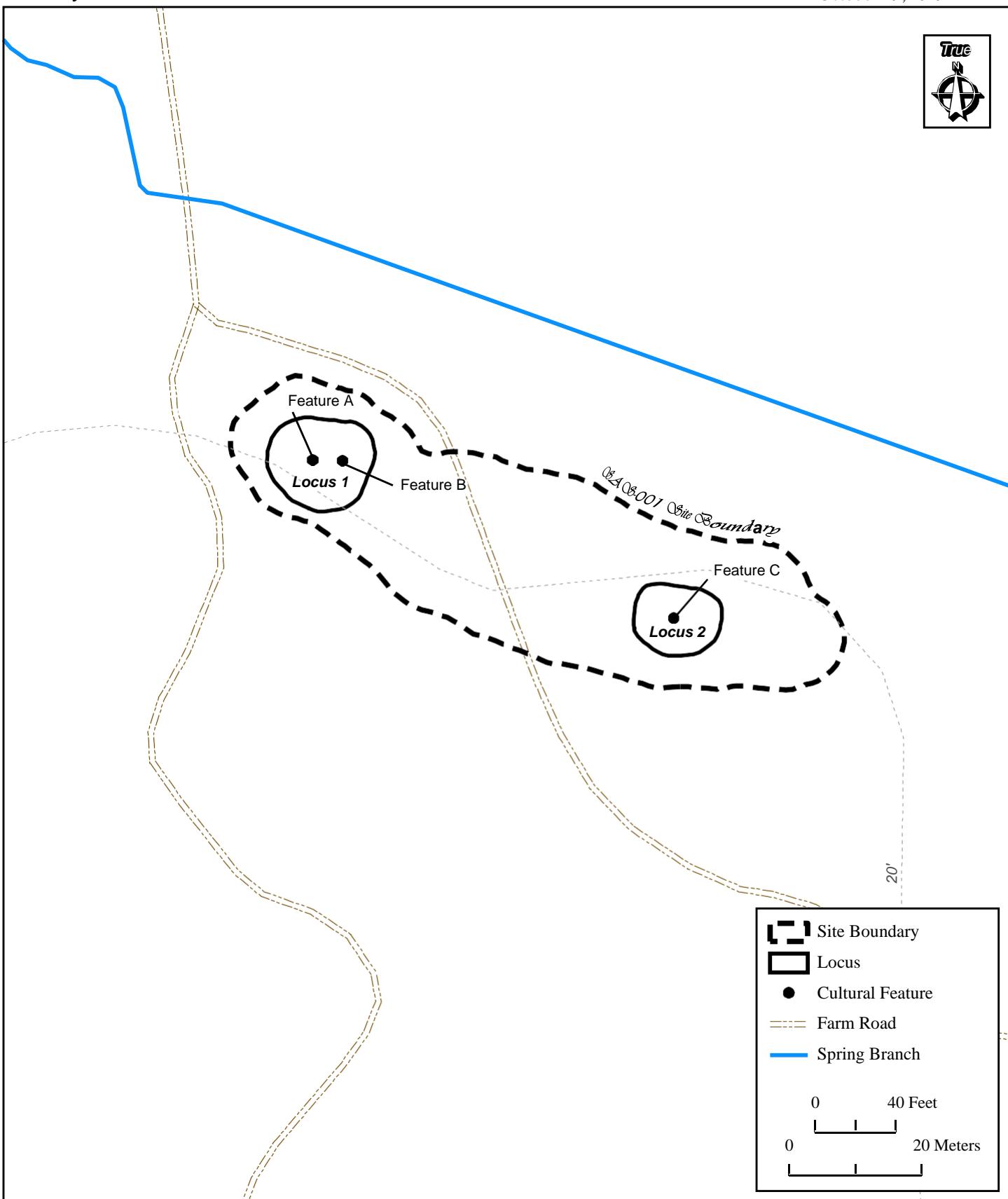
Trinomial

Page 8 of 9

*Resource Name or # SAS-001 / UCDRR16-01

Drawn By: L. Wood and J. Coleman

*Date October 29, 2019



LOCATION MAP

Page 9 of 9

*Resource Name or # SAS-001 / UCDRR16-01

Primary #

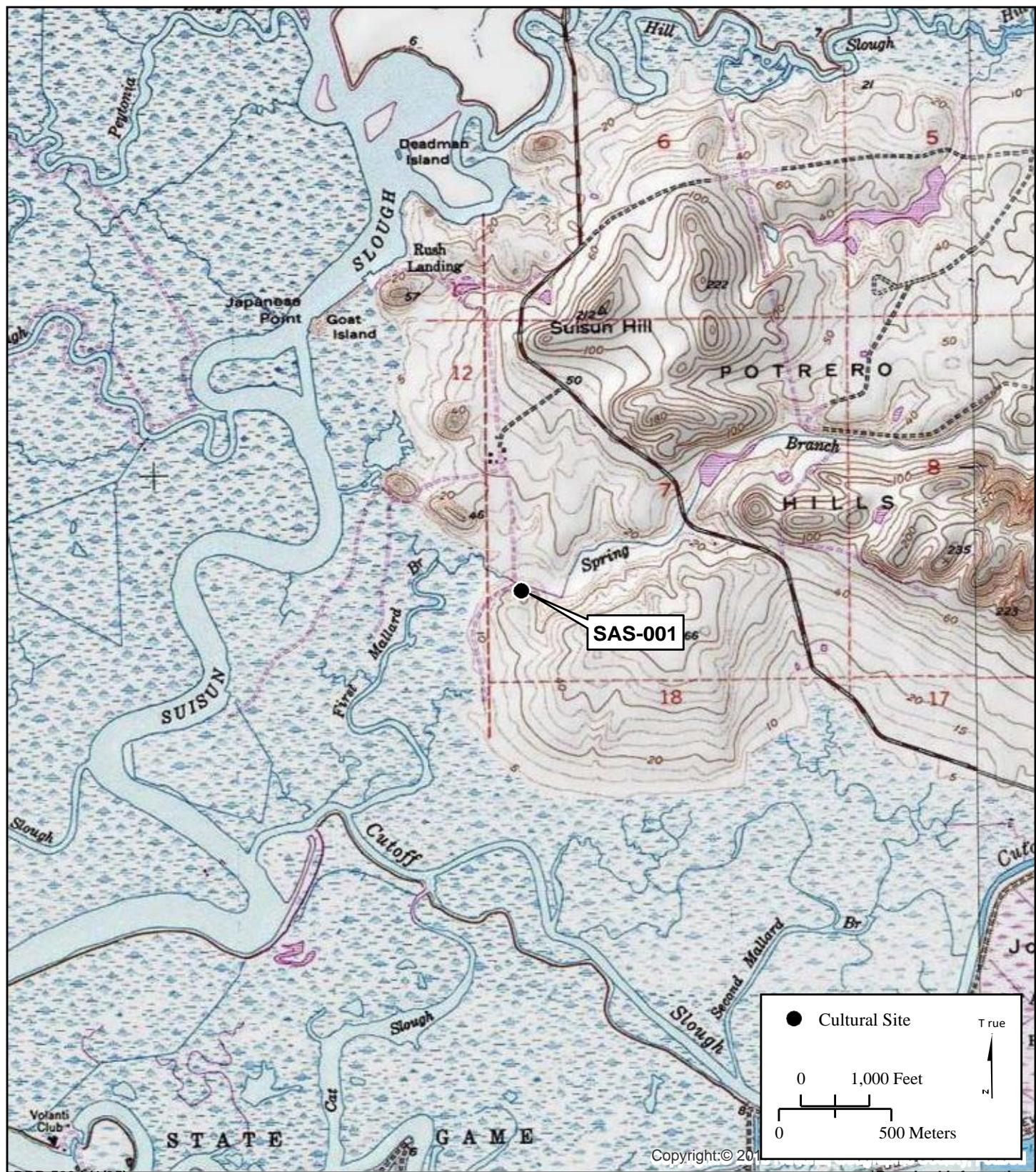
HRI#

Trinomial

*Map Name: Fairfield South

*Scale: 1:24,000

*Date of Map: 1980



ATTACHMENT C

Photographs



Trench construction near Lower Spring Branch Creek, facing west



Trench construction near Lower Spring Branch Creek, facing northeast



Monitoring overview from SAS-001/UCDRR16-01, facing north



SAS-001/UCDRR16-01 Feature A overview, facing north



SAS-001/UCDRR16-01 Feature B overview, facing north



SAS-001/UCDRR16-01 Feature C overview, facing north

ANNUAL REPORT

2019



California Ridgway's Rail and California Black Rail, Suisun Marsh, California



Photo: Sarah Estrella. Wells Slough near Suisun Slough with Mt. Diablo in background.

Report to: California Department of Water Resources

Agreement #4600011215

(California Department of Fish & Wildlife contract #R1530001)

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INTRODUCTION

Introduction

In 1981, the U.S. Fish and Wildlife Service (USFWS) issued a Section 7 Biological Opinion (BO) AFA-SE, 1-1-81-F-130 for the implementation of the Suisun Marsh Plan of Protection (Plan of Protection). The following recommendation was made to carry out programs for the conservation of the federally and California state endangered California Ridgway's (formerly Clapper) Rail (RIRA; Federal Register 50 CFR 17.11; USFWS 1973; California Code of Regulations Title 14, Section 670.5):

“Survey California clapper rail populations every 3 years in suitable habitats and locations throughout the Suisun [Marsh]. Survey areas should include tidal and non-tidal marshes, vegetative control areas, State lands managed for the salt marsh harvest mouse (SMHM), and private management areas. Surveys should be conducted in conjunction with the habitat monitoring program and aerial surveys”.

The BO also defined restrictions on construction and maintenance activities during the RIRA breeding season (March-July). These restrictions were later broadened in a 1994 letter from the USFWS to the United States Army Corps of Engineers (USACE) amending the Regional General Permit for maintenance activities in the Suisun Marsh issued to Suisun Resource Conservation District (USACE Permit No. R20066E98). Following surveys conducted by California Department of Water Resources (CDWR) from 1991-1994, several areas in Suisun Marsh were designated as current or potential RIRA breeding locations. Maintenance activities were restricted on the crown of or the tidal side of levees on properties within 500 feet of these locations during nesting season (February 1 through August 31): Rush Ranch (Spring Branch), parts of Joice Island, Cutoff Slough (including First and Second Mallard Branches), Goodyear Slough, the mouth of Goodyear Slough to the Mothball (Reserve) Fleet (Benicia), and Hill Slough (see Figure 1 for these locations).

Annually from 2002-2012, sampling occurred in the six areas described above; where RIRAs were last known to breed. The goal was to redocument presence in these areas. In addition to these areas, sampling took place in areas where populations may occur based on suitable habitat or past breeding-season or non-breeding-season detections.

Beginning in 2013, CDFW in Suisun began implementing the San Francisco Estuary Marsh Bird Survey Protocol (Version 2012.4) based on the North American Marsh Bird Monitoring Protocols by Conway (2011) for some surveys. This protocol included documentation and call broadcast of a larger group of secretive marsh birds concurrently with RIRA and California Black Rail (BLRA; *Laterallus jamaicensis coturniculus*) surveys.

Also in 2013, the Suisun Marsh Habitat Management, Preservation, and Restoration Plan (SMP) was finalized (USBR 2013). This plan required RIRA surveys prior to initiation of SMP projects. The protocol appears in the SMP Final EIS/EIR Mitigation Monitoring and Reporting Program pp F-12,13.

Also in 2013, the Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (US Fish & Wildlife Service 2013) established downlisting and delisting criteria that included population objectives for

INTRODUCTION

RIRA and recommendations for annual monitoring; however, no specific survey protocol was established for that purpose.

In 2015, a survey protocol was released by the USFWS as the recommended standard methodology used to detect the presence or absence of Ridgway's Rails prior to the initiation of projects in the San Francisco Bay Area, including Suisun Marsh (Appendix A). Modification of this protocol must be approved by the USFWS.

In 2017, the San Francisco Bay Secretive Marsh Bird Survey Protocol (Version 1.0 – Dec 2016; Appendix B) was slightly altered after much testing and review, finalized, renamed, published, and began widespread use in the Bay (Site-specific Protocol for Monitoring Marsh Birds; Wood et al. 2017). Beginning in 2018, CDFW adopted this methodology for rotating, non-project-related surveys in Suisun Marsh.

In 2019, CDFW used this protocol (Site-specific Protocol for Monitoring Marsh Birds; Wood et al. 2017) for non-project surveys, and the SMP protocol (USBR 2013) for the Hill Slough Tidal Marsh Restoration project.

Additional surveys were conducted in conjunction with California Department of Water Resources (CDWR) using the USFWS 2015 protocol; however, those will be reported separately by CDWR.

This is the 17th annual report for this project.

INTRODUCTION



Figure 1. 2019 Ridgway's rail, black rail, and other secretive marsh bird survey locations, designated Ridgway's rail breeding areas, and levees affected by breeding season restrictions.

OBJECTIVES

Objectives

- 1) Provide data needed to evaluate the performance of the 1984 Suisun Marsh Plan of Protection (CDWR 1984) in regard to protection of RIRAs.
 - a. Surveys were conducted where RIRAs were previously documented and where RIRAs may be present but are undocumented.
 - b. RIRA habitat was assessed through aerial photography and vegetation analysis by CDFW's Biogeographic Data Branch Vegetation Classification and Mapping Program (VegCAMP) or other means of analysis.
 - c. Surveys were also conducted in restricted areas where construction and maintenance activities may be needed during the RIRA breeding season.
- 2) Provide data needed to comply with applicable permits.

METHODS

Methods

Surveys were conducted during the early part of the RIRA breeding season when birds are most likely to vocalize (mid-January through mid-April 2019, Table 1) to establish presence of RIRAs at each location. In addition to RIRA, other “focal species” were recorded: BLRA, Virginia Rail (*Rallus limicola*), Sora (*Porzana carolina*), American Bittern (*Botaurus lentiginosus*), American Coot (*Fulica americana*), Common Moorhen (*Gallinula chloropus*), Pied-billed Grebe (*Podilymbus podiceps*), Least Bittern (*Ixobrychus exilis*) and Yellow Rail (*Coturnicops noveboracensis*).

STUDY SITES

In an effort to make at least some surveys repeatable over time and compatible with range-wide secretive marsh bird surveys, in 2016 we identified 12 transects throughout the marsh that can be visited every third year on a rotating basis. Transects were chosen based on previous detections, including areas where construction is restricted during the breeding season, and inclusive of most potential RIRA habitat in Suisun Marsh. Those transects are Hill Slough west, middle, and east; Cutoff Slough/Rush Ranch west, middle, and east; Benicia shoreline (north of the Benicia/Martinez bridge), the shoreline adjacent to the Reserve Fleet, and Goodyear Slough; and Lower Joice Island, Roe Island, and Ryer Island. Four transects per year would be surveyed a minimum of twice each (early season and late season) using the Site-specific Protocol for Monitoring Marsh Birds (Wood et al. 2017). Unanticipated conditions may necessitate modifications to these transects.

In 2016, we surveyed Hill Slough east, Cutoff Slough middle, Benicia, and Roe Island. In 2017, we surveyed 20 stations (3 transects) at the Hill Slough Restoration site (Hill Slough west), Cutoff Slough west, and Lower Joice Island. In 2018, we surveyed Hill Slough middle, Cutoff Slough east, Goodyear Slough, and Ryer Island. We also surveyed Grizzly Island Road through the Hill Slough Wildlife Area in anticipation of road construction needed for the Hill Slough Restoration Project and 1 transect for the Restoration Project one time, before it was clear that the project would not start in 2018. In 2019, we surveyed Hill Slough west (including the western part of the Restoration Project), Cutoff Slough west, Reserve Fleet, and Roe Island. We also surveyed Grizzly Island Road through the Hill Slough Wildlife Area prior to road construction for the Hill Slough Restoration Project and a transect along McCoy Creek, also for the Restoration Project.

METHODS

FIELD METHODS

Surveys were conducted at sunrise or sunset when sloughs within marshes were less than bank full. Surveys conducted at sunrise began within 60 minutes before sunrise until within 60 minutes after sunrise. Surveys conducted at sunset began within 60 minutes before sunset until within 60 minutes after sunset.

For all protocols, all detections were recorded, noting the call type (or if seen, with a "V" for "visual"), compass direction, approximate distance in meters, and time using a Garmin Oregon® 650t GPS unit and data sheet specific to each protocol (Appendix D).

Wind velocity and temperature were measured with a handheld Kestrel® wind/weather meter. Surveys were not conducted when average wind velocities exceeded 10 mph, during moderate to heavy rains, or under any other conditions in which ambient noise was high. Information on disturbances (e.g., human activity, cattle or other domestic animals, and wild pigs [*Sus scrofa*]) apparent during the surveys and evidence of potential predators were recorded. The volume of the taped call was approximately 80 dB at 1 meter in front of the speaker. Playback was stopped immediately if a predator approached within 100 m of a marsh bird.

See each protocol type for more specific details (Appendices).

FIELD OBSERVERS

Primary survey observers included Sarah Estrella (CDFW, Environmental Scientist), Laureen Barthman-Thompson (CDFW, Environmental Scientist), and Melissa Riley (CDFW, Environmental Scientist).

Additional observers were Randy Weinrich (CDFW), Candice Rose (CDFW), Elaine Jeu (CDWR), Sadie Trombley (CDFW), and other guests.

POST FIELD DATA PROCESSING

In the office, ArcMap is used to estimate the location of each detected bird. From the known GPS-located point of each survey station, the Direction-Distance function on the editor toolbar is used to measure the direction and distance from the station that was recorded on the datasheet. If two location points for the same species on the same survey day overlap, it may be assumed to be one bird, unless otherwise noted on the datasheet. Therefore, one "detection" may be discarded. Location points may also be slightly adjusted, if terrain characteristics indicate the point is not accurate. For instance, if the point is measured and placed in open water, but the bird was clearly in vegetation, the point may be moved to the nearest suitable vegetation.

RESULTS

Results

In 2019, we again detected no RIRA. Black Rails were present at Hill Slough, Cutoff Slough west, the Reserve Fleet, and Roe Island. At least 1 was heard in tidal marsh east of the Hill Slough Restoration boundary, at least 6 were observed at Cutoff Slough, at least 1 at the Reserve Fleet on the diked side of the levee, and at least 5 at Roe Island (Table 1). Additionally, we detected Virginia Rails, Sora, a Pied-billed Grebe, and American Bitterns (Figures 1-6). No American Coots, Common Moorhens, Least Bitterns, or Yellow Rails were detected. Survey transects were made up of 3, 6, or 8 stations.

Hill Slough west, Cutoff Slough west, and Roe Island surveys were conducted by boat. Hill Slough road and Restoration, and the Reserve Fleet were walking surveys.

Potential aerial predators observed were Northern Harrier (*Circus cyaneus*), White-tailed Kite (*Elanus leucurus*), Coopers Hawk (*Accipiter cooperii*), Red-tailed Hawk (*Buteo Jamaicensis*), Barn Owl (*Tyto alba*), and Great Horned Owl (*Bubo virginianus*). Potential ground predators included coyotes (*Canis latrans*), feral pigs, and North American river otters (*Lontra canadensis*).

We also observed beavers (*Castor canadensis*), muskrats (*Ondatra zibethicus*), and Osprey (*Pandion haliaetus*).

RESULTS

Table 1. California Department of Fish and Wildlife, Region 3, California Ridgway's Rail and California Black Rail 2019 survey results for Suisun Marsh, California.

Bold numbers indicate highest minimum count at each site.

Location	Date 2019	# Stations	# RIRRA	# BLRA	# Virginia Rail	# Sora	# American Bittern	# Pied-billed Grebe	Comments
Hill Slough Restoration Stn. 18-20	01/24	3	0	0	4	0	0	1	Otter at #18
	02/21		0	1	3	0	0	0	Coopers hawk in tree at #18
	03/07		0	0	6	0	0	0	Great horned owl (GHOW) near #20
	03/21		0	0	4	0	0	0	Northern Harrier (NOHA)
Hill Slough Road	01/22	6	0	0	11	4	0	0	
	02/19		0	0	2	0	0	0	2 muskrats in ditches
	03/07		0	0	2	1	0	0	2 muskrats in ditches
	03/21		0	0	0	0	0	0	
Hill Slough West	01/29	8	0	0	1	0	0	0	2 NOHAs, GHOW at Peytonia
	02/28		0	0	2	0	0	0	GHOW at Wings Landing, 2 RTHAs on nest at W. tower, Hill Slough WA
	03/11		0	0	3	1	0	0	
	04/11		0	0	3	4	6	0	

RESULTS

Location	Date 2019	# Stations	# RRA	# BLRA	# Virginia Rail	# Sora	# American Bittern	# Pied-billed Grebe	Comments
Cutoff Slough West	01/28	8	0	0	9	0	0	0	BAOW, coyotes heard
	02/11		0	0	8	0	0	0	Coyote heard to SW
	03/08		0	6	10	0	0	0	WTKI, pig heard at IMAL65
	04/09		0	0	1	0	1	0	Beaver and hut observed
Reserve Fleet	01/30	6	0	0	36	2	0	0	RTHA, NOHA, sea lion on ship
	03/11		0	1	24	1	0	0	DSPR at RVFT06, muskrat at RVFT01
Ryer Island	02/12	6	0	5	9	0	0	0	NOHA at ROEI08, Sea lions heard at Port Chicago
	03/15		0	2	7	1	0	0	BAOW, NOHA at ROEI09, seals heard to east

RESULTS

Hill Slough Stations 18-20 PreProject Rail Surveys 2019

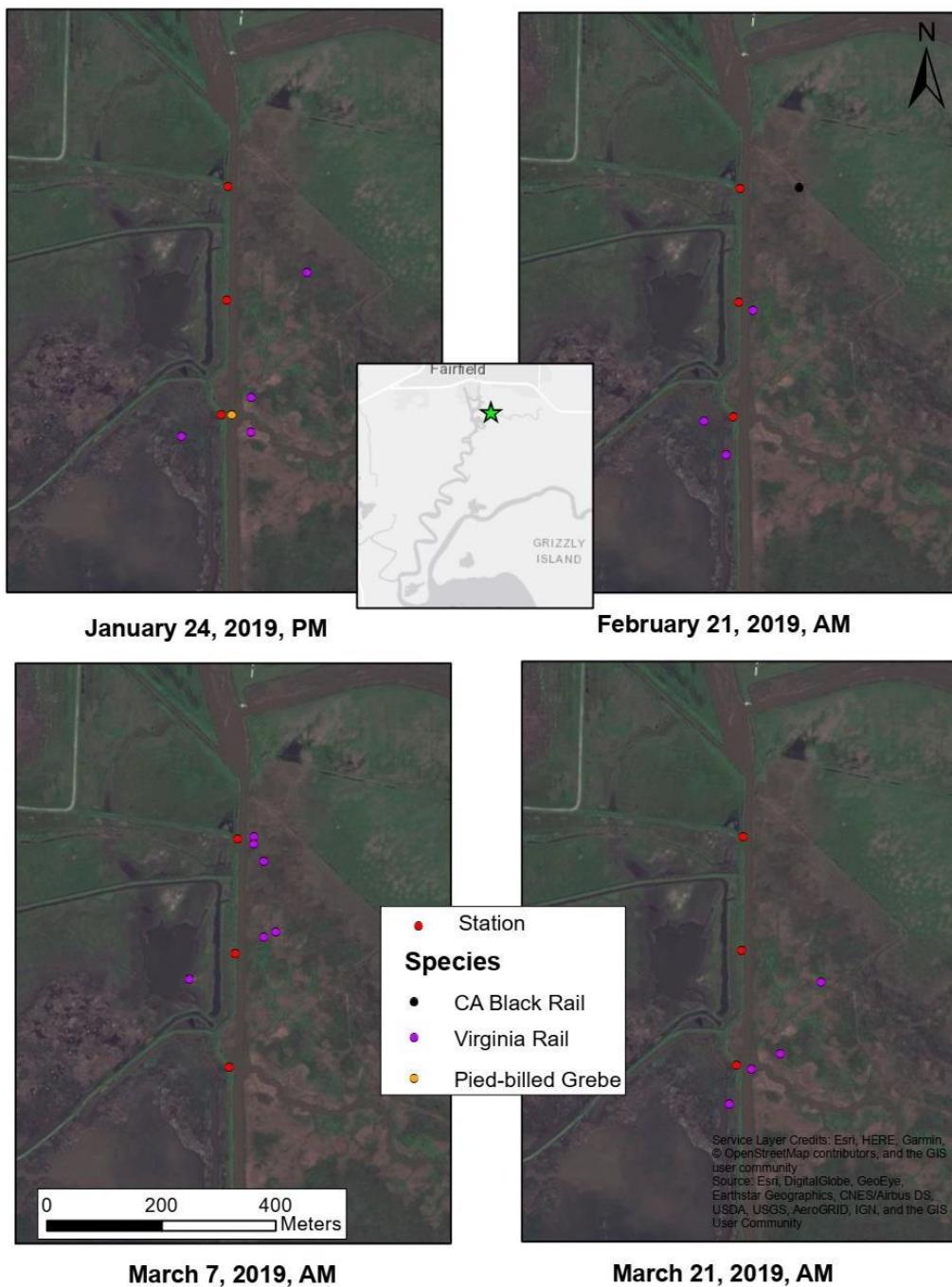


Figure 2. Rail and other secretive marsh bird surveys Hill Slough Restoration stations 18-20, 2019.

RESULTS

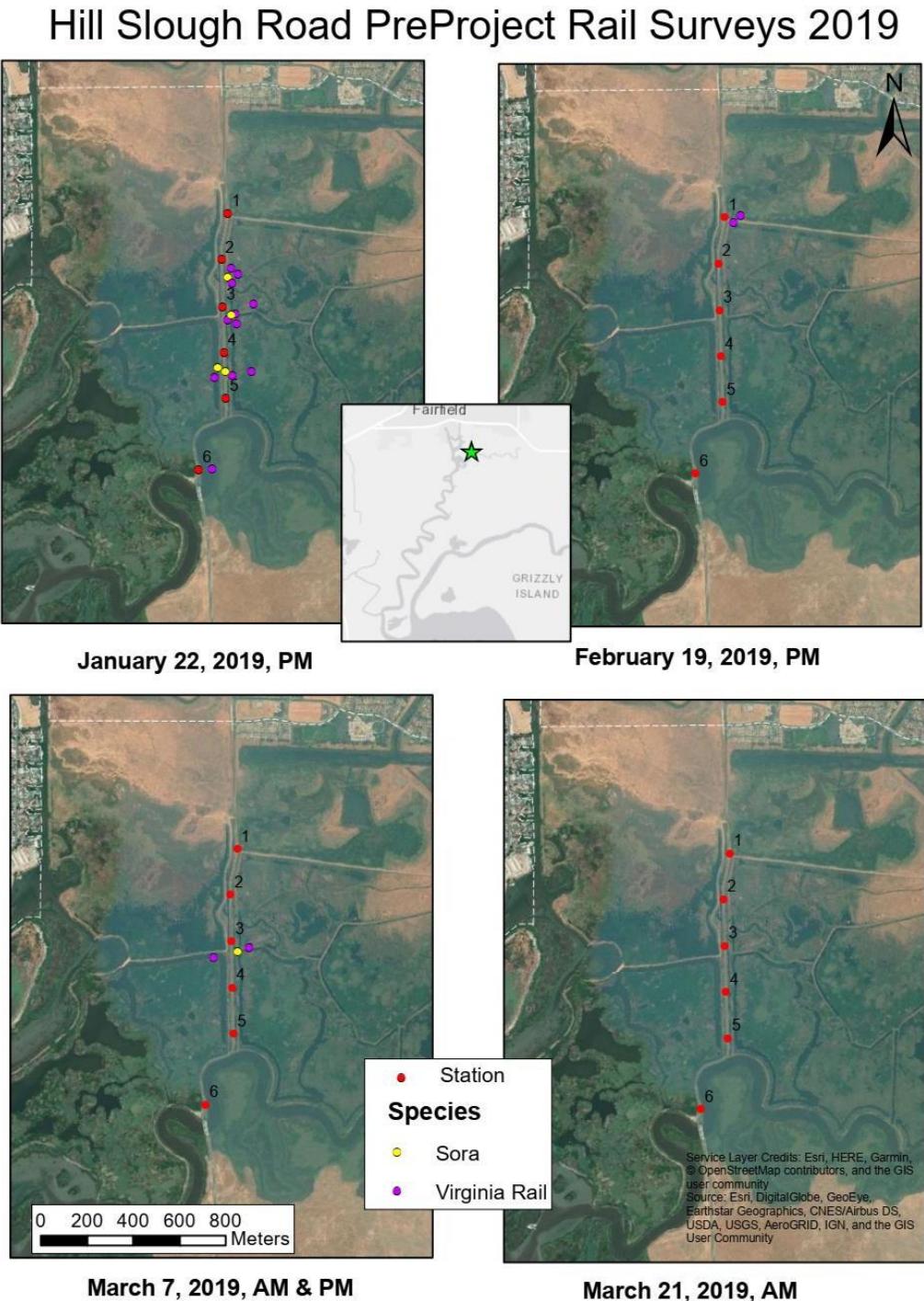


Figure 3. Rail and other secretive marsh bird surveys Hill Slough Restoration Road, 2019.

RESULTS

Hill Slough West PreProject Rail Surveys 2019

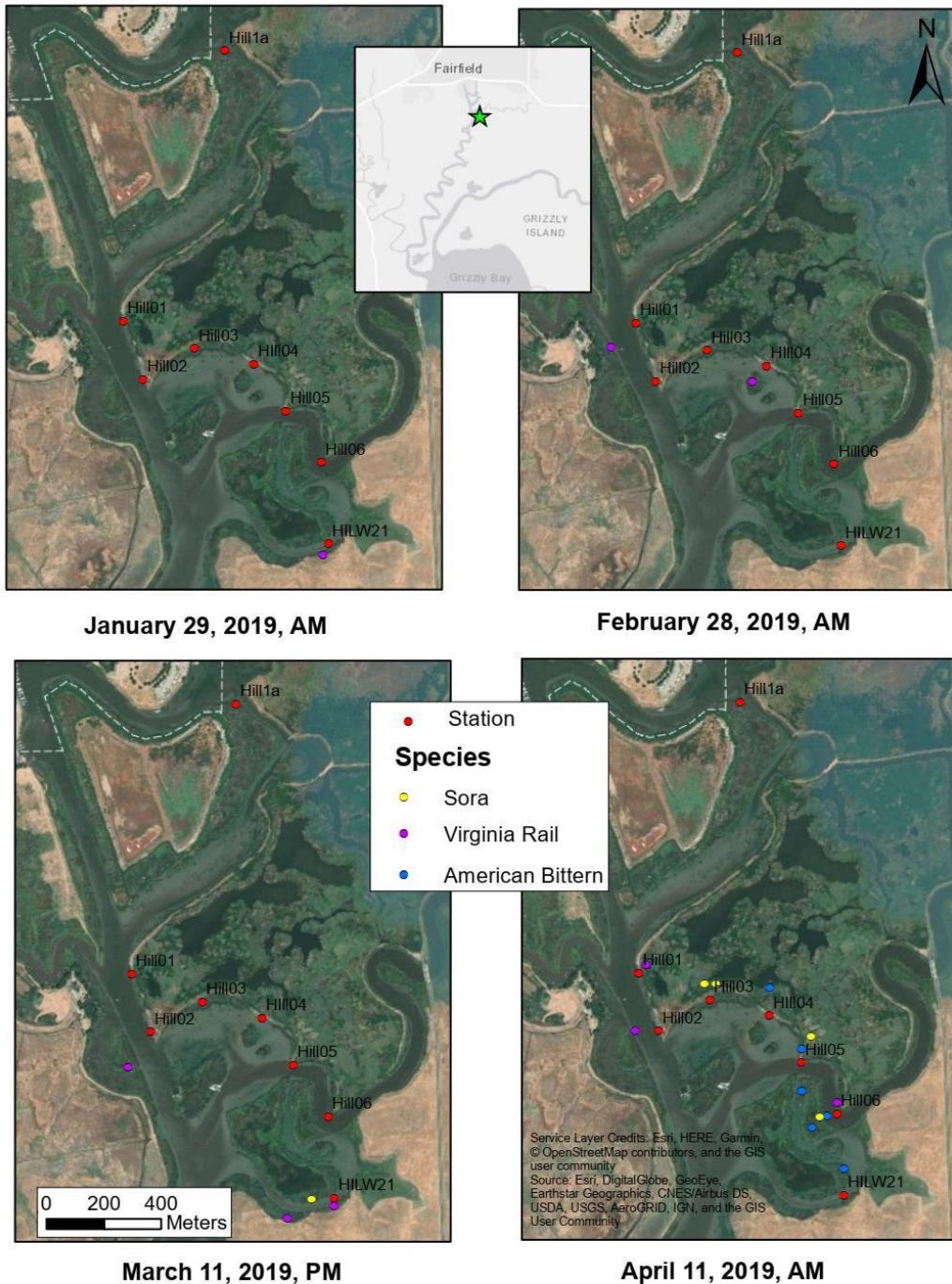


Figure 4. Rail and other secretive marsh bird surveys Hill Slough West, 2019.

RESULTS

Cutoff Slough West Rail Surveys 2019

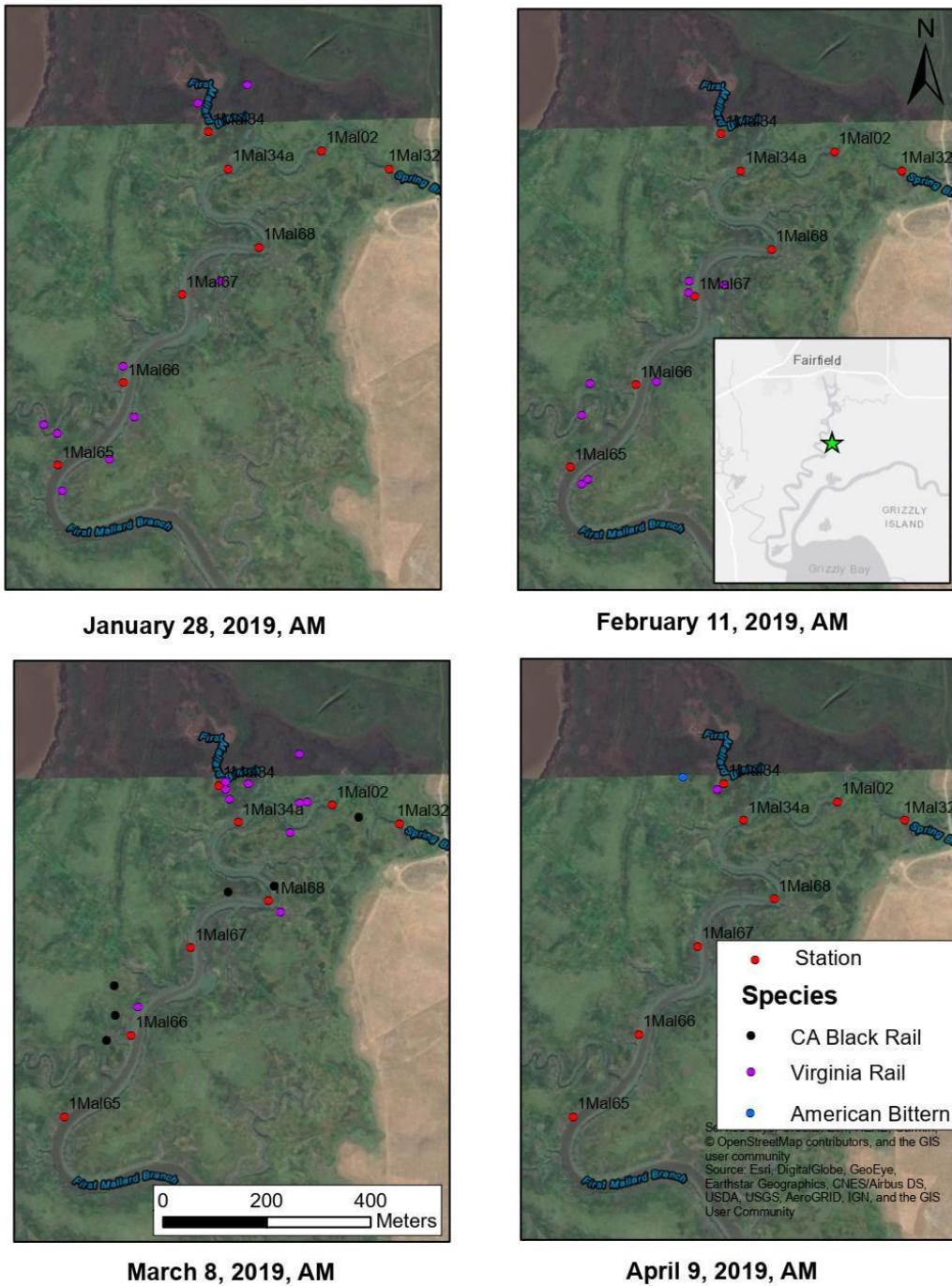


Figure 5. Rail and other secretive marsh bird surveys Cutoff Slough West 2019.

RESULTS

Reserve Fleet 2019

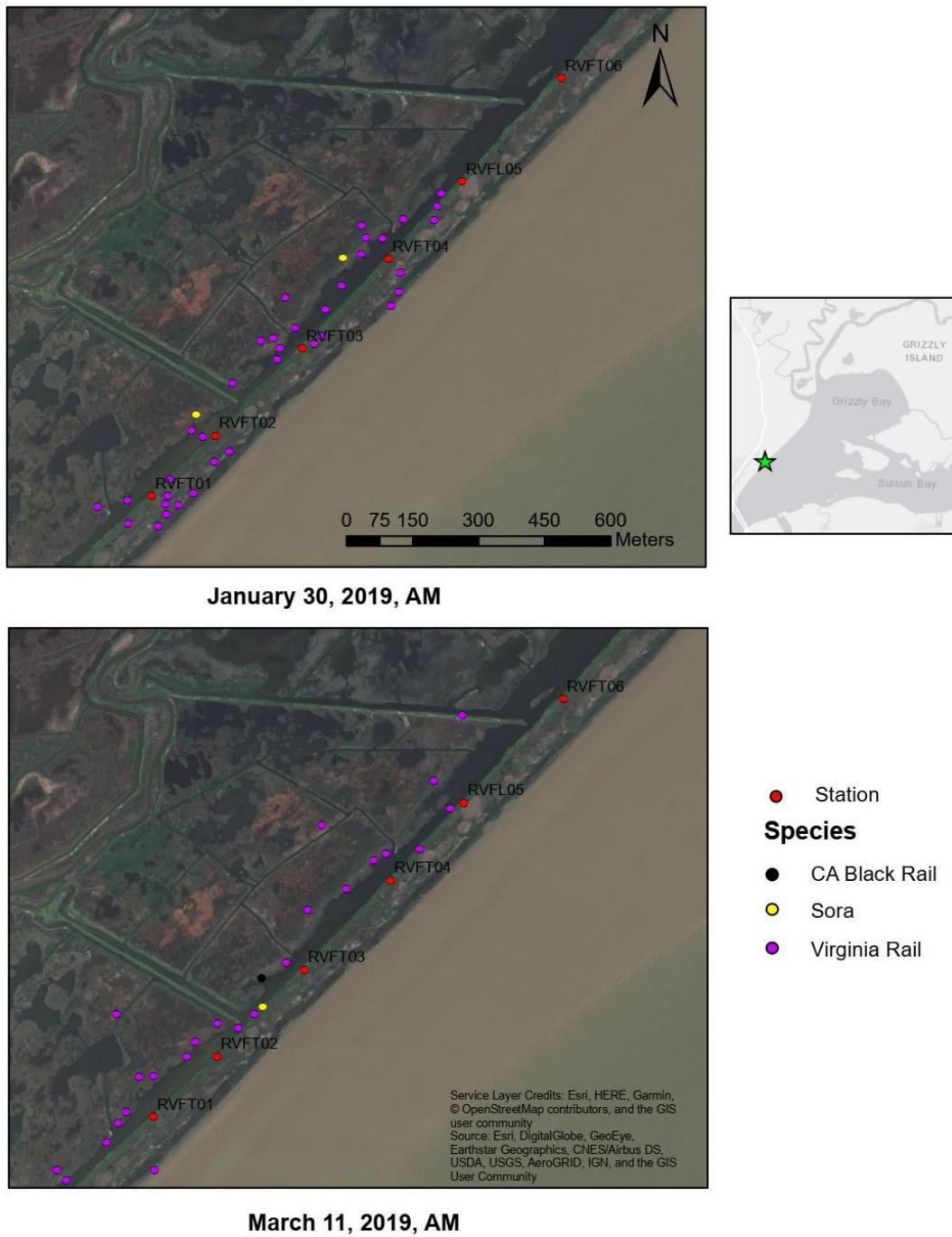
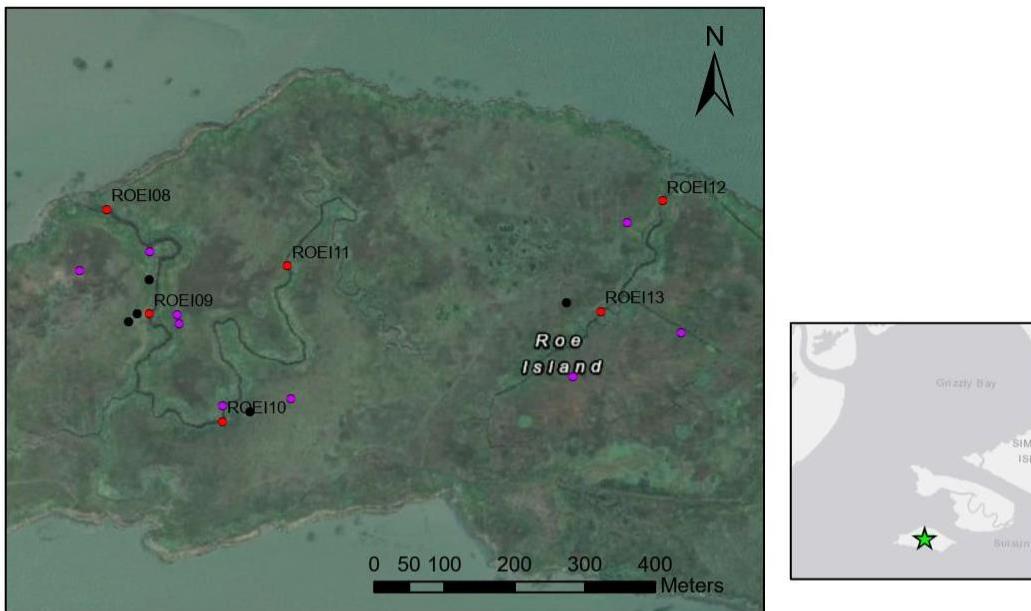


Figure 6. Rail and other secretive marsh bird surveys Reserve Fleet 2019.

RESULTS

Roe Island 2019



February 12, 2019, AM



March 15, 2019, AM

Figure 7. Rail and other secretive marsh bird surveys Roe Island 2019.

DISCUSSION

Discussion

Our surveys detected no RIRAs in Suisun Marsh in 2019. Breeding-season detections in Suisun Marsh are problematic because the frequency of calling is dependent upon population density (Zembal & Massey 1987) which is very low in Suisun. Furthermore, tidal marshes are fragmented throughout Suisun. Out of 28,330 hectares (ha) of land, about 25,600 ha are managed or leveed marshes and 2,700 ha are tidal or muted (restricted) tidal marshes. These tidal marshes are divided into several larger marshes, such as tidal portions of Solano Land Trust's Rush Ranch (420 ha), CDFW's Hill Slough Wildlife Area (350 ha), and CDFW's Peytonia Slough Ecological Reserve (210 ha), as well as many smaller marsh fragments. The vast majority of RIRAs do not move more than one km, though post-breeding dispersal may occur in fall and early winter (Albertson & Evens 2000).

The last time RIRA was detected by CDFW surveys was in 2011 at Rush Ranch. However, USGS recorded a single female kek-burring over a 24-hour period at the end of March 2015 at Lower Joice Island (C. Overton, pers. comm.).

The range-wide RIRA population was relatively stable in 2005-2007, declined significantly in 2008 (51%), and regained low but relatively stable densities in 2009-2011 (Liu et al 2012). The decline in the South Bay (south of the San Francisco-Oakland Bay Bridge) was steeper and densities were lower than in the North Bay during the period 2008-2011. Their range-wide population size was estimated at 1,167 individuals (range 954 to 1426) during 2009–2011. No range-wide surveys have taken place since 2011; however, surveys at 90 sites from 2010-2016 show stable numbers overall at those sites, with an increase in 2016 (MBLRoom 2016). Point Blue Conservation Science detected 417 RIRA in 16 of the 17 sites they surveyed in San Pablo Bay and San Francisco Bay in 2018, but cautioned that the “number of detections are subject to high variation among years, study areas, and survey rounds and do not account for factors that are known to affect probability of detection (Wood et al 2018).”

The CDFW Biogeographic Data Branch Vegetation Classification and Mapping Program (VegCAMP) conducted a triennial vegetation update of Suisun Marsh (north of the Solano County line) in 2015 (Boul et al 2018). The survey uses aerial photography in combination with ground verification to document the overall vegetation composition of the Marsh through digital photograph interpretation, database functions, and geographic information systems (GIS) editing and processing. When 13 CCR detections from 2002-2011 are overlaid onto the 2015 vegetation map, the points appear in four different vegetation classification types: *Schoenoplectus americanus* - *Lepidium latifolium* Association, six times; *Schoenoplectus (acutus, californicus)* - *Typha (angustifolia, latifolia, domingensis)* Mapping Unit, four times; *Schoenoplectus americanus* Herbaceous Alliance, twice; and *Typha (angustifolia, latifolia, domingensis)* Herbaceous Alliance, once. Three previous RIRAs were in areas not mapped. For explanations of vegetation classifications, refer to Boul et al 2018. It is important to note, however, that vegetation in 2015 may differ from that present at the time the RIRA was detected. Aerial photography took place in 2018, but has not been interpreted as of this writing.

DISCUSSION

The vast majority of RIRAs are found in the San Pablo Bay and San Francisco Bay, downstream of Suisun Marsh, where water salinities are higher. Salinity influences other variables, such as vegetation and invertebrates. Some studies have found two habitat variables of importance: youthful marshes (low stem densities and little residual vegetation produced by occasional scouring) and extensive *Spartina* (cordgrass) beds (Albertson & Evens 2000, Collins et al. 1994, Conway et al. 1993). More specifically, Zedler (2003) found that *Spartina foliosa* height and density characteristics were the most important habitat variables for predicting Ridgway's Rail habitat suitability. Suisun Marsh is generally too fresh to support *Spartina foliosa*, which may also contribute to low RIRA densities.

The vegetation analysis measures the change in acreage of some invasive plants in Suisun Marsh (Boul et al 2018). The non-native genotype of common reed (*Phragmites australis*) increased by 227% in tidal marsh between 1999 and 2015. It now covers 1,182.8 acres in Suisun tidal marshes. Likewise, perennial pepperweed (*Lepidium latifolium*) increased by 75.4% from 2012-2015, after previously showing a decrease since 2009 in tidal marsh. It now covers 984.8 acres of tidal marsh. Oppositeleaf Russian thistle (*Salsola soda*) increased from 4.8 acres in 2012 to 67.0 acres in 2015, however it had not appeared in tidal marsh as of 2015. It is unclear how these invasives impact rails in Suisun Marsh.

CONCLUSION

Conclusion

In the past 18 years, RIRA detections during CDFW surveys have been sporadic:

- 2002 – 0
- 2003 – 8 (outside the breeding season)
- 2004 – 1 (January)
- 2005 – 0
- 2006 – 5 (January – March)
- 2007 – 0
- 2008 – 1 (March)
- 2009 – 0
- 2010 – 0
- 2011 – 1 (January)
- 2012 – 0
- 2013 – 0
- 2014 – 0
- 2015 – not surveyed
- 2016 – 0
- 2017 – 0
- 2018 – 0

Given the variable history of RIRA presence in Suisun Marsh, Suisun may represent crucial habitat for this critically endangered subspecies of Ridgway's Rail. Environmental or anthropogenic factors in Suisun or elsewhere in the San Francisco Bay region may affect movement and survival of the RIRA. Though it is not fully known, they may include: fluctuations in water salinity, native or non-native mammal populations, non-native plant populations, water contaminants, and shifts in land use.

CONCLUSION

Specific locations in Suisun Marsh will continue to be surveyed annually or until RIRAs are detected for the purposes of habitat quality assessment, future construction and maintenance activities, and land acquisitions.

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APPENDICES

Appendices

Appendix A: US Fish and Wildlife Service California Clapper Rail Survey Protocol

United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish and Wildlife Office
650 Capitol Mall, Suite 8-300
Sacramento, California 95814

California Clapper Rail Survey Protocol

The California clapper rail was recently reclassified, and is now referred to in scientific literature as the **California Ridgway's Rail** (*Rallus obsoletus obsoletus*), but for the purposes of this document we will use the original name, **California Clapper Rail** (*Rallus longirostris obsoletus*) as that remains the listed entity under the Act.

Below is a description of the standard methodology used to detect the presence or absence of California clapper rails. Once a survey proposal using this survey methodology has been developed, it should be mailed or emailed to the San Francisco Bay-Delta Fish and Wildlife Office. The Service will review the survey proposal and determine if it is adequate for implementation. The qualifications, including copies of applicable 10(a)(1)(A) permit(s), of all observers proposed for a survey should be included in the proposal and provided to the Service for review and approval. (Note: Submit survey proposal with maps identifying the location of listening and playback stations to the Service at least three (3) weeks prior to the scheduled initiation of the surveys). Approval by the San Francisco Bay-Delta Fish and Wildlife Office to conduct surveys will be given via email to the applicant. After the surveys are completed, the survey results should be compiled and submitted to the San Francisco Bay-Delta Fish and Wildlife Office for review to determine if work or other activities proposed in the survey area may proceed.

Survey Methodology:

1. For each **project site** (or marsh), **survey stations** (individual survey locations) should be established so that the entire marsh is covered by 100-meter radius circular plots. Listening (passive) and call playback (active) survey stations should be established no more than 200 meters apart along transects in or adjacent to marsh areas. If the marsh in question is too large (e.g. Outer Bair Island) to accommodate this requirement, please contact us for alternative procedures. Survey stations should be located on levee crowns or boardwalks to minimize disturbances to marsh areas. When surveys are conducted within a marsh (as opposed to from the edge), listening stations should not be placed along slough or channel edges to minimize disturbance to rail species. We do recognize that this will not be possible at all times. A detailed map depicting sloughs and other marsh landmarks or features in relation to the proposed survey stations should be developed.
2. **Surveys** should be initiated between January 15 and February 1. For each survey station, four surveys are to be conducted: two (2) passive surveys, followed by two (2) active surveys. Surveys should be spaced at least two (2) weeks apart and should cover the time period from the date of the first survey through the end of March or mid-April. This will allow for the surveys to encompass the optimum time period when the highest frequency of calls is likely to occur. Survey at one project site may span multiple days if the project site is large or multiple observers are not available. Surveys should proceed until clapper rail(s) are detected. Once a clapper rail is detected, the project site is considered occupied. At this time, all active surveys within the project site shall be terminated. It is at the discretion of the surveying party as to whether or not to conclude passive surveys at this time.

3. Survey Duration

Morning and evening surveys can be conducted. Morning surveys will be initiated no sooner than one hour before sunrise and extended no more than one hour after sunrise; evening surveys will begin one hour prior to sunset and extend no more than one hour following sunset.

Passive surveys: An observer should be assigned to each survey station for the duration of two hours.

Active surveys: An observer should be assigned to each survey station for the duration of 45 minutes. A total of 3 clapper rail calls will be broadcast at each survey station spaced at 15 minutes apart. Each broadcast will have a duration of 30 seconds and will include three vocalizations: duet, kek and kek-burr. Volume should be between 80-90 dB at 1-m in front of the speaker. Calls will start at the arrival of the surveyor at the station. Playback will be stopped immediately if a clapper rail predator (e.g., northern harrier, great blue heron, short-eared owl, cat, etc.) approaches within 100 m of the survey station or a clapper rail location.

Trainees should familiarize themselves with various calls and with estimating distances to calls before training in the field. In-field training should include ways to minimize disturbance to rails and marsh vegetation. The 2004 “Rail Training Document” guidelines should be followed with the exception of guideline #6. Trainees should be stationed with an experienced California clapper rail observer for a minimum of four (4) surveys to assess the trainee’s ability to accurately detect and map calls in the field. Surveyors should contact the San Francisco Bay-Delta FWO for recommendations on favorable training sites for new observers and their instructors.

4. All rail vocalizations should be recorded, noting the call type, location, and time on a detailed map of the marsh. The call types are coded as C = clapper/clatter, D = duet, K = kek, B=kek-burr, KH = kek-hurrah, SK = squawk and V = visual sighting. Other unusual calls also should be noted. If a rail is moving during the survey, several locations may be noted for the same bird(s).
5. Weather information, including wind velocities and direction, should be recorded. Information on disturbances (e.g., dogs or cats in marsh and aircraft flyovers) occurring during the surveys should be recorded.

General Requirements:

1. A 10(a)(1)(A) permit is required to conduct active surveys. This 10(a)(1)(A) permit can be used to supervise other fully trained and qualified biologist as long as surveys are being conducted within sight distance of the 10(a)(1)(A) permit holder for all station locations.
2. Surveys should not be conducted when tides greater than 4.5 feet National Geodetic Vertical Datum (NGVD) as predicted at the Golden Gate occur at the marsh during the survey period or during full moon periods.
3. Surveys should not be conducted when wind velocities exceed 10 mph or wind gusts exceed 12 mph, or during moderate to heavy rains. If a survey of a marsh is conducted over more than one day in a row, observers should be assigned to stations adjacent to their previous day’s station if at all possible.

APPENDICES

Appendix B: San Francisco Bay Secretive Marsh Bird Survey (Version 1.0 – Dec 2016)

San Francisco Bay Secretive Marsh Bird Survey Field Methods

The following list of instructions describe the necessary steps to prepare for and conduct a secretive marsh bird survey. Refer to the numbered Elements in the San Francisco Bay Secretive Marsh Bird Survey Protocol for details.

Pre-survey Requirements

1. Obtain required survey permits (See [Element 6](#))
 - a. USFWS Endangered Species Permit, ESA Section 10(a)(1)(A) including a List of Authorized Individuals containing the observer's name.
 - b. California DFW Memorandum of Understanding (if applicable)
 - c. Site-specific permissions (e.g. Special Use Permit from a National Wildlife Refuge)
2. Training (See [Element 6](#))
 - a. All observers conducting surveys under this protocol are required to receive training from a biologist carrying a 10(a)(1)(A) permit and to accompany her/him on at least ten surveys where Ridgway's Rails are detected (see [Element 6](#)). More training may be required and is up to the discretion of the permitted biologist
 - b. Attend annual secretive marsh bird field training and calibration sessions to identify secretive marsh bird calls, estimate distance to calling birds, record accurate bearing and review other aspects of data collection.
 - c. Read and understand the "Walking in the Marsh" document (Appendix B).

Equipment

- Vehicle (truck, boat, or bike)
- GPS Unit
- binoculars
- rangefinder
- thermometer (optional)
- anemometer (wind meter)
- compass with adjustable declination
- clipboard (optional: rope sling for carrying)
- rubber bands or clips (for holding forms on clipboard)
- sufficient blank data forms (Appendix C)
- map of the study area and surrounding area with survey points
- portable speaker
 - Speaker volume should be between 80-90 dB at 1-m in front of the speaker without distortion
- audio player
 - USFWS-approved audio file with California Ridgway's rail and California black rail vocalizations and minute call-outs <insert link or contact for file>
- cell phone or radio (for safety and communication)
- water and snacks
- headlamp
- spare supplies (e.g., batteries, pens)

- hat (large brimmed hats such as lifeguard hats that interfere with one's ability to hear clearly in all directions should be avoided. Hats that muffle one's ears should be folded or lifted fashionably above the ears during the 10-minute survey period.)
- sunscreen

Environmental Restrictions

1. Conduct surveys at tides when tidal sloughs are no more than bank full, approximately <4.5-ft MLLW at the nearest tide station. Tide height at bank full will vary by study area. Avoid high (flood) tides when possible.
2. Surveys during the day of a full moon that is visible during the survey period should be avoided because birds may be more visible to predators if they respond to broadcasts.
3. Surveys should not be conducted in winds averaging >10 mph or with gusts reaching 15 mph which alters, distorts, or muffles rail vocalizations. An anemometer should be used to accurately measure wind speed.
4. Surveys should not be conducted during steady rain. Conducting surveys during precipitating fog and light, short duration showers is acceptable provided that observer's ability to accurately estimate distance and to record data onto the paper datasheets is not adversely affected.
5. Avoid surveying study areas during particularly noisy periods such as commute hours or during construction. In some cases this will not be possible highlighting the importance of modeling the probability of detection.

Survey Timing

1. Conduct surveys between 15 January and 15 April. Because detection probability decreases later in the season, efforts should be made to complete most surveys by 25 March.
2. Surveys at a particular location should be spaced at least 1 week apart.
3. Surveys will be conducted within a 2-hour window and ideally, 80-90 minutes, centered on local sunrise or sunset (e.g., surveys may begin no earlier than 1 hour before sunrise or sunset and may extend no longer than 1 hour after sunrise or sunset).
4. Alter the direction or time of day (am vs. pm) of your surveys such that the same points are not surveyed during very dark or very light hours on each round. Ideally, each point should be visited close to peak calling time (sunrise/sunset) in at least one round which may involve arriving at the study area earlier to start at the far end of the transect.
5. Ideally, round 1 should be completed from 15 January to 6 February, round 2 from 7 February to 28 February, and round 3 from 1 March to 25 March. The period from 25 March to 15 April can be used to finish any remaining surveys if previous visits were cancelled due to weather or other logistics.

Data collection procedures

Pre-survey procedures and considerations

1. We recommend that the same observer be used for all survey points within a site-visit, that is, within one 2-hr session. However, it is preferable to use different observers for different visits within the same year (see *Sources of error*, pg. 38).
2. Approach the survey point with as little disturbance to the birds as possible, and begin your survey as soon as you are oriented and are confident you can estimate distances accurately and all necessary gear is ready (ideally, less than 1 minute).
3. Any bird flushed by an approaching observer prior to the start of a survey or after a survey has concluded should be recorded on a separate line as a bird detected "outside time" unless the same bird was also detected during the survey.

4. If something substantially interferes with your ability to detect birds during the 10-minute count (e.g., a loud airplane or vehicle), stop the count until the disturbance has passed and start over. Cross out the interrupted data and note what happened on your form.
5. Call-broadcast should be halted in the presence of a potential rail predator within 200 m of the survey point and not resumed until the predator leaves the area. If the predator does not leave the area within 10 minutes, resume the count without employing the broadcast.

Visit Information

1. Before you begin the first point on the transect, fill out the top of the data sheet. First, record the observer(s) conducting the survey.
2. Record the study area(s) that are the target of the survey; i.e., those study areas that will be within range of the points on the transect that are of interest for the project (see *Sample selection*, pg. 31). Study Area 1 is considered the primary study area; we assume that all birds are detected in Study Area 1 unless a different Study Area is specified in the “Study Area Detected” column in the detection section below.
3. Record the transect code, visit number for that year and date (mm-dd-yyyy).
4. Check a box to indicate the protocol. All surveys should use the 2-species North American Marsh Bird Protocol unless a passive survey is conducted due to equipment failure or the presence of predators.

Study area Conditions

1. Record weather conditions at the beginning of the transect and, if desired, from any survey point along the transect as conditions change. Additional weather data can be recorded in the Notes section or on the back of the form.
2. Record wind speed using an anemometer (mph or kph) or use the Beaufort wind scale: 0 smoke rises vertically, 1 wind direction shown by smoke drift; 2 wind felt on face, leaves rustle; 3 leaves & small twigs in constant motion, light flag extended; 4 raises dust and loose paper, small branches are moved, 5 small trees with leaves sway, crested wavelets on inland.
3. Record the temperature (in Fahrenheit or Celsius) using a thermometer.
4. Record sky conditions/code: 0 clear or a few clouds, 1 partly cloudy or variable sky, 2 cloudy or overcast, 4 fog or smoke, 5 drizzle, 6 rain, 8 showers.
5. Record noise levels at the study area either by estimating and using the noise code or using a decibel meter and recording an average over a 10-second period and marking whether in dbA or dbC.

Survey Procedure

1. To begin the 10-minute survey, record the Point ID using the Study Area code representing the study area and the 2-digit point number (e.g., DUMW01), record the start time (24-hr clock) and press play on the audio device. The first bird detection will be entered on the next line below. The speaker should be placed on the ground or on the bow of the boat pointing toward the majority of the marsh and away from the observer. For your convenience, the sound track will announce the beginning of each 1-minute segment and the species call broadcasts will begin at minute 6. The call broadcasts should continue regardless of rail response. Check the Min 1, Min 2, etc. boxes to the right of the “study area detected” column on the same row where you recorded the point code and start time to track where you are in the call broadcast sequence. Rail vocalizations will be broadcast on each visit at every point, unless a potential rail predator is present (see above). If the broadcast is halted or not employed for any reason, enter a “Y” under “Playback halted (Y/N)?” and record in the notes a description of why.
2. Record all vocalizations for focal marsh birds on the datasheet

- a. Each individual bird is given its own line on the data sheet; detections for each bird are recorded by writing the call type within the minute it was detected (minute 1-10). For duetting pairs, each bird will be recorded on its own line using the clatter, “C,” detection code (i.e., there will be two lines of data for each duetting pair). Enter the same map code for each individual of a duetting pair to indicate they are paired. Only record the call type once per minute segment, even if a bird repeats the same vocalization multiple times within the same minute. Do not record detections from same individual on more than one line at a survey point. This may involve crossing out a line of data if the individual is discovered to have been already recorded from the *same* point. Individuals that were recorded from another point will be kept and marked as “duplicate bird.”
 - b. Record all detections using the following species-specific codes that correspond to the type of detection:
 - i. All species: V = visual sighting
 - ii. Ridgway’s Rail: C = Clatter, K = kek, B = kek-burr, KH=kek-hurrah, SK = squawk, P = purr, CH = churr (Do not use a duet code. See above.)
 - iii. Black Rail: KKD= ki-ki-doo, GR = grr, CHT = churt/krup, TCH = tch (laugh), PE = peep
 - iv. Virginia Rail: G = grunt, T = tick-it/kiddick, KI = kicker, KIU = kiu/squawk, KK = kikik
 - v. Sora: WH = whinny, PW = per-weep, KEE = kee
 - vi. American Bittern: PL = pump-er-lunk, CP = chu-peep, KO = kok
 - vii. Least Bittern: COO = coo; KAK = kak, ERT = ert
 - viii. Yellow Rail: CC = click, CA = cackle, WHZ = wheeze
 - ix. Predators (e.g., feral cats, raptors and corvids) and any notable behavior (e.g. nest building) should be recorded in the notes along with the point number the predator is closest to.
 - x. Other bird species of interest can be recorded in the notes section.
 - c. Record the bearing to each individual rail detected relative to true north (i.e., compass declination should be set annually).
 - d. Record the distance to each individual marsh bird detected from the surveyor, standing at the center of the survey point. The distance should be to the location where an individual was first detected, regardless of its behavior. If the bird subsequently moves, do not change the original distance recorded.
 - e. If the bird was detected in Study Area 2 or 3, record the name or code of the study area in the “study area detected” column. If the bird was detected in the primary study area (Study Area 1), this field can be left blank. If the bird was detected in a non-target study area (not of concern for the project), the code can be entered or left black if the area is not named.
 - f. Mark any rails detected in outside study areas identified at the top of the form as “outside study area.” Whether a Study Area is considered a “target” study area (those identified at the top of the form) should be determined prior to the season and may depend on factors such as restoration, marsh type, and if a study area is surveyed by another observer or organization (see *Sample selection* pg. 31).
3. Rails detected before or after the 10-minute point count period will be recorded as “outside time.”
 4. If no birds are detected at a point, keep the check marks you entered under each minute bin
 5. Skip a line to leave a blank row before entering information for the next point.

Mapping detections and determining unique counts

1. All detections will be mapped onto a paper map of the study area AFTER the transect is complete to determine whether each detection is unique.
2. Using a compass adjusted for local declination and a map of the study area showing true north, plot the location of each detection onto the paper map.
3. To map the location, turn the compass dial until the desired bearing is aligned with the notch or arrow at the top of the compass. Place the compass on the map and rotate the compass until the north of the compass (marked "N" or 0 degrees) with the true north on the map. Most compasses with adjustable declination will have a series of red or black parallel orientation lines on the bottom of the dial that are aligned with true north.
4. Place the edge of the compass on the survey point. The edge of the compass will now be pointing in the direction indicated on the dial.
5. Create a scale bar by marking a small piece of paper that exactly matches the scale bar on the map. Alternatively, creating maps with concentric circles of known distance from each survey point will speed up the mapping process.
6. Hold the scale bar to the compass edge with 0 m originating at survey point.
7. Mark the map based on the estimated distance from the survey point to the individual.
8. Each mapped individual or pair is marked with a number or letter on the map that corresponds to the "map ref. code" field on the datasheet.
9. After mapping all individuals, assess which birds may be duplicates by looking for locations that fall within your distance estimation and bearing measurement error. Note that many factors can influence the estimated distance to calling birds such as wind, background noise, whether the bird is calling from within a channel, the direction of the bird's head relative to the observer, etc.
10. If there is reasonable doubt that two or more detections are duplicates, do not enter the suspected duplicates as unique individuals.
11. If two or more birds are considered duplicates, assign the unique detection to the point that is closest to the calling center (duplicate bird = N). The other detection(s) will be entered as duplicate bird = Y.
12. To calculate the "highest minimum count," sum the number of unique detections (duplicate bird = N) for each species (separately) for each study area including unique birds detected outside of the survey time (i.e., not during a 10 min count). Detections at all distances from survey points are included. Sum the number of unique detections for each study area separately if more than one target study area is surveyed on the same datasheet.

APPENDICES

Appendix C: Suisun Marsh Habitat Management, Preservation, and Restoration Plan (SMP) California Clapper Rail Survey Protocol

Mitigation Measures and Environmental Commitments	Type of Action	Implementation Schedule	Party Responsible
RESTORATION ACTIVITIES			
<p>times per month) to identify existing nests that may be used during the nesting season;</p> <ul style="list-style-type: none"> • Raptors may nest from later winter through mid-summer; therefore, multiple nesting season surveys will be performed; • DFG will be notified of all raptor nests located during the preconstruction surveys. If a raptor nest is located within the recommended buffer, the project proponents will coordinate with DFG to determine an acceptable buffer width; and • If an active raptor nest is found outside the construction areas, a buffer zone will be created around the nest tree. For special-status species a larger buffer will be required (e.g., 0.5-mile Swainson's hawk buffer). The project proponents will coordinate with DFG prior to project implementation to determine the species-specific buffer widths. 			
<p>Perform preconstruction surveys for California clapper rail and California black rail if construction activities are necessary during the breeding season as follows:</p> <ul style="list-style-type: none"> • Surveys will be conducted at and adjacent to areas of potential tidal and managed wetlands habitats for California clapper rail and black rail; • Surveys will focus on potential habitat that may be disturbed by construction activities during the breeding season to ensure that these species are not nesting in these locations. Survey methods will follow the protocols used by DFG during previous rail surveys in Suisun Marsh (California Department of Fish and Game 2007). The specific project proponent will implement the following survey protocols: <ul style="list-style-type: none"> ◦ Surveys should be initiated sometime between January 15 and February 1. A minimum of four surveys should be conducted. The survey dates should be spaced at least 2 to 3 weeks apart and should cover the time period from the date of the first survey through the end of March or mid-April. This will allow the surveys to encompass the time period when the highest frequency of calls is likely to occur; ◦ Listening stations will be established at 150-meter intervals along road, trails, and levees that will be affected by plan implementation; ◦ California clapper rail and California black rail vocalization recordings will be played at each station; ◦ For California clapper rails, each listening station will be occupied for a period of 10 minutes, followed by 1 minute of playing California clapper rail vocalization recordings, then followed by an additional minute of listening; ◦ For black rails, each listening station will be occupied for 1 minute of passive listening, 1 minute of “grr” calls followed by 30 seconds of “ki-ki-krrr” calls, then followed by another 	<p>Environmental commitment</p>	<p>Prior to construction</p>	<p>Project proponent/contractor</p>

Mitigation Measures and Environmental Commitments	Type of Action	Implementation Schedule	Party Responsible
RESTORATION ACTIVITIES			
<p>3.5 minutes or passive listening;</p> <ul style="list-style-type: none"> ○ Sunrise surveys will begin 60 minutes before sunrise and conclude 75 minutes after sunrise (or until presence is detected); ○ Sunset surveys will begin 75 minutes before sunset and conclude 60 minutes after sunset (or until presence is detected); ○ Surveys will not be conducted when tides are greater than 4.5 National Geodetic Vertical Datum (NGVD) or when sloughs and marshes are more than bankfull; and ○ California clapper rail and California black rail vocalizations will be recorded. A GPS receiver will be used to identify call location and distance. The call type, location, distance, and time will be recorded on a data sheet. 			

If California clapper rail or black rail is present in the immediate construction area, the following measures will apply during construction activities:

- To avoid the loss of individual California clapper rails or black rails, activities within or adjacent to California clapper rail or black rail habitat will not occur within 2 hours before or after extreme high tides (6.5 feet or above, as measured at the Golden Gate Bridge), when the marsh plain is inundated, because protective cover for California clapper rails is limited and activities could prevent them from reaching available cover;
- To avoid the loss of individual California clapper rails or black rails, activities within or adjacent to tidal marsh areas will be avoided during the California clapper rail breeding season from February 1 through August 31 each year unless surveys are conducted to determine California clapper rail locations and California clapper rail and black rail territories can be avoided. Figure 2-5 shows the areas of known clapper rail breeding habitat;
- If breeding California clapper rails or black rails are determined to be present, activities will not occur within 700 feet of an identified calling center. If the intervening distance across a major slough channel or across a substantial barrier between the California clapper rail calling center and any activity area is greater than 200 feet, it may proceed at that location within the breeding season.
- *Exception:* Only inspection, maintenance, research, or monitoring activities may be performed during the California clapper rail or black rail breeding season in areas within or adjacent to California clapper rail breeding habitat with approval of the USFWS and DFG under the supervision of a qualified biologist.

APPENDICES

Appendix D: California Ridgway's Rail Survey Forms

Rail survey form

USFWS Protocol

Date _____ Site _____ Observers _____

Temp °F _____ Sky _____ Wind _____ Noise _____

Start time _____ End time _____ Survey type _____

Entered _____ Proofed _____

Pg. _____ of _____

Rail survey form

USFWS Protocol

Point ID	Name of survey station
Start time	survey start time
Detection time	Time bird was heard
Species	4-letter species code
Number	
Distance (m)	enter distance/direction if not noting approx location on map
Direction (deg)	enter distance/direction if not noting approx location on map
Call type	See codes
Duplicate bird?	Y if bird has been counted at previous point or earlier in survey, N if bird is unique
Map code	identifier used for noting approximate location on map

San Francisco Bay Secretive Marsh Bird Survey Form

Observer (last, first) _____ **Study Area(s)** 1 _____ 2 _____ 3 _____

Add'l observers _____ **Transect** _____ **Visit** _____ **Date (mm-dd-yyyy)** _____

Protocol [] 2-sp North American Marsh Bird Protocol OR [] Other (please describe) _____

Comments/Predators and predator events: _____

[†] See reverse for codes

Initials: Entered Proofer Scanned Page of

[Insert project, organization's name and address]

Study Areas 1,2,3: See Protocol pg. 31-32 for a list of additional accepted Study Areas. Detections from these study areas are entered as OutsideSite="N." Detections in other areas not listed are OutsideSite="Y."

***Duplicate Bird:** **Y** if bird is counted as unique from another point; **N** if bird is counted as unique to the point.

Weather Codes:

Wind speed Beaufort codes:

- 0** Calm, smoke rises vertically, water surface smooth and mirror-like (<1 mph)
- 1** Light air: Smoke indicates direction, scaly ripples on water with no foam crests (1-3 mph)
- 2** Light breeze: Wind felt on face, leaves rustle, small wavelets, crests glassy, no waves breaking (4-7 mph)
- 3** Gentle breeze: Leaves, twigs in constant motion, large wavelets, crests begin to break, scattered whitecaps (8-12 mph)
- 4** Moderate breeze: Small branches moving, raises dust, small waves 1-4 ft, numerous whitecaps (13-18 mph)

Stop survey when winds average >10 mph or gusts reach 15 mph

Sky codes: **0** clear or a few clouds **1** partly cloudy or variable sky **2** cloudy or overcast **4** fog or smoke **5** drizzle **6** rain **8** showers

Noise codes:

- 0** No noise (<40 dB)
- 1** Faint noise (40-45 dB)
- 2** Moderate noise (probably can't hear some birds beyond 100m, 45-50 dB)
- 3** Loud noise (probably can't hear some birds beyond 50m, 50-60 dB)
- 4** Intense noise (probably can't hear some birds beyond 25m, >60 dB)

All Species	<u>Black Rail</u> <u>(BLRA):</u>	<u>Virginia Rail</u> <u>(VIRA):</u>	<u>Sora (SORA):</u>	<u>American Bittern</u> <u>(AMBI):</u>	<u>Least Bittern</u> <u>(LEBI):</u>	<u>Yellow Rail</u> <u>(YERA):</u>
V visual <u>Ridgway's Rail</u> <u>(RIRA):</u> C= clatter K= kek B= kek-burr KH= kek-hurrah SK= squawk P= purr CH= churr	KKD= ki-ki-doo GR= grrr CHT= churt TCH = tch (laugh) PE= peep	G= grunt T = tick-it KI= kicker KIU= kiu/squawk KK= kikik	WH= whinny PW= per-weep KEE= keep	PL= pump-er-lunk CP= chu-peep KO= kok	COO= coo KAK= kak ERT= ert	CC= click-click CA= cackle WHZ= wheeze

Hill Slough Restoration Rail Survey Data Sheet

Observers _____ **Stations** _____ **Visit** _____ **Date** (e.g., 5-May-2017) _____

Site Notes:

V visual	*RIRA, BLRA, VIRA, SORA, AMBI, AMCO, COMO, YERA, PBGR **Sky: 0 clear or a few clouds 1 partly cloudy or variable sky 2 cloudy or overcast 4 fog or smoke 5 drizzle 6 rain 8 showers ***Noise: 0 none 1 faint 2 moderate 3 loud 4 intense
-----------------	--

Comparison Photos

Pre-Construction Nov 2017

Post-Construction Nov-Dec 2019

Rush Ranch

Lower Spring Branch Creek and Suisun Hill Hollow Restoration Project

Key:

WP01 = Waypoint on map @**250** = bearing of photo in degrees: **07-11-14** = date photo was taken **Berm**= Feature location

Suisun Hill Hollow

**Pre-
Construction
Nov 2017**



WP003 @200 Quarry area showing bank/berm to be removed in distance

**Post-
Construction
Nov 2019**



WP 003 @200 bank/berm removed



WP003@ 220 Former Quarry proposed fill placement vicinity



WP004 @ 320 look east along slough . Gravel road to be removed



WP003@220 Fill placement complete.



Mid project looking west. Alkali pool construction, berm lowered, road removed.

Suisun Hill Hollow

**Pre-
Construction
Nov 2017**



From mid-project east pre-construction . Gravel road and drainage shown.

**Post-
Construction
Nov 2019**



From mid project area, alkali pool and removed gravel road



WP005@ 220 along berm to be removed with stockpond on east side



WP 005 @ 220 looking north along lowered berm. Culvert re-



WP6@20 southern public access gate looking west into marsh and cattle exclusion area; berm to right



From south gate looking northwest into undisturbed drainage. Berm lowered to left.

Lower Spring Branch Creek

**Pre-
Construction
Nov 2017**

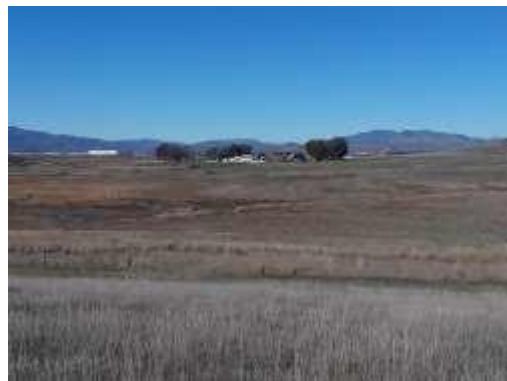


WP009@300 East end "L" Berm"and seasonal wetland west (left)

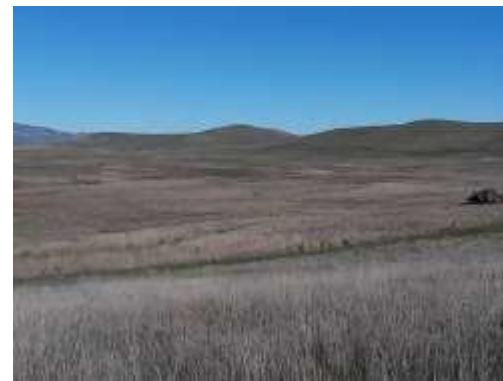


WP009@ 320 East end "L" Berm to be removed

**Post-
Construction
Nov 2019**



WP 009 @ 300 Removed L berm center with newly tidal area



WP 009 @ 320 East end sea-sonal wetland



Lowered L berm from trail access looking east. Mid-tide.

Lower Spring Branch Creek

**Pre-
Construction
Nov 2017**



WP11@ 280 west view of "L" berm (closer)



WP 12@ 0 looking north along berm alignment



WP 12@30 looking east view of LSBC and distant hills

**Post
Construction
Nov 2017**



WP11@ 280 west view of "removed L berm and new chan-



WP 12@ 0 looking north along trail over half culvert, new channel to right



WP 12@30 New channel with mowed sides-looking east

Lower Spring Branch Creek

**Pre-
Construction
Nov 2017**



WP16 @ 0 along berm looking north to nature center



WP14@180 looking south along berm



WP 15-from berm looking down at culverts east side berm

**Post-
Construction
Nov 2019**



WP 16@0 along access trail toward new culvert. Rails on cul-



WP 14 A 180 along trail access with new channel to left.



WP 15 New channel under new half culvert , from culvert top

Lower Spring Branch Creek

**Pre-
Construction
Nov 2017**



WP 15 from berm looking

**Post-
Construction
Nov 2019**



WP 15 from top half culvert into slough to west.



New half culvert from SW corner looking north. Railing posts on



New channel from NE corner of culvert looking east.