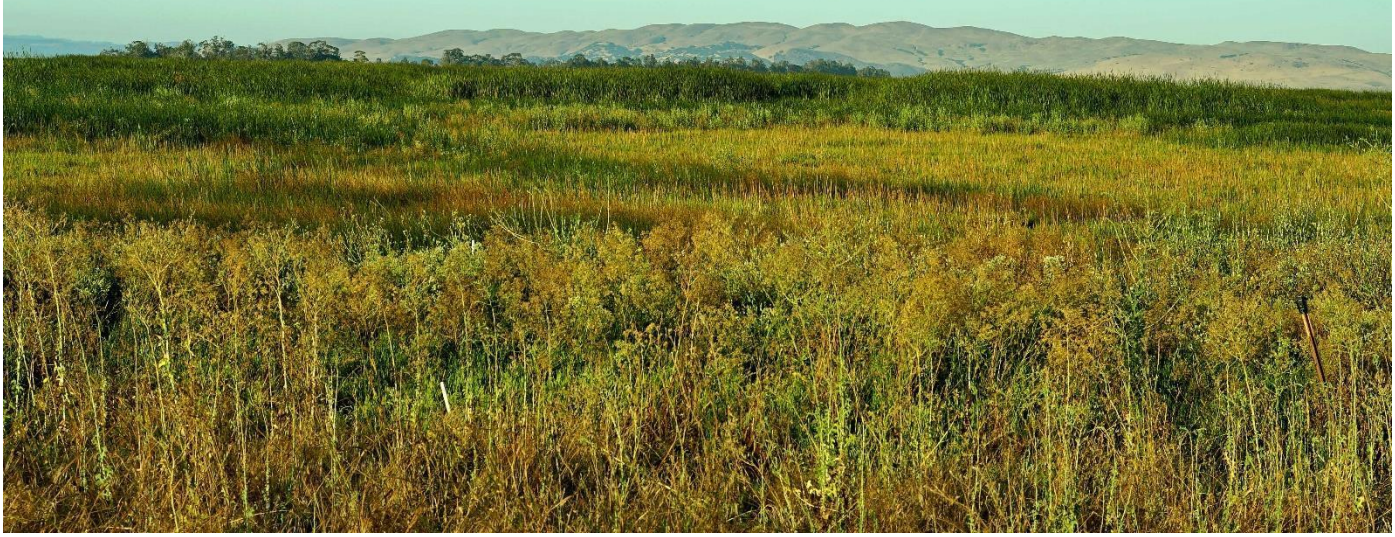
Final Grant Report

Lower Spring Branch Creek and Suisun Hill Hollow Restoration Project

Rush Ranch Open Space Preserve

Suisun Marsh, Solano County, California



April 6, 2020

Delta Water Quality and Ecosystem Restoration Program
Grant Agreement P1596027

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1 Project Background Information

The Lower Spring Branch Creek (LSBC) and Suisun Hill Hollow (SHH) Restoration Project is located within Rush Ranch in Solano County, a property owned and operated by Solano Land Trust (SLT). (Figure 1 Location Map).“While much of Suisun Marsh has been leveed and managed as habitat for migrating waterfowl, a large part of Rush Ranch remained biologically diverse free-flowing tidal marsh. A unique remnant of historical conditions, the estuarine area of Rush Ranch is studied as a reference site for marsh restoration and to gain insight into climate change and sea-level rise. “ (CDFW P1596027, 2016, P.4) Rush Ranch is a component of the San Francisco Bay National Estuarine Research Reserve (SF Bay NERR).

The project consisted of two discrete sites at Rush Ranch (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 is the final report for grant funding provided by the Delta Water Quality and Ecosystem Restoration Program Grant Agreement P1596027 administered by CDFW, June 30, 2016.

1.1 Purpose of the Project

“The primary purpose of the project is to remove barriers to estuarine transgression in order to allow habitats to move up the drainage gradient as sea level rises. The project will restore tidal flow from Suisun Marsh to two braided creeks which have headwaters in Potrero Hills. The project will remove berm and berm barriers along waterways in order to reinitiate the exchange of flows, sediment, nutrients, and wildlife. Non-native species will be removed and native plants will be established within the tidal and seasonal wetlands and the upland to wetland transition zones. The Suisun Hill Hollow portion of the project will also involve fencing of the creek to exclude cattle and installation of off-channel water sources for livestock. Grazing infrastructure improvements will allow cattle to perform the vegetation management function historically provided by native ungulates. Recreational and educational public access within the project site will be supported through the installation of low-impact trails” (CDFW, 2016).

1.2 Restoration Projects Goals

In the process of design, permitting and construction of the project many documents were issued that provided guidance for the monitoring, construction and monitoring. Permits and consultations for the project were with US Army Corps of Engineers (USACE) and the US Fish and Wildlife Service (USFWS), California Regional Water Quality Control Board (RWQCB); California Fish and Wildlife (CDFW); Bay Conservation Development Commission (BCDC) and local Solano County.

The project goals and objectives were stated in Grant itself and in Table 1 of the Adaptive Management and Monitoring Plan (AMMP) approved by regulatory agencies and grant administrators for the project.

- Develop final design and acquire necessary permits. *completed*
- (Goal 1 AMMP) Increase hydrological and hydraulic connectivity between upland, fluvial and estuarine habitat – LSBC *completed with construction of arch culvert and new channel, removal of berms and berm barriers. SHH-completed by lowering of berm, removal of old road*
- (GOAL 1 AMMP) Reconnect the creek to its floodplain and facilitate the establishment of natural fluvial processes- *Completed :LSBC with construction of new channel and arch culvert. SHH removal of berm and old road barriers, removal of excess quarry soil from bank*
- (Goal 1&2 AMMP) Restore natural form and function to creeks and estuarine systems
    - 5 acres of seasonal wetlands SHH *constructed to specification with added seasonal wetland components*
    - 15 acres tidal wetland LSBC *constructed to specification with added new channel and removal of barriers.*
- (Goal 2 AMMP) Reduce abundance of invasive and non-native plant species *Restoration planting of native species, future weed control measures*
- (Goal 2 AMMP)Increase relative cover of native and special status plants in tidal marsh and seasonal wetlands. *LSBC_ SHH natural enhancement through tidal action and seasonal flows. Future monitoring.*
- (Goal 2 AMMP) Maintain and enhance habitat for special status species that currently use the site or have potential to use the site. *LSBC – Soft bird's beak will be monitored; wildlife observed as encountered.*
- (Goal 3 AMMP) Maintain and enhance existing public and educational use. *LSBC – educational turnout constructed, arch culvert has rail with gate opening; interpretive signage, low impact trails; SHH low impact trails*
- (Goal 4 AMMP) Accommodate cattle rotation between pastures and limit cattle access to project site SHH- *Exclusion fencing installed, off site water constructed; cattle management. LSBC – fencing along new trail.*

1.3 Restoration Project Objectives and Performance Measures

Restoration project performance measures are provided in Table 4 of the AMMP. Given that restoration construction was completed in November 2019, there has been no time for restoration development to occur and no post construction monitoring, other than as-built topography, has yet taken place, thus no assessment of progress toward meeting any of these performance measures is possible as of February 2020. What can be stated at this very beginning stage is that the project was constructed according to its design plans and all indications are that it should have no impediments to achieving these performance measures. Project construction adhered to the boundaries in the restoration plan. The footprints of the As Built Features (Figures 12 and 13) match those in the planning documents, which was designed to restore approximately 5 acres of seasonal wetland in Suisun Hill Hollow and approximately 15 acres of tidal wetland in Lower Spring Branch Creek. Acres restored to tidal wetland depend on tidal actions. Observations to date show that the tidal influence is behaving as modeled, which indicates a positive trajectory towards accomplishing the acreages modeled. Monitoring will continue and adaptive management techniques will be employed as possible to promote desired outcomes.

Table 1. Performance Objectives, Triggers, Potential Adaptive Management Actions, and Assessment as of February 2020 (Appended from AMMP Table 4)

No.	Site	Criteria	Restoration Objectives Addressed	Trigger	Potential Adaptive Management Actions	Assessment as of February 2020
Lower Spring Branch Creek						
PO-1	LSBC	Tidal heights aligned between upper channel and First Mallard Slough at arch culvert.	LSBC-1.1, 1.3	More than 0.5 ft of reduction in tide height compared to tides at arch culvert	• Assess whether caused by channel blockage or undersized channel • Evaluate potential to clear blockage, enlarge channel	No quantitative data yet, field observations indicate full tidal action throughout constructed channel
PO-2	LSBC	Adequate combined downstream tidal and fluvial conveyance through the channel and across the high water overflow bench to reduce residence time of stormwater upstream of the ranch road by 25%.	LSBC-1.1, 1.2, 1.3	Residence time of fluvial flows is >75% of pre-project conditions	Lower elevation of high water overflow bench or install weirs or culverts through the berm.	No quantitative data yet, no storms since Dec 2019 to observe for a qualitative assessment
PO-3	LSBC	Persistence of the tidal channel extended upstream of the ranch road crossing, allowing for natural geometry adjustments to conveyed flows	LSBC-1.1, 2.3, 2.4	More than 0.5 ft of reduction in tide height compared to tides at arch culvert	• Assess degree of channel sedimentation • Evaluate potential to enlarge channel	No quantitative data yet, field observations indicate channel geometry stable
PO-4	LSBC	Revegetation of disturbed areas with native vegetation cover (>25%) by year-5 post-construction.	LSBC-2.1, 2.2	Non-native vegetation within disturbed areas exceeds 75% cover	Implement weed control program (weeding, herbicide, etc.)	SLT carried out plantings late 2019, too soon to assess outcomes

No.	Site	Criteria	Restoration Objectives Addressed	Trigger	Potential Adaptive Management Actions	Assessment as of February 2020
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.	LSBC-1.4, 2.1, 2.2	Significant difference in vegetation community composition	• Assess drivers (e.g., hydrologic, soils, invasives) • Evaluate potential to implement active native plant revegetation effort • Evaluate potential to address other drivers	Too soon to make observations
PO-9	LSBC	No major erosion or slumping along the high water overflow bench and public access path by year-5 post-construction.	LSBC-3.3, 3.4	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 visible signs of erosion or slumping from the late 2019 storms, no storms or extreme tides since then
PO-10	LSBC	No indications of culvert structural instability by year-5 post-construction	LSBC-1.1, 2.4, 3.4	Signs of erosion around the culvert footings or wing-walls that an engineer determines could cause unsafe conditions	Repair culver as-needed to alleviate the concern.	Observations indicate culvert very stable. Two elevation reference points established on headwall to assess vertical change in future
PO-11	LSBC	Interpretive sign intact and public access turnout being maintained by year-5 post construction	LSBC-3.1, 3.2, 3.3	Sign no longer providing interpretive information, access turnout not accessible	• Repair sign • Clear vegetation in access turnout, fill potholes	Installed as of February 2020

No.	Site	Criteria	Restoration Objectives Addressed	Trigger	Potential Adaptive Management Actions	Assessment as of February 2020
PO-12	LSBC	Cattle excluded from site during wet season	LSBC-4.1	Cattle enter during wet season	• Inspect perimeter fencing for damage and repair • Review allowable use areas with grazing tenant	One cow got loose in January 2020 and entered LSBC floodplain just above restoration area; fence hole remedied immediately
Suisun Hill Hollow						
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.	SHH-1.1	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	No quantitative data to date, qualitative observations indicate late 2019 storms resulted in lesser ponding and storm flows passed the lowered berm.
PO-14	SHH	No major erosion or slumping of the quarry slope layback area by year-5 post-construction	SHH-1.2	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	Too soon to determine, no observed slumping to date
PO-15	SHH	Development of predicted seasonal wetland, vernal pool, and impoundment habitats by year-5 post-construction.	SHH-2.1	Absence of intended habitats forming	Assess need to repair impoundment berm, assess need to conduct additional plantings, make adjustments as assessments indicate	Too soon to determine

No.	Site	Criteria	Restoration Objectives Addressed	Trigger	Potential Adaptive Management Actions	Assessment as of February 2020
PO-16	SHH	Revegetation of disturbed areas with native vegetation cover (>25%) by year-5 post-construction.	SHH-2.1, 2.2, 2.3	Non-native vegetation within disturbed areas exceeds 75% cover	Implement weed control program (weeding, herbicide, etc.)	SLT carried out plantings late 2019, too soon to assess outcomes. Winter may be too dry for good germination.
PO-17	SHH	No major erosion of slumping of the high water overflow bench and public access path by year-5 post-construction.	SHH-3.1	Erosion or slumping along the high water overflow bench that threatens the integrity of the access path	Repair eroded/slumped area and install appropriate erosion control measures (e.g., jute/coir netting) as-needed to control further erosion	A small amount of erosion was observed after the late 2019 storms. SLT added small diversion berms. No additional storms have occurred to assess efficacy
PO-18	SHH	Wet season access to areas north of Suisun Hill Hollow meets public use needs by year-5 post construction	HH-3.2	Public complaints logged	• Assess nature of complaints • Post additional signage about storm wetness of trail • Consider trail around area	Public access not constrained to date
PO-19	SHH	Cattle excluded from site during wet season	SHH-4.2	Cattle enter during wet season	• Inspect perimeter fencing for damage and repair • Review allowable use areas with grazing tenant	Cattle excluded in wet season. Grazing for vegetation control completed in late summer.

2 Evaluation of the Conceptual Model

The project proposal hypothesized that adapting the First Mallard Slough – Lower Spring Branch Creek interface to sea level rise by removing hydrologic barriers and improving hydrologic connectivity would result in improved ecological functions in the near term and resiliency to climate change over the longer term through connecting the landscape for marsh transgression. The underlying conceptual model of this hypothesis is that tidal marsh landscapes with unconstrained connection to their adjacent uplands have the ability to move laterally upslope with sea level rise and thereby transfer the tidal marsh inundation regimes onto the submerged adjacent uplands thereby transforming these newly inundated areas to tidal marsh. This concept has been referred to as "land-water connectivity" and is the process by which Holocene sea level rise created tidal marshes around the world.

The restoration project followed this conceptual model. Rush Ranch is one of a very few locations in the entire San Francisco Bay-Delta where this opportunity exists without significant complexity at resolving infrastructure impediments. The Restoration Plan (Siegel, 2018) took maximum advantage of the landscape setting at Rush Ranch. The Lower Spring Branch Creek floodplain is broad, extends upstream east of Grizzly Island Road, and is bordered in its lower reaches by low elevation alluvial fans. Figure 7 of the Restoration Plan shows the topography of this floodplain and adjacent alluvial fan, defining the natural landscape space for estuarine transgression. Figure 11 of the Restoration Plan shows the projected near-term upland migration of the tidal marsh-upland ecotone that reflects removal of the hydrologic barriers.

Given that the restoration was completed only three months ago and the winter so far has been very dry, it is too soon to obtain field data and observations to quantify the achievement of these hypothesized outcomes. In early 2020 on behalf of the Land Trust, Siegel Environmental and the SF Bay NERR installed a suite of hydrologic monitoring stations to assess post-restoration outcomes. They installed a stilling well and staff gauge at the new culvert and three pairs of marsh plain surface water stilling wells-shallow groundwater piezometers along the floodplain gradient and outfitted them with recording water level loggers. As data downloads take place later this winter the data will be available to examine the extent to which the restoration project is achieving its hypothesized outcomes, and those data could be compared to the very limited pre-restoration data collected by Jessie Olson in the early 2010s just upstream of the replaced culverts. Field observations during recent extreme high tide events are encouraging, showing unconstrained tidal inundation throughout the constructed channel and onto the restored marsh plain. This indicates that the project is on track to restore the projected 15 acres of tidal ma[illegible]

The Restoration Plan (Siegel, 2018) also built upon the hypothesis from the fisheries restoration field , put forth that improving stream crossings with unconstrained flows and natural channel beds maximizes the ecological functions of the waterway for fish. The restoration project replaced two undersized corrugated metal culverts that functioned as barriers to water and fish movement with a very large arch culvert sized to accommodate several feet of sea level rise and that established a natural channel bed. No fish sampling has taken place nor is proposed. Field observations following restoration identified a

river otter or small beaver swimming through the culvert into the restored marsh, a positive indicator that the project is likely to provide this new fish habitat.

3 Results and Findings

All tasks in the Design Plan were implemented for this project. AS discussed in prior sections, the project monitoring were not able to be completed to date because of the timing of the construction relative to the grant term end.

One post-construction report was completed and submitted to regulatory agencies as part of permit requirements and also to the Grant manager (SLT, 2020). While monitoring data could not be included, an important portion of that document are the As-Built Aerial and DEM Topographic Maps . These data are the basis for future monitoring.

4 Conclusions and Recommendations

4.1 Recommendations for tidal marsh restoration approaches

Further actions that will result in benefits to species and habitats local to the project and regionally, as appropriate

For LSBC, further actions that will result in benefits to species and habitats local to the project and regionally include the following:

- Planting the topographic margins of the restored valley floor with appropriate native tidal marsh-upland ecotone plants. This work is contained in the Proposition 1 proposal made by SLT to CDFW in late 2019.
- Assessing benefit of planting the valley floor just upstream of the restored marsh area. The expectation is that increased tidal flows in the restored marsh will also result in moving the wetland-upland transition upstream (see Figure 11 in the Restoration Plan). This up-valley shift of vegetation may occur naturally, so monitoring before taking further action would be appropriate.

For SHH, further actions that will result in benefits to species and habitats local to the project and regionally include the following:

- Restore tidal action to the downstream Goat Island diked marsh and thereby reconnect the unimpaired tidal-fluvial connectivity of this small watershed.
- Assess plant community dynamics and determine whether planting of native seasonal wetland vegetation will be beneficial.

4.2 What worked, what didn't

For LSBC, qualitative observations of the outcomes following completion of restoration suggest the design and its construction worked very well. Tides are flowing unconstrained through the new arch culvert and up the newly constructed channel and the higher high tides are inundating the marsh plain including the lowered L-berm area.

The one issue that worked poorly was obtaining the USFWS Section 7 consultation during the permitting process. This element took nearly one year and resulted in implementation delay of one year, from 2018 to 2019. The USFWS elected to prepare a full Biological Opinion for this small restoration project, which required SLT and its consultants to prepare a full Biological Assessment. The concept of tiering off the programmatic Biological Opinion for the Suisun Marsh Plan as a means to expedite tidal marsh restoration in Suisun proved elusive. In the end, the Biological Opinion did not include any additional conservation measures not already included in the programmatic Biological Opinion nor incorporated into the design itself.

For SHH, qualitative observations of the outcomes following completion of restoration suggest the design and its construction worked very well, with one area needing further attention. The lowered impoundment berm was intended to be graded to drain and instead its final grading has allowed ponding atop portions of the berm and some very small (6-12 inches wide) erosional swales formed during the late 2019 storms. Minor hand-work by SLT seems to have remedied the ponding and the area will be reassessed during the dry season.

4.3 Future Monitoring

Monitoring is unfunded at this time. As part of the original CDFW grant, monitoring would have had some initial funding but between construction delay of one year and no ability to extend the grant timeline and the higher cost of project construction compared to that anticipated in 2015 (due to higher contractor bids during boom economy and use of the pre-fabricated arch culvert), minimal monitoring could be accomplished.

Hydrologic and topographic monitoring

The following have been completed:

- Installation of a stilling well and staff gauge in the tidal slough at the new culvert
- Installation of three pairs of marsh plain surface water stilling wells and shallow groundwater piezometers
- Deployment of water level recorders at the above locations
- Initial calibration of these water level recorders

No funds are in place at this time to pay for use of the water level recorders nor staff time for additional calibration and downloads. The SF Bay NERR and Siegel Environmental have been donating time, materials, and equipment to date for this work, but this model is not sustainable.

The Proposition 1 grant proposal to CDFW that SLT submitted in late 2019 if awarded would provide the funds necessary to carry out this work. Solano Land Trust and SF Bay NERR will work together to apply for additional grants from Measure AA, Prop 1, or other relevant funding sources.

Vegetation monitoring

Solano Land Trust staff will carry out vegetation monitoring in the Grassland and grassland/upland ecotone restoration sites in SHH. Restoration sites 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. Vegetation monitoring in tidal marsh and tidal marsh ecotone habitats may be suspended pending funding.

Grazing monitoring

Grazing will be used as a tool to reduce fuel loading and fire risk and to manage vegetation, specifically targeting invasive species, including medusahead ryegrass (*Taenatherum caput-medusae*) and Harding grass (*Phalaris acquatica*), which are both present on LSBC and SHH sites. Grazing will be used to manage habitat for birds and other species. Burrowing owls and killdeer have been observed on the LSBC 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 SHH vernal pools. The Lower Spring Branch Creek pasture will be grazed 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. Grazing will occur within the window of August 1st through January 31st, with specific dates and stocking densities depending on precipitation in that year.

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.

Infrastructure and public access monitoring

Solano Land Trust staff will maintain annual monitoring of the infrastructure and public access features through the use of the LSBC SHH Infrastructure Monitoring 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, who are familiar with the project.

4.4 Total Cost and Time to Complete the Project

Grant P1596027 was initially issued in June of 2016. SLT staff and consultant Siegel Environmental immediately began re-visiting the original design of removing the barrier at LSBC entirely and investigating the possibility of retaining the berm and replacing the old small culverts with one larger arch culvert. This was mainly due to objections of removing public access and operation access on this berm to the southern portion of the ranch. Hydrologic modeling was based on known tidal data through Suisun Marsh and some data from graduate student work at LSBC. Once the model showed that an improved opening in the berm would result in the necessary tidal flow to extend int0 the proposed restoration area of LSBC, An engineering consultant, Northgate, was hired to complete a design. This design, which was constructed, included a 20-foot wide arch culvert to allow tidal flow. The new design work was approved by CDFW engineers and other regulatory agencies. Once the new design was approved, SLT and its subcontractors requested subcontractor bids for the new design, most importantly the new arch culvert itself. Geotechnical testing of the site revealed soft bay muds soils that would need stabilization prior to installation of the arch culvert. One surprise was the cost of soil stabilization at over $ 100,000. This type of work is usually done on a much larger scale and it was difficult to find a contractor who would do this small project at all. Concurrently Siegel prepared permit applications for regulatory agencies. RWQCB and CDFW issued certifications and permits by mid 2018, however USACE permits were not issued until August of 2019 due to delays with the USFWS consultation. One of the delays was due to the need for a rail survey in the area. This was performed by CDFW as part of their Suisun Marsh monitoring. However, in the end construction was pushed to September 1 to avoid all rails and be able to allow the construction contractor, Hanford ARC, to schedule their men and equipment.

Construction by Hanford ARC began September 1, 2019 and was completed on November 23, 2019. The soil stabilization was done in mid October and required 30 days of cure prior to installation of the arch culvert. Hanford was able to schedule their work around the curing. The only delays during construction were due to high fire danger days when contractors were not permitted to work. The grant term ends April 30, 2020.

Expenditures

All of the grant amount, $839,449, is scheduled to be spent with the majority of the funds going to Hanford ARC for the construction and subcontractors Siegel and Northgate for design, permitting and engineering. Siegel prepared all of the preconstruction documents in conjunction with SLT and the engineers. Additional subcontracting for cultural resources was paid with grant funds. Some SLT staff and restoration equipment and supplies were paid by the grant. Siegel and SLT prepared post construction permit required reports and this Final Grant Report.

Due to design changes, it became obvious that the grant would not cover all of the project expenses. SLT is a non-profit land trust with the ability to accept donations. Approximately $120,000 was donated by the Solano County Orderly Growth Committee using local funds earmarked for public access and restoration. Of this amount $ 60,000 was paid for design and fabrication of the arch culvert by Contech.

The remainder of the donated funds also paid for biological monitoring during construction, some of the cultural resource monitoring, some of Siegel, and some SLT staff.

SLT also had a volunteer project manager who helped with grant reporting and invoicing and some on the ground work, such as photo monitoring and reporting. Other volunteers helped rebuild the interpretive sign kiosk and plant plugs and seed in impacted areas of the construction sites. SLT staff and volunteers also helped install a railing on the new arch culvert for safety purposes.

4.5 How information will be used and disseminated

Information about the project for the community and students will be disseminated through SLTs ongoing docent led tours that occurs monthly, and three educational programs for students from grade 3 to 6 occurring during the school year at Rush Ranch. The new arch culvert at LSBC and its adjacent viewing platform make a perfect stopping point for viewing tides, observing the marsh plants and wildlife, and discussion of the restoration. A gate in the railing allows sampling of the waters below. SLT also issues newsletters via email and mail and is set to announce the completion of the project this spring in a celebration and via the website. An interpretive sign is being placed as part of the grant. The sign discusses the purpose of the project and encourages the viewer to see the site. LSBC is on the South Pasture Trail, well used for public access.

The Marsh Trail at Rush Ranch leads visitors to SHH where they can observe the restoration site from various angles. Docents lead tours on this trail and it is open to the public.

Scientific information about the project is public and various documents, such as the Design Plan are on the EcoAtlas portal at San Francisco Estuary Institute (SFEI) and is available publicly. Additional documents may be placed there in the future. SF Bay NERR is also seeking to upgrade their website to include site data and have the ability for others to use data. SF Bay NERR can always be contacted directly for data that is not on their website.

All of the data including the GIS data will be submitted to CDFW which will be a repository for the data until such time as other opportunities for public use are developed.

4.6 Are other phases of this project planned

Solano Land Trust staff, in partnership with SF Bay NERR and Siegel Environmental, have applied for a second CDFW grant to continue and expand upon the opportunities provided by this first grant. Rush Ranch Lower Spring Branch Creek and Suisun Hill Hollow Tidal Connections Project Phase 2 would fund enhancements to the Lower Spring Branch Creek project component through wetland-upland transition zone revegetation, additional grazing management capacities, public access improvements, and would fund monitoring which would contribute to the broader understanding of restoration and habitat transgression in tidal marshes.

The current grant funded the restoration of tidal connectivity. This is anticipated to allow habitat transgression up the LSBC floodplain. However, habitat transgression can be a slow process, and species like the endangered salt marsh harvest mouse (*Reithrodontomys raviventris*) and soft bird's-beak (*Chloropyron molle ssp. molle*) are dependent upon other marsh species establishing habitat before their own populations can move. *Chloropyron molle* is hemiparasitic, and requires healthy perennial host plants. *Chloropyron molle* seedlings have been found to fail when annual grasses are the dominant hosts (Whitcraft et al. 2011). Annual grasses have become established in the floodplains surrounding the tidal wetland and on gently sloping uplands, and could be a barrier to successful transgression of the *C. molle* population. Planting key habitat species will enhance and expand habitat for salt marsh harvest mouse, soft bird's-beak, and other species already present at the project site in the short term, and may accelerate the transgression of habitat ahead of sea level rise. In the first grant, funds were used to fence the northern boundary of SHH.

The second grant would replace and improve fencing around LSBC. Part of the fence around LSBC was removed for the restoration in phase 1, but funds were spent before the fence could be replaced. Currently, there is no way to graze LSBC in a controlled manner. Fencing the restoration area will allow grazing management to reduce invasive species and meet water quality and habitat management goals.

Public access would be improved through funding maintenance of the existing boardwalk at the LSBC site, additional signage, trail maintenance, and the installation of new, accessible stiles. The first phase of this project afforded a unique opportunity to engage the public about climate change and sea level rise. Dozens of volunteers, ranging from seasoned Citizen Scientists to elementary school children, participated in the active revegetation efforts that were part of this project. Future efforts could prove similarly engaging and educational.

The second grant would also ensure that the originally planned monitoring could be fully funded, and even expand upon that monitoring. Monitoring funds from phase 2 would go towards vegetation, hydrology, geomorphology, and wildlife monitoring in the restoration areas. Adaptive management monitoring of LSBC and SHH is essential for understanding the effects of the hydrological and geomorphic improvements carried out in the original tidal connectivity restoration. Monitoring would document the response of the restoration projects to sea level rise at one of the very few locations in the San Francisco Estuary where natural tidal marsh adjoins natural upland habitats,and would contribute to understanding impacts of future sea level rise and the resiliency of these systems. Rush Ranch is part of the San Francisco Bay National Estuarine Research Reserve and was so designated because it is amongst the very last remaining examples of tidal marsh-upland ecosystem complexes, areas around which great effort is focused regionally to support ecosystem recovery and resiliency in the face of sea level rise.

5 How project addresses the purposes of Prop 1 and the objectives of the CA Water Action Plan.

Action 1- Make Conservation A California Way of Life. This project manages cattle watering in a natural stream and implements greenhouse gas reduction through increased riparian function. It is a highly visible project in a public area.

Action 2- Increase Regional Self- Reliance and Integrated Water Management Across All Levels of Government. This project supports resilience to sea-level rise and storm water retention by removing barriers to floodwater and sea level rise accommodation.

Action 3- Achieve co-Equal Goals for the Delta This project returns a portion of Suisun Marsh from seasonal wetland to tidal. Ongoing ecosystem studies at the site provide important baseline data for similar system wide restoration projects.

Action 4 Protect and Restore Important Ecosystems. This project provides tidal wetland habitat enhancement and connecting upland fluvial systems with the Suisun marsh. It protects and restores functions for native fish, plants and animal populations by restoring instream flows and tidal marsh foodwebs.

Action 5. Manage and prepare for Dry Periods. This project provides significant drought adaptation by removing cattle reliance on surface flows.

Action 6. Increase Flood Protection. Significant flood water and sea-level rise accommodation opportunities are achieved through removal of the barriers, expanding floodplains and stabilizing stream beds.

This project fulfills the Delta Water Quality and Ecosystem Restoration Grant Program Priorities of habitat restoration, conservation and Enhancement.

6 Pertinent Documents Prepared for this Project

Northgate Environmental Management, Inc. and Contech, Inc. *Rush Ranch Restoration Project Restoration Design Plans and Specification.* Prepared for Solano Land Trust. June 5.

Northgate Environmental Management, Inc. 2018. *Soil Treatment Amendment* Technical Memorandum. July 16.

Siegel Environmental. 2018. *100% Restoration Design Report*, *Rush Ranch Open Space Preserve, Lower Spring Branch Creek and Suisun Hill Hollow Restoration Project,* Prepared for Solano Land Trust. June 5

Siegel Environmental, 2018, *Tidal Channel Design Basis, Erosion Assessment and Sea Level Rise Accommodation Overview, Lower Spring Branch Creek Restoration Project;* Technical Memorandum Prepared for Solano Land Trust. July 6.

Siegel Environmental. 2018. *Base Flood Elevation and Erosion Considerations at Arch Culvert, Lower Spring Branch Creek Tidal Marsh Restoration Project, Rush Ranch Open Space Preserve, Suisun Marsh, Solano County, California.* Prepared for the Solano Land Trust. August 8.

Siegel Environmental, 2018. *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.* Prepared for Solano Land Trust. August 31.

Siegel Environmental. 2018. *Suisun Marsh Adaptive Management Advisory Team Project Presentation, Rush Ranch Restoration.* Prepared for the Solano Land Trust. November.

Siegel Environmental. 2019. *Federal Endangered Species Act Biological Assessment, Lower Spring Branch Creek and Suisun Hill Hollow Restoration Project, Rush Ranch Open Space Preserve.* Prepared for the Solano Land Trust. January 31.

Solano Land Trust, 2020*, 2019 Annual Monitoring Report*, Prepared for regulatory agencies and grant manager, dated February 25, 2019

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

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

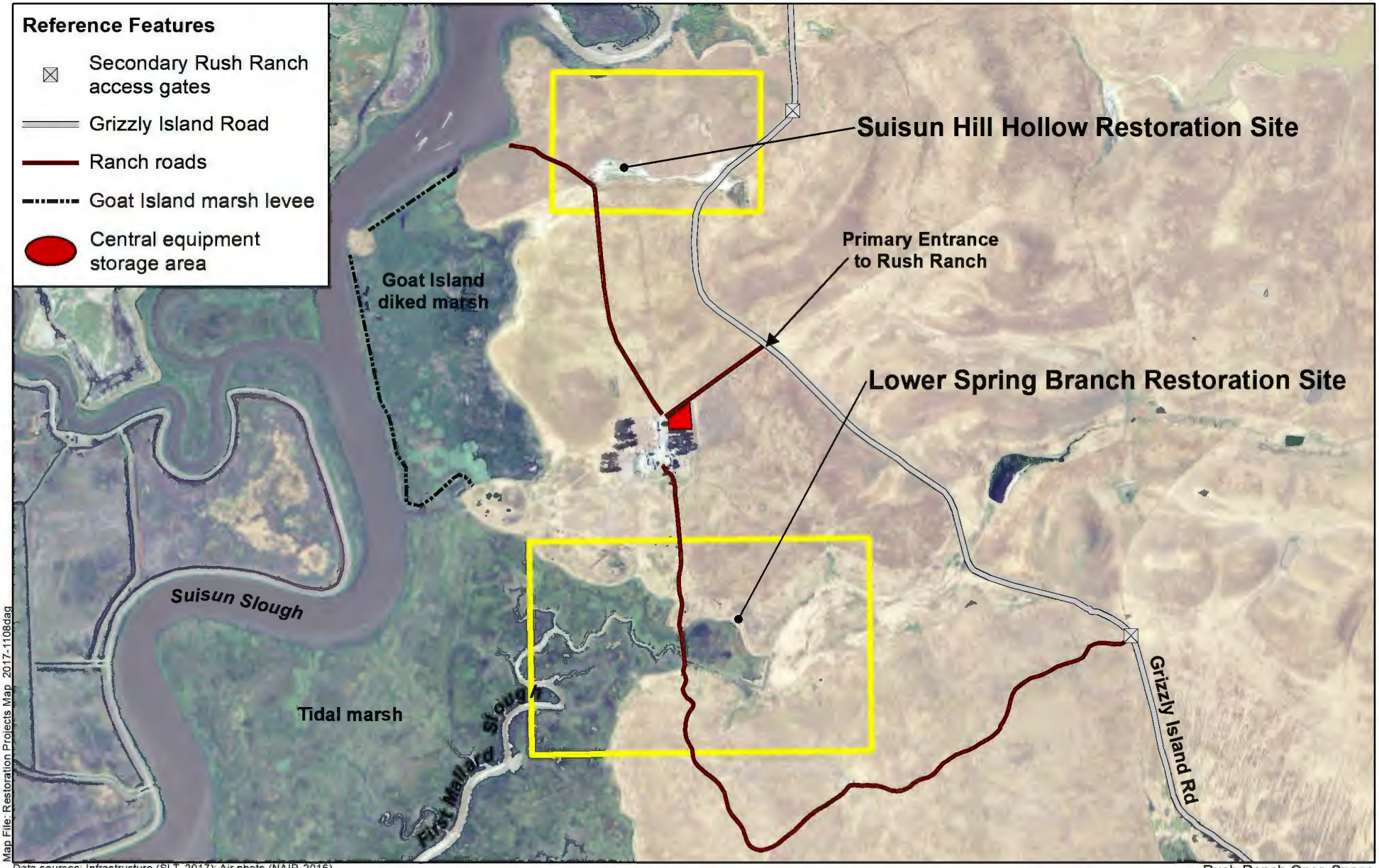
0 2.5 5 Miles

0 4 8 Kilometers

Rush Ranch Open Space
Solano County, CA

Figure 1

Project Vicinity USGS 7.5' Quad Map



Map File: Restoration Projects Map_2017-1108dag

Data sources: Infrastructure (SLT, 2017); Air photo (NAIP, 2016)

1:14,400 (1" = 1,200' at letter size)

0 600 1,200 ft

0 200 400 m

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Solano County, CA

Figure 2

Restoration Projects Location Map

Map File: mouse-fence-alignment_LSBC_2020-0213dag

Data sources: Air photo (EnviroDrones, 2019; Terravion, 2016);
Fence (SE, 2020)

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

0 50 100 ft

0 15 30 Meters

Rush Ranch Open Space
Solano County, CA

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Figure 3

Mouse Exclusion and Silt Fence Alignment

0 50 100 200 Feet

Soft Bird's Beak at Lower Spring Branch Creek

N

Legend

- Continuous Patches 2019
- Individuals 2019
- Continous Patches 2018
- Individuals 2018
- Study Plots

Figure 4

Map File: air-photo-Nov-base_SHH_EL_2016-1227dag

Data sources: Air photo (Terravion, 2016)

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

0 50 100 200 ft

0 15 30 60 m

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Solano County, CA

Figure 5
Suisun Hill Hollow
November 2016 Aerial Photograph

Map File: air-photo-base LBC EL 2016-1227dag

Data sources: Air photo (Terravion, 2016)

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

Map File: As-built-photo-Nov2019_LSBC_2020-0120dag

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

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

0 75 150 ft

0 22.5 45 Meters

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Solano County, CA

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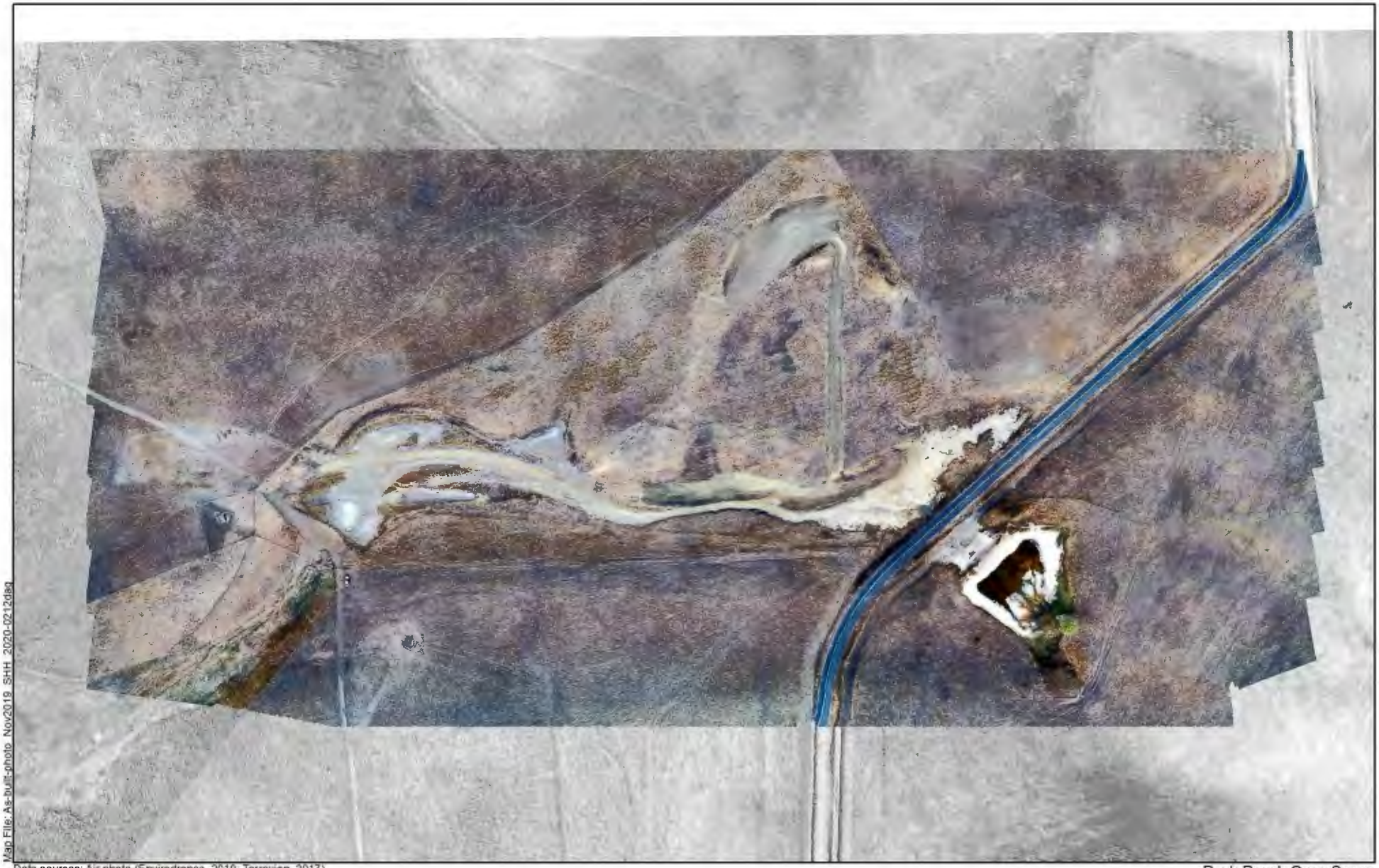
Figure 7

November 15, 2019 UAV Photograph - LSBC



Map File: As-built-photo_Nov2019_SHH_2020-0212dag

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

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

0 125 250 ft

0 35 70 m

Rush Ranch Open Space
Solano County, CA

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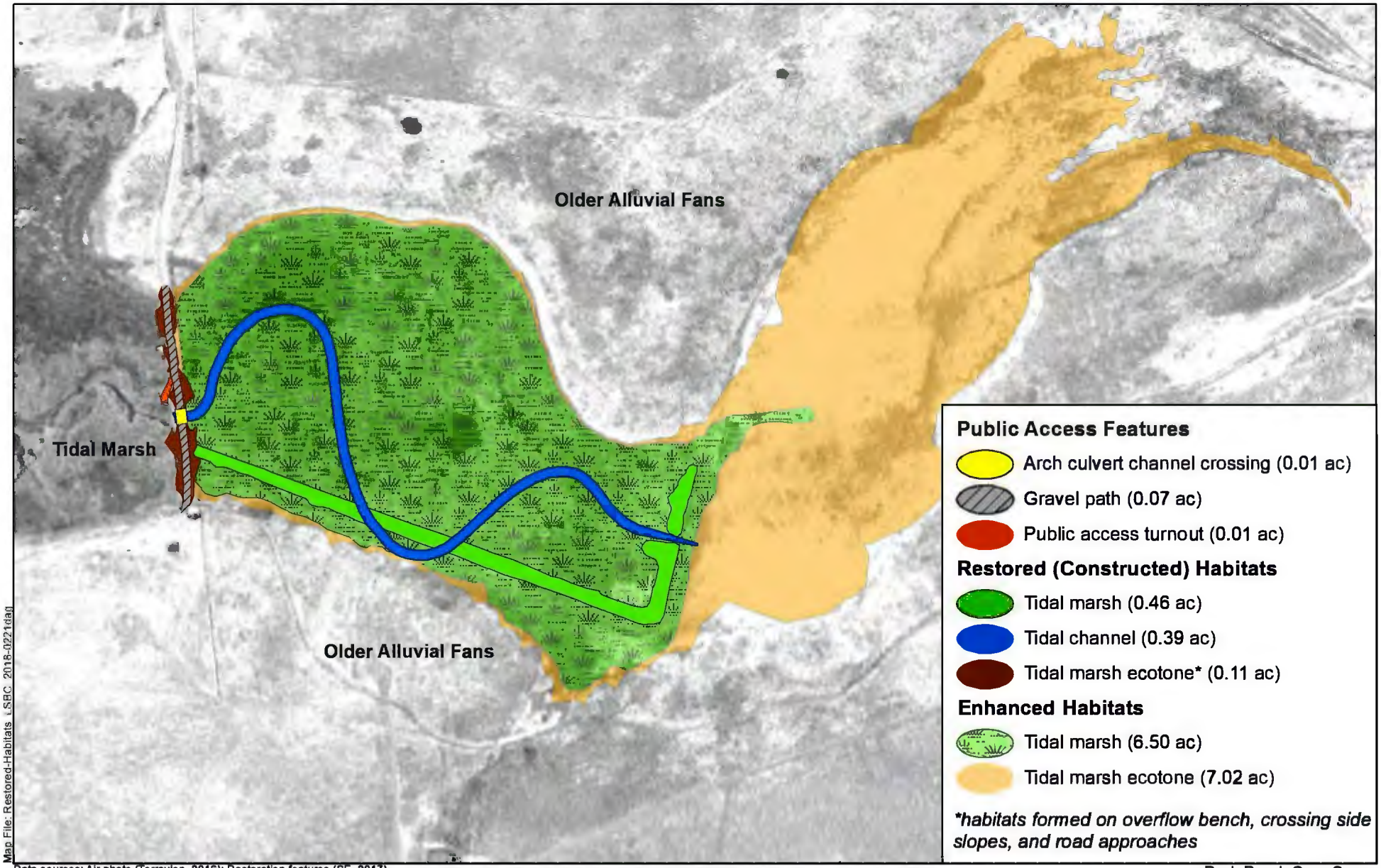
SIEGEL ENVIRONMENTAL

Figure 8

November 15, 2019 UAV Photograph, SHH



Map File: Restored-Habitats_LSBC_2018-0221dag

Data sources: Air photo (Terravion, 2016); Restoration features (SE, 2017)

1:2,400 (1" = 200' at letter size)

0 100 200 ft

0 30 60 Meters

Rush Ranch Open Space
Solano County, CA

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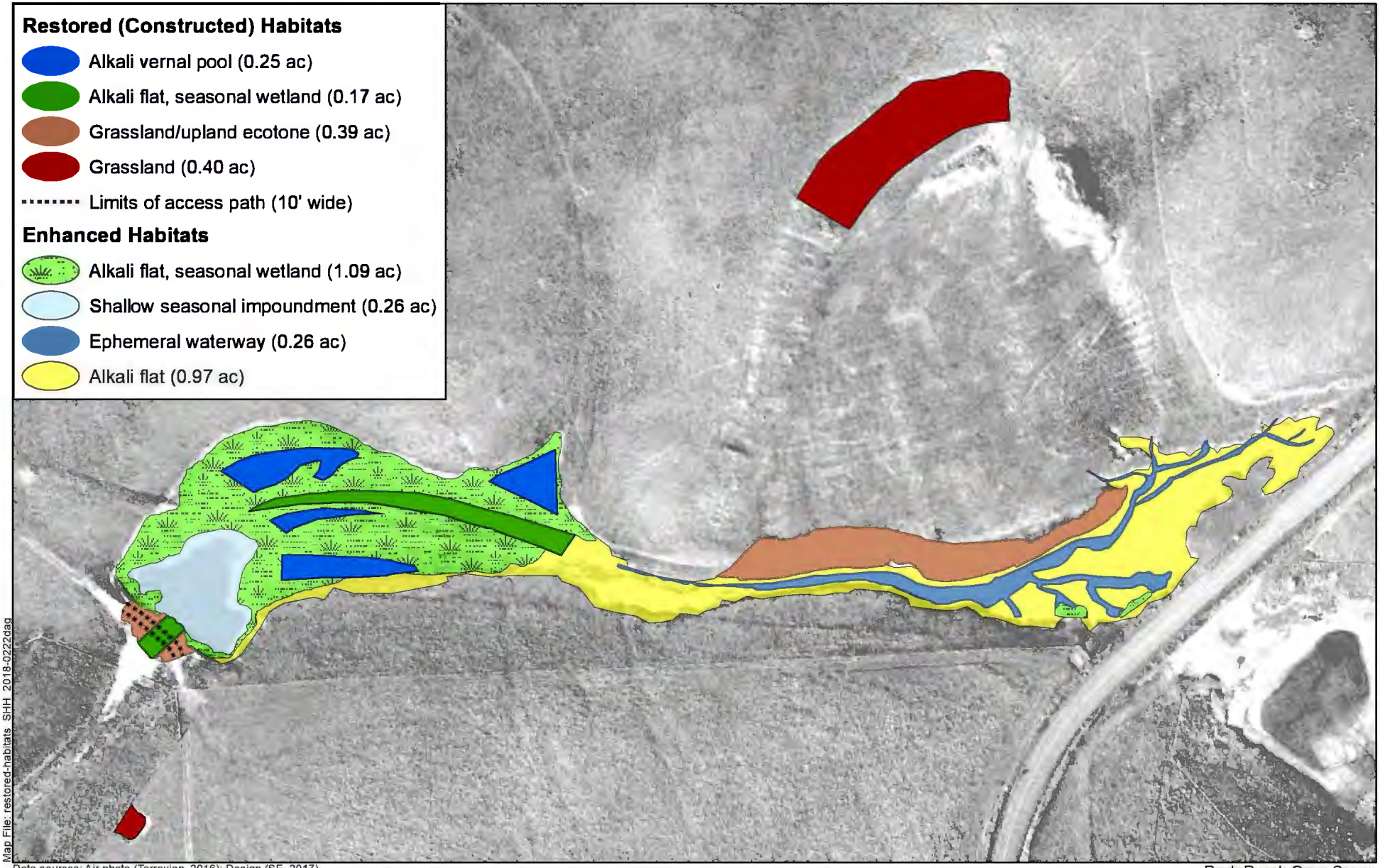
Figure 9

Restored and Enhanced Habitats and Public Access Features, LSBC



Map File: restored-habitats_SHH_2018-0222dag

Data sources: Air photo (Terravion, 2016); Design (SE, 2017)

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

0 75 150 ft

0 25 50 m

Rush Ranch Open Space
Solano County, CA

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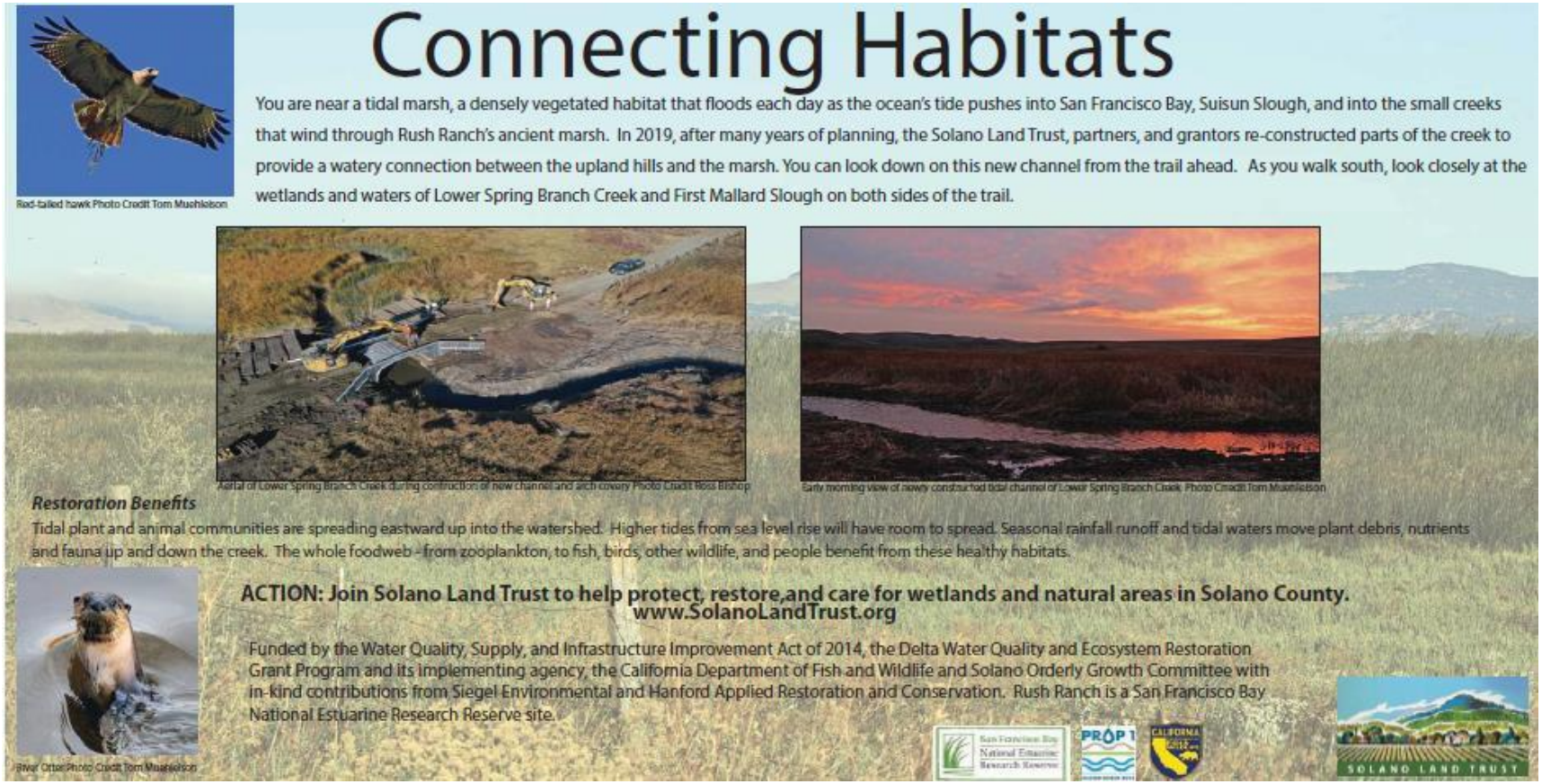
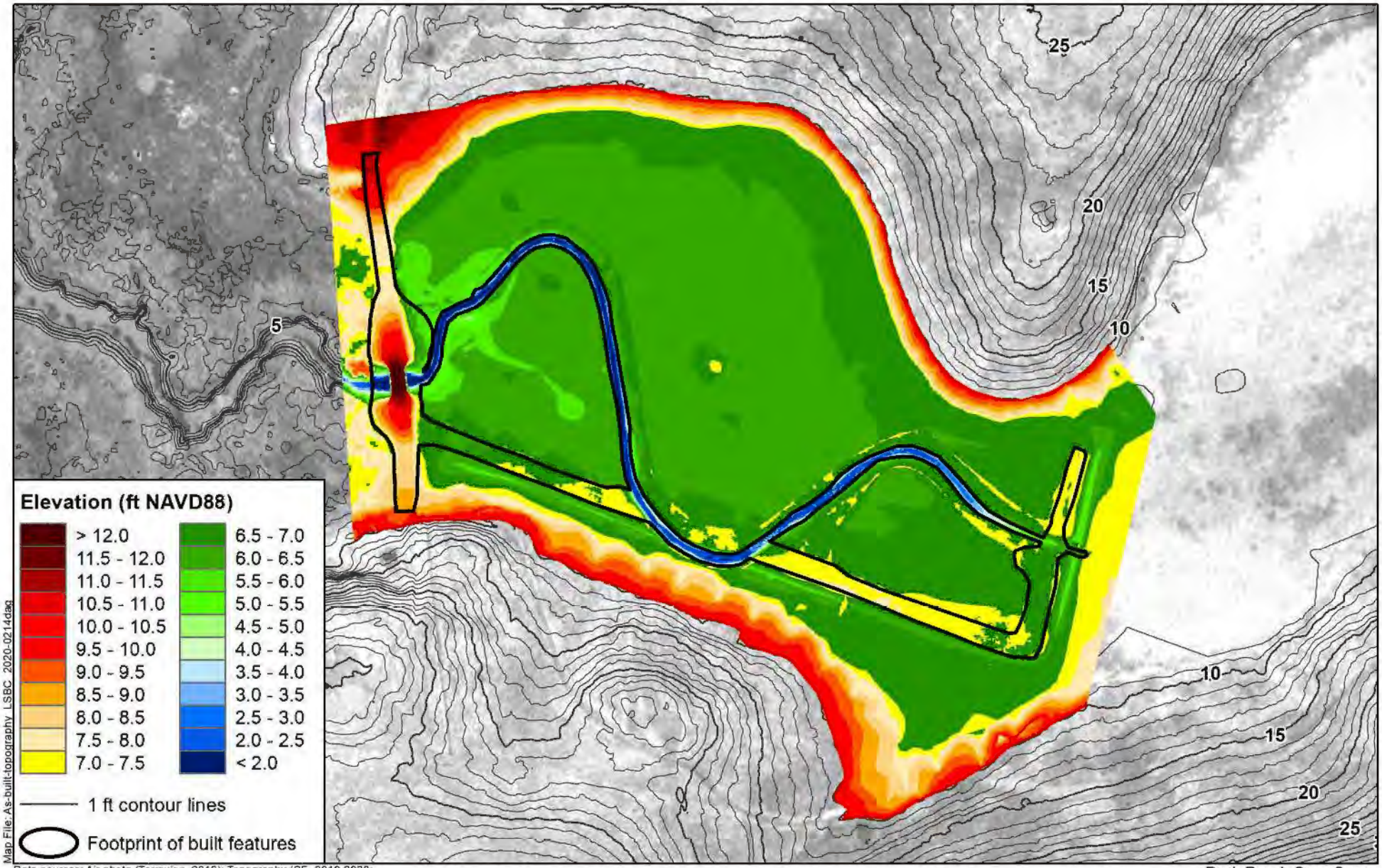
Figure 10
Restored and Enhanced Habitats, SHH



Rush Ranch Open Space
Solano County, CA

Figure 11

Interpretive Sign, Lower Spring Branch Creek



Map File: As-built-topography_LSBC_2020-0214dag

Data sources: Air photo (Terravion, 2016); Topography (SE, 2019-2020; SCC, 2011; SLT, 2010)

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

0 75 150 ft

0 25 50 m

Rush Ranch Open Space
Solano County, CA

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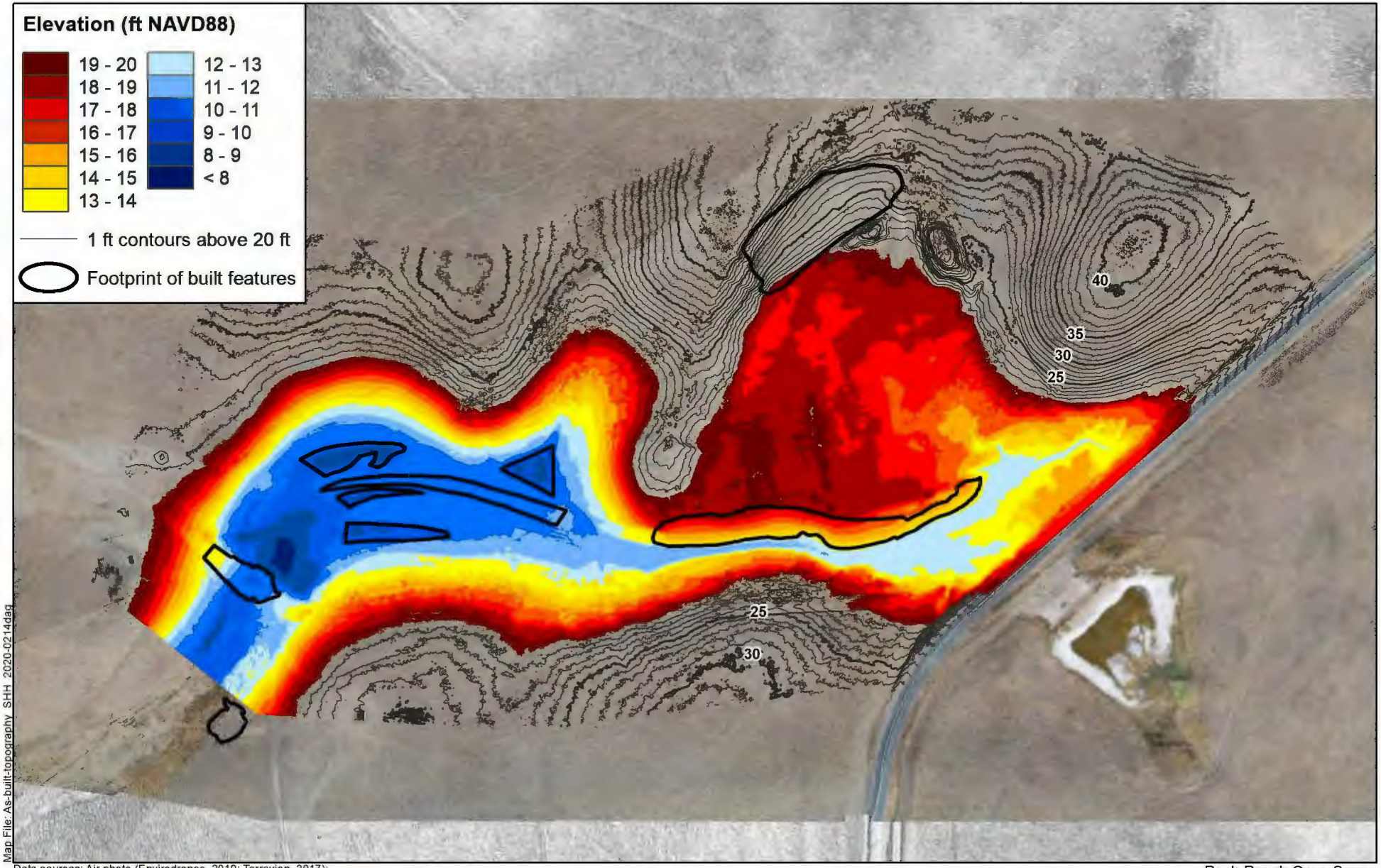
Figure 12

2019 As-Built Topography, LSBC



Map File: As-built-topography_SHH_2020-0214dag

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

1:2,400 (1" = 200' at letter size)

0 100 200 ft

0 30 60 m

Rush Ranch Open Space
Solano County, CA

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Figure 13

2019 As-Built Topography, SHH