# California Ridgway's Rail Surveys for the San Francisco Estuary Invasive *Spartina* Project 2016

Report to:

The State Coastal Conservancy
San Francisco Estuary Invasive *Spartina* Project
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# Table of Contents

1. Introduction ..... 1
2. Study Area ..... 3
3. Methods ..... 11
3.1 Field Methods ..... 11
3.1.1. Protocol A: Passive Call Count Survey ..... 11
3.1.2. Protocol C: Active Call Count Survey ..... 12
3.1.3. Protocol B: Stationary Call Count Survey ..... 12
3.1.4. Protocol F: Habitat Assessment Survey ..... 12
3.1.5. Protocol G: Stationary Survey with Broadcast to Determine Absence ..... 13
3.2 Data Management ..... 13
3.3 Data Interpretation ..... 14
4. 2016 Survey Results ..... 15
4.1 Bay Bridge North Region ..... 17
4.2 San Leandro Bay Region ..... 19
4.3 Hayward Region ..... 22
4.4 Union City Region ..... 25
4.5 Dumbarton South Region ..... 28
4.6 San Mateo Region ..... 31
4.7 San Francisco Peninsula Region ..... 34
4.8 Marin Region ..... 37
4.9 San Pablo Bay – Vallejo and Petaluma Regions ..... 39
5. Discussion ..... 41
6. Permits ..... 43
7. References ..... 45
Appendix I: Complete List of 2016 Spartina Treatment Sites and Ridgway's Rail Survey Plans by Site ..... 47
Appendix II: 2016 Survey Station Coordinates in UTM (NAD83, Zone 10) ..... 55
Appendix III: Standard Survey Protocols for Ridgway's Rails in the San Francisco Estuary 69
Appendix IV: Survey Forms ..... 77
Appendix V: 2016 OEI Survey Results for Each Round ..... 81

## Table of Figures

Figure 1. Map of regional boundaries of ISP sites included in this report. ..... 4
Figure 2. Survey results from 2010 to 2016 at sites without restrictions on *Spartina* treatment and at sites where treatment is restricted. ..... 16
Figure 3. Map of survey results in the Bay Bridge North Region. ..... 18
Figure 4. Map of survey results in the San Leandro Bay Region ..... 21
Figure 5. Map of survey results in the Hayward Region ..... 24
Figure 6. Photo of a *Spartina foliosa* revegetation plot at AFCC in 2012 and in 2014. ..... 25
Figure 7. Map of survey results in the Union City Region ..... 27
Figure 8. Map of survey results in the Dumbarton South Region ..... 30
Figure 9. Map of survey results in the San Mateo Region ..... 33
Figure 10. Map of survey results in the SF Peninsula Region ..... 36
Figure 11. Map of survey results in the Marin Region ..... 38
Figure 12. Map of survey results in San Pablo Bay (Petaluma and Vallejo Regions) ..... 40

## Table of Tables

Table 1. Summary of site information grouped by region ..... 5
Table 2. Survey results from 2010-2016 at the Bay Bridge North Region. ..... 17
Table 3. Survey results from 2010-2016 in the San Leandro Bay Region ..... 20
Table 4. Survey results from 2010 to 2016 in the Hayward Region ..... 23
Table 5. Survey results from 2010 to 2016 in the Union City Region ..... 26
Table 6. Survey results from 2010 to 2016 in the Dumbarton South Region ..... 29
Table 7. Survey results from 2010 to 2016 in the San Mateo Region ..... 32
Table 8. Survey results from 2010 to 2016 in the San Francisco Peninsula Region. ..... 35
Table 9. Survey results from 2010 to 2016 in the Marin Region ..... 37
Table 10. Survey results from 2010 to 2016 in the San Pablo Bay Region ..... 39

# 1. Introduction

Annual monitoring for the endangered California Ridgway's rail (*Rallus obsoletus obsoletus*; formerly California clapper rail, *Rallus longirostris obsoletus*) is an essential component of the State Coastal Conservancy's Invasive *Spartina* Project (ISP). California Ridgway's rails are year-round residents of the tidal wetlands of the San Francisco Estuary and co-occur with native and non-native *Spartina*. The ISP requires information on the number of rails at each site for the planning and permitting of *Spartina* treatment. Additionally, annual breeding-season surveys provide a standardized measure of Ridgway's rail presence and distribution in *Spartina*-invaded marshes throughout the Estuary.

The California Ridgway's rail is classified as endangered by both the U.S. Fish and Wildlife Service (Federal Register 50 CFR 17.11) and the State of California (California Code of Regulations Title 14, Section 670.5). The most recent analysis from Point Blue Conservation Science (PBCS) estimates that the average total population was about 1,167 individuals between 2009 to 2011 (Liu, et al., 2012). The present range of the California Ridgway's rail is limited to the tidal marshes of the San Francisco Estuary, with the exception of occasional observations along the outer coast in Tomales Bay.

California Ridgway's rails occur only in salt and brackish tidal marsh habitat and require vegetative cover suitable for both nesting and refuge during high tide events (U.S. Fish and Wildlife Service, 2013). Marshes where they occur are characterized by unrestricted daily tidal flows through a network of well-developed channels. Channel density has been shown to be the most important landscape feature to positively influence Ridgway's rail density (Liu, et al., 2012). Additionally, large continuous marshes with a low perimeter-area ratio support higher densities of California Ridgway's rail (Liu, et al., 2012).

In collaboration with partner organizations, including Point Blue Conservation Science (PBCS), Don Edwards National Wildlife Refuge (DENWR), Avocet Research and Associates (ARA) and San Pablo Bay National Wildlife Refuge (SPBNWR), Olofson Environmental, Inc. (OEI) conducted surveys for California Ridgway's rails to inform the ISP about rail populations at sites slated for *Spartina* treatment in 2016. Trained and permitted biologists performed standard-protocol surveys at 129 *Spartina*-invaded sites between January 15 and April 15, 2016. The data were gathered in a geodatabase for analysis and summarized on a site-by-site basis.

The results of surveys conducted in 2016 by OEI are presented in this report. The ISP relies on partner organizations to conduct surveys and report results collected at other *Spartina*-invaded sites that are not surveyed by OEI. The summary data presented here represent unique detections of Ridgway's rails within the areas surveyed by OEI. These data should not be misinterpreted to be a range-wide population estimate or a comprehensive count of Ridgway's rails at all *Spartina*-invaded sites. For a complete list of ISP subareas and associated survey organizations, see **Appendix I**: Complete List of 2016 Spartina Treatment Sites and Ridgway's Rail Survey Plans by Site.

Where available, data from 2010 to 2015 are also included in this report. However, caution should be used when comparing survey results between years. Rails are difficult to detect and survey results can be highly variable even when there is a stable population. Weather, timing, observer, and survey effort can all bias results. The best way to understand Bay-wide trends is through rigorous statistical analysis, which is beyond the scope of this report.

# 2. Study Area

OEI conducted surveys for California Ridgway's rail within 129 tidal marsh sites in the San Francisco Estuary. To facilitate presentation and evaluation of rail survey information, these sites were grouped into nine reporting regions: Bay Bridge North, San Leandro Bay, Hayward, Union City, Dumbarton South, San Mateo, San Francisco Peninsula, Marin, and San Pablo Bay (**Figure 1)**. The study area spanned the counties of Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma.

All of the 129 sites surveyed contained non-native *Spartina*, and all but 11 sites are slated for full treatment by the ISP in 2016. The remaining 11 sites (shown in red on Figure 1) were surveyed to track local trends in rail populations even though *Spartina* treatment is restricted at these sites in 2016. Partner organizations surveyed an additional 50 ISP sites that will be treated for non-native *Spartina* in 2016. Rail survey data from these sites are not included in this report. The results from these surveys will be reported on by the survey organizations. For a complete list of all ISP sites and associated survey organizations, see **Appendix I**: Complete List of 2016 Spartina Treatment Sites and Ridgway's Rail Survey Plans by Site.

Twenty-four sites surveyed by OEI in previous years were not surveyed in 2016 because they no longer contained invasive *Spartina*. Recent *Spartina* inventory from 2015 reported no non-native *Spartina* remaining to require treatment, and rail surveys at the sites in recent years had not documented any rails, so rail surveys were deemed unnecessary.

A summary of survey information is presented in **Table 1**, and includes information on the number of stations surveyed at each site, the proportion of the site surveyed, as well as the type of survey conducted. For a complete list of OEI survey stations and their geographic coordinates in UTM, see **Appendix II**: 2016 Survey Station Coordinates.

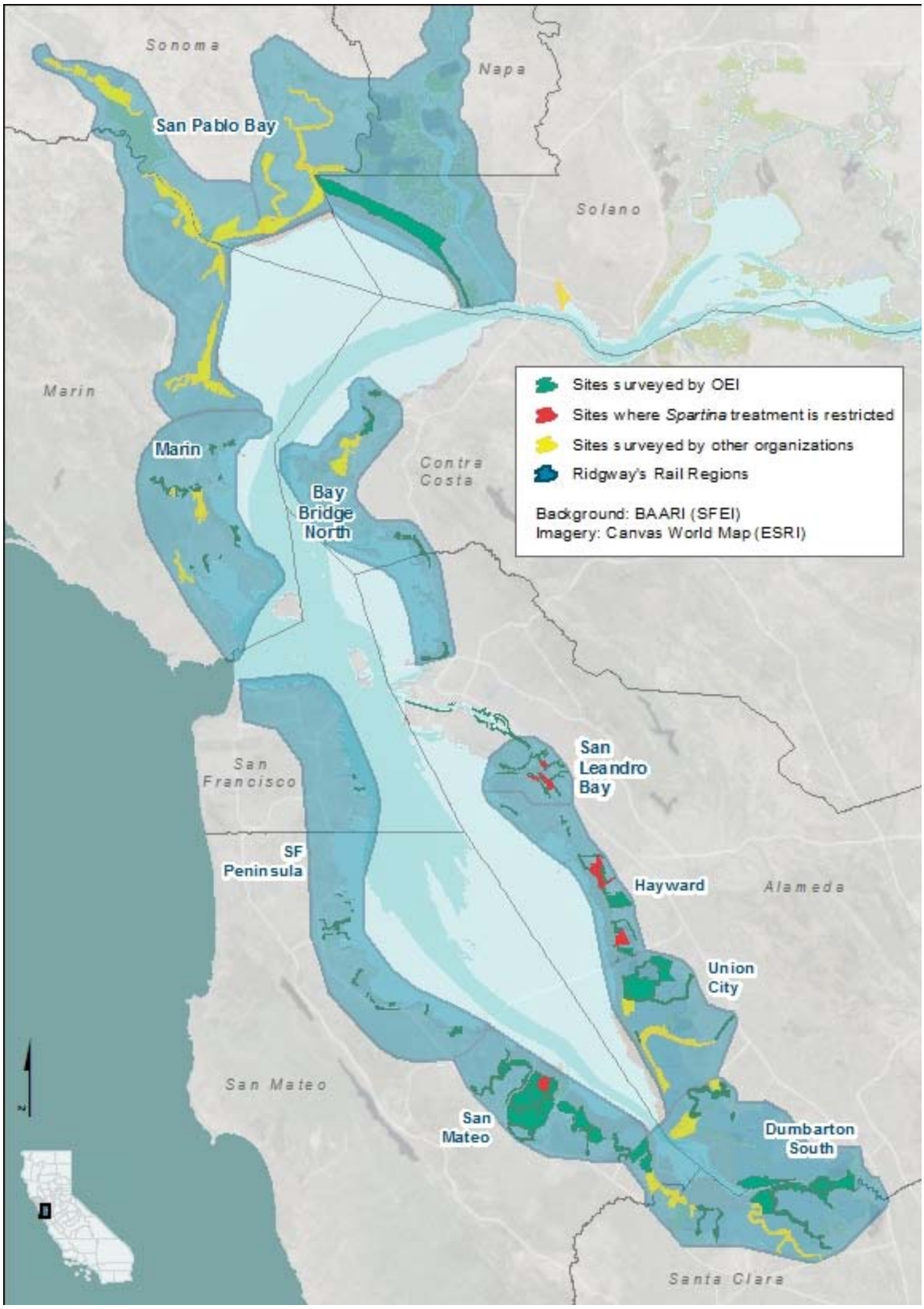


**Figure 1.** Regional boundaries of ISP sites surveyed for California Ridgway's rail by OEI and others in 2016.

**Table 1.** Summary of site information grouped by region. Survey protocols are described in detail in Section 3.1. Site areas were defined in GIS based on the intersection of *Spartina* treatment sub-areas and areas where rails could potentially be found (generally excluding areas such as large mudflats and riprap shorelines). Survey area and the proportion of site surveyed were calculated assuming a 200-meter detection area around each survey station, though rails were frequently detected beyond this threshold. Survey area was considered null for sites lacking suitable breeding habitat during the initial F-survey site assessment.

| ***REGION: Bay Bridge North*** | | | | | | |
|---|---|---|---|---|---|---|
| **Site Name and ID** | **Survey Protocol** | **Number of Stations** | **Station Placement** | **Site Area (ha)** | **Survey Area (ha)** | **Proportion of Site Surveyed** |
| Emeryville Crescent - East (06a) | C | 2 | marsh edge | 21.93 | 5.89 | 27% |
| Emeryville Crescent - West (06b) | A | 7 | road | 12.75 | 12.75 | 100% |
| Whittell Marsh (10a) | A | 4 | footpath | 18.16 | 17.37 | 96% |
| Southern Marsh (10b) | F | - | - | 3.09 | - | - |
| Giant Marsh (10c) | A | 4 | footpath | 11.75 | 11.49 | 98% |
| Wildcat Marsh (22a) | A | 8 | boardwalk | 117.14 | 53.56 | 46% |
| San Pablo Marsh (22b) | A | 5 | boardwalk | 65.60 | 40.90 | 62% |
| Rheem Creek Area (22c) | A | 4 | footpath | 10.04 | 8.99 | 89% |
| Stege Marsh (22d) | A | 2 | footpath | 11.46 | 10.65 | 93% |
| Meeker Slough (22d) | A | 2 | footpath | 9.70 | 8.54 | 88% |
| Hoffman Marsh (22e) | A | 3 | footpath | 14.58 | 13.55 | 93% |
| Albany Shoreline (22f) | F | - | - | 5.30 | - | - |
| ***REGION: San Leandro Bay*** | | | | | | |
| **Site Name and ID** | **Survey Protocol** | **Number of Stations** | **Station Placement** | **Site Area (ha)** | **Survey Area (ha)** | **Proportion of Site Surveyed** |
| Elsie Roemer (17a) | C | 7 | footpath | 7.19 | 7.06 | 98% |
| Bay Farm Island (17b) | F | - | - | 3.07 | - | - |
| Arrowhead Marsh (17c)[1] | B | 1 | marsh edge | 17.77 | 5.95 | 33% |
| *Arrowhead Marsh - West (17c.1)* | *-* | *-* | *-* | *9.19* | *4.31* | *47%* |
| *Arrowhead Marsh – East (17c.2)* | *-* | *-* | *-* | *8.58* | *1.65* | *19%* |
| Airport Channel - Fan Shore (17d.1) | F | - | - | 3.04 | - | - |
| MLK Regional Shoreline - Damon (17d.4) | A | 3 | footpath | 4.09 | 4.09 | 100% |
| San Leandro Creek (17e) | A | 7 | footpath | 2.99 | 2.99 | 100% |
| Oakland Inner Harbor (17f) | F | - | - | 13.02 | - | - |
| Coast Guard Is (17g) | F | - | - | 1.26 | - | - |
| MLK New Marsh (17h) | A | 7 | footpath | 13.89 | 13.86 | 100% |
| Coliseum Channels (17i) | F | - | - | 5.43 | - | - |
| Fan Marsh (17j) | A | 3 | road & levee | 5.05 | 4.99 | 99% |
| Airport Channel (17k) | F | - | - | 1.64 | - | - |
| Doolittle Pond (17l) | C | 2 | footpath | 1.34 | 0.84 | 63% |
| Alameda Island - East (17m) | F | - | - | 2.36 | - | - |

[1] Site is split according to treatment permissions (treatment is only permitted on a portion of the overall site).

(Table 1 continued on next page)

**Table 1**. Summary of site information, continued from previous page.

| ***REGION: Hayward*** | | | | | | |
|---|---|---|---|---|---|---|
| **Site Name and ID** | **Survey Protocol** | **Number of Stations** | **Station Placement** | **Site Area (ha)** | **Survey Area (ha)** | **Proportion of Site Surveyed** |
| Oro Loma - East (07a) | A | 8 | old levee | 79.74 | 51.73 | 65% |
| Oro Loma - West (07b) | A | 16 | old levee | 52.90 | 42.97 | 81% |
| Oyster Bay Regional Shoreline (20a) | F | - | - | 4.61 | - | - |
| Oakland Golf Links (20b) | F | - | - | 0.78 | - | - |
| Dog Bone Marsh (20c) | F | - | - | 2.85 | - | - |
| Citation Marsh (20d)[1] | A | 7 | levee | 45.09 | 27.65 | 61% |
| *Citation Marsh - South (20d.1)* | *-* | *-* | *-* | *17.95* | *7.95* | *44%* |
| *Citation Marsh - North (20d.2)* | *-* | *-* | *-* | *27.14* | *19.69* | *73%* |
| East Marsh (20e) | A | 0 | footpath | 15.04 | 4.55 | 30% |
| North Marsh (20f) | A | 6 | footpath | 35.99 | 33.71 | 94% |
| Bunker Marsh (20g) | A | 4 | footpath | 14.49 | 13.71 | 95% |
| San Lorenzo Creek (20h)[1] | A | 8 | marsh edge | 10.93 | 10.61 | 97% |
| *San Lorenzo Creek - North (20h.1)* | *-* | *-* | *-* | *5.47* | *5.38* | *98%* |
| *San Lorenzo Creek - South (20h.2)* | *-* | *-* | *-* | *5.46* | *5.17* | *95%* |
| Bockmann Channel (20i) | F | - | - | 1.01 | - | - |
| Sulphur Creek (20j) | A | 3 | footpath | 3.33 | 3.33 | 100% |
| Hayward Landing (20k) | C | 1 | footpath | 1.24 | 1.24 | 100% |
| Johnson's Landing (20l) | F | - | - | 4.10 | - | - |
| Cogswell - Sec A (20m) | A | 7 | footpath | 14.11 | 14.06 | 100% |
| Cogswell - Sec B (20n) | A | 7 | footpath | 40.53 | 37.28 | 92% |
| Cogswell - Sec C (20o) | A | 7 | footpath | 20.15 | 20.11 | 100% |
| Hayward Shoreline Outliers (20p) | F | - | - | 1.57 | - | - |
| San Leandro Shoreline Outliers (20q) | F | - | - | 4.68 | - | - |
| Oakland Airport (20r) | C | 3 | road | 7.66 | 5.23 | 68% |
| HARD Marsh (20s) | A | 5 | footpath | 26.65 | 21.32 | 80% |
| San Leandro Marina (20t) | F | - | - | 3.93 | - | - |
| Estudillo Creek Channel (20u) | F | - | - | 5.81 | - | - |
| Hayward Landing Canal (20v) | F | - | - | 4.79 | - | - |
| Triangle Marsh - Hayward (20w) | C | 2 | footpath | 5.00 | 3.67 | 74% |

[1] Site is split according to treatment permissions (treatment is only permitted on a portion of the overall site).

(Table 1 continued on next page)

**Table 1**. Summary of site information, continued from previous page.

| ***REGION: Union City*** | | | | | | |
|---|---|---|---|---|---|---|
| **Site Name and ID** | **Survey Protocol** | **Number of Stations** | **Station Placement** | **Site Area (ha)** | **Survey Area (ha)** | **Proportion of Site Surveyed** |
| AFCC - Upper (01c) | G | 13 | levee | 30.47 | 29.61 | 97% |
| AFCC - Strip Marsh (01e) | F | - | - | 2.94 | - | - |
| OAC - North Bank (13a) | A | 6 | levee | 10.87 | 10.11 | 93% |
| OAC - Island (13b) | A | 9 | footpath | 37.94 | 34.99 | 92% |
| OAC - South Bank (13c) | A | 6 | footpath | 9.75 | 8.98 | 92% |
| Whale's Tail - North (13d) | A | 8 | footpath | 56.89 | 26.63 | 47% |
| OAC - Upstream 20 Tide Gates (13g) | F | - | - | 10.14 | - | - |
| Eden Landing - North Creek (13h) | F | - | - | 14.51 | - | - |
| Eden Landing - Pond 10 (13i) | F | - | - | 87.46 | - | - |
| Eden Landing - Mt Eden Creek (13j) | C | 6 | footpath | 50.52 | 24.95 | 49% |
| Eden Landing Reserve - South (13k) | C | 4 | footpath | 96.98 | 16.21 | 17% |
| Eden Landing Reserve - North (13l) | C | 4 | levee | 92.99 | 32.41 | 35% |
| Eden Landing - Ponds E8A, E9, E8X (13m) | F | - | - | 272.71 | - | - |
| ***REGION: Dumbarton South*** | | | | | | |
| **Site Name and ID** | **Survey Protocol** | **Number of Stations** | **Station Placement** | **Site Area (ha)** | **Survey Area (ha)** | **Proportion of Site Surveyed** |
| Ravenswood Open Space Preserve (02j) | F | - | - | 9.19 | - | - |
| SF2 (02n) | F | - | - | 98.18 | - | - |
| Calaveras Marsh (05a.2) | A | 8 | levee | 184.41 | 28.86 | 16% |
| Dumbarton/Audubon (05b) | A | 7 | levee | 201.34 | 72.00 | 36% |
| Newark Slough (05c) | A | 7 | bay trail | 97.27 | 21.25 | 22% |
| Mayhew's Landing (05e) | C | 2 | footpath | 11.31 | 8.51 | 75% |
| Cargill Pond (W Suites Hotel) (05g) | C | 1 | footpath | 7.36 | 7.09 | 96% |
| Plummer Creek Mitigation (05h) | C | 3 | footpath | 6.73 | 6.55 | 97% |
| Palo Alto Baylands (08) | A | 7 | footpath | 47.02 | 29.92 | 64% |
| Palo Alto Harbor (08) | A | 6 | footpath | 51.94 | 35.68 | 69% |
| Charleston Slough (15a.1) | A | 2 | footpath | 14.66 | 10.72 | 73% |
| Mountain View Slough (15a.1) | A | 2 | levee | 29.94 | 8.85 | 30% |
| Stevens Creek to Long Point (15a.2) | A | 5 | levee | 23.03 | 14.52 | 63% |
| Guadalupe Slough (15a.3) | A | 8 | levee | 127.96 | 35.92 | 28% |
| Alviso Slough (15a.4) | A | 8 | levee | 176.58 | 25.39 | 14% |
| Coyote Creek South East (15a.5) | A | 8 | levee | 84.34 | 42.01 | 50% |
| Knapp Tract (15a.6) | F | - | - | 154.94 | - | - |
| Faber Marsh (15b) | A | 5 | footpath | 46.87 | 40.63 | 87% |
| Laumeister Marsh (15b) | A | 6 | footpath | 36.54 | 22.43 | 61% |
| Stevens Creek (15c) | C | 2 | levee | 11.27 | 8.42 | 75% |
| Cooley Landing (16) | A | 8 | footpath | 70.86 | 45.07 | 64% |

(Table 1 continued on next page)

**Table 1**. Summary of site information, continued from previous page.

| ***REGION: San Mateo*** | | | | | | |
|---|---|---|---|---|---|---|
| **Site Name and ID** | **Survey Protocol** | **Number of Stations** | **Station Placement** | **Site Area (ha)** | **Survey Area (ha)** | **Proportion of Site Surveyed** |
| Belmont Slough (02a.1) | A | 8 | footpath | 72.08 | 27.44 | 38% |
| Redwood Shores (02a.3) | A | 6 | footpath | 52.25 | 23.58 | 45% |
| Redwood Shores Mitigation Bank (02a.4) | F | - | - | 35.96 | - | - |
| Corkscrew Slough (02b.1) | A | 7 | boat | 92.03 | 33.08 | 36% |
| Steinberger Slough (02b.2) | C | 6 | footpath | 42.74 | 16.61 | 39% |
| B2 North Quadrant (02c)[1] | A | 7 | boat | 211.71 | 86.32 | 41% |
| *B2 North Quadrant - NW (02c.1a)* | *-* | *-* | *-* | *60.85* | *28.59* | *47%* |
| *B2 North Quadrant - NE (02c.1b)* | *-* | *-* | *-* | *58.98* | *42.36* | *72%* |
| *B2 North Quadrant - S (02c.2)* | *-* | *-* | *-* | *91.88* | *23.80* | *26%* |
| B2 South Quadrant (02d) | A | 6 | levee | 76.12 | 35.51 | 47% |
| West Point Slough - NW (02e) | A | 1 | road | 2.15 | 2.15 | 100% |
| Greco Island - North (02f) | A | 8 | boardwalk | 206.85 | 63.84 | 31% |
| West Point Slough - SW / E (02g) | A | 4 | road | 16.12 | 10.44 | 65% |
| Greco Island - South (02h) | A | 6 | old levee | 96.28 | 40.35 | 42% |
| Ravenswood Slough (02i) | A | 7 | footpath | 47.68 | 27.61 | 58% |
| Middle Bair N (02k) | A | 5 | boardwalk | 89.68 | 46.83 | 52% |
| Middle Bair SE (02k) | A | 3 | boardwalk | 81.05 | 26.90 | 33% |
| Inner Bair Island Restoration (02l) | C | 4 | footpath | 24.13 | 15.73 | 65% |
| Pond B3 Bair Island Restoration (02m) | F | - | - | 166.67 | - | - |
| Middle Bair West (02o) | F | - | - | 273.24 | - | - |

[1] Site is split according to treatment permissions (treatment is only permitted on a portion of the overall site).

(Table 1 continued on next page)

| *REGION: San Francisco Peninsula* | | | | | | |
|---|---|---|---|---|---|---|
| **Site Name and ID** | **Survey Protocol** | **Number of Stations** | **Station Placement** | **Site Area (ha)** | **Survey Area (ha)** | **Proportion of Site Surveyed** |
| Pier 94 (12a) | F | - | - | 1.68 | - | - |
| Pier 98/Heron's Head (12b) | A | 2 | footpath | 4.42 | 4.13 | 93% |
| Yosemite Channel (12e) | F | - | - | 1.34 | - | - |
| Candlestick Cove (12f) | F | - | - | 0.75 | - | - |
| Crissy Field (12g) | F | - | - | 5.76 | - | - |
| Colma Creek (18a) | F | - | - | 2.81 | - | - |
| Sam Trans Peninsula (18e) | C | 1 | footpath | 5.78 | 1.66 | 29% |
| Confluence Marsh (18f) | F | - | - | 2.92 | - | - |
| San Bruno Marsh (18g) | C | 4 | footpath | 11.53 | 9.04 | 78% |
| San Bruno Creek (18h) | F | - | - | 2.06 | - | - |
| Brisbane Lagoon (19a) | F | - | - | 4.19 | - | - |
| Sierra Point (19b) | F | - | - | 0.98 | - | - |
| Oyster Point Marina (19d) | F | - | - | 0.67 | - | - |
| Oyster Point Park (19e) | F | - | - | 0.96 | - | - |
| Point San Bruno (19f) | F | - | - | 1.06 | - | - |
| Seaplane Harbor (19g) | F | - | - | 1.67 | - | - |
| SFO (19h) | A | 4 | road | 10.18 | 6.60 | 65% |
| Mills Creek Mouth (19i) | F | - | - | 1.11 | - | - |
| Easton Creek Mouth (19j) | F | - | - | 2.50 | - | - |
| Sanchez Marsh (19k) | F | - | - | 6.14 | - | - |
| Burlingame Lagoon (19l) | F | - | - | 2.16 | - | - |
| Coyote Point Marina (19n) | F | - | - | 4.85 | - | - |
| Seal Slough (19p) | A | 5 | marsh edge | 27.74 | 22.36 | 81% |

(Table 1 continued on next page)

**Table 1**. Summary of site information, continued from previous page.

| ***REGION: Marin*** | | | | | | |
|---|---|---|---|---|---|---|
| **Site Name and ID** | **Survey Protocol** | **Number of Stations** | **Station Placement** | **Site Area (ha)** | **Survey Area (ha)** | **Proportion of Site Surveyed** |
| Blackie's Creek (03a) | F | - | - | 0.22 | - | - |
| Blackie's Creek Mouth (03b) | F | - | - | 0.40 | - | - |
| Corte Madera Ecological Reserve (Heerdt Marsh) (04a) | A | 6 | marsh | 31.21 | 31.17 | 100% |
| College of Marin (04b) | A | 1 | footpath | 1.79 | 1.00 | 56% |
| Piper Park - East (04c) | A | 2 | marsh edge | 4.09 | 4.06 | 99% |
| Piper Park - West (04d) | A | 3 | footpath | 5.60 | 5.60 | 100% |
| Larkspur Ferry Landing Area (04e) | F | - | - | 0.42 | - | - |
| Riviera Circle (04f) | F | - | - | 1.56 | - | - |
| Creekside Park (04g) | A | 4 | footpath | 8.40 | 8.40 | 100% |
| CMC - Upper (04h) | A | 5 | footpath | 5.53 | 5.20 | 94% |
| CMC - Lower (04i) | A | 2 | footpath | 6.44 | 2.55 | 40% |
| CMC - Mouth (04j) | A | 5 | footpath | 7.35 | 6.94 | 94% |
| Boardwalk No. 1 (04k) | A | 0 | - | 3.42 | 3.42 | 100% |
| Pickleweed Park (09) | A | 3 | footpath | 5.73 | 5.73 | 100% |
| Brickyard Cove (23a) | F | - | - | 16.97 | - | - |
| Beach Drive (23b) | F | - | - | 3.51 | - | - |
| Loch Lomond Marina (23c) | F | - | - | 1.86 | - | - |
| San Rafael Canal Mouth (23d) | A | 2 | road | 2.71 | 2.71 | 100% |
| Martas Marsh (23e) | A | 5 | levee | 8.02 | 7.96 | 99% |
| San Clemente Creek (23e) | A | 1 | levee | 7.59 | 3.77 | 50% |
| Muzzi Marsh (23e) | A | 6 | levee | 56.03 | 39.68 | 71% |
| Paradise Cay (23f) | F | - | - | 9.05 | - | - |
| Greenwood Beach (23g) | F | - | - | 1.60 | - | - |
| Strawberry Point (23h) | F | - | - | 5.57 | - | - |
| Strawberry Cove (23i) | F | - | - | 4.27 | - | - |
| Bothin Marsh (23j) | A | 8 | footpath | 42.96 | 32.53 | 76% |
| Sausalito (23k) | F | - | - | 2.22 | - | - |
| Starkweather Park (23l) | F | - | - | 3.36 | - | - |
| Triangle Marsh - Marin (23n) | C | 2 | road | 7.73 | 5.87 | 76% |
| ***REGION: San Pablo Bay - Vallejo and Petaluma*** | | | | | | |
| **Site Name and ID** | **Survey Protocol** | **Number of Stations** | **Station Placement** | **Site Area (ha)** | **Survey Area (ha)** | **Proportion of Site Surveyed** |
| Petaluma River - Upper (24a) | A | 3 | footpath | 55.91 | 25.64 | 46% |
| Grey's Field (24b) | A | 3 | footpath | 43.94 | 13.08 | 30% |
| Ellis Creek (24c) | A | 2 | footpath | 218.28 | 8.44 | 4% |
| San Pablo Bay NWR Shoreline (26b) | C | 5 | levee | 1043.14 | 19.60 | 2% |

# 3. Methods

## 3.1 Field Methods

California Ridgway's rail surveys were conducted between January 15 and April 15, 2016, using standardized survey protocols approved by the USFWS (**Appendix III**: Standard Survey Protocols for Ridgway's Rails in the San Francisco Estuary). Surveys were conducted by the following trained and permitted field biologists at Olofson Environmental, Inc.: Jen McBroom, Jeanne Hammond, Stephanie Chen, Tobias Rohmer, Whitney Thornton, Anastasia Ennis, Simon Gunner, Pim Laulikitnont, Nate Deakers, and Kevin Eng.

In 2016, OEI surveyed 129 *Spartina*-invaded sites for Ridgway's rails or for presence of rail habitat. Call count surveys were conducted at 75 sites; 44 sites were surveyed using Protocol A, 30 sites were surveyed using Protocol C, and one site was surveyed using Protocol B. The remaining 54 sites were evaluated for the presence of habitat only (F-survey) and were deemed unlikely to be used by breeding rails. Two additional ISP sites were surveyed using Protocol G in support of a project outside of the ISP for another agency; results from these surveys are also included in this report. A description of each survey protocol employed by OEI biologists in 2016 is summarized below and the full protocol descriptions are included in **Appendix III:** Standard Survey Protocols for Ridgway's Rails in the San Francisco Estuary

### *3.1.1. Protocol A: Passive Call Count Survey*

Protocol A is the standard survey protocol developed by USFWS biologists and used by researchers throughout the San Francisco Estuary. This survey type is used at sites where Ridgway's rails have been observed within the past two years. Typically, survey stations are placed at 200-meter (m) intervals on peripheral paths around the site. The number of survey stations established at each site varied due to site size, configuration, and accessibility. **Table 1** shows the number of survey stations at each site. The locations of the survey stations were entered into a GIS and navigated to in the field using a tablet GPS unit. For consistency and repeatability, all efforts were made to use the same survey station locations that were established during the previous survey seasons. For a complete list of OEI survey stations and their geographic coordinates in UTM, see **Appendix II**: 2016 Survey Station Coordinates

Sites were visited at least three times during the season, with at least two weeks between visits. During the first two rounds, a trained observer stood at each point for 10 minutes, recording all rails detected visually or aurally. For each bird or pair of birds detected, the observer recorded on a datasheet: (1) the number of birds, (2) the call type, (3) the minute in which the bird(s) called, and (4) distance and direction to the calling center. Additionally, the approximate locations of each rail or pair were plotted on a field map of the site.

If no Ridgway's rails were detected within 200-meters of a survey station during the first two rounds, pre-recorded Ridgway's rail vocalizations were broadcast from that station during the third round. During the ten-minute visit to the station, recordings were broadcast during the sixth minute to elicit a response from rails. The standardized, pre-recorded vocalizations were provided by USFWS and were played from an mp3 player or the tablet GPS in

conjunction with portable speakers. If a Ridgway's rail responded during the broadcast call, the speakers and player were immediately turned off to avoid harassment of rails.

### 3.1.2. Protocol C: Active Call Count Survey

A modified protocol for call count surveys was developed by USFWS and ISP staff to maximize the chances of detecting rails at sites that have a low probability of supporting Ridgway's rails. Protocol C is identical to the standard survey (Protocol A), except that it allows permitted biologists to play pre-recorded rail vocalizations during all three visits to a site. If a rail is detected, the recording must be immediately switched off and cannot be played again within 200 meters of the detection for the remainder of the season.

Sites that are surveyed using Protocol C are typically isolated, small marsh patches that provide marginal or low-quality rail habitat and where Ridgway's rails have not been detected during the prior two years. To determine whether Protocol C is appropriate to use, sites are first evaluated by a rail biologist using Protocol F. However, if a site was surveyed using Protocol C in previous years, it will continue to be surveyed using active call counts until either (1) the site is reevaluated using Protocol F and habitat is determined absent, or (2) a Ridgway's rail is detected, at which point the site will be surveyed using passive surveys (Protocol A).

### 3.1.3. Protocol B: Stationary Call Count Survey

Protocol B is a stationary call count survey, used infrequently and generally only at sites where Ridgway's rails occur at a high density. Listening stations are established along a grid or transect, with stations set apart by 200 meters or more. Observers are present at each station for the entire 2-hour survey period. When calls are recorded, the observer must take care to record the exact time and direction, and best estimate of the distance to the call, so that the data can be reconciled with other observers' data. Reconciliation of data from multiple observers must be planned and closely supervised by a scientist with expertise in field data interpretation. Protocol B will typically produce higher rail counts than Protocol A or C surveys.

The Protocol B stationary survey is a passive listening survey, and does not include playing of recorded calls. Currently only two sites in the Estuary are surveyed using Protocol B: Arrowhead Marsh (surveyed by both ISP and East Bay Regional Park District) and La Riviere (surveyed by DENWR).

### 3.1.4. Protocol F: Habitat Assessment Survey

This protocol was developed for the ISP in 2005, with guidance from Jules Evens (ARA) and Joy Albertson (USFWS), to determine whether apparently-marginal habitat meets a suggested minimum set of criteria for likely Ridgway's rail use. These criteria include restoration status, salinity, tidal regime, marsh size and configuration, levee configuration, marsh elevation, presence of high marsh vegetation, degree of non-native *Spartina* invasion, distance from the nearest marsh with known Ridgway's rails, degree of channelization, and amount of open water (ponding). If at least four criteria related to Ridgway's rail presence were met, the site was deemed to have sufficient probability that Ridgway's rails were present, and a recommendation was made for further call count surveys, usually Protocol C. If these criteria were not met, the site was assumed to not support Ridgway's rails, and no

further rail surveys were recommended. Marginal and low-quality sites are (re)evaluated in this fashion every year.

### *3.1.5. Protocol G: Stationary Survey with Broadcast to Determine Absence*

In 2009, the USFWS developed a draft survey protocol for consultants to determine Ridgway's rail absence from a marsh. This protocol was created in order to help biologists determine rail absence from a marsh when construction activities are planned in or adjacent to tidal wetlands during rail breeding season (February 1 to September 1) and surveys are recommended by USFWS staff to assess potential impacts to rails.

Similar to Protocol B, Protocol G is a stationary survey conducted by multiple observers stationed at 200 meter intervals around the survey area. Surveys are conducted for four rounds between January 15 and April 15, with broadcast of vocalizations played during the third and fourth rounds. Because this protocol is used to establish rail absence, if rails are detected at any time during the four rounds of surveys, surveys can cease and presence is established at the site.

OEI conducted Protocol G surveys at two ISP sites in 2016: AFCC – Upper in the Union City Region and Bockmann Channel in the Hayward Region. OEI was contracted to survey these sites using Protocol G for the Alameda County Flood Control District (ACFCD). Results from these surveys are included in this report.

## 3.2 Data Management

Staff at OEI used ArcGIS 10.3 (Environmental Systems Research Institute (ESRI), Redlands, CA) to create a versioned geodatabase to store and manage call count survey data in 2016. The design of the database was based on a preexisting Access database developed by Point Blue Conservation Science in 2005, but has been modified to suit the needs of the ISP. All table elements of the Access database were preserved in the new geodatabase, along with the spatial components of the data.

Data were recorded in the field on paper datasheets (**Appendix IV**: Survey Forms), on paper field maps, and in Yuma GPS units with ArcPad 10.2 mapping software (ESRI). The GPS units were used both to navigate to survey stations and to digitally record data in the field. During a survey, stations and site boundaries were updated in ArcPad with current visit information, such as weather data and other environmental variables.

Each rail observation was recorded on a paper datasheet with time detected, call type, number of rails, distance, confidence interval for estimated distance, and direction to the observed rail. Additionally, each rail was assigned a unique map reference identifier and the approximate location of each detected rail was recorded on a paper field map allowing for interpretation of repeat detections of any individuals/pairs. Compass and rulers were used to accurately plot rails on paper maps. At sites with overlap between other observers, birds were plotted together on a single map to determine which detections were unique. All other bird species observed at the site were recorded at the bottom of the datasheet. Potential predators of rail nests, young, or adults were also noted.

In the office, data were uploaded from the GPS units and checked in to the geodatabase. Each observer maintained his/her own data in the geodatabase during the field season. Data entered into ArcPad in the field were added to the geodatabase and reviewed for quality and accuracy. Additionally, rail observation data that were recorded on a datasheet in the field

were entered into the geodatabase. OEI staff used the Direction/Length tool in ArcGIS 10.3 to enter the direction (in degrees) and distance (in meters) in order to create a line feature, which were called 'offsets'. A point feature, called 'location,' was created at the end of each offset line to represent the location of each unique rail or pair. When a rail was detected from more than one station, the location point feature was moved toward the intersection of the offset lines, to triangulate a more precise position of the observed rail.

At the end of the field season, all data were proofed against original datasheets for accuracy before analysis. For sites requiring multiple concurrent surveyors, the data for each round were re-evaluated to minimize duplicate counting of rail or rail pairs when detected by multiple surveyors.

## 3.3 Data Interpretation

*2016 Survey Data*

The minimum number of detected Ridgway's rails was summed at the end of each round to estimate the total number of rails detected at each site on each round. Birds that were detected from more than one station or by more than one observer during a single round were counted only once toward the total number of rails detected. Birds that were detected outside of survey time were included in the summary and counted toward the total. Once all data were summed for each round at each site, we used the round with the highest count to report the number of rails detected for each site. This metric is called the "highest minimum count" in the following tables of this report.

To visualize these data in maps, survey results were transformed into a density calculation. First, we estimated the survey area, which is based on an assumed detection threshold of 200 meters, beyond which our ability to detect Ridgway's rails is diminished. Survey area for each site is reported in **Table 1**. We then divided the minimum number of rails detected during the highest survey round by the survey area to estimate the density at the entire site. Because we are often surveying only a portion of the site, we make the assumption that density is similar across the entire site in the map representations that follow.

*Seven-year Trends*

In order to estimate the direction of change in rail data over time, we calculated a linear trend at each site and for each region over the past seven years. We assigned a simple up (↗), down (↘), or straight/stable (→) arrow based on the direction indicated by the slope of the line, rounded to a whole number. This does not imply statistical significance, nor that a straight line is the best fit for the data. Instead it offers a quick, simple, and repeatable method to quickly evaluate change in rail data over time. Additionally, we calculated the average number of Ridgway's rails detected over the past seven years and calculated the change from the average in 2016.

There are few data gaps over the last seven years at a subset of sites included in this report. The sites where they occur are dealt with in one of two ways: sites with data missing at the beginning of the time series are excluded from the regional summary and are given a trend line at the site level based on the years where data are available; alternatively, data gaps from the middle of the time series are assigned an average from the year preceding and the year following the gap. These data gaps are included in the regional trends and noted in the tables by brackets.

# 4. 2016 Survey Results

A minimum of 474 California Ridgway's rails were present at 48 of the 129 sites surveyed by OEI for the ISP in 2016. No Ridgway's rails were detected in 2016 at the remaining 81 sites, 54 of which were deemed unsuitable to support breeding rails (surveyed using Protocol F only). Detailed survey results from each round are included in **Appendix V**: 2016 OEI Survey Results for Each Round.

Because most sites have been continuously surveyed for the past seven years, we are able to compare 2016 results with data collected since 2010. Some sites are excluded from the regional summary because they were not surveyed at the beginning of the time series. These sites include Calaveras Marsh (05a.2), Coyote Creek SE (15a.5), Coyote Creek (05f), and Guadalupe Slough (15a.3) in the Dumbarton South Region, and represent an additional 58 Ridgway's rails detected in 2016 that are excluded from the graph on the following page (**Figure 2**).

Over the past three years, the number of detected Ridgway's rails has increased rapidly at the eleven sites where *Spartina* control has been restricted since 2011 (**Figure 2**). Ten of the eleven sites are limited to just two regions: San Leandro Bay and Hayward Regions. The only restricted treatment site beyond these two regions, B2 North – NE (02c.1b), is partially treated with a sublethal dose of herbicide to prevent seed set and expansion of non-native *Spartina*. Rail detections in these untreated areas are up by over 100 rails from 2010, most of that gained during the last two breeding seasons. The relatively stable trend from 2010 to 2014 implies a lag effect, as the rail numbers followed the growth and expansion of non-native *Spartina* in the absence of treatment.

In contrast, at the sites where *Spartina* treatment has continued, the number of Ridgway's rails detected at sites surveyed by OEI has been relatively stable during the study period. Initial reports from partner organizations indicate that this stable trend might be increasing when other sites from partner organizations are included in the analysis, however that is beyond the scope of this report. In general, at sites where *Spartina* treatment has continued, hybrid *Spartina* has been so greatly reduced that it no longer provides significant benefits in the way of rail habitat. For this reason, the continued treatment of non-native *Spartina* at these sites is not expected to have much impact on the resident rails.

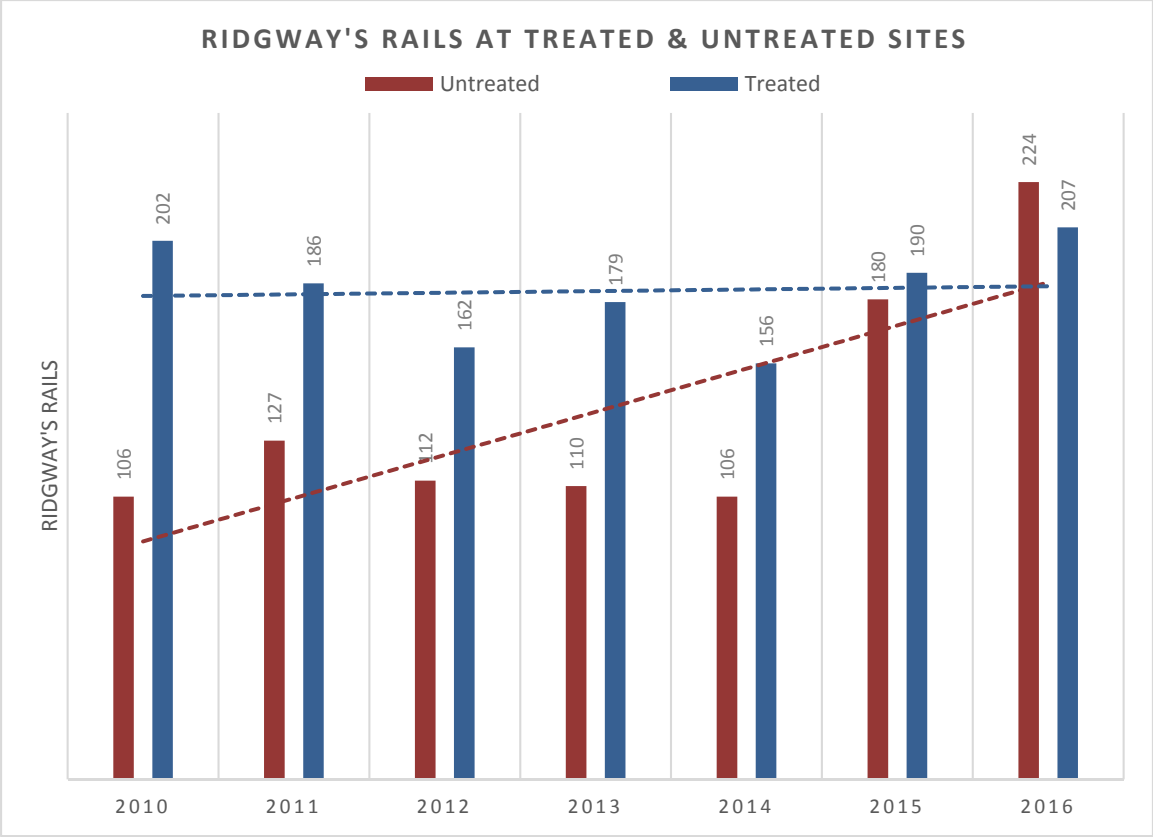


**Figure 2.** Survey results from 2010 to 2016 at 79 sites without restrictions on *Spartina* treatment (shown in blue) and at the eleven sites where treatment of non-native *Spartina* has been restricted since 2011 (shown in red). Note that **t**his subset of sites only includes those surveyed by OEI; this does not represent a range-wide population estimate nor is it comprehensive for all ISP sites (many of which were surveyed by partner organizations)**.**

## 4.1 Bay Bridge North Region

The Bay Bridge North Region is located in Alameda and Contra Costa Counties, extending from the Bay Bridge in Emeryville to Point Pinole north of the City of Richmond (**Figure 3**). This shoreline is heavily urbanized: the southern half is predominantly commercial, industrial and high-density residential developments; the northern half is lined with single-family residential communities and the one of the largest and oldest oil refinery on the West Coast operated by Chevron Corporation. The northern portion of this region, which hosts some large remnant tidal marshes, was surveyed by PBCS, while the smaller isolated marshes in the southern portion were surveyed by OEI.

The region includes 13 ISP rail sites, eleven of which were surveyed by OEI in 2016 (**Table 2**). Passive call count surveys (Protocol A) were conducted at five sites and active call count surveys (Protocol C) at three sites. Three more sites were evaluated for Ridgway's rail habitat (using Protocol F), which was determined to be absent from the sites, and so no further surveys were conducted at those locations.

The trend in the Bay Bridge North is continuing to slowly rise. OEI detected 17 Ridgway's rails in the region this year. Early results from PBCS indicate a similar positive trend. Although OEI did not detect any rails in Giant Marsh this year, staff at WRA Environmental Consultants detected two Ridgway's rails in Giant Marsh when conducting surveys using Protocol G adjacent to the site.

**Table 2.** Summary survey results from 2010-2016 at the Bay Bridge North Region.

| | Highest Minimum Count | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Site Name (ID)** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **Average** | **Change from Average** | **Trend** |
| Emeryville Crescent - East (06a) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Emeryville Crescent - West (06b) | 8 | 4 | 0 | 1 | 2 | 0 | 1 | 2 | -1 | ↘ |
| Whittell Marsh (10a) | 1 | 0 | 1 | 2 | 0 | 3 | 3 | 1 | 2 | → |
| Southern Marsh (10b) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | → |
| Giant Marsh (10c) | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | → |
| Breuner Marsh Restoration (10d) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Rheem Creek Area (22c) | 1 | 6 | 9 | 11 | 4 | 4 | 7 | 6 | 1 | → |
| Meeker Slough (22d)[1] | 2 | [1.5] | 1 | 3 | 2 | 7 | 2 | 3 | -1 | → |
| Stege Marsh (22d)[1] | 0 | [1] | 2 | 6 | 4 | 7 | 4 | 3 | 1 | ↗ |
| Hoffman Marsh (22e) | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | → |
| Albany Shoreline (22f) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| **Bay Bridge North Region TOTAL** | **13** | **12.5** | **14** | **24** | **13** | **22** | **17** | **16.5** | **0.5** | **↗** |

[1] Data gaps in the middle of the time series were assigned data based on the average of the preceding and subsequent years and are noted in brackets.

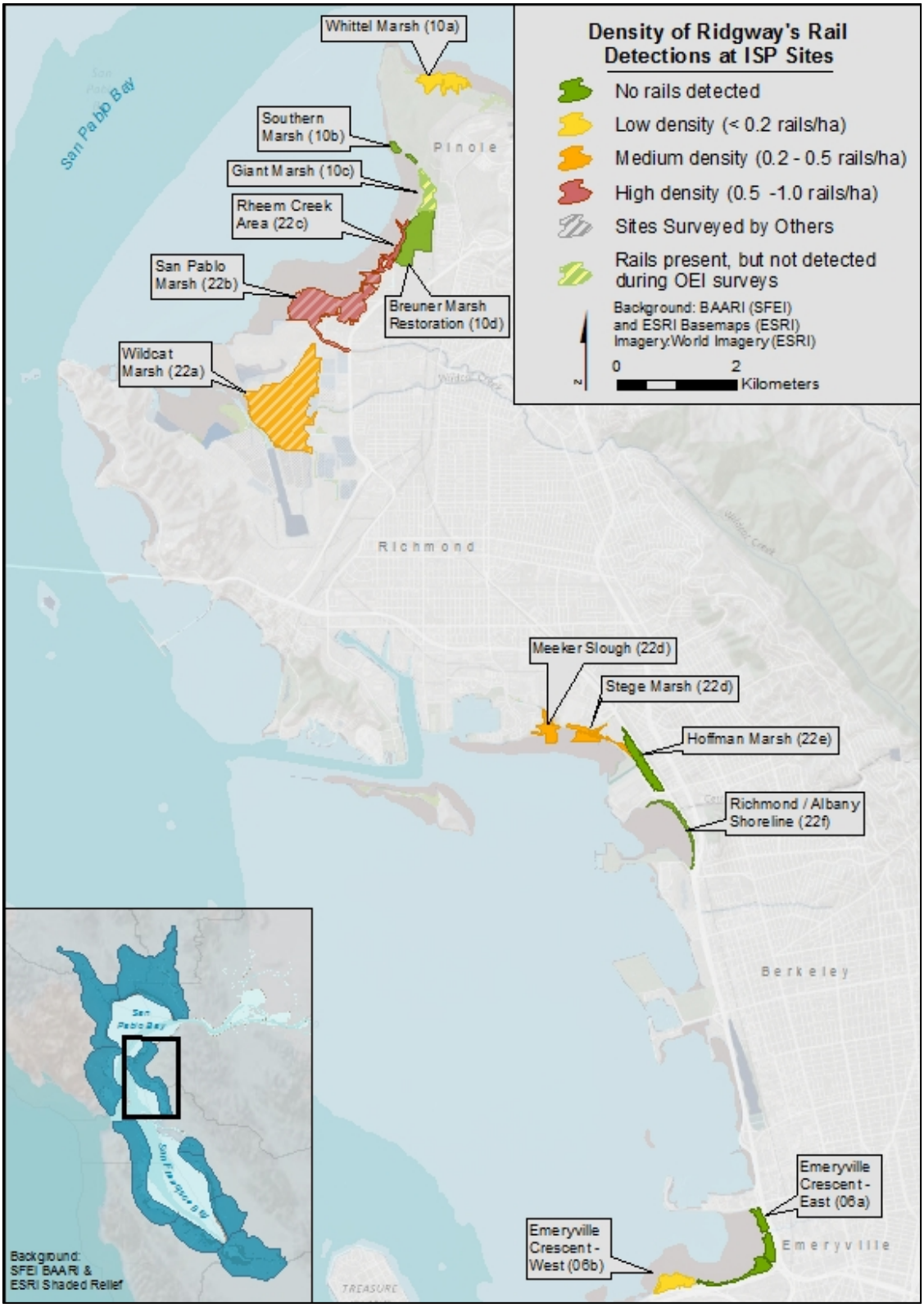


**Figure 3.** Density of Ridgway's rails detected in 2016 at sites in the Bay Bridge North Region. Density was calculated based on the highest minimum count within the survey area. Wildcat Marsh and San Pablo Marsh were surveyed by PBCS. WRA detected Ridgway's rails at Giant Marsh during Protocol G surveys at an adjacent site.

## 4.2 San Leandro Bay Region

The San Leandro Bay Region in Alameda County is bounded by the cities of Oakland and Alameda (**Figure 4**) and is surrounded by commercial development, landfills, highways, and the Oakland International Airport. It is a highly urbanized tidal estuary ringed mostly by rip-rap levees, with a few fragmented parcels of small tidal wetlands that developed in recent decades in places where sediment has accumulated along the shoreline. Most of the marshes in the region have few if any natural tidal channels and high edge-to-area ratios. An exception is Arrowhead Marsh, which formed when the earthen dam at Lake Chabot ruptured in the 1860's, and has networks of tidal channels and is mostly surrounded by water rather than upland edge.

The region includes 14 ISP rail sites, all of which were surveyed by OEI in 2016 (**Table 3**). Passive call count surveys (Protocol A) were conducted at four sites and active call count surveys (Protocol C) at one site. One site, Arrowhead Marsh, was surveyed using the stationary survey (Protocol B), where all rails are recorded for a full two-hour period. Though the method is not comparable with other sites, Arrowhead Marsh has been surveyed using this method for the past seven years to maintain consistency between years. Eight of the 14 sites were evaluated for Ridgway's rail habitat (using Protocol F), which was determined to be absent from the sites, and so no further surveys were conducted at those locations.

The San Leandro Bay Region has some of the largest remaining stands of non-native hybrid *Spartina* in the entire estuary. Four of the fourteen sites in the region have been left untreated since 2011 due concerns over rails dependent on the cover provided by the hybrid *Spartina*. In 2016, nearly all of the rails detected in the region were detected within the four sites where *Spartina* treatment is restricted, and they were detected at very high densities. To note, Arrowhead Marsh is surveyed using Protocol B, which may result in over-counting birds. However, the density of rails at this site likely would still qualify as very high even if it were surveyed using standard protocols.

The rising trend and the high densities of rails in the region are attributable to the increasing hybrid *Spartina* cover at the sites with treatment restrictions. Hybrid *Spartina* provides taller and thicker vegetative cover than native *Spartina foliosa* and it is likely that the Ridgway's rail population in this region currently exceeds what a native condition could support. Additionally, native *Spartina foliosa* is nearly absent from the region, having been outcompeted and extirpated by non-native *Spartina*. The only location where native *Spartina* can be found is where it has been planted at Elsie Roemer by ISP, and far upstream in the Coliseum Channels.

ISP and its partners implemented a restoration plan in the region in an effort to improve the native habitat for Ridgway's rails before *Spartina* control resumes at the restricted sites. Several years ago, the Conservancy funded the installation of five high tide refuge islands and plantings of both *Grindelia stricta* and native *Spartina foliosa* within the region. Unfortunately, the combination of the expansion of hybrid *Spartina* and the limited availability of tidal marsh habitat has inhibited restoration efforts in the region. As non-native *Spartina* grows and spreads, there are fewer and fewer suitable areas to reintroduce native plants and ISP has tabled revegetation efforts in the area until there is better control of hybrid *Spartina*.

Ridgway's rail populations in the region are likely to decline when *Spartina* control work is permitted to resume, especially since this region will not have any *Spartina*, native or

otherwise, to provide that necessary component of rail habitat. This region presents a unique opportunity to identify creative solutions to the competing management of endangered species and the eradication of a noxious weed.

**Table 3.** Survey results from 2010-2016 in the San Leandro Bay Region. Sites that were split according to treatment permissions in 2011 are shown in grey italic font (and are not included in the region totals). Sites where *Spartina* control work has been suspended since 2011 are noted in grey shading.

| | Highest Minimum Count | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Site Name (ID)** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **Average** | **Change from Average** | **Trend** |
| Elsie Roemer (17a) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | → |
| Bay Farm Island (17b) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Arrowhead Marsh (17c) | 41 | 31 | 32 | 34 | 35 | 45 | 31 | 36 | -5 | → |
| *Arrowhead Marsh (17c.1)* | *10* | *6* | *2* | *4* | *4* | *6* | *3* | *5* | *-2* | ↘ |
| *Arrowhead Marsh (17c.2)* | *27* | *31* | *32* | *33* | *33* | *43* | *29* | *33* | *-4* | ↗ |
| Airport Channel - Fan Shore (17d.1) | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | → |
| MLK Regional Shoreline - Damon (17d.4) | 5 | 4 | 1 | 2 | 2 | 2 | 6 | 3 | 3 | → |
| San Leandro Creek (17e) | 3 | 1 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | → |
| Oakland Inner Harbor (17f) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Coast Guard Island (17g) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| MLK New Marsh (17h) | 14 | 13 | 18 | 21 | 25 | 30 | 51 | 25 | 26 | ↗ |
| Coliseum Channels (17i) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Fan Marsh (17j) | 12 | 8 | 2 | 2 | 4 | 9 | 20 | 8 | 12 | ↗ |
| Airport Channel (17k) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Doolittle Pond (17l) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | → |
| Alameda Island - East (17m) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | → |
| **San Leandro Bay Region TOTAL** | **79** | **59** | **53** | **59** | **66** | **88** | **109** | **73** | **36** | **↗** |

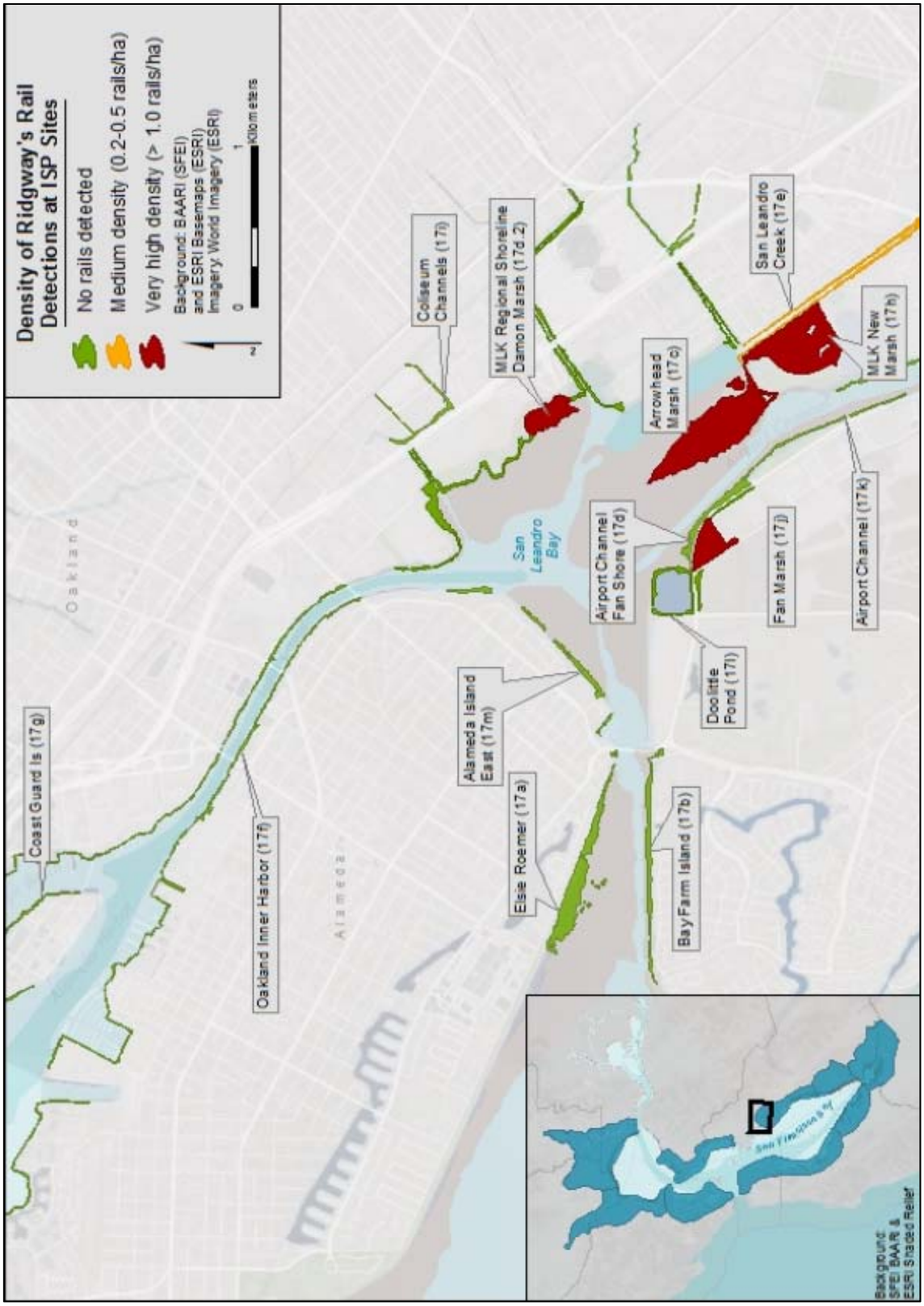


**Figure 4.** Density of Ridgway's rail detected in 2016 at ISP sites in the San Leandro Bay Region. Density was calculated based on the highest minimum count within the survey area.

## 4.3 Hayward Region

The Hayward Region in Alameda County extends from the Oakland International Airport south to the San Mateo Bridge (**Figure 5**). Most of the sites within the region are mid-sized marshes that were restored to tidal flow in recent decades. These young restoration sites exhibit a lack of channel density and vegetative structure and thus provide mediocre habitat for Ridgway's rails. However, as in the case of San Leandro Bay, the Hayward Region still has large stands of hybrid *Spartina* remaining at the six sites in the region where treatment is prohibited. The cover provided by non-native *Spartina* offers protection from predators, which are particularly abundant in the region.

OEI surveyed all 24 sites within the region and detected a minimum of 111 Ridgway's rails at half of the sites surveyed; no rails were found at the remaining 12 sites (**Table 4**). The total number of rails detected at the six sites with treatment restrictions has increased rapidly in the past three years. In 2014, we detected 37 rails at those six sites; in 2015, the number rose to 77; this year, we detected 99 rails at those six sites. One of the largest increases has been at North Marsh (20f) within the Robert's Landing Complex, which increased from six rails detected in 2014 to 41 rails detected this year. Of the six sites where treatment is prohibited, the only site to show a decreasing trend is the split site of San Lorenzo Creek – North (20h.1).

The Coastal Conservancy has invested heavily in revegetation and other habitat enhancements in the region, particularly at the Cogswell Complex. They funded the installation of six high tide refuge islands at Cogswell and an additional two islands at Bunker Marsh in the Robert's Landing Complex. Additionally, thousands of *Grindelia stricta* seedlings have been planted in the region over the past four years.

Similar to San Leandro Bay, this region lacks native *Spartina foliosa*, which was lost to the invasion of hybrid *Spartina*. Over the past three years, native *Spartina foliosa* has been reintroduced at several carefully selected sites where hybrid *Spartina* is nearing eradication: Oro Loma - East (07a), Johnson's Landing (20l), Cogswell – Sec A (20m), HARD Marsh (20s), and Triangle Marsh – Hayward (20w). Unfortunately, some of these efforts were put on hold when hybrid *Spartina* propagules from adjacent untreated sites began invading revegetation plots. Still, based on early successes with native *Spartina* plantings, this region remains a good candidate for revegetation efforts when treatment of hybrid *Spartina* resumes at the six sites where it is currently prohibited.

**Table 4.** Survey results from 2010 to 2016 in the Hayward Region. Sites that were split according to treatment permissions in 2011 are shown in grey italic font (and are not included in the region totals). Sites where *Spartina* control work has been suspended since 2011 are noted in grey shading.

| Site Name (ID) | Highest Minimum Count | | | | | | | Average | Change from Average | Trend |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | | | |
| Oro Loma - East (07a) | 4 | 6 | 4 | 1 | 1 | 1 | 3 | 3 | 0 | ↘ |
| Oro Loma - West (07b) | 0 | 0 | 1 | 3 | 0 | 1 | 1 | 1 | 0 | → |
| Oyster Bay Regional Shoreline (20a) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Oakland Golf Links (20b) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Dog Bone Marsh (20c) | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | → |
| Citation Marsh (20d) | 5 | 20 | 6 | 2 | 9 | 7 | 12 | 9 | 3 | → |
| *Citation Marsh - South (20d.1)* | *1* | *3* | *1* | *0* | *0* | *2* | *2* | *1* | *1* | → |
| *Citation Marsh - North (20d.2)* | *4* | *18* | *5* | *2* | *9* | *7* | *12* | *8* | *4* | → |
| East Marsh (20e) | 0 | 1 | 0 | 1 | 2 | 0 | 2 | 1 | 1 | → |
| North Marsh (20f) | 12 | 14 | 8 | 5 | 6 | 27 | 41 | 16 | 25 | ↗ |
| Bunker Marsh (20g) | 4 | 8 | 8 | 5 | 6 | 6 | 14 | 7 | 7 | ↗ |
| San Lorenzo Creek (20h) | 3 | 4 | 2 | 1 | 1 | 0 | 1 | 2 | -1 | ↘ |
| *San Lorenzo Creek - North (20h.1)* | *2* | *4* | *2* | *1* | *1* | *0* | *1* | *2* | *-1* | ↘ |
| *San Lorenzo Creek - South (20h.2)* | *1* | *0* | *0* | *0* | *0* | *0* | *0* | *0* | *0* | → |
| Bockmann Channel (20i) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Sulphur Creek (20j) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Hayward Landing (20k) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | → |
| Johnson's Landing (20l) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Cogswell - Sec A (20m) | 6 | 3 | 0 | 1 | 0 | 2 | 2 | 2 | 0 | ↘ |
| Cogswell - Sec B (20n) | 20 | 9 | 17 | 18 | 13 | 26 | 24 | 18 | 6 | ↗ |
| Cogswell - Sec C (20o) | 3 | 2 | 8 | 1 | 2 | 11 | 7 | 5 | 2 | ↗ |
| Hayward Shoreline Outliers (20p) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| San Leandro Shoreline Outliers (20q) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Oakland Airport (20r) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| HARD Marsh (20s) | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 1 | 1 | → |
| Estudillo Creek Channel (20u) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Hayward Landing Canal (20v) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Triangle Marsh - Hayward (20w) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | → |
| **Hayward Region TOTAL** | **57** | **69** | **55** | **38** | **41** | **81** | **111** | **65** | **46** | ↗ |

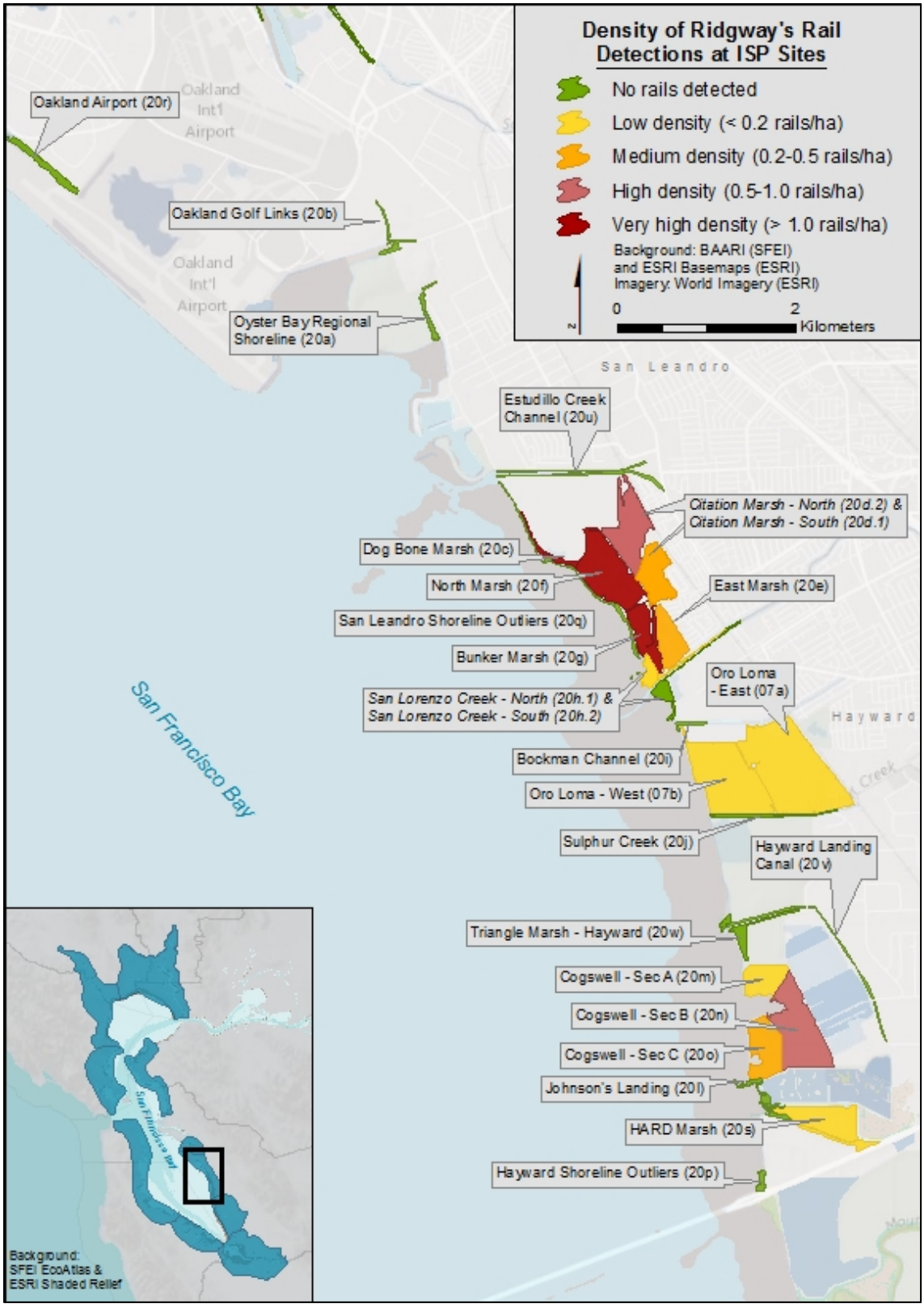


**Figure 5**. Density of Ridgway's rail detected in 2016 at ISP sites in the Hayward Region. Density was calculated based on the highest minimum count within the survey area.

## 4.4 Union City Region

The Union City Region in Alameda County extends from the San Mateo Bridge to the Dumbarton Bridge (**Figure 7**). There are a variety of habitats in this region, including mature restoration marshes, flood control channels, young restoration sites with little vegetation, and mudflats. The region includes the Eden Landing Ecological Reserve, which is an important component of the larger South Bay Salt Pond Restoration Project. Although the Union City Region was the epicenter of the original *Spartina* invasion, it now has one of the lowest remaining infestations in the Estuary.

OEI surveyed 12 of the 20 sites in the region in 2016 and detected a minimum of nine Ridgway's rails (**Table 5**). One of these 12 sites, AFCC Upper, was surveyed by OEI for the Alameda County Flood Control District (ACFCD) using Protocol G, which is used to determine if rails are absent from the site. The other eight sites in the region were surveyed by staff at DENWR, who detected an additional 19 Ridgway's rails within the region in 2016 (R. Tertes, personal communication, April 27, 2016).

The number of Ridgway's rails detected in the region by OEI is currently at the seven-year average, though the overall trend is slightly negative. In general, the marshes in the region have a low density of rails, in part due to a deficiency of *Spartina* in the region. Because the initial hybrid *Spartina* invasion began here, much of the native *Spartina foliosa* in the region was swamped and extirpated by the expansion of non-native *Spartina*. The subsequent treatment and successful removal of much of the hybrid *Spartina* has left the region bereft of *Spartina*.

In response, the ISP Restoration Program has been reintroducing native *Spartina,* as well as *Grindelia stricta*, to the region over the past five years. As these plantings continue to mature, more rail habitat will become available and the region's rail population is expected to increase in both size and density. Point Blue Conservation Science has begun a multi-year research project to identify the response of rails to revegetation efforts using call count data.

**Figure 6**. Photo of a *Spartina foliosa* revegetation plot at AFCC at the time of initial planting in 2012 (left) and after two years of growth and maturation (right). These plantings are now mature enough to provide habitat for Ridgway's rails present at the site.

**Table 5**. Survey results in the Union City Region from 2010 to 2016 at sites surveyed by OEI this year.

| Site Name (ID) | Highest Minimum Count | | | | | | | Average | Change from Average | Trend |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | | | |
| AFCC - to I-880 (01d) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| AFCC - Strip Marsh (01e) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| OAC - North Bank (13a)[1] | [1] | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | → |
| OAC - Island (13b)[1] | [5] | 2 | 3 | 5 | 4 | 2 | 4 | 4 | 0 | → |
| OAC - South Bank (13c)[1] | [0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Whale's Tail - North (13d)[1] | [5] | 8 | 8 | 2 | 3 | 2 | 2 | 4 | -2 | ↘ |
| OAC - Upstream 20 Tide Gates (13g)[1] | [0] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Eden Landing - North Creek (13h) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Eden Landing - Mt Eden Creek (13j) | 2 | 2 | 0 | 0 | 0 | 0 | 3 | 1 | 2 | → |
| Eden Landing Reserve - South (13k) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Eden Landing Reserve - North (13l) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Eden Landing - Ponds E8A, E9, E8X (13m) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| **Union City Region TOTAL** | **13** | **12** | **11** | **8** | **8** | **4** | **9** | **9** | **0** | ↘ |

[1] Data gaps from 2010 in the Union City Region were assigned data based on the average of 2009 (not shown) and 2011 survey results and are noted in brackets.

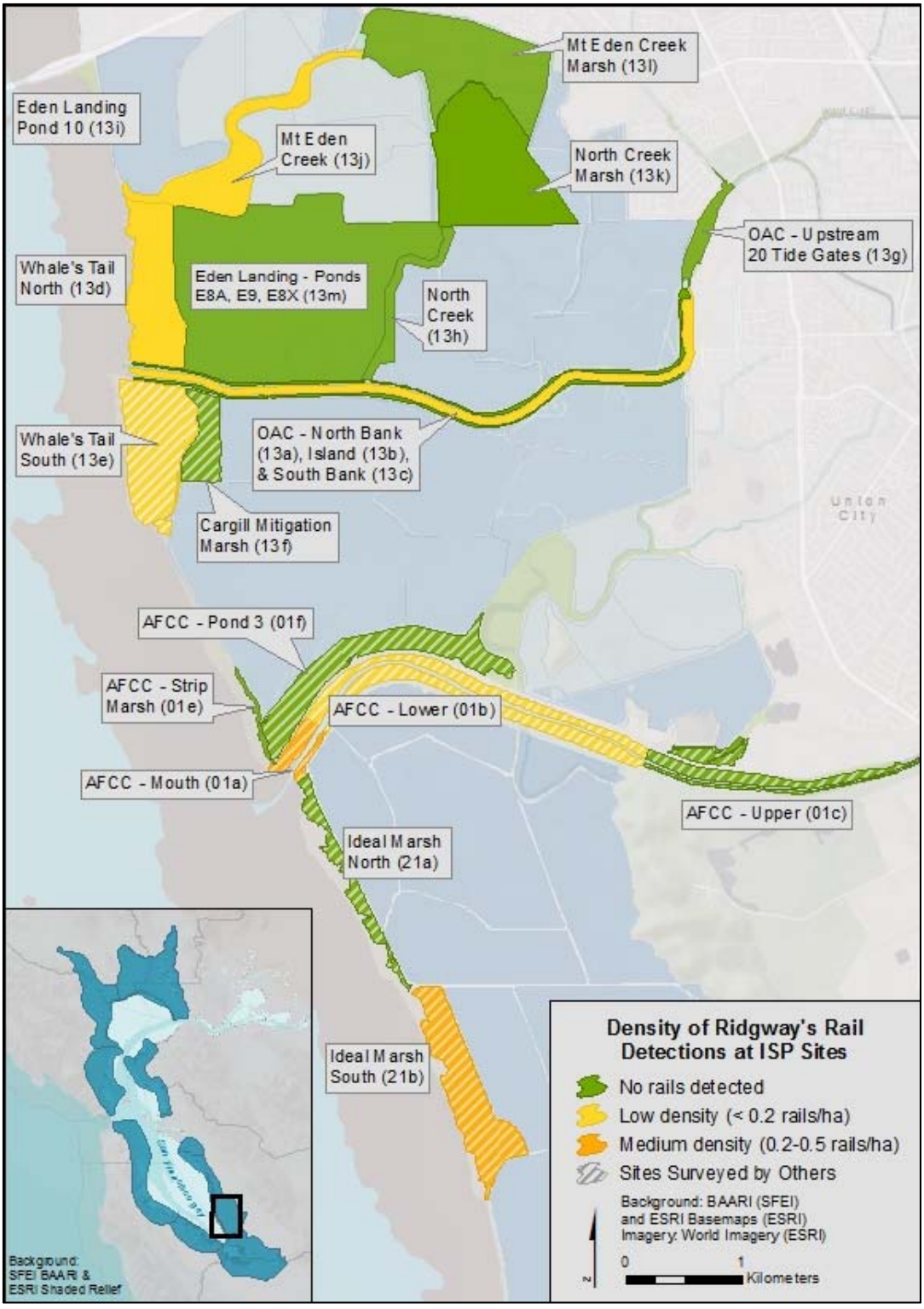


**Figure 7**. Density of Ridgway's rail detected in 2016 at ISP sites in the Union City Region. Density was calculated based on the highest minimum count within the survey area. Sites not surveyed by OEI were surveyed by biologists at the Don Edwards National Wildlife Refuge (DENWR).

## 4.5 Dumbarton South Region

Dumbarton South includes all marshes south of the Dumbarton Bridge, from Newark to Mountain View (**Figure 8**). Sites in this region are generally large parcels of mature marshes on managed and protected lands. They include a variety of habitat types, including freshwater creeks, restored salt ponds, tidal and brackish sloughs, creek deltas, fringing tidal marsh benches, and historic tidal marsh plains. The complex vegetative structure and channel networks of the tidal marshes in the region provide excellent habitat for Ridgway's rails. Accordingly, the region supports large numbers of Ridgway's rails and has some of the most densely occupied sites in the Estuary.

In 2016, OEI conducted surveys at 16 of the 34 ISP rail sites in the region (**Table 6**). DENWR surveyed three sites in the region [(LaRiviere Marsh (05d), Guadalupe Slough (15a.3), and Dumbarton/Audubon Marsh (05b)] and PBCS surveyed an additional five sites [Palo Alto Baylands (08), Palo Alto Harbor (08), Faber Marsh (15b), Laumeister Marsh (15b), and Charleston Slough (15a.1)]. The remaining sites in the region were not surveyed in 2016. One of the unsurveyed sites, Mowry Marsh (05a.1), was intended to be surveyed by airboat during winter high tides by DENWR, however the tides and weather did not allow for these surveys to be completed as planned.

OEI conducted a thorough survey at Island Pond A21 for the first time in 2016 and detected three Ridgway's rails within the site boundary. This site was rapidly colonized by native vegetation since it was restored to tidal action in 2006. Ridgway's rails have, in turn, responded quickly to the restoration. Now that they are established at the site, it is expected that the Ridgway's rail population will continue to grow in response to the high quality habitat at A21.

Rail numbers are increasing in the Dumbarton South Region. This region represents one of the largest Ridgway's rail population centers in the Estuary. OEI detected a minimum of 30 rails in the region, while DENWR detected an additional 23 rails and PBCS detected over 100 more rails in the Dumbarton South Region. There are likely many more rails than that in the region since there are many large tracts of tidal wetlands that are not included in the survey effort or are beyond our threshold of detection.

The region's extensive native tidal wetlands are also being expanded with the restoration of several large tracts of former salt evaporator ponds to marsh. In addition to the restoration of the former salt ponds, the Coastal Conservancy has funded the installation of high tide refuge islands over the past several years at Cooley Landing, Palo Alto Baylands, and Dumbarton Marsh. These restoration and enhancement efforts will enable the continued support of the large rail population center in this region.

**Table 6**. Survey results in the Dumbarton South Region from 2010 to 2016 at sites surveyed by OEI this year.

| Site Name (ID) | Highest Minimum Count | | | | | | | Average | Change from Average | Trend |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | | | |
| Cooley Landing (16) | 3 | 2 | 1 | 16 | 5 | 4 | 10 | 6 | 4 | ↗ |
| Ravenswood Open Space Preserve (02j) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| SF2 (02n) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Calaveras Point (05a.2)[1] | - | - | 37 | 19 | 16 | 13 | 21 | 21 | 0 | ↘ |
| Newark Slough (05c) | 5 | 5 | 8 | 5 | 3 | 3 | 8 | 5 | 3 | → |
| Mayhew's Landing (05e)[1] | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Coyote Creek (05f)[1] | - | - | 0 | 0 | 0 | 0 | 16 | 3 | 13 | ↗ |
| Cargill Pond (W Suites Hotel) (05g)[1] | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Plummer Creek Mitigation (05h)[1] | - | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Island Ponds – A21 (05i) | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | → |
| Mountain View Slough (15a.1)[2] | 2 | [2.5] | 3 | 0 | 1 | 2 | 2 | 2 | 0 | → |
| Stevens Creek to Long Point (15a.2) | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | → |
| Alviso Slough (15a.4) | 9 | 4 | 1 | 3 | 2 | 9 | 8 | 5 | 3 | → |
| Coyote Creek South East (15a.5)[1] | - | 9 | 6 | 6 | 8 | 18 | 19 | 11 | 8 | ↗ |
| Knapp Tract (15a.6) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Stevens Creek (15c) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | → |
| **Dumbarton South Region TOTAL** | **19** | **13.5** | **13** | **25** | **11** | **18** | **33** | **19** | **14** | ↗ |

[1] Sites missing data from the beginning of the time period are excluded from the regional total. The trends and averages for these sites represent less than seven years of data.

[2] Data gaps in the middle of the time series were assigned data based on the average of the preceding and subsequent years and are noted by brackets.

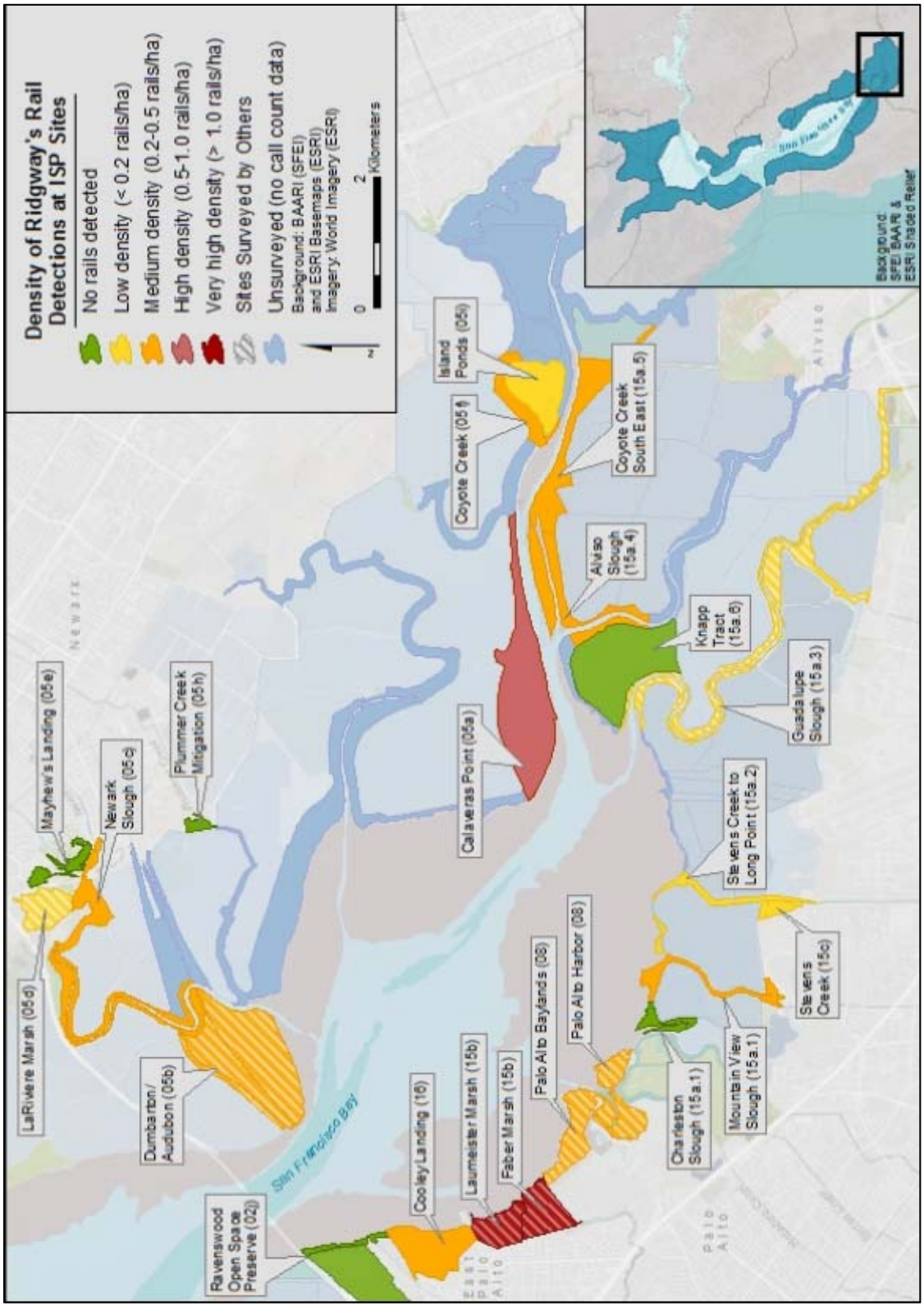


**Figure 8.** Density of Ridgway's rail detected in 2016 at ISP sites in the Dumbarton South Region. Density was calculated based on the highest minimum count within the survey area. LaRiviere Marsh, Dumbarton Marsh, and Guadalupe Slough were surveyed by DENWR. Faber, Laumeister, Palo Alto Baylands, and Palo Alto Harbor were surveyed by PBCS.

## 4.6 San Mateo Region

The San Mateo region extends from the San Mateo Bridge to the Dumbarton Bridge on the west side of the Bay (**Figure 9**). This region contains a variety of wetland habitats, including marsh islands, active and inactive commercial salt ponds, large tidal channels, and bayfront strip marshes. The older marsh parcels in the region support a diverse vegetative community and extensive dendritic channel complexes. These large marshes have a low perimeter-area ratio and are disconnected from the urban mainland by wide sloughs. They provide high-quality habitat for Ridgway's rails.

The region includes 20 ISP rail sites, seventeen of which were surveyed by OEI in 2016. The other sites that were not surveyed either did not support any *Spartina* in 2015 or were part of a larger ISP treatment subarea that was surveyed by an adjacent transect, and so rail surveys were deemed unnecessary. OEI detected a minimum of 128 Ridgway's rails in the San Mateo Region in 2016, a continuation of the positive trend in the region (**Table 7**). Most sites had small to moderate increases, indicating a steady upward trend.

A portion of one site within the region, B2 North (02c), is unique in the Bay in that it is being experimentally treated for invasive *Spartina* using a sub-lethal dose of herbicide (seed suppression) in order to prevent seed set and clonal expansion while still retaining vegetative structure for Ridgway's rails. Rail numbers at this site have been increasing, both within the experimental portion of the site in the north-east and in the fully treated remainder of the site. However, non-native *Spartina* remains a significant component of the overall habitat in the marsh.

Also, the recently restored Pond B3 was surveyed using call counts for the first time this year. However, after repeated visits to the site at mid-to-higher tides, it became apparent that there is too little vegetation and not enough cover to support breeding rails at this site yet. OEI plans to revisit the site using call-count surveys in 2018.

Several avian predators and their nests were observed at Middle Bair (AKA Deepwater Slough) again this year, including red-tailed hawks, peregrine falcons, and common ravens. These observations were reported to DENWR, who planned to remove some of these nests. Several breeding raptors were also observed and reported in 2015, however the Refuge was not able to remove the peregrine falcon nest which probably fledged young last summer. A successful falcon nest last year could be implicated in the decline in detections at this site in 2016. In fact, over the course of the year, rail body parts were found along the boardwalk under the PG&E towers where the falcons and other avian predators were often observed.

The Coastal Conservancy has invested in rail habitat enhancements in the region, including the construction of high tide refuge islands at B2 North, Bird Island, Belmont Slough, Corkscrew Slough, Middle Bair (Deepwater Slough), and Greco Island North. Additionally, the ISP Restoration Program has planted thousands of *Grindelia stricta* seedlings in the region, particularly at Greco North and B2 North. The size of the marshes within the region and the potential habitat available through the restoration of salt ponds should continue to support a stable rail population in the years to come.

**Table 7. S**urvey results from 2010 to 2016 in the San Mateo Region. Sites that were split according to treatment permissions in 2011 are shown in grey italic font (and are not included in the region totals). *Spartina* control work has been restricted to a low dose of herbicide (seed suppression) in B2 North – NE (02c.1b) since 2011; this site is noted in grey shading.

| Site Name (ID) | Highest Minimum Count | | | | | | | Average | Change from Average | Trend |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | | | |
| Belmont Slough (02a.1) | 3 | 4 | 3 | 3 | 5 | 7 | 6 | 4 | 2 | ↗ |
| Redwood Shores (02a.3) | 2 | 2 | 6 | 1 | 0 | 0 | 0[1] | 2 | -2 | ↘ |
| Redwood Shores Mitigation Bank (02a.4) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Corkscrew Slough (02b.1) | 22 | 12 | 17 | 13 | 16 | 15 | 16 | 16 | 0 | → |
| Steinberger Slough (02b.2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| B2 North Quadrant (02c) | 14 | 22 | 12 | 20 | 5 | 18 | 28 | 17 | 11 | ↗ |
| *B2 North Quadrant - NW (02c.1a)* | *0* | *0* | *2* | *2* | *0* | *4* | *6* | *2* | *4* | ↗ |
| *B2 North Quadrant - NE (02c.1b)* | *6* | *16* | *11* | *20* | *5* | *19* | *19* | *14* | *5* | ↗ |
| *B2 North Quadrant - South (02c.2)* | *3* | *2* | *4* | *7* | *0* | *2* | *11* | *4* | *7* | ↗ |
| B2 South Quadrant (02d) | 7 | 6 | 4 | 9 | 3 | 6 | 6 | 6 | 0 | → |
| West Point Slough - NW (02e) | 1 | 2 | 0 | 1 | 0 | 0 | 2 | 1 | 1 | → |
| Greco Island - North (02f) | 9 | 3 | 10 | 6 | 6 | 8 | 5 | 7 | -2 | → |
| West Point Slough - SW/E (02g) | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | → |
| Greco Island - South (02h) | 24 | 22 | 22 | 22 | 32 | 31 | 38 | 27 | 11 | ↗ |
| Ravenswood Slough (02i) | 3 | 9 | 1 | 2 | 2 | 12 | 8 | 5 | 3 | ↗ |
| Middle Bair N (02k) | 10 | 14 | 19 | 24 | 28 | 37 | 19 | 22 | -3 | ↗ |
| Middle Bair SE (02k) | 8 | 9 | 2 | 7 | 7 | 0 | 0[1] | 5 | -5 | ↘ |
| Inner Bair Island Restoration (02l) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Pond B3 Bair Island Restoration (02m) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Middle Bair West (02o) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| **San Mateo Region TOTAL** | **104** | **105** | **97** | **108** | **104** | **134** | **128** | **111** | **14** | ↗ |

[1] No rails were detected at these sites (Redwood Shores and Middle Bair SE) during surveys; however, rails were incidentally detected during *Spartina* surveys later in the year. These detections fell outside of breeding season (after September 1).

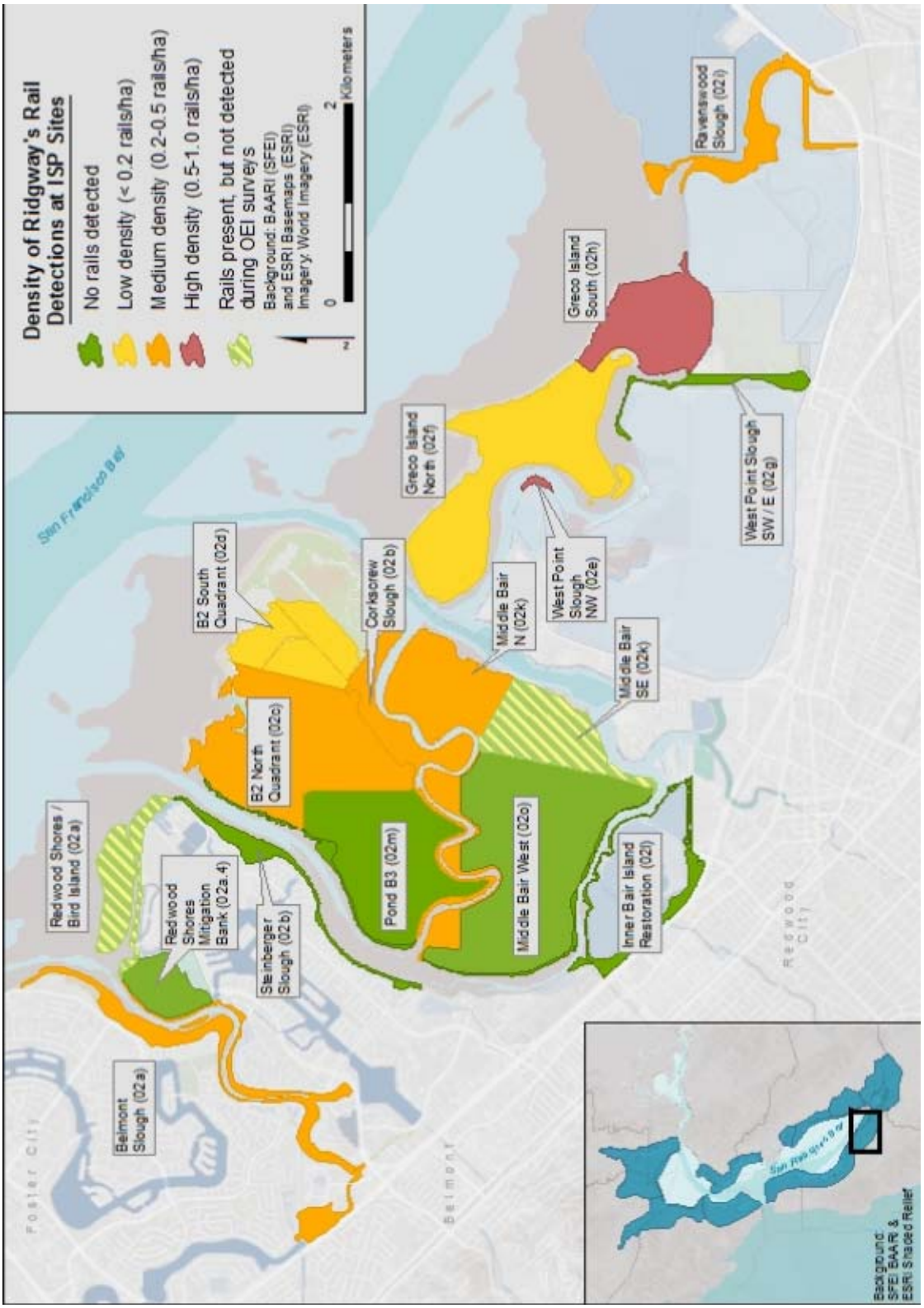


**Figure 9**. Density of Ridgway's rail detected in 2016 at ISP sites in the San Mateo Region. Density was calculated based on the highest minimum count within the survey area. Rails were not detected at Redwood Shores and Middle Bair SE during regular surveys; however, rails were incidentally detected during *Spartina* surveys later in the year, though these detections fell outside of breeding season (after September 1).

## 4.7 San Francisco Peninsula Region

The San Francisco Peninsula Region extends from the Golden Gate Bridge to the San Mateo Bridge (**Figure 10**). This urban region is highly developed and includes several marinas, tidal lagoons, flood control channels, small fragmented patches of remnant marsh, invaded mudflats, and the mouths of several creeks and sloughs. A wide range of land uses can be found here, from San Francisco International Airport (SFO) and shipyards, to light and heavy industry, to commercial and residential development. It includes the cluster of sites within the Colma Creek Complex, as well as the scattered sites along the length of the Peninsula.

The region includes 34 ISP rail sites, 19 of which were surveyed by OEI in 2016 (**Table 8Table 8. Survey results from 2010 to 2016 in the San Francisco Peninsula Region.**). No non-native *Spartina* was detected at the remaining 15 sites in 2015 so surveys were deemed unnecessary in 2016. OEI conducted passive call count surveys (Protocol A) at one site and active call count surveys (Protocol C) at four sites. The remaining 14 sites were assessed for the presence of Ridgway's rail habitat (Protocol F), which was determined to be lacking and no further surveys were necessary.

Once again in 2016, Ridgway's rails were detected at only one site in the region: SFO. The vast majority of the sites in the region are smaller than 10 hectares with high perimeter-to-area ratios. Additionally, the sites are mostly isolated, so dispersal to and from these marshes would be a challenge for juveniles. The absence of rails is expected with the lack of habitat availability in the region.

There are very few opportunities for habitat enhancement along this urban shoreline. Portions of the Colma Creek complex were experimentally planted with native *Spartina foliosa* (Whitney Thornton, Romburg Tiburon Center, SFSU) and San Mateo County has continued to plant along the upland transition zone within the Colma Creek Complex. The remaining marsh fragments in the region offer little opportunity for enhancement and are unlikely to sustain rail populations in the future.

**Table 8**. Survey results from 2010 to 2016 in the San Francisco Peninsula Region.

| Site Name (ID) | Highest Minimum Count | | | | | | | Average | Change from Average | Trend |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | | | |
| Pier 94 (12a) | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Pier 98/Heron's Head (12b) | 1 | 1 | 1 | 3 | 1 | 0 | 0 | 1 | -1 | → |
| Colma Creek (18a) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Navigable Slough (18b)[1] | 0 | 1 | 0 | 0 | 0 | [0] | 0 | 0 | 0 | → |
| Sam Trans Peninsula (18e) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | → |
| San Bruno Marsh (18g) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| San Bruno Creek (18h) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Oyster Cove (19c)[1] | 0 | 0 | 0 | 0 | 0 | [0] | 0 | 0 | 0 | - |
| Oyster Point Park (19e) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Point San Bruno (19f) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | → |
| Seaplane Harbor (19g) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| SFO (19h) | 1 | 2 | 3 | 2 | 3 | 3 | 1 | 2 | -1 | → |
| Mills Creek Mouth (19i) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Easton Creek Mouth (19j) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Sanchez Marsh (19k) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Burlingame Lagoon (19l) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Coyote Point Marina (19n) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Seal Slough (19p) | 1 | 3 | 0 | 1 | 0 | 0 | 0 | 1 | -1 | → |
| Anza Lagoon (19r)[1] | 0 | 0 | 0 | 0 | 0 | [0] | 0 | 0 | 0 | - |
| **San Francisco Peninsula Region TOTAL** | **6** | **7** | **4** | **6** | **4** | **3** | **1** | **4** | **-3** | **↘** |

[1] Data gaps in the middle of the time series were assigned data based on the average of the preceding and subsequent years and are noted by brackets.

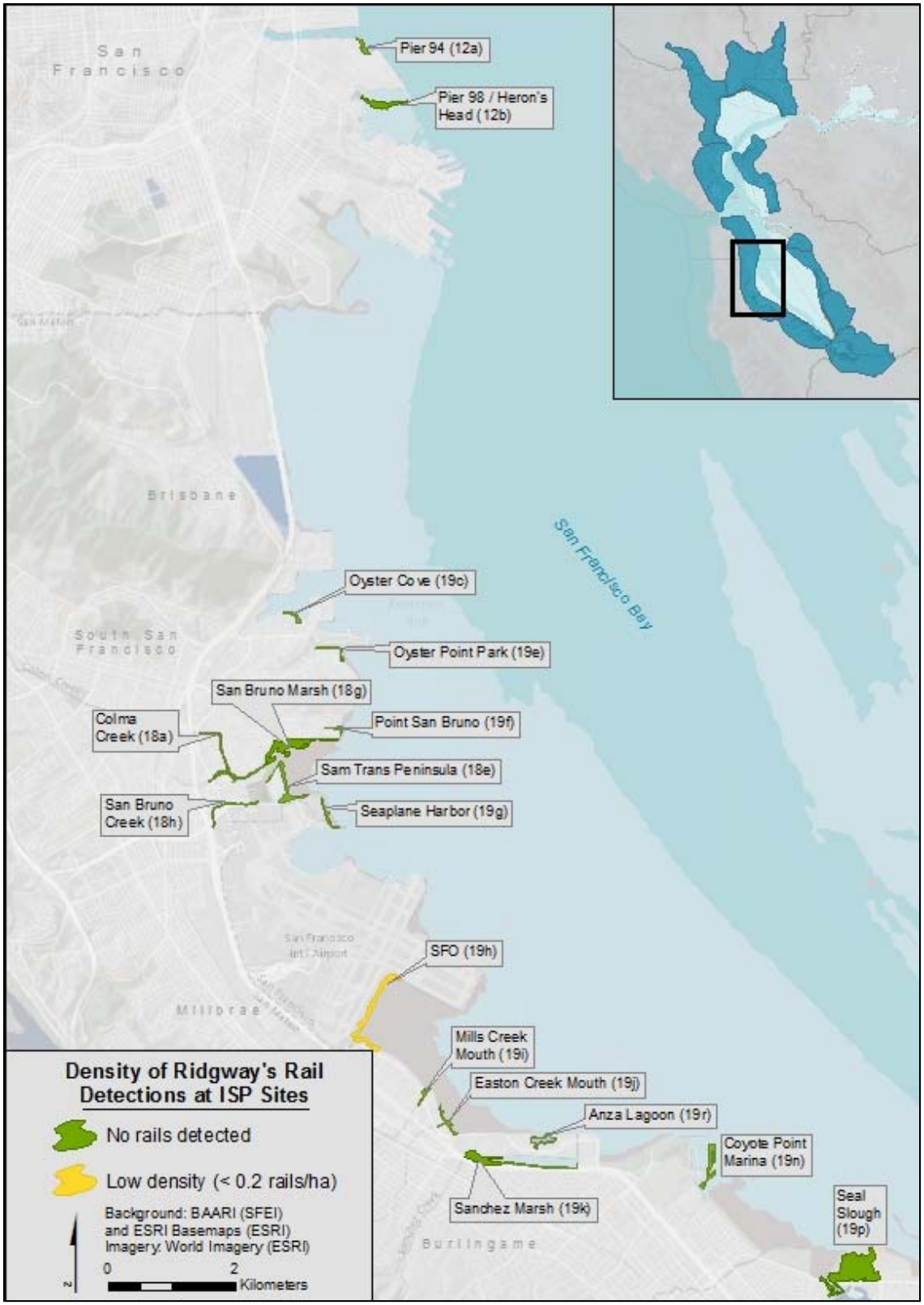


**Figure 10.** Density of Ridgway's rail detected in 2016 at ISP sites in the SF Peninsula Region. Density was calculated based on the highest minimum count within the survey area. Crissy Field (12g) is located in northern San Francisco and is not displayed on this map; the site does not provide habitat for Ridgway's rails.

## 4.8 Marin Region

The Marin Region extends from the Golden Gate Bridge to the Richmond Bridge in Marin County (**Figure 11**). The region contains many small, disconnected sites scattered along the shoreline and some larger, older marshes at the mouth of Corte Madera Creek. The shoreline is fairly developed, with a variety of wetland habitat types, including several marinas, tidal lagoons, flood control channels, small fragmented marshes, large restored marshes, invaded mudflats, and several creeks and sloughs. The Marin Region has had relatively little impact from hybrid *Spartina*, which never gained a substantial foothold in the area. The Corte Madera Creek Complex, however, has been the epicenter for the invasive *Spartina densiflora* invasion in the Bay.

The region includes 30 ISP rail sites, 17 of which were surveyed by OEI in 2016 (**Table 9**). PBCS surveyed an additional eight sites, including the more densely occupied tidal marshes in the Corte Madera Complex. OEI detected a total of 13 rails in the Marin Region in 2016 and PBCS detected approximately 50 Ridgway's rails during their surveys there.

The sites that OEI surveys within the region are small tidal wetlands in Marin's residential neighborhoods along the Bay. Overall, the number of rails detected has declined over the past seven years at sites surveyed by OEI in the region. However, we did see a return of rails to a site where they have been absent for several years: Pickleweed Park (AKA Tiscornia Marsh). This site historically had a consistent rail population for many years, surprising considering the small size of the marsh (less than 6 hectares). However, rails had not been detected at the site since 2012. The return of rails to this site is likely from the dispersal of rails at the larger, more densely occupied marshes in the Petaluma Region to the north and could indicate population increases there.

**Table 9.** Survey results in the Marin Region from 2010 to 2016 at sites surveyed by OEI this year.

| | Highest Minimum Count | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Site Name (ID) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Average | Change from Average | Trend |
| Pickleweed Park (9) | 10 | 8 | 1 | 0 | 0 | 0 | 6 | 4 | 2 | ↘ |
| Blackie's Creek (03a) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Blackie's Creek Mouth (03b) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Larkspur Ferry Landing (04e) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Riviera Circle (04f) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Creekside Park (04g) | 8 | 9 | 12 | 3 | 9 | 4 | 5 | 7 | -2 | ↘ |
| CMC - Upper (04h) | 4 | 8 | 3 | 2 | 2 | 2 | 0 | 3 | -3 | ↘ |
| CMC - Lower (04i) | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | - |
| CMC - Mouth (04j) | 4 | 5 | 2 | 2 | 1 | 1 | 0 | 2 | -2 | ↘ |
| Beach Drive (23b) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Loch Lomond Marina (23c) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| San Rafael Canal Mouth (23d) | 2 | 2 | 2 | 1 | 1 | 0 | 2 | 1 | 1 | ↘ |
| Paradise Cay (23f) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Greenwood Beach (23g) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Strawberry Point (23h) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Strawberry Cove (23i) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Starkweather Park (23l) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| **Marin Region TOTAL** | **28** | **32** | **20** | **9** | **13** | **7** | **13** | **17** | **-4** | **↘** |

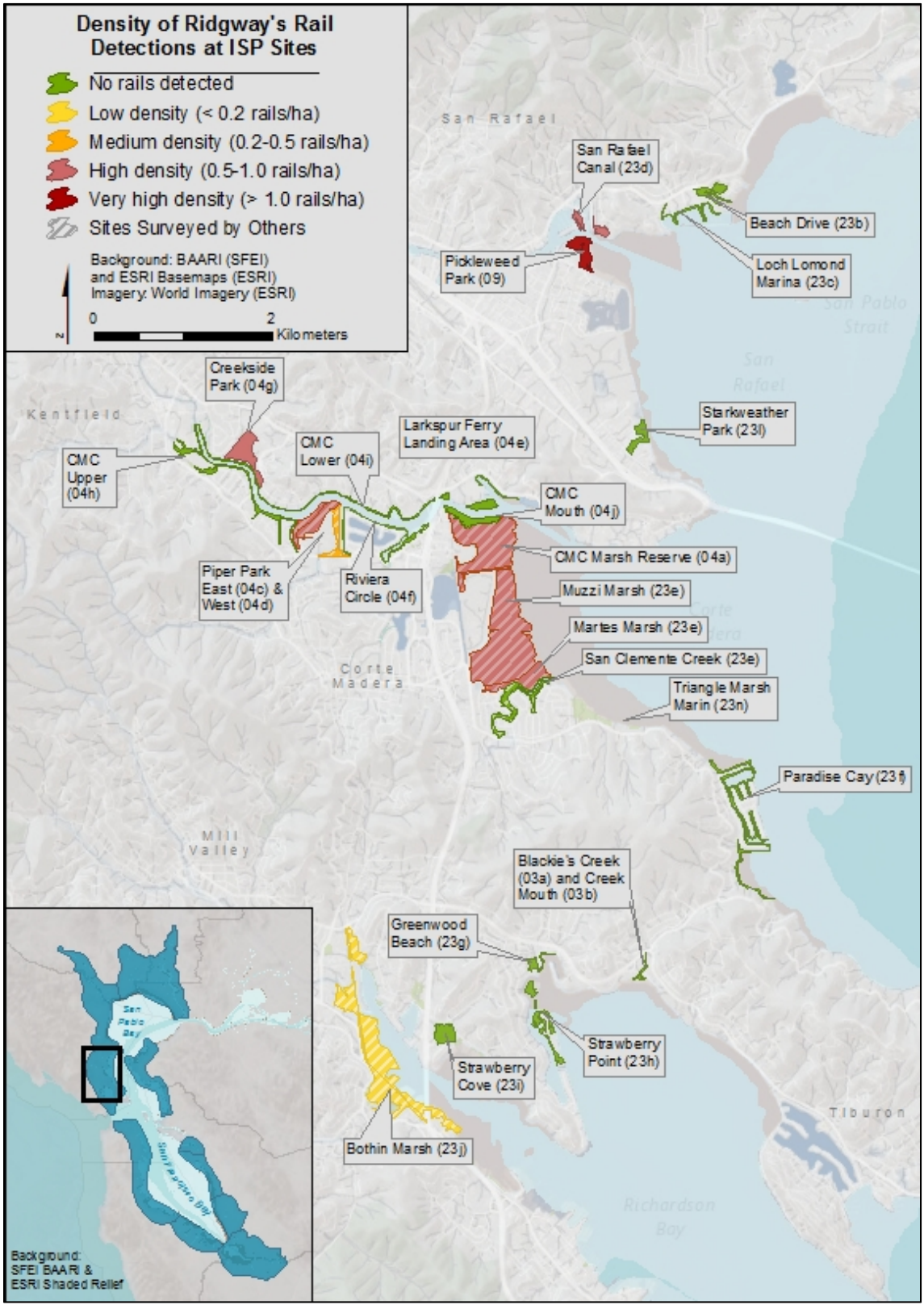


**Figure 11.** Density of Ridgway's rail detected in 2016 at ISP sites in the Marin Region. Density was calculated based on the highest minimum count within the survey area.

## 4.9 San Pablo Bay – Vallejo and Petaluma Regions

San Pablo Bay includes both the Vallejo and Petaluma Regions (**Figure 12**). The Petaluma Region includes some of the largest and most densely occupied marshes in the North Bay, including McInnis Marsh, Gallinas Creek, and the marshes along the Petaluma River. Most of the sites within the San Pablo Bay regions were surveyed by other organizations: PBCS surveyed 19 sites, SPBNWR surveyed three sites, DENWR surveyed two sites, ARA surveyed two sites, and Len Liu surveyed one site. Invasive *Spartina* has a very small presence in the area and the survey effort by OEI in the Petaluma and Vallejo Regions was minimal.

In 2016, OEI only surveyed a small portion of one marsh within this large region: San Pablo Bay NWR Shoreline (AKA Mare Island Shoreline) (**Table 10**). No rails were detected in the portion of the site that OEI surveys. However, OEI only surveys 2% of this very large site, so the lack of rail detections by OEI does not indicate an absence of Ridgway's rails at the site. Although OEI did not detect any rails in this region this year, the Ridgway's rail population is actually quite substantial in the San Pablo Bay regions. In fact, PBCS detected over 250 Ridgway's rails in the area in 2016 (M. Elrod, personal communication, June 24, 2016). Survey results from other organizations are still being tallied, but it is clear that these regions contain a substantial portion of the Estuary-wide population of Ridgway's rails.

**Table 10.** Survey results from 2010 to 2016 at the only site surveyed by OEI in the San Pablo Bay Region this year.

| | Highest Minimum Count | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Site Name (ID) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Average | Change from Average | Trend |
| San Pablo Bay NWR Shoreline (26b) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |

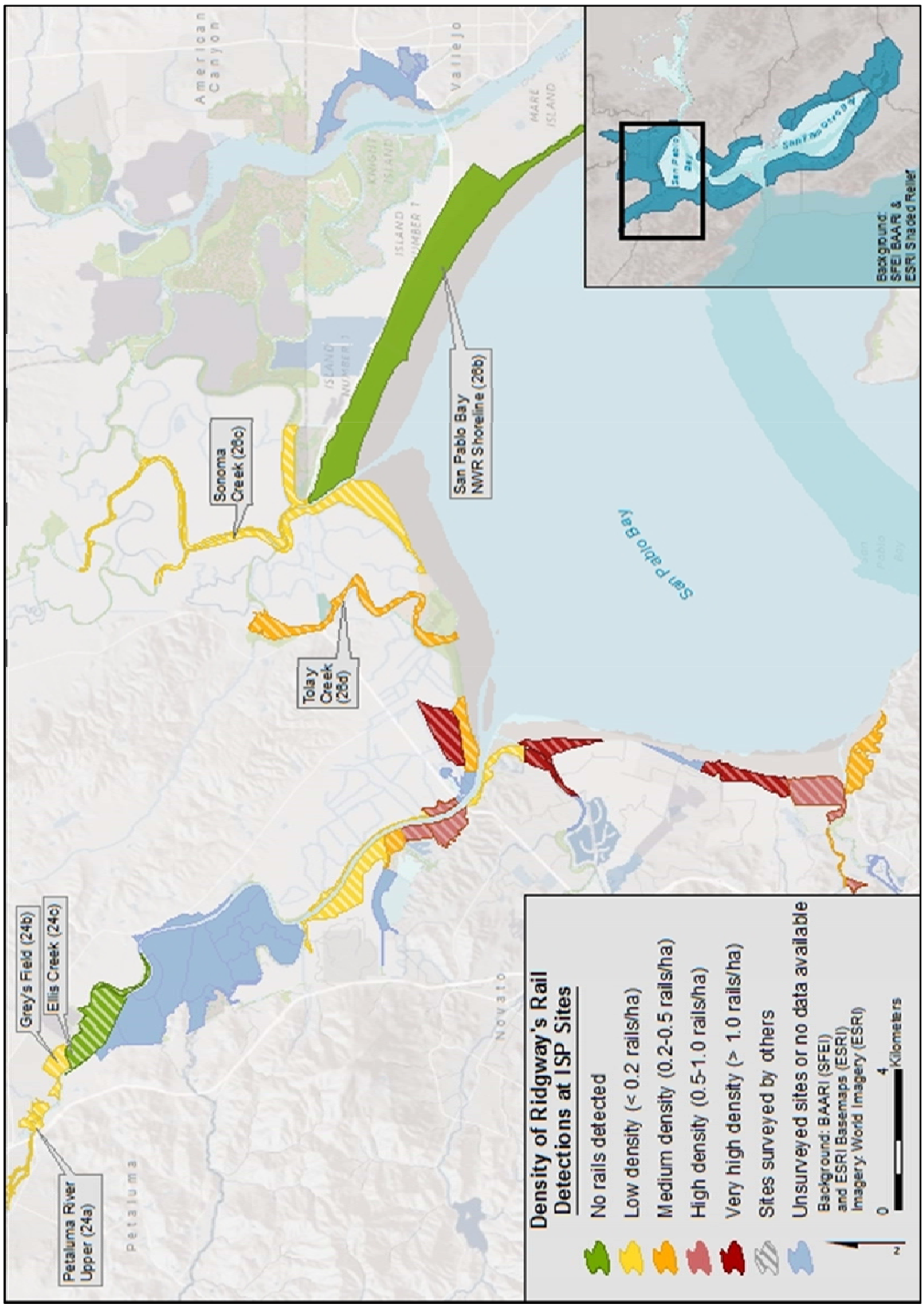


**Figure 12.** Density of Ridgway's rail detected in 2016 at ISP sites in San Pablo Bay (Petaluma and Vallejo Regions). Density was calculated based on the highest minimum count within the survey area. Sites not surveyed by OEI were surveyed by PBCS and DENWR.

# 5. Discussion

The number of California Ridgway's rails detected at sites surveyed by OEI in 2016 is at its highest over our seven-year study period. In 2016, OEI biologists detected a total of approximately 420 rails, which is an increase of about 100 detections over the seven-year average. However, over 75% of the increase in detections at the subset of sites surveyed by OEI are from the eleven sites where *Spartina* treatment is currently restricted.

In 2011, USFWS indicated that full treatment of hybrid *Spartina* would not be permitted at these eleven sites until rail numbers increased by 80 rails bay-wide over 2010 numbers for three consecutive years. A subset of ISP sites surveyed by OEI and partners at DENWR, PBCS, and SPBNWR are included in the 2010 baseline and subsequent analysis. Preliminary results from partners indicate that the past two years each exceed 80 rails above the 2010 baseline and the average of the past three years also exceed 80 rails over the 2010 baseline. If and when USFWS has agreed that the goal has been met, phased *Spartina* treatment will resume at some of the restricted sites through careful coordination and planning with USFWS to minimize impacts to rails.

It is clear that the increased hybrid *Spartina* cover at the eleven restricted-treatment sites is providing added habitat value and the rail numbers are positively responding to the expansion of *Spartina* and the resumption of treatment at these sites will result in local declines to rail numbers. Mechanisms to reduce these loses must be identified and enacted. Habitat enhancement and restoration may ameliorate the effects of the temporary loss of cover due to *Spartina* removal. However more extreme solutions, such as translocation, should be considered, particularly at sites where the native condition cannot support the number of rails currently present.

The ISP is working to rapidly reestablish native vegetation and high tide refuge to support and increase the bay-wide Ridgway's rail population. These efforts include extensive revegetation of both *Grindelia stricta* and *Spartina foliosa* plantings. Additionally, the Coastal Conservancy has invested in the construction of high tide refuge islands. Approximately 60 islands have been installed to date. The efficacy of these enhancements for Ridgway's rails remains to be determined. Currently PBCS is working on a multi-year analysis of call-count data to identify the response of rail populations at sites with habitat enhancements. However, it will take several more years before the magnitude of the rail response can be identified.

Ultimately, the most effective means to increase the Ridgway's rail population in the Estuary in the long term will be to increase the amount of salt marsh habitat available through the restoration of large tracts of tidal wetlands. Many of these efforts are already well on their way through the South Bay Salt Pond Restoration Project and the restoration of the Napa-Sonoma Baylands. As more of these newly-breached sites mature and become vegetated, biologists expect to see Ridgway's rails colonize and increase in numbers in response to the restored habitat. Island Pond A21 is an example of the positive response by rails to restoration.

# 6. Permits

Surveys were conducted under the authority of U.S. Fish and Wildlife Service permit TE118356-3 and a Memorandum of Understanding with the California Department of Fish and Wildlife. Surveys were required by and conducted pursuant to conditions of the Programmatic Formal Intra-Service Endangered Species Consultation on the San Francisco Estuary Invasive *Spartina* Project and subsequent additional formal intra-Service consultations on implementation of the San Francisco Estuary Invasive *Spartina* Project. Permission for site access was granted by East Bay Regional Park District, the City of San Leandro, California Department of Fish and Wildlife, Cargill, City of Mountain View, Mid-Peninsula Regional Open Space District, Redwood City Marina, Westpoint Harbor, SFO International Airport, and Don Edwards San Francisco Bay National Wildlife Refuge.

# 7. References

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# Appendix I: Complete List of 2016 Spartina Treatment Sites and Ridgway's Rail Survey Plans by Site

**Appendix I:** Complete list of 2016 *Spartina* treatment sites and associated Ridgway's rail survey plans by survey organization (key to acronyms of survey organizations follows) and survey type (see Appendix II for complete descriptions of survey protocols). Sites noted by asterisks (*) no longer support non-native *Spartina*

| Complex Code | Complex Name | Site Code | Site Name | Survey Organization | Survey Type |
|---|---|---|---|---|---|
| 1 | Alameda Flood Control Channel | 01a | AFCC - Mouth | DENWR | C |
| | | 01b | AFCC - Lower | DENWR | C |
| | | 01c | AFCC - Upper | DENWR | C |
| | | 01d | AFCC - to I-880 | ISP | F |
| | | 01e | AFCC - Strip Marsh | ISP | F |
| | | 01f | AFCC - Pond 3 | DENWR | C |
| 2 | Bair / Greco Islands | 02a.1 | Belmont Slough North | ISP | A |
| | | 02a.2 | Belmont to Steinberger | ISP | A |
| | | 02a.3 | Redwood Shores / Bird Island | ISP | A |
| | | 02a.4 | Redwood Shores Mitigation Marsh | ISP | F |
| | | 02b.1 | Corkscrew Slough | ISP | A |
| | | 02b.2 | Steinberger Slough | ISP | C |
| | | 02c | B2 North Quadrant | ISP | A |
| | | 02d | B2 South Quadrant | ISP | A |
| | | 02e | West Point Slough - NW | ISP | C |
| | | 02f | Greco Island - North | ISP | A |
| | | 02g | West Point Slough - SW / E | ISP | C |
| | | 02h | Greco Island - South | ISP | A |
| | | 02i | Ravenswood Slough/Mouth | ISP | A |
| | | 02j | Ravenswood Open Space Preserve | ISP | C |
| | | 02k | Middle Bair N | ISP | A |
| | | 02k | Middle Bair SE | ISP | A |
| | | 02l | Inner Bair Island Restoration | ISP | C |
| | | 02m | Pond B3 Bair Island Restoration | ISP | C |
| | | 02n | SF2 | ISP | F |
| | | 02o | Middle Bair West | ISP | F |
| 3 | Blackie's Pasture | 03a | Blackie's Creek | ISP | F |
| | | 03b | Blackie's Creek Mouth | ISP | F |
| 4 | Corte Madera Creek | 04a | CMC Marsh Reserve | PBCS | A |
| | | 04b | College of Marin* | none | - |
| | | 04c | Piper Park - East | PBCS | A |
| | | 04d | Piper Park - West | PBCS | A |
| | | 04e | Larkspur Ferry Landing Area | ISP | F |
| | | 04f | Riviera Circle | ISP | F |
| | | 04g | Creekside Park | ISP | A |
| | | 04h | CMC - Upper | ISP | A |
| | | 04i | CMC - Lower | ISP | C |
| | | 04j | CMC - Mouth | ISP | A |
| | | 04k | Boardwalk No. 1 | PBCS | A |
| | | 04l | Murphy Creek * | none | - |

*These sites no longer support non-native *Spartina*.

| Complex Code | Complex Name | Site Code | Site Name | Survey Organization | Survey Type |
|---|---|---|---|---|---|
| 5 | Coyote Creek / Mowry | 05a.1 | Mowry Marsh North[¥] | None | - |
| | | 05a.2 | Calaveras Point | ISP | A |
| | | 05b | Dumbarton/Audubon | ISP | A |
| | | 05c | Newark Slough | ISP | A |
| | | 05d | LaRiviere Marsh | DENWR | B |
| | | 05e | Mayhew's Landing | ISP | C |
| | | 05f | Coyote Creek | DENWR | A |
| | | 05g | Cargill Pond (W Suites Hotel) | ISP | C |
| | | 05h | Plummer Creek Mitigation | ISP | C |
| | | 05i | Island Ponds | DENWR | C |
| 6 | Emeryville Crescent | 06a | Emeryville Crescent - East | ISP | C |
| | | 06b | Emeryville Crescent - West | ISP | C |
| 7 | Oro Loma Marsh | 07a | Oro Loma - East | ISP | A |
| | | 07b | Oro Loma - West | ISP | A |
| 8 | Palo Alto Baylands | 08 | Palo Alto Baylands | PBCS | A |
| | | 08 | Palo Alto Harbor | PBCS | A |
| 9 | Pickleweed Park | 09 | Pickleweed Park | ISP | C |
| 10 | Point Pinole Marshes | 10a | Whittel Marsh | ISP | A |
| | | 10b | Southern Marsh | ISP | F |
| | | 10c | Giant Marsh | ISP | C |
| | | 10d | Breuner Marsh Restoration | ISP | F |
| 11 | Carquinez Straits | 11 | Southampton Marsh | ARA | A |
| 12 | Southeast San Francisco | 12a | Pier 94 | ISP | F |
| | | 12b | Pier 98/Heron's Head | ISP | C |
| | | 12c | India Basin * | None | - |
| | | 12d | Hunters Point Naval Reserve * | None | - |
| | | 12e | Yosemite Channel* | None | - |
| | | 12f | Candlestick Cove* | None | - |
| | | 12g | Crissy Field* | None | - |
| | | 12h | Yerba Buena Island * | None | - |
| | | 12i | Mission Creek * | None | - |
| 13 | Whale's Tail Complex | 13a | OAC - North Bank | ISP | A |
| | | 13b | OAC - Island | ISP | A |
| | | 13c | OAC - South Bank | ISP | A |
| | | 13d | Whale's Tail - North | ISP | A |
| | | 13e | Whale's Tail - South | DENWR | C |
| | | 13f | Cargill Mitigation Marsh | DENWR | C |
| | | 13g | OAC - Upstream 20 Tide Gates | ISP | F |
| | | 13h | Eden Landing - North Creek | ISP | F |
| | | 13i | Eden Landing - Pond 10* | None | - |
| | | 13j | Eden Landing - Mt Eden Creek | ISP | C |
| | | 13k | Eden Landing Reserve - South | ISP | C |
| | | 13l | Eden Landing Reserve - North | ISP | F |
| | | 13m | Eden Landing – Ponds E8A, E9, E8X | ISP | F |

[¥] This site was slated to be surveyed by DENWR using an airboat during the highest winter tides (Protocol E). However, tides and weather were not suitable to conduct the survey and this portion of site 05a was not surveyed in 2016 by any organizations.
* These sites no longer support non-native *Spartina*.

| Complex Code | Complex Name | Site Code | Site Name | Survey Organization | Survey Type |
|---|---|---|---|---|---|
| 15 | South Bay Marshes | 15a.1 | Charleston / Mountain View Slough | PBCS | A |
| | | 15a.2 | Stevens Creek to Long Point | ISP | C |
| | | 15a.3 | Guadalupe Slough | ISP | A |
| | | 15a.4 | Alviso Slough | ISP | A |
| | | 15a.5 | Coyote Creek South East | ISP | A |
| | | 15a.6 | Knapp Tract | ISP | F |
| | | 15b | Faber/ Laumeister Marsh | PBCS | A |
| | | 15c | Stevens Creek | ISP | C |
| 16 | Cooley Landing | 16 | Cooley Landing | ISP | A |
| 17 | San Leandro Bay | 17a | Elsie Roemer | ISP | F |
| | | 17b | Bay Farm Island | ISP | F |
| | | 17c | Arrowhead Marsh | EBRPD/ISP | B |
| | | 17d | MLK Regional Shoreline – Damon Marsh | ISP | A |
| | | 17e | San Leandro Creek | ISP | A |
| | | 17f | Oakland Inner Harbor | ISP | F |
| | | 17g | Coast Guard Is | ISP | F |
| | | 17h | MLK New Marsh | ISP | A |
| | | 17i | Coliseum Channels | ISP | F |
| | | 17j | Fan Marsh | ISP | A |
| | | 17k | Airport Channel | ISP | F |
| | | 17l | Doolittle Pond | ISP | C |
| | | 17m | Alameda Island - East | ISP | F |
| 18 | Colma Creek / San Bruno | 18a | Colma Creek | ISP | F |
| | | 18b | Navigable Slough | ISP | F |
| | | 18c | Old Marina* | None | - |
| | | 18d | Inner Harbor* | None | - |
| | | 18e | Sam Trans Peninsula | ISP | F |
| | | 18f | Confluence Marsh* | None | - |
| | | 18g | San Bruno Marsh | ISP | C |
| | | 18h | San Bruno Creek | ISP | F |
| 19 | West San Francisco Bay | 19a | Brisbane Lagoon* | None | - |
| | | 19b | Sierra Point* | None | - |
| | | 19c | Oyster Cove | ISP | F |
| | | 19d | Oyster Point Marina* | None | - |
| | | 19e | Oyster Point Park | ISP | F |
| | | 19f | Point San Bruno | ISP | F |
| | | 19g | Seaplane Harbor | ISP | F |
| | | 19h | SFO | ISP | A |
| | | 19i | Mills Creek Mouth | ISP | F |
| | | 19j | Easton Creek Mouth | ISP | F |
| | | 19k | Sanchez Marsh | ISP | C |
| | | 19l | Burlingame Lagoon | ISP | F |
| | | 19m | Fisherman's Park* | None | - |
| | | 19n | Coyote Point Marina | ISP | F |
| | | 19o | San Mateo Creek* | None | - |
| | | 19p | Seal Slough Mouth | ISP | C |
| | | 19q | Foster City* | None | - |
| | | 19r | Anza Lagoon | ISP | F |
| | | 19s | Maple Street Channel* | None | - |

*These sites no longer support non-native *Spartina*.

| Complex Code | Complex Name | Site Code | Site Name | Survey Organization | Survey Type |
|---|---|---|---|---|---|
| 20 | San Leandro / Hayward Shoreline | 20a | Oyster Bay Regional Shoreline | ISP | F |
| | | 20b | Oakland Golf Links | ISP | F |
| | | 20c | Dog Bone Marsh | ISP | C |
| | | 20d | Citation Marsh | ISP | A |
| | | 20e | East Marsh | ISP | A |
| | | 20f | North Marsh | ISP | A |
| | | 20g | Bunker Marsh | ISP | A |
| | | 20h | San Lorenzo Creek & Mouth | ISP | A |
| | | 20i | Bockmann Channel | OEI | G |
| | | 20j | Sulphur Creek | ISP | A |
| | | 20k | Hayward Landing | ISP | C |
| | | 20l | Johnson's Landing | ISP | F |
| | | 20m | Cogswell - Sec A | ISP | A |
| | | 20n | Cogswell - Sec B | ISP | A |
| | | 20o | Cogswell - Sec C | ISP | A |
| | | 20p | Hayward Shoreline Outliers | ISP | F |
| | | 20q | San Leandro Shoreline Outliers | ISP | F |
| | | 20r | Oakland Airport | ISP | C |
| | | 20s | HARD Marsh | ISP | C |
| | | 20t | San Leandro Marina* | None | - |
| | | 20u | Estudillo Creek Channel | ISP | F |
| | | 20v | Hayward Landing Canal | ISP | F |
| | | 20w | Triangle Marsh - Hayward | ISP | C |
| 21 | Ideal Marsh | 21a | Ideal Marsh - North | DENWR | C |
| | | 21b | Ideal Marsh - South | DENWR | C |
| 22 | Two Points Complex | 22a | Wildcat Marsh | PBCS | A |
| | | 22b | San Pablo Marsh | PBCS | A |
| | | 22c | Rheem Creek Area | ISP | A |
| | | 22d | Meeker Slough | ISP | A |
| | | 22d | Stege Marsh | ISP | A |
| | | 22e | Hoffman Marsh | ISP | A |
| | | 22f | Richmond/Albany Shoreline | ISP | F |
| 23 | Marin Outliers | 23a | Brickyard Cove* | None | - |
| | | 23b | Beach Drive | ISP | F |
| | | 23c | Loch Lomond Marina | ISP | F |
| | | 23d | San Rafael Canal Mouth North | ISP | C |
| | | 23e | Muzzi Marsh | PBCS | A |
| | | 23f | Paradise Cay | ISP | F |
| | | 23g | Greenwood Beach | ISP | F |
| | | 23h | Strawberry Point | ISP | F |
| | | 23i | Strawberry Cove | ISP | F |
| | | 23j | Bothin Marsh | PBCS | A |
| | | 23k | Sausalito* | None | - |
| | | 23l | Starkweather Park | ISP | F |
| | | 23m | Santa Venetia | PBCS | A |
| | | 23m | McInnis Marsh | PBCS | A |
| | | 23n | Triangle Marsh – Marin* | None | - |
| | | 23o | China Camp | PBCS | A |

*These sites no longer support non-native *Spartina*.

| Complex Code | Complex Name | Site Code | Site Name | Survey Organization | Survey Type |
|---|---|---|---|---|---|
| 24 | Petaluma River | 24a | Petaluma River - Upper | PBCS | A |
| | | 24b | Grey's Field | PBCS | A |
| | | 24c | Petaluma Marsh | PBCS | A |
| | | 24d | Black John Slough North | PBCS | A |
| 26 | North San Pablo Bay | 26a | White Slough Marsh* | none | - |
| | | 26b | San Pablo Bay NWR Shoreline | ISP | F |
| | | 26c | Sonoma Creek | SPBNWR | A |
| | | 26d | Lower Tubbs Island | SPBNWR | A |
| | | 26d | Tolay Creek | SPBNWR | A |
| | | 26d | Sonoma Baylands East | SPBNWR | A |

*These sites no longer support non-native *Spartina*.

**KEY to Survey Organizations:**

- **ARA** = Avocet Research Associates (contact Jules Evens)
- **ISP** = Olofson Environmental, Inc. for the Invasive *Spartina* Project (contact Jen McBroom)
- **OEI** = Olofson Environmental, Inc. for an outside agency or company (contact Jen McBroom)
- **PBCS** = Point Blue Conservation Science (contact Julian Wood)
- **DENWR** = Don Edwards National Wildlife Refuge (contact Rachel Tertes)
- **SPBNWR** = San Pablo Bay National Wildlife Refuge (contact Meg Marriott)

# Appendix II: 2016 Survey Station Coordinates in UTM (NAD83, Zone 10)

Appendix II: Survey stations by site and their geographic coordinates in UTM (NAD83, Zone10)

**REGION: BAY BRIDGE NORTH**

| Sub-area Code | Site Name | Point ID | X Coordinate | Y Coordinate |
|---|---|---|---|---|
| 06a | Emeryville Crescent - East | EMCR07 | 560954 | 4186746 |
| 06a | Emeryville Crescent - East | EMCR14 | 561702 | 4187997 |
| 06a | Emeryville Crescent - East | EMCR15 | 561891 | 4187888 |
| 06b | Emeryville Crescent - West | EMCR02 | 560250 | 4186896 |
| 06b | Emeryville Crescent - West | EMCR03 | 560177 | 4186720 |
| 06b | Emeryville Crescent - West | EMCR04 | 560358 | 4186670 |
| 06b | Emeryville Crescent - West | EMCR05 | 560565 | 4186723 |
| 06b | Emeryville Crescent - West | EMCR06 | 560742 | 4186744 |
| 06b | Emeryville Crescent - West | EMCR01 | 560433 | 4186905 |
| 10a | Whittel Marsh | PTPN01 | 556260 | 4206711 |
| 10a | Whittel Marsh | PTPN02 | 556460 | 4206771 |
| 10a | Whittel Marsh | PTPN03 | 556645 | 4206685 |
| 10a | Whittel Marsh | PTPN04 | 556830 | 4206771 |
| 10c | Giant Marsh | PPF01 | 556238 | 4205274 |
| 10c | Giant Marsh | PPF05 | 556420 | 4205053 |
| 10c | Giant Marsh | PPF06 | 556443 | 4204834 |
| 10c | Giant Marsh | PPF07 | 556234 | 4204657 |
| 22c | Rheem Creek Area | RCRA03 | 555821 | 4203918 |
| 22c | Rheem Creek Area | RCRA04 | 555895 | 4204106 |
| 22c | Rheem Creek Area | RCRA05 | 555917 | 4204343 |
| 22c | Rheem Creek Area | RCRA12 | 555741 | 4203735 |
| 22d | Stege Marsh | MEEK03 | 558280 | 4196127 |
| 22d | Stege Marsh | MEEK04 | 558463 | 4196076 |
| 22d | Stege Marsh | MEEK05 | 558183 | 4195946 |
| 22d | Stege Marsh | MEEK06 | 558770 | 4195989 |
| 22d | Stege Marsh | MEEK07 | 559080 | 4195902 |
| 22e | Hoffman Marsh | HOM06 | 559640 | 4195672 |
| 22e | Hoffman Marsh | HOM07 | 559818 | 4195374 |
| 22e | Hoffman Marsh | HOM08 | 560031 | 4195055 |

**REGION: SAN LEANDRO BAY**

| Sub-area Code | Site Name | Point ID | X Coordinate | Y Coordinate |
|---|---|---|---|---|
| 17c | Arrowhead Marsh | ARHE01 | 569510 | 4177535 |
| 17d | MLK Regional Shoreline | MLKS09 | 569336 | 4178901 |
| 17d | MLK Regional Shoreline | MLKS10 | 569456 | 4178741 |
| 17d | MLK Regional Shoreline | MLKS11 | 569515 | 4178546 |
| 17e | San Leandro Creek | SLEA01 | 569805 | 4177557 |
| 17e | San Leandro Creek | SLEA02 | 569923 | 4177386 |
| 17e | San Leandro Creek | SLEA03 | 570046 | 4177211 |
| 17e | San Leandro Creek | SLEA04 | 570174 | 4177030 |
| 17e | San Leandro Creek | SLEA05 | 570298 | 4176856 |
| 17e | San Leandro Creek | SLEA06 | 570418 | 4176690 |
| 17e | San Leandro Creek | SLEA07 | 570529 | 4176533 |
| 17h | MLK New Marsh | MLKR01 | 569671 | 4177003 |
| 17h | MLK New Marsh | MLKR02 | 569622 | 4177196 |
| 17h | MLK New Marsh | MLKR03 | 569706 | 4177372 |
| 17h | MLK New Marsh | MLKR04 | 569712 | 4177546 |
| 17h | MLK New Marsh | MLKR05 | 569837 | 4177413 |
| 17h | MLK New Marsh | MLKR06 | 569948 | 4177254 |
| 17h | MLK New Marsh | MLKR07 | 570046 | 4177104 |
| 17j | Fan Marsh | FANM01 | 568582 | 4177668 |
| 17j | Fan Marsh | FANM03 | 568635 | 4177820 |
| 17j | Fan Marsh | FANM04 | 568768 | 4177689 |
| 17l | Doolittle Pond | DOPO03 | 568130 | 4177879 |
| 17l | Doolittle Pond | DOPO04 | 568396 | 4177885 |

**REGION: HAYWARD**

| Sub-area Code | Site Name | Point ID | X Coordinate | Y Coordinate |
|---|---|---|---|---|
| 07a | Oro Loma - East | ORLW17 | 574749 | 4168949 |
| 07a | Oro Loma - East | ORLW18 | 574912 | 4169047 |
| 07a | Oro Loma - East | ORLW19 | 575313 | 4169028 |
| 07a | Oro Loma - East | ORLW20 | 575474 | 4168815 |
| 07a | Oro Loma - East | ORLW21 | 575441 | 4168567 |
| 07b | Oro Loma - West | ORLW01 | 574936 | 4168382 |
| 07b | Oro Loma - West | ORLW02 | 575023 | 4168204 |
| 07b | Oro Loma - West | ORLW03 | 574972 | 4168062 |
| 07b | Oro Loma - West | ORLW04 | 574771 | 4168057 |
| 07b | Oro Loma - West | ORLW05 | 574584 | 4168057 |
| 07b | Oro Loma - West | ORLW06 | 574382 | 4168054 |
| 07b | Oro Loma - West | ORLW07 | 574308 | 4168235 |
| 07b | Oro Loma - West | ORLW08 | 574215 | 4168393 |
| 07b | Oro Loma - West | ORLW09 | 574150 | 4168521 |
| 07b | Oro Loma - West | ORLW10 | 574098 | 4168723 |
| 07b | Oro Loma - West | ORLW11 | 574095 | 4168866 |
| 07b | Oro Loma - West | ORLW12 | 574302 | 4168857 |
| 07b | Oro Loma - West | ORLW13 | 574495 | 4168854 |
| 07b | Oro Loma - West | ORLW14 | 574661 | 4168784 |
| 07b | Oro Loma - West | ORLW15 | 574739 | 4168633 |
| 07b | Oro Loma - West | ORLW16 | 574840 | 4168558 |
| 20c | Dogbone Marsh | DOGB01 | 572695 | 4170847 |
| 20d | Citation Marsh | CITA01 | 573661 | 4170466 |
| 20d | Citation Marsh | CITA02 | 573555 | 4170639 |
| 20d | Citation Marsh | CITA03 | 573435 | 4170800 |
| 20d | Citation Marsh | CITA04 | 573314 | 4170961 |
| 20d | Citation Marsh | CITA05 | 573318 | 4171265 |
| 20d | Citation Marsh | CITA06 | 573316 | 4171466 |
| 20d | Citation Marsh | CITA07 | 573314 | 4171666 |
| 20f | North Marsh | NORT01 | 573097 | 4171251 |
| 20f | North Marsh | NORT02 | 572949 | 4171118 |
| 20f | North Marsh | NORT03 | 572920 | 4170920 |
| 20f | North Marsh | NORT04 | 572877 | 4170757 |
| 20f | North Marsh | NORT05 | 572997 | 4170591 |
| 20f | North Marsh | NORT06 | 573168 | 4170488 |
| 20f | North Marsh | NORT08 | 573588 | 4170397 |
| 20g | Bunker Marsh | BUNK01 | 573456 | 4170331 |
| 20g | Bunker Marsh | BUNK02 | 573507 | 4170104 |
| 20g | Bunker Marsh | BUNK03 | 573561 | 4169912 |
| 20g | Bunker Marsh | BUNK04 | 573631 | 4169725 |
| 20h | San Lorenzo Creek | SLRZ01 | 573737 | 4169556 |
| 20h | San Lorenzo Creek | SLRZ03 | 573943 | 4169633 |
| 20h | San Lorenzo Creek | SLRZ04 | 574138 | 4169774 |
| 20h | San Lorenzo Creek | SLRZ05 | 574277 | 4169889 |
| 20h | San Lorenzo Creek | SLRZ07 | 573896 | 4169503 |
| 20h | San Lorenzo Creek | SLRZ08 | 573955 | 4169323 |

**REGION: HAYWARD (continued)**

| Sub-area Code | Site Name | Point ID | X Coordinate | Y Coordinate |
|---|---|---|---|---|
| 20h | San Lorenzo Creek | SLRZ09 | 573951 | 4169136 |
| 20j | Sulphur Creek | SULF04 | 575178 | 4168030 |
| 20j | Sulphur Creek | SULF05 | 575382 | 4168032 |
| 20j | Sulphur Creek | SULF06 | 575580 | 4168049 |
| 20l | Johnson's Landing | JOLA02 | 575064 | 4164736 |
| 20l | Johnson's Landing | JOLA04 | 574909 | 4165104 |
| 20m | Cogswell - Sec A | COGS01 | 574738 | 4166041 |
| 20m | Cogswell - Sec A | COGS02 | 574713 | 4166250 |
| 20m | Cogswell - Sec A | COGS03 | 574862 | 4166363 |
| 20m | Cogswell - Sec A | COGS04 | 575059 | 4166368 |
| 20m | Cogswell - Sec A | COGS05 | 575218 | 4166336 |
| 20m | Cogswell - Sec A | COGS06 | 575158 | 4166170 |
| 20m | Cogswell - Sec A | COGS07 | 575043 | 4166004 |
| 20n | Cogswell - Sec B | COGS15 | 575367 | 4165223 |
| 20n | Cogswell - Sec B | COGS16 | 575572 | 4165228 |
| 20n | Cogswell - Sec B | COGS17 | 575710 | 4165373 |
| 20n | Cogswell - Sec B | COGS18 | 575620 | 4165538 |
| 20n | Cogswell - Sec B | COGS19 | 575531 | 4165722 |
| 20n | Cogswell - Sec B | COGS20 | 575436 | 4165912 |
| 20n | Cogswell - Sec B | COGS21 | 575340 | 4166092 |
| 20o | Cogswell - Sec C | COGS08 | 574984 | 4165788 |
| 20o | Cogswell - Sec C | COGS09 | 575124 | 4165612 |
| 20o | Cogswell - Sec C | COGS10 | 575138 | 4165412 |
| 20o | Cogswell - Sec C | COGS11 | 575105 | 4165165 |
| 20o | Cogswell - Sec C | COGS12 | 574791 | 4165248 |
| 20o | Cogswell - Sec C | COGS13 | 574779 | 4165542 |
| 20o | Cogswell - Sec C | COGS14 | 574781 | 4165740 |
| 20p | Hayward Landing | HALA01 | 574524 | 4166812 |
| 20r | Oakland Airport | OAKA01 | 566746 | 4175486 |
| 20r | Oakland Airport | OAKA02 | 566898 | 4175357 |
| 20r | Oakland Airport | OAKA03 | 567055 | 4175234 |
| 20s | HARD Marsh | HARD01 | 575252 | 4164654 |
| 20s | HARD Marsh | HARD02 | 575438 | 4164560 |
| 20s | HARD Marsh | HARD03 | 575619 | 4164493 |
| 20s | HARD Marsh | HARD04 | 575816 | 4164414 |
| 20s | HARD Marsh | HARD05 | 575988 | 4164619 |
| 20w | Triangle Marsh - Hayward | TRMA01 | 574647 | 4166655 |
| 20w | Triangle Marsh - Hayward | TRMA02 | 574714 | 4166471 |

**REGION: UNION CITY**

| Sub-area Code | Site Name | Point ID | X Coordinate | Y Coordinate |
|---|---|---|---|---|
| 13a | OAC - North Bank | ALCK11 | 577774 | 4161008 |
| 13a | OAC - North Bank | ALCK12 | 577954 | 4160949 |
| 13a | OAC - North Bank | ALCK13 | 578133 | 4160880 |
| 13a | OAC - North Bank | ALCK14 | 578290 | 4160821 |
| 13a | OAC - North Bank | ALCK15 | 578491 | 4160791 |
| 13a | OAC - North Bank | ALCK16 | 578684 | 4160842 |
| 13a | OAC - North Bank | ALCK17 | 578837 | 4160946 |
| 13a | OAC - North Bank | ALCK18 | 578983 | 4161058 |
| 13a | OAC - North Bank | ALCK19 | 579146 | 4161152 |
| 13a | OAC - North Bank | ALCK20 | 579342 | 4161159 |
| 13a | OAC - North Bank | ALCK21 | 579538 | 4161155 |
| 13a | OAC - North Bank | ALCK22 | 579723 | 4161150 |
| 13a | OAC - North Bank | ALCK23 | 579901 | 4161149 |
| 13a | OAC - North Bank | ALCK24 | 580056 | 4161217 |
| 13a | OAC - North Bank | ALCK25 | 580098 | 4161389 |
| 13a | OAC - North Bank | ALCK26 | 580095 | 4161571 |
| 13a | OAC - North Bank | ALCK27 | 580088 | 4161744 |
| 13a | OAC - North Bank | ALCK10 | 577579 | 4161047 |
| 13c | OAC - South Bank | OACS01 | 576227 | 4160905 |
| 13c | OAC - South Bank | OACS02 | 576429 | 4160900 |
| 13c | OAC - South Bank | OACS03 | 576629 | 4160907 |
| 13c | OAC - South Bank | OACS04 | 576829 | 4160914 |
| 13c | OAC - South Bank | OACS05 | 577029 | 4160921 |
| 13c | OAC - South Bank | OACS06 | 577225 | 4160925 |
| 13c | OAC - South Bank | OACS07 | 577426 | 4160925 |
| 13d | Whale's Tail - North | WTN10 | 575754 | 4162376 |
| 13d | Whale's Tail - North | WTN4 | 575865 | 4161341 |
| 13d | Whale's Tail - North | WTN5 | 575886 | 4161530 |
| 13d | Whale's Tail - North | WTN6 | 575813 | 4161676 |
| 13d | Whale's Tail - North | WTN7 | 575771 | 4161849 |
| 13d | Whale's Tail - North | WTN8 | 575767 | 4162027 |
| 13d | Whale's Tail - North | WTN9 | 575762 | 4162212 |
| 13f | OAC - South Bank | WTS37 | 576032 | 4160957 |
| 13j | Eden Landing - Mt Eden Creek | EDEN01 | 576480 | 4163098 |
| 13j | Eden Landing - Mt Eden Creek | EDEN02 | 576489 | 4162896 |
| 13j | Eden Landing - Mt Eden Creek | EDEN03 | 576430 | 4162704 |
| 13j | Eden Landing - Mt Eden Creek | EDEN04 | 576379 | 4162512 |
| 13j | Eden Landing - Mt Eden Creek | EDEN05 | 576179 | 4162480 |
| 13j | Eden Landing - Mt Eden Creek | EDEN06 | 575980 | 4162529 |
| 13j | Eden Landing - Mt Eden Creek | WTN11 | 575778 | 4162563 |
| 13k | Eden Landing Reserve - South | ELRS01 | 578202 | 4163533 |
| 13k | Eden Landing Reserve - South | ELRS02 | 578057 | 4163383 |
| 13k | Eden Landing Reserve - South | ELRS03 | 577994 | 4163189 |
| 13k | Eden Landing Reserve - South | ELRS04 | 578001 | 4162988 |
| 13k | Eden Landing Reserve - South | ELRS05 | 578422 | 4163525 |
| 13k | Eden Landing Reserve - South | ELRS06 | 578540 | 4163362 |
| 13k | Eden Landing Reserve - South | ELRS07 | 578657 | 4163200 |
| 13k | Eden Landing Reserve - South | ELRS08 | 578777 | 4163039 |

**REGION: DUMBARTON SOUTH**

| Sub-area Code | Site Name | Point ID | X Coordinate | Y Coordinate |
|---|---|---|---|---|
| 16 | Cooley Landing | COLA05 | 576891 | 4148770 |
| 16 | Cooley Landing | COLA06 | 576956 | 4148944 |
| 16 | Cooley Landing | COLA07 | 577129 | 4149051 |
| 16 | Cooley Landing | COLA08 | 577293 | 4149164 |
| 16 | Cooley Landing | COLA09 | 576775 | 4148568 |
| 16 | Cooley Landing | COLA10 | 576825 | 4148373 |
| 16 | Cooley Landing | COLA11 | 576961 | 4148238 |
| 16 | Cooley Landing | COLA12 | 577112 | 4148090 |
| 05a | Calaveras Point | CAPT09a | 586275 | 4146957 |
| 05a | Calaveras Point | CAPT10 | 586088 | 4146915 |
| 05a | Calaveras Point | CAPT11 | 585877 | 4146873 |
| 05a | Calaveras Point | CAPT12 | 585689 | 4146818 |
| 05a | Calaveras Point | CAPT13 | 585492 | 4146774 |
| 05a | Calaveras Point | CAPT15 | 584921 | 4146583 |
| 05a | Calaveras Point | CAPT08 | 586510 | 4147007 |
| 05a | Calaveras Point | CAPT14a | 585333 | 4146717 |
| 05c | Newark Slough | NEW02 | 581705 | 4154094 |
| 05c | Newark Slough | NEW03 | 581878 | 4153982 |
| 05c | Newark Slough | NEW04 | 582059 | 4153878 |
| 05c | Newark Slough | NEW05 | 582040 | 4153642 |
| 05c | Newark Slough | NEW06 | 582159 | 4153474 |
| 05c | Newark Slough | NEW07 | 582333 | 4153544 |
| 05c | Newark Slough | NEW09 | 581635 | 4154254 |
| 05e | Mayhew's Landing | May-3 | 582878 | 4154195 |
| 05e | Mayhew's Landing | May-5 | 583046 | 4153879 |
| 05g | Cargill Pond (W Suites Hotel) | May-1 | 582737 | 4154617 |
| 05h | Plummer Creek Mitigation | PLCM01 | 583615 | 4152372 |
| 05h | Plummer Creek Mitigation | PLCM02 | 583484 | 4152202 |
| 05h | Plummer Creek Mitigation | PLCM03 | 583517 | 4152021 |
| 05i | Island Ponds | A21-1 | 589676 | 4146880 |
| 05i | Island Ponds | A21-3 | 590549 | 4147430 |
| 05i | Island Ponds | A21-5 | 590110 | 4147286 |
| 05i | Island Ponds | A21-6 | 590276 | 4147430 |
| 05i | Island Ponds | A21-7 | 590658 | 4147236 |
| 05i | Island Ponds | A21-8 | 590646 | 4147026 |
| 05i | Island Ponds | A21-4 | 589991 | 4147127 |
| 05i | Island Ponds | A21-2 | 589855 | 4146992 |
| 15a.1 | Charleston Slough | CHSL03 | 580657 | 4145153 |
| 15a.1 | Mountain View Slough | MVSL04 | 581043 | 4145153 |
| 15a.1 | Mountain View Slough | MVSL05 | 581422 | 4145011 |
| 15a.2 | Stevens Creek to Long Point | LONG09 | 582630 | 4144724 |
| 15a.2 | Stevens Creek to Long Point | LONG10 | 582401 | 4144385 |
| 15a.2 | Stevens Creek to Long Point | LONG11 | 582369 | 4144019 |
| 15a.4 | Alviso Slough | MAL01 | 586761 | 4146451 |
| 15a.4 | Alviso Slough | MAL02 | 586668 | 4146281 |
| 15a.4 | Alviso Slough | MAL04 | 586898 | 4145918 |
| 15a.4 | Alviso Slough | MAL06 | 586942 | 4145527 |

| REGION: DUMBARTON SOUTH (continued) | | | | |
|---|---|---|---|---|
| **Sub-area Code** | **Site Name** | **Point ID** | **X Coordinate** | **Y Coordinate** |
| 15a.4 | Alviso Slough | MAL07 | 587021 | 4146548 |
| 15a.4 | Alviso Slough | MAL08 | 587328 | 4146607 |
| 15a.4 | Alviso Slough | MAL09 | 587646 | 4146656 |
| 15a.4 | Alviso Slough | MAL10 | 587905 | 4146704 |
| 15a.5 | Coyote Creek South East | COYE6B | 590413 | 4145832 |
| 15a.5 | Coyote Creek South East | COYE6C | 590265 | 4145968 |
| 15a.5 | Coyote Creek South East | COYE6D | 590121 | 4146110 |
| 15a.5 | Coyote Creek South East | COYE6E | 589970 | 4146243 |
| 15a.5 | Coyote Creek South East | COYE6F | 589817 | 4146372 |
| 15a.5 | Coyote Creek South East | COYE5C | 588689 | 4146707 |
| 15a.5 | Coyote Creek South East | COYE5A | 588951 | 4146466 |
| 15a.5 | Coyote Creek South East | COYE5E | 588312 | 4146686 |
| 15c | Stevens Creek | STEV01 | 582431 | 4143425 |
| 15c | Stevens Creek | STEV02 | 582421 | 4143224 |

## REGION: SAN MATEO

| Sub-area Code | Site Name | Point ID | X Coordinate | Y Coordinate |
|---|---|---|---|---|
| 02a | Belmont Slough | BELM01 | 566369 | 4156426 |
| 02a | Belmont Slough | BELM02 | 566069 | 4156168 |
| 02a | Belmont Slough | BELM03 | 565966 | 4155996 |
| 02a | Belmont Slough | BELM04 | 565882 | 4155814 |
| 02a | Belmont Slough | BELM05 | 565895 | 4155614 |
| 02a | Belmont Slough | BELM06 | 565938 | 4155419 |
| 02a | Belmont Slough | BELM07 | 566028 | 4155239 |
| 02a | Belmont Slough | BELM08 | 565828 | 4155213 |
| 02a | Redwood Shores | RESH01 | 568179 | 4155891 |
| 02a | Redwood Shores | RESH02 | 567964 | 4155983 |
| 02a | Redwood Shores | RESH03 | 567751 | 4156006 |
| 02a | Redwood Shores | RESH04 | 567545 | 4156002 |
| 02a | Redwood Shores | RESH06 | 567118 | 4156026 |
| 02a | Redwood Shores | RESH07 | 566894 | 4156065 |
| 02b | Corkscrew Slough | CORK01 | 569367 | 4153611 |
| 02b | Corkscrew Slough | CORK03 | 568904 | 4152988 |
| 02b | Corkscrew Slough | CORK04 | 568894 | 4152635 |
| 02b | Corkscrew Slough | CORK05 | 568642 | 4152904 |
| 02b | Corkscrew Slough | CORK06 | 568356 | 4153005 |
| 02b | Steinberger Slough | RESH16 | 567956 | 4155133 |
| 02b | Steinberger Slough | RESH15 | 567780 | 4154559 |
| 02b | Steinberger Slough | RESH17 | 568105 | 4155282 |
| 02b | Steinberger Slough | RESH18 | 568239 | 4155444 |
| 02b | Steinberger Slough | RESH13 | 567756 | 4154757 |
| 02b | Steinberger Slough | RESH14 | 567816 | 4154983 |
| 02b | Corkscrew Slough | CORK02a | 569244 | 4153305 |
| 02c | B2 North Quadrant | OBE06 | 569311 | 4154036 |
| 02c | B2 North Quadrant | OBE09 | 568814 | 4154381 |
| 02c | B2 North Quadrant | OBE11 | 568471 | 4154620 |
| 02c | B2 North Quadrant | OBE12 | 569256 | 4154869 |
| 02c | B2 North Quadrant | OBE14 | 569206 | 4154429 |
| 02c | B2 North Quadrant | OBE16 | 568775 | 4154924 |
| 02c | B2 North Quadrant | OBE19 | 568408 | 4155098 |
| 02d | B2 South Quadrant | OBE04 | 569963 | 4154250 |
| 02d | B2 South Quadrant | OBE22 | 569611 | 4154402 |
| 02d | B2 South Quadrant | OBE23 | 569663 | 4154619 |
| 02d | B2 South Quadrant | OBE25 | 569779 | 4155053 |
| 02d | B2 South Quadrant | OBE26 | 569843 | 4154667 |
| 02d | B2 South Quadrant | OBE27 | 569990 | 4154545 |
| 02d | B2 South Quadrant | OBES24 | 569733 | 4154871 |
| 02e | West Point Slough - NW | WPSN03 | 571586 | 4151985 |
| 02f | Greco Island - North | GRIN17 | 571635 | 4152418 |
| 02f | Greco Island - North | GRIN18 | 571800 | 4152305 |
| 02f | Greco Island - North | GRIN11 | 570647 | 4153106 |
| 02f | Greco Island - North | GRIN12 | 570811 | 4152993 |
| 02f | Greco Island - North | GRIN13 | 570976 | 4152877 |

**REGION: SAN MATEO (continued)**

| Sub-area Code | Site Name | Point ID | X Coordinate | Y Coordinate |
|---|---|---|---|---|
| 02f | Greco Island - North | GRIN14 | 571140 | 4152762 |
| 02f | Greco Island - North | GRIN15 | 571306 | 4152647 |
| 02f | Greco Island - North | GRIN16 | 571471 | 4152533 |
| 02g | West Point Slough - SW / E | WPSS09 | 572707 | 4150059 |
| 02g | West Point Slough - SW / E | WPSS10 | 572706 | 4149686 |
| 02g | West Point Slough - SW / E | WPSS11 | 572704 | 4149455 |
| 02g | West Point Slough - SW / E | WPSS12 | 572561 | 4149237 |
| 02h | Greco Island - South | GRIS01 | 573018 | 4150394 |
| 02h | Greco Island - South | GRIS02 | 573016 | 4150596 |
| 02h | Greco Island - South | GRIS03 | 573015 | 4150799 |
| 02h | Greco Island - South | GRIS04 | 573014 | 4150998 |
| 02h | Greco Island - South | GRIS05 | 572969 | 4151193 |
| 02h | Greco Island - South | GRIS06 | 572825 | 4151345 |
| 02i | Ravenswood Slough | RAV02 | 575826 | 4149650 |
| 02i | Ravenswood Slough | RAV03 | 575665 | 4149768 |
| 02i | Ravenswood Slough | RAV04 | 575468 | 4149813 |
| 02i | Ravenswood Slough | RAV05 | 575260 | 4149863 |
| 02i | Ravenswood Slough | RAV06 | 574884 | 4150110 |
| 02i | Ravenswood Slough | RAV09 | 574950 | 4149885 |
| 02i | Ravenswood Slough | RAV10 | 574806 | 4150724 |
| 02k | Middle Bair N | MBE01 | 569714 | 4153286 |
| 02k | Middle Bair N | MBE02 | 569544 | 4153178 |
| 02k | Middle Bair N | MBE03 | 569366 | 4153061 |
| 02k | Middle Bair N | MBE04 | 569249 | 4152883 |
| 02k | Middle Bair N | MBE05 | 569153 | 4152697 |
| 02k | Middle Bair SE | MBSE06 | 568955 | 4152326 |
| 02k | Middle Bair SE | MBSE02 | 568726 | 4151546 |
| 02k | Middle Bair SE | MBSE04 | 568800 | 4151947 |
| 02l | Inner Bair Island Restoration | IBI11 | 567713 | 4150454 |
| 02l | Inner Bair Island Restoration | IBI13 | 567298 | 4150636 |
| 02l | Inner Bair Island Restoration | IBI15 | 567004 | 4150939 |
| 02l | Inner Bair Island Restoration | IBI17 | 566763 | 4151267 |
| 02m | Pond B3 Bair Island Restoration | OBW02 | 567997 | 4154227 |
| 02m | Pond B3 Bair Island Restoration | OBW03 | 568180 | 4154348 |
| 02m | Pond B3 Bair Island Restoration | OBW01 | 567882 | 4154015 |
| 02m | Pond B3 Bair Island Restoration | OBW04 | 568467 | 4154287 |
| 02m | Pond B3 Bair Island Restoration | OBW05 | 568469 | 4154054 |
| 02m | Pond B3 Bair Island Restoration | OBW06 | 568470 | 4153817 |
| 02m | Pond B3 Bair Island Restoration | OBW07 | 568471 | 4153575 |
| 02m | Pond B3 Bair Island Restoration | OBW08 | 568471 | 4153347 |

**REGION: SAN FRANCISCO PENINSULA**

| Sub-area Code | Site Name | Point ID | X Coordinate | Y Coordinate |
|---|---|---|---|---|
| 12b | Pier 98/Heron's Head | HEHE01 | 555235 | 4176946 |
| 12b | Pier 98/Heron's Head | HEHE02 | 555429 | 4176923 |
| 18g | San Bruno Marsh | SBMA06 | 553599 | 4166863 |
| 18g | San Bruno Marsh | SBMA01 | 553847 | 4166947 |
| 18g | San Bruno Marsh | SBMA02 | 554049 | 4166950 |
| 18g | San Bruno Marsh | SBMA03 | 554248 | 4166959 |
| 19h | SFO | SFO04 | 555438 | 4163237 |
| 19h | SFO | SFO05 | 555203 | 4162889 |
| 19h | SFO | SFO06 | 555111 | 4162711 |
| 19h | SFO | SFO07 | 555019 | 4162530 |
| 19k | Sanchez Marsh | PAF01 | 556703 | 4160468 |
| 19k | Sanchez Marsh | SANC05 | 556844 | 4160430 |
| 19k | Sanchez Marsh | SANC03 | 557028 | 4160398 |
| 19k | Sanchez Marsh | SANC04 | 557215 | 4160382 |
| 19p | Seal Slough | SEAL01 | 562560 | 4158484 |
| 19p | Seal Slough | SEAL03 | 562728 | 4158450 |
| 19p | Seal Slough | SEAL04 | 562857 | 4158548 |
| 19p | Seal Slough | SEAL05 | 562861 | 4158725 |
| 19p | Seal Slough | SEAL07 | 562432 | 4158448 |

**REGION: MARIN**

| Sub-area Code | Site Name | Point ID | X Coordinate | Y Coordinate |
|---|---|---|---|---|
| 9 | Pickleweed Park | PIPK01 | 544265 | 4202286 |
| 9 | Pickleweed Park | PIPK02 | 544239 | 4202484 |
| 9 | Pickleweed Park | PIPK03 | 544183 | 4202641 |
| 04b | College of Marin | CMER03 | 540053 | 4200235 |
| 04g | Creekside Park | CRPA01 | 540284 | 4200157 |
| 04g | Creekside Park | CRPA04 | 540477 | 4200115 |
| 04g | Creekside Park | CRPA05 | 540583 | 4199940 |
| 04g | Creekside Park | CRPA06 | 540535 | 4200305 |
| 04h | CMC - Upper | UCMC01 | 539765 | 4200265 |
| 04h | CMC - Upper | UCMC02 | 539978 | 4200186 |
| 04h | CMC - Upper | UCMC03 | 540142 | 4200079 |
| 04h | CMC - Upper | UCMC04 | 540358 | 4200046 |
| 04h | CMC - Upper | UCMC05 | 540500 | 4199902 |
| 04i | CMC - Lower | LCMC11 | 540632 | 4199553 |
| 04i | CMC - Lower | LCMC12 | 540831 | 4199466 |
| 04j | CMC - Mouth | CMCM12 | 542958 | 4199629 |
| 04j | CMC - Mouth | CMCM13 | 543185 | 4199682 |
| 04j | CMC - Mouth | CMCM14 | 542814 | 4199523 |
| 04j | CMC - Mouth | CMCM15 | 543007 | 4199427 |
| 04j | CMC - Mouth | CMCM16 | 543234 | 4199447 |
| 23d | San Rafael Canal Mouth | SRCM01 | 544244 | 4202876 |
| 23d | San Rafael Canal Mouth | SRCM02 | 544370 | 4202758 |

# Appendix III: Standard Survey Protocols for Ridgway's Rails in the San Francisco Estuary

# San Francisco Estuary Invasive *Spartina* Project

## California Ridgway's Rail Survey Protocols

## General Survey Requirements:

1) *Permits*. Obtain required survey permits: USFWS Endangered Species Permit, ESA Section 10(a)(1)(A); California DFG permit (i.e. Memorandum of Understanding); site-specific permissions (e.g., Special Use Permit from a NWR).

2) *Training*. Observers must be trained to identify Ridgway's rail calls and distinguish RIRA calls from other marsh bird species (see Rail Training document, April 2004). Observers must also be trained to minimize disturbance while conducting surveys (see Walking in the Marsh document, April 2004).

3) *Tides and moon phase*. Conduct surveys when tidal sloughs are less than bank full, <4.5-ft NGVD at the nearest tide station. Tide height at bank full will vary by site. Avoid high (flood) tides. Full moon periods should be avoided during active surveys when tape playback is utilized, as birds may be attracted out of cover or a response may be elicited, increasing the likelihood of predation. There is also evidence of reduced calling rates during full moon periods.

4) *Survey Timing*. Morning surveys should be initiated 1 hour before sunrise and extended no more than 1.5 hours after sunrise; evening surveys should begin 1 hour prior to sunset and extend no more than 1 hour following sunset. Surveys at a particular location should be spaced at least 1 week apart and should be conducted at both sunrise and sunset.

5) *Weather*. Record wind velocities and weather; conduct surveys at winds <10 mph; do not conduct surveys during heavy rainfall.

6) *Seasonality*. Conduct surveys between January 15 and mid-April.

7) *Survey Stations*. Stations should be spaced approximately 200m apart. Stations should be placed on boardwalks or levee tops when possible to minimize disturbance. When surveys are conducted within a marsh, stations should be placed away from slough/channel edges to minimize disturbance to rail species.

8) *Data collection*. All rail vocalizations should be recorded, noting the call type, location, and time. Locations where rails are detected should be plotted on a map during the survey with numbered reference codes that correspond to detections on the datasheet. The call types should be coded as follows:

| Call Code | Call Description | Number of Birds Indicated |
|---|---|---|
| C | Clapper/clatter by one individual | 1 bird |
| D | "Duet"- two individuals clattering simultaneously | 2 birds |
| K | "kek" | 1 bird |
| KH | "kek-hurrah" | 1 bird |
| B | "kek-burr" | 1 bird |
| V | Visual sighting | 1 bird per sighting |
| SK | "squawk" | 1 bird |
| SC | "screech" | 1 bird |
| CH | "chur" | 1 bird |
| P | "purr" | 1 bird |

If the bird was definitely or possibly previously detected, e.g., as part of a pair, make this clear on the datasheet. Make a note when birds were detected simultaneously or nearly so, to verify that they were separate individuals. Calls of other rail species should also be recorded as above, with species clearly marked.

9) *Disturbance*. Record all information on disturbance (e.g., predator sightings or boats) detected during surveys.

10) Review the WRMP CLRA protocol (Evens 2002) for other general information (http://www.wrmp.org/docs/protocols/Wetland%20Birds.pdf, p.21 Rails). Defer to the requirements listed above if they are more restrictive than the WRMP protocol.

## Survey Specifics – Standard Protocol Types

| Type | Common Protocol Name | Description |
|---|---|---|
| A | Standard USFWS Transect Survey | *As described in Albertson & Downard, 2004 and Spautz 2005*. Used for most sites where rails are expected to occur. An observer moves to stations along a transect, remaining at each station for 10-minutes. Three rounds of surveys are conducted over the course of the season, with recording played at end of 3rd round if no prior detections. |
| B | Standing or Stationary Survey | *As described in Albertson & Downard, 2004 and Spautz 2005*. Used at two sites in the Bay: Arrowhead Marsh and LaRiviere Marsh. Requires one person at each station for 1½ hour. Typically, 3 survey rounds, with recording played at end of 3rd round if no prior detections. |
| C | ISP-Modified Transect Survey | *Originally described in Zaremba & Albertson, 2004*; modified in Spautz & Albertson 2006. Used to determine presence or absence of RIRA at sites with low potential for RIRA presence, where *Spartina* control activities are planned. Same as Type A, except recording is played from first survey round. Recordings are discontinued upon detection and surveys proceed using Protocol A. |
| E | Winter High Tide Survey | *Described by EBRPD pers. comm.* RIRA are flushed out of marsh habitat by airboat and counted during winter high tide. |
| F | Preliminary Habitat Suitability Assessment | Quick assessment by RIRA biologist to determine if suitable RIRA habitat is present; if habitat is suitable, a call count survey is conducted (typically using protocol C). |
| G | Standing or stationary survey to determine absence (AKA consultant protocol) | As described by *USFWS Draft Survey Protocol, 2009*; modified in January 2015 to include broadcast. Used to determine absence of RIRA at sites where proposed construction activities may impact any rails present at the site. Similar to Protocol B, but with four survey rounds, with recording played during the 3rd and 4th round if no prior detections. |

**Protocol A.** The Protocol A transect survey is the standard method of survey for most marshes in the Bay. Listening stations are established at approximately 200-meter intervals along a transect, preferably along the edge of the marsh. The first two of three surveys are passive (listening) for 10-minutes at each station. On the third survey, if a Ridgway's rail was not previously detected within 200 meters of a listening station during the two previous passive surveys or incidentally within the season, recorded calls are played, according to the "*Recorded Call Playback Procedure*" described below. If a Ridgway's rail has been previously detected within 200 meters of a listening station, the third survey should also be passive. There should be a minimum of 2 weeks between surveys.

**Protocol B.** The Protocol B stationary survey is only used at two sites in the Bay: LaRiviere Marsh and Arrowhead Marsh.

The Protocol B stationary survey requires a sufficient number of observers to have one person at each listening station. Listening stations are established along a grid or transect, with stations set apart by 200 meters or more. Observers are present at each station for an

entire 1.5-hour survey period. When calls are recorded, the observer must take care to record the exact time and direction, and best estimate of the distance of the call, so that the data can be reconciled with other observers' data. Reconciliation of data from multiple observers must be planned and closely supervised by a scientist with expertise in field data interpretation. The Protocol B stationary survey is a passive listening survey, and does not include playing of recorded calls. Protocol B surveys are typically conducted for three rounds.

**Protocol C.** Protocol C (ISP modified transect survey) was developed to more efficiently confirm presence or absence of California Ridgway's rails at certain non-native *Spartina*-invaded sites, so that *Spartina* control could be undertaken at sites with no rails during rail nesting season. Protocol C surveys are implemented only at sites where the probability of Ridgway's rail presence is relatively low, i.e., at sites where Ridgway's rails have not been previously detected, but where marginally suitable habitat or other conditions suggest that rails may be present. Protocol C differs from Protocol A (USFWS standard transect survey) in that it allows the broadcasting of pre-recorded Ridgway's rail vocalizations beginning on the initial round of surveys in order to elicit responses from birds in the marsh. If a Ridgway's rail responds, the broadcast is immediately discontinued and not repeated on subsequent survey rounds at that station, and *Spartina* control at that location is postponed until times authorized by the USFWS Section 7 Biological Opinion. If Ridgway's rail presence is determined using Protocol C, the survey is completed using Protocol A in order to determine the number of birds present at the site.

The suitability of using Protocol C is determined based on whether Ridgway's rails have been previously detected at the site, and whether conditions at the site suggest that Ridgway's rails may be present. The ISP regularly reviews Ridgway's rail records from all known sources to identify locations where Ridgway's rails have been detected in the past. Also, the ISP evaluates all planned *Spartina* treatment sites for potential habitat, and conducts habitat assessment surveys (Protocol F) at any locations that are thought to be potentially, albeit marginally, suitable Ridgway's rail habitat. If the ISP plans to do *Spartina* control at a location where (1) the collective records do not indicate Ridgway's rails have been detected for the prior two years, and (2) the habitat at the site is determined to be at least marginally sufficient for Ridgway's rails, then a Protocol C survey would be performed. If the ISP requires Ridgway's rail data at locations where Ridgway's rail presence was previously confirmed within the prior two years, it would use Protocol A (Standard USFWS transect), rather than Protocol C. Generally speaking, Protocol C surveys are conducted at sites that have a low probability of Ridgway's rail presence.

**Protocol F.** Protocol F was developed to assess the quality of the Ridgway's rail habitat at marginal sites where rails have not been previously documented and are not likely to occur so that a determination of rail absence could be made without call count surveys where habitat is obviously lacking. Sites requiring *Spartina* control exhibit a continuum of habitat characteristics, many of which are documented Ridgway's rail habitat requirements (e.g., extensive channels for foraging and vegetated upper marsh for refuge during high tides). This makes it difficult in some cases to determine whether the habitat at the site is of sufficiently high quality to require a call count survey. In 2005, the ISP developed a standardized method to document the decision as to whether or not a Ridgway's rail survey was required (Protocol F).

ISP staff consulted with Joy Albertson and Jules Evens to develop a list of required habitat elements for Ridgway's rails based on field knowledge and published sources. This information was used to develop a field checklist to assess the habitat using multiple criteria and to document the decision as to whether the marsh will require a formal Ridgway's rail call count survey. The habitat assessment is typically completed at sites where Ridgway's rails have previously not been documented. Protocol F may also be employed in sites with historic Ridgway's rail presence, but where there have been no detections over the prior two years of formal survey. This scenario has become more prevalent as marshes once fully invaded by hybrid *Spartina* have been treated and the resulting landscape is no longer suitable to support rail populations.

The process of determining whether the site is of sufficient quality to require a call count survey is based on a cumulative score of positive characteristics. Patches with no necessary habitat elements are considered very poor habitat in which Ridgway's rail use is "highly unlikely," and require no further Ridgway's rail survey; such sites are determined to be available for early non-native *Spartina* treatment. If the site is poor but is geographically near enough to good habitat or known rail habitat to potentially provide habitat for at least some Ridgway's rail activities (such as foraging or shelter), it will require a call count survey. Potentially good habitat with at least two positive characteristics will also be likely to require a call count survey, but this will be site-dependent. Possibly good habitat or likely good habitat (with at least four or six characteristics, respectively) will require a call count survey (Protocol A or C).

Habitat characteristics documented to be associated with California Ridgway's rails and included on the habitat assessment datasheet include the following:

1. Young or mature restoration site (at least 50% vegetated)
2. Upper marsh vegetation present
3. Vegetated levee slopes
4. Marsh patch size > 10 ha
5. Closer than 500 m to nearest marsh with documented Ridgway's rail presence
6. Fully tidal
7. Saline
8. High proportion of *Sarcocornia pacifica*, tall hybrid *Spartina* clones, and/or *Grindelia stricta* cover
9. At least a few second and third order channels, or highly channelized

Habitat characteristics associated with California Ridgway's rail absence and included on the habitat assessment datasheet as negative characteristics include the following:

1. New restoration site < 50% vegetated
2. Upper marsh vegetation absent
3. Levee slopes unvegetated
4. Small marsh patch size (< 1 ha)
5. Distance to nearest known marsh with Ridgway's rails > 1000 m
6. Sparse vegetation in rip-rap
7. Highly muted tidal regime or non-tidal
8. Freshwater

**Protocol G.** In 2009, the USFWS developed a draft survey protocol for consultants to determine Ridgway's rail absence from a marsh. This protocol should be employed if construction or other impactful activities are planned in or adjacent to a tidal marsh during rail breeding season (February 1 to September 1) and surveys are recommended by a USFWS staff assisting with a Biological Opinion or other permit to assess potential impacts.

Similar to Protocol B, this is a stationary survey conducted by multiple observers stationed at 200 meter intervals around the survey area. Surveys are conducted for four rounds between January 15 and April 15. In the most recent protocol, recorded vocalizations are broadcast for the third and fourth rounds if no rails have been previously detected within 200 meters of the station. Because this protocol is used to establish rail absence, if rails are detected at any time during the four rounds of surveys, surveys can cease and presence is established at the site.

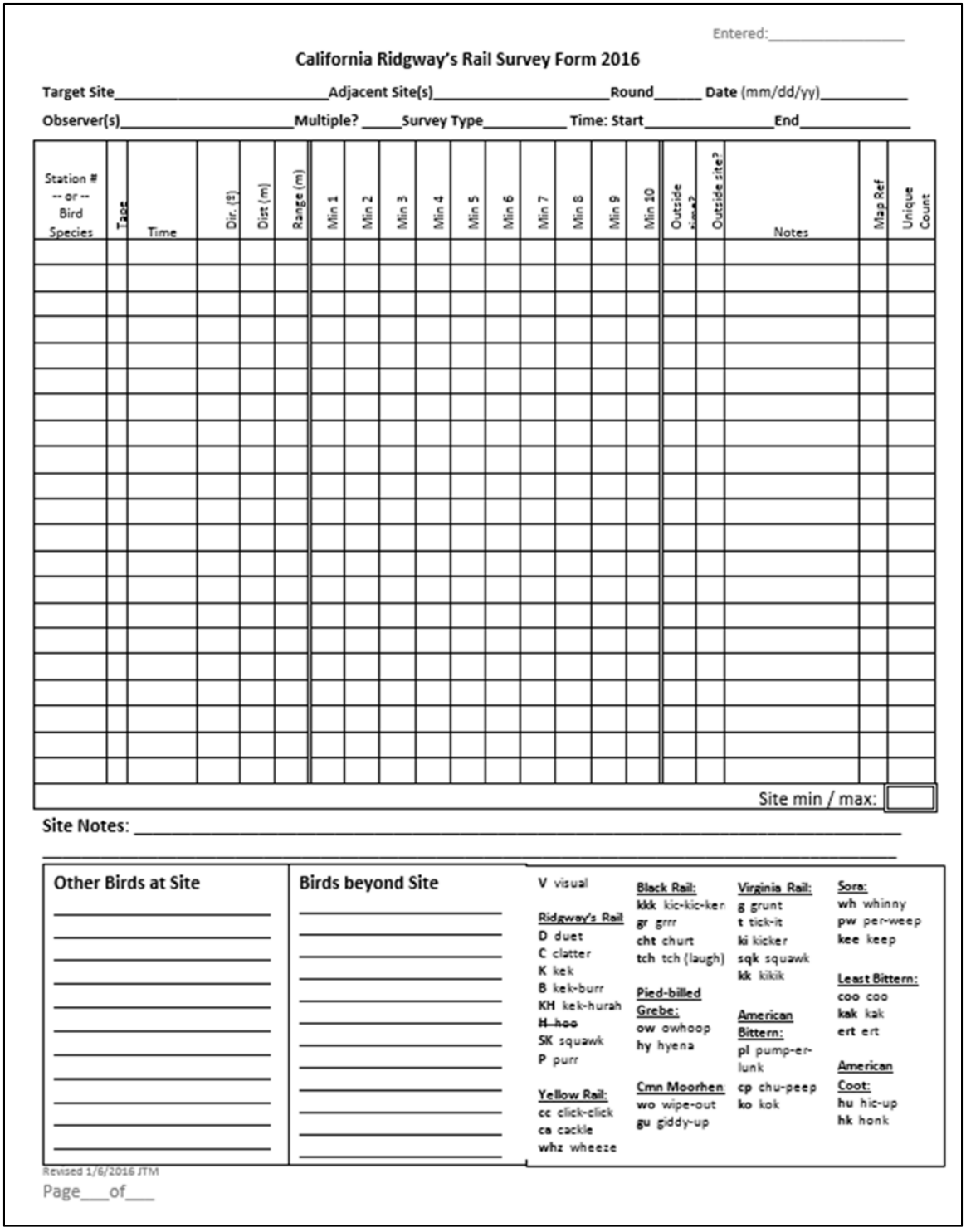
## Recorded Call Playback Procedure

A standardized recording of Ridgway's rail calls should be obtained from USFWS. The recording should include a combination of clatter and duet calls, and there should be at least four complete calls with at least 5 seconds of silence between calls. The recording should be of good quality, and should be played at a volume of 80-90 dB at 1-meter distance from the speaker. A digital sound level meter should be used to calibrate the playback device.

The survey should begin with an initial 5-minute passive listening period, followed by 1-minute of Ridgway's rail calls, and completed with a 4-minute passive listening period (10-minutes/survey). Tape playbacks should be broadcast in all directions over the marsh at a station. Assume rails can hear tapes at distances of ≤200 m.

Note: Only play recorded Ridgway's rail calls at stations when you are certain rails have not yet been detected within a 200-m radius. As soon as a Ridgway's rail is detected, stop the recording.

# Appendix IV: Survey Forms



Entered:_____

**California Ridgway's Rail Survey Form 2016**

**Target Site**_____**Adjacent Site(s)**_____**Round**_____ **Date** (mm/dd/yy)_____

**Observer(s)**_____**Multiple?** _____**Survey Type**_____ **Time: Start**_____**End**_____

| Station # -- or -- Bird Species | Tape | Time | Dir. (°) | Dist (m) | Range (m) | Min 1 | Min 2 | Min 3 | Min 4 | Min 5 | Min 6 | Min 7 | Min 8 | Min 9 | Min 10 | Outside zone? | Outside site? | Notes | Map Ref | Unique Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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Site min / max: ____

**Site Notes**: _____

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| Other Birds at Site | Birds beyond Site |
|---|---|
| | |

V visual

**Ridgway's Rail**
D duet
C clatter
K kek
B kek-burr
KH kek-hurah
~~H-hoo~~
SK squawk
P purr

**Yellow Rail:**
cc click-click
ca cackle
whz wheeze

**Black Rail:**
kkk kic-kic-ker
gr grrr
cht churt
tch tch (laugh)

**Pied-billed Grebe:**
ow owhoop
hy hyena

**Cmn Moorhen**
wo wipe-out
gu giddy-up

**Virginia Rail:**
g grunt
t tick-it
ki kicker
sqk squawk
kk kikik

**American Bittern:**
pl pump-er-lunk
cp chu-peep
ko kok

**Sora:**
wh whinny
pw per-weep
kee keep

**Least Bittern:**
coo coo
kak kak
ert ert

**American Coot:**
hu hic-up
hk honk

Revised 1/6/2016 JTM

Page___of___

Survey form for call count surveys using Protocol A and C.

ISP RIDGWAY'S RAIL HABITAT ASSESSMENT (F-SURVEY) 2016

**Site Name (& ID):** _____ **Photo?** _____

**Surveyor:** _____ **Date:** _____ **Time:** _____ **Tide:** _____

**Channels**
0 Invaded shoreline or only 1st order
1 2nd order
2 3rd order
3 4th order +

**Distance from Bay***
0 >500m
1 20-500 m
2 1-20 m (outboard levee)
3 0 m (direct connection)
*or major channel/creek/river

**Distance from nearest known CLRA**
0 > 1000 m
1 500 - 1000 m
2 200 - 500 m
3 1 - 200 m
4 Recently detected at site

**Hydrology**
0 Extremely muted (dry or ponded)
1 Slightly muted
2 Fully tidal

**Salinity**
0 Freshwater
1 Brackish
2 Salt marsh

**Marsh Size**
0 0 - 5 ha
1 5 - 25 ha
2 25 - 50 ha
3 > 50 ha

**Perimeter:Area Ratio**
0 > 8%
1 4 - 8%
2 2.5 - 4%
3 < 2.5%

**Vegetative Structure**
0 <50% vegetated
1 >50% vegetated, but ceiling is <15cm
2 >50% vegetated, and ceiling is 15-30cm
3 >50% vegetated, and ceiling is >30cm

**Overall Marsh Quality**
0 Poor
1 Fair
2 Good
3 Excellent

**Final Determination**
F Unlikely to support any CLRA
F May support migrant CLRA, but not a breeding pair
C May support breeding CLRA
A Breeding CLRA likely present

**Raptors:** _____

_____

**Mammals:** _____

_____

**Surrounding Land Use:** _____

_____

**Disturbance:** _____

_____

**Site Notes:** _____

_____

Datasheet for habitat evaluation using Protocol F.

# Appendix V: 2016 OEI Survey Results for Each Round

| *REGION: Bay Bridge North* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Round 1 | | | Round 2 | | | Round 3 | | | |
| Site Name and ID | Site Quality | Survey Type | Date | Observer | # RIRA Detected | Date | Observer | # RIRA Detected | Date | Observer | # RIRA Detected | Notes |
| Emeryville Crescent - East (06a) | Poor | C | 2/5/2016 | ND | 0 | 2/29/2016 | KE | 0 | 3/29/2016 | SG | 0 | |
| Emeryville Crescent - West (06b) | Good | C | 1/19/2016 | WT | 0 | 2/11/2016 | JM | 0 | 3/10/2016 | PL | 1 | |
| Whittel Marsh (10a) | Good | A | 2/4/2016 | AE | 1 | 2/24/2016 | AE | 2 | 3/17/2016 | JM | 3 | |
| Southern Marsh (10b) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Giant Marsh (10c) | Fair | C | 2/4/2016 | SG | 0 | 2/24/2016 | JM | 0 | 3/17/2016 | SG | 0 | |
| Breuner Marsh Restoration (10d) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Rheem Creek Area (22c) | Good | A | 1/20/2016 | JM | 0 | 2/22/2016 | SG | 6 | 3/25/2016 | ND | 7 | |
| Meeker Slough (22d) | Good | A | 1/19/2016 | JM | 0 | 2/11/2016 | JH | 0 | 3/8/2016 | SG | 2 | |
| Stege Marsh (22d) | Good | A | 1/19/2016 | JM | 3 | 2/11/2016 | JH | 4 | 3/8/2016 | SG | 2 | |
| Hoffman Marsh (22e) | Fair | A | 1/19/2016 | JM | 0 | 2/11/2016 | JH | 0 | 3/8/2016 | SG | 0 | |
| Albany Shoreline (22f) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |

| *REGION: San Leandro Bay* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Round 1 | | | Round 2 | | | Round 3 | | | |
| **Site Name and ID** | **Site Quality** | **Survey Type** | **Date** | **Observer** | **# RIRA Detected** | **Date** | **Observer** | **# RIRA Detected** | **Date** | **Observer** | **# RIRA Detected** | **Notes** |
| Elsie Roemer (17a) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Bay Farm Island (17b) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Arrowhead Marsh (17c) | Good | B | 2/2/2016 | JM | 20 | 2/23/2016 | JM | **31** | 3/24/2016 | JM | 30 | Partial treatment at site |
| *Arrowhead Marsh – West (17c.1)* | Good | B | 2/2/2016 | JM | 2 | 2/23/2016 | JM | 2 | 3/24/2016 | JM | **3** | Treatment permitted |
| *Arrowhead Marsh - East (17c.2)* | Excellent | B | 2/2/2016 | JM | 18 | 2/23/2016 | JM | **29** | 3/24/2016 | JM | 27 | No treatment allowed |
| Airport Channel - Fan Shore (17d.1) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| MLK Shoreline - Damon (17d.4) | Fair | A | 2/2/2016 | TR | 4 | 2/24/2016 | TR | 6 | 3/21/2016 | JH | 3 | No treatment allowed |
| San Leandro Creek (17e) | Poor | A | 2/8/2016 | TR | 0 | 2/25/2016 | AE | 1 | 3/17/2016 | TR | 0 | |
| Oakland Inner Harbor (17f) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Coast Guard Is (17g) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| MLK New Marsh (17h) | Good | A | 2/8/2016 | JM | 33 | 2/25/2016 | JH | 38 | 3/18/2016 | SC | 45 | No treatment allowed |
| Coliseum Channels (17i) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Fan Marsh (17j) | Good | A | 2/3/2016 | WT | 4 | 2/22/2016 | JM | 15 | 3/22/2016 | AE | 20 | No treatment allowed |
| Airport Channel (17k) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Doolittle Pond (17l) | Poor | C | 2/3/2016 | WT | 0 | 2/22/2016 | JM | 0 | 3/22/2016 | AE | 0 | |
| Alameda Island - East (17m) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |

| REGION: Hayward | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Round 1 | | | Round 2 | | | Round 3 | | | |
| Site Name and ID | Site Quality | Survey Type | Date | Observer | # RIRA Detected | Date | Observer | # RIRA Detected | Date | Observer | # RIRA Detected | Notes |
| Oro Loma - East (07a) | Fair | A | 2/2/2016 | SC | 0 | 2/22/2016 | JH | 0 | 4/6/2016 | PL | 3 | |
| Oro Loma - West (07b) | Fair | A | 2/2/2016 | KE | 0 | 2/22/2016 | ND | 0 | 4/6/2016 | ND | 1 | |
| Oyster Bay Regional Shoreline (20a) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Oakland Golf Links (20b) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Dogbone Marsh (20c) | Poor | A | 1/18/2016 | WT | 0 | 2/10/2016 | SC | 0 | 3/25/2016 | JH | 2 | |
| Citation Marsh (20d) | Good | A | 1/18/2016 | SC | 12 | 2/10/2016 | JM | 11 | 3/25/2016 | JM | 5 | Partial treatment at site |
| *Citation Marsh – South (20d.1)* | Good | A | 1/18/2016 | SC | 0 | 2/10/2016 | JM | 0 | 3/25/2016 | JM | 2 | Treatment permitted |
| *Citation Marsh – North (20d.2)* | Good | A | 1/18/2016 | SC | 12 | 2/10/2016 | JM | 11 | 3/25/2016 | JM | 3 | No treatment allowed |
| East Marsh (20e) | Fair | A | 1/18/2016 | PL | 0 | 2/10/2016 | PL | 2 | 3/25/2016 | SG | 0 | |
| North Marsh (20f) | Good | A | 1/18/2016 | WT | 37 | 2/10/2016 | SC | 27 | 3/25/2016 | JH | 39 | No treatment allowed |
| Bunker Marsh (20g) | Good | A | 1/18/2016 | JM | 10 | 2/10/2016 | WT | 14 | 3/25/2016 | SG | 8 | No treatment allowed |
| San Lorenzo Creek (20h) | Poor | A | 1/18/2016 | PL | 1 | 2/10/2016 | PL | 0 | 3/25/2016 | SG | 0 | Partial treatment at site |
| *San Lorenzo Creek – North (20h.1)* | Poor | A | 1/18/2016 | PL | 1 | 2/10/2016 | PL | 0 | 3/25/2016 | SG | 0 | No treatment allowed |
| *San Lorenzo Creek – South (20h)* | Poor | A | 1/18/2016 | PL | 0 | 2/10/2016 | PL | 0 | 3/25/2016 | SG | 0 | Treatment permitted |
| Bockman Channel (20i) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Sulphur Creek (20j) | Poor | A | 2/2/2016 | KE | 0 | 2/22/2016 | KE | 0 | 4/6/2016 | PL | 0 | |
| Hayward Landing (20k) | Poor | C | 2/2/2016 | WT | 0 | 2/19/2016 | ND | 0 | 3/10/2016 | ND | 0 | |
| Johnson's Landing (20l) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Cogswell - Sec A (20m) | Fair | A | 2/3/2016 | SG | 0 | 2/26/2016 | KE | 0 | 4/5/2016 | PL | 2 | |
| Cogswell - Sec B (20n) | Good | A | 2/3/2016 | JM | 8 | 2/26/2016 | TR | 22 | 4/5/2016 | KE | 24 | No treatment allowed |
| Cogswell - Sec C (20o) | Good | A | 2/3/2016 | SC | 7 | 2/26/2016 | JM | 5 | 4/5/2016 | JM | 6 | No treatment allowed |
| Hayward Shoreline Outliers (20p) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| San Leandro Shoreline Outliers (20q) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| HARD Marsh (20s) | Fair | C - A | 2/3/2016 | ND | 0 | 2/26/2016 | PL | 2 | 4/5/2016 | ND | 0 | |
| Estudillo Creek Channel (20u) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Hayward Landing Canal (20v) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Triangle Marsh - Hayward (20w) | Fair | C | 2/2/2016 | WT | 0 | 2/19/2016 | ND | 0 | 3/10/2016 | ND | 0 | |

| *REGION: Union City* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Round 1 | | | Round 2 | | | Round 3 | | | |
| **Site Name and ID** | **Site Quality** | **Survey Type** | **Date** | **Observer** | **# RIRA Detected** | **Date** | **Observer** | **# RIRA Detected** | **Date** | **Observer** | **# RIRA Detected** | **Notes** |
| AFCC – to I-880 (01d) | Poor | G | 1/25/2016 | JM* | 0 | 2/19/2016 | JM* | 0 | 3/22/2016 | JM* | 0 | Surveyed using protocol G; *observer is lead surveyor with assistants at each station |
| AFCC - Strip Marsh (01e) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| OAC - North Bank (13a) | Fair | A | 1/27/2016 | SC | 0 | 2/10/2016 | JH | 0 | 2/24/2016 | KE | 0 | |
| OAC - Island (13b) | Good | A | 1/27/2016 | WT | 0 | 2/10/2016 | SG | 0 | 4/5/2016 | JH | 4 | |
| OAC - South Bank (13c) | Fair | A | 2/4/2016 | WT | 0 | 2/23/2016 | ND | 0 | 4/5/2016 | JH | 0 | |
| Whale's Tail - North (13d) | Good | A | 2/12/2016 | JM | 0 | 3/1/2016 | AE | 0 | 3/16/2016 | JM | 2 | |
| OAC - Upstream 20 Tide Gates (13g) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Eden Landing - North Creek (13h) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Eden Landing - Mt Eden Creek (13j) | Fair | A | 2/8/2016 | KE | 3 | 2/25/2016 | TR | 0 | 3/23/2016 | JM | 0 | |
| Eden Landing Reserve - South (13k) | Fair | C | 2/8/2016 | ND | 0 | 2/25/2016 | SC | 0 | 3/23/2016 | SG | 0 | |
| Eden Landing Reserve - North (13l) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Eden Landing - Ponds E8A, E9, E8X (13m) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |

| *REGION: Dumbarton South* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Round 1 | | | Round 2 | | | Round 3 | | | |
| **Site Name and ID** | **Site Quality** | **Survey Type** | **Date** | **Observer** | **# RIRA Detected** | **Date** | **Observer** | **# RIRA Detected** | **Date** | **Observer** | **# RIRA Detected** | **Notes** |
| Ravenswood Open Space Preserve (02j) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| SF2 (02n) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Calaveras Point (05a.2) | Excellent | A | 2/4/2016 | JM | 4 | 3/1/2016 | TR | 9 | 3/16/2016 | TR | 21 | |
| Newark Slough (05c) | Good | A | 2/8/2016 | SC | 0 | 2/23/2016 | SG | 6 | 3/24/2016 | SC | 8 | |
| Mayhew's Landing (05e) | Poor | C | 1/22/2016 | WT | 0 | 2/10/2016 | KE | 0 | 3/9/2016 | KE | 0 | |
| Coyote Creek (05f) | Good | A | 1/28/2016 | JM | 2 | 3/1/2016 | JM | 0 | 3/16/2016 | JM | 14 | |
| Cargill Pond (W Suites Hotel) (05g) | Poor | C | 1/22/2016 | WT | 0 | 2/10/2016 | KE | 0 | 3/9/2016 | KE | 0 | |
| Plummer Creek Mitigation (05h) | Fair | C | 1/22/2016 | WT | 0 | 2/10/2016 | KE | 0 | 3/9/2016 | KE | 0 | |
| Island Ponds (05i) | Fair | A | 1/28/2016 | JM | 2 | 3/1/2016 | JM | 0 | 3/16/2016 | JM | 2 | |
| Mountain View Slough (15a.1) | Good | A | 2/8/2016 | SG | 0 | 3/9/2016 | SG | 0 | 3/24/2016 | SG | 2 | |
| Stevens Creek to Long Point (15a.2) | Fair | A | 2/8/2016 | PL | 1 | 2/25/2016 | PL | 1 | 4/6/2016 | AE | 0 | |
| Alviso Slough (15a.4) | Good | A | 1/28/2016 | SG | 8 | 2/16/2016 | AE | 5 | 4/7/2016 | JM | 4 | |
| Coyote Creek South East (15a.5) | Excellent | A | 1/28/2016 | JM | 4 | 2/16/2016 | JM | 19 | 4/7/2016 | TR | 1 | +1 BLRA in round 1 |
| Knapp Tract (15a.6) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Stevens Creek (15c) | Fair | C | 2/8/2016 | PL | 0 | 2/25/2016 | PL | 0 | 4/6/2016 | AE | 1 | |
| Cooley Landing (16) | Fair | A | 1/22/2016 | TR | 5 | 2/10/2016 | TR | 5 | 3/8/2016 | PL | 10 | |

| *REGION: San Mateo* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Round 1 | | | Round 2 | | | Round 3 | | | |
| **Site Name and ID** | **Site Quality** | **Survey Type** | **Date** | **Observer** | **# RIRA Detected** | **Date** | **Observer** | **# RIRA Detected** | **Date** | **Observer** | **# RIRA Detected** | **Notes** |
| Belmont Slough (02a.1) | Good | A | 2/4/2016 | TR | 0 | 2/23/2016 | PL | 2 | 3/21/2016 | PL | 6 | |
| Redwood Shores (02a.3) | Fair | C | 2/3/2016 | TR | 0 | 2/22/2016 | TR | 0 | 3/24/2016 | TR | 0 | |
| Redwood Shores Mitigation Bank (02a.4) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Corkscrew Slough (02b.1) | Excellent | A | 2/5/2016 | SC | 13 | 2/29/2016 | SC | 10 | 3/15/2016 | KE | 2 | |
| Steinberger Slough (02b.2) | Good | C | 2/3/2016 | AE | 0 | 2/22/2016 | AE | 0 | 3/24/2016 | AE | 0 | |
| B2 North Quadrant (02c) | Good | A | 2/15/2016 | TR | 13 | 3/2/2016 | TR | 25 | 3/31/2016 | TR | 26 | Partial treatment at site |
| *B2 North Quadrant – NW (02c.1a)* | *Good* | *A* | *2/15/2016* | *TR* | *2* | *3/2/2016* | *TR* | *6* | *3/31/2016* | *TR* | *4* | *Treatment permitted* |
| *B2 North Quadrant – NE (02c.1b)* | *Good* | *A* | *2/15/2016* | *TR* | *9* | *3/2/2016* | *TR* | *19* | *3/31/2016* | *TR* | *12* | *No treatment allowed* |
| *B2 North Quadrant – S (02c.2)* | *Good* | *A* | *2/15/2016* | *TR* | *2 (1)* | *3/2/2016* | *TR* | *0 (8)* | *3/31/2016* | *TR* | *0 (16)* | *Treatment permitted; detections from adjacent sites included in parenthesis* |
| B2 South Quadrant (02d) | Good | A | 2/5/2016 | AE | 1 | 2/29/2016 | AE | 6 | 3/15/2016 | JH | 0 | |
| West Point Slough - NW (02e) | Good | C | 1/25/2016 | AE | 2 | 2/18/2016 | AE | 0 | 3/9/2016 | PL | 1 | |
| Greco Island - North (02f) | Good | A | 2/5/2016 | PL | 5 | 2/29/2016 | JM | 0 | 3/15/2016 | SC | 0 | |
| West Point Slough - SW / E (02g) | Good | C | 1/25/2016 | AE | 0 | 2/18/2016 | AE | 0 | 3/9/2016 | PL | 0 | |
| Greco Island - South (02h) | Excellent | A | 1/21/2016 | TR | 38 | 2/9/2016 | TR | 29 | 3/23/2016 | TR | 31 | |
| Ravenswood Slough (02i) | Good | A | 1/28/2016 | TR | 3 | 2/23/2016 | KE | 8 | 4/8/2016 | KE | 1 | |
| Middle Bair N (02k) | Excellent | A | 2/5/2016 | JM | 13 | 2/29/2016 | TR | 14 | 3/15/2016 | TR | 7 | |
| Middle Bair SE (02k) | Good | A | 2/5/2016 | JM | 0 | 2/29/2016 | TR | 0 | 3/15/2016 | TR | 0 | |
| Inner Bair Island Restoration (02l) | Poor | C | 2/5/2016 | SG | 0 | 2/26/2016 | AE | 0 | 4/5/2016 | AE | 0 | |
| Pond B3 Bair Island Restoration (02m) | Poor | C | 2/15/2016 | JM | 0 | 3/2/2016 | JM | 0 | 3/31/2016 | JM | 0 | |
| Middle Bair West (02o) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |

| *REGION: San Francisco Peninsula* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Round 1 | | | Round 2 | | | Round 3 | | | |
| **Site Name and ID** | **Site Quality** | **Survey Type** | **Date** | **Observer** | **# RIRA Detected** | **Date** | **Observer** | **# RIRA Detected** | **Date** | **Observer** | **# RIRA Detected** | **Notes** |
| Pier 94 (12a) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Pier 98/Heron's Head (12b) | Fair | C | 1/29/2016 | TR | 0 | 3/18/2016 | AE | 0 | 4/5/2016 | TR | 0 | |
| Colma Creek (18a) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Navigable Slough (18b) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Sam Trans Peninsula (18e) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| San Bruno Marsh (18g) | Poor | C | 2/3/2016 | PL | 0 | 2/22/2016 | PL | 0 | 3/25/2016 | PL | 0 | |
| San Bruno Creek (18h) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Oyster Cove (19c) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Oyster Point Park (19e) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Point San Bruno (19f) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Seaplane Harbor (19g) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| SFO (19h) | Fair | A | 1/21/2016 | AE | 0 | 2/10/2016 | AE | 1 | 3/8/2016 | AE | 1 | |
| Mills Creek Mouth (19i) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Easton Creek Mouth (19j) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Sanchez Marsh (19k) | Fair | C | 2/9/2016 | AE | 0 | 3/4/2016 | AE | 0 | 4/7/2016 | TR | 0 | |
| Burlingame Lagoon (19l) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Coyote Point Marina (19n) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Seal Slough (19p) | Fair | C | 1/26/2016 | AE | 0 | 2/23/2016 | ND | 0 | 3/24/2016 | PL | 0 | |
| Anza Lagoon (19r) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |

| *REGION: Marin* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Round 1 | | | Round 2 | | | Round 3 | | | |
| **Site Name and ID** | **Site Quality** | **Survey Type** | **Date** | **Observer** | **# RIRA Detected** | **Date** | **Observer** | **# RIRA Detected** | **Date** | **Observer** | **# RIRA Detected** | **Notes** |
| Blackie's Creek (03a) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Blackie's Creek Mouth (03b) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Larkspur Ferry Landing Area (04e) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Riviera Circle (04f) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Creekside Park (04g) | Good | A | 1/20/2016 | SC | 1 | 2/11/2016 | AE | 0 | 4/4/2016 | SC | 5 | |
| CMC - Upper (04h) | Fair | A | 1/20/2016 | KE | 0 | 2/11/2016 | ND | 0 | 4/4/2016 | SG | 0 | |
| CMC - Lower (04i) | Poor | C | 1/20/2016 | KE | 0 | 2/11/2016 | ND | 0 | 4/4/2016 | SG | 0 | |
| CMC - Mouth (04j) | Good | A | 1/20/2016 | TR | 0 | 2/11/2016 | WT | 0 | 4/4/2016 | AE | 0 | |
| Pickleweed Park (09) | Good | C | 1/19/2016 | PL | 0 | 2/23/2016 | AE | 2 | 3/25/2016 | AE | 3 | |
| Beach Drive (23b) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Loch Lomond Marina (23c) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| San Rafael Canal Mouth (23d) | Good | C | 1/19/2016 | PL | 0 | 2/23/2016 | AE | 2 | 3/25/2016 | AE | 0 | |
| Paradise Cay (23f) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Greenwood Beach (23g) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Strawberry Point (23h) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Strawberry Cove (23i) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |
| Starkweather Park (23l) | Poor | F | - | - | - | - | - | - | - | - | - | Insufficient habitat |

| *REGION: San Pablo Bay* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Round 1 | | | Round 2 | | | Round 3 | | | |
| Site Name and ID | Site Quality | Survey Type | Date | Observer | # RIRA Detected | Date | Observer | # RIRA Detected | Date | Observer | # RIRA Detected | Notes |
| San Pablo Bay NWR Shoreline (26b) | Fair | F | - | - | - | - | - | - | - | - | - | Survey in alternate years |

**KEY to Observers:**

- **AE** = Anastasia Ennis
- **JH** = Jeanne Hammond
- **JM** = Jen McBroom
- **KE** = Kevin Eng
- **ND** = Nate Deakers
- **PL** = Pim Laulikitnont
- **SG** = Simon Gunner
- **SC** = Stephanie Chen
- **TR** = Tobias Rohmer
- **WT** = Whitney Thornton