
E-9: Line 407 East Dry-Season Sampling for Branchiopod

**DRY-SEASON SAMPLING
FOR
FEDERALLY-LISTED LARGE BRANCHIOPODS
AT THE
PG&E LINE 407 EAST PROJECT**



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INTRODUCTION

Helm Biological Consulting was contracted by Gallaway Consulting, Inc. to conduct dry-season sampling for large branchiopods (fairy shrimp, tadpole shrimp, and clam shrimp) that are listed as threatened or endangered under the Federal Endangered Species Act (e.g., vernal pool fairy shrimp [*Branchinecta lynchi*] and vernal pool tadpole shrimp [*Lepidurus packardii*]) at the PG&E Line 407 East Project.

The PG&E Line 407 East Project is proposed for natural gas transmission pipeline installation. The survey area for this linear project consists of approximately 1,800 acres occurring along the north and south sides of Baseline and Riego Roads as well as, the east and west side of Powerline Road, just west of the City of Roseville and just north of the Cities of Rio Linda and North Highlands, in Placer, Sutter, and Sacramento Counties, California. Moreover, the PG&E Line 407 East Project encompasses portions of Sections 1-8 and 17-20 of Township 10 North, Range 4 East of the Taylor Monument 7.5-minute U.S. Geological Survey topographic quadrangle map (hereafter “USGS map”), Sections 31-36 of Township 11 North, Range 4 East of the Verona USGS map, Sections 1-6 of Township 10 North, Range 5 East of the Rio Linda USGS map, Sections 31-36 of Township 11 North, Range 5 East of the Pleasant Grove USGS map, Section 6 of Township 10 North, Range 6 East of the Citrus Heights USGS map, and Section 31 of Township 11 North, Range 6 East of the Roseville USGS map (Figure 1).

Gallaway Consulting, Inc. identified 33.739 acres of wetlands, including (4.089 acres) of fresh emergent wetlands, (0.217 acre) of riparian, (1.950 acres) of seasonal swales, (21.785 acres) of seasonal wetlands, (4.359 acres) of vernal pools, and (1.339 acres) of vernal swales onsite (Attachments DS-01 – DS-26).

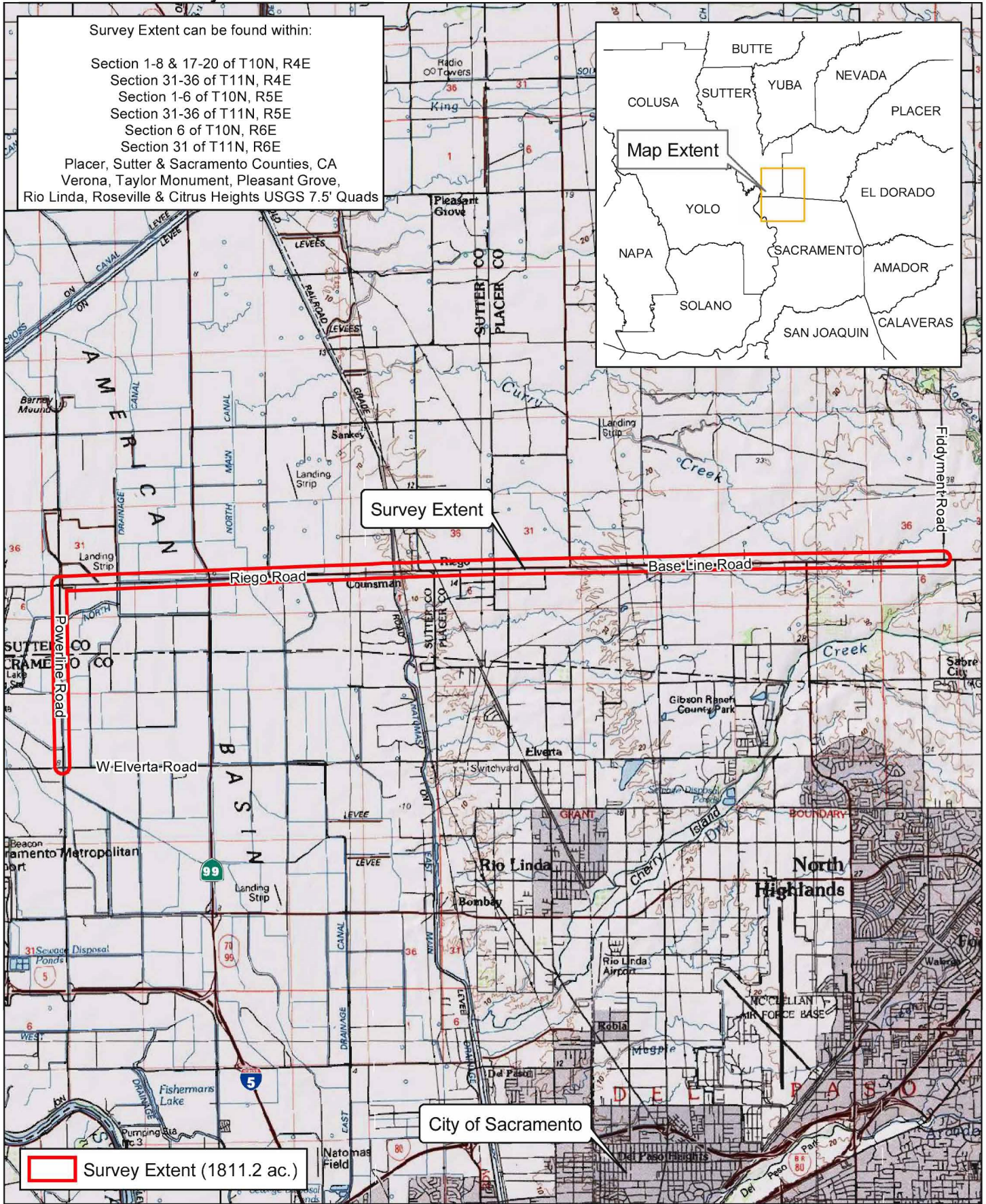
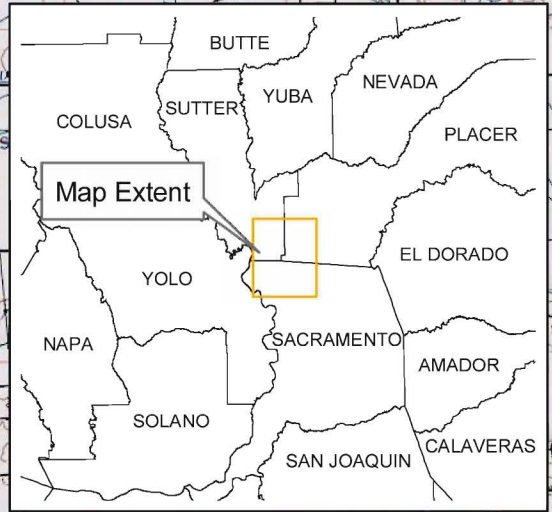
This report discusses the methods and results of the dry-season sampling for the presence of federally-listed large branchiopods at the PG&E Line 407 East Project.

PG&E Line 407 East Project

Survey Extent can be found within:

- Section 1-8 & 17-20 of T10N, R4E
- Section 31-36 of T11N, R4E
- Section 1-6 of T10N, R5E
- Section 31-36 of T11N, R5E
- Section 6 of T10N, R6E
- Section 31 of T11N, R6E

Placer, Sutter & Sacramento Counties, CA
 Verona, Taylor Monument, Pleasant Grove,
 Rio Linda, Roseville & Citrus Heights USGS 7.5' Quads



Survey Extent (1811.2 ac.)



USGS 7.5' Quad.
 Map Date: Aug. 10, 2006.



Figure 1.



METHODS

Dr. Brent Helm conducted dry-season sampling on November 5, 6, and 18, 2006 as authorized by U.S. Fish and Wildlife Service (USFWS) (Appendix A). Sampling was conducted under permit TE-795930-4 of Section 10(a)(1)(A) of the Federal Endangered Species Act, 16 U.S.C. 1531 *et seq.*, and its implementing regulations. Methods generally followed USFWS's *Interim Survey Guidelines to Permittees for Recovery Permits under Section 10(a)(1)(A) of the Endangered Species Act for the Listed Vernal Pool Branchiopods* (1996) and are described below.

All areas that potentially could support federally-listed large branchiopods were sampled. Potential habitat for federally-listed large branchiopods is defined as any seasonal inundated depression that on average ponds water two (2) inches or greater in depth for 30 or more consecutive days. Potential habitat characteristics of large branchiopods are based on the life history of Central Valley endemics (Eriksen and Belk 1999; Helm 1998, 1999; Helm and Vollmar 2002). The presence of water marks, algae mats, driftlines, hydrophytic ("water-loving") vegetation, slope, contributing watershed, maximum potential ponding depth and aquatic arthropods (i.e., crustaceans and insects) exoskeletons were helpful indicators for evidence of ponding depth and duration. Habitats that swiftly flow water (e.g., creeks, streams, ephemeral drainages) or semi-to-permanently inundated areas that support population of predators (e.g. bullfrogs, fish, and crayfish) were not generally considered suitable habitat for federally-listed large branchiopods.

Dry-season sampling involved the collection of a minimum of ten-soil sub-samples mainly from the lowest topographic areas within each basin considered potential habitat onsite. Soil samples were placed in liter size plastic freezer bags and marked with the project name, basin number, and date. The soil was then transported to a laboratory for processing and analysis.

In the laboratory, a brine solution was prepared by mixing table salt (NaCl) with lukewarm tap water in a large container. The collected soil material was placed in the brine solution. The soil material was then gently worked by hand to breakdown any persistent soil structure. The organic material rising to the top of the brine solution was skimmed off and placed in a 600-micron diameter pore-size sieve stacked atop a 75-micron diameter pore-size sieve. The soil material was processed through the top sieve by flushing it with lukewarm tap water while gently rubbing it with a soft-bristle brush. The



soil retained from the 75-micron diameter pore size sieve was then removed and thinly (1 mm) spread into plastic petri dishes.

The contents of each petri dish were examined under a 10 to 240-power zoom binocular microscope. A minimum of 0.5-hour was spent searching the contents of each petri dish for large branchiopod cysts (embryonic eggs). Dr. Helm's large branchiopod cyst reference collection and scanning electron micrographs of cysts (Hill and Shepard 1998, Mura 1991, and Gilchrist 1978) were used to identify and compare any cysts observed within the soil samples.

RESULTS

A total of 177 basins were sampled using dry-season techniques. This included 136 wetlands mapped by Gallaway Consulting Inc., and an additional 41 basins (HBC1–HBC14) identified by Helm Biological Consulting as potential large branchiopod habitat (Attachments DS-01 – DS-26). A total of 96 wetlands mapped by Gallaway Consulting Inc. were not sampled for the following reasons:

- Eighteen wetlands occurring in non-accessible parcels (WF001, WF002, WF007, WF023, OW193, WF057, OW094, OW093, WF060, WF061, WF062, WF059, WF063, WF090, WF091, WF092, OW0145, and OW0154)
- Six wetlands that are semi-perennial to perennial and/or would have swift flows (OW075, WF018, OW210, WF034, OW091, and WF112)
- Four wetlands did not possess adequate ponding depth and duration characteristics for federally-listed large branchiopods to complete their life cycle (WF054, WF055, WF056, and WF034)
- Two perennial ponds (OW226 and OW227)
- All of the irrigation ditches (a total of 66) that contain summer water due to crop maintenance, except for three (OW013, OW135, and OW195)

Cysts belonging to the genus *Branchinecta* were observed in soils collected from 41 basins onsite (Table 1). Cysts belonging to the California fairy shrimp (*Linderiella occidentalis*) were observed in soils collected from 21 basins onsite (Table 1). Representative photographs of the basins onsite are found in Appendix B.

Table 1. Results of Soil Examinations

Basin No.	Insect Exo Skeletons	Micro- Turbularian Cysts	Cladocera Ephippia	Ostracods Live/Cysts/ Carapaces	Large Branchiopod Cysts		Hydracarina Live/Eggs	Nematoda	Collembola
					<i>Branchinecta</i> sp.	<i>Linderiella</i> <i>occidentalis</i>			
HBC	X						X	X	
HBCA	X			X					
HBCB	X						X	X	
HBC1	X		X				X		
HBC1A	X								
HBC1B	X	X	X	X					
HBC1C	X	X							
HBC1D	X		X	X					
HBC1E	X	X	X						
HBC1F	X	X		X					
HBC2	X	X	X						
HBC2A	X	X		X					
HBC3			X	X				X	
HBC3A	X	X		X					
HBC4	X		X						
HBC4A	X								
HBC4B	X	X	X				X		
HBC4C	X	X	X		1	1			
HBC4D	X	X							
HBC5	X	X	X		5				
HBC6		X							
HBC6A	X		X						
HBC7	X						X		
HBC8	X		X				X		
HBC8A	X	X	X						
HBC8B	X	X							
HBC8C	X		X	X					
HBC8D	X				3				
HBC8E	X	X	X						X
HBC8F	X		X	X					X
HBC9	X		X					X	X
HBC9A	X	X	X						
HBC10	X		X					X	
HBC11	X	X						X	
HBC12	X	X	X				X		
HBC12A	X	X							
HBC12B	X				2				
HBC12C	X	X							
HBC12D	X	X							
HBC13									
HBC14	X		X				X	X	
OW008,OW113,OW097, OW101,OW103,OW105, OW107,OW109,OW111	X								X
OW013	X		X	X	≈ 30		X	X	X
OW043	X		X						
OW065		X	X				X		X
OW066	X								
OW068	X								
OW069	X							X	X
OW070									
OW074	X							X	X
OW080,OW082		X							X
OW086	X	X		X			X	X	
OW087	X			X			X		X
OW088,OW089								X	X
OW097	X								
OW099	X						X		X
OW114	X								
OW115	X								X
OW117,OW119,OW120, OW122									
OW124	X	X					X	X	X

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Basin No.	Insect Exo Skeletons	Micro- Turbularian Cysts	Cladocera Ephippia	Ostracods Live/Cysts/ Carapaces	Large Branchiopod Cysts		Hydracarina Live/Eggs	Nematoda	Collembola
					<i>Branchinecta</i> sp.	<i>Linderiella</i> <i>occidentalis</i>			
OW127	X		X	X		5	X		
OW128	X			X			X	X	X
OW135	X				>100		X	X	X
OW195					>50			X	X
OW217,OW219	X		X	X		2	X		X
WF003	X	X	X	X			X		
WF004	X	X	X				X		
WF005	X	X					X	X	
WF006	X	X							
WF008	X	X	X				X		
WF009	X		X				X		
WF010		X						X	
WF011		X	X	X			X		
WF012	X	X	X		>100				
WF013	X			X			X	X	X
WF014	X		X				X	X	
WF015							X	X	
WF016	X	X	X				X	X	
WF017	X		X				X		
WF020	X						X	X	X
WF022	X	X	X	X			X	X	X
WF024	X	X	X				X	X	
WF025,WF026	X	X	X	X			X		
WF028	X	X	X	X			X	X	X
WF029,WF030,OW078	X	X	X	X			X	X	
WF031,WF027	X		X	X			X	X	
WF032		X	X	X				X	
WF033	X		X				X		
WF035	X		X				X	X	
WF036	X								
WF037	X			X		3	X	X	
WF038	X							X	
WF039	X							X	
WF040				X	2				X
WF041	X	X	X	X	3	2	X		
WF042	X								
WF043	X		X		≈ 15		X		
WF044	X	X	X						
WF045			X				X	X	
WF046	X	X	X		3				
WF047	X		X						
WF048	X	X	X	X	≈ 60	≈ 10	X	X	X
WF049	X	X		X			X	X	
WF050	X	X	X	X			X		
WF051	X		X	X					
WF052	X	X	X	X					
WF053	X								
WF058	X	X	X						
WF064,OW225	X	X	X	X	2			X	
WF066	X	X	X		≈ 20	≈ 10	X		
WF067	X		X						
WF068	X	X	X				X	X	
WF069	X	X	X	X	≈ 15		X	X	
WF070	X	X	X	X	5		X	X	
WF071	X		X		≈ 30				
WF072	X	X	X		≈ 50		X	X	
WF073	X	X	X		2		X	X	
WF074	X							X	
WF075					3		X		
WF077	X		X	X			X		
WF078	X	X	X	X			X	X	
WF079	X	X	X	X			X		
WF080	X	X		X	20	8			
WF081	X	X							

Table 1. Results of Soil Examinations

Basin No.	Insect Exo Skeletons	Micro- Turbularian Cysts	Cladocera Ephippia	Ostracods Live/Cysts/ Carapaces	Large Branchiopod Cysts		Hydracarina Live/Eggs	Nematoda	Collembola
					<i>Branchinecta</i> sp.	<i>Linderiella</i> <i>occidentalis</i>			
WF082	X	X	X		≈ 50			X	X
WF083	X	X	X				X		
WF084	X						X		
WF085	X	X	X						X
WF086	X	X	X		1		X		X
WF087	X	X					X	X	
WF088	X	X	X	X	1		X	X	
WF089	X		X	X	5		X		
WF094	X		X	X	1	1			
WF095	X		X		≈ 50	1		X	
WF096	X		X		35	5			
WF097	X	X			≈ 20	≈ 10			
WF098	X		X		≈ 25	≈ 10		X	X
WF099			X		≈ 40	≈ 20			
WF100	X	X	X		>100	≈ 15			
WF101	X	X	X		>100	≈ 10			
WF102	X	X	X		>100	≈ 10			
WF103	X	X	X		>100	≈ 30			
WF104		X			>150	≈ 30			
WF105	X		X		>200	5			
WF106	X		X		≈ 50	≈ 10			X
WF107			X						
WF108	X	X						X	
WF109	X		X					X	
WF110	X	X			≈ 30				
WF111		X	X				X		X
WF113	X	X							
WF114	X	X	X						
WF115	X	X	X						
WF116									
WF117	X						X		
WF118	X			X			X		
WF119	X	X		X	1				
WF120	X	X	X				X	X	



DISCUSSION

The California fairy shrimp is a somewhat common large branchiopod found in the Central Valley and has no state or federal status (e.g., listed as threatened or endangered). However, several species within the genus *Branchinecta* are listed as threatened or endangered under the Federal Endangered Species Act. Positive identification of the *Branchinecta* sp. cysts to species would entail hatching and rearing the cysts to maturity or the collection of mature branchiopod specimens from the occupied habitat during the wet-season.



LITERATURE CITED

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- Gilchrist, B. M. 1978. Scanning electron microscope studies of the egg shell in some Anostraca (Crustacea: Branchiopoda). *Cell Tiss. Res.* 193: 337-351.
- Helm, B. P. 1998. Biogeography of eight large branchiopods endemic to California. Pages 124-139 *in* Witham, C. W., E. T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff. (eds.). Ecology, conservation, and management of vernal pool ecosystems – proceeding from a 1996 conference. California Native Plant Society, Sacramento, CA. 285 pp.
- Helm, B. P. 1999. Feeding ecology of *Lindleriella occidentalis* (Dodds) (Crustacea: Anostraca). Doctoral thesis. University of California, Davis. 158 pp.
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- Mura, G. 1991. SEM morphology of resting eggs in the species of the genus *Branchinecta* from North America. *J. Crust. Biol.* 11: 432-436.
- U. S. Fish and Wildlife Service. 1996. Interim Survey Guidelines to Permittees for Recovery Permits under Section 10 (a)(1)(A) of the Endangered Species Act for the Listed Vernal Pool Branchiopods. 11 pp.



APPENDIX A. USFWS AUTHORIZATION LETTER

Subj: **Survey Authorization for [REDACTED] and PGE Project site**
Date: 9/22/2006 1:42:28 P.M. Pacific Standard Time
From: Mary_Hammer@fws.gov
To: bhelm69485@aol.com
CC: Lawrence_Host@fws.gov, holly_herod@fws.gov

Brent, by this email message you are authorized to conduct wet and dry season sampling for federally-listed vernal pool crustaceans per the conditions of your permit, TE-795930-3, at the [REDACTED] along the PG&E Project site in Placer, Sutter, and Sacramento Counties. [REDACTED]

[REDACTED] The PG& E project site consists of approximately 1,800 acres and is located just west of the city of Roseville and north of Rio Linda and North Highlands. Approximately 30 seasonal wetland habitats were identified on site.

Please remember to have all biologists carry a copy of their permit while doing the work, and to follow the terms and conditions of the permit and the survey protocol, including the reporting requirements. Please include the recovery permit numbers and all persons involved in the reports of the results of surveys, and the date of this authorization, to help ensure that we correctly record the fulfillment of the reporting requirement under this authorization.

Please send separate copies of the report(s) at the time of any formal or informal consultation under section 7 of the Endangered Species Act with the Fish and Wildlife Service.

Please let us know if the surveys are not performed as authorized, or if they are done by a different permittee under a separate authorization. Also include a summary of what surveys were authorized, who was authorized, when the surveys were done, and who did the surveys in your annual report for each recovery permit involved with this survey authorization.

Thank you for your assistance.

Mary Hammer
Senior Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
Endangered Species Division
2800 Cottage Way, Rm. W-2605
Sacramento, CA 95825-1846
(916) 414-6600
Fax: (916) 414-6713



APPENDIX B. REPRESENTATIVE PHOTOGRAPHS



PG&E Line 407 East Project – WF083



PG&E Line 407 East Project – WF105



PG&E Line 407 East Project – WF108



PG&E Line 407 East Project – WF087



PG&E Line 407 East Project – WF072



PG&E Line 407 East Project – WF114



PG&E Line 407 East Project – WF039



PG&E Line 407 East Project – WF026



PG&E Line 407 East Project – WF003



PG&E Line 407 East Project – OW086



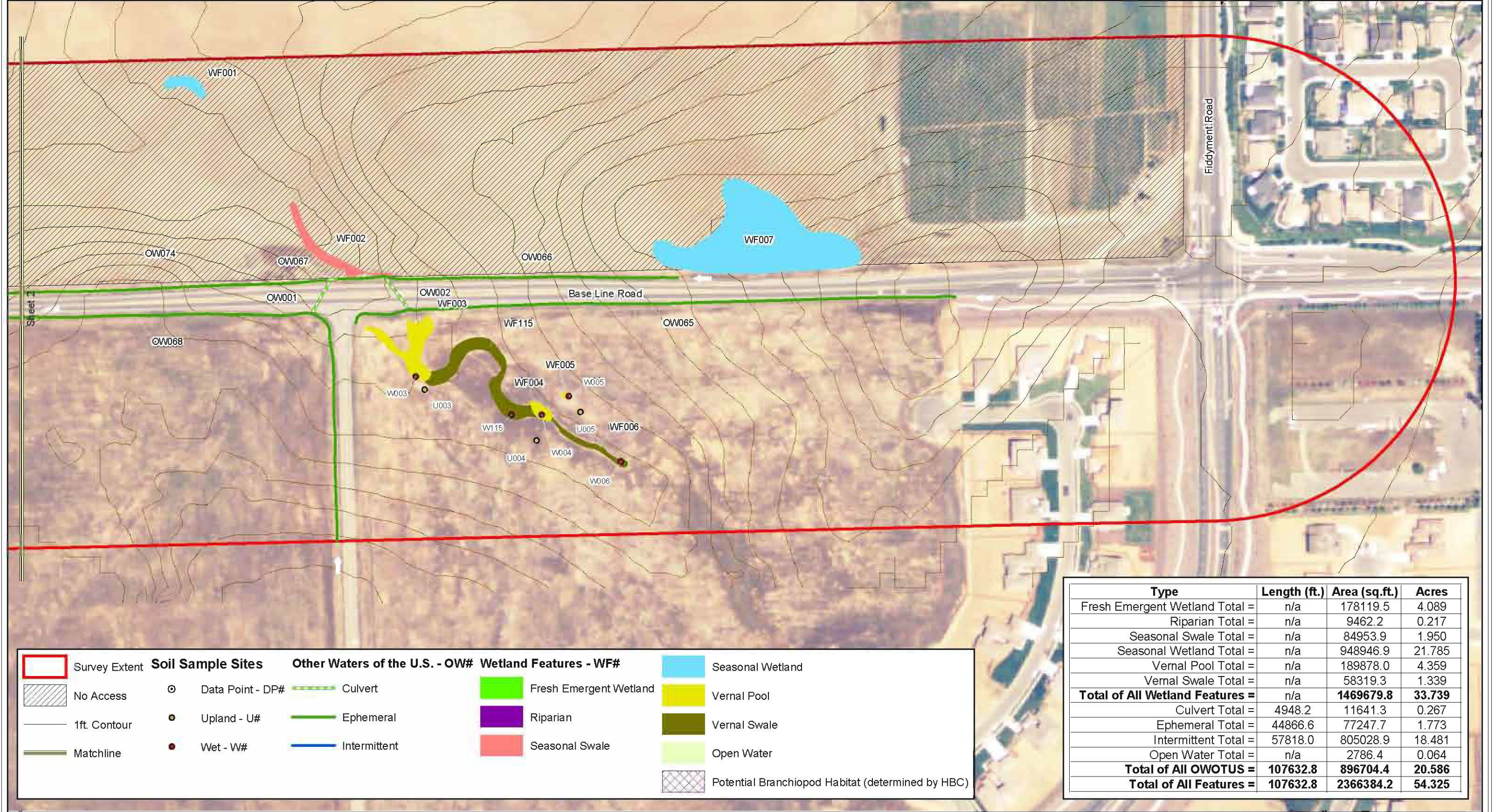
PG&E Line 407 East Project – OW066



PG&E Line 407 East Project – OW135

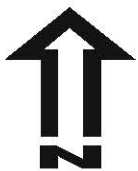


ATTACHMENTS (DS-01 – DS-26)



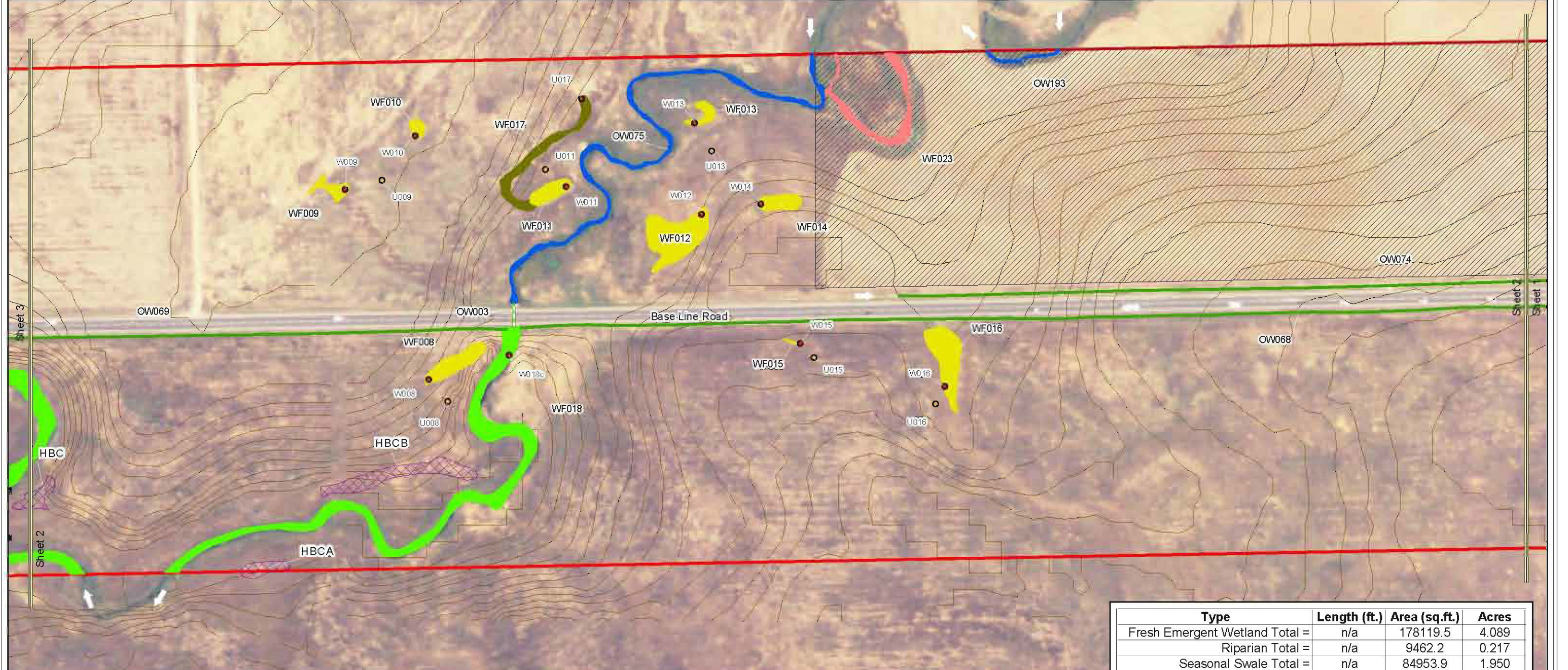
Survey Extent	Soil Sample Sites	Other Waters of the U.S. - OW#	Wetland Features - WF#	Seasonal Wetland
No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
1ft. Contour	Upland - U#	Ephemeral	Riparian	Vernal Swale
Matchline	Wet - W#	Intermittent	Seasonal Swale	Open Water
				Potential Branchiopod Habitat (determined by HBC)

Type	Length (ft.)	Area (sq.ft.)	Acres
Fresh Emergent Wetland Total =	n/a	178119.5	4.089
Riparian Total =	n/a	9462.2	0.217
Seasonal Swale Total =	n/a	84953.9	1.950
Seasonal Wetland Total =	n/a	948946.9	21.785
Vernal Pool Total =	n/a	189878.0	4.359
Vernal Swale Total =	n/a	58319.3	1.339
Total of All Wetland Features =	n/a	1469679.8	33.739
Culvert Total =	4948.2	11641.3	0.267
Ephemeral Total =	44866.6	77247.7	1.773
Intermittent Total =	57818.0	805028.9	18.481
Open Water Total =	n/a	2786.4	0.064
Total of All OWOTUS =	107632.8	896704.4	20.586
Total of All Features =	107632.8	2366384.2	54.325



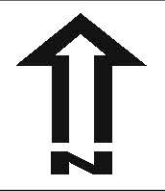
The information contained in this figure shall be considered preliminary until written verification by the USACE. Survey Extent derived from 500 ft. buffer of roadway. Features that fall within No Access areas were derived from roadside delineation and aerial photo interpretation. Survey Dates: July 21, 24 - 28, Aug. 10 & 25 2006/Surveyors: JG, SI, EA. Date of Aerial: Feb. 2005 (NAIP)/Contours derived from USGS DEM. Map Date: Aug. 29, 2006/Revisions:





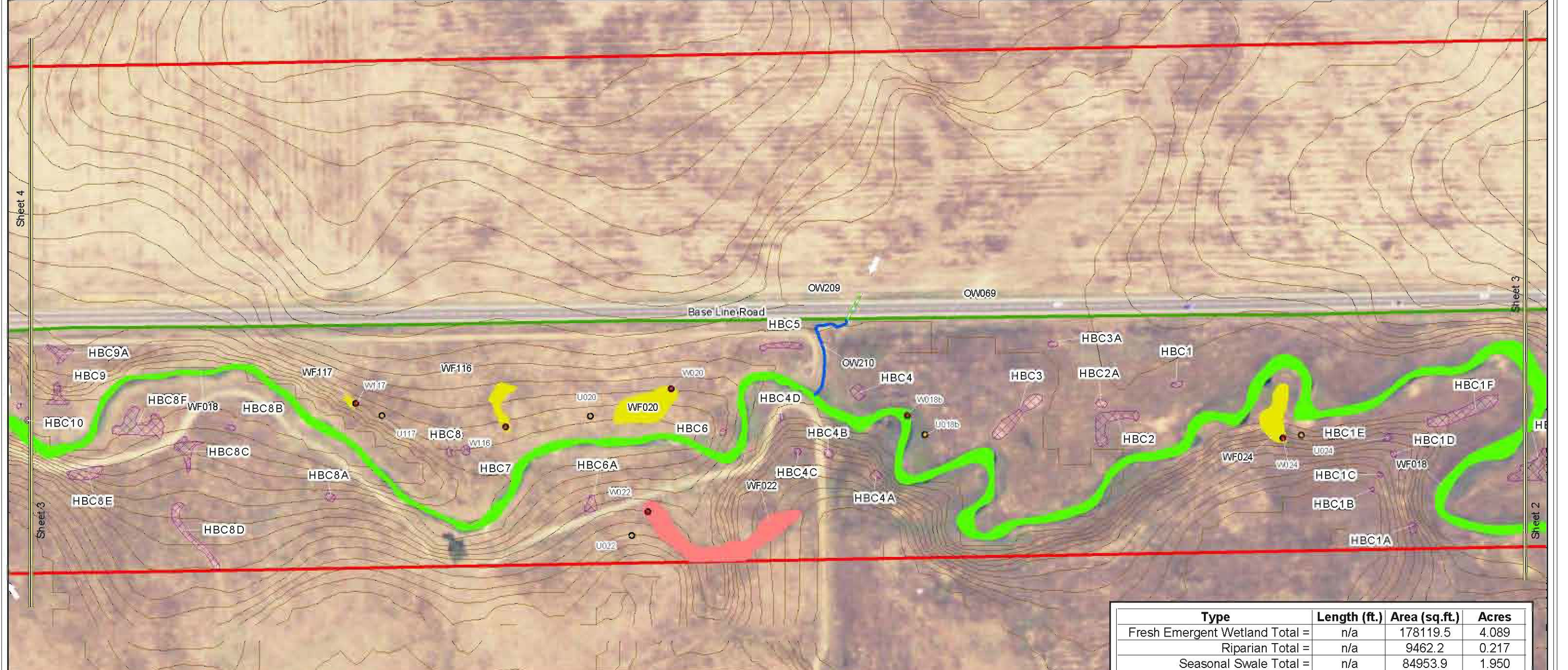
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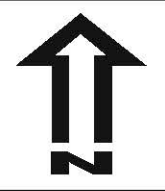
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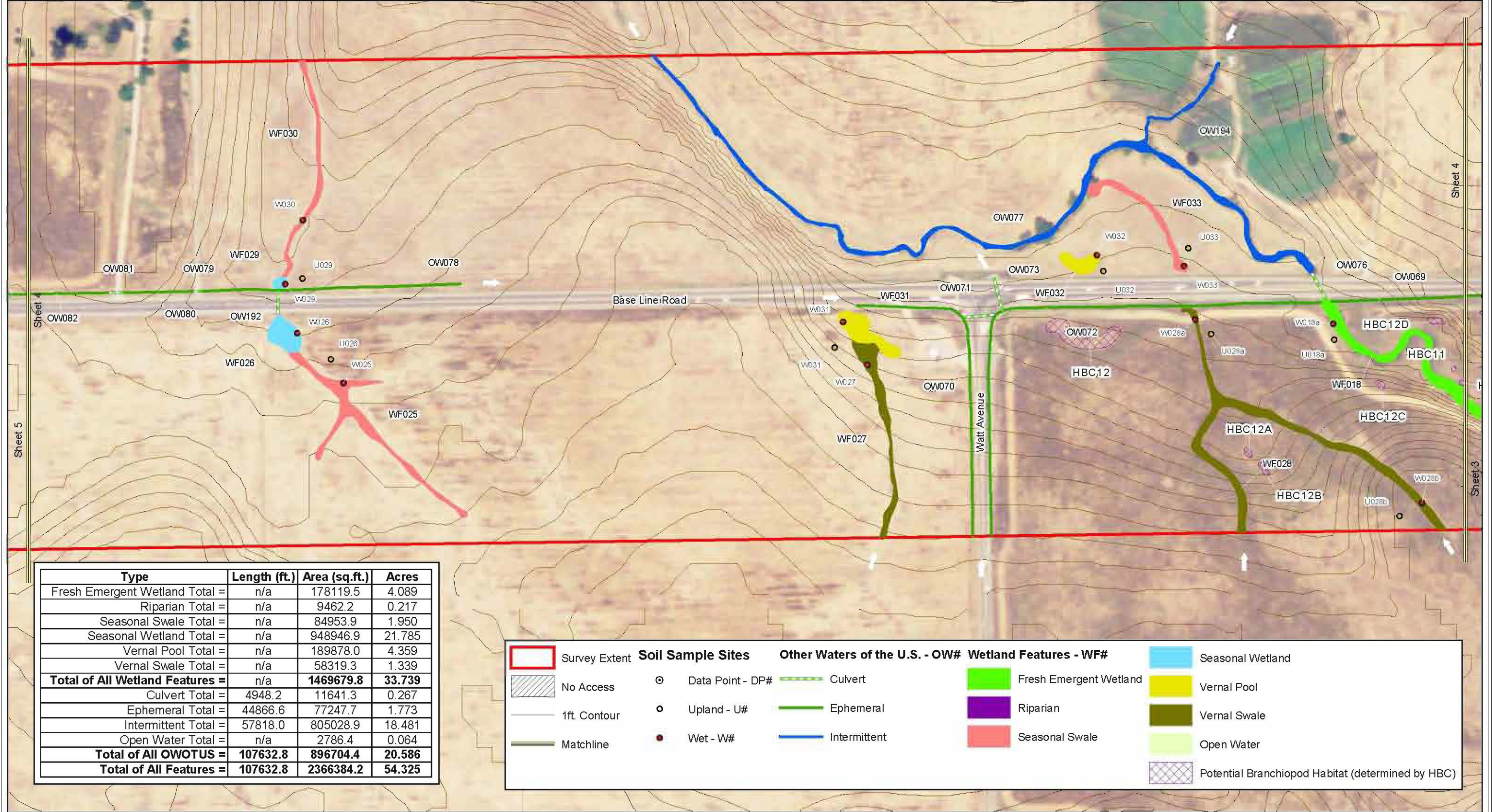
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Open Water Total =	n/a	2786.4	0.064
Total of All OWOTUS =	107632.8	896704.4	20.586
Total of All Features =	107632.8	2366384.2	54.325



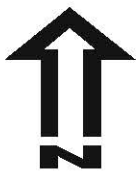
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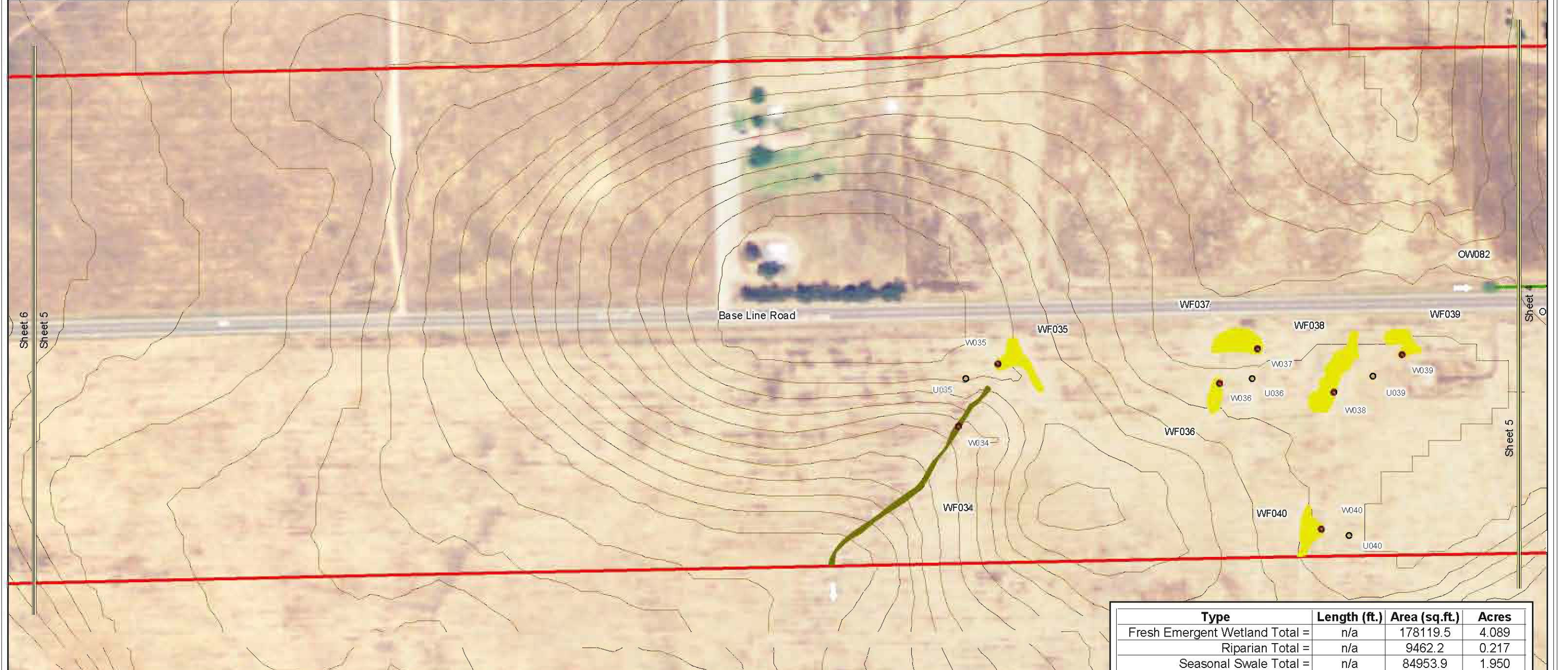
Type	Length (ft.)	Area (sq.ft.)	Acres
Fresh Emergent Wetland Total =	n/a	178119.5	4.089
Riparian Total =	n/a	9462.2	0.217
Seasonal Swale Total =	n/a	84953.9	1.950
Seasonal Wetland Total =	n/a	948946.9	21.785
Vernal Pool Total =	n/a	189878.0	4.359
Vernal Swale Total =	n/a	58319.3	1.339
Total of All Wetland Features =	n/a	1469679.8	33.739
Culvert Total =	4948.2	11641.3	0.267
Ephemeral Total =	44866.6	77247.7	1.773
Intermittent Total =	57818.0	805028.9	18.481
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Survey Extent	Data Point - DP#	Culvert	Fresh Emergent Wetland	Seasonal Wetland
No Access	Upland - U#	Ephemeral	Riparian	Vernal Pool
1ft. Contour	Wet - W#	Intermittent	Seasonal Swale	Vernal Swale
Matchline			Open Water	Potential Branchiopod Habitat (determined by HBC)



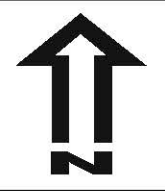
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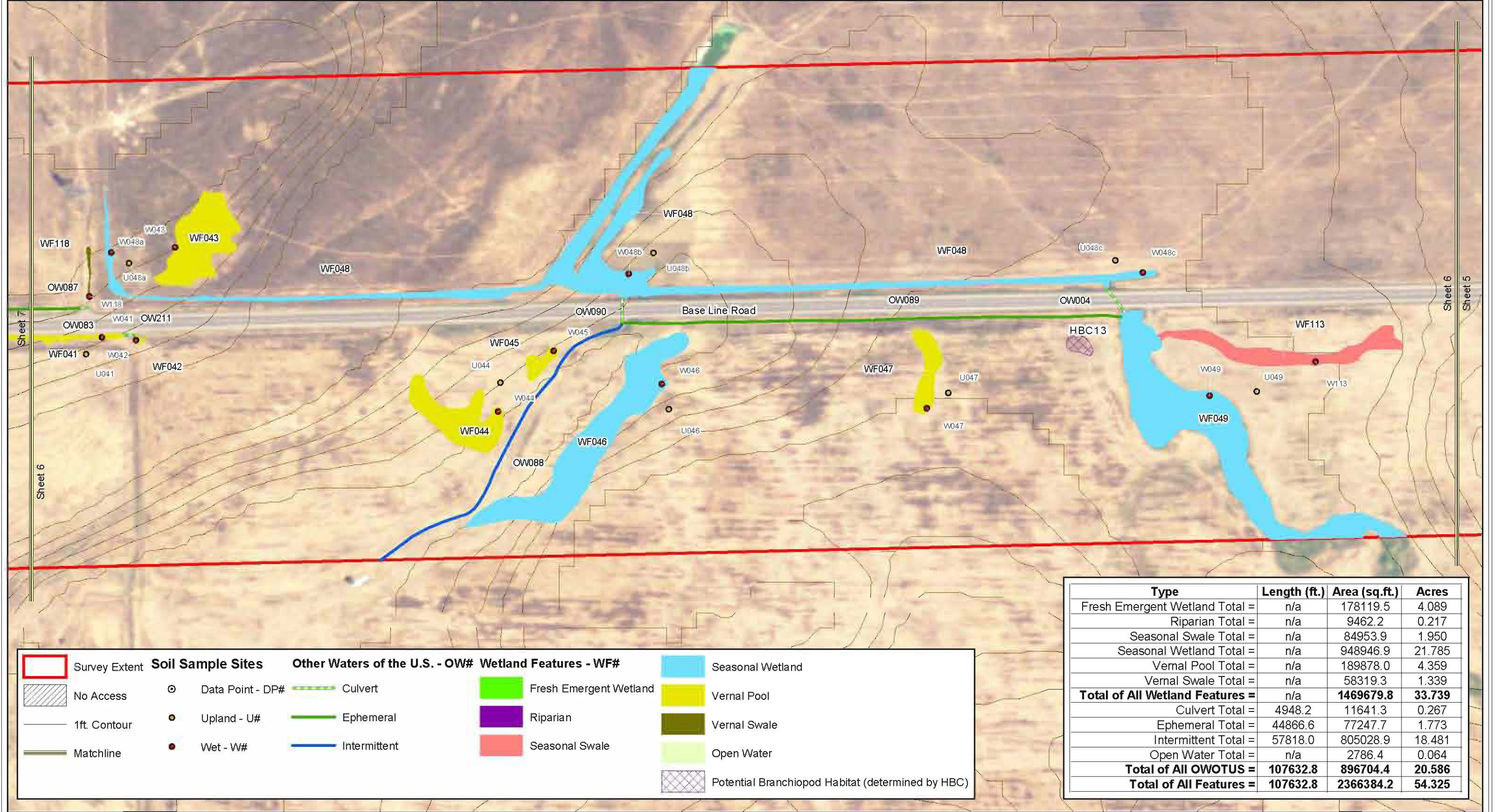
Survey Extent	Soil Sample Sites	Other Waters of the U.S. - OW#	Wetland Features - WF#	Seasonal Wetland
No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
1ft. Contour	Upland - U#	Ephemeral	Riparian	Vernal Swale
Matchline	Wet - W#	Intermittent	Seasonal Swale	Open Water
				Potential Branchiopod Habitat (determined by HBC)

Type	Length (ft.)	Area (sq.ft.)	Acres
Fresh Emergent Wetland Total =	n/a	178119.5	4.089
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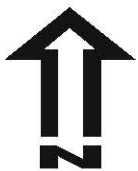
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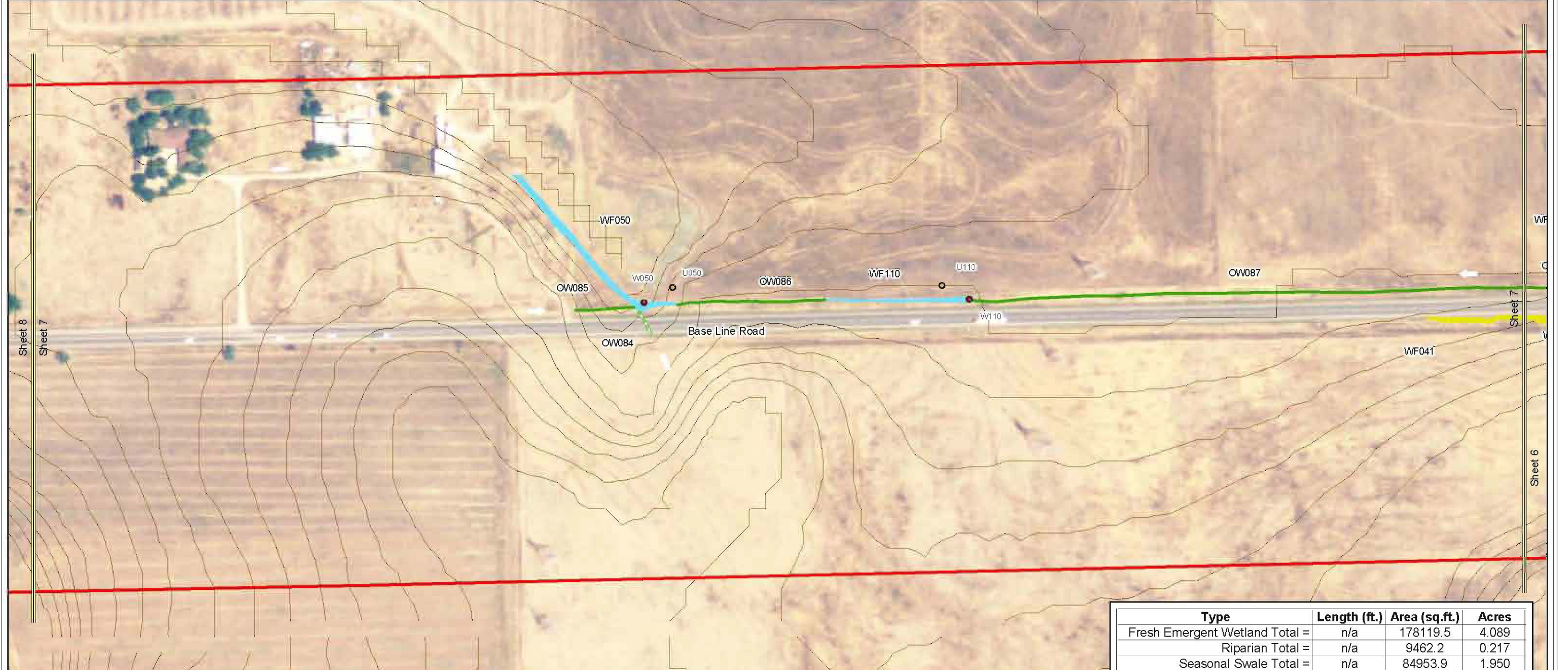
Survey Extent	Soil Sample Sites	Other Waters of the U.S. - OW#	Wetland Features - WF#	Seasonal Wetland
No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
1ft. Contour	Upland - U#	Ephemeral	Riparian	Vernal Swale
Matchline	Wet - W#	Intermittent	Seasonal Swale	Open Water
				Potential Branchiopod Habitat (determined by HBC)

Type	Length (ft.)	Area (sq.ft.)	Acres
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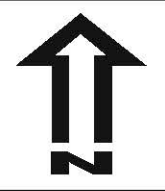
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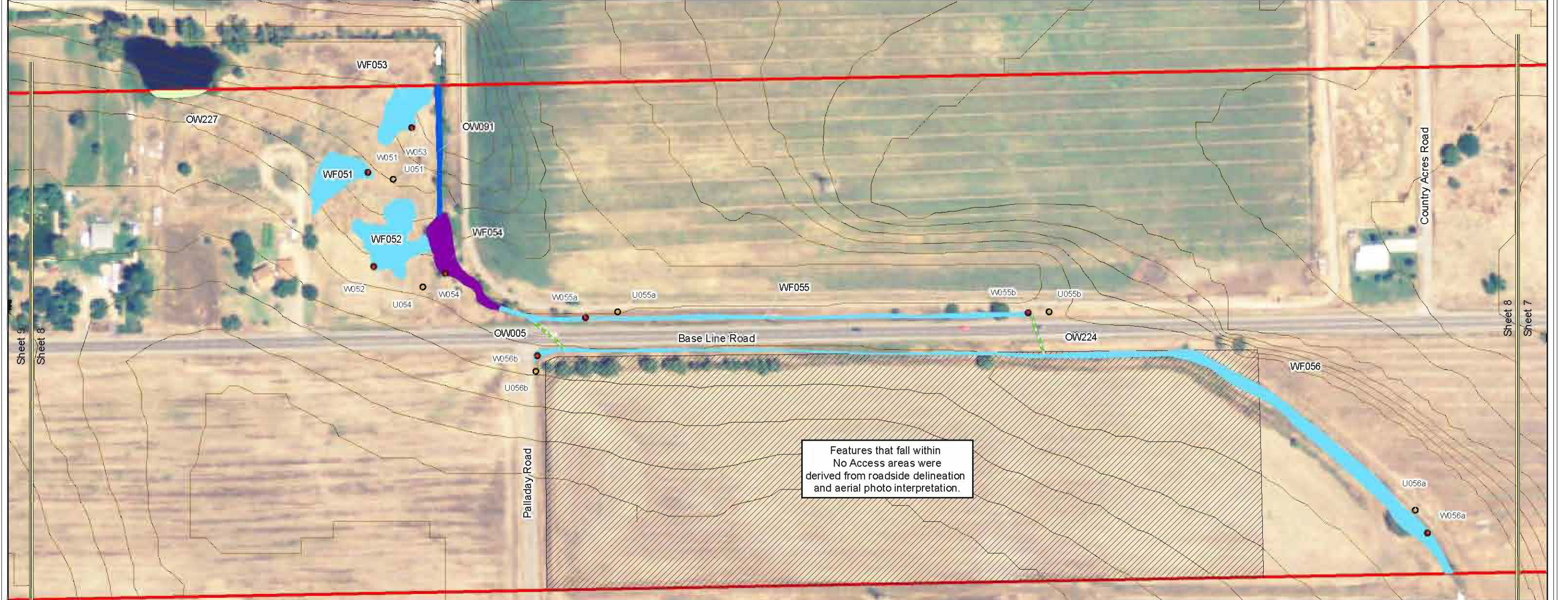
Survey Extent	Soil Sample Sites	Other Waters of the U.S. - OW#	Wetland Features - WF#	Seasonal Wetland
No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
1ft. Contour	Upland - U#	Ephemeral	Riparian	Vernal Swale
Matchline	Wet - W#	Intermittent	Seasonal Swale	Open Water
				Potential Branchiopod Habitat (determined by HBC)

Type	Length (ft.)	Area (sq.ft.)	Acres
Fresh Emergent Wetland Total =	n/a	178119.5	4.089
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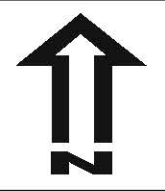




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Survey Extent	Soil Sample Sites	Other Waters of the U.S. - OW#	Wetland Features - WF#	Seasonal Wetland
No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
1ft. Contour	Upland - U#	Ephemeral	Riparian	Vernal Swale
Matchline	Wet - W#	Intermittent	Seasonal Swale	Open Water
				Potential Branchiopod Habitat (determined by HBC)

Type	Length (ft.)	Area (sq.ft.)	Acres
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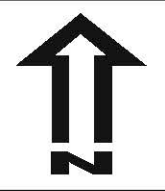




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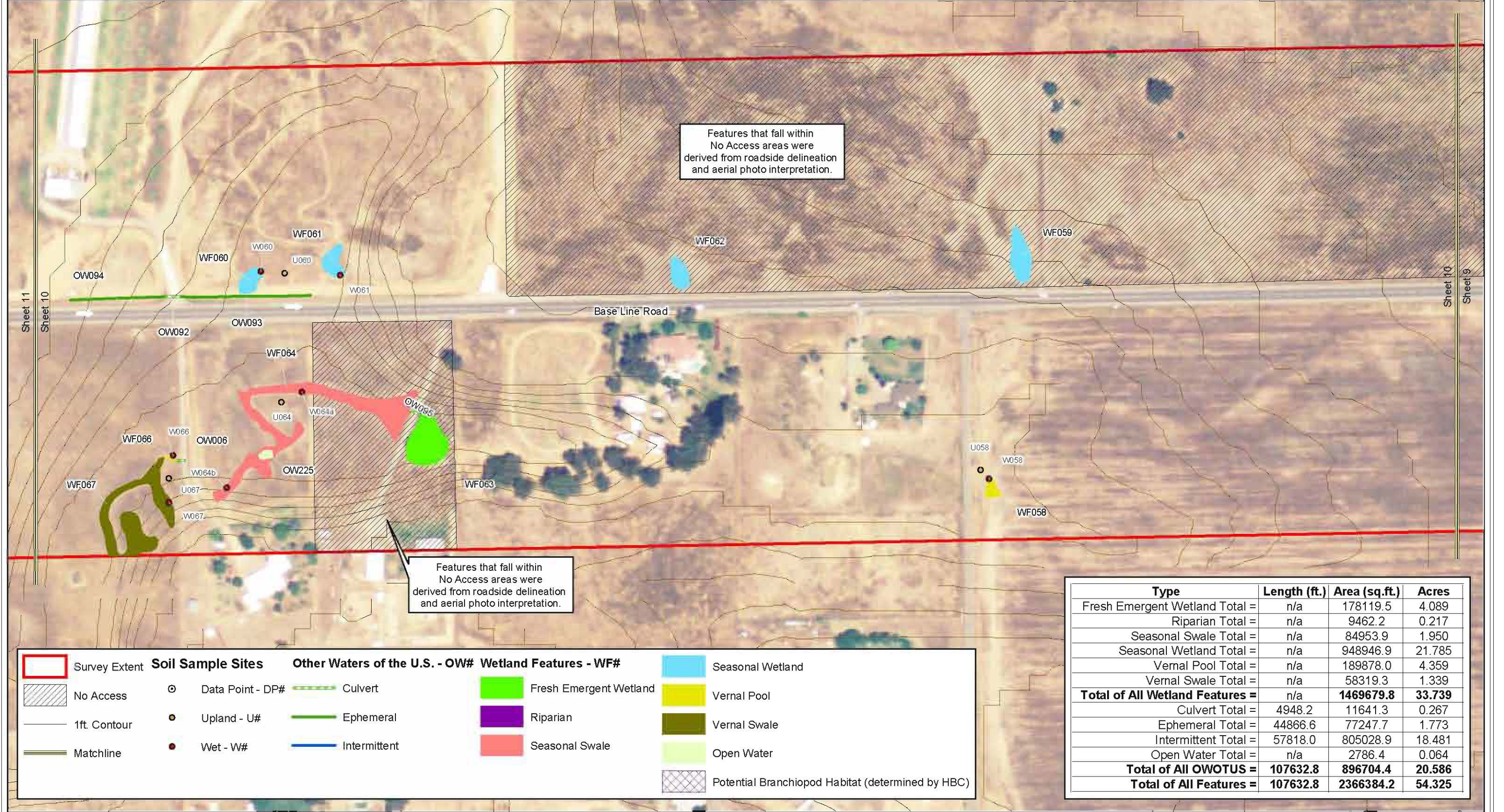
Soil Sample Sites		Other Waters of the U.S. - OW#		Wetland Features - WF#	
	Data Point - DP#		Culvert		Seasonal Wetland
	Upland - U#		Ephemeral		Vernal Pool
	Wet - W#		Intermittent		Vernal Swale
	Survey Extent		Seasonal Swale		Open Water
	No Access		Potential Branchiopod Habitat (determined by HBC)		
	1ft. Contour				
	Matchline				

Type	Length (ft.)	Area (sq.ft.)	Acres
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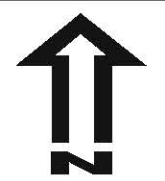


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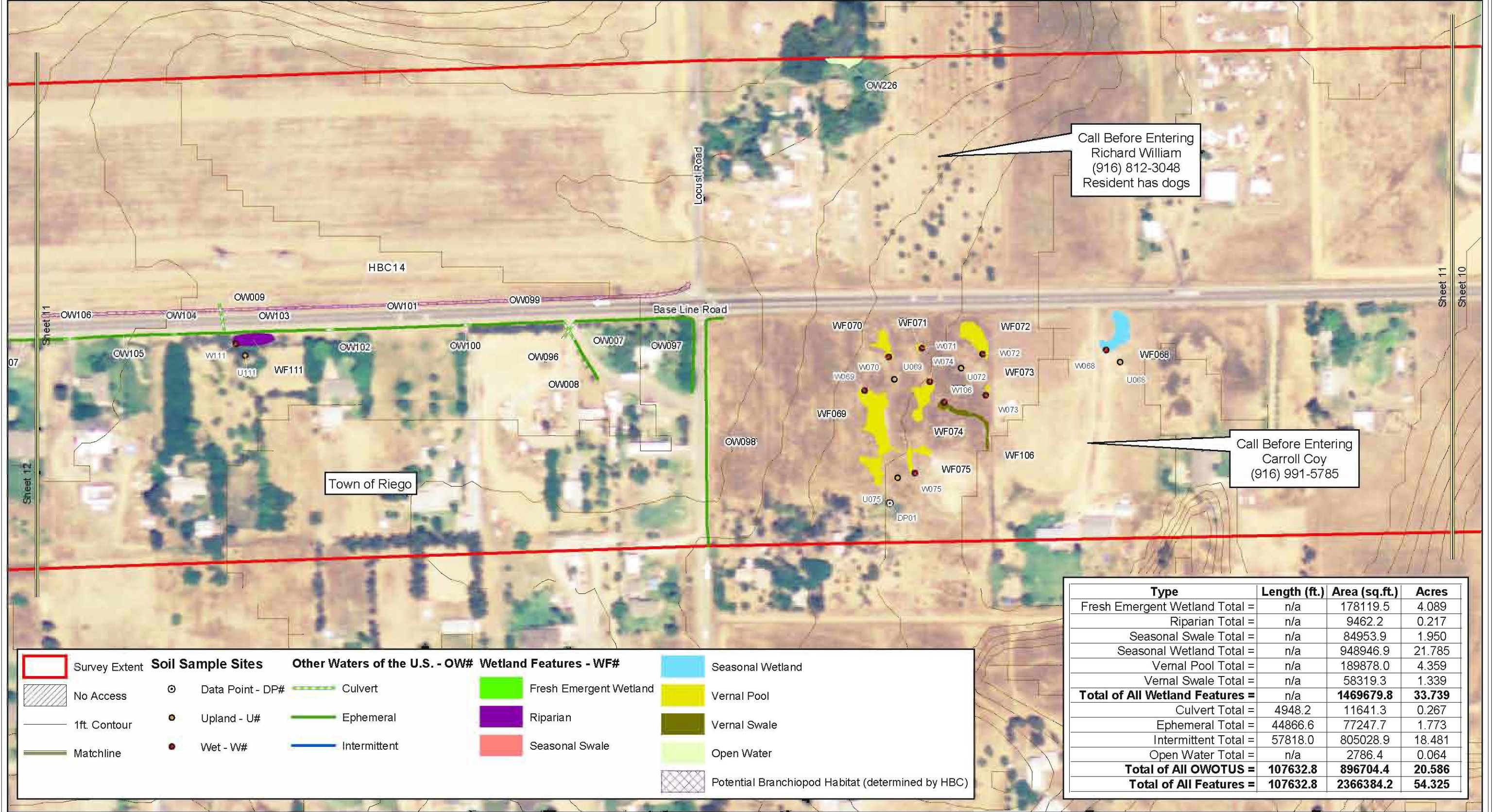


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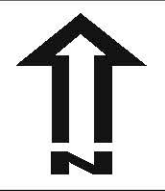


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Carroll Coy
(916) 991-5785

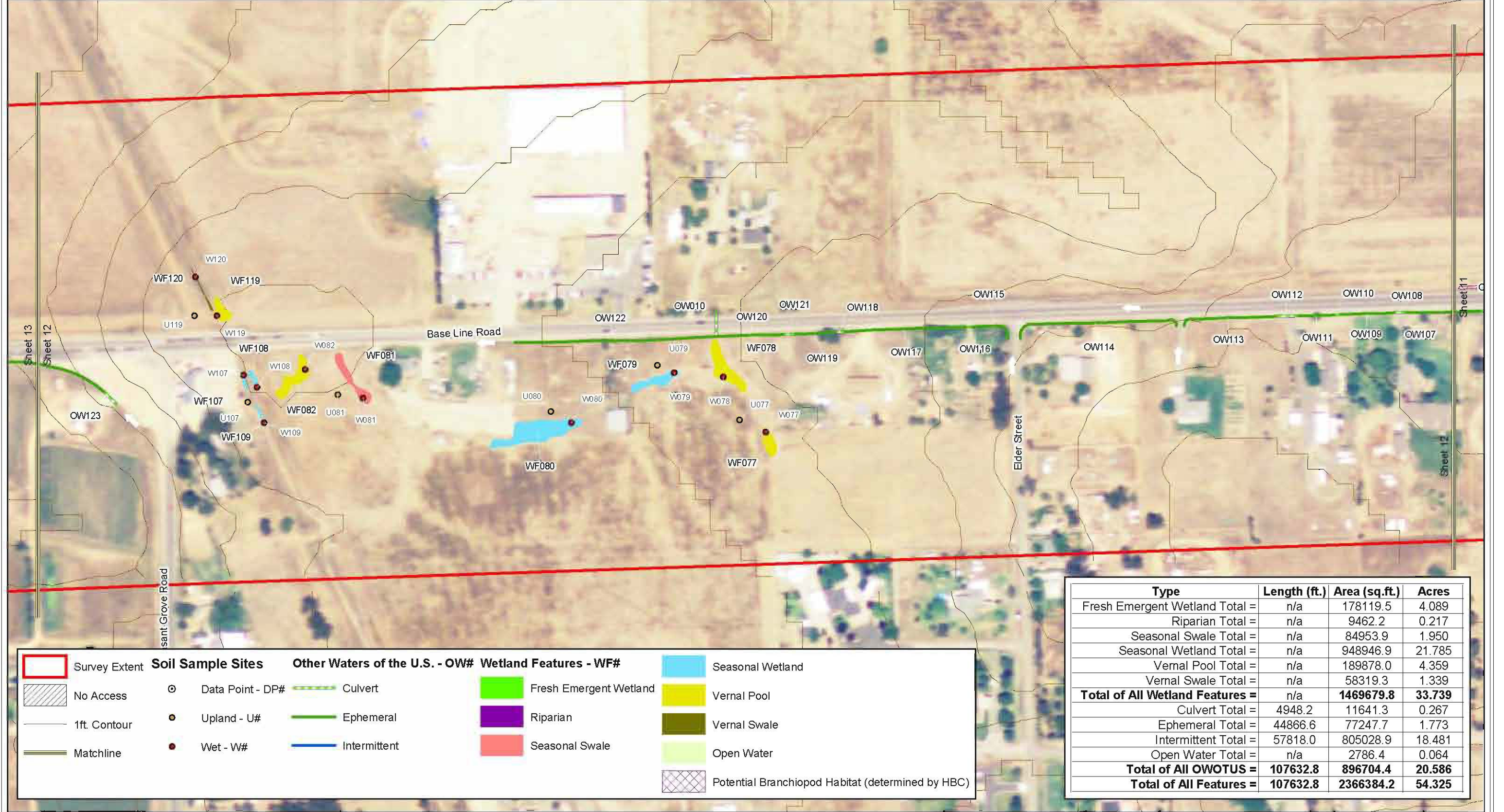
Survey Extent	Soil Sample Sites	Other Waters of the U.S. - OW#	Wetland Features - WF#	Seasonal Wetland
No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
1ft. Contour	Upland - U#	Ephemeral	Riparian	Vernal Swale
Matchline	Wet - W#	Intermittent	Seasonal Swale	Open Water
				Potential Branchiopod Habitat (determined by HBC)

Type	Length (ft.)	Area (sq.ft.)	Acres
Fresh Emergent Wetland Total =	n/a	178119.5	4.089
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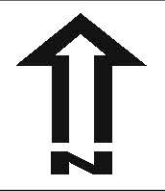
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Survey Extent	Soil Sample Sites	Other Waters of the U.S. - OW#	Wetland Features - WF#	Seasonal Wetland
No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
1ft. Contour	Upland - U#	Ephemeral	Riparian	Vernal Swale
Matchline	Wet - W#	Intermittent	Seasonal Swale	Open Water
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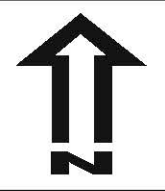




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(916) 991-1204

Survey Extent	Soil Sample Sites	Other Waters of the U.S. - OW#	Wetland Features - WF#	Seasonal Wetland
No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
1ft. Contour	Upland - U#	Ephemeral	Riparian	Vernal Swale
Matchline	Wet - W#	Intermittent	Seasonal Swale	Open Water
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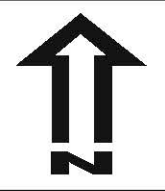
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Survey Extent	Soil Sample Sites	Other Waters of the U.S. - OW#	Wetland Features - WF#	Seasonal Wetland
No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
1ft. Contour	Upland - U#	Ephemeral	Riparian	Vernal Swale
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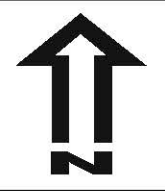
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No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
1ft. Contour	Upland - U#	Ephemeral	Riparian	Vernal Swale
Matchline	Wet - W#	Intermittent	Seasonal Swale	Open Water
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Total of All OWOTUS =	107632.8	896704.4	20.586
Total of All Features =	107632.8	2366384.2	54.325



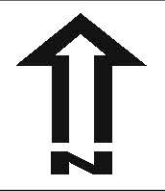
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Survey Extent	Soil Sample Sites	Other Waters of the U.S. - OW#	Wetland Features - WF#	Seasonal Wetland
No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
1ft. Contour	Upland - U#	Ephemeral	Riparian	Vernal Swale
Matchline	Wet - W#	Intermittent	Seasonal Swale	Open Water
				Potential Branchiopod Habitat (determined by HBC)

Type	Length (ft.)	Area (sq.ft.)	Acres
Fresh Emergent Wetland Total =	n/a	178119.5	4.089
Riparian Total =	n/a	9462.2	0.217
Seasonal Swale Total =	n/a	84953.9	1.950
Seasonal Wetland Total =	n/a	948946.9	21.785
Vernal Pool Total =	n/a	189878.0	4.359
Vernal Swale Total =	n/a	58319.3	1.339
Total of All Wetland Features =	n/a	1469679.8	33.739
Culvert Total =	4948.2	11641.3	0.267
Ephemeral Total =	44866.6	77247.7	1.773
Intermittent Total =	57818.0	805028.9	18.481
Open Water Total =	n/a	2786.4	0.064
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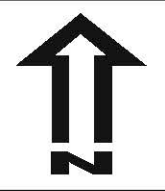




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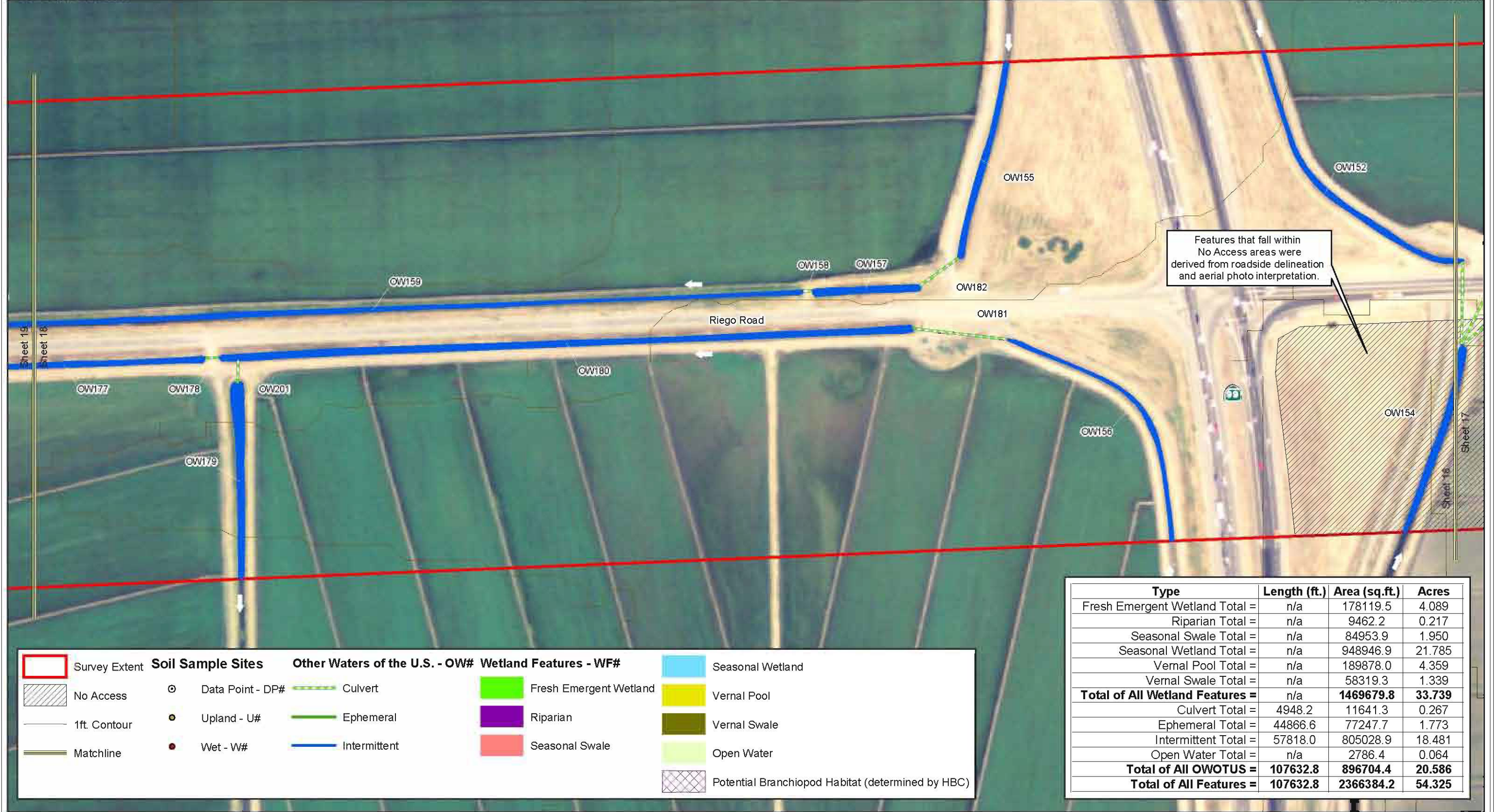
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No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
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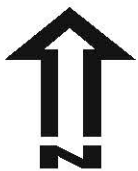




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Survey Extent	Soil Sample Sites	Other Waters of the U.S. - OW#	Wetland Features - WF#	Seasonal Wetland
No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
1ft. Contour	Upland - U#	Ephemeral	Riparian	Vernal Swale
Matchline	Wet - W#	Intermittent	Seasonal Swale	Open Water
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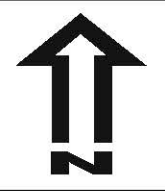
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Survey Extent	Soil Sample Sites	Other Waters of the U.S. - OW#	Wetland Features - WF#	Seasonal Wetland
No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
1ft. Contour	Upland - U#	Ephemeral	Riparian	Vernal Swale
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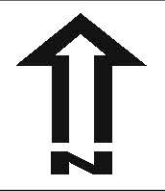
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No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
1ft. Contour	Upland - U#	Ephemeral	Riparian	Vernal Swale
Matchline	Wet - W#	Intermittent	Seasonal Swale	Open Water
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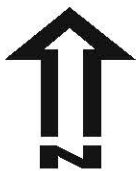
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Survey Extent	Soil Sample Sites	Other Waters of the U.S. - OW#	Wetland Features - WF#	Seasonal Wetland
No Access	Data Point - DP#	Culvert	Fresh Emergent Wetland	Vernal Pool
1ft. Contour	Upland - U#	Ephemeral	Riparian	Vernal Swale
Matchline	Wet - W#	Intermittent	Seasonal Swale	Open Water
				Potential Branchiopod Habitat (determined by HBC)



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Sheet 21

Sheet 22

Legend

-  Survey Extent
-  No Access
-  Matchline
-  1ft. Contour

Wetland Features - WF#

-  Fresh Emergent Wetland
-  Riparian
-  Seasonal Swale
-  Seasonal Wetland
-  Vernal Pool
-  Vernal Swale

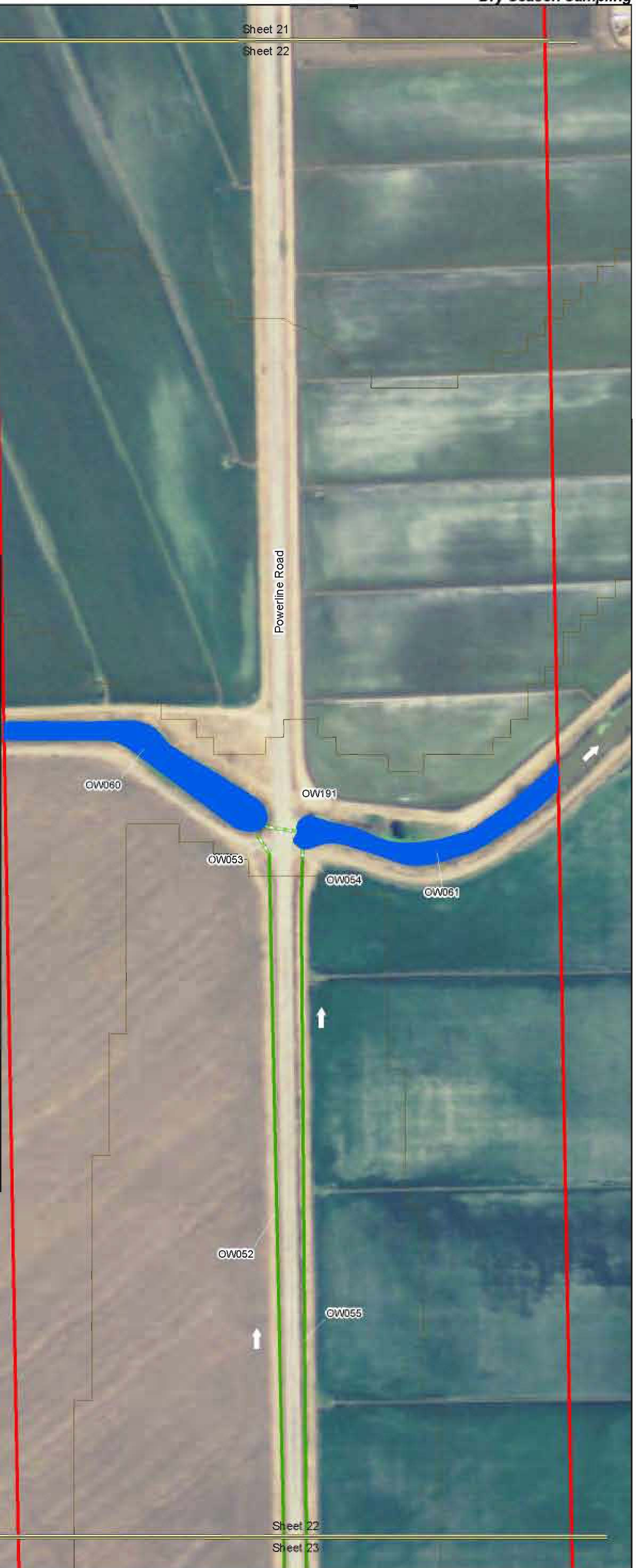
Soil Sample Sites

-  Upland - U#
-  Wet - W#

Other Waters of the U.S. - OW#

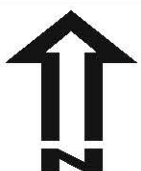
-  Culvert
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Sheet 22

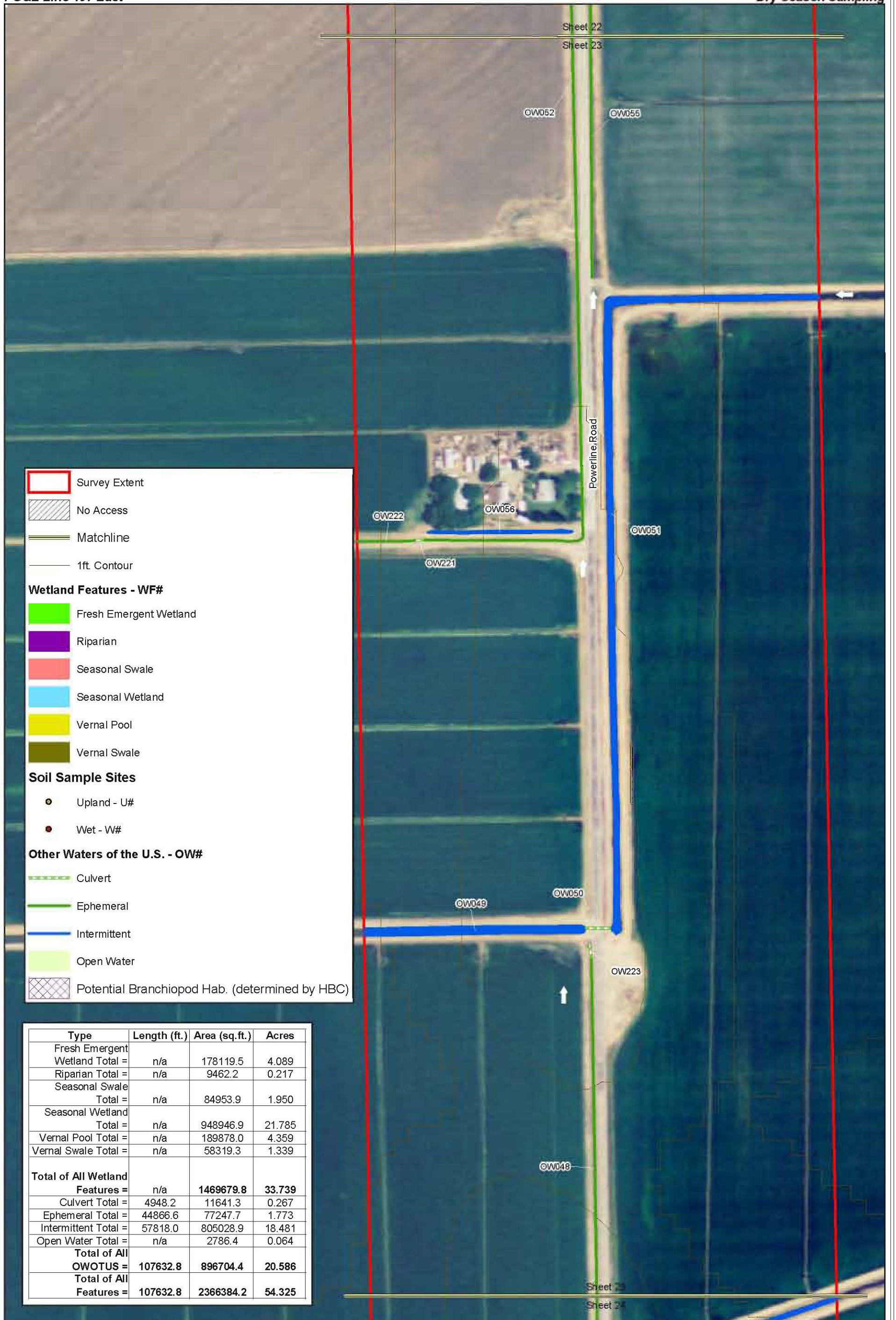
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Legend

- Survey Extent
- No Access
- Matchline
- 1ft. Contour

Wetland Features - WF#

- Fresh Emergent Wetland
- Riparian
- Seasonal Swale
- Seasonal Wetland
- Vernal Pool
- Vernal Swale

Soil Sample Sites

- Upland - U#
- Wet - W#

Other Waters of the U.S. - OW#

- Culvert
- Ephemeral
- Intermittent
- Open Water
- Potential Branchiopod Hab. (determined by HBC)

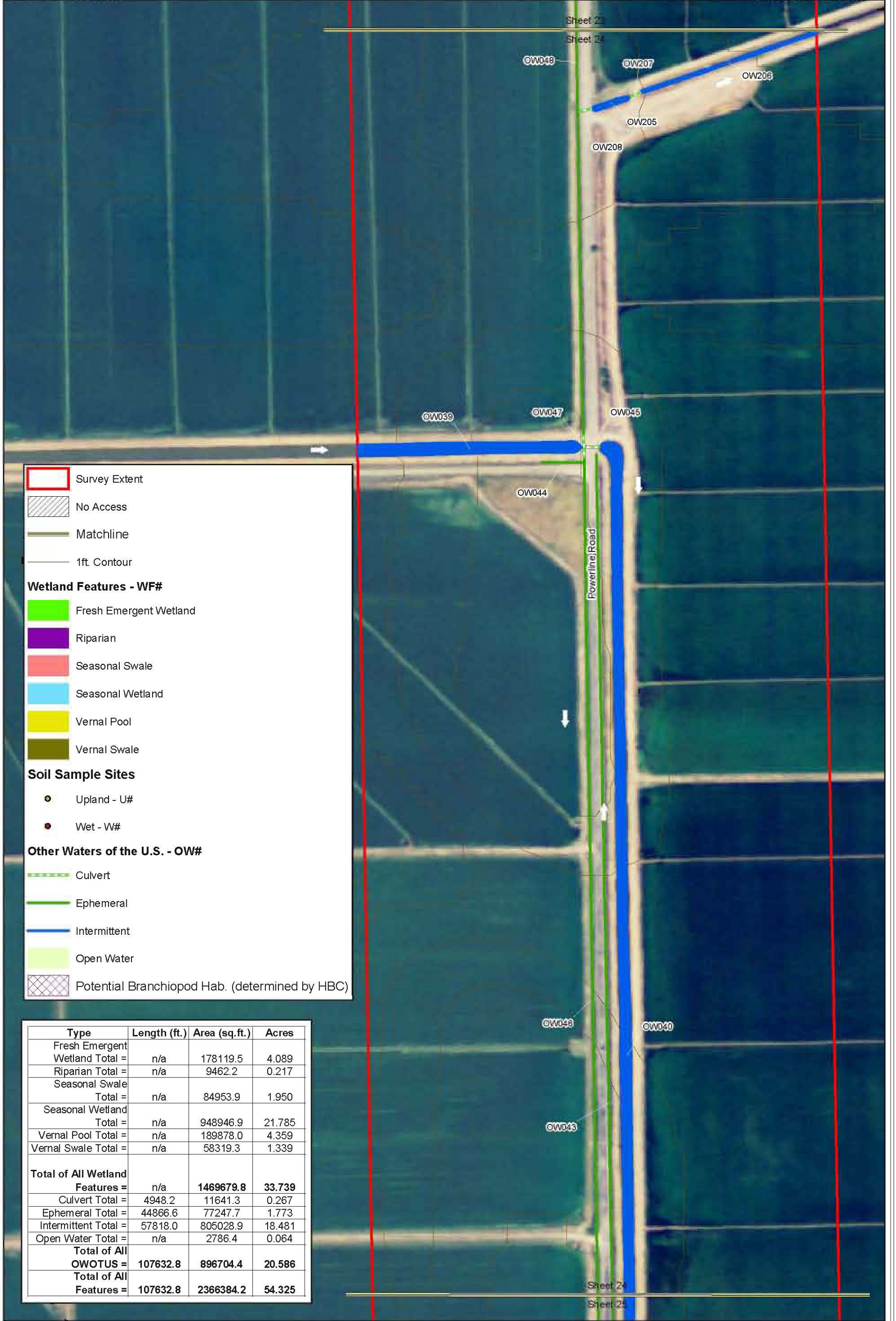
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Legend

- Survey Extent
- No Access
- Matchline
- 1ft. Contour

Wetland Features - WF#

- Fresh Emergent Wetland
- Riparian
- Seasonal Swale
- Seasonal Wetland
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- Vernal Swale

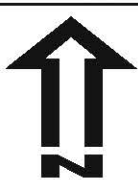
Soil Sample Sites

- Upland - U#
- Wet - W#

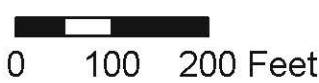
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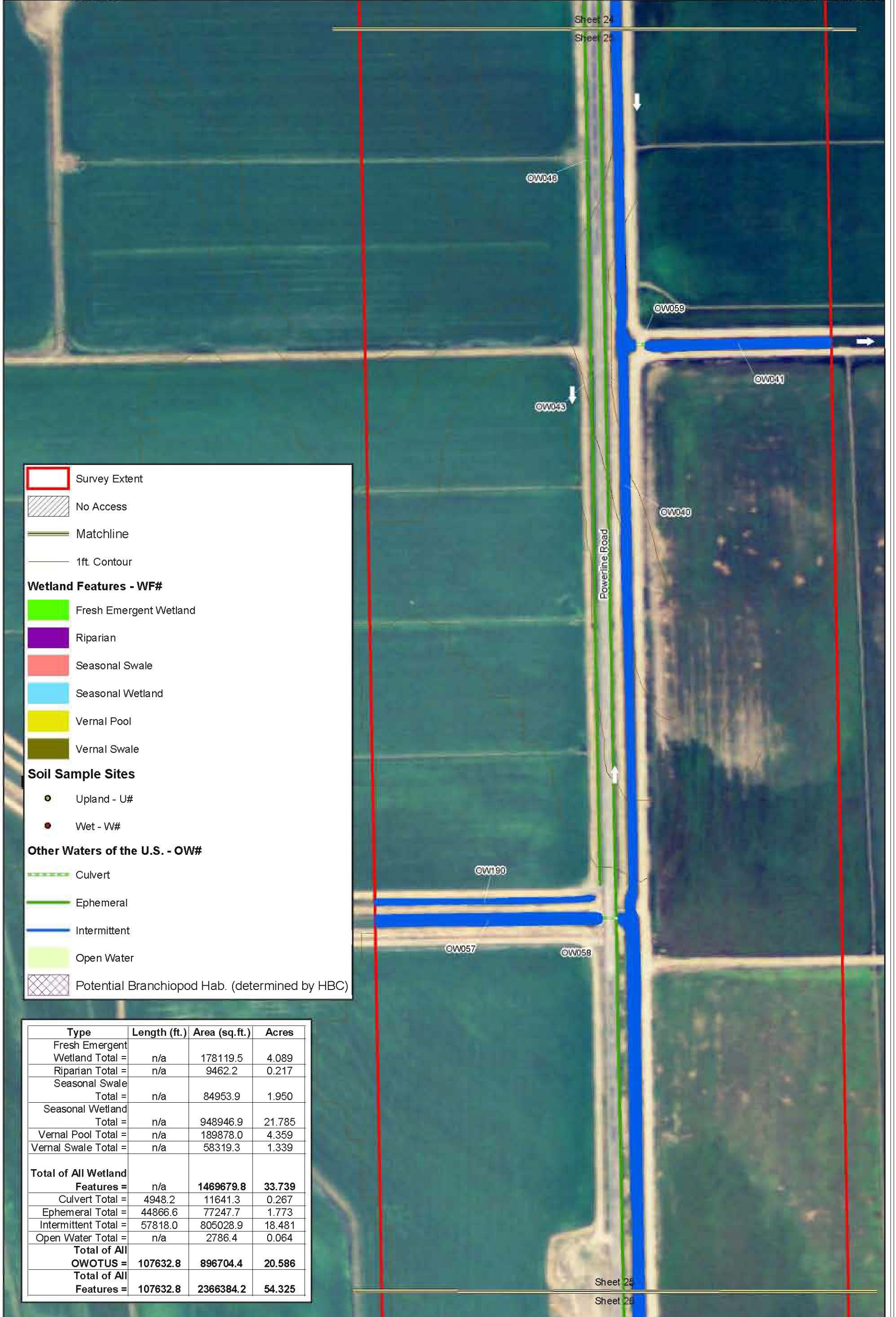
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Wetland Features - WF#

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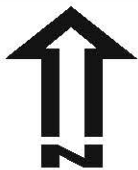
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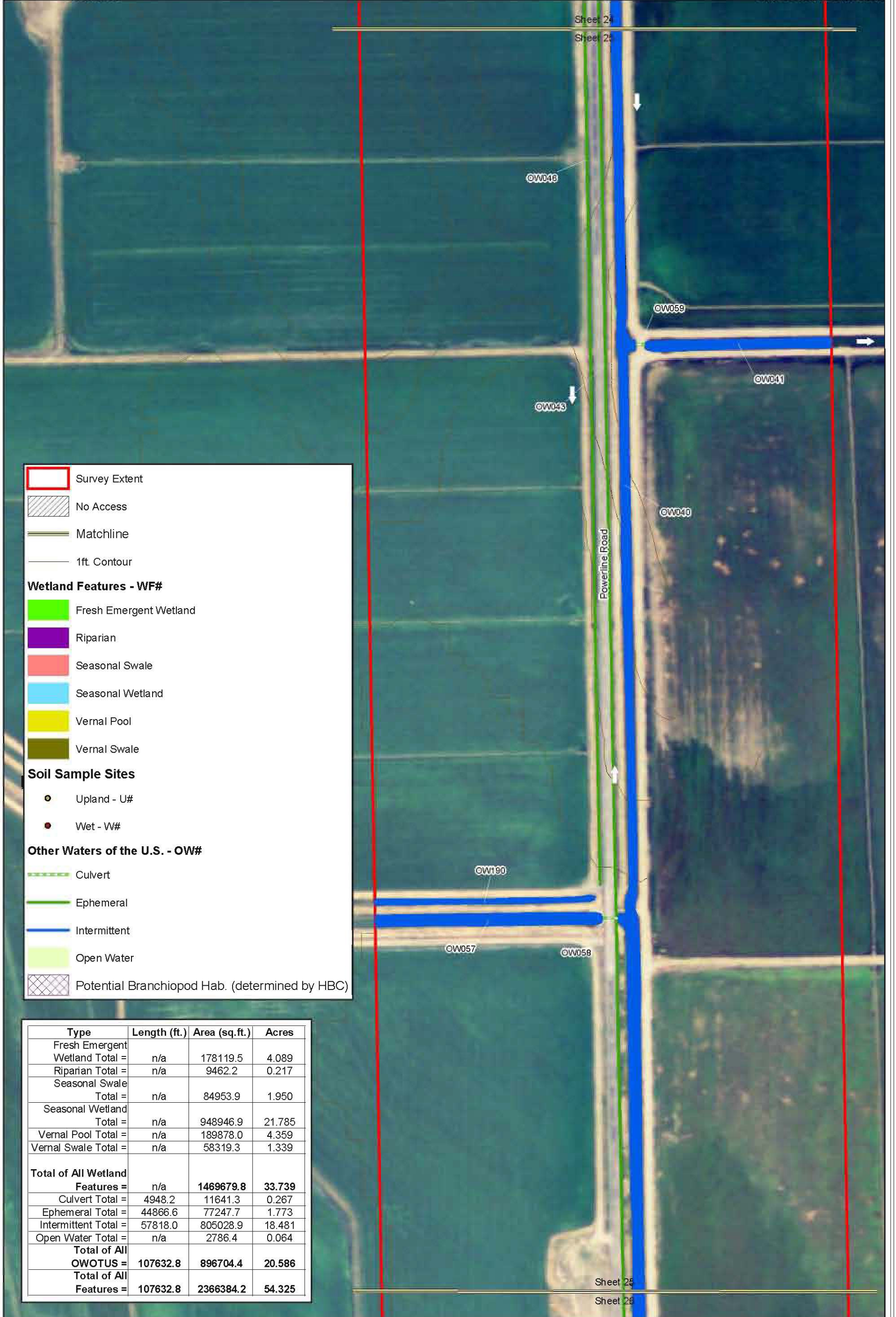
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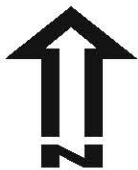
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