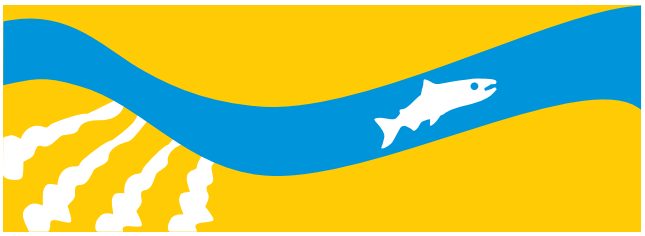
Appendix M

Soils Classes and Geomorphology in the Restoration Area

Draft
Program Environmental Impact Statement/Report

SAN JOAQUIN RIVER
RESTORATION PROGRAM



Draft
April 2011

Table of Contents

Tables

Exhibit

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1.0 Introduction

This appendix comprises two tables that contain information relevant to the discussion of geology and soils in the Restoration Area. Table 1 is a complete list of soil classes found in the Restoration Area and their acreages. Table 2 details major infrastructure in the Restoration Area and the geomorphic processes each structure affects. The exhibit identifies the following within the Restoration Area:

- **Exhibit – Generalized Soil Texture Maps, Reaches 1-5, and Bypasses-** shows the soil textures within the river and bypass channels of the Restoration Area

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Table 1.
Complete List of Soil Classes in the Restoration Area and Their Acreages by Reach

	Soil Area (acres) in Restoration Area[1,2]													
Soil Classification	**1A**	**1B**	**1 Total**	**2A**	**2B**	**2 Total**	**3**	**4A**	**4B1**	**4B2**	**4 Total**	**5**	**Bypasses[3]**	**Total All Reaches**
Ahwahnee and Vista	15	--	15	--	--	--	--	--	--	--	--	--	--	15
Alros	--	--	--	--	--	--	--	--	<1	193	193	99	--	291
Armona	--	--	--	--	--	--	184	<1	96	36	132	1	--	318
Bapos-Arburua	--	--	--	--	--	--	--	--	--	--	--	2	--	2
Bisgani	--	--	--	--	--	--	92	163	184	--	347	255	--	694
Bisgani-Elnido	--	--	--	--	--	--	450	95	--	--	95	--	--	545
Bolfar	--	--	--	--	--	--	--	153	1,161	70	1,384	64	--	1,448
Cajon	345	--	345	430	--	430	--	125	355	64	544	70	166	1,554
Calhi	--	--	--	12	--	12	--	--	--	--	--	--	186	198
Chino	--	--	--	267	1,514	1,782	383	272	654	415	1,341	789	784	5,078
Columbia	--	--	--	--	12	12	1,582	1,180	--	--	1,180	171	--	2,945
Delhi	7	36	44	--	--	--	--	--	--	--	--	5	3	51
Dello	18	--	18	323	49	371	--	--	--	--	--	--	--	389
Dinuba	--	--	--	--	--	--	--	--	--	--	--	86	27	112
Dinuba-El Peco	--	--	--	19	--	19	--	--	--	--	--	--	154	173
Dospalos	--	--	--	--	--	--	--	1	424	--	425	334	--	758
Dospalos-Bolfar	--	--	--	--	--	--	--	--	--	--	--	631	--	631
Edminster	--	--	--	--	--	--	--	--	--	71	71	44	--	115
Edminster-Kesterson	--	--	--	--	--	--	--	--	--	--	--	190	--	190
El Peco-Dinuba	--	--	--	29	--	29	--	--	--	--	--	--	362	391
Elnido	--	--	--	--	--	--	1,769	915	259	--	1,175	--	--	2,943
Escano	--	--	--	--	--	--	--	63	--	--	63	--	--	63
Exeter	95	--	95		--	--	--	--	--	--	--	--	--	95

Table 1.
Complete List of Soil Classes in the Restoration Area and Their Acreages by Reach (contd.)

	Soil Area (acres) in Restoration Area													
Soil Classification	**1A**	**1B**	**1 Total**	**2A**	**2B**	**2 Total**	**3**	**4A**	**4B1**	**4B2**	**4 Total**	**5**	**Bypasses[3]**	**Total All Reaches**
Foster	--	--	--	--	--	--	632	43	--	--	43	--	--	675
Fresno	--	--	--	--	--	--	--	--	--	94	94	136	2,422	2,652
Fresno-El Peco	--	--	--	--	--	--	--	1	--	--	1		3,685	3,686
Fresno-El Peco-Chino	--	--	--	--	--	--	--	--	--	--	--	--	119	119
Fresno-El Peco-Lewis	--	--	--	--	--	--	--	--	--	--	--	--	14	14
Friant	12	--	12	--	--	--	--	--	--	--	--	--	--	12
Grangeville	2,225	370	2,595	1,552	1,594	3,147	492	--	--	--	--	--	200	6,434
Greenfield	147		147	10	--	10	--	--	--	--	--	--	--	158
Hanford	2,620	2,735	5,355	41	--	41	--	7	--	--	7	--	--	5,402
Hesperia	216	76	292	66	--	66	--	--	--	--	--	--	--	358
Hilmar	--	--	--	--	--	--	--	--	--	18	18	223	162	404
Hornitos	12	--	12	--	--	--	--	--	--	--	--	--	--	12
Kesterson	--	--	--	--	--	--	--	--	62	185	246	--	--	246
Kesterson-Edminster	--	--	--	--	--	--	--	--	--	93	93	--	--	93
Landlow	--	--	--	--	--	--	--	--	--	--	--	--	23	23
Lewis	--	--	--	--	--	--	--	--	--	--	--	--	229	229
Merced	103	--	103	--	124	124	--	336	1,317	327	1,980	105	2,031	4,343
Miscellaneous[4]	2,732	610	3,342	780	658	1,438	588	402	701	983	2,086	1,464	2,142	11,060
Pachappa	--	--	--	11	--	11	--	--	--	--	--	--	381	392
Palazzo	--	--	--	--	32	32	853	624	477	--	1,101	--	--	1,986
Pedcat	--	--	--	--	--	--	--	--	--	--	--	176	--	176
Piper	--	--	--	--	--	--	--	--	14	--	14	195	--	209
Pollasky	43	28	71	--	--	--	--	--	--	--	--	--	--	71
Pollasky-Montpellier	9	--	9	--	--	--	--	--	--	--	--	--	--	9
Pozo	--	--	--	--	--	--	119	140	61	8	209	--	1,607	1,936
Ramona	65	--	65	--	--	--	--	--	--	--	--	--	--	65
Rocklin	2	--	2	--	--	--	--	--	--	--	--	--	--	2
Rossi	--	--	--	--	--	--	51	74	95	275	443	28	3,600	4,123
San Joaquin	145	9	154	--	--	--	--	--	--	--	--	--	--	154

Table 1.
Complete List of Soil Classes in the Restoration Area and Their Acreages by Reach (contd.)

	Soil Area (acres) in Restoration Area													
Soil Classification	**1A**	**1B**	**1 Total**	**2A**	**2B**	**2 Total**	**3**	**4A**	**4B1**	**4B2**	**4 Total**	**5**	**Bypasses[3]**	**Total All Reaches**
Tachi	--	--	--	--	393	393	420	--	--	--	--	--	--	813
Temple	--	--	--	--	--	--	321	<1	440	270	711	274	70	1,376
Traver	--	24	24	187	47	234	--	--	--	80	80	<1	297	634
Traver-Chino	--	--	--	59	--	59	--	--	--	--	--	--	63	122
Triangle	--	--	--	--	--	--	--	--	39	10	49	--	--	49
Tujunga	1,171	866	2,037	98	129	227	40	--	--	--	--	--	151	2,454
Tujunga-Hanford	570	312	882	--	--	--	--	--	--	--	--	--	--	882
Turlock	--	--	--	--	--	--	--	--	110	140	250	--	--	250
Visalia	25	--	25	--	39	39	17	--	--	--	--	--	90	171
Waukena	--	--	--	--	--	--	--	--	63	--	63	119	511	693
Wekoda	--	--	--	--	--	--	53	--	--	--	--	--	--	53
Whitney	17	--	17	--	--	--	--	--	--	--	--	--	--	17
Whitney-Rocklin	61	--	61	--	--	--	--	--	--	--	--	--	--	61
Wunjey	8	99	108	645	53	698	10	--	--	--	--	--	142	957
Totals	10,663	5,165	15,828	4,530	4,644	9,173	8,056	4,595	6,513	3,331	14,439	5,460	19,623	72,580

Source: Soil Survey Staff 2008
Notes
[1]Soil areas are rounded to the nearest whole acre.
[2]The placeholder "--" indicates zero acreage for that soil type in that reach.
[3]The category "Bypasses" includes the Chowchilla, Eastside, and Mariposa bypasses.
[4] The category "miscellaneous" includes soils of undifferentiated classification as well as areas that were not mapped by NRCS (i.e., covered by water during the mapping period).

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	Soil Area (acres) in Restoration Area													
Soil Classification	**1A**	**1B**	**1 Total**	**2A**	**2B**	**2 Total**	**3**	**4A**	**4B1**	**4B2**	**4 Total**	**5**	**Bypasses[3]**	**Total All Reaches**
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Fresno	--	--	--	--	--	--	--	--	--	94	94	136	2,422	2,652
Fresno-El Peco	--	--	--	--	--	--	--	1	--	--	1		3,685	3,686
Fresno-El Peco-Chino	--	--	--	--	--	--	--	--	--	--	--	--	119	119
Fresno-El Peco-Lewis	--	--	--	--	--	--	--	--	--	--	--	--	14	14
Friant	12	--	12	--	--	--	--	--	--	--	--	--	--	12
Grangeville	2,225	370	2,595	1,552	1,594	3,147	492	--	--	--	--	--	200	6,434
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Hesperia	216	76	292	66	--	66	--	--	--	--	--	--	--	358
Hilmar	--	--	--	--	--	--	--	--	--	18	18	223	162	404
Hornitos	12	--	12	--	--	--	--	--	--	--	--	--	--	12
Kesterson	--	--	--	--	--	--	--	--	62	185	246	--	--	246
Kesterson-Edminster	--	--	--	--	--	--	--	--	--	93	93	--	--	93
Landlow	--	--	--	--	--	--	--	--	--	--	--	--	23	23
Lewis	--	--	--	--	--	--	--	--	--	--	--	--	229	229
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Pedcat	--	--	--	--	--	--	--	--	--	--	--	176	--	176
Piper	--	--	--	--	--	--	--	--	14	--	14	195	--	209
Pollasky	43	28	71	--	--	--	--	--	--	--	--	--	--	71
Pollasky-Montpellier	9	--	9	--	--	--	--	--	--	--	--	--	--	9
Pozo	--	--	--	--	--	--	119	140	61	8	209	--	1,607	1,936
Ramona	65	--	65	--	--	--	--	--	--	--	--	--	--	65
Rocklin	2	--	2	--	--	--	--	--	--	--	--	--	--	2
Rossi	--	--	--	--	--	--	51	74	95	275	443	28	3,600	4,123
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Tujunga	1,171	866	2,037	98	129	227	40	--	--	--	--	--	151	2,454
Tujunga-Hanford	570	312	882	--	--	--	--	--	--	--	--	--	--	882
Turlock	--	--	--	--	--	--	--	--	110	140	250	--	--	250
Visalia	25	--	25	--	39	39	17	--	--	--	--	--	90	171
Waukena	--	--	--	--	--	--	--	--	63	--	63	119	511	693
Wekoda	--	--	--	--	--	--	53	--	--	--	--	--	--	53
Whitney	17	--	17	--	--	--	--	--	--	--	--	--	--	17
Whitney-Rocklin	61	--	61	--	--	--	--	--	--	--	--	--	--	61
Wunjey	8	99	108	645	53	698	10	--	--	--	--	--	142	957
Totals	10,663	5,165	15,828	4,530	4,644	9,173	8,056	4,595	6,513	3,331	14,439	5,460	19,623	72,580

Source: Soil Survey Staff 2008
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Table 2.
Infrastructure on the San Joaquin River and Bypasses from Friant Dam to the Merced River Confluence and Affected Geomorphic Processes

Reach	Infrastructure	Description	Affected Geomorphic Processes					
			Sediment Transport – Short Term	Sediment Transport – Long Term	Sediment Transport - High Flows	Sediment Transport - Low Flows	Local Incision/ Deposition	Channel Migration/ Avulsion
Diversion Structures								
1A	Big Willow Unit Diversion	Cobble and rock weir structure diverts flow to DFG fish hatchery					x	
	Rank Island Diversion	Cobble weir structure diverts about 5 cfs					x	
	Unnamed Diversion	Rock weir provides head for a pump upstream					x	
2A	Unnamed Diversion	Sand and gravel berm constructed to provide head for upstream pump, extends across most of river					x	
3	Mendota Dam	Low-head dam provides the headworks for distributing water brought into the system through the DMC	x			x	x	
4A	Sack Dam	Low-head earth and concrete structure with wooden flap gates diverts DMC flows into Arroyo Canal	x			x	x	
Bypass Diversion Structures								
2B	Chowchilla Bypass Bifurcation Structure	Diverts flood flows from the mainstem SJR to the Chowchilla Bypass Canal	x	x	x	x	x	
4B	Mariposa Bypass Bifurcation Structure	Diverts flood flows from the Eastside Bypass/Mariposa Bypass confluence back to SJR	x	x	x	x	x	
Bypasses								
3	James Bypass/Fresno Slough	Conveys flood flows from the Kings River north to Mendota Pool	x		x			
2B to 4B1	Chowchilla Bypass	Currently functions solely as a flood conveyance system conveying flood flows from the Chowchilla Bypass Bifurcation Structure to the Eastside Bypass canal	x	x	x	x		

Table 2.
Infrastructure on the San Joaquin River and Bypasses from Friant Dam to the Merced River Confluence and Affected Geomorphic Processes (contd.)

Reach	Infrastructure	Description	Geomorphic processes affected					
			Sediment Transport – Short Term	Sediment Transport – Long Term	Sediment Transport - High Flows	Sediment Transport - Low Flows	Local Incision/ Deposition	Channel Migration/ Avulsion
4B	Mariposa Bypass	Conveys water from the Mariposa Bypass Bifurcation Structure back to SJR	x	x	x	x		
	Eastside Bypass	Conveys water from the Chowchilla Bypass to the Mariposa Bypass Bifurcation Structure and back to SJR	x	x	x	x		
Other Hydraulic Control Structures								
4B	Sand Slough Control Structure	Low head control structure in Sand Slough between SJR and Eastside Bypass	x			x	x	
Eastside Bypass	Eastside Bypass Control Structures	Low head grade control structures within the Eastside Bypass	x	x	x	x	x	
Mariposa Bypass	Mariposa Bypass Control Structures	Low head grade control structures within the Mariposa Bypass	x	x	x	x	x	
4B	Reach 4B headgates	Low head control structure within the mainstem SJR that controls flows into Reach 4B	x	x	x	x	x	
Offstream (non-SJR) Flood Control Dams								
na	Pine Flat Dam	Dam on the Kings River that provides flood control to the Tulare Lake basin; a portion of flood control release is conveyed to the SJR via James Bypass and Fresno Slough	x		x			
	Buchanan Dam	Dam on the Chowchilla River that provides flood control; releases into the Fresno River are delivered to the Chowchilla Bypass	x		x			
	Hidden Dam	Dam on the Fresno River that provides flood control; releases into the Fresno River are delivered to Chowchilla Bypass	x		x			

Table 2.
Infrastructure on the San Joaquin River and Bypasses from Friant Dam to the Merced River Confluence and Affected Geomorphic Processes (contd.)

Reach	Infrastructure	Description	Geomorphic processes affected					
			Sediment Transport – Short Term	Sediment Transport – Long Term	Sediment Transport - High Flows	Sediment Transport - Low Flows	Local Incision/ Deposition	Channel Migration/ Avulsion
Levees								
2A; 4B2 to 5; bypasses	Project Levees	Line the Chowchilla Bypass, Eastside Bypass, and SJR from 4 miles downstream of Gravelly Ford to the Chowchilla Bypass Bifurcation Structure, then again from the Mariposa Bypass confluence downstream to the Merced River						x
2B to 4B	Nonproject Levees	Line both sides of the river from the Chowchilla Bypass Bifurcation Structure to the confluence of the Mariposa Bypass						x
Canals								
2B to 3	Helm Ditch	Left bank canal borders the river						x
2B to 3	Columbia Canal	Right bank canal borders the river						x
3 to 4A	Poso Canal	Left bank canal borders the river						x
4A	Riverside Canal	Left bank canal borders the river						x
	Arroyo Canal	Left bank canal conveys DMC water, does not border the river (little effect on geomorphology)						

Source: Adapted from McBain & Trush, Inc. 2002
Key:
cfs = cubic feet per second
DFG = California Department of Fish and Game
DMC = Delta-Mendota Canal
SJR = San Joaquin River

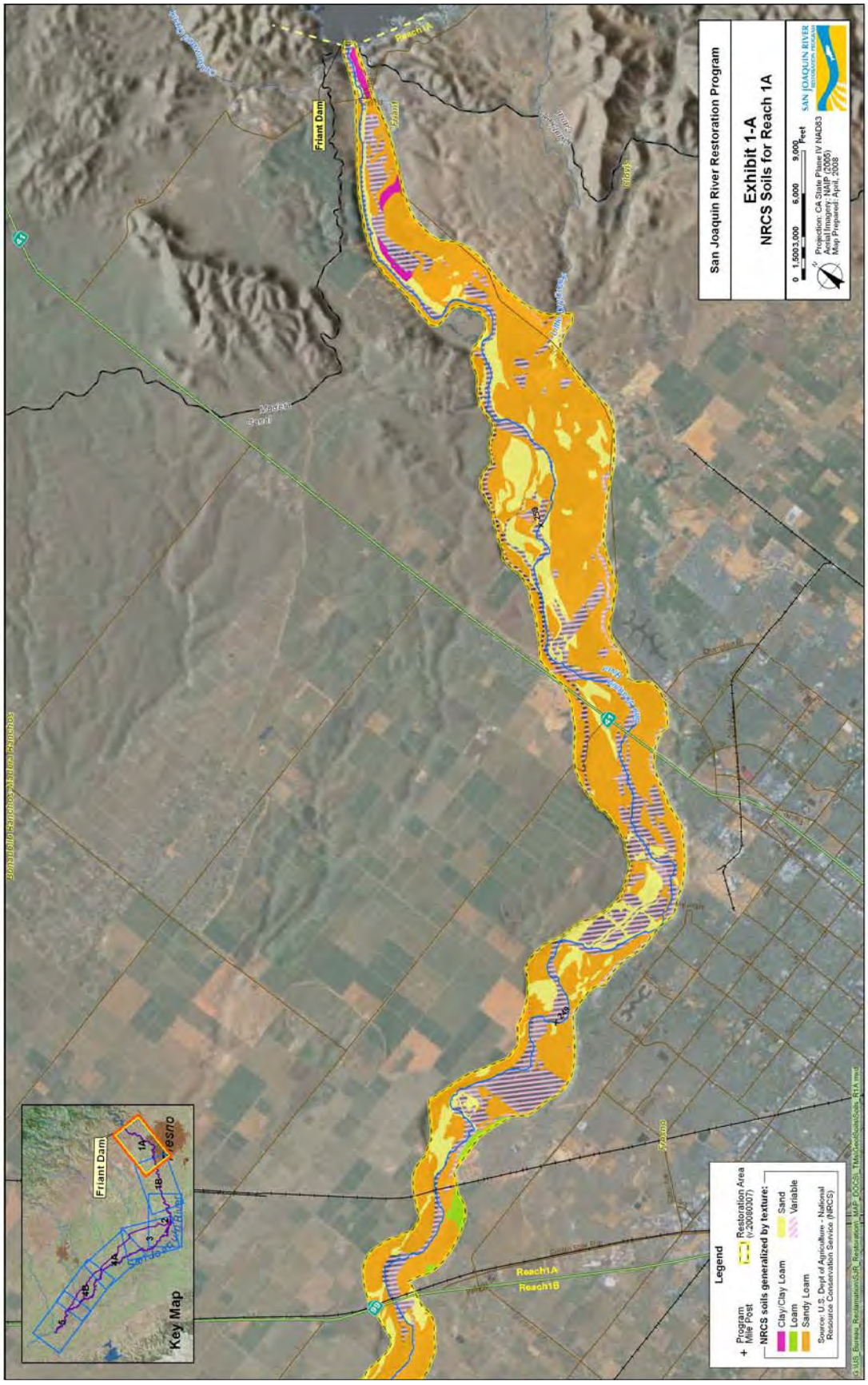
Exhibit

Generalized Soil Texture Maps, Reaches 1-5, and Bypasses

Draft
Soils Classes and Geomorphology in the Restoration Area Appendix

SAN JOAQUIN RIVER
RESTORATION PROGRAM

Draft
April 2011


San Joaquin River Restoration Program
Exhibit 1-A
NRCS Soils for Reach 1A
0 1,500 3,000 6,000 9,000 Feet
Projection: CA State Plane IV NAD83
Aerial Imagery: NAIP (2005)
Map Prepared: April, 2008
SAN JOAQUIN RIVER RESTORATION PROGRAM
Friant Dam
Reach1A
Reach1B
Legend
Program Mile Post
Restoration Area (Y2000007)
NRCS soils generalized by texture:
Clay/Clay Loam
Loam
Sandy Loam
Sand
Variable
Source: U.S. Dept of Agriculture - National Resource Conservation Service (NRCS)
Key Map
Friant Dam
1A
1B
2
3
4
5
esmo

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San Joaquin River Restoration Program
Exhibit 1-B
NRCS Soils for Reach 1B
Legend
Program Mile Post
Restoration Area (v.20080307)
NRCS soils generalized by texture:
Clay/Clay Loam
Loam
Sandy Loam
Sand
Variable
Source: U.S. Dept of Agriculture - National Resource Conservation Service (NRCS)
Key Map
Friant Dam
Reach1B
Reach2A
239
229

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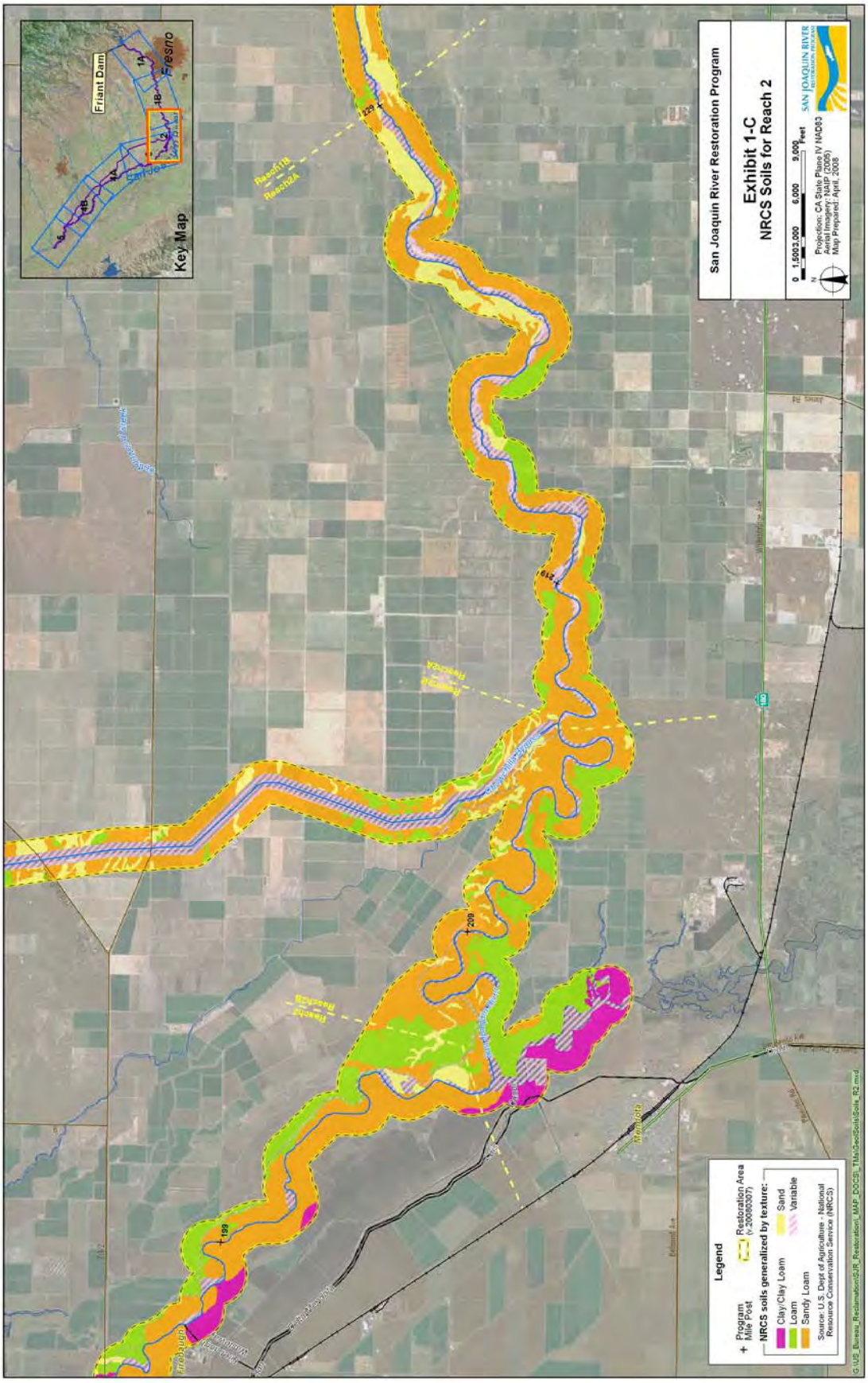
San Joaquin River Restoration Program
Exhibit 1-C
NRCS Soils for Reach 2
Projection: CA State Plane IV NAD83
Aerial Imagery: NAIP (2005)
Map Prepared: April, 2008
0 1,500 3,000 6,000 9,000 Feet
N
SAN JOAQUIN RIVER RESTORATION PROGRAM
Key Map
Friant Dam
Fresno
1A
1B
2
3A
3B
Reach1B
Reach0A
Legend
Program Mile Post
Restoration Area (v.20080307)
NRCS soils generalized by texture:
Clay/Clay Loam
Loam
Sandy Loam
Sand
Variable
Source: U.S. Dept of Agriculture - National Resource Conservation Service (NRCS)
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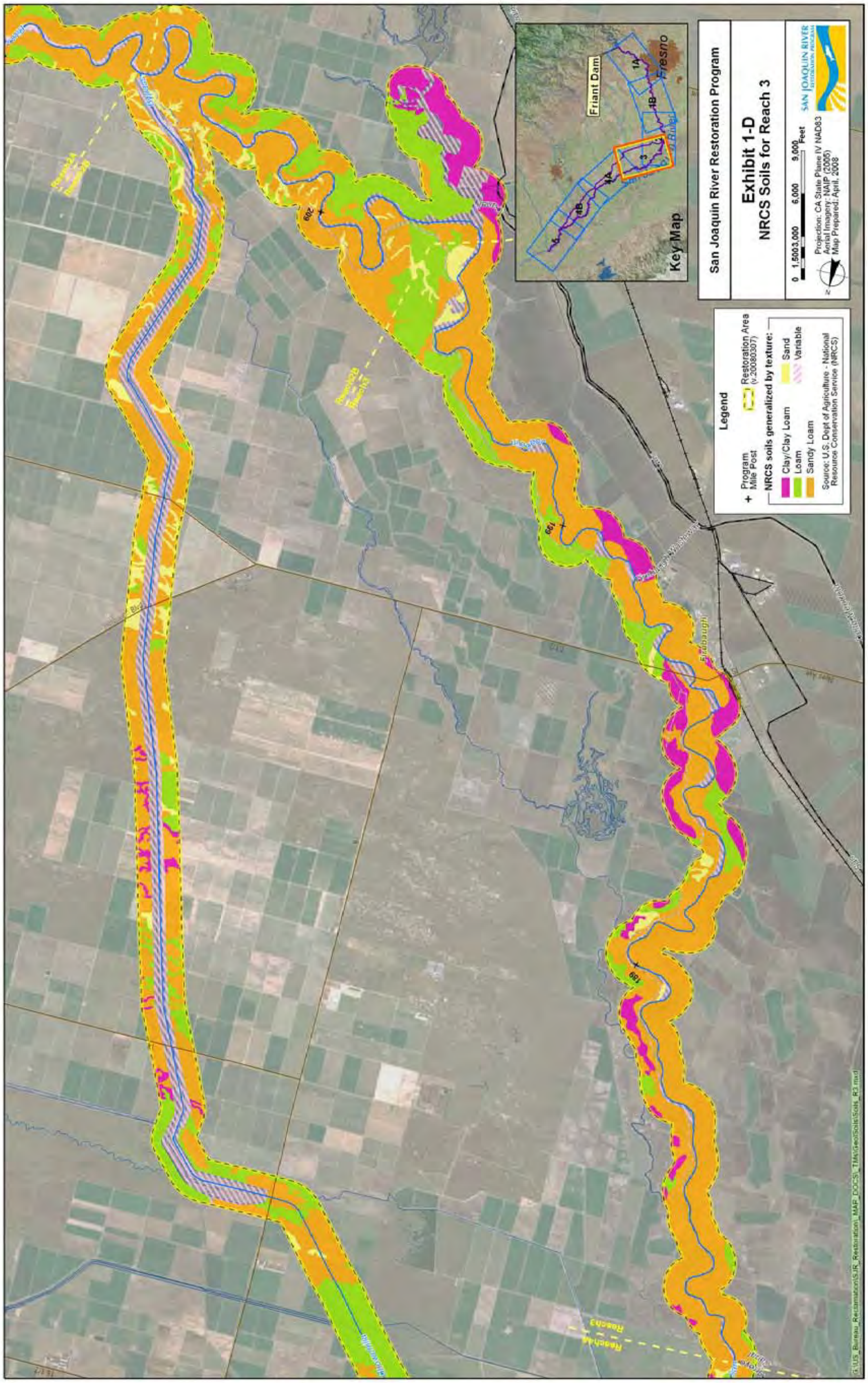
San Joaquin River Restoration Program
Exhibit 1-D
NRCS Soils for Reach 3
Key Map
Friant Dam
Fresno
Legend
Program Mile Post
Restoration Area (v.20080307)
NRCS soils generalized by texture:
Clay/Clay Loam
Loam
Sandy Loam
Sand
Variable
Source: U.S. Dept of Agriculture - National Resource Conservation Service (NRCS)
0 1,500 3,000 6,000 9,000 Feet
Projection: CA State Plane IV NAD83
Aerial Imagery: NAIP (2005)
Map Prepared: April, 2008
SAN JOAQUIN RIVER RESTORATION PROGRAM

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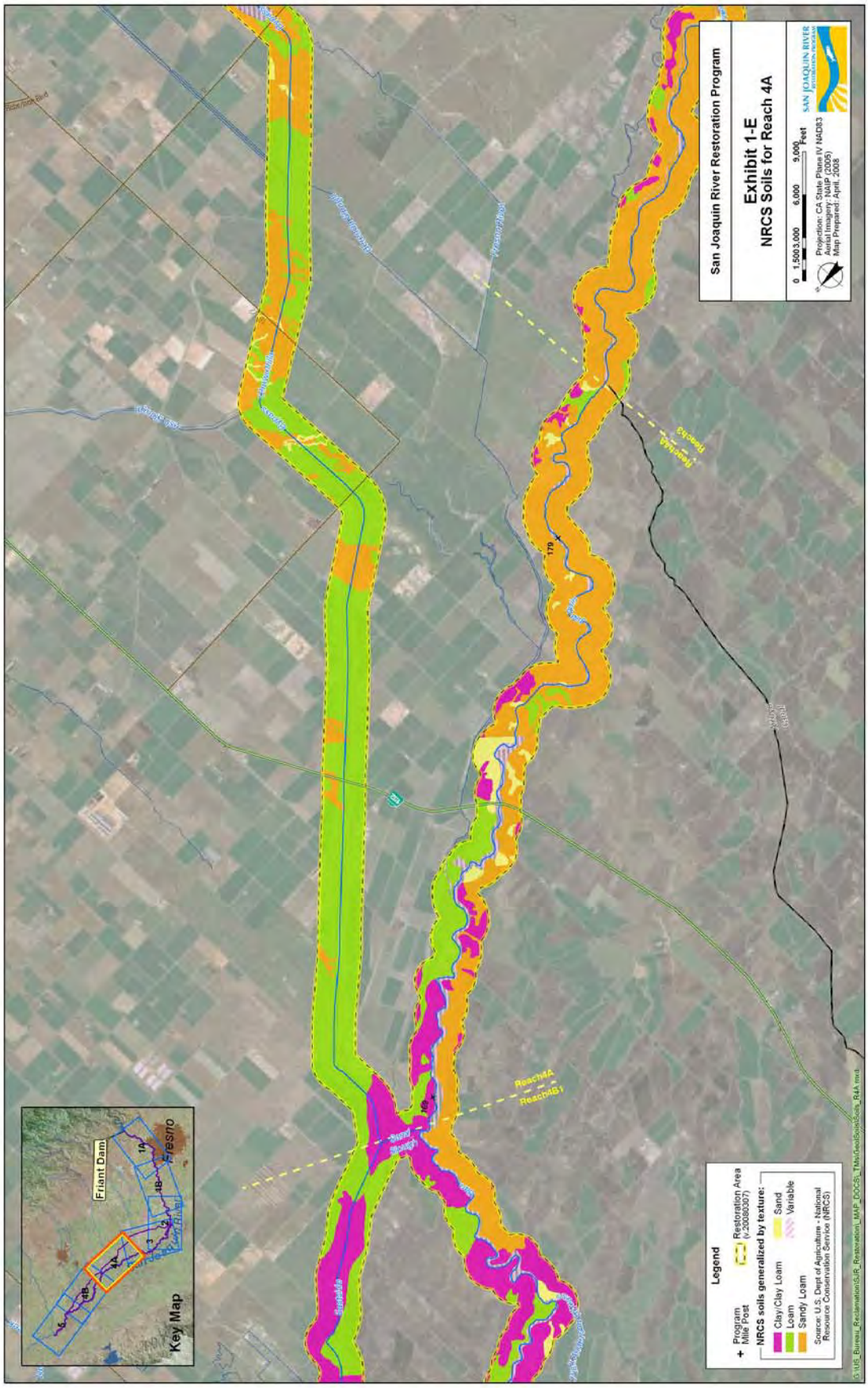
San Joaquin River Restoration Program
Exhibit 1-E
NRCS Soils for Reach 4A
0 1,500 3,000 6,000 9,000 Feet
Projection: CA State Plane IV NAD83
Aerial Imagery: USDA (2005)
Map Prepared: April, 2008
SAN JOAQUIN RIVER RESTORATION PROGRAM
Legend
Program Mile Post
Restoration Area (V-20080307)
NRCS soils generalized by texture:
Clay/Clay Loam
Loam
Sandy Loam
Sand
Variable
Source: U.S. Dept of Agriculture - National Resource Conservation Service (NRCS)
Key Map
Friant Dam
Fresno
Reach4A
Reach4B1
Reach3

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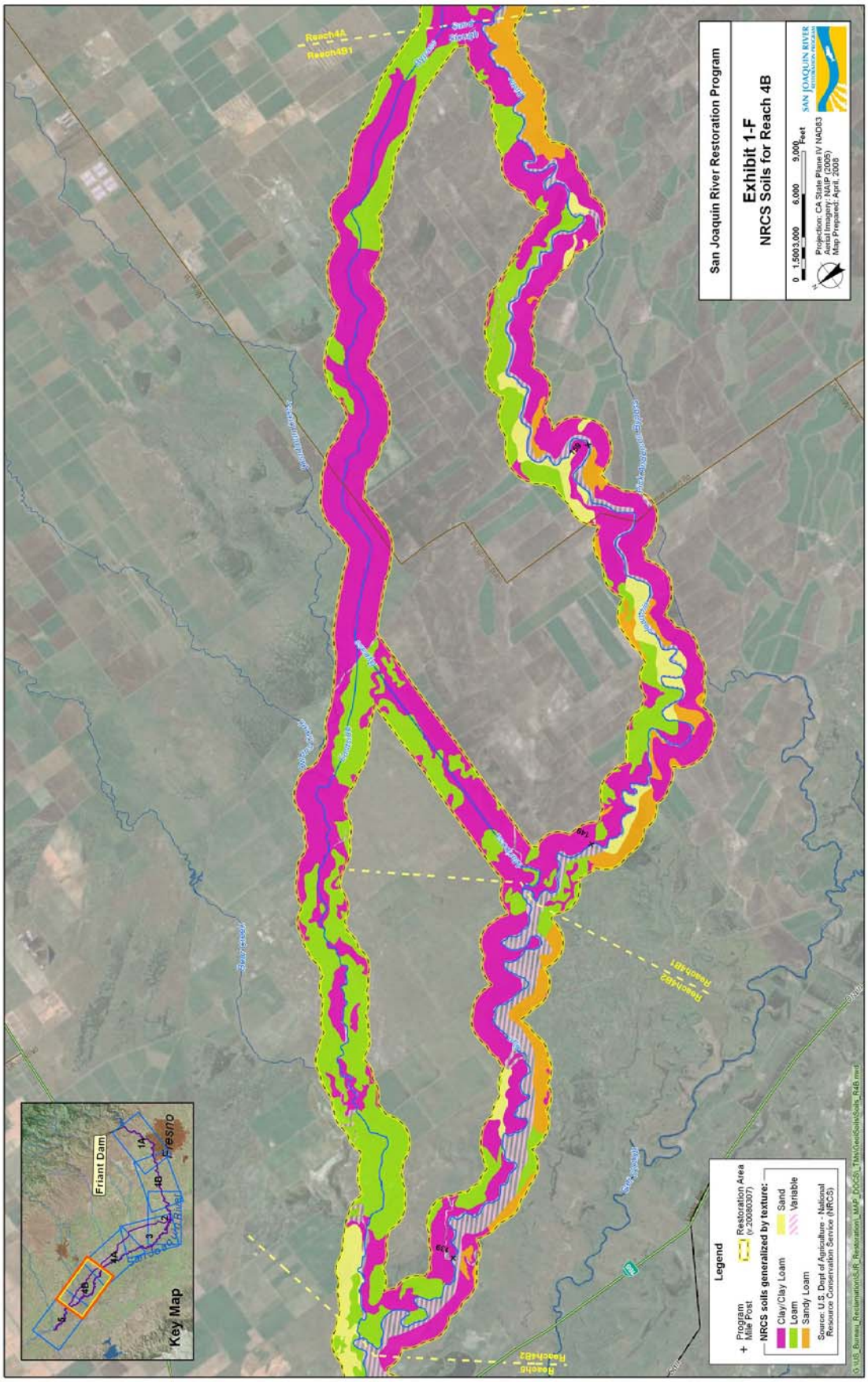
San Joaquin River Restoration Program
Exhibit 1-F
NRCS Soils for Reach 4B
0 1,500 3,000 6,000 9,000 Feet
Projection: CA State Plane IV NAD83
Aerial Imagery: NAIP (2005)
Map Prepared: April, 2008
SAN JOAQUIN RIVER
Restoration Program
Legend
Program Mile Post
Restoration Area (v.20080307)
NRCS soils generalized by texture:
Clay/Clay Loam
Loam
Sandy Loam
Sand
Variable
Source: U.S. Dept of Agriculture - National Resource Conservation Service (NRCS)
Key Map
Friant Dam
Fresno
Reach4A
Reach4B1
Reach4B2
Reach5A
Reach5B

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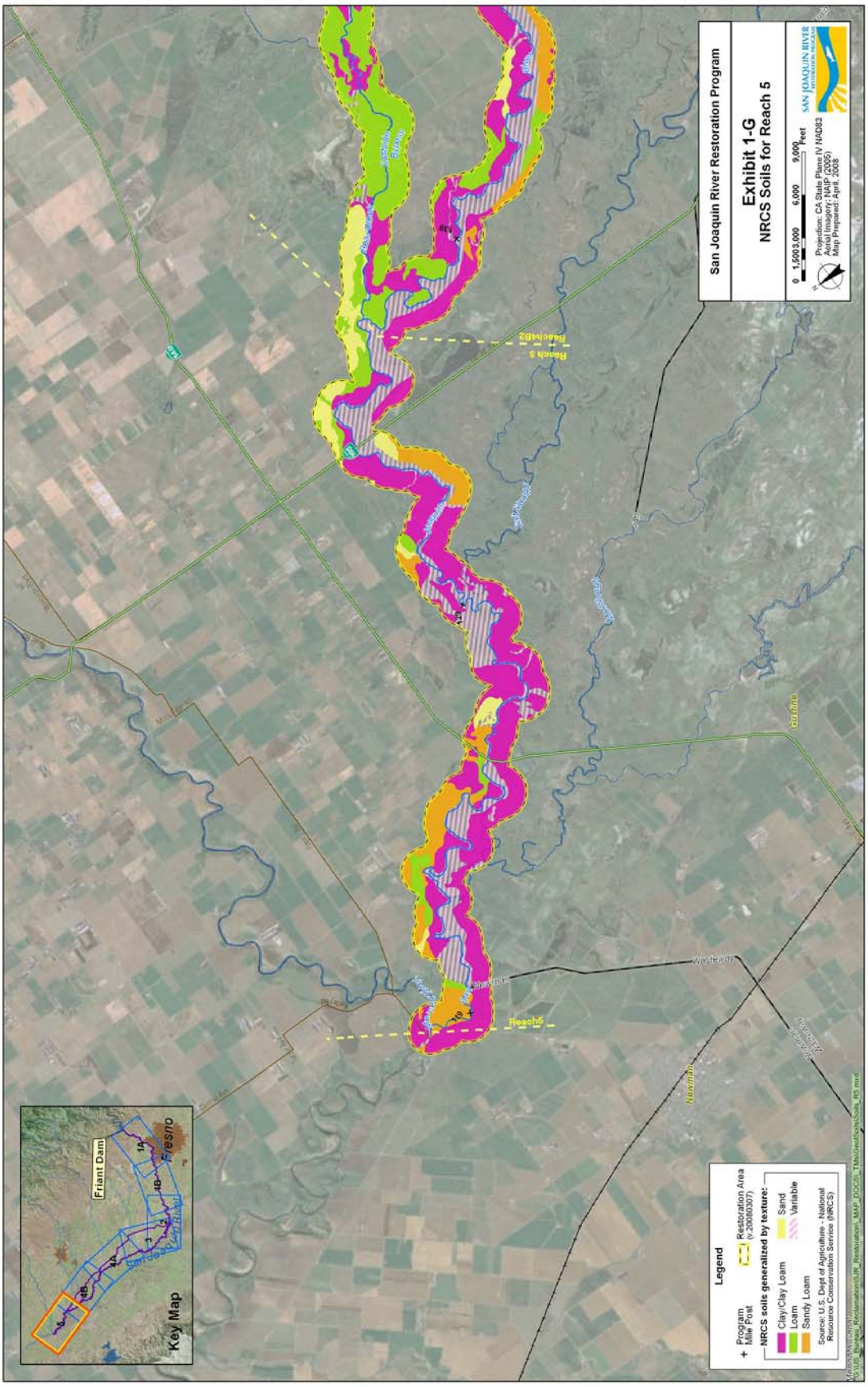
San Joaquin River Restoration Program
Exhibit 1-G
NRCS Soils for Reach 5
0 1,500 3,000 6,000 9,000 Feet
Projection: CA State Plane IV NAD83
Aerial Imagery: NAIP (2005)
Map Prepared: April, 2008
SAN JOAQUIN RIVER RESTORATION PROGRAM
Legend
Program Mile Post
Restoration Area (r.20060307)
NRCS soils generalized by texture:
Clay/Clay Loam
Loam
Sandy Loam
Sand
Variable
Source: U.S. Dept of Agriculture - National Resource Conservation Service (NRCS)
Reach5
Reach4B2
Reach 5
Key Map
Friant Dam
Fresno

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