SAN JOAQUIN RIVER RESTORATION PROGRAM

Seepage and Conveyance Technical Feedback Group Meeting

April 8, 2013

Patti Ransdell

INTRODUCTION

Agenda

- Introductions
- Purpose
- Spring Flow Update
- Levee Update
- Status of Seepage Projects
- Seepage Management Plan (SMP) Revisions
- Groundwater Baseline Discussion

SAN JOAQUIN RIVER RESTORATION PROGRAM

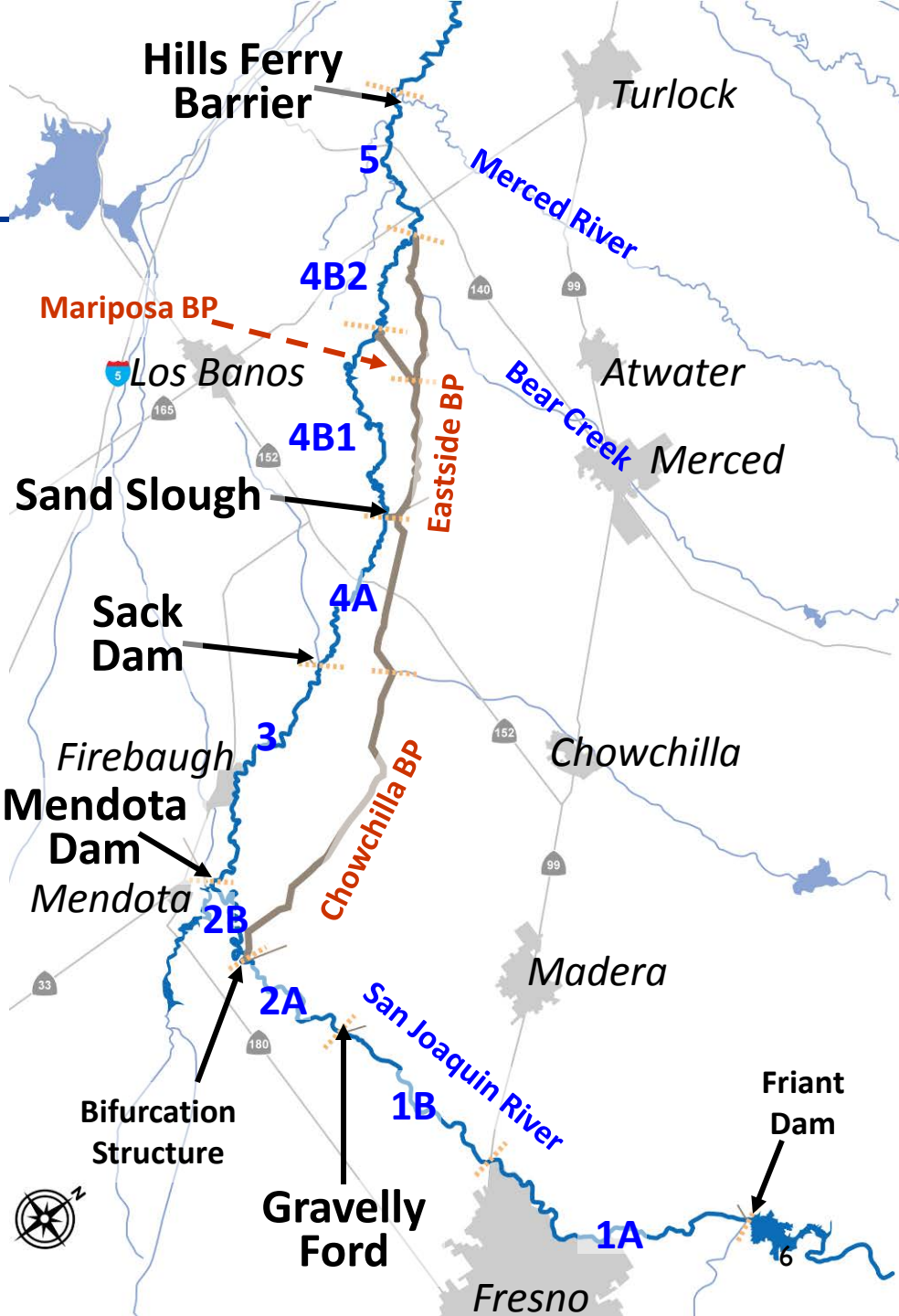
- Present revised Seepage Management Plan
- Objectives
  - Solicit comments
  - Brainstorm groundwater baseline study

Katrina Harrison

INTERIM FLOW SCHEDULE

SAN JOAQUIN RIVER RESTORATION PROGRAM

- SJRRP Flow Releases
  - To Mendota Pool
  - No flow below Sack Dam
- Dry Water Year Type
  - Expecting reduced SJRRP allocation



Preliminary draft – subject to change

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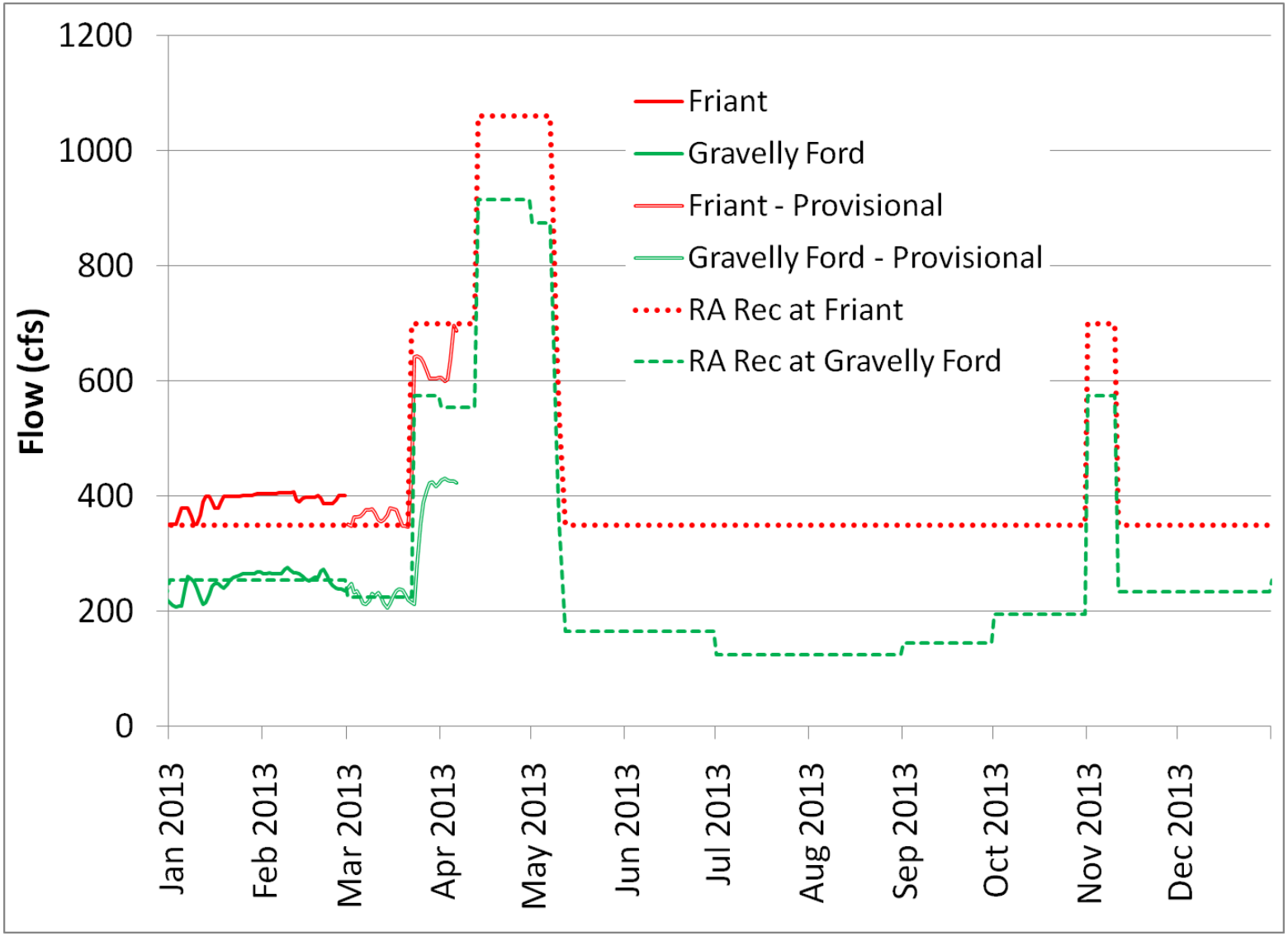
Water Year 2013 Flows



Preliminary draft – subject to change

Greg Farley

LEVEE UPDATE

Brian Heywood

SEEPAGE PROJECTS

Seepage Project Approach

- Split potential areas of impact into seepage parcel groups
- Prioritize parcel groups based on most at-risk properties
- Initiate first tier of priority parcel groups

Flow	# Projects
300 cfs	3
700 cfs	1
1,300 cfs	7
2,000 cfs	11
4,500 cfs	69
Total	**91**

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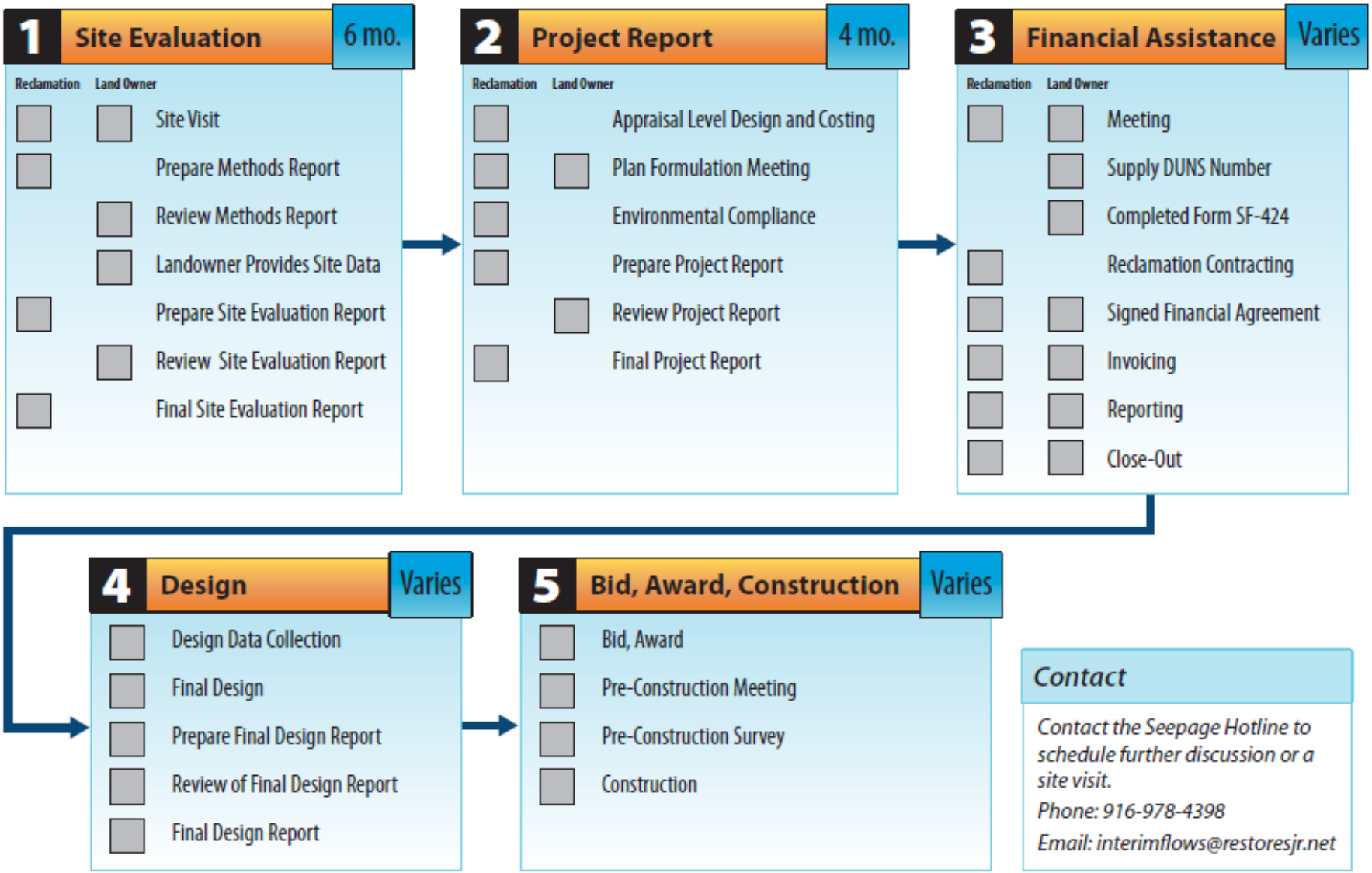
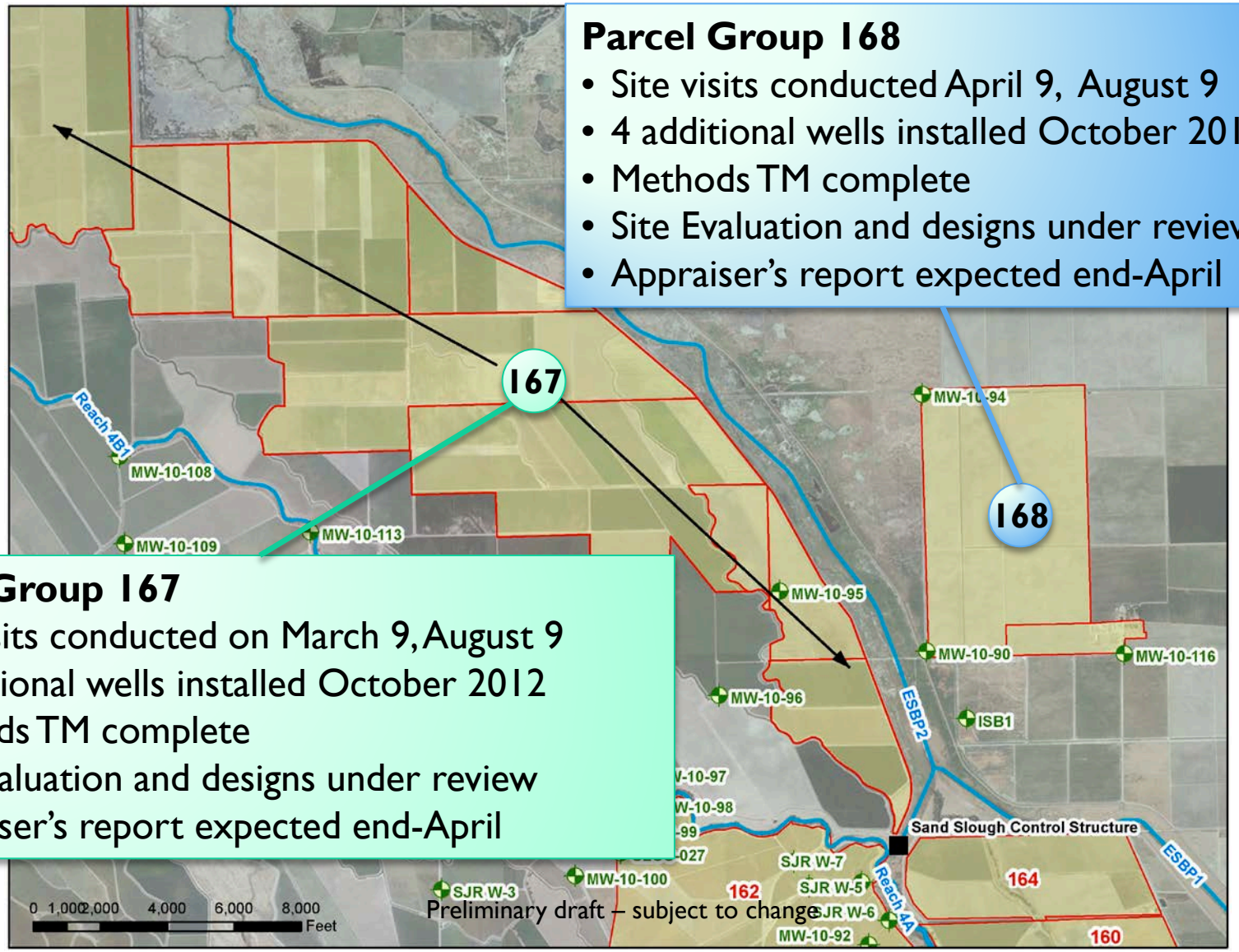
Seepage Project Process



Preliminary draft – subject to change

Priority Parcel Groups and Projects Initiated



Parcel Group 168

- Site visits conducted April 9, August 9
- 4 additional wells installed October 2012
- Methods TM complete
- Site Evaluation and designs under review
- Appraiser's report expected end-April

Parcel Group 167

- Site visits conducted on March 9, August 9
- 3 additional wells installed October 2012
- Methods TM complete
- Site Evaluation and designs under review
- Appraiser's report expected end-April

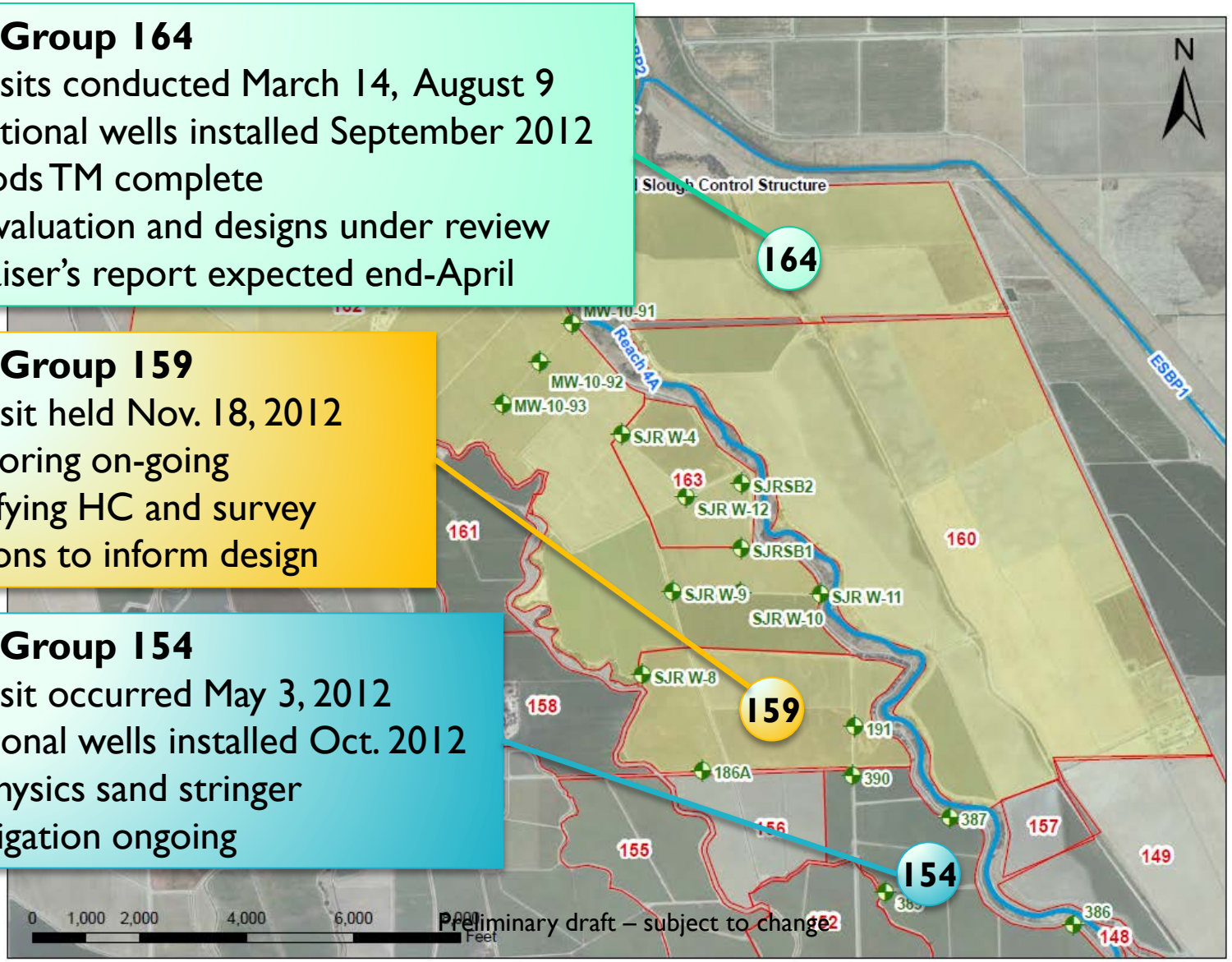
Preliminary draft – subject to change

Priority Parcel Groups and Projects Initiated

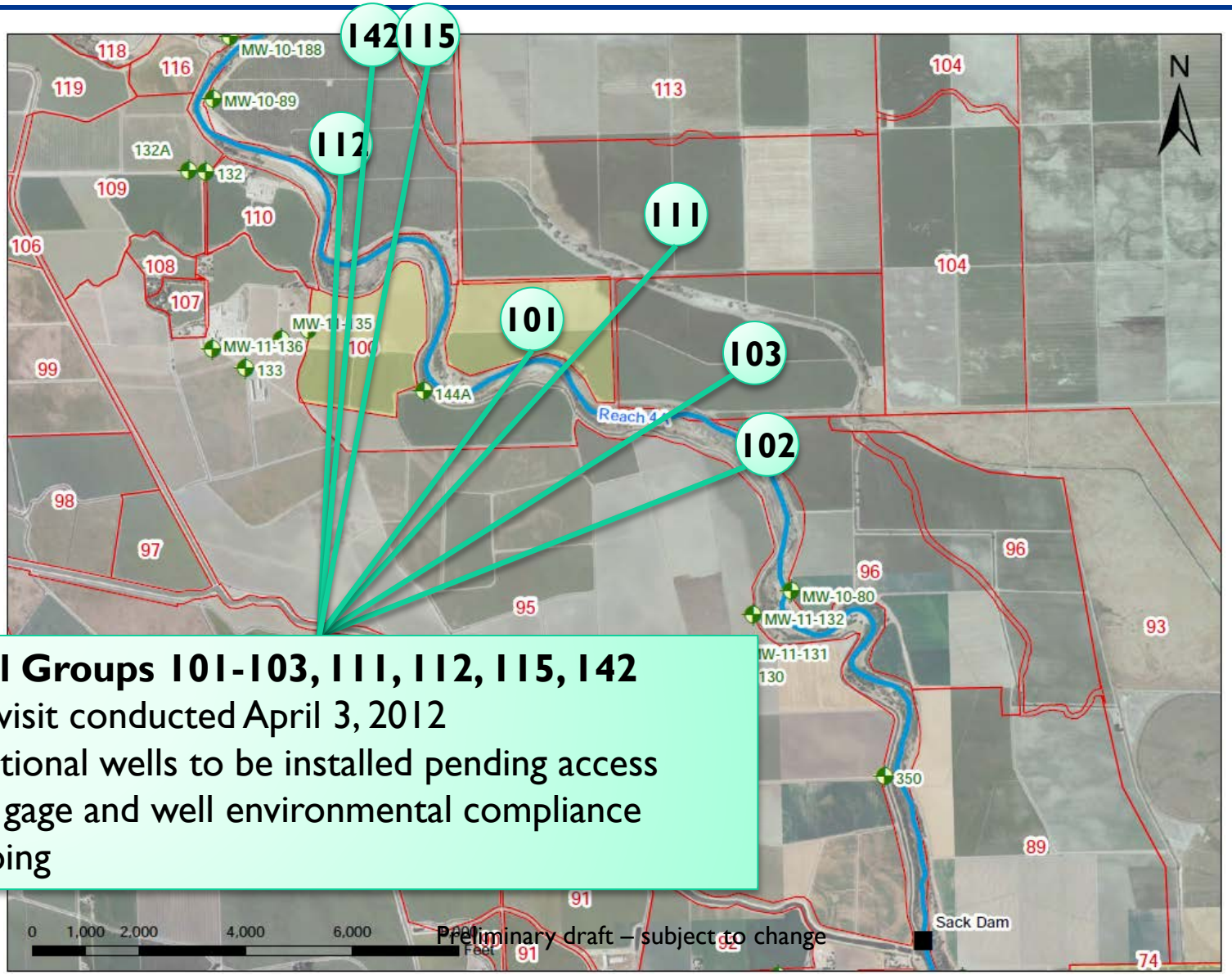
Parcel Group 164
- Site visits conducted March 14, August 9
- 5 additional wells installed September 2012
- Methods TM complete
- Site Evaluation and designs under review
- Appraiser's report expected end-April

Parcel Group 159
- Site visit held Nov. 18, 2012
- Monitoring on-going
- Identifying HC and survey locations to inform design

Parcel Group 154
- Site visit occurred May 3, 2012
- Additional wells installed Oct. 2012
- Geophysics sand stringer investigation ongoing



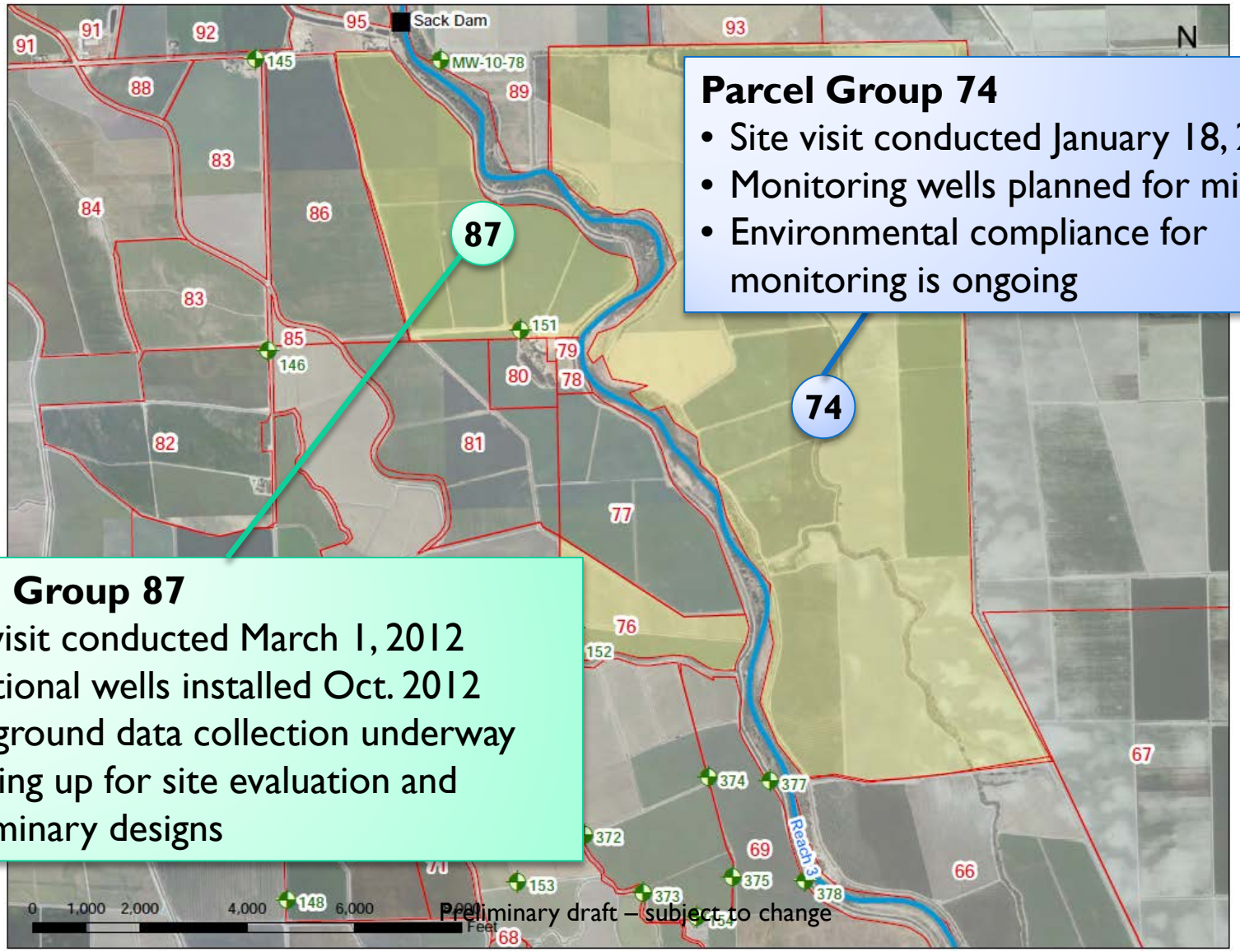
Priority Parcel Groups and Projects Initiated



Parcel Groups 101-103, 111, 112, 115, 142

- Site visit conducted April 3, 2012
- Additional wells to be installed pending access
- Staff gage and well environmental compliance ongoing

Priority Parcel Groups and Projects Initiated



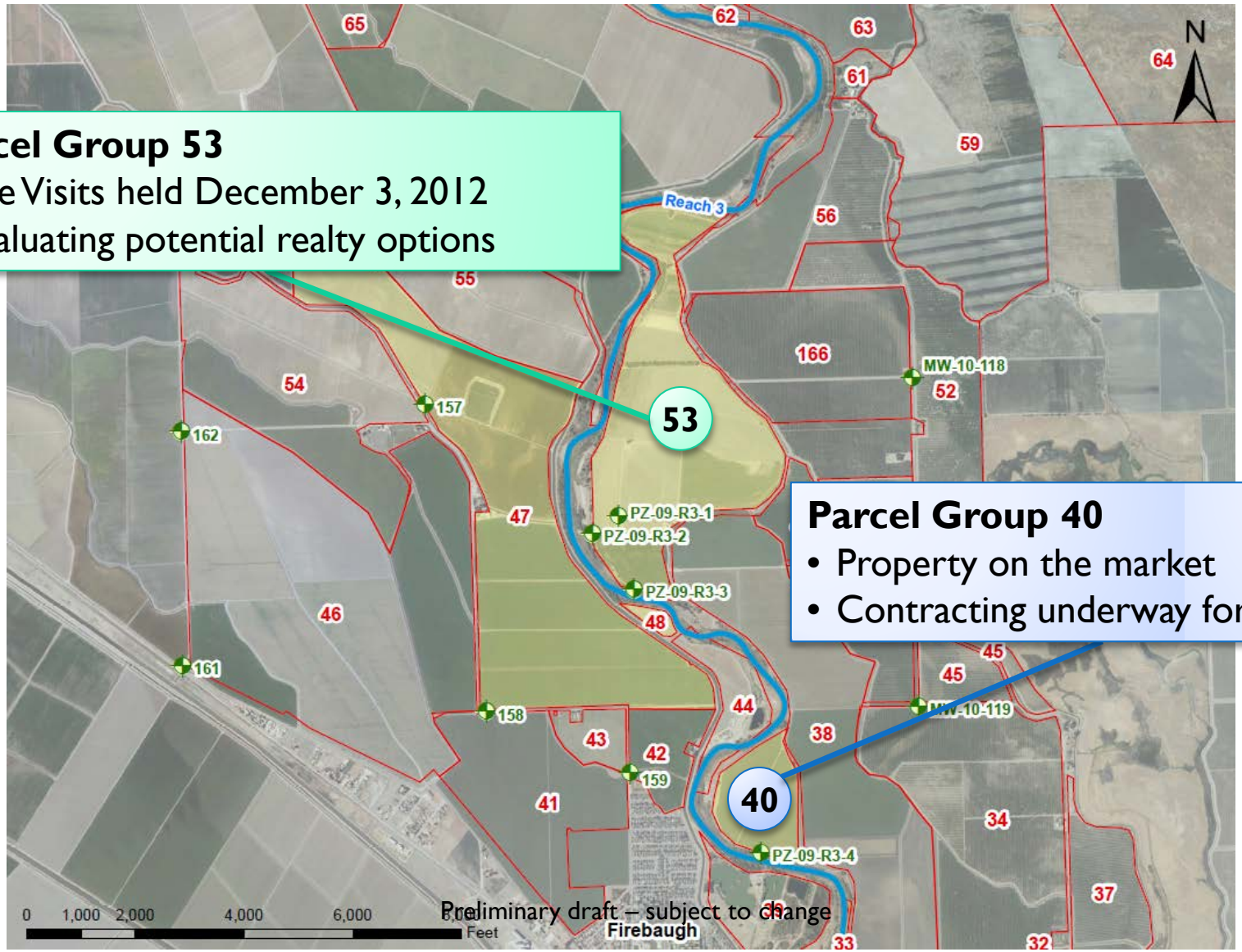
Parcel Group 74

- Site visit conducted January 18, 2013
- Monitoring wells planned for mid-2013
- Environmental compliance for monitoring is ongoing

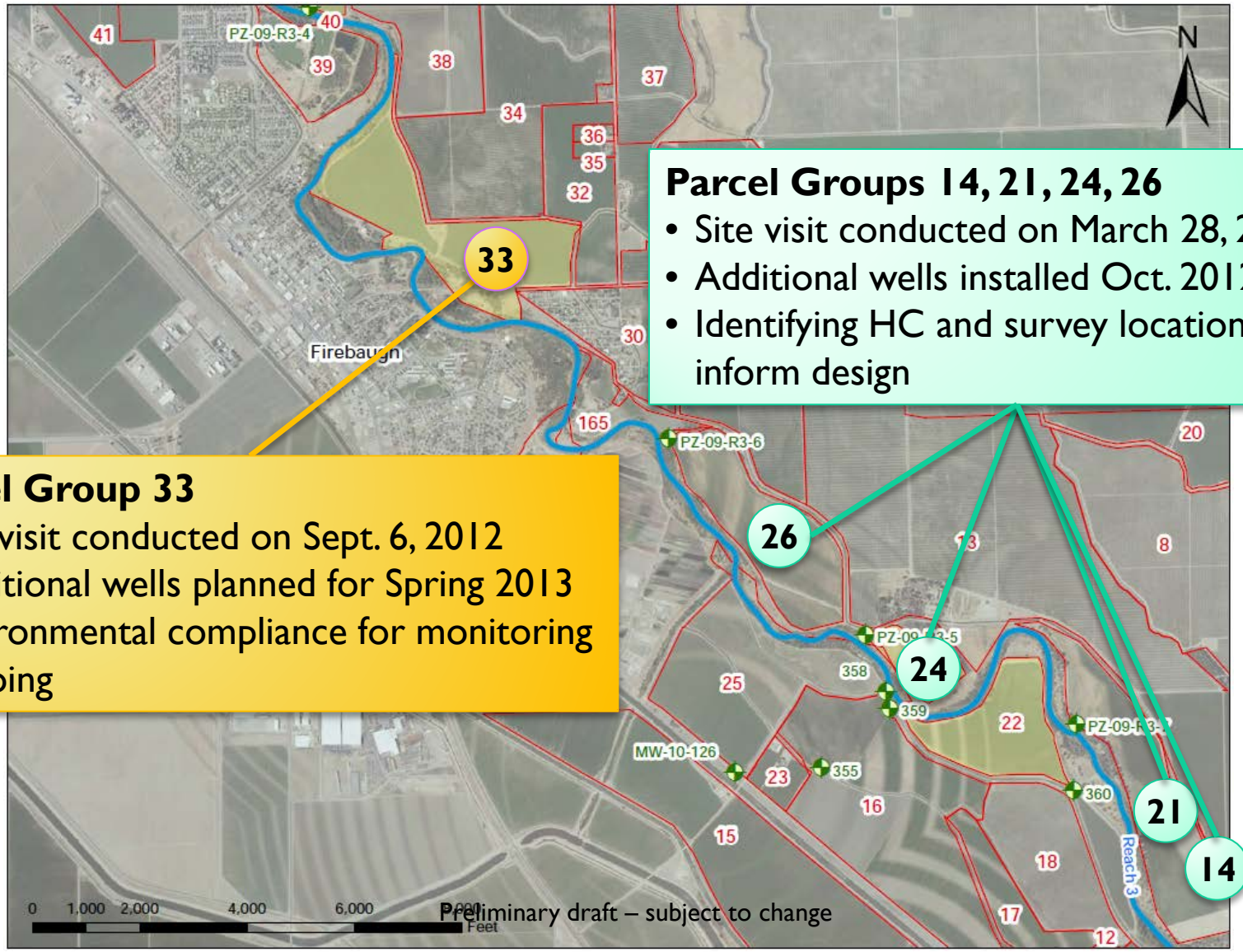
Parcel Group 87

- Site visit conducted March 1, 2012
- Additional wells installed Oct. 2012
- Background data collection underway
- Gearing up for site evaluation and preliminary designs

Priority Parcel Groups and Projects Initiated



Priority Parcel Groups and Projects Initiated



Parcel Groups 14, 21, 24, 26

- Site visit conducted on March 28, 2012
- Additional wells installed Oct. 2012
- Identifying HC and survey locations to inform design

Parcel Group 33

- Site visit conducted on Sept. 6, 2012
- Additional wells planned for Spring 2013
- Environmental compliance for monitoring ongoing

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Seepage Projects Summary

Flow	# Projects	Site Visits Performed	Targeted Monitoring Begun	Targeted Monitoring after 4/2013	Site Evaluations Begun
300 cfs	3	3	3	3	3
700 cfs	1	1		1	
1,300 cfs	7	6	2	3	
2,000 cfs	11	4	2	3	
4,500 cfs	69	1	1	2	
Total	**91**	**15**	**8**	**12**	**3**

Katrina Harrison

SEEPAGE MANAGEMENT PLAN REVISION

Purpose and Objective

- The Seepage Management Plan describes
  - Monitoring and operating guidelines to reduce Restoration/Interim flows to address adverse material impacts (per Public Law 111-11)
  - Projects to increase flows while avoiding seepage impacts
- Meant to be dynamic and adaptive
- Objective: convey Restoration/Interim flows while avoiding seepage impacts

SMP Peer Review Process

- 7 Member Panel
  - Multiple experience types
- September 13, 2012
  - SCTFG, Fieldtrip
- Fall 2012
- December 10, 2012
  - SCTFG Presentation February 8, 2013
- Reclamation
  - USGS
  - CDM Smith
- Comments Due April 19, 2013

SMP Revisions

- Revisions were made throughout the Seepage Management Plan per Peer Review recommendations

- Main Body of Document
  - Minor Edits
  - Formatting for consistency
- Appendices
  - Revisions per Peer Review recommendations
  - Data sources added
  - Re-ordered to be consistent with order of introduction
  - Formatting for consistency

SAN JOAQUIN RIVER RESTORATION PROGRAM

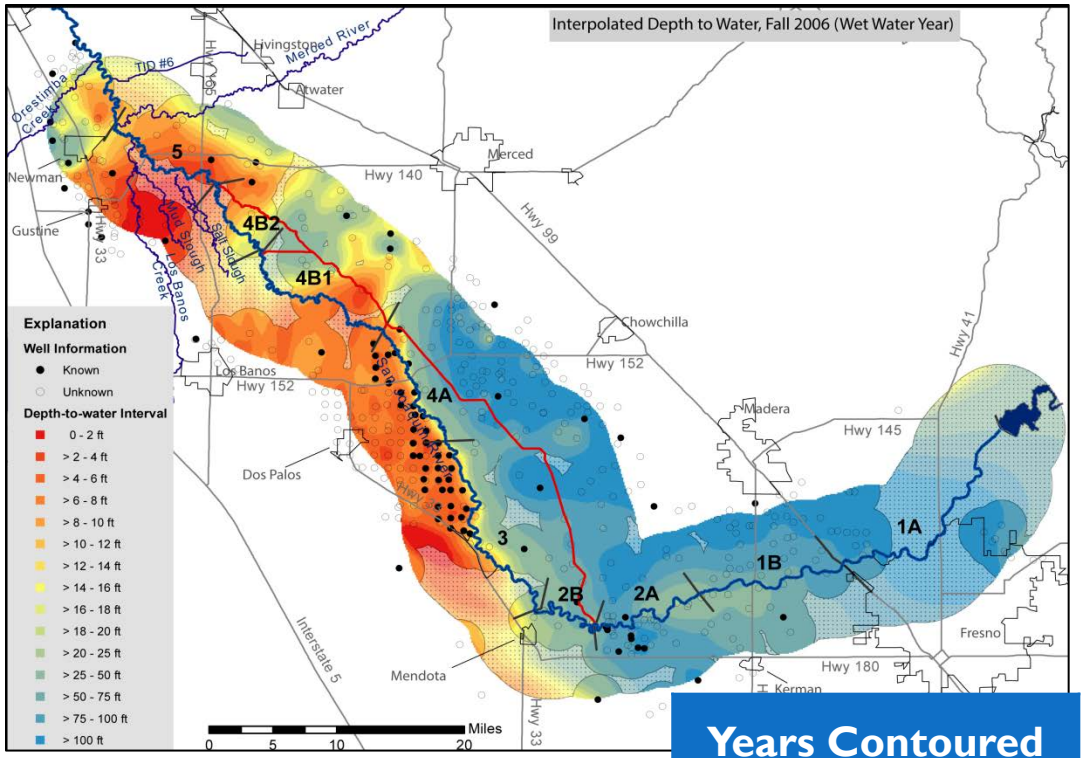
SMP Appendices

ID	Title
A	Seepage Effects of Concern
B (formerly C)	Historic Groundwater Levels and Surface-Water Flow
C (formerly B)	Areas Potentially Vulnerable to Seepage Effects
D	Sediment Texture and Other Data
E (formerly F)	Monitoring Network
F (new)	Aerial Imagery, Remote Sensing Data
G	Soil Salinity Thresholds
H	Groundwater Level Thresholds
I (formerly J)	Groundwater Modeling
J (formerly E)	Operations
K (formerly I)	Landowner Claims Process
L (formerly K)	Seepage Project Handbook
M (formerly L)	References Cited

SAN JOAQUIN RIVER RESTORATION PROGRAM

SMP Revisions

- Appendix A
  - Minor re-wording



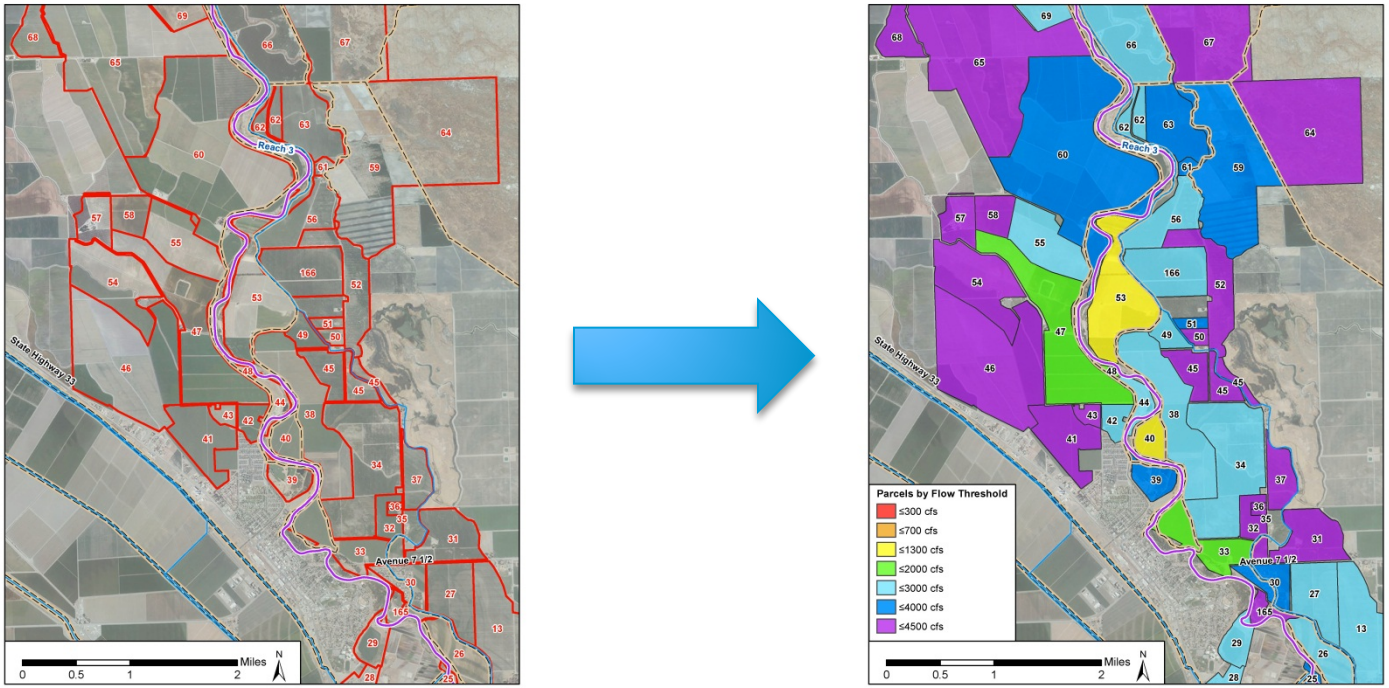
- Appendix B
  - Revised interpolation method to develop groundwater level contours
  - Noted areas of uncertainty

Years Contoured	
1981	1983
1988	1991
1994	1999
2006	2007
2008	2009
2010	

Preliminary draft – subject to change

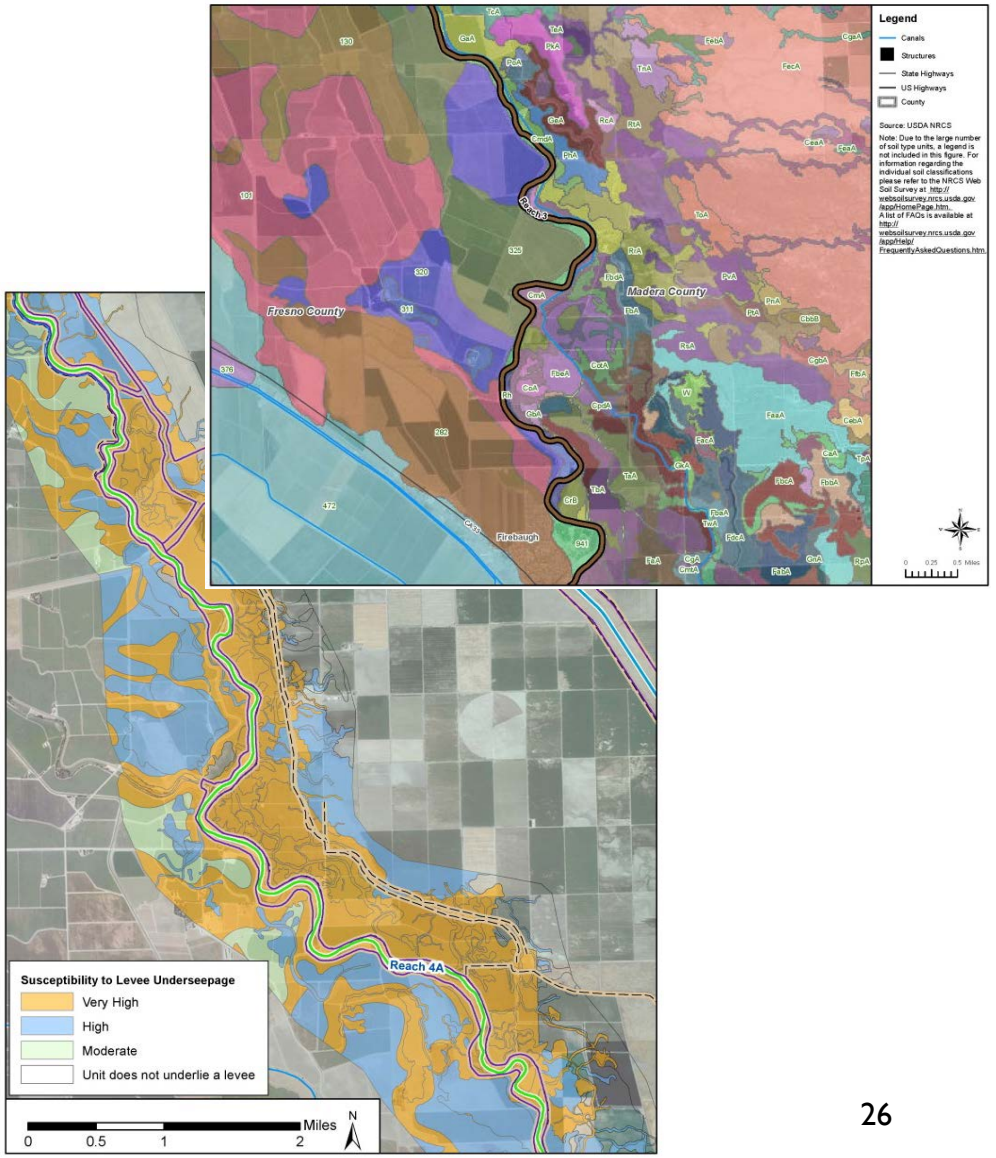
SMP Revisions

- Appendix C
  - Depth To Water maps from Appendix B
  - Added discussion of parcel group prioritization



SMP Revision

- Appendix D
  - Added description of Natural Resources Conservation Service soil type data set
  - Added "underseepage susceptibility" from DWR Non-Urban Levee Evaluation data



SMP Revision

- Appendix E
  - Added figures/maps for Weekly Groundwater Report

SAN JOAQUIN RIVER RESTORATION PROGRAM
Weekly Groundwater Report - Week Ending July 14, 2012

REACH 2A			Buffer Zone (ft			
Well ID	Date	DTW_GS (ft)	BGS)	River Mile	Bank	
FA-9	7/9/2012	9.02	4-6	218.2	Left	
MW-47	7/9/2012	9.22	6-8	218.2	Right	
MA-4	7/9/2012	12.03	6-8	217.2	Right	
MW-49B	7/9/2012	6.49	4-6	217.2	Left	
REACH 2B			**Buffer Zone (ft**			
Well ID	Date	DTW_GS (ft)	BGS)	River Mile	Bank	
MW-54B	7/9/2012	17.02	TBD	211.8	Right	
MW-55B	7/9/2012	10.78	6-8	211.8	Left	
R2B-1	7/9/2012	NR	4-6	207.1	Right	
R2B-2	7/9/2012	10.97	4-6	205.1	Right	
REACH 3			**Buffer Zone (ft**			
Well ID	Date	DTW_GS (ft)	BGS)	River Mile	Bank	
R3-5	7/11/2012	9.78	TBD	197.8	Right	
R3-6	7/11/2012	8.41	4-6	196.6	Right	
R3-7	7/11/2012	7.23	3-5	199.2	Right	
MW-75	7/10/2012	12.18	6-8	187.0	Left	
REACH 4A			**Buffer Zone (ft**			
Well ID	Date	DTW_GS (ft)	BGS)	River Mile	Bank	
MW-84	7/10/2012	38.52	4-6	173.9	Right	
MW-87B	7/10/2012	Dry	4-6	173.9	Left	
MW-89	7/11/2012	15.48	6-8	175.4	Right	
MW-92	7/11/2012	5.13	TBD	170.0	Left	
REACH 4B			**Buffer Zone (ft**			
Well ID	Date	DTW_GS (ft)	BGS)	River Mile	Bank	
MW-90	7/11/2012	6.83	TBD	168.0	Right	
MW-94	7/11/2012	20.59	TBD	166.7	Right	
MW-95	7/11/2012	4.17	TBD	166.7	Right	

PRELIMINARY SAN JOAQUIN RIVER FLOW DATA

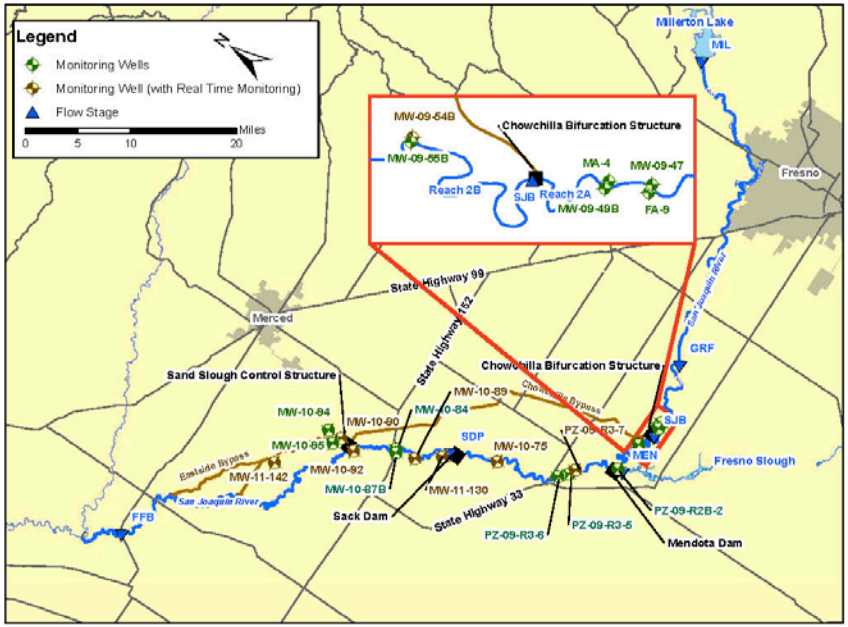
Location	Station_ID	Reach	River Mile	Flow (cfs)	Date	Time
Friant Dam	MIL	1	267.6	350	7/12/2012	24 hr Avg.
Gravelly Ford	GRF	2A	227.6	159	7/12/2012	1200
SJR below BIF	SJB	2B	216	66	7/12/2012	1200
SJR near Mendota	MEN	3	202.1	671	7/12/2012	1200
SJR near Dos Palos	SDP	4	181.5	1	7/12/2012	1200
SJR at Fremont Ford	FFB	5	125.1	130	7/12/2012	1200
SJR above Merced River	11273400	5	118.3	178	7/12/2012	1200

REAL TIME GROUNDWATER MONITOR WELL INFORMATION

Well ID	CDEC_ID	Weblink
MW-54B	W54	http://cdec.water.ca.gov/cgi-progs/queryF?s=w54
R3-7	R37	http://cdec.water.ca.gov/cgi-progs/queryF?s=r37
MW-75	W75	http://cdec.water.ca.gov/cgi-progs/queryF?s=w75
MW-89	W89	http://cdec.water.ca.gov/cgi-progs/queryF?s=w89
MW-92	W92	http://cdec.water.ca.gov/cgi-progs/queryF?s=w92
MW-90	W90	http://cdec.water.ca.gov/cgi-progs/queryF?s=w90
MW-130	130	http://cdec4gov.water.ca.gov/cgi-progs/queryF?130
MW-142	142	http://cdec4gov.water.ca.gov/cgi-progs/queryF?142

NOTE: All data are provisional and are subject to revision
TBD=To be determined NR=No Reading (Well Inaccessible)
Buffer Zone as defined in the Draft SJRRP Seepage Mgt Plan (ft BGS= feet below ground surface)
DTW_GS = Depth to Groundwater from Ground Surface

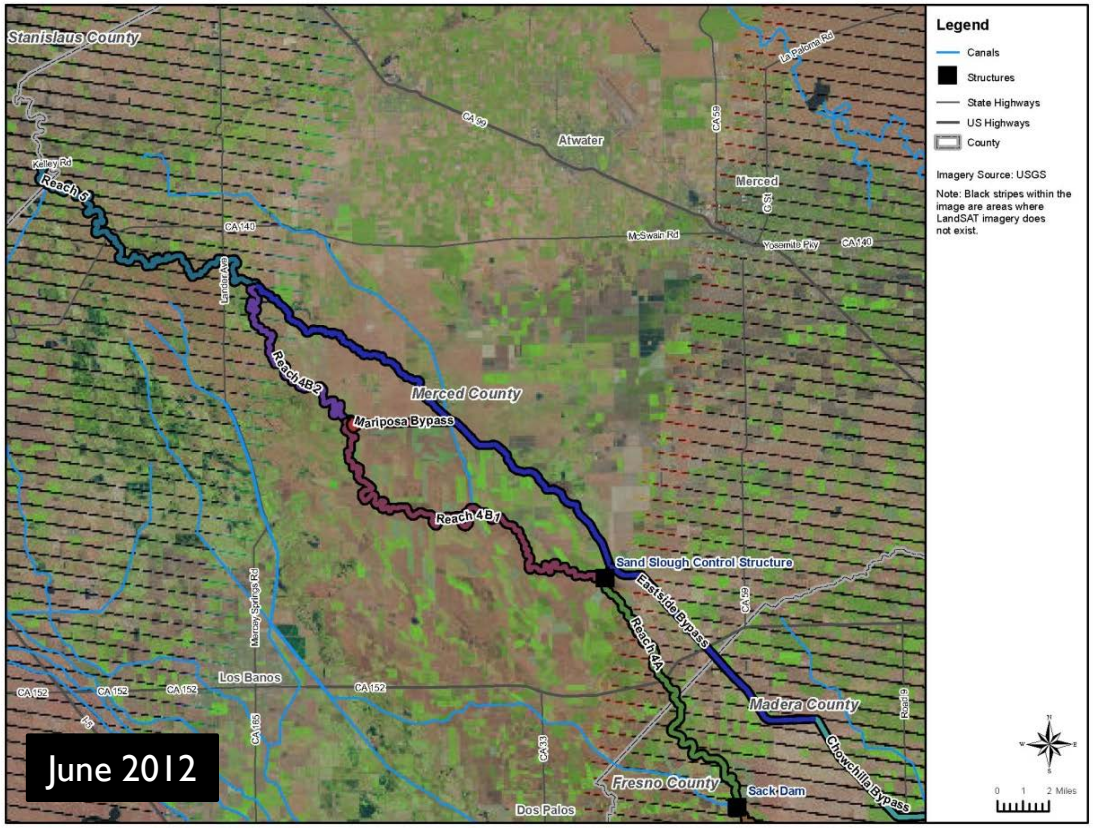
CDEC = California Data Exchange Center
BRT=Below Rating Table
ART=Above Rating Table



Preliminary draft – subject to change

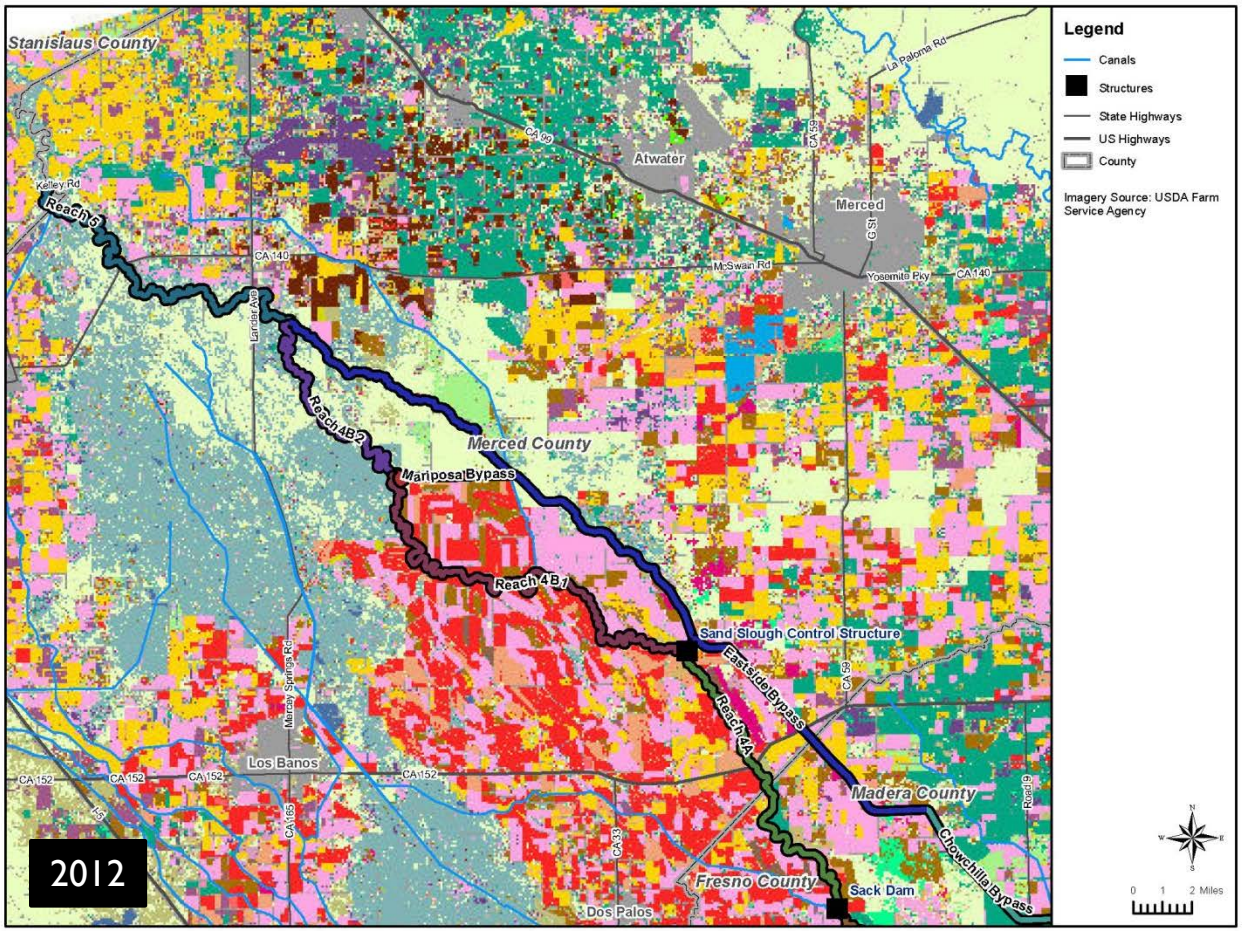
SMP Revision

- Appendix F
  - Added list of several remote sensing data types
  - Landsat
    - Monthly
    - 1999 - Present



SMP Revision

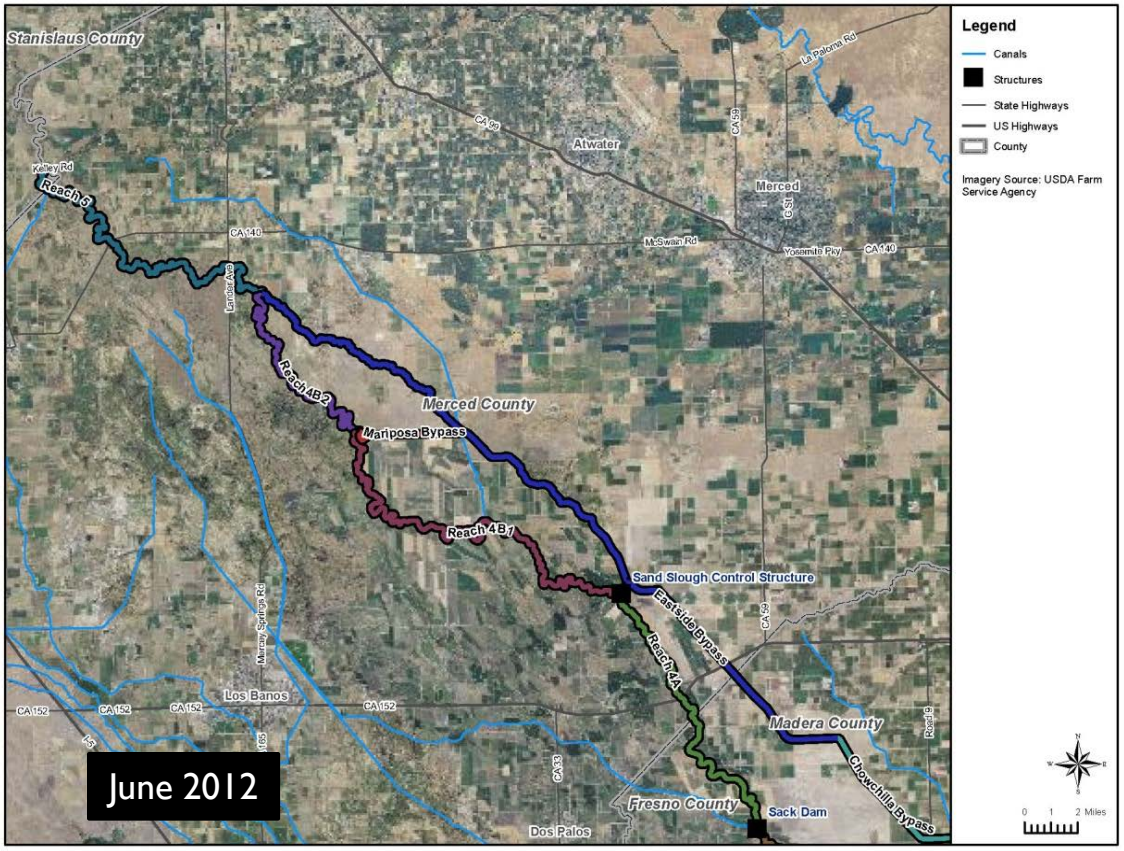
- Appendix F
  - Cropland Data Layer (CDL)
    - USDA
    - Annual
    - 1997 - Present



Preliminary draft – subject to change

SMP Revision

- Appendix F
  - National Agriculture Imagery Program (NAIP)
    - USDA
    - Annually
    - 2004, 2005, 2006, 2009, 2010, 2012



SMP Revision

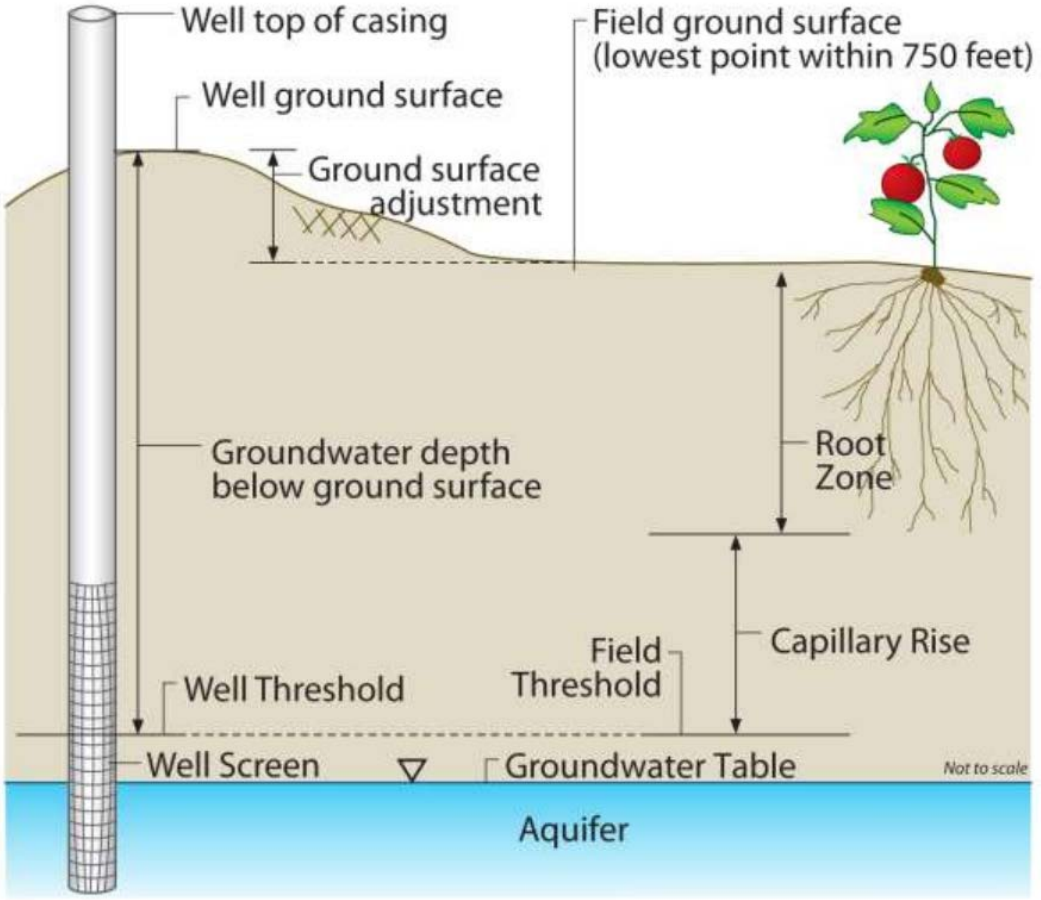
- Appendix G
  - Added/revised salt tolerance information
  - Added description of salinity monitoring

SMP Revision – Appendix H: Threshold Methods

1) Agricultural Practices
   - Based on ideal conditions for the crop
2) Historical Groundwater Level
   - Shallow historical groundwater levels restrict root growth and represent less than ideal conditions

Agricultural Practices Method

- Removed "irrigation buffer" per peer review panel recommendations



Agricultural Practices Method

- Converted to using "effective" root zone per peer review panel recommendations

Crop	Root Zone Depth
Almonds, alfalfa, grapes, pomegranates, safflower	6 feet
Cotton, tomatoes, wheat, barley, melon, pistachio, sweet corn, palms	5 feet
Sugar beet, lima beans	4 feet

Crop	Effective Root Depth, various sources (feet)
Alfalfa (Hay)	3.3-6.6 5
Almonds	3.3-6.6 2.5
Barley	3.3-4.9 3.5
Lima Beans	2.6-3.9
Cotton	3.3-5.6
Grape	3.3-6.6 2
Corn	3.3-5.6 (sweet) 2.6-3.9 (field) 4
Melon	2.6-4.9 2
Pistachio	3.3-4.9
Safflower	3.3-6.6
Spring Wheat Winter	3.3-4.9 3.5 2
Sugar Beet	2.3-3.9 4 3.3
Tomato	2.3-4.9 2
Wheat (Fall Planted)	3.3-4.9 2

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Agricultural Practices Method

- Root zone comparison

Crop	2011-2012 Root Zone Depth (ft)	2013 Root Zone Depth (ft)
Almonds	9	6
Grapes	6	6
Pistachios	6	5
Pomegranates	6	6
Cotton	4	5
Alfalfa	4	6
Tomatoes	3	5
Lima Beans	3	4
Melons	3	5
Sweet Corn	3	5
Wheat, Barley, Palms	4	5

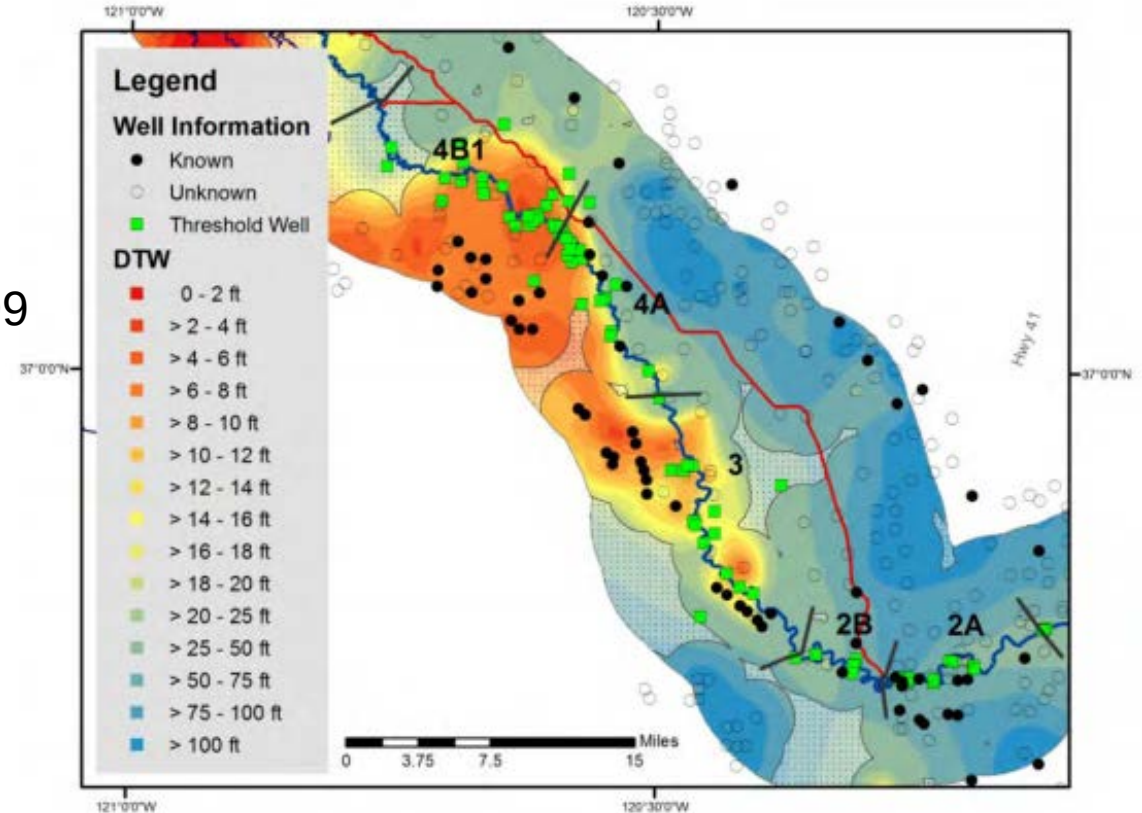
Historical Groundwater Method

- Method A: wells with a long-term record
- Method B: wells near wells with a long term record
- Method C: wells with no long-term record
  - CCID average contour map
  - Fall 1999 contour map
  - Fall 2009 contour map
  - Winter 2012 deepest level

Historical Groundwater Method

- Revised contour maps for Method C based on peer review recommendations for kriging
- Fall 1999 (Normal-Wet); Fall 2009 (Normal-Dry)

Fall 1999

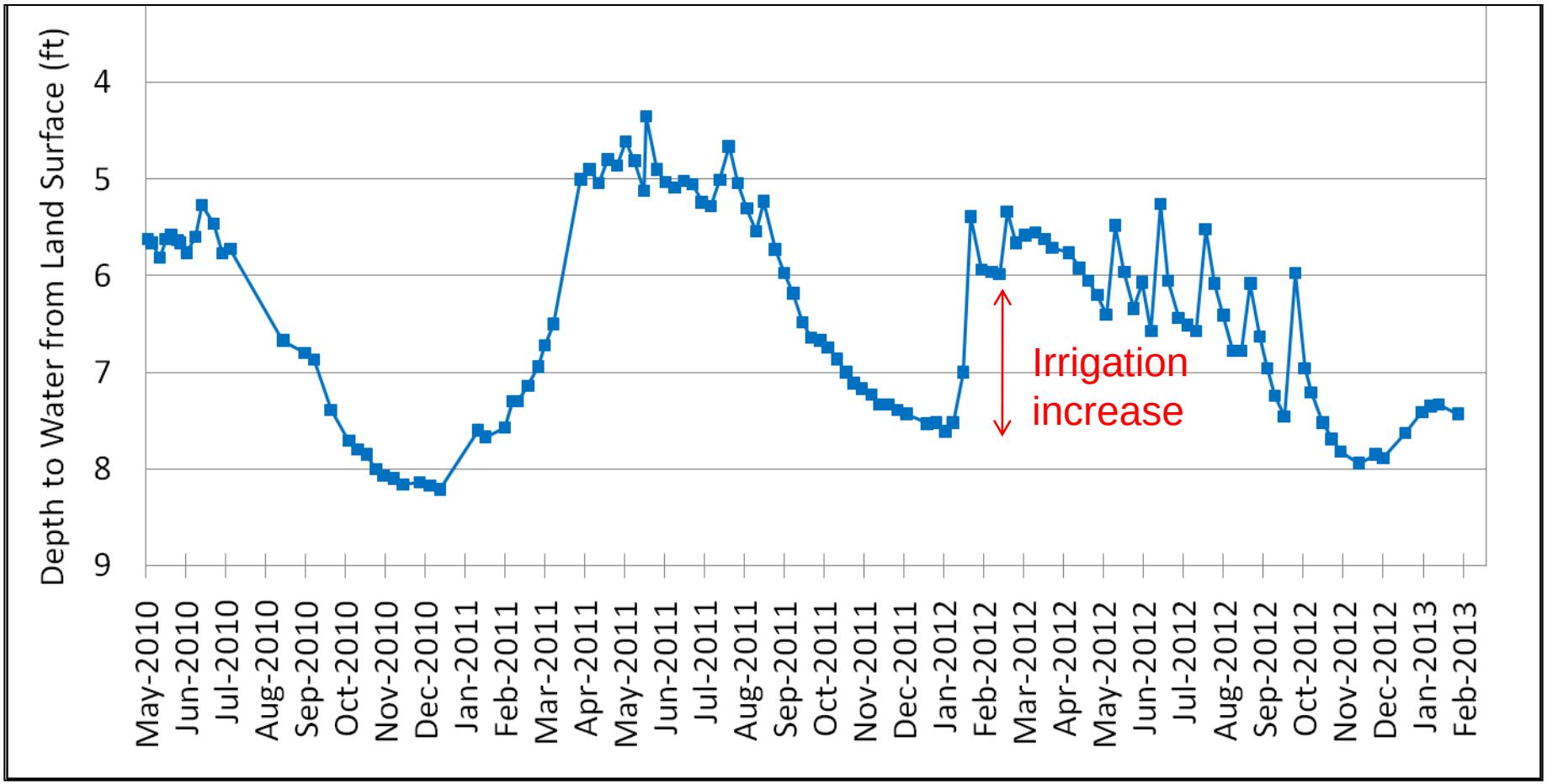


Historical Groundwater Method

- Winter 2012 method
  - Deepest groundwater level of observations from January and February 2012
  - Drainage concerns
    - Deeper pre-irrigation season groundwater level needed
  - Effects potentially included:
    - Merced National Wildlife Refuge
    - Any leftover water table rise from 2011 flood flows
    - 50 cfs flow below Sack Dam in November 2011 and Mendota Pool drainage flows soon after

Historical Groundwater Method

- Drainage Explanation (MW-10-97)
  - Reach 4B1



Historical Groundwater Method

- Winter 2012 method
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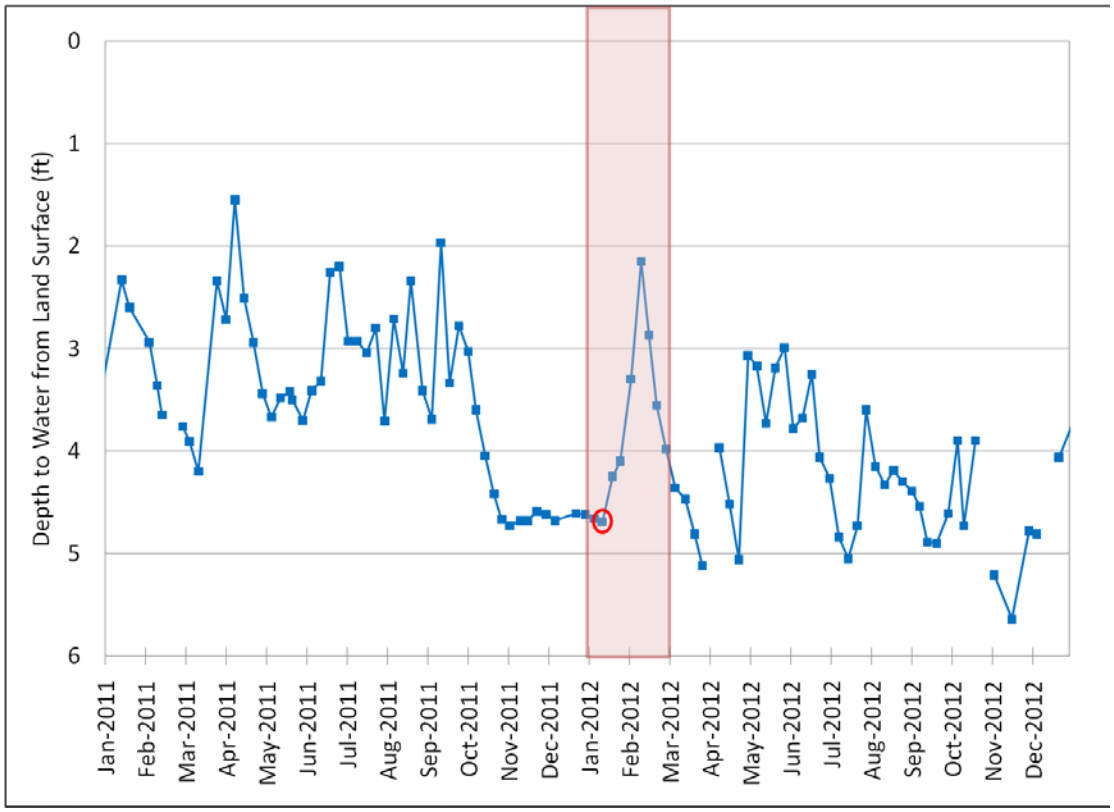


MW-10-95

4.7 feet below ground surface (bgs) in well

Historical Groundwater Method

- Ground surface Correction
- Maximum difference in ground surface within 750' of a well

4.7 feet bgs in well

– 2.2 foot ground surface adjustment

+ 1.0 lateral gradient

= 3.5 feet below ground surface in the field

Threshold Example MW-10-95

- Agricultural Thresholds Method

Root Zone	Capillary Fringe	Field Threshold
6 feet	1 foot	7 feet

- Historical Groundwater Method C

Fall 1999 Interpolated Field level (Normal-Wet)	Fall 2009 Interpolated Field level (Normal-Dry)	Winter 2012 Observed Field level (no flow)
11 feet	7 feet	3.5 feet
Minimum (i.e. shallowest) groundwater level		**3.5 feet**

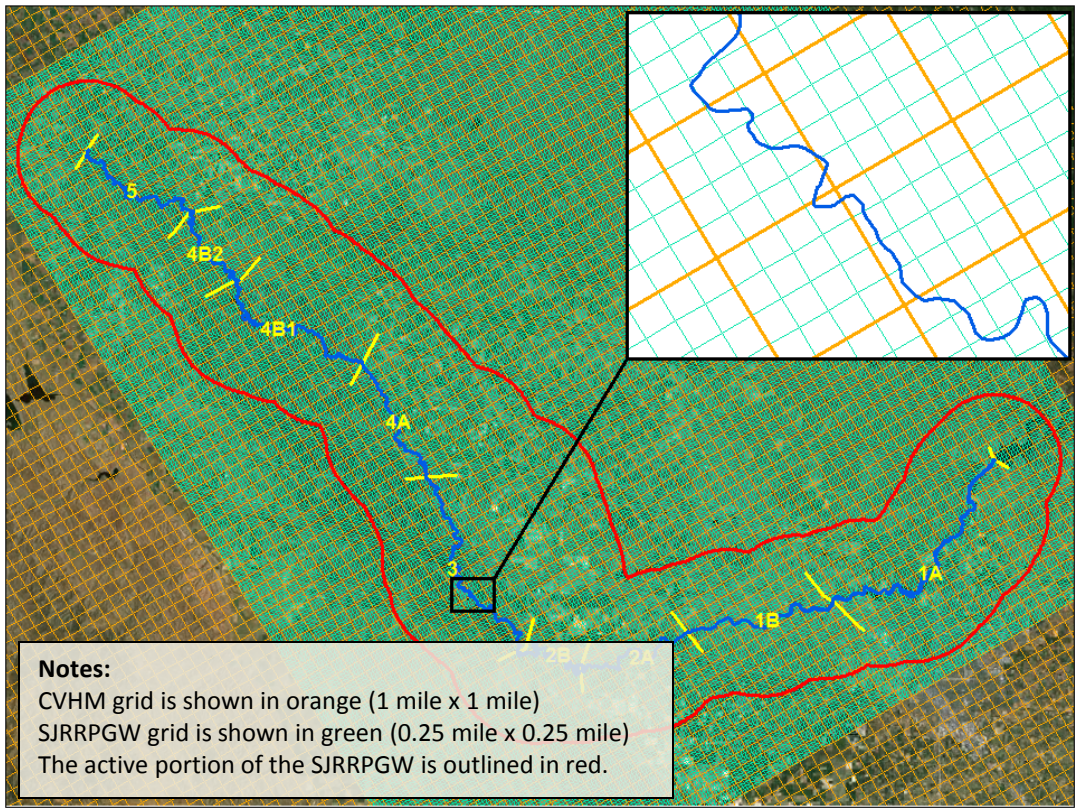
Threshold Example MW-10-95 cont.

- Historical levels shallower than agricultural practices threshold indicate pre-SJRRP groundwater issue
- Minimum (i.e. shallowest) of agricultural practices method or historical method sets threshold

Agricultural Practices Field Threshold	Historical Method Field Threshold	Field Threshold	Well Threshold
7 feet	3.5 feet	3.5 feet	4.7 feet

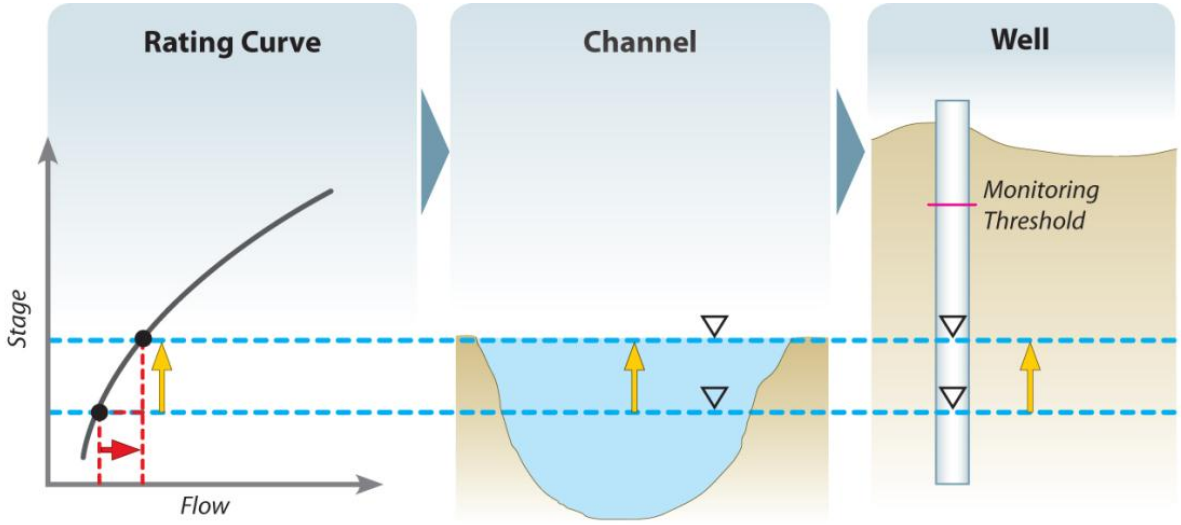
SMP Revision

- Appendix I
  - Expanded the discussion of groundwater model (SJRRPGW)



SMP Revisions

- Appendix J
  - Revised text to improve understanding
  - Reformatted "Flow Bench Evaluation" for clarity

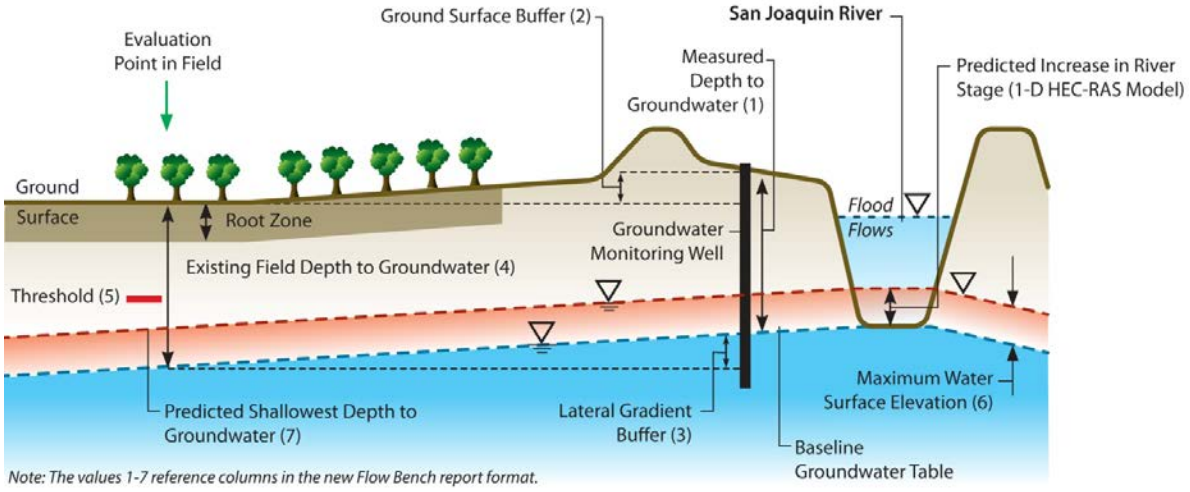


Described 1:1 assumption relating surface water levels changes to groundwater level changes

SMP Revisions

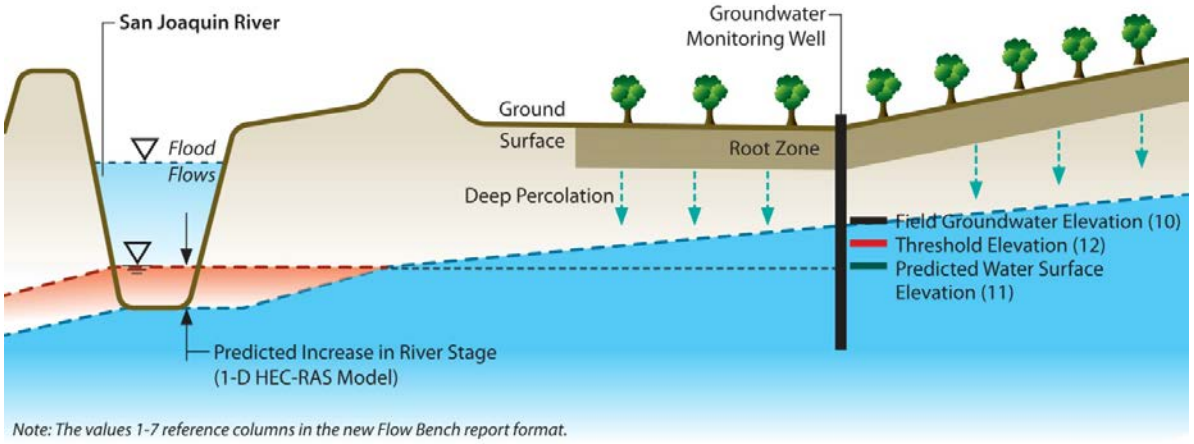
- Appendix J

Increase in Stage Method



Improved graphics to relate observed and calculated numbers to a conceptual diagram

Drainage Method



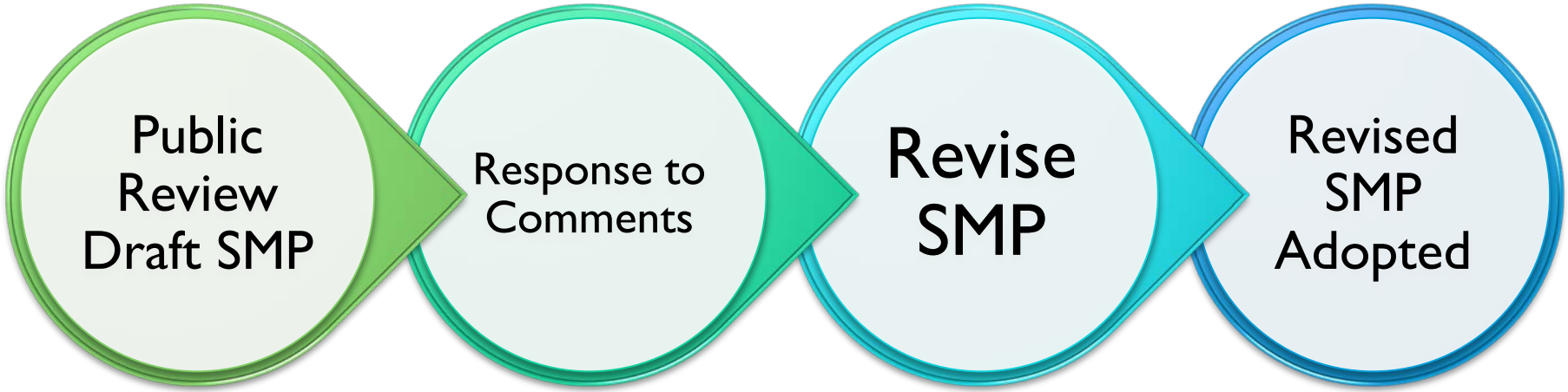
SMP Revisions

- Appendix K
  - Minor formatting changes
- Appendix L
  - Re-dated to March 26, 2013 to match SMP
  - Minor formatting changes
- Appendix M
  - New references added

Comments on the SMP

- Comments on the March 26, 2013 proposed changes
- 20+ day comment period
- Comments due
  - April 19, 2013
  - interimflows@restoresjr.net

SMP Next Steps



- Comments Due April 19, 2013
- Reclamation
- As necessary, per comments
- Estimated date: May 3, 2013

Katrina Harrison

SCOPING OF GROUNDWATER BASELINE STUDY

Purpose

- Establish reasonable, defensible historical groundwater level baseline
- Informs:
  - Historical Groundwater Level Thresholds
  - Realty Actions
  - Damages
- Brainstorming Session

SAN JOAQUIN RIVER RESTORATION PROGRAM

Possible Areas of Study

- Intra-annual variability
  - Evaluate need for deeper groundwater levels in certain times of year
  - Evaluate drainage and anoxia
- Year type variability
  - Evaluate potential for thresholds to change by yeartype
  - Variety of indirect data sources to determine range of historical groundwater levels

Thoughts?

- Hypotheses
- Tools
  - Monitoring
  - Modeling
  - Analysis
- Constraints

Hypotheses – Seasonal Variation

- Salts rise into the root zone via capillary rise or any increase in groundwater level
- Deeper groundwater levels are required annually to allow drainage of leachate in fall or winter, mobilizing salts out of the root zone
- The saturated zone in the soil rises during the irrigation season
- Drainage direction is towards the ESB even with low flows
- In losing reaches, SJRRP flows do not impede drainage

Hypotheses – Year type variation

- Groundwater levels vary by yeartype historically
- SJRRP flows cause increased groundwater levels especially in Dry to Normal Wet years
- 2012 represents Normal conditions
- Additional data sources can provide insight into historically shallow groundwater areas

Possible Tools – Seasonal Variation

- Pressure transducers with electrical conductivity and temperature in monitoring wells at different depths
- Oxidation Reduction Potential sensors in wells at depth to track anoxia
- Analysis of existing monitoring well transects for drainage direction
- Modeling of drainage in key areas

Possible Tools – Year type variation

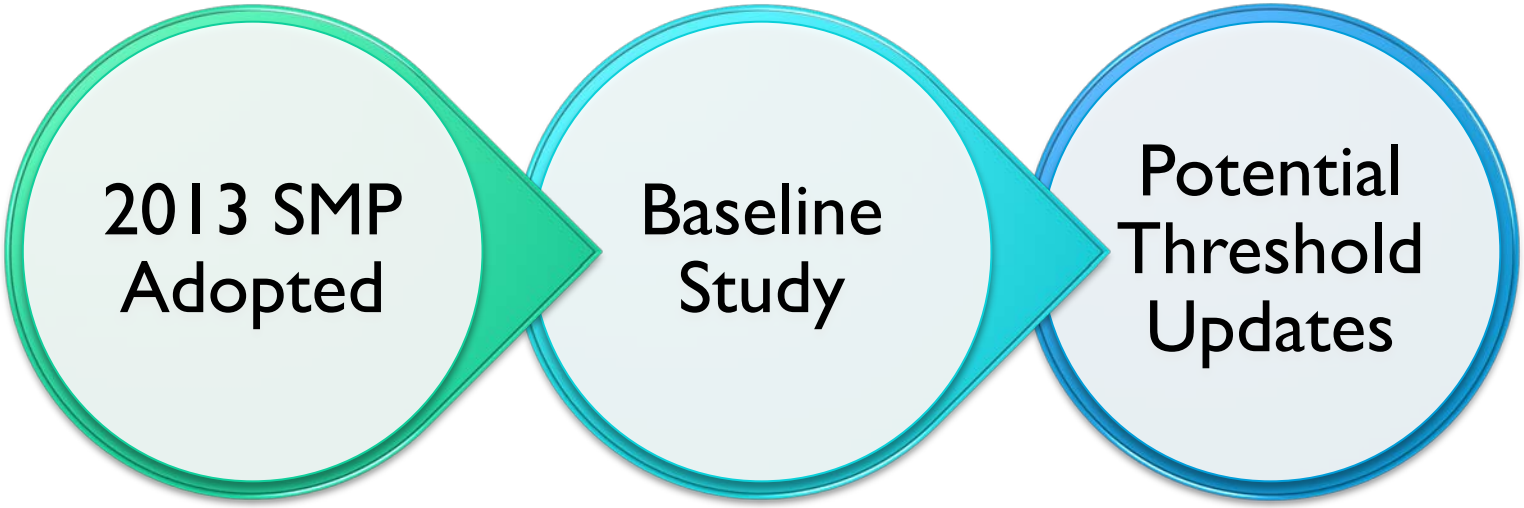
- Aerial imagery of crop health to identify historically shallow groundwater areas
- Existence of drains indicates historical shallow groundwater problem
- Soil classification characteristics, and gleying and mottling from monitoring can indicate top of the water table
- 2012 water levels comparison by yeartype
- Modeling of groundwater levels pre and post SJRRP by yeartype

Next Steps

- Prioritization
- Access
- Environmental Compliance
- Equipment Purchase
- Schedule

- Possible Threshold Revisions in 2014 based on study results

Schedule



- Estimated date: May 3, 2013

- 2014

QUESTIONS

Contact

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