SAN JOAQUIN RIVER RESTORATION PROGRAM

Seepage and Conveyance Technical Feedback Group Meeting

February 8, 2013

Preliminary draft – subject to change

Patti Ransdell

INTRODUCTION

Agenda

- Introductions
- Purpose
- Anticipated Spring Flow Schedule
- Status of Seepage Projects
- SMP Peer Review Panel Findings
  - Discussion
- Seepage Management Plan Next Steps

Purpose

- Discuss the SMP Peer Review Panel's findings

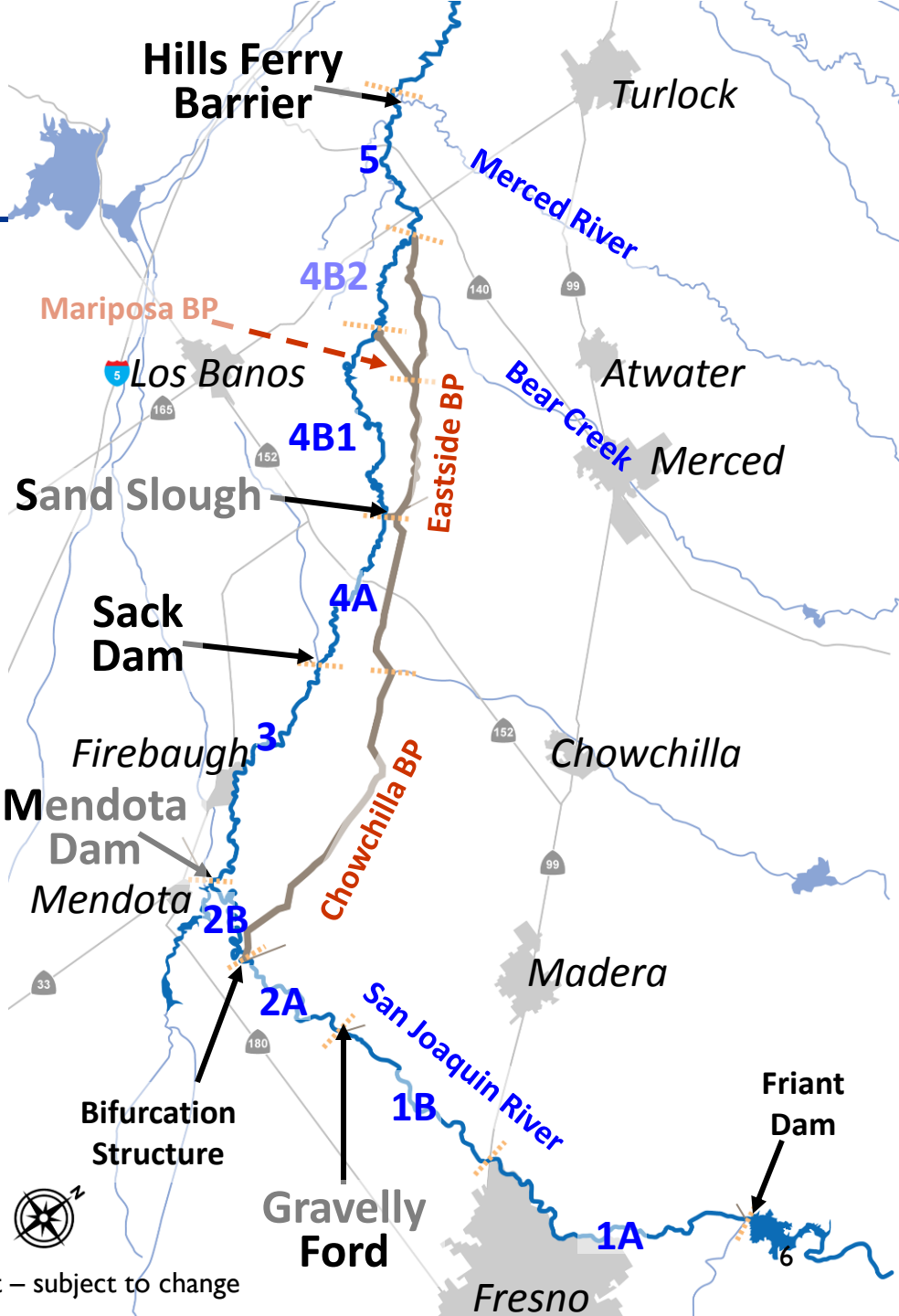
- Objectives
  - Disseminate information to SCTFG
  - Solicit comments on peer review findings

Katrina Harrison

INTERIM FLOW SCHEDULE

Restoration Area

- 150 miles of River
- Historically Dry Reaches
- Water Supply Facilities
- Agriculture
- Sand and Gravel Mining
- Flood Control
- Urban Areas



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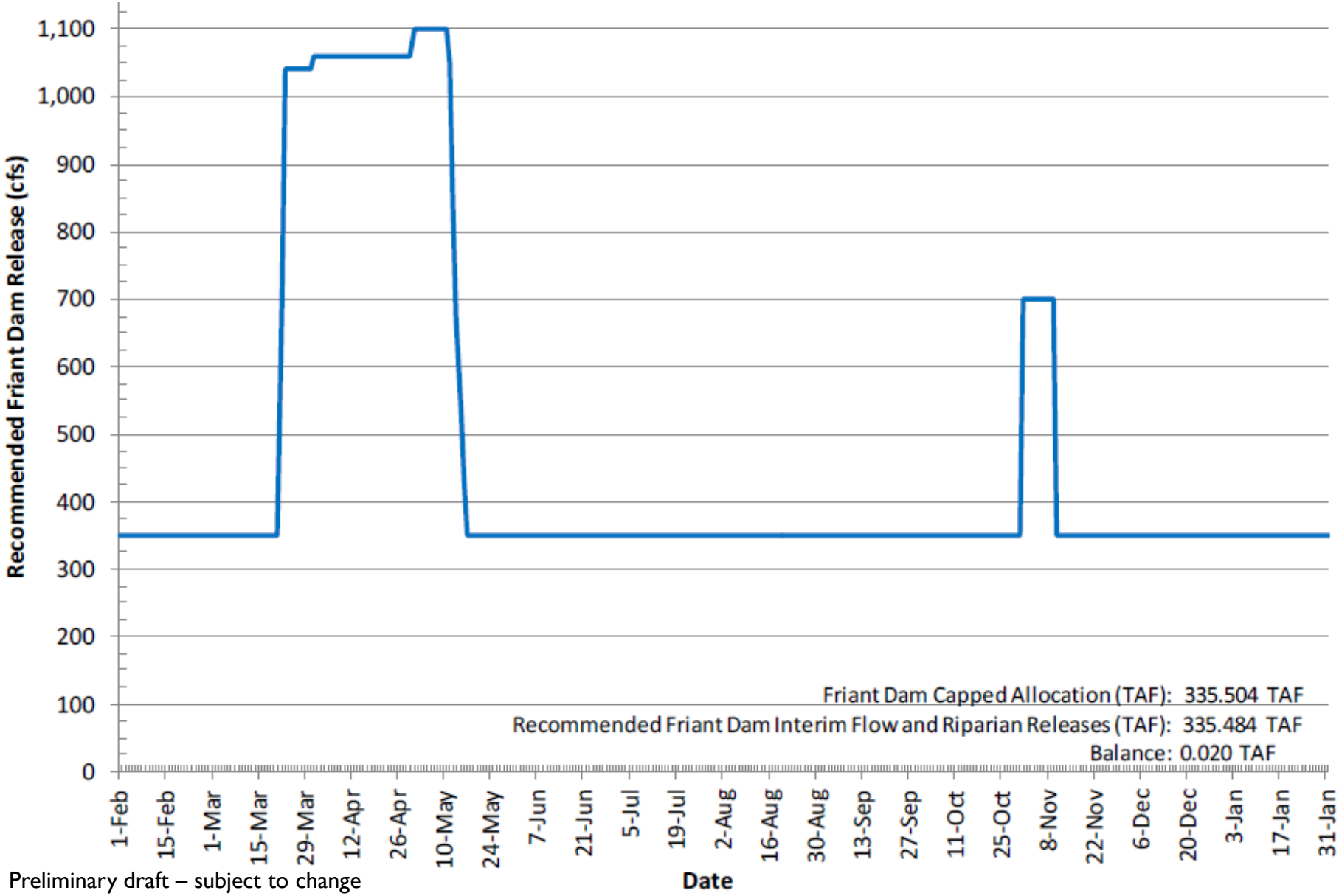
Restoration Administrator: Recommended WY 2013 Flows



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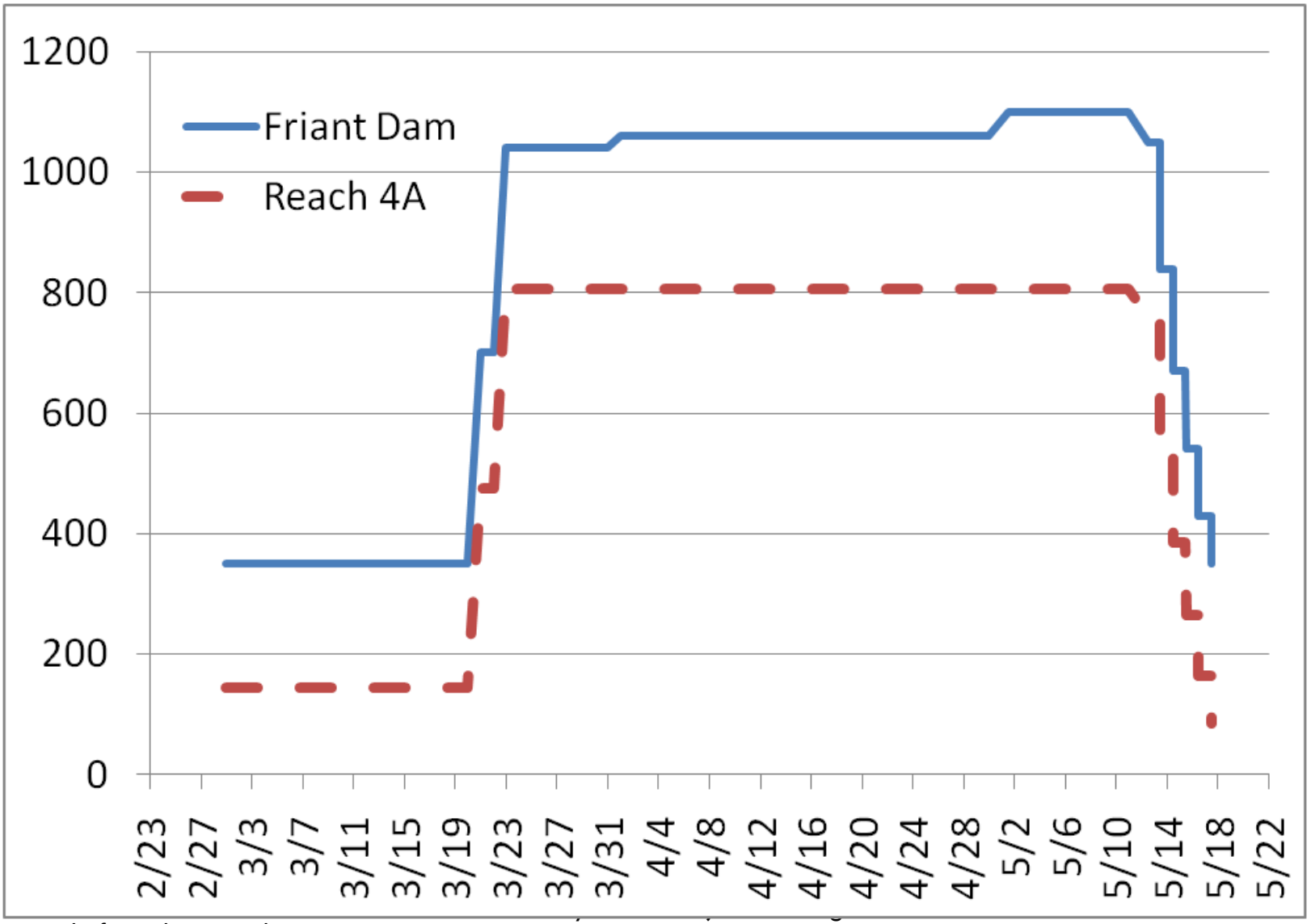
Spring 2013 Pulse Flows



Brian Heywood

SEEPAGE PROJECTS

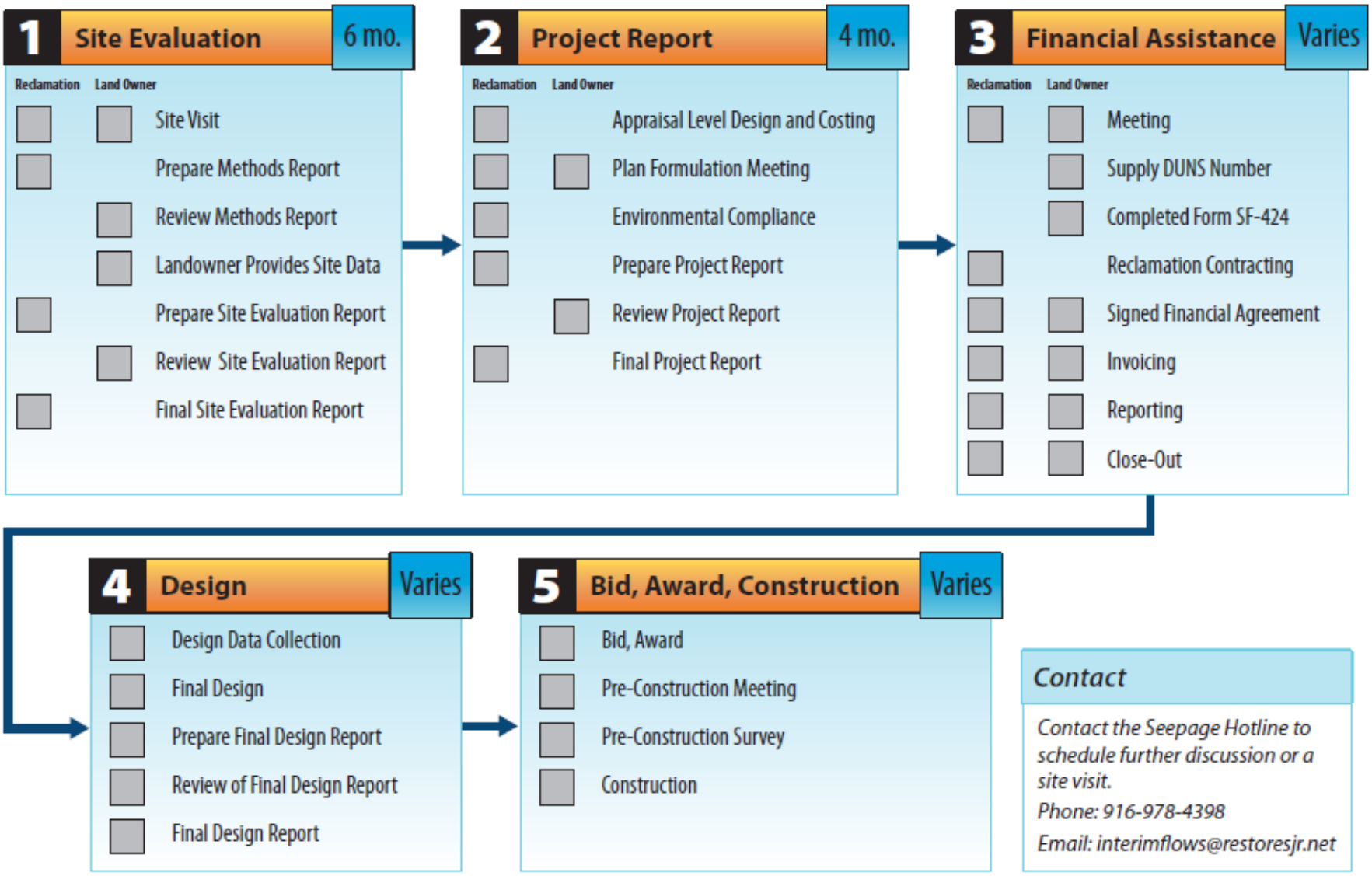
Seepage Project Approach

- 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**

SAN JOAQUIN RIVER RESTORATION PROGRAM

Seepage Project Process



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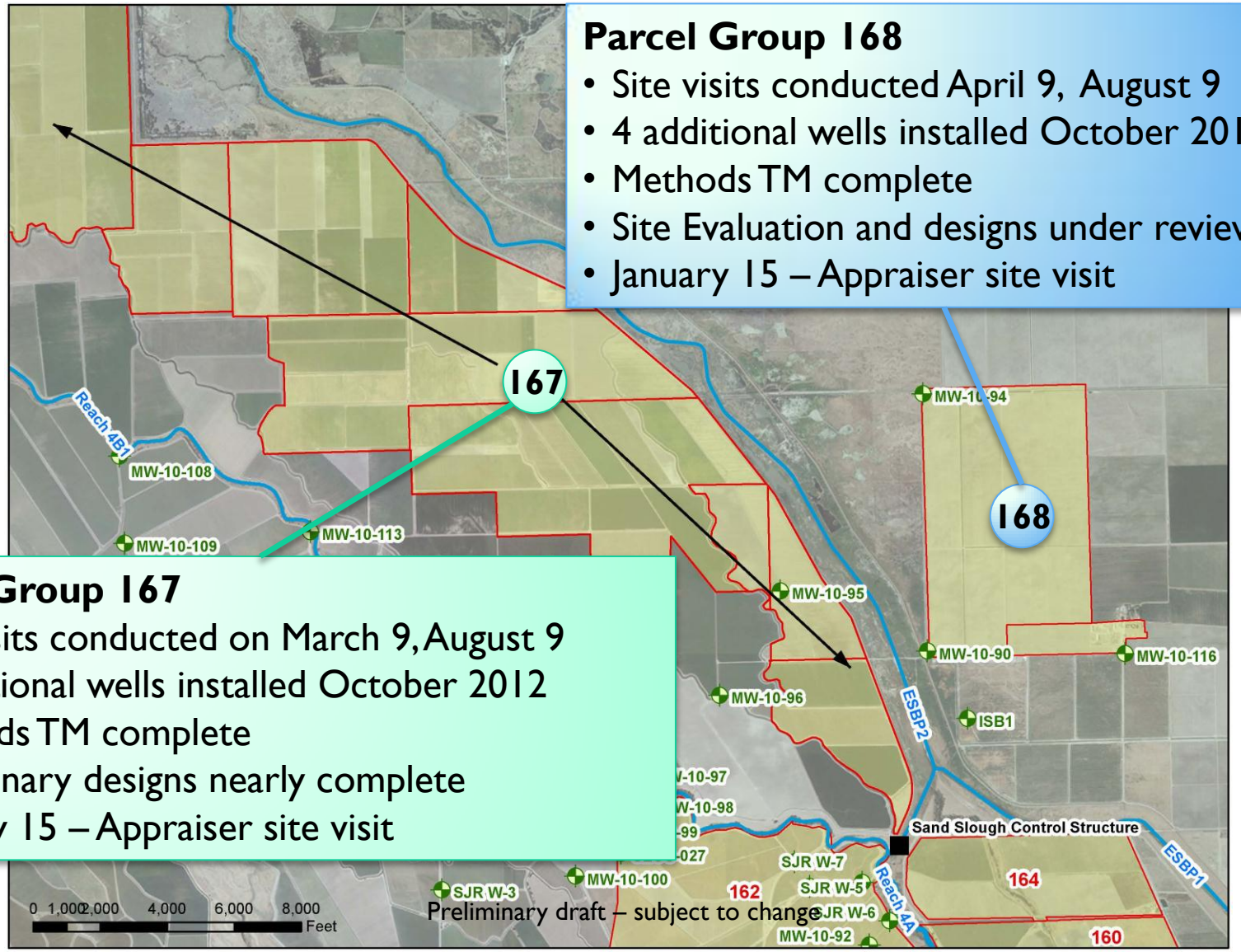
Priority Parcel Groups and Projects Initiated



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
- January 15 – Appraiser site visit

Parcel Group 167

- Site visits conducted on March 9, August 9
- 3 additional wells installed October 2012
- Methods TM complete
- Preliminary designs nearly complete
- January 15 – Appraiser site visit

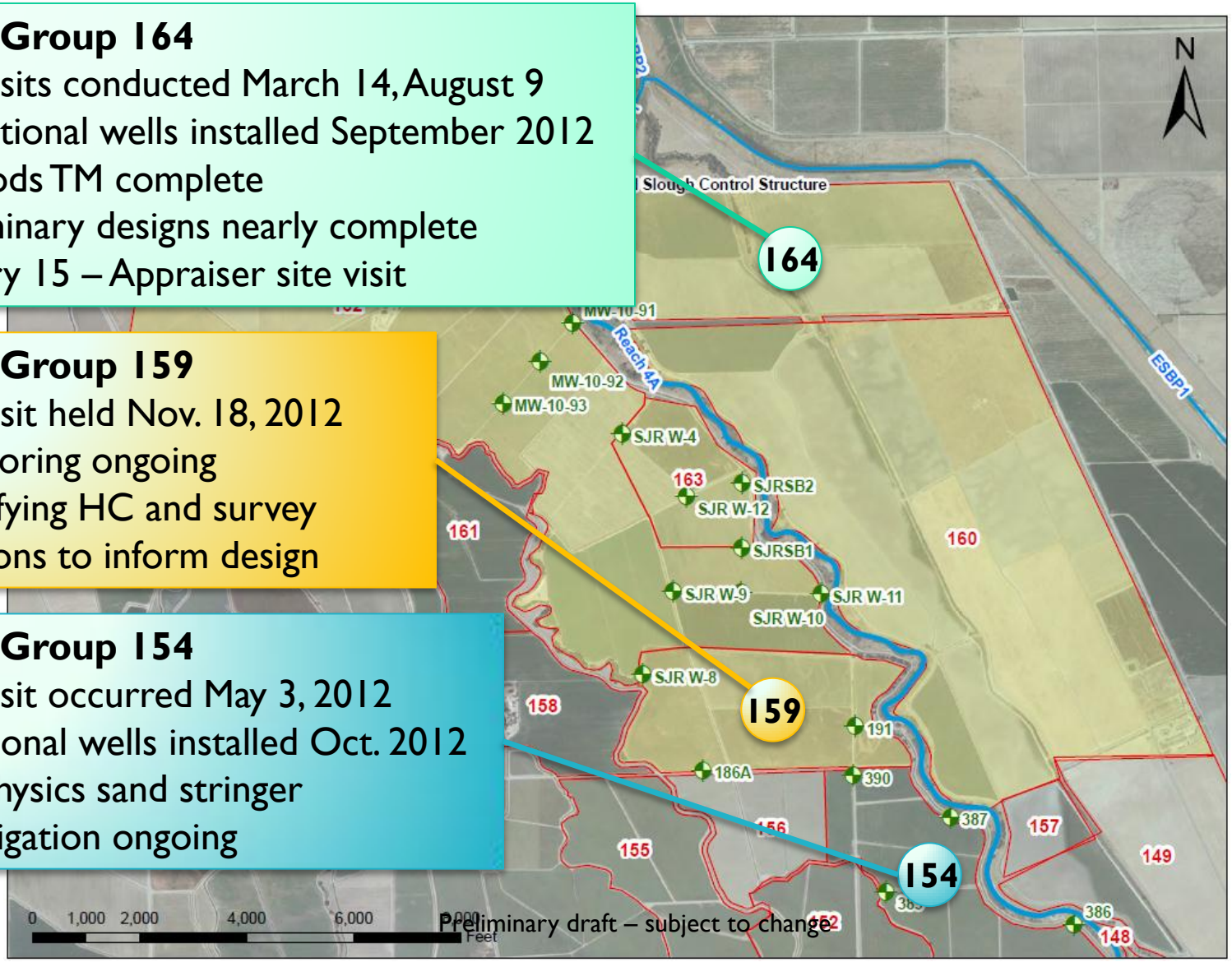
Preliminary draft – subject to change

Priority Parcel Groups and Projects Initiated

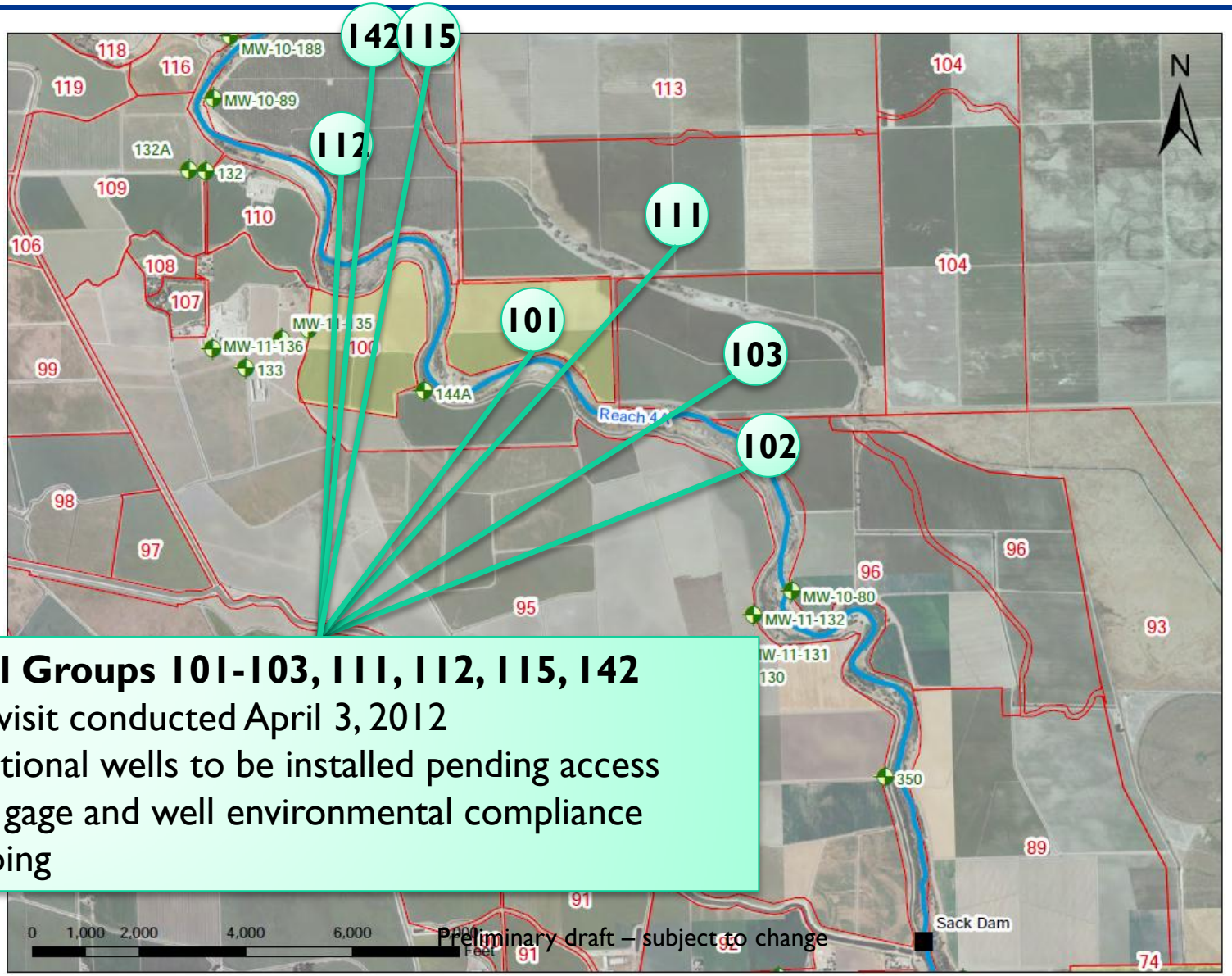
Parcel Group 164
- Site visits conducted March 14, August 9
- 5 additional wells installed September 2012
- Methods TM complete
- Preliminary designs nearly complete
- January 15 – Appraiser site visit

Parcel Group 159
- Site visit held Nov. 18, 2012
- Monitoring ongoing
- 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



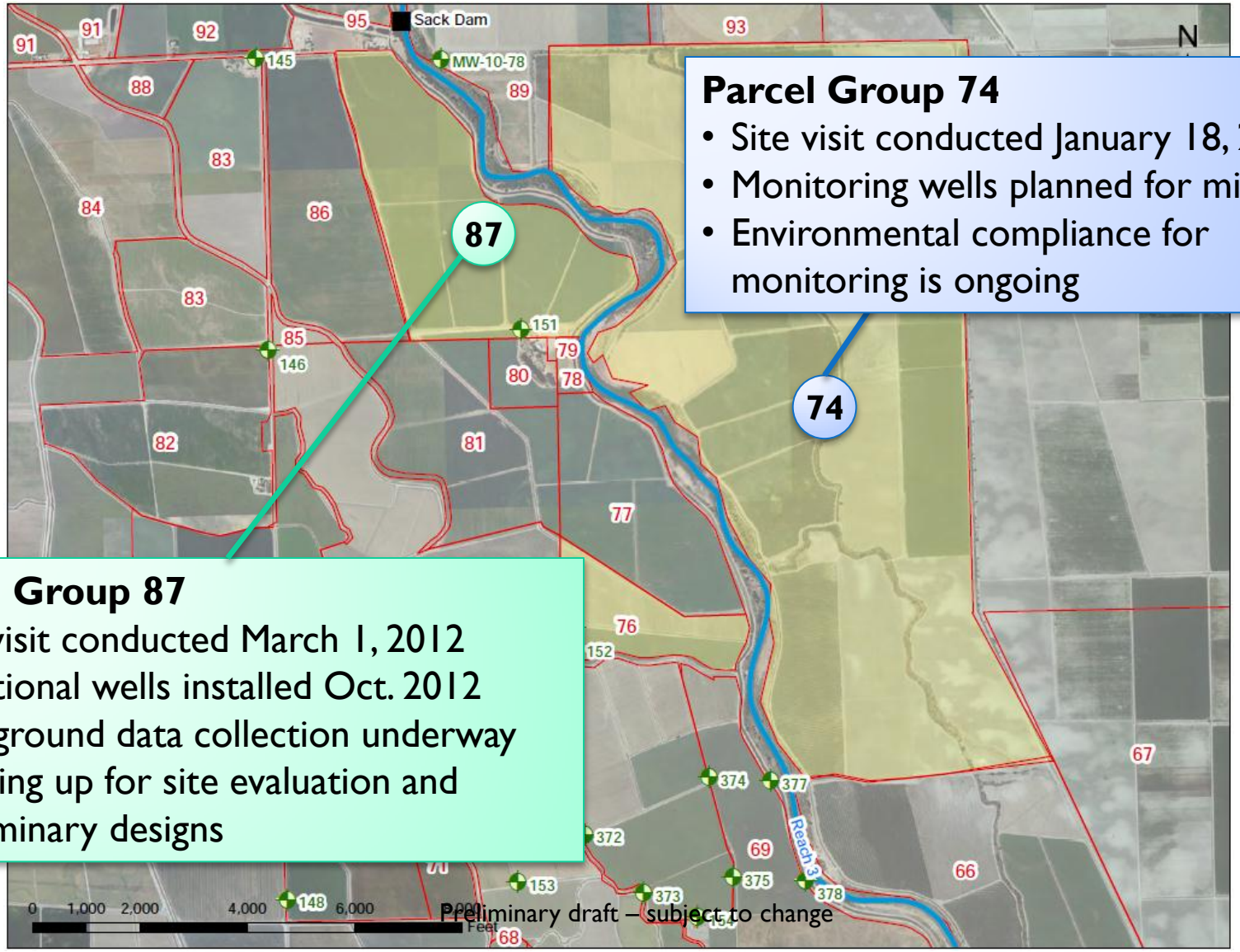
Priority Parcel Groups and Projects Initiated



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

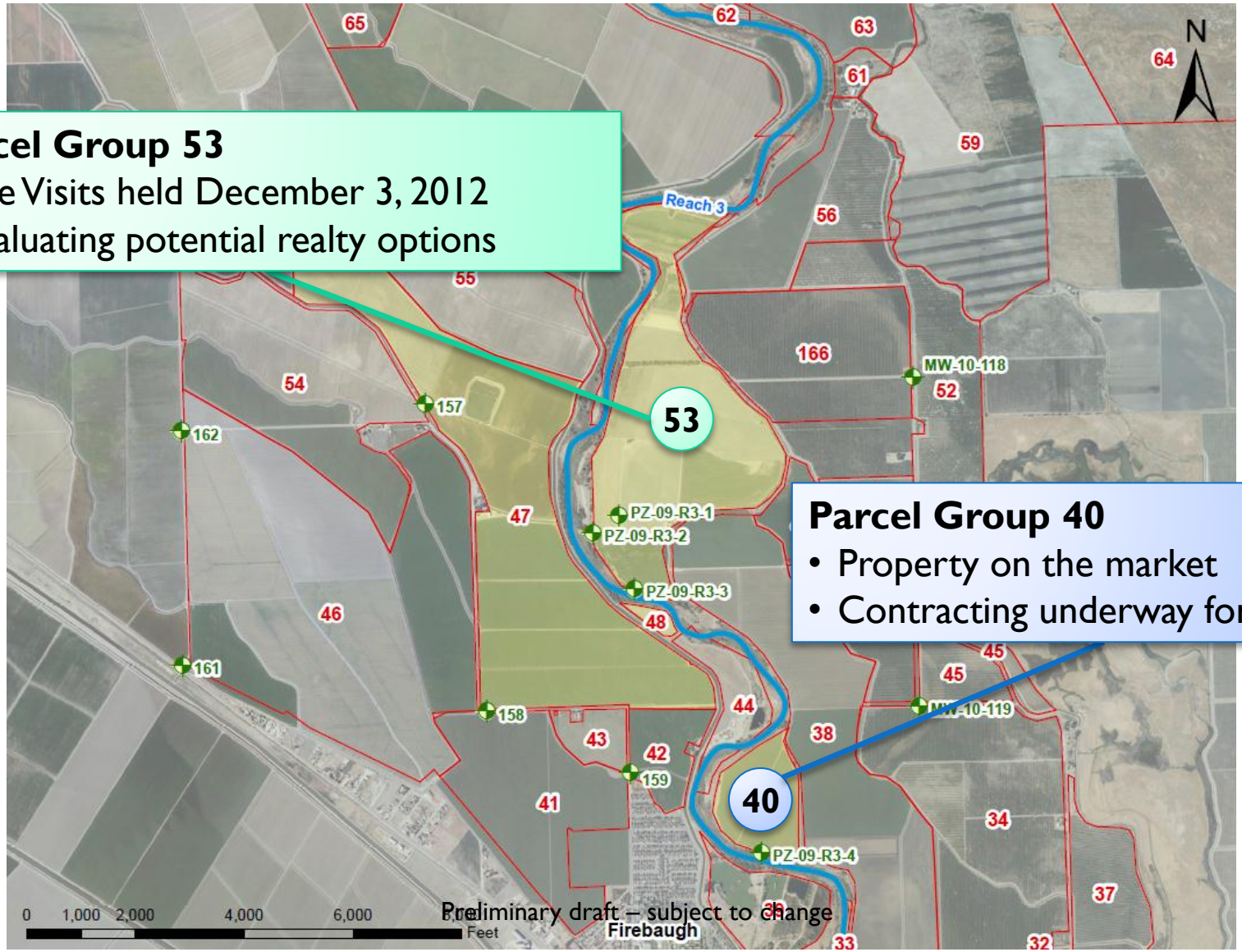
- Site visit conducted January 18, 2013
- Monitoring wells planned for mid-2013
- Environmental compliance for monitoring is ongoing

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

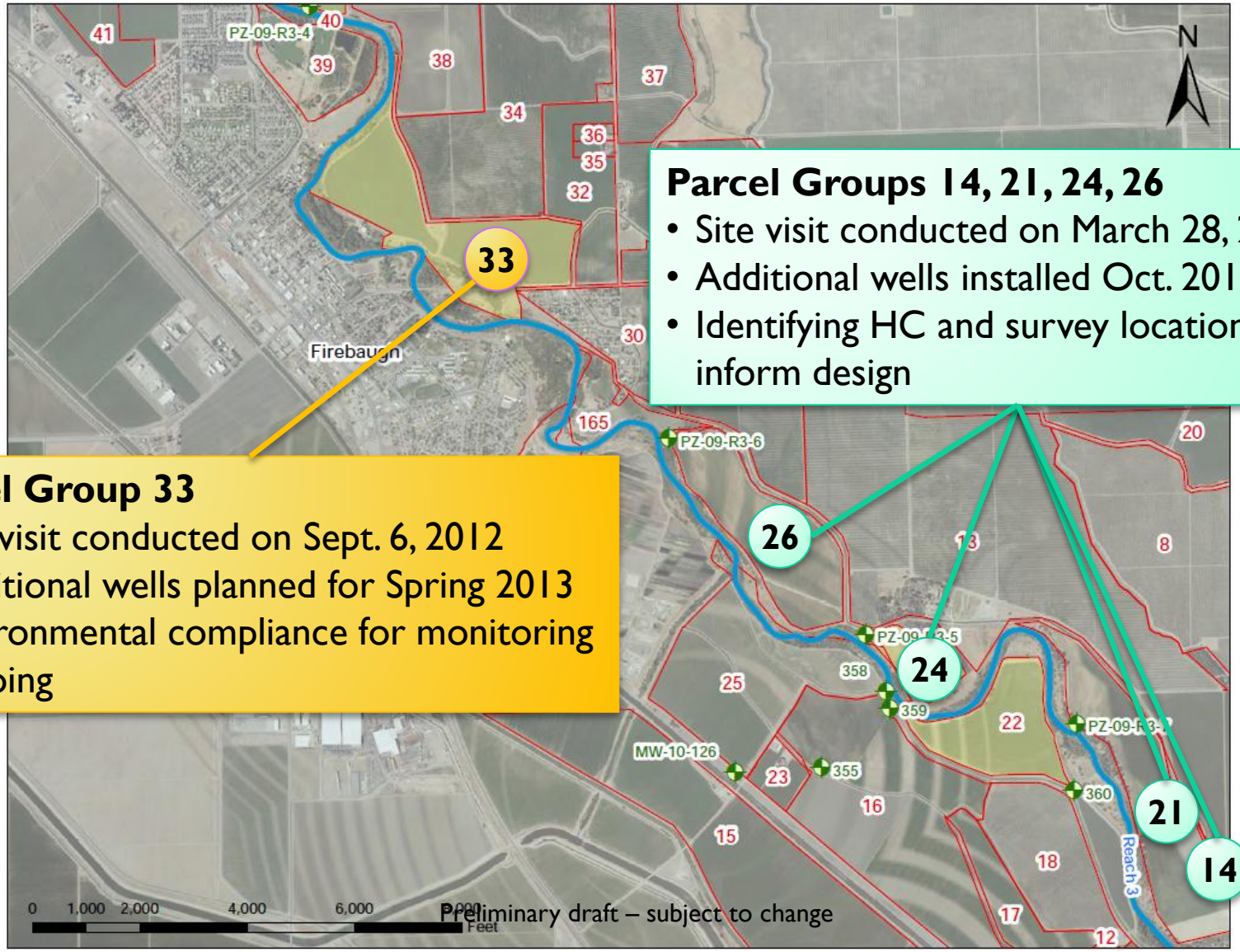
Priority Parcel Groups and Projects Initiated

Parcel Group 53
- Site Visits held December 3, 2012
- Evaluating potential realty options



Parcel Group 40
- Property on the market
- Contracting underway for appraisal

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

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**

SMP PEER REVIEW PANEL FINDINGS

Purpose and Objective

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

Peer Review Process

- List of Questions
  - Overall, does the SMP maximize flows while avoiding seepage impacts?
  - Are operations predictions, methods and accuracy reasonable?
  - Are agricultural thresholds reasonable?
  - How do we reasonably account for historical conditions that may impair groundwater even in the absence of SJRRP flows?
  - Are there missing components or other refinements to the SMP necessary
- Kick-off meeting September 13, 2012
- Draft Report
- Follow-up Questions from SJRRP

SMP Peer Review Panel

- Jason J. Gurdak, PH.D., P.H.
- Joel Kimmelshue, Ph.D., CPSS
- Daniel Munk, M.S.
- Nigel Quinn, Ph.D., P.E., D.WRE
- Mark Roberson, Ph.D.
- Albert Steele, P.G., C.H.G.
- Stuart Styles, D.E., P.E., D.WRE

General Comments

- The SJRRP has done a commendable job in engaging stakeholders in developing an equitable and science-based Seepage Management Plan (SMP)
- SMP presents a balanced approach - providing methods and general guidance that can be effective in reducing material adverse seepage impacts caused by Interim and Restoration Flows
- Methods and decision support tools are data-driven and conceptually sound – although some decision tools need to be further developed to be effective

Review Questions

1. Do the operational practices use reasonable predictors and are the methods of sufficient accuracy?
2. Do the agricultural thresholds provide a reasonable amount of protection when setting a threshold?
3. How do we reasonably account for historical conditions that may impair groundwater even in the absence of SJRRP flows?

Review Questions, continued

4. Are there missing components or other refinements to the SMP necessary to achieve the goals of releasing and conveying Interim and Restoration flows while avoiding material adverse effects due to groundwater seepage?
5. Does the SMP maximize release of flows to the River for furtherance of the Restoration Goal while providing reasonable measures to avoid material adverse impacts from groundwater seepage?

Q1: Do the operational practices use reasonable predictors and are the methods of sufficient accuracy?

Findings

- The well monitoring network is reasonable for characterization of the problem and the associated methods outlined in the SMP appear sufficiently accurate
- The Priority Well network is adequately spaced along the length of the study area and located close enough to the SJR.
- The weekly water-level measurements at the Priority Wells in most cases are of sufficient temporal resolution to be appropriate in most scenarios for informing the Flow Bench Evaluations or Daily Seepage Evaluations.
- The cross-river transects are of adequate design to characterize horizontal and vertical hydraulic gradients along various reaches of the San Joaquin River.

Q1: Do the operational practices use reasonable predictors and are the methods of sufficient accuracy?

Findings (cont.)

- It is reasonable and appropriate to develop a soil salinity monitoring and mapping program that works to document the changes in root zone salinity levels over time and particularly those areas where water table levels are thought to be influenced by restoration flows.
- The SMP PRP endorses selection of the EM38 by the SJRRP for assessing soil salinity changes over time in affected fields.
- The EC of the water (grower-provided values at field site) appears more saline the riverside wells suggesting that the groundwater salinity further from the River is greater than areas closer to the river.

Q1: Do the operational practices use reasonable predictors and are the methods of sufficient accuracy?

Findings (cont.)

- Lab testing procedures are acceptable but it is not clear that this is the best use of resources for monitoring. Soil analysis for SAR, EC, pH etc. provide good information but since the primary issue is to drainage, laboratory monitoring of these components may not always be warranted.
- The long-term viability of area farms will in part depend on the growers' capacity to continue to plant a diversity of crops that are both stable and profitable in the marketplace.
- It will be difficult to expect some permanent crops such as almonds, grapes, stone fruit and other salt sensitive crops to grow in areas that are regularly or periodically impacted by water table level rises into the root zone.

Q1: Do the operational practices use reasonable predictors and are the methods of sufficient accuracy?

Findings (cont.)

- To improve yields in poorly drained fields, growers have changed in-season management practices such as earlier and more frequent irrigation events and changes in irrigation technologies from furrow and flood to sprinkler and drip.
- Rarely are salinity problems uniform throughout a field. Small changes in the depth to water table can have a significant impact on root zone salinity.
- Fields exposed to transient rises in groundwater levels retain considerable salt content in the root zone - growers manage these salts by applying additional leaching – this would not be necessary if shallow water table rises caused by increased river flows are minimized.

Q1: Do the operational practices use reasonable predictors and are the methods of sufficient accuracy?

Findings (cont.)

- The SJRRP study area has available a large selection of RS imagery products, both historical and current. A rich inventory of National Agriculture Inventory Program (NAIP) imagery offers a high-resolution (1m spatial resolution) photographic record of the study area (4 complete inventories in the last 8 years).
- Based on background information on protocols used by the USBR, USGS, and DWR the flow rates, groundwater data, and analysis performed in the Flow Bench Evaluations is of sufficient accuracy to develop an initial estimate of where thresholds were exceeded or triggers initiated that result in adverse impacts to landowners.

Suggested changes to Table 3
Method 1 - Increase in Stage Evaluation of Field Threshold

SJRRP Flow Bench Evaluation

November 1, 2012

Table 3: Predicted Groundwater Levels for Key Wells

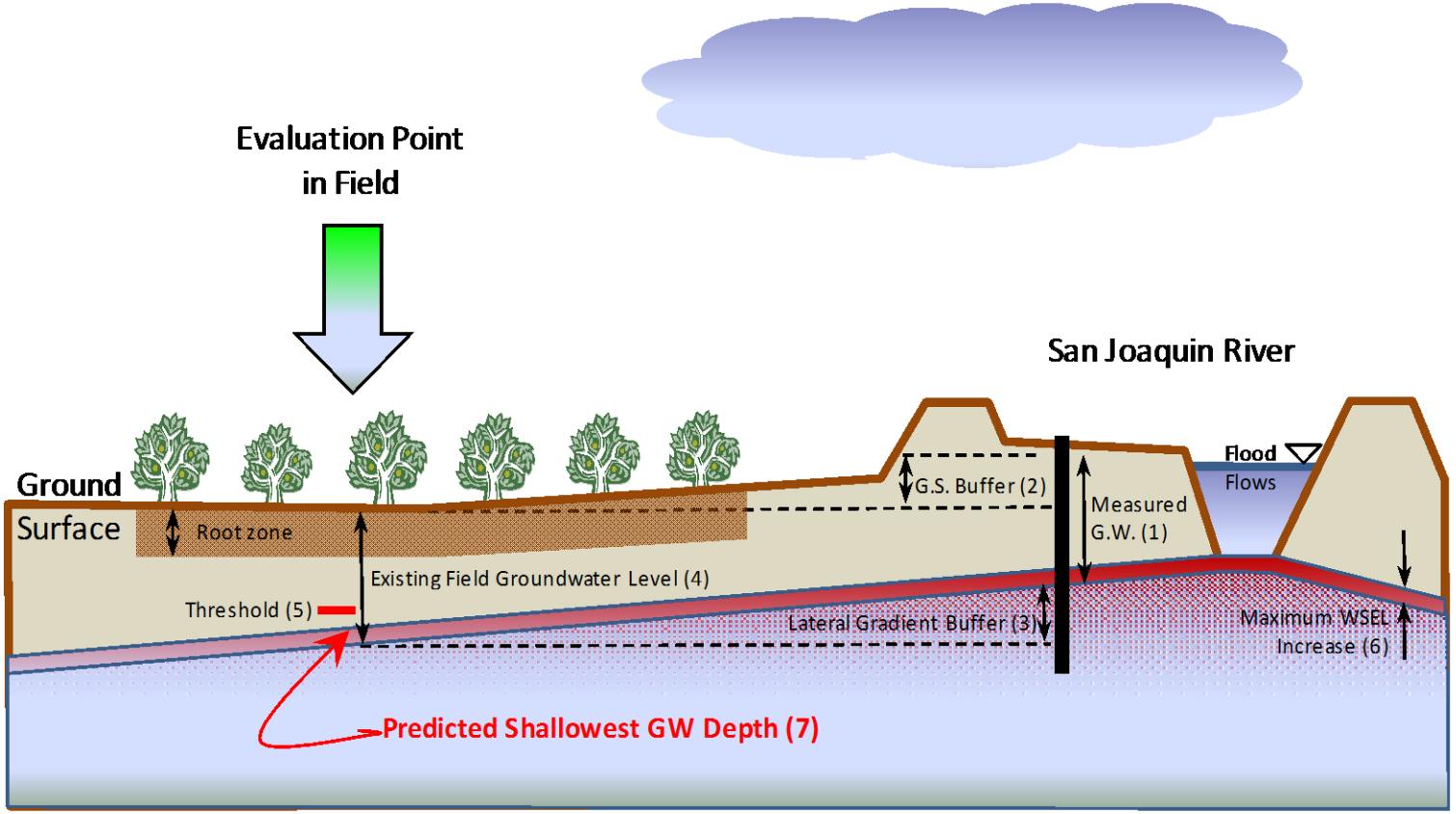
		1	2	3	4	6	7	5	Check
Well	Reach	Measured Groundwater Depth in Well (feet bgs)	Ground Surface Buffer (feet)	Lateral Gradient Buffer (feet)	Field GW Depth (feet bgs)	Maximum Predicted WSEL Increase (feet)	Predicted Shallowest GW Depth (feet bgs)	Field Threshold (feet bgs)	Comment
FA-9	2A	9.3	-3.7	2.5	8.1	1.0	7.1	5.0	Acceptable
MW-09-47	2A	9.2	-3.5	3.3	9.1	1.0	8.0	7.0	Acceptable
MA-4	2A	12.2	-6.1	4.6	10.7	1.4	9.3	7.0	Acceptable
MW-09-49B	2A	6.6	-1.7	2.4	7.3	1.4	5.9	4.5	Acceptable
MW-09-54B	2B	16.2	-7.9	5.5	13.8	1.6	12.2	10.0	Acceptable
MW-09-55B	2B	10.7	-3.7	3.0	10.0	1.6	8.4	7.0	Acceptable
PZ-09-R2B-1	2B	-	-1.3	0.0	-	0.2	-	5.0	-
PZ-09-R2B-2	2B	11.8	-3.9	0.0	7.9	0.0	-	4.5	Acceptable
PZ-09-R3-5	3	11.4	-1.2	0.0	10.2	0.1	10.2	5.0	Acceptable
PZ-09-R3-6	3	10.2	-1.5	0.0	8.7	0.1	8.7	4.0	Acceptable
PZ-09-R3-7	3	9.1	-0.7	0.0	8.3	0.1	8.3	3.5	Acceptable
MW-10-75	3	13.1	-0.5	0.2	12.8	0.1	12.7	6.3	Acceptable

Column Explanation:

1	Current data collected from well
2	Difference in elevation between the surface elevation of the well and the ***evaluation point*** in the field
3	Difference in assumed elevation due to the slope of the WT between the well and the evaluation point in the field
4	Calculated. Column 4 (ESTIMATED water level at the ***evaluation point*** in the field) = Column 1 + 2 + 3
5	Calculated based on crop
6	Evaluated based on the SJ River hydrographs. Foe a flow increase of X CFS, the river stage will increase Y feet.
7	Calculated. Column 7 (PREDICTED water level at the ***evaluation point*** in the field) = Column 1 + 2 + 3
Check	Is Column 7 (PREDICTED Water Level) > Column 5 (ESTIMNATED Water Level) at the ***evaluation point*** in the field

Preliminary draft – subject to change

Q1: Do the operational practices use reasonable predictors and are the methods of sufficient accuracy?



Proposed new figure for "Increase in Stage" Method

Note: The values 1-7 reference columns in the new Flow Bench report format.

Q1: Do the operational practices use reasonable predictors and are the methods of sufficient accuracy?

Findings (cont.)

- The current practice of assuming a 1 ft increase in the River bed water surface (WSEL) equating to a 1 ft rise in a nearby observation well is overly conservative. Even in instances where significant hydraulic communication is evident, there is typically a time lag between the river rise and the water table response.
- The key problem is the variability of timing of the groundwater movement. Although the groundwater response time is a function of the rate of porous flow through the connecting aquifer layer, the response can be more rapid in situations where elevated river stage blocks regional groundwater flow.

Q1: Do the operational practices use reasonable predictors and are the methods of sufficient accuracy?

Recommendations: Wells

- It is recommended to increase the number of monitoring wells where necessary for decision support - to improve recognition and reporting of seepage problems.
- As a general guideline, these should be spaced at approximately one-mile intervals along both sides of the River in reaches 2B, 3, 4A, and 4B targeted at areas where seepage is expected to be a problem. The additional monitoring wells should be as close to the river as possible.
- The observation wells for the SJRRP should be submitted to the California Department of Water Resources (DWR) for inclusion in their labeling system since this is a long-term evaluation project.

Recommendations: Data Acquisition/Access

- The use of data loggers and telemetry is encouraged on all wells in the program that are used in decision making for the Flow Bench Evaluation.
- All of the strategic monitoring wells should be equipped with data loggers.
- The Program will need to invest in an enterprise-level hydrological data management system for data acquisition, data processing and data quality assurance analysis to ensure provision of timely data.
- Utilize CDEC system for real-time monitoring until they have an equivalent website available for real-time data access.

Recommendations: Salinity Monitoring

- Salinity monitoring activities need to have a refined protocol with realistic expectations of the outcome of the evaluation.
- The use of the EM-38 for salinity evaluation as presented in the SMP not well-evolved. Note that the changes in salinity may take time to be recognized.
- Additional details should be provided on the protocols used to assess increased soil salinity.

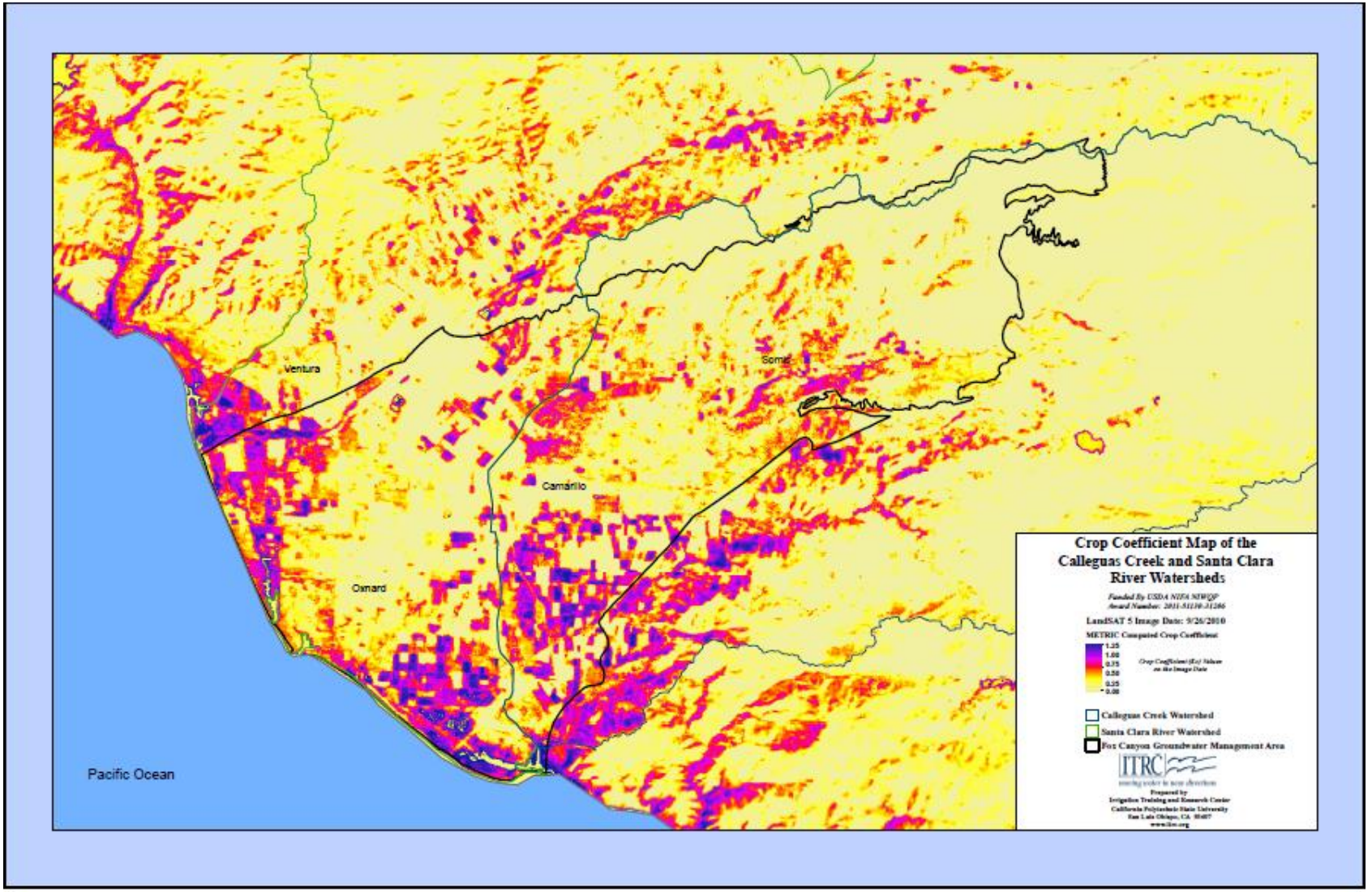
Q1: Do the operational practices use reasonable predictors and are the methods of sufficient accuracy?

Recommendations: Laboratory Testing

- The PRP suggests the inclusion of multispectral imagery remote sensing to the operational practices of the SMP in order to help document long-term impacts to the area due to seepage.
- The impact area as shown in the SMP documents seems to be very narrow. The area of evaluation extend at least 1 mile from the River on areas upslope from the River water surface and 5 miles for the fields that are downslope. These evaluations could be focused on flood years to show the areas impacted by high water tables.

SAN JOAQUIN RIVER RESTORATION PROGRAM

Remote Sensing Example. Evaluating the ET and crop water use for Ventura County using METRIC



Q1: Do the operational practices use reasonable predictors and are the methods of sufficient accuracy?

Recommendations: Cropping Patterns, Productivity

- Establish control sites for crop productivity monitoring.
- Link multispectral imagery remote sensing with control sites can be used to establish production impacts from elevated groundwater and salinity. Historical imagery can be used to establish baseline biomass productivity.
- Develop a method for determining crop risks associated with seepage and link those risks to crop selection categories.
- Outline specific land reclamation plans following salinization events that addresses potential need of additional water and soil amendments.

Q1: Do the operational practices use reasonable predictors and are the methods of sufficient accuracy?

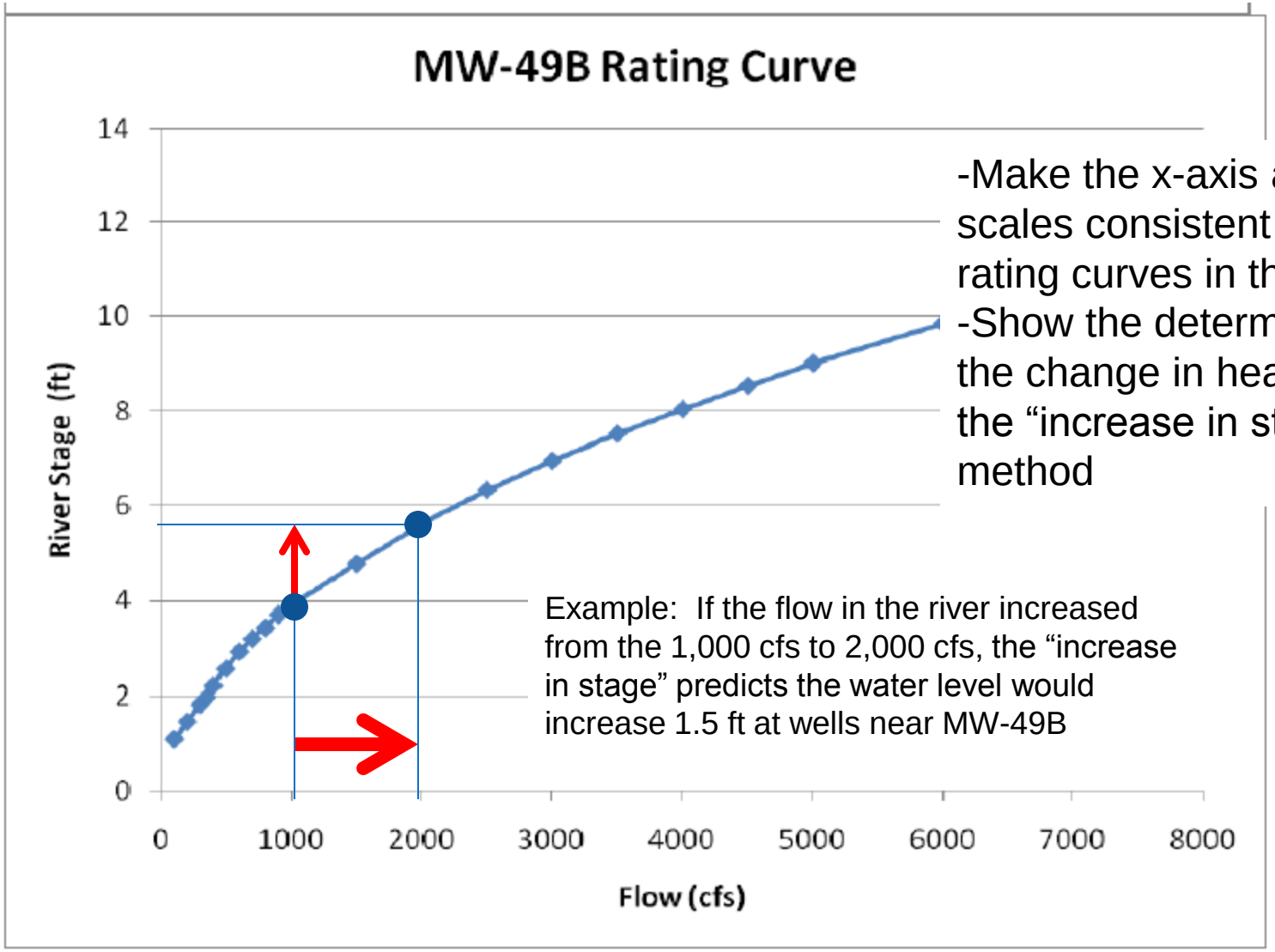
Recommendations: Data Management, QA

- It wasn't clear in the SMP if there is a formal Quality Assurance/Quality Control (QA/QC) protocol for monitoring data collection? If so, we suggest including that QA/QC protocol in the SMP.
- The SMP report is deficient in its plan for long-term data acquisition, data management and data quality assurance.
- An enterprise-level hydrologic data management system will eventually be needed as the program transitions from the more experimental interim flow event response paradigm to fully operational status.

Recommendations: Use of HEC-RAS Model

- The use of HEC-RAS is appropriate for estimation of travel time and flow attenuation - the SMP doesn't clearly describe how the travel times or flow attenuation were verified and the steps taken to calibrate the HEC-RAS model.
- In the Flow Bench report, the graphs generated by the HEC-RAS data should be standardized. Currently, they have different scales reported on both the x-axis and the y-axis.

Suggested changes to the Rating Curves



-Make the x-axis and y-axis scales consistent on the 13 rating curves in the report

-Show the determination of the change in head using the "increase in stage" method

Recommendations: Flow Bench Evaluation

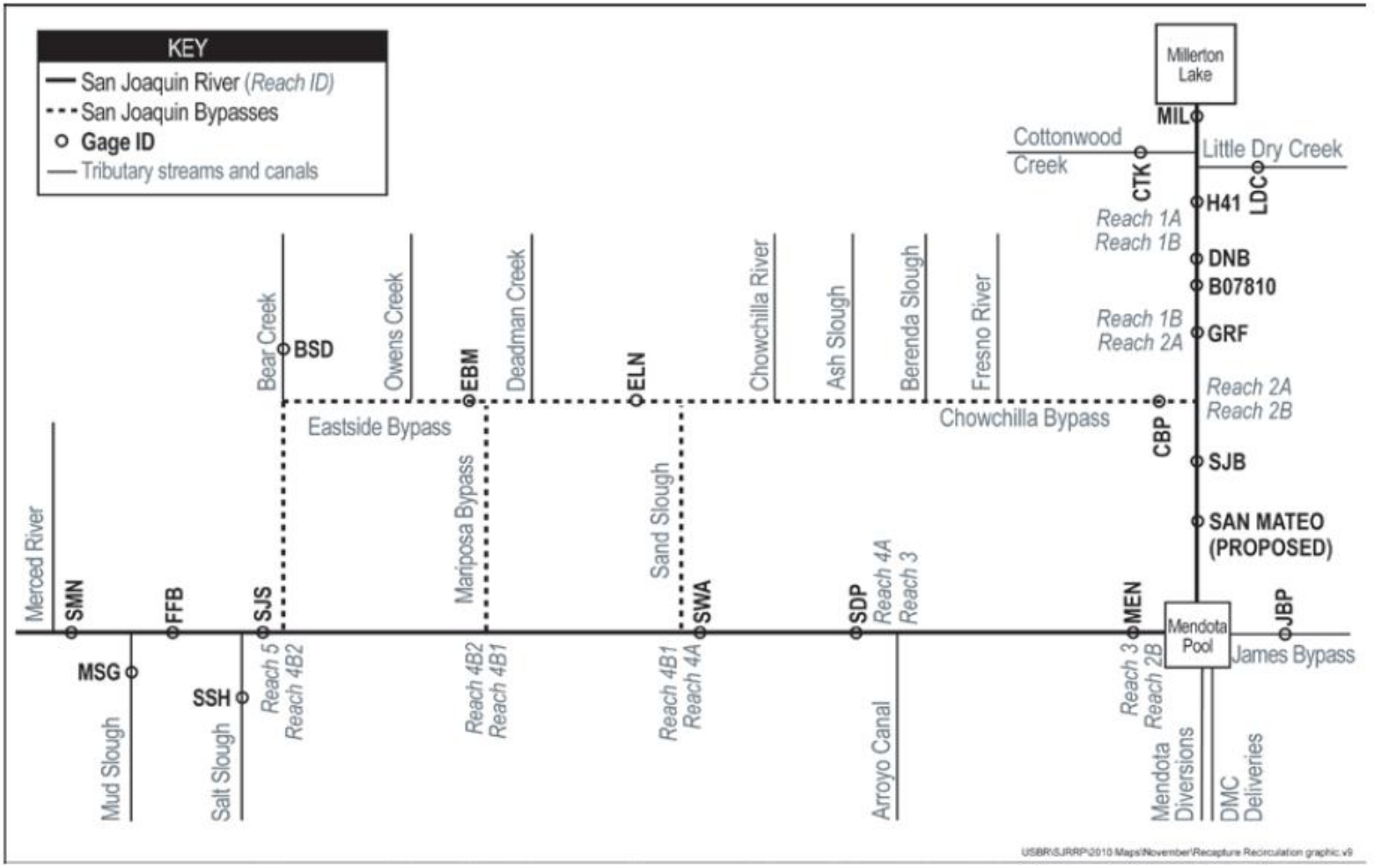
- The Flow Bench Evaluation Reports could be expanded and made more informative. The PRP found it difficult to interpret all of the information in the reports.
- The visual representation of what is happening during the drainage flow condition from a field is missing from the SMP and Flow Bench Evaluation reports. It is recommended that a new schematic be used to describe the drainage method.
- The PRP agrees with the method used to correct the field groundwater levels based on the flow bench evaluations. In the future, additional wells and operational knowledge will reduce the need for the field corrections.

Q1: Do the operational practices use reasonable predictors and are the methods of sufficient accuracy?

Recommendations: Use of HEC-RAS Model

- The use of HEC-RAS is appropriate for estimation of travel time and flow attenuation - the SMP doesn't clearly describe how the travel times or flow attenuation were verified and the steps taken to calibrate the HEC-RAS model. .
- In the Flow Bench report, the graphs generated by the HEC-RAS data should be standardized. Currently, they have different scales reported on both the x-axis and the y-axis.
- Seepage from the river using the river gaging stations should be included as part of the SMP

Existing Gaging Stations and Reaches



Reference: 2013 Draft Monitoring Plan and Analysis Plan (September, 2012)
http://restoresjr.net/flows/ATR/index.html

Q2: Do the agricultural thresholds provide a reasonable amount of protection when setting a threshold?

- Crop root zones
  - Purpose: provide unsaturated zone to avoid waterlogging of crops
  - We distinguish between effective and maximum root depth
  - Soil texture and root depth
    - Report root depths for unrestricted soils only; root depths are not documented for "restricted" soils because they are site-specific
  - Irrigation practices and root depth
    - Assumption that optimum irrigation decreases root depth may not hold true for all crops – variable

Q2: Do the agricultural thresholds provide a reasonable amount of protection when setting a threshold?

- Capillary rise
  - Field data in SMP is too sparse to derive meaningful averages
  - Wide range in data indicating high field variability
  - If empirical data is used, more is needed
  - Estimates for medium and fine textured soils are likely on the low end of the range

Q2: Do the agricultural thresholds provide a reasonable amount of protection when setting a threshold?

- Irrigation buffer
  - Allow for leaching fraction to remove salts from root zone
  - Water duties for crops
    - Need clarification
    - Need further supporting documentation
  - Assumptions need explanation or support for their basis
  - At this point, an irrigation buffer is questionable

Q2: Do the agricultural thresholds provide a reasonable amount of protection when setting a threshold?

- Crop salinity thresholds
  - FAO recommendations should be viewed as guidelines only; do not necessarily represent regional practices or crop varieties
  - Regional sources should be referenced when possible
  - Pistachio, pomegranate and safflower salinity thresholds should be refined from specific scientific literature, not assumed from general crop tolerance salinity ranking

Q3. How do we reasonably account for historical conditions that may impair groundwater even in the absence of SJRRP flows?

- Historical conditions include periodic river bottom flooding over the past 20 to 30 years
- The PRP considered the existing SMP information: Appendix C (Historical Groundwater Levels and Surface-Water Flow), and the attachment. The groundwater level database, hydrographs, stream flow gage measurements and other available data to assess the historical record efforts. (e.g., map)

A. Are historical groundwater levels reasonable?

B. Using historical groundwater levels to set thresholds?

C. Are historical groundwater levels overly conservative?

Q3. How do we reasonably account for historical conditions that may impair groundwater even in the absence of SJRRP flows?

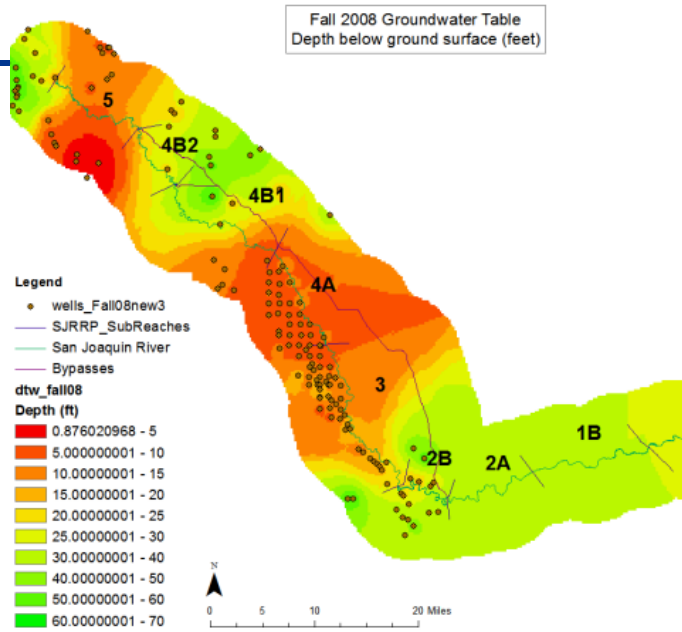


Figure 12

Are historical groundwater levels reasonable?

- Historical GW maps are sound.
- Recommend adding methods that refine and reduce potential errors caused by human, spatial density and interpolation techniques used to create maps.
- Adopt a guideline for minimum spatial density used for all maps.

Q3. How do we reasonably account for historical conditions that may impair groundwater even in the absence of SJRRP flows?

Are historical groundwater levels reasonable?

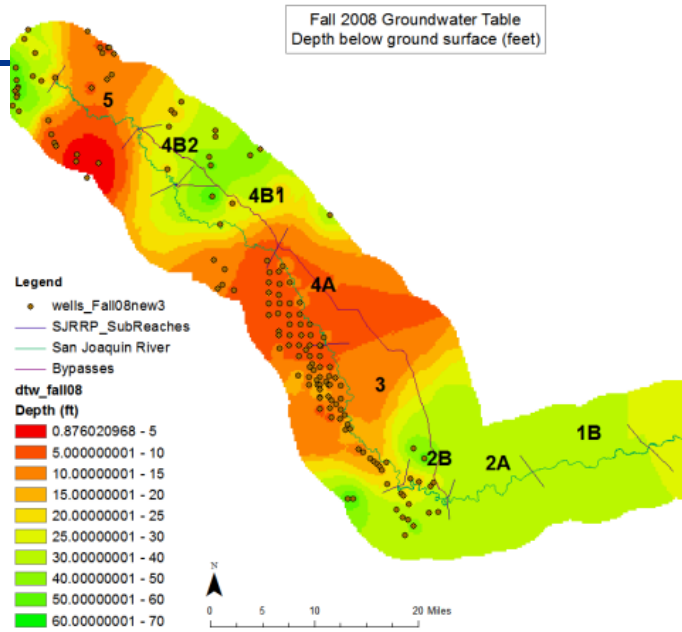


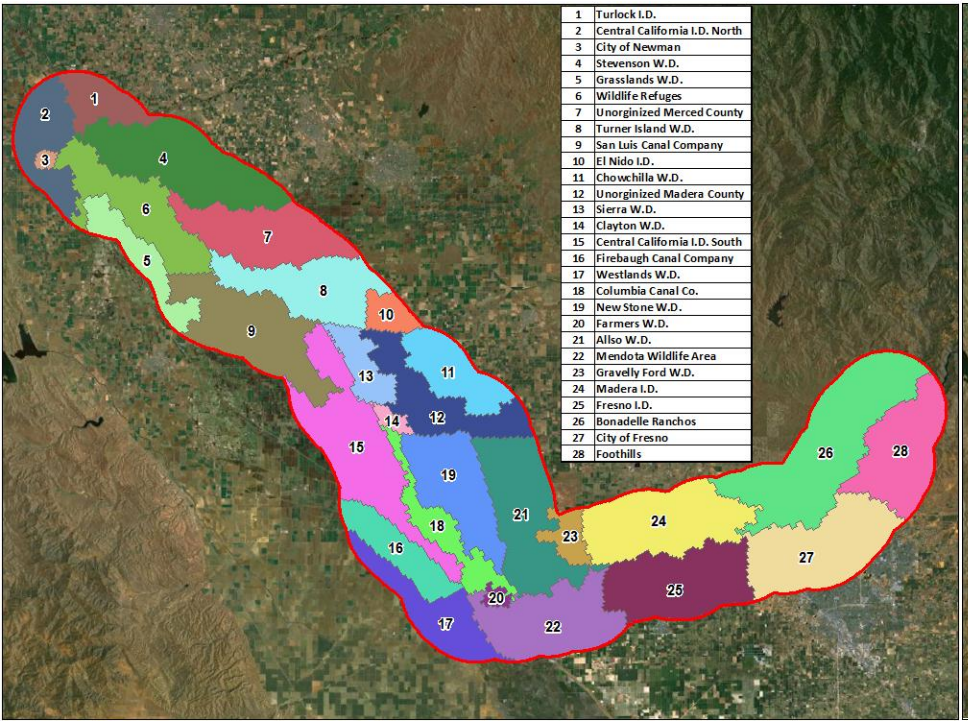
Figure 12

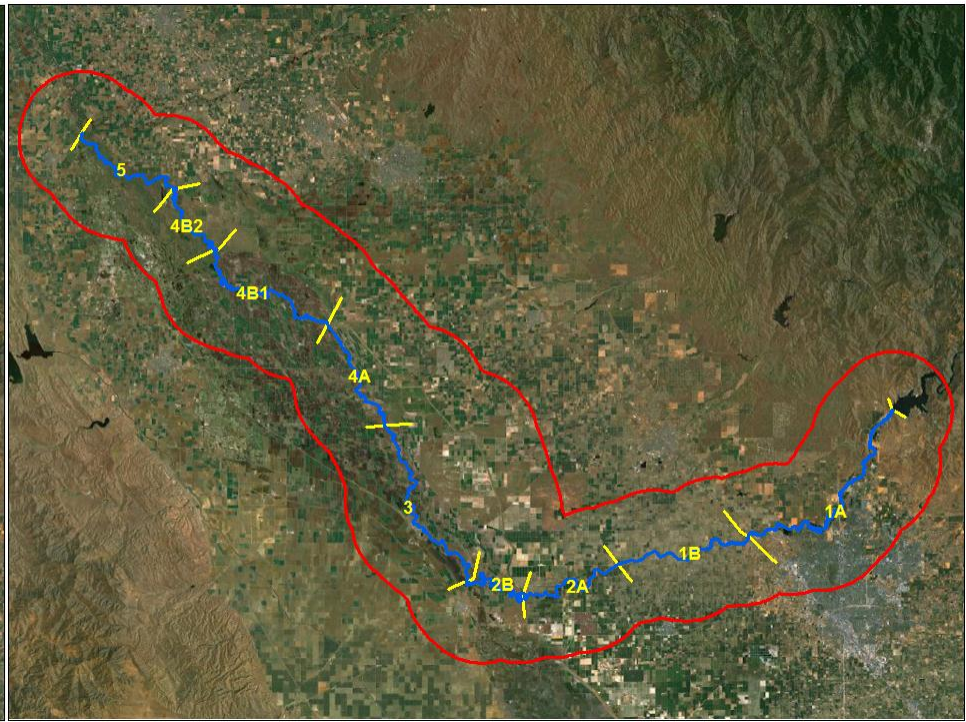
- Recommend Reclamation consult historical published reports including Soil Survey, predevelopment maps, other observed seepage records.

Q3. How do we reasonably account for historical conditions that may impair groundwater even in the absence of SJRRP flows?

Using historical groundwater levels to set thresholds?

- Historical WT Maps are valuable but do not clearly address the magnitude and scope of the seepage problem.
- Need context and explanation





Q3. How do we reasonably account for historical conditions that may impair groundwater even in the absence of SJRRP flows?

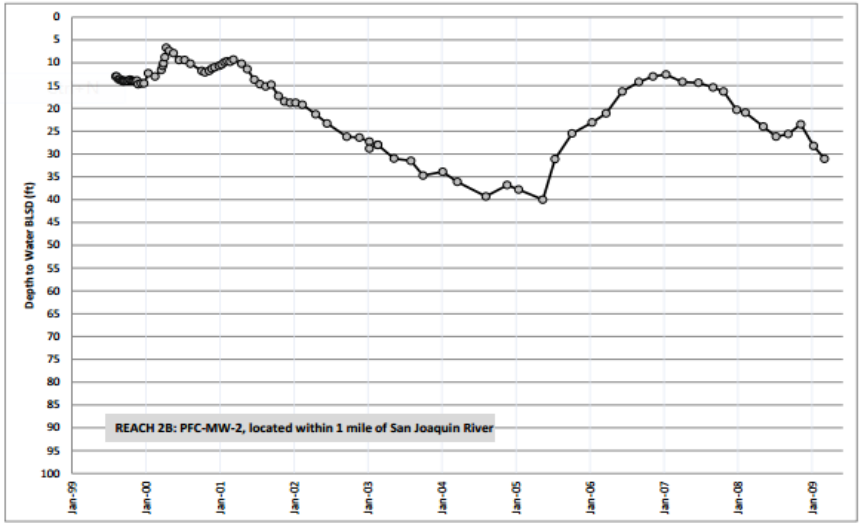
Using historical groundwater levels to set thresholds?

- Recommendation to develop a comprehensive diagram-model that describes the groundwater flow system and changes over time and space
- Recommend developing maps that delineate the magnitude of historic GW levels exceeding current thresholds

Single location over time

↓

Regional flow over time



Q3. How do we reasonably account for historical conditions that may impair groundwater even in the absence of SJRRP flows?

Are historical groundwater levels overly conservative?

- Generally, historic levels are reasonable and help establish SMP thresholds.
- But depending on year type, historical levels could be overly conservative and potentially limit releases.
- Establishing year-type indexing will help evaluate what is or is not conservative

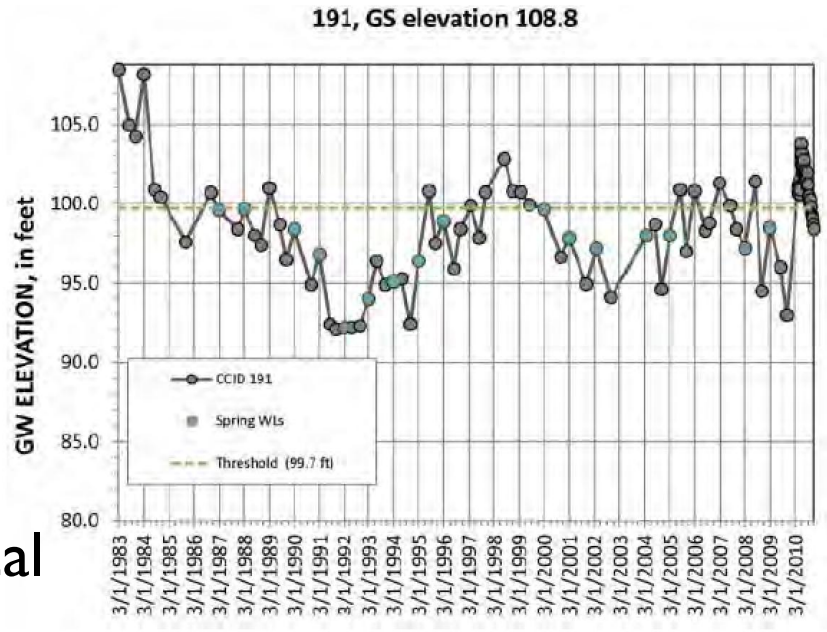


Figure H-7
Thresholds developed using historical groundwater-level measurements in CCID Well 191

Q4: Are there missing components or other necessary refinements to the SMP?

Findings

- The SMP does not directly mention climate variability or change. Future hydrology under climate change could result in prolonged increases in the water table.
- Insufficient detail on some of the surface water modeling. How will these tools be integrated with groundwater tools and used for decision support?
- The current SJRRPGW model lacks the spatial and temporal resolution necessary to be effective as a management tool. This resolution is necessary to be able to simulate benefits of various tile drainage and impermeable barrier seepage management options.

Q4: Are there missing components or other necessary refinements to the SMP?

Findings

- The SJRRPGW model needs to include the drainage package and simulate drainage options explicitly if it is to have utility as a decision tool.
- The CVHM model upon which the SJRRPGW model is based was a good choice – it is the best regional-scale model available for the project area.
- Land subsidence appears to be a major problem in some areas close to the San Joaquin River. The first step in addressing subsidence impacts is determining where subsidence is occurring, and the current rate of land deformation.

Q4: Are there missing components or other necessary refinements to the SMP?

Recommendations

- The SJRRPGW groundwater model could eventually be used to evaluate climate variability and change effects on seepage and be used to help evaluate implications for the SMP.
- Revisions to the SMP should describe surface water modeling tools in greater detail.
- The SJRRPGW groundwater model can be used to provide boundary conditions for more detailed decision models that operate on a daily time-step with a more refined model mesh of suggested cell size of 30-50 meters. Models will need to be continuously updated if they are to provide utility.

Q4: Are there missing components or other necessary refinements to the SMP?

Recommendations

- The first step in addressing subsidence impacts is determining where subsidence is occurring, and the current rate of land deformation.
- A working group should be established to coordinate efforts to document subsidence, and seek additional funding to safely and effectively manage the transmission of water through the subsidence areas.

Q5. Does the Plan maximize the release of flows for the furtherance of the Restoration Goal while avoiding material adverse seepage impacts?

A. Does the Plan describe the significant material adverse effects due to groundwater seepage or are there other effects to consider?

B. Will the Plan avoid the identified material adverse effects? If not, what revisions would avoid the material effects?

C. Is the Plan overly restrictive on the release flows? If so, would revisions allow for increases in flows while avoiding material adverse effects?

D. Potential Projects

E. Project Scoring

Q5. Does the Plan maximize the release of flows for the furtherance of the Restoration Goal while avoiding material adverse seepage impacts?

A. Does the Plan describe the significant material adverse effects due to groundwater seepage or are there other effects to consider?

- The SMP describes the adverse effects caused by elevated groundwater but does not describe the effects of seepage on cropping patterns or crop productivity.
- Pre-project cropping patterns can help guide and inform historic shifts caused by year-type
- Crop productivity information helps establish baseline production for a year type without the influence of a restoration flows.

Q5. Does the Plan maximize the release of flows for the furtherance of the Restoration Goal while avoiding material adverse seepage impacts?

B. Will the Plan avoid the identified material adverse effects? If not, what revisions would avoid the material effects?

- Using established triggers, the plan will avoid most material adverse effects caused by elevated groundwater; however, without a pre-project baseline and monitoring program of cropping patterns and productivity, it is not known if adverse impacts have occurred because of restoration flows.

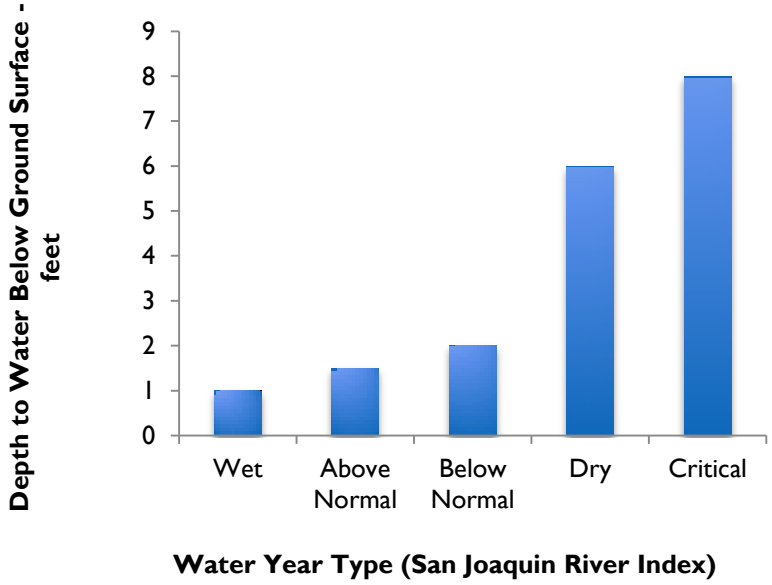
Q5. Does the Plan maximize the release of flows for the furtherance of the Restoration Goal while avoiding material adverse seepage impacts?

C. Is the Plan overly restrictive on the release flows? If so, would revisions allow for increases in flows while avoiding material adverse effects?

- The program does take a conservative approach to protecting agricultural operations.
- Recommendation to take initial actions that increase the opportunities to release flows by:
  1. Establish a year-type baseline

Q5. Does the Plan maximize the release of flows for the furtherance of the Restoration Goal while avoiding material adverse seepage impacts?

C. Is the Plan overly restrictive on the release flows? If so, would revisions allow for increases in flows while avoiding material adverse effects?



Q5. Does the Plan maximize the release of flows for the furtherance of the Restoration Goal while avoiding material adverse seepage impacts?

C. Is the Plan overly restrictive on the release flows? If so, would revisions allow for increases in flows while avoiding material adverse effects?

2. Additional data should be collected and analyzed in order to utilize the "Method 1" (Agricultural Practices) approach to determine thresholds. The approach of adding an irrigation buffer, capillary rise and rooting depth information is not inherently flawed, rather it should be supported by information on crop productivity. Engage method 1 as more confidence is gained.

Q5. Does the Plan maximize the release of flows for the furtherance of the Restoration Goal while avoiding material adverse seepage impacts?

C. Is the Plan overly restrictive on the release flows? If so, would revisions allow for increases in flows while avoiding material adverse effects?

3. Improve the monitoring network
    - Increase # monitoring wells along toe-slope of levee
    - Increase the use of data loggers and telemetry to improve data management system in place allowing it to be more timely and targeted.
    - Refine salinity monitoring protocols to account for long and short term changes
    - Improve analytical tools used for decision making. SJRRPGW model lacks the spatial and temporal resolution,

Q5. Does the Plan maximize the release of flows for the furtherance of the Restoration Goal while avoiding material adverse seepage impacts?

D. Potential Projects

- Interceptor drains (tile drains relieving regional water tables)
- Relief Drains (tile drains relieving local water tables)
- Drainage Ditches (disruptive of farming operations)
- Shallow GW pumping (less cost effective relative to drainage)
- Slurry or cutoff walls (expensive and time consuming)
- Buildup of low lying areas (may be expensive)

Q5. Does the Plan maximize the release of flows for the furtherance of the Restoration Goal while avoiding material adverse seepage impacts?

D. Potential Projects

- Channel conveyance improvements (difficult to assess)
- License agreements and easements (allowing impacts and may involve compensation)
- Acquisition (an extension of license agreements and easements)
- Changes to cropping pattern (a form of easement)
- Partnerships (agreed upon arrangements including easements and cropping pattern changes)

Q5. Does the Plan maximize the release of flows for the furtherance of the Restoration Goal while avoiding material adverse seepage impacts?

E. Project Scoring

- Point system seems reasonable but does not outline criteria definitions clearly
- Additional criteria might include:
- Year –type (does the project improve the release of flows?)
- Seasonal viability (improve release flows a certain time?)
- Cost share (what is the cost share split?)

Feedback

- Feedback from the SCTFG on PRP Report
  - Comments due by February 22, 2013
    - Katrina Harrison or Brian Heywood

- Peer review recommendations will be incorporated along with SCTFG comments in Spring 2013

Katrina Harrison

SEEPAGE MANAGEMENT PLAN NEXT STEPS

SMP Revisions – Spring 2013

- Include additional data sources:
  - NRCS soil textures
  - LANDSAT / NAIP / infrared aerial imagery
  - Soil textures from geomorphology (NULE)
- Updated figures and charts
  - Flow Bench Evaluation
  - Historical Groundwater Maps
- Clarity and error revisions
- Reorganize so background information is at the back or referenced to website

Monitoring

- Put dataloggers in more wells
- Add wells as necessary
- Optimize well telemetry
- Calibrate EM 38 / optimize salinity monitoring

Proposed Threshold Revision

- Peer review panel states historical threshold method is reasonable
- Lack of pre-project shallow wells in area with shallowest water table
- Use 2012 data to represent pre-project conditions – i.e. without flow in the river
- Implemented in Reach 4 only

Proposed Threshold Revision Example

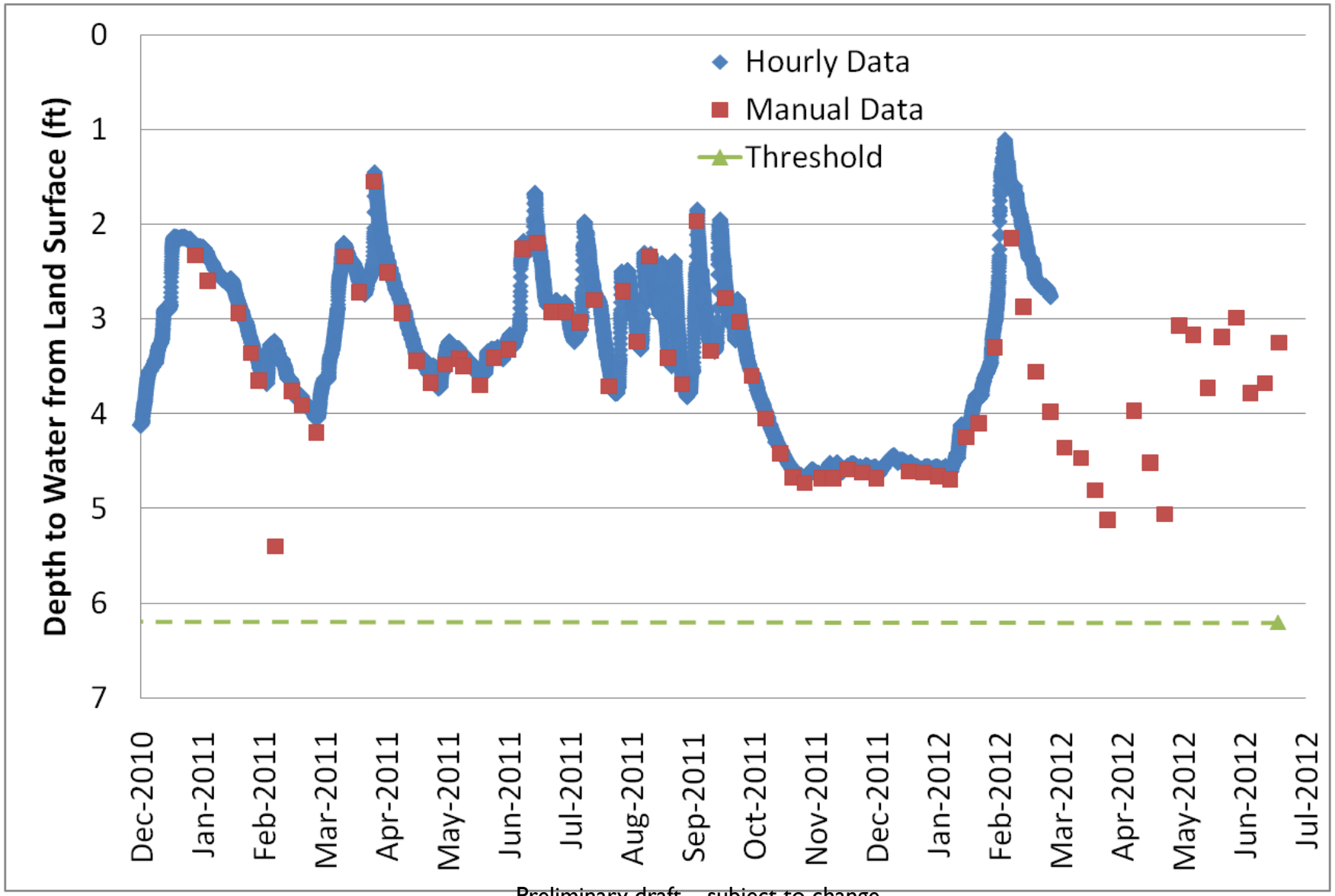
1. Current threshold in MW-10-95
2. Comparison of threshold and measured groundwater levels in MW-10-95
3. Historical threshold method concept
4. Threshold revision steps
5. Threshold revision example for MW-10-95
6. Threshold process edits

MW-10-95 Existing Threshold Components Example

- 4 foot root zone (annual crops)
- 1 foot capillary rise
- Field Threshold: 5 feet bgs
- Ground surface buffer: 2.2 feet
  - To protect lowest point within 750' of well
- Lateral gradient buffer: -1.0 feet
- Threshold in well: 6.2 feet below ground surface

SAN JOAQUIN RIVER RESTORATION PROGRAM

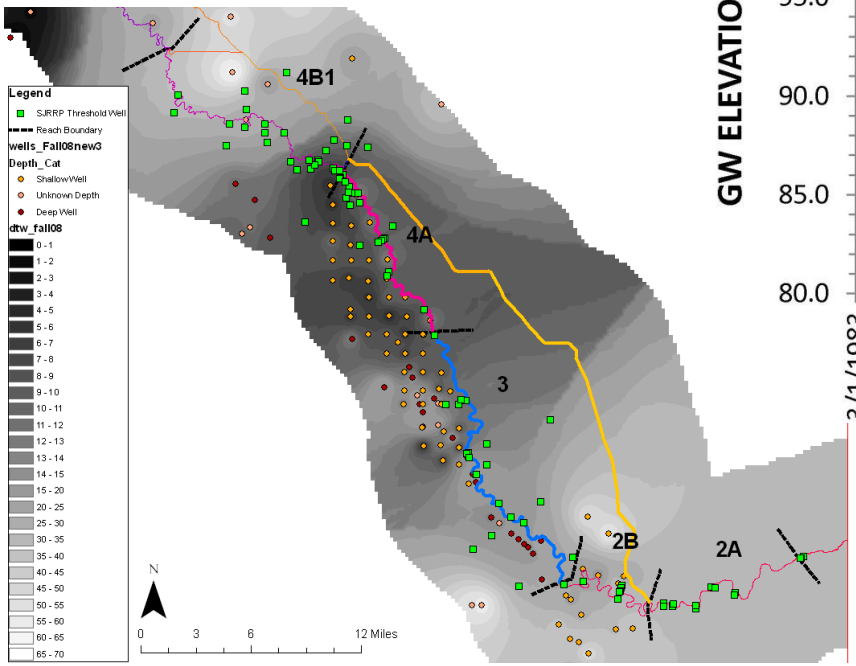
MW-10-95 Water Levels 2011-2012

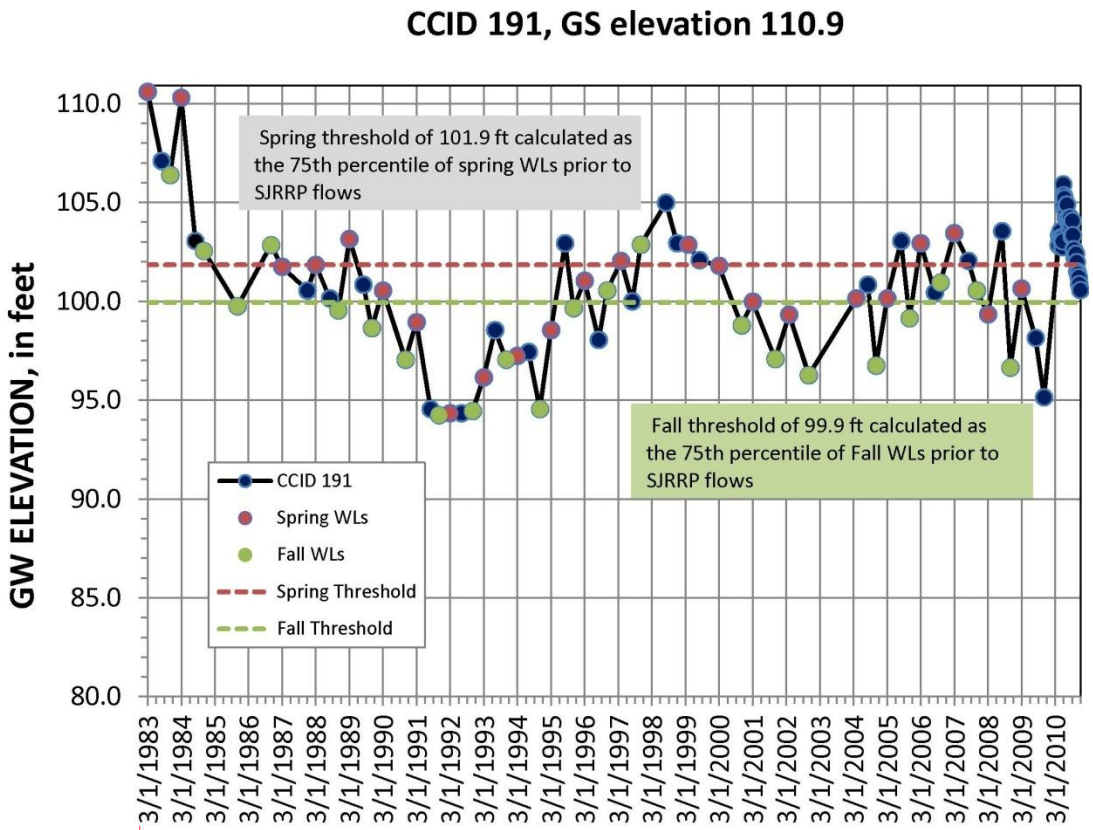


Preliminary draft – subject to change

Thresholds – Historical Method

All historical groundwater level data minus top 31% of measurements (Wet years)



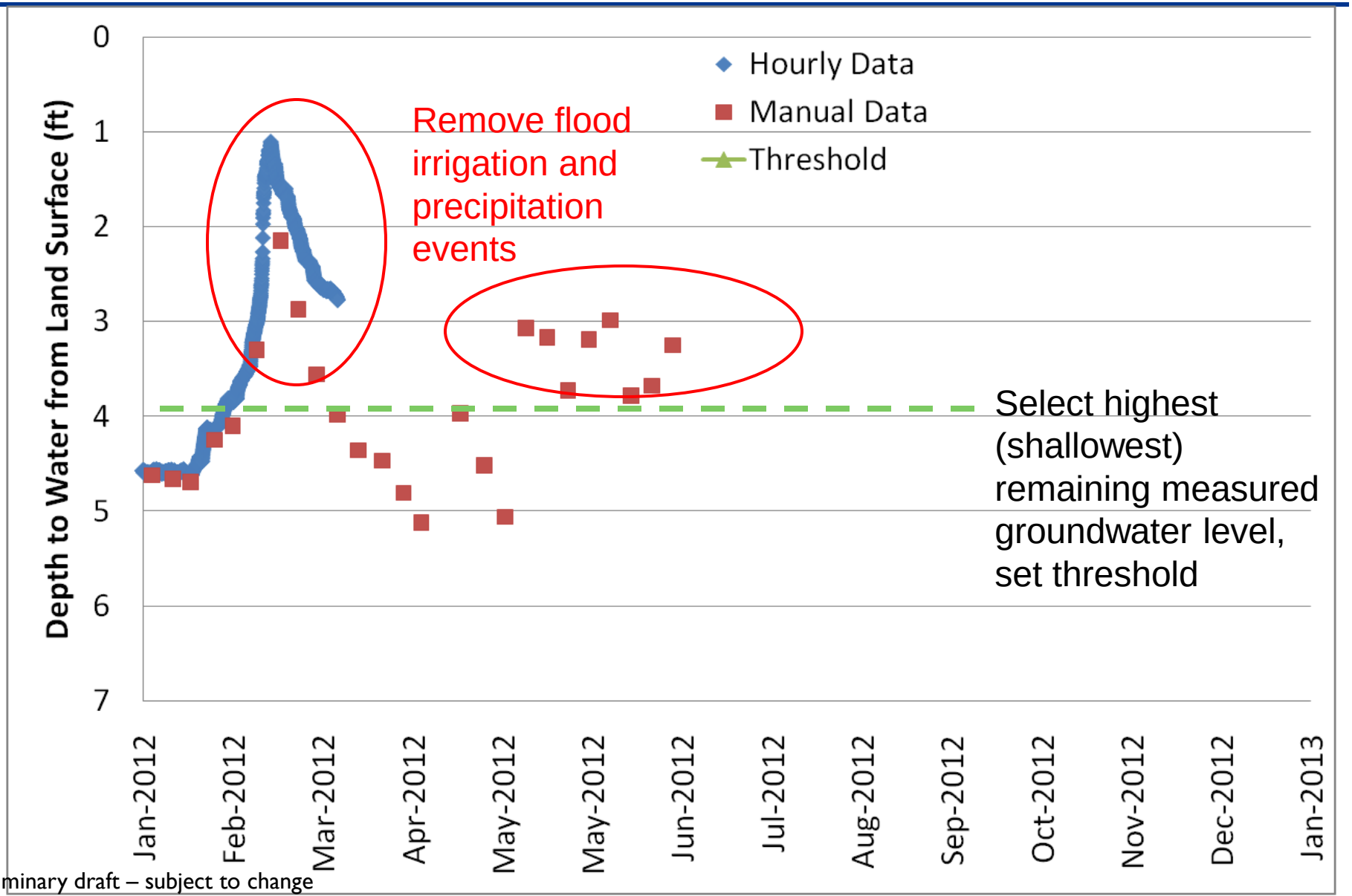


Preliminary draft – subject to change

Threshold Revision Steps

1. Obtain 2012 data
2. Determine flood irrigation events (from well monitoring field notes)
3. Determine precipitation events (from Los Banos CIMIS data)
4. Determine infiltration time (based on soil textures)
5. Remove data points caused by flood irrigation or precipitation within the infiltration time period
6. Set the threshold at the highest remaining groundwater level

Threshold Revision Example



Threshold Process Edits

- Compare thresholds without flood irrigation to field measurements without flood irrigation
- Reclamation will not reduce Interim Flows or halt increases to Interim Flows based on groundwater levels that are above thresholds due to adjacent flood irrigation.

Threshold Revision Process

- Revise SMP, thresholds, and monitoring this spring
- March 2013: Revised SMP on restoresjr.net
- 20 day public comment period
- April 2013: Finalize SMP
- Implement Interim Flows based on updated thresholds

Feedback

- Feedback from the SCTFG on peer review recommendations or SMP revisions
  - Comments due by February 22, 2013
    - Katrina Harrison or Brian Heywood

- Peer review recommendations will be incorporated along with SCTFG comments in Spring 2013

QUESTIONS

Contact

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