Santa Rosa Plain Interconnected Surface Water Mapping:

- Initial selection of Interconnected Surface Water based on Stream Reaches with 7 or more points (orange –colored cells

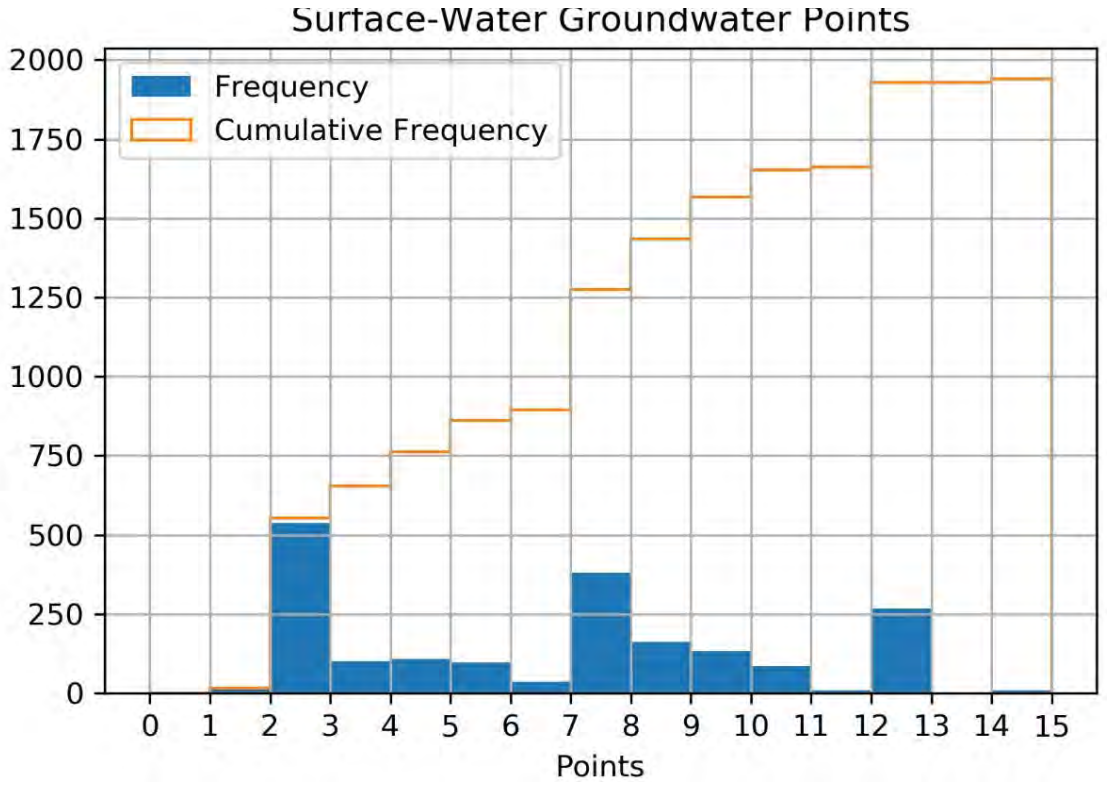
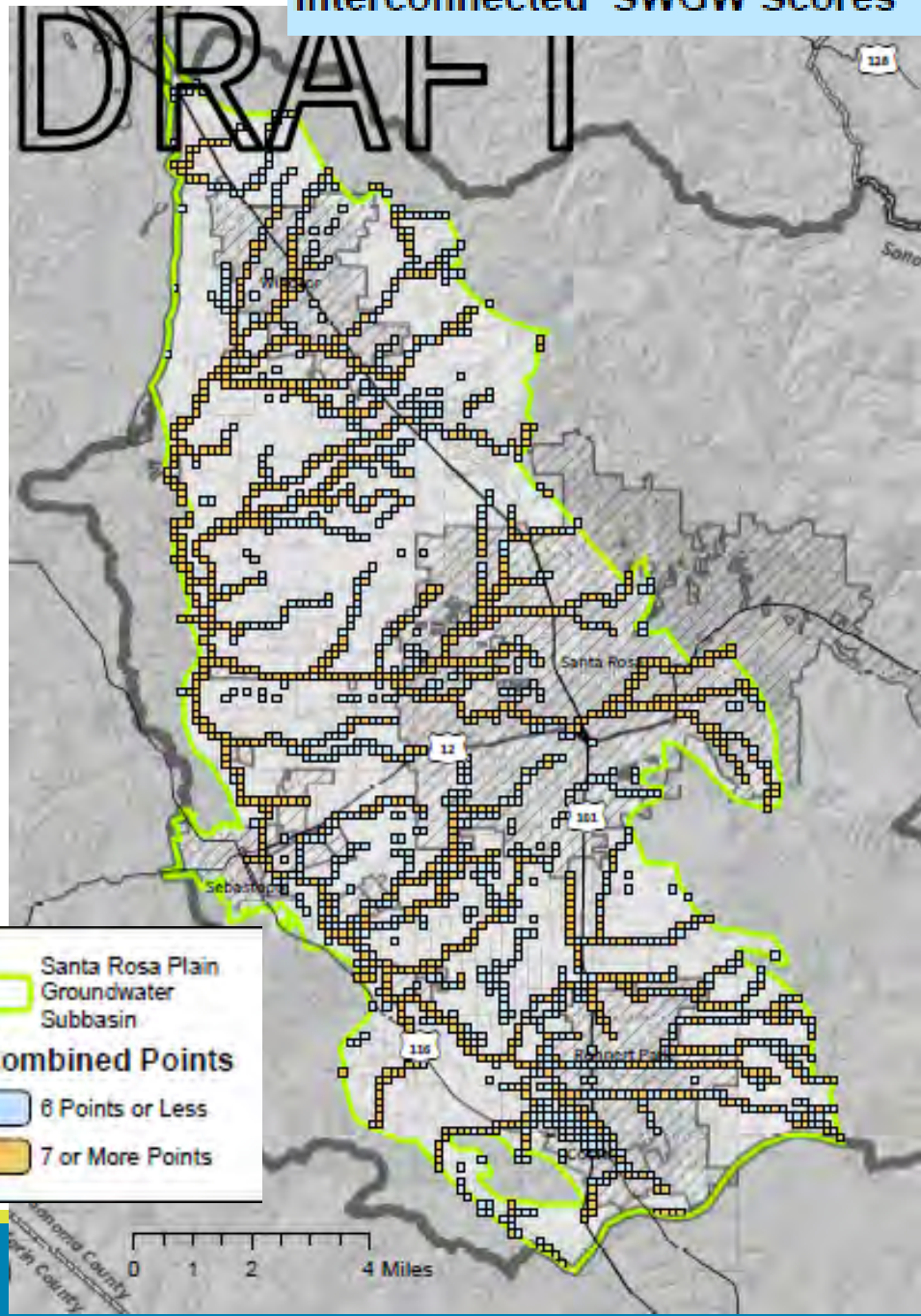


Figure 3-18f Combined Interconnected SWGW Scores

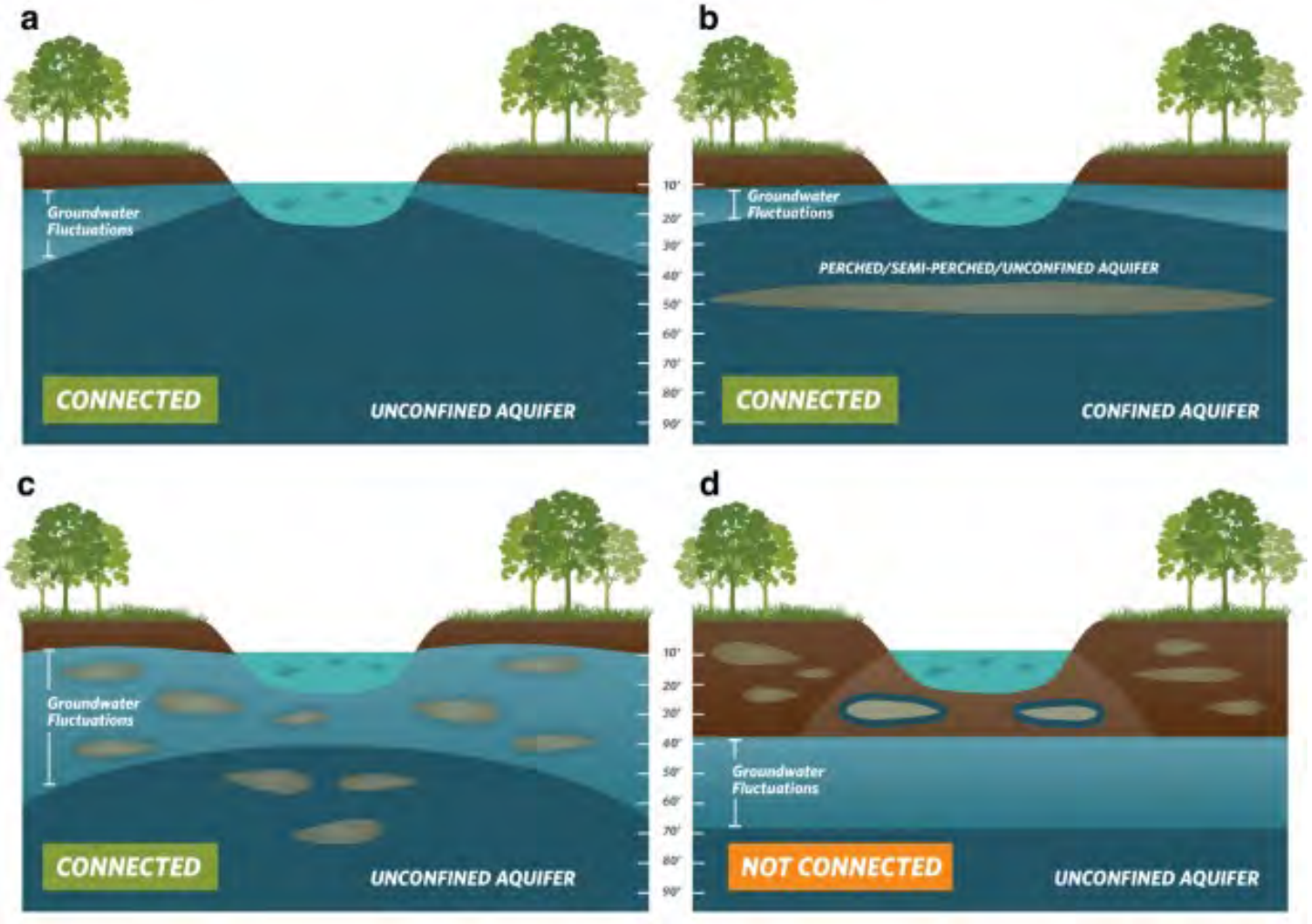


Questions/Discussion

Update on GDE Mapping – Marcus Trotta

Proposed Approach for GDE Mapping

- Focus on ecosystems that can be affected by groundwater conditions and management and are within jurisdiction of GSAs
- Utilize available statewide and local datasets to develop best available information
- Consider using “indicator” species and/or grouping of GDEs with similar characteristics/habitat needs
- Prioritize GDEs for consideration in developing SMCs for Surface Water Depletion (separate workgroup)



https://groundwaterresourcehub.org/

Source: The Nature Conservancy, Identifying GDEs Under SGMA Best Practices for using the NC Dataset, 2019

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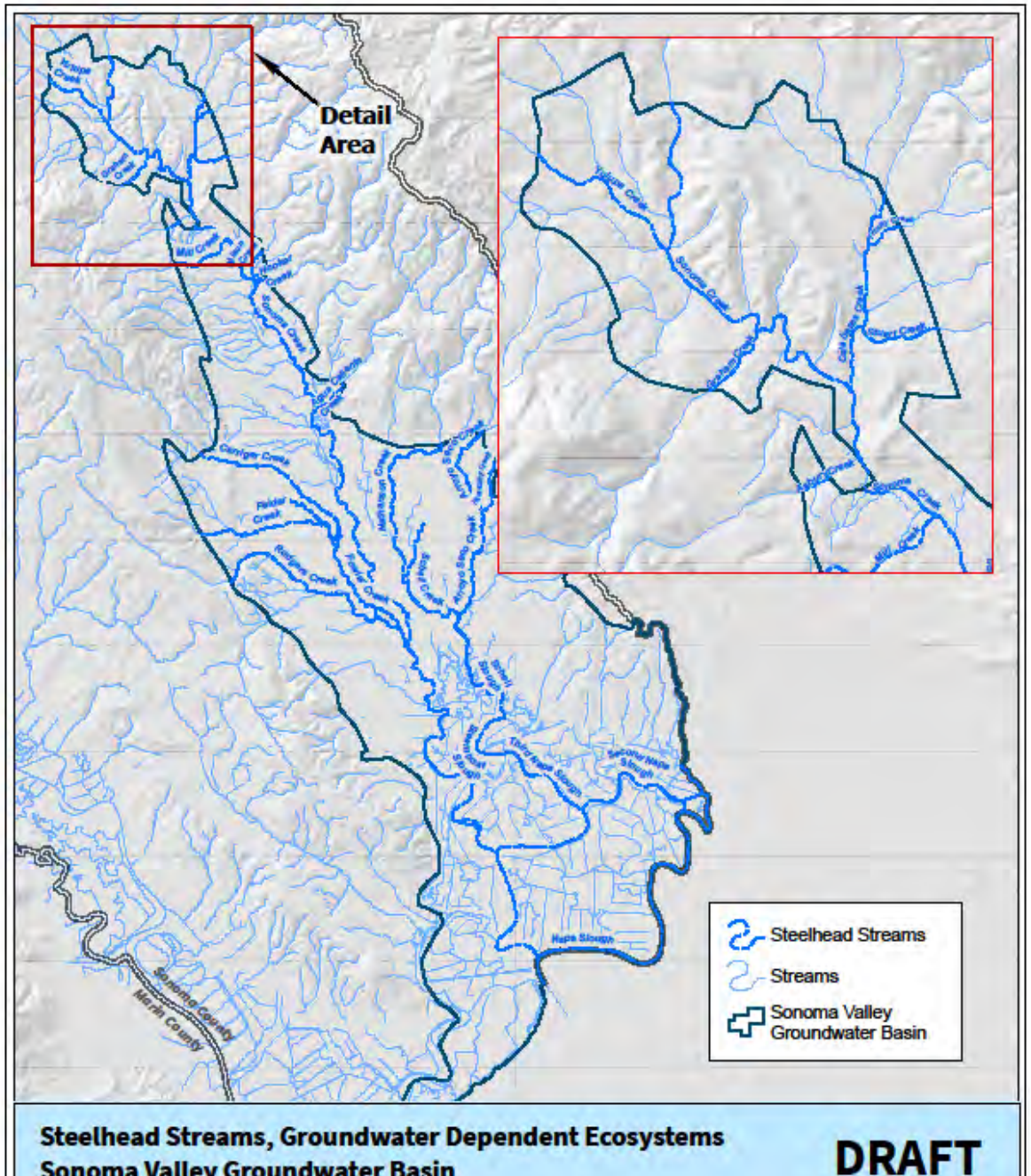
Preliminary Aquatic Groundwater Dependent Species Update

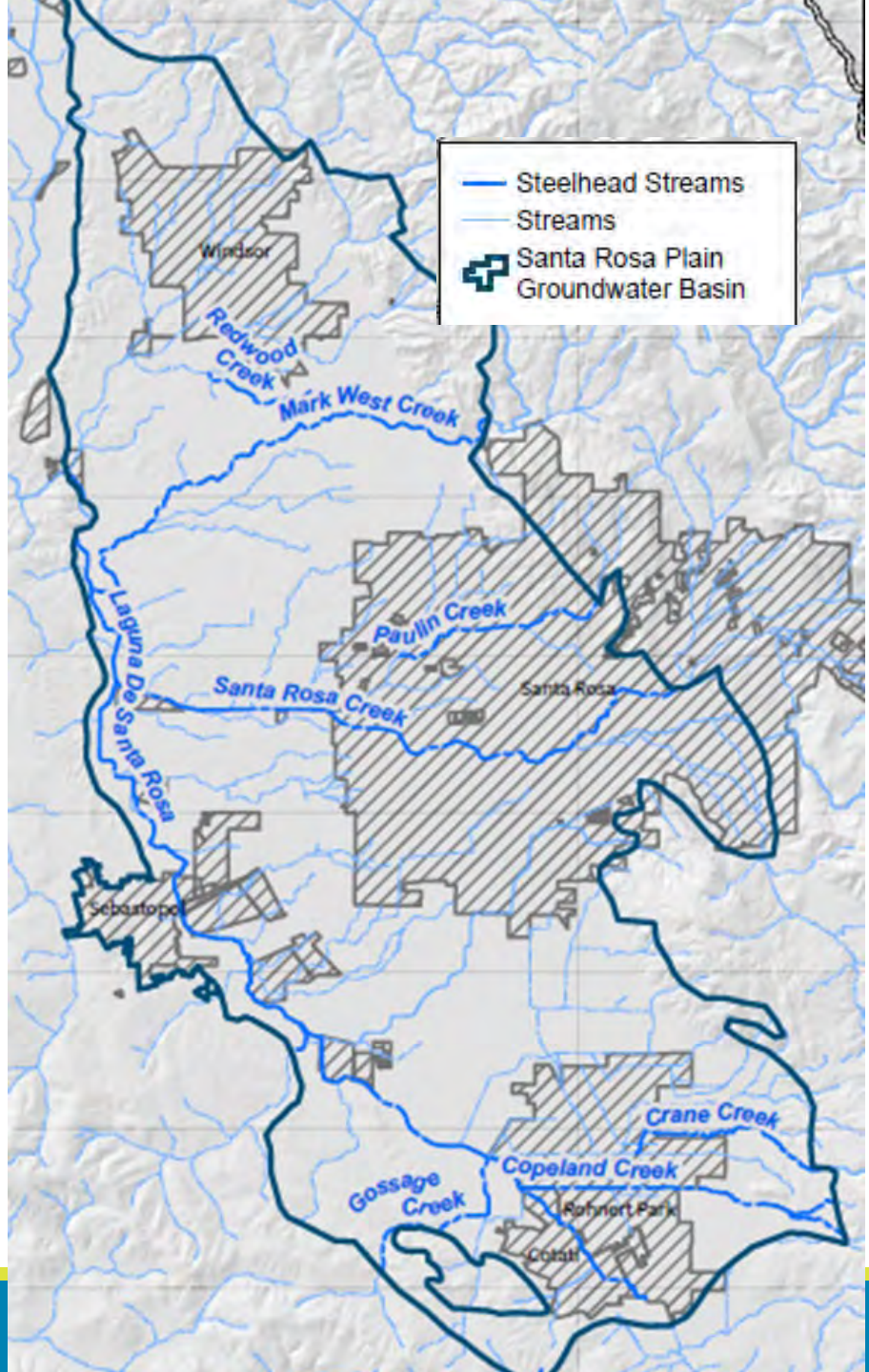
- Animals considered are listed in Critical Species LookBook (Rohde et al. 2019)
  - steelhead, Chinook salmon, coho salmon, California red-legged frog, and California tiger salamander.
  - Also, endangered California freshwater shrimp considered at the request of resource agency staff.
  - California tiger salamander excluded because species has “no known reliance on groundwater” (Rohde et al. 2019).
- Distribution of target species is based on:
  - Leidy et al. (2005), Salmonid Sample Frame Development for Coastal Monitoring Plan Implementation in the Russian River Watershed.
  - California Natural Diversity Data Base.

Preliminary Aquatic Groundwater Dependent Species (continued)

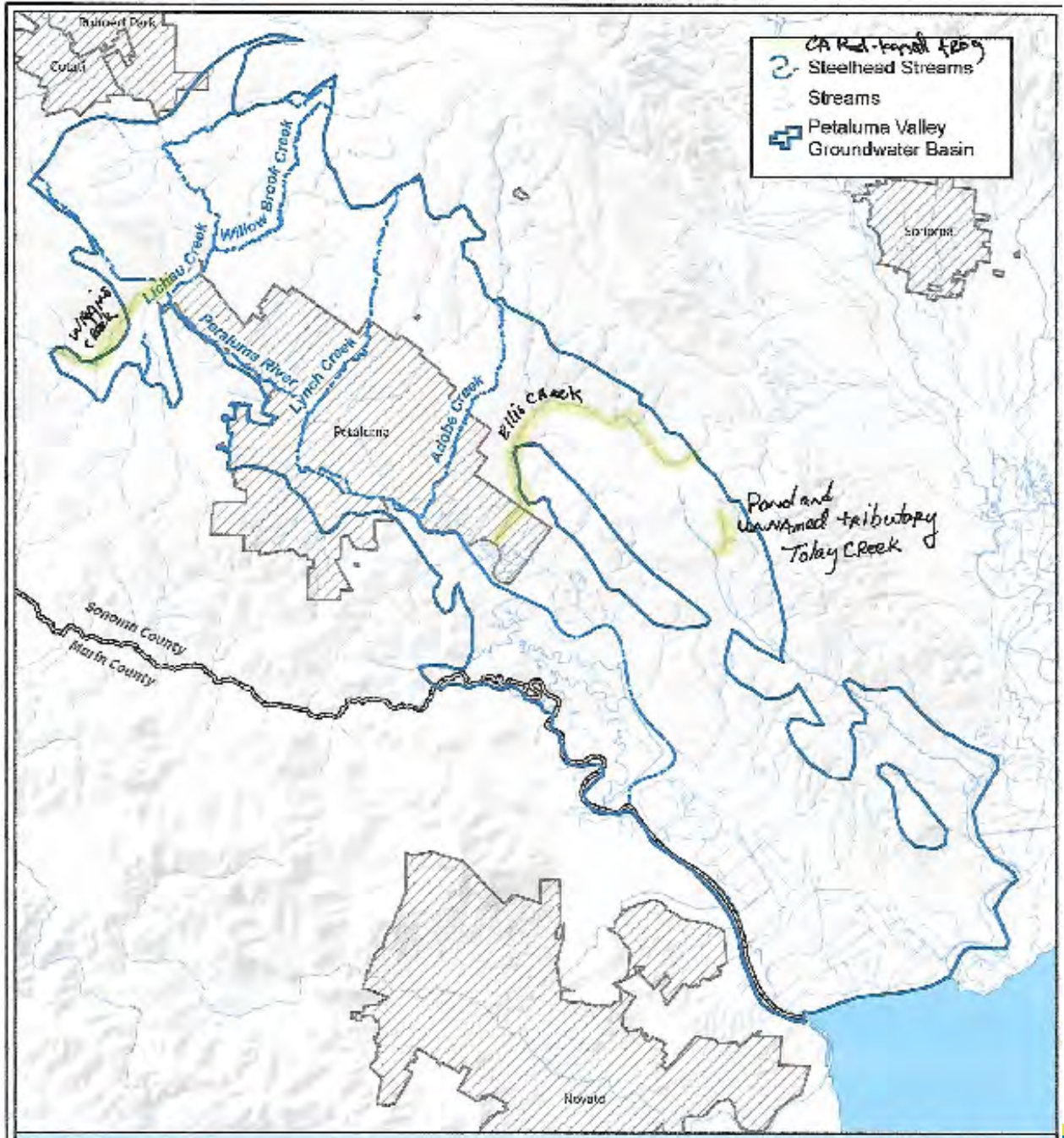
- A total of 35 streams were identified as habitat for at least one target species.
- Steelhead was the most wide spread species occurring in 32 (91%) of all streams.
- In Petaluma Valley, California red-legged frog occur in three streams not identified as a steelhead stream.
  - Wiggins Creek and Ellis Creek
  - Pond on unnamed tributary of Tolay Creek (recommend removal)
- Distribution of Chinook salmon, coho salmon, and California freshwater shrimp overlap entirely with steelhead streams.

Preliminary Aquatic Groundwater Dependent Species





Preliminary Aquatic Groundwater Dependent Species: Petaluma Valley



Vegetation Mapping Update

Summary of Methodology

- Map classes used in initial draft maps removed from consideration as GDEs (e.g. vernal pools).

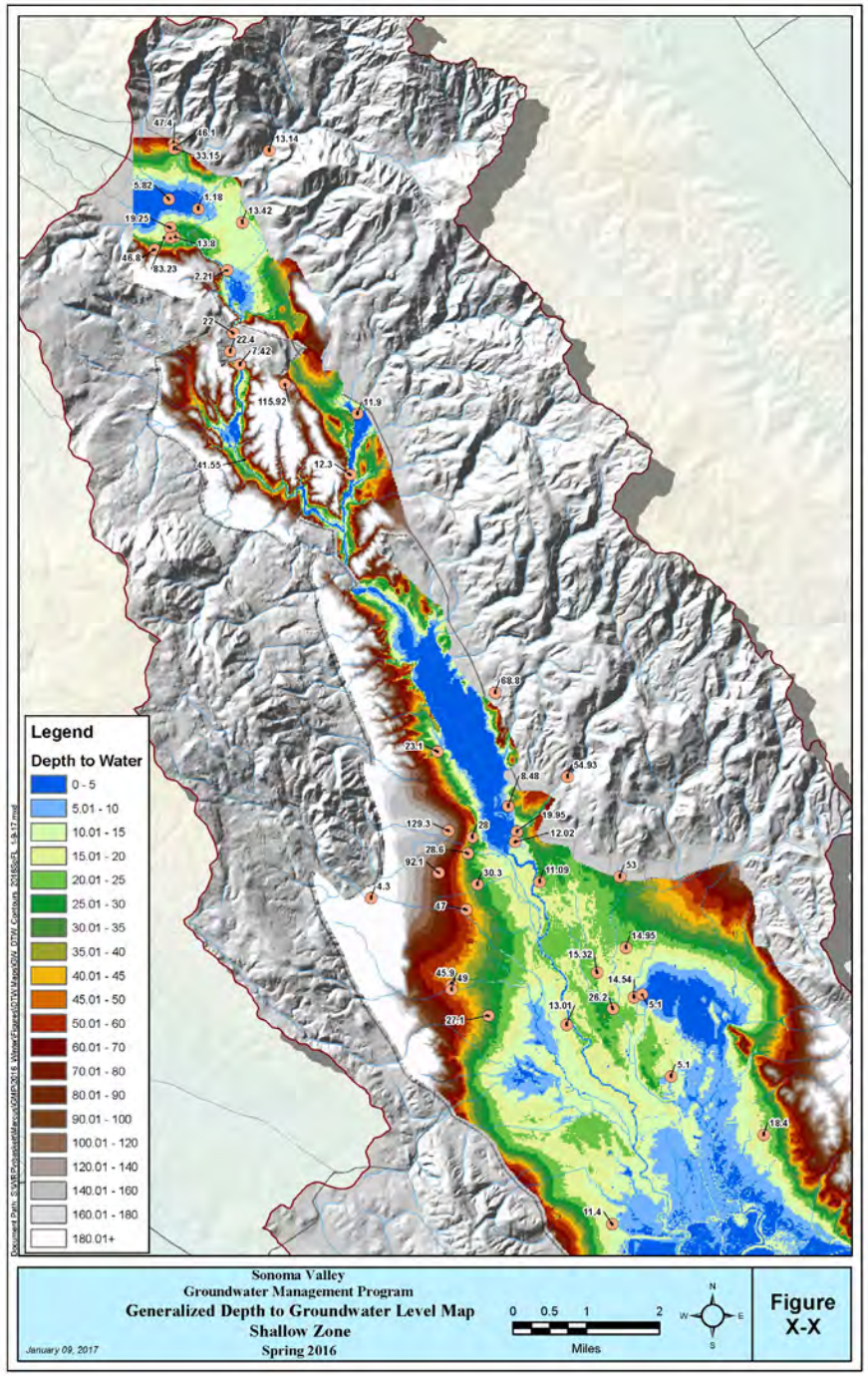
- Incorporate root depths of common tree species as available and compare to depth-to-groundwater (DTW) mapping.

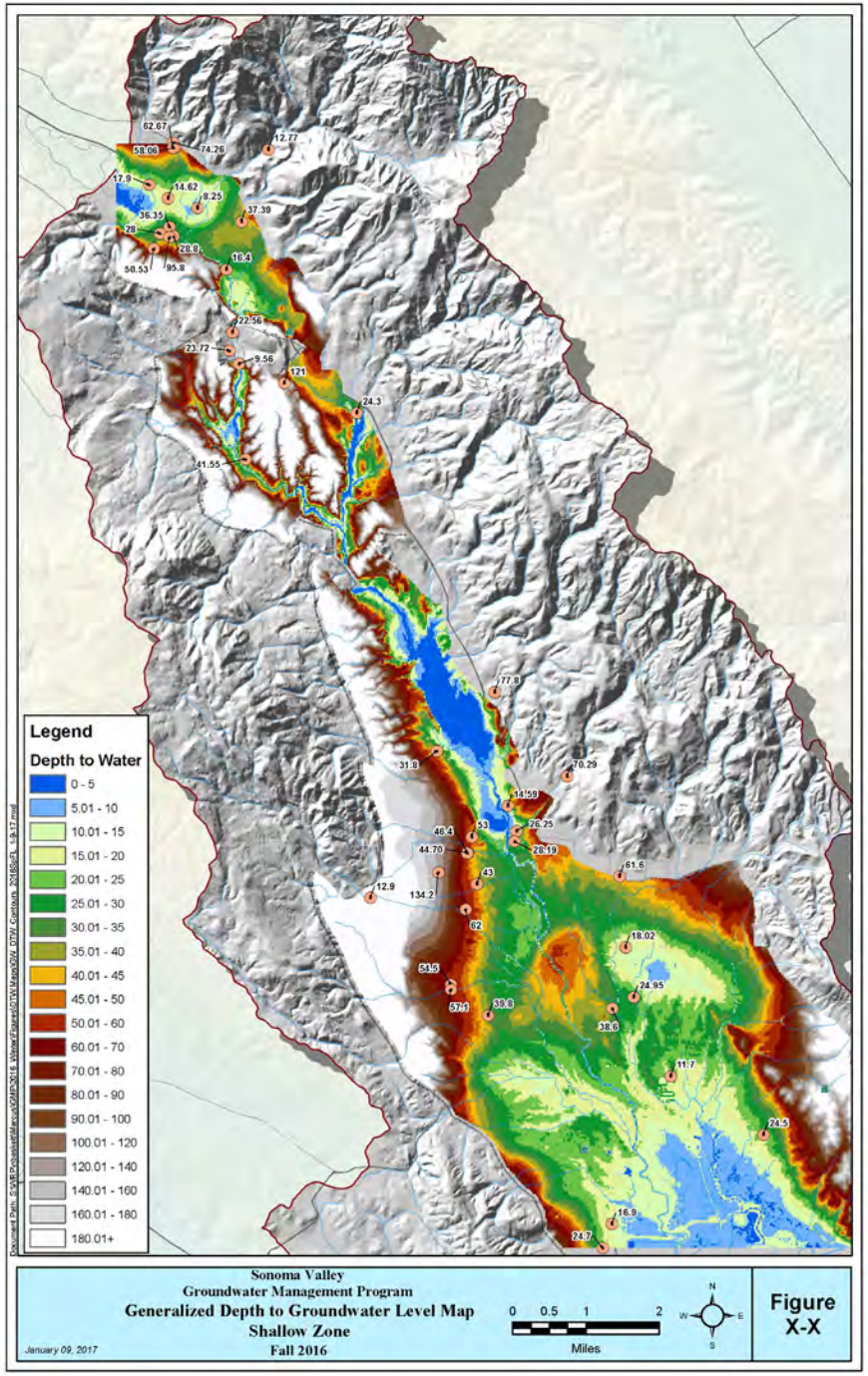
    -Minimal information of rooting depth of riparian tree species
    -Presumably riparian species have relatively shallow root systems
    -*Q. agrifolia* and *Q. lobata* are phreatophytes and common in riparian areas throughout Sonoma County.

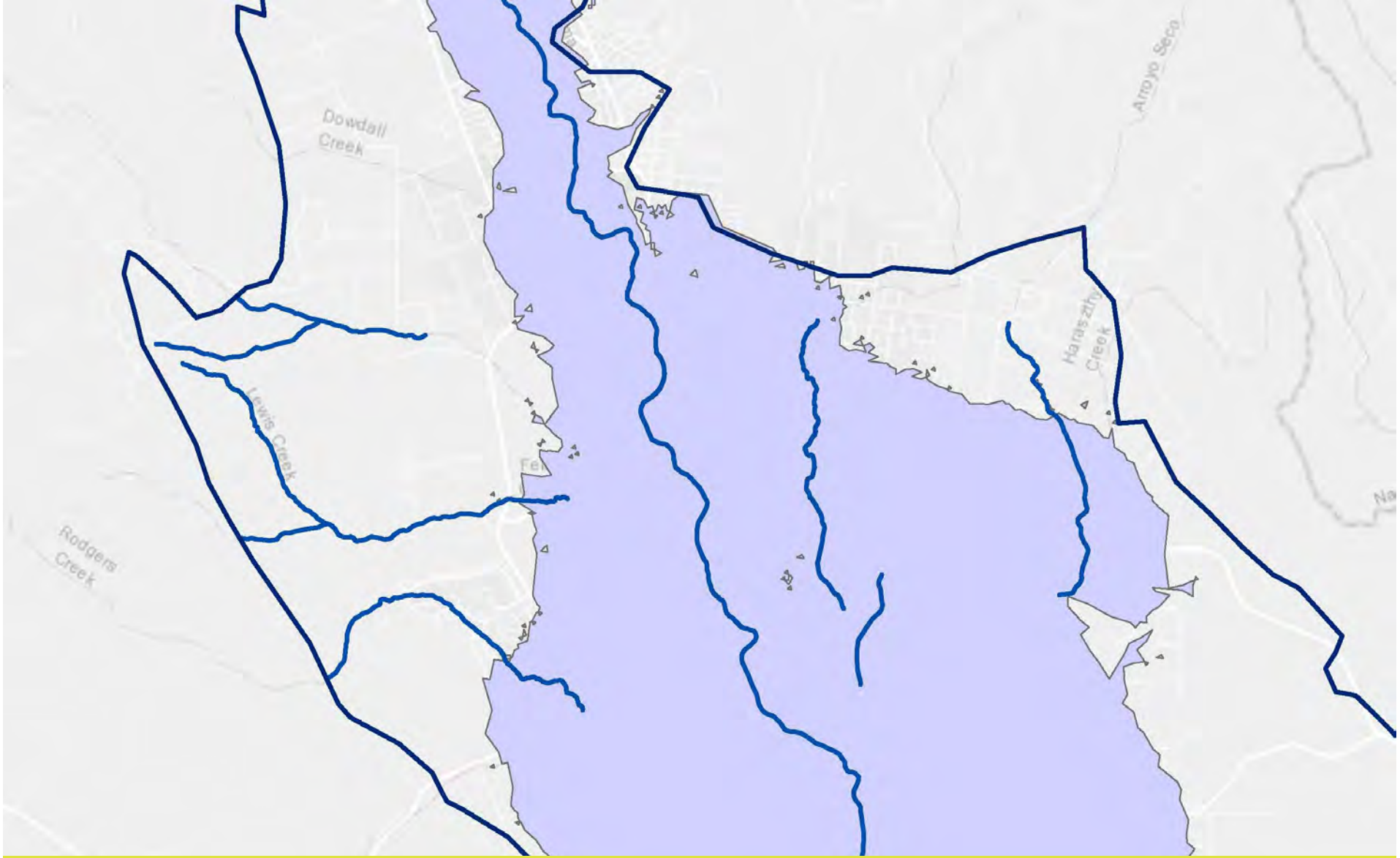
- Selected potential GDEs from areas mapped with depth to groundwater of 30 feet or less.

- Included Riparian Woodland and Oak Woodland habitat within 100 feet of mapped interconnected surface waters.

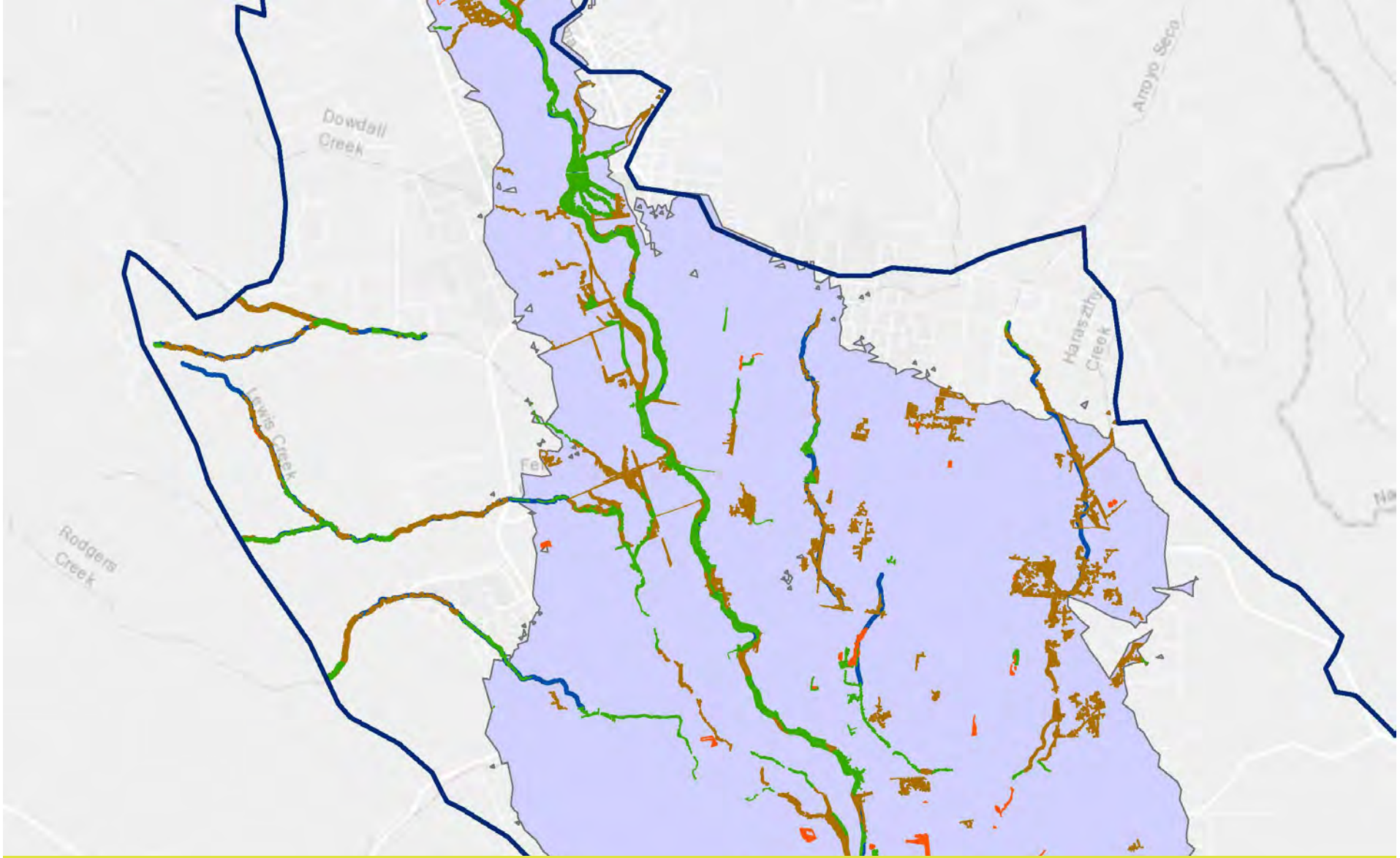
Depth-to-Groundwater Maps for Shallow Unconfined Aquifer System: Sonoma Valley – Spring and Fall 2016



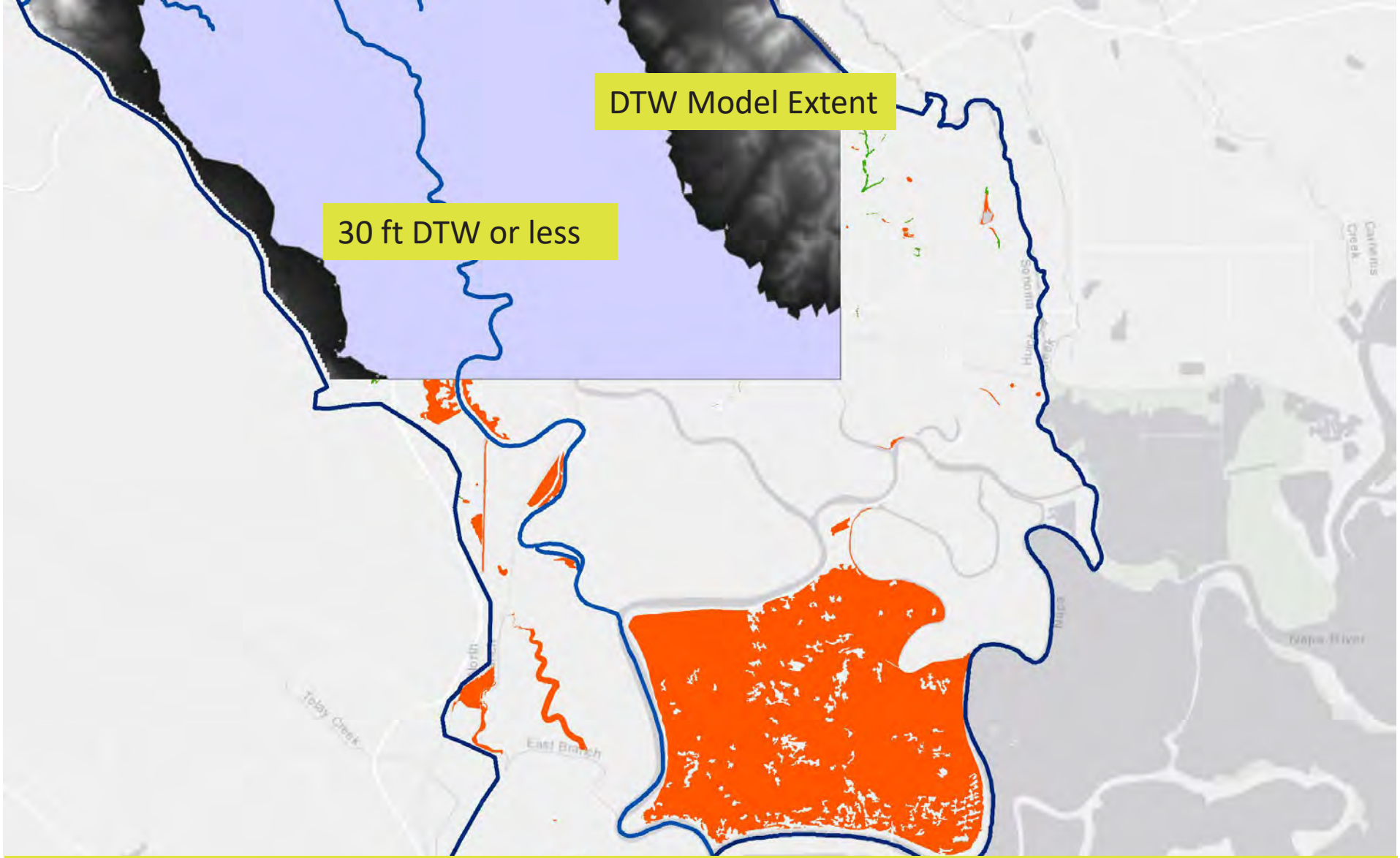




Interconnected surface waters and areas with depth to groundwater 30 feet or less (shaded blue).

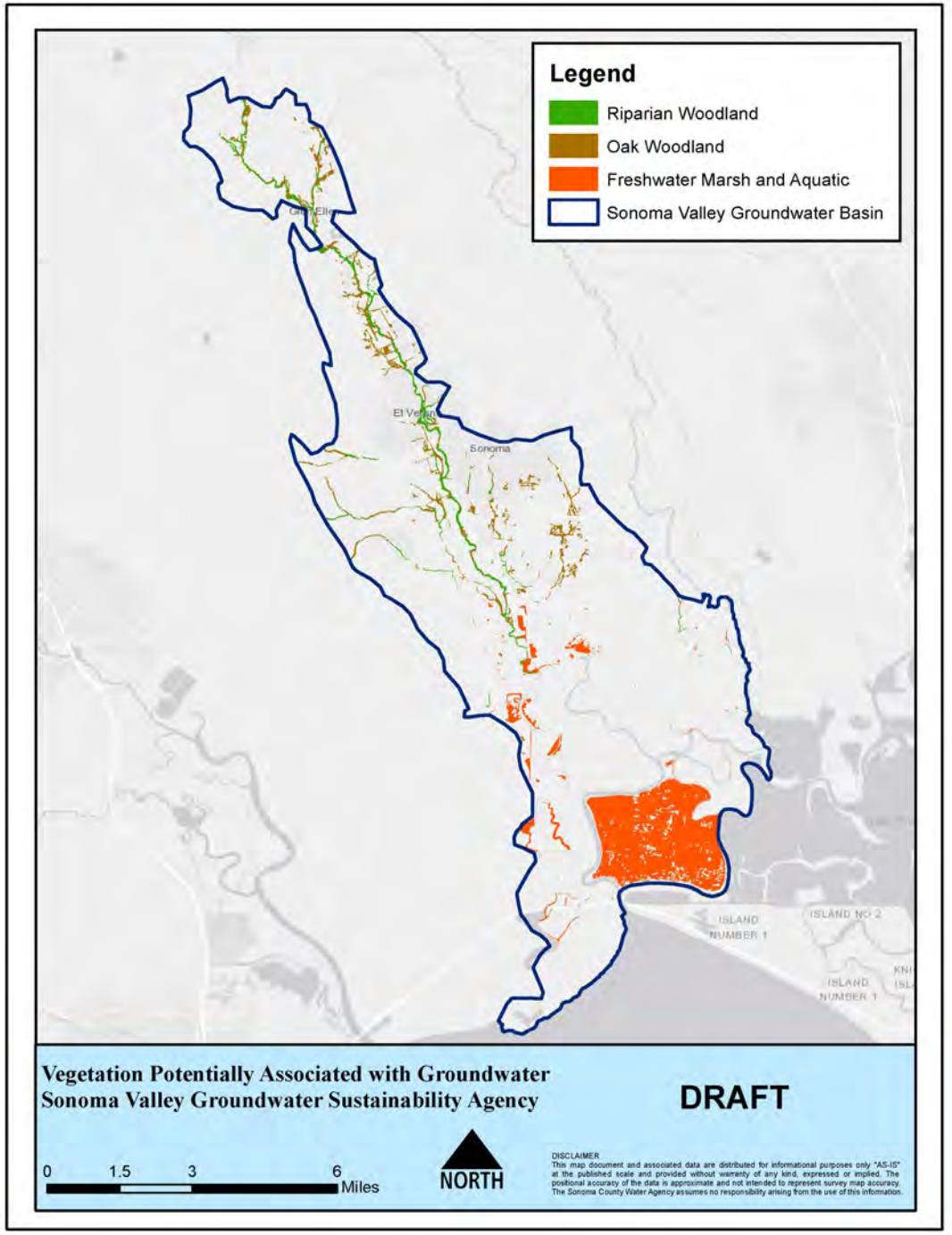


Vegetative Classes within interconnected surface waters (100ft buffer) and areas with depth to groundwater 30 feet or less (shaded blue).



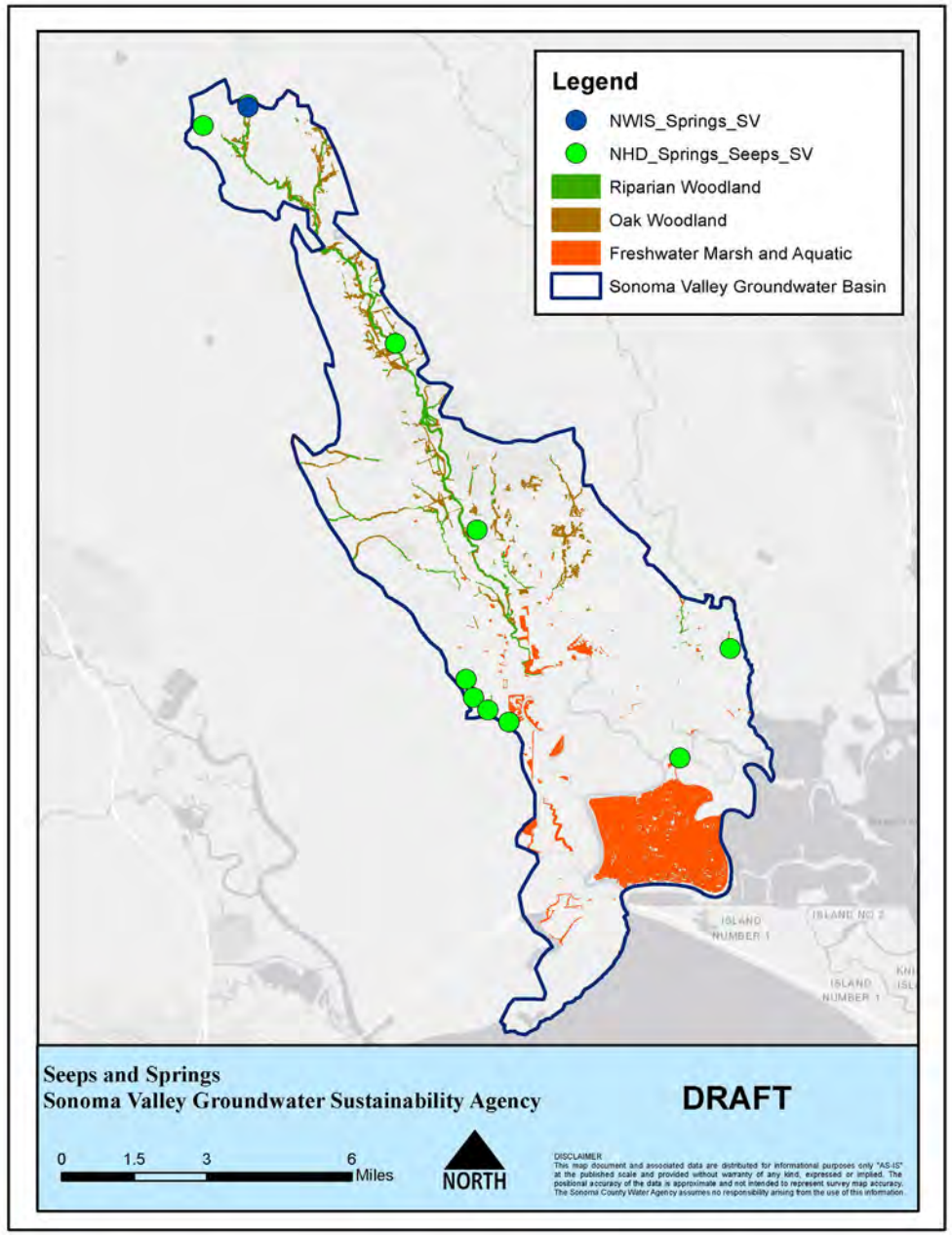
All Riparian Woodlands, Oak Woodlands, and Freshwater Marsh and Aquatic habitat were included in areas lacking depth to groundwater models were included in the draft map.

Results


Legend
Riparian Woodland
Oak Woodland
Freshwater Marsh and Aquatic
Sonoma Valley Groundwater Basin
Sonoma
ISLAND NUMBER 1
ISLAND NO 2
Vegetation Potentially Associated with Groundwater
Sonoma Valley Groundwater Sustainability Agency
DRAFT
0 1.5 3 6 Miles
NORTH
DISCLAIMER
This map document and associated data are distributed for informational purposes only "AS-IS" at the published scale and provided without warranty of any kind, expressed or implied. The positional accuracy of the data is approximate and not intended to represent survey map accuracy. The Sonoma County Water Agency assumes no responsibility arising from the use of this information.

Seeps and Springs

- Not particularly informative using NWIS and NHD data.
- A few were located within potential GDEs, others located in developed areas.
- Ground-truthing would be necessary to determine if there are GDEs associated with springs and seeps.



Next Steps in GDE Mapping

- Complete vegetation mapping for Santa Rosa Plain and Petaluma Valley
- Integrated maps with proposed vegetation and aquatic species GDEs
- Comparison mapping with TNC datasets
- Consideration of grouping GDEs based on habitat needs (timing, proximity to known and estimated groundwater pumping, etc.)
- Initial draft narrative describing process and how mapping will be used in GSP
- Share maps and approach with Surface Water Depletion SMC Workgroup

- What additional data collection is recommended for implementation phase of GSP?

Possible Approaches to Developing SMC
– Marcus Trotta & Stephen Maples

Motivation

Objective: Identify opportunities for using shallow GW wells as a proxy for GW/SW interactions

Approach:

1. Characterize GW/SW interactions using paired shallow GW and gage data
2. Develop regression relations between data and larger-scale stream-aquifer responses from the calibrated model.
3. Use regression relation to infer stream-aquifer responses in near-real-time with an indicator well (i.e., GW levels as a proxy).

How can we leverage measurements and models to characterize GW/SW interactions and SW depletion?

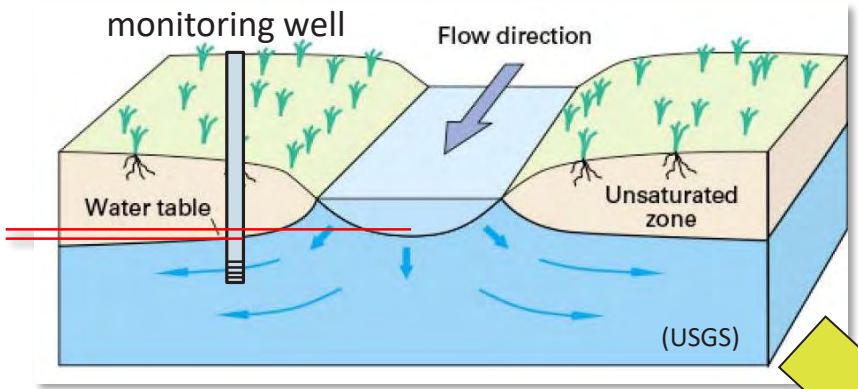
SGMA requires …

1. An understanding of the exchanges of groundwater and surface water within the basin (i.e., groundwater/surface-water interactions).
2. An assessment of the impact of groundwater management on groundwater/surface-water interactions.

Interactions of groundwater and surface water are typically …

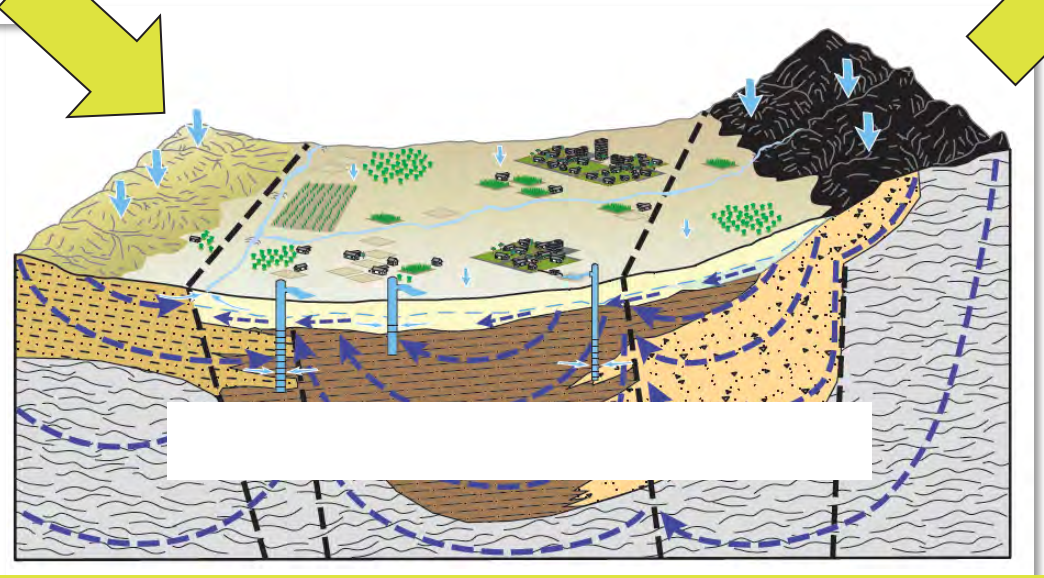
1. Highly variable in space and time.
2. Typically characterized directly at only a few locations.
3. Challenging to simulate with models, resulting in significant uncertainty.

How can we leverage measurements and models to characterize GW/SW interactions and SW depletion?

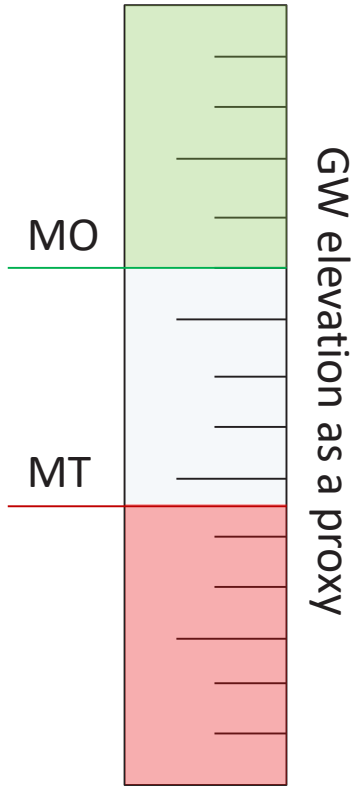


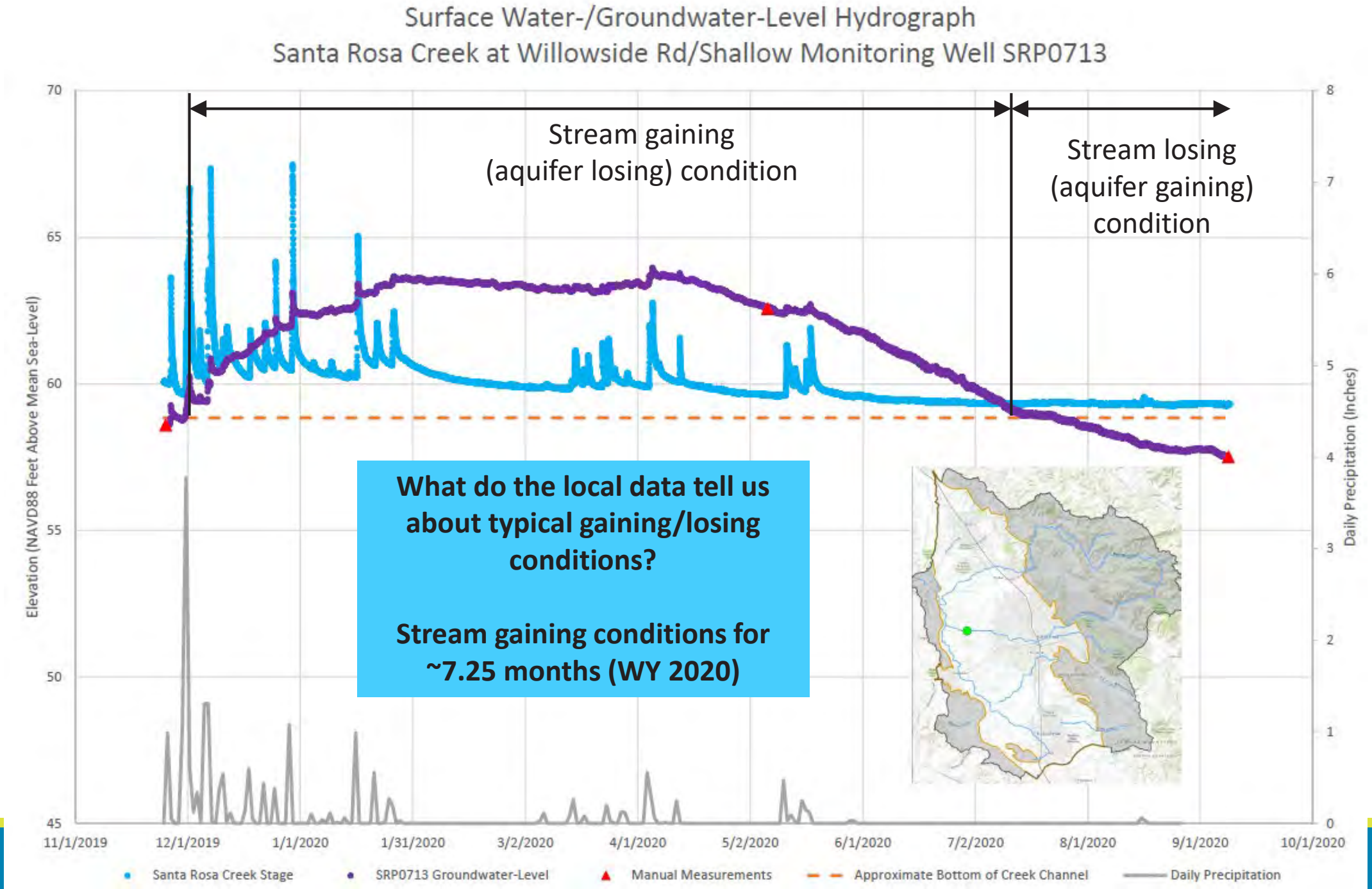
Local **GW/SW interaction characterization (measured)**

Regional **GW/SW interaction characterization (simulated)**



SMCs are tied to GW elevations and informed by simulation results

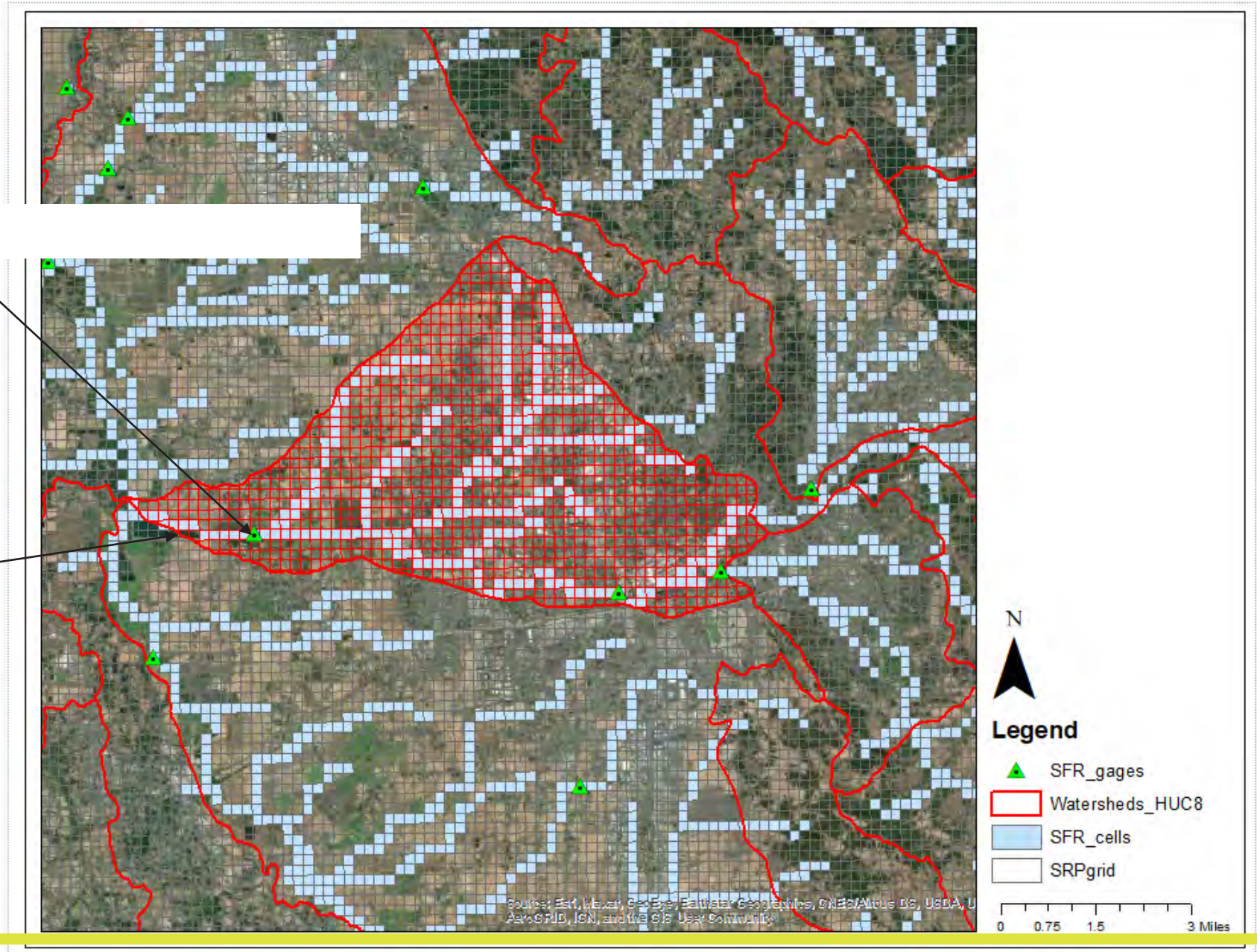


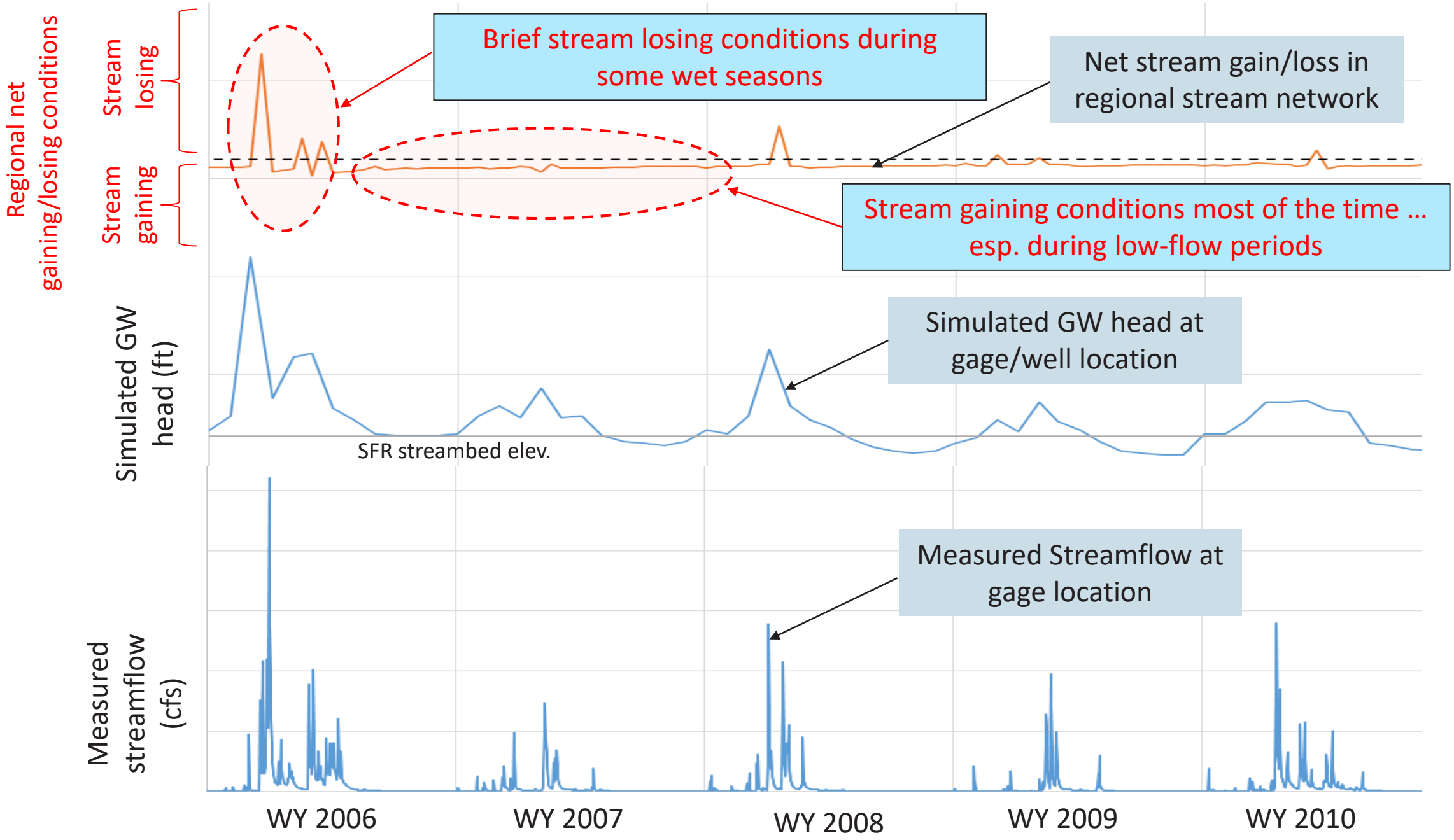

Surface Water-/Groundwater-Level Hydrograph
Santa Rosa Creek at Willowside Rd/Shallow Monitoring Well SRP0713
Stream gaining
(aquifer losing) condition
Stream losing
(aquifer gaining)
condition
What do the local data tell us about typical gaining/losing conditions?
Stream gaining conditions for ~7.25 months (WY 2020)
Elevation (NAVD88 Feet Above Mean Sea-Level)
Daily Precipitation (Inches)
70
65
60
55
50
45
8
7
6
5
4
3
2
1
0
11/1/2019
12/1/2019
1/1/2020
1/31/2020
3/2/2020
4/1/2020
5/2/2020
6/1/2020
7/2/2020
8/1/2020
9/1/2020
10/1/2020
Santa Rosa Creek Stage
SRP0713 Groundwater-Level
Manual Measurements
Approximate Bottom of Creek Channel
Daily Precipitation

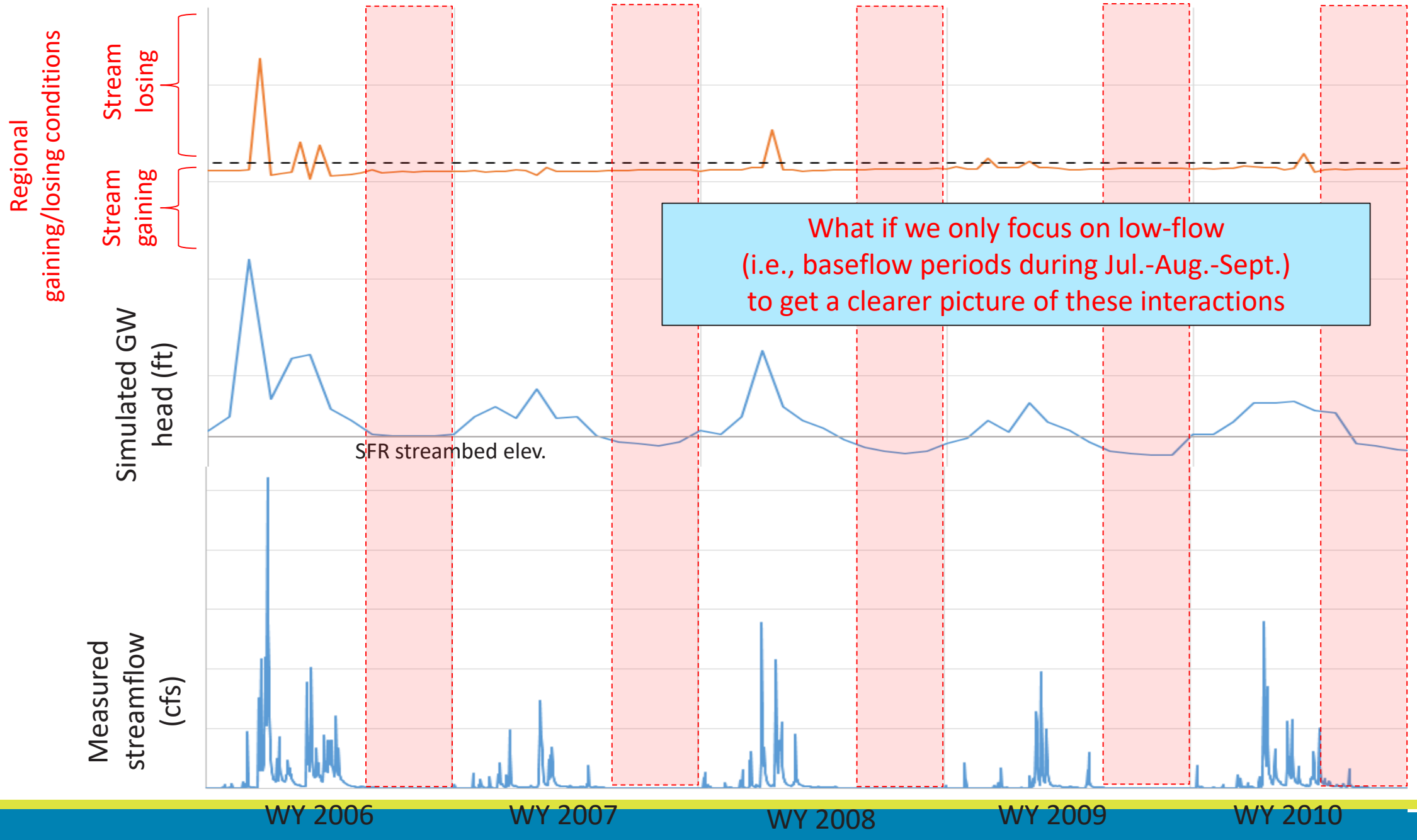
What does the model tell us about gaining/losing conditions over the greater region?

Paired gage/shallow GW well at Santa Rosa Cr. and Willowside Rd.

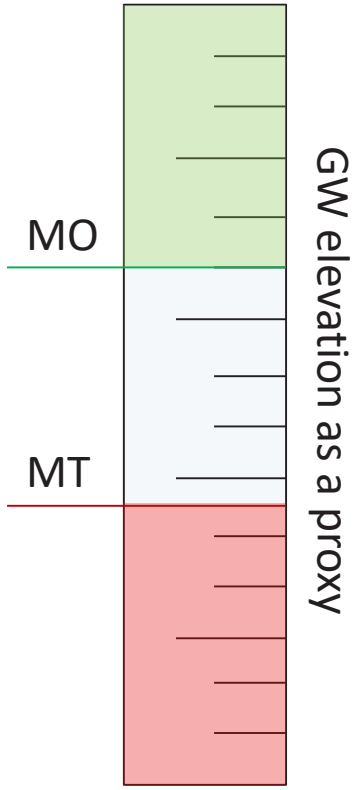
MODFLOW/SFR cells included within greater HUC8 boundary



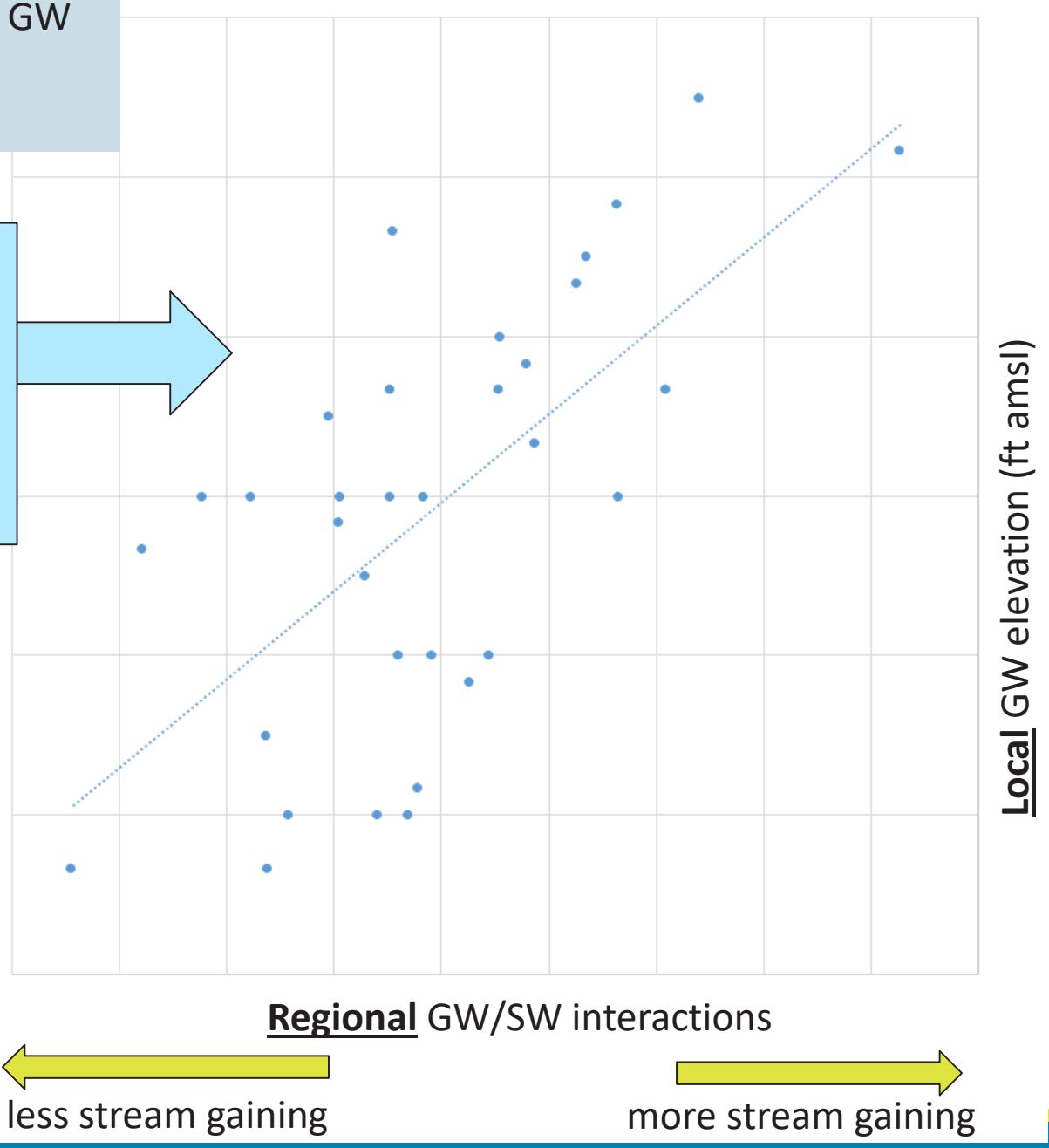

Regional net gaining/losing conditions
Stream losing
Stream gaining
Brief stream losing conditions during some wet seasons
Net stream gain/loss in regional stream network
Stream gaining conditions most of the time … esp. during low-flow periods
Simulated GW head (ft)
Simulated GW head at gage/well location
SFR streambed elev.
Measured streamflow (cfs)
Measured Streamflow at gage location
WY 2006
WY 2007
WY 2008
WY 2009
WY 2010


Regional gaining/losing conditions
Stream losing
Stream gaining
Simulated GW head (ft)
SFR streambed elev.
Measured streamflow (cfs)
What if we only focus on low-flow
(i.e., baseflow periods during Jul.-Aug.-Sept.)
to get a clearer picture of these interactions
WY 2006
WY 2007
WY 2008
WY 2009
WY 2010

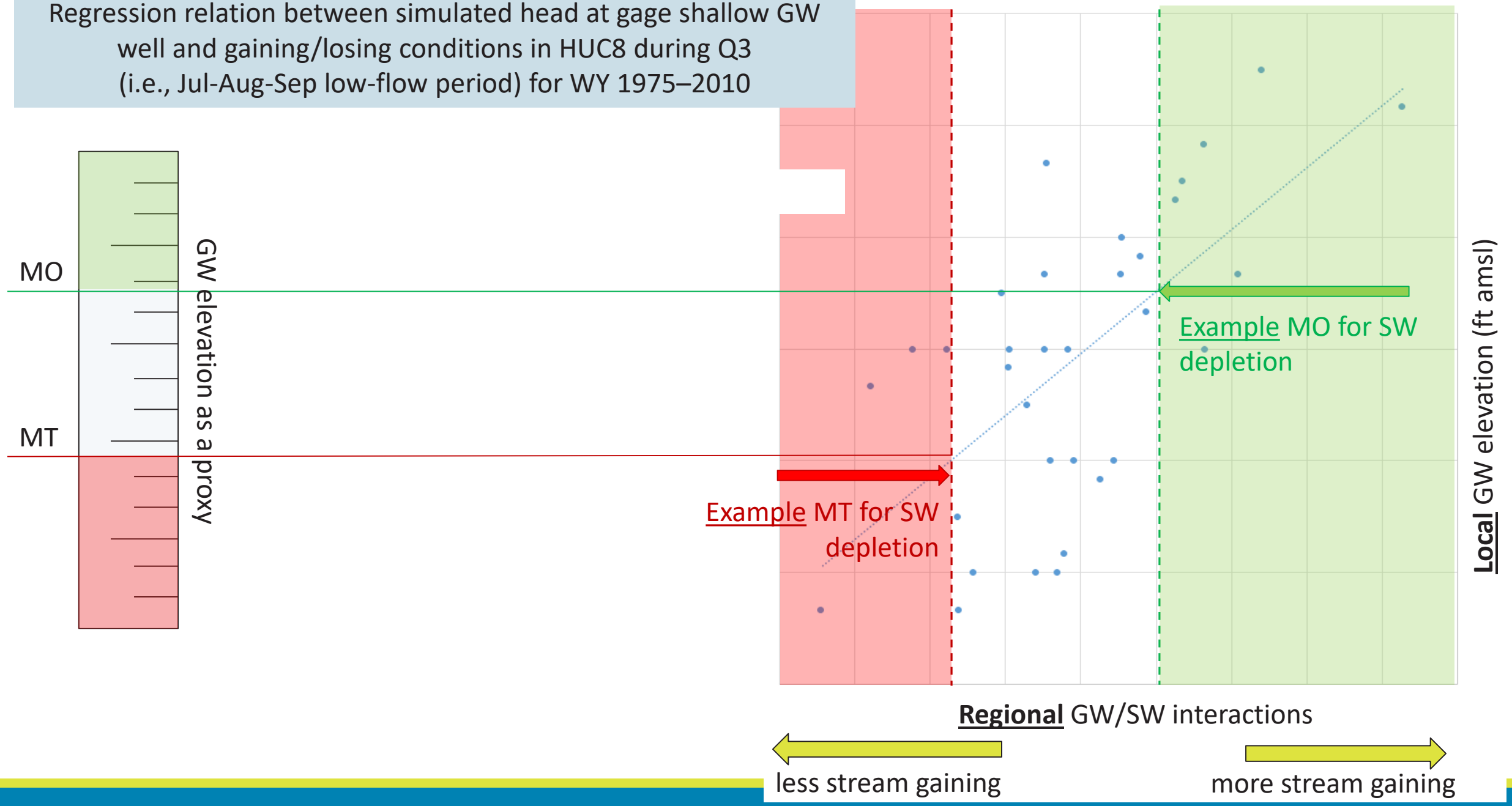
Regression relation between simulated head at gage shallow GW well and gaining/losing conditions in HUC8 during Q3 (i.e., Jul-Aug-Sep low-flow period) for WY 1975–2010



Example regression relation between local GW heads and simulated regional GW/SW interactions be used to inform SMCs



Regression relation between simulated head at gage shallow GW well and gaining/losing conditions in HUC8 during Q3 (i.e., Jul-Aug-Sep low-flow period) for WY 1975–2010



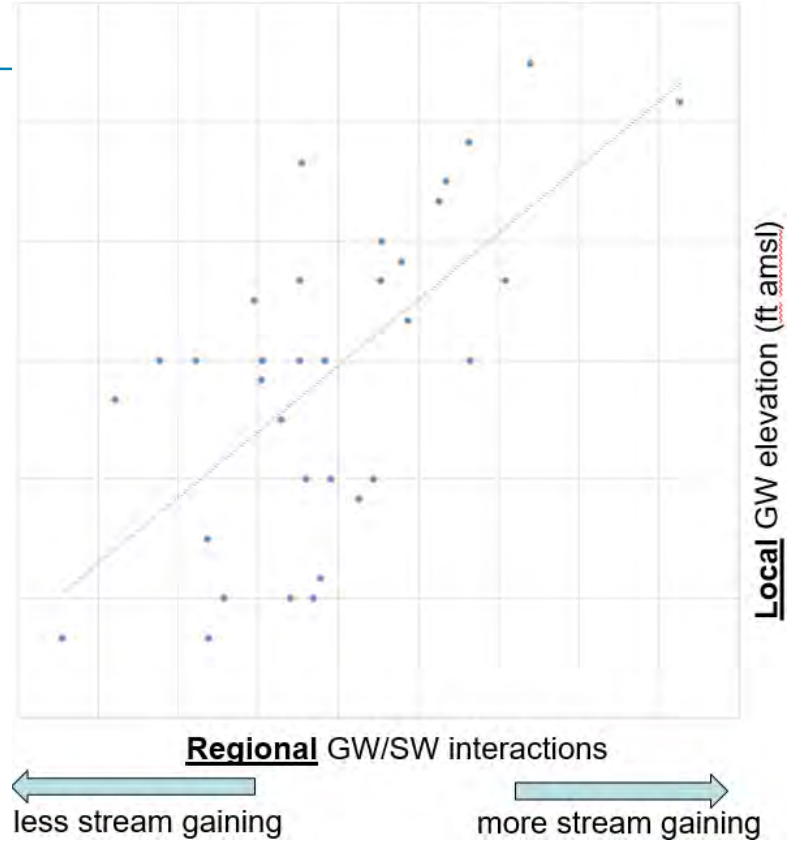
Outstanding Questions & Next Steps …

1. Are (1) simulated/observed heads in good enough agreement and (2) the regression relation robust enough to perform this assessment?

2. Can a regression be developed to assess other metrics, like for the GW/SW gradient? Or duration of interconnection?

3. Are different regression relations needed for different periods within a year (i.e., wet/dry periods)? Or for differing water year types?

4. What is the best approach for assessing the contribution from GW pumping? Differencing multiple simulations?



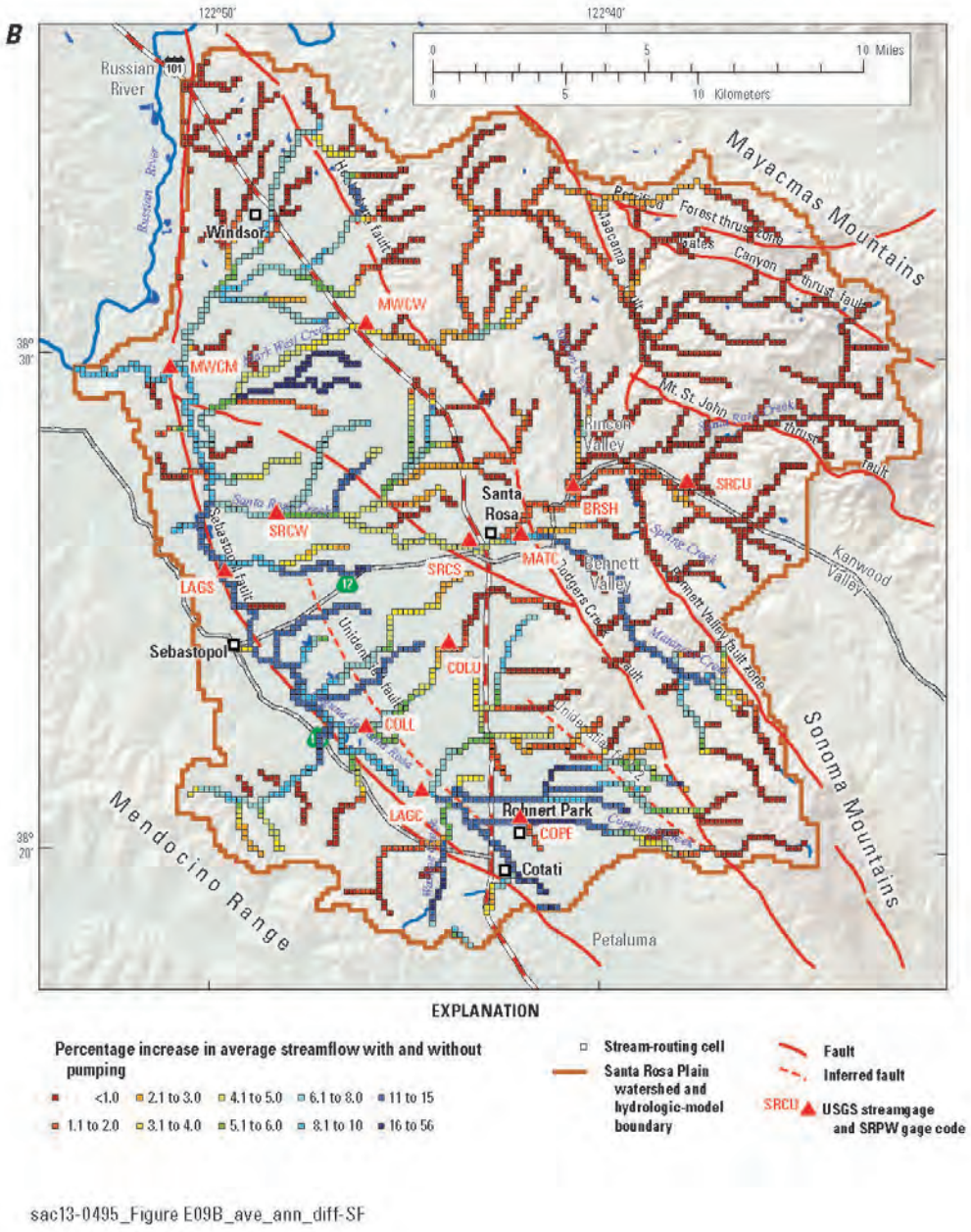
Questions/Discussion

Initial Discussion of Data Gaps

1. Are there other existing data sources that should be included for GSP?
2. What additional data collection is recommended for implementation phase of GSP?

Simulated Change in Streamflow With and Without Groundwater Pumping (USGS, 2014)

- Average 8% change in total simulated streamflow (35 year simulation)



sac13-0495_Figure E09B_ave_ann_diff-SF

SMC for Depletion of Interconnected Surface Water

Friday, December 11, 2020

Meeting Notes

Contact: Sam Magill, Practitioner Work Group Facilitator

Agenda Review and Work Group Introductions

Jay Jasperse welcomed the group and expressed his appreciation for the participants taking time out of their busy schedules to join the meeting.

Sam Magill, Work Group Facilitator walked through the agenda and meeting protocol then suggested a round of introductions.

Summary of ISW SMC Work Group Input to Date

Sam Magill provided a summary of initial work group input from the October 7 meeting.

Review and Discuss Draft Significant and Unreasonable Conditions Statement

A statement of **Significant & Unreasonable** is a qualitative statement describing groundwater conditions unacceptable to beneficial uses and users of water in the basin. These describe what conditions are to be avoided and serve as an initial framework around which the quantitative SMC are developed. Marcus Trotta provided example statements from other Groundwater Sustainability Plans and initial Advisory Committee input.

Questions/Comments

Jessie Maxfield (chat) – I am curious what "biological flows" are from the Salinas example.

> Lisa Porta – The point for that agency is that they need to manage the flows on the river so the biological flows wouldn't be impacted.
> Maxfield – In terms of biology are you looking at fish?
> Porta – Yes, related to their specific biological opinion on fish on the river.

Sam Magill said that all input from the group, Advisory Committees, and ongoing staff work were put together to develop the current proposed Strawman Significant and Unreasonable statement:

"Significant and unreasonable depletion of surface water from interconnected streams, occurs when groundwater pumping within the Basin/Subbasin depletes stream flows below historical levels and adversely impacts the viability of GDEs or to other beneficial surface water users."

Marcus Trotta said he was hoping for feedback from the group on the statement.

Rick Rogers (chat) – The inclusion of "below historical levels" should be removed.
It seems like including that wording leaves the door open for a pre SGMA baseline approach which has nothing to do with trying to prevent impacts or Undesirable Results, especially ones that impact beneficial uses of surface water. Putting the two together doesn't work for me.

Maxfeld (chat) – I second Rick's comment. It could read instead ".....depletes stream flows to levels that adversely impacts the viability of GDEs or other beneficial surface water users."

Trotta – We added the language to have something to work to as we develop our technical methodology for what could be considered significant and unreasonable. We haven't received information from the basins on levels or flow requirements that would help us define adverse impacts on the viability of the GDEs or surface water users. I understand the comments.

Sam Boland – If you remove the "below historical levels" the statement still works as a good strawman proposal because you still need to figure out how to define what adversely impacts these things and how they can be quantified in a measurable way. The challenge is equally difficult with or without the "historical levels".

Maurice Hall – If you remove "below historical levels", it seems like you are saying that pumping significant and unreasonable depletion of stream water from interconnected streams occurs when groundwater pumping occurs. I think some reference to historical levels is appropriate given the way SGMA is written. The depletion of stream flows below historical levels of streamflow – It seems to be linking groundwater pumping to stream flow when many other things affect stream flow. My recommendation would be to tie it to historical groundwater depletions of stream flows.

Val Zimmer – I think of something like surface water such as wetlands that may or may not be connected to groundwater or stream flows year-round, you might have OK streamflow but if you drying out wetland that is adjacent to it, it might be a different thing even though it is near it. I wonder if the language around stream flow needs to be adjusted.

Trotta – Both those points are helpful. Maybe something like "results in more depletion of surface water than has occurred historically" rather than reference the flows.

Georgina King – The indicator is surface water, so it does cover both, wetlands and stream flow. A lot of the metrics you propose to use is stream flow as an indicator, it is hard to do with a surface water body. In general, if it is groundwater affecting stream flow that is connected directly to the stream, a wetland is often separate from the stream. If it is separate from the stream it would come under "Groundwater Level".

Zimmer – I think speaking to an expert on wetlands would be useful.

Rogers (chat) - The problem is that in these med/high basins, streamflow depletion is likely impacting beneficial uses (and ESA-listed species) currently. Managing to a historical point in time does not ensure you are avoiding these impacts but would likely lead to a situation where the current impacts are continued or worsened (most proposed pre-SGMA baselines are chosen during our recent drought).
He added verbally – In most of these basins that are undergoing SMGA right now in where stream flow depletion has an impact, that impact is occurring right now and should be addressed. Using a point in time in the past as a management point, doesn't do anything to deal with the potential impact especially if the point in time chosen is during our past drought.

Rogers – I would suggest a different way of looking at this. What are some of the beneficial uses of surface water that would be significant and unreasonable? It seems it would be much more consistent with the definition within the regulations as to how you would solve the problem.

Boland - I agree with Rick, just replacing significant and unreasonable with adverse impacts, it doesn't take you much further than the original statements. The other suggestion is it seems the viability of GDEs and beneficial uses of surface water are synonymous here. GDEs that aren't in the surface water body – I

am not sure they are in scope for this Undesirable Result like they would be addressed by water level considerations.

Trotta – I think some of the details are things we thought about. Rather than including all GDEs, it sounds like focus on GDE fish and other animals within the surface water itself rather than riparian vegetation outside.

Boland – Yes, I meant GDEs in this context is a subset of beneficial uses.

Maxfield – The Dept. supports not using historic levels or conditions but using stream flows appropriate for the different life stages rather than looking at historic levels or a certain point in time.

Rohde – I am trying to see this statement as a goal statement. This statement is more like an "I want to get fit" statement and not very helpful for guiding what Minimum Thresholds and Measurable Objectives should be. It should be a little more explicit about what would constitute that.

King – Melissa – your analogy – isn't that more the Undesirable Result? The Significant and Unreasonable is supposed to be general.

Melissa – I thought in Santa Cruz County we were more specific in the process. Maybe I am getting the two mixed up.

King – Yes, we got a lot more specific in the Undesirable Results.

Boland – Could you remind me of the distinction between Undesirable Results and Significant and Unreasonable.

King – The Significant and Unreasonable are conditions you don't want in the basin, a general guiding statement. If you didn't know anything about SGMA, you would think they are very similar. In the SGMA process, the Undesirable Results are defined as a combination of Minimum Threshold exceedances. You can have Minimum Thresholds set in your monitoring wells, and these Undesirable Results allow you to fall below the Minimum Thresholds a certain number of times without being classified as Undesirable. It is a definition of how many times you can exceed Minimum Thresholds.

Potential Methodology for Determining ISW SMC

Marcus Trotta provided an overview of the technical work staff has been doing and what we need to do to move forward with this Sustainable Management Criteria. He presented the Strawman methodology for determining Interconnected Surface Water SMC.

Stephen Maples, Sonoma Water went into detail on work completed so far and presented model results intended to help indicate surface water behavior that might be occurring in the basin. Maples explained the goal is to leverage measurements and models to characterize groundwater – surface water interactions and surface water depletion.

Marcus Trotta suggested it might make sense to set interim SMC while working to build datasets and model capabilities during GSP implementation.

1. For Remote Monitoring Points where we have less than five years of data, use autumn groundwater-level contour maps of shallow aquifer system from year with greatest simulated SWD (e.g., autumn 2015 for SRP) to pick Minimum Threshold elevations at the locations of the Remote Monitoring Points
2. For any Remote Monitoring Points with more than five years of data, use measured historical low elevations

3. For Measurable Objectives, pick a year representative of lower values of surface water depletion or set "aspirational" Measurable Objectives of maintaining groundwater levels above streambed?
4. Include a detailed plan in the GSP for how we will build our datasets and improve simulation capabilities to more fully incorporate the correlation assessment methodology we have tested.

Sam Magill then asked for feedback and reactions from the group about what Stephen presented.

Questions/Comments

Hall (chat) - What does RMP mean again?

Trotta (chat) – Representative Monitoring Point, which is where SMCs are set and monitored.

Maurice Hall – You indicated your modeling didn't overlap with the monitoring period. I am guessing that will be corrected and you extend your model into the monitoring period?

Trotta – We recently updated the model through 2018 conditions for the GSP. We will be making refinements and extending the model period during the implementation phase of the GSP so we can better capture more recent high-resolution data once we have more than one year's data to calibrate.

Rogers – How will the relationship between stream flow depletion and impact of surface water beneficial uses be fleshed out? Are there plans in the future?

Trotta – I think Stephen's analysis show that some of the metrics could be incorporated into setting the groundwater level as an SMC are potential increases of streamflow at certain times of the year or year-round. If there are certain flow requirements for certain beneficial users in certain areas that need to be considered, I think this methodology would be well suited to address that.

Rogers – So, in the interim are we going to be flushing those out in the future or will it happen in the first couple years of the GSP? When would those thresholds be developed?

Trotta – Those thresholds are where we would need longer data sets to better correlate the model results with our observations. And to help develop what the targets and thresholds are that are considered for beneficial uses in the streams. How we do that will be detailed in the GSP.

Maples – This type of analysis can tell us if you have a flow during a certain year, what would it have been without the pumping. Based on the results of biological studies, here is what an ebb and flow should be in this tributary, then we can go back and say this is what the model is telling us.

Hall – It looks like you have some nice approaches for correlating with groundwater levels to stream depletions and an amazing set of data. Tracking as best I could from what was provided, I would say in no case would you want to set your targets at or below one of the more severe droughts on record. You would want a margin of error above thresholds, because you don't want to go that low, and there is uncertainty in the model. I would also say you should consider having target levels that vary for different year times. Seems you would want to set targets at or above historic levels and do it for different times of the year. One additional point is that SGMA does allow to continue depletions at historic levels if it is the best you can do. Adding onto the basic SGMA requirement we should try to characterize how we can go above and beyond the basic requirements and have projects that raise levels above historic levels.

Boland – On the graph that shows the water level line with and without pumping - could a similar graph be made for stream flows with and without surface diversion?

Maples– I think it would be possible. I think turning of the pumping in the model is relatively easy to do.

Boland – I don't think it is necessary for the SMC but paints a picture of what is happening in the stream system.
Maples – Yes, it could give some context to pumping relative to surface water deletion.
Boland – Certain years and times of year are more important.

Zimmer – The original SRP model modelled all diversions as groundwater pumping. We have some data from the 2014-2015 drought. Data show that surface water diversions are not the major type of diversion in the summer and groundwater pumping becomes more prevalent due to supply, there isn't enough surface water to divert. That is the pattern that surface water diversions can drop off during the summer.
Andy Rich – I think the total surface water rights is about 200 acre-feet per year total face value within the subbasin. My gut feeling is the 200 acre-feet per year value is going to be a lot smaller than the total stream flow depletion caused by overall pumping in the basin and areas outside it. I don't think removing the surface water rights will cause a big change in the overall stream flow.
Maples – The model suggests it is much more than the 200-acre feet of stream flow depletion due to pumping.
Boland – If you pair it with management actions that involve coordinate surface water activities, it may make the depletion more reasonable.
Lisa Parker – One could also say that it is significant but not unreasonable. It could be significant for other reasons. If it doesn't affect beneficial users, then it isn't unreasonable.
Boland – I think you should keep in mind what management actions could be done.

Jasperse (chat) – What about wells pumping under riparian rights?
Boland. The Russian River is unique. Riparian rights aren't subject to the authority of SGMA. I believe the well pumping into the riparian rights would not be contributing to depletions as defined by SGMA.

Rohde – It would be good to understand what biological flow requirements are necessary for key ecological assets identified as being a GDE or endangered and seeing what their needs are when establishing aspirational measurable objectives. If people will have to reduce or cease pumping to achieve a measurable objective, it will have to be for a good reason.

Hall – I assume you are open to receiving feedback after this meeting about what was presented today?
Trotta – Yes, Stephen's presentations will be sent to you with specific questions.

Natalie Stork – You have all done some great work and I appreciate getting everyone together to provide feedback. Very helpful conversations. Thank you for sharing.

Rogers – I believe that whatever thresholds we come up with, they need to have a linkage to what the impact is to the beneficial use of the surface water. I am looking forward to working with everyone to figure out what this might be.

Andrew Renshaw – I would like to emphasize bullet #4 on slide 16. One thing to consider is developing a plan and schedule for filling data gaps and describing how you would move from an interim type SMC to something more permanent.

Representative Monitoring Point (RMP) Overview and Next Steps

Marcus Trotta shared the work currently being done related to identifying Representative Monitoring Points for surface water depletion and presented maps.

Questions/Comments

Maxfield (chat) – Can files of these maps be shared with us? I would like to look at them more closely and it is hard to read them here.

Trotta – Yes, we will send out the maps and hydrographs.

Review Meeting Action Items / Next steps

Marcus covered next steps in developing SMC for Depletion of Interconnected Surface Water that include:

1. *Continue developing DRAFT Significant and Unreasonable Statement*
2. *Complete GDE and ISW mapping*
3. *Further evaluate potential RMP network*
4. *Develop draft SMC at each proposed RMP based on potential methodology*
5. *Provide update on potential methodology at January AC meetings*

Marcus suggested Sam schedule an additional meeting for this group in early January.

Jay Jasperse reiterated there is lots of work ahead of us. He thanked the folks for participating and wished everyone happy holidays.

Questions/Comments

Hall (chat) – Thanks to you folks at the GSA - thanks for the opportunity to weigh in. I look forward to seeing the materials, digging in a bit more, and hopefully providing some useful input.

Attendees

Jessie Maxfield, CA Department of Fish and Wildlife
Natalie Stork, State Water Resources Control Board
Val Zimmer, State Water Resources Control Board
Sam Boland-Brien, State Water Resources Control Board
Maurice Hall, Environmental Defense Fund
Melissa Rohde, The Nature Conservancy
Rick Rogers, National Marine Fisheries Service
Andrew Renshaw, Dept. of Water Resources

Lisa Porta, Montgomery & Associates
Georgina King, Montgomery & Associates
Jay Jasperse, Sonoma Water
Marcus Trotta, Sonoma Water
Andy Rich, Sonoma Water
Mitch Buttress, Sonoma Water
Stephen Maples, Sonoma Water
Sam Magill, Work Group Facilitator
Simone Peters, Sonoma Water (recorder of meeting notes)

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GROUNDWATER SUSTAINABILITY AGENCIES

SUSTAINABLE MANAGEMENT CRITERIA FOR DEPLETION OF INTERCONNECTED SURFACE WATER

Time	Agenda Item
1:00	Agenda Review and Work Group Introductions Sam Magill , Work Group Facilitator All Work Group Participants
1:05	Summary of ISW SMC Work Group Input to Date Sam Magill
1:15	Review and Discuss Draft Significant and Unreasonable Conditions Statement • Review Initial Draft Statement • Summary of Previous Advisory Committee Input • Review Updated Draft Statement Marcus Trotta, Sonoma Water Sam Magill
1:35	Potential Methodology for Determining ISW SMC • Correlation Assessment of Simulated Streamflow Depletion with Groundwater Levels • Discussion of Potential Methodology Approaches for establishing minimum thresholds (MTs) and measurable objectives (MOs) Marcus Trotta Stephen Maples, Sonoma Water
2:35	Representative Monitoring Point (RMP) Overview and Next Steps Marcus Trotta, Sonoma Water
2:55	
3:00	Meeting Adjourns

Summary of ISW SMC Work Group Input to Date

Summary of Initial Work Group Input from 10/7 Meeting

- Characterizing hydrologic variability is important
- Measuring potential impacts and defining cause/effect to surface water depletion is important for establishing MTs
- Start by defining where the critical areas for preserving surface water levels; placing monitoring at these “choke points” could help define impacts
- Analysis is promising, and shows the connection between groundwater levels and stream flows
- 2015 baseline- using a dry year could lower MTs; use a variety of document water years and habitat conditions
- Think about in terms of what can be done to manage the SMC
- Recommend developing significant and unreasonable statement to guide SMC development

Review and Discuss Draft Significant and Unreasonable Conditions Statement

Significant & Unreasonable Depletion of Interconnected Surface Water

Statement of **Significant & Unreasonable** is a qualitative statement describing groundwater conditions unacceptable to beneficial uses and users of water in the basin. These describe what conditions are to be avoided and serve as an initial framework around which the quantitative SMC are developed.

As defined in the draft DWR SMC BMP (DWR, 2017), statements of significant and unreasonable conditions should identify the following:

- Who or what is impacted by significant and unreasonable conditions,
- What kind of impact constitutes significant and unreasonable,
- Over what time period are conditions significant and unreasonable, and
- Over what geographic area are conditions evaluated.

Example Statements from Other GSPs

Santa Cruz Mid-County Basin GSP:

Significant and unreasonable depletion of surface water due to groundwater extraction, in interconnected streams supporting priority species, would be undesirable if there is more depletion than experienced since the start of shallow groundwater level monitoring through 2015.

Eastern San Joaquin and Merced GSPs:

Significant and unreasonable depletions of interconnected surface water in the Eastern San Joaquin Subbasin are depletions that result in reductions in flow or levels of major rivers and streams that are hydrologically connected to the basin such that the reduced surface water flow or levels have a significant adverse impact on beneficial uses and users of the surface water within the Subbasin over the planning and implementation horizon of this GSP.

Example Statements from Other GSPs

Salinas 180/400 Subbasin GSP:

Significant and unreasonable depletion of interconnected surface water in theSubbasin is depletion of interconnected surface water flows that may prevent the MCWRA from meeting biological flow requirements in the Salinas River, or would induce an unreasonable impact on other beneficial uses and users such as surface water rights holders. The GSA does not have authority to manage reservoir releases and is not required to manage surface waters.

Cayuma Basin GSP:

Significant and unreasonable depletions of interconnected surface water are reductions in the viability of agriculture or riparian habitat within the Basin over the planning and implementation horizon of this GSP.

Significant and Unreasonable Conditions- Initial Advisory Committee Input

- **Who/what is impacted by S&U conditions?**
  - Recreation
  - Water well levels
  - Desiccation of riparian vegetation/habitat or direct impacts to species
  - Surface water rights holders (particularly in late summer/fall)
  - Specific areas of impact:
    - Nathanson Creek
    - Other?

Advisory Committee Input (cont.)

- **What kind of impact constitutes S&U?**
  - Easter San Joaquin model may be useful- maintain stream flows to protect beneficial users and uses
  - Lowering of static and dynamic well-water levels could be an early warning trend
  - Any groundwater pumping activities which stop or reverse recovery of sensitive species
  - Repeated or progressive surface water depletions impacting surface water withdrawal

Initial Advisory Committee Input (cont.)

- **Over what time period are conditions S&U?**
  - Year round- there could be negative impacts in wet months due to over pumping
  - Year-to-year surface water depletions can severely impact species (in addition to impacts within a single year)
  - Over various water-year types- impacts are dependent on how much/how little rainfall in a given year

Initial Advisory Committee Input (cont.)

- **Over what geographic area are conditions evaluated?**
  - Atascadero/Green Valley Creeks serve as recharge for Sebastopol-to-Graton GSA should be included
  - Areas near stream channels not already encroached on/urbanized
  - Critical recharge areas
  - Stream courses/wetlands with high past/current saturation zones

Current Strawman Significant and Unreasonable Statement

Significant and unreasonable depletion of surface water from interconnected streams, occurs when groundwater pumping within the Basin/Subbasin depletes streamflows below historical levels and adversely impacts the viability of GDEs or other beneficial surface water users.

Potential Methodology for Determining ISW SMC

Potential Methodology for Determining ISW SMC

1. Correlation Assessment of Simulated Streamflow Depletion with Groundwater Levels
   - Incorporates available historical data and variety of water-year types
   - Analysis of groundwater pumping effects on surface water depletion
   - Use simulation analysis and historical data together to inform selection of SMCs
   - Allow for any potential future instream flow requirements, etc.

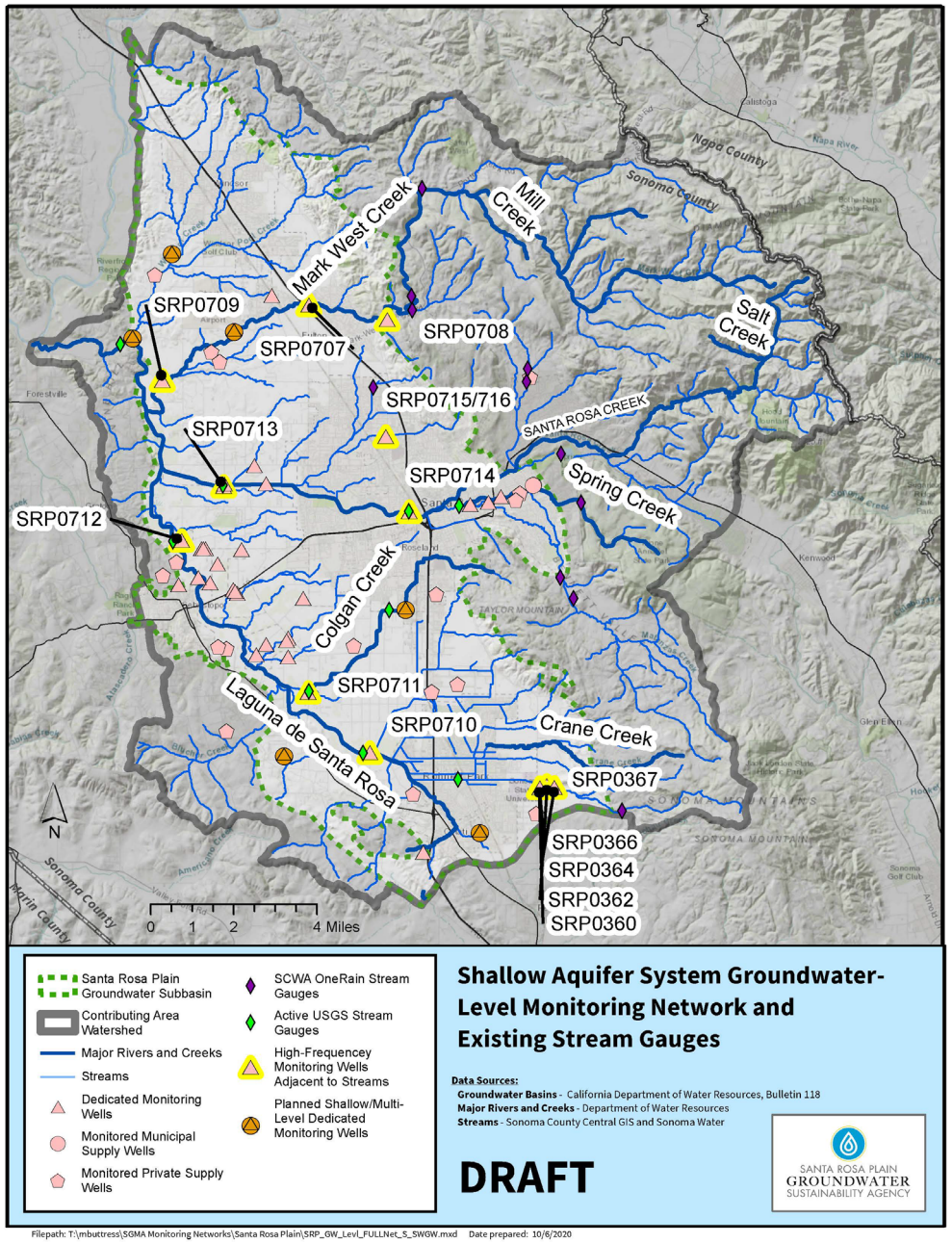
2. Discussion of potential methodology approaches for establishing minimum thresholds (MTs) and measurable objectives (MOs)

Strawman Methodology for Determining ISW SMC

Strawman proposal for setting "interim" SMCs while we work to build datasets and model capabilities during GSP implementation:

1. For RMPs where we have less than 5-years of data, use Fall groundwater-level contour maps of shallow aquifer system from year with greatest simulated SWD (eg, Fall 2015 for SRP) to pick MT elevations at the locations of the RMPs
2. For any RMPs with >5 years of data, use measured historical low elevations
3. For MOs, pick a year representative of lower values of SWD or set "aspirational" MO of maintaining GWLs above streambed?
4. Include a detailed plan in the GSP for how we will build our datasets and improve simulation capabilities to more fully incorporate the correlation assessment methodology we have tested.

Representative Monitoring Point (RMP) Overview and Next Steps


Mark West Creek
Mill Creek
Salt Creek
SRP0709
SRP0708
SRP0707
SRP0715/716
SANTA ROSA CREEK
SRP0713
SRP0714
Spring Creek
SRP0712
Colgan Creek
SRP0711
Laguna de Santa Rosa
SRP0710
Crane Creek
SRP0367
SRP0366
SRP0364
SRP0362
SRP0360
N
0 1 2 4 Miles
Santa Rosa Plain Groundwater Subbasin
Contributing Area Watershed
Major Rivers and Creeks
Streams
Dedicated Monitoring Wells
Monitored Municipal Supply Wells
Monitored Private Supply Wells
SCWA OneRain Stream Gauges
Active USGS Stream Gauges
High-Frequency Monitoring Wells Adjacent to Streams
Planned Shallow/Multi-Level Dedicated Monitoring Wells
Shallow Aquifer System Groundwater-Level Monitoring Network and Existing Stream Gauges
Data Sources:
Groundwater Basins - California Department of Water Resources, Bulletin 118
Major Rivers and Creeks - Department of Water Resources
Streams - Sonoma County Central GIS and Sonoma Water
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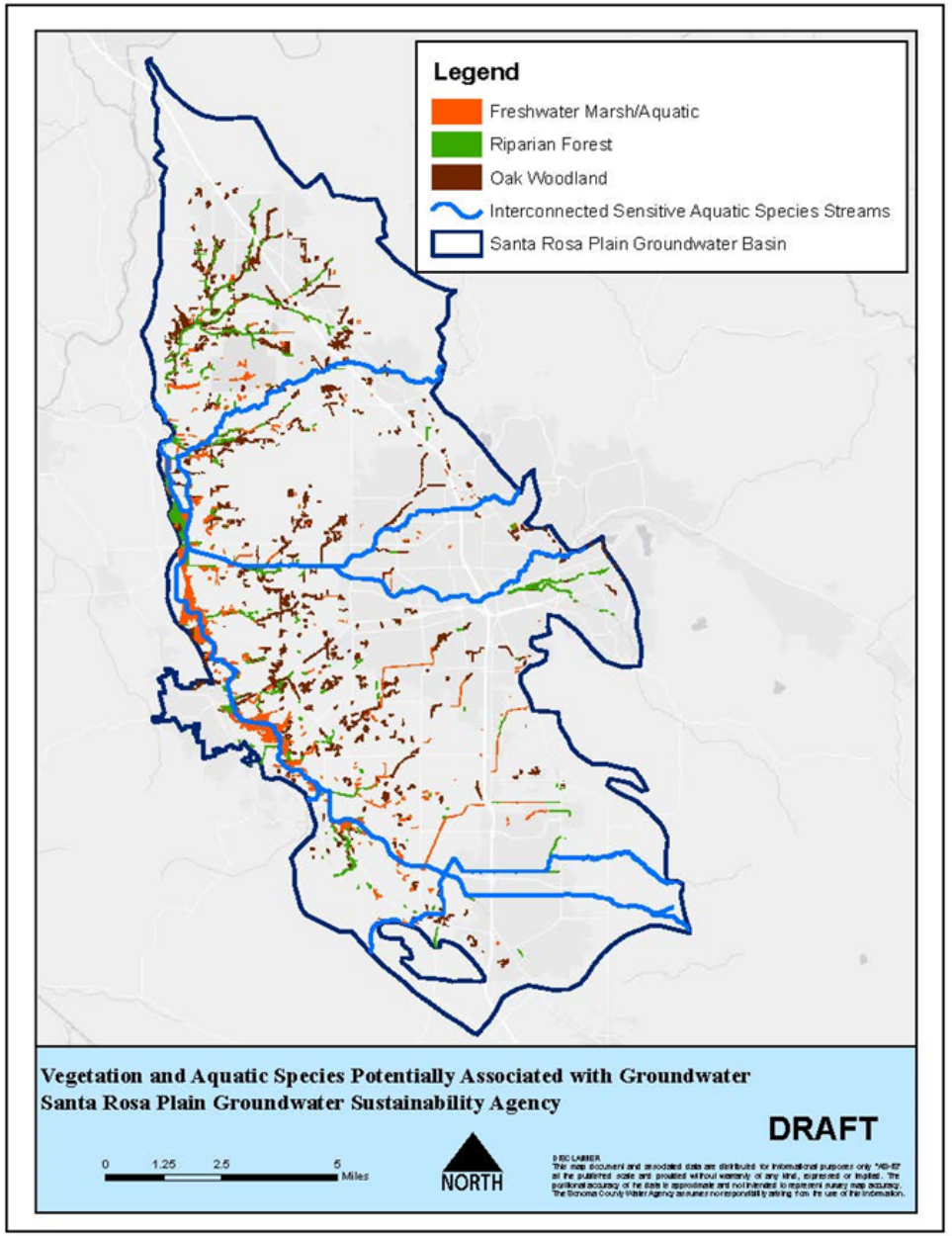
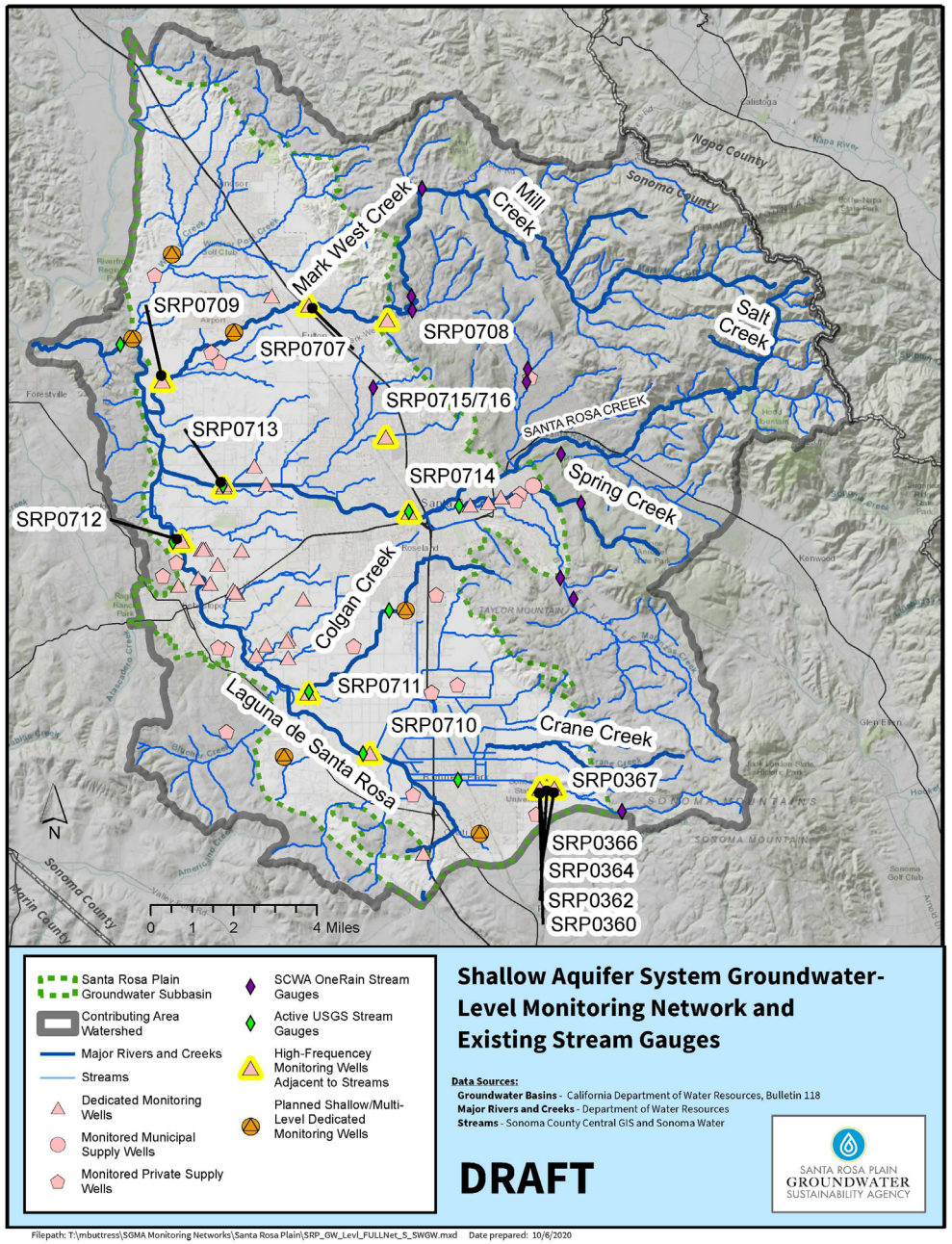
SANTA ROSA PLAIN GROUNDWATER SUSTAINABILITY AGENCY
Filepath: T:\mbuttress\SGMA Monitoring Networks\Santa Rosa Plain\SRP_GW_Levl_FULLNet_S_SWGW.mxd Date prepared: 10/6/2020


Legend
Freshwater Marsh/Aquatic
Riparian Forest
Oak Woodland
Interconnected Sensitive Aquatic Species Streams
Santa Rosa Plain Groundwater Basin
Vegetation and Aquatic Species Potentially Associated with Groundwater
Santa Rosa Plain Groundwater Sustainability Agency
DRAFT
0 1.25 2.5 5 Miles
NORTH


Mark West Creek
Mill Creek
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SRP0709
SRP0707
SRP0708
SRP0715/716
SANTA ROSA CREEK
SRP0713
SRP0714
Spring Creek
SRP0712
Colgan Creek
SRP0711
Laguna de Santa Rosa
SRP0710
Crane Creek
SRP0367
SRP0366
SRP0364
SRP0362
SRP0360
Napa County
Sonoma County
Marin County
N
0 1 2 4 Miles
Santa Rosa Plain Groundwater Subbasin
Contributing Area Watershed
Major Rivers and Creeks
Streams
Dedicated Monitoring Wells
Monitored Municipal Supply Wells
Monitored Private Supply Wells
SCWA OneRain Stream Gauges
Active USGS Stream Gauges
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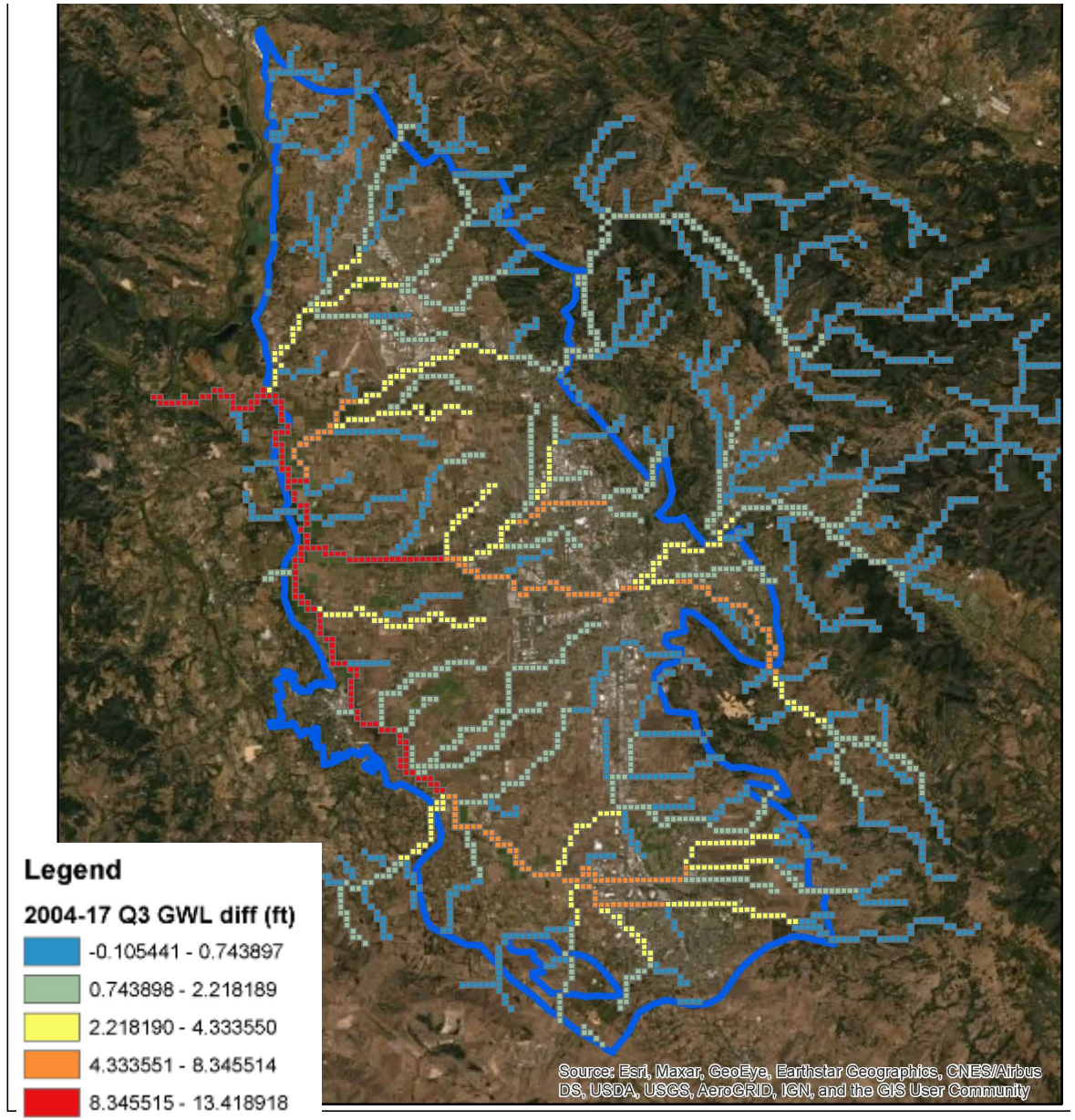
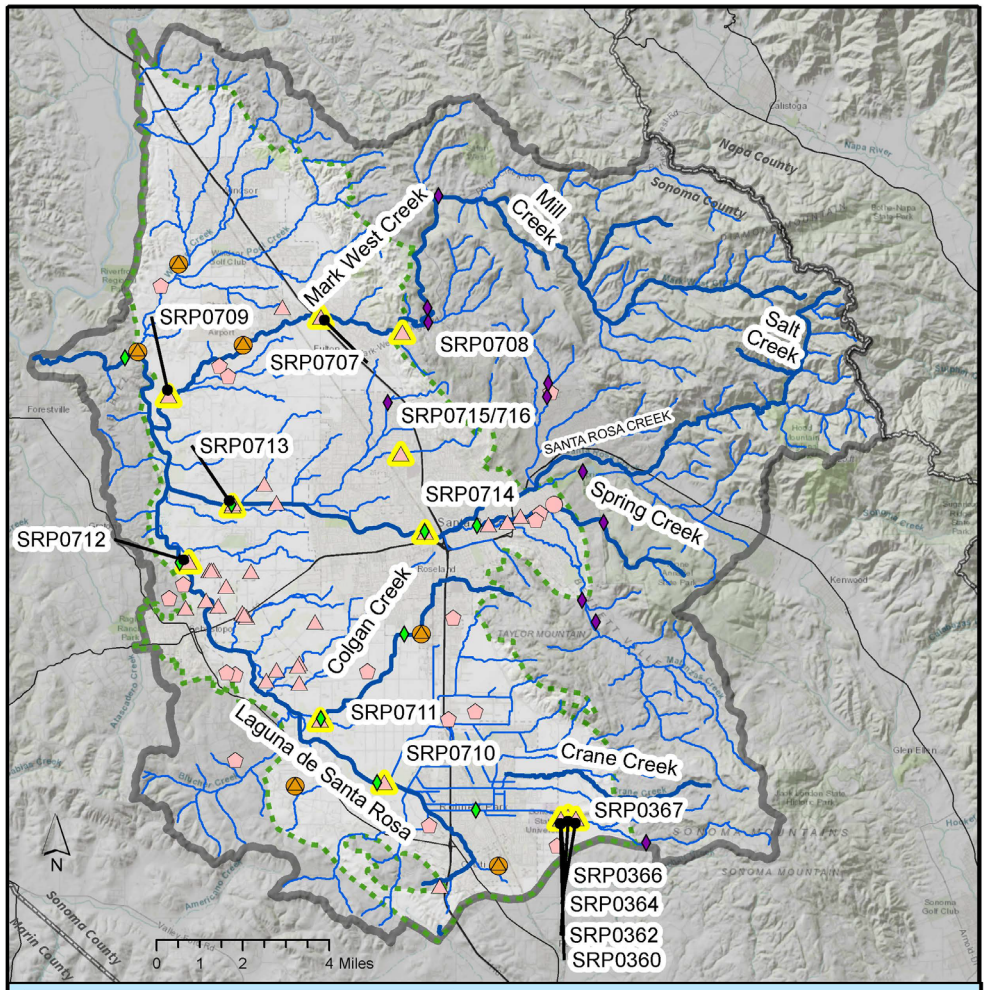
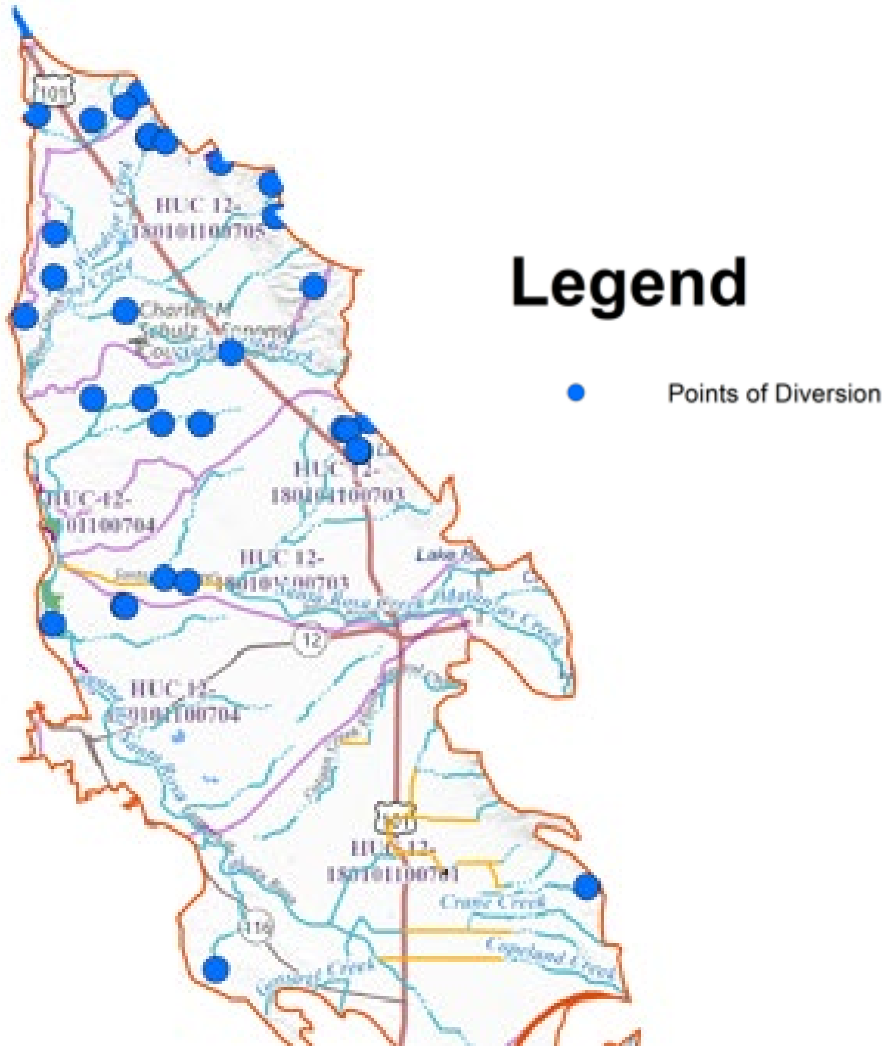

Legend
2004-17 Q3 GWL diff (ft)
-0.105441 - 0.743897
0.743898 - 2.218189
2.218190 - 4.333550
4.333551 - 8.345514
8.345515 - 13.418918
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community





Locations of Surface Water Diversions

Next Steps in Developing SMC for Depletion of Interconnected Surface Water

1. Continue developing DRAFT Significant and Unreasonable Statement
2. Complete GDE and ISW mapping
3. Further evaluate potential RMP network
4. Develop draft SMC at each proposed RMP based on potential methodology
5. Provide update on potential methodology at January AC meetings

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GROUNDWATER SUSTAINABILITY AGENCIES

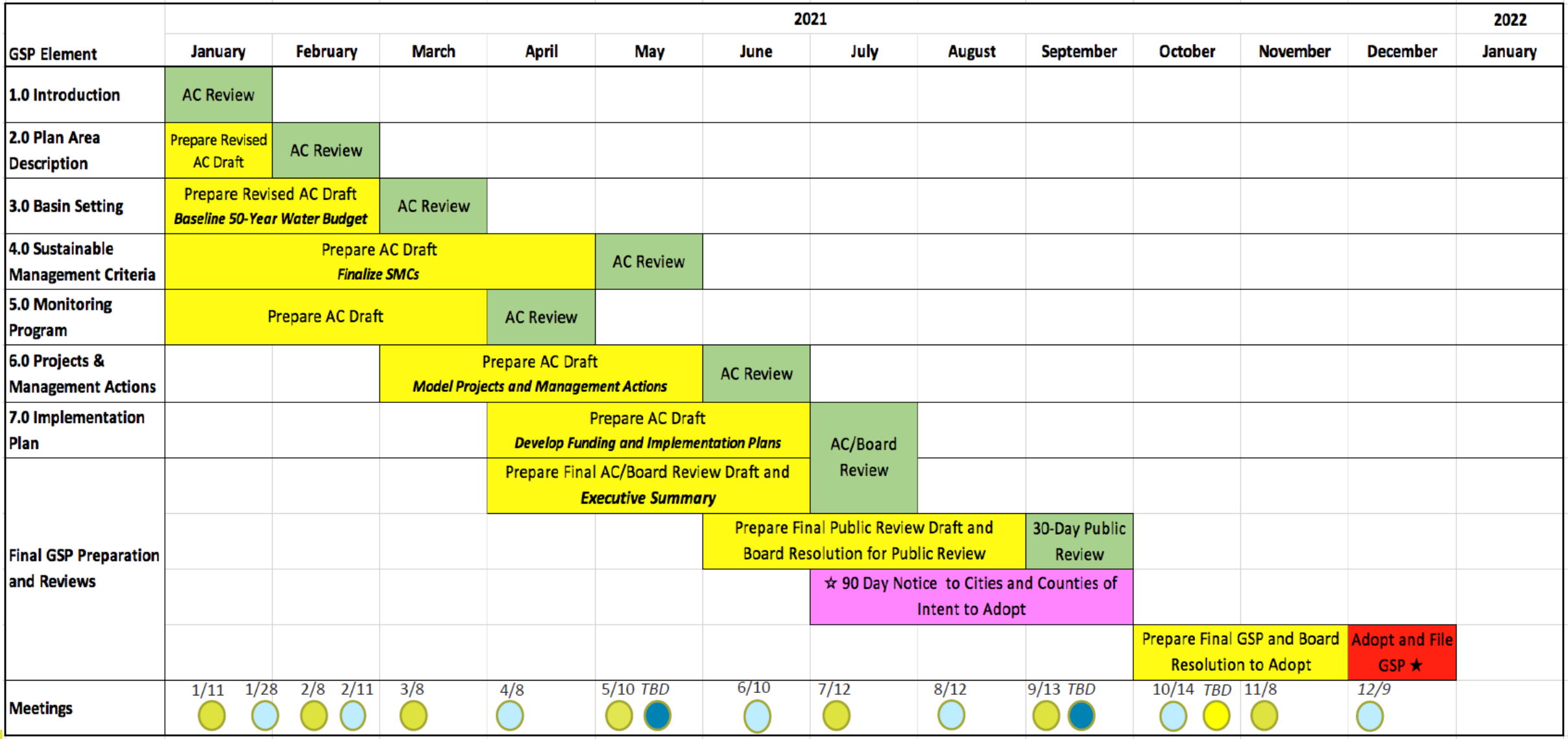
SUSTAINABLE MANAGEMENT CRITERIA FOR DEPLETION OF INTERCONNECTED SURFACE WATER

PRACTITIONER WORK GROUP MEETING #3

Agenda

1. Welcome and Intro (5 min)
2. Schedule (5 min)
3. Revisit SMC S&U and assumptions (15 min)
4. Methodology Options for MTs/MOs (45 min):
    a. Methodology descriptions with examples
    b. Discussion of benefits/issues with each example
    c. Workgroup input on approach preferences
5. Possible options for URs (20 min)
6. Data Gaps and Future Recommended Activities (30 min)
7. Next Steps

DRAFT GSP Schedule – Santa Rosa Plain



GSA Board Meeting GSA Advisory Committee Meeting GSA Community Meeting GSP Public Hearing

Work Group Schedule

January 26 Work Group Meeting (today): *Revisit Significant and Unreasonable statement, recommendations on MT/MO methodology, discuss options for URs, develop initial list of data gaps and future recommended activities for implementation plan*

February 8-10 Advisory Committee (AC) Meetings: Technical staff brief ACs on methodology approach

February 18 - Final Work Group Meeting: *Review draft MTs and MOs for each basin, develop recommendations on options for GSA Board consideration for URs, final list of data gaps and recommendations/prioritization for future activities to further develop SMC*

March 8-10 AC Meetings: Technical staff present Recommendations to ACs (Work Group members welcome to attend, help with questions)

March 11, 22, and 25 GSA Board Meetings: Technical staff present recommendations to GSA Boards for consideration (Work Group members welcome to attend, help with questions)

Revisit Significant and Unreasonable Statement

"Significant and unreasonable conditions" - phrase used to identify conditions that lead to undesirable results - not specifically defined in the GSP Regulations.

Often confused with, or used interchangeably with, undesirable results.

Significant and unreasonable conditions are physical conditions to be avoided; an undesirable result is a quantitative assessment based on minimum thresholds.

Defining significant and unreasonable conditions early in the process of developing SMC for each sustainability indicator helps set the framework by which the quantitative SMC metrics are determined.

Previous S&U Statement

Significant and unreasonable depletion of surface water from interconnected streams, occurs when groundwater pumping within the Basin/Subbasin depletes streamflows below historical levels and adversely impacts the viability of GDEs or other beneficial surface water users.

ISW SMC Practitioner Work Group 12/7/20 Feedback

- Remove reference to “stream flows below historical levels”; the goal is to be protective of stream levels independent of a historical baseline
- Maintain reference to historical levels; may provide reference point for long-term health of streams and potential impacts or fluctuations in groundwater usage
- “Stream flows” may be too restrictive; consider using “surface water” generally to cover groundwater impacts to wetlands as well
- Consider replacing “significant and unreasonable” with “adverse impacts to beneficial uses.”

Revised Strawman Significant and Unreasonable Statement

Significant and unreasonable depletion of surface water from interconnected streams occurs when surface water depletion, caused by groundwater pumping within the Basin/Subbasin, exceeds ~~depletes streamflows below~~ historical depletion ~~and~~ or adversely impacts the viability of groundwater dependent ecosystems (GDEs) or other beneficial users of surface water ~~users~~.

Notes/definitions:

- Provides guidance for technical staff to move forward with methodology based on available historical information and allows for future incorporation of flow targets or other information concerning adverse impacts to beneficial users developed by others
- "Groundwater pumping" excludes any diversions by surface water rights holders
- "Historical levels" to be defined using minimum threshold methodology
- "groundwater dependent ecosystems" defined in Basin Setting
- "other beneficial users of surface water" include surface water rights holders and recreational uses (where applicable)

Potential Methodology for Determining ISW SMC

Potential Methodology for Determining ISW SMC

Correlation Assessment of Simulated Streamflow Depletion with Groundwater Levels

- Incorporate available historical data and variety of water-year types
- Analysis of groundwater pumping effects on surface water depletion
- Use simulation analysis and historical data together to inform selection of SMCs
- Allow for any potential future instream flow requirements, etc.
- Include a detailed plan in the GSP for how we will build our datasets and improve simulation capabilities to more fully incorporate the correlation assessment methodology we have tested.

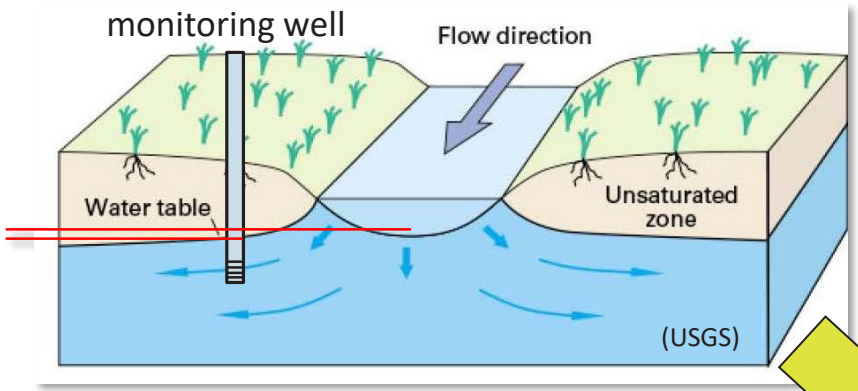
Challenges:

- At majority of potential Representative Monitoring Points (RMPs), we only have one years worth of groundwater-level data
- Variable levels of correlation between simulated streamflow depletion and groundwater levels
- Potential instream flow targets not available
- Limited data and information for assessing presence of any historical significant and unreasonable conditions

ISW SMC Practitioner Work Group Feedback on SMC Methodology Approaches

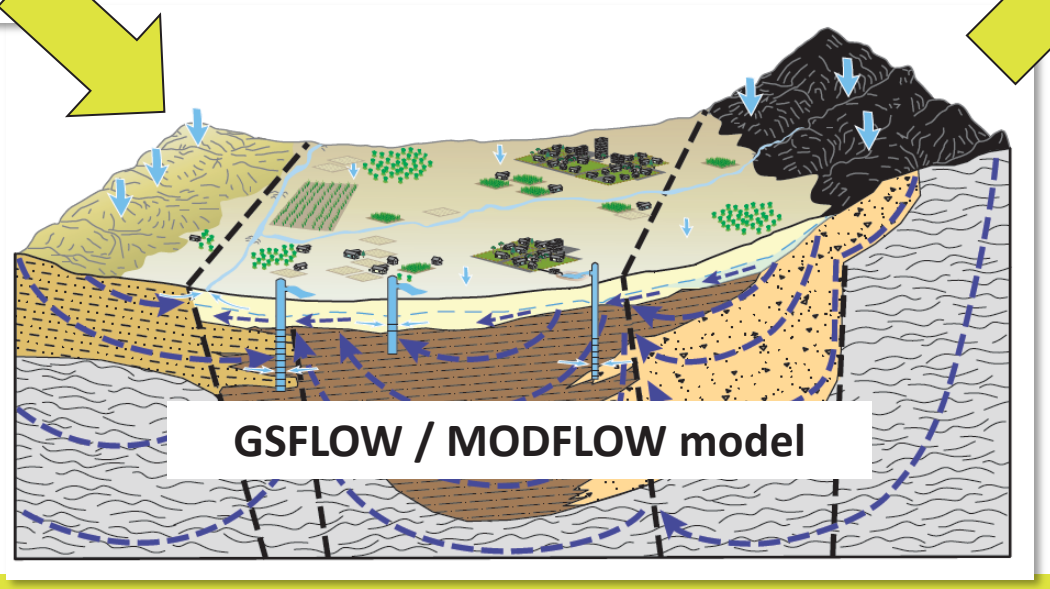
- General support for straw methodology
- Clearly linking stream flow depletion to adverse impacts from groundwater usage is important for successful implementation of the SMC
- Thresholds should not be set to one or more severe droughts in the historical records
- Linking existing biological flow requirements to the SMC may help illustrate the importance of any actions associated with the SMC
- The SMC will require an explanation of when data gaps will be filled in during the GSP implementation process

How can we leverage measurements and models to characterize GW/SW interactions and SW depletion?

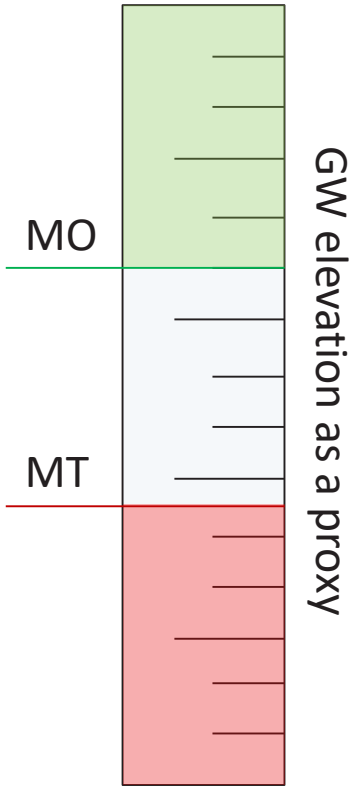


Local GW elevation (measured/simulated)

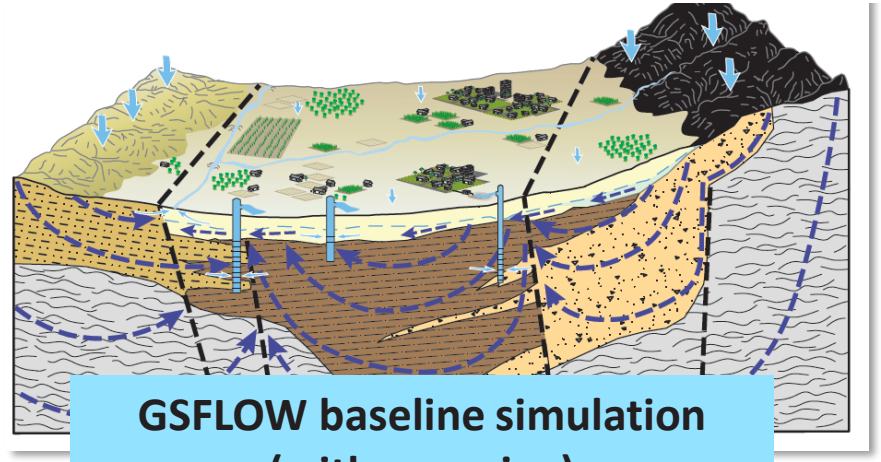
Regional SW depletion characterization (simulated)



SMCs are tied to GW elevations and informed by simulation results

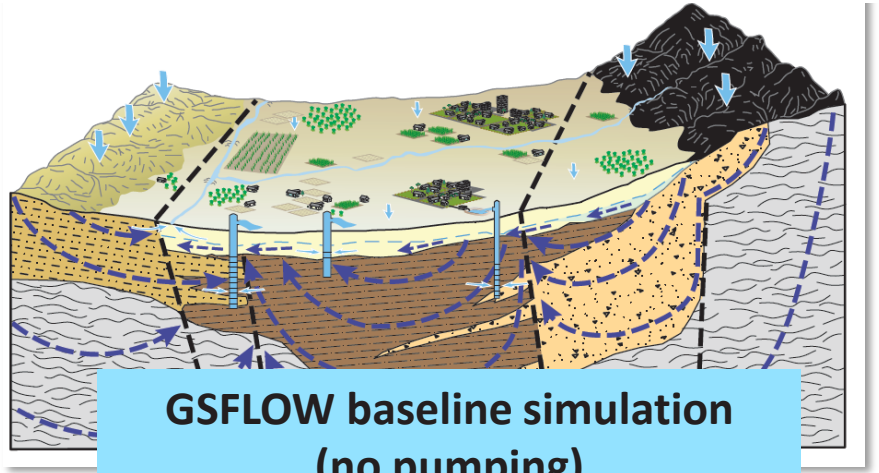


Isolate GW pumping impacts by “differencing” a historical baseline simulation (with pumping) from a identical simulation without pumping



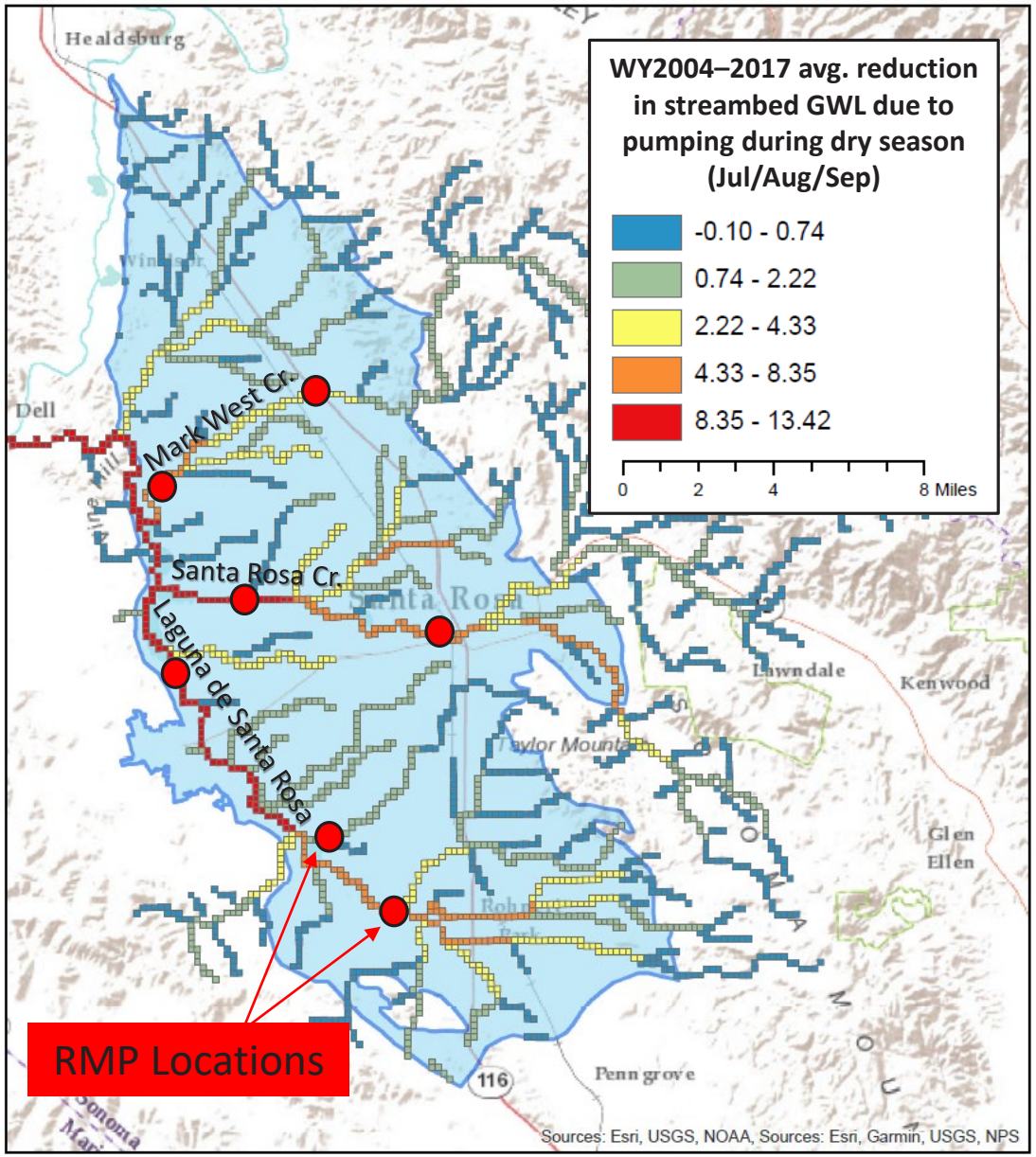
GSFLOW baseline simulation (<u>with</u> pumping)

minus



GSFLOW baseline simulation (<u>no</u> pumping)

Isolate Surface Water Depletion (SWD) from groundwater pumping



Where does pumping have greater potential to impact streamflows?

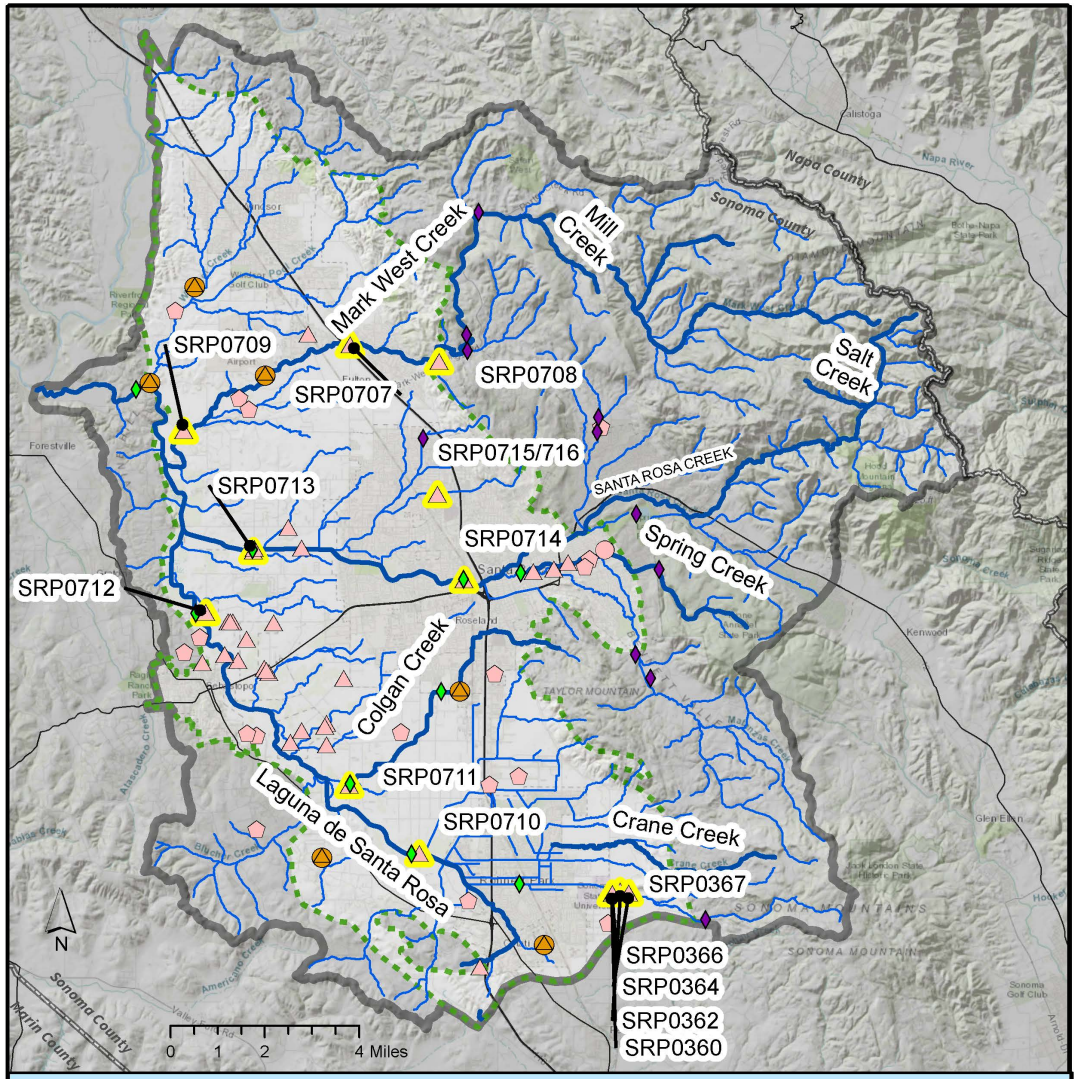
Modeling suggests that pumping has greater potential to impact streamflows on:

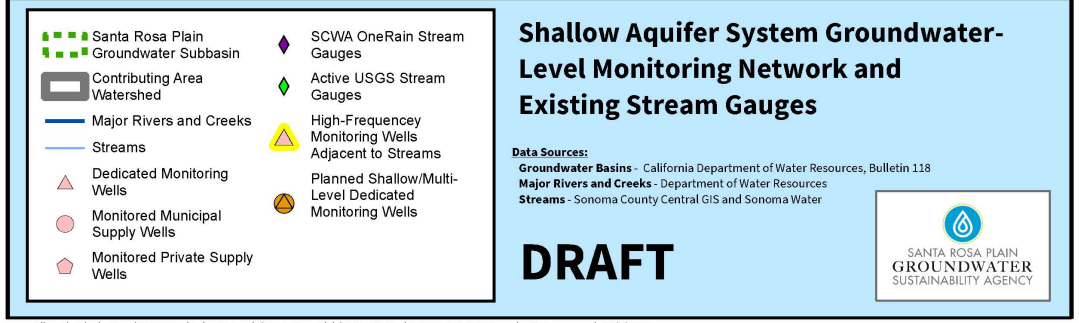
Laguna de Santa Rosa
Santa Rosa Cr.
Mark West Cr.

Actual impacts are very dependent upon:

(1) streambed/shallow aquifer hydraulic conductivity
(2) stream/aquifer configuration

What is the impact of pumping on outflows from the basin?





Shallow Aquifer System Groundwater-Level Monitoring Network and Existing Stream Gauges

Data Sources:
Groundwater Basins - California Department of Water Resources, Bulletin 118
Major Rivers and Creeks - Department of Water Resources
Streams - Sonoma County Central GIS and Sonoma Water

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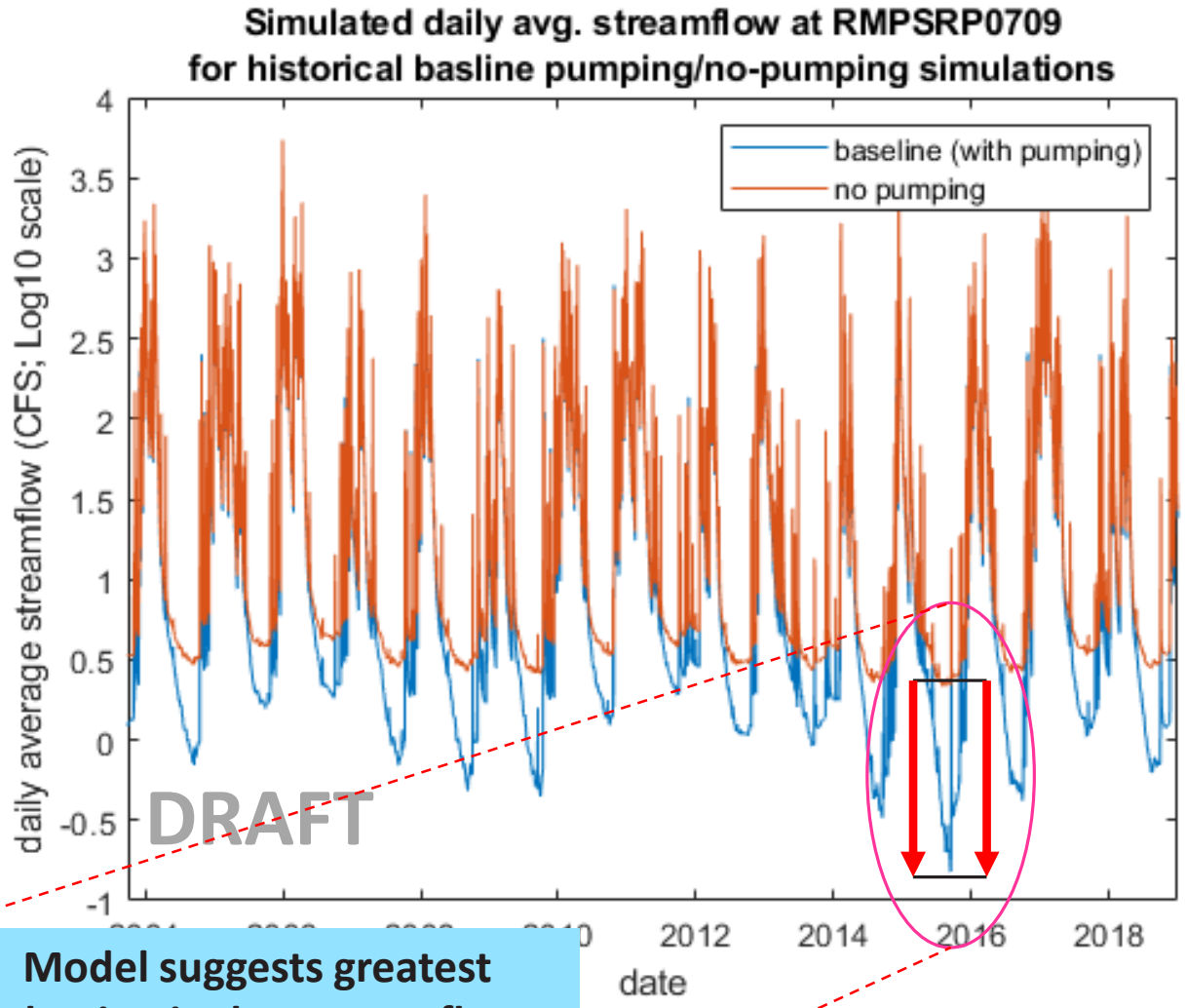
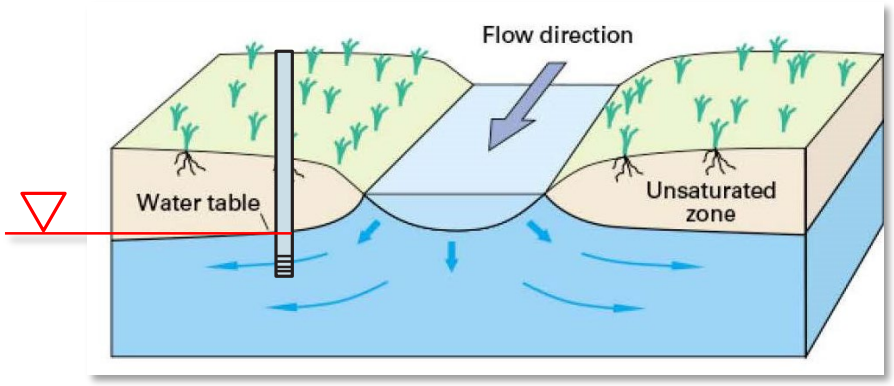
Filepath: T:\mbuttress\SGMA Monitoring Networks\Santa Rosa Plain\SRP_GW_Levl_FULLNet_S_SWGW.mxd Date prepared: 10/6/2020

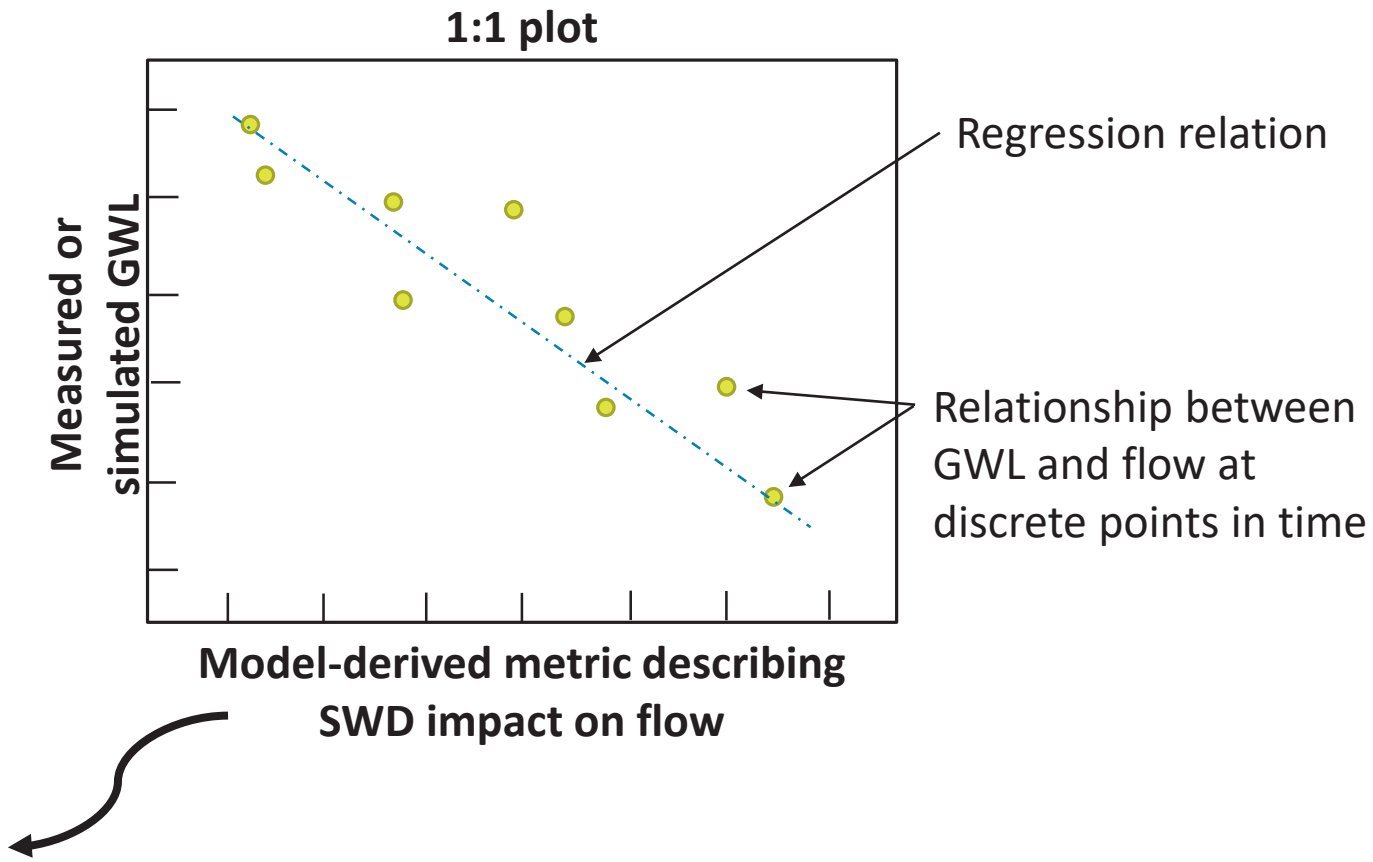


Model suggests greatest reduction in dry-season flows due to pumping during 2015

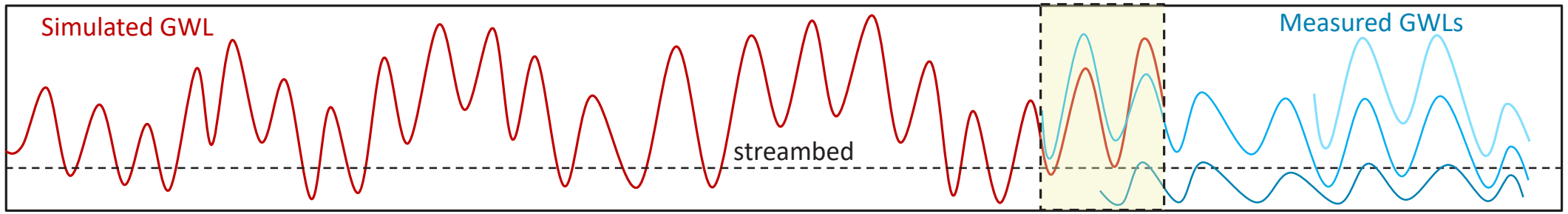
How can GWL be used as a proxy for surface water depletion?



1. **Percent reduction in streamflow due to pumping (over entire WY)**
2. **Percent reduction in streamflow due to pumping (during low-flow periods)**
3. **Number of days that SWD exceeds threshold value**



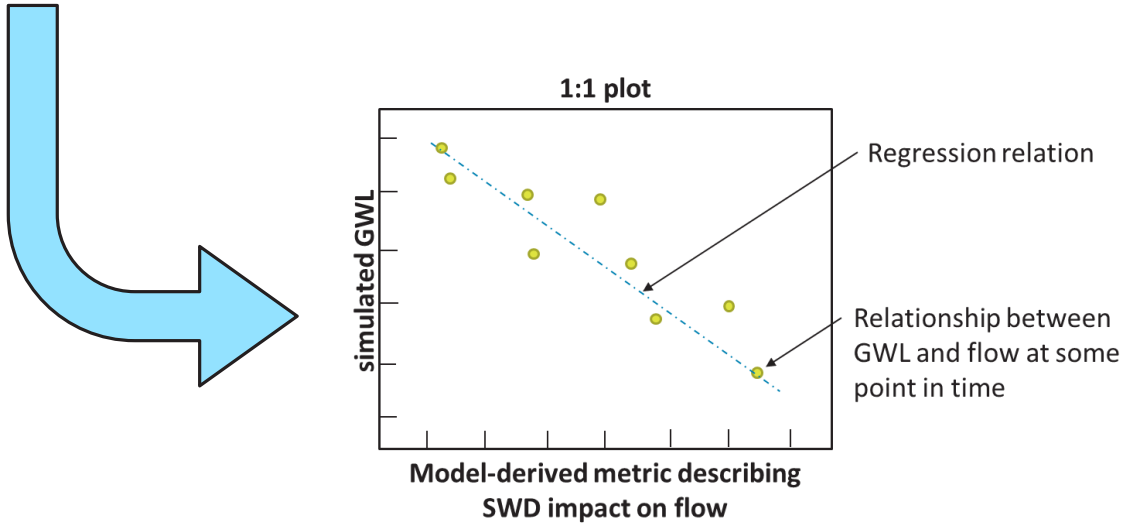
How can GWL – SWD relationship be used to inform SMC choice?



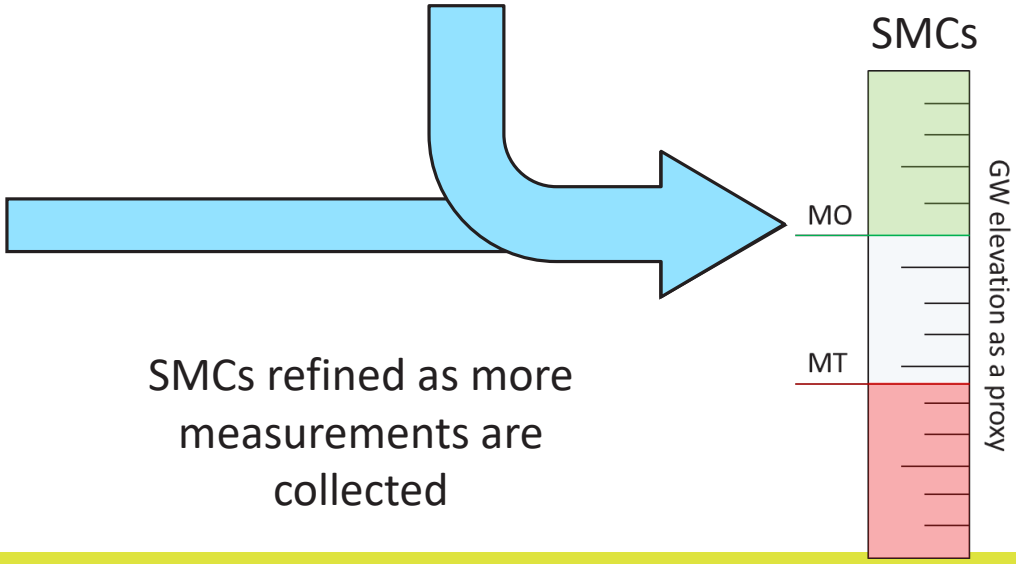
Simulation Period (1974–2018)

Little or no temporal overlap

Measurement Period (recent past-present)



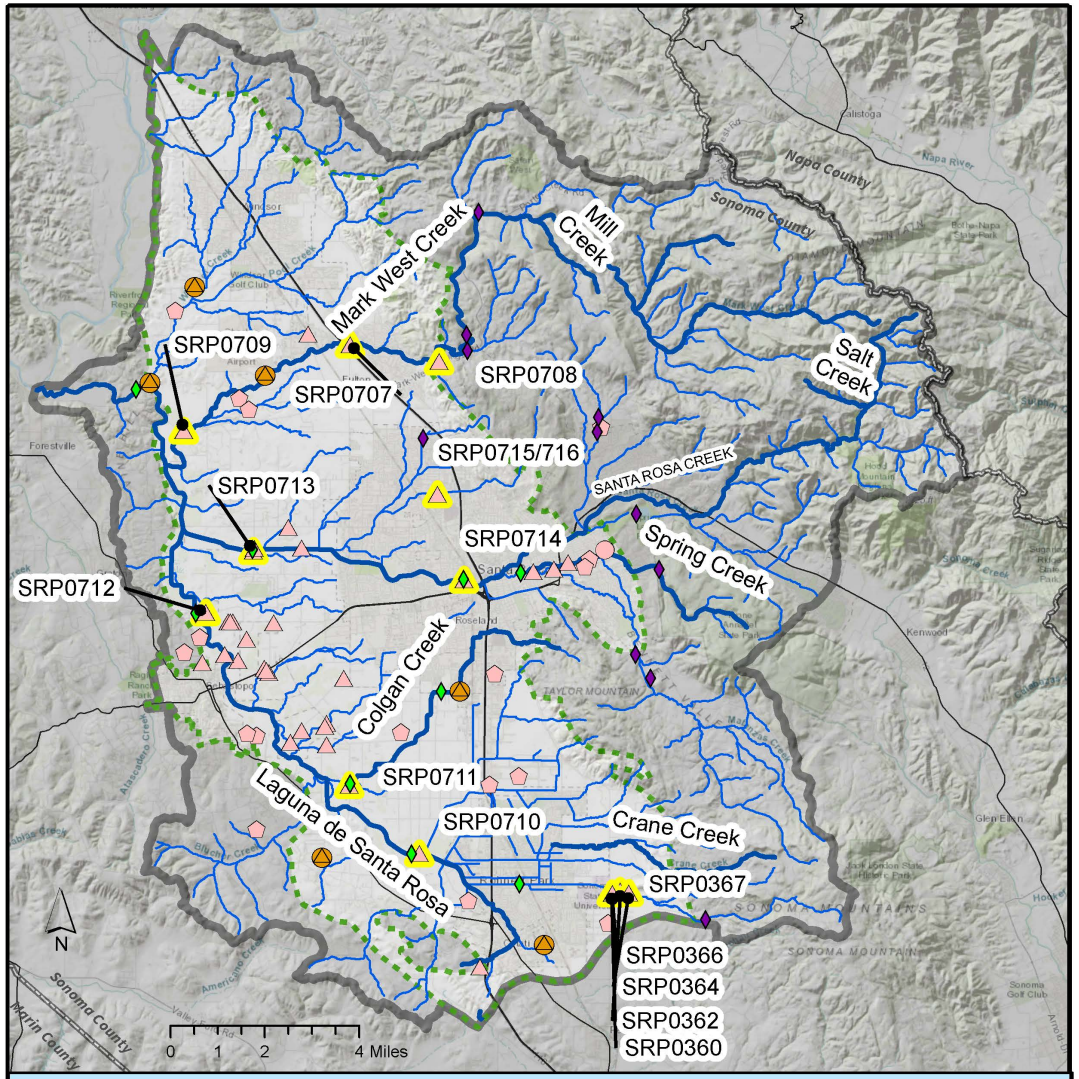
SMC choices informed by modeled SWD

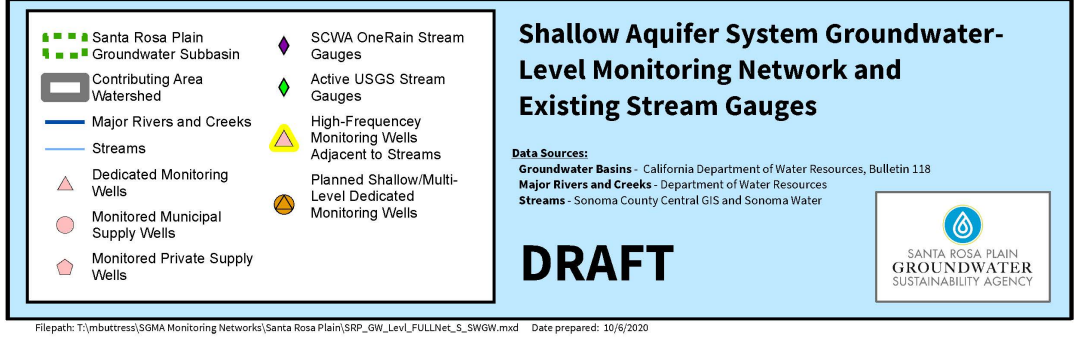


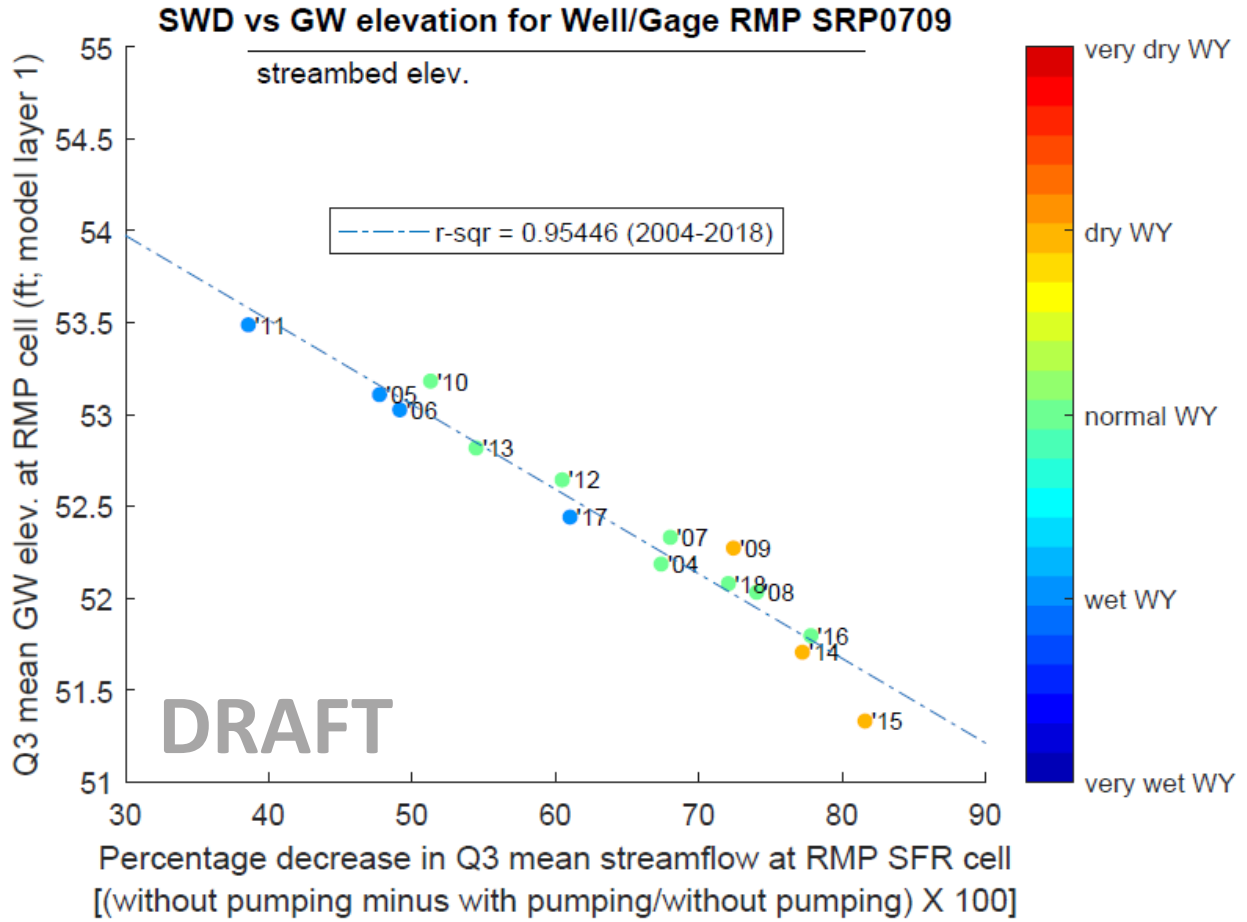
SMCs refined as more measurements are collected

Can we use GW levels as a proxy for SWD?

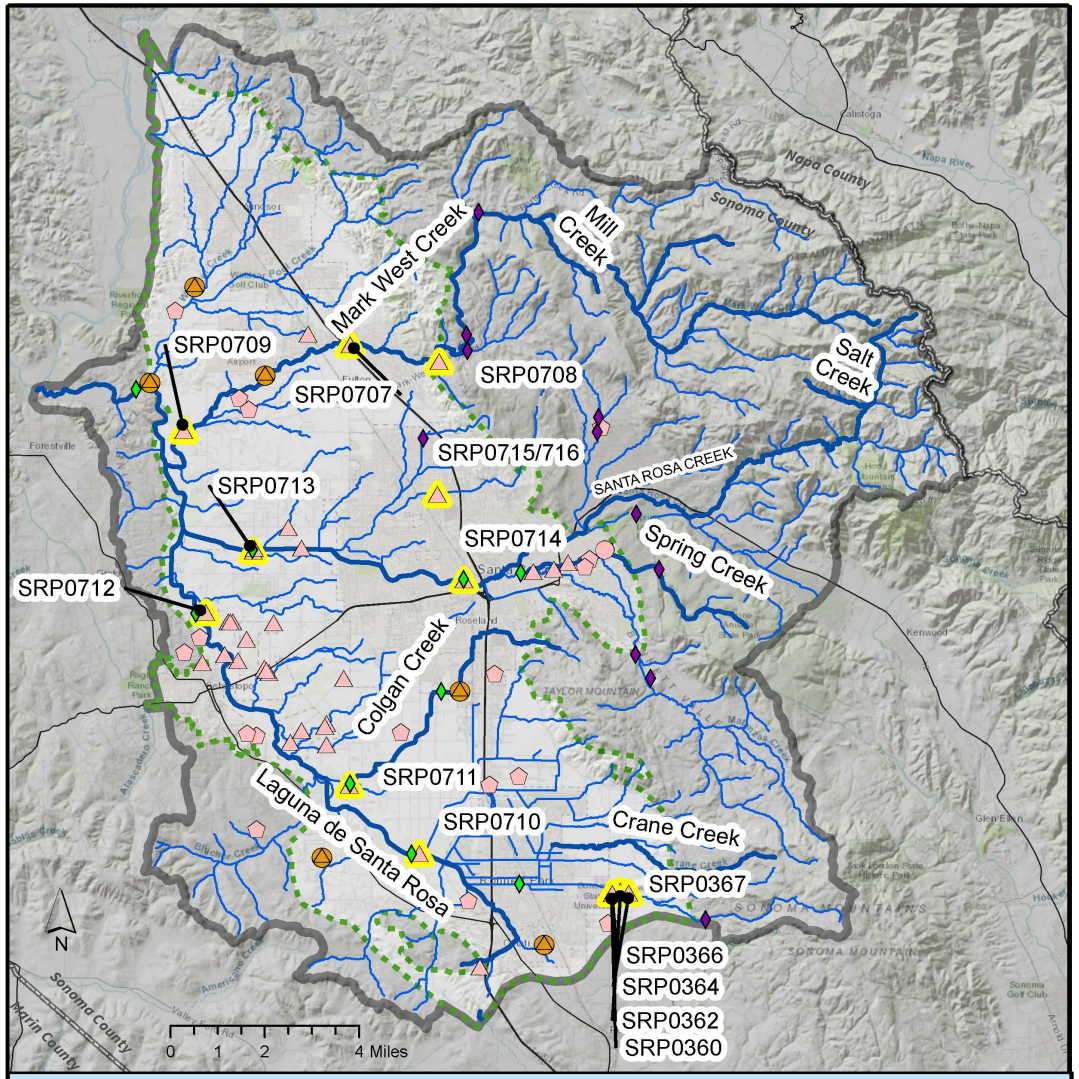
Good correlation … for simulated GW levels and SWD at some RMPs

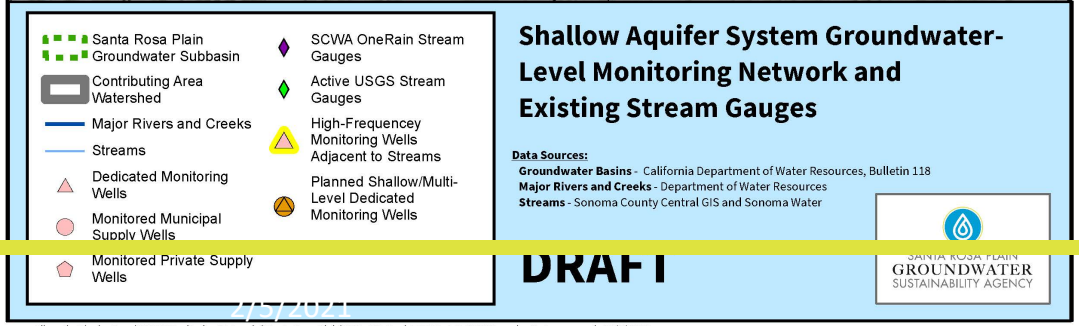


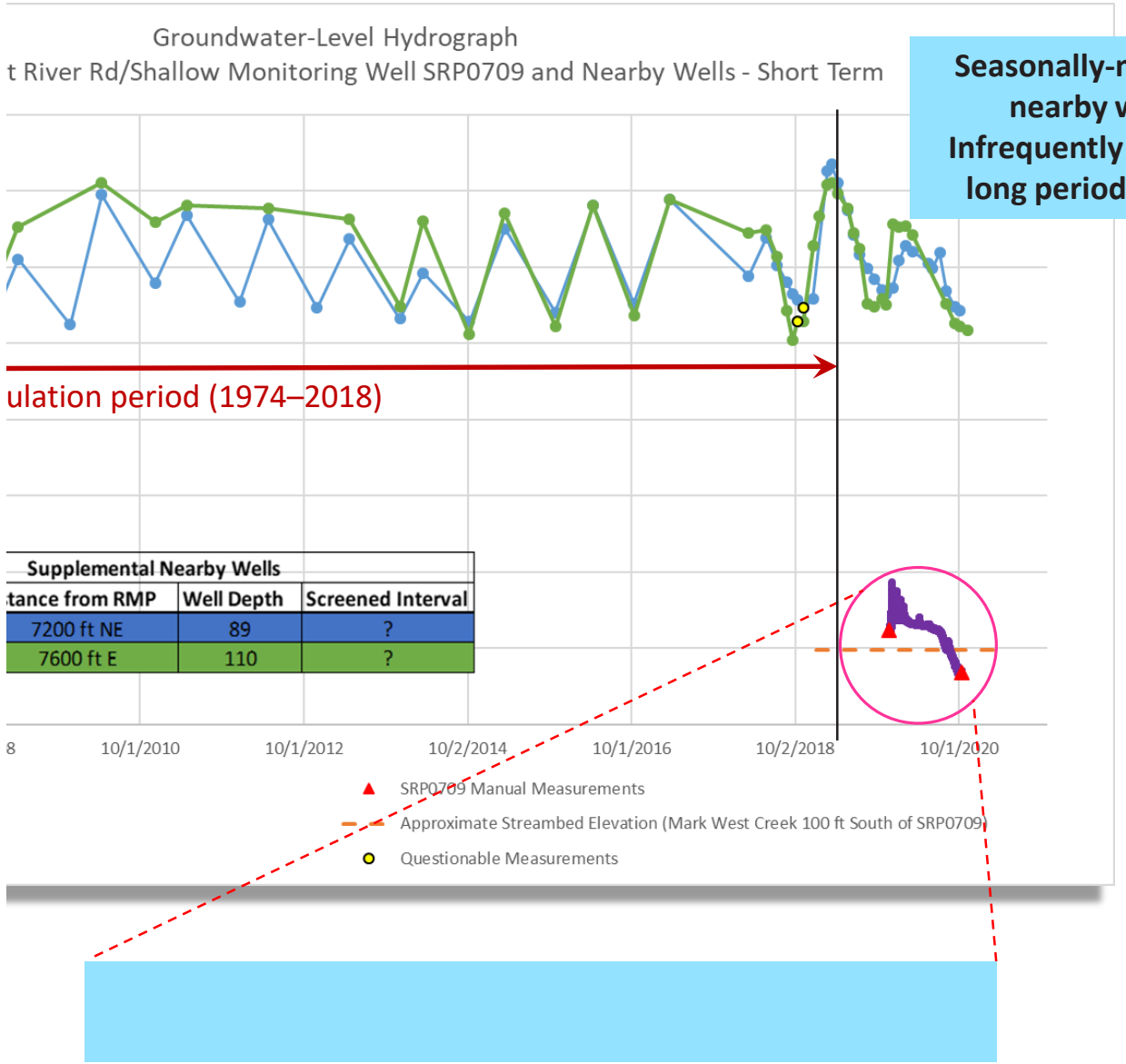




What GWL measurements do we have at RMPs?

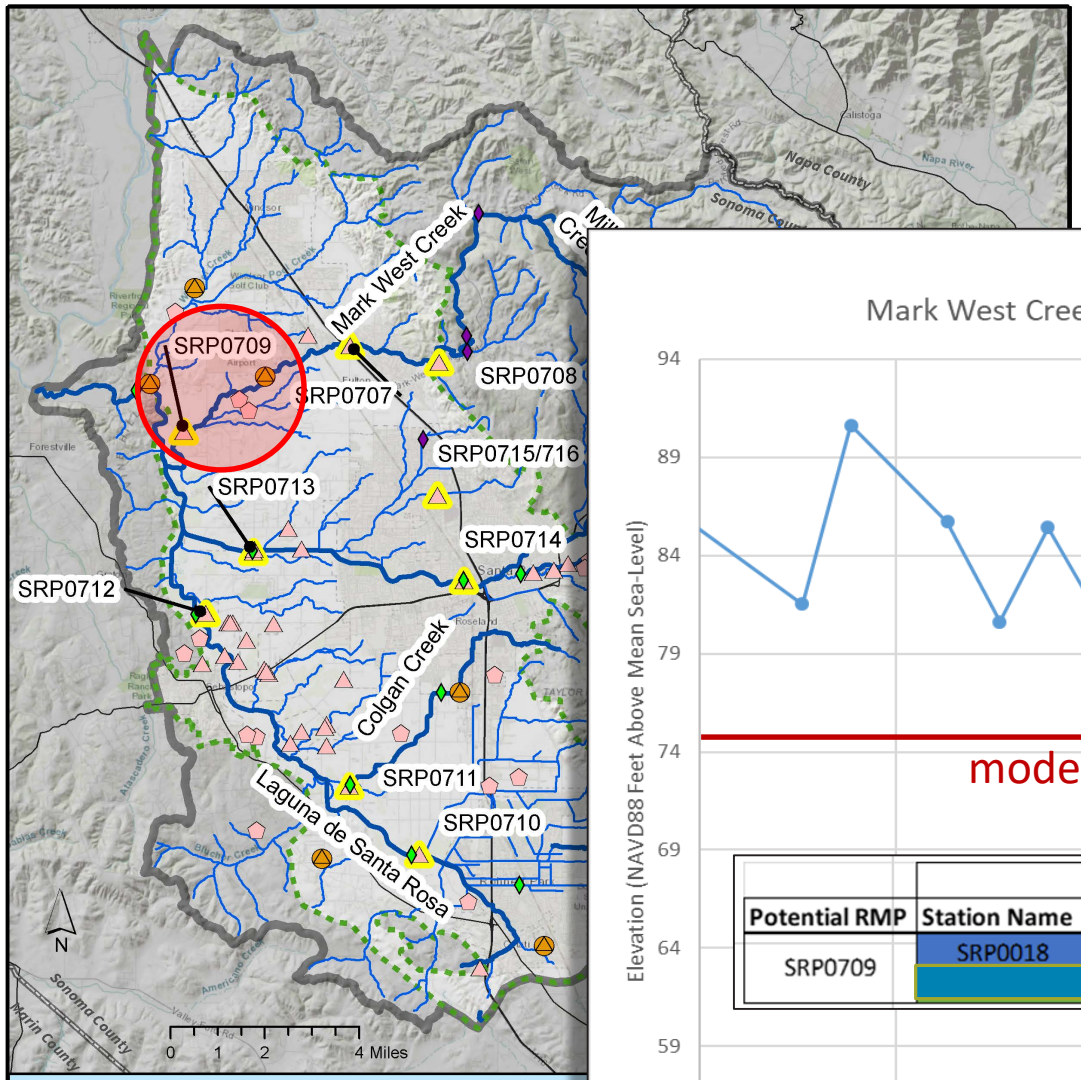


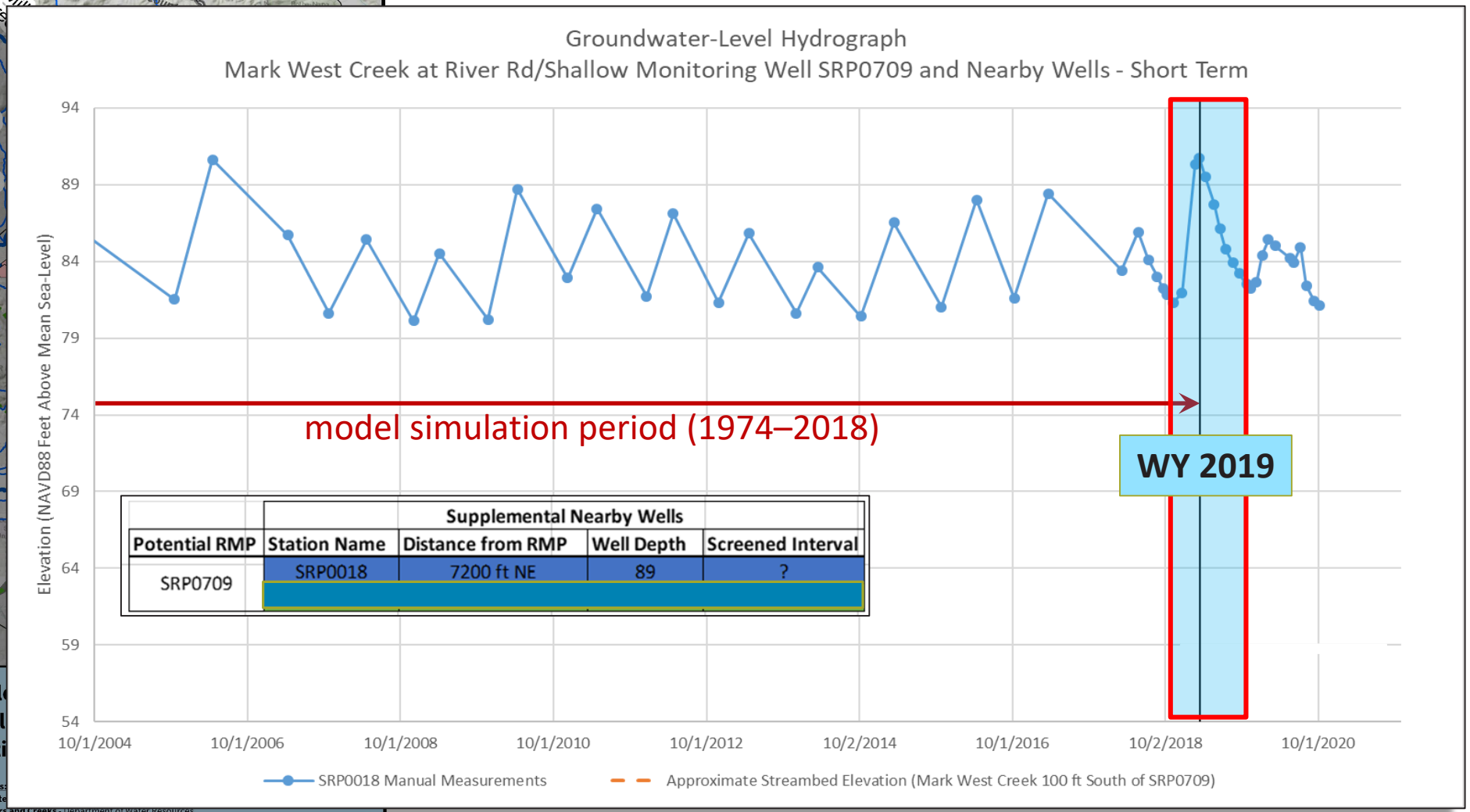




Seasonally-monitored, nearby wells …
Infrequently measured, long period of record

How do we use model results to characterize SWD from measurements? Example: WY 2019





Potential RMP	Supplemental Nearby Wells			
	Station Name	Distance from RMP	Well Depth	Screened Interval
SRP0709	SRP0018	7200 ft NE	89	?

Santa Rosa Plain Groundwater Subbasin
Contributing Area Watershed
Major Rivers and Creeks
Streams
Dedicated Monitoring Wells
Monitored Municipal Supply Wells
Monitored Private Supply Wells
SCWA OneRain Stream Gauges
Active USGS Stream Gauges
High-Frequency Monitoring Wells Adjacent to Streams
Planned Shallow/Multi-Level Dedicated Monitoring Wells

Data Sources:
Groundwate
Major Rivers and Creeks - Department of Water Resources
Streams - Sonoma County Central GIS and Sonoma Water

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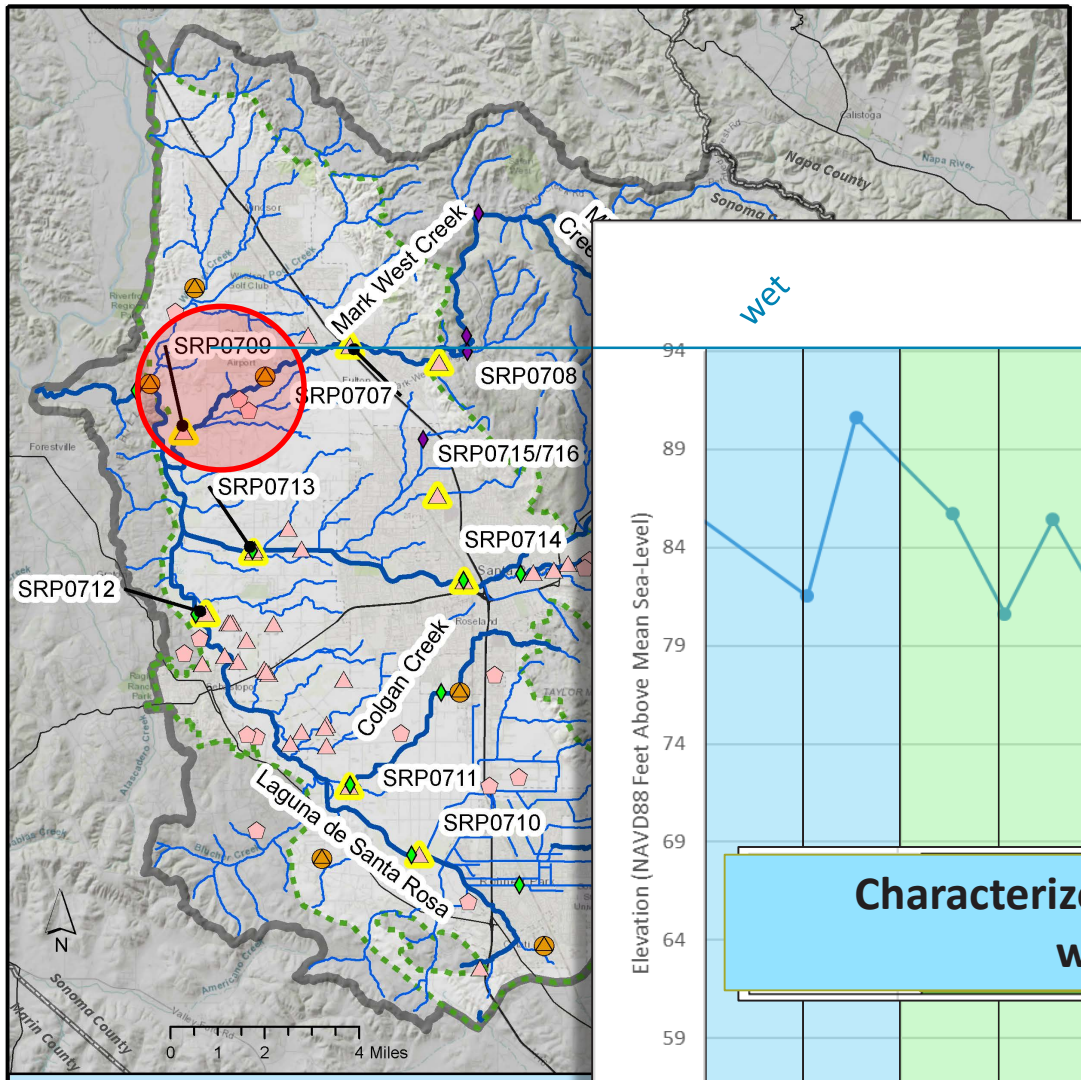
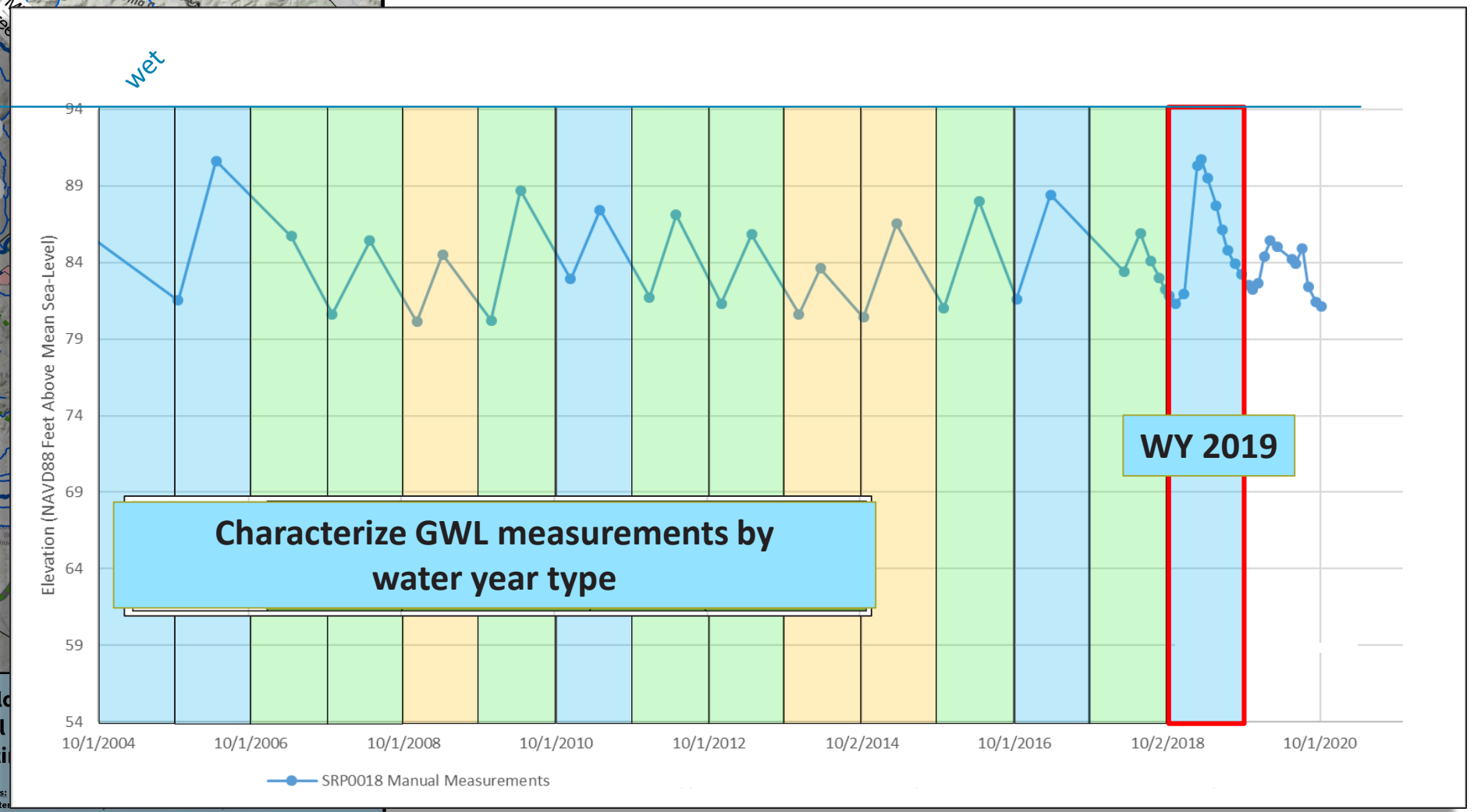
SANTA ROSA PLAIN GROUNDWATER SUSTAINABILITY AGENCY

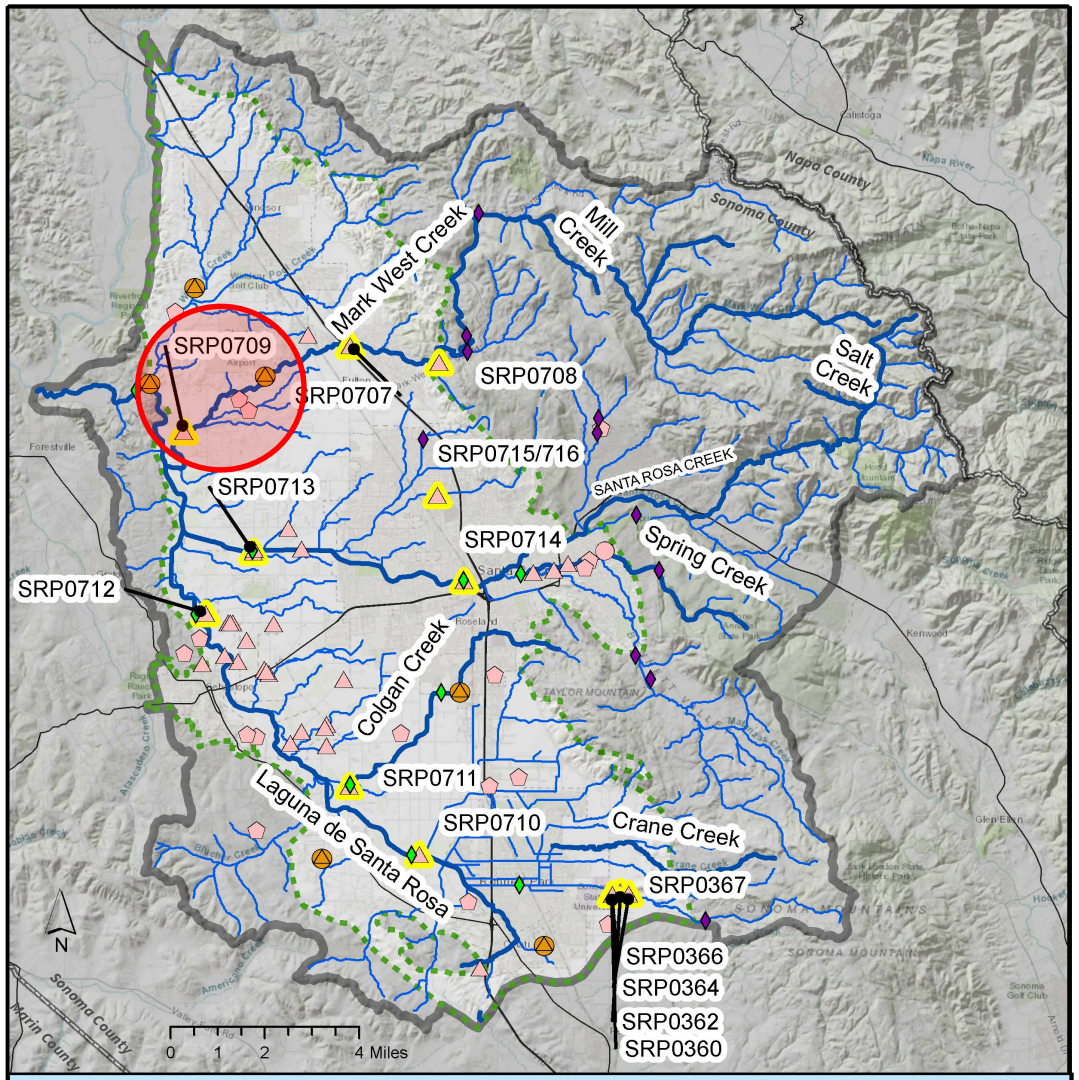
Filepath: T:\mbuttress\SGMA Monitoring Networks\Santa Rosa Plain\SRP_GW_Levl_FULLNet_S_SWGW.mxd Date prepared: 10/6/2020

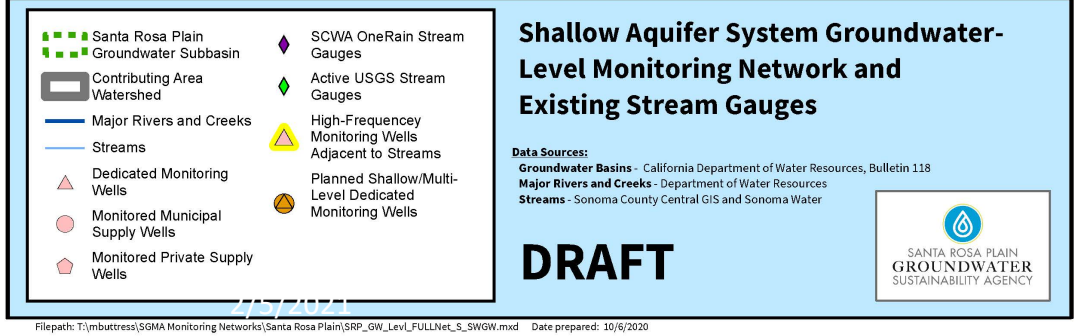
How do we use model results to characterize SWD from measurements? — Example: WY 2019

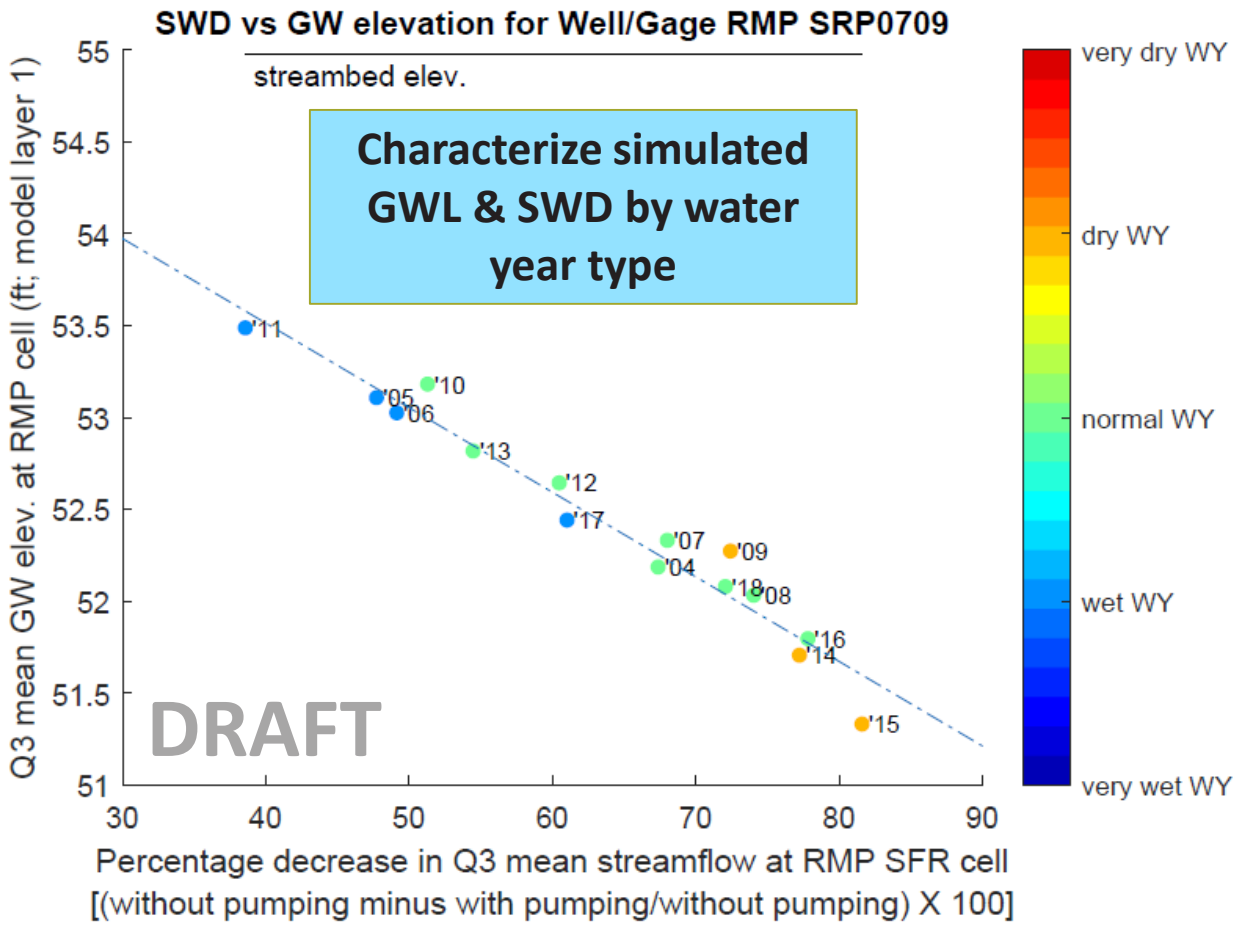




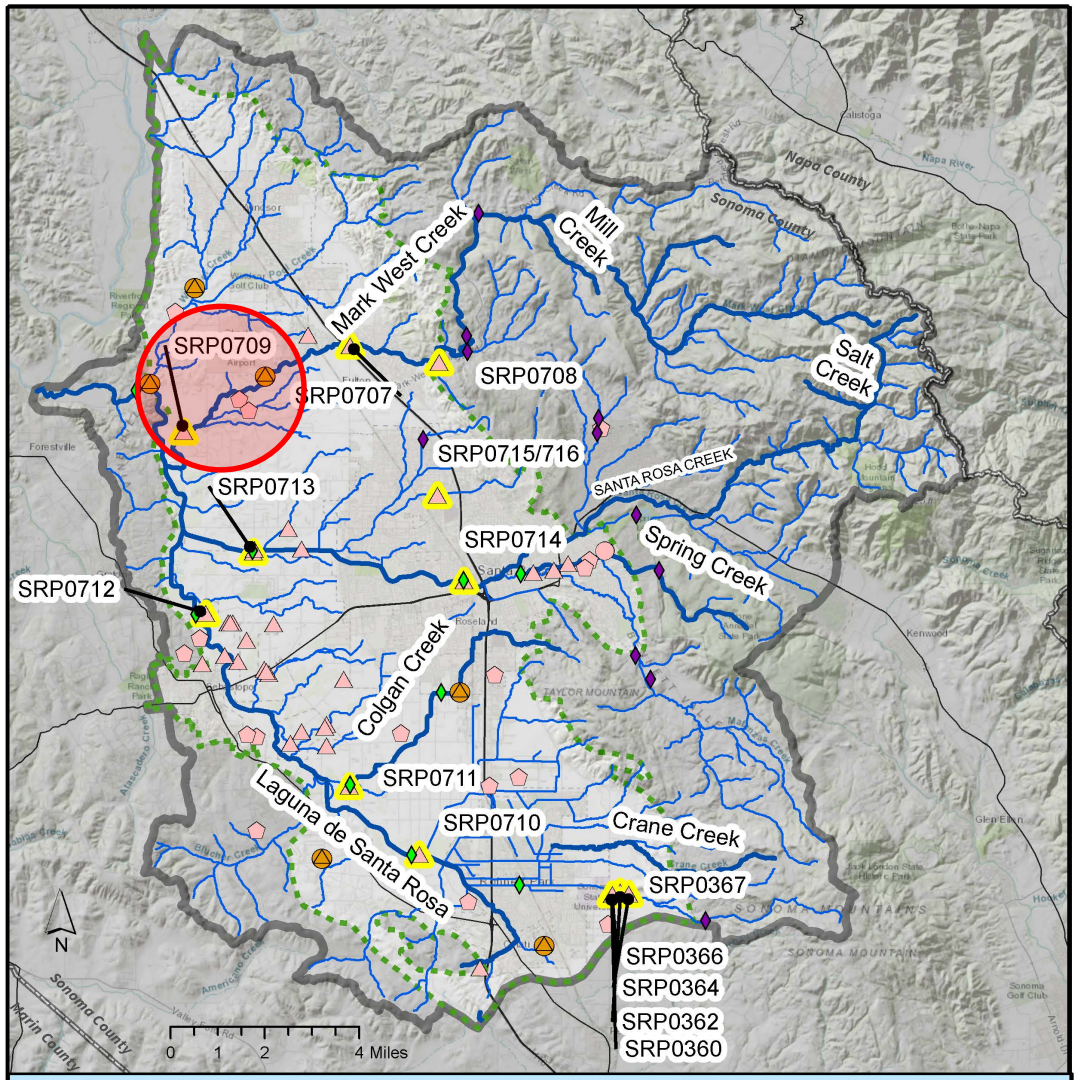
How do we use model results to characterize SWD from measurements? — Example: WY 2019

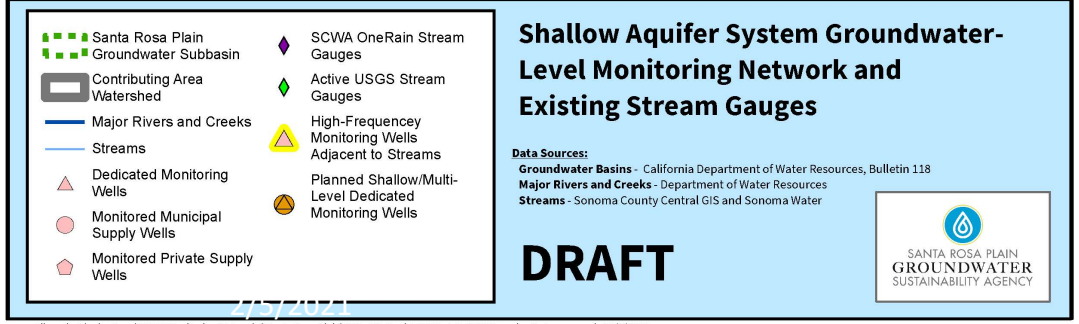


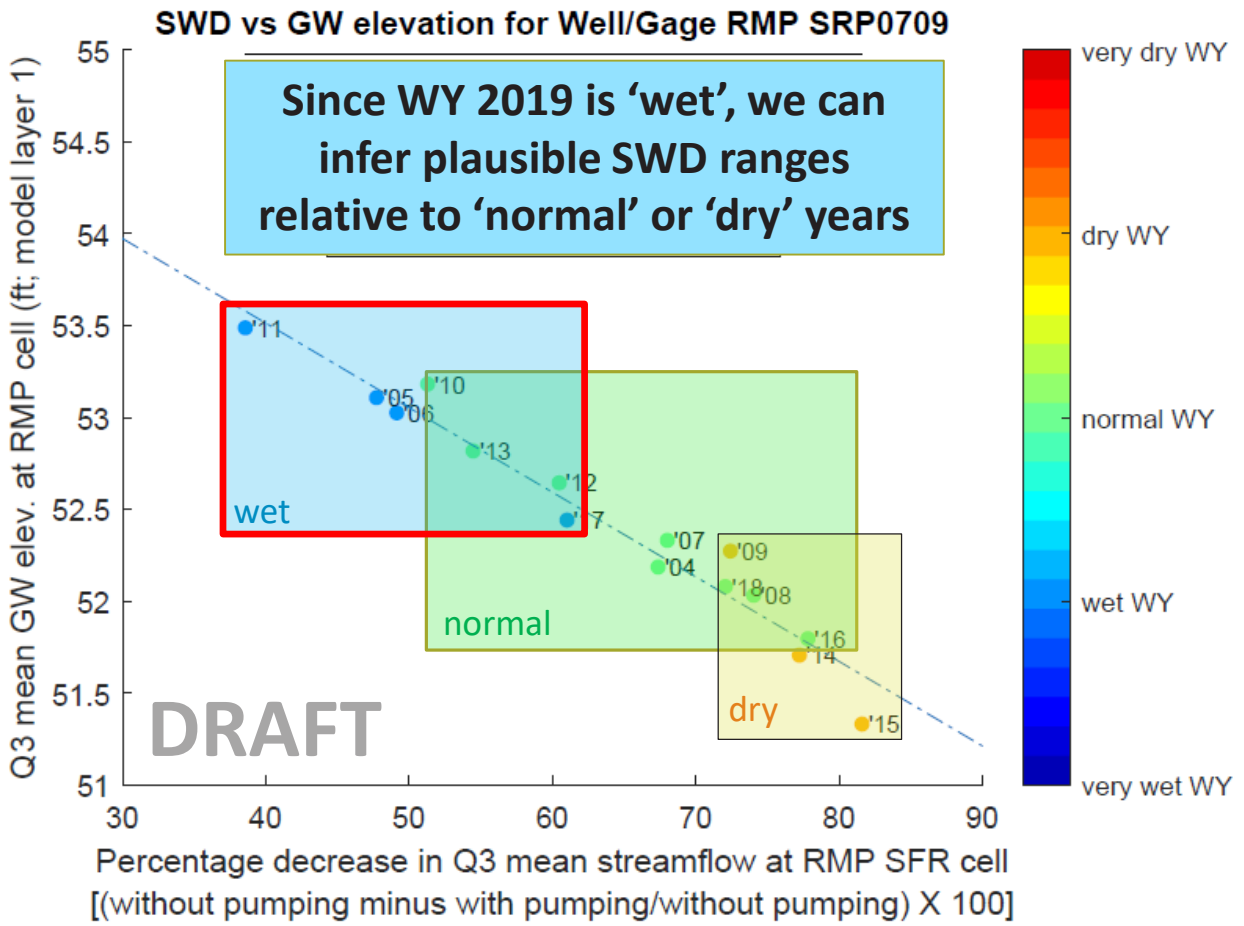




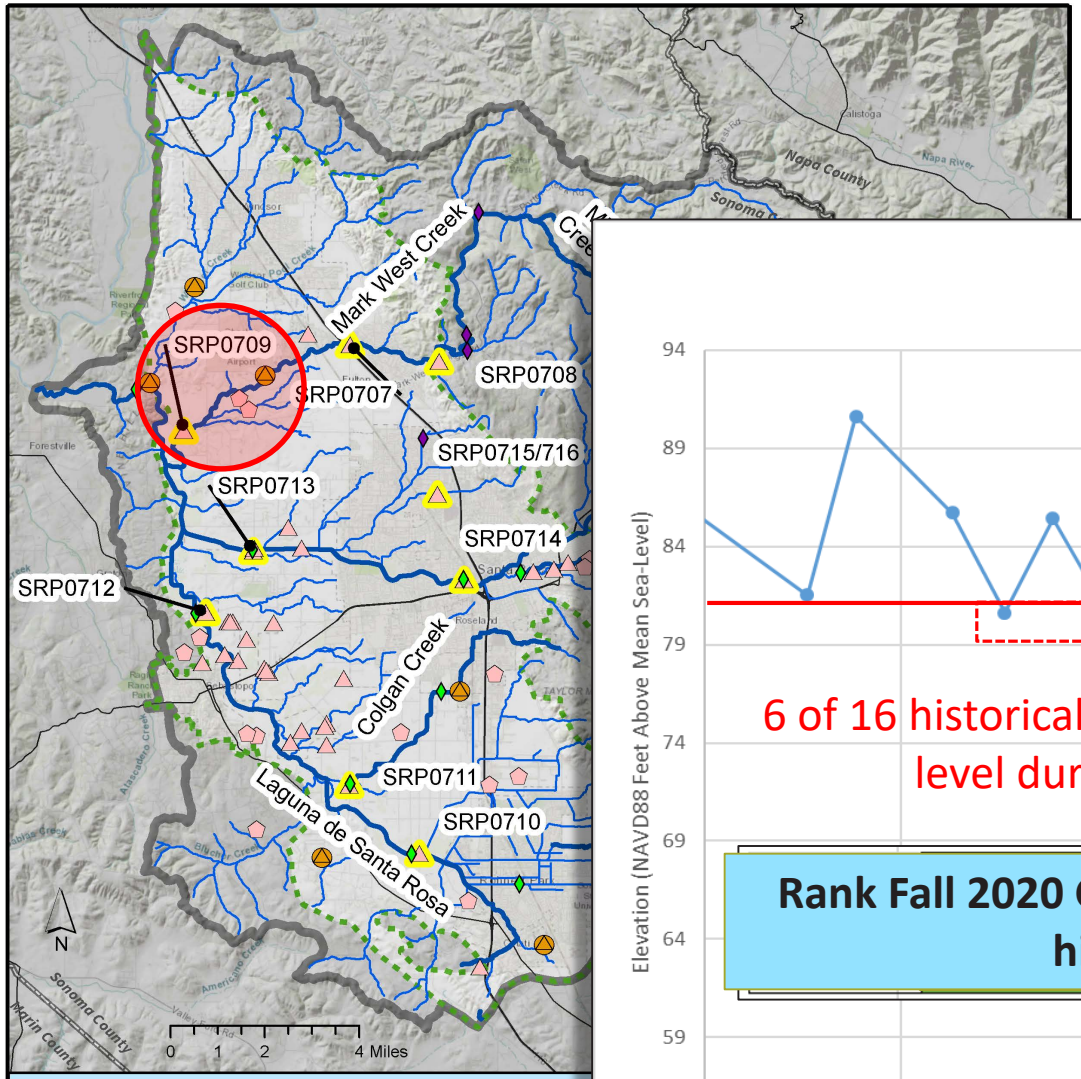
How do we use model results to characterize SWD from measurements? — Example: WY 2019

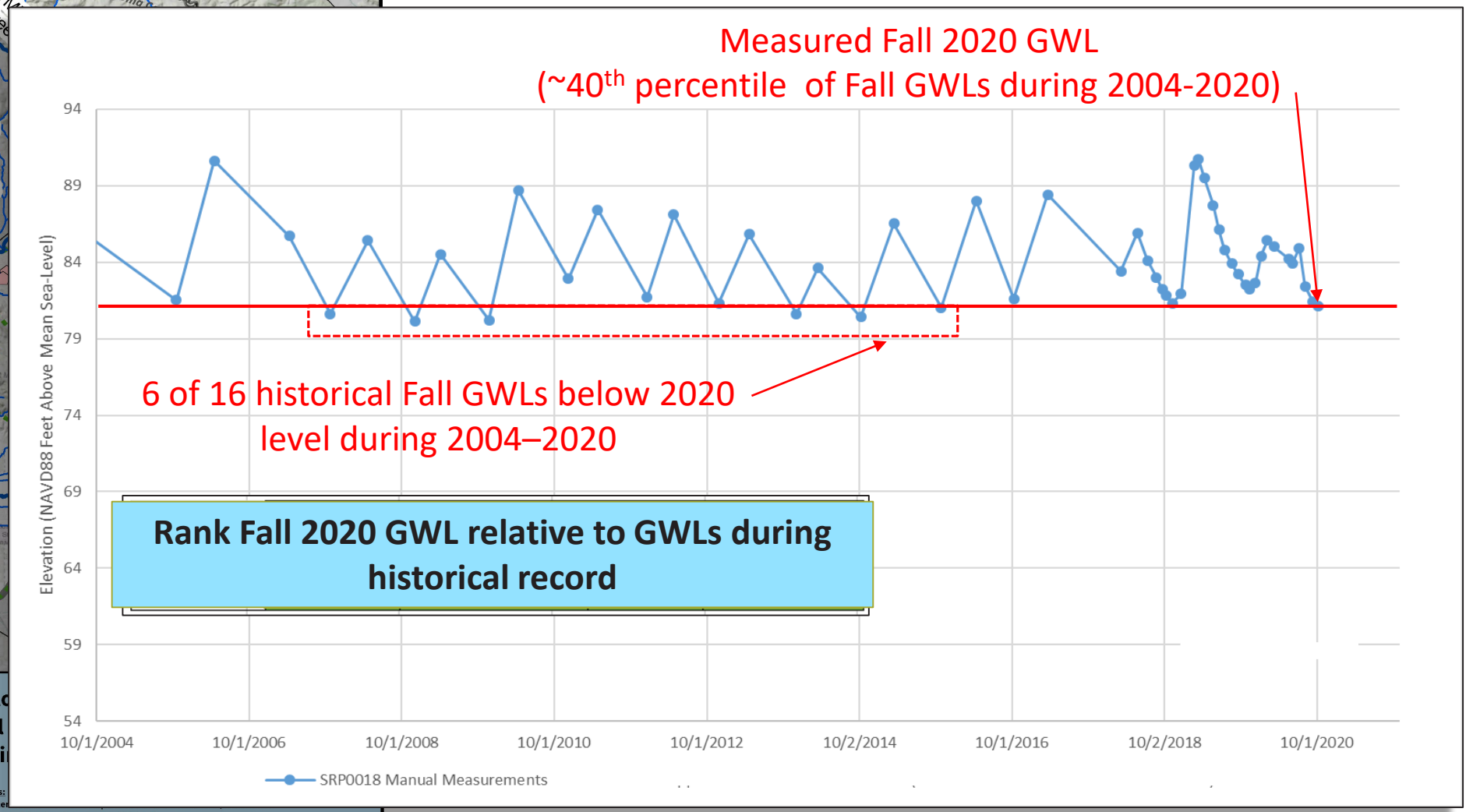




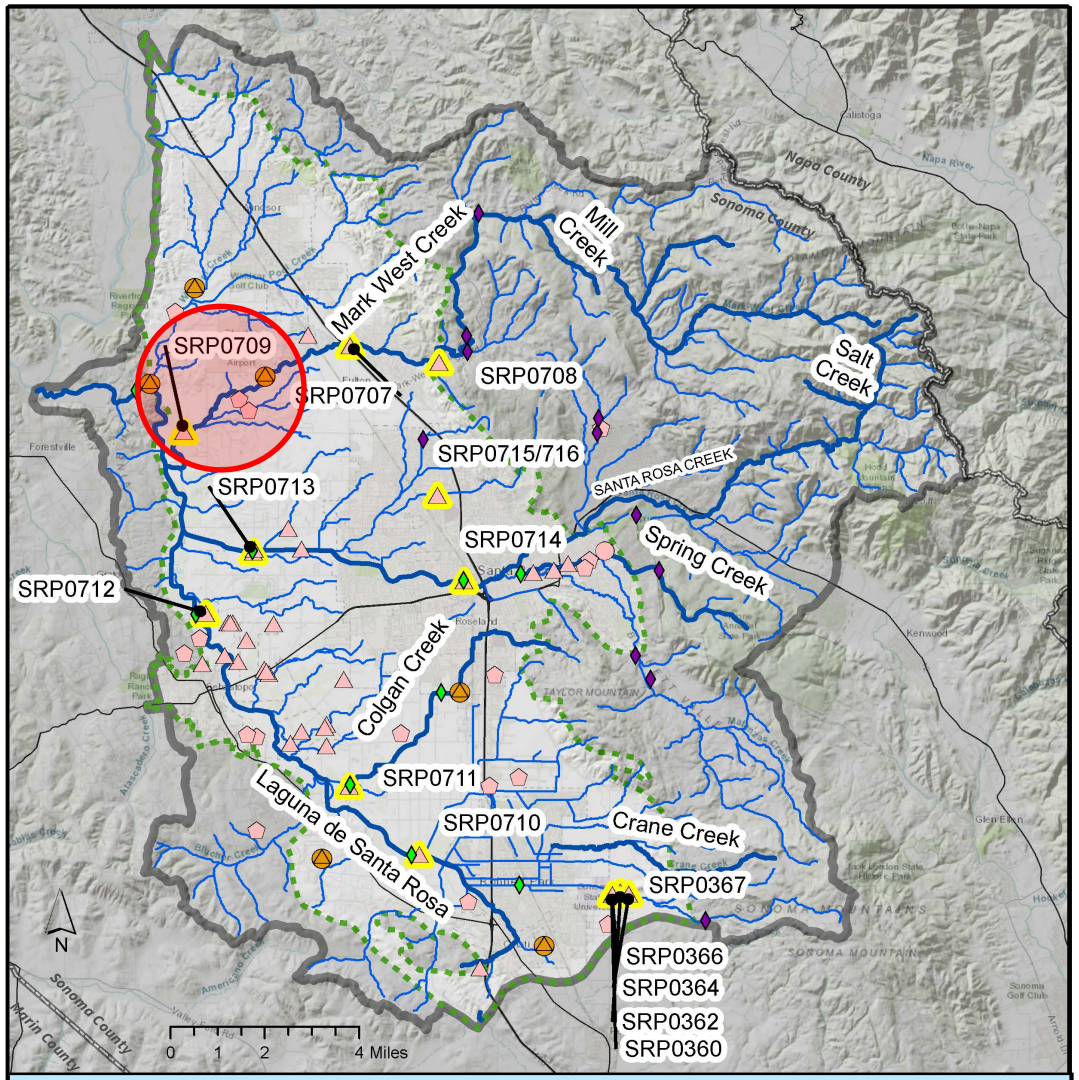


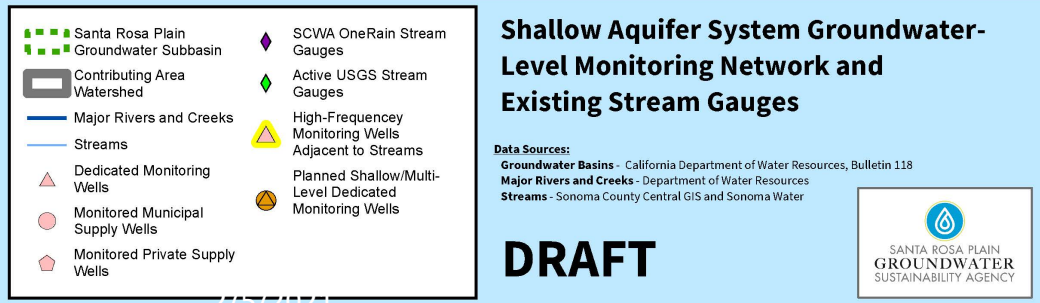
How do we use model results to characterize SWD from measurements? — Example: Fall 2020 GWL

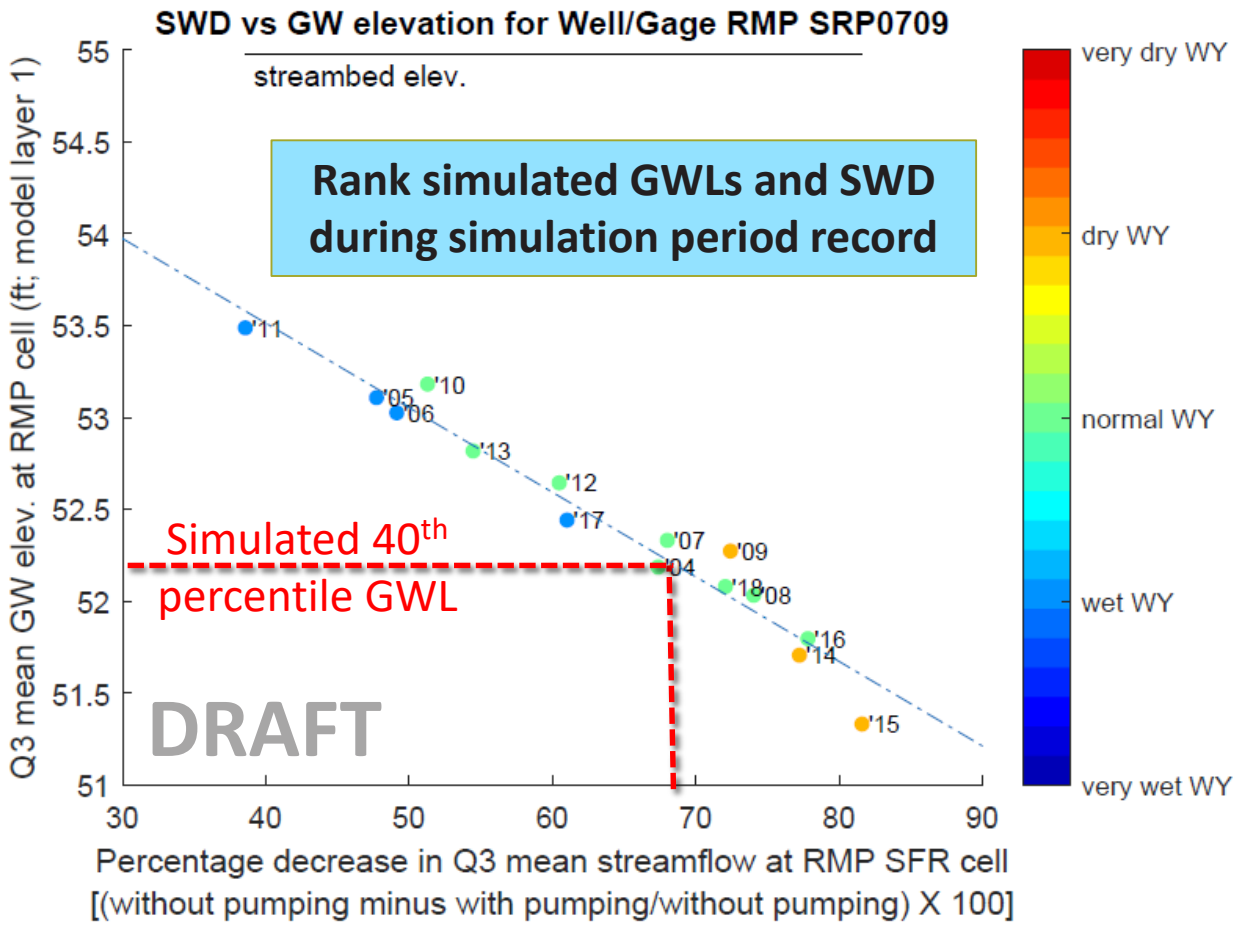


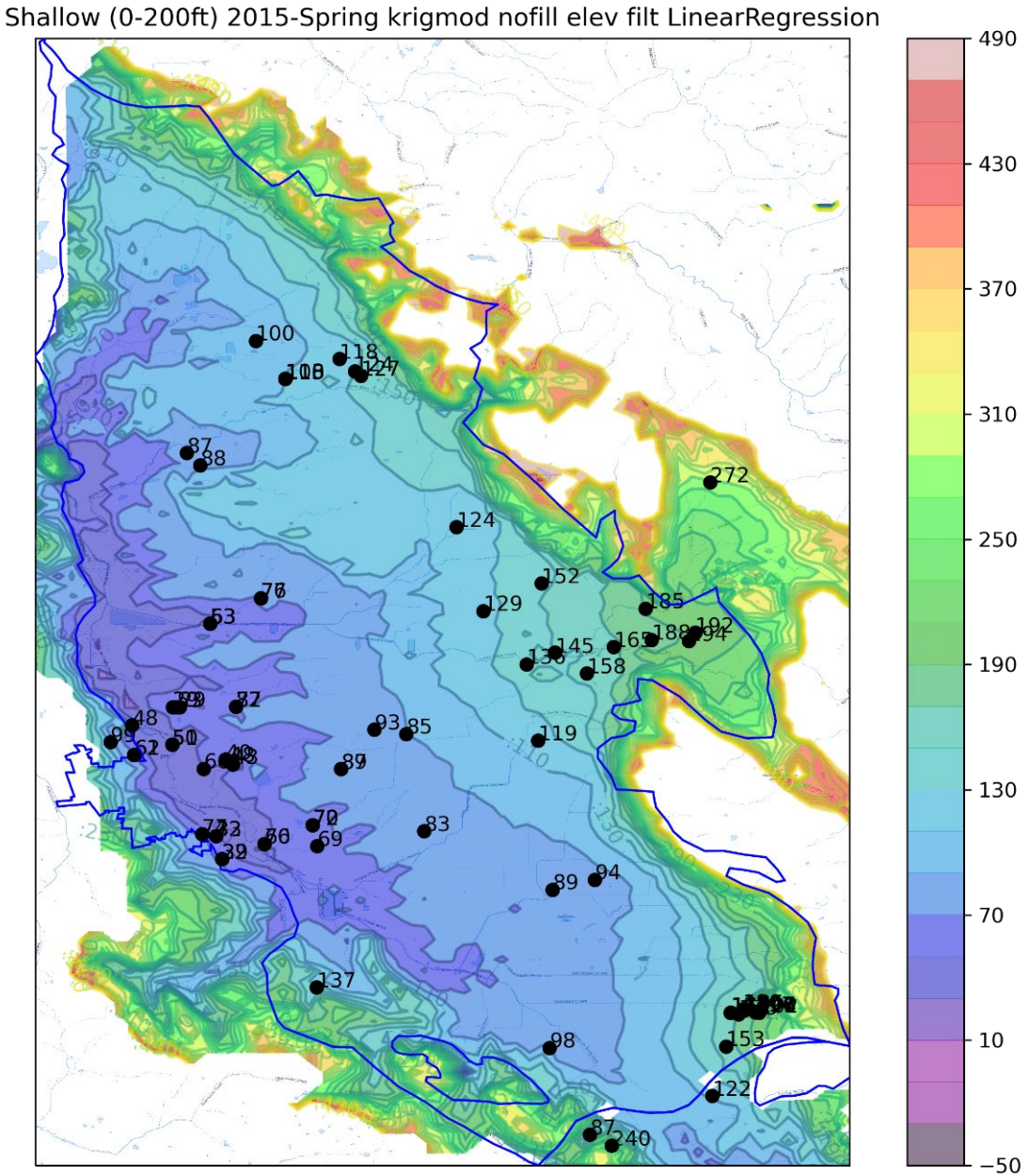


How do we use model results to characterize SWD from measurements? — Example: Fall 2020 GWL

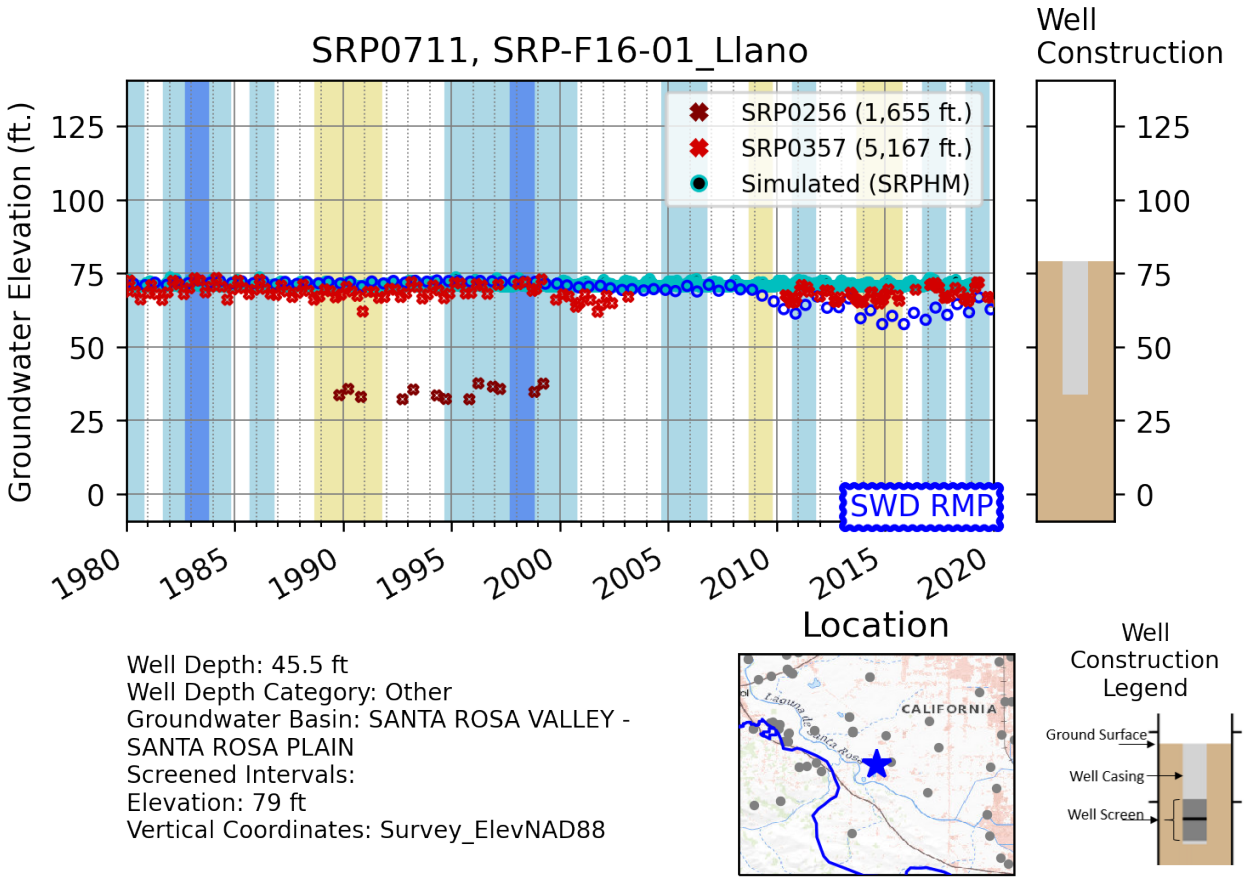








Machine learning techniques can leverage historical GWLs to generate historical GWL hydrographs at RMP locations



Well Depth: 45.5 ft
Well Depth Category: Other
Groundwater Basin: SANTA ROSA VALLEY - SANTA ROSA PLAIN
Screened Intervals:
Elevation: 79 ft
Vertical Coordinates: Survey_ElevNAD88

Surface Water Depletion Methodology Options

Technical staff evaluated a number of different options:

- Historical method (eg, 2015 or other historical conditions)
- Straight Surface water depletions thresholds (percentage discharge)
- Surface water depletions thresholds based on summertime threshold (discharge)
- Surface depletion impacts on streamflow (discharge)

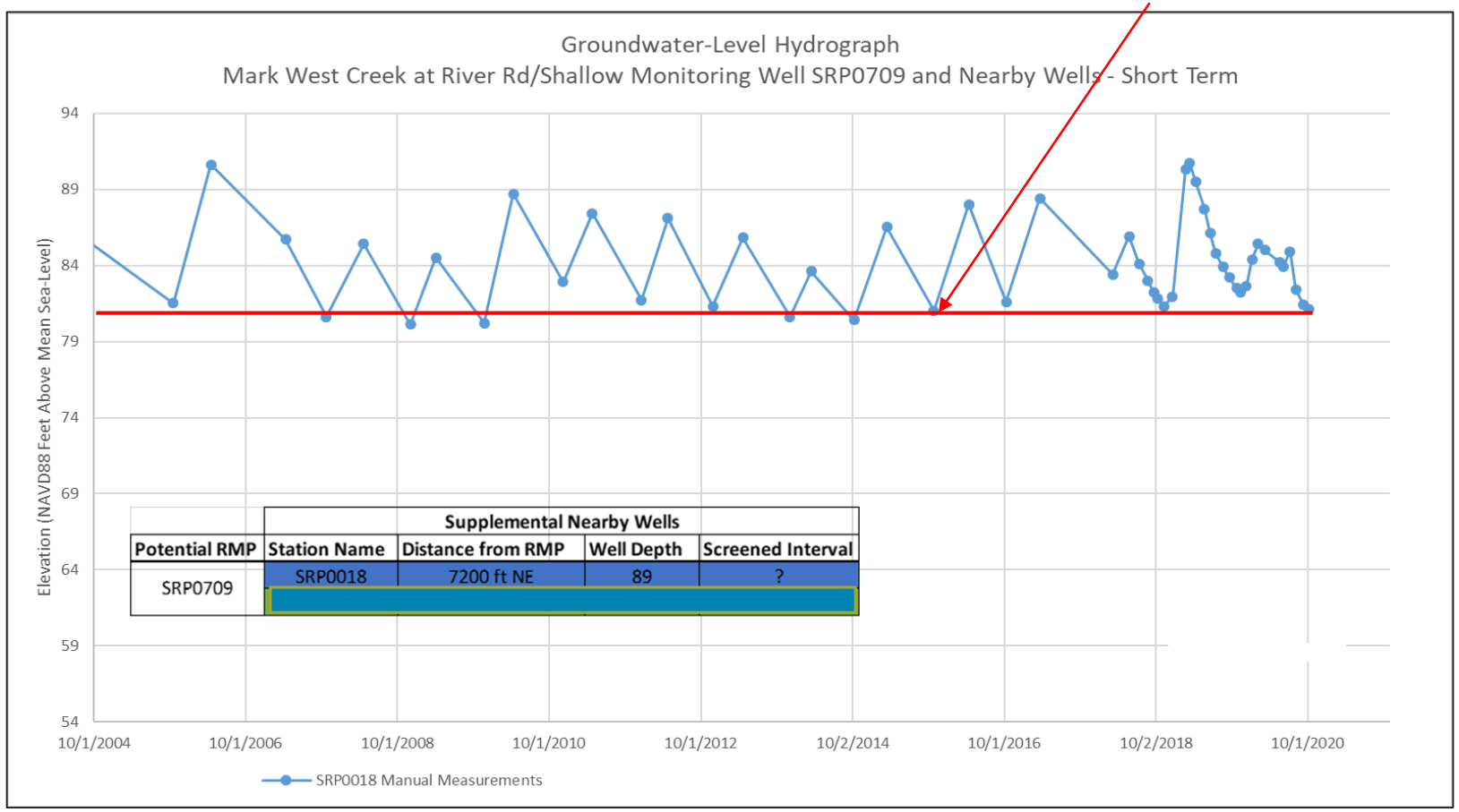
Paired down to two options for consideration today:

1. Fall 2015 GWL as Minimum Threshold
2. SWD Threshold (percentage of discharge) as Minimum Threshold

Surface Water Depletion SMC Strawman Options

1. Fall 2015 GWLs as Minimum Threshold

Measured 2015 Fall GWL



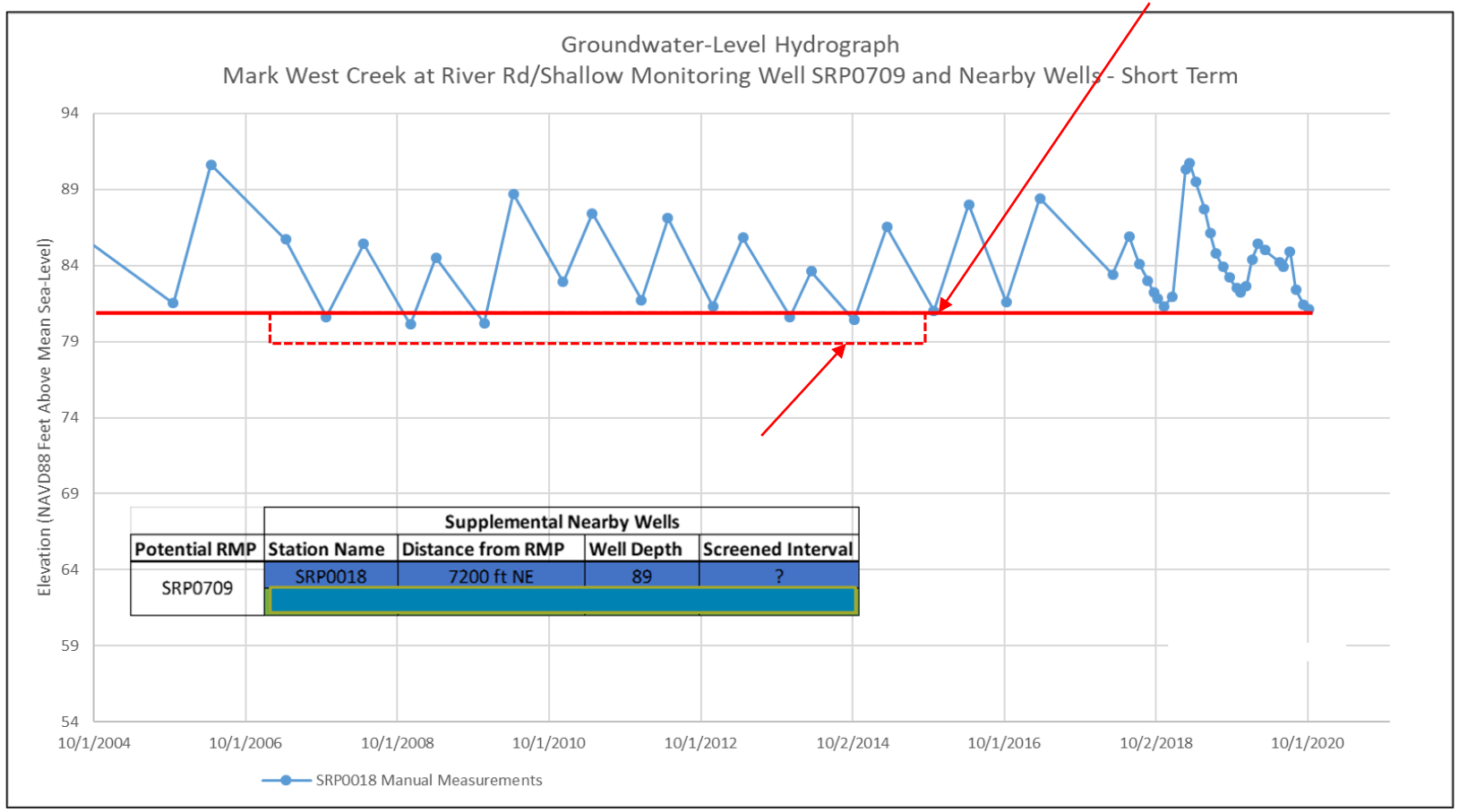
	Supplemental Nearby Wells			
Potential RMP	Station Name	Distance from RMP	Well Depth	Screened Interval
SRP0709	SRP0018	7200 ft NE	89	?

Surface Water Depletion SMC Strawman Options

1. Fall 2015 GWLs as Minimum Threshold

Set SMC based on GWL, use relationship to infer SWD impact

Measured 2015 Fall GWL (~30th percentile during 2004-2020)



	Supplemental Nearby Wells			
Potential RMP	Station Name	Distance from RMP	Well Depth	Screened Interval
SRP0709	SRP0018	7200 ft NE	89	?

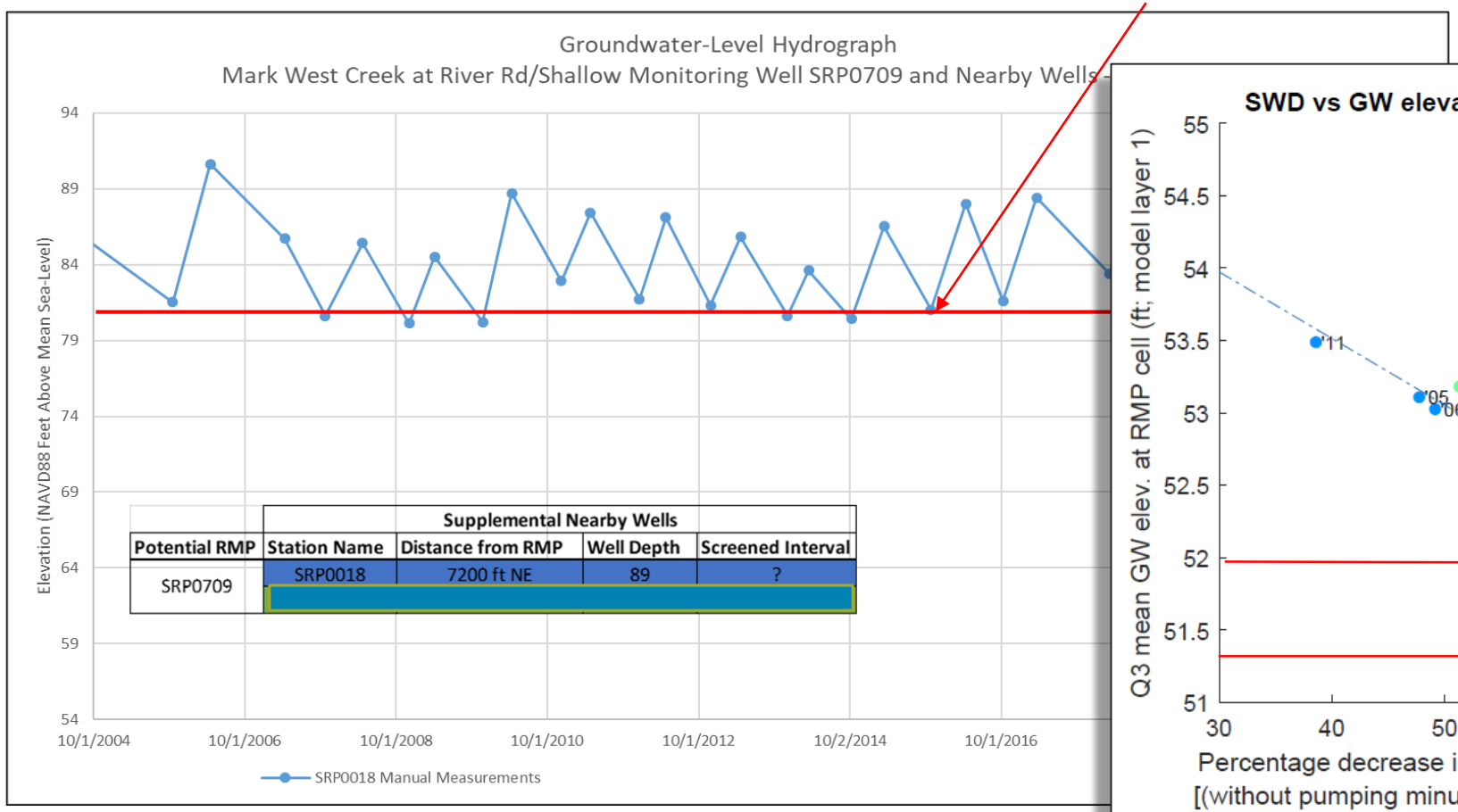
Surface Water Depletion SMC Strawman Options

1. Fall 2015 GWLs as Minimum Threshold

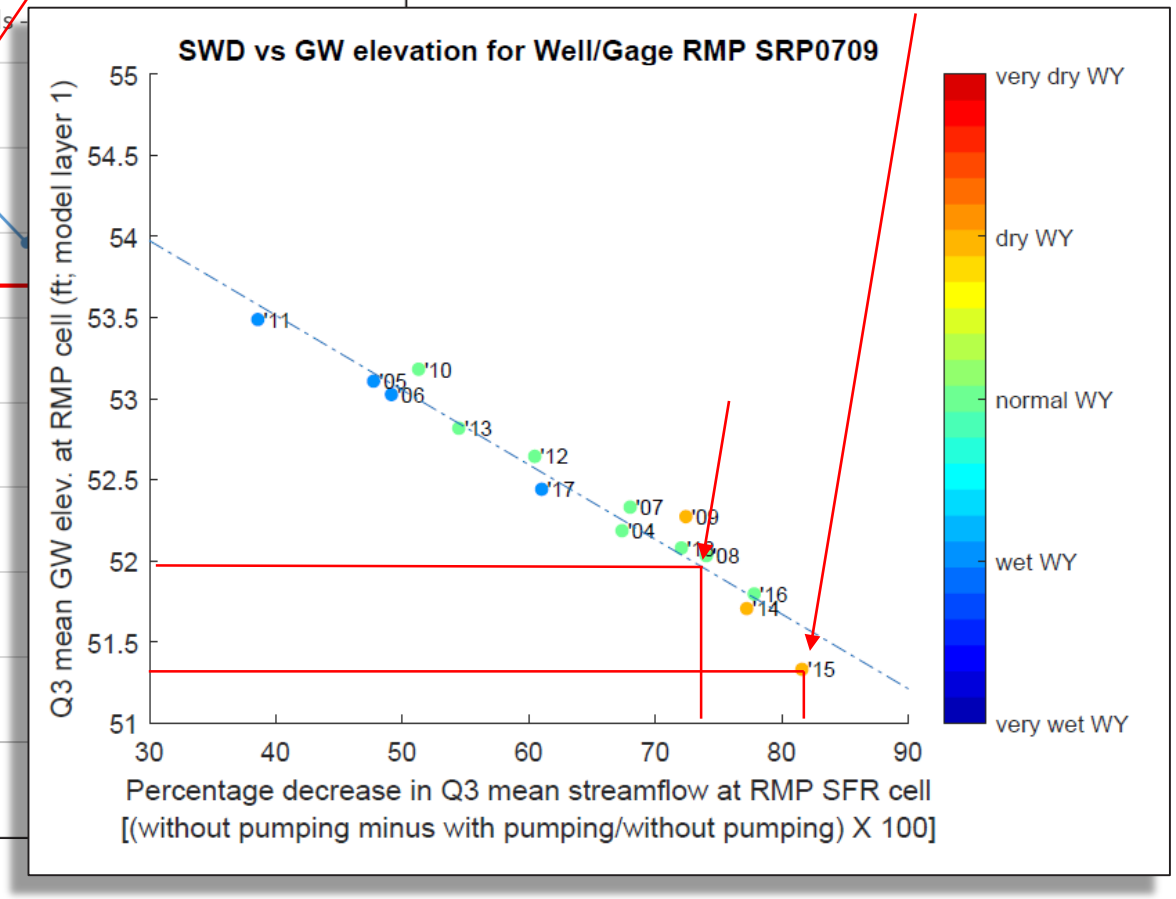
Set SMC based on GWL, use relationship to infer SWD impact

Measured 2015 Fall GWL (~30th percentile during 2004-2020)

Simulated 2015 Q3 GWL (lowest during 2004-2020)



	Supplemental Nearby Wells			
Potential RMP	Station Name	Distance from RMP	Well Depth	Screened Interval
SRP0709	SRP0018	7200 ft NE	89	?



Surface Water Depletion SMC Strawman Options … Pros/Cons

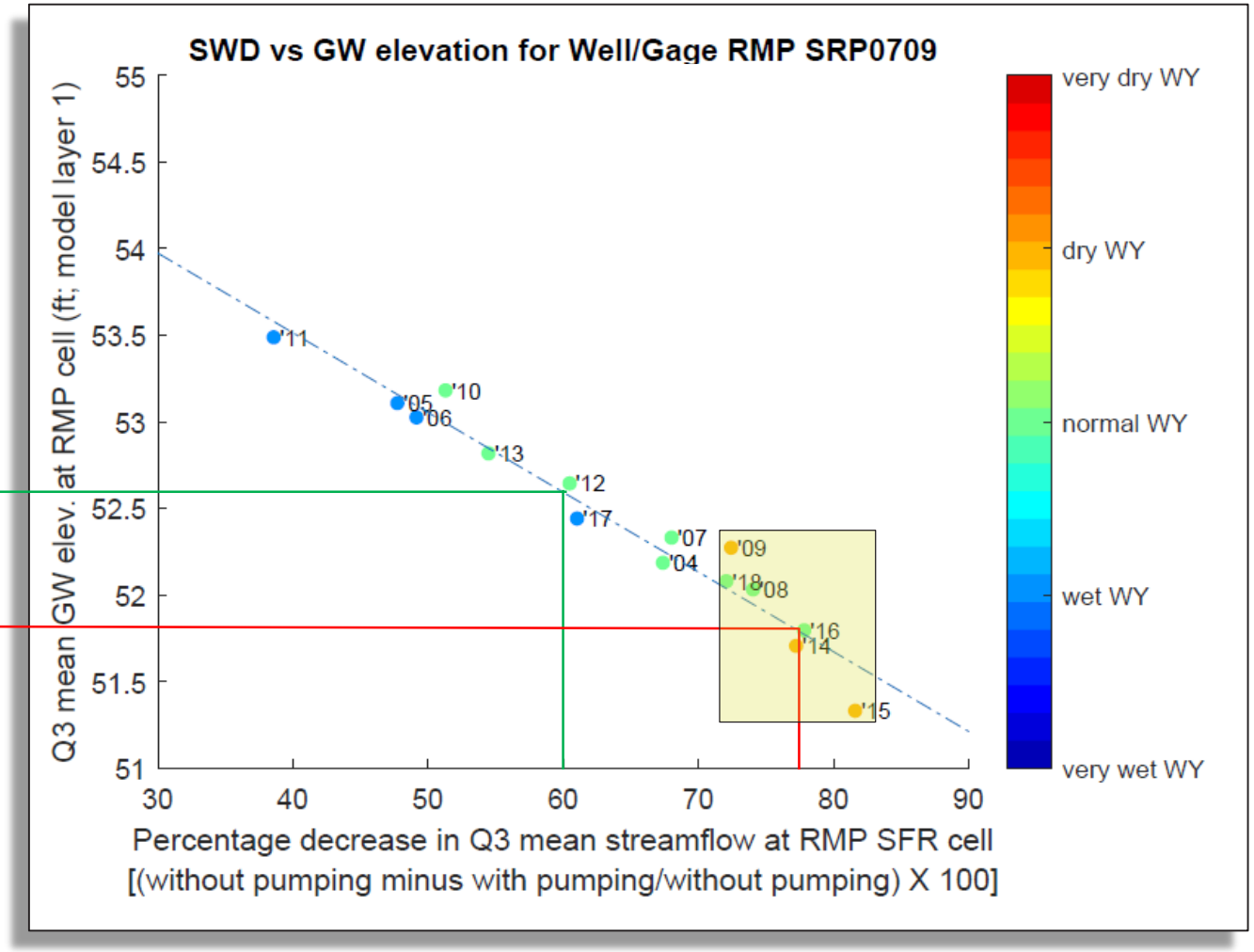
2. SWD Threshold (percentage of discharge) as Minimum Threshold

Use relationship to determine GWL proxy for SWD threshold.

… Requires very high confidence in model results

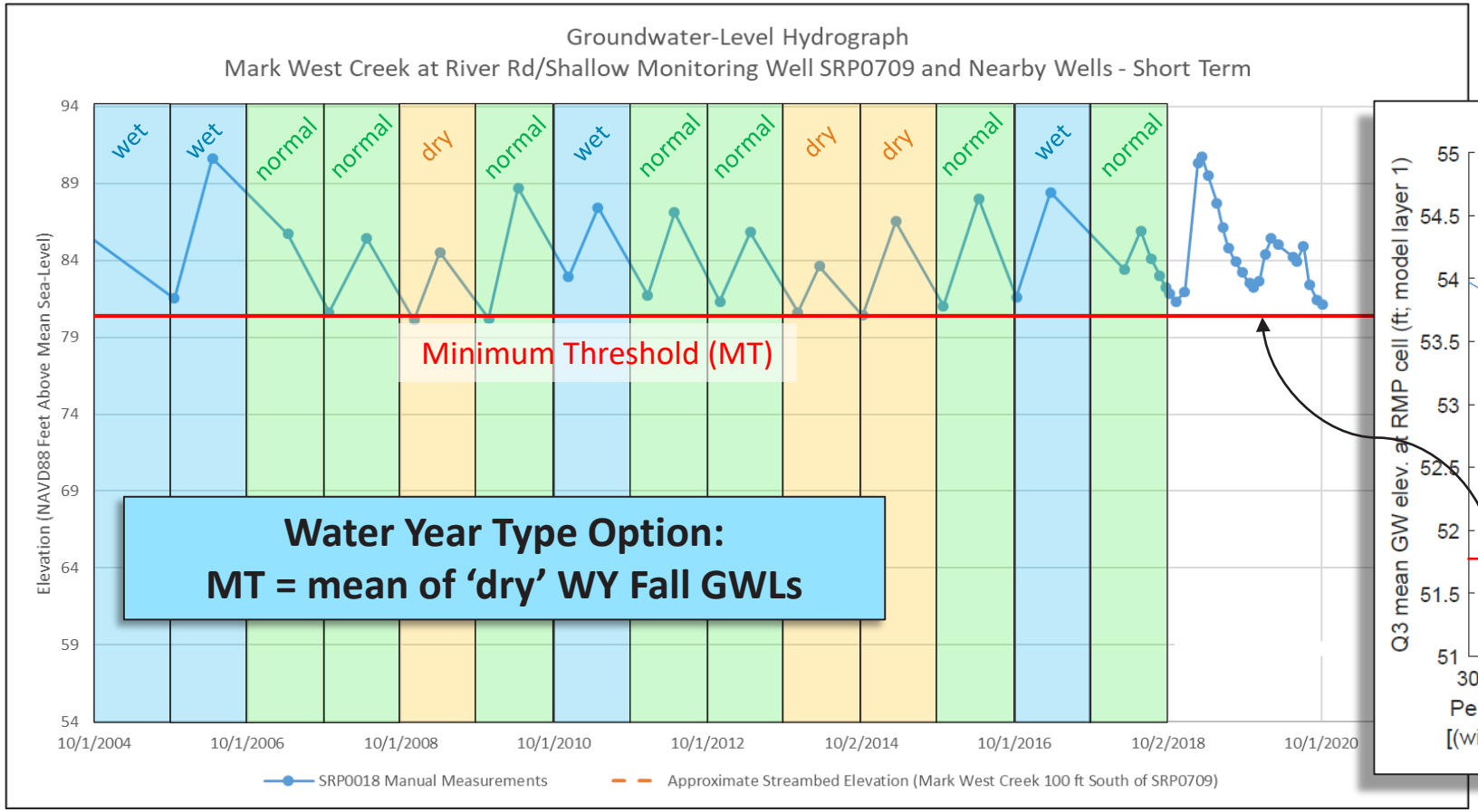
Example measurable objective (MO) =
No more than mean depletion during ’04–’18 i.e., 60% during Jul/Aug/Sep (Q3)

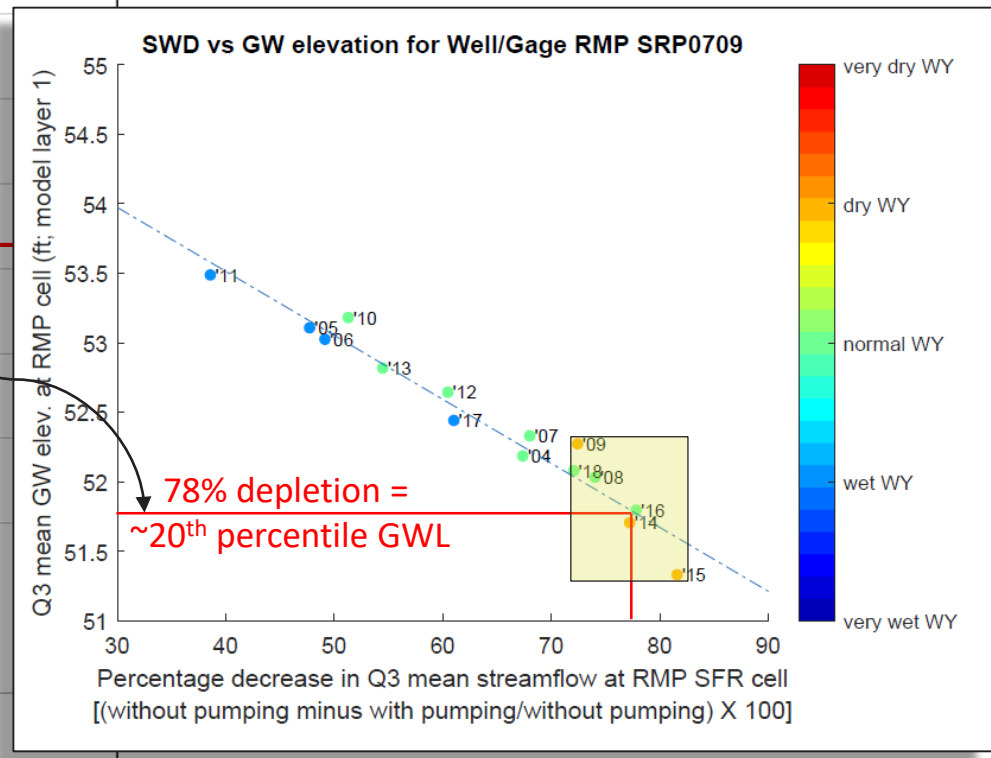
Example minimum threshold (MT) =
Goal of no more than ~78% depletion during Jul/Aug/Sep (Q3): Mean depletion during dry years.



Surface Water Depletion SMC Strawman Options … Pros/Cons

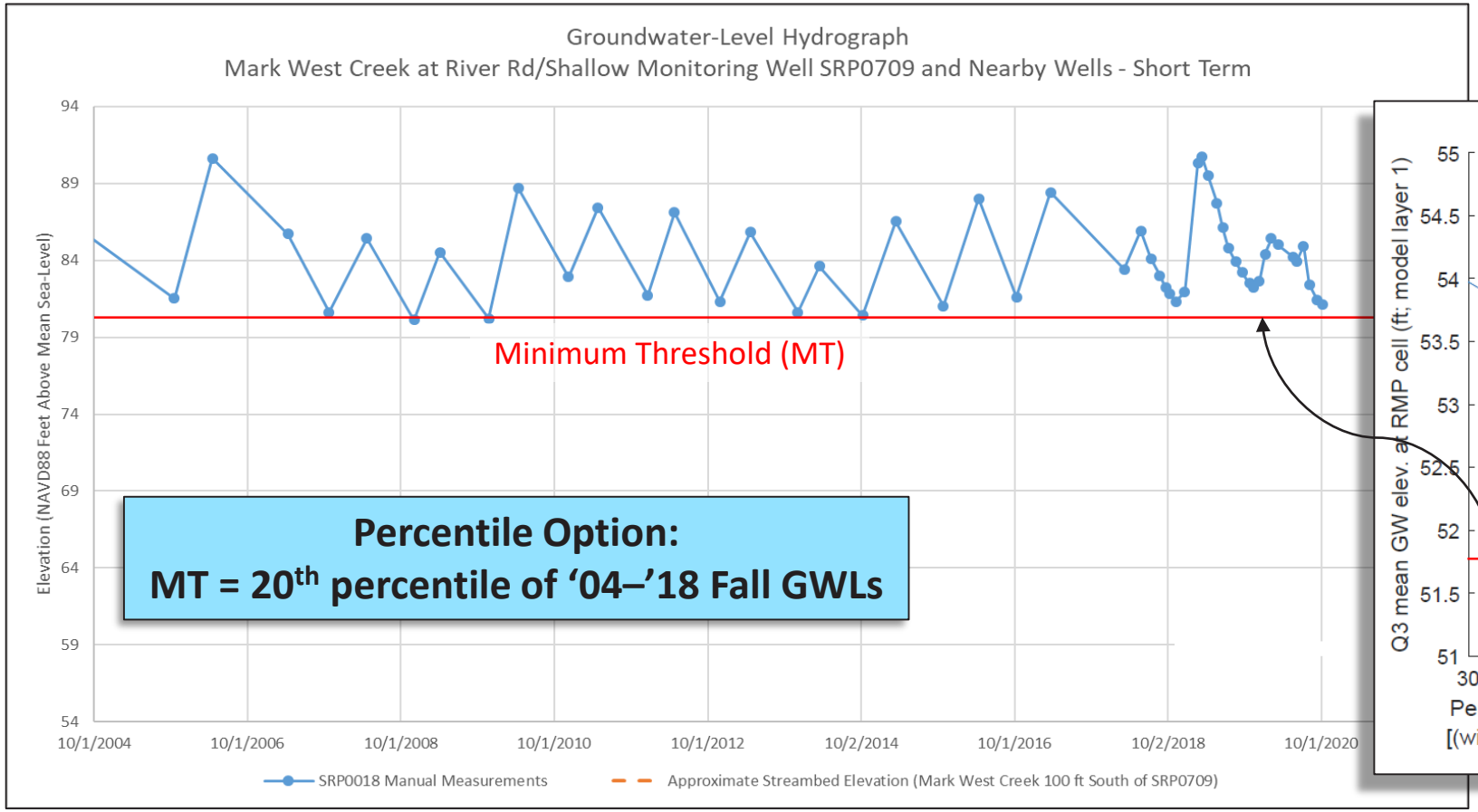
2. SWD Threshold (percentage of discharge) as Minimum Threshold

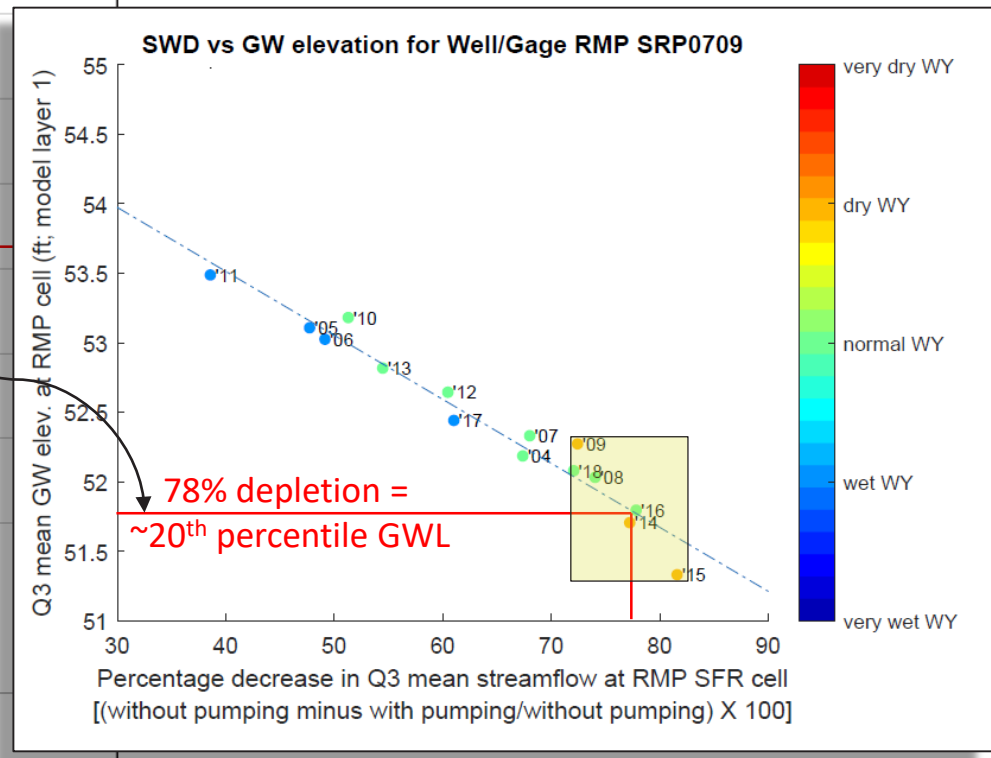


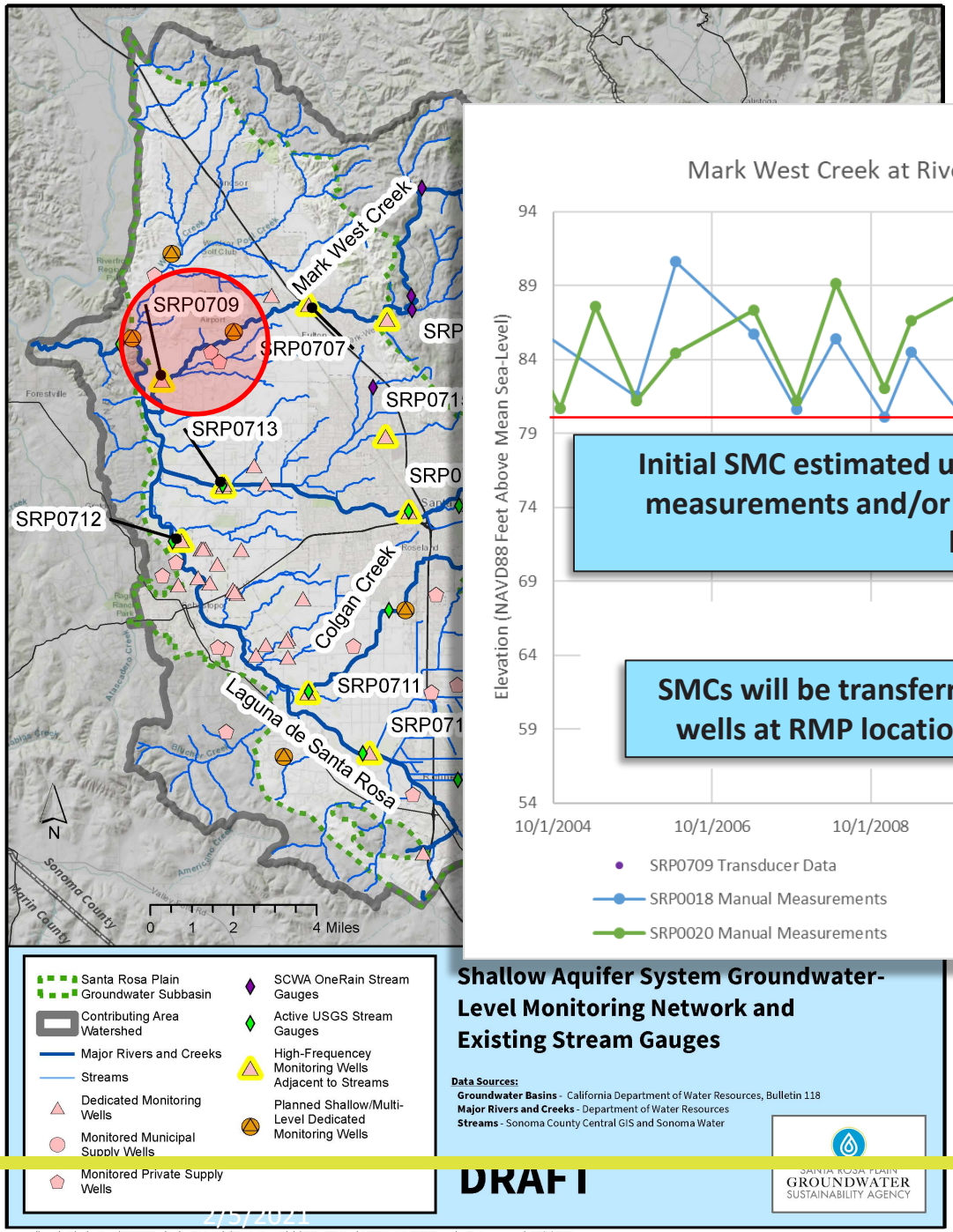


Surface Water Depletion SMC Strawman Options … Pros/Cons

2. SWD Threshold (percentage of discharge) as Minimum Threshold






Mark West Creek
SRP0709
SRP0707
SRP0713
SRP0712
Colgan Creek
SRP0711
Laguna de Santa Rosa
N
0 1 2 4 Miles
Santa Rosa Plain Groundwater Subbasin
Contributing Area Watershed
Major Rivers and Creeks
Streams
Dedicated Monitoring Wells
Monitored Municipal Supply Wells
Monitored Private Supply Wells
SCWA OneRain Stream Gauges
Active USGS Stream Gauges
High-Frequency Monitoring Wells Adjacent to Streams
Planned Shallow/Multi-Level Dedicated Monitoring Wells
Shallow Aquifer System Groundwater-Level Monitoring Network and Existing Stream Gauges
Data Sources:
Groundwater Basins - California Department of Water Resources, Bulletin 118
Major Rivers and Creeks - Department of Water Resources
Streams - Sonoma County Central GIS and Sonoma Water
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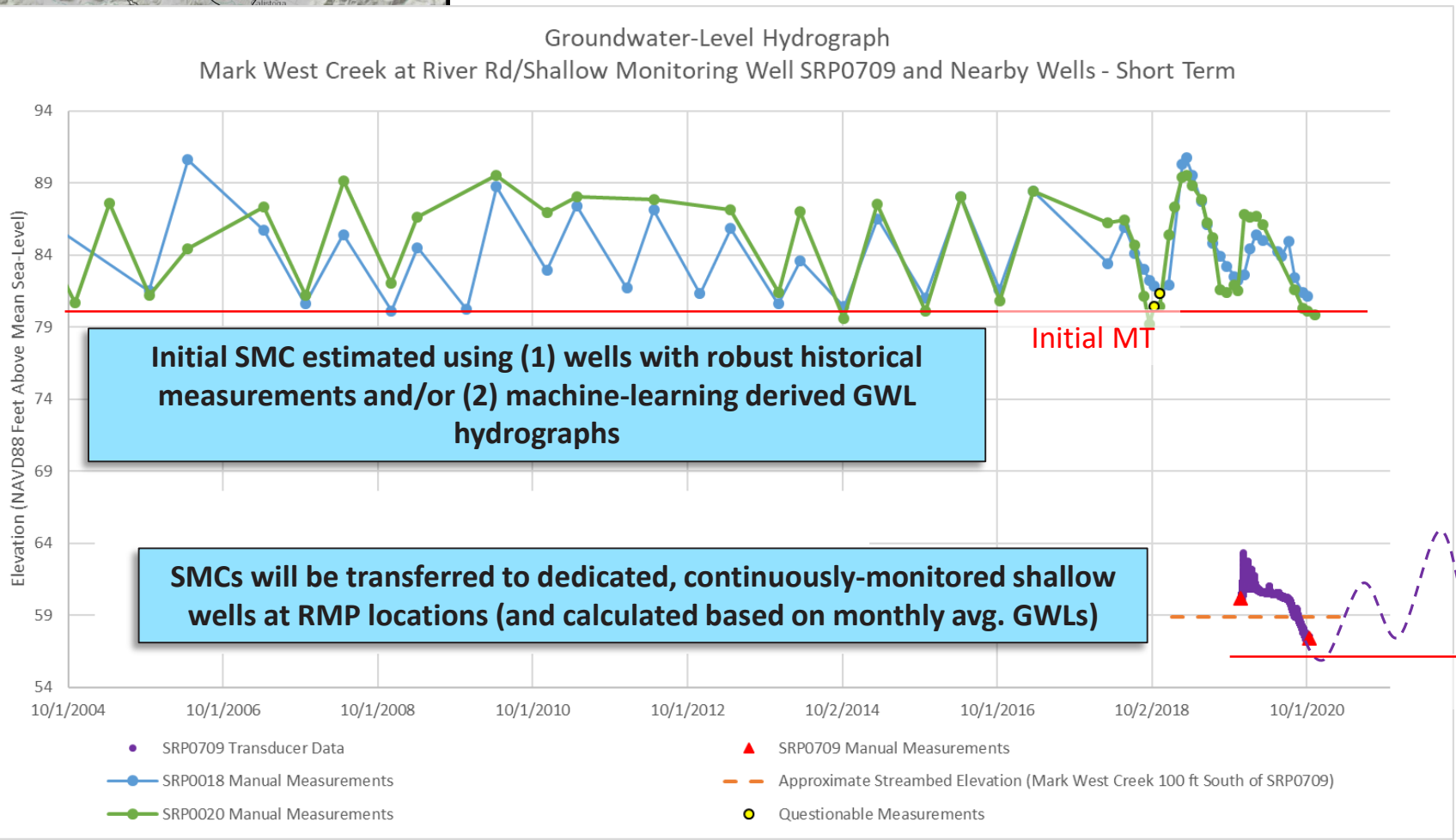
Filepath: T:\mbuttress\SGMA Monitoring Networks\Santa Rosa Plain\SRP_GW_Levl_FULLNet_S_SWGW.mxd Date prepared: 10/6/2020


Groundwater-Level Hydrograph
Mark West Creek at River Rd/Shallow Monitoring Well SRP0709 and Nearby Wells - Short Term
Elevation (NAVD88 Feet Above Mean Sea-Level)
94
89
84
79
74
69
64
59
54
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/2/2014
10/1/2016
10/2/2018
10/1/2020
Initial MT
Initial SMC estimated using (1) wells with robust historical measurements and/or (2) machine-learning derived GWL hydrographs
SMCs will be transferred to dedicated, continuously-monitored shallow wells at RMP locations (and calculated based on monthly avg. GWLs)
Final MT
SRP0709 Transducer Data
SRP0709 Manual Measurements
SRP0018 Manual Measurements
Approximate Streambed Elevation (Mark West Creek 100 ft South of SRP0709)
SRP0020 Manual Measurements
Questionable Measurements

Surface Water Depletion SMC Strawman … Two Examples … Pros/Cons

1. Fall 2015 GWL as Minimum Threshold
2. SWD Threshold (percentage of discharge) as Minimum Threshold

Criteria	Fall 2015 GWLs	SWD Thresholds (percentage of discharge)
Reliance on simulated data	Medium/Low	High (simulated depletion + discharge)
Relevance to Potential Beneficial User Impacts	Low	Medium/High
Pros	Indirectly supported by regulations	Emphasizes lower flows, good correlation w/ modeled heads in SRPHM. More easily tied to Undesirable Results
Cons	No established relationship with SWD, inflexible, some locations with no data	No established relationship with GDEs; not a depletion volume
Adaptable to future knowledge, instream flow thresholds	No	Yes
Simplicity/Communication	Easy to communicate/Estimate	Moderately easy to communicate/Estimate
Arbitrary?	Low	Currently High

Questions/Discussion/Work Group Input

Initial Discussion of Possible Options for Undesirable Results

Undesirable Result: *Quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the Basin/Subbasin.*

Goal is to provide options for the GSA Board to consider for determining Undesirable Results:

1. Some percentage of MT exceedances (eg, 25% of RMPs, etc.)
2. Multiple years of MT exceedances (eg, 2 consecutive years)
3. Some combination of 1 and 2
4. Other ideas?

Prior to determining if undesirable results are occurring based on MT exceedances, the GSA would need to assess whether potential causes of exceedances are related to depletions associated with groundwater pumping or other activities related to surface water rights. Developing a description of this assessment in coordination with SWRCB.

Data Gaps and Future Recommended Activities

Initial List of Data Gaps and Future Recommended Activities

- Informational Data Gaps:
  - Location, completion details and pumping estimates for existing water wells (particularly near streams)
  - Type, location and rates of permitted surface water diversions (including any diversions made through wells)
- Monitoring Needs:
  - Additional shallow monitoring wells in data gap areas and near existing RMPs to better assess hydraulic gradients and potential causes of depletion
  - Additional streamflow gauges and/or routine seepage measurements to better evaluate spatial and temporal gaining/losing conditions
- Modeling Improvements:
  - Improve ability of models to accurately simulate shallow aquifer system groundwater levels and surface water/groundwater interaction: incorporate data that will be collected from new shallow monitoring wells and other studies/monitoring conducted during initial GSP implementation period
- Others?

Next Steps in Developing SMC for Depletion of Interconnected Surface Water

1. Complete GDE and ISW mapping
2. Further evaluate potential RMP networks
3. Develop draft SMC at each proposed RMP for all three basins based on potential methodology
4. Develop options for Undesirable Result determination
5. Develop narrative for GSP SMC section

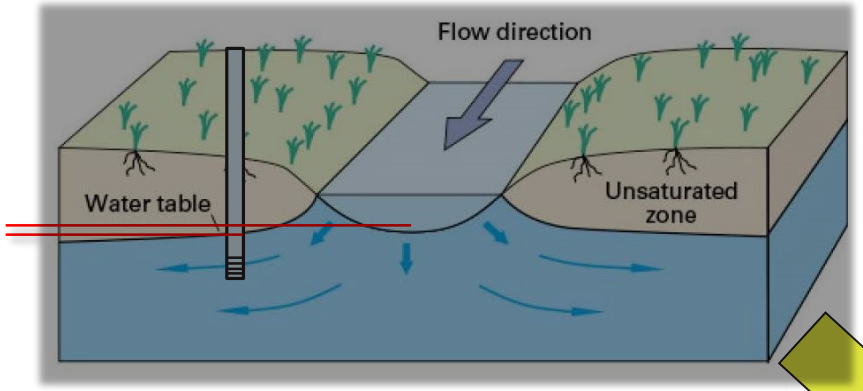
SANTA ROSA PLAIN
GROUNDWATER
SUSTAINABILITY AGENCY

SW Depletion SMC Development

STEPHEN MAPLES

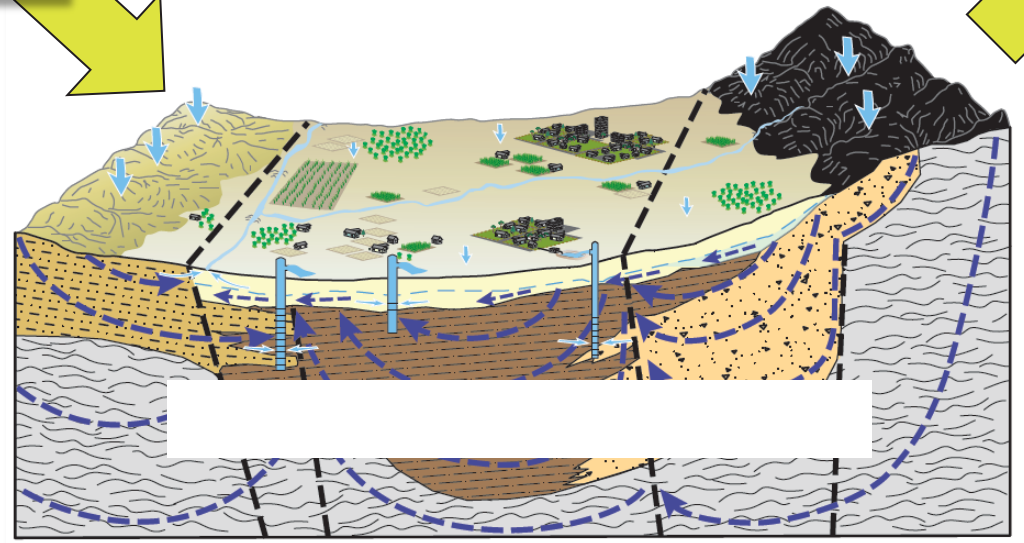
12/09/2020 UPDATE

How can we leverage measurements and models to characterize GW/SW interactions and SW depletion?

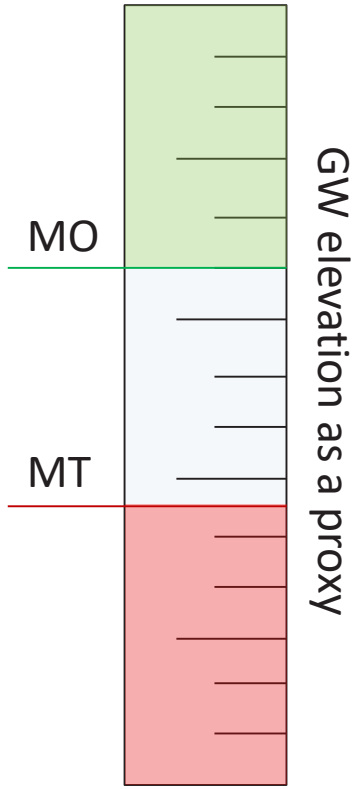


Local GW elevation (measured/simulated)

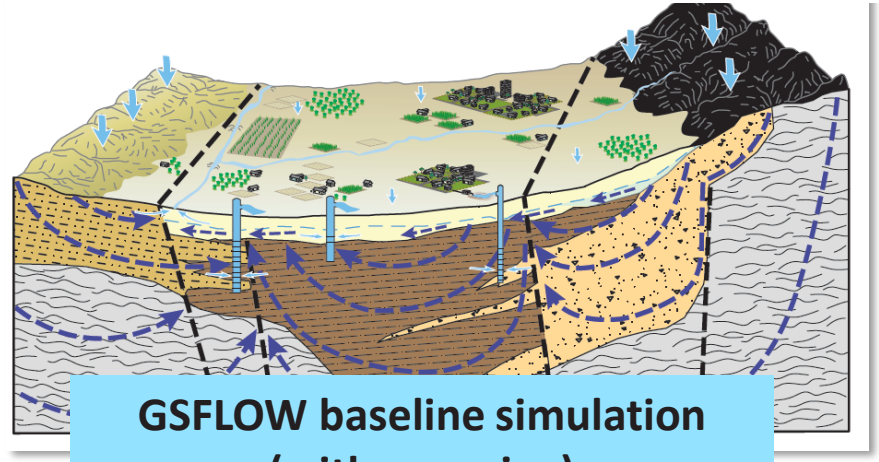
Regional SW depletion characterization (simulated)



SMCs are tied to GW elevations and informed by simulation results

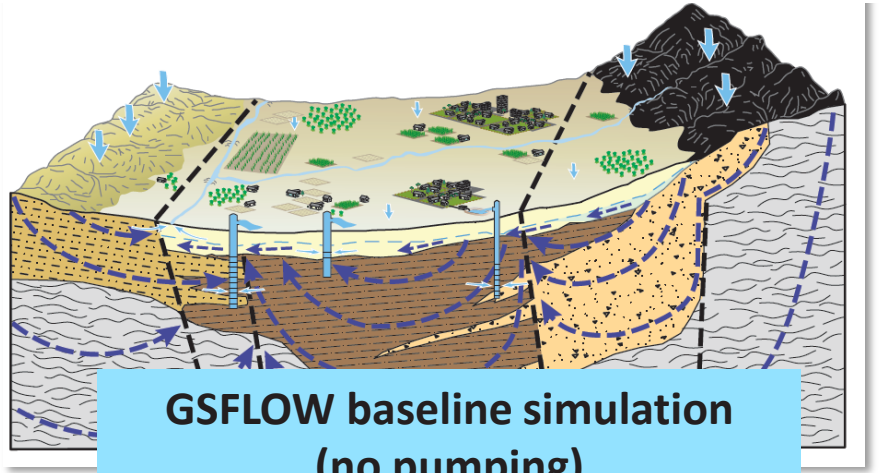


Isolate GW pumping impacts by “differencing” a historical baseline simulation (with pumping) from a identical simulation without pumping



GSFLOW baseline simulation (<u>with</u> pumping)

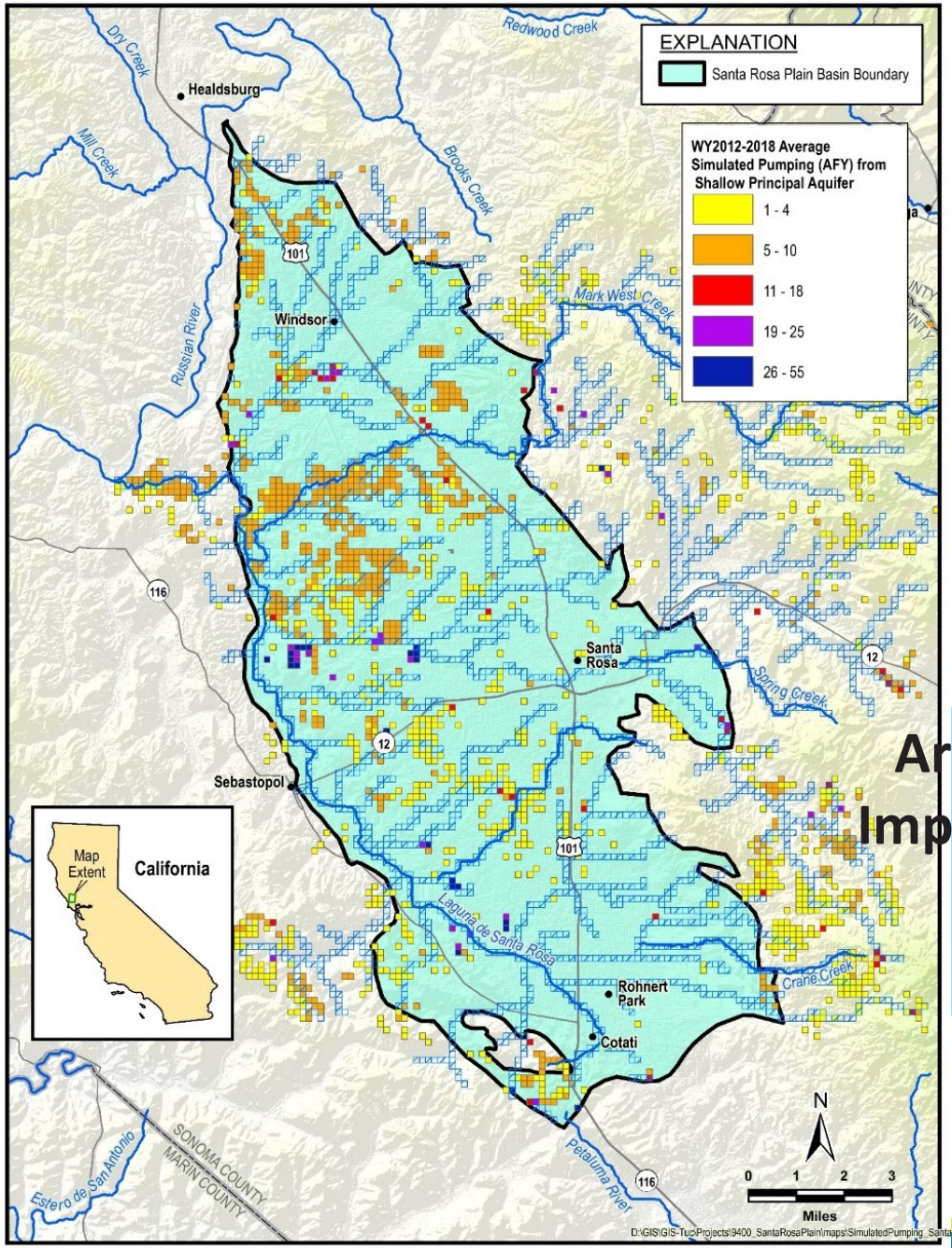
minus



GSFLOW baseline simulation (<u>no</u> pumping)

Isolate Surface Water Depletion (SWD) from groundwater pumping

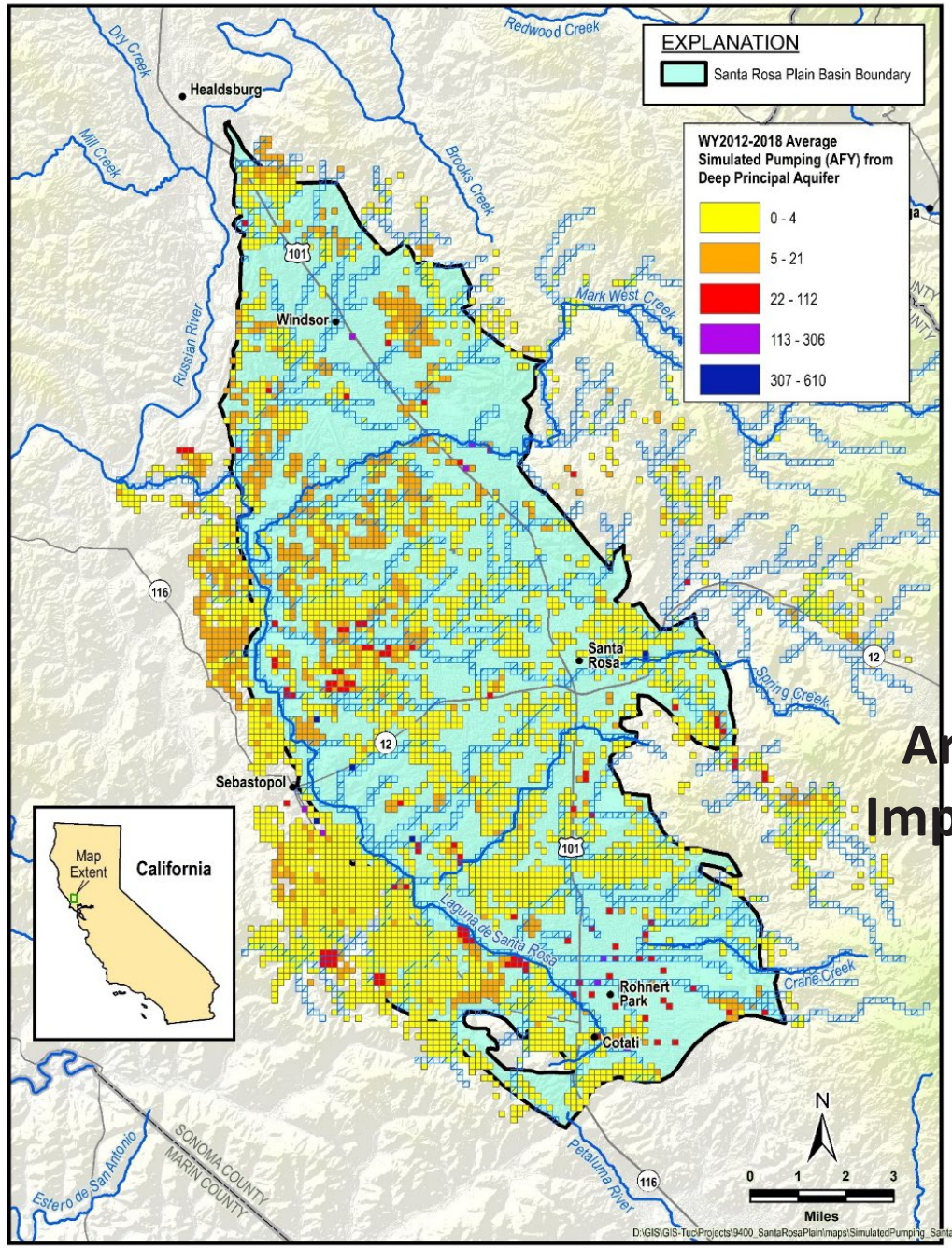
Where does pumping occur within the basin?



Areal Extent of Pumping Impacts in Santa Rosa Plain

Layer 1

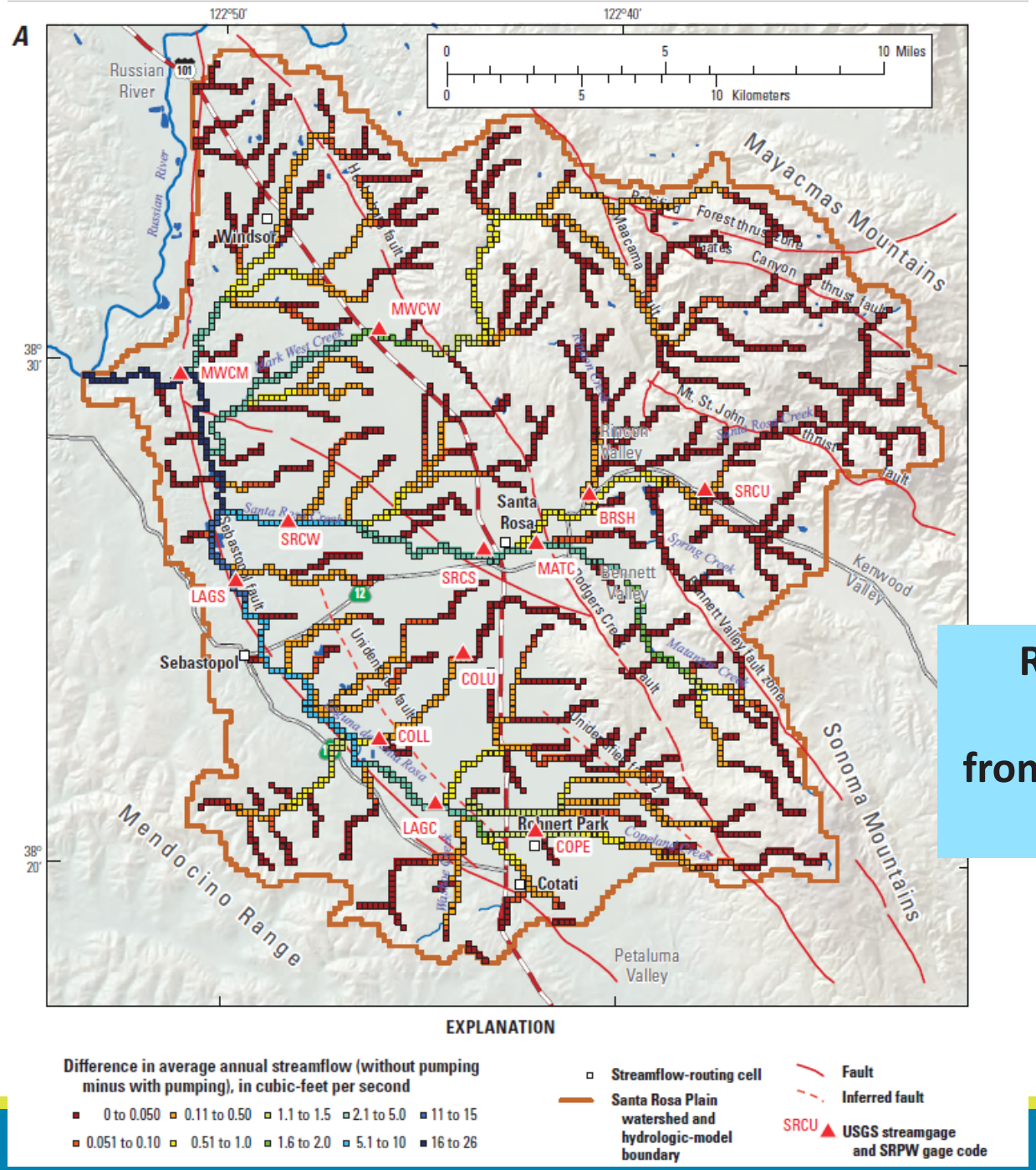
Where does pumping occur within the basin?



Areal Extent of Pumping Impacts in Santa Rosa Plain

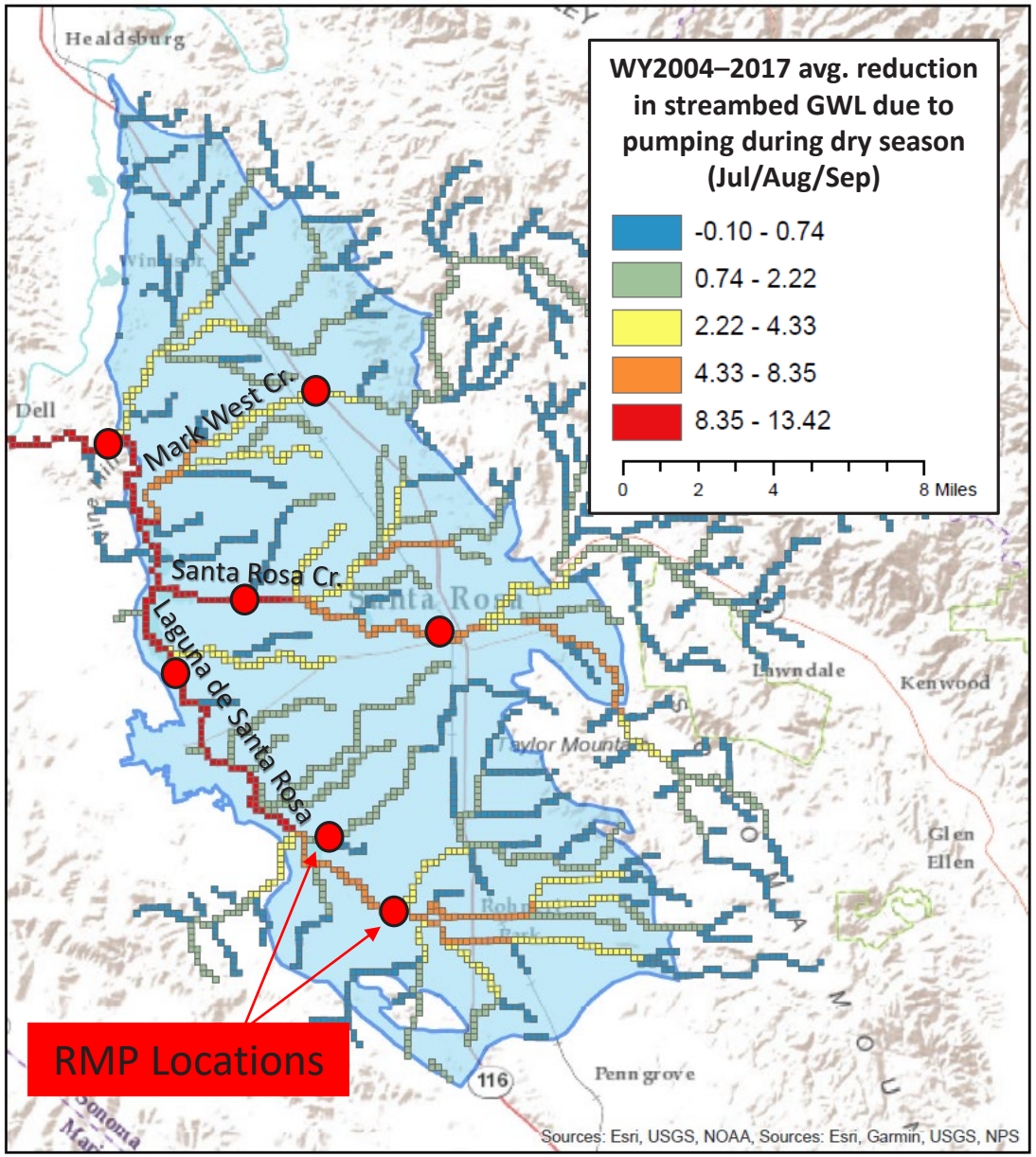
Layers 2–8

Where does pumping have greater potential to impact streamflows?



Reductions in streamflow due to pumping.

from: Woolfenden and Nishikawa, 2014, Chapter E Figure 9A



Where does pumping have greater potential to impact streamflows?

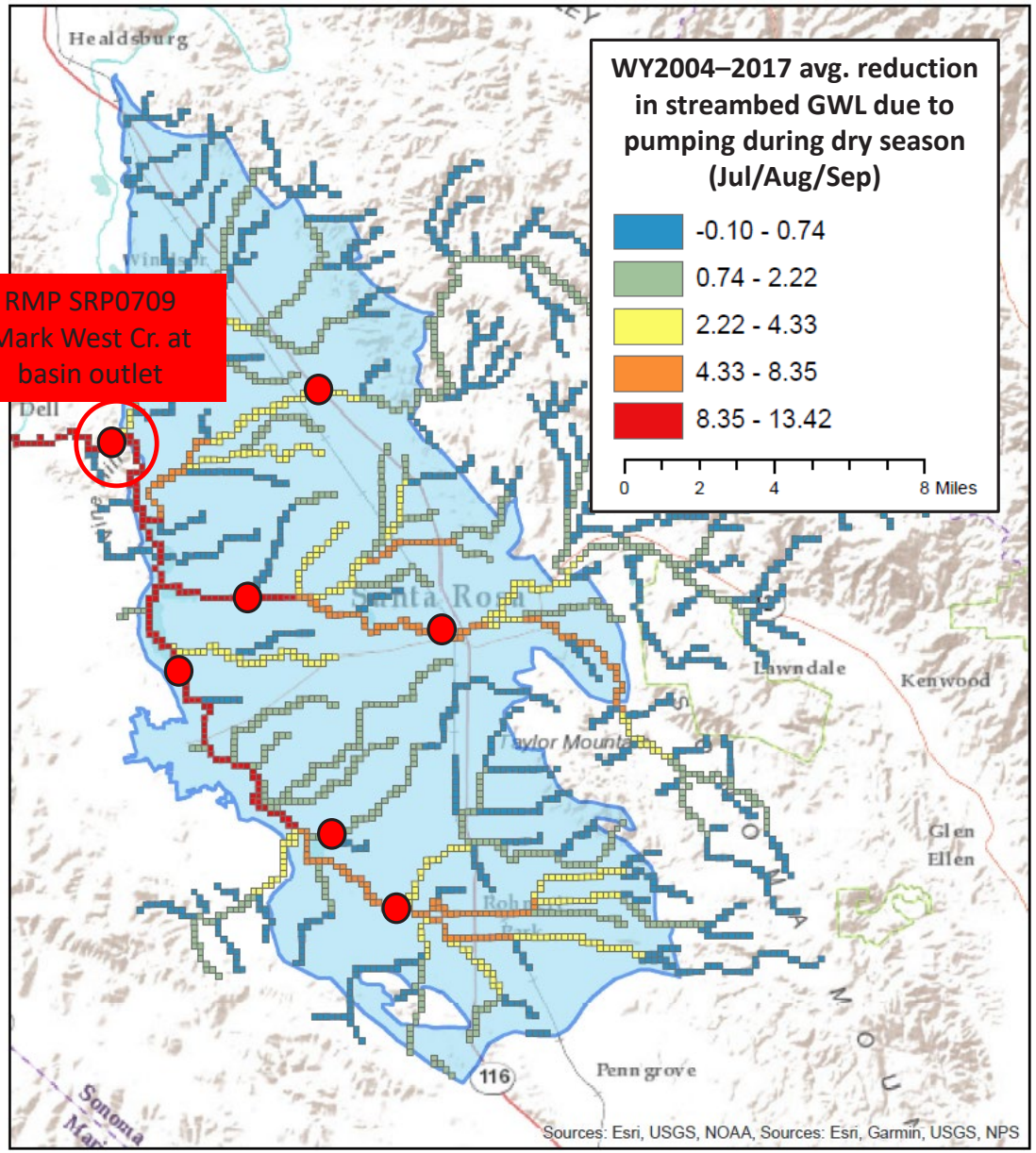
Modeling suggests that pumping has greater potential to impact streamflows on:

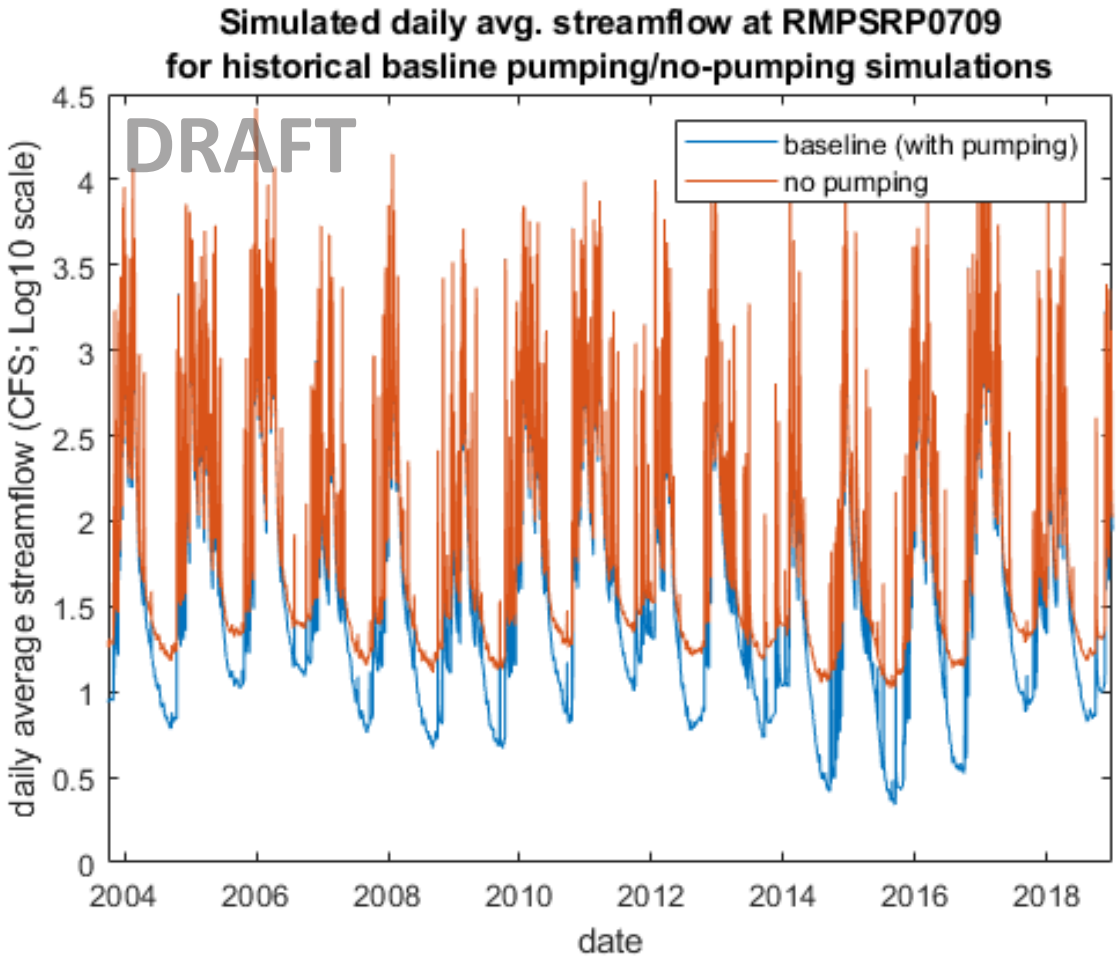
Laguna de Santa Rosa
Santa Rosa Cr.
Mark West Cr.

Actual impacts are very dependent upon:

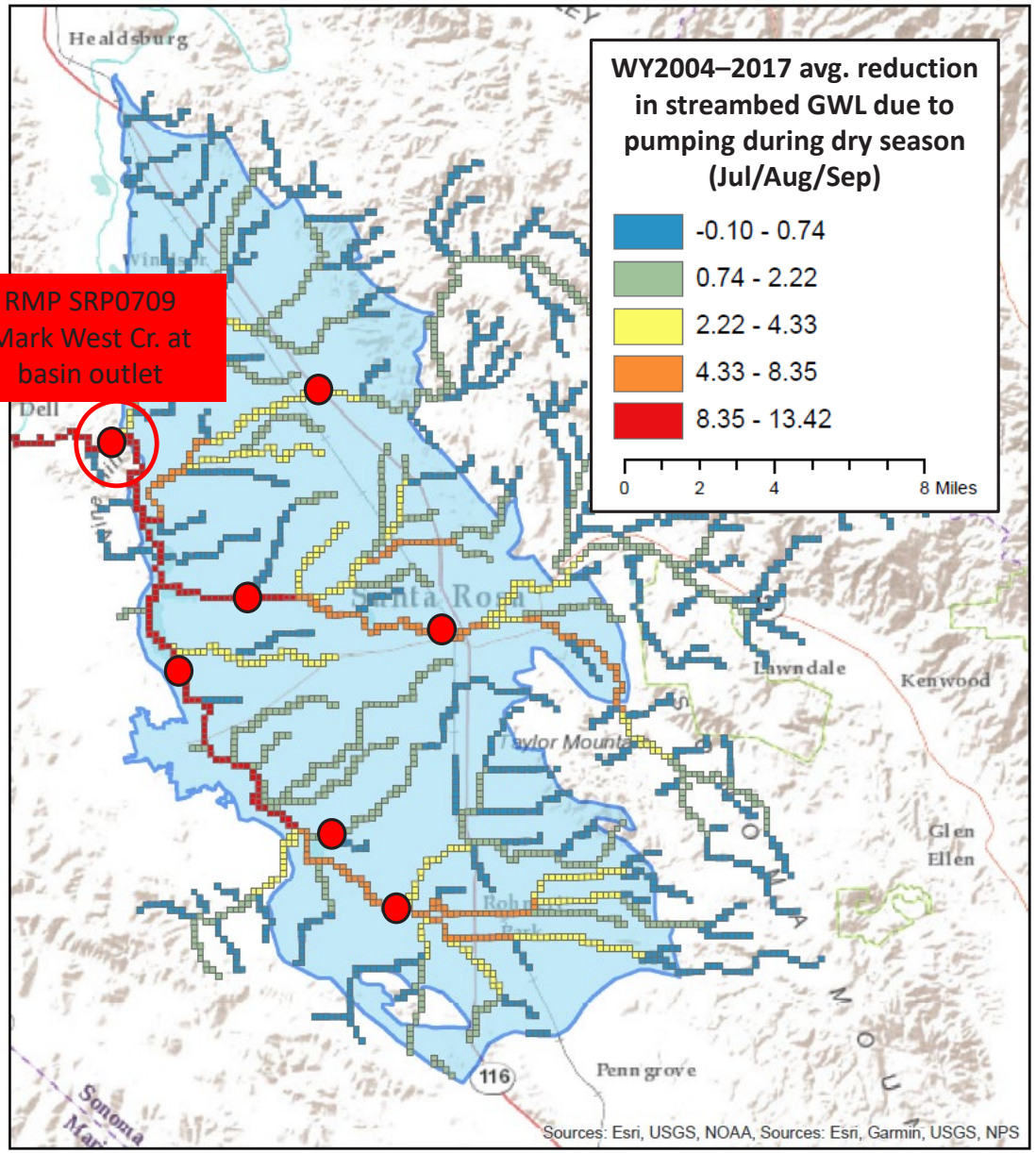
(1) streambed/shallow aquifer hydraulic conductivity
(2) stream/aquifer configuration

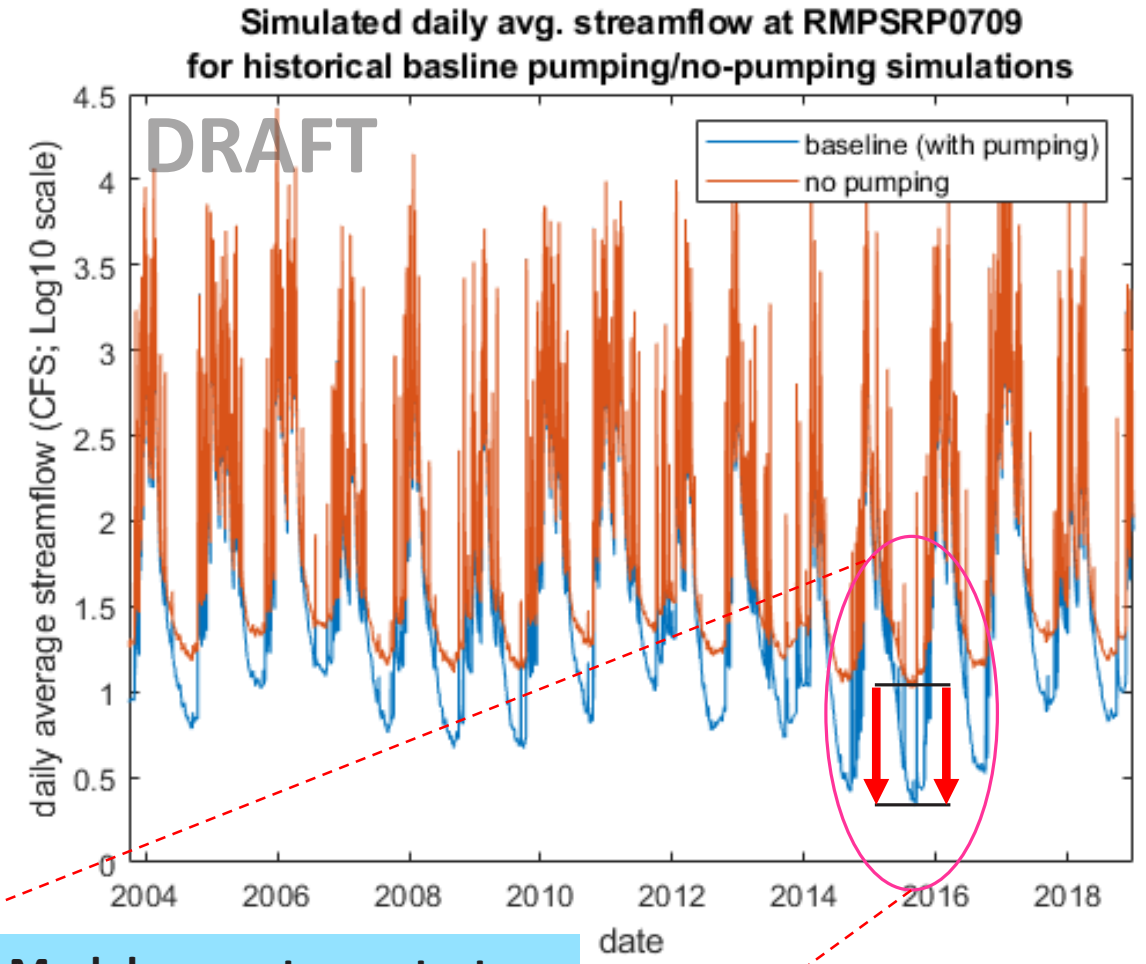
What is the impact of pumping on outflows from the basin?





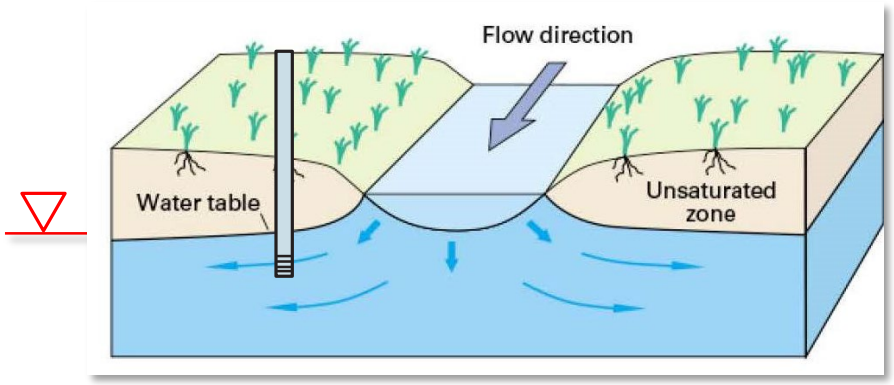
What is the impact of pumping on outflows from the basin?



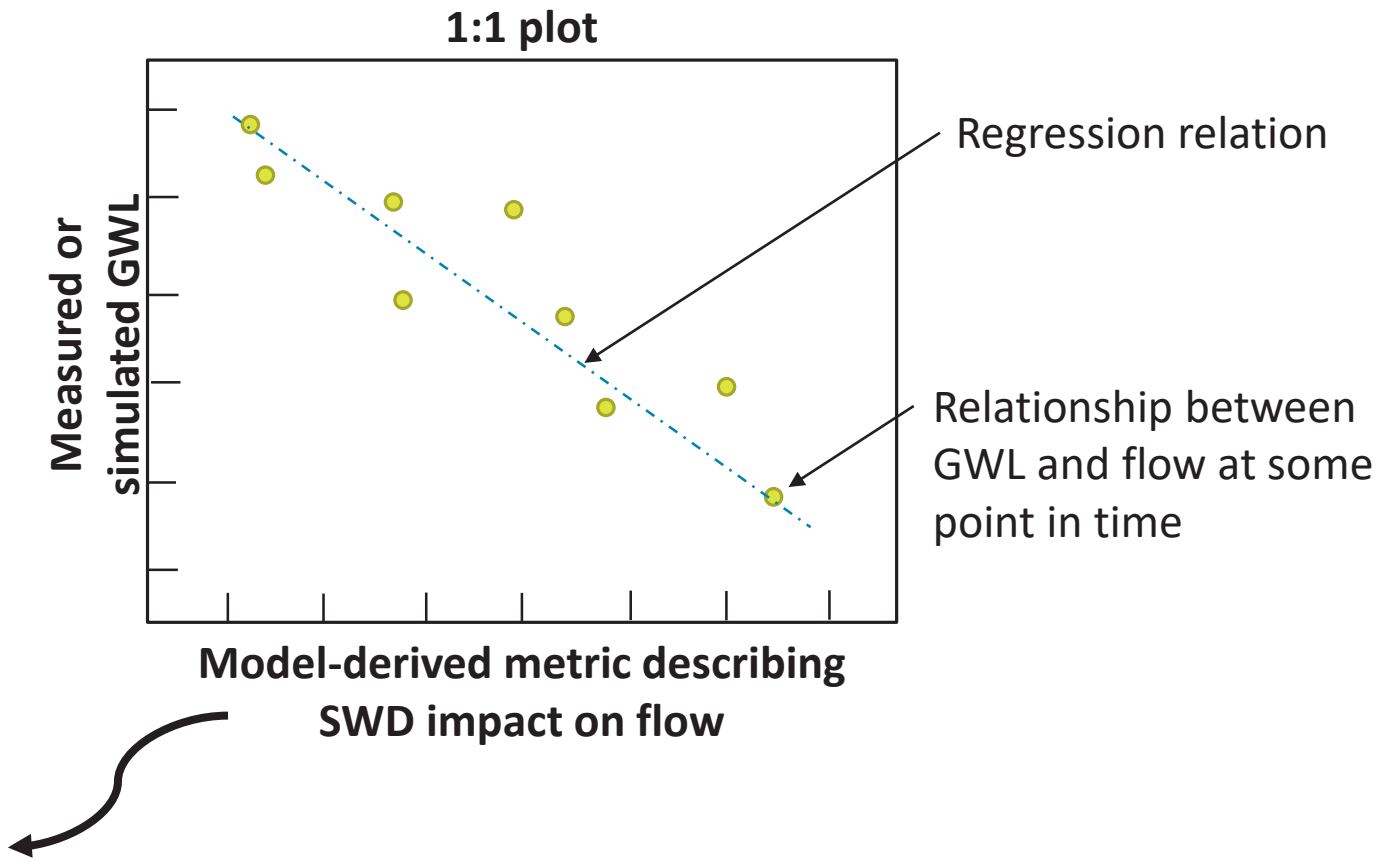


Model suggests greatest reduction in dry-season flows due to pumping during 2015

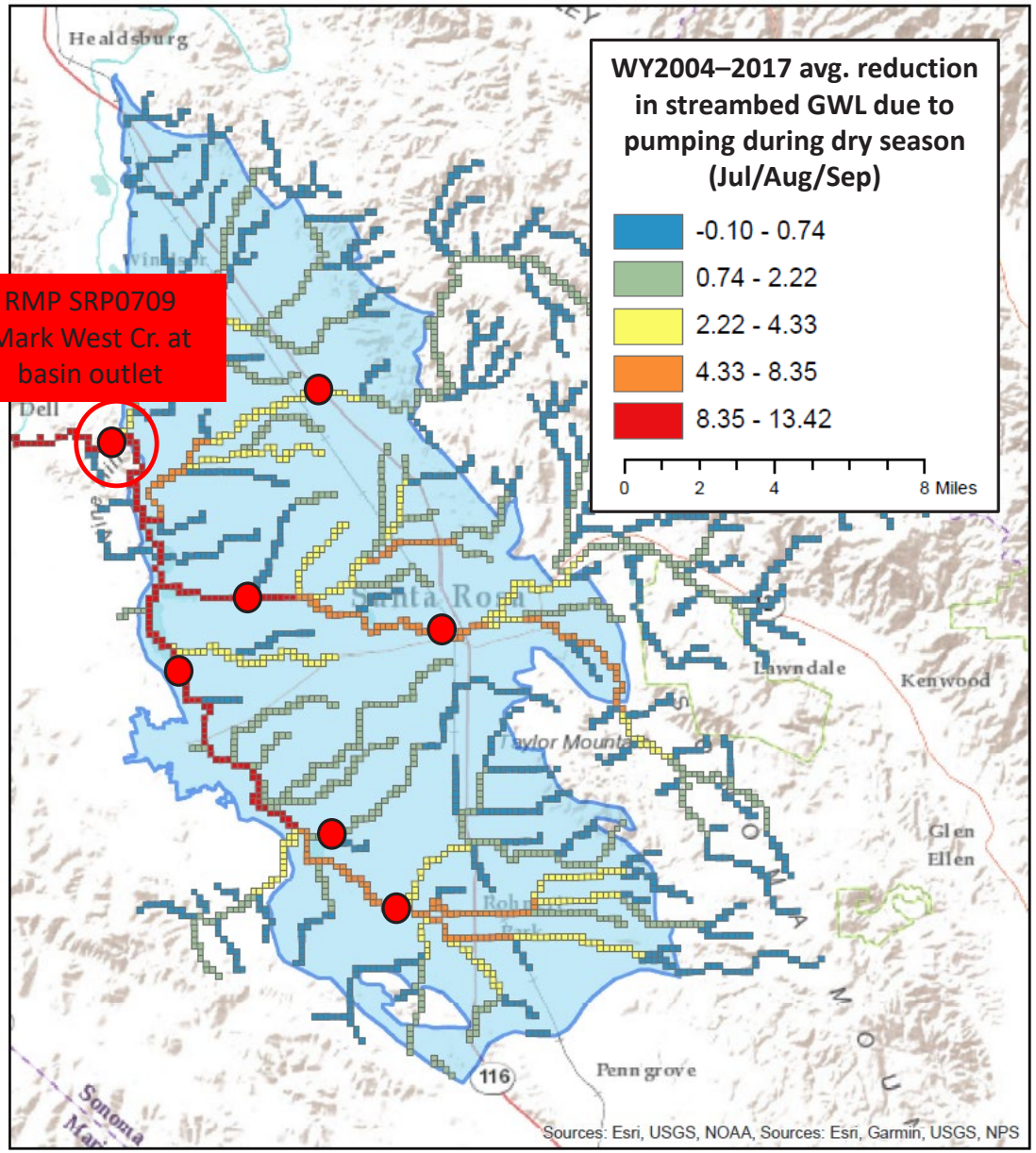
How can GWL be used as a proxy for surface water depletion?



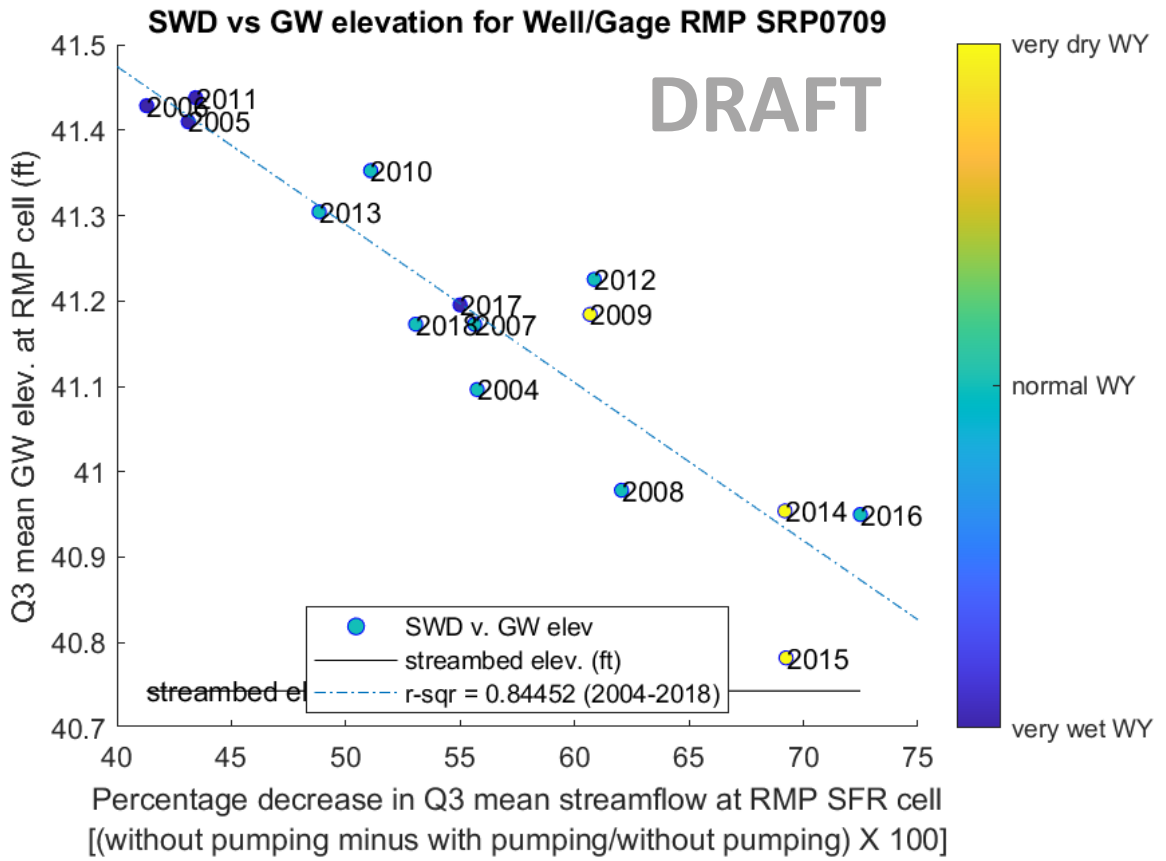
1. **Percent reduction in streamflow due to pumping (over entire WY)**
2. **Percent reduction in streamflow due to pumping (during low-flow periods)**
3. **Number of days that SWD exceeds threshold value**



Can we use GW levels as a proxy for SWD?



Good correlation … for simulated GW levels and SWD at some RMPs



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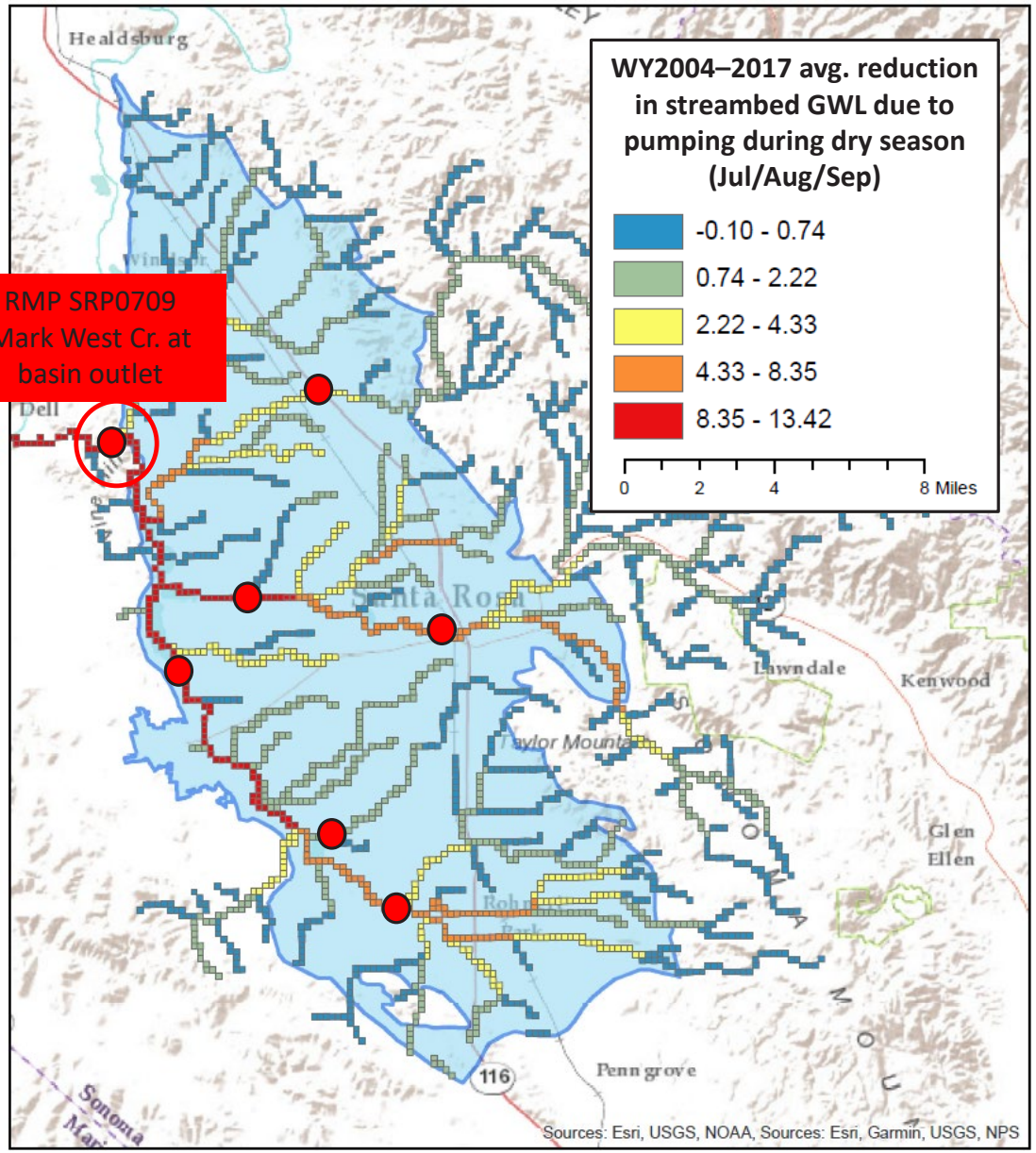

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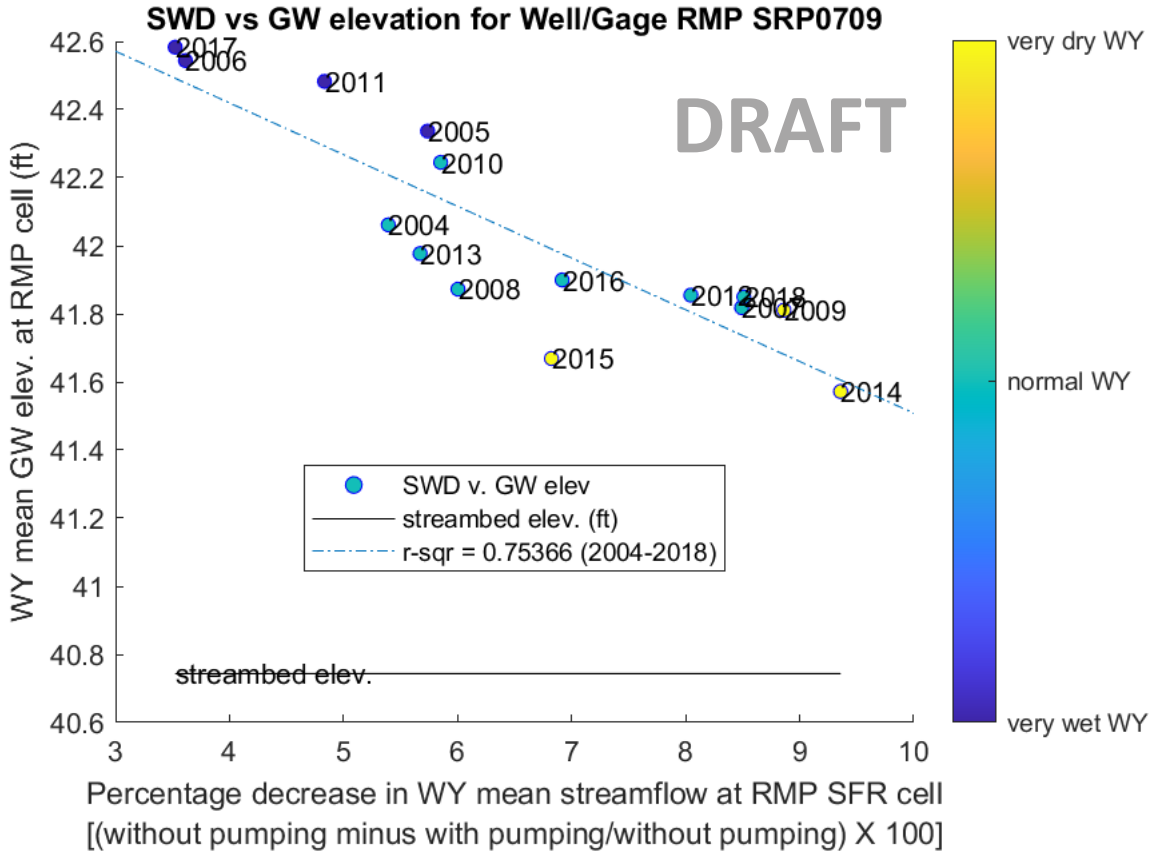
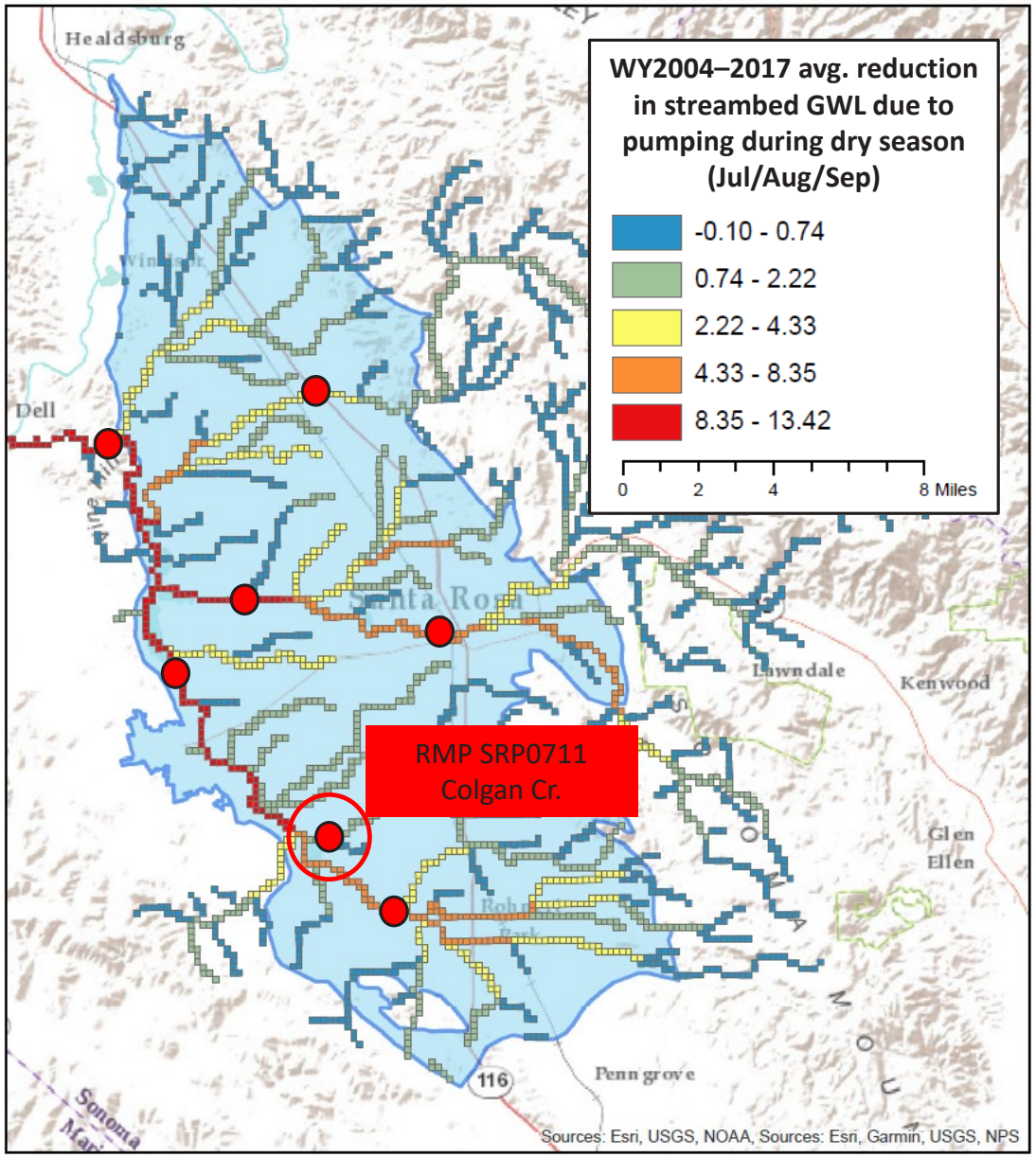
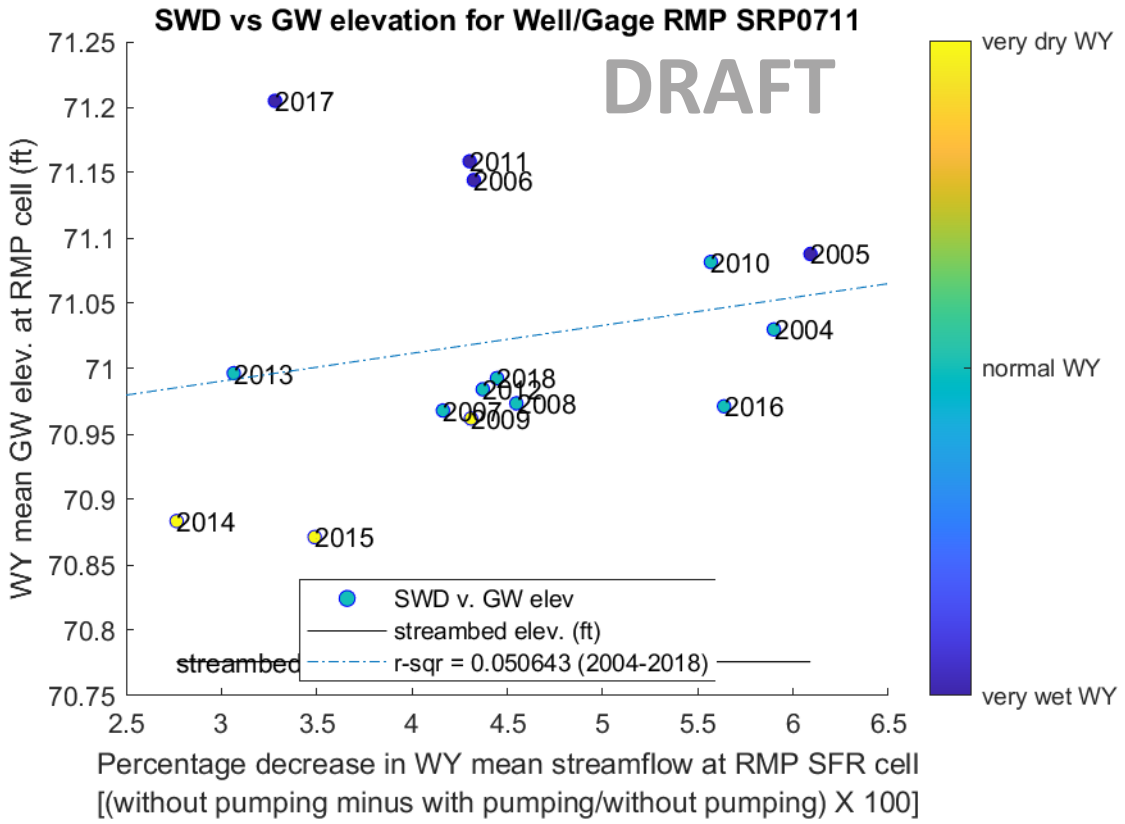


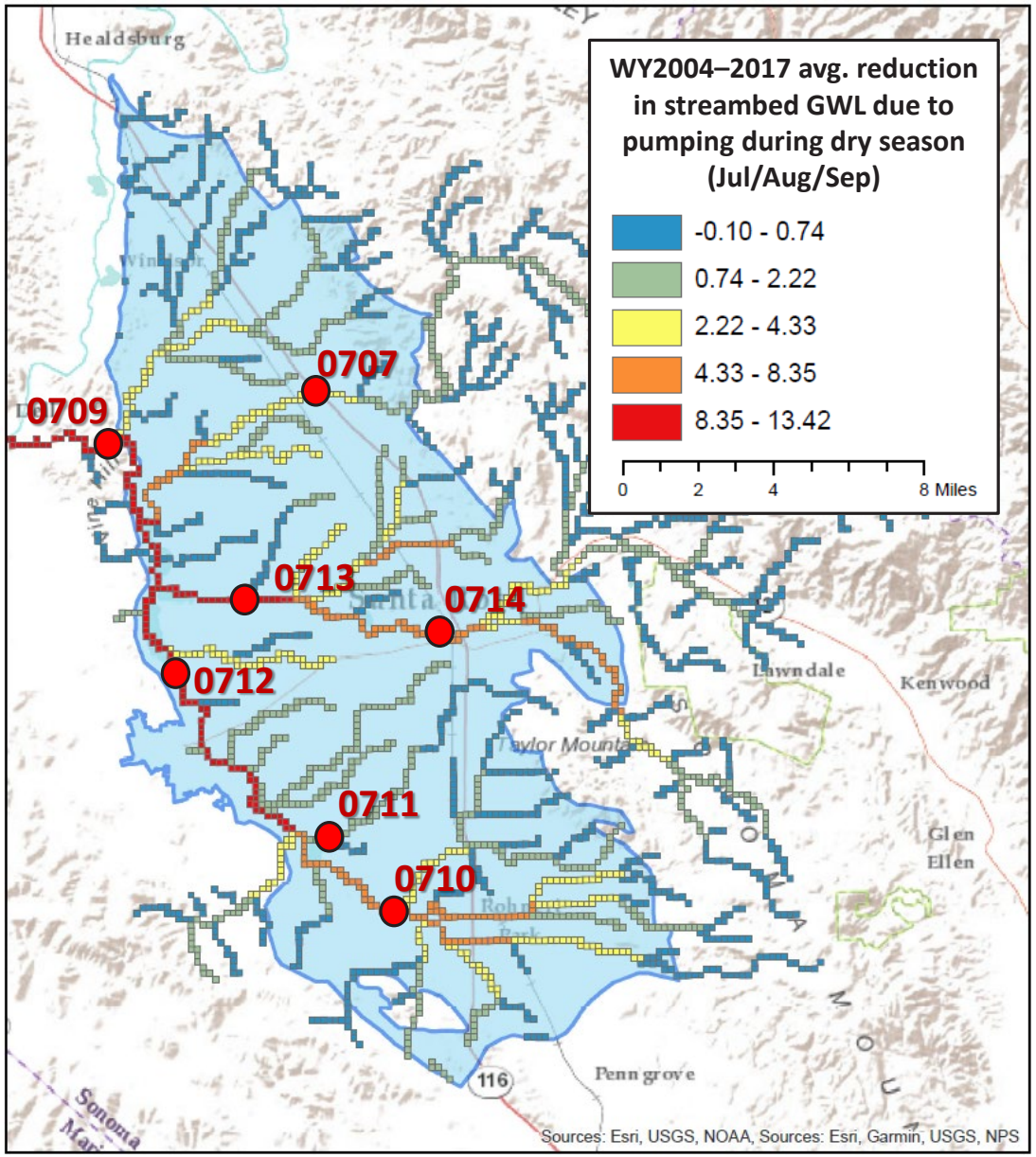
Can we use GW levels as a proxy for SWD?



Poor correlation … for some RMPs where little SWD is occurring

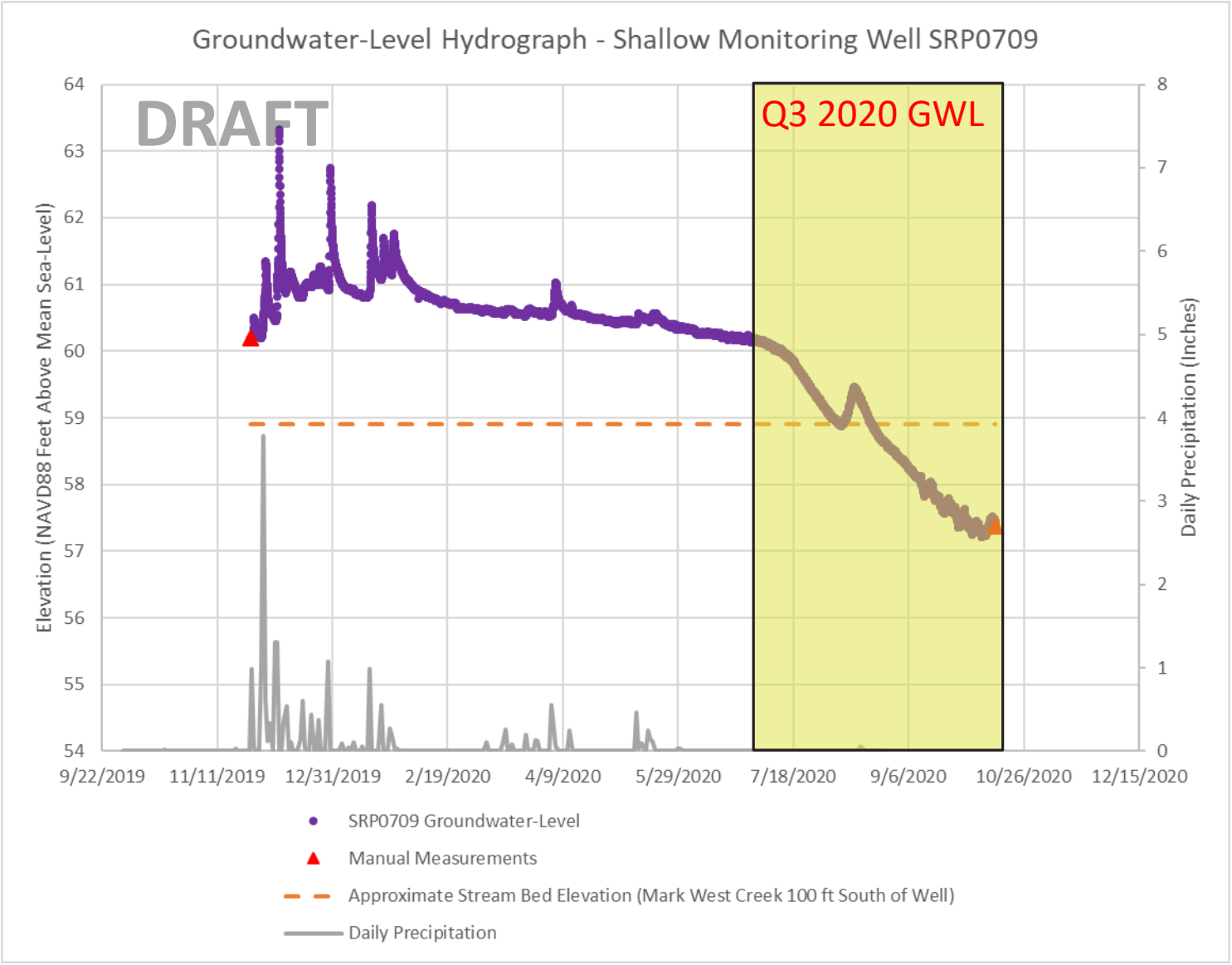


Can we use GW levels as a proxy for SWD?



Good correlation between modeled GWL and SWD is noted at several monitoring locations.

RMP	r-squared agreement between GWL and SWD	
	Full Water Year (WY)	Q3 dry period (Jul/Aug/Sep)
SRP0707	0.72	0.78
SRP0709	0.75	0.84
SRP0710	0.49	0.03
SRP0711	0.05	0.16
SRP0712	0.28	0.74
SRP0713	0.54	0.13
SRP0714	0.71	0.27



Model results show promise … How do they compare with measured data?

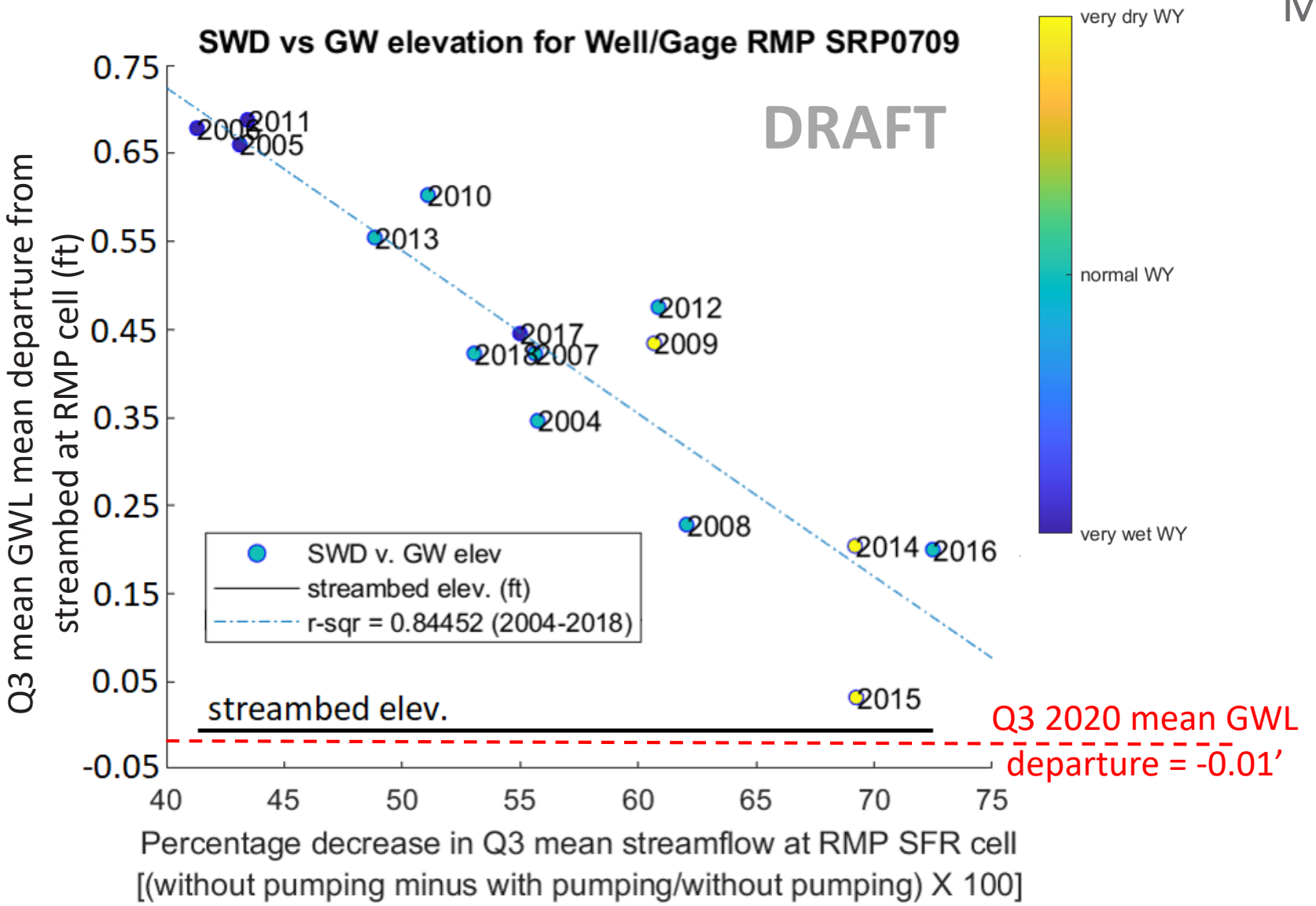
Problem:

Model simulation period (WY1974–2018) does not overlap with RMP data collection (2019–present)

Reliance on model results assumes well calibrated model, esp. at RMP locations.

Potential Solution:

Compare measured/modeled behavior for similar WY type.
(WY2020 = dry year)



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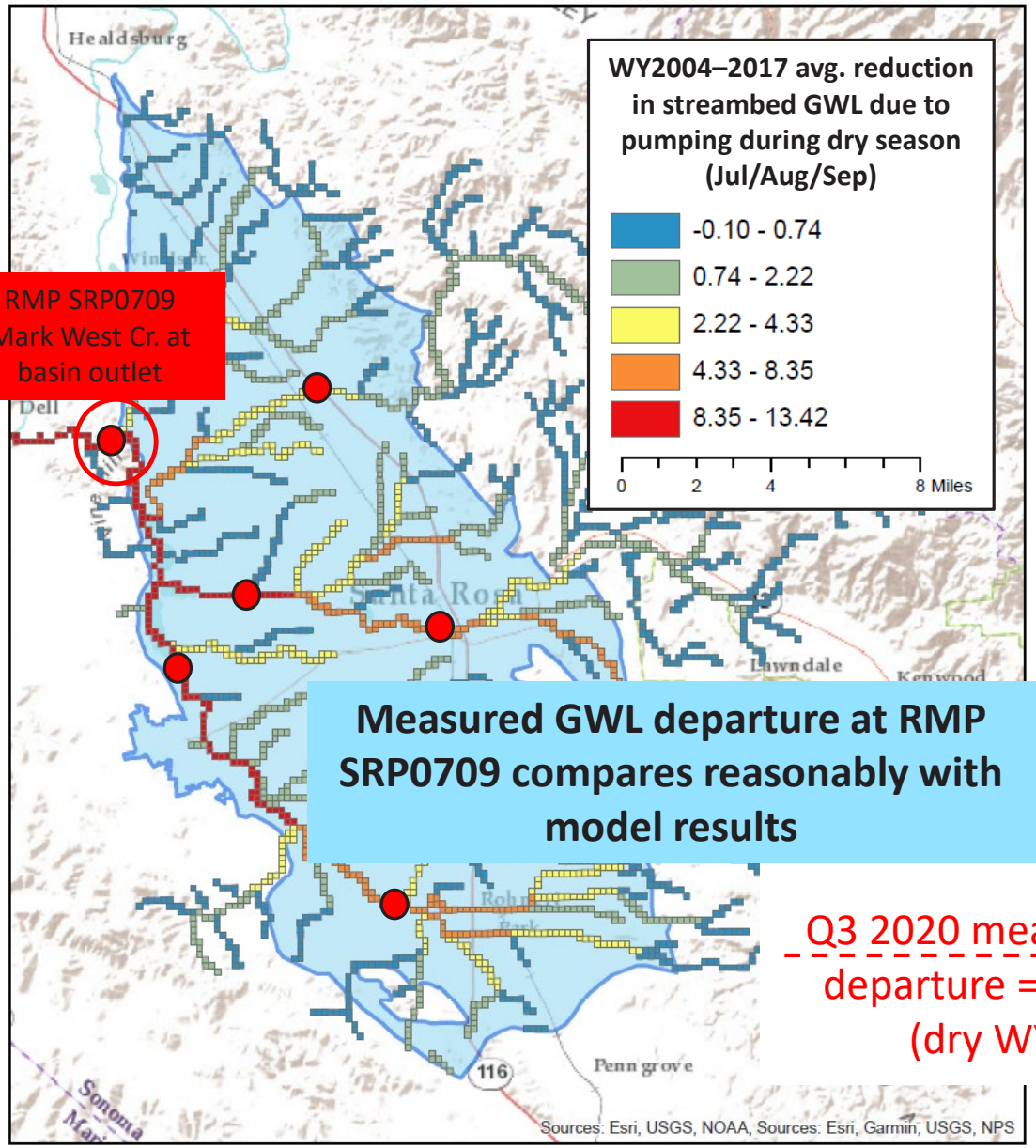

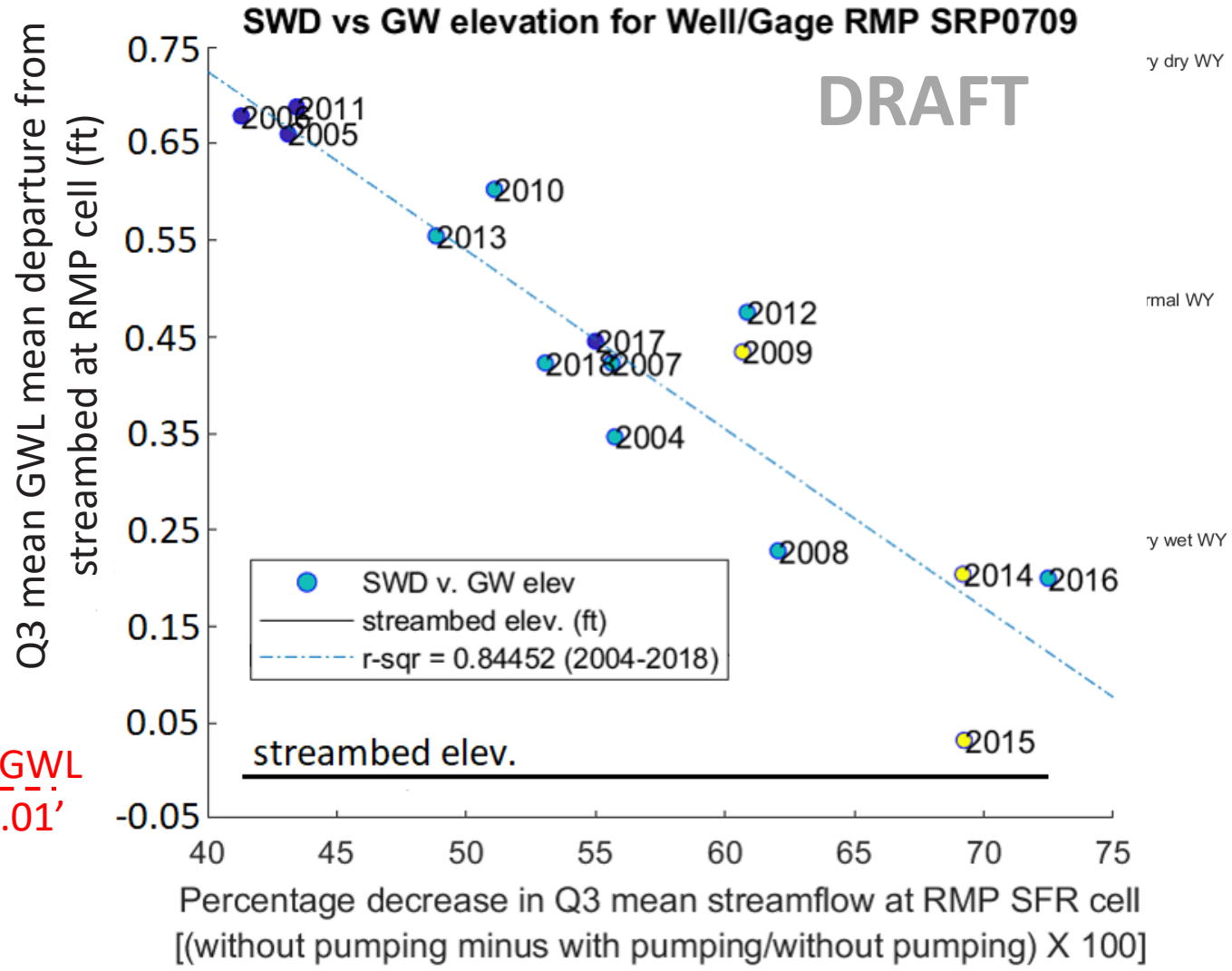

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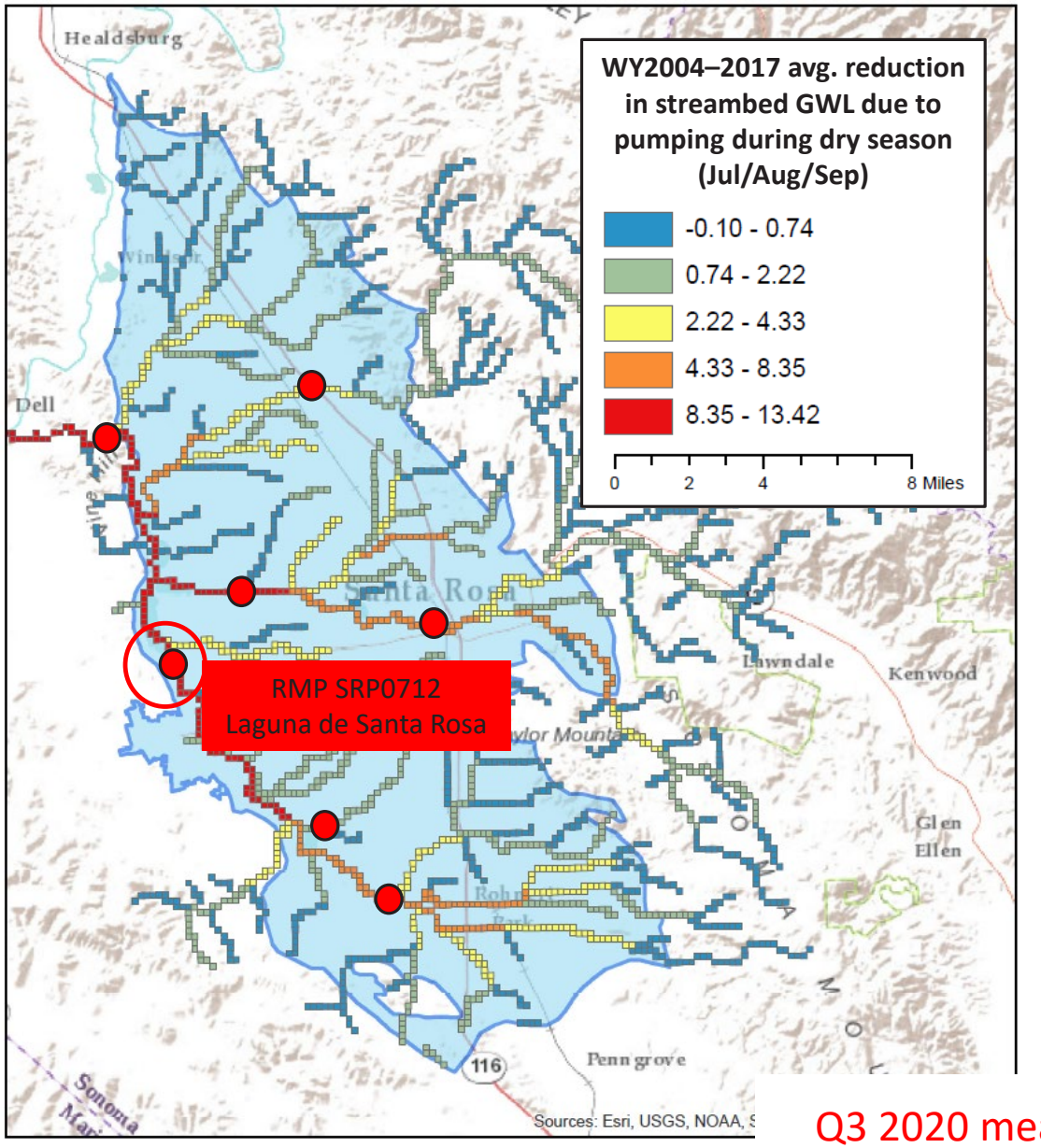
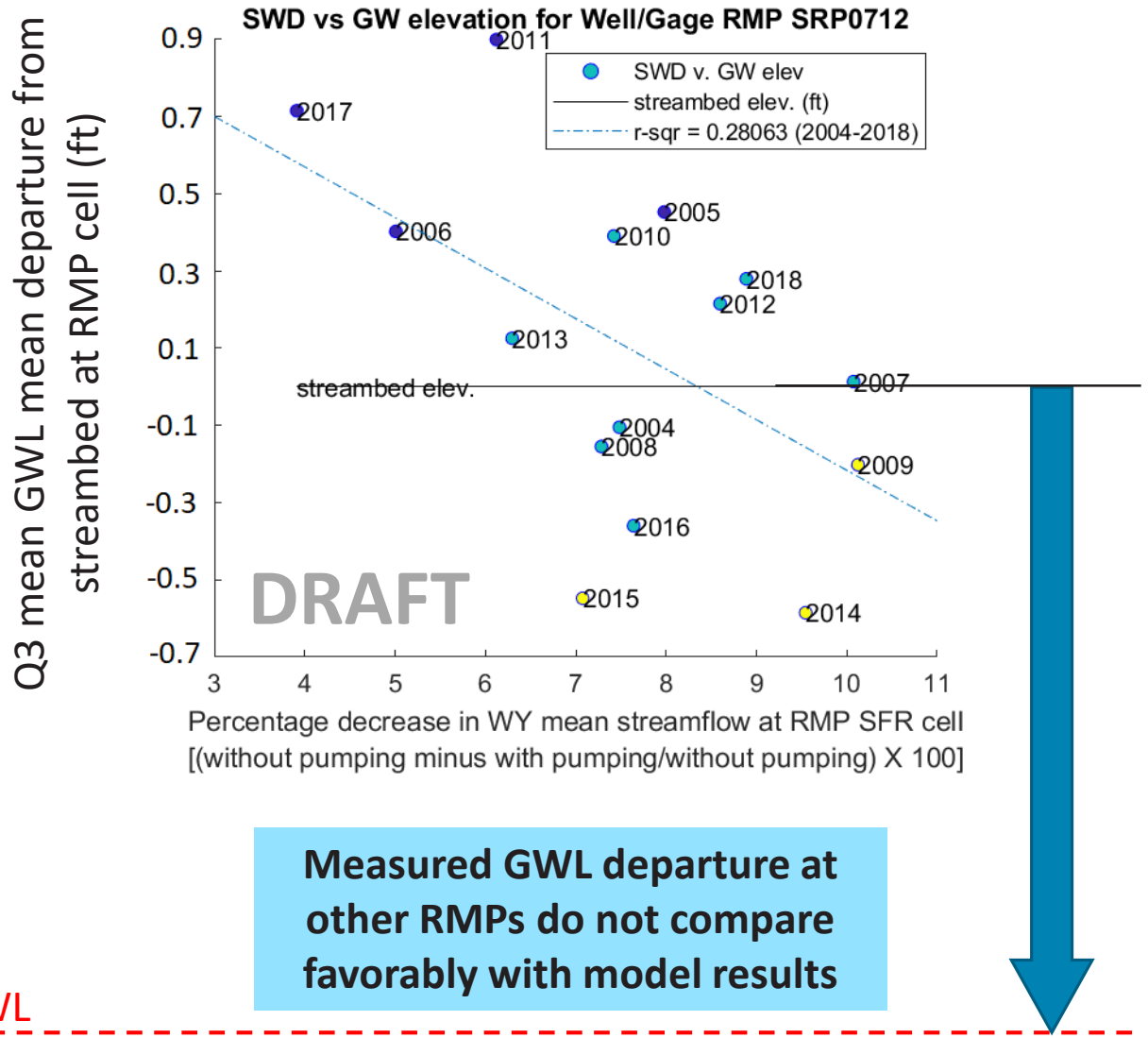


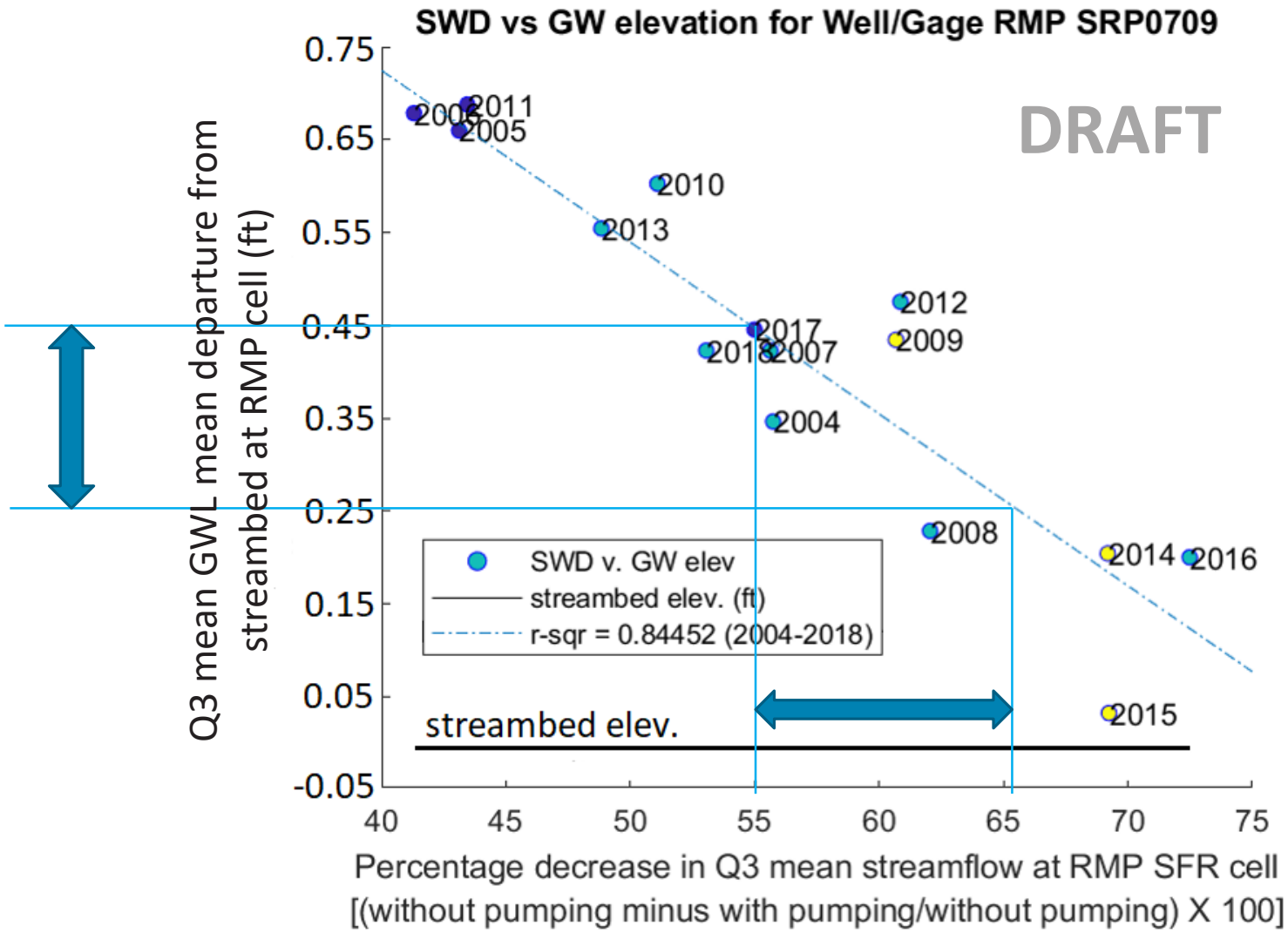


Measured GWL departure at other RMPs do not compare favorably with model results

Q3 2020 mean GWL departure = -4.5’ (dry WY)

How can GWL – SWD relationship be used to inform SMC choice?
… Assuming good agreement between measured data and model results

Relationship suggests 0.1 ft reduction in mean Q3 GWL corresponds with ~10% increase in SWD.



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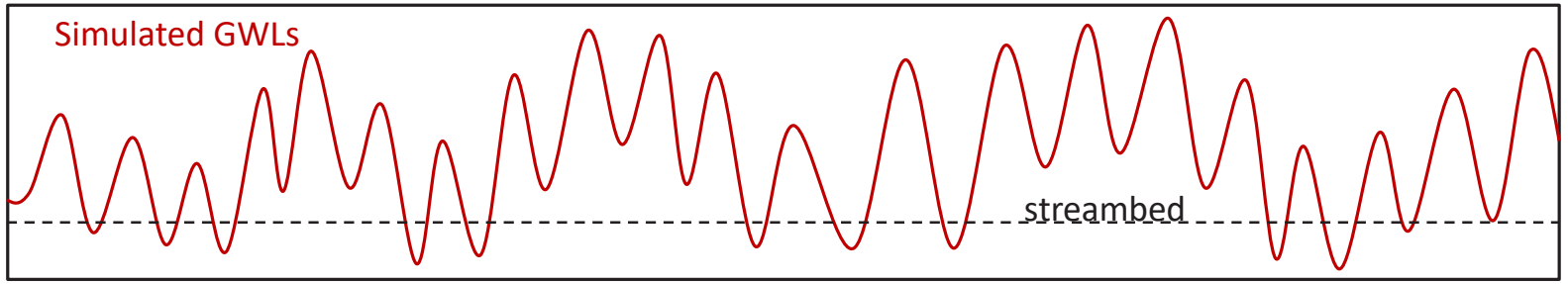
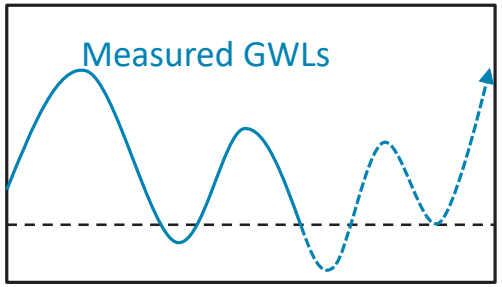
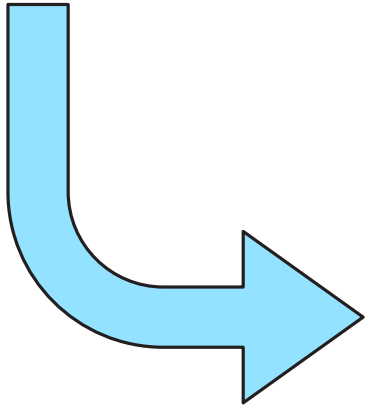
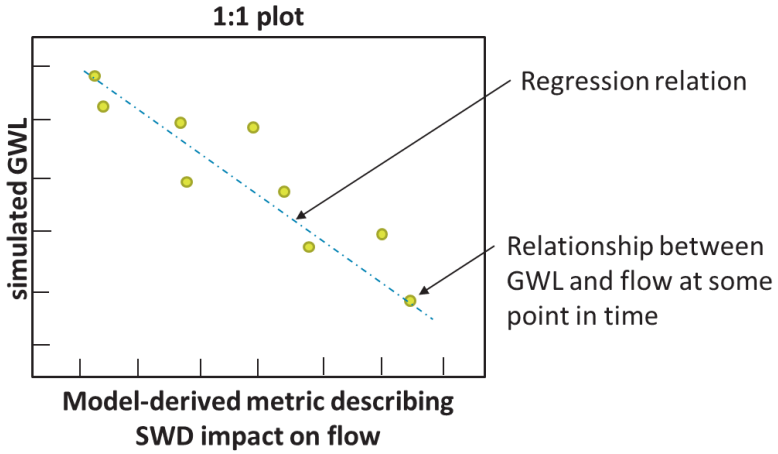


Simulation Period (1974–2018)

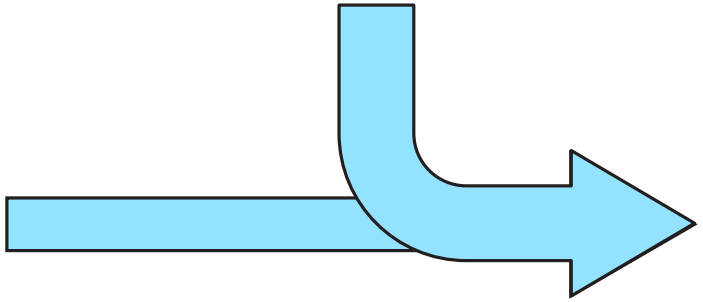


Measurement Period
(2019–present and beyond)

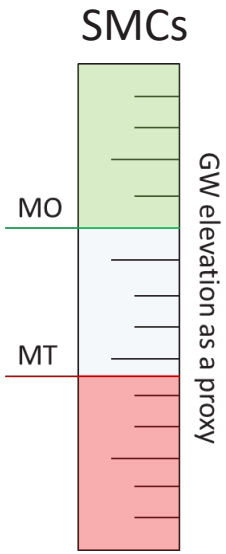




Initial SMC choices informed by model results



SMCs refined as more measurements are collected



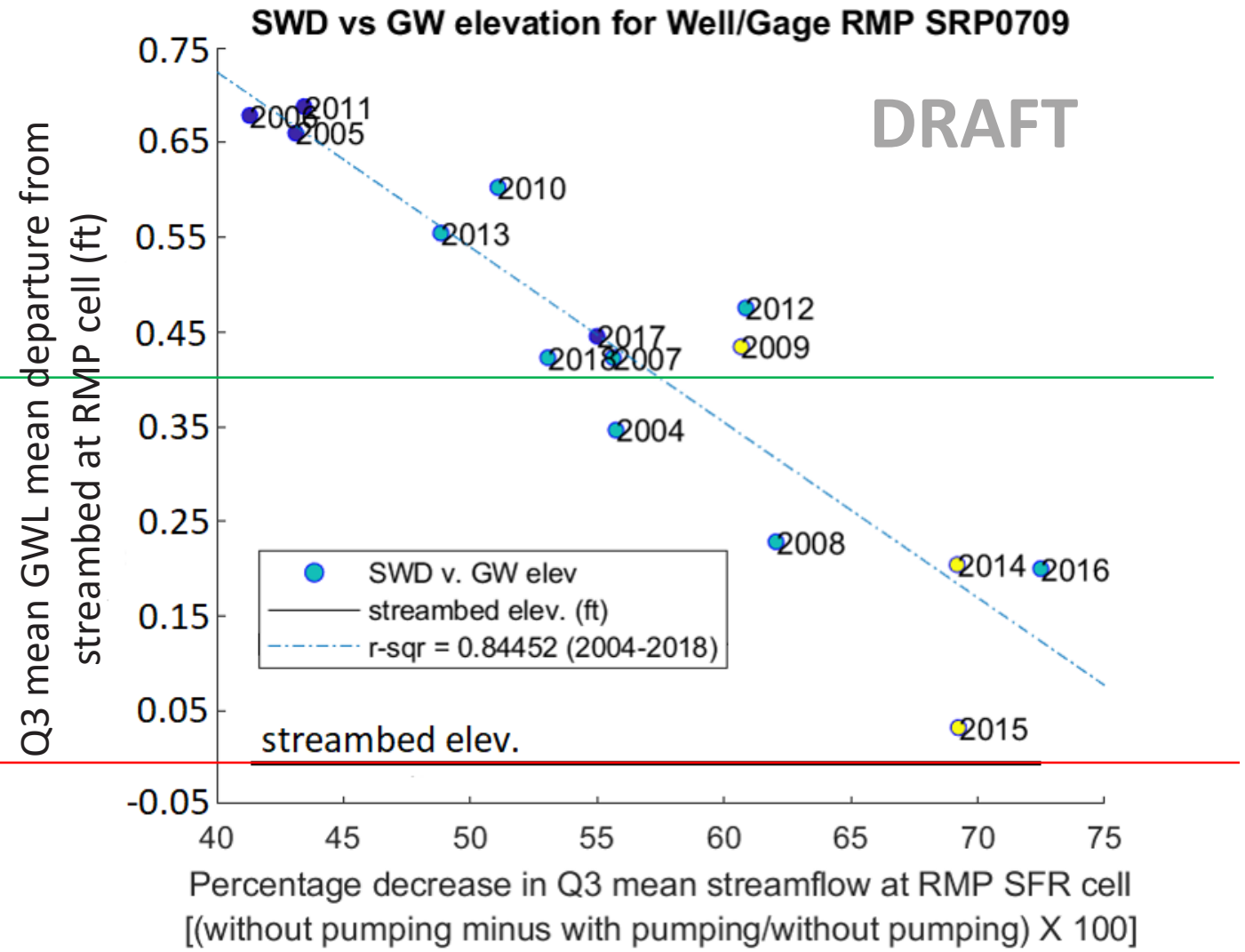
How can GWL – SWD relationship be used to inform SMC choice?
… Assuming good agreement between measured data and model results

Potential Approach:

Set SMC based on GWL, use relationship to infer SWD impact

Example measurable objective (MO) =
Q3 GWL > mean Q3 GWL during 2004–2018
= ~55-60% avg. decrease in Q3 streamflow

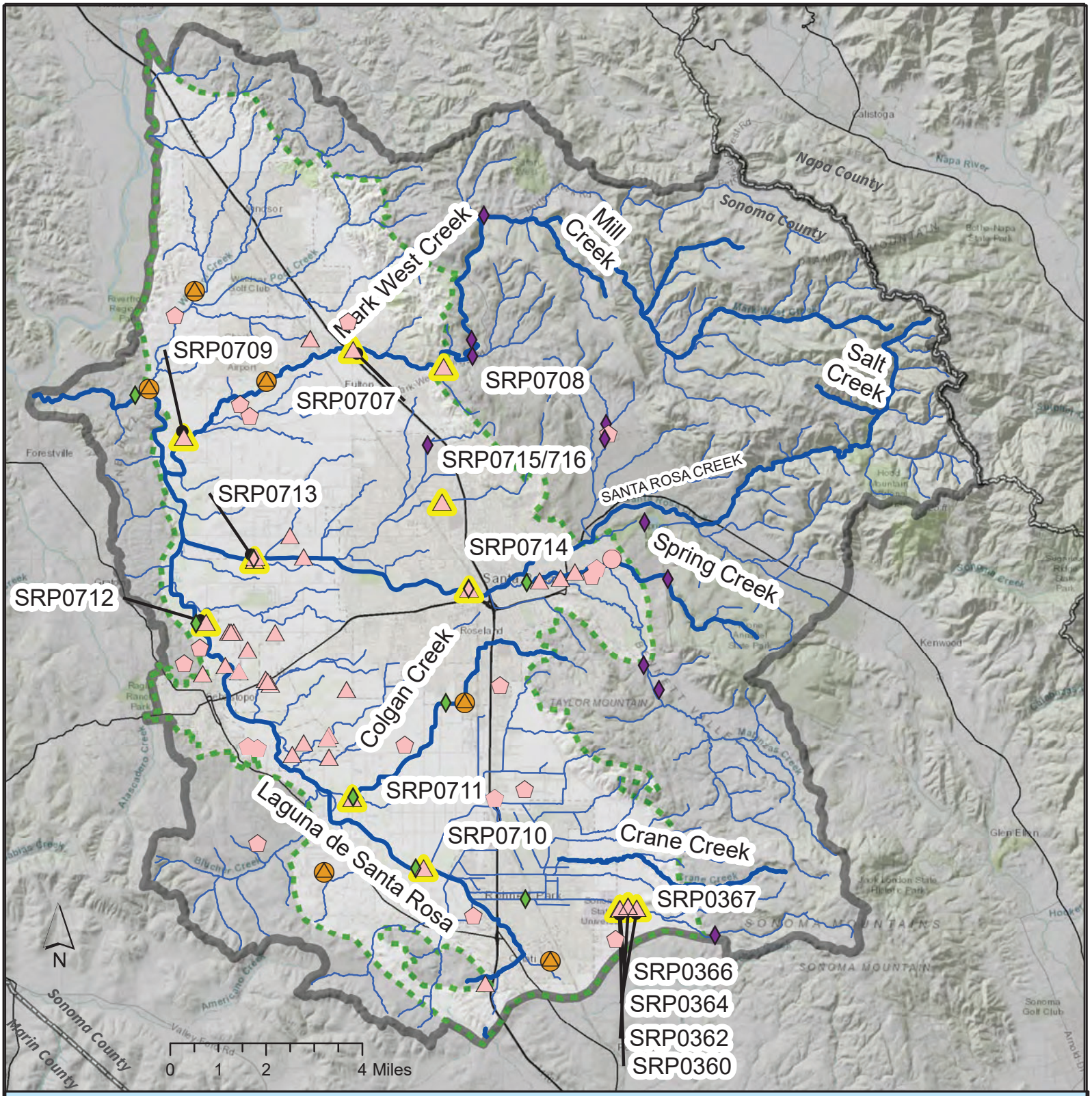
Example minimum threshold (MT) =
Q3 GWL > streambed elev.
= >75% avg. decrease in Q3 streamflow



Shallow TSS Monitoring Well Details
Santa Rosa Plain Groundwater Subbasin

Station Name	Station Number	Location Description	Well Depth (ft BGS)	Screened Interval (ft BGS)	Well TOC Elevation (ft MSL)	Approximate Distance from Well to Creek (ft)	Direction of Well from Creek
SRP0707	SRP-F07-04_Fulton	Mark West Creek at Fulton Rd	50.5	30-50	143.92	200	S
SRP0708	SRP-H07-01_Mark West	Mark West Creek at Mark West Springs Rd.	25.5	15-25	196.18	275	SE
SRP0710	SRP-H18-02_Stony	Laguna de Santa Rosa at Stony Point Rd.	45.5	35-45	89.67	75	N
SRP0709	SRP-C09-01_River Rd	Mark West Creek at River Rd	33.5	23-33	71.86	100	N
SRP0711	SRP-F16-01_Llano	Colgan Creek at Llano Rd.	45.5	35-45	79.26	110	S
SRP0712	SRP-C13-03_Sanford	Laguna de Santa Rosa at Occidental Rd.	48.5	28-48	69.28	1135	E
SRP0713	SRP-D11-02_Willow	Santa Rosa Creek at Willowside Rd.	45.5	25-45	78.77	115	S
SRP0714	SRP-H12-01_Pierson	Santa Rosa Creek at Pierson St.	51.5	41-51	150.34	65	S
SRP0715	SRP-H10-04_Hardies	Paulin Creek at Hardies Ln.	40.5	30-40	135.45	35	S
SRP0716	SRP-H10-04s_Hardies	Paulin Creek at Hardies Ln - Shallow	20.5	15-20	135.55	35	S

Notes:
ft BGS - Feet Below Ground Surface
ft MSL - Feet Above Mean Sea Level (North American Vertical Datum of 1988)
TOC - Top of Casing



- Santa Rosa Plain Groundwater Subbasin
- Contributing Area Watershed
- Major Rivers and Creeks
- Streams
- Dedicated Monitoring Wells
- Monitored Municipal Supply Wells
- Monitored Private Supply Wells
- SCWA OneRain Stream Gauges
- Active USGS Stream Gauges
- High-Frequency Monitoring Wells Adjacent to Streams
- Planned Shallow/Multi-Level Dedicated Monitoring Wells

Shallow Aquifer System Groundwater-Level Monitoring Network and Existing Stream Gauges

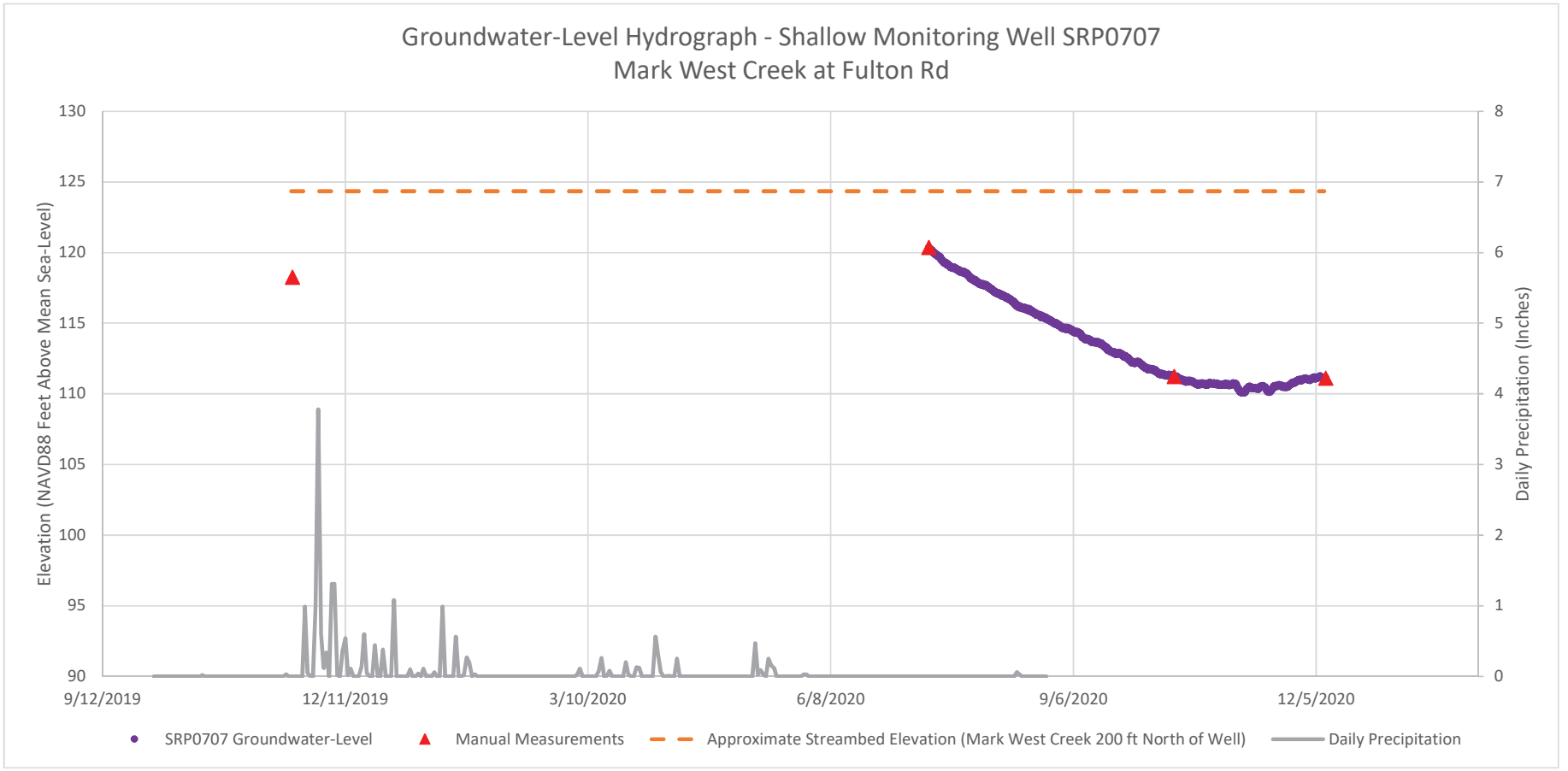
Data Sources:

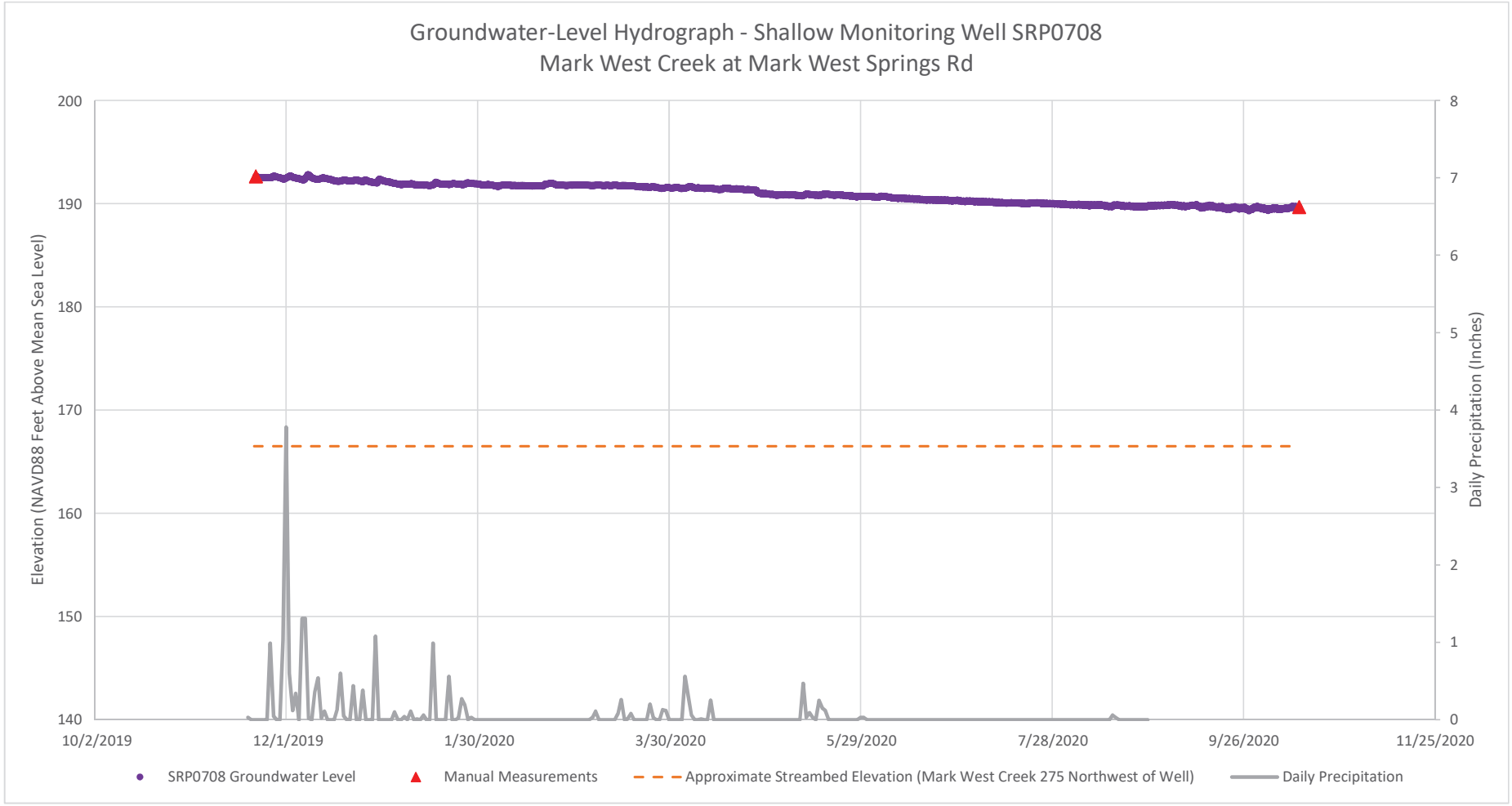
Groundwater Basins - California Department of Water Resources, Bulletin 118
Major Rivers and Creeks - Department of Water Resources
Streams - Sonoma County Central GIS and Sonoma Water

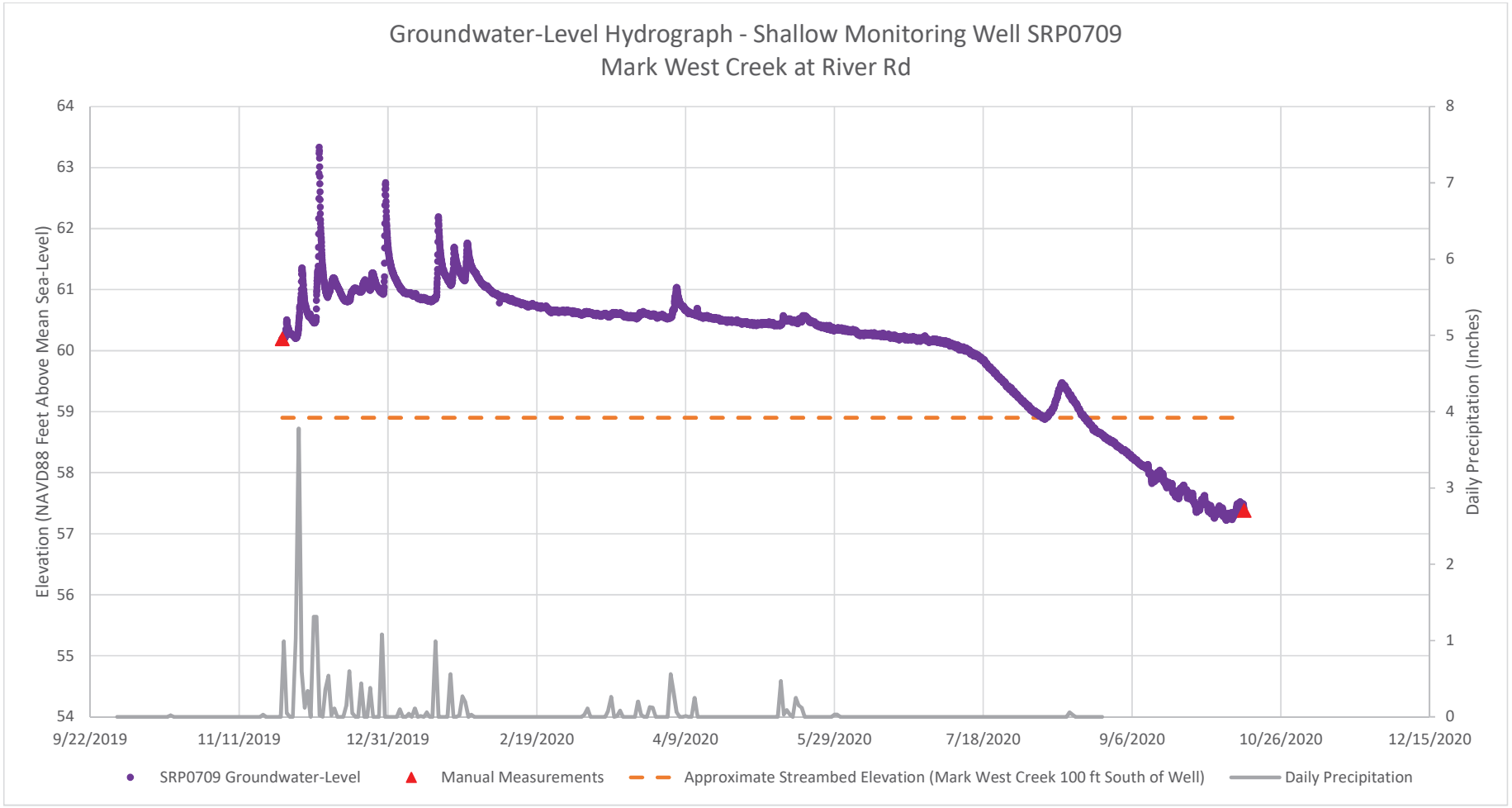
DRAFT

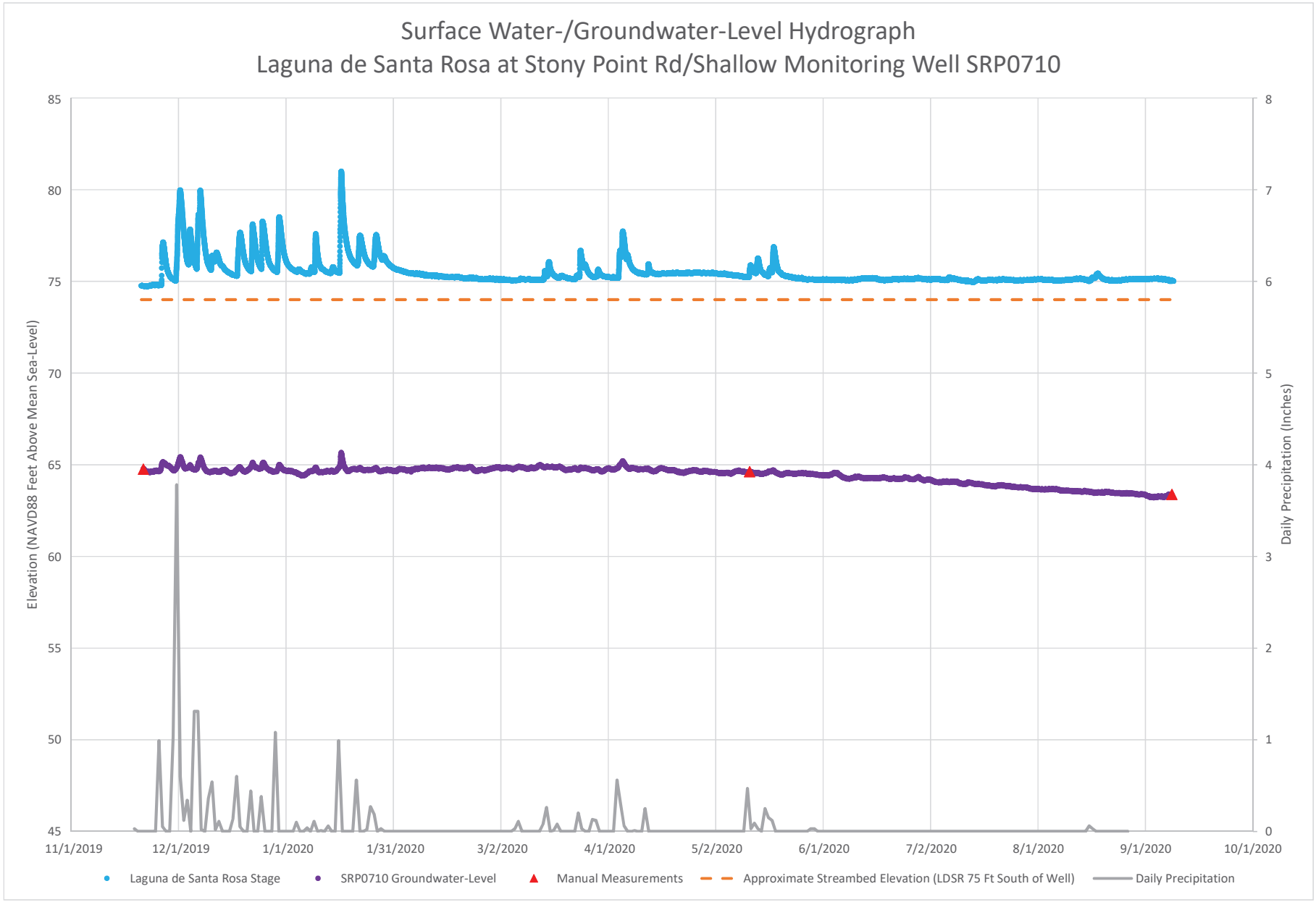
SANTA ROSA PLAIN GROUNDWATER SUSTAINABILITY AGENCY

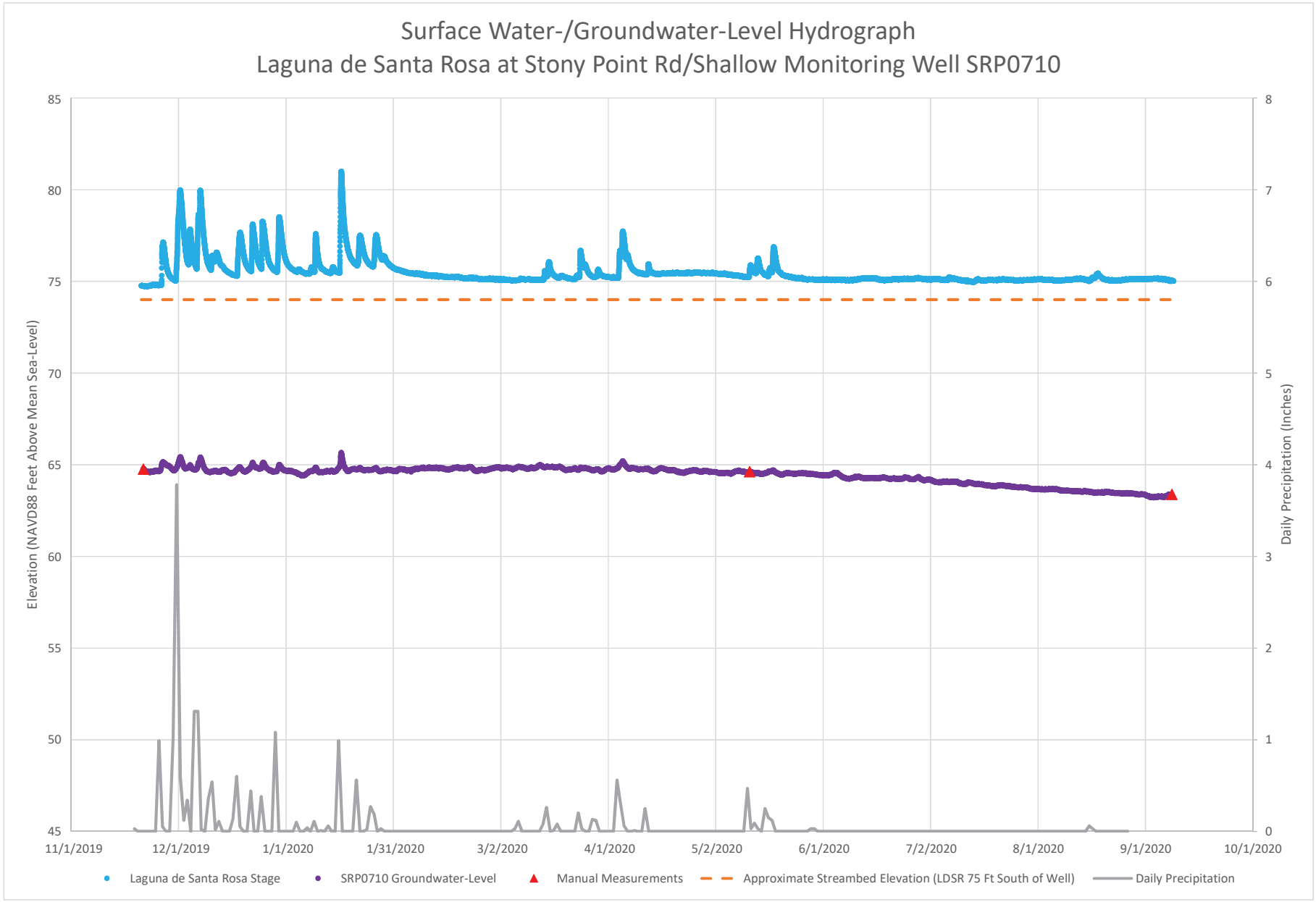
Filepath: T:\mbuttress\SGMA Monitoring Networks\Santa Rosa Plain\SRP_GW_Levl_FULLNet_S_SWGW.mxd Date prepared: 10/6/2020

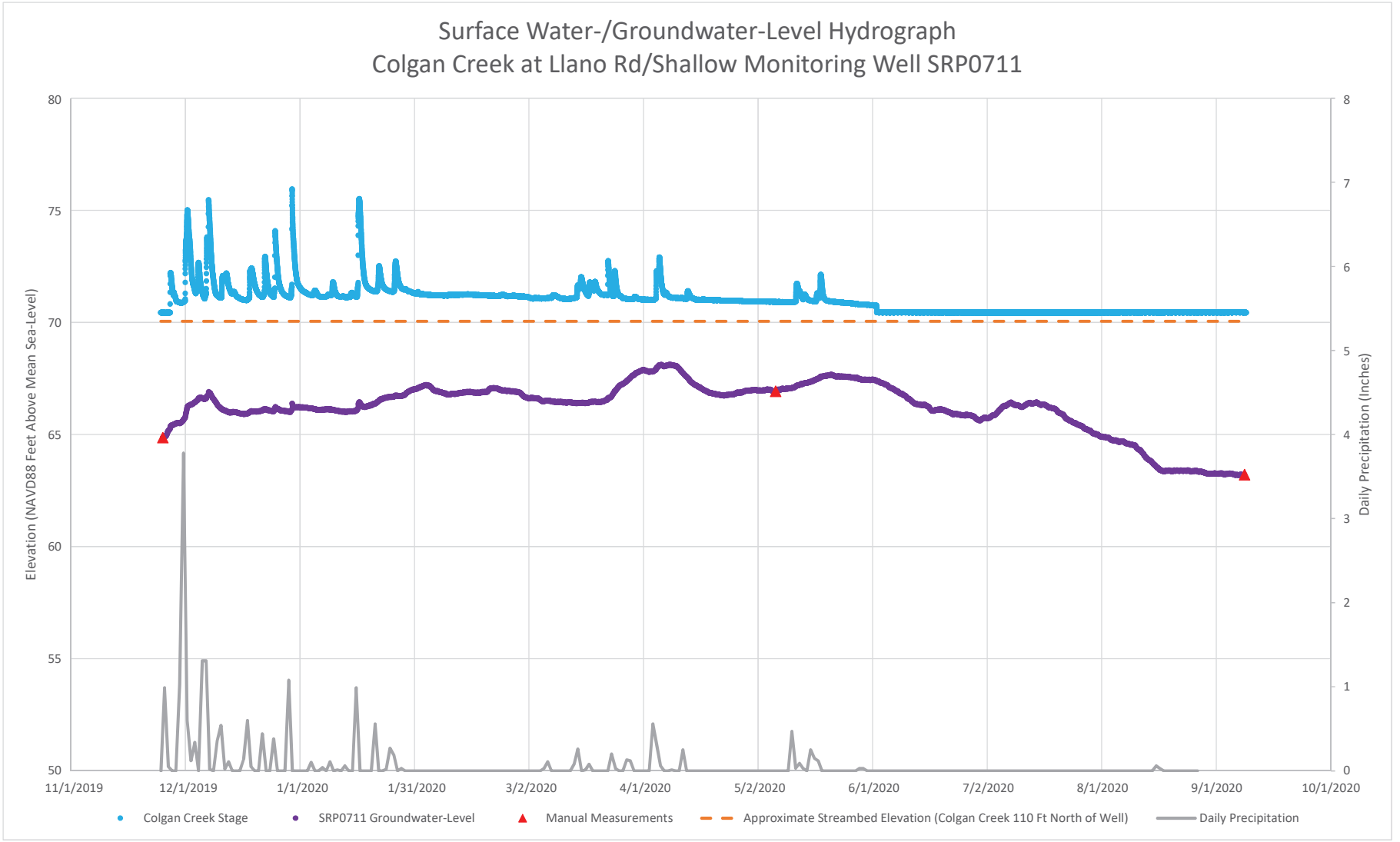

Groundwater-Level Hydrograph - Shallow Monitoring Well SRP0707
Mark West Creek at Fulton Rd
Elevation (NAVD88 Feet Above Mean Sea-Level)
Daily Precipitation (Inches)
130
125
120
115
110
105
100
95
90
8
7
6
5
4
3
2
1
0
9/12/2019
12/11/2019
3/10/2020
6/8/2020
9/6/2020
12/5/2020
SRP0707 Groundwater-Level
Manual Measurements
Approximate Streambed Elevation (Mark West Creek 200 ft North of Well)
Daily Precipitation

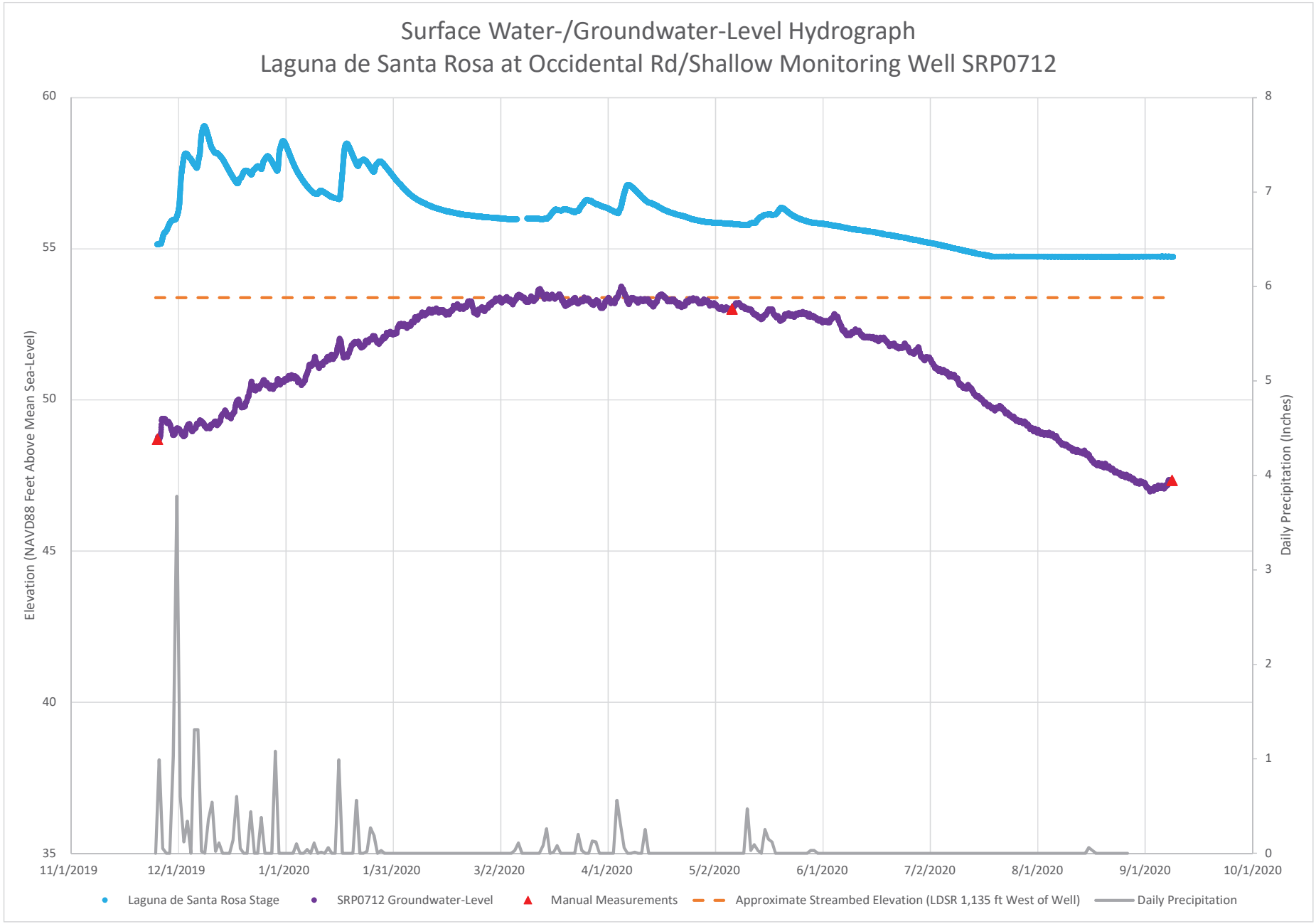

Groundwater-Level Hydrograph - Shallow Monitoring Well SRP0708
Mark West Creek at Mark West Springs Rd
Elevation (NAVD88 Feet Above Mean Sea Level)
Daily Precipitation (Inches)
200
190
180
170
160
150
140
8
7
6
5
4
3
2
1
0
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
7/28/2020
9/26/2020
11/25/2020
SRP0708 Groundwater Level
Manual Measurements
Approximate Streambed Elevation (Mark West Creek 275 Northwest of Well)
Daily Precipitation

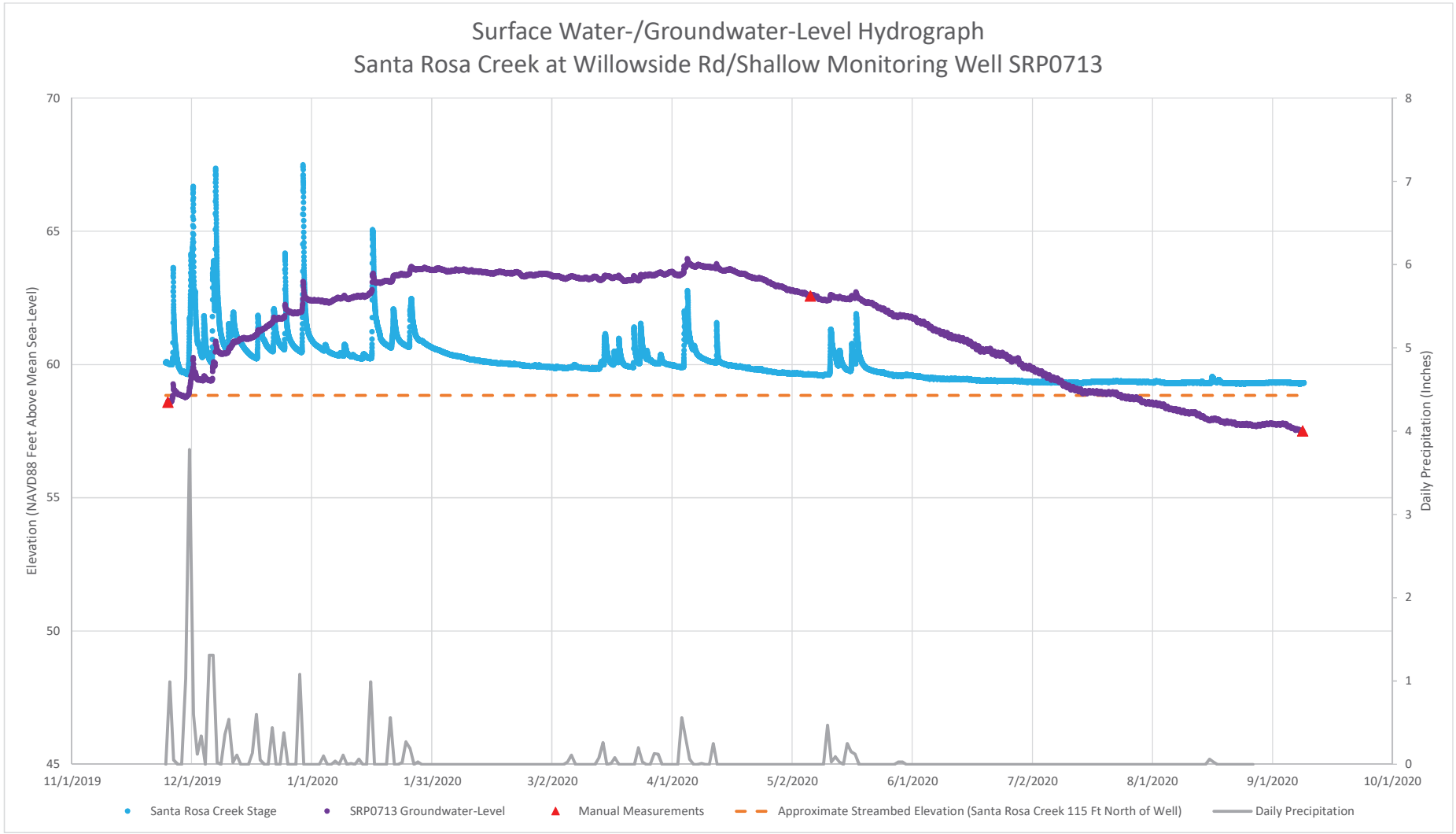

Groundwater-Level Hydrograph - Shallow Monitoring Well SRP0709
Mark West Creek at River Rd
Elevation (NAVD88 Feet Above Mean Sea-Level)
Daily Precipitation (Inches)
64
63
62
61
60
59
58
57
56
55
54
8
7
6
5
4
3
2
1
0
9/22/2019
11/11/2019
12/31/2019
2/19/2020
4/9/2020
5/29/2020
7/18/2020
9/6/2020
10/26/2020
12/15/2020
SRP0709 Groundwater-Level
Manual Measurements
Approximate Streambed Elevation (Mark West Creek 100 ft South of Well)
Daily Precipitation

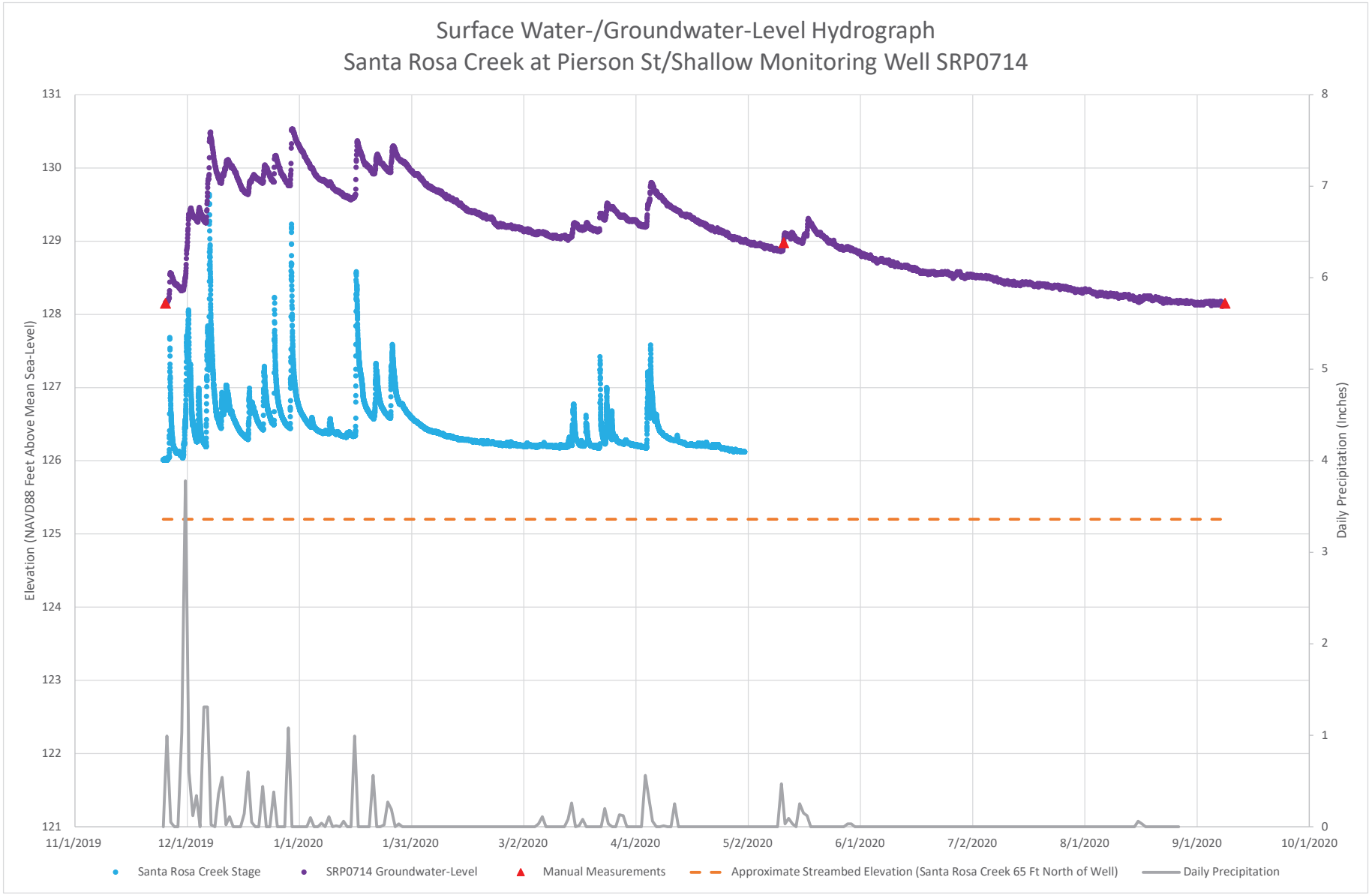

Surface Water-/Groundwater-Level Hydrograph
Laguna de Santa Rosa at Stony Point Rd/Shallow Monitoring Well SRP0710
Elevation (NAVD88 Feet Above Mean Sea-Level)
Daily Precipitation (Inches)
85
80
75
70
65
60
55
50
45
8
7
6
5
4
3
2
1
0
11/1/2019
12/1/2019
1/1/2020
1/31/2020
3/2/2020
4/1/2020
5/2/2020
6/1/2020
7/2/2020
8/1/2020
9/1/2020
10/1/2020
Laguna de Santa Rosa Stage
SRP0710 Groundwater-Level
Manual Measurements
Approximate Streambed Elevation (LDSR 75 Ft South of Well)
Daily Precipitation


Surface Water-/Groundwater-Level Hydrograph
Laguna de Santa Rosa at Stony Point Rd/Shallow Monitoring Well SRP0710
Elevation (NAVD88 Feet Above Mean Sea-Level)
Daily Precipitation (Inches)
85
80
75
70
65
60
55
50
45
8
7
6
5
4
3
2
1
0
11/1/2019
12/1/2019
1/1/2020
1/31/2020
3/2/2020
4/1/2020
5/2/2020
6/1/2020
7/2/2020
8/1/2020
9/1/2020
10/1/2020
Laguna de Santa Rosa Stage
SRP0710 Groundwater-Level
Manual Measurements
Approximate Streambed Elevation (LDSR 75 Ft South of Well)
Daily Precipitation


Surface Water-/Groundwater-Level Hydrograph
Colgan Creek at Llano Rd/Shallow Monitoring Well SRP0711
Elevation (NAVD88 Feet Above Mean Sea-Level)
Daily Precipitation (Inches)
80
75
70
65
60
55
50
8
7
6
5
4
3
2
1
0
11/1/2019
12/1/2019
1/1/2020
1/31/2020
3/2/2020
4/1/2020
5/2/2020
6/1/2020
7/2/2020
8/1/2020
9/1/2020
10/1/2020
Colgan Creek Stage
SRP0711 Groundwater-Level
Manual Measurements
Approximate Streambed Elevation (Colgan Creek 110 Ft North of Well)
Daily Precipitation


Surface Water-/Groundwater-Level Hydrograph
Laguna de Santa Rosa at Occidental Rd/Shallow Monitoring Well SRP0712
Elevation (NAVD88 Feet Above Mean Sea-Level)
Daily Precipitation (Inches)
60
55
50
45
40
35
8
7
6
5
4
3
2
1
0
11/1/2019
12/1/2019
1/1/2020
1/31/2020
3/2/2020
4/1/2020
5/2/2020
6/1/2020
7/2/2020
8/1/2020
9/1/2020
10/1/2020
Laguna de Santa Rosa Stage
SRP0712 Groundwater-Level
Manual Measurements
Approximate Streambed Elevation (LDSR 1,135 ft West of Well)
Daily Precipitation


Surface Water-/Groundwater-Level Hydrograph
Santa Rosa Creek at Willowside Rd/Shallow Monitoring Well SRP0713
Elevation (NAVD88 Feet Above Mean Sea-Level)
Daily Precipitation (Inches)
70
65
60
55
50
45
8
7
6
5
4
3
2
1
0
11/1/2019
12/1/2019
1/1/2020
1/31/2020
3/2/2020
4/1/2020
5/2/2020
6/1/2020
7/2/2020
8/1/2020
9/1/2020
10/1/2020
Santa Rosa Creek Stage
SRP0713 Groundwater-Level
Manual Measurements
Approximate Streambed Elevation (Santa Rosa Creek 115 Ft North of Well)
Daily Precipitation


Surface Water-/Groundwater-Level Hydrograph
Santa Rosa Creek at Pierson St/Shallow Monitoring Well SRP0714
Elevation (NAVD88 Feet Above Mean Sea-Level)
Daily Precipitation (Inches)
131
130
129
128
127
126
125
124
123
122
121
8
7
6
5
4
3
2
1
0
11/1/2019
12/1/2019
1/1/2020
1/31/2020
3/2/2020
4/1/2020
5/2/2020
6/1/2020
7/2/2020
8/1/2020
9/1/2020
10/1/2020
Santa Rosa Creek Stage
SRP0714 Groundwater-Level
Manual Measurements
Approximate Streambed Elevation (Santa Rosa Creek 65 Ft North of Well)
Daily Precipitation