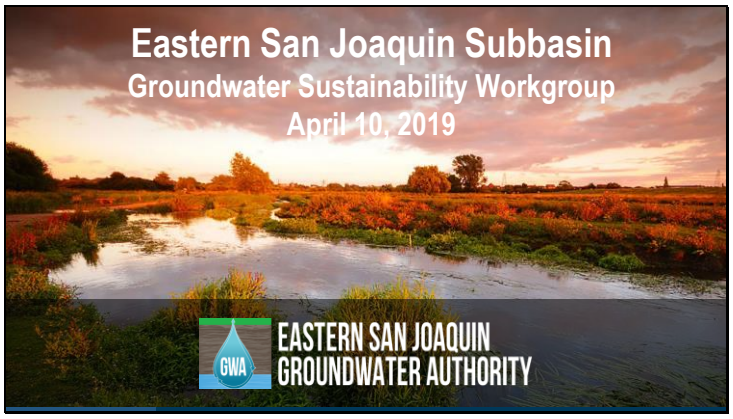
Slide 1

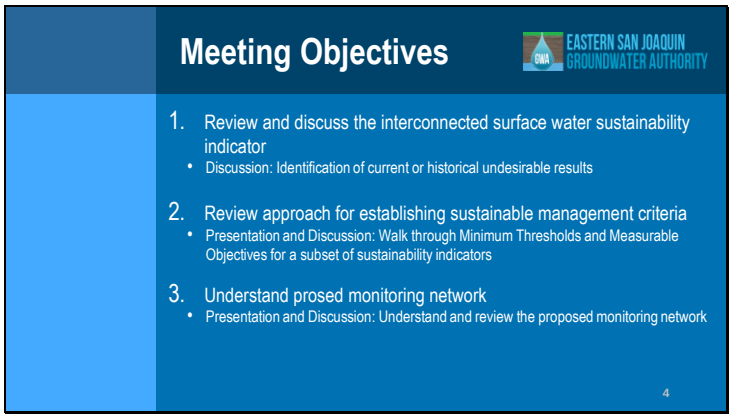

Eastern San Joaquin Subbasin
Groundwater Sustainability Workgroup
April 10, 2019
GWA
EASTERN SAN JOAQUIN
GROUNDWATER AUTHORITY

Slide 2


Agenda
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
Meeting Objectives
Interconnected Surface Water
Sustainability Indicators (Seawater Intrusion, Storage, Subsidence)
Monitoring Network
Announcements
2

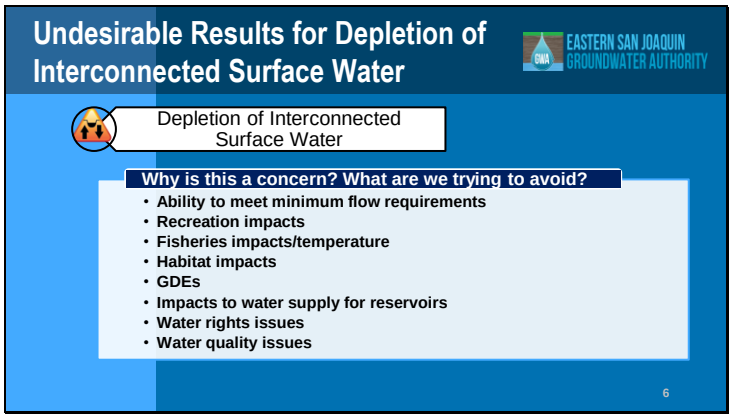
Slide 3

Slide 4


Meeting Objectives
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
1. Review and discuss the interconnected surface water sustainability indicator
• Discussion: Identification of current or historical undesirable results
2. Review approach for establishing sustainable management criteria
• Presentation and Discussion: Walk through Minimum Thresholds and Measurable Objectives for a subset of sustainability indicators
3. Understand prosed monitoring network
• Presentation and Discussion: Understand and review the proposed monitoring network
4

Slide 5

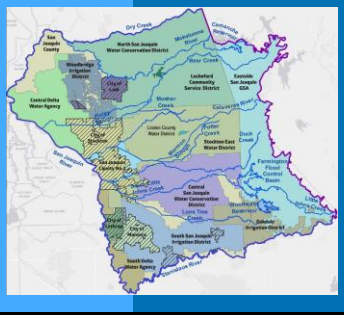
Slide 6


Undesirable Results for Depletion of Interconnected Surface Water
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
Depletion of Interconnected Surface Water
Why is this a concern? What are we trying to avoid?
• Ability to meet minimum flow requirements
• Recreation impacts
• Fisheries impacts/temperature
• Habitat impacts
• GDEs
• Impacts to water supply for reservoirs
• Water rights issues
• Water quality issues
6

Slide 7

Minimum Threshold Development for Depletion of Interconnected Surface Water

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

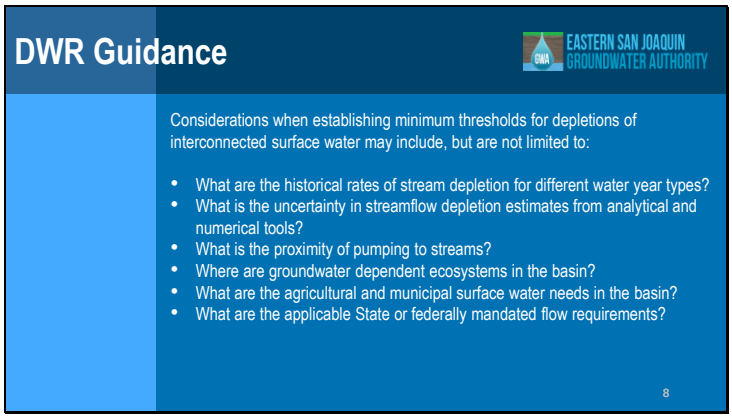


Major river systems in the Subbasin are highly managed.

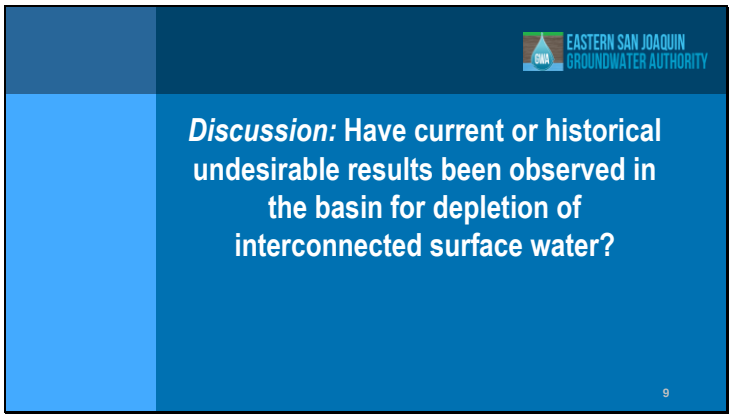
Instream flow requirements, water quality standards, and water rights govern upstream releases.

7

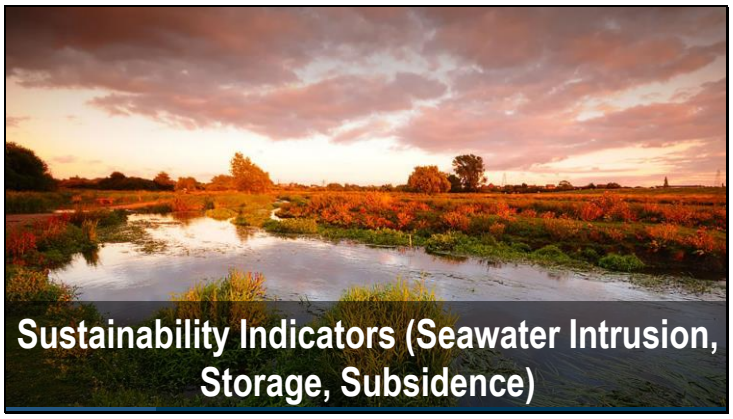
Slide 8


DWR Guidance
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
Considerations when establishing minimum thresholds for depletions of interconnected surface water may include, but are not limited to:
What are the historical rates of stream depletion for different water year types?
What is the uncertainty in streamflow depletion estimates from analytical and numerical tools?
What is the proximity of pumping to streams?
Where are groundwater dependent ecosystems in the basin?
What are the agricultural and municipal surface water needs in the basin?
What are the applicable State or federally mandated flow requirements?
8

Slide 9


EASTERN SAN JOAQUIN
GROUNDWATER AUTHORITY
Discussion: Have current or historical undesirable results been observed in the basin for depletion of interconnected surface water?
9

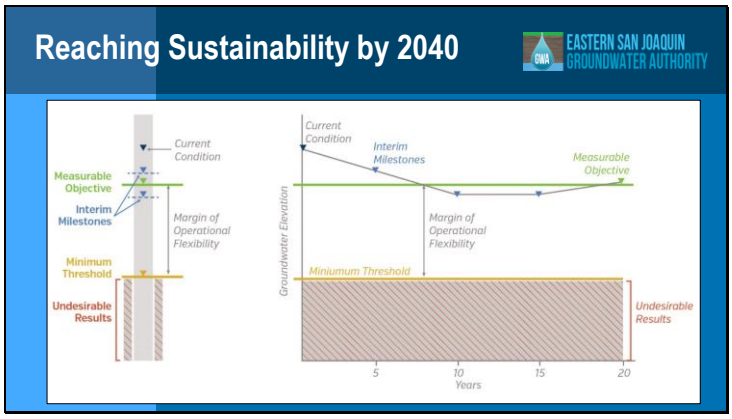
Slide 10


Sustainability Indicators (Seawater Intrusion, Storage, Subsidence)

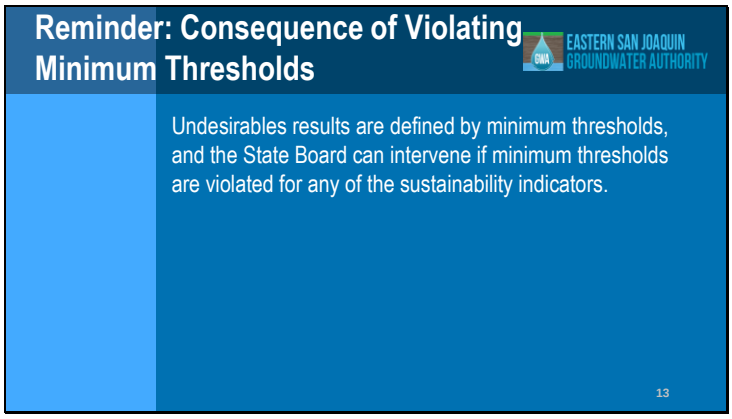
Slide 11


Review – Let's Talk Terminology
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
Why are terms important?
• Established by regulation
• Used by regulators during GSP review
• Consistency of terms assists SGMA discussion
Important to understand the relationship between:
• Sustainability Indicators
• Sustainable Management Criteria (Built off Each Sustainability Indicator)
• Sustainability Goal
• Undesirable Results
• Minimum Thresholds
• Measurable Objectives
a. Interim Milestones
b. Margin of Operational Flexibility
• Monitoring Network
11

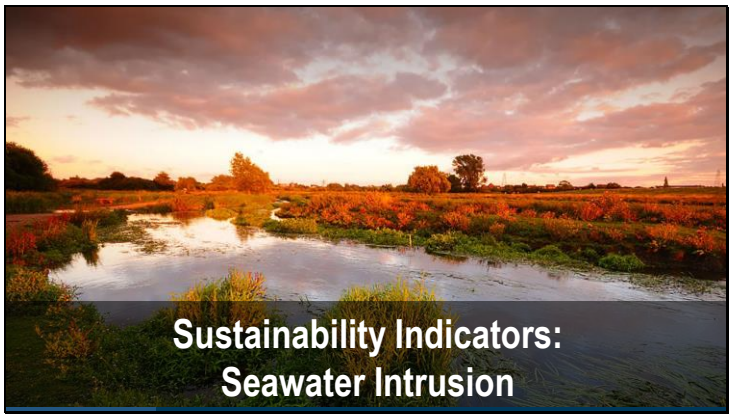
Slide 12


Reaching Sustainability by 2040
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
Current Condition
Measurable Objective
Interim Milestones
Margin of Operational Flexibility
Minimum Threshold
Undesirable Results
Groundwater Elevation
Current Condition
Interim Milestones
Measurable Objective
Margin of Operational Flexibility
Miniumum Threshold
Undesirable Results
5
10
15
20
Years

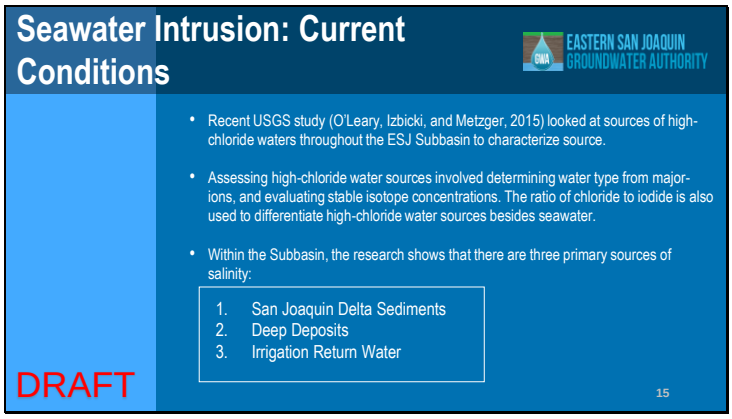
Slide 13


Reminder: Consequence of Violating Minimum Thresholds
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
Undesirables results are defined by minimum thresholds, and the State Board can intervene if minimum thresholds are violated for any of the sustainability indicators.
13

Slide 14



Slide 15


Seawater Intrusion: Current Conditions
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
Recent USGS study (O'Leary, Izbicki, and Metzger, 2015) looked at sources of high-chloride waters throughout the ESJ Subbasin to characterize source.
Assessing high-chloride water sources involved determining water type from major-ions, and evaluating stable isotope concentrations. The ratio of chloride to iodide is also used to differentiate high-chloride water sources besides seawater.
Within the Subbasin, the research shows that there are three primary sources of salinity:
1. San Joaquin Delta Sediments
2. Deep Deposits
3. Irrigation Return Water
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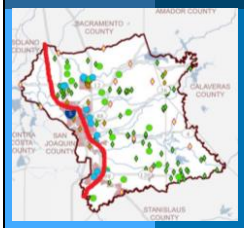
Slide 16

Seawater Intrusion: Developing an Isocontour Line

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY



- The proposed contour would be between the westernmost monitoring points and the next most-westerly points, to serve as a sentinels.
- Alternately, it could be placed along I-5 for simplicity.

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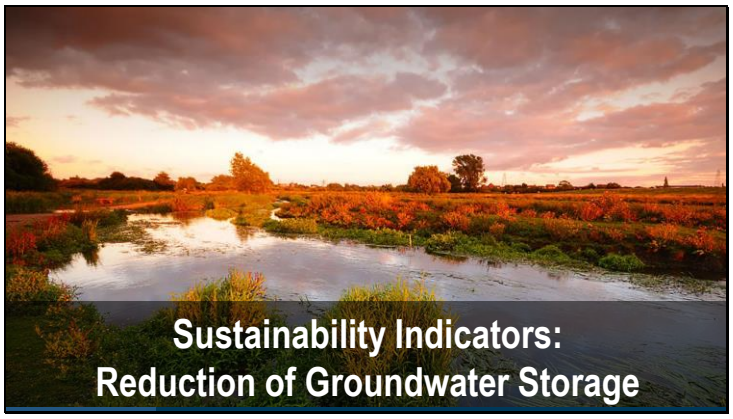
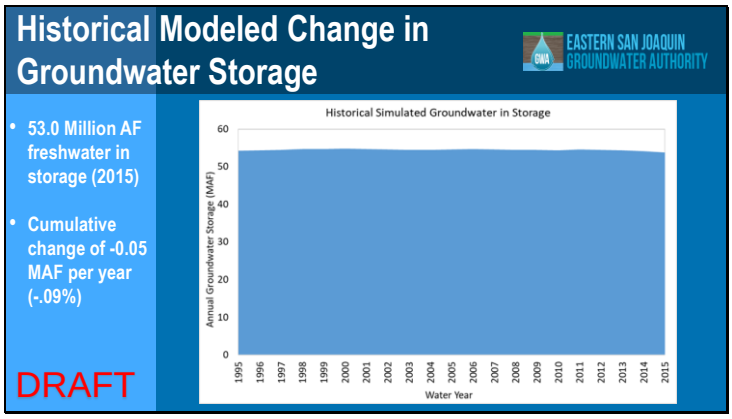
Slide 17


Advisory Committee Recommendation – Seawater Intrusion
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
Policy decision will go to the Board in May.
Sustainable Management Criteria Summary – Seawater Intrusion
Criteria
Narrative Description
Proposed Minimum Threshold
2,000 mg/L chloride isocontour line
Proposed Measurable Objective
The current condition (2015-2018 average)
Proposed Interim Milestone
5-year milestones along a linear trend between current condition and the measurable objective
Definition of Violation
Undesirable results are considered to occur during GSP implementation when 2,000 mg/L chloride reaches an established isocontour line and where these concentrations are caused by intrusion of a seawater source. The proposed contour would be between the westernmost monitoring points and the next most-westerly points, to serve as a sentinels. Alternately, it could be placed along I-5 for simplicity.
Trigger and Action Plan
Put action plan in place at to trigger additional monitoring and analysis to confirm seawater source at lower concentrations (proposed at 1,000 mg/L chloride)

Slide 18


Sustainability Indicators:
Reduction of Groundwater Storage

Slide 19


Historical Modeled Change in Groundwater Storage
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
53.0 Million AF freshwater in storage (2015)
Cumulative change of -0.05 MAF per year (-.09%)
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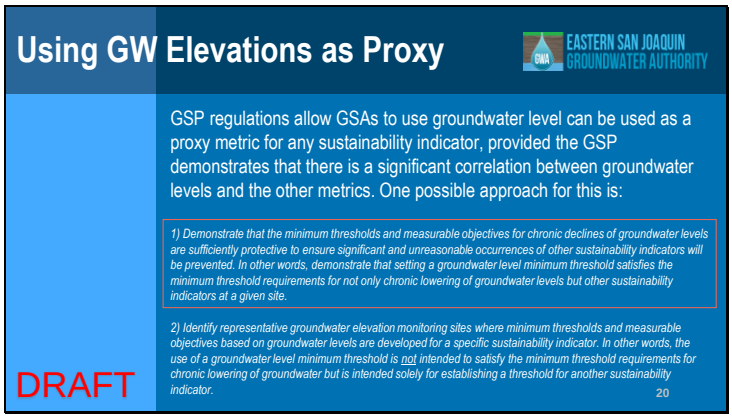
Historical Simulated Groundwater in Storage
Annual Groundwater Storage (MAF)
0
10
20
30
40
50
60
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Water Year

Slide 20


Using GW Elevations as Proxy
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
GSP regulations allow GSAs to use groundwater level can be used as a proxy metric for any sustainability indicator, provided the GSP demonstrates that there is a significant correlation between groundwater levels and the other metrics. One possible approach for this is:
1) Demonstrate that the minimum thresholds and measurable objectives for chronic declines of groundwater levels are sufficiently protective to ensure significant and unreasonable occurrences of other sustainability indicators will be prevented. In other words, demonstrate that setting a groundwater level minimum threshold satisfies the minimum threshold requirements for not only chronic lowering of groundwater levels but other sustainability indicators at a given site.
2) Identify representative groundwater elevation monitoring sites where minimum thresholds and measurable objectives based on groundwater levels are developed for a specific sustainability indicator. In other words, the use of a groundwater level minimum threshold is not intended to satisfy the minimum threshold requirements for chronic lowering of groundwater but is intended solely for establishing a threshold for another sustainability indicator.
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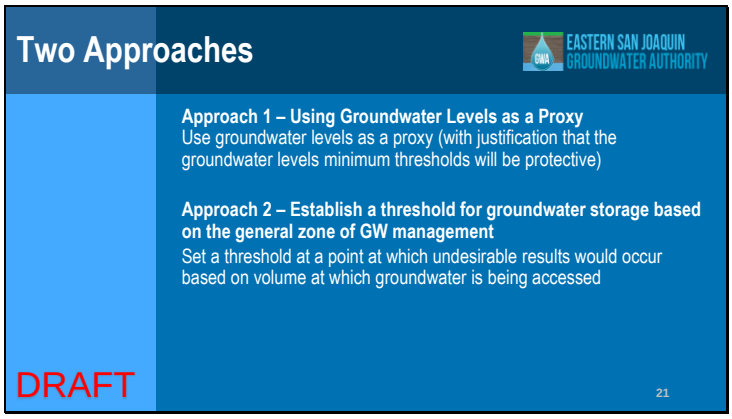
Slide 21


Two Approaches
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
Approach 1 – Using Groundwater Levels as a Proxy
Use groundwater levels as a proxy (with justification that the groundwater levels minimum thresholds will be protective)
Approach 2 – Establish a threshold for groundwater storage based on the general zone of GW management
Set a threshold at a point at which undesirable results would occur based on volume at which groundwater is being accessed
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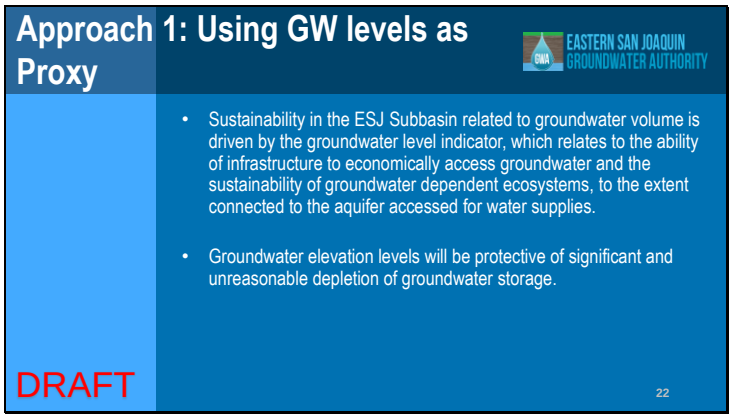
Slide 22


Approach 1: Using GW levels as Proxy
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
• Sustainability in the ESJ Subbasin related to groundwater volume is driven by the groundwater level indicator, which relates to the ability of infrastructure to economically access groundwater and the sustainability of groundwater dependent ecosystems, to the extent connected to the aquifer accessed for water supplies.
• Groundwater elevation levels will be protective of significant and unreasonable depletion of groundwater storage.
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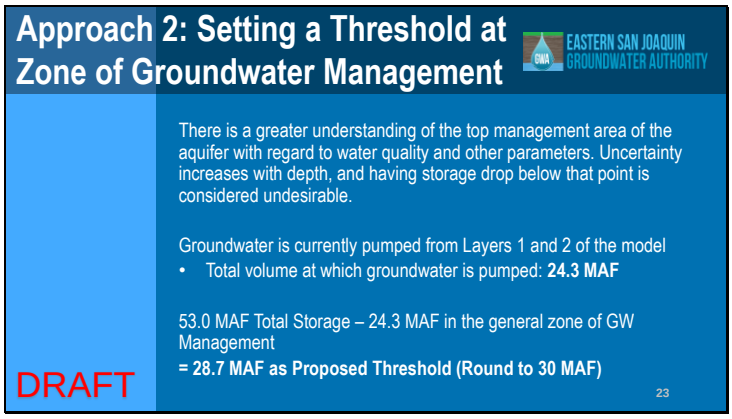
Approach 2: Setting a Threshold at Zone of Groundwater Management
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
There is a greater understanding of the top management area of the aquifer with regard to water quality and other parameters. Uncertainty increases with depth, and having storage drop below that point is considered undesirable.
Groundwater is currently pumped from Layers 1 and 2 of the model
• Total volume at which groundwater is pumped: 24.3 MAF
53.0 MAF Total Storage – 24.3 MAF in the general zone of GW Management
= 28.7 MAF as Proposed Threshold (Round to 30 MAF)
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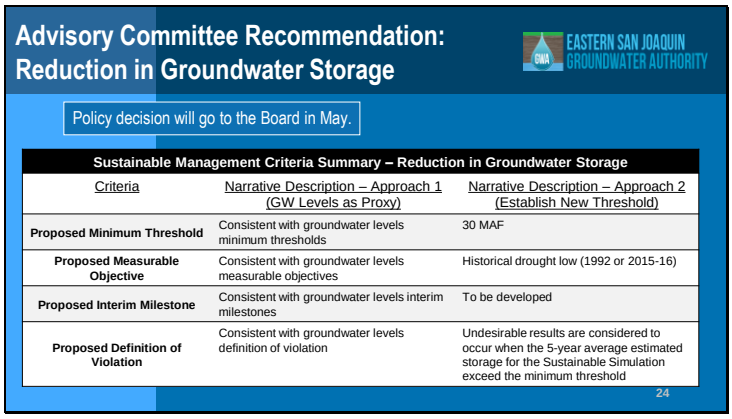
Slide 24


Advisory Committee Recommendation:
Reduction in Groundwater Storage
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
Policy decision will go to the Board in May.
Sustainable Management Criteria Summary – Reduction in Groundwater Storage
Criteria
Narrative Description – Approach 1 (GW Levels as Proxy)
Narrative Description – Approach 2 (Establish New Threshold)
Proposed Minimum Threshold
Consistent with groundwater levels minimum thresholds
30 MAF
Proposed Measurable Objective
Consistent with groundwater levels measurable objectives
Historical drought low (1992 or 2015-16)
Proposed Interim Milestone
Consistent with groundwater levels interim milestones
To be developed
Proposed Definition of Violation
Consistent with groundwater levels definition of violation
Undesirable results are considered to occur when the 5-year average estimated storage for the Sustainable Simulation exceed the minimum threshold
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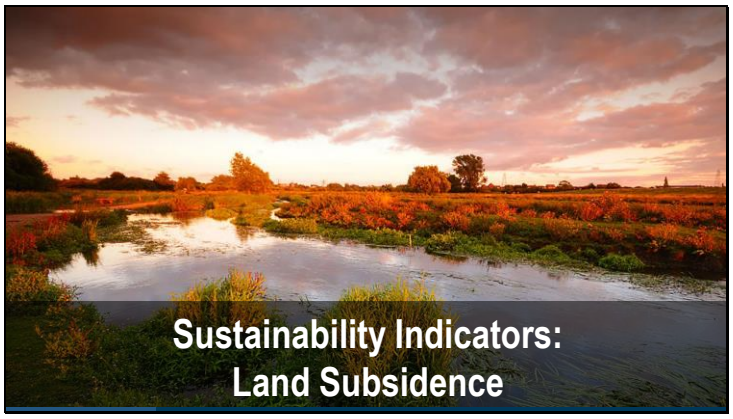

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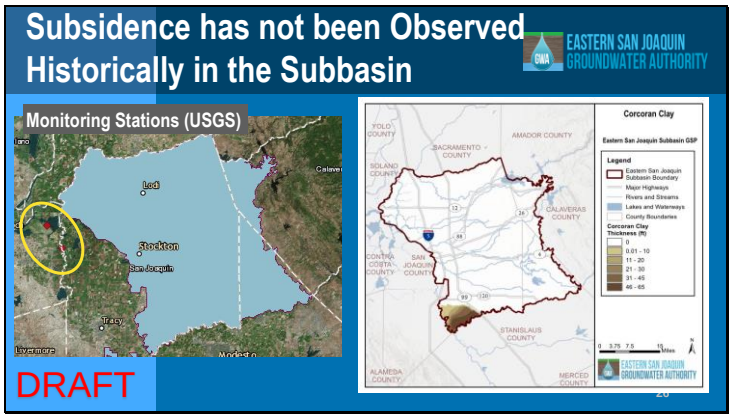
Subsidence has not been Observed Historically in the Subbasin
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
Monitoring Stations (USGS)
Lodi
Stockton
San Joaquin
Tracy
Livermore
Corcoran Clay
Eastern San Joaquin Subbasin GSP
Legend
Eastern San Joaquin Subbasin Boundary
Major Highways
Rivers and Streams
Lakes and Waterways
County Boundaries
Corcoran Clay Thickness (ft)
0
0.01 - 10
11 - 20
21 - 30
31 - 45
46 - 65
YOLO COUNTY
SACRAMENTO COUNTY
AMADOR COUNTY
SOLANO COUNTY
CALAVERAS COUNTY
CONTRA COSTA COUNTY
SAN JOAQUIN COUNTY
STANISLAUS COUNTY
ALAMEDA COUNTY
MERCED COUNTY
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
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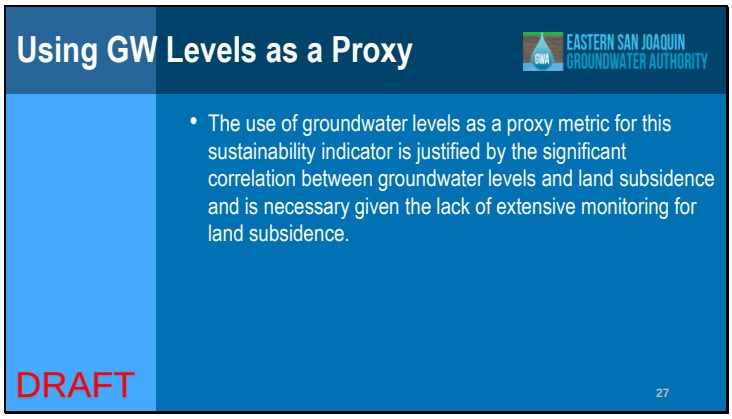
Slide 27


Using GW Levels as a Proxy
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
• The use of groundwater levels as a proxy metric for this sustainability indicator is justified by the significant correlation between groundwater levels and land subsidence and is necessary given the lack of extensive monitoring for land subsidence.
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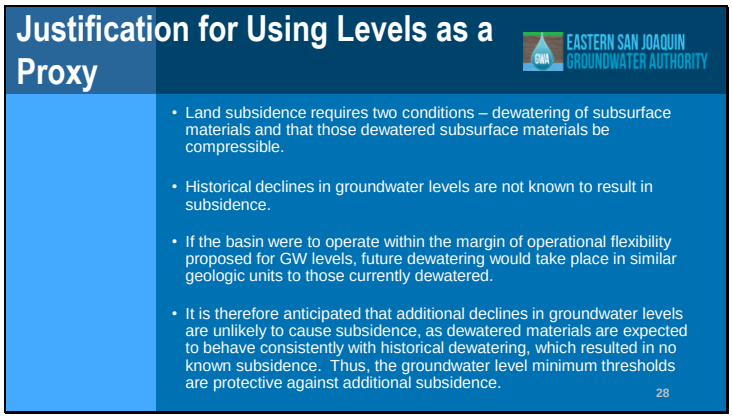
Justification for Using Levels as a Proxy
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
• Land subsidence requires two conditions – dewatering of subsurface materials and that those dewatered subsurface materials be compressible.
• Historical declines in groundwater levels are not known to result in subsidence.
• If the basin were to operate within the margin of operational flexibility proposed for GW levels, future dewatering would take place in similar geologic units to those currently dewatered.
• It is therefore anticipated that additional declines in groundwater levels are unlikely to cause subsidence, as dewatered materials are expected to behave consistently with historical dewatering, which resulted in no known subsidence. Thus, the groundwater level minimum thresholds are protective against additional subsidence.
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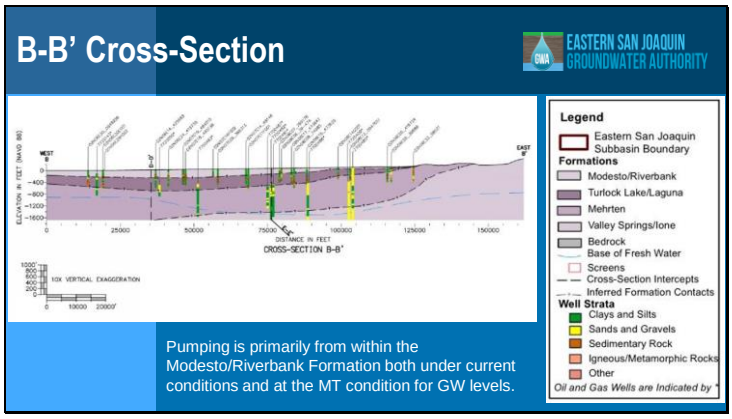
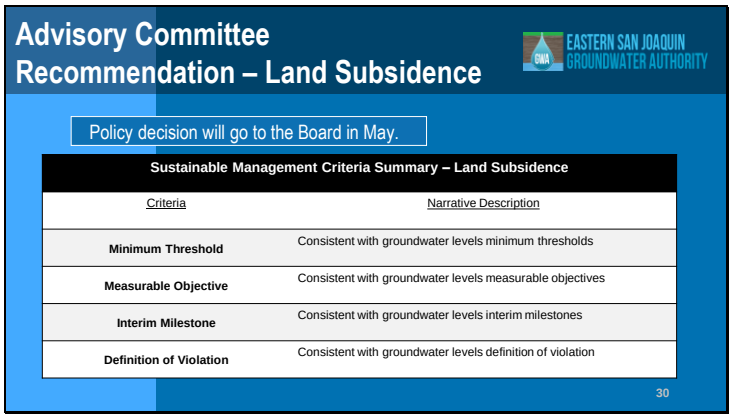

B-B' Cross-Section
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
CROSS-SECTION B-B'
DISTANCE IN FEET
10X VERTICAL EXAGGERATION
Pumping is primarily from within the Modesto/Riverbank Formation both under current conditions and at the MT condition for GW levels.
Legend
Eastern San Joaquin Subbasin Boundary
Formations
Modesto/Riverbank
Turlock Lake/Laguna
Mehrten
Valley Springs/Ione
Bedrock
Base of Fresh Water
Screens
Cross-Section Intercepts
Inferred Formation Contacts
Well Strata
Clays and Silts
Sands and Gravels
Sedimentary Rock
Igneous/Metamorphic Rocks
Other
Oil and Gas Wells are Indicated by *

Slide 30


Advisory Committee
Recommendation – Land Subsidence
EASTERN SAN JOAQUIN
GROUNDWATER AUTHORITY
Policy decision will go to the Board in May.
Sustainable Management Criteria Summary – Land Subsidence
Criteria
Narrative Description
Minimum Threshold
Consistent with groundwater levels minimum thresholds
Measurable Objective
Consistent with groundwater levels measurable objectives
Interim Milestone
Consistent with groundwater levels interim milestones
Definition of Violation
Consistent with groundwater levels definition of violation
30

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Monitoring Network

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

- Is used to monitor for conditions that would cause undesirable results
- Must address the six sustainability indicators
- Adequate spatial and temporal coverage for each primary aquifer
- Need minimum thresholds and measurable objectives for each “representative” monitoring point, but there can be a broader network without thresholds assigned

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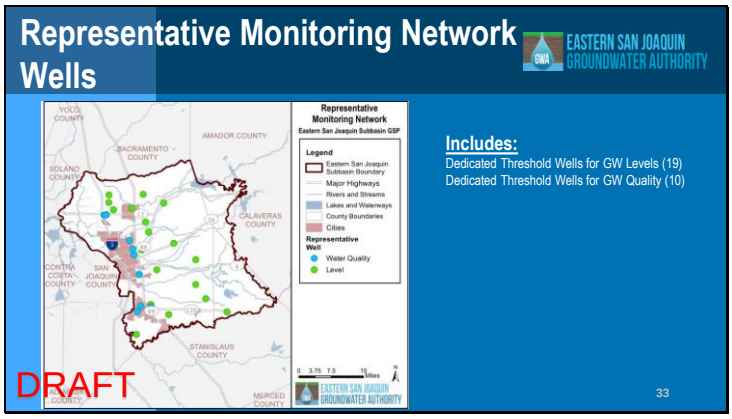
Slide 33


Representative Monitoring Network Wells
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
YOLO COUNTY
AMADOR COUNTY
SACRAMENTO COUNTY
SOLANO COUNTY
CALAVERAS COUNTY
CONTRA COSTA COUNTY
SAN JOAQUIN COUNTY
STANISLAUS COUNTY
MERCED COUNTY
Representative Monitoring Network
Eastern San Joaquin Subbasin GSP
Legend
Eastern San Joaquin Subbasin Boundary
Major Highways
Rivers and Streams
Lakes and Waterways
County Boundaries
Cities
Representative Well
Water Quality
Level
0 3.75 7.5 15 Miles
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
Includes:
Dedicated Threshold Wells for GW Levels (19)
Dedicated Threshold Wells for GW Quality (10)
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Broad Monitoring Network

- Representative monitoring and additional broader network

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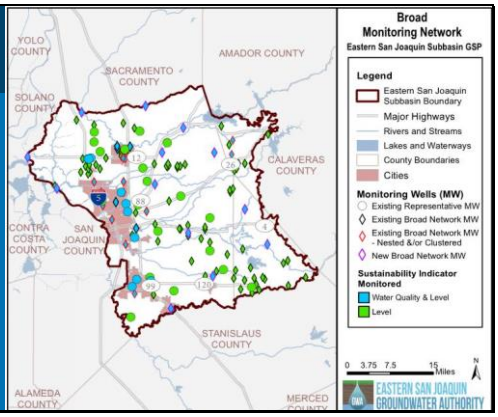

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Monitoring Network Summary

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

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Well Type	#	Monitoring Network	Constituent Monitored		Proposed Frequency
			Elevation	Water Quality	
Dedicated level Threshold	19	Representative Monitoring	X		Quarterly
Dedicated Groundwater Quality Threshold	10	Representative Monitoring	X	X	Quarterly
CASGEM Wells (Official)	76	Broad	X		Semi-Annually
Nested &/or Clustered Wells	21	Broad	X	X	Semi-Annually
TSS Wells + 10 New Wells (Planned)	13	Broad	X	X	Semi-Annually
Additional local wells in water quality network	5	Broad	X	X	Semi-Annually

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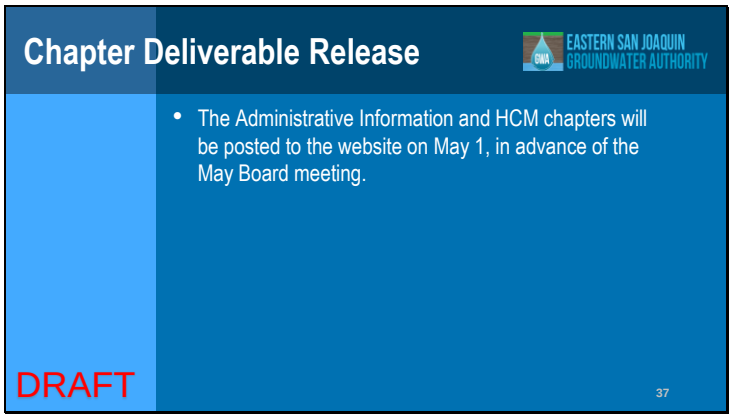
Slide 37


Chapter Deliverable Release
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY
• The Administrative Information and HCM chapters will be posted to the website on May 1, in advance of the May Board meeting.
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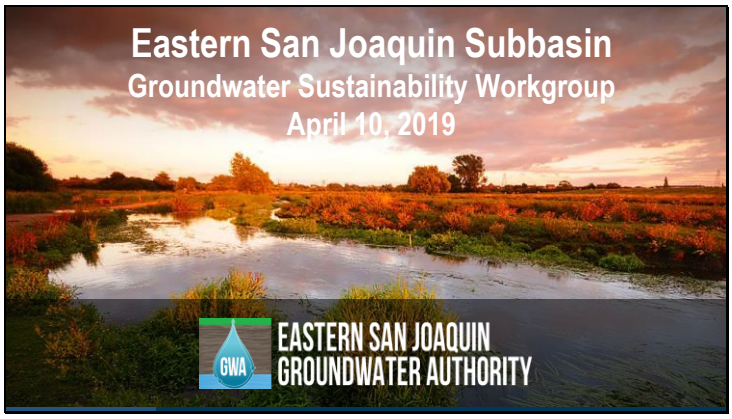
Eastern San Joaquin Subbasin
Groundwater Sustainability Workgroup
April 10, 2019
GWA
EASTERN SAN JOAQUIN
GROUNDWATER AUTHORITY