

# Sustainable Groundwater Management in California: A Framework and Implementation Roadmap

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# SGMA 101

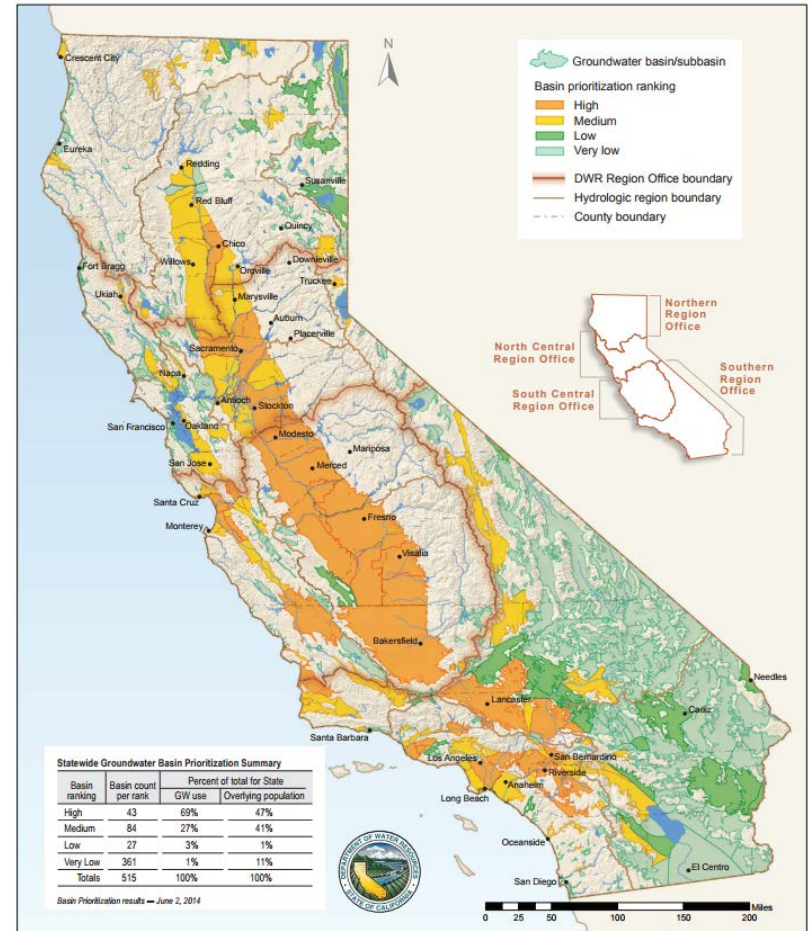
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## **Significant unreasonable and undesirable results**

- (1) Depletion of groundwater levels
- (2) Reduction of groundwater storage
- (3) Land subsidence
- (4) Potentially adverse impacts on surface water use
- (5) Seawater intrusion
- (6) Degradation of water quality

# SGMA: An Overview

- Challenges local communities to form agencies & prepare plans that prevent 6 “undesirable results” occurring
- Leaves the detail to local communities
- Is silent on water rights, allocation arrangements, administrative structures, enforcement and accounting, etc.






# The Roadmap and GSP Mock-up

Offers a mock-up of a GSP ready for DWR approval.

Written to help GSAs

- Think through the detail
- Understand the state of the art
- Avoid making mistakes
- Fills in SGMA's gaps

Envisions SGMA as a pathway to increased prosperity.



**Working Paper**  
NI WP 17-02  
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www.nicholasinstitute.duke.edu

## Sharing Groundwater: A Robust Framework and Implementation Roadmap for Sustainable Groundwater Management in California

Mike Young\* and Bryce McAteer\*\*

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**Review**  
This working paper was reviewed by multiple experts inside and outside the Nicholas Institute for Environmental Policy Solutions. However, it has not undergone a formal review process as it is intended to present preliminary analysis, stimulate discussion, and inform debate on emerging issues. It may eventually be published in another form and its content revised.

**SUMMARY**  
This working paper offers a framework and roadmap for development of a robust groundwater-sharing system consistent with California's Sustainable Groundwater Management Act, which requires communities in priority areas to prepare groundwater sustainability plans.  
The proposed system draws on global experience. Robustness is its signature feature. Opportunities are maximized by a suite of robust local governance, allocation, and administrative arrangements. Additionally, the proposed system incentivizes innovation, stimulates investment, and facilitates low-cost adjustment to changes in groundwater demand.  
Among the dynamic components underlying this sharing system is a share register that records ownership and transfers of ownership in a basin's available shares. These unit shares are fungible; each represents a proportional stake in access to the basin's groundwater resources. Volumetric allocations are made in proportion to the number of shares held during determined periods throughout the water year. These allocations are recorded in bank-like water accounts, affording account holders an efficient means to manage their resource but also ensuring that they cannot use more than is available. Unused water can be saved for later use. At the start of the transition to the new system, users are given an allocation buffer so that they have flexibility and time to adjust. Those who want to can make quick non-contestable trades at low cost.

• Google "Young McAteer groundwater" to read more

# Two extracts from the GSP Mock-up

*14. Shareholders will be free to choose whether or not to use, save, or, by way of transfer, sell any allocations made to their water account.*

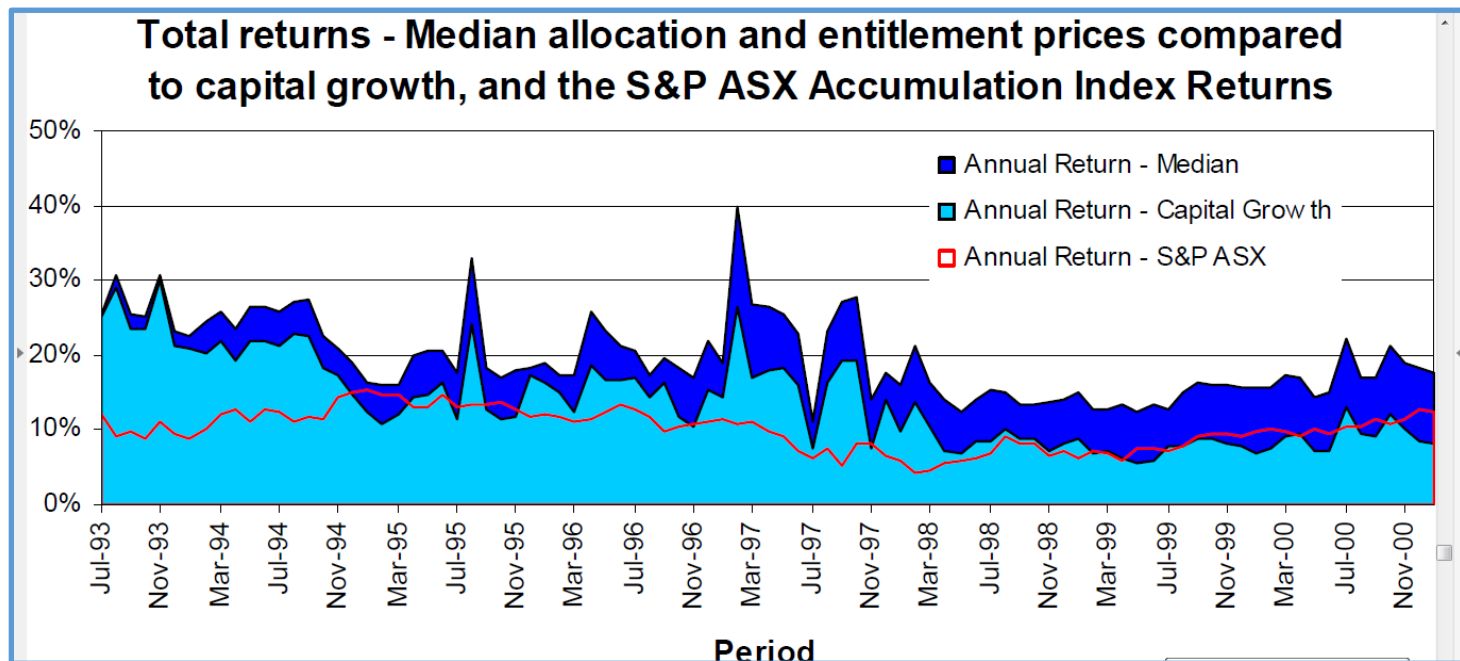
*Adjusted only for hydrological losses, account holders will be allowed to carry forward unused water allocations from one water year to the next.*

*15. Share ownership will be defined by reference to the ABC Basin Share Register.*

*Any claimed interest in an ABC Basin share shall be deemed to be invalid unless it is recorded in the ABC Basin Share Register.*

# International insights

- Markets offer the most efficient known way of managing a access to a limited resource (Avoiding tragedies)
- If you focus on building robust administrative systems
- Markets will emerge naturally



# SGMA invites communities to find a way to share access to groundwater

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The value of each water right is determined by the opportunities and risks associated with it.

The better the system, the greater the opportunities and the less the investment risk.

Rather than just doing the required minimum, there is chance to get things right.



# The Proposed Sharing Framework

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1. Issue shares to all existing users
2. Annual volumetric allocations to shareholders
3. Require users to hold a groundwater permit
4. An unambiguous Plan with statutory approval
5. Trusted, independent Basin Authority appointed by GSA
6. A Watermaster employed by the Authority
7. Robust value adding share registers and water accounts
8. Low-cost administrative systems that have integrity



# Legal Structure

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- SGMA enables the development of regulations that sit on top of existing groundwater rights.
- Rather than extinguish existing rights, it may be easier to another add another layer.
- Under SGMA landowners could be required to
  1. Have an existing right
    - A Land Parcel
    - An approved well
  2. Comply with conditions set out in an approved plan (GSP)
    1. Have a water account in a positive balance
    2. Hold a permit requiring compliance with a GSP

# Suggested Objectives & Goals

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## Six objectives:

1. **Avoid SGMA's 6 undesirable groundwater results**
2. Maximize local profits → Economically efficient groundwater use, investment, and SGMA compliance
3. Encourage and reward water conservation
4. Facilitate continuous adjustment as conditions change
5. Provide fair and equitable access for domestic purposes
6. Maintain local control

## One Sustainability Goal

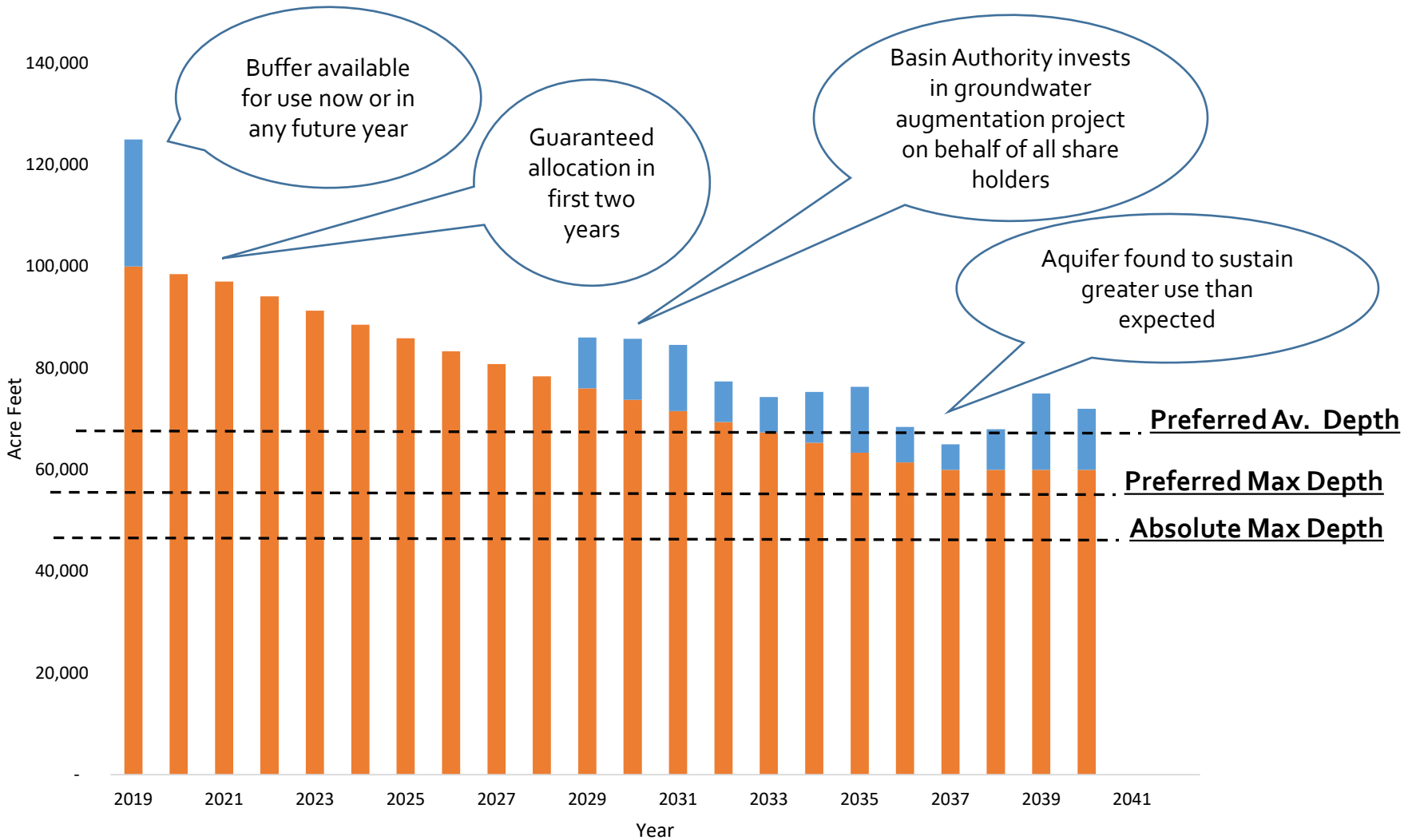
- Groundwater use is in balance and free of 6 undesirable results by 2042 (at the latest)

# GSP Design Strategies

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1. Maximize value and investment opportunity
  - Guaranteed registers and water accounts
  - Shares mortgageable at low cost
2. Avoid massive disruption
  - Recognize current use and investments
  - A start-up buffer and carry-forward provisions
3. Encourage drought preparedness
  - Credit savings and banking water
  - Low cost trading
4. Require the State Government (DWR, SWRCB) to make timely & binding decisions
  - “Ratify” decisions -- because fiddling & procrastinating decreases confidence
5. Keep it simple and affordable
  - Unbundled entitlement, allocation, and use management systems
  - Depth to groundwater as a proxy indicator of variable sustainable yield
  - Adaptive management of allocations

# Indicative Allocation Plan



# Keeping it simple!

Every time depth to groundwater drops, allocations per share must go down by at least 1.5%!

When the absolute maximum depth is reached, allocations per share must go to zero and remain at zero until there is a return to the preferred minimum.

Any water left in any water account may still be used.



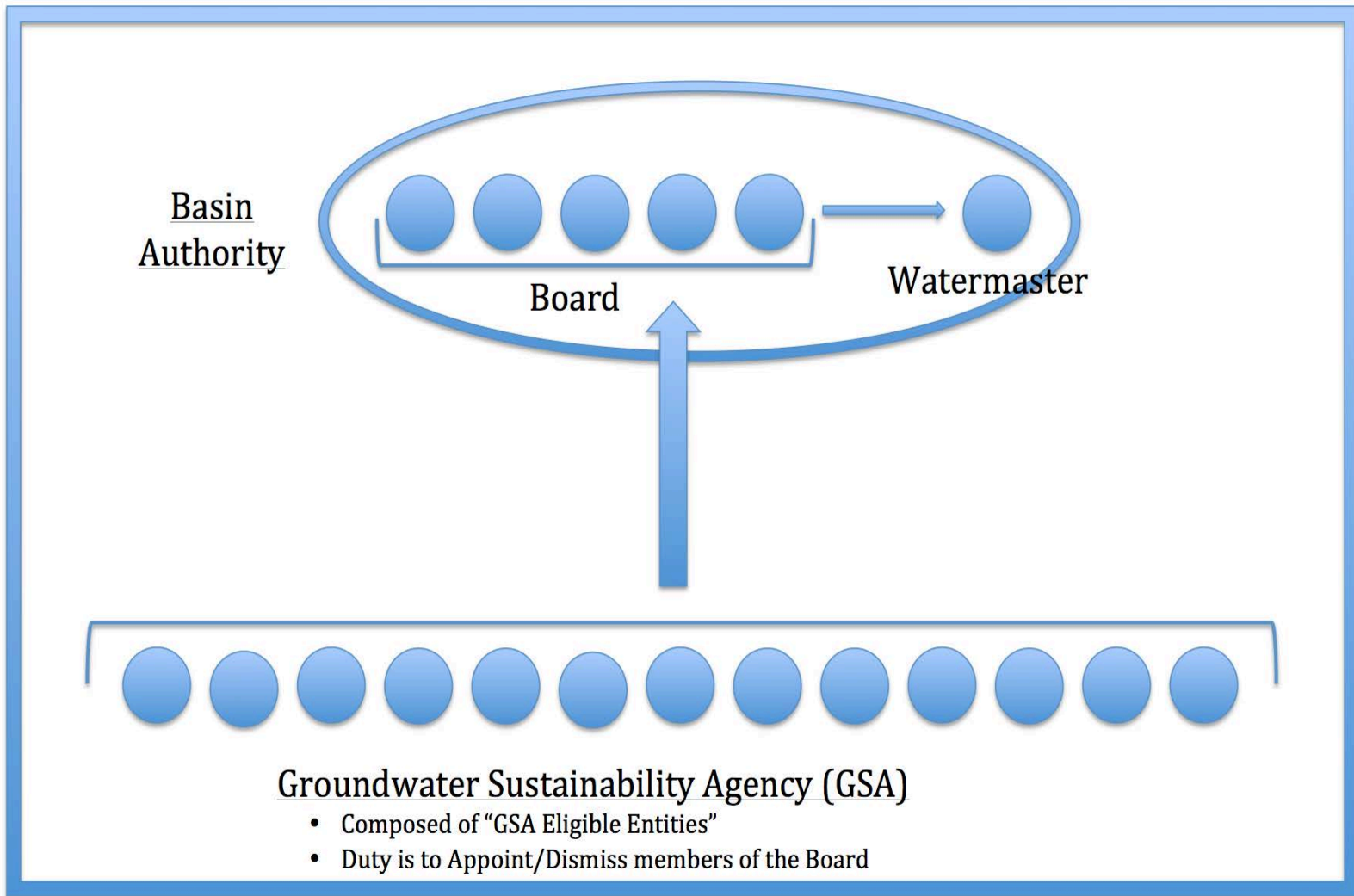
# A Mock-Up Water Account

Date	Action or event	Debit	Credit	Balance
1 Oct 2019	Opening balance			0.00
1 Oct 2019	Start-up buffer		+83.33	+83.33
1 Oct 2019	Share allocation 10,000 shares at one acre-inch per share		+833.33	+916.66
15 Oct 2019	Net use—estimated using satellite imagery and land parcel area	-10		+906.66
30 Oct 2019	Net use—estimated using satellite imagery and land parcel area	-15		+891.66
5 Oct 2019	Within-zone allocation transfer to M.D. and S.M.	-50		+841.66

# Gross v's Net Accounting

- Gross accounting systems adjust for changes in average return flows
- Net accounting systems adjust for changes in return flow at the farm level
- Gross accounting systems rely upon meters
- Net accounting systems are still in their infancy and rely upon satellite-based estimates of Evapo-Transpiration

# Governance



# Domestic Water Use

- Shares held by County or City with obligation to keep the “domestic water account” in positive balance
- 5 yr estimate of average use
- Each household allowed to take **up to** locally agreed limit
- When allocations per share @ zero, households still allowed to take sufficient for essential purposes

# Making it all work

- Need a Chair who is trusted and is a skilled communicator
- When in un- intentionally in deficit,  
30 days to make good
- After 30 days, Watermaster required to make good for you and charge double
- Require DWR to be as disciplined as it expects users to be.



# Issuing Shares

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Requires careful engagement and consultation

1. Determining eligibility criteria
2. Design the share allocation database
3. Assemble and validate the database
- 4. Develop and finalize the allocation formula**
5. Build share register and, where appropriate, record financial interests
6. Confirm accuracy of share register

# Possible Share Allocation Formula

- Best management practice for hottest of last 7 years
- Initial allocation in proportion to current land use
- Adjusted for age of current crop
- 1.1% of shares re-allocated in proportion to land use for ten years
- Special 10 year reserve set aside to be allocated in proportion to land area
- Maximum volume used in last 7 years allocated to packing sheds, businesses, etc.

## Issues for Discussion

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1. Shares as the long-term entitlement
2. Water allocations and Water accounting
3. Governance arrangements (GSA, Authority & Watermaster)
4. A gross or net accounting system
5. Metering v. remote ET assessment
6. Formula for issuing shares
7. Domestic water-use arrangements
8. Enforcement
9. Ensuring register and account integrity
  
10. Detail not covered in this presentation
  1. Zones, boundary modifications, etc.
  2. Cooperation with other GSAs and managing connections via Coordination Agreements
  3. GSP's drought guarantee

# ACKNOWLEDGEMENTS

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- Water Funders Initiative
  - Rockefeller Foundation
  - Pisces Foundation
  - Bechtel Foundation
  - Walton Foundation

**Google "Young McAteer Groundwater" to access our Roadmap**

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  2. [Plan Framework](#)
    - [Purpose of Plan and Goals](#)
    - [Avoiding Undesirable Results](#)
    - [Sustainability Goal](#)
  3. [Zones](#)
  4. [ABC Groundwater Basin Authority](#)
    - [Quorum](#)
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  8. [Water Use Accounts](#)
    - [Carryforward of Unused Allocations Allowed](#)
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