SGMA Planning Needs

1. **Where** is recharge best done? **When**?
2. **How much** surface water can we capture?
3. What would it **cost**?
4. **How much of our groundwater overdraft** can be addressed by increasing recharge?
Groundwater Recharge Assessment Tool

**Water Available for Recharge**
- Surface water availability
- Excess flood flows
- Water rights

**Conveyance**
- Conveyance infrastructure
- Delivery capacity to fields

**Site Suitability**
- Recharge suitability: slope, soil type, clay layers, underlying geology, depth to groundwater
- Crop and land use suitability

**On-Farm and Fallow Recharge**
- Infiltration-percolation potential (crop compatibility calendar)

**Dedicated Basins**
- Percolation rate of existing dedicated recharge basins

**Recharge Benefit/Cost Analysis**
- Relative cost per acre foot ($/acre foot)
- Increased groundwater recharge
Data Needs in the SGMA Era - Water Available for Recharge with Climate Change

Annual Merced River Flow (Nov-Mar)

Flow (TAF/year)

- Remaining Winter Flood Flows
- Winter Flood Flows that can be Conveyed
- Historical Winter Diversion

RMC 2015
Water Available for Recharge – Predicting Weekly Flows

Monthly Wet Year Merced River Flow (Nov-Mar)

San Joaquin River 2017

RMC 2015
Recharge Suitability Indexes

Weighted indexes of slope, soil type, clay layers, underlying geology, depth to groundwater

UC Davis SAGBI

Land IQ Recharge Suitability Index
Crop Compatibility Calendar

- Weekly capacity of crops to receive water in excess of crop demand
- Best available data based on farmer and field agronomist experience
- Assumes well drained soils
- Available for grapes, alfalfa, walnuts, almonds, pistachios
Welcome to the
Groundwater Recharge Assessment Tool

SELECT AN IRRIGATION DISTRICT

Username
Password
Forgot Password?
SUBMIT
Individual fields ranked by Recharge Potential
Site Selection Weighting Criteria

1. **Conveyance / Water Access**
   Proximity and size of existing water conveyance for any field unit

2. **Volume Applied**
   Amount of water applied per crop compatibility calendars

3. **Deep Percolation**
   The ability of water to percolate down to the first encountered aquifer per SAGBI/LandIQ index

4. **Retention**
   How much deep percolation water is retained in the GSA, based on proximity to surface water source or GSA boundary

Relative weighting of each criteria can be adjusted to conduct sensitivity analyses.
Scenarios: Water Availability

Set Water Availability
- Wet: 150,000 AF
- Above Normal: 120,000 AF
- Below Normal: 80,000 AF
- Dry: 30,000 AF
- Critical: 0 AF
- Start Year: 2016

Select Recharge Type
- On-Farm Recharge
- Fallow Recharge
- Existing Dedicated

Select Crops for On-Farm Recharge
- Madera
- Almonds
- Walnuts
- Alfalfa
Scenarios: Recharge Type

Select Recharge Type
- On-Farm Recharge
- Fallow Recharge
- Existing Dedicated

Select Crops for On-Farm Recharge
- Madera
- Almonds
- Walnuts
- Alfalfa
- Pistachios
- Grapes
Select Sites: Recharge Quantities and Costs

Recharge Target for Wettest Year
Volume, AF: 100,000
Total Recharge: 111,005 AF
Site Contribution to Recharge: 83,721 AF
Recharge from Canal Seepage: 27,284 AF
Cost: $1,000,000
Annual Cost for Wettest Year: $6,682,367

Potential Recharge Sites
- 700 SITES SELECTED

Site: 1841
- Site Details
  - Crop: Walnuts
  - Acres: 63
  - Permittee: RIO DEL SOL
  - Parcel #: 047100028000
  - Cost: $8,064
  - Average AF of Recharge: 209 AF
Results: Net Groundwater Change
Results: Net Groundwater Change with pumping restrictions

75,000 AF Annual GW pumpage
66,035 AF Average Annual Recharge

Cumulative Net Groundwater Change with and without Recharge

With Recharge: -179,289
**Results: Unused Water Available for Recharge**

### Graphs

- GW and Recharge
- Recharge by Type
- On-Farm Recharge by Crop
- Unused Water Available for Recharge
- Financials

### Table: Unused WAFR

<table>
<thead>
<tr>
<th>Condition</th>
<th>Below Normal</th>
<th>Above Normal</th>
<th>Wet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unused WAFR: Acre-Feet</td>
<td>17,968</td>
<td>37,319</td>
<td>59,051</td>
</tr>
<tr>
<td>Unused WAFR: % of Total</td>
<td>22.5%</td>
<td>31.1%</td>
<td>39.4%</td>
</tr>
</tbody>
</table>
Results: Investment Cost by Year and Total

Total 20 Year Investment Needed: $116,854,390

Estimated Total Costs by Year

- On-Farm Recharge
- Dedicated Recharge
- Fallow Recharge

X-axis: Years
Y-axis: Investment needed ($M)
<table>
<thead>
<tr>
<th>Potential GRAT Plus functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>New Storage/Conveyance</strong></td>
</tr>
<tr>
<td>• Site new dedicated basins.</td>
</tr>
<tr>
<td>• <strong>On-farm to fallow</strong>. Option to change current crops to fallow land</td>
</tr>
<tr>
<td>• <strong>New conveyance</strong>. Add new infrastructure</td>
</tr>
<tr>
<td><strong>Operations</strong></td>
</tr>
<tr>
<td>• <strong>Daily/weekly timescale</strong>. Assist near real-time decisions on where to divert WAFR</td>
</tr>
<tr>
<td><strong>Science and Modeling</strong></td>
</tr>
<tr>
<td>• <strong>Groundwater modeling</strong>. Add capabilities on groundwater movement</td>
</tr>
<tr>
<td>• <strong>Actual percolation</strong>. Add soil moisture flux and on-farm recharge data based on pilots</td>
</tr>
<tr>
<td>• <strong>Conveyance</strong>. Model conveyance limitations</td>
</tr>
<tr>
<td><strong>Financials</strong></td>
</tr>
<tr>
<td>• <strong>Value in financials</strong>. Build in positive value into the financials (not just costs)</td>
</tr>
</tbody>
</table>
For further information

suscon.org/GRAT/

Daniel Mountjoy  dmountjoy@suscon.org

Glen Low  glen@earthgenome.org
Results: Acreage Used by Crop and Water Year and remaining acreage potential

- On-Farm Recharge Acreage Available by Crop
- On-Farm Recharge for each Rainfall Year Type