Presenters:
Charles Gardiner
Alyson Watson

MERCED IRWMP
INTEGRATED REGIONAL WATER MANAGEMENT PLAN

December 18, 2012

Regional Advisory Committee Meeting #8

Today's Agenda

- ✓ Introductions and Overview
- ✓ DWR Update
- ✓ RAC Activities
- ✓ Workgroup Reports
- ✓ Governance
- ✓ Summary of Technical Studies
- ✓ Implementation Grant Update
- ✓ Next Steps
- ✓ Public Comment

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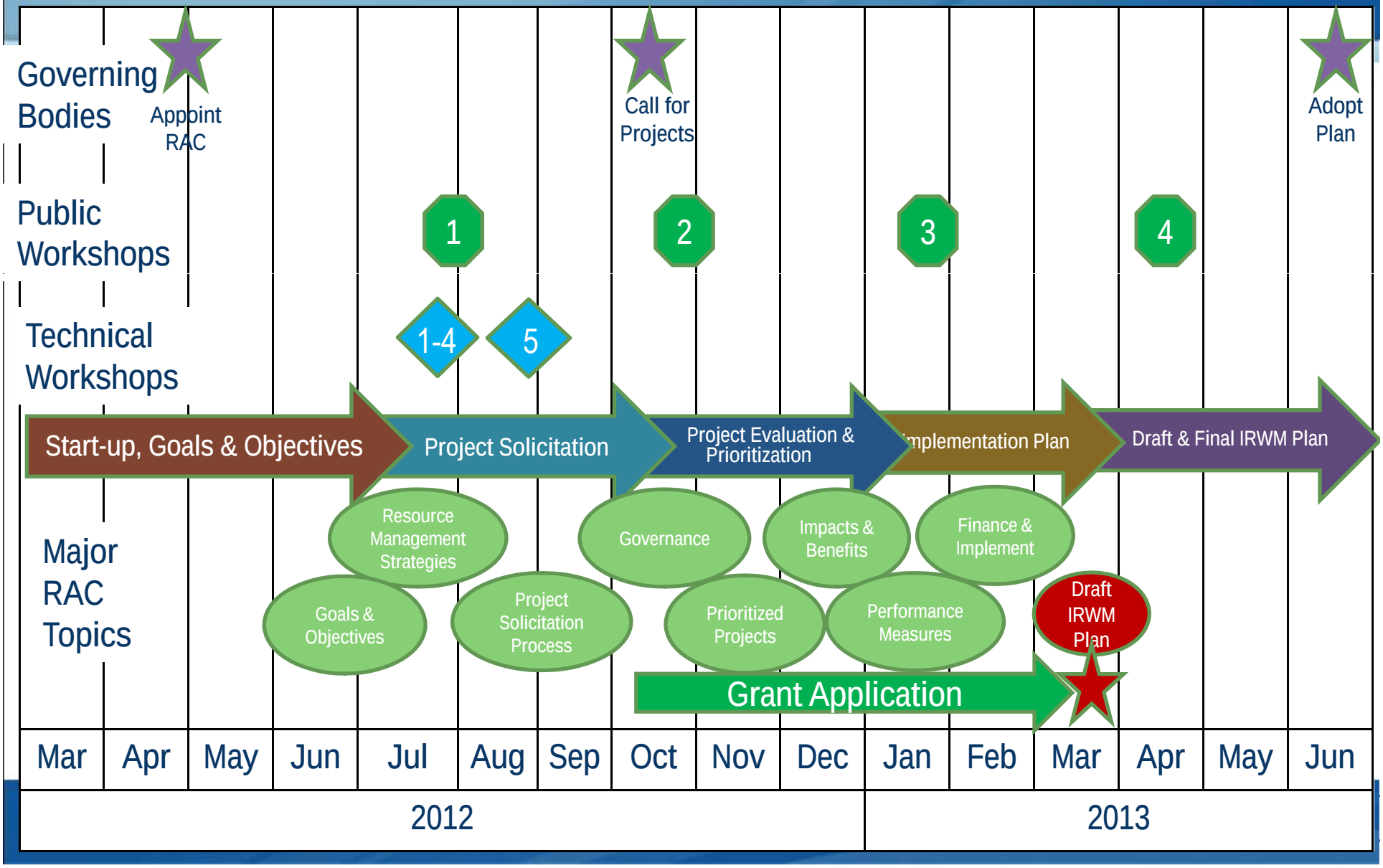
Regional Advisory Committee Purpose

- ✓ Represent the broad interests and perspectives in the region
- ✓ Assist in the completion of the Merced Integrated Regional Water Management Plan (IRWM) Plan
- ✓ Encourage cooperative planning among various aspects of water resources management in the Merced Region
- ✓ Review regional water management issues and needs, goals and objectives, plans and projects, and future funding and governance
- ✓ Advise the Regional Water Management Group (RWMG) and the governing bodies on these topics

RAC Ground Rules

- ✓ Civility is required.
  - ✓ Treat one another with courtesy.
  - ✓ Respect the personal integrity, values, motivations, and intentions of each member.
  - ✓ Be honest, fair, and as candid as possible.
  - ✓ Participate with an open mind and respect for other's interests.
  - ✓ Personal attacks and stereotyping will not be tolerated.
- ✓ Creativity is encouraged.
  - ✓ Think outside the box and welcome new ideas.
  - ✓ Build on the ideas of others to improve results.
  - ✓ Disagreements will be treated as problems to be solved rather than battles to be won.
- ✓ Efficiency is important.
  - ✓ Participate fully, without distractions.
  - ✓ Respect time constraints and be succinct.
  - ✓ Let one person speak at a time.
- ✓ Constructiveness is essential.
  - ✓ Take responsibility for the group as a whole and ask for what you need.
  - ✓ Enter commitments honestly, and keep them.
  - ✓ Delay will not be employed as a tactic to avoid an undesired result.

Project Schedule



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RAC Activities

- ✓ Approval of notes from RAC Meeting #7

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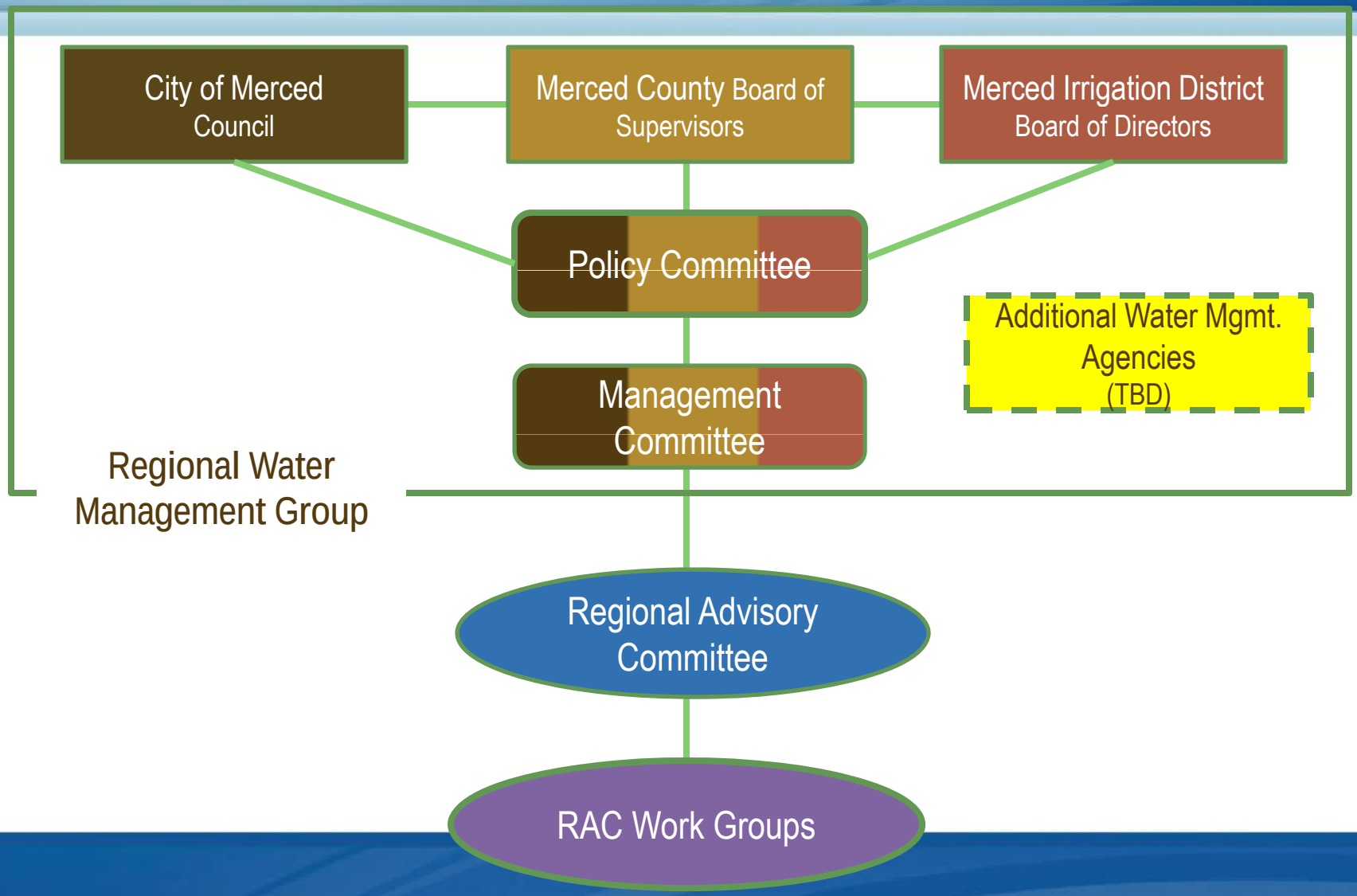
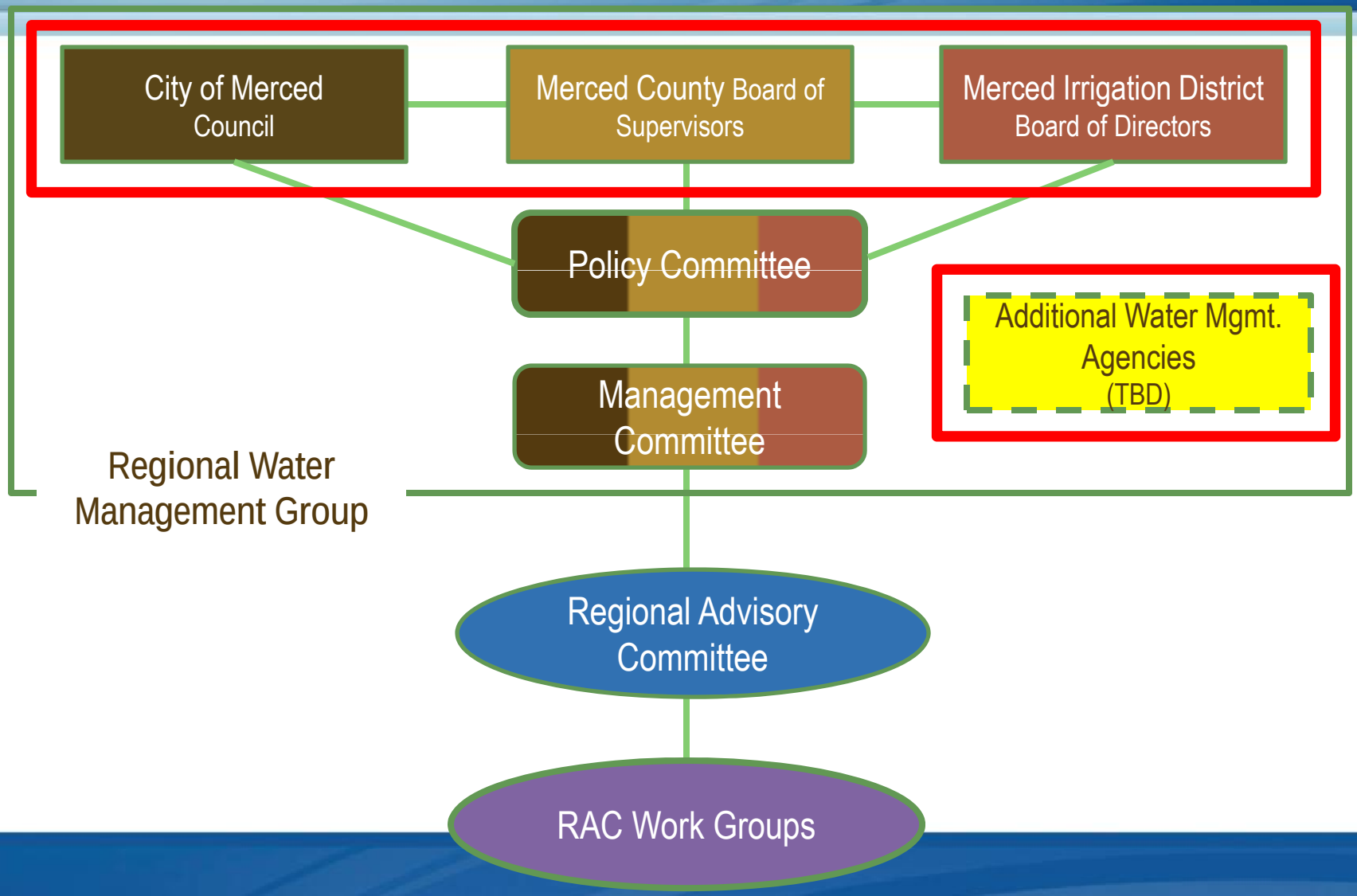
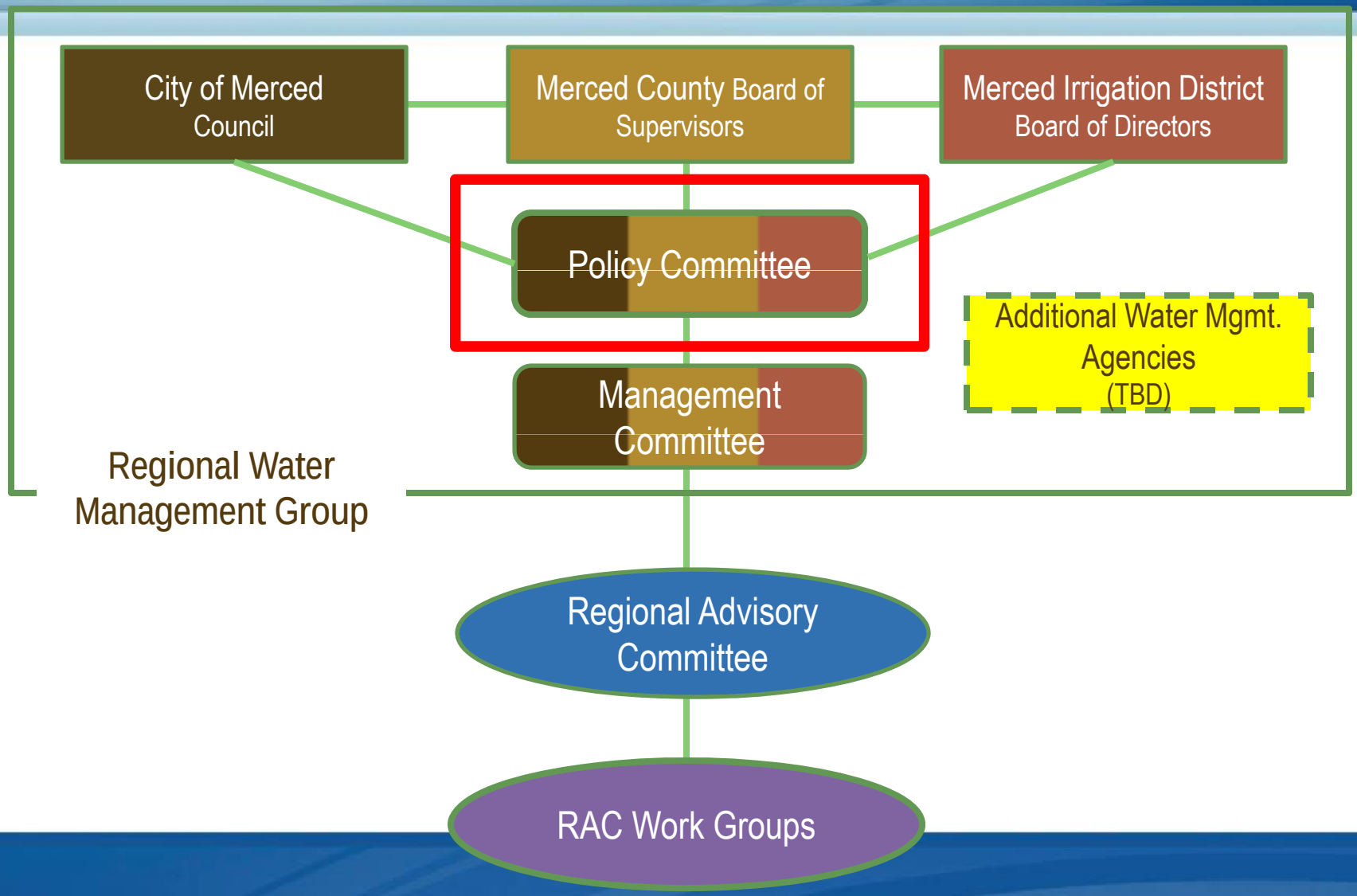
Draft Governance Structure



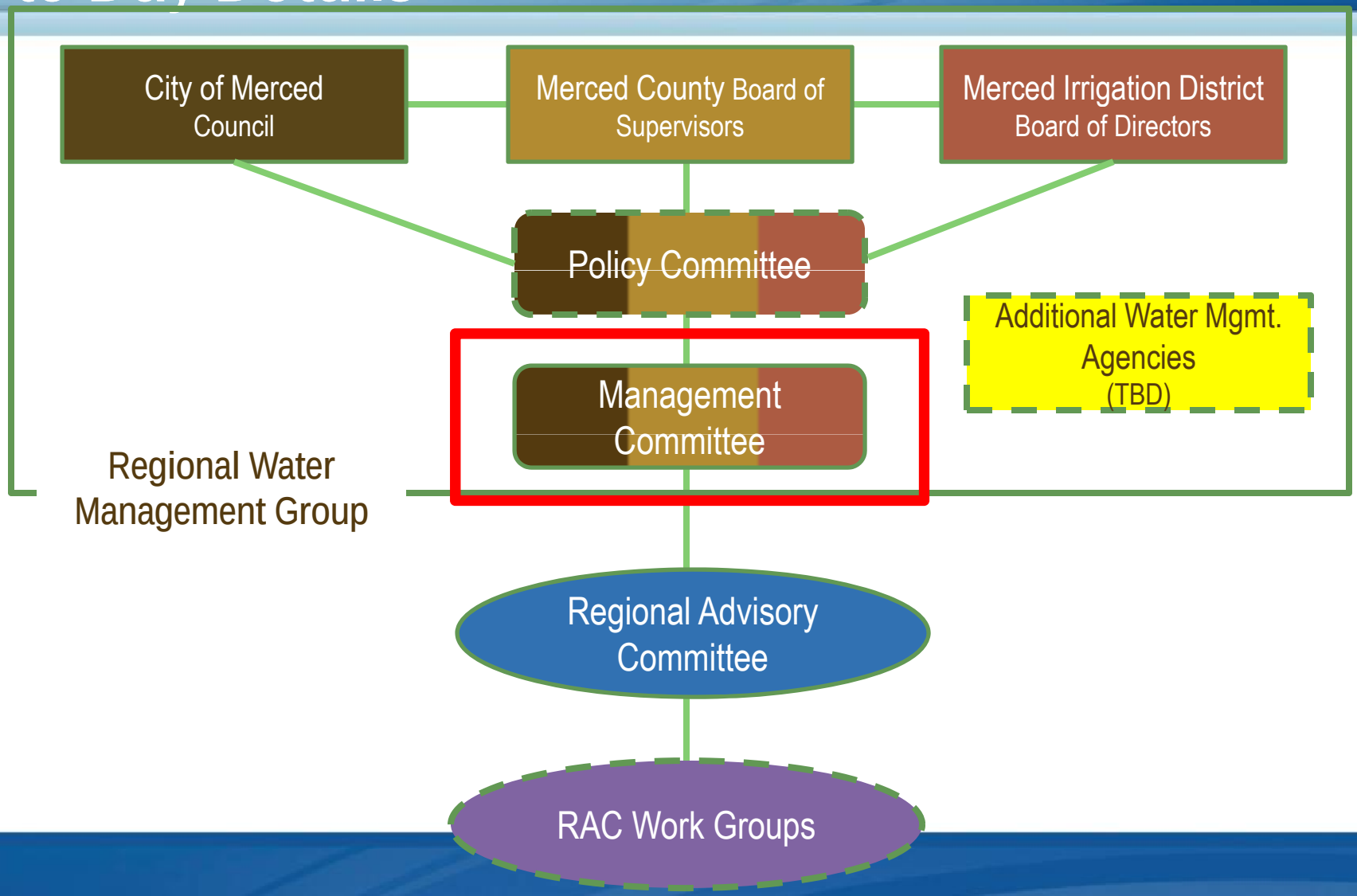
Governing Boards Comprise the RWMG; Additional Agencies Added in the Future



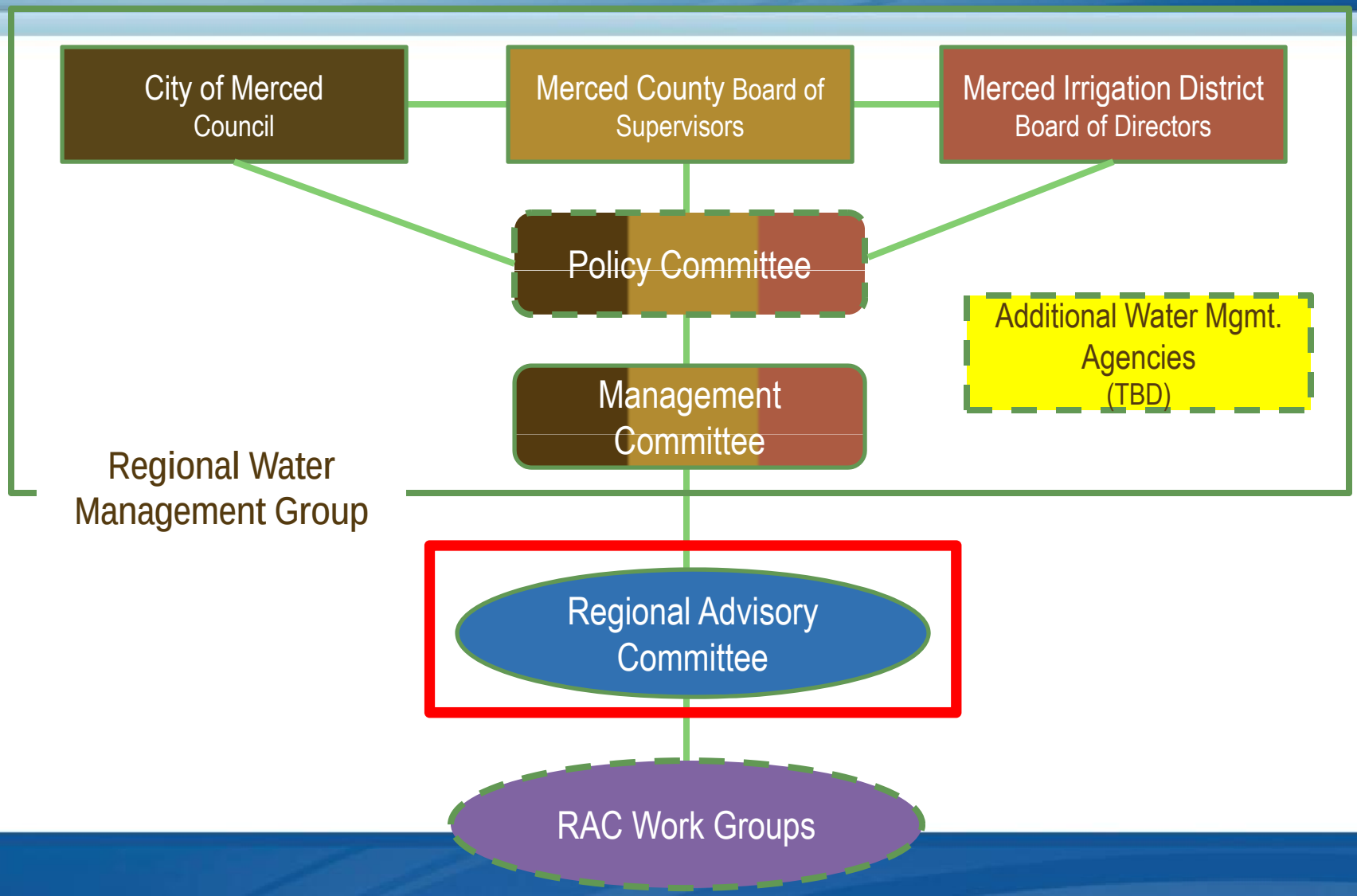
Policy Committee Comprised of Governing Board Reps Provides Interface



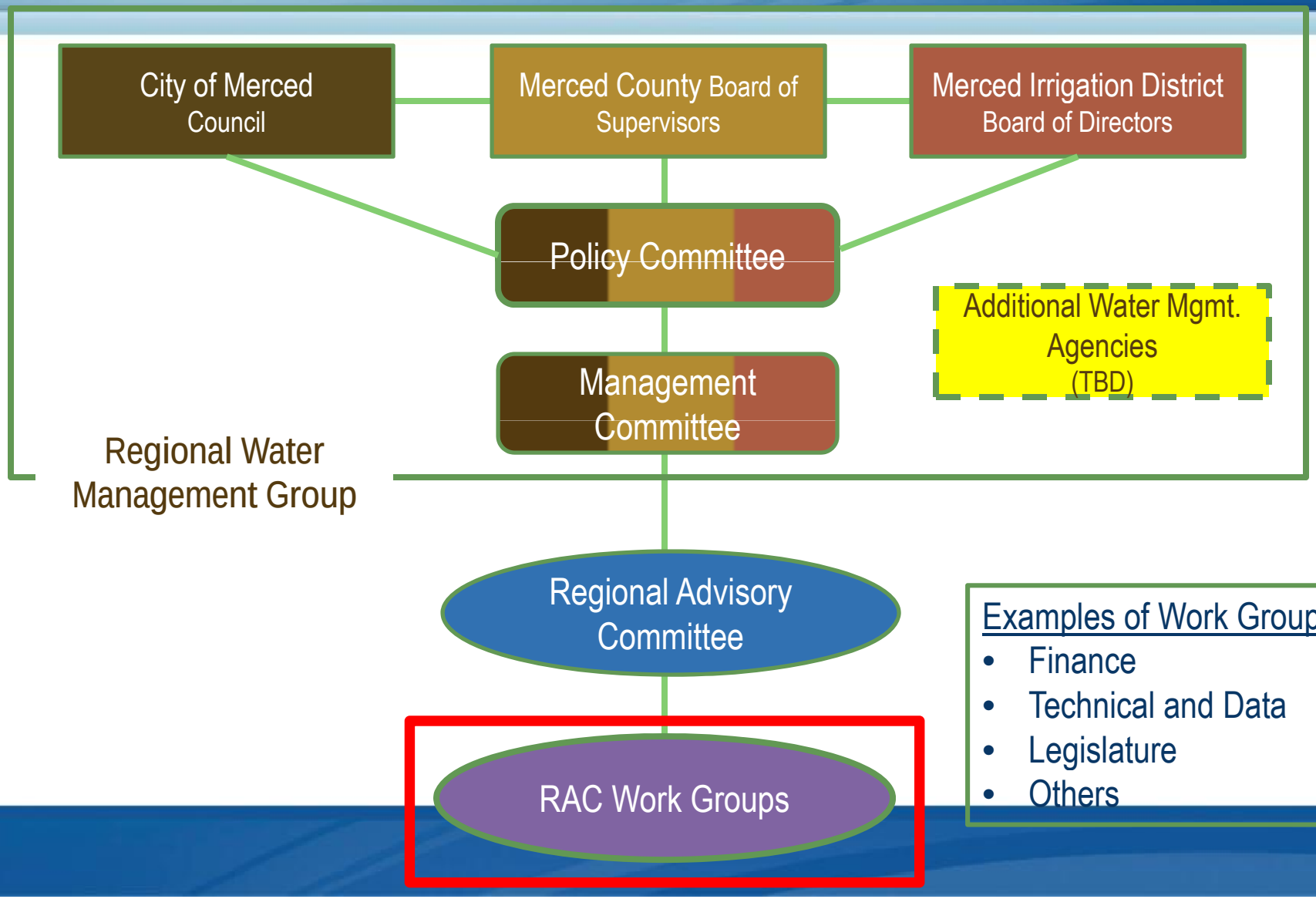
Management Committee Comprised of Reps from RWMG Member Agencies Oversee Day-to-Day Details



RAC Continues to be Primary Advisory Body / Forum for Decisions



RAC Assembles Work Groups As Needed to Address Specific Issues



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Technical Studies

- ✓ Water Conservation
- ✓ Integrated Flood Management
- ✓ Groundwater Recharge
- ✓ Salt & Nutrient Management
- ✓ Climate Change

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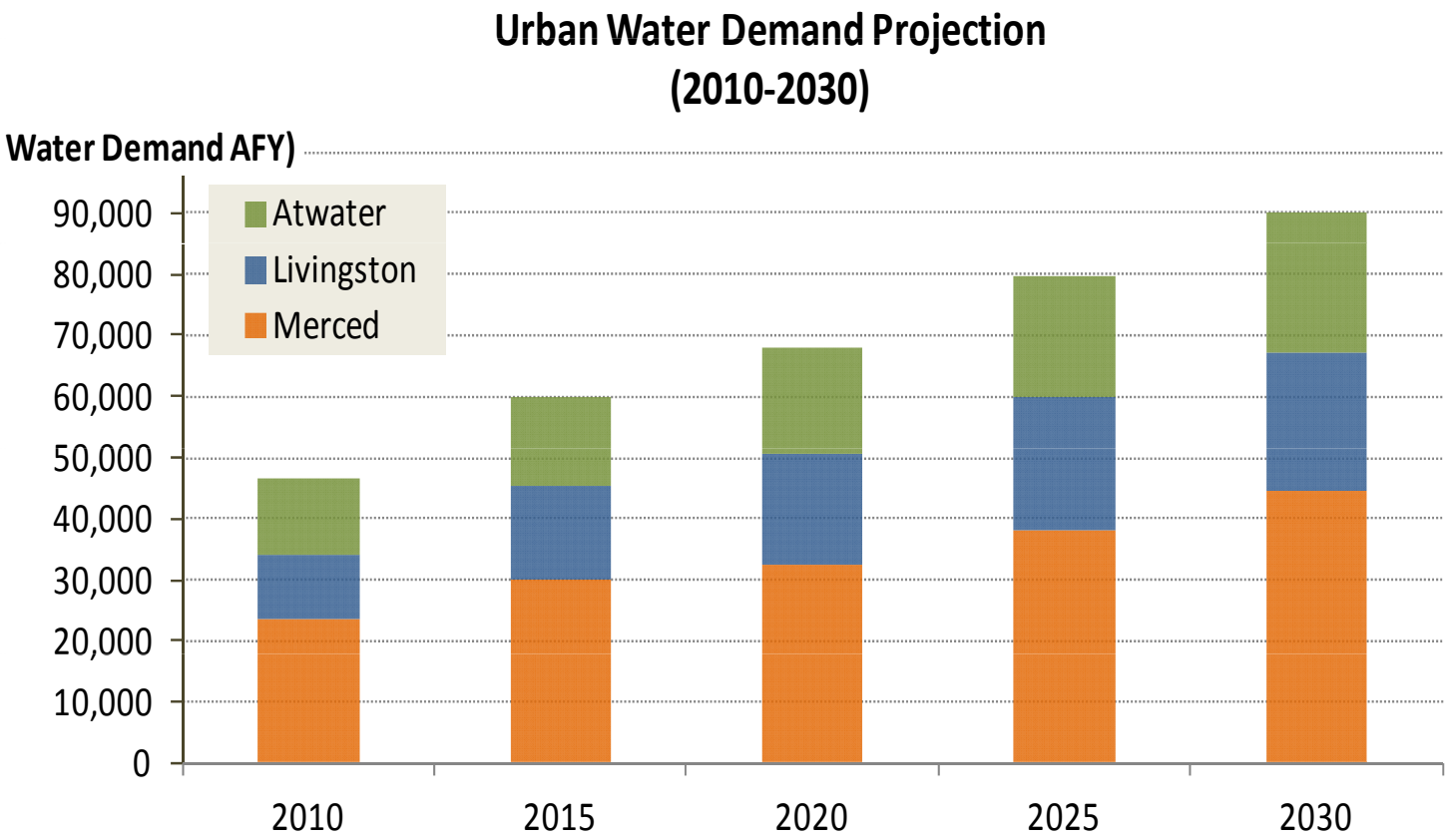
Water Conservation

- ✓ Assessed urban demands (based on Urban Water Management Plans) and agricultural water demand
- ✓ Summarized water conservation measures in place
- ✓ Identified recommendations for potential future conservation

Urban Water Demands

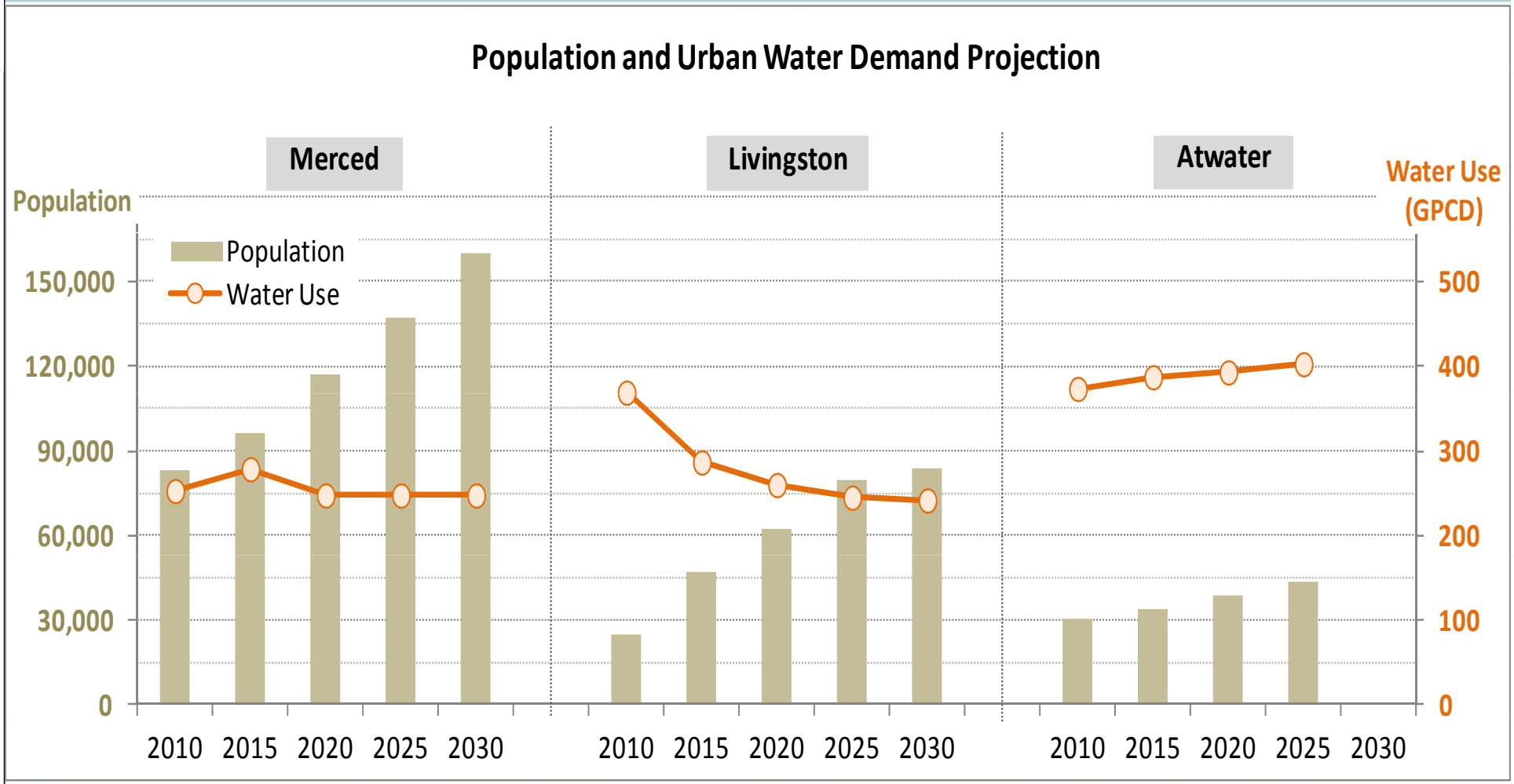


Notes:

(1) Source: City of Merced 2010 UWMP, City of Livingston 2005 UWMP, and City of Atwater 2005 UWMP.

(2) City of Atwater's 2005 UWMP does not have population and water demand projection for 2030. Values shown are extrapolated based on previous years.

Population and Per Capita Water Demands



Implementation of Demand Management Measures

	Demand Management Measure(	Merced	Livingston	Atwater
1	Water Survey Program	⊘	○	●
2	Residential Plumbing Retrofit	●	○	●
3	System Water Audits, Leak Detection and Repair	●	●	●
4	Metering with Commodity Rates	●	●	●
5	Large Landscape Conservation Programs	○	●	●
6	High-Efficiency Washing Machine Rebate Program	⊘	○	⊘
7	Public Information Programs	●	○	●
8	School Education Program	●	○	●
9	Conservation Programs for CII Accounts	⊘	○	●
10	Wholesale Agency Programs	n/a	n/a	n/a
11	Conservation Pricing	○	●	●
12	Water Conservation Coordinator	●	○	●
13	Water Waste Prohibition	●	●	●
14	Residential ULFT Replacement Programs(2)	⊘	○	⊘

Footnotes:

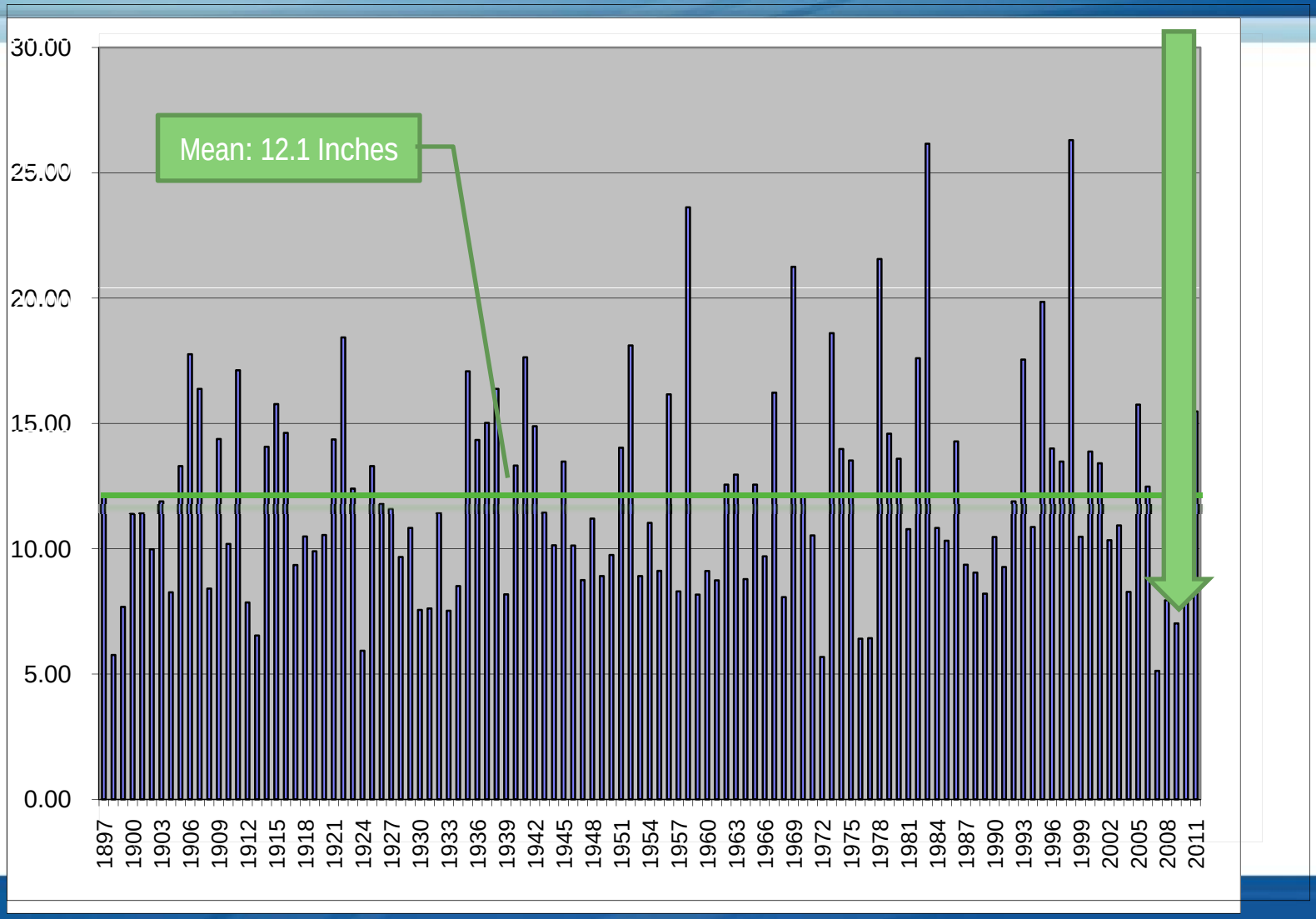
● *- Implemented;* ○ *- Planned or in Evaluation;* ⊘ *- Not Implemented; N/A -Not applicable to agency*

Potential Future Urban Water Conservation Measures

	Proposed Project/Measure	Effectiveness/Applicability[1]		
		City of Merced	City of Livingston	City of Atwater
1	Meter Installation	✓✓	✓✓	✓✓✓
2	Water Audit Program	✓✓	⌖	⌖
3	Residential Retrofit Rebate Program	✓	✓	✓
4	Non-Residential Retrofit Partnership Program	✓	✓	✓
5	Rainwater/Graywater Program	✓	✓	✓
6	Conservation Modeling	✓✓✓	✓✓	✓✓
7	Conservation Planning	✓✓✓	✓✓✓	✓✓✓

Footnote:
✓✓✓=Highly effective/applicable; ✓✓ = Effective/Applicable; ✓ = Merits consideration, conduct pilot or evaluate cost-effectiveness before full-scale implementation; ⌖ = already implementing but can improve

Analyzed Agricultural Water Use for 2009, a Below Normal Water Year



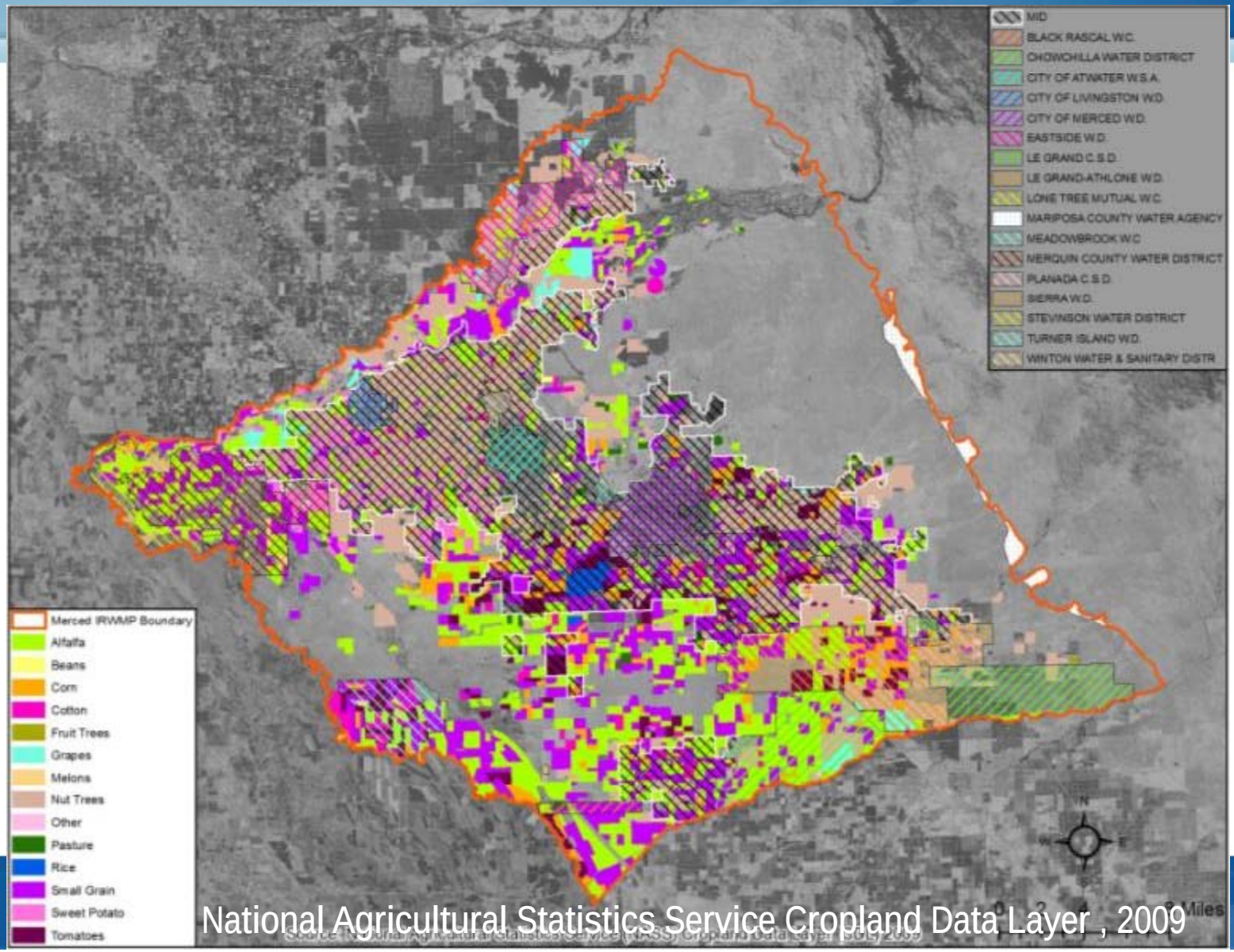
Source: Merced Irrigation District Office, 2423 Canal Street, Merced, CA

Overview of Irrigated Area in Merced IRWM Region

Agricultural Water Suppliers within Merced IRWMP Boundaries	Adequacy of Surface Water Supplies	Total 2009 Irrigated Ag area, acres	Total 2009 Non-Ag area, acres	Total Area, acres
Merced Irrigation District	Adequate Most Years	113,000	51,000	164,000
Other Organized Agricultural Water Suppliers	Inadequate All Years	72,600	29,400	102,000
No Organized Agricultural Water Suppliers	Inadequate All Years	94,000	220,600	314,600
Total		279,600	301,000	580,600

*Estimates are based on 2009 Water Year, which was a below-normal water year according to the San Joaquin River 60-20-20 Index

Land Use



National Agricultural Statistics Service Cropland Data Layer , 2009

Estimated Annual Water Demands (2009)

Agricultural Water Suppliers within Merced IRWMP Boundaries	Adequacy of Surface Water Supplies	Total Irrigated area, acres	ET_{aw}, acre-feet	ET_{aw}, acre-feet per acre
Merced Irrigation District	Adequate Most Years	113,000	250,500	2.2
Other Organized Agricultural Water Suppliers	Inadequate All Years	72,600	173,200	2.4
No Organized Agricultural Water Suppliers	Inadequate All Years	94,000	227,200	2.4
Total		279,600	650,900	2.3

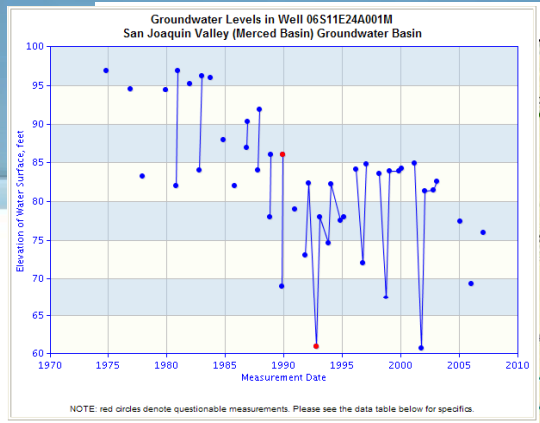
ETaw is demand for applied water (portion of evapotranspiration not met by precipitation)

Estimated Net Groundwater Withdrawals (2009)

Agricultural Water Suppliers within Merced IRWMP Boundaries	Adequacy of Surface Water Supplies	Total Irrigated area, acres	Estimated Total Net Extraction, AF	Estimated Total Net Extraction, AF per acre
Merced Irrigation District	Adequate Most Years	113,000	-167,439	-1.5
Other Organized Agricultural Water Suppliers	Inadequate All Years	72,600	116,980	1.6
No Organized Agricultural Water Suppliers	Inadequate All Years	94,000	208,744	2.2
Total		279,600	158,285	0.6

*Positive net extraction indicates that withdrawals exceed inputs; negative net extraction indicates that inputs exceed withdrawals.

GW Levels have been declining in Merced Basin



Conclusions

- ✓ Deep percolation of applied water from MID is a significant source of groundwater recharge in the region
- ✓ Agricultural production and irrigation impacts on groundwater vary substantially depending on the adequacy of surface water supplies
  - ✓ Areas with adequate surface water supplies have a net positive effect on groundwater through recharge in below normal water years
  - ✓ Areas with inadequate surface water supplies have a net effect of extracting water from groundwater storage
- ✓ Most irrigation return flows are reused within the region
- ✓ Net outflows of applied irrigation water are unknown at this time; reduction in net outflows would represent conserved water for the region

Conclusions, cont'd

- The main benefit of irrigation water conservation is reduced groundwater pumping resulting in:
  - Potential reductions in energy consumption
  - Water quality benefits
  - Increased supply to the Region, to the extent that net outflows are reduced

Recommendations

- ✓ In areas with inadequate surface water supplies, implement Efficient Water Management Practices (EWMPs) to improve irrigation efficiency
- ✓ In areas with adequate surface water supplies, evaluate EWMPs to prevent reductions in groundwater recharge
- ✓ Consider direct recharge, in lieu recharge, or a combination of artificial recharge strategies
- ✓ Investigate comprehensive flood management solutions that redirect flood waters into spreading basins in recharge areas
- ✓ Develop detailed multi-year water balance analyses structured around water supplier and groundwater only areas to better understand water supply conditions, water conservation opportunities, and interactions between supply areas within the Region

Water Conservation Comments / Questions?

- ✓ Water Conservation
- ✓ Integrated Flood Management
- ✓ Groundwater Recharge
- ✓ Salt & Nutrient Management
- ✓ Climate Change

Technical Studies

- ✓ Water Conservation
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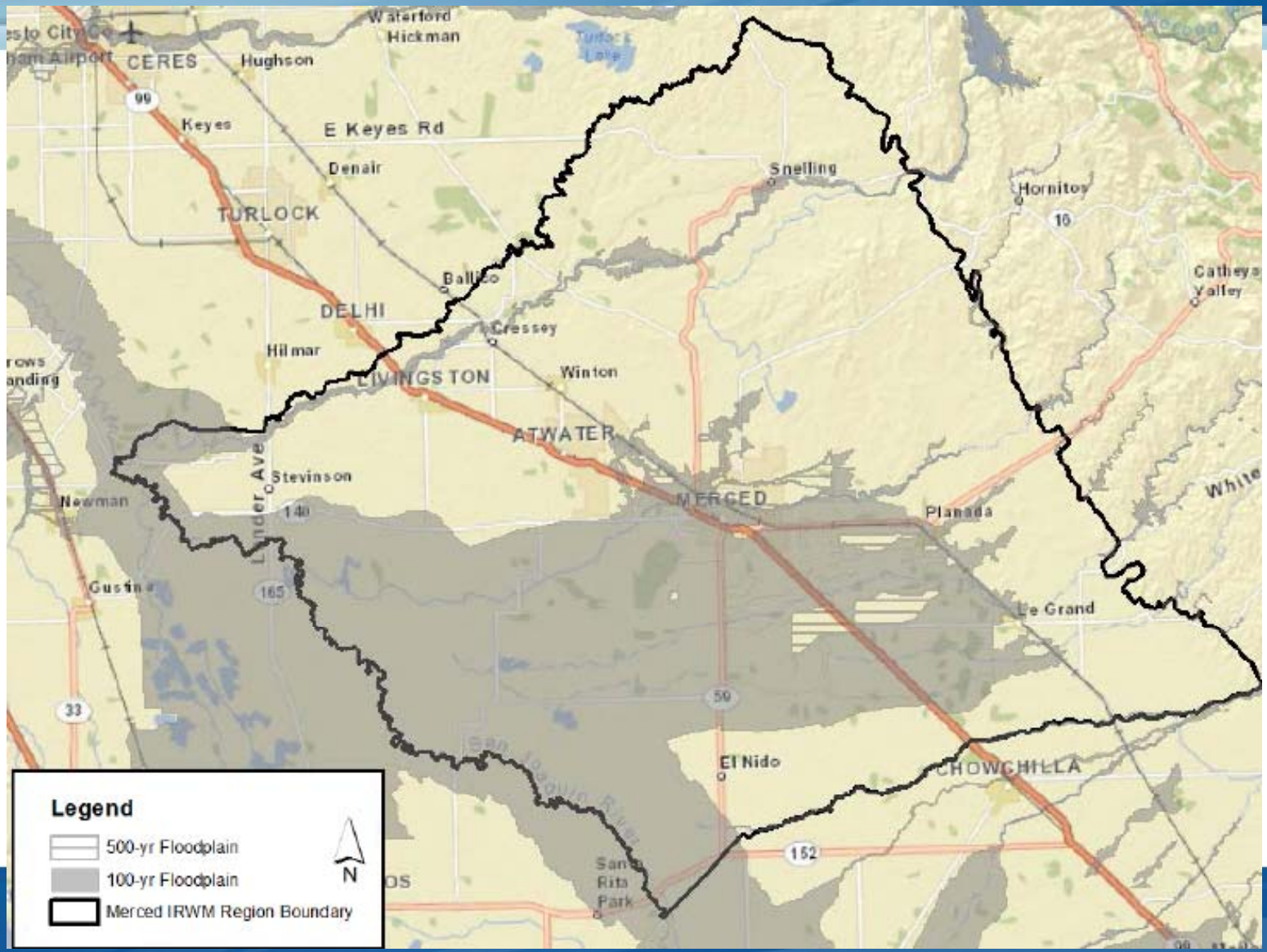
Integrated Flood Management

- ✓ Identify potential projects to assist in achieving IRWM objective to manage flood flows for public safety, water supply, recharge, and natural resource management
- ✓ Coordinate proposed flood management solutions with potential beneficial use and/or groundwater recharge sites to potentially help achieve this goal

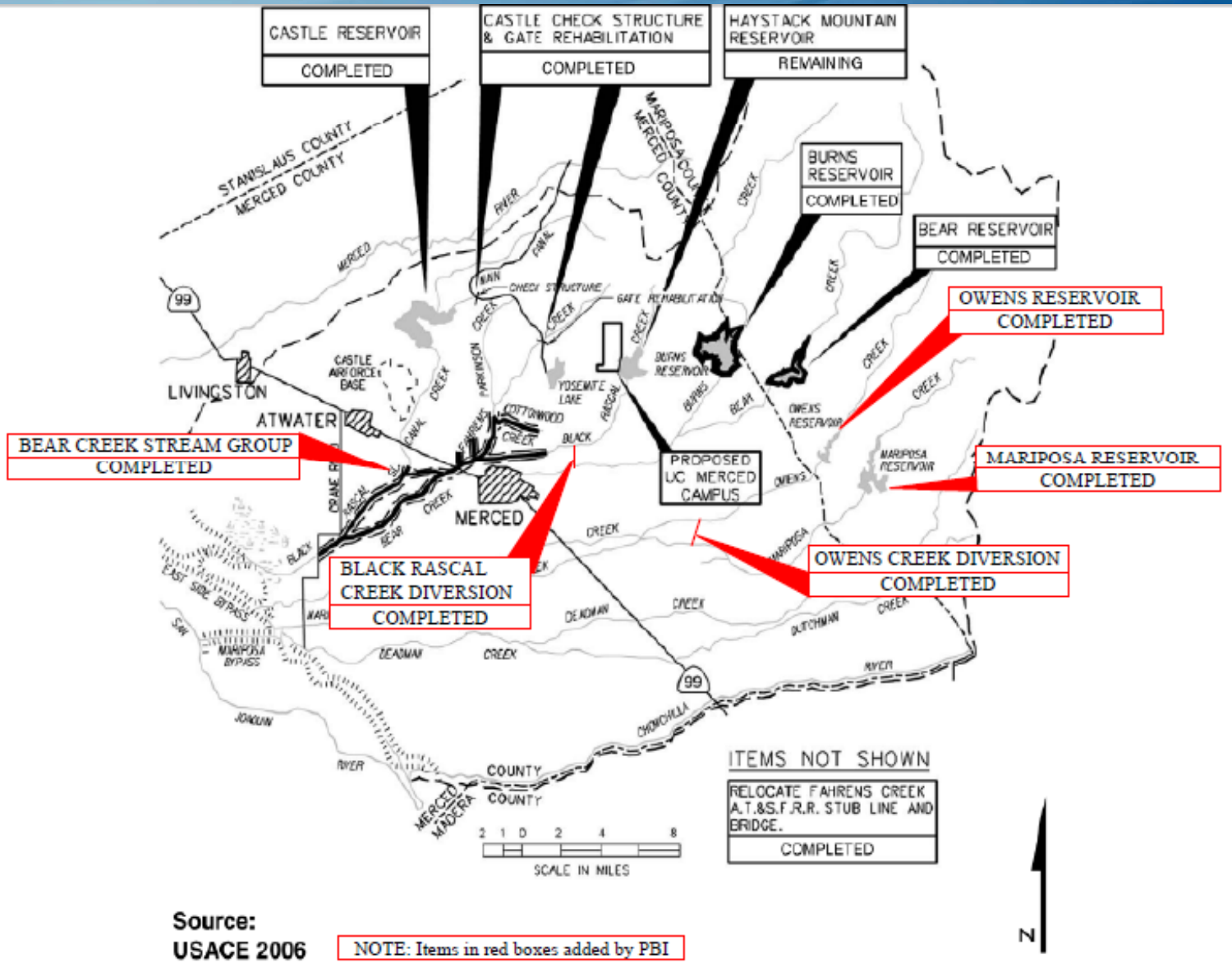
380,000 Acres in the Merced County are in a 100-Year Floodplain



Flood Management in the Region

- ✓ 1944 - Merced County Streams Group (MSG) project
- ✓ 1970- Original project proposed by the United States Army Corps of Engineers (USACE) updated to include a dam on Black Rascal Creek (Haystack Dam)
  - ✓ Later determined that environmental issues might be a significant challenge to implementing the Haystack Dam.
- ✓ MSG effort continues today
  - ✓ USACE studying alternative flood control structures on Black Rascal Creek

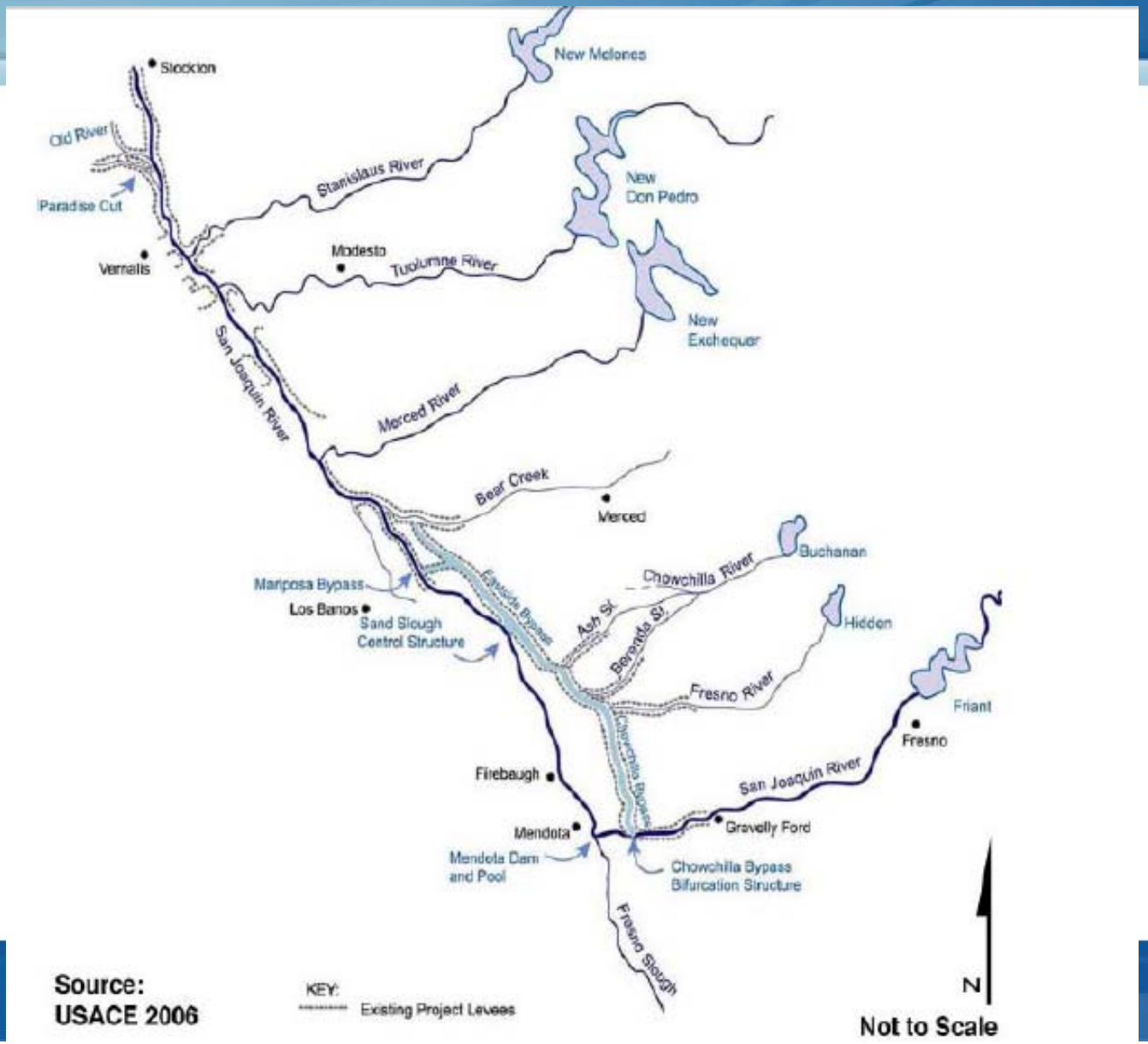
Merced County Streams Group Project Status



Source:
USACE 2006

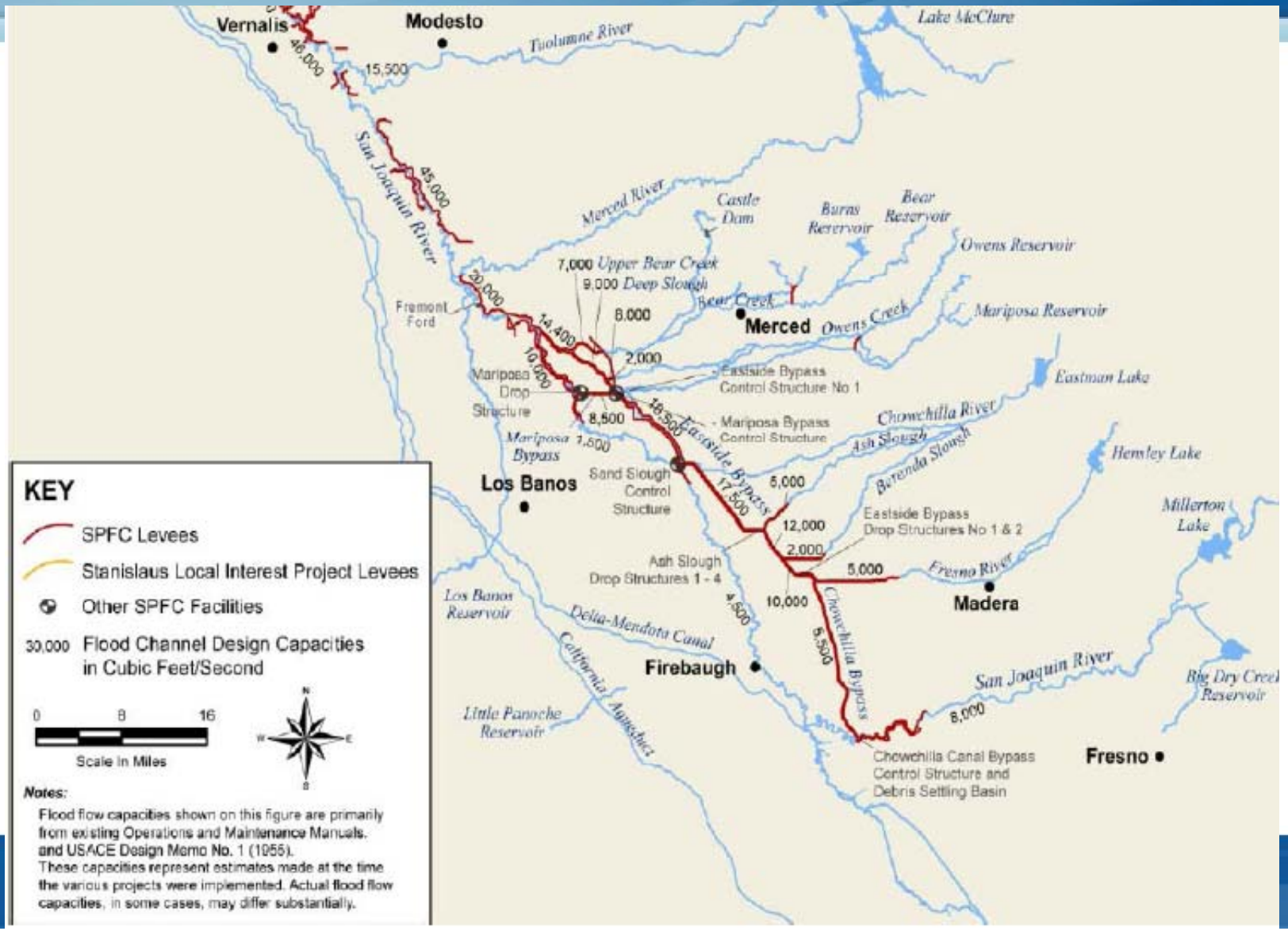
NOTE: Items in red boxes added by PBI

USACE Project Levees in the Region

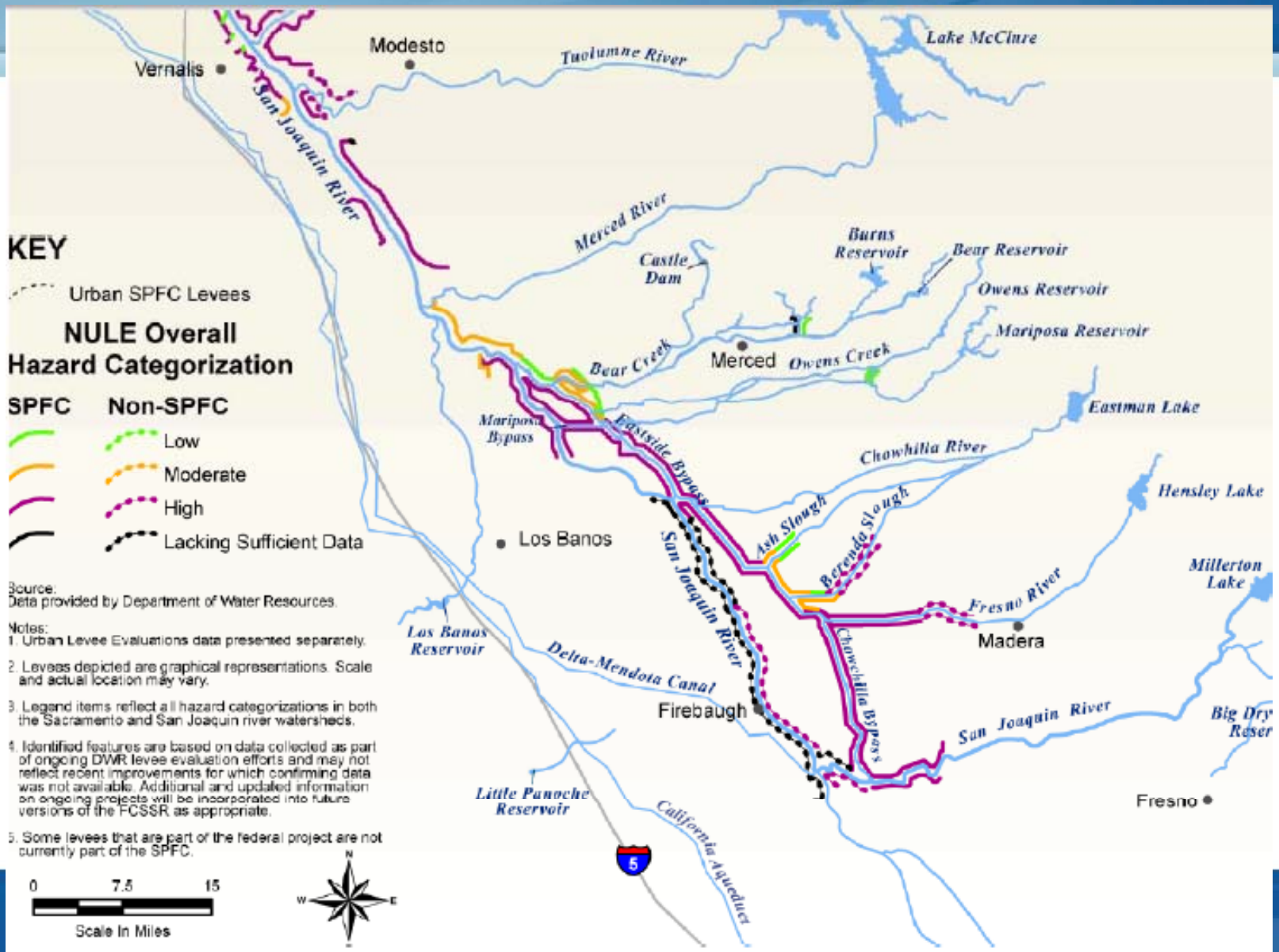


Source:
USACE 2006

State Plan of Flood Control (SPFC) Levees in the Region



SPFC Deficiencies Pose Hazards



SPFC Channel Capacity

Other Regional Flood Protection Deficiencies

- ✓ Capacity deficiencies of Bear Creek and the Black Rascal Creek diversion
  - ✓ FEMA freeboard requirements not met by the levees on Bear Creek and the east levee of the Black Rascal Diversion Channel
  - ✓ Solutions face environmental challenges
- ✓ The Region's extensive canal system vulnerable to failure during excessive storm events due to a lack of significant flood control improvements
- ✓ Deadman Slough, Duck Slough (Mariposa Creek), Miles Creek, and Owens Creek lack adequate capacity to convey 100-year flows
- ✓ Severe flooding occurs along Fahrens Creek and along the San Joaquin River

Integrated Flood Management Opportunities – Main Approaches

- ✓ Reduce the Flow Entering Merced
- ✓ Contain the Flow through Merced
- ✓ Get out of the way of the flow

Options to Reduce the Flow Entering Merced

- ✓ Black Rascal Creek Dam (Haystack Reservoir)
- ✓ Black Rascal Creek Detention Basin
- ✓ Route Flood Flows to Agricultural Lands East of Merced
- ✓ Ecosystem Restoration Along Waterways
- ✓ Bear Creek Detention Basin/Groundwater Recharge Facility
- ✓ Bear Creek Diversion Channel (Feasibility Study)

Options to Contain the Flow through Merced

- ✓ Levees along Channels
- ✓ Channel Dredging and/or Vegetation Removal

Options to Get Out of the Way of the Flow

- ✓ Modify Land Use
- ✓ Develop Emergency Response Plans
- ✓ Ring Levees around Flood-Prone Areas
- ✓ Increase Public Awareness of Flooding
- ✓ Establish a Regional Flood Control District

Integrated Flood Management
Comments / Questions?

- ✓ Water Conservation
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Technical Studies

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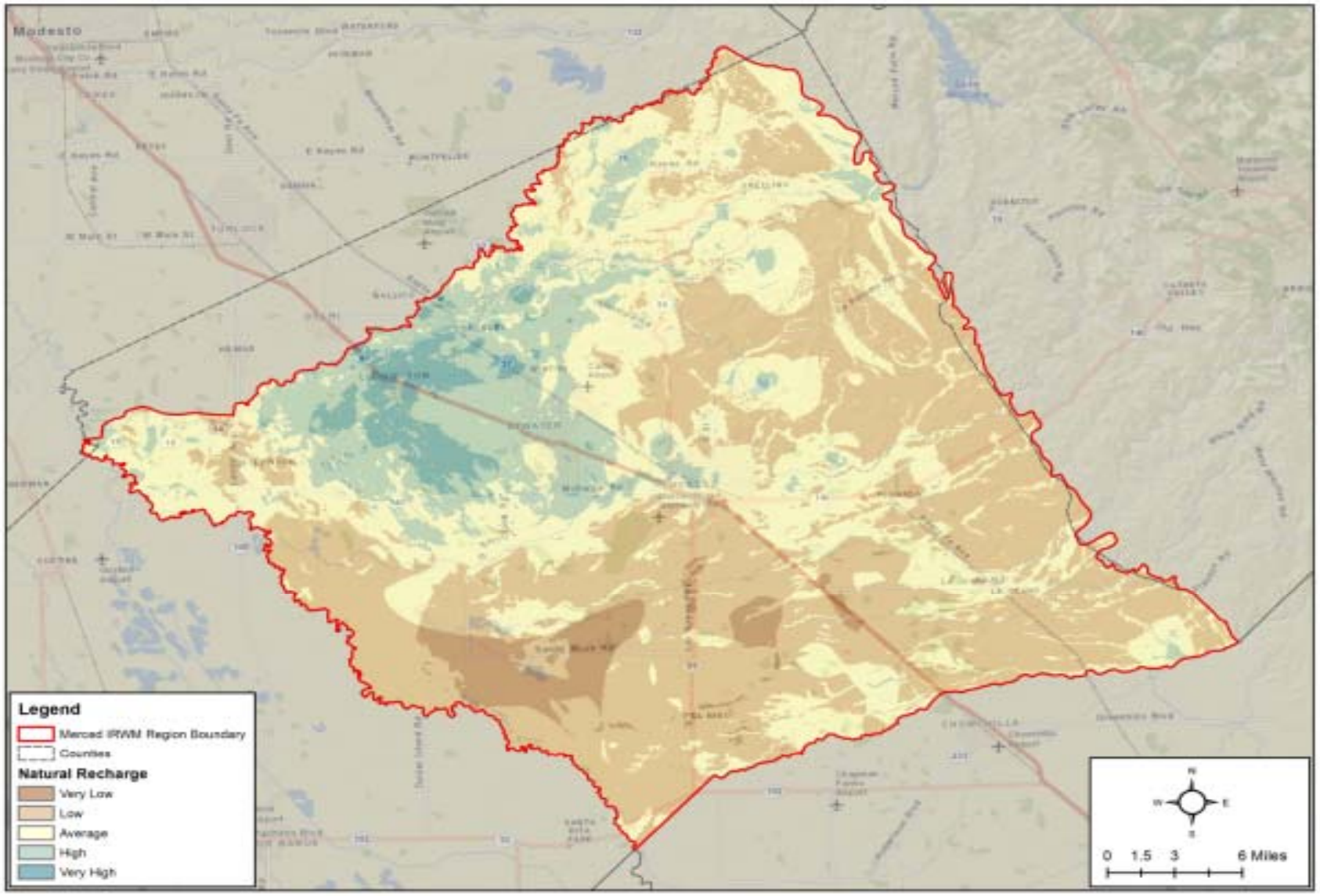
Groundwater Recharge Study

- ✓ Ranked potential recharge areas using GIS data:
  - ✓ Land use
  - ✓ Hydrologic soil groups
  - ✓ Slope
  - ✓ Texture of subsurface materials
  - ✓ Presence and thickness of the Corcoran Clay
  - ✓ Depth to groundwater
  - ✓ Groundwater flow direction
- ✓ Weighted data based on importance to groundwater recharge
- ✓ Three types of recharge considered
  - ✓ Natural recharge: estimated where recharge was more focused prior to development.
  - ✓ Anthropogenic recharge: estimated where recharge occurs, taking into account current land use and water use practices
  - ✓ Facility Siting index: prioritize locations better suited for new spreading basins

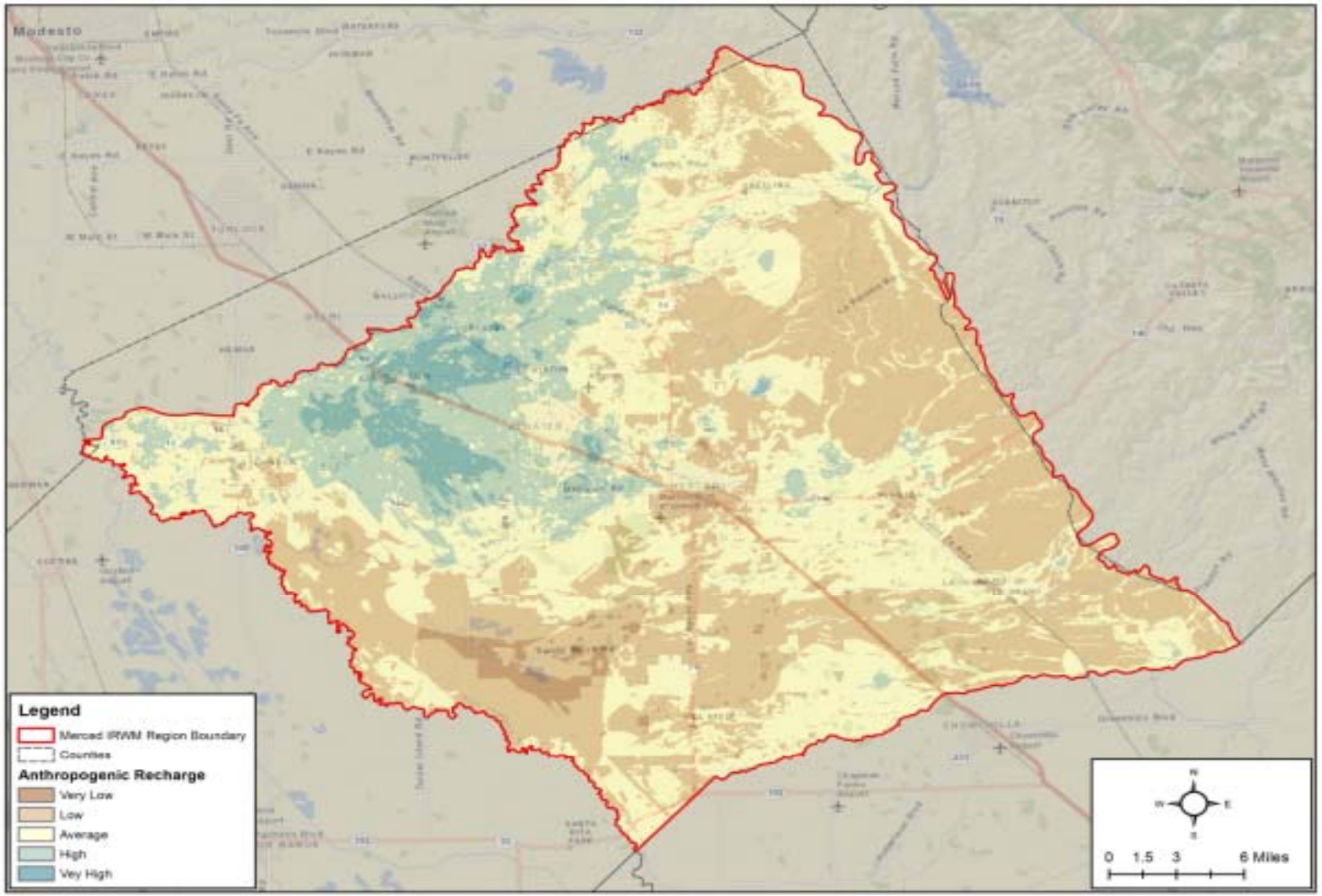
Data Used for Recharge Prioritization

	Natural	Anthropogenic	Facility Siting
Land use		√	√
Hydrologic soils group	√	√	√
Surface slope	√	√	√
Texture of subsurface materials, 0 -50 ft	√	√	√
Texture of subsurface materials, 50 -100 ft	√	√	√
Texture of subsurface materials, 100 -150 ft	√	√	√
Corcoran Clay thickness	√	√	√
Depth to groundwater	√	√	√
Groundwater flow direction			√

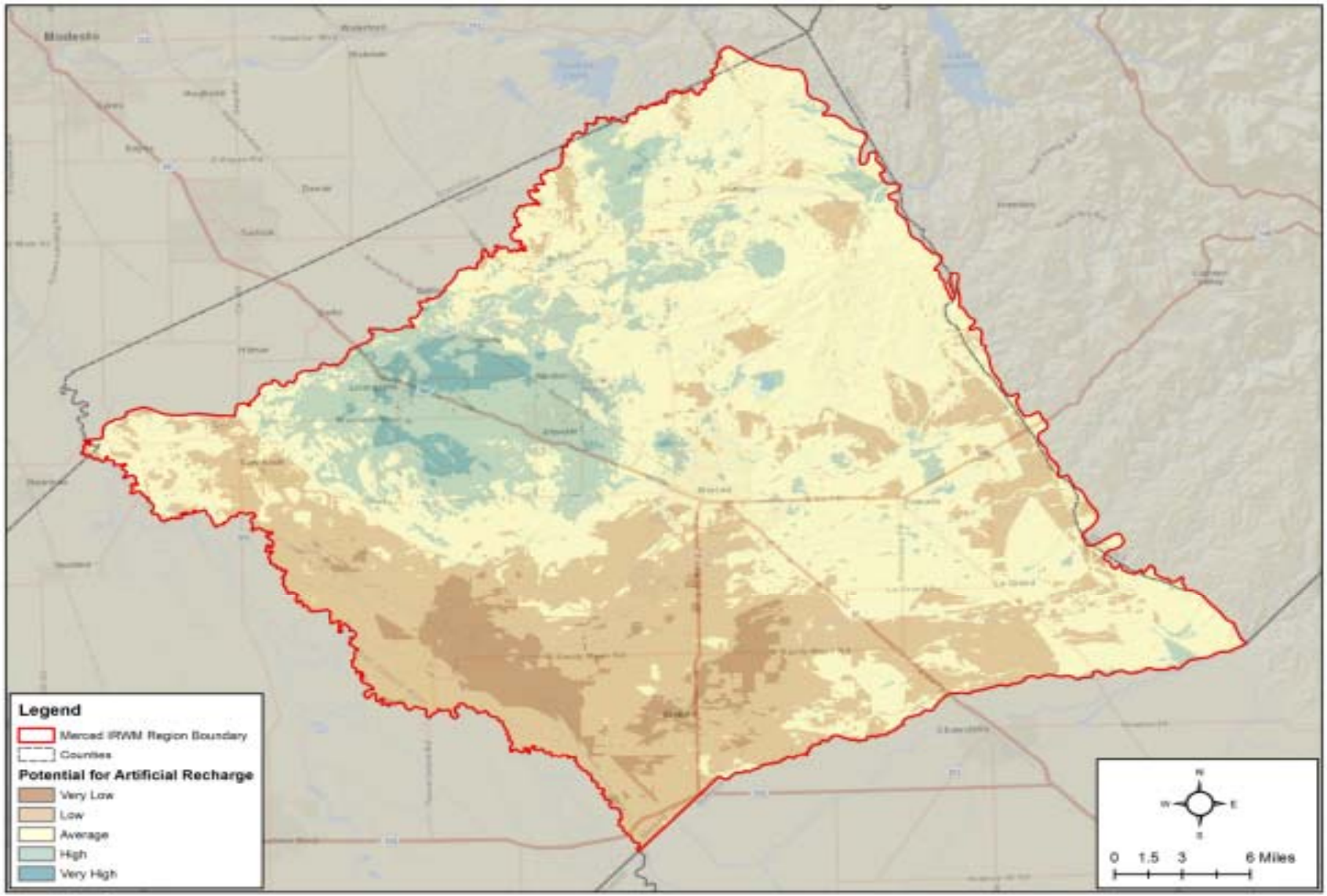
Natural Recharge Results



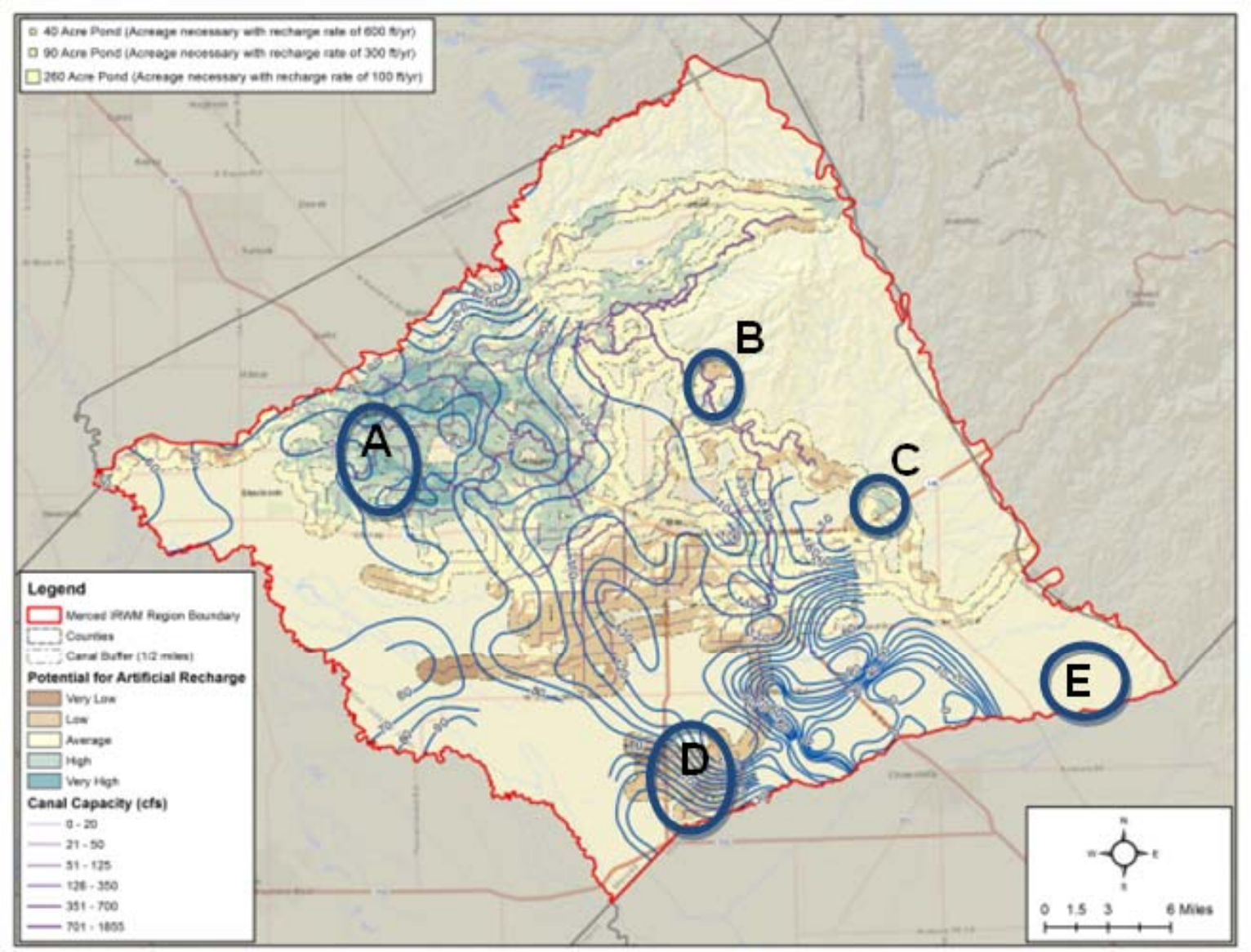
Anthropogenic Recharge Results



Facility Siting Results



Recharge Opportunity Areas



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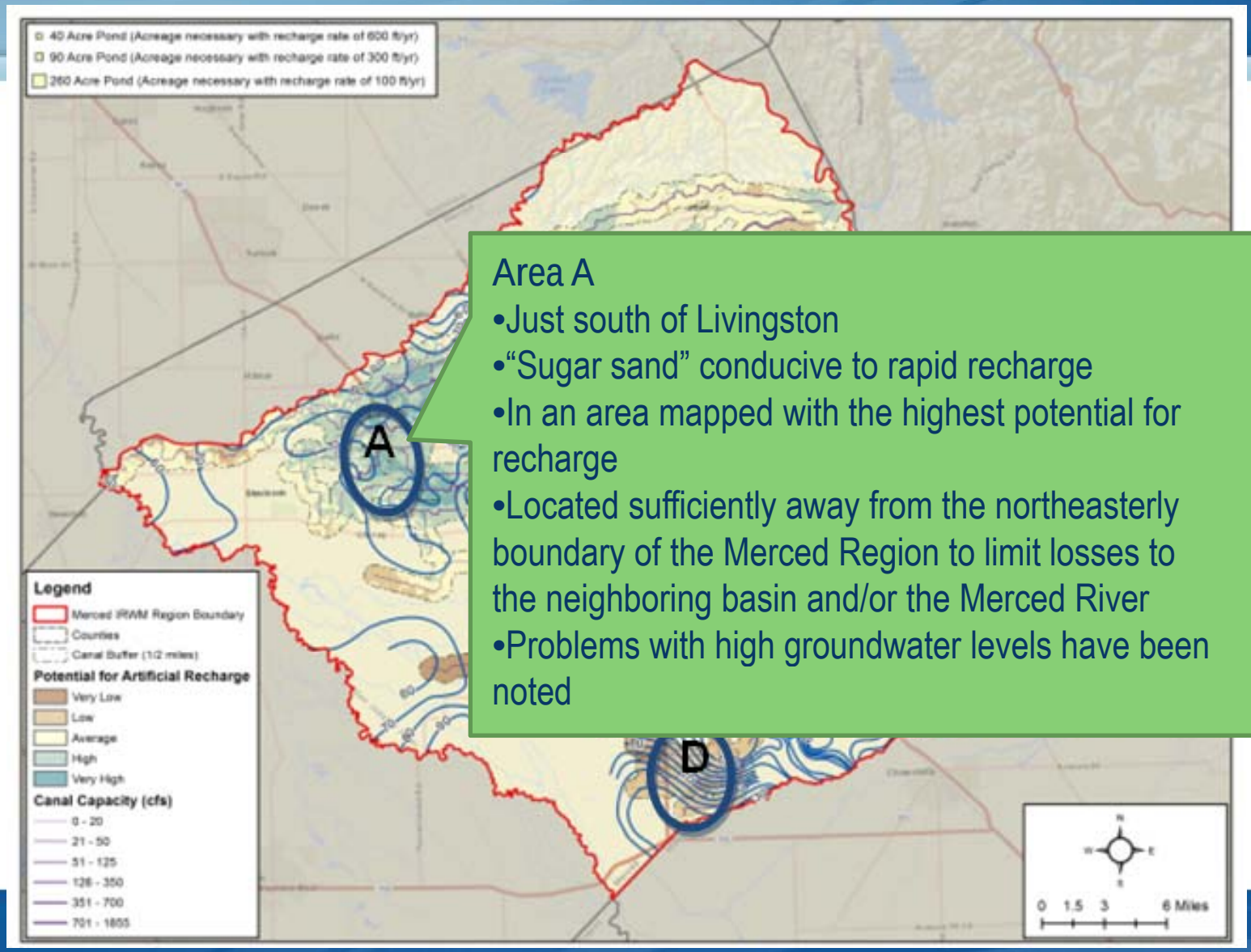
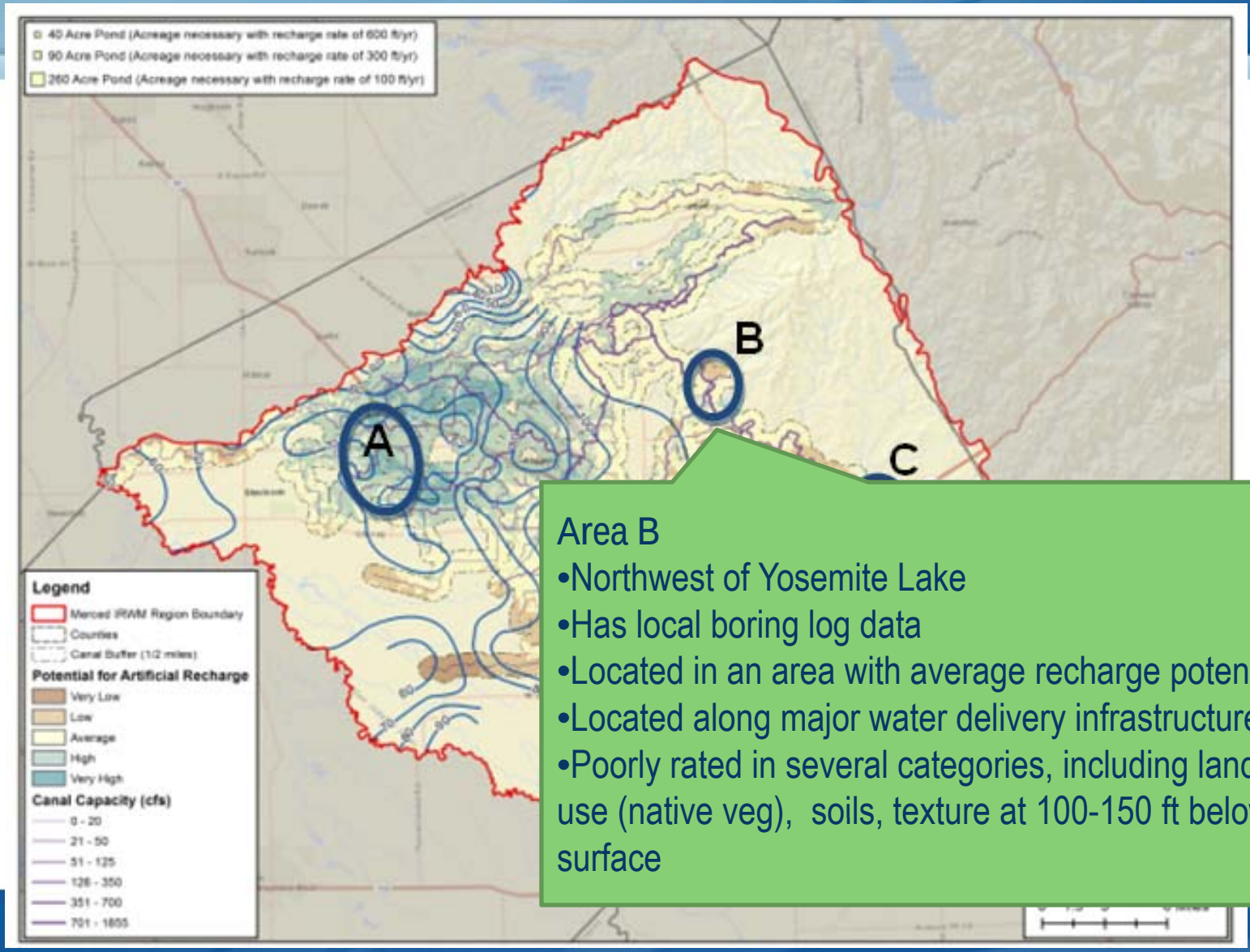


Area A

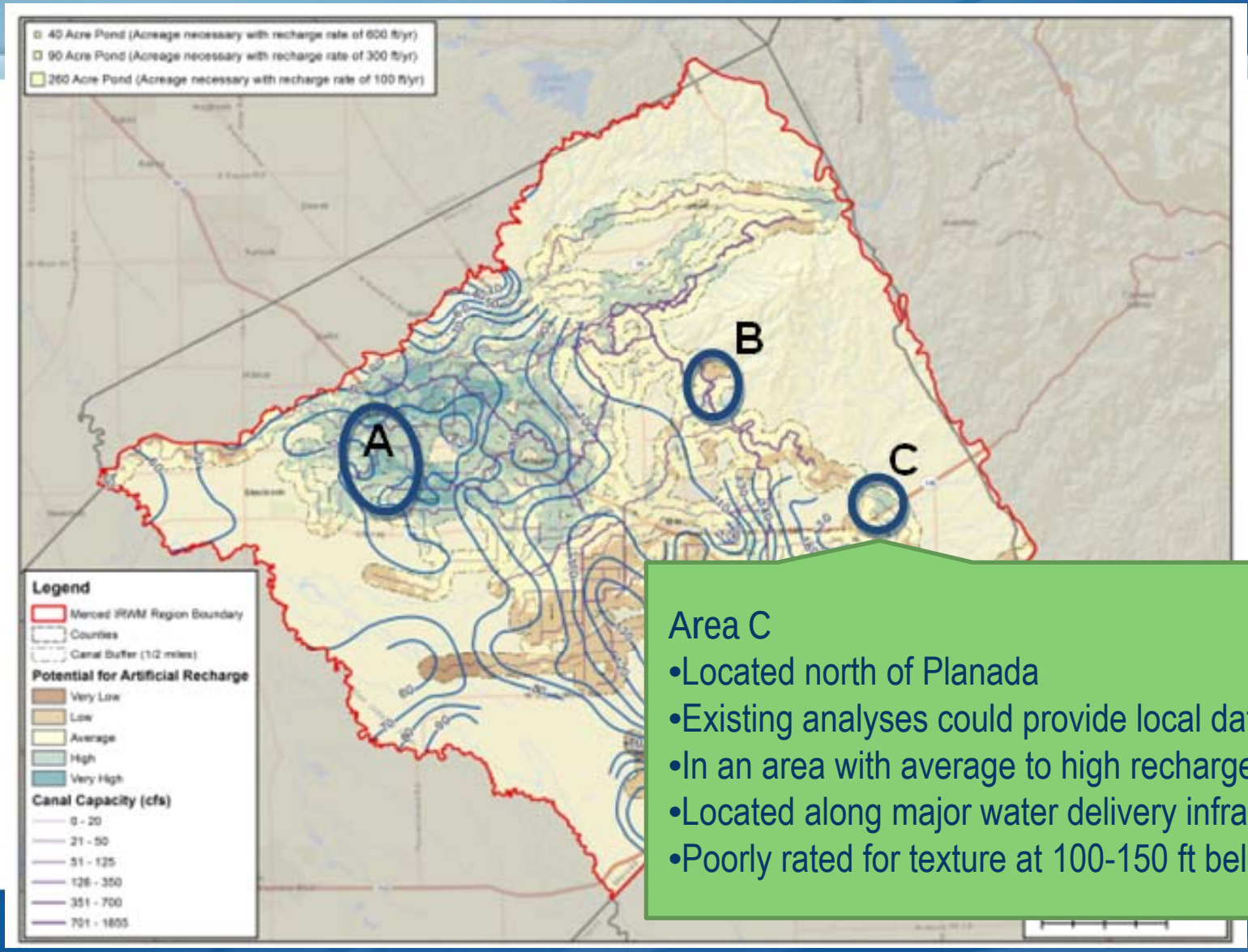
- Just south of Livingston
- "Sugar sand" conducive to rapid recharge
- In an area mapped with the highest potential for recharge
- Located sufficiently away from the northeasterly boundary of the Merced Region to limit losses to the neighboring basin and/or the Merced River
- Problems with high groundwater levels have been noted

Recharge Opportunity Areas



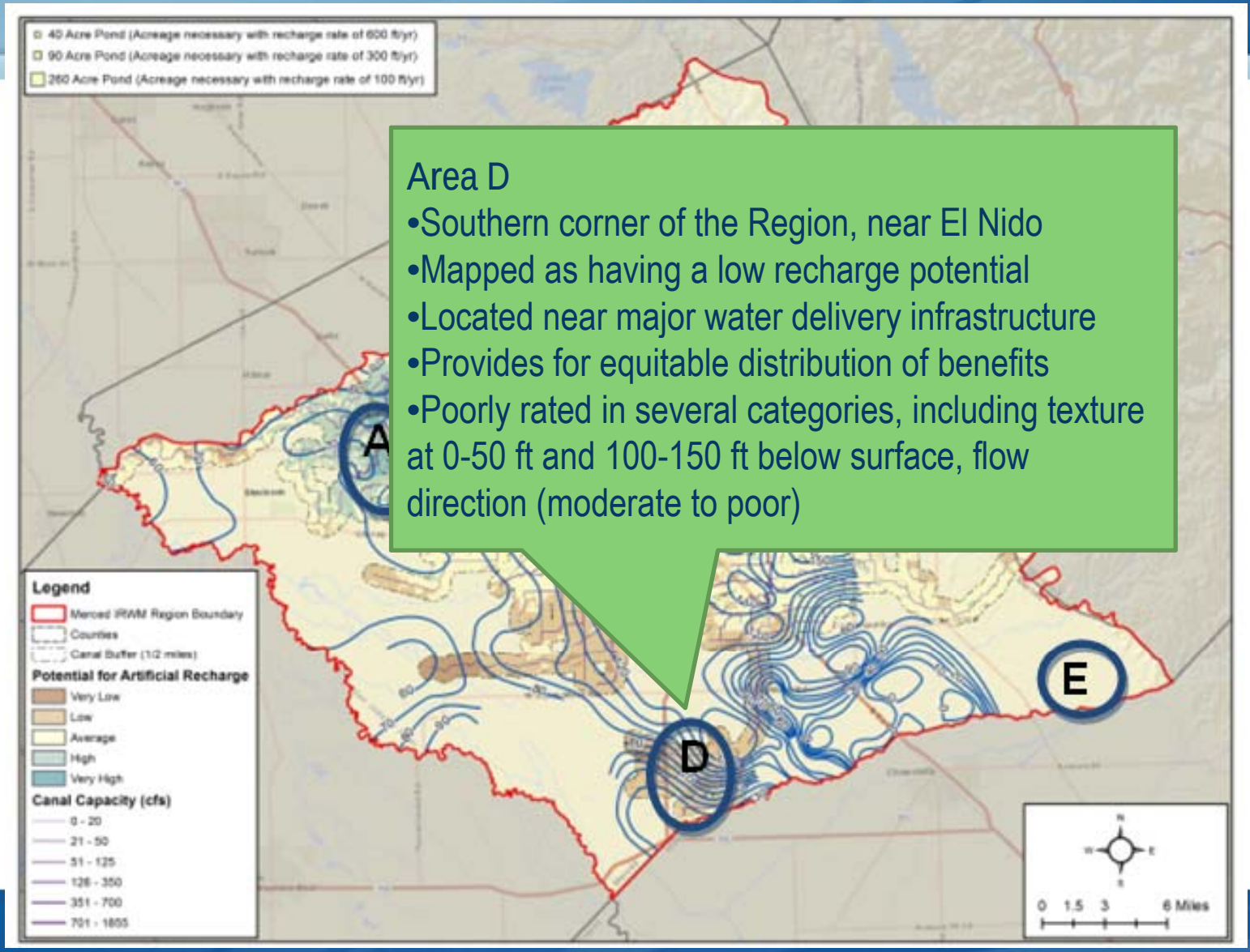
Area B
- Northwest of Yosemite Lake
- Has local boring log data
- Located in an area with average recharge potential
- Located along major water delivery infrastructure
- Poorly rated in several categories, including land use (native veg), soils, texture at 100-150 ft below surface

Recharge Opportunity Areas

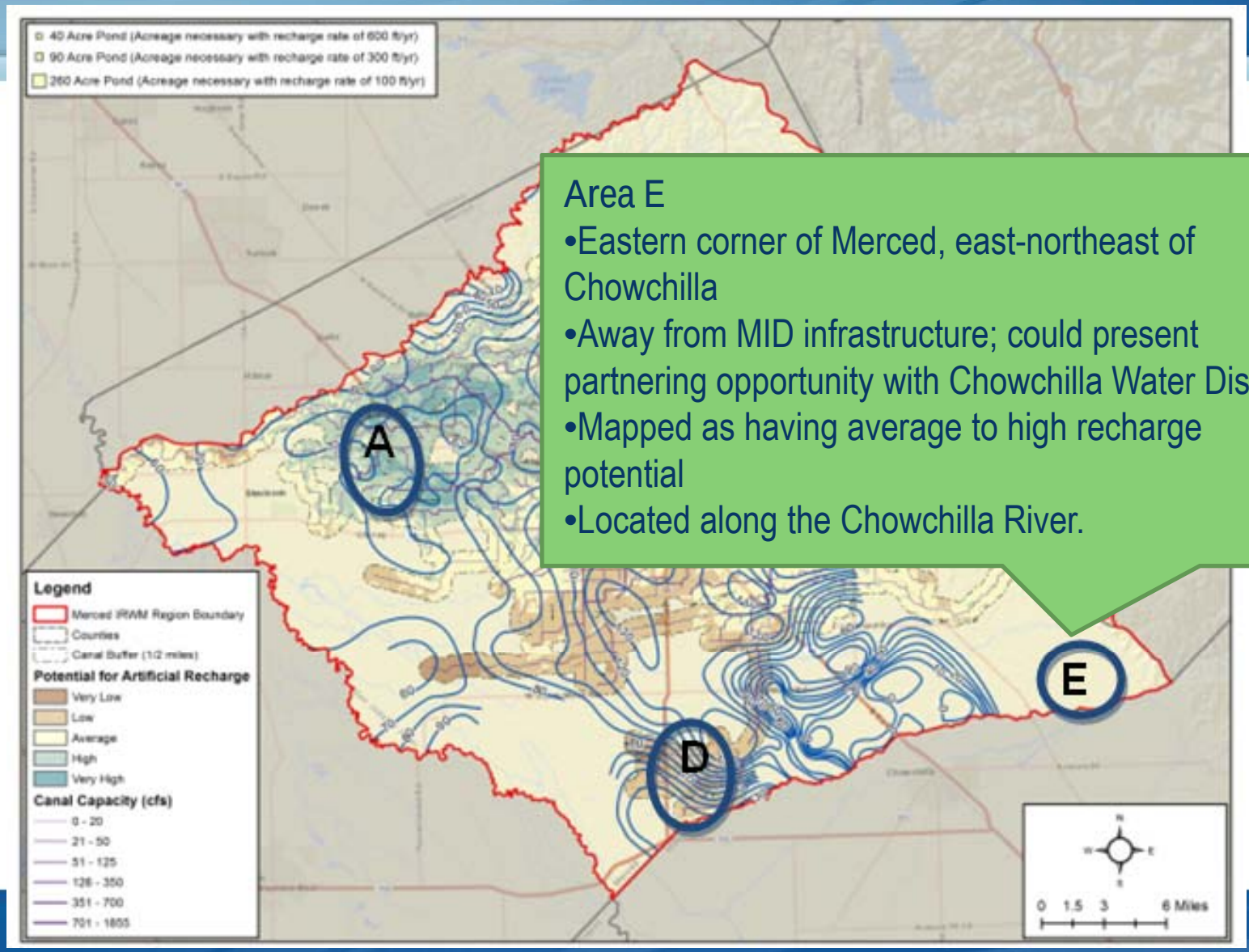


Area C
- Located north of Planada
- Existing analyses could provide local data
- In an area with average to high recharge potential
- Located along major water delivery infrastructure
- Poorly rated for texture at 100-150 ft below surface

Recharge Opportunity Areas



Recharge Opportunity Areas



Area E

- Eastern corner of Merced, east-northeast of Chowchilla
- Away from MID infrastructure; could present partnering opportunity with Chowchilla Water District
- Mapped as having average to high recharge potential
- Located along the Chowchilla River.

Recommendations

- ✓ Implement additional monitoring for individual recharge basins
- ✓ Identify potential for harm due to waterlogging at adjacent properties
- ✓ Monitor groundwater quality near the basin
- ✓ Base extent of monitoring on a qualitative cost-benefit analysis
- ✓ Develop a Water Availability Tool including streamflow, water rights, and available canal capacities
- ✓ Develop a Water Accounting Tool

Groundwater Recharge Comments / Questions?

- ✓ Water Conservation
- ✓ Integrated Flood Management
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Technical Studies

- ✓ Water Conservation
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- ✓ Salt & Nutrient Management – Coming in January
- ✓ Climate Change

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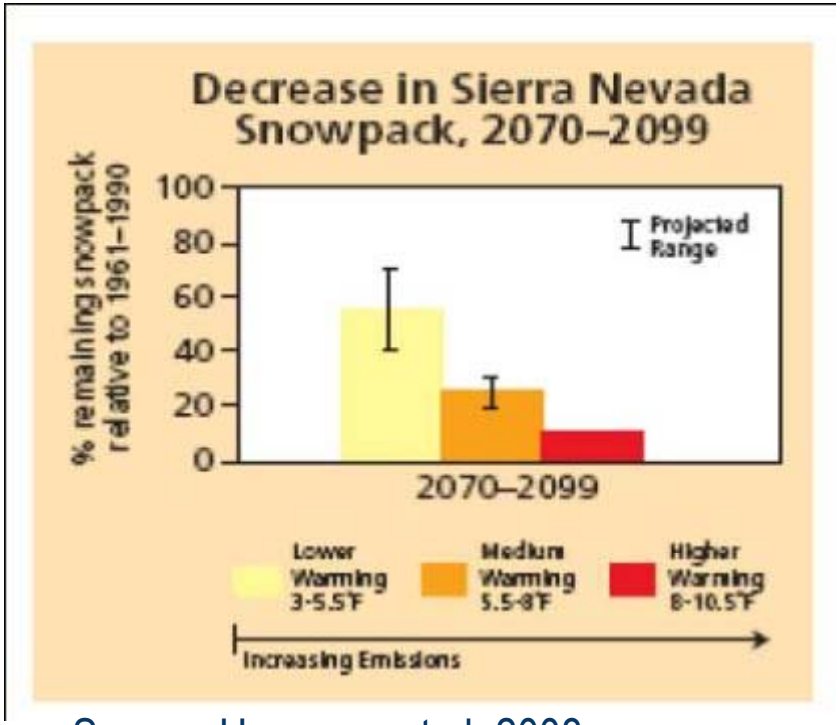
Climate Change

- Key Section Components
  - Introduction
  - Background
  - Statewide observations and projections
  - Legislative and policy context
  - Potential regional impacts
  - Regional Resource Vulnerability
  - Adaptation and mitigation
  - Plan for data gathering

Statewide Observations and Projections

- ✓ +4 degC increase in air temperatures by the year 2040
- ✓ Changes in precipitation unknown (some models predict increase, others predict decrease)

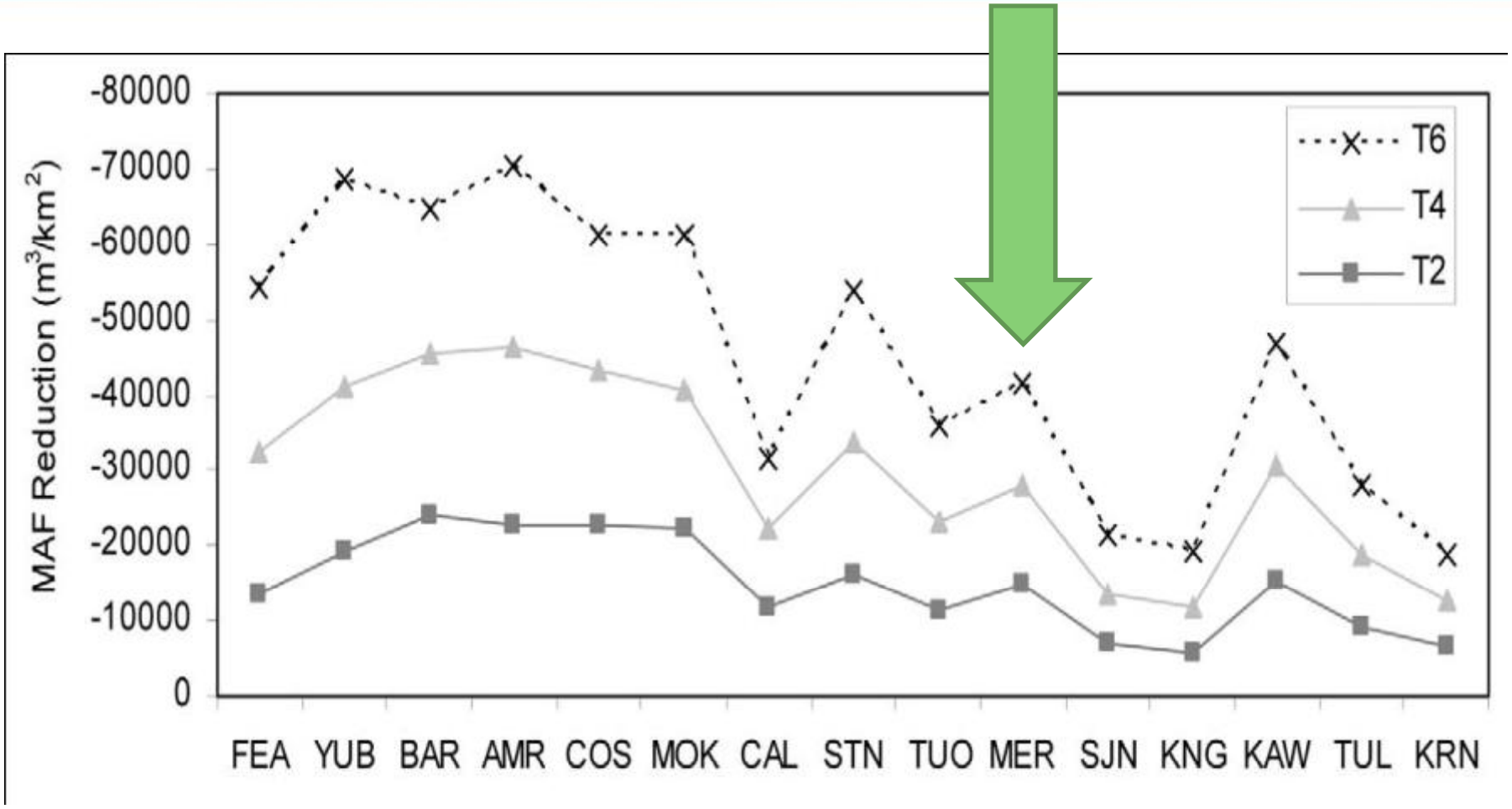


Source: Hopmans et al. 2008

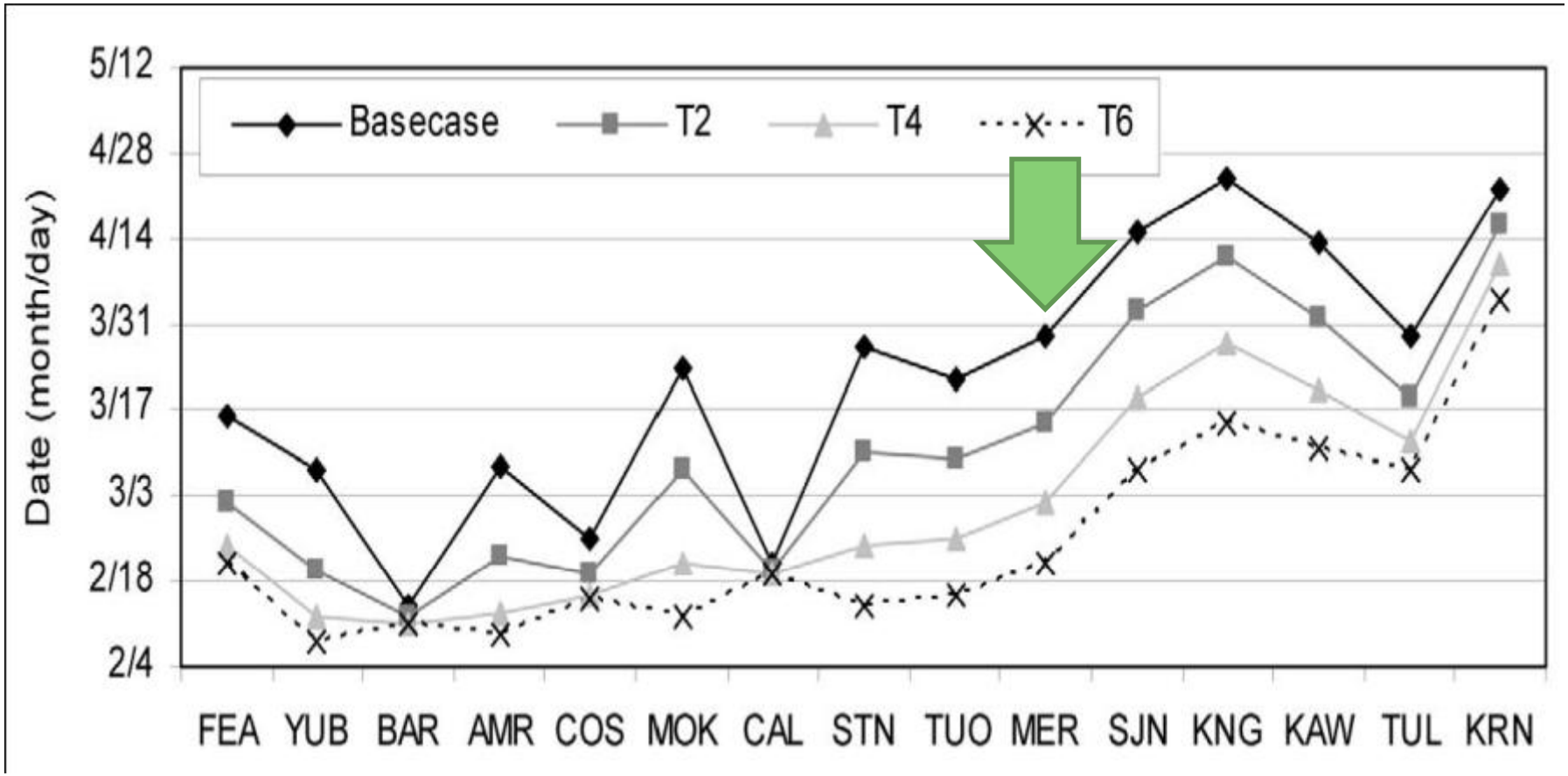
Regional Studies and Information In Progress

- ✓ Impacts of climate change on the Lyell and Maclure Glaciers in Yosemite National Park (Yosemite National Park);
- ✓ Changes in snow cover patterns in the Sierra Nevada (University of Washington);
- ✓ The role of atmospheric rivers in extreme events in the Sierra Nevada (USGS);
- ✓ Impacts of climate changes on soil properties and habitats in the Sierra Nevada (UC-Merced and USGS); and
- ✓ Study of the effects of climate change on hydrology and stream temperatures in the Merced and Tuolumne River watersheds (Santa Clara University).

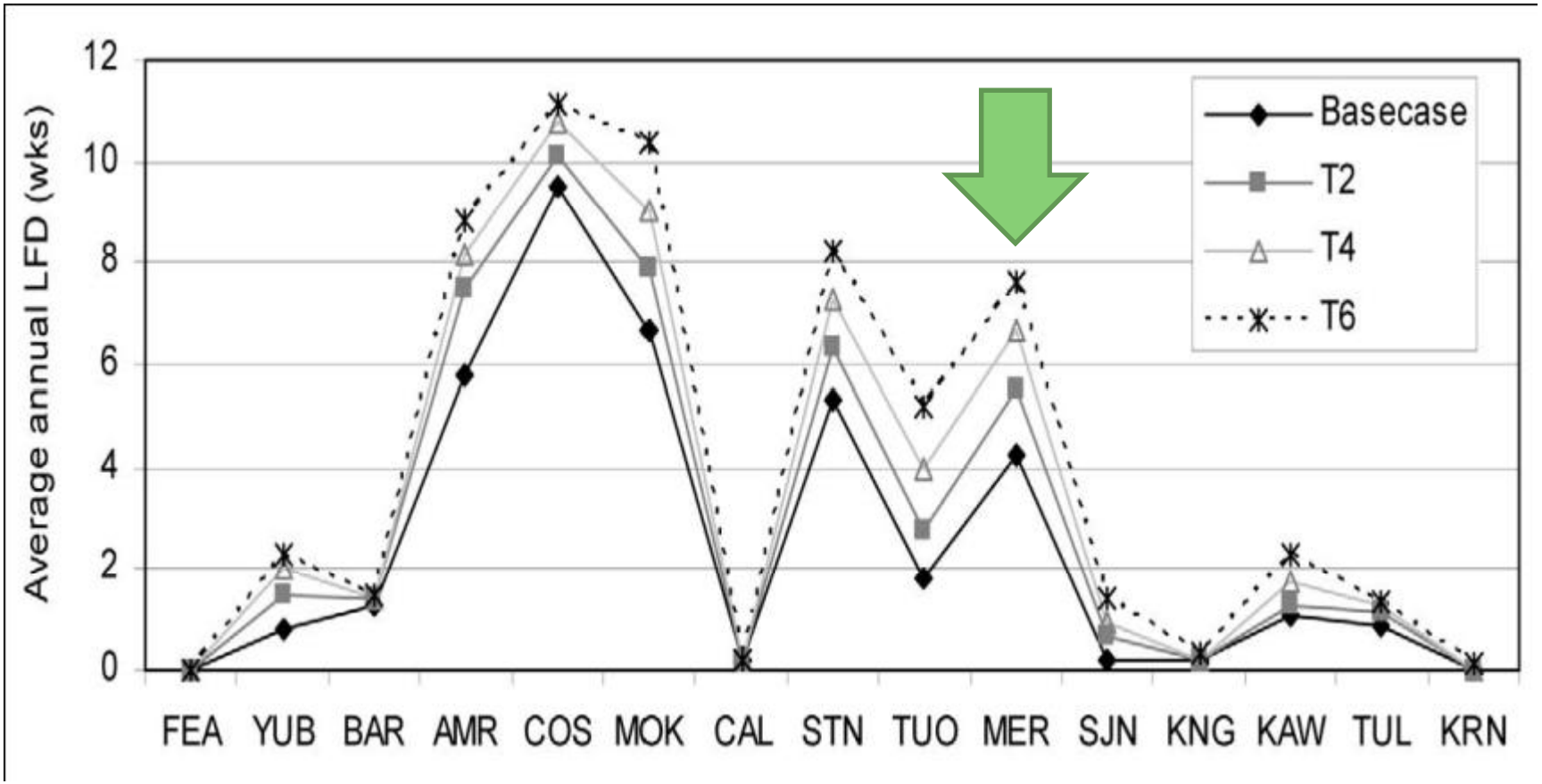
2010 UC Davis Study (Null et al.) Projected Moderate Changes to Merced River Flows



2010 UC Davis Study (Null et al.) Projected 2-6 wk Shift in Timing of Merced River Centroid



2010 UC Davis Study (Null et al.) Projected 2-4 wk Increase in Low Flow Duration



Regional Resource Vulnerabilities

Vulnerability	Description
Water Demand	Vulnerable to increased agricultural demands due to longer growing season, increased temperatures and evapotranspiration rates, and more frequent/severe droughts. Vulnerable to increased urban and commercial, industrial, and institutional (CII) demand due to increased outside temperatures.
Water Supply and Quality	Vulnerable to decreased snowpack in the Sierra Nevada, shifts in timing of seasonal runoff, increased demands exacerbating groundwater overdraft, degraded surface and groundwater quality resulting from lower flows, exaggerated overdraft conditions, a reduction of meadows which can provide contaminant reduction, and more frequent/severe droughts and storm events increasing turbidity in surface supplies.
Flood Management	More severe/flashier storm events and earlier springtime runoff leading to increased flooding, and a reduction of meadows which help reduce floods in the winter.
Hydropower	Vulnerable to increased customer demand combined with changes in timing of seasonal runoff and flashier storm systems affecting reservoir storage.
Ecosystem and Habitat	Vulnerable to decreased snowpack, more frequent/severe droughts and wildfires, shift in seasonal runoff, increased low flow periods and increased water temperatures (degraded water quality).

Climate Change Comments / Questions?

- ✓ Water Conservation
- ✓ Integrated Flood Management
- ✓ Groundwater Recharge
- ✓ Salt & Nutrient Management
- ✓ Climate Change

Today's Agenda

- ✓ Introductions and Overview
- ✓ DWR Update
- ✓ RAC Activities
- ✓ Governance
- ✓ Workgroup Reports
- ✓ Summary of Technical Studies
- ✓ Implementation Grant Update
- ✓ Next Steps
- ✓ Public Comment

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Next Steps

- ✓ Draft Technical Studies to be sent via email by December 25, 2012
- ✓ Comments on draft Technical Studies to comments@mercedirwmp.org by January 15, 2012
- ✓ Next Meeting: January 22, 2012 from 2:00 pm – 5:00 pm
- ✓ Topics for Next Meeting
  - ✓ Salt and Nutrient Management
  - ✓ Technical Analysis
  - ✓ Plan Performance and Monitoring
  - ✓ Data Management

Today's Agenda

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