

Tehama County Groundwater Recharge Area Investigation



December 2010

BROWN AND CALDWELL

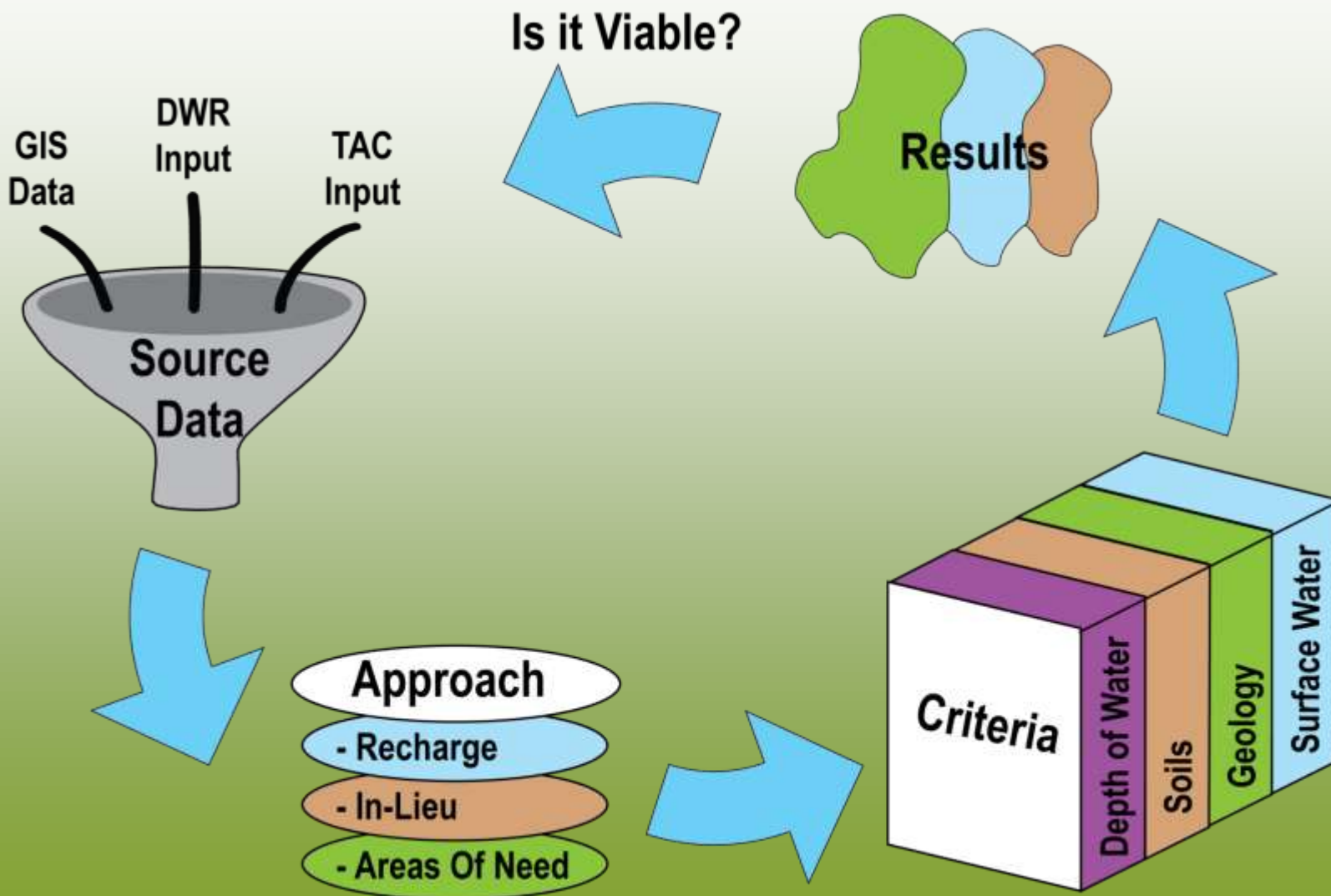
Outline

- Project Purpose
- Data
- Project Approach
- Selection Criteria
- Results
- Next Steps

Project Purpose

- Identify areas within Tehama County for detailed investigation of groundwater recharge potential
- Set the stage for further discussion of enhanced recharge and investigation with the 4-county region
- Be **proactive** by preparing Tehama County to be in a position to advance enhanced groundwater recharge in the future

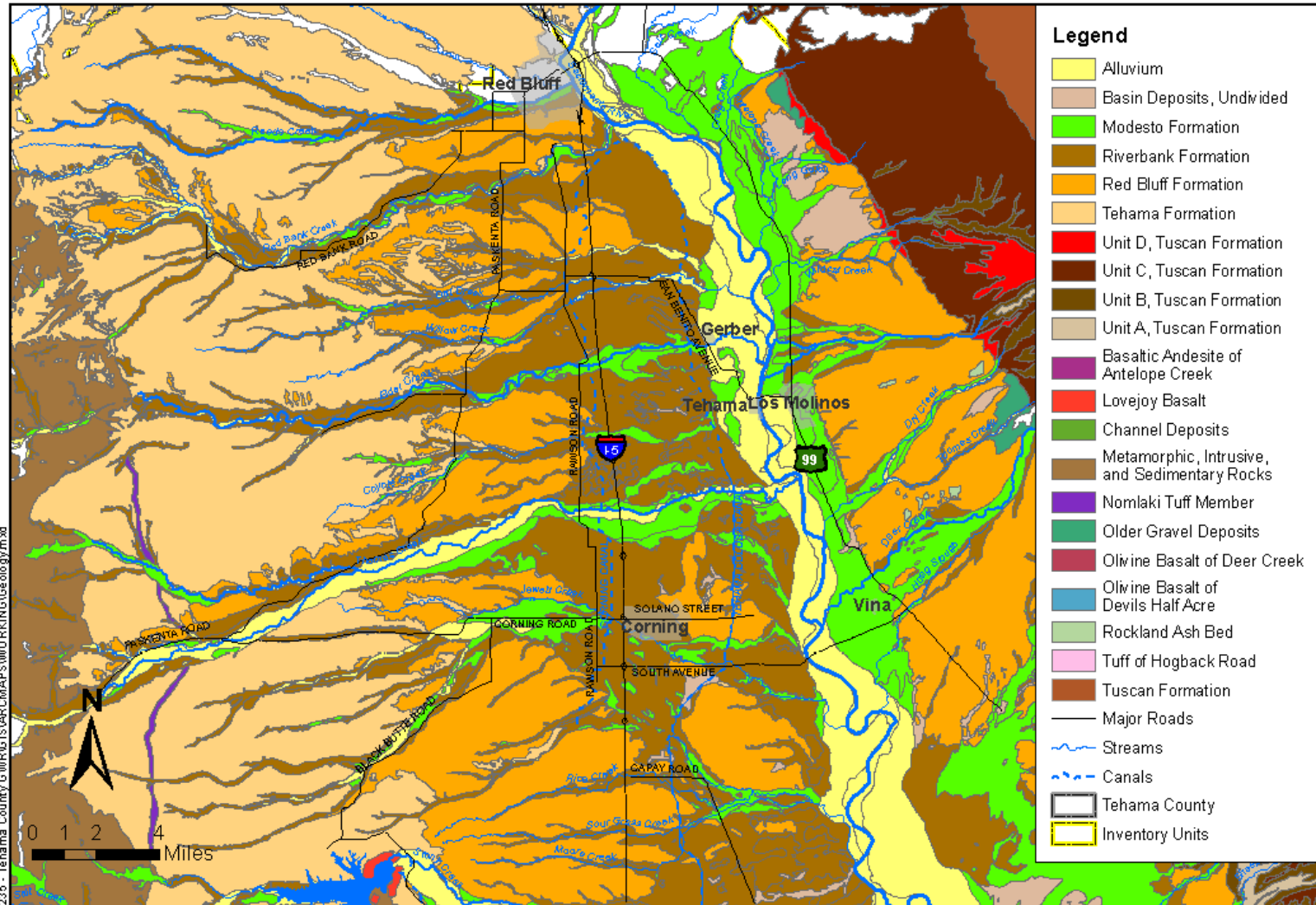
Project Approach: Summary



Project Approach: Selection Criteria

Selection Criteria	Category	Reason for Use
Riverbank, Modesto, Alluvium	Geology	Potential for recharge
Non-silty loams, and stream gravels	Soils	Potential for recharge
1000 feet from streams, 2000 from canals, Surface water using Irrigation Districts	Near Water	Practical constraint
areas that experienced a larger than 15 foot decline from 2006 to 2009	> 15 feet drawdown in spring 06 to 09	Area of need
Areas that experienced a larger than 25 foot decline from spring to summer 2 or more times out of 4 years	2 years with > 25 feet spring - summer drawdown	Area of need
Depth to water in Summer 2008 estimated to be larger than 40 feet in shallow wells	DTW > 40 feet in shallow wells	Potential for recharge

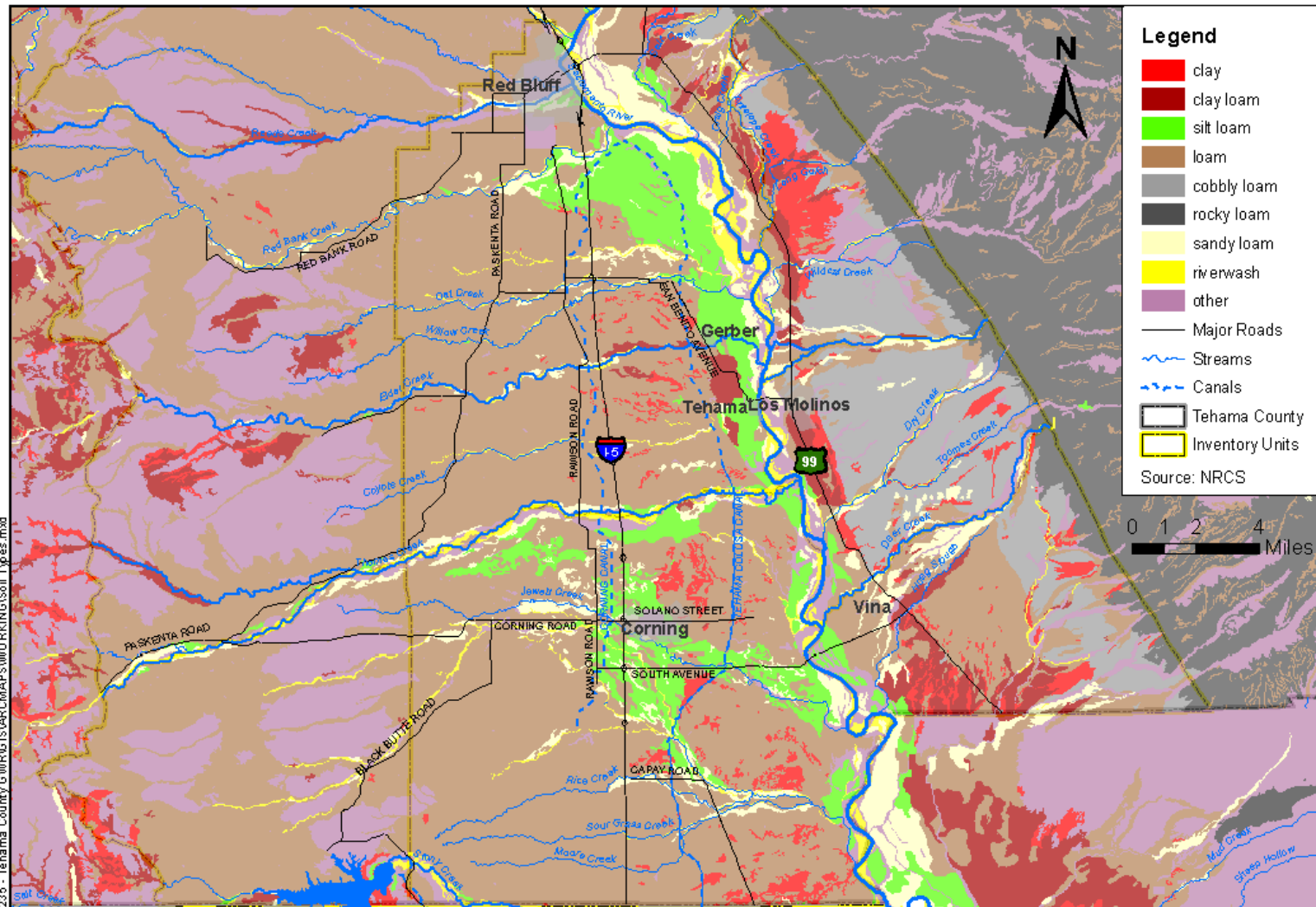
Source Data - Geology



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	PROJECT	139235	SITE	Tehama County, CA		Figure 14
	DATE	7/14/10	TITLE	Geology Data		

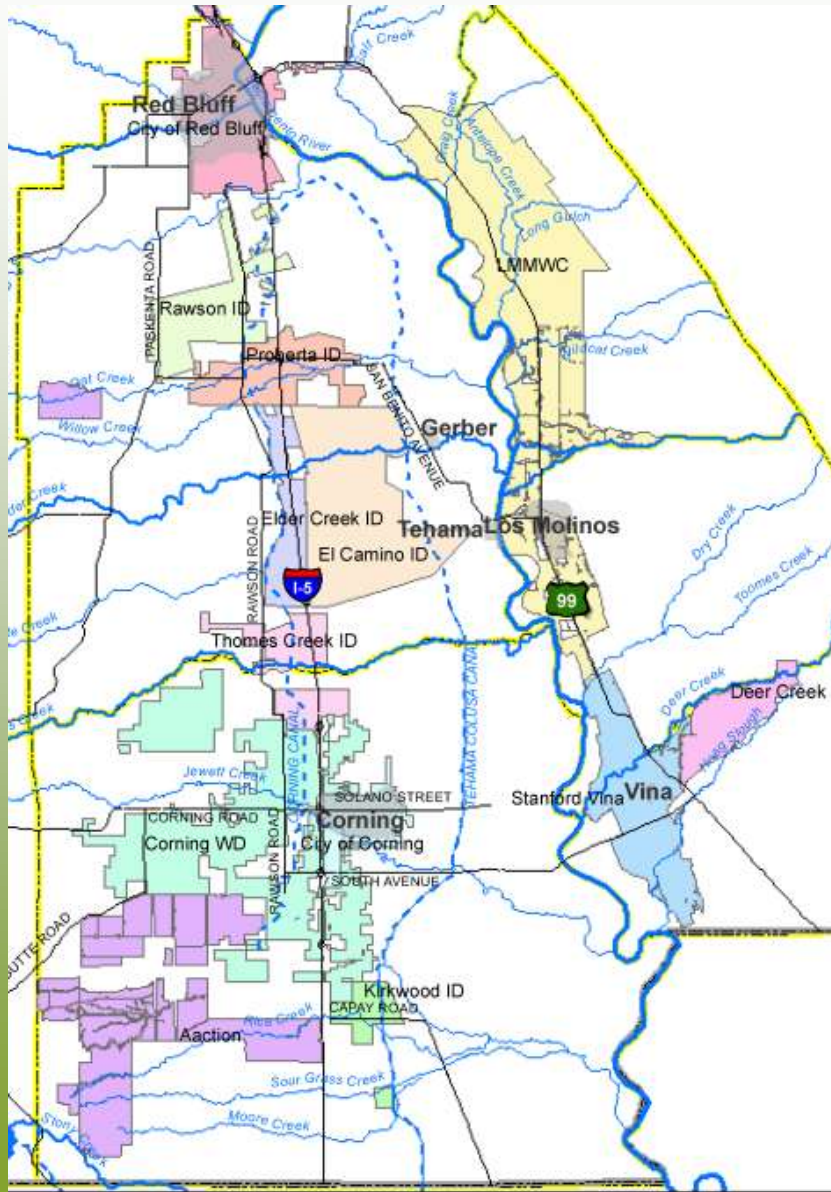
Source Data - Soils



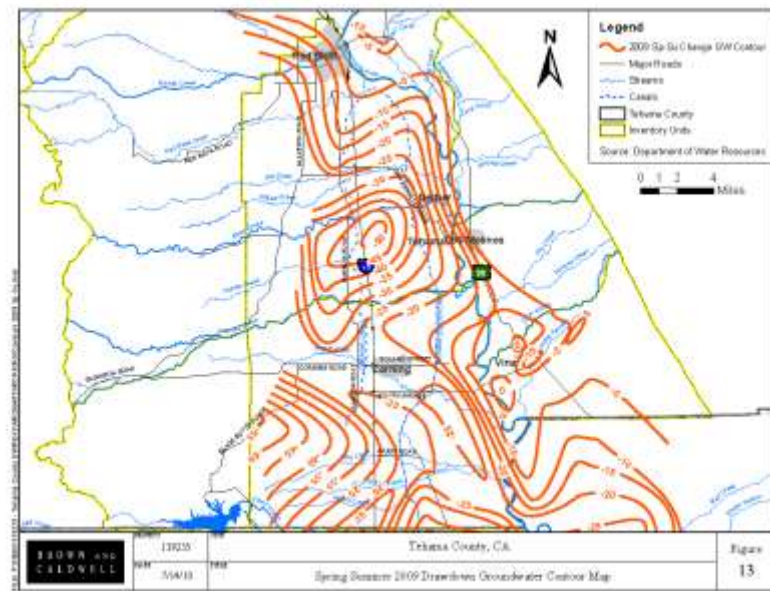
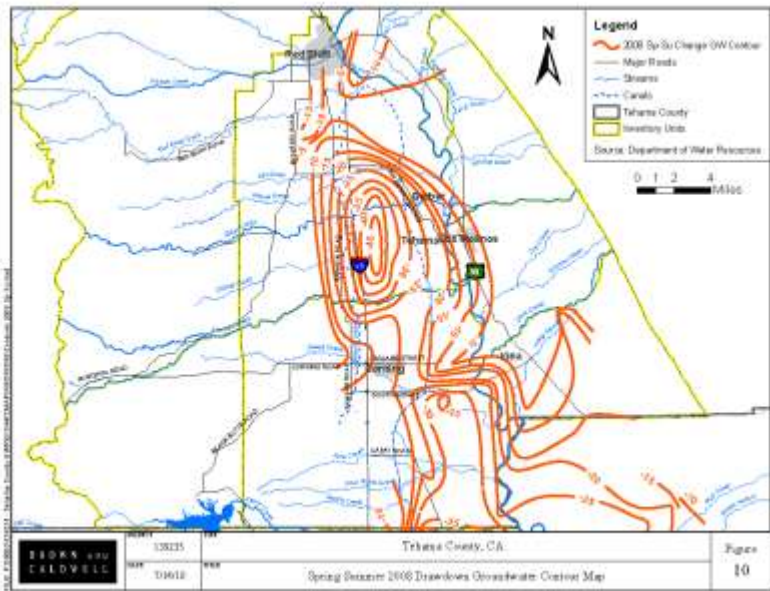
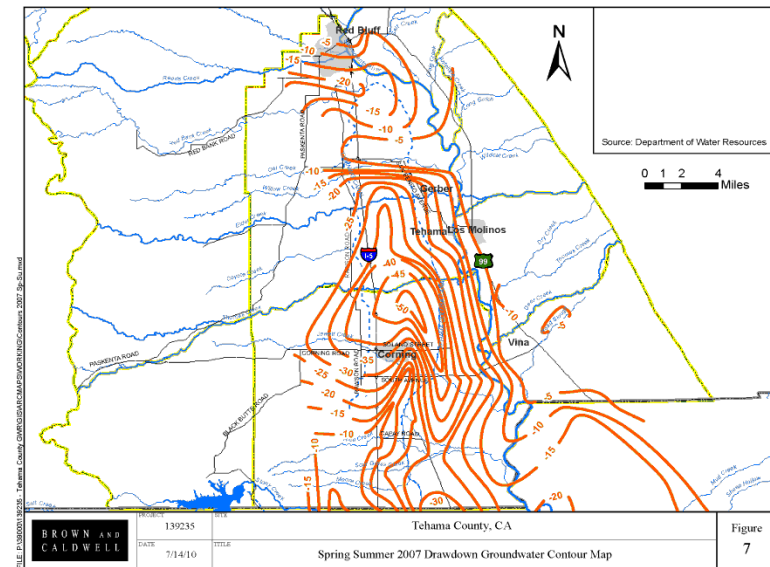
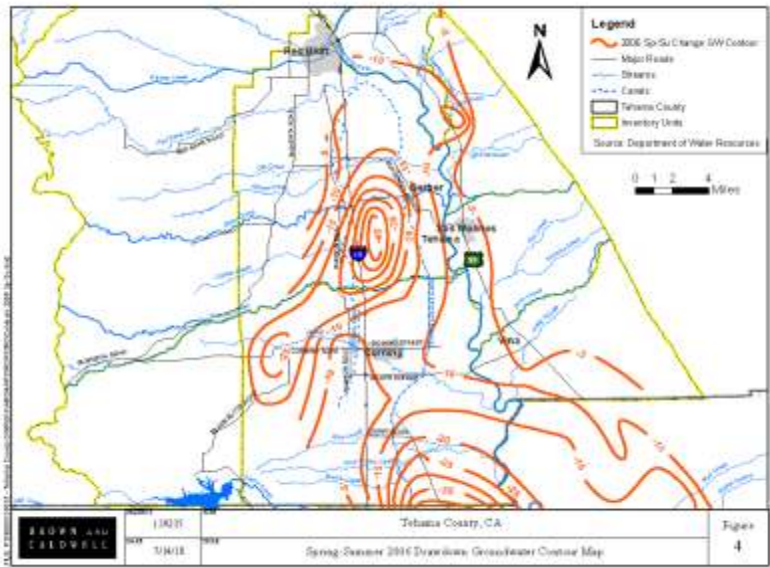
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	PROJECT	139235	SITE	Tehama County, CA	Figure 15
	DATE	7/14/10	TITLE	Soil Types	

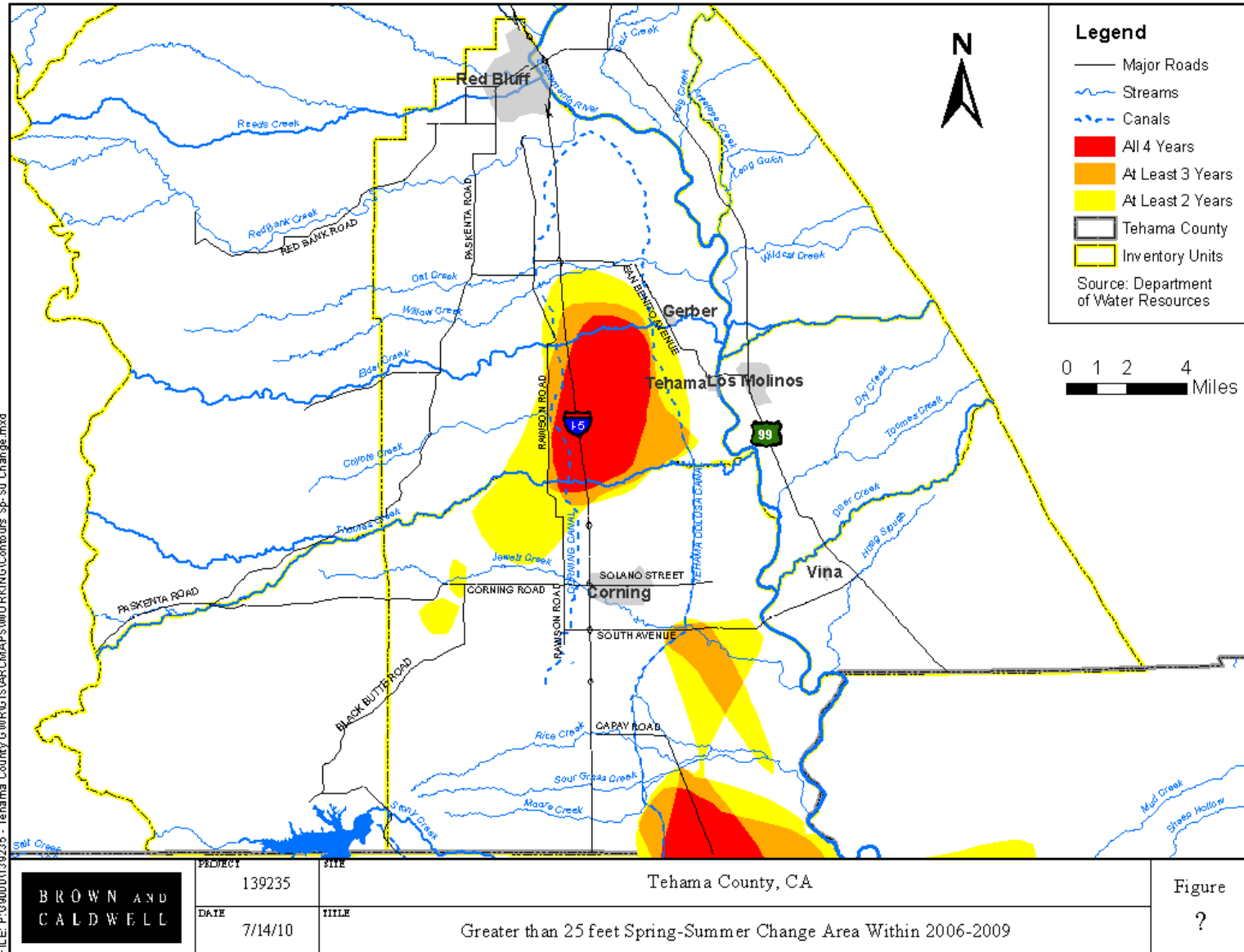
Source Data – Irrigation Districts



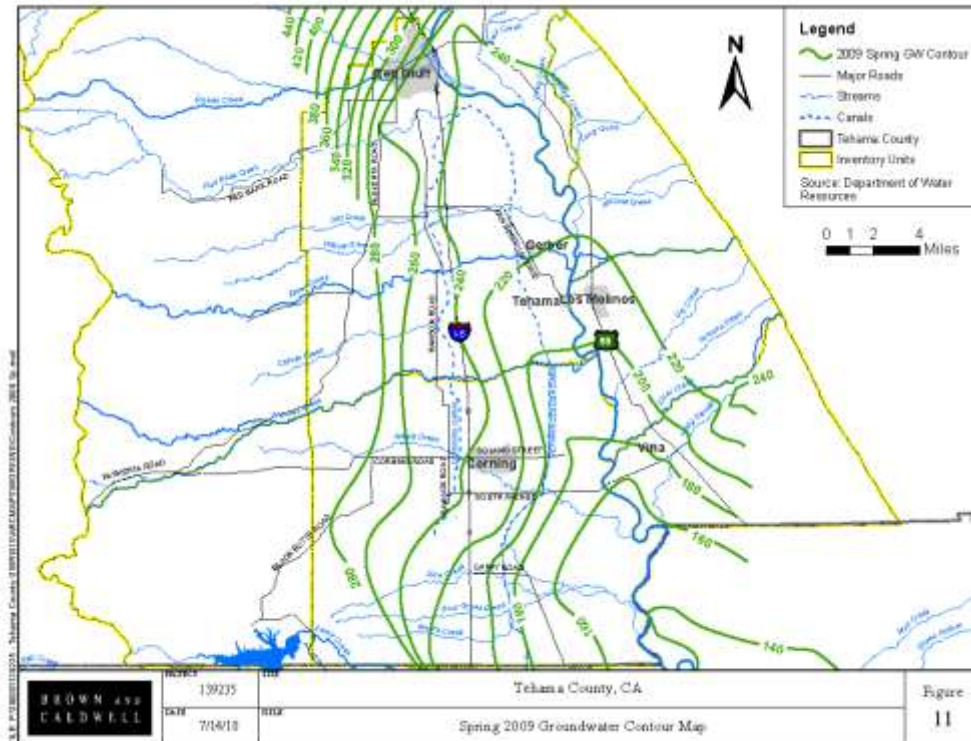
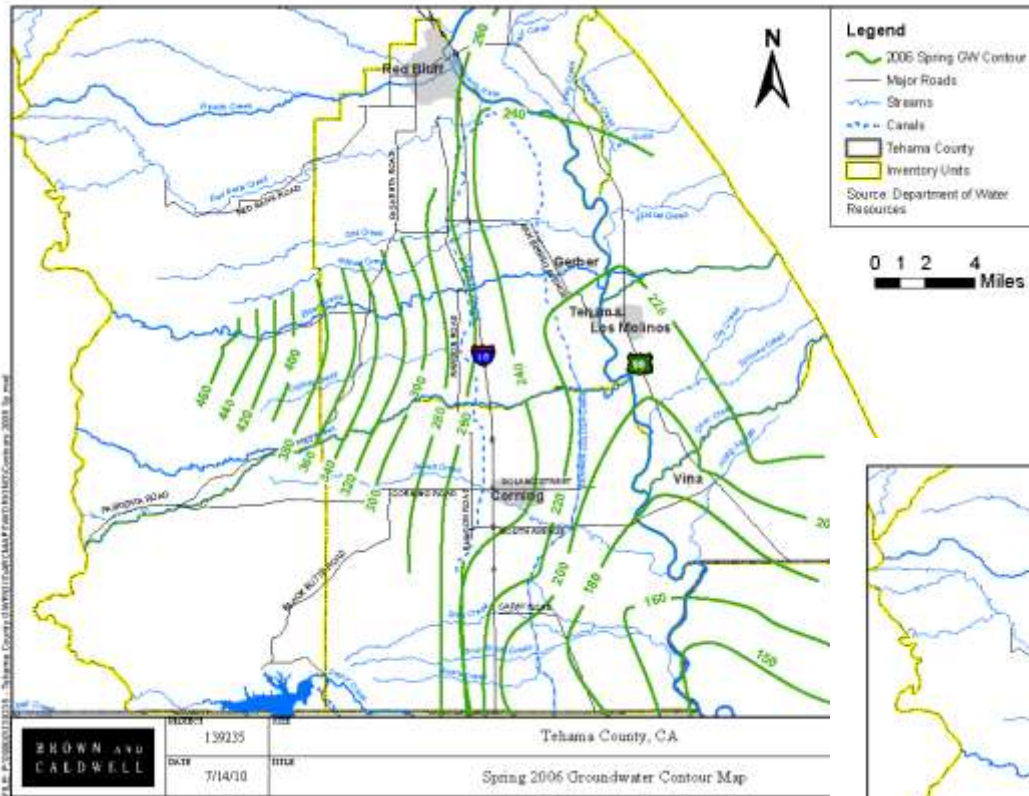
Source Data - Spring – Summer Drawdown



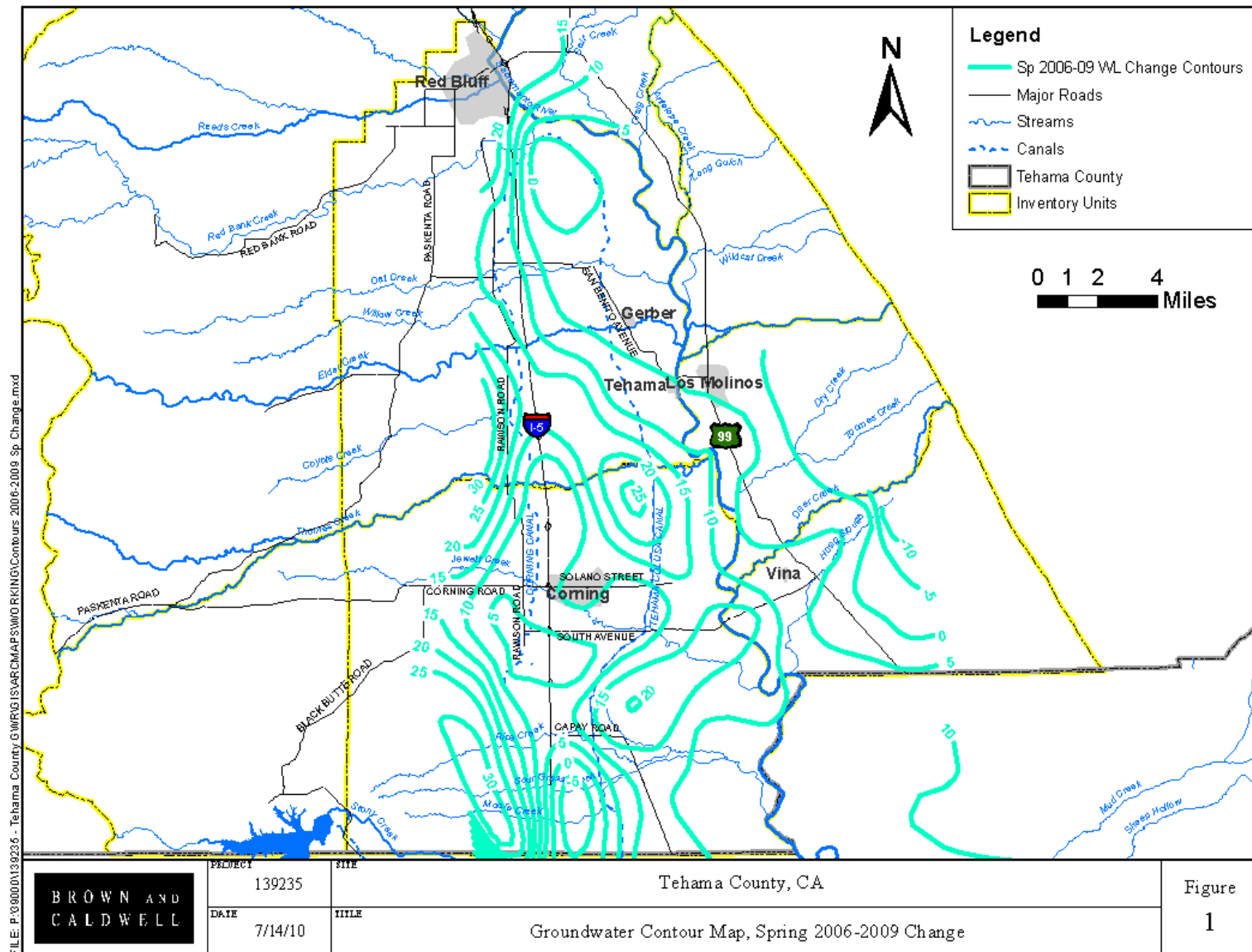
Source Data - Spring – Summer Drawdown



Source Data – Spring Contours



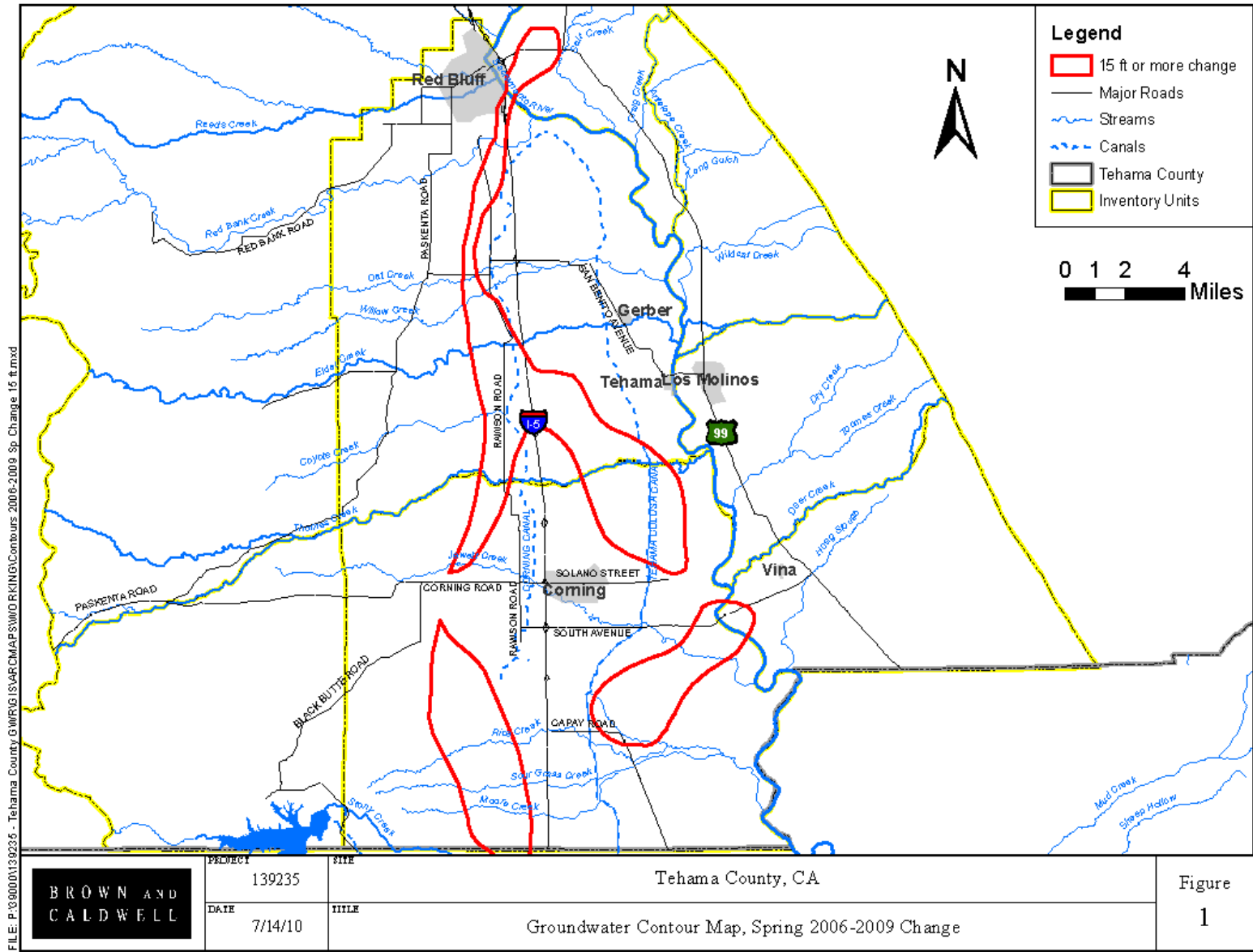
Source Data – Spring 2006 to Spring 2009



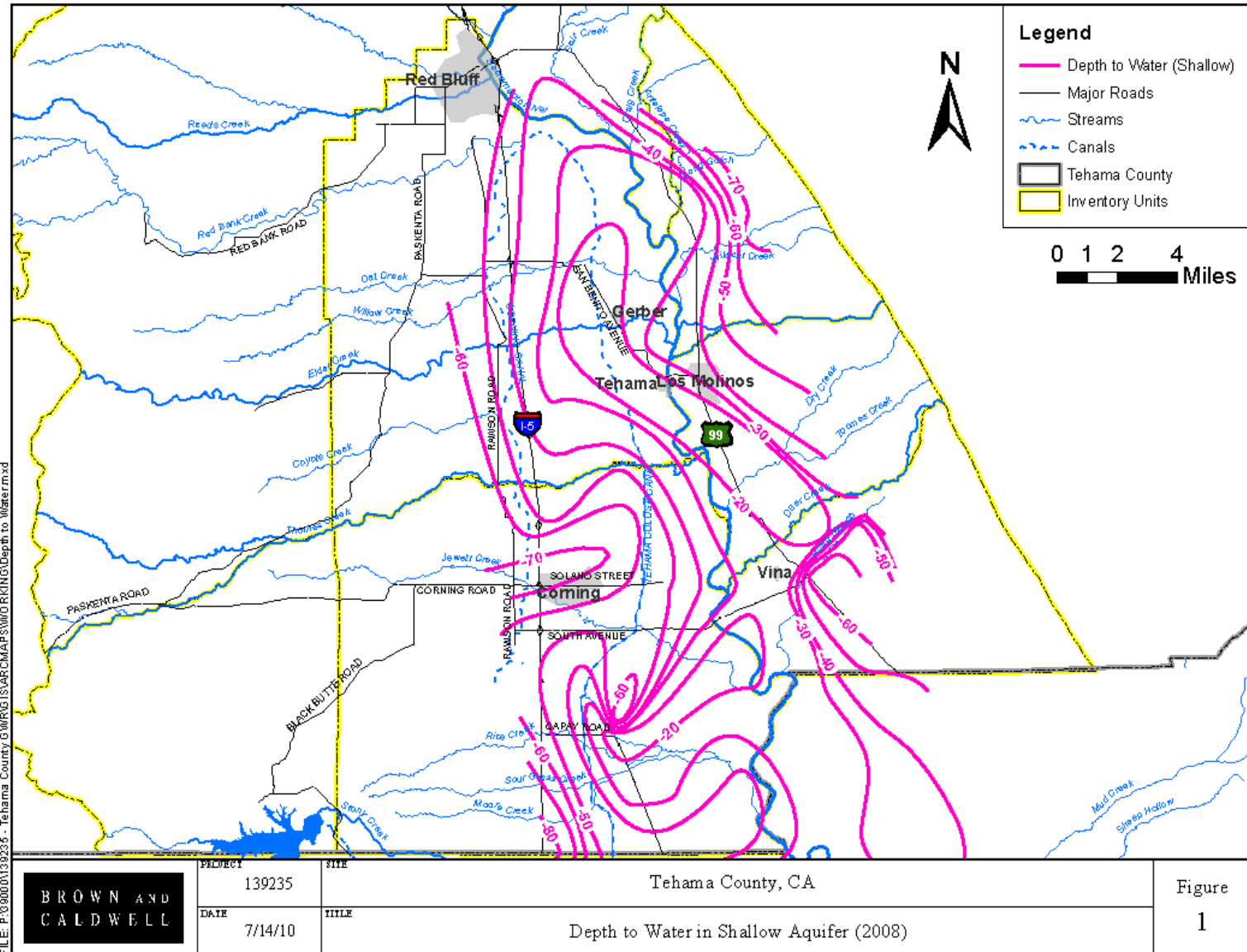
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Figure 1

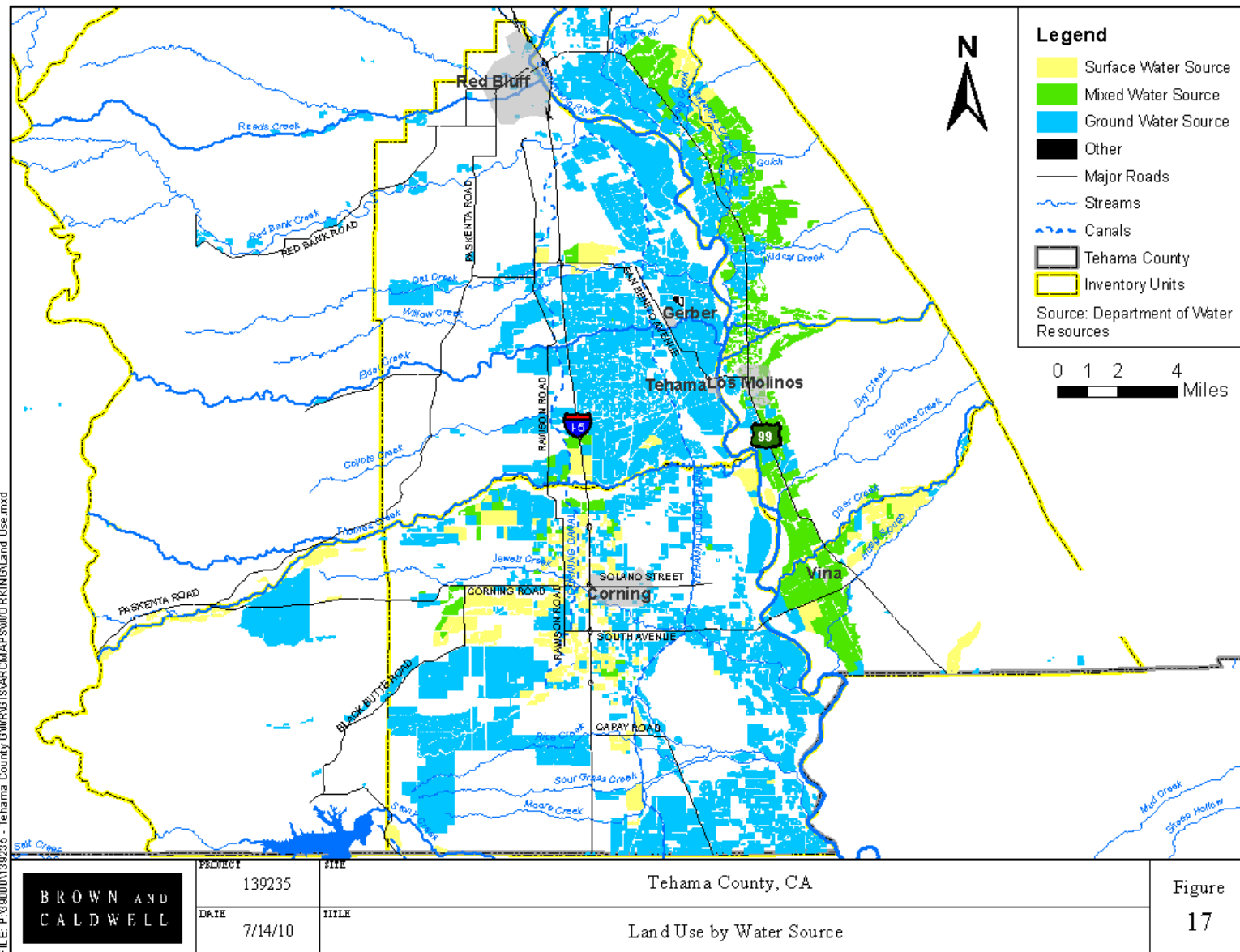
Source Data – Spring 2006 to Spring 2009



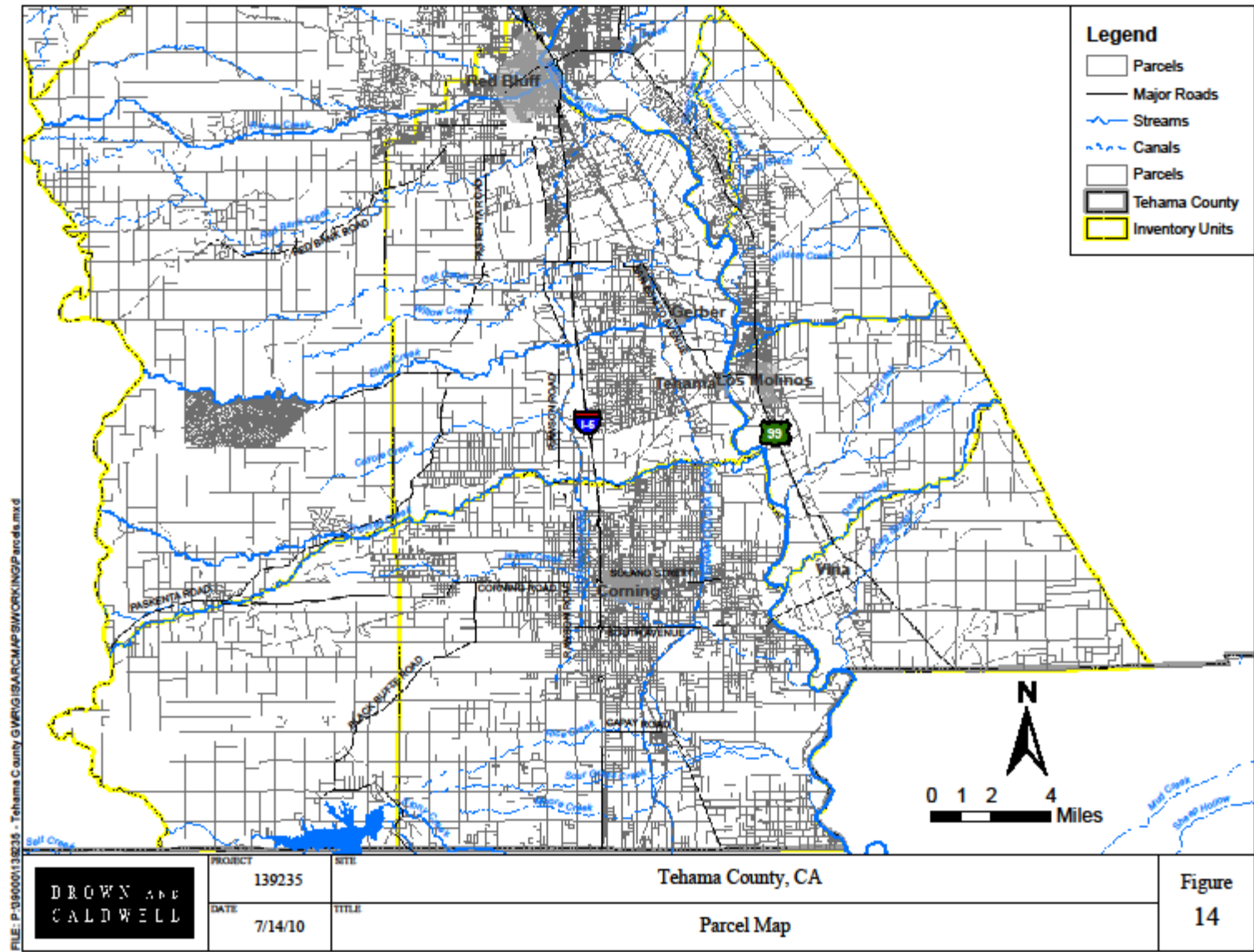
Source Data – Depth to Water in Wells Less Than 150 Feet Deep



Source Data - Land and Water Use

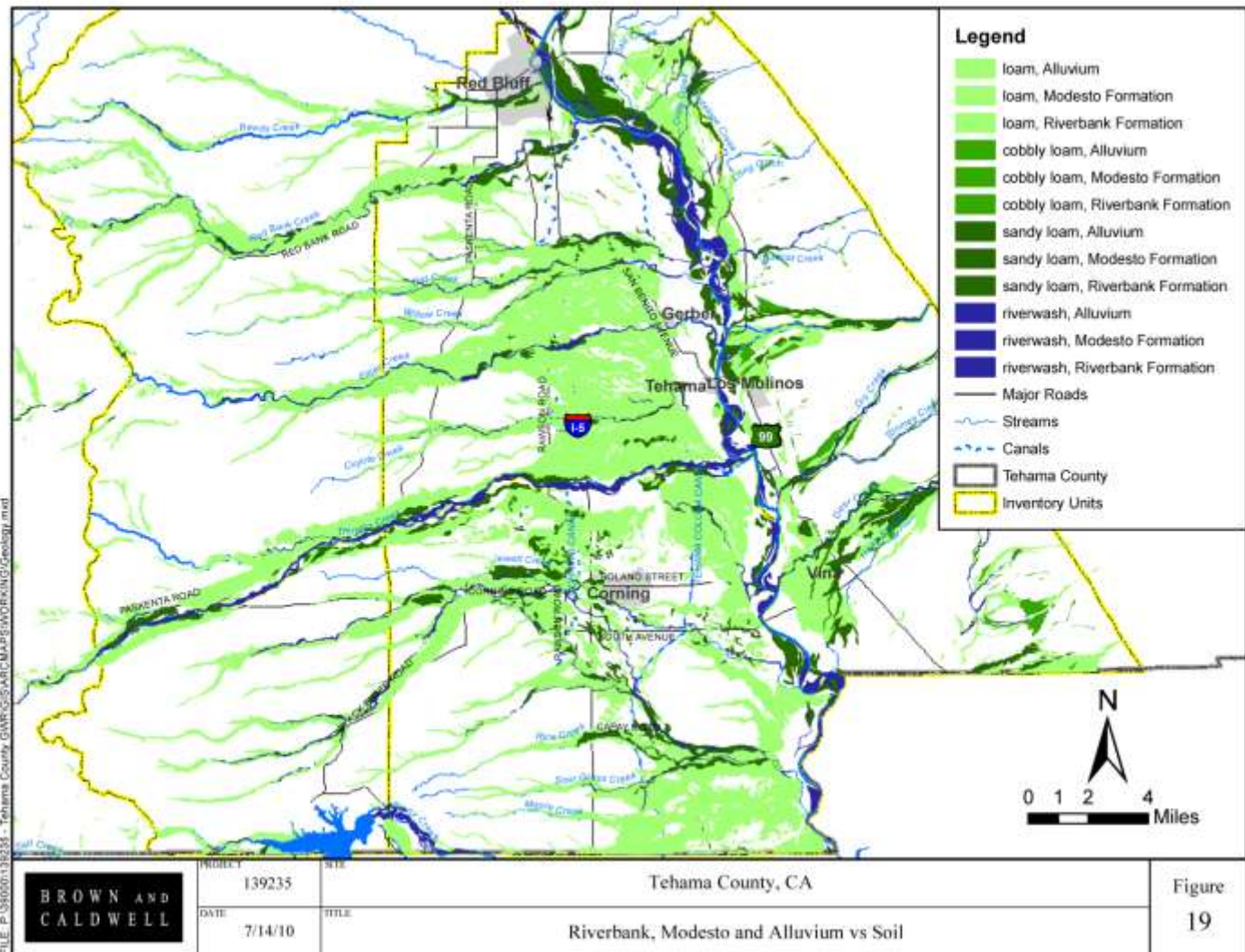


Source Data - Parcels



Criteria: Soil and Geology

- Riverbank and Modesto Formations
- Loam, Sandy Loam, and Riverwash soils



Criteria: Geology, Soil, and Proximity to a Water Source

- Riverbank and Modesto Formations
- Loam, Sandy Loam, and Riverwash soils
- Within 2000 feet of a canal or 1000 feet of a stream

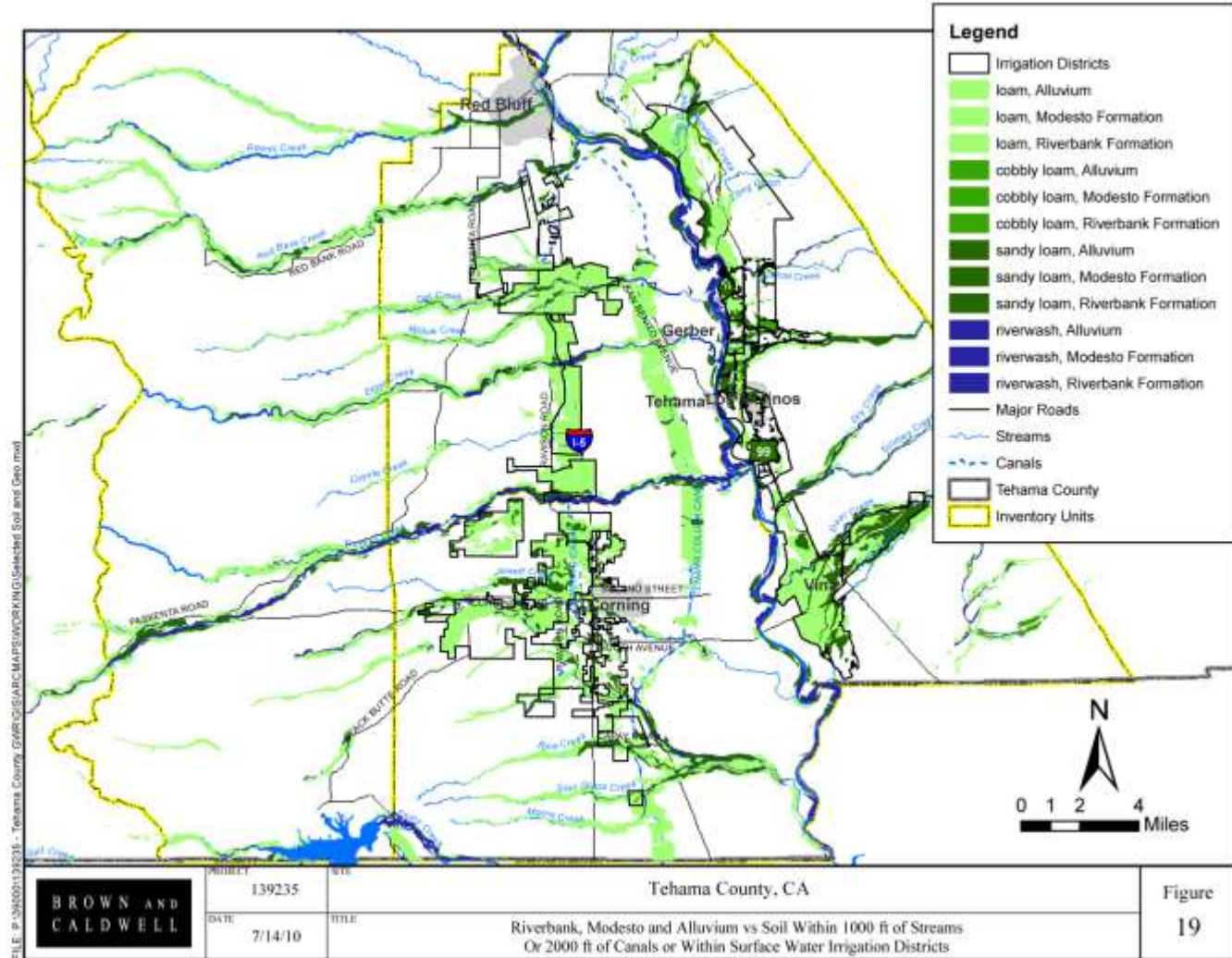


Figure 19

Criteria: Geology, Soil, Surface Water, and Drawdown

- Riverbank and Modesto Formations
- Loam, Sandy Loam, and Riverwash soils
- Areas within 1-2000 feet of streams/canals
- Areas with either >25 spring-summer DD or >15 2006-2009 spring DD

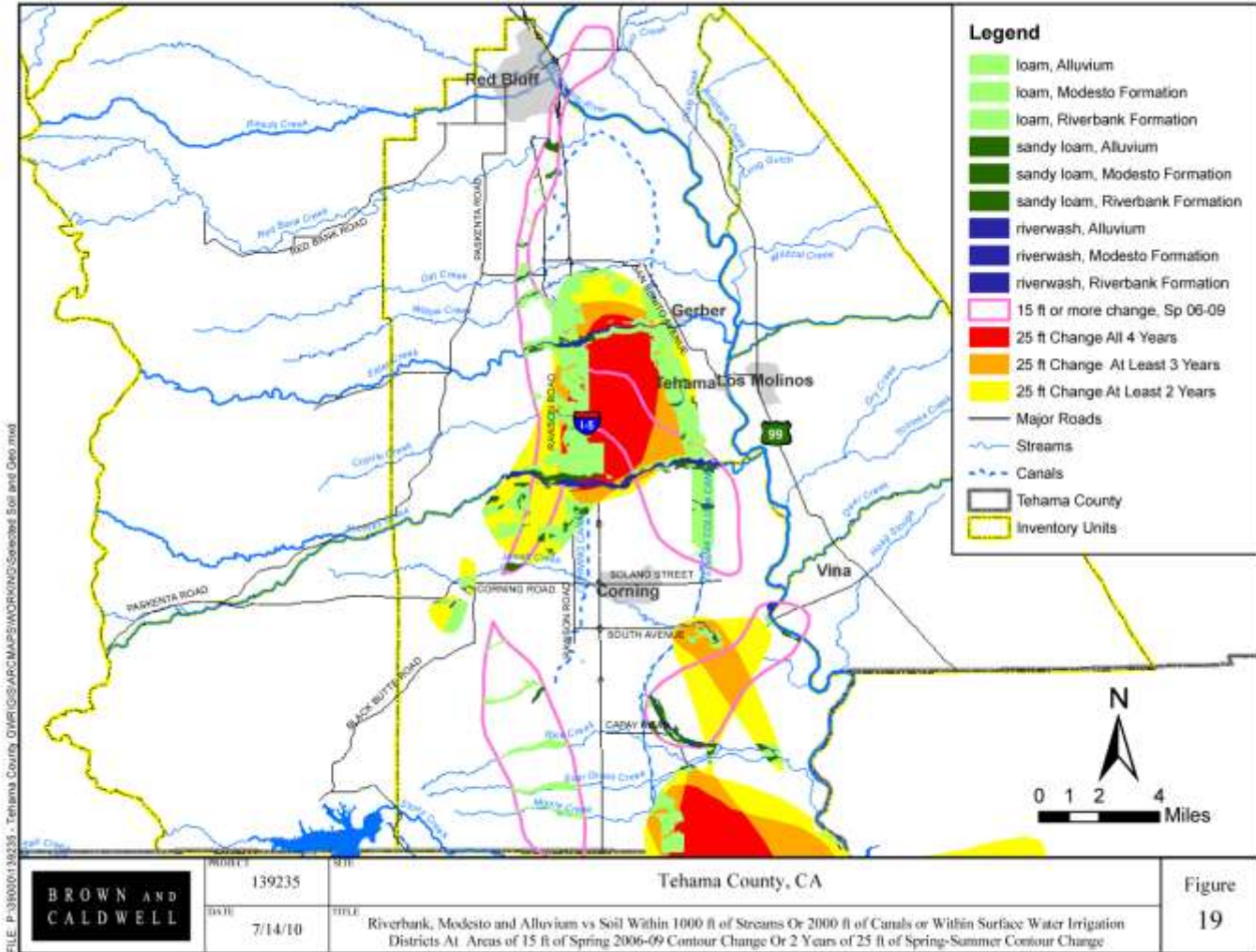
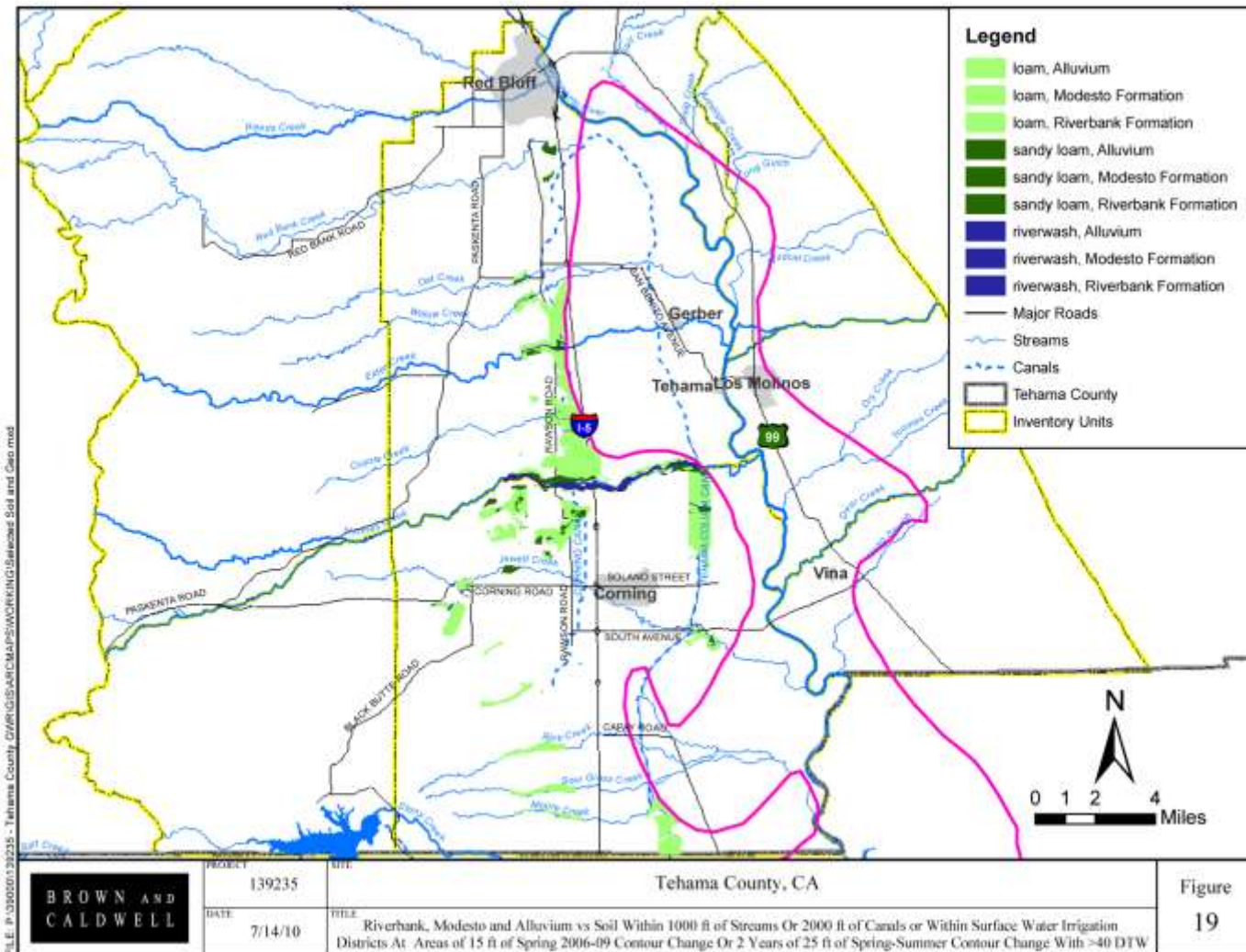


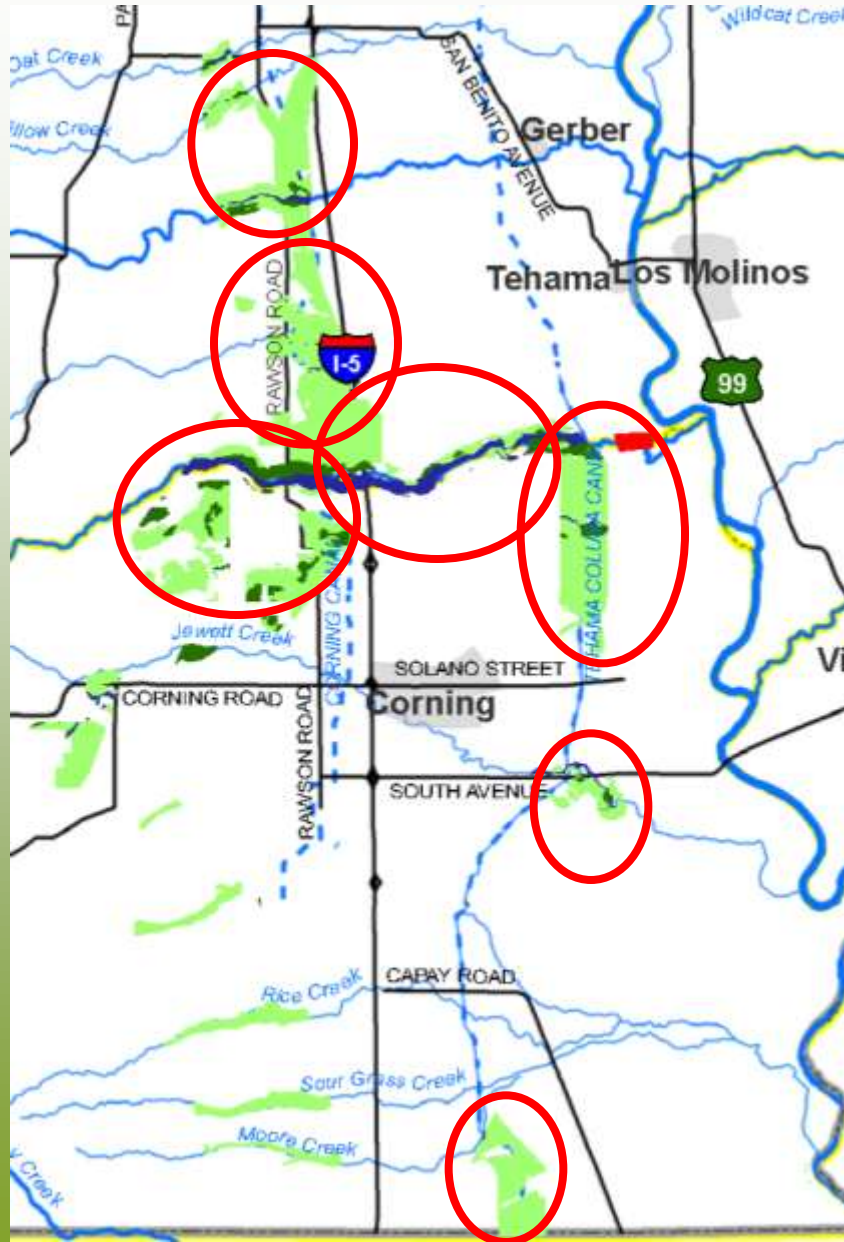
Figure 19

Criteria: Geology, Soil, Surface Water, Drawdown and Depth to Water

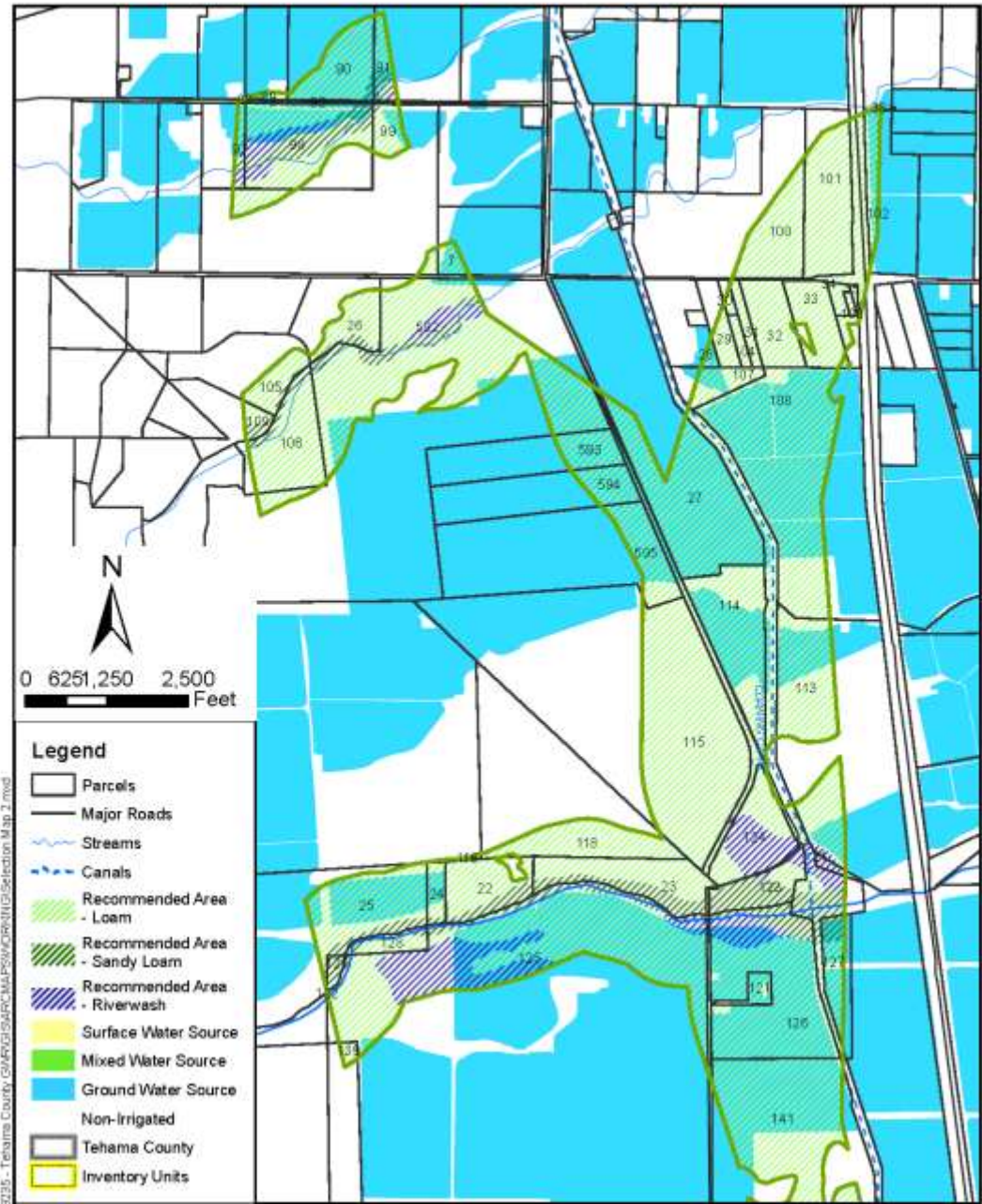
- Riverbank and Modesto Formations
- Loam, Sandy Loam, and Riverwash soils
- Areas within 1-2000 feet of streams/canals
- Areas with either >25 spring-summer DD or >15 2006-2009 spring DD
- DTW > 40 feet



Results

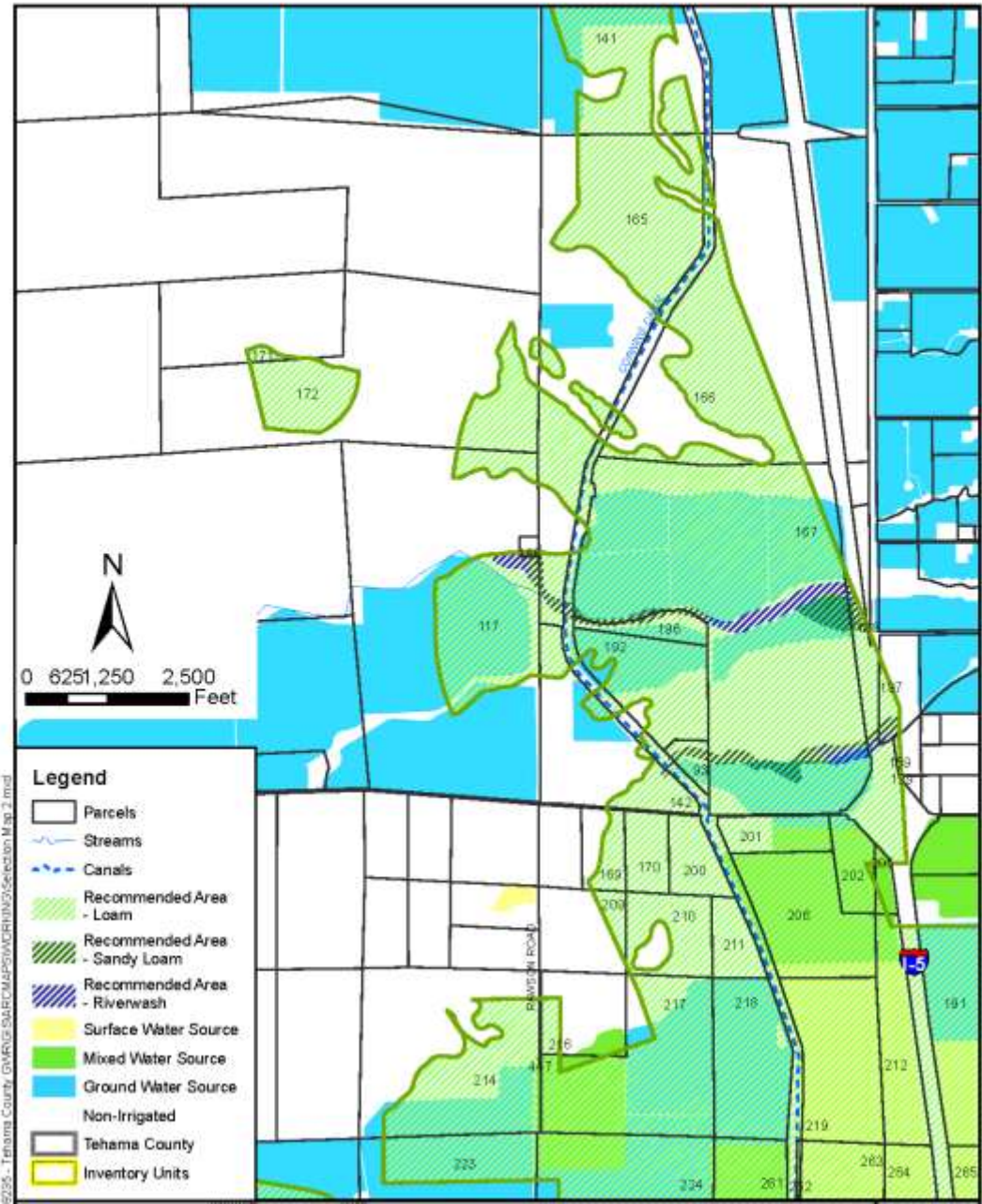


Results - Recommended Area A

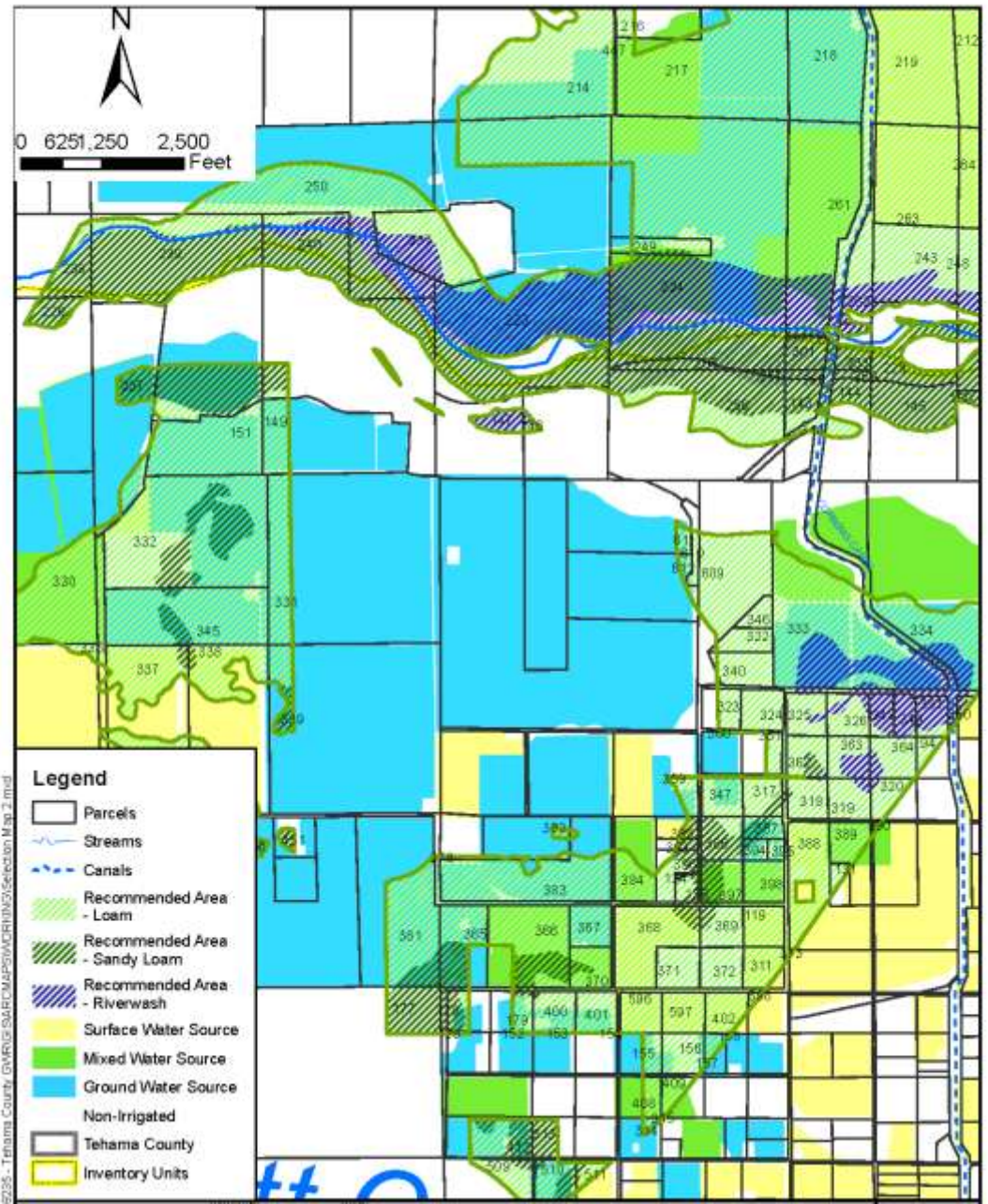


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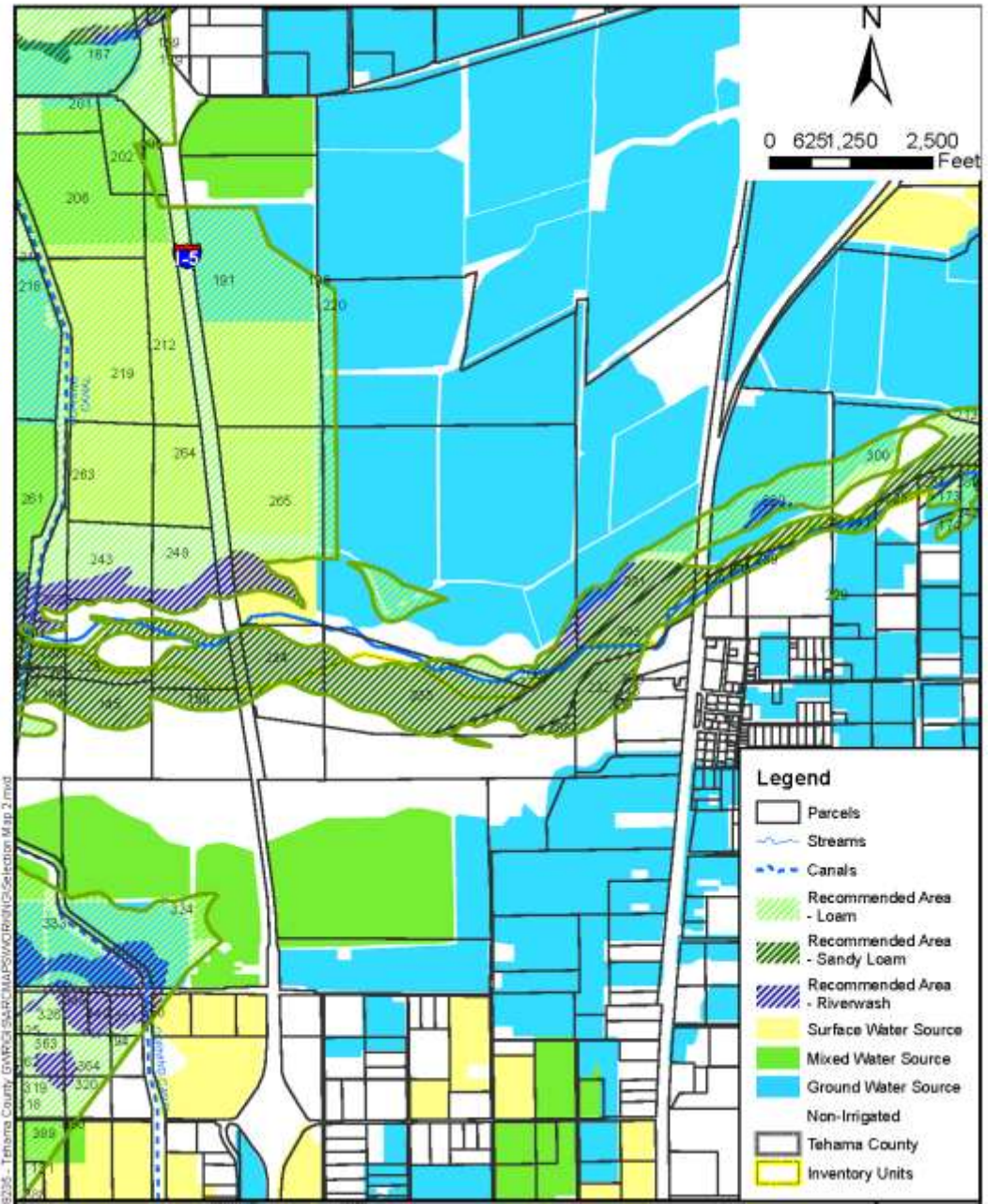
Results - Recommended Area B



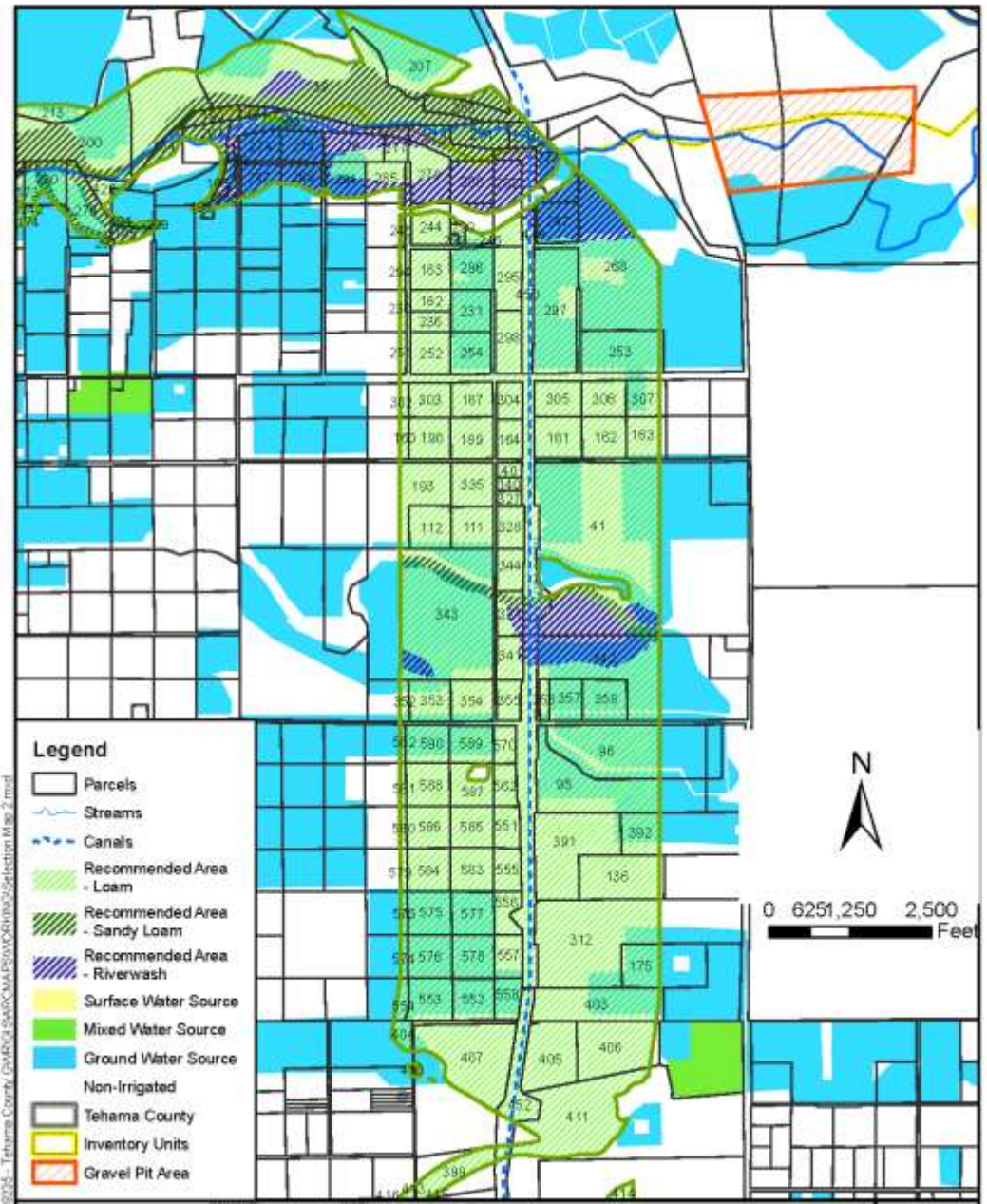
Results - Recommended Area C



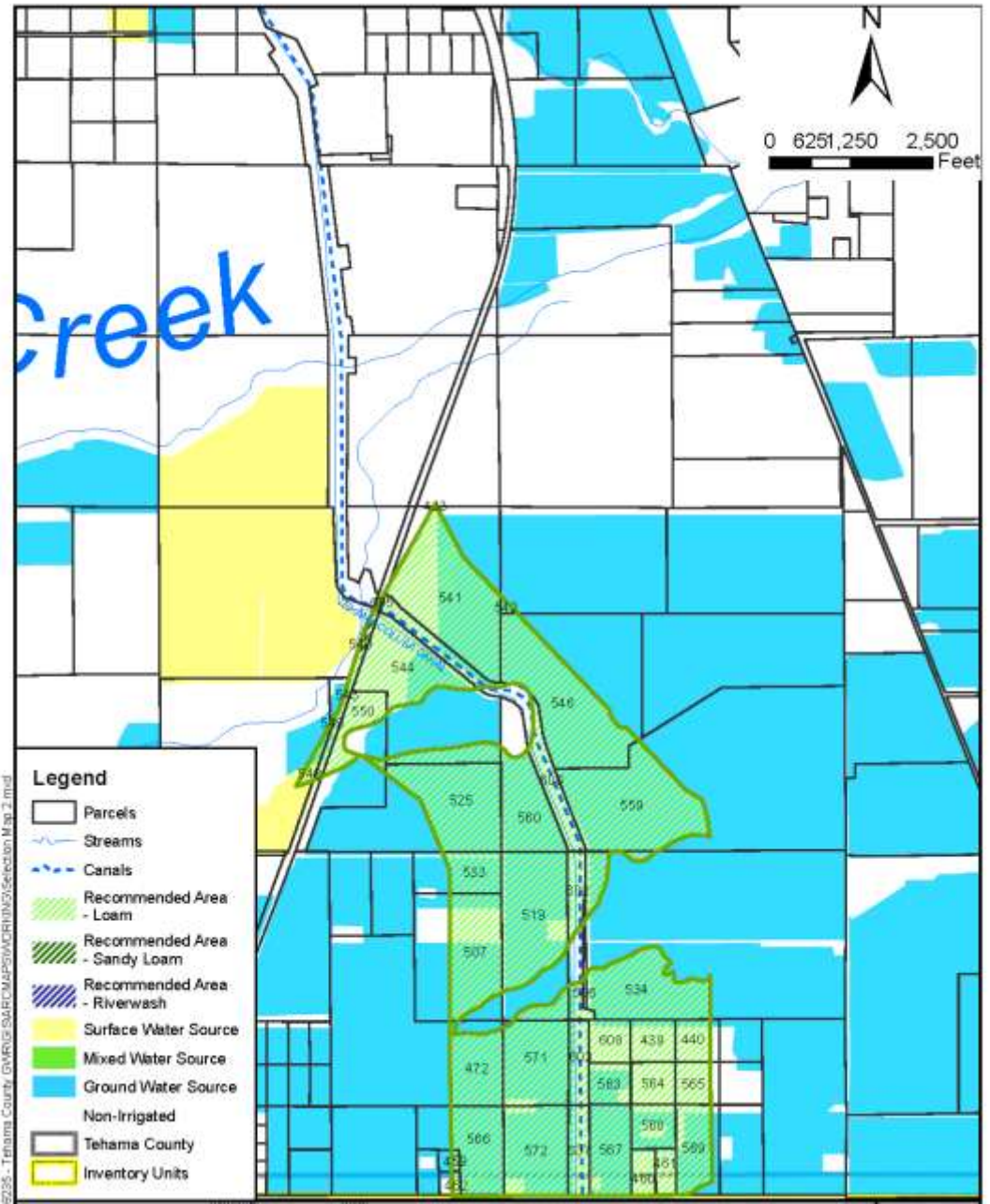
Results - Recommended Area D



Results - Recommended Area E

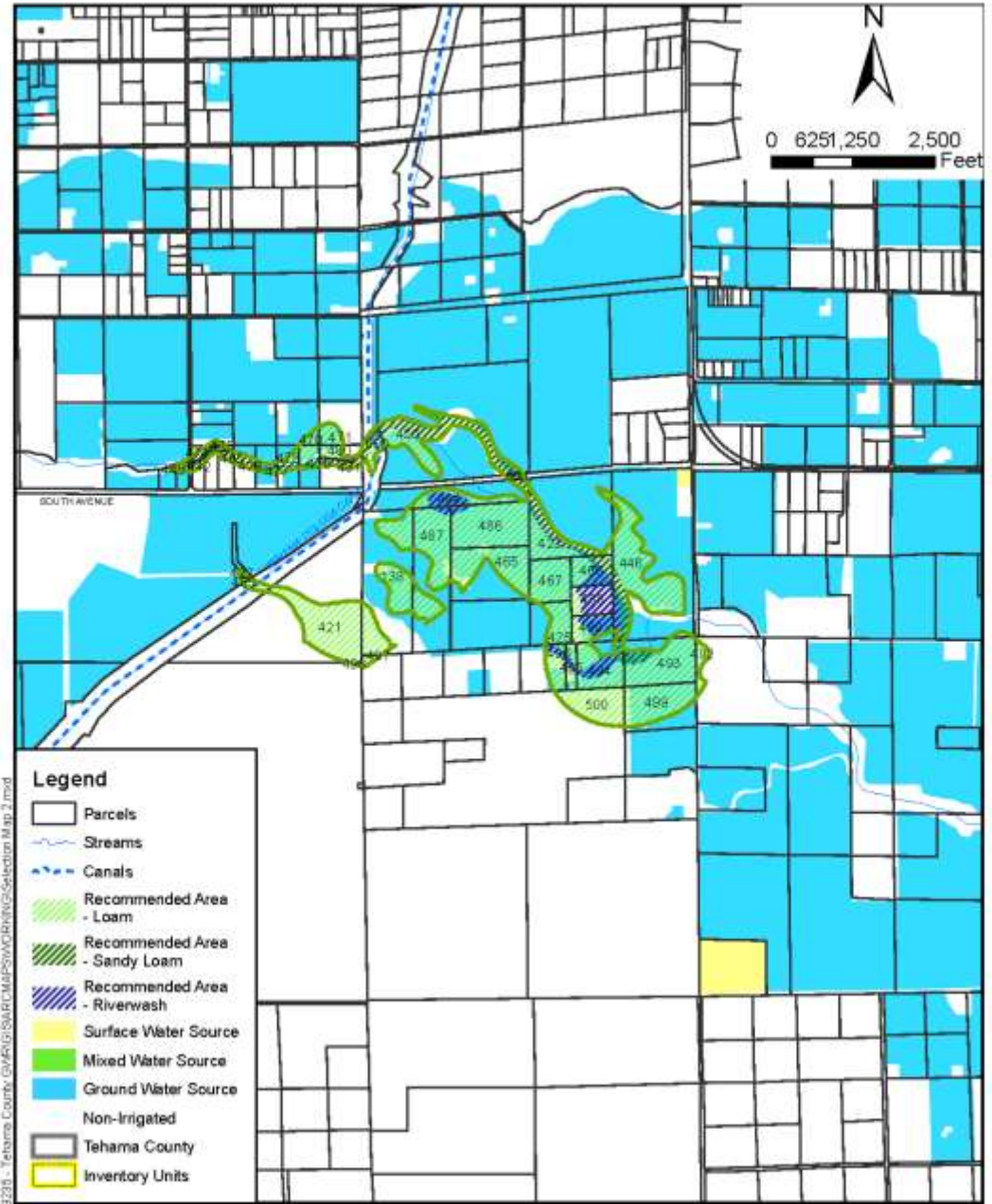


Results - Recommended Area F



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Results - Recommended Area G



Next Steps

- Summary Report
 - To TAC for review prior to next AB3030 meeting
 - Discuss report at next AB3030 meeting
- AB303 grant application (Spring 2011)
- Identify potential water supplies
- Find willing landowner/participants
- Perform feasibility studies on specific sites



BMO Revisions

Cumulative Frequency and Well Depth
Distribution

BMO versus Dedicated Well Comparison

Presentation Outline

- Why revise BMOs
- Recommended BMO revisions
- Example Results
- Next steps

Why Revise BMOs

- Current BMO levels, established in 2001, are not indicative of actual levels of concern
- New methodology helps establish levels that are meaningful for management purposes
- Most of the dedicated monitoring wells now have a long enough period of record to be utilized as BMO well replacements

Recommended BMO Revisions

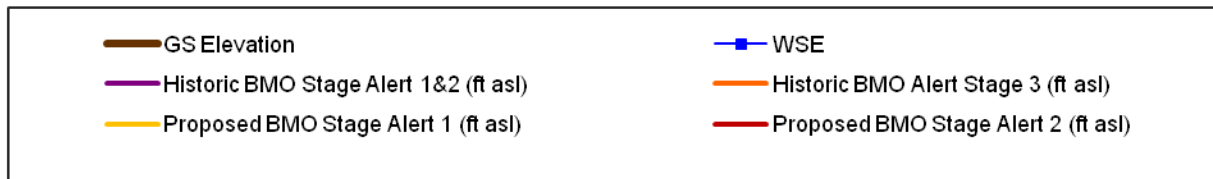
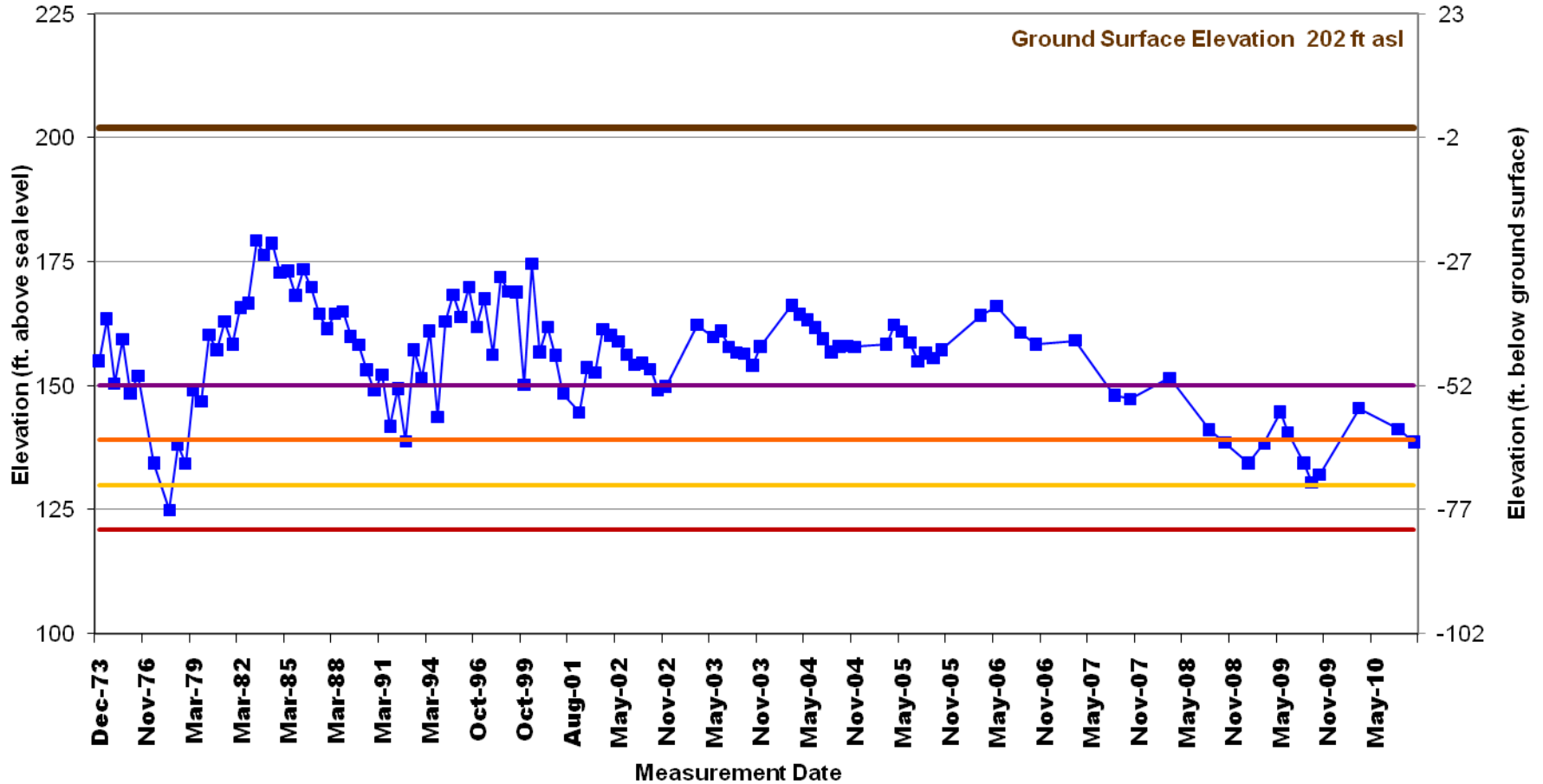
- Establish new levels for each BMO well utilizing a standardized methodology
- Compare and assess BMO levels to nearby well infrastructure
- Provides a first step necessary to assess risk of exceeding safe yield (as defined in BMO process)
- Correlate and consolidate some existing BMO wells to dedicated monitoring wells where appropriate

Standard Methodology

- Existing BMO levels utilize a wide variety of methodologies.
- Consolidating methodologies allows for comparison of wells within areas and between areas.
- Recommend utilizing a 2 standard deviation methodology

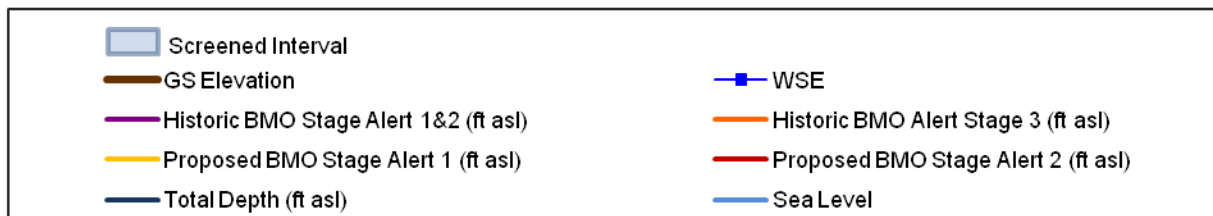
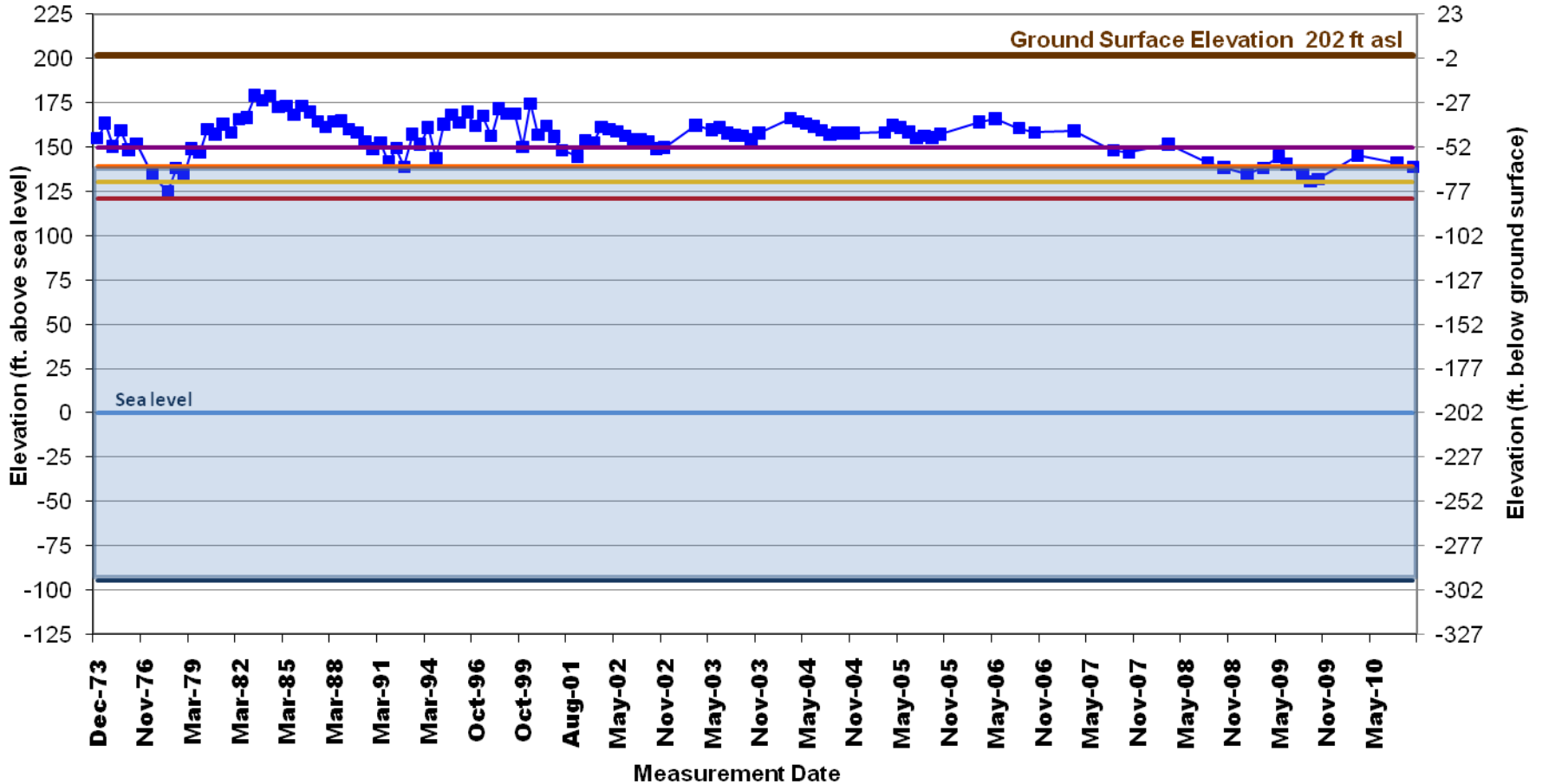
Standard Methodology

Water Surface Elevation and Stage Alert Levels for
State Well Number 21N03W22H001M



Standard Methodology

Water Surface Elevation and Stage Alert Levels for
State Well Number 21N03W22H001M



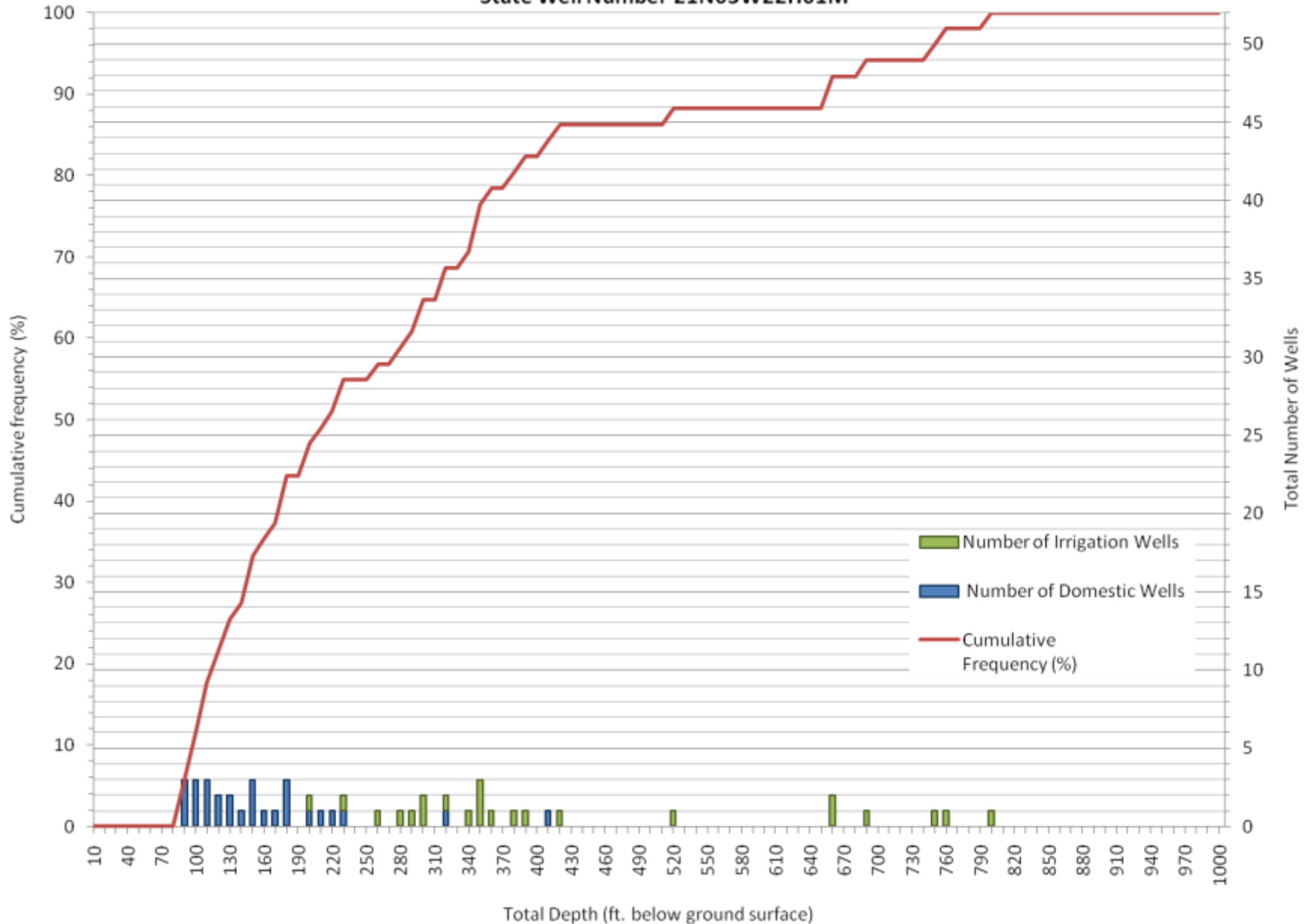
Compare to Well Infrastructure

- Helps validate appropriateness of BMO levels for the specific area
- Collects and analyzes the nine square miles around an existing BMO well



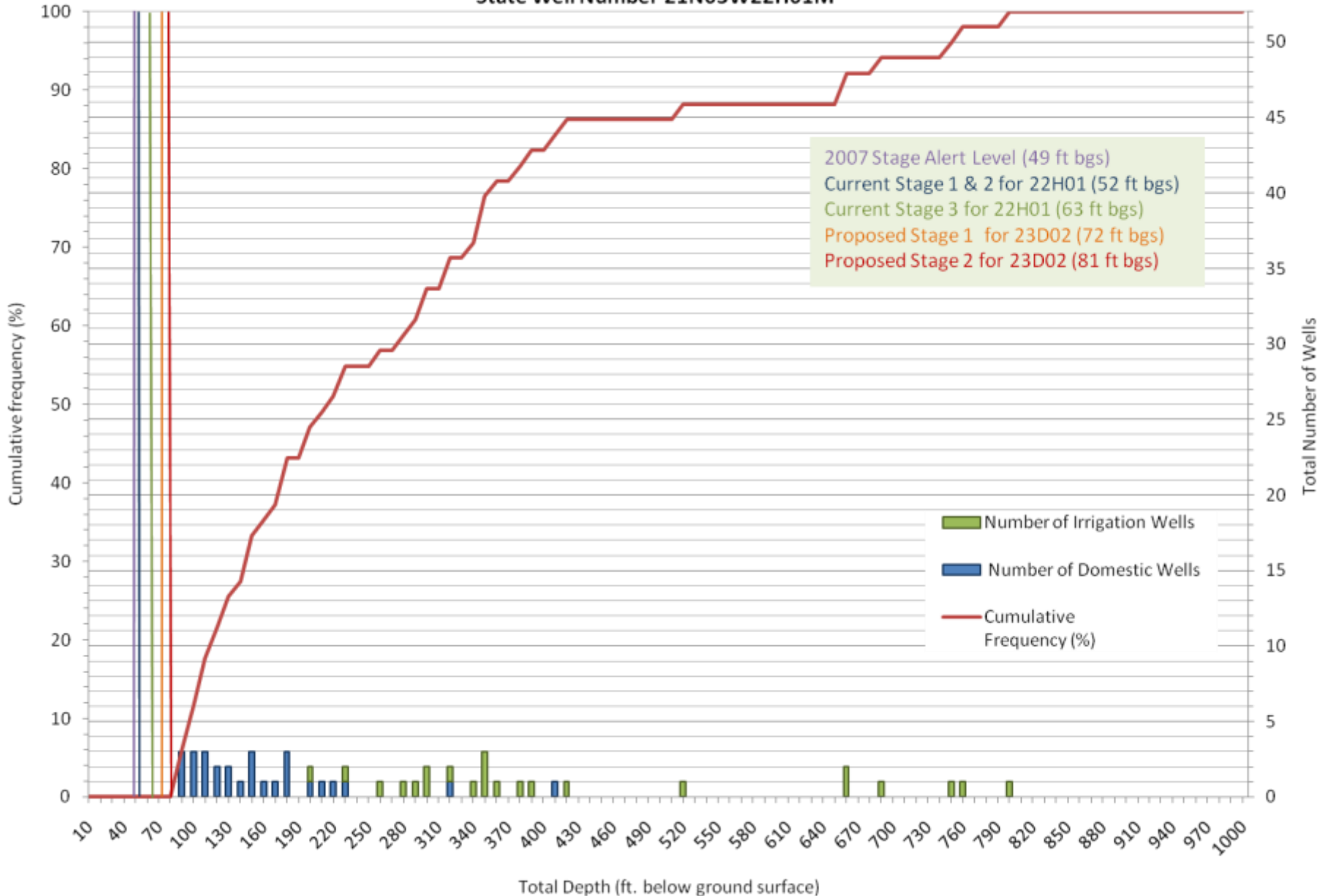
Compare to Well Infrastructure

Wells Installed From 1950 to 2010 Within 9 Square Miles Surrounding
State Well Number 21N03W22H01M

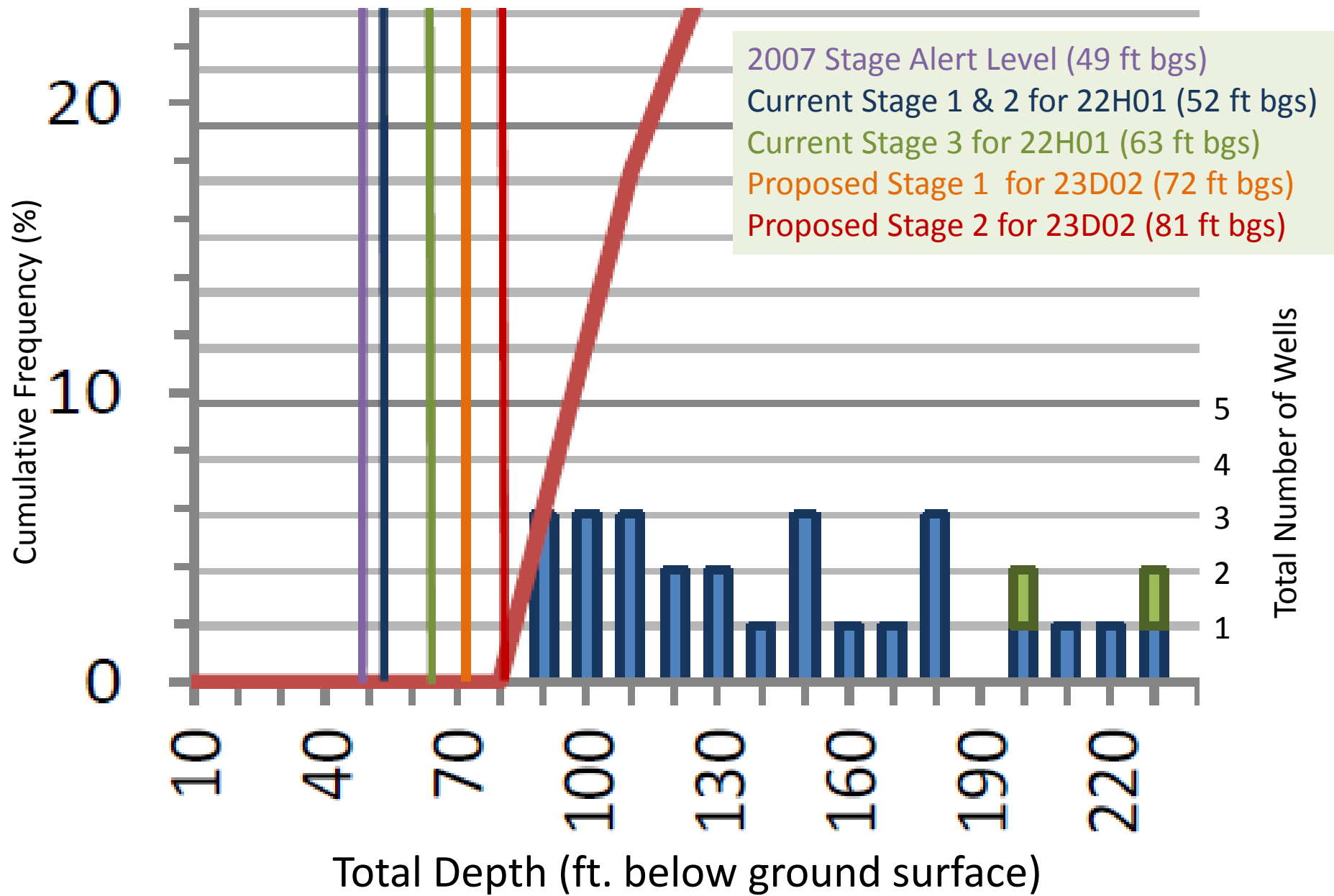


Compare to Well Infrastructure

Wells Installed From 1950 to 2010 Within 9 Square Miles Surrounding
State Well Number 21N03W22H01M



Compare to Well Infrastructure



Correlate to Dedicated Monitoring Wells

- Dedicated monitoring wells are more consistent than the current BMO wells
 - Well construction is known
 - No pumping occurs at the monitoring well
 - Monitoring can be correlated to specific aquifers
 - Continuous dataloggers

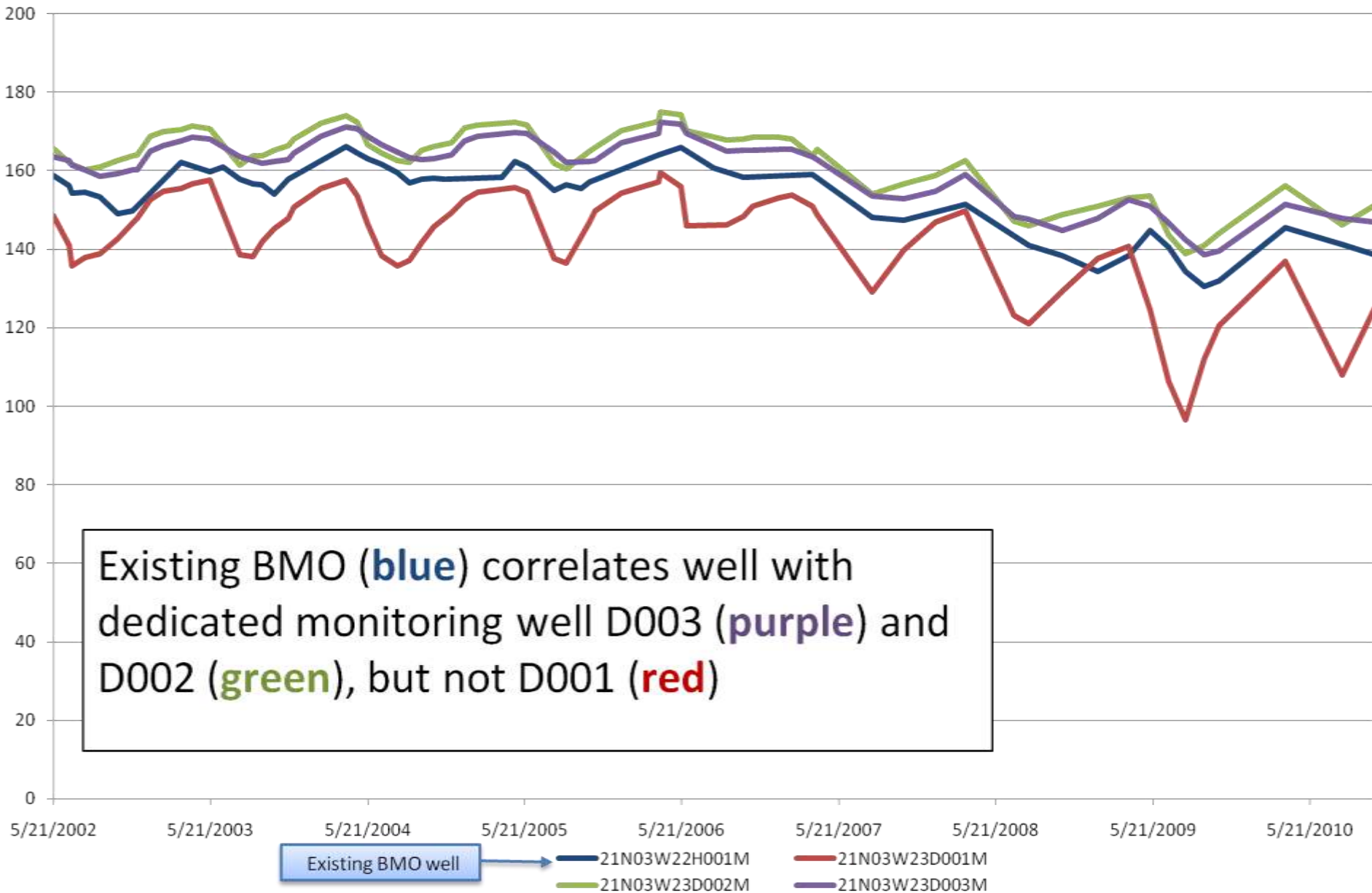
Correlate to Dedicated Monitoring Wells

- Correlate location (within 2 miles)
- Correlate to monitoring history
 - Similar responses to seasonal changes
 - Similar responses to long term changes
- Correlate screened intervals
 - Similar depth of screened intervals

Correlate Location

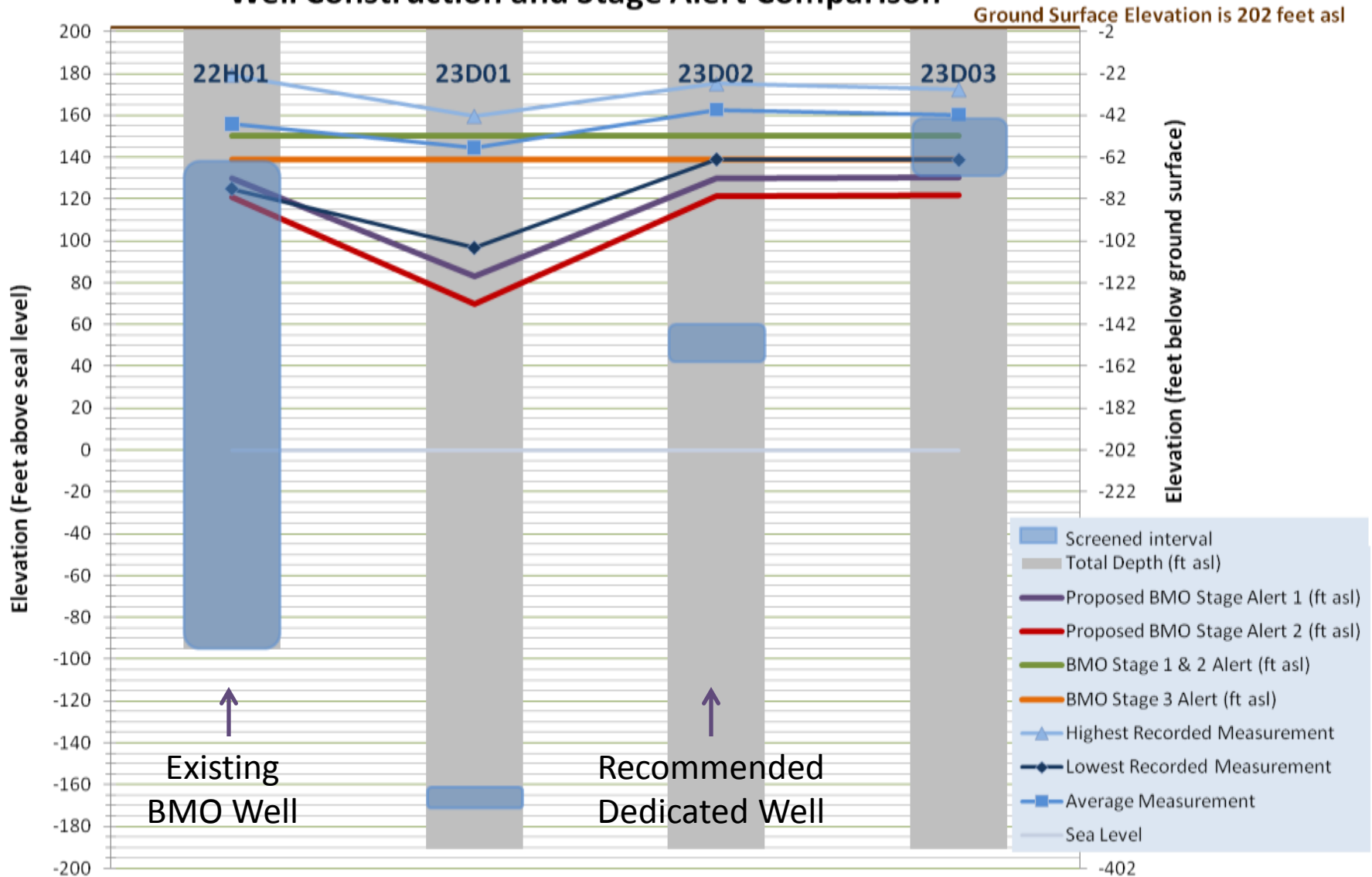


Correlate Monitoring History



Correlate Screened Intervals

Well Construction and Stage Alert Comparison



Example Results

- New BMO levels that are of consistent methodology County wide
- New BMO levels that consider existing well infrastructure
- New BMO wells that are more reliable and indicative of regional trends

Next Steps

- Apply new BMO stage methodology to other BMO wells
- Create cumulative frequency graphs for areas around BMO wells
- Correlate and consolidate existing BMO wells to dedicated monitoring wells where appropriate