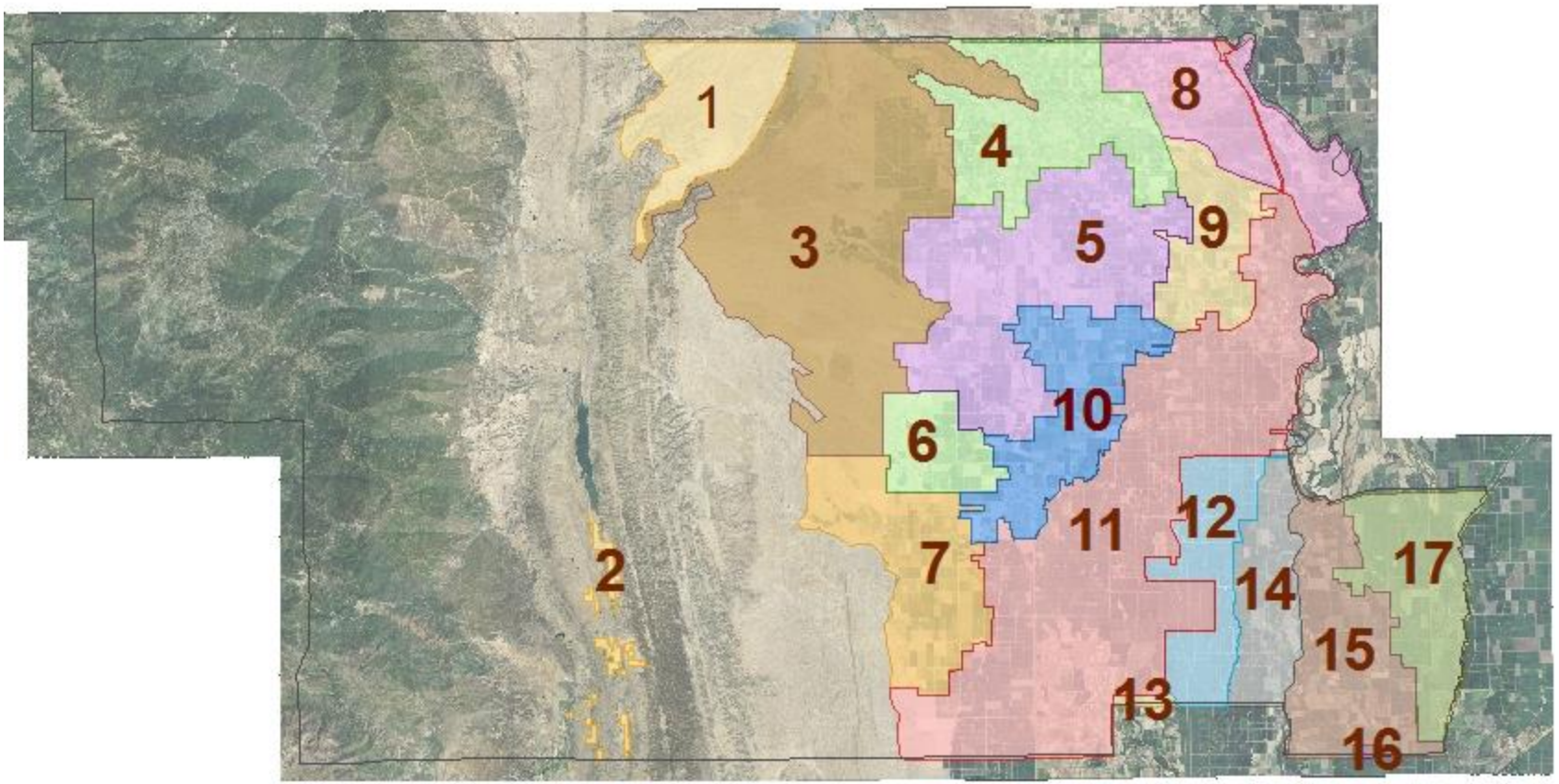
BMO REVISIONS

Glenn County Technical Advisory Committee

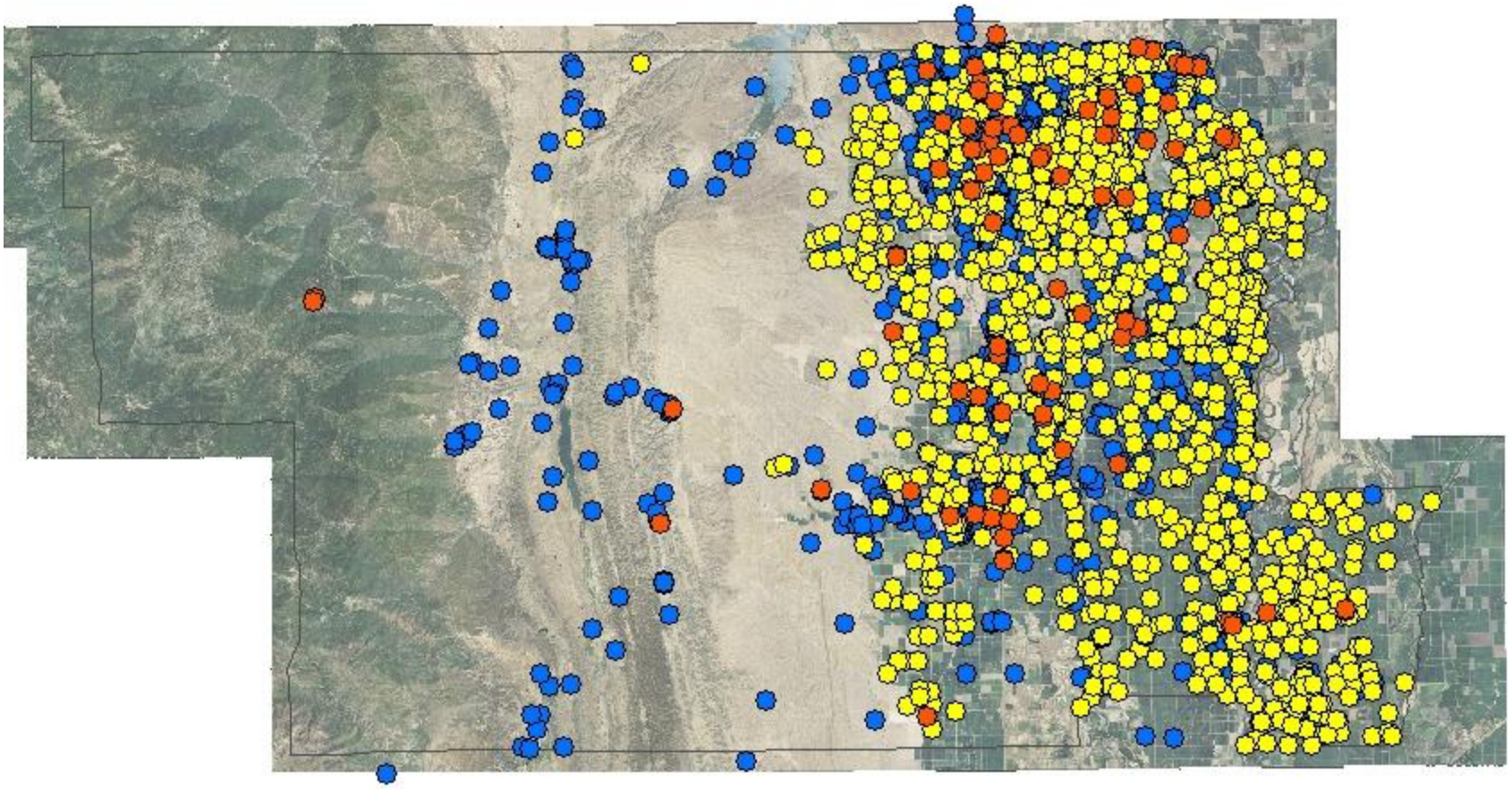
August 2014

RECAP

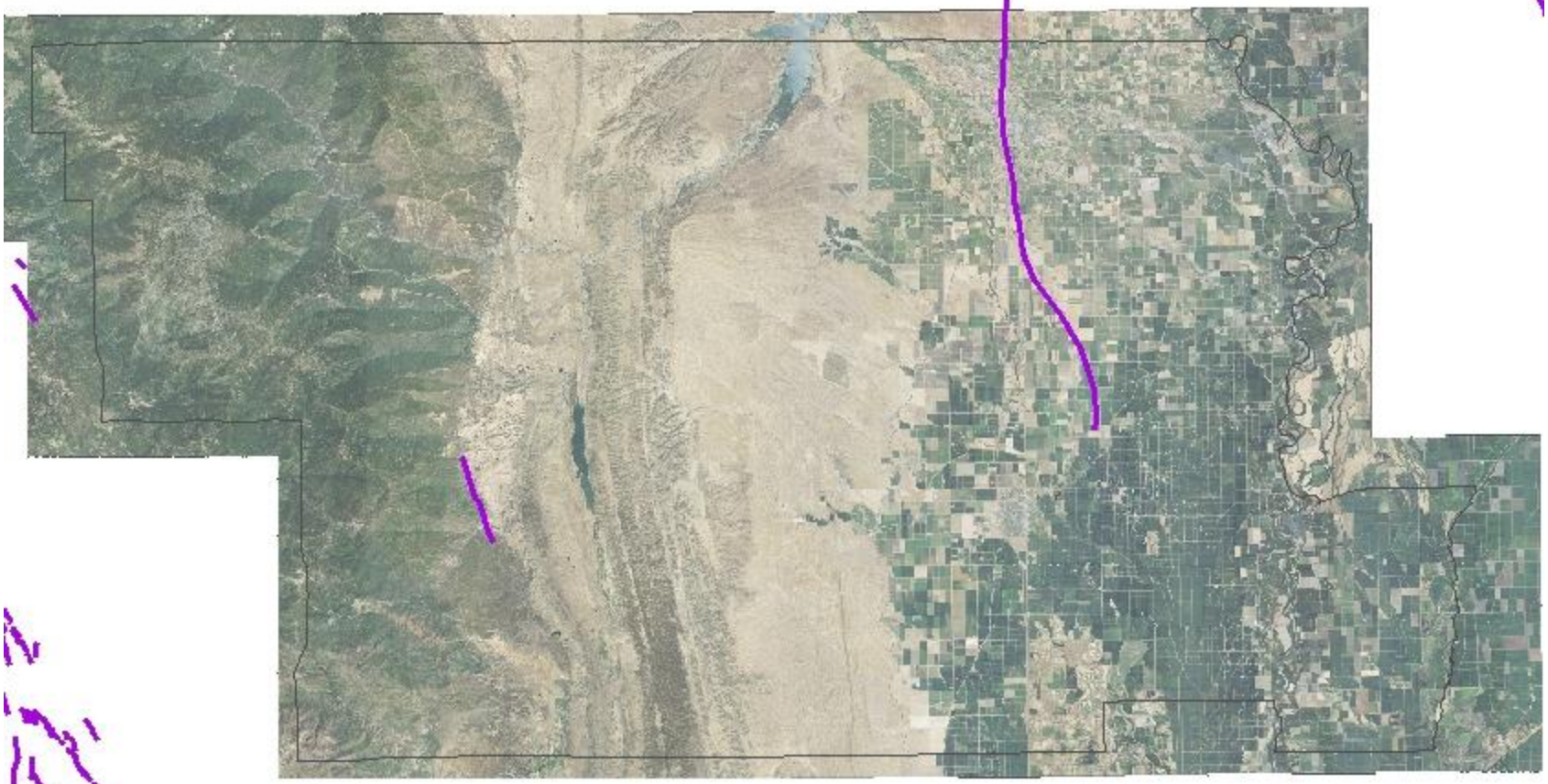
July 15, 2014 TAC meeting



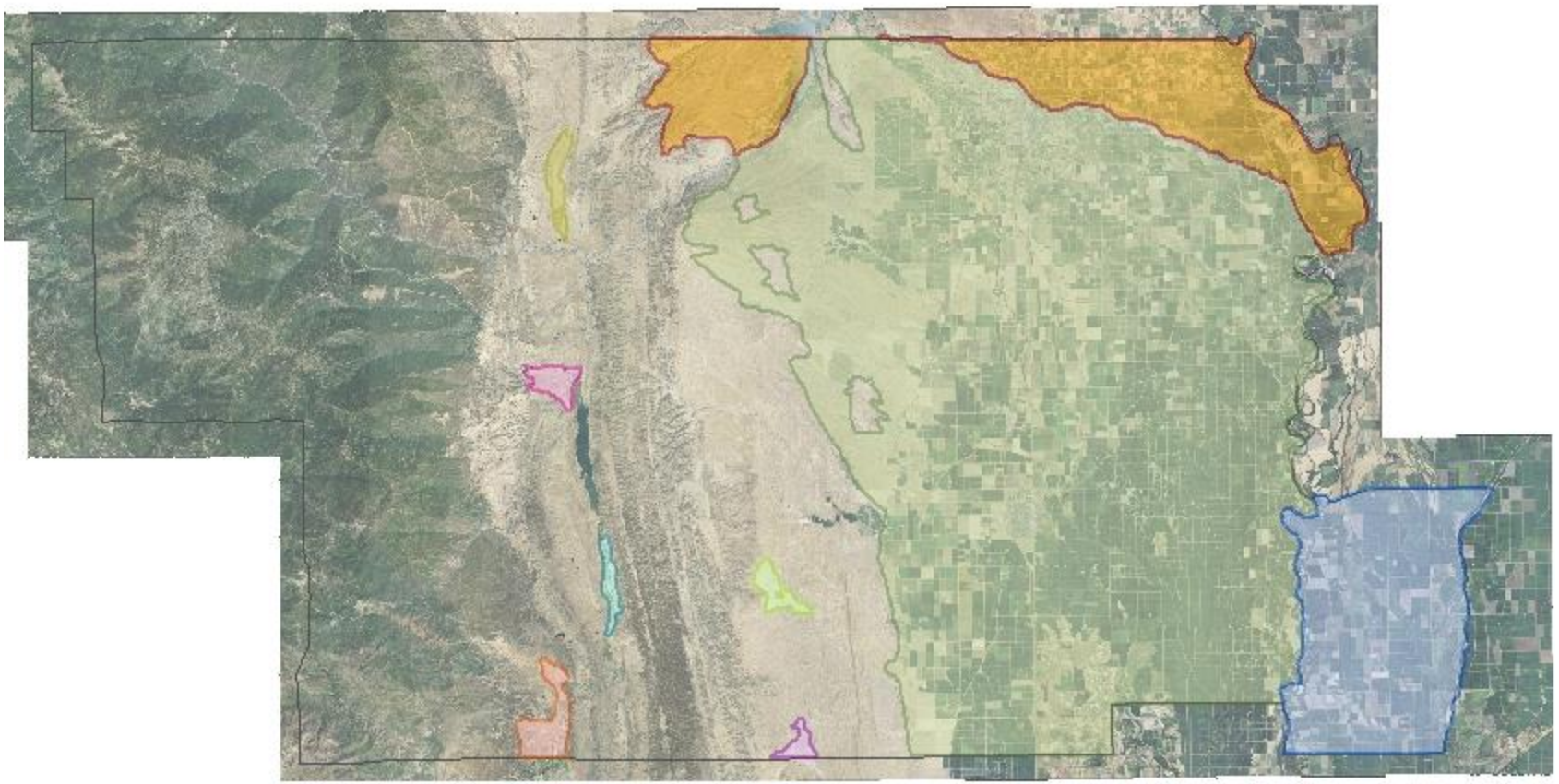
Current BMO Subareas



Well Distribution (2010)



Faults
USGS and California
Geologic Survey (CGS)



Bulletin 118 Groundwater Basins

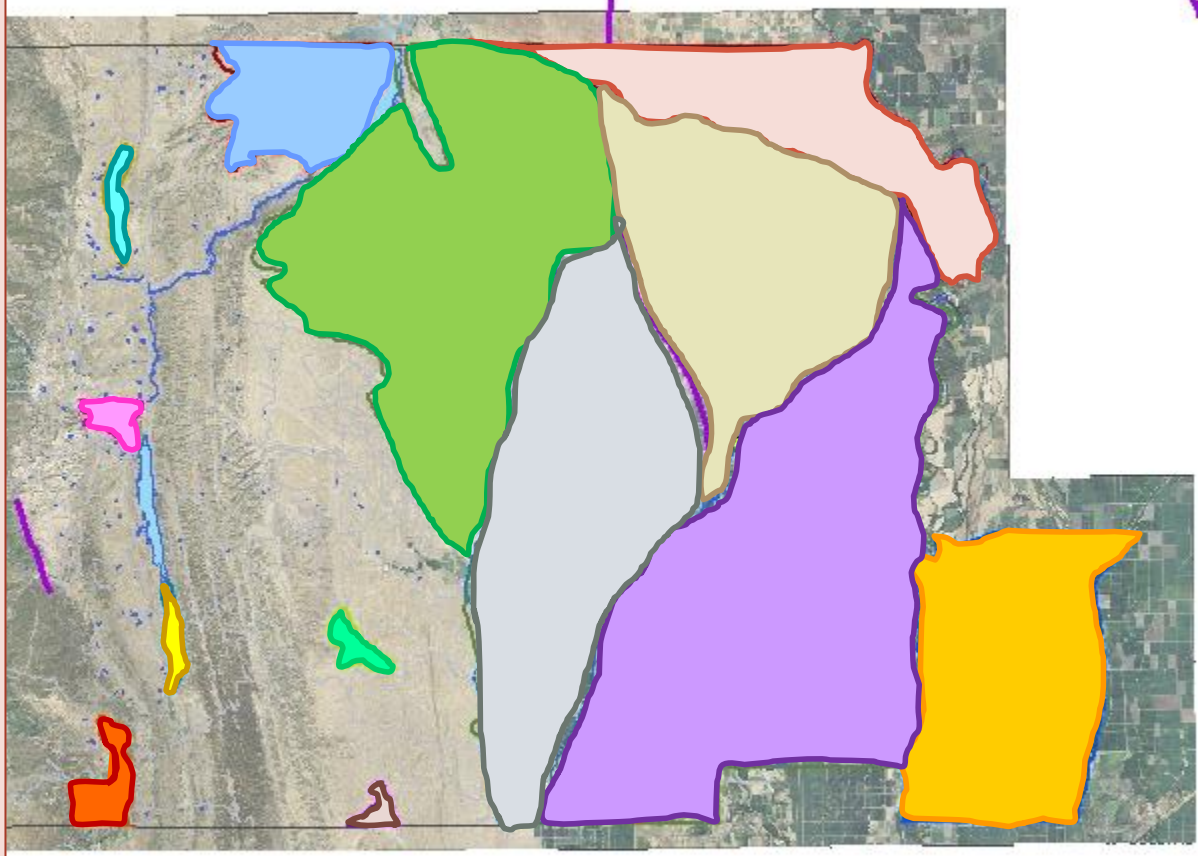
Considerations for Boundaries

- DWR's Bulletin 118 Groundwater Basins
- Sacramento River and Stony Creek
- Canals
- Fault lines
- Soils
- Land use
- Density of wells-domestic/ag
- Watersheds
- Potential groundwater sustainability legislation

Considerations for Boundaries

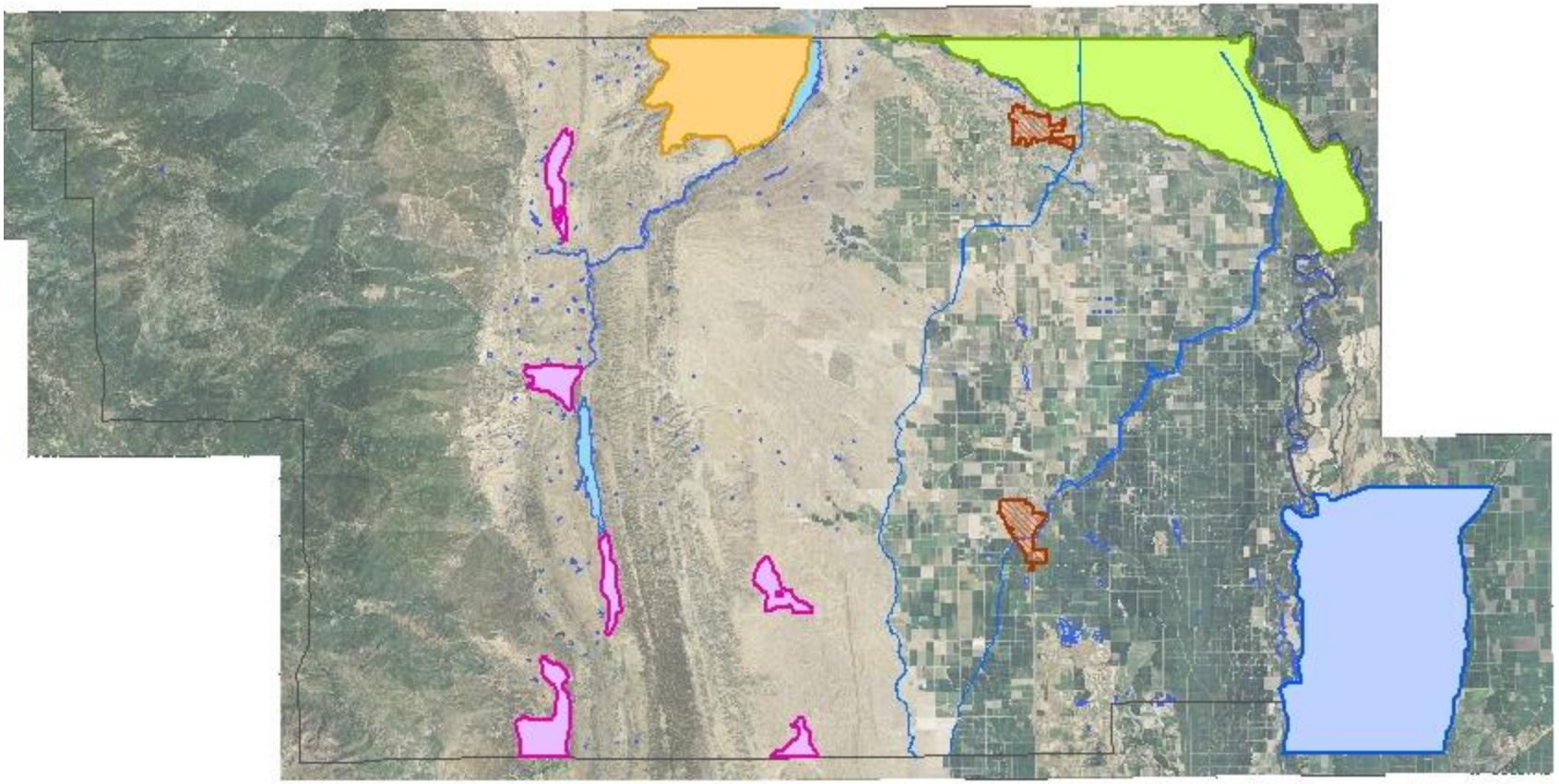
- Separate management areas for each foothill basins identified in Bulletin 118 (same in all recommendations).
- Corning Basin may remain the same management area (as identified in Bulletin 118) or divided into east and west portions due to differences in well density, land use, soils, watersheds, and location.
- West Butte Basin identified in Bulletin 118 (east of Sacramento River) should be a separate management area (same in all recommendations).
- The Colusa Basin as identified in Bulletin 118 should be sub-divided.
- Additional management area for non-alluvial basins (the rest of the County).

- Blue-West Corning Basin using Bulletin 118 and County line as boundaries
- Peach-East Corning Basin using Bulletin 118 and County line as boundaries
- Green-Bulletin 118 boundary on the west, the fault line and the TC Canal to the east, and Stony Creek to the north
- Grey-Fault line and GCID canal to the east, TC canal and Bulletin 118 boundary to the west
- Tan-Stony Creek to the north, fault line to the west, and GCID canal to the east
- Purple-GCID canal to the west, Sacramento River to the east, Stony Creek to the north



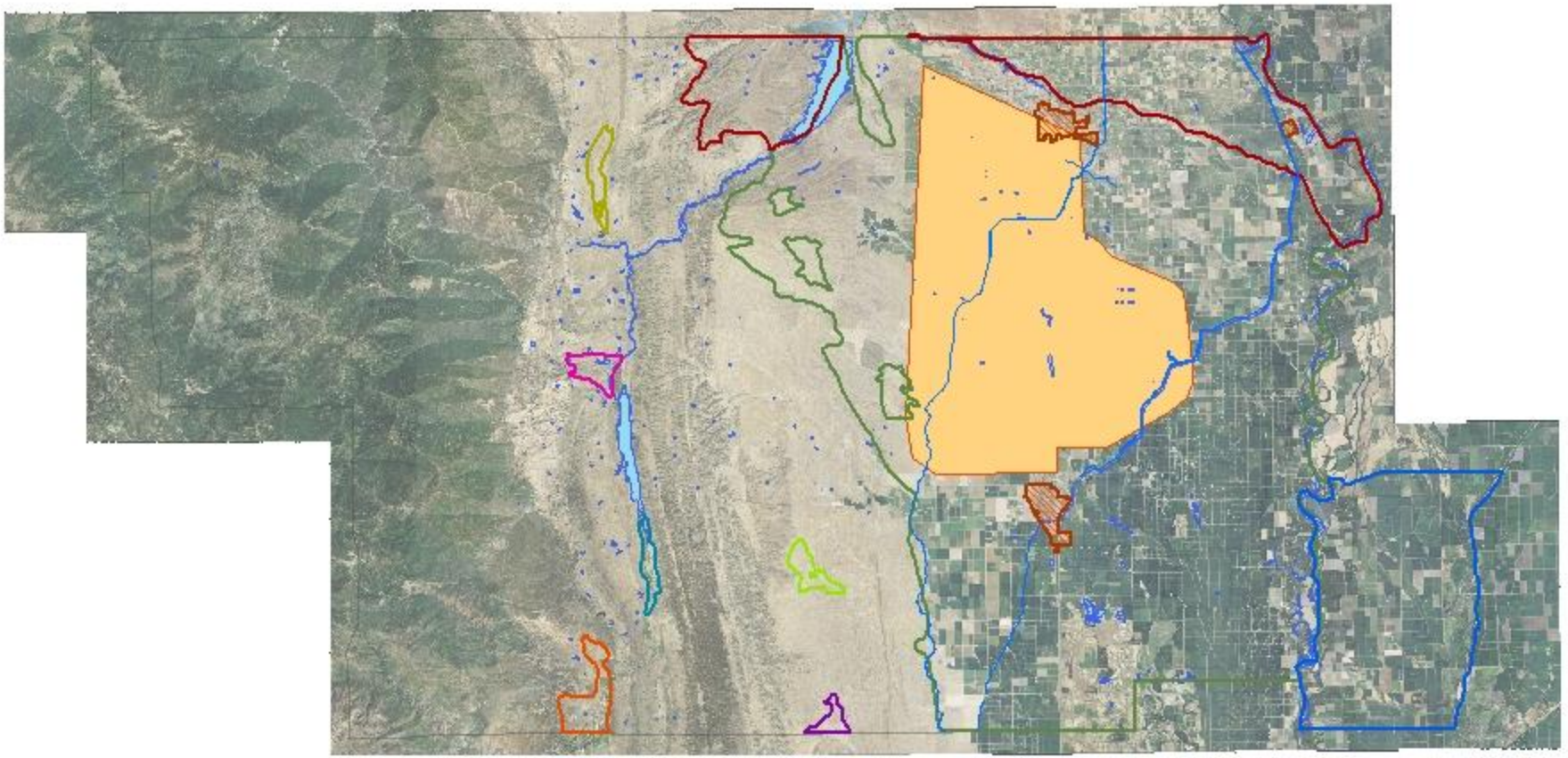
Recommendation 4

NEXT CONSIDERATIONS



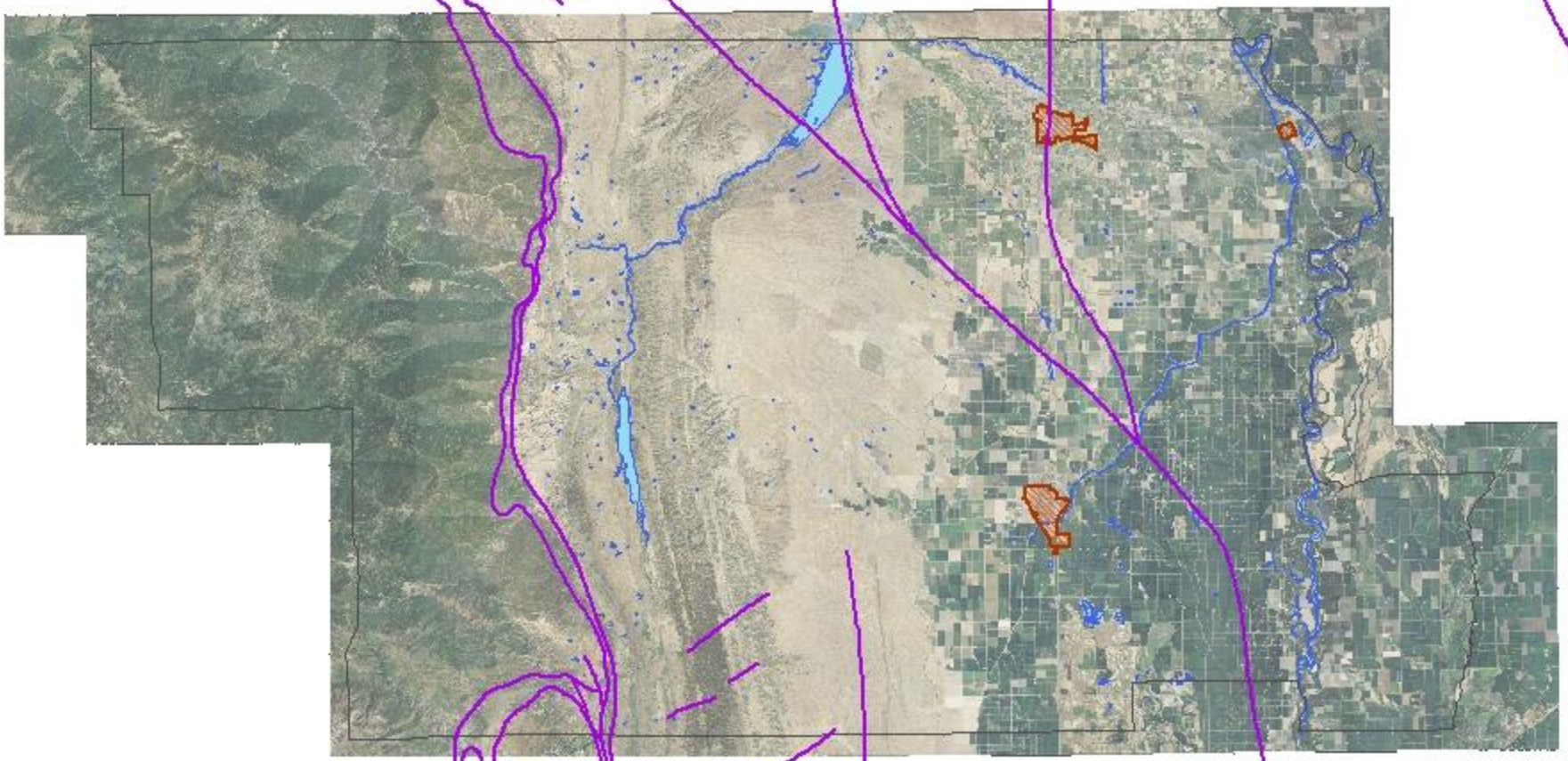
Agreed upon portions of Recommendation 4 (from July TAC)

August 2014

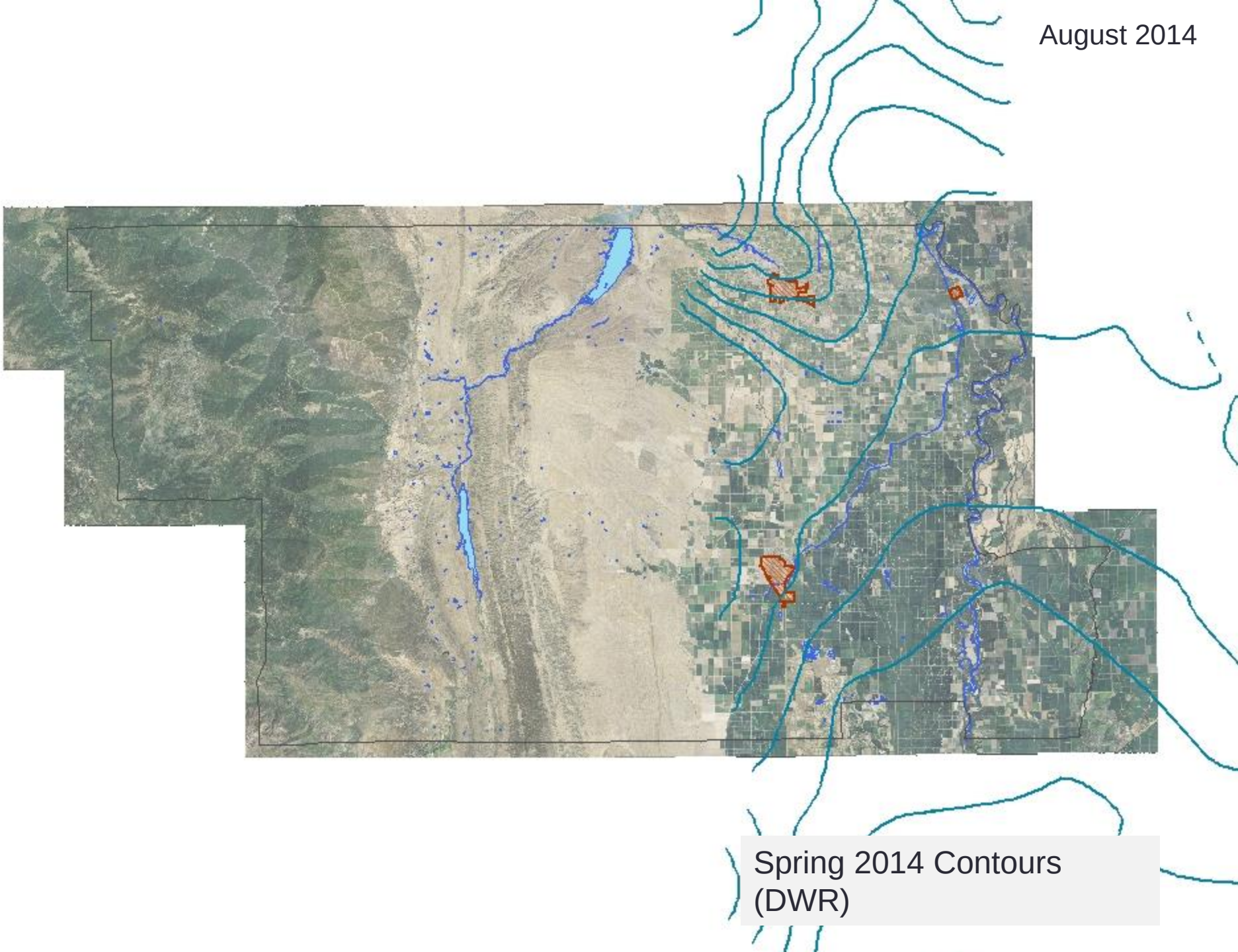


Draft “Area of Concern” and Groundwater Basins

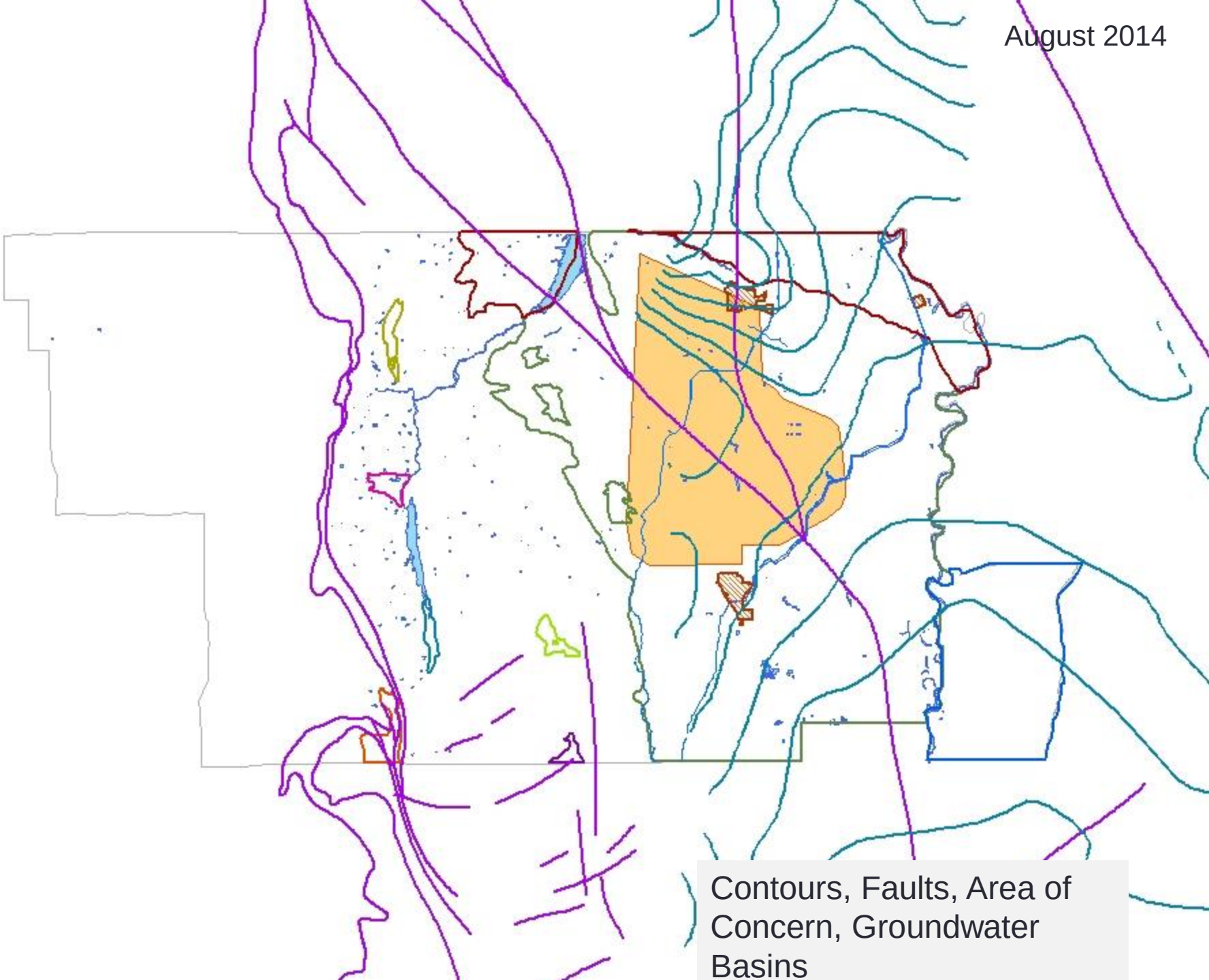
August 2014



Updated Faults (DWR)

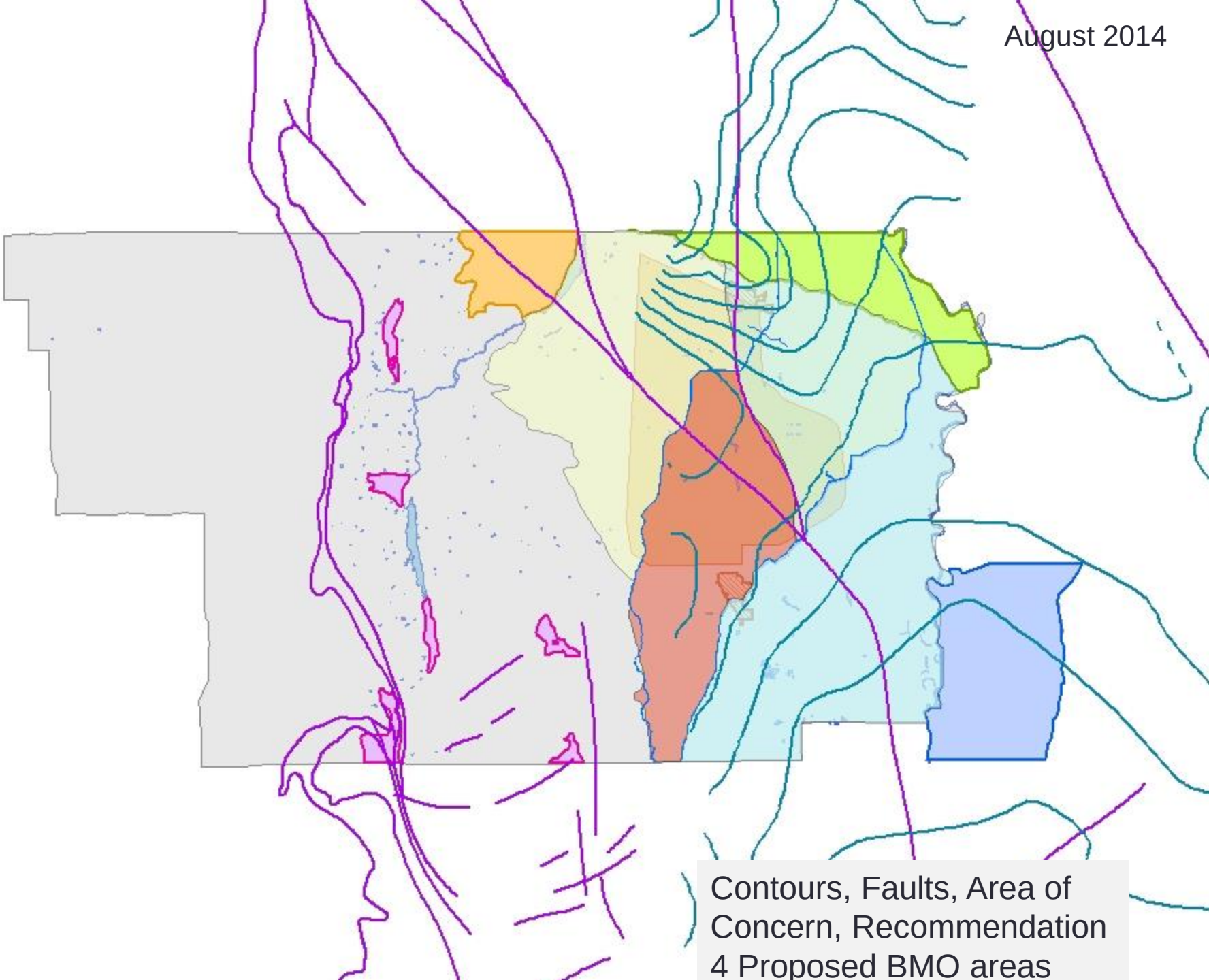

August 2014
Spring 2014 Contours (DWR)

August 2014



Contours, Faults, Area of Concern, Groundwater Basins

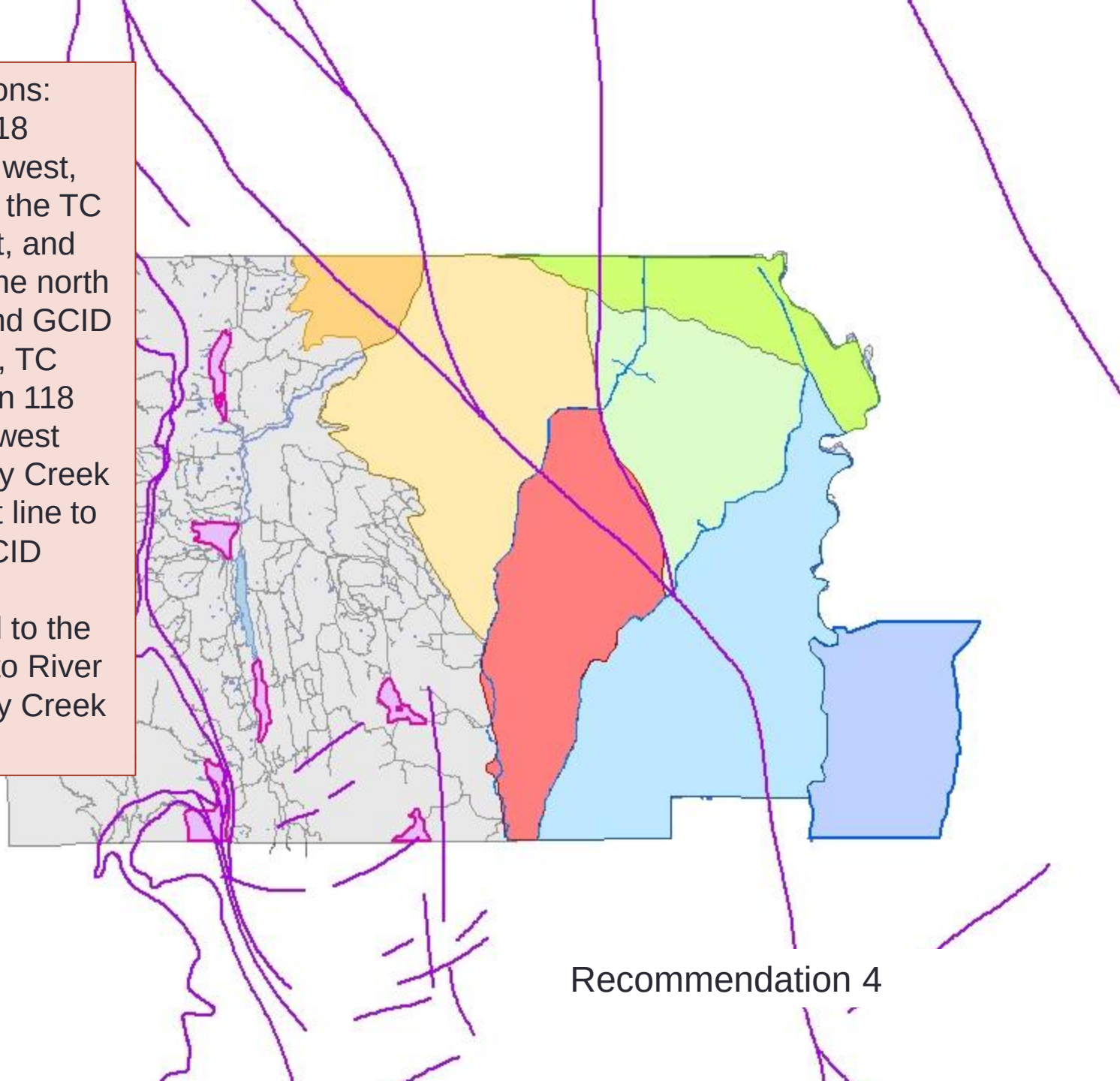
August 2014



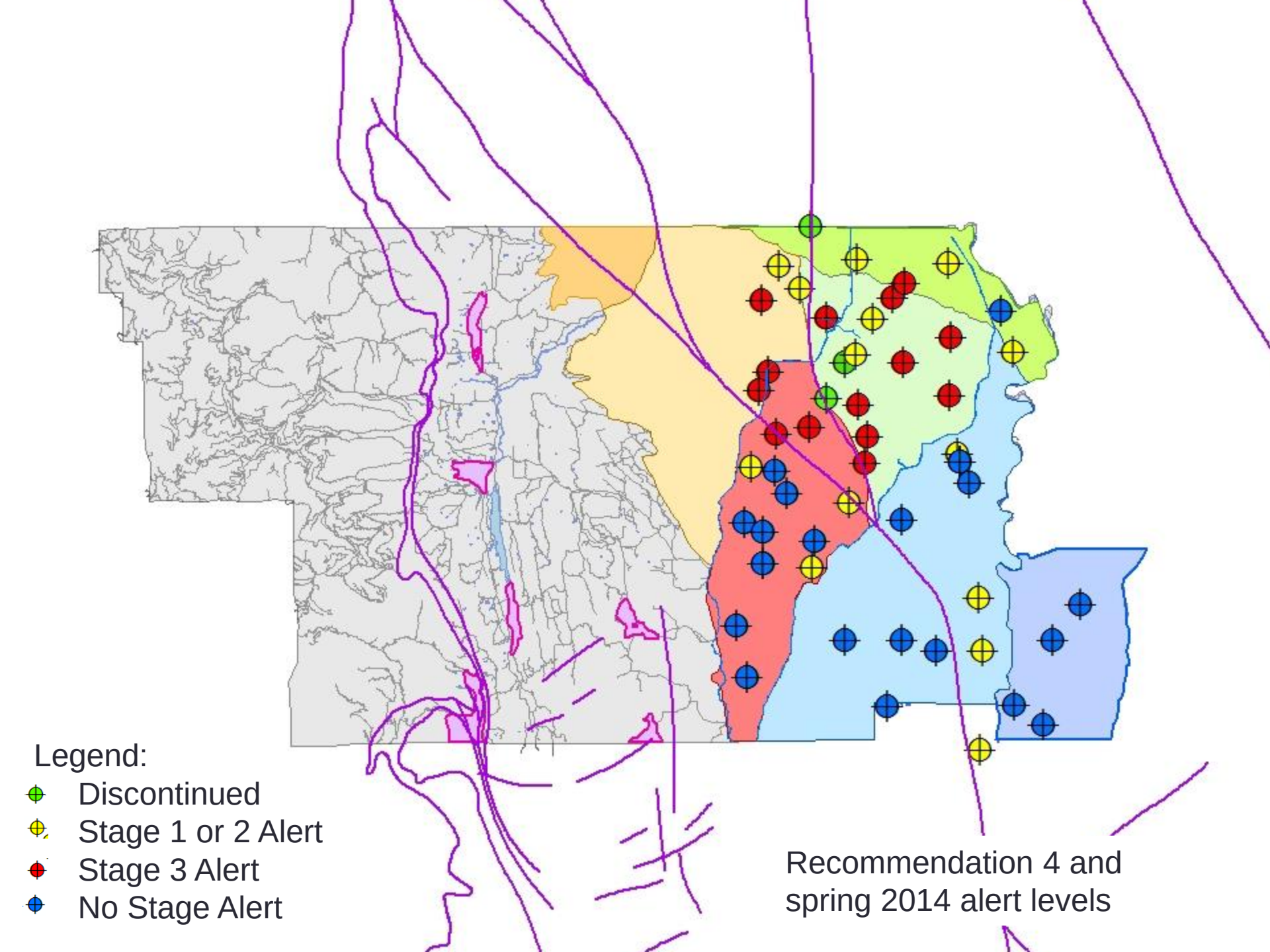
Contours, Faults, Area of Concern, Recommendation 4 Proposed BMO areas

Colusa Basin Divisions:

- Yellow-Bulletin 118 boundary on the west, the fault line and the TC Canal to the east, and Stony Creek to the north
- Red-Fault line and GCID canal to the east, TC canal and Bulletin 118 boundary to the west
- Light green-Stony Creek to the north, fault line to the west, and GCID canal to the east
- Blue-GCID canal to the west, Sacramento River to the east, Stony Creek to the north

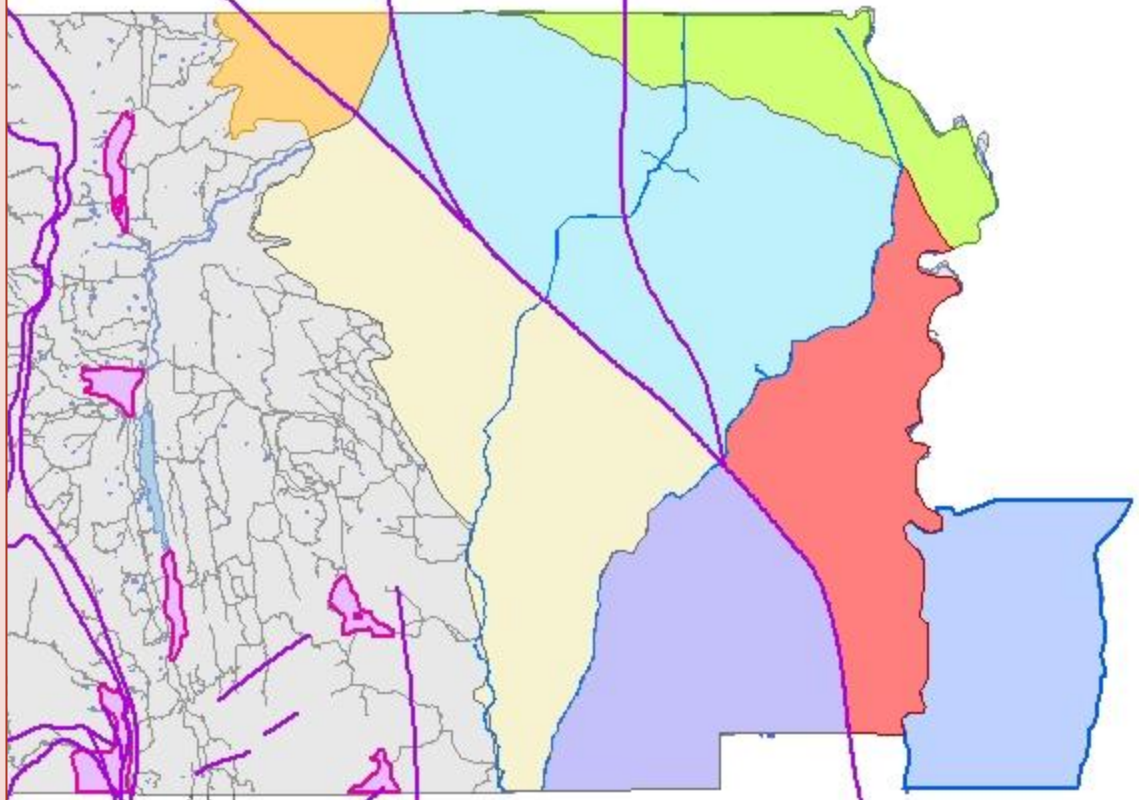


Recommendation 4

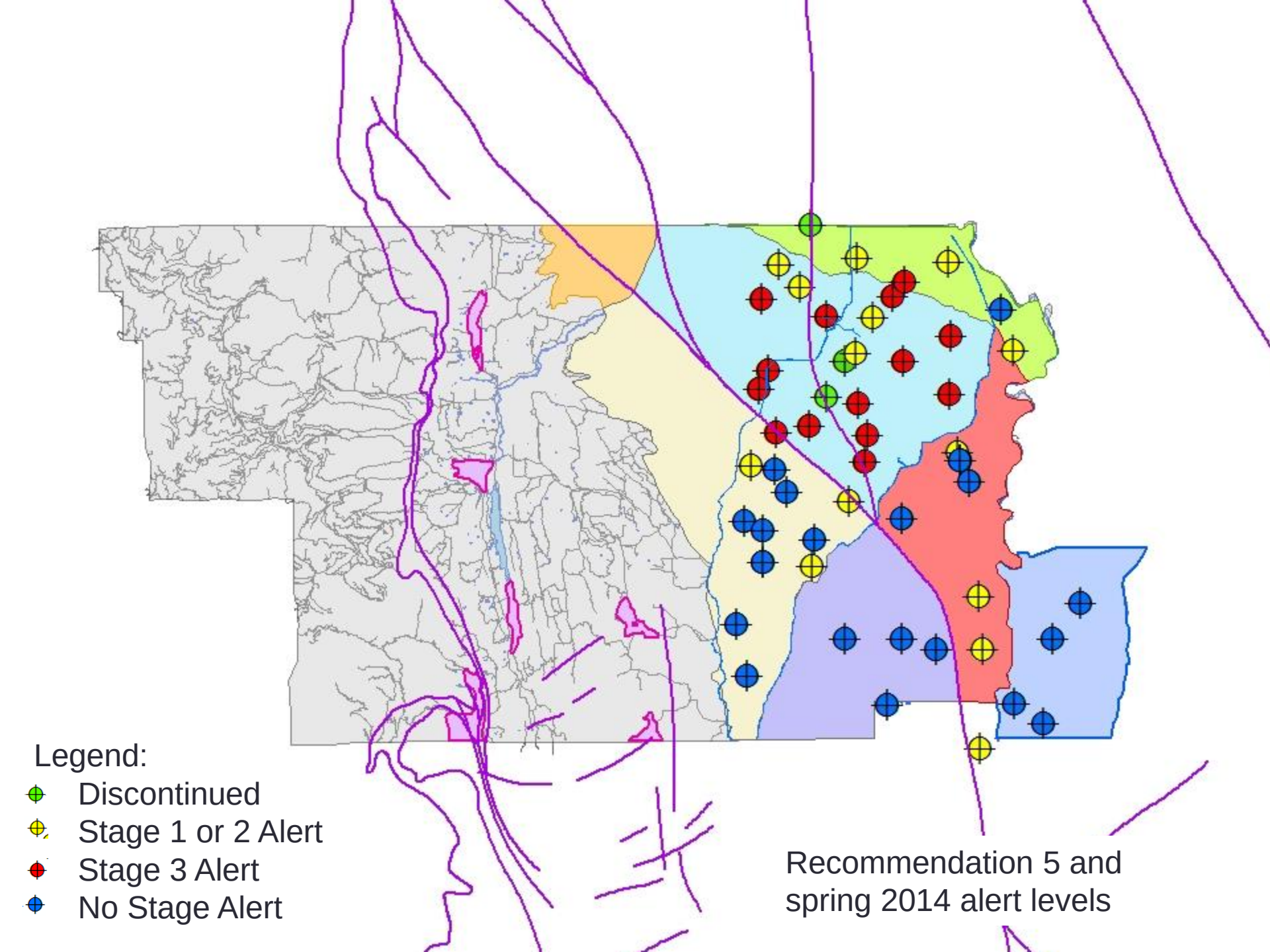

Legend:
Discontinued
Stage 1 or 2 Alert
Stage 3 Alert
No Stage Alert
Recommendation 4 and
spring 2014 alert levels

Colusa Basin Divisions:

- Yellow-Bulletin 118 boundary on the west, the fault line to the north, and the GCID Canal to the east
- Blue-Fault line to the south, Stony Creek to the north, and GCID canal to the east, and Bulletin 118 boundary to the west
- Red-Stony Creek to the north, GCID canal and fault line to the west, and Sacramento River to the east
- Purple-GCID canal to the west and the fault line to the east



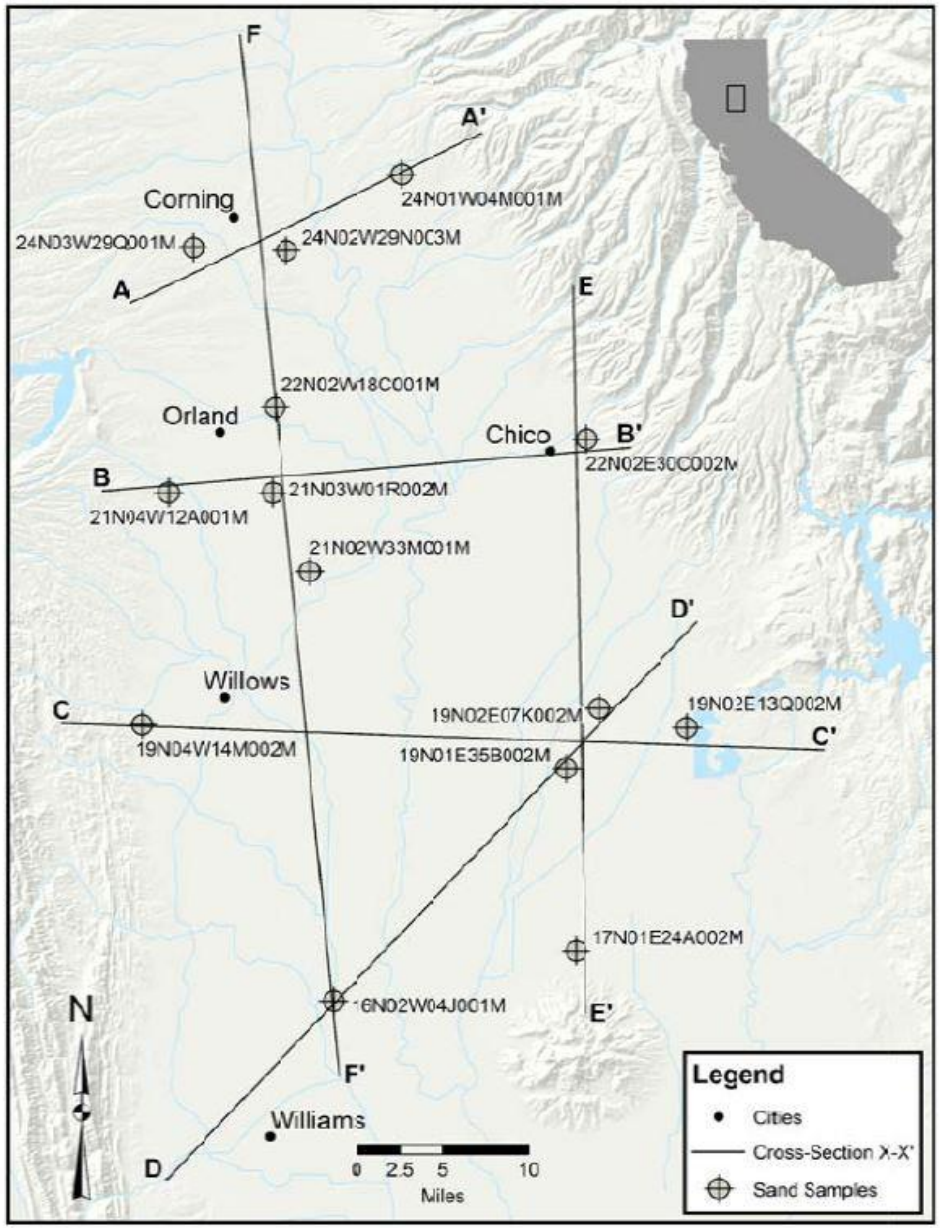
Recommendation 5

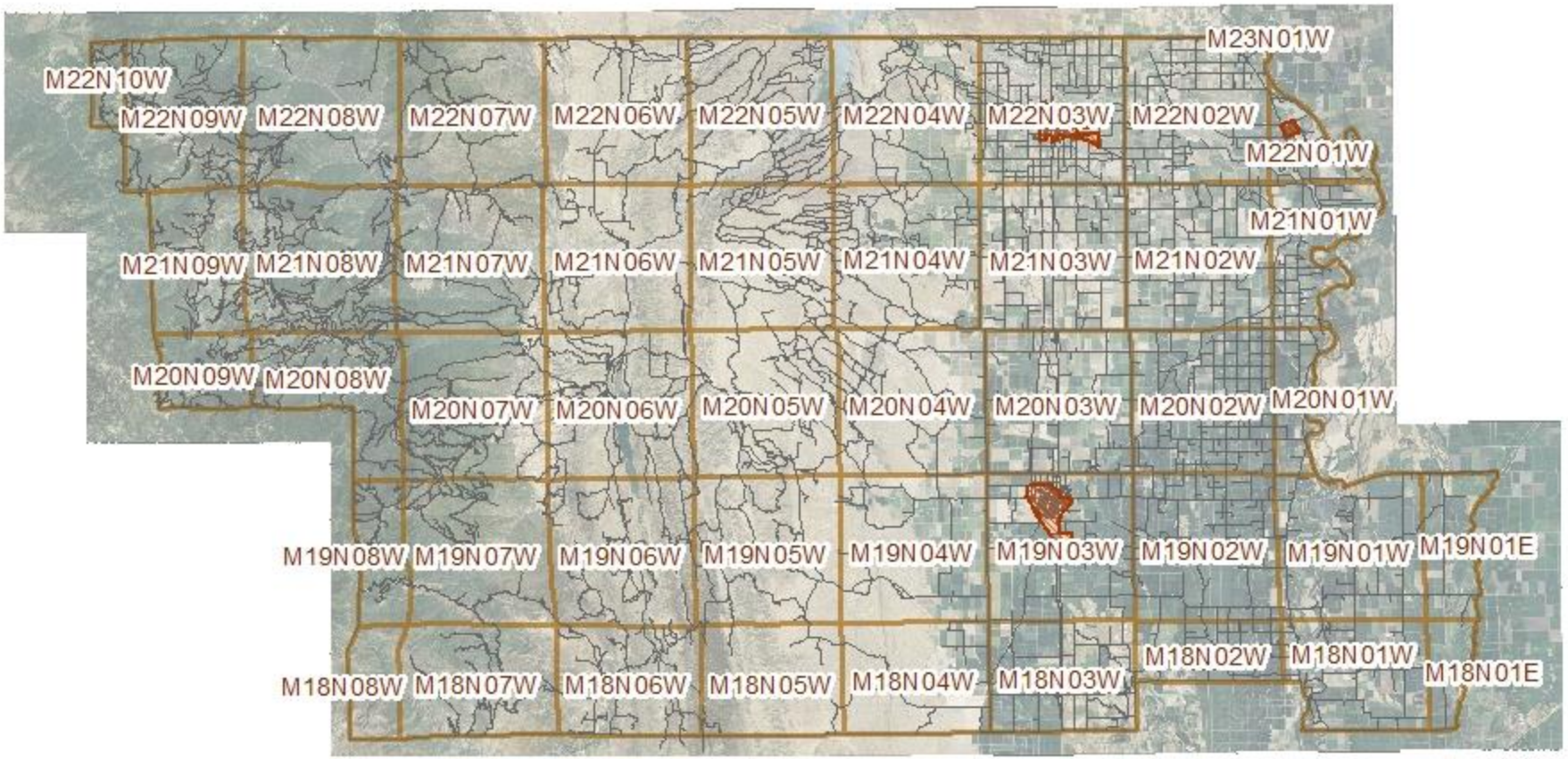

Legend:
Discontinued
Stage 1 or 2 Alert
Stage 3 Alert
No Stage Alert
Recommendation 5 and
spring 2014 alert levels

CROSS SECTIONS

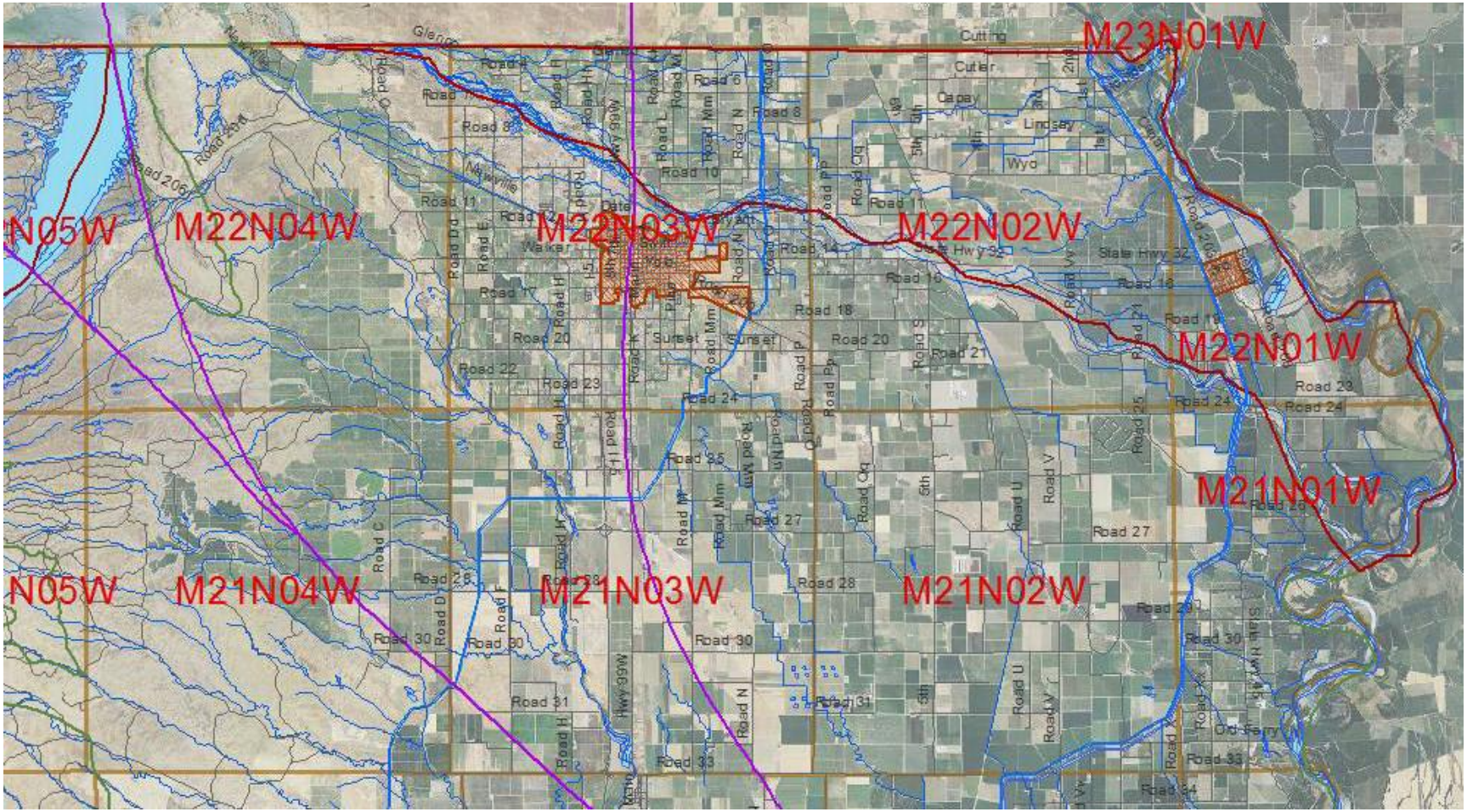
Provided by Department of Water Resources, Northern Region Office

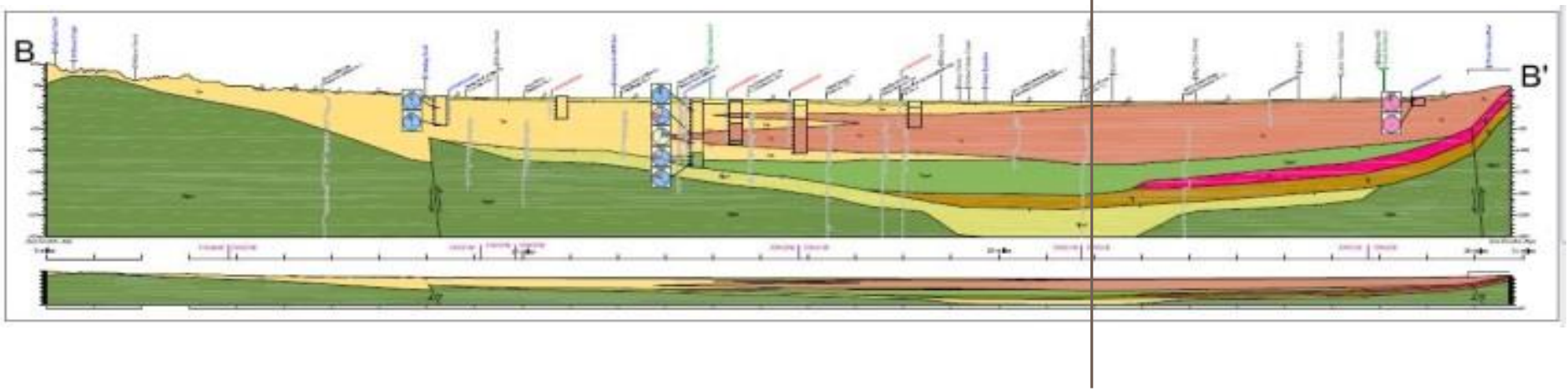
LOCATION MAP




M23N01W
M22N10W
M22N09W
M22N08W
M22N07W
M22N06W
M22N05W
M22N04W
M22N03W
M22N02W
M22N01W
M21N01W
M21N09W
M21N08W
M21N07W
M21N06W
M21N05W
M21N04W
M21N03W
M21N02W
M20N09W
M20N08W
M20N07W
M20N06W
M20N05W
M20N04W
M20N03W
M20N02W
M20N01W
M19N08W
M19N07W
M19N06W
M19N05W
M19N04W
M19N03W
M19N02W
M19N01W
M19N01E
M18N08W
M18N07W
M18N06W
M18N05W
M18N04W
M18N03W
M18N02W
M18N01W
M18N01E


M23N01W
M22N10W
M22N09W
M22N08W
M22N07W
M22N06W
M22N05W
M22N04W
M22N03W
M22N02W
M22N01W
M21N01W
M21N09W
M21N08W
M21N07W
M21N06W
M21N05W
M21N04W
M21N03W
M21N02W
M20N09W
M20N08W
M20N07W
M20N06W
M20N05W
M20N04W
M20N03W
M20N02W
M20N01W
M19N08W
M19N07W
M19N06W
M19N05W
M19N04W
M19N03W
M19N02W
M19N01W
M19N01E
M18N08W
M18N07W
M18N06W
M18N05W
M18N04W
M18N03W
M18N02W
M18N01W
M18N01E


M23N01W
N05W
M22N04W
M22N03W
M22N02W
M22N01W
N05W
M21N04W
M21N03W
M21N02W
M21N01W


B
B'

DESCRIPTION OF MAP UNITS

Q — **Includes the following formations:**

Qa — **Alluvium** (Holocene)-Includes surficial alluvium and stream channel deposits of unweathered gravel, sand and silt; maximum thickness 80 ft. *(adapted from Helley & Harwood, 1985).*

Qb — **Basin deposits** (Holocene)-Fine-grained silt and clay derived from adjacent mountain ranges; maximum thickness up to 200 ft. *(adapted from Helley & Harwood, 1985)*.

Qm — **Modesto Formation** (Pleistocene)-Includes upper and lower formation members. Alluvial fan and terrace deposits consisting of unconsolidated weathered and unweathered gravel, sand, silt and clay; maximum thickness approximately 200 ft. *(adapted from Helley & Harwood, 1985).*

Qr — **Riverbank Formation** (Pleistocene)-Includes upper and lower formation members. Alluvial fan and terrace deposits consisting of unconsolidated to semi-consolidated gravel, sand, and silt; maximum thickness approximately 200 ft. *(adapted from Helley & Harwood, 1985).*

Qrb — **Red Bluff Formation**

Qtm — **Tuff Breccia** (Plio-Pleistocene)-Tuff breccia forming outer ring surrounding the Sutter Buttes *(adapted from Helley & Harwood, 1985)*.

ozoic **Qta** — **Volcanic Andesites**, Undifferentiated (Plio–Pleistocene)-Younger andesites forming the center of the Sutter Buttes *(adapted from Helley & Harwood, 1985).*

Tte — **Tehama Formation** (Plio–Pleistocene)-Includes Red Bluff Formation. Pale green, gray and tan sandstone and siltstone with lenses of pebble and cobble conglomerate; maximum thickness 2,000 ft. *(adapted from Helley & Harwood, 1985).*

Tt — **Tuscan Formation** (Plio–Pleistocene)-Interbedded lahars, volcanic conglomerate, volcanic sandstone, siltstone, and pumiceous tuff *(adapted from Helley & Harwood, 1985).* Includes the following unit divisions:

Ttd — **Tuscan Unit D** (Plio–Pleistocene)-Fragmental flow deposits characterized by monolithic masses containing gray hornblende and basaltic andesites and black pumice; maximum thickness 160 ft. *(adapted from Helley & Harwood, 1985).*

Ttc — **Tuscan Unit C** (Plio–Pleistocene)-Includes Red Bluff Formation. Volcanic lahars with some interbedded volcanic conglomerate and sandstone, and reworked sediments; maximum thickness 600 ft. *(adapted from Helley & Harwood, 1985).*

Ttb — **Tuscan Unit B** (Pliocene)-Layered, interbedded lahars, volcanic conglomerate, volcanic sandstone and siltstone; maximum thickness 600 ft. *(adapted from Helley and Harwood, 1985).*

Tta — **Tuscan Unit A** (Pliocene)-Interbedded lahars, volcanic conglomerate, volcanic sandstone, and siltstone containing metamorphic rock fragments; maximum thickness 400 ft. *(adapted from Helley & Harwood, 1985).*

Tla — **Laguna Formation** (Pliocene)-Interbedded alluvial gravel, sand, and silt; maximum thickness 450 feet. *(adapted from Helley & Harwood, 1985; Olmsted and Davis, 1961; DWR Bulletin 118-6, 1978).*

Tupvf — **Upper Princeton Valley Fill** (Miocene)-Non–marine sediments composed of sandstone with interbeds of mudstone, occasional conglomerate, and conglomerate sandstone; maximum thickness 1,400 ft. *(adapted from Redwine, 1972).*

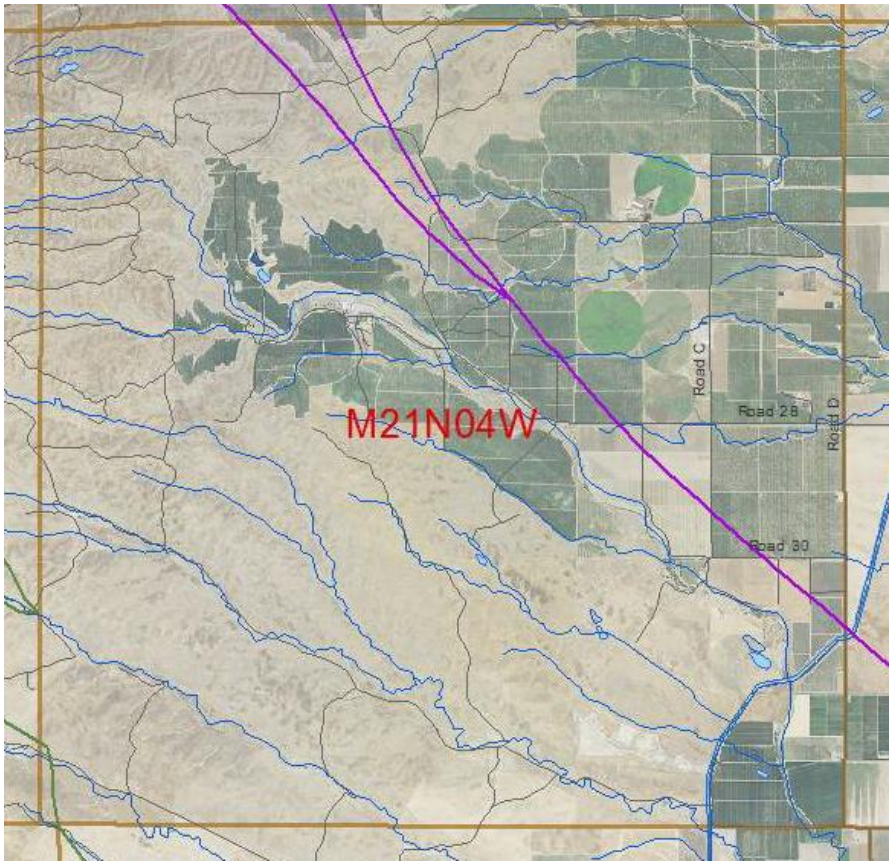
Tl — **Lovejoy Basalt** (early Miocene)-Black, dense, hard microcrystalline basalt; maximum thickness 65 ft. *(adapted from Helley & Harwood, 1985).*

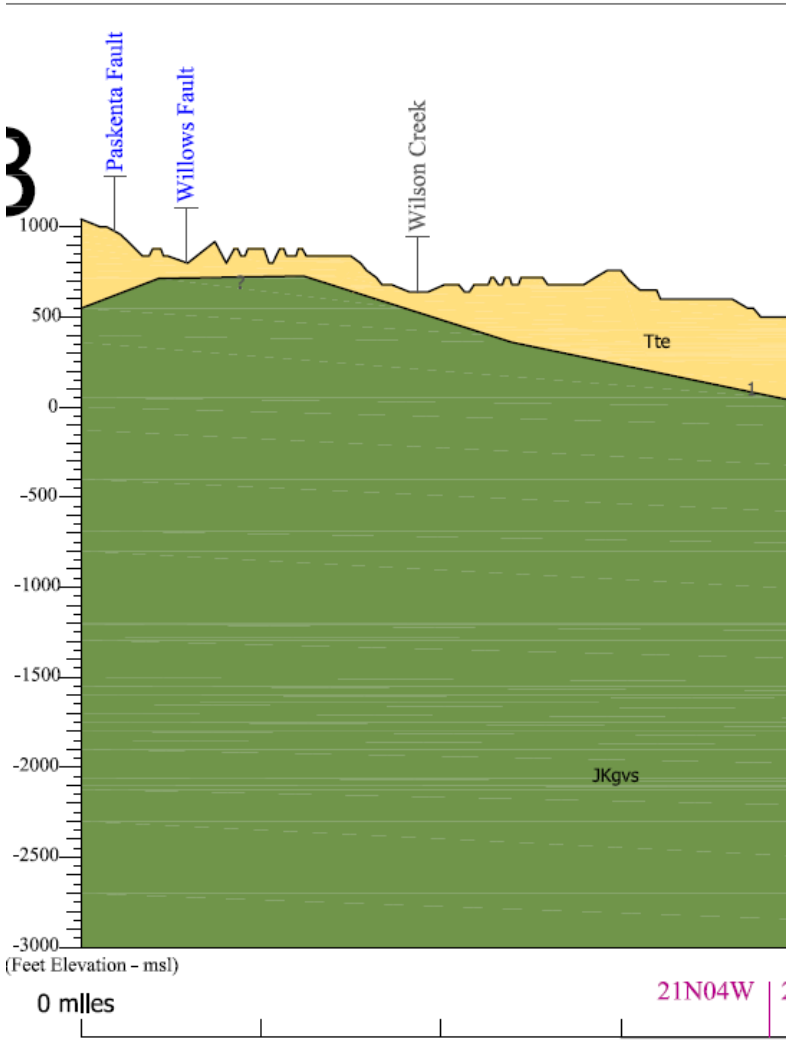
ozoic **Ti** — **Ione Formation** (Eocene)-Marine to non–marine deltaic sediments, light colored, commonly white conglomerate, sandstone and siltstone, soft and easily eroded; maximum thickness 650 ft. *(adapted from DWR Bulletin 118-6, 1978; Creely, 1965).*

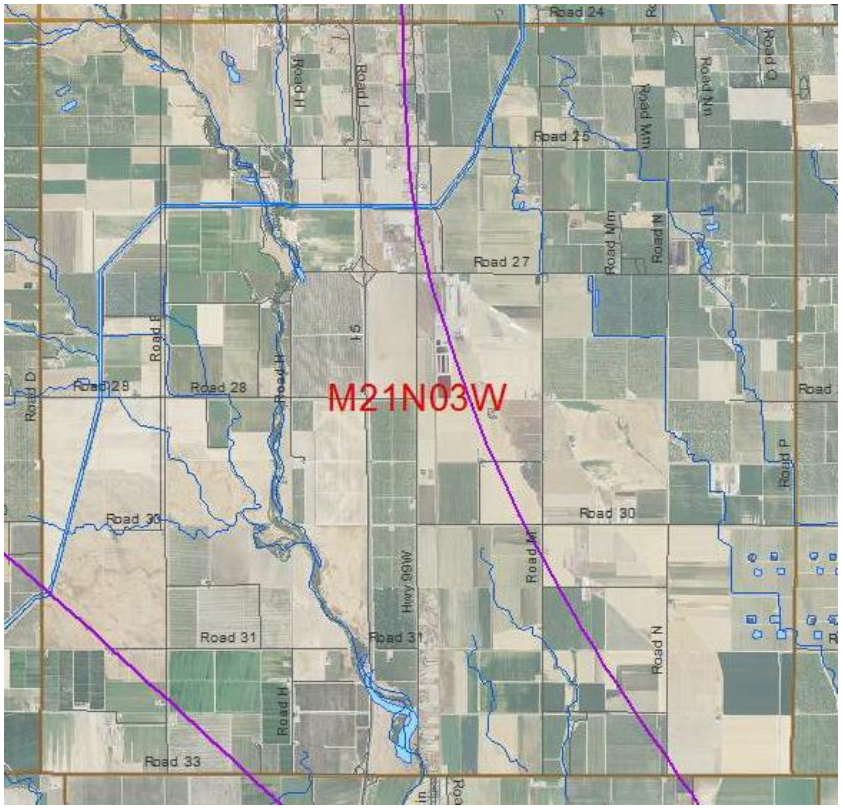
Tlpvf — **Lower Princeton Valley Fill** (Eocene)-Includes Capay Formation. Marine sandstone, conglomerate, and interbedded silty shale; maximum thickness 2,400 ft. *(adapted from Redwine, 1972)*

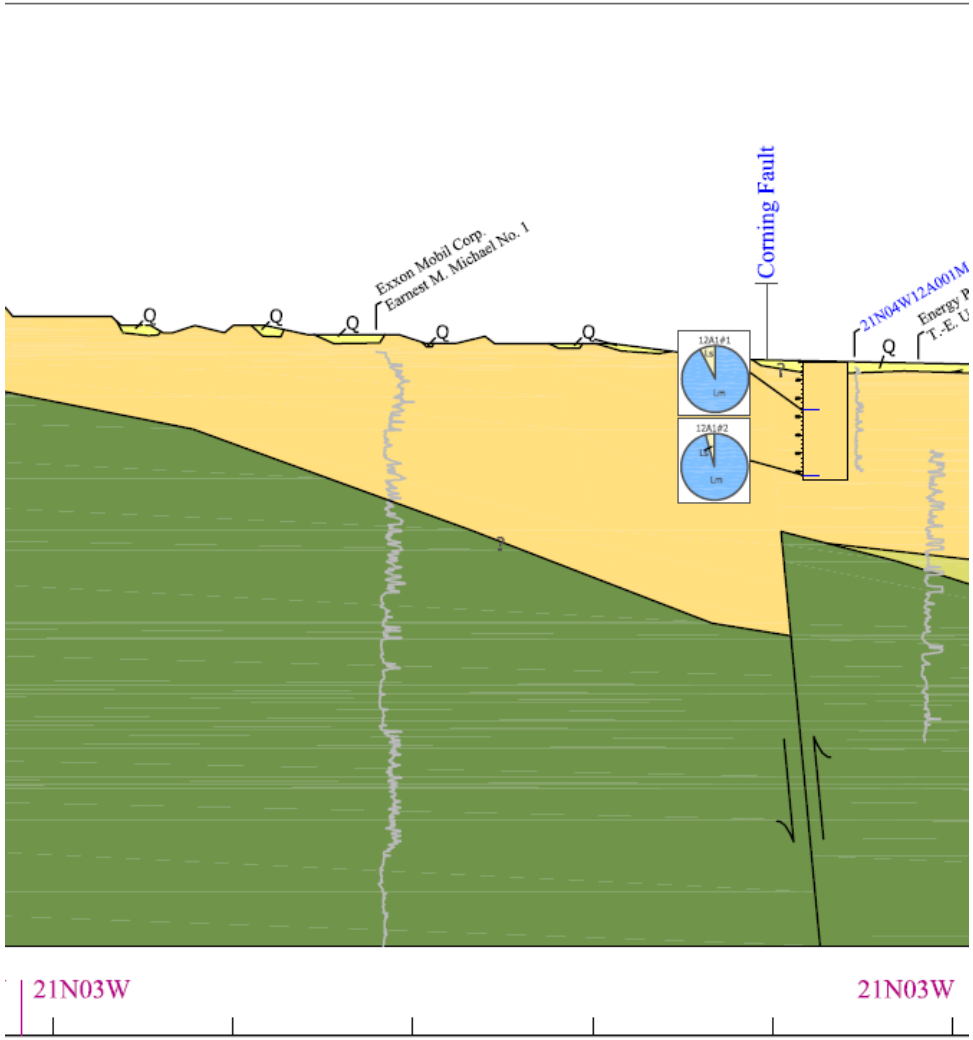
JKgvs — **Great Valley Sequence** (Late Jurassic to Upper Cretaceous)-Marine clastic sedimentary rock consisting of siltstone, shale, sandstone, and conglomerate; maximum thickness 15,000 ft.

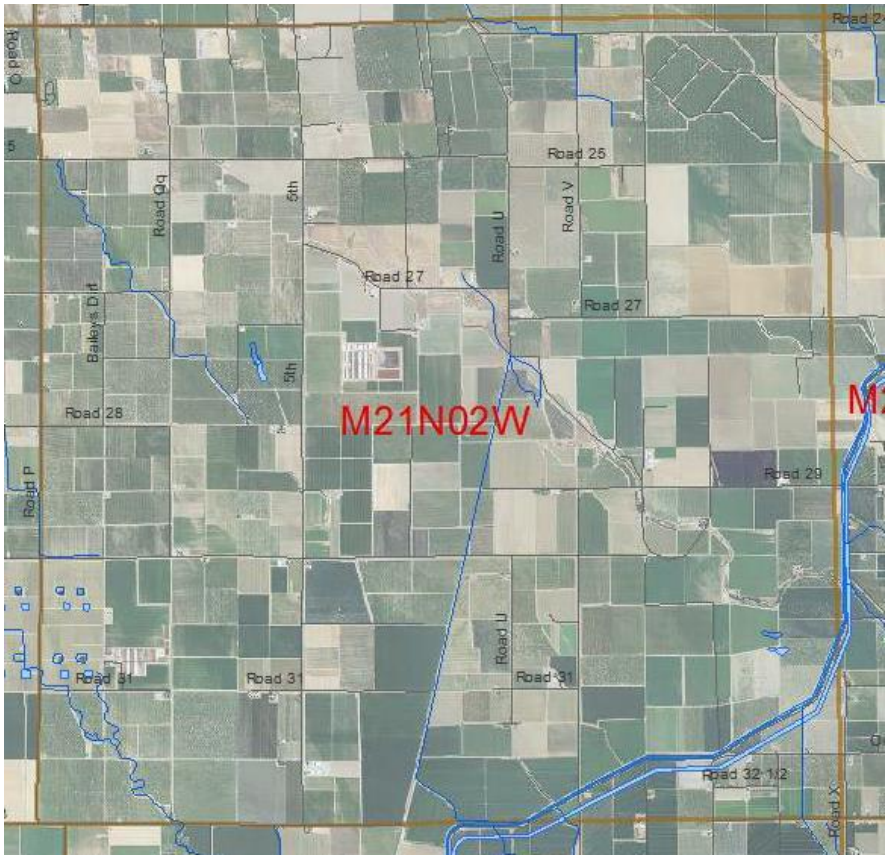
pKmi — **Metamorphic and Igneous Rocks** (pre–Cretaceous)-Undivided. Slate, quartzite, metaconglomerate, marble, metamorphic rocks, serpentinite, metagabbro, diorite, and monzonite; maximum thickness unknown. *(adapted from Helley & Harwood, 1985).*

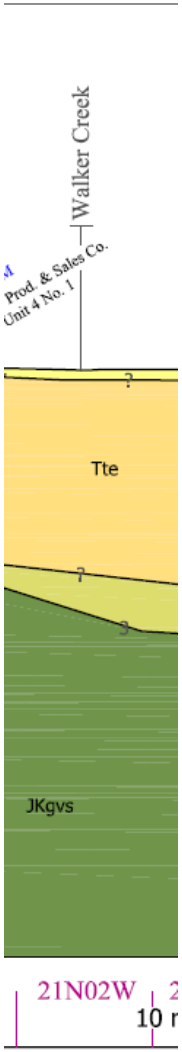

M21N04W
Road C
Road 28
Road D
Road 30


B
Paskenta Fault
Willows Fault
Wilson Creek
1000
500
0
-500
-1000
-1500
-2000
-2500
-3000
Tte
JKgvs
(Feet Elevation - msl)
0 miles
21N04W

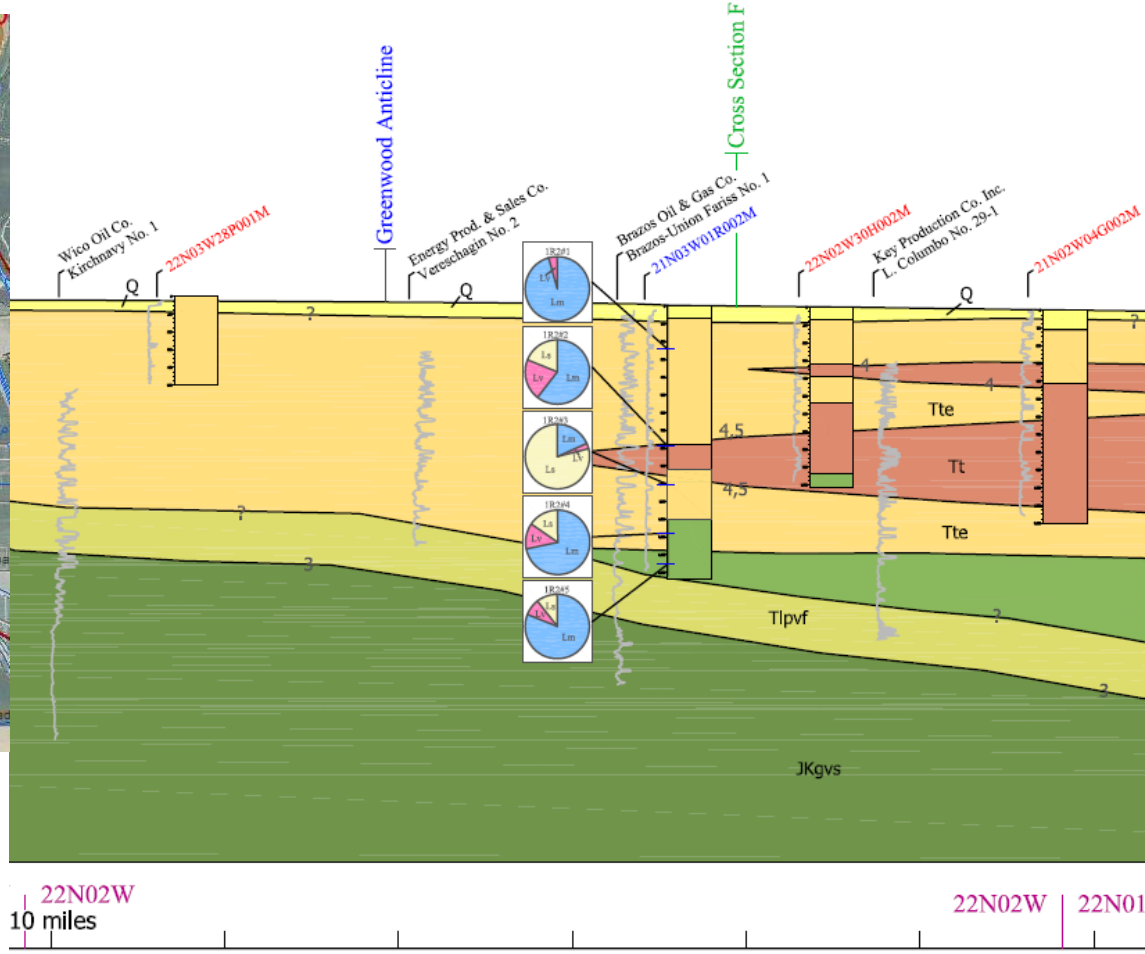

M21N03W
Road 24
Road 25
Road 27
Road 28
Road 29
Road 30
Road 31
Road 33
Road H
Road I
Road K
Road M
Road N
Road P
Hwy 99W


Exxon Mobil Corp.
Earnest M. Michael No. 1
Corning Fault
21N04W12A001M
12A1#1
12A1#2
Q
21N03W
21N03W

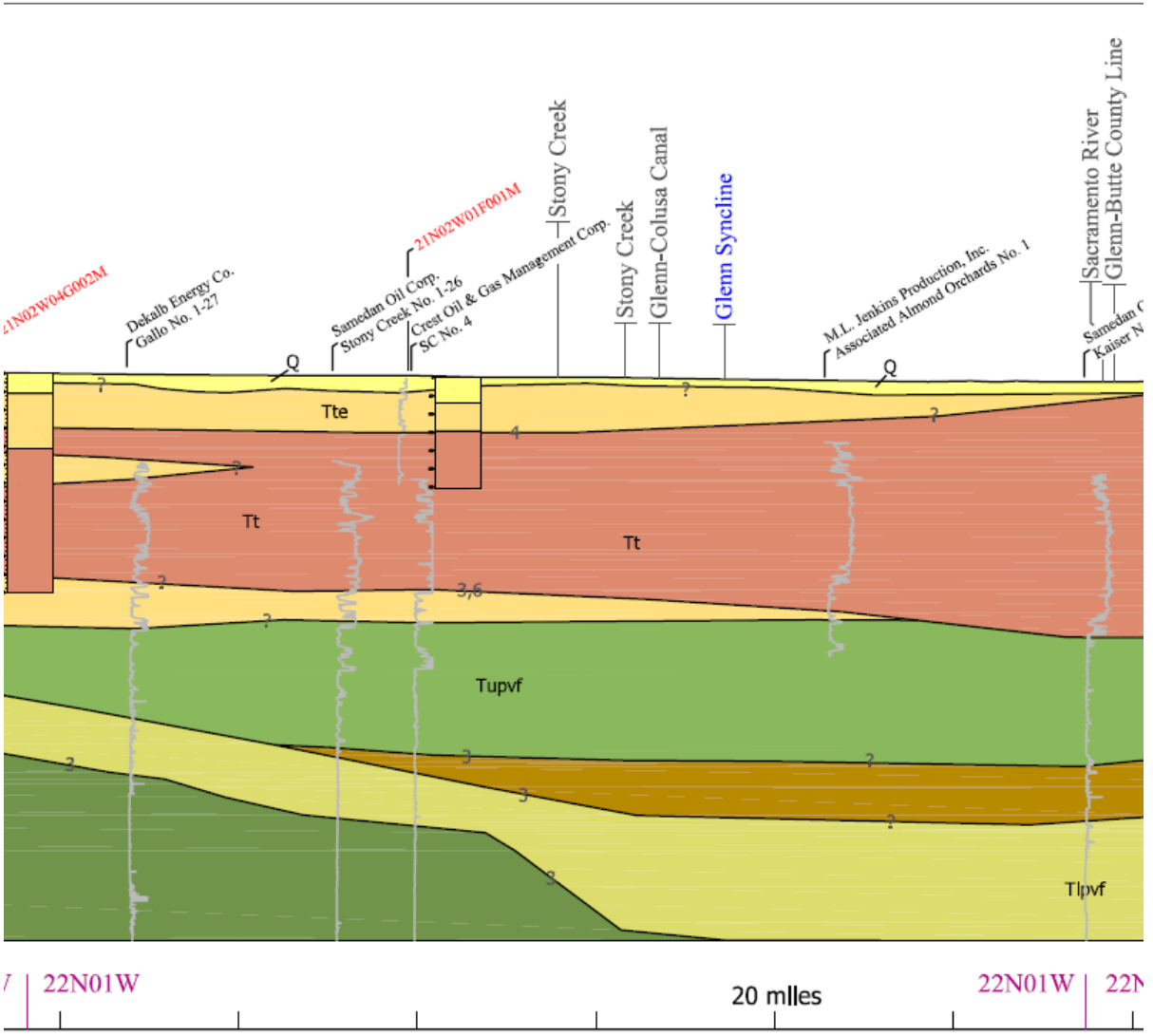

Road 25
Road Qb
5th
Road U
Road V
Road 27
Road 27
Bailey's Dirt
5th
Road 28
M21N02W
Road 29
Road P
Road 31
Road 31
Road 31
Road U
Road 32 1/2
Road X


Walker Creek
Prod. & Sales Co.
Unit 4 No. 1
?
Tte
?
?
JKgvs
21N02W
10 r


Cutting
Cutler
Capay
Lindsey
Lindsey Canal
Road 11
Road 14
Road 15
Road 16
Road 19
Road 20
Road 21
State Hwy 32
M22N02W


Greenwood Anticline
Cross Section F
Wico Oil Co.
Kirchnavy No. 1
22N03W28P001M
Energy Prod. & Sales Co.
Vereschagin No. 2
Brazos Oil & Gas Co.
Brazos-Union Fariss No. 1
21N03W01R002M
22N02W30H002M
Key Production Co. Inc.
L. Columbo No. 29-1
21N02W04G002M
Q
Tte
Tt
Tlpvf
JKgvs
4.5
4,5
22N02W
10 miles
22N02W
22N01


N01W
M22N01W
Road 19
Road 21
Road 23
Road 24
Road 24
Road 203
Road 208
State Hwy
Rogers Ranch


21N02W04G002M
Dekalb Energy Co.
Gallo No. 1-27
Samedan Oil Corp.
Stony Creek No. 1-26
21N02W01F001M
Crest Oil & Gas Management Corp.
SC No. 4
Stony Creek
Stony Creek
Glenn-Colusa Canal
Glenn Syncline
M.L. Jenkins Production, Inc.
Associated Almond Orchards No. 1
Sacramento River
Glenn-Butte County Line
Q
Q
Tte
Tt
Tt
Tupvf
Tlpvf
4
3,6
22N01W
20 miles
22N01W

STAGE ALERT

Definitions, Actions, Enforcement

Stage Alert Definitions

- How many stage alert levels are necessary? Currently 3
- Period of Record: Entire record of well or specific timeframe (1976-2014)
- Season: Spring or Fall, Both
- Measurements: Average or Low
- Determination: 1 standard deviation below the average of spring measurements (stage 1), or 2 standard deviations below the average of spring measurements (stage 2 & 3)

Stage Alert Actions (Compliance)

- Stage 1: Informational- report WAC and notify the public
- Stage 2: Informational-report to WAC and public; Investigational- WAC direct TAC to investigate, determine possible cause, recommend how to address. TAC present to WAC in a timely manner.
- Stage 3: Informational-report to WAC and public; Investigational-WAC direct TAC to investigate, determine possible cause, recommend how to address. TAC present to WAC in a timely manner; Actionable-WAC to work with local and adjoining BMO areas, implement adaptive management activities necessary to correct issue.

Adaptive Management

- Adaptive Management shall include, but not limited to: voluntary water conservation measures, redistribution or reduction of groundwater extraction, and/or other measures(s) referred to or identified in Ordinance 1115 as recommended by the WAC and approved by the BOS.

When to Rescind the Stage Alert

- Stage 1,2, and 3 shall be rescinded when measured groundwater surface elevations return to an elevation above 1 standard deviation for the corresponding BMO key well

Enforcement Actions

- Adaptive management-should it be more specific?

OTHER THOUGHTS AND SUGGESTIONS