Eastside Water District

Geologic, Hydrologic, and Hydrogeologic Characterizations for Potential Managed Aquifer Recharge of Diffused Stormwater

Prepared By:

Presented By:

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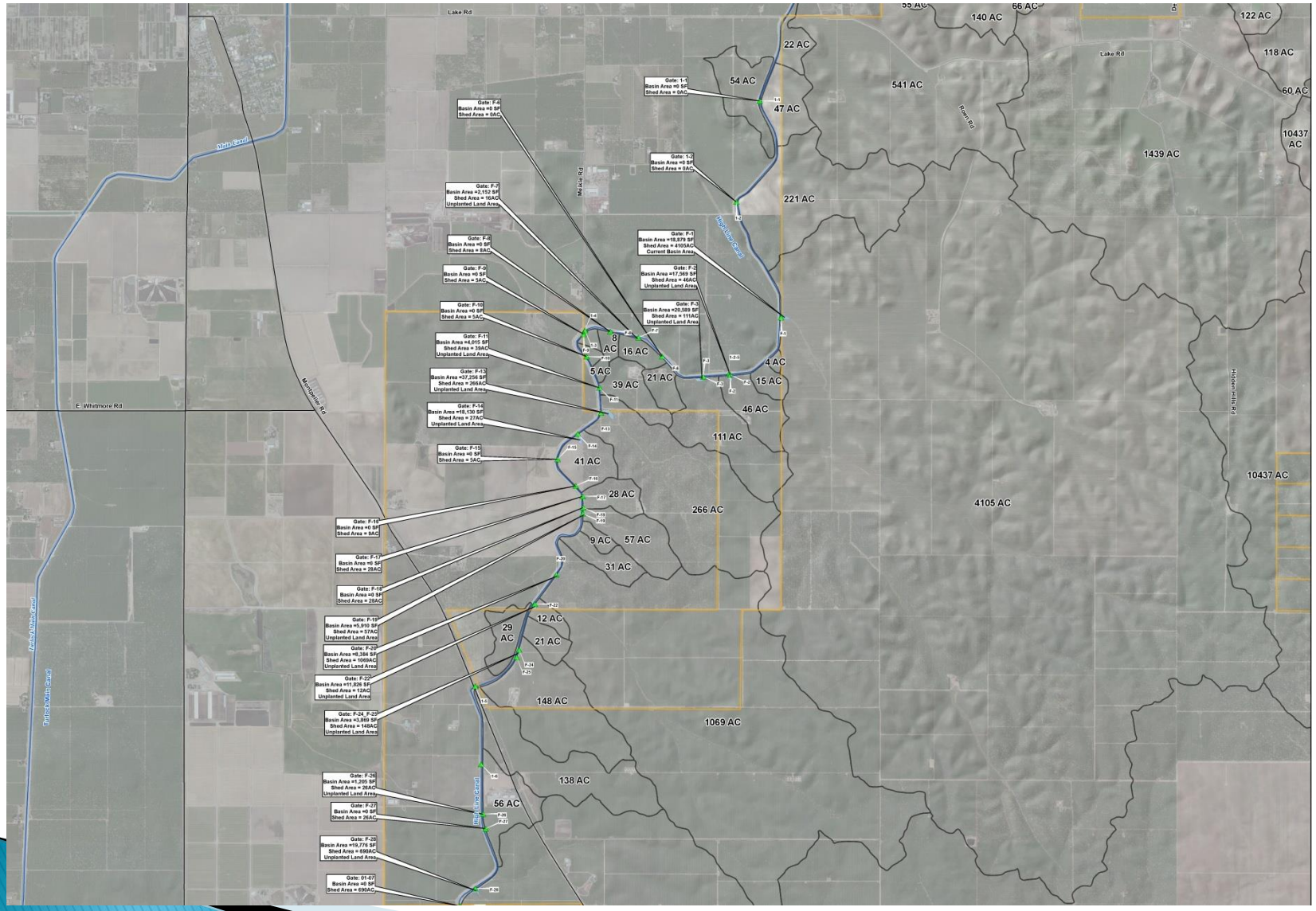
Principal Hydrogeologist/Wood Rodgers

November 21, 2014

Hydrologic and Geologic Objectives for Eastside Water District MAR Project

- Identify Diffused Stormwater Flow Areas and Stormwater Entry Points to TID Canals
- Evaluate Geology beneath and around EWD
- Evaluate Good Locations for Aquifer Recharge
  - Based on Groundwater Elevations and Depth to Water
  - Based on Hydraulic Conductivity in the Unsaturated Zone
  - Based on USDA Near-Surface Soil Mapping of EWD
- Develop Prospective MAR-Site Identification-Criteria
- Provide Technical Support to MAR Site Selection

Diffused Stormwater



Geologic Map

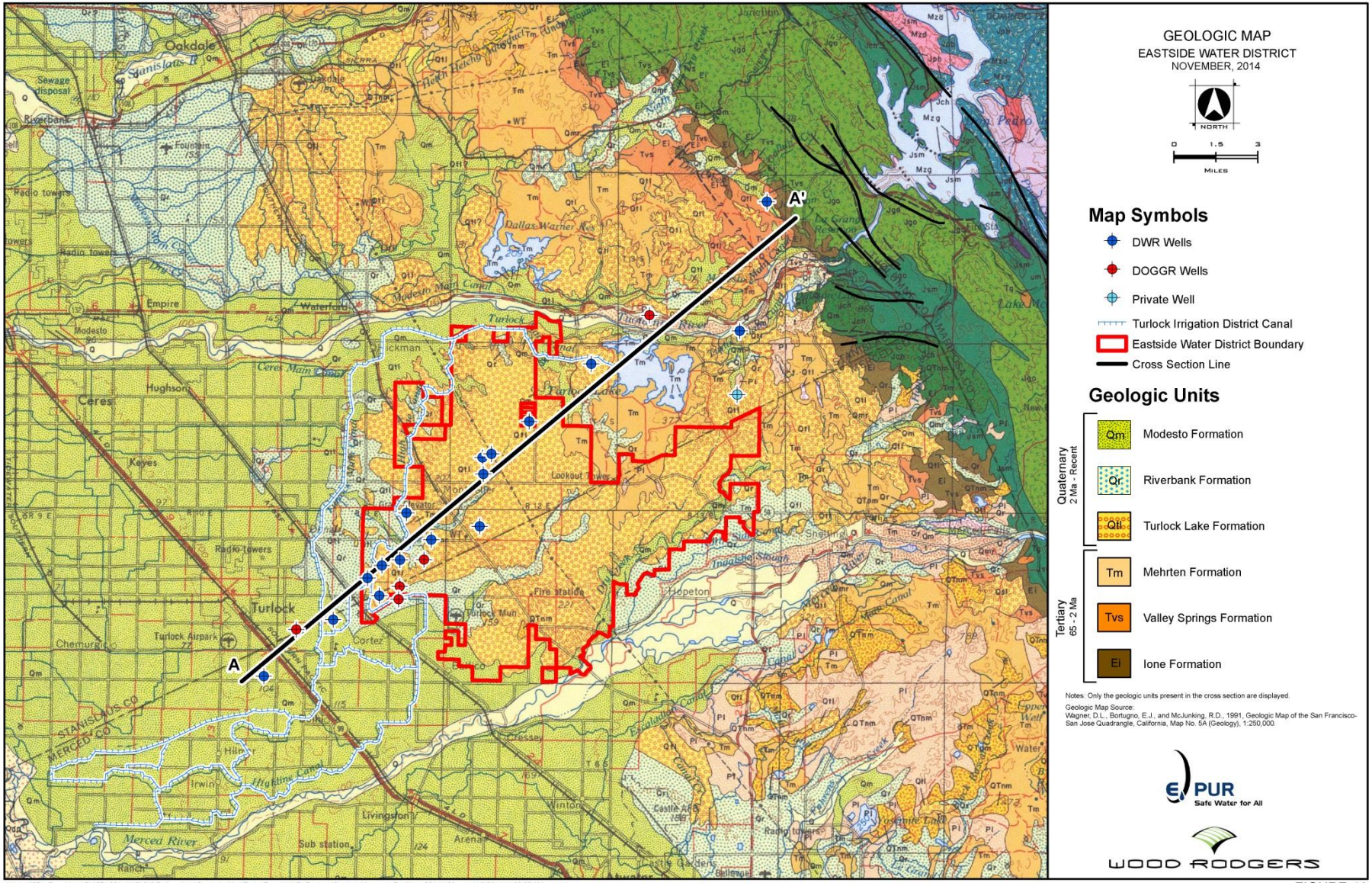


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FIGURE 4A

Geologic Cross-Section

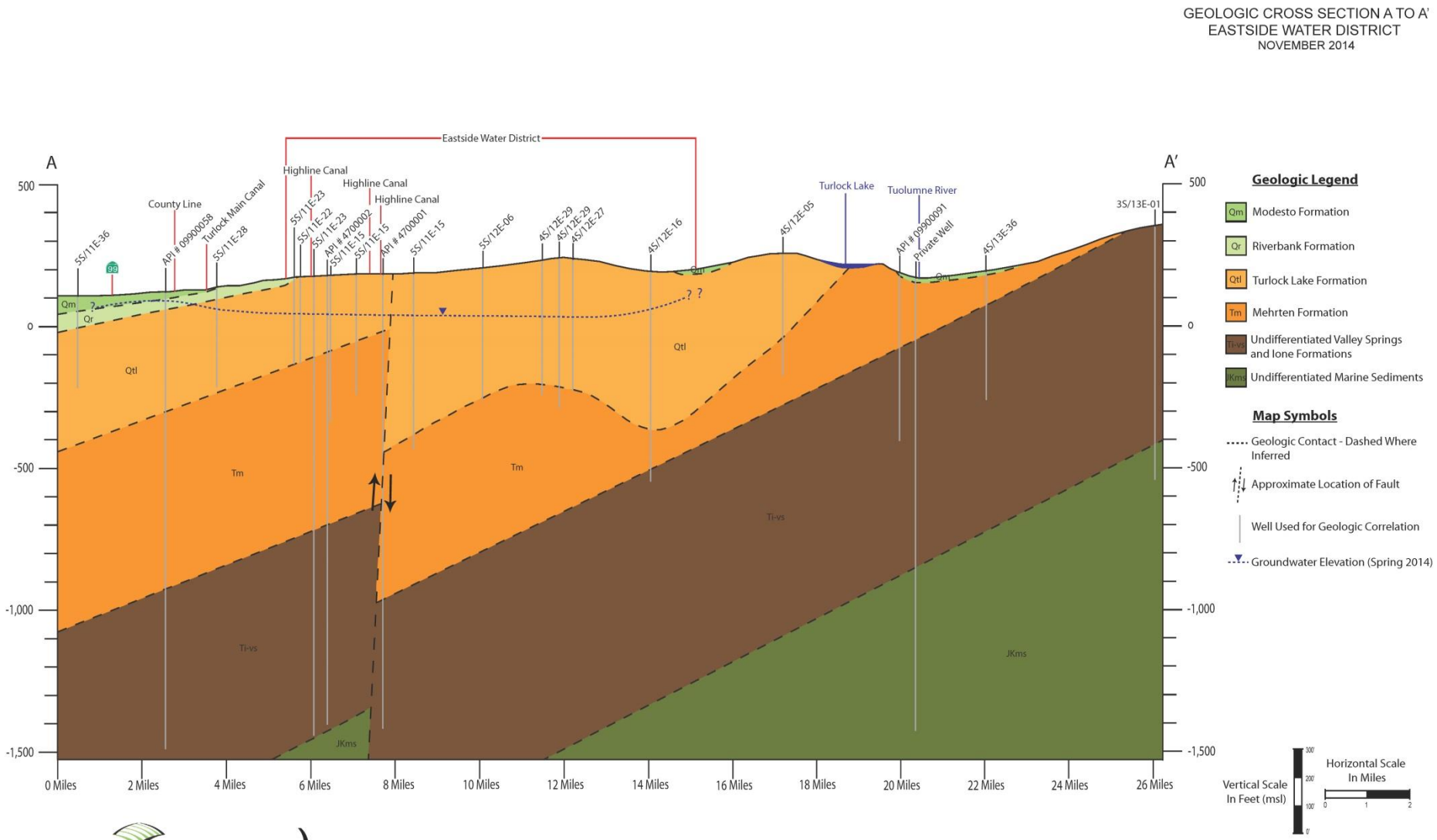

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FIGURE 4B

Historic Groundwater Elevations

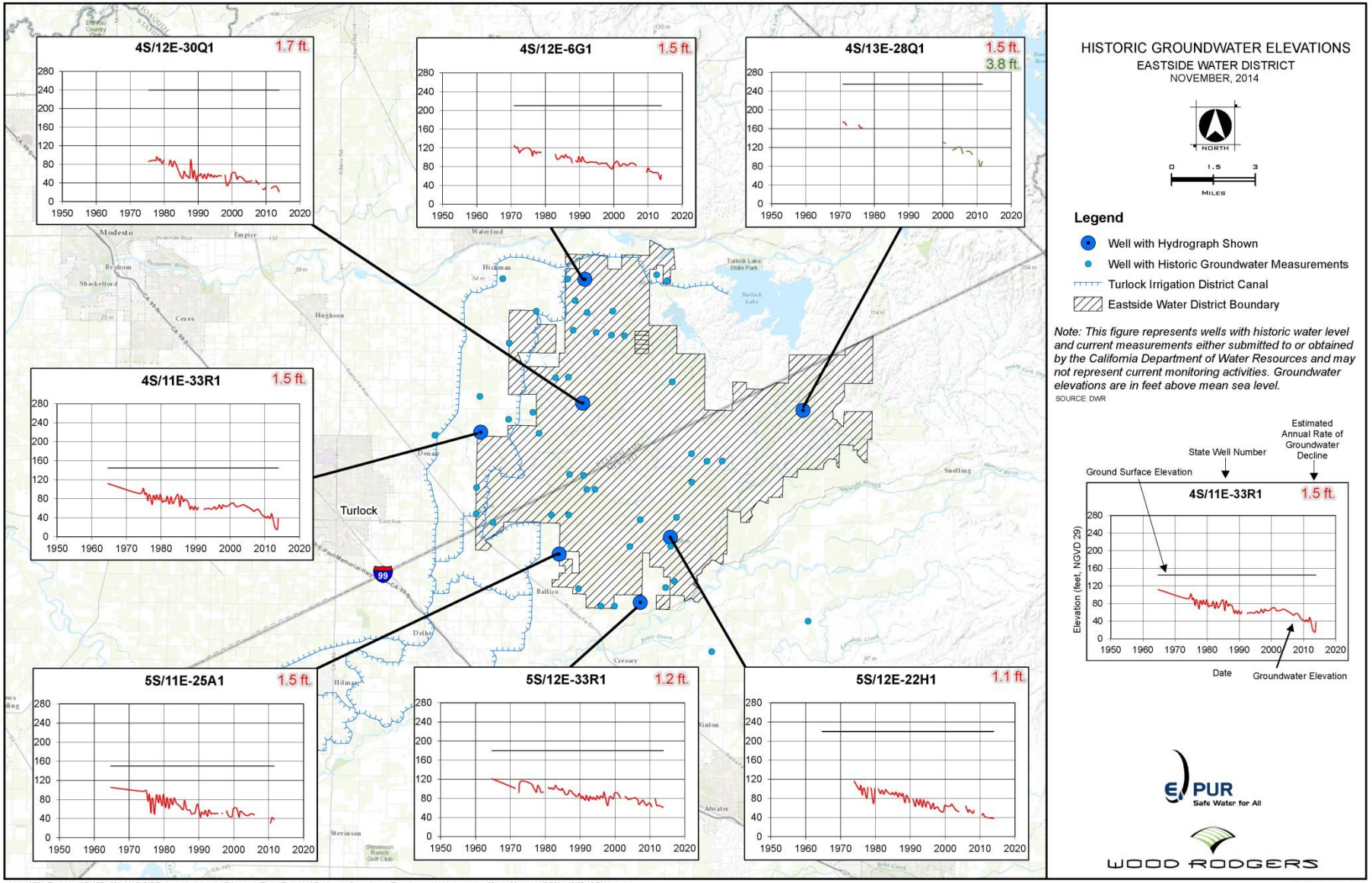

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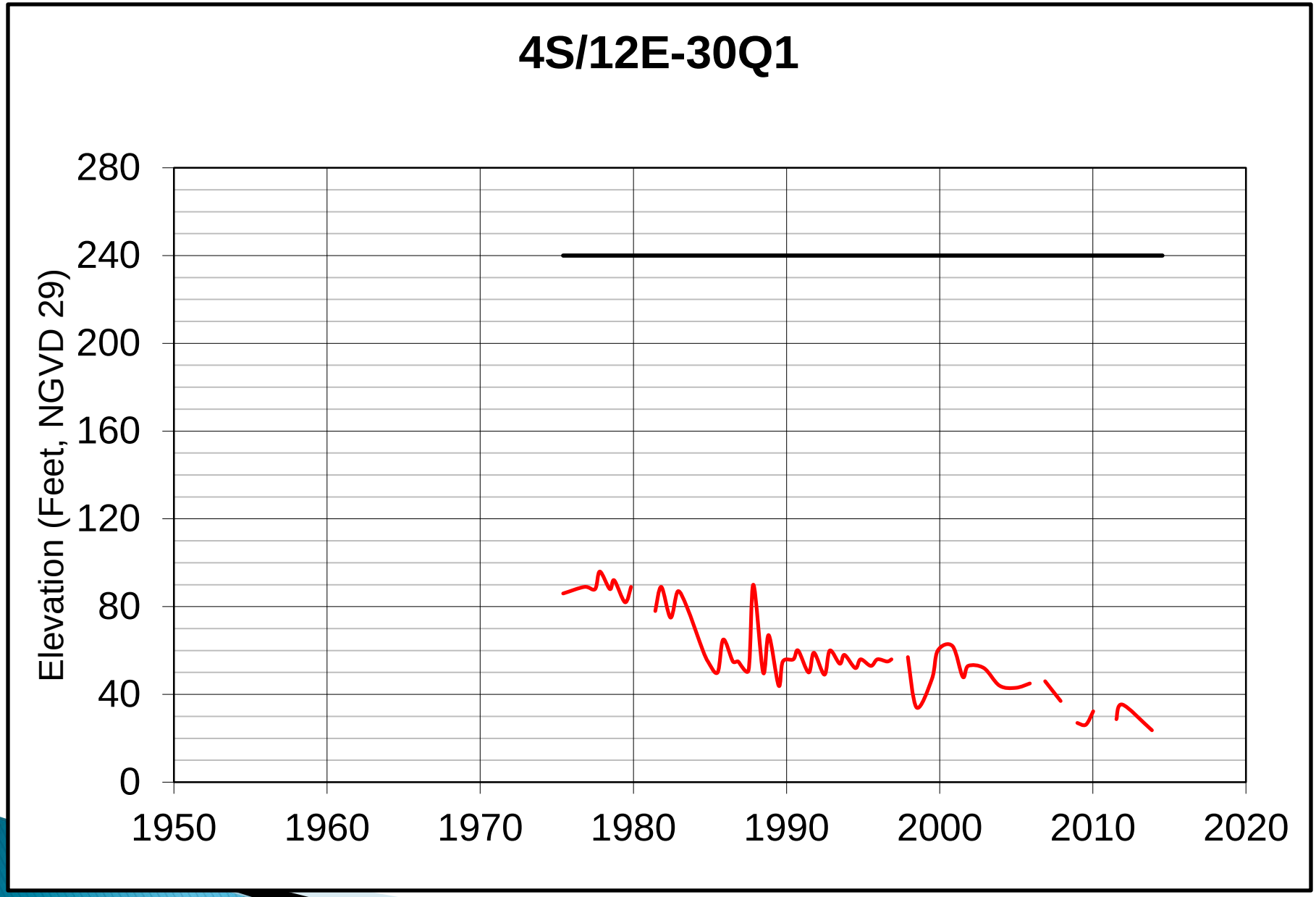
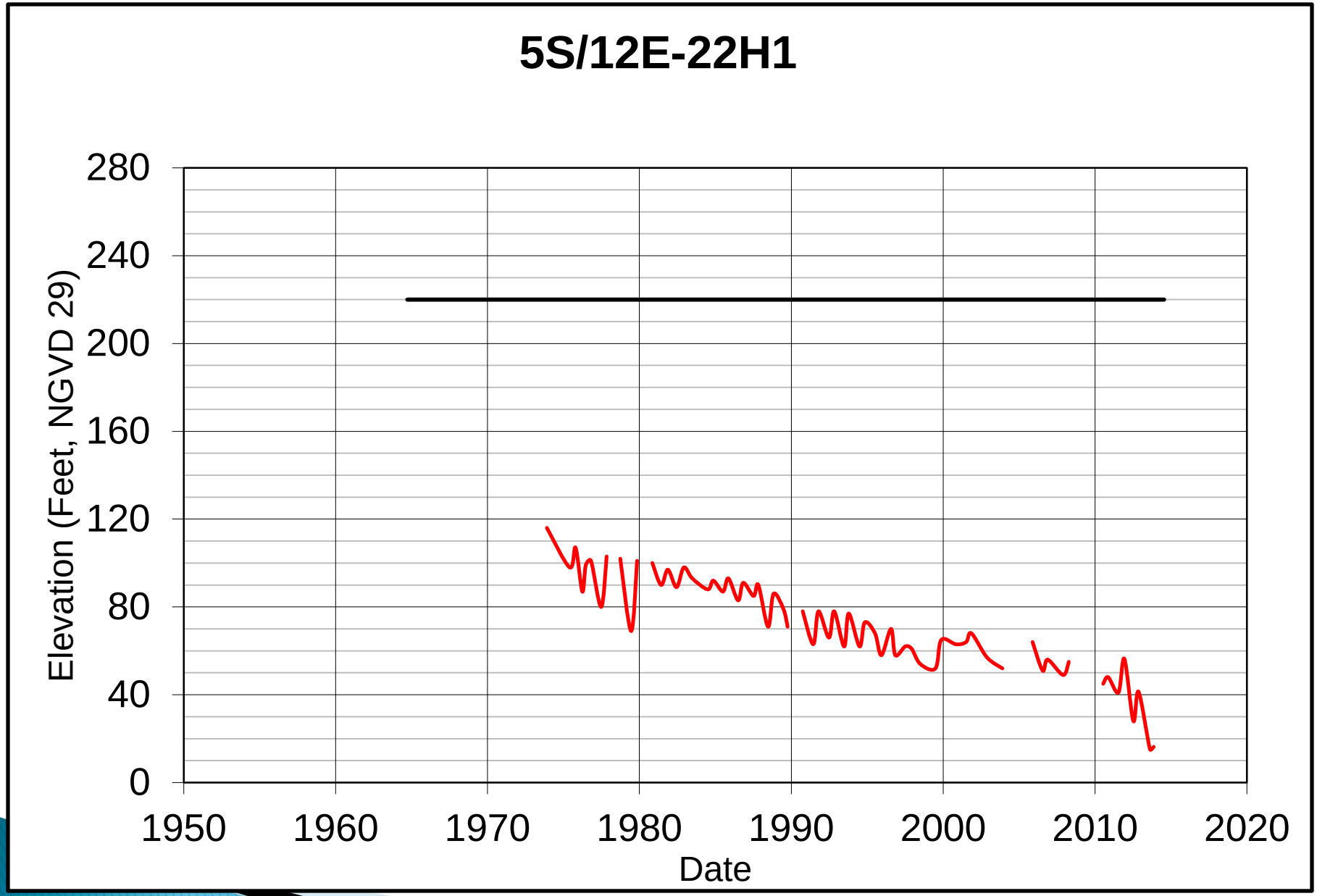
FIGURE 1A


4S/12E-30Q1
Elevation (Feet, NGVD 29)
280
240
200
160
120
80
40
0
1950
1960
1970
1980
1990
2000
2010
2020


5S/12E-22H1
Elevation (Feet, NGVD 29)
280
240
200
160
120
80
40
0
1950
1960
1970
1980
1990
2000
2010
2020
Date

Depth to Groundwater Contours April 2014

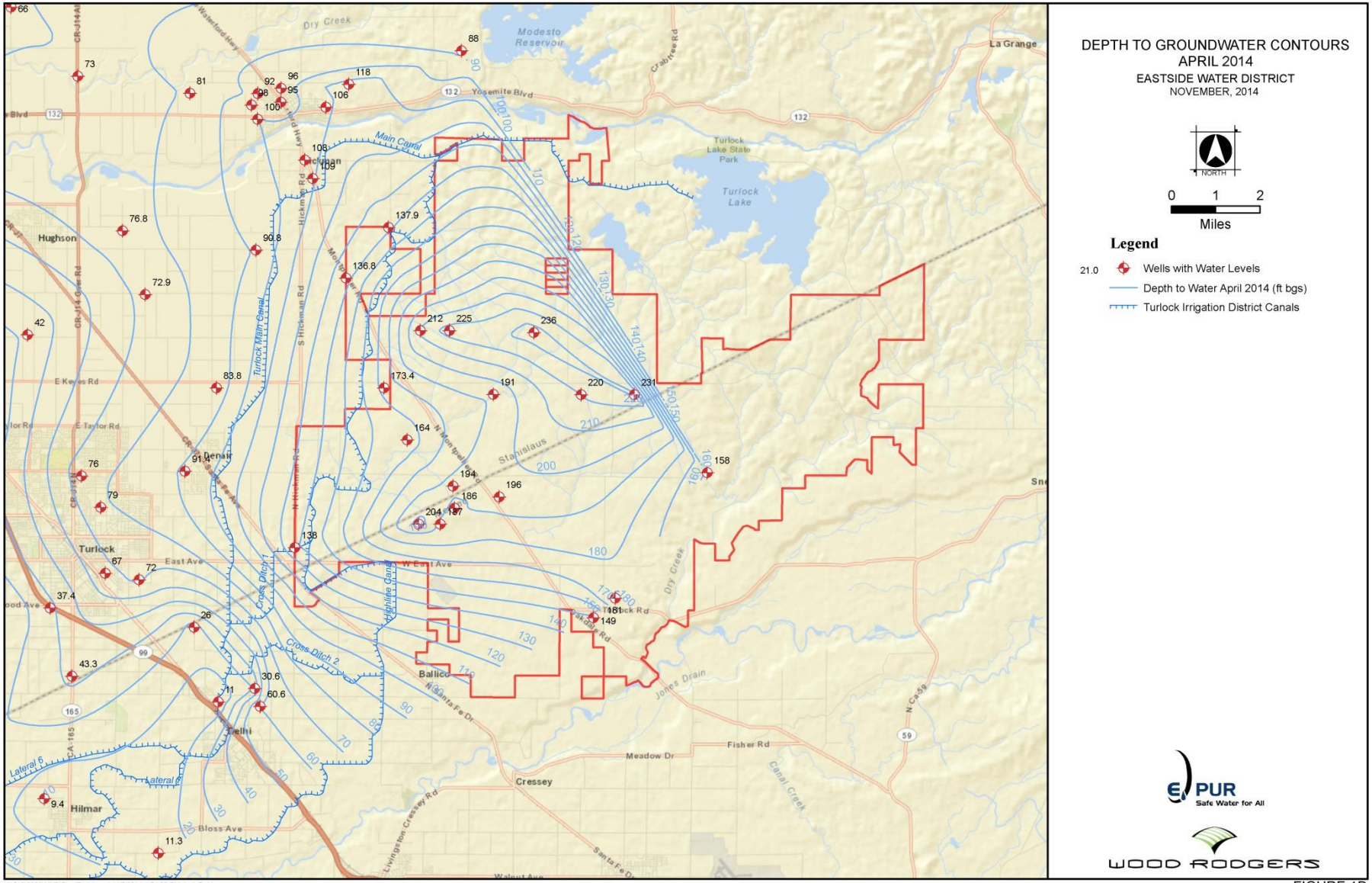


FIGURE 1D

Groundwater Elevation Contours April 2014

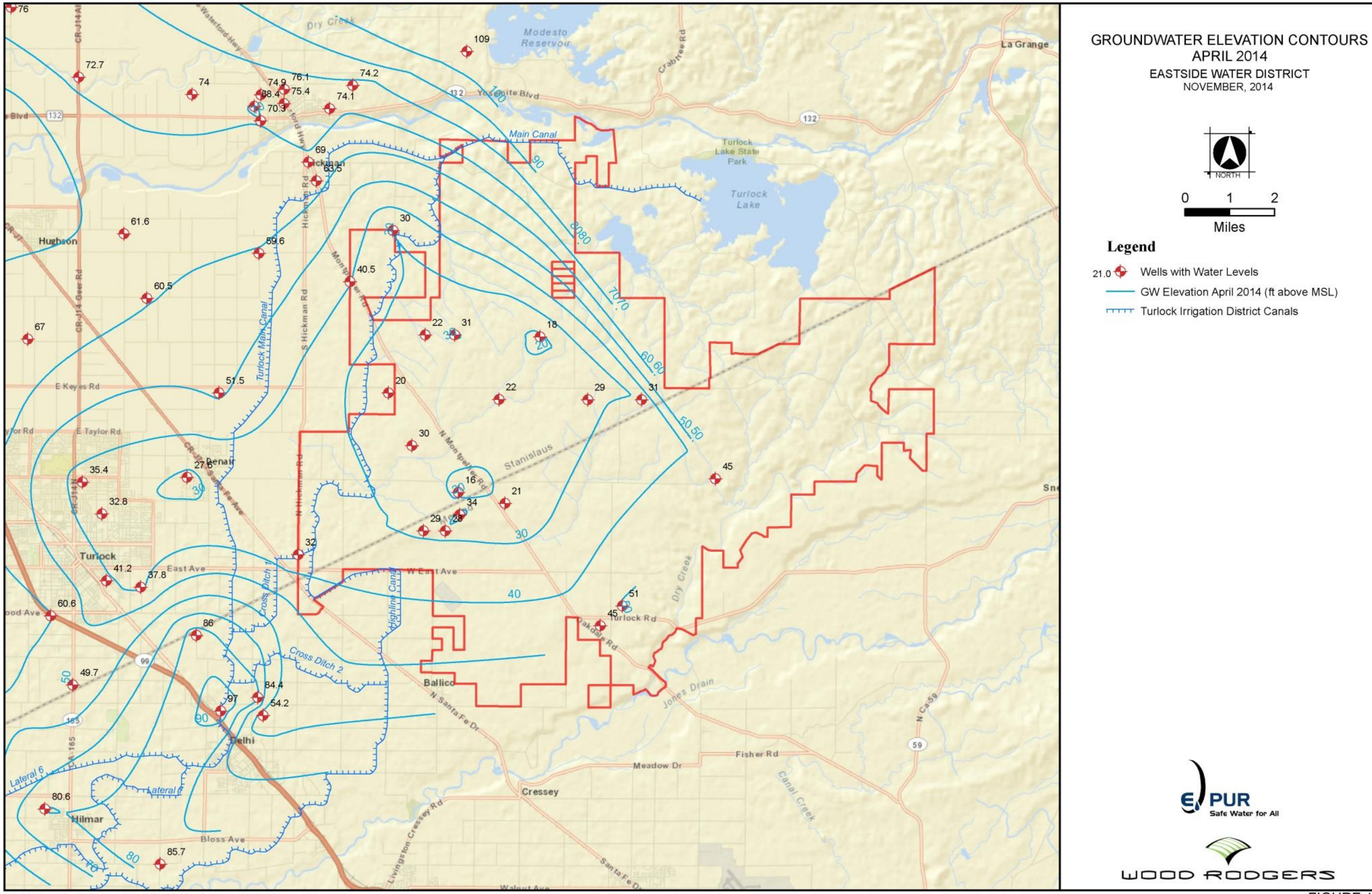


FIGURE 1C

Estimates of Relative Vertical Hydraulic Conductivity in Unsaturated Zone

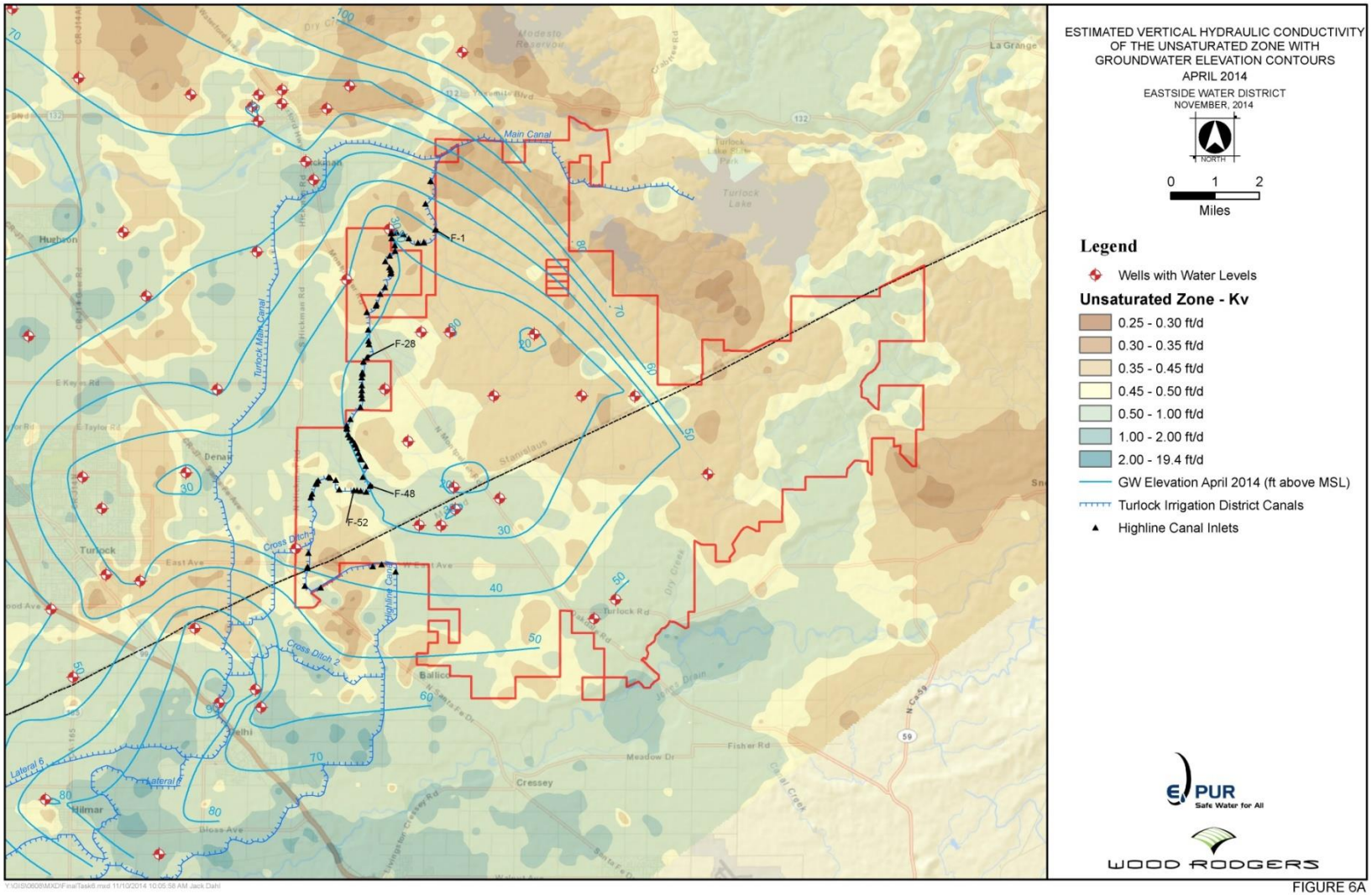


FIGURE 6A

Potential Recharge Sites

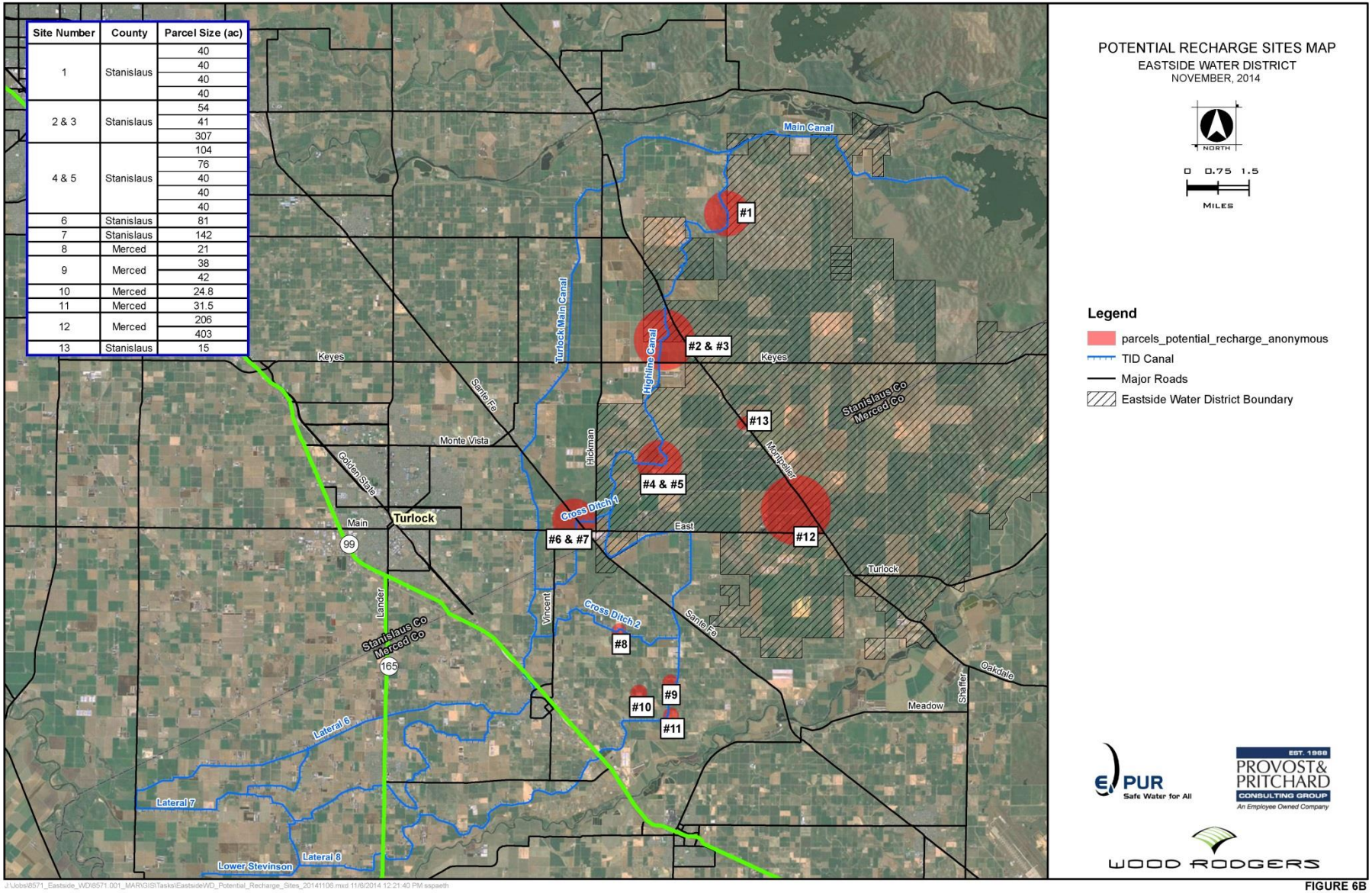


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FIGURE 6B

QUESTIONS

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Eastside WD Diffused Surface Water Project – Preliminary Site Screening

Randy Hopkins, PE

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Locations

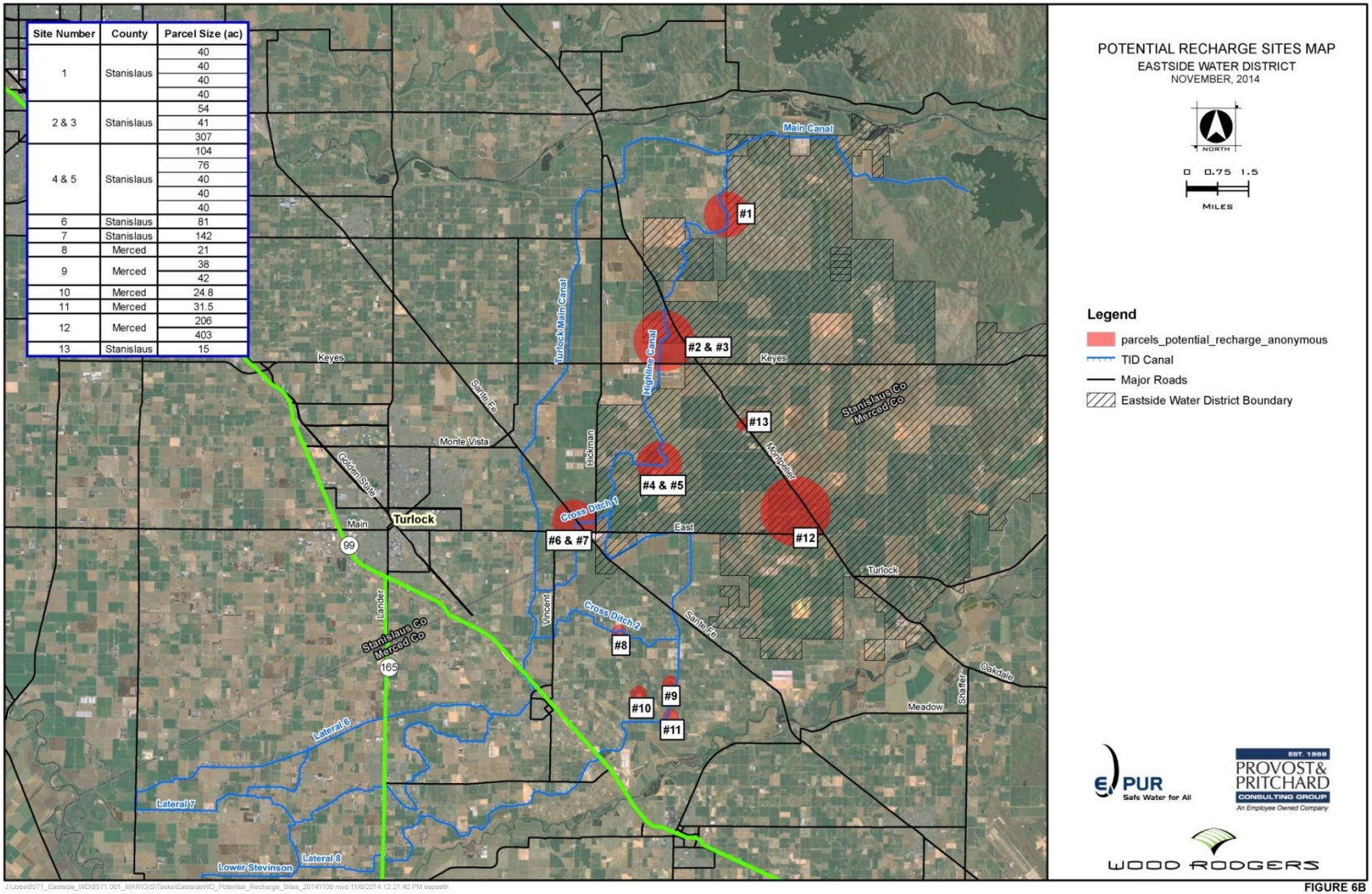
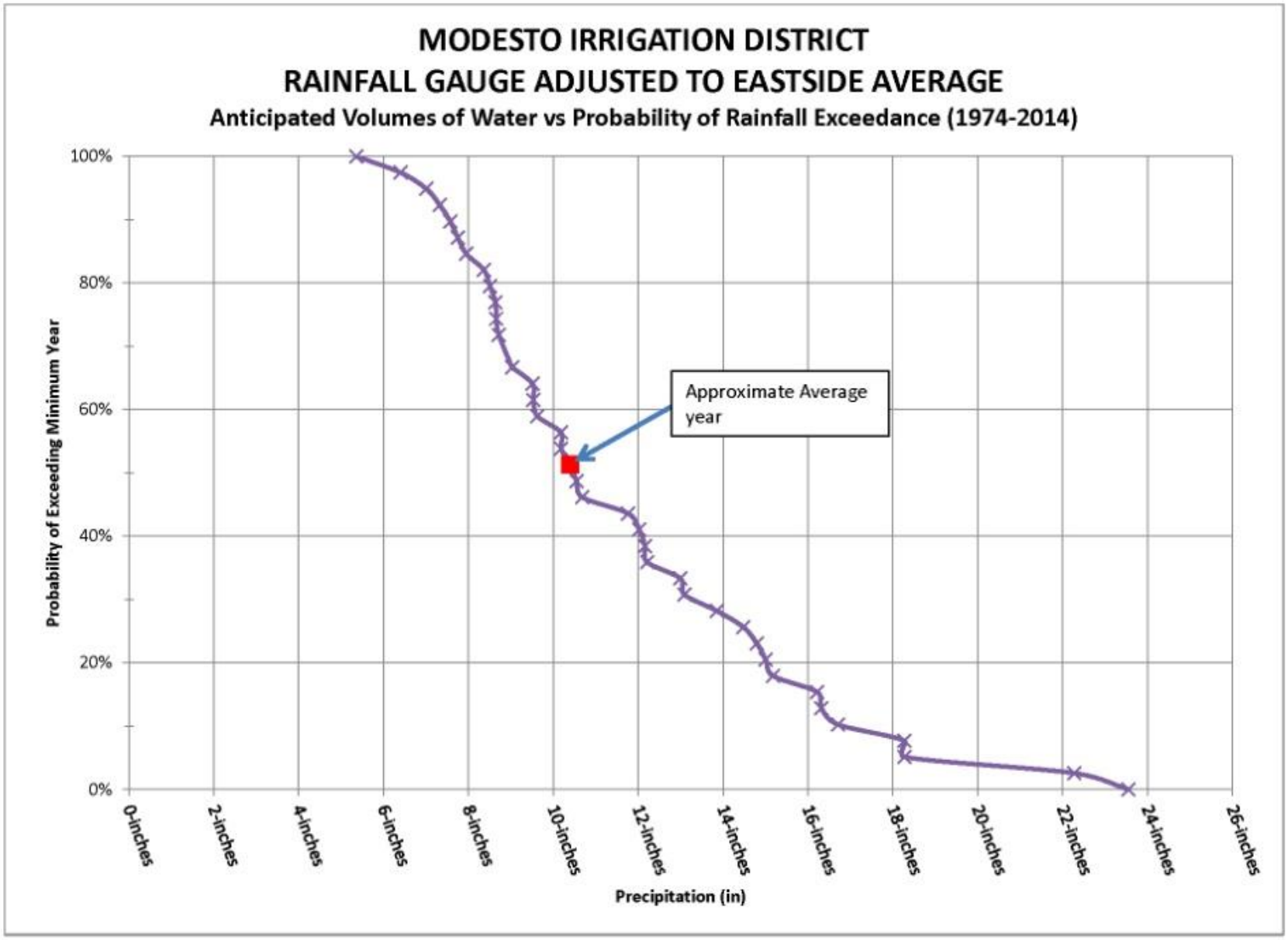
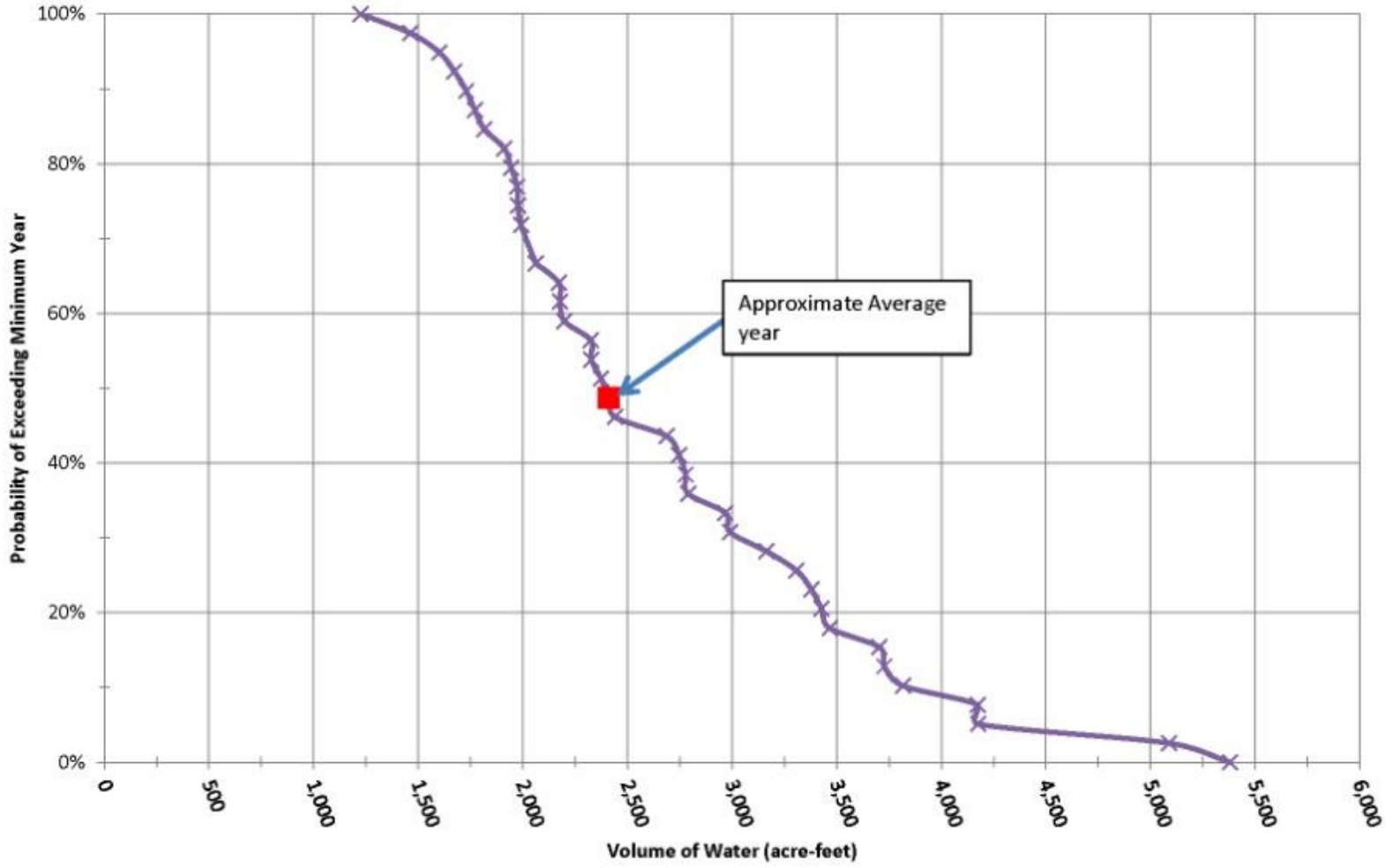


FIGURE 6B


MODESTO IRRIGATION DISTRICT
RAINFALL GAUGE ADJUSTED TO EASTSIDE AVERAGE
Anticipated Volumes of Water vs Probability of Rainfall Exceedance (1974-2014)
Probability of Exceeding Minimum Year
100%
80%
60%
40%
20%
0%
Approximate Average year
0-inches
2-inches
4-inches
6-inches
8-inches
10-inches
12-inches
14-inches
16-inches
18-inches
20-inches
22-inches
24-inches
26-inches
Precipitation (in)

MODESTO IRRIGATION DISTRICT
RAINFALL GAUGE ADJUSTED TO EASTSIDE AVERAGE
Anticipated Volumes of Water vs Probability of Volume Exceedance (1974-2014)



Screening Factors Used

Category	Criterion	Max Score Possible	Scoring Factors for Each
Hydrogeology	Likelihood of Deeper Percolation to Water Table Low Beneath Eastside	20	The the closer the project site is located closer to the groundwater depression, the higher the ranking. Point system: 1 = 5+ miles, 2 -5 = 4-5 miles, 6-10 = 3-4 miles, 11-15 = 2-3 miles, 16-19 = 1-2 miles, 20 = <1 mile
	Estimated Vertical Hydraulic Conductivity of Unsaturated Zone	20	The higher permeability the site has, the high ranking. Point system: <0.5 ft/day= 2, 0.5-1.0 ft/day = 10, 1.0 - 2.0 ft/day = 15, >2.0 ft/day = 20
Hydrology	Proposed Site APN selected acres, versus acreage necessary to match flows available	10	The closer the site size is in relation to the necessary size the higher the scoring. 10 = 90% + of recommended, 5 = 50%-90% of recommended, 0 = <50%
	Is the water available diffused?	10	If site will receive all or portion of water from Highline = 10, if sites water supply will not be diffused and will exclusively come from a creek that will potentially require a request on water rights = 0
Land	Multi-Water Source, Multi-Use Potential	10	If the project site has the ability to capture water for multiple purposes, the higher the ranking. The point system is as follows: 0 = needs pipelines for a long distance to accomplish, 5 = 1 channel adjacent, 10 = 2+ channels adjacent
	Current Land Use	10	Less permanent crops and pastureland provide a more preferrable alternative site due to 1) the site will easilly convert into a recharge site, 2) permanent crops that have a long productive life remaining will be a lost investment for the landowner therefore these lands will be more costly to acquire and convert. Point system: 1-2=young producing orchards, 3-4=old orchard with degrading yields, 5-6=new trees not yet producing, 6-7=rotating high $ row crop fields, 8-9 = Forage crops, 10 = pasture/rangeland
Constructability Issues	Depth of Duripan	10	The shallower the duripan, the more easily the material can be removed to allow proper recharge. Point System: 0-3 ft = 10, 3-6 ft = 5, 6+ feet = 0
	Gravity Flow Water to Site/ Cost of Future Conveyance Facilities	10	Conveyance facilities required to deliver the diffused water to the site. Higher preference placed on sites that can receive water by gravity. Point System: Pumping Required = 0, Siphon Required = 5, Open Channel or Pipe flow = 10
	Land Slope	5	The flatter the property, the more preferrable the site. Point System > 2% = 0, 1%-2% = 3, <1% = 5
Environmental Constraints	Proximity of Dairy or High Nitrate Ag.	5	How close is the nearest location of a dairy or farming operation with highnitrate discharges. Point System: <0.25 mi = 0, 0.25-0.5 mi = 1, 0.5-1 mi = 3, >1 mi = 5
	Proximity of Existing Ag. Well	3	How close is the nearest location of an ag irrigation production well. Point System: <0.25 mi = 0, 0.25-0.5 mi = 1, 0.5-1 mi = 2, >1 mi = 3
	Proximity to Residential	4	Design Consideration
	Habitat Creation/ESA Issues	3	Design Consideration
	Total Possible	120	

Selected Areas to Focus on

Category	Criterion	Max Score Possible	Site 4	Site 5	Site 6	Scoring Factors for Each
Hydrogeology	Likelihood of Deeper Percolation to Water Table Low Beneath Eastside	**20**	20	20	18	The the closer the project site is located closer to the groundwater depression, the higher the ranking. Point system: 1 = 5+ miles, 2 -5 = 4-5 miles, 6-10 = 3-4 miles, 11-15 = 2-3 miles, 16-19 = 1-2 miles, 20 = <1 mile
	Estimated Vertical Hydraulic Conductivity of Unsaturated Zone	**20**	10	10	10	The higher permeability the site has, the high ranking. Point system: <0.5 ft/day= 2, 0.5-1.0 ft/day = 10, 1.0 - 2.0 ft/day = 15, >2.0 ft/day = 20
Hydrology	Proposed Site APN selected acres, versus acreage necessary to match flows available	**10**	10	10	5	The closer the site size is in relation to the necessary size the higher the scoring. 10 = 90% + of recommended, 5 = 50%-90% of recommended, 0 = <50%
	Is the water available diffused?	**10**	10	10	10	If site will receive all or portion of water from Highline = 10, if sites water supply will not be diffused and will exclusively come from a creek that will potentially require a request on water rights = 0
Land	Multi-Water Source, Multi-Use Potential	**10**	10	10	10	If the project site has the ability to capture water for multiple purposes, the higher the ranking. The point system is as follows: 0 = needs pipelines for a long distance to accomplish, 5 = 1 channel adjacent, 10 = 2+ channels adjacent
	Current Land Use	**10**	10	8	8	Less permanent crops and pastureland provide a more preferrable alternative site due to 1) the site will easilly convert into a recharge site, 2) permanent crops that have a long productive life remaining will be a lost investment for the landowner therefore these lands will be more costly to acquire and convert. Point system: 1-2=young producing orchards, 3-4=old orchard with degrading yields, 5-6=new trees not yet producing, 6-7=rotating high $ row crop fields, 8-9 = Forage crops, 10 = pasture/rangeland
Constructability Issues	Depth of Duripan	**10**	5	5	10	The shallower the duripan, the more easily the material can be removed to allow proper recharge. Point System: 0-3 ft = 10, 3-6 ft = 5, 6+ feet = 0
	Gravity Flow Water to Site/ Cost of Future Conveyance Facilities	**10**	10	10	10	Conveyance facilities required to deliver the diffused water to the site. Higher preference placed on sites that can receive water by gravity. Point System: Pumping Required = 0, Siphon Required = 5, Open Channel or Pipe flow = 10
	Land Slope	**5**	3	3	5	The flatter the property, the more preferrable the site. Point System > 2% = 0, 1%-2% = 3, <1% = 5
Environmental Constraints	Proximity of Dairy or High Nitrate Ag.	**5**	1	1	0	How close is the nearest location of a dairy or farming operation with highnitrate discharges. Point System: <0.25 mi = 0, 0.25-0.5 mi = 1, 0.5-1 mi = 3, >1 mi = 5
	Proximity of Existing Ag. Well	**3**	3	3	0	How close is the nearest location of an ag irrigation production well. Point System: <0.25 mi = 0, 0.25-0.5 mi = 1, 0.5-1 mi = 2, >1 mi = 3
	Proximity to Residential	**4**	1	2	3	Design Consideration
	Habitat Creation/ESA Issues	**3**	1	1	1	Design Consideration
	Total Possible	**120**	94	93	90	

Locations

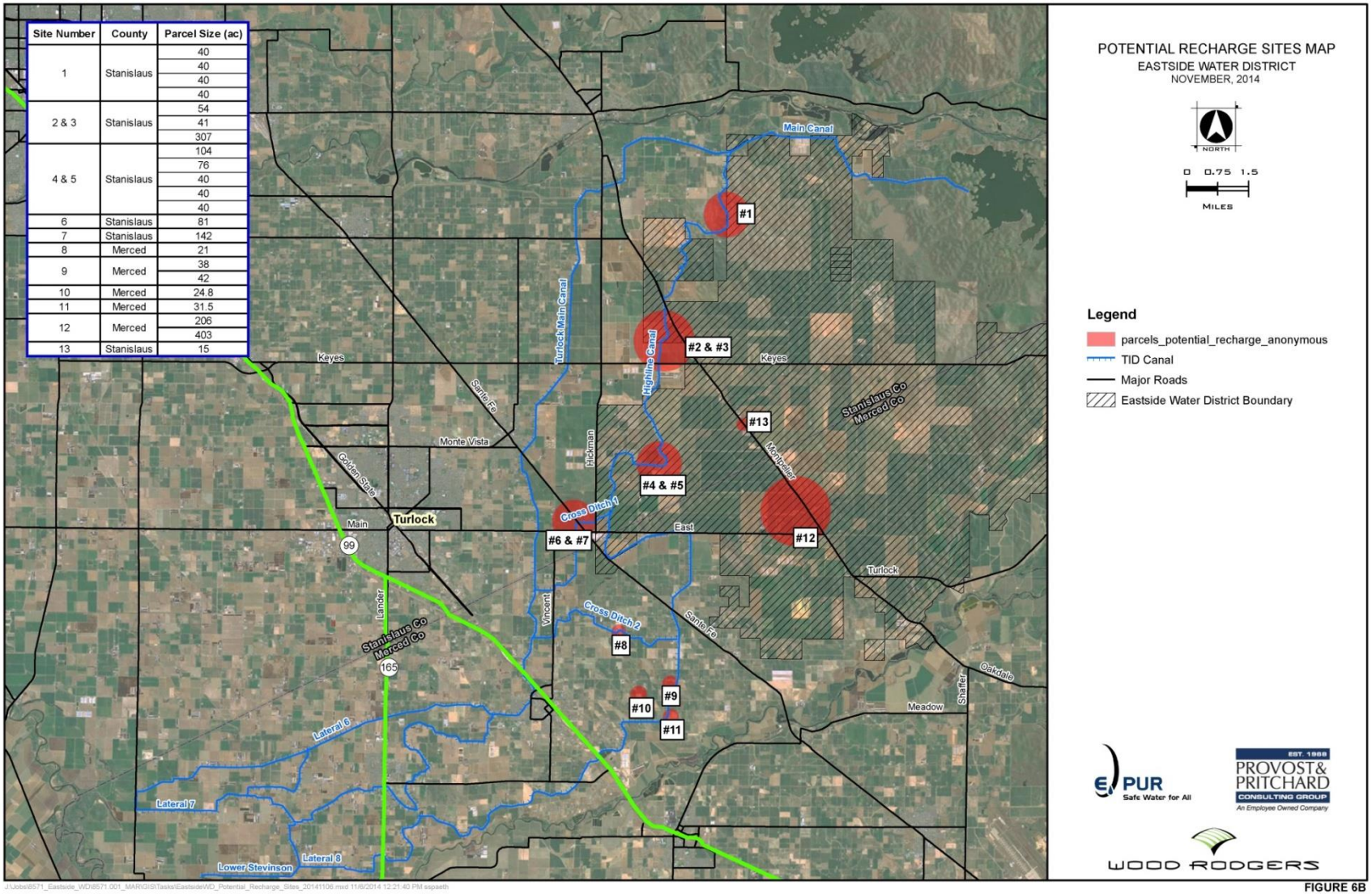


FIGURE 6B

Potential Facility Size Evaluations

- 40 Acre Site
  - Average Year Capacity = 1,800 acre-feet of 2,100 acre-feet available
- Design issues
  - Will be limited on the volume of surface water during wet year storm events
  - Allow for farming when not in use

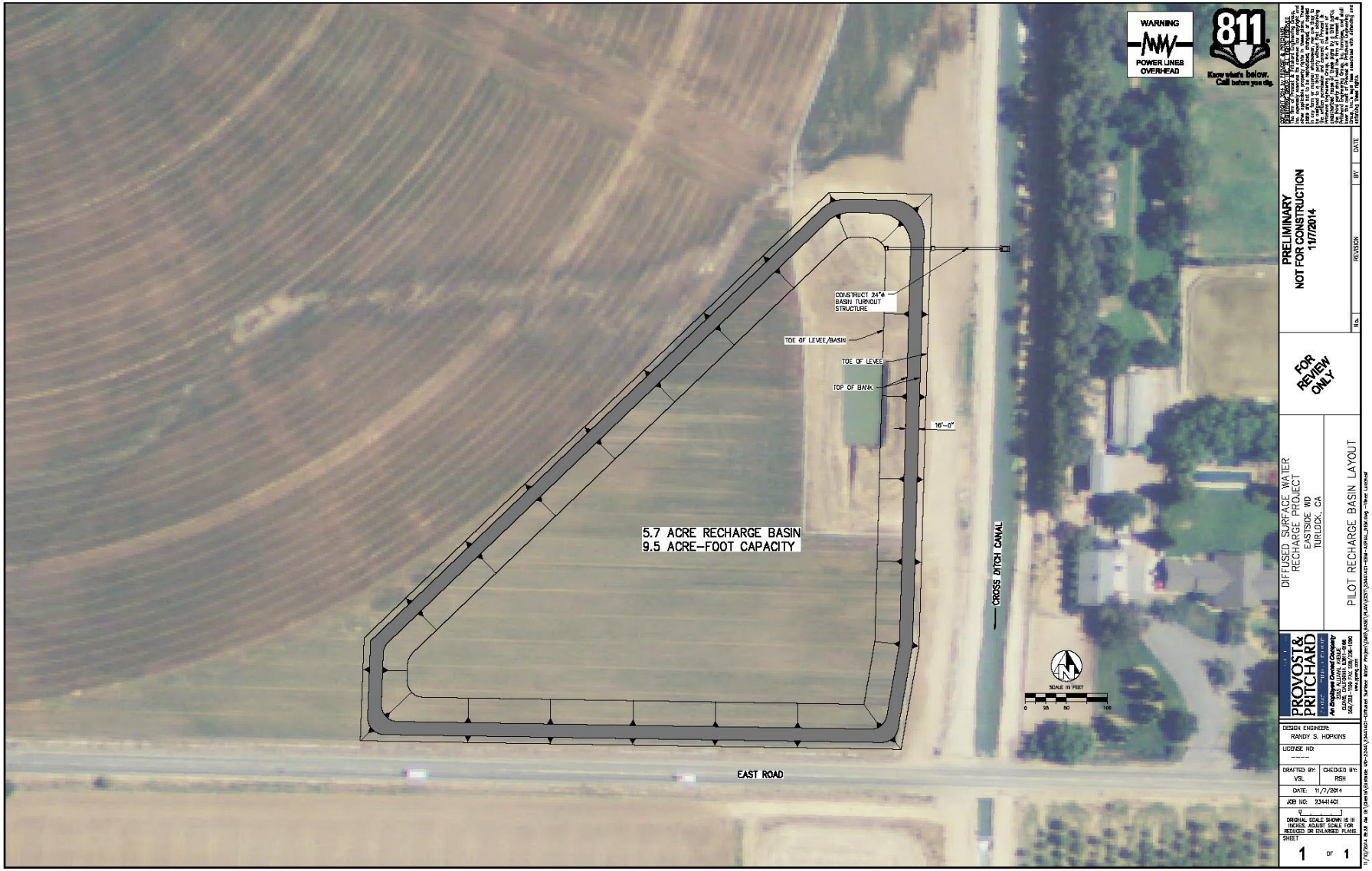
Expected Costs

- Capital
  - 40 acre property with balanced earthwork – $3.0M
  - Annualized over a 20 year period at 3% interest
    - $200,000/year
- Unit
  - Average year – $110 / AF recharged

Next Steps

- Look for Grant Funding
- Soil Investigation

Pilot Project



Pilot Project

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PRELIMINARY DESIGN

Eastside Water District

Diffused Surface Water Recharge Project

PRELIMINARY

11/9/2014

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
	General				
1	Mobilization/Demobilization, Bonds and Insurance	1	LS	$ 6,000	$ 6,000
2	Worker Protection	1	LS	$ 1,000	$ 1,000
3	Miscellaneous Facilities and Operations	1	LS	$ 4,000	$ 4,000
4	SWPPP Preparation and Implementation & Dust Control	1	LS	$ 1,000	$ 1,000
				Subtotal	**$ 12,000**
5	Clearing & Grubbing	7	AC	$ 850	$ 6,000
6	Compacted In-Place Fill	9,800	CY	$ 4	$ 40,000
7	Construct Levee Keyway	3,900	CY	$ 4	$ 16,000
8	Drive Surface (3" Thick Gravel)	460	TN	$ 30	$ 14,000
9	Construct 24" Turnout to Basin	1	LS	$ 47,000	$ 47,000
				Subtotal	**$ 123,000**
				Subtotal All Items	**$ 135,000**
				Contingency 25%	**$ 34,000**
				Construction Total (incl. contingency)	**$ 169,000**
	Non-Field Costs				
				Engineering Design, Surveys, & Environmental Review 15%	**$ 26,000**
				Soils Testing / Geotechnical Investigation 4%	**$ 7,000**
				Legal & Admin 4%	**$ 7,000**
				Construction Testing, Review, and Management 10%	**$ 17,000**
				Total	**$ 226,000**

Notes:

1. This opinion of probable cost is based on the engineer's experience with prior projects and cost sources such as RS Means.
2. Totals rounded to the nearest one-thousand dollars.

QUESTIONS

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Eastside WD Diffused Surface Water Project – Status Update

Kevin M. Kauffman, PE
Kevin Kauffman Consulting

Project Summary

The 7/1/14 EWD newsletter illustrated the following land assessment figures to pay for each $2 million portion of the cost of building and operating the Diffused Surface Water Project:

Capital Costs = $16.13 per acre
Annual Operating = $323 per acre

Please recall that these figures and those in the table below assume 50% funding from others (Government or Partners).

The following table attempts to illustrate how such a project (assuming a $6 million project completed over 5 to 6 years) could be financed on a cash-basis. Should the EWD seek and acquire financing for the capital cost portion of this project, annual assessment could be reduced from these amounts, but would obviously occur on a annual basis in order to collect the the total capital cost plus interest.

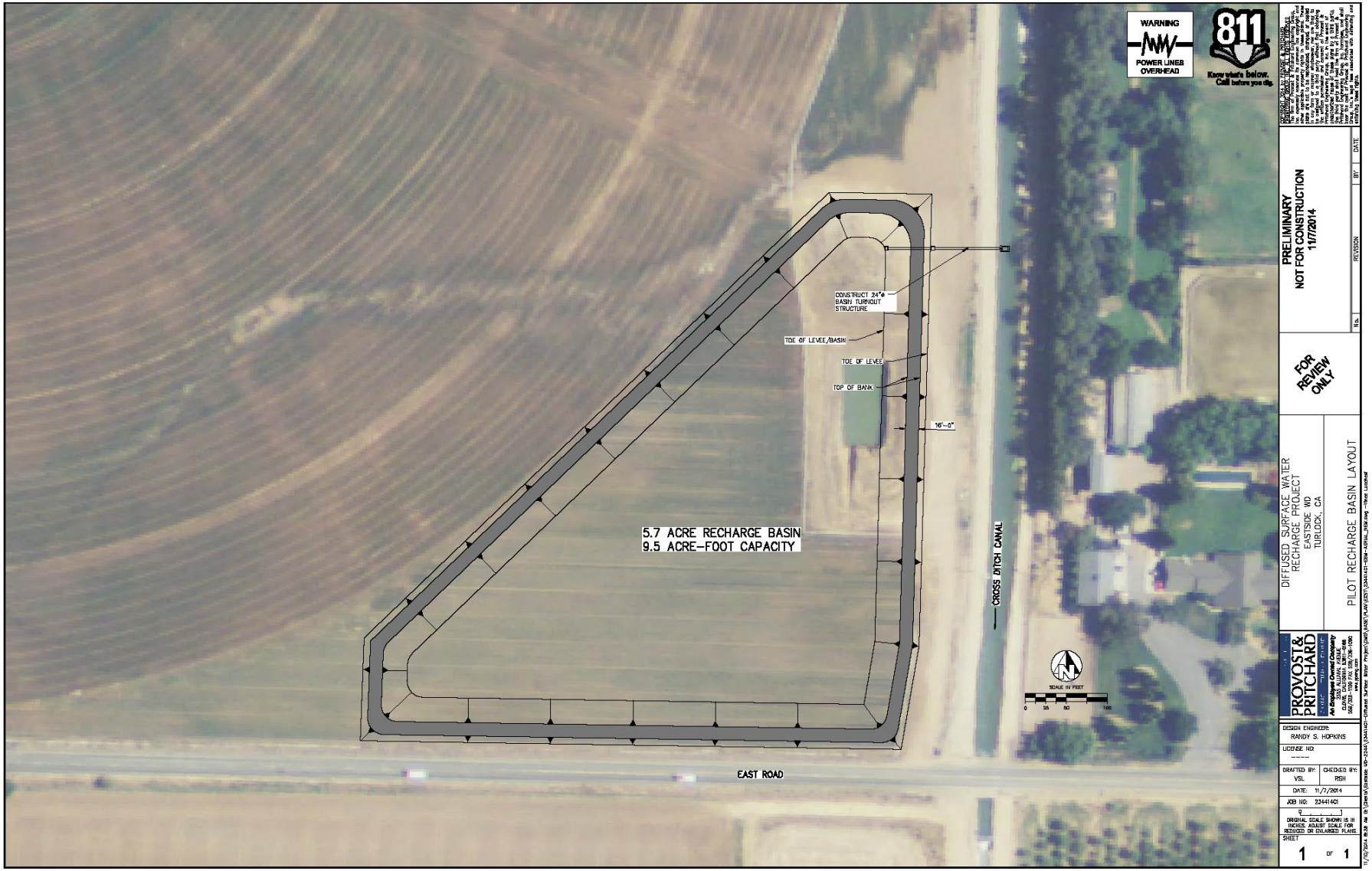
	2015	2016	2017	2018	2019	2020
Current Assessment	$ 2.00	$ 2.00	$ 2.00	$ 2.00	$ 2.00	$ 2.00
Capital Cost Assessment	$ 16.13	$ -	$ 16.13	$ -	$ 16.13	$ -
Operating Cost Assessment	$ 3.23	$ 3.23	$ 6.46	$ 6.46	$ 9.69	$ 9.69
Total	$ 21.36	$ 5.23	$ 24.59	$ 8.46	$ 27.82	$ 11.69

Following the November 21, 2014 EWD Board of Directors meeting and landowner workshop, the plan is to complete the 30% design level project and cost estimate by year's end. With input from its landowners, the EWD Board will then be asked to consider the following actions shortly after the first of the year:

1. Accept the design work and cost estimate
2. Conduct a Proposition 218 Election to legally establish new landowner assessments
3. Submit grant application(s) for Government funding support of the DSWP
4. Approach other potential Partners in the DSWP for funding support

Together with its landowners, EWD is prepared to begin the steps necessary to assure a long-term sustainable water supply for its service area.

Pilot Project



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