INTERDEPARTMENTAL MEMORANDUM

TO: Butte County Water Commission

FROM: Kristen McKillop, Manager – Program Development
Water and Resource Conservation

SUBJECT: 2010 Cumulative Groundwater Quality Trend Monitoring update

DATE: August 4, 2010

INTRODUCTION and BACKGROUND

The Butte County Department of Water and Resource Conservation (DW&RC) conducted its ninth year of groundwater quality trend monitoring within the county during the week of July 12-15, 2010. As required by Chapter 33A, the parameters monitored were temperature, pH, Electrical Conductivity. Total Dissolved Solids were also recorded. These parameters encompass the basic characteristics to consider when evaluating water for evidence of saline intrusion. The groundwater quality trend monitoring program is designed to track single monitoring events throughout the county on an annual basis. This year, all samples fell within the acceptable range of water quality values.

METHODOLOGY and ANALYSIS

The Department owns a Hach sensION multi-parameter meter, which is used to do the groundwater quality testing with. This is the same meter being used by Glenn County for their monitoring efforts. This year, Glenn County sampled its grid during the same week. Data collected by both Butte and Glenn County can be reviewed through the Four County BMOIC. This collaboration will ensure that we are collecting, analyzing and reporting data in the same manner, which will allow for greater confidence in comparing data across county lines. The sites visited were on private land and the wells are typically used for agricultural purposes (irrigating orchards, rice, or pasture), but the two Thermalito wells as well as the Llano Seco sample represent supply for domestic use. The sampling grid spans from north of the Chico Urban Area (Vina sub-inventory unit), west towards the Sacramento River (M & T sub-inventory unit), east towards the foothills (Pentz sub-inventory unit), and south towards Gridley (Biggs-West Gridley sub-inventory unit). Just to note, one of the wells in the Thermalito sub-inventory unit was not sampled this year, as Thermalito Water & Sewer District had taken the well we sample offline for repairs.

As in previous years, we are fortunate to have the support and permission from the local property owners who allowed access to their wells. We have provided them with the preliminary results from this year's monitoring for their general knowledge.

The data collected this summer is comparable to data collected in the eight preceding years. Every effort is made to sample each location within the same hourly window as in previous years. To date, temperature has been consistent in all wells. Temperature is a standard parameter measured when assessing water quality mostly to indicate the point at which water being sampled is representative of aquifer water and not water standing in the well casing. Data is recorded when the temperature, pH and EC from the well stabilizes, typically after purging a minimum of three well volumes. Considerable changes in temperature could be an indication of other source waters migrating into the aquifer system such as stream seepage or flow from a different aquifer system. The lowest temperature reading was in the M&T sub-inventory unit (17.8 oC) and the high being in the Cherokee sub-inventory unit (21.9 oC). Temperature is an important parameter because it

affects chemical reactions that may occur in groundwater. Other parameters such as pH remained stable and within the secondary water quality thresholds.

Total dissolved solids measures water quality suitability for public, industrial, and agricultural uses and electrical conductivity measures the ability of a solution to conduct an electrical current. Readings for total dissolved solids and electrical conductivity varied more than pH and temperature. However, the readings we observed were well within the secondary water quality thresholds established by State and Federal regulatory agencies.

The US Environmental Protection Agency (US EPA) establishes drinking water quality standards using two categories; Primary Standards and Secondary Standards[1]. Primary Standards are based on health considerations and Secondary Standards are based on taste, odor, color, corrosivity, foaming, and staining properties of water. Examples of secondary water quality thresholds are summarized in Table 1 below:

Table 1. US EPA Secondary Standards for measured parameters

Parameter	Secondary Standard or Secondary WQ Threshold	Range of Observed 2009 Readings	Notes re: Butte County Study
pH	6.5 to 8.5	6.6 – 7.9	Within range of secondary water quality thresholds.
Total Dissolved Solids (TDS)	< 500 ppm – drinking water < 450 ppm – ag water	75.6 - 237	Within range of secondary water quality thresholds
Electrical Conductivity (EC)	< 900 uS – drinking water < 700 uS – ag water	151.8 - 488	Within range of secondary water quality thresholds

Water quality data collected from the specific wells are presented in tables on the attached pages.

CONCLUSION

This was the ninth season the DW&RC collected groundwater quality information. The information was presented to, and reviewed by, the Technical Advisory Committee at their July 22, 2010 meeting. Overall, the results of the water quality sampling indicate that groundwater in the basin is of high-quality, free of saline intrusion and is in good health. Water quality parameters have naturally occurring variability, so year to year changes are expected and not a cause for investigation or analysis. Further investigation would only be necessary if values were to fall outside of acceptable range. This data will help the DW&RC continue building a foundation that serves to establish baseline levels of these parameters across the county so that any future changes in water quality can be detected and further investigation and monitoring can subsequently be developed. The full report including graphical and tabular data can be found on the Department website http://www.buttecounty.net/waterandresource/ under the MONITORING tab.

Further information on water quality standards for different constituents can be found at www.swrcb.ca.gov or in the *Compilation of Water Quality Goals*, published by the State Water Resources Control Board. Additionally, the State Water Resources Control Board has recently published a *DRAFT Groundwater Quality Protection Strategy, A "Roadmap" for the Central Valley Region*[2]. The intent the "Roadmap" is not to initiate any new regulatory programs, but rather to provide a long range planning document that defines the regulatory programs to be enhanced, and identify ways to expand on all partnering opportunities with other federal, state, and/or local agencies to protect groundwater quality. Included as an Appendix to this document is a data table from the DRAFT "Roadmap" that lists existing groundwater protection programs along with the responsible Federal, State and Local agencies for monitoring and regulation. If you have questions please contact Kristen McKillop at 538-6265.

[1] http://www.epa.gov/safewater/consumer/2ndstandards.html
[2] http://www.swrcb.ca.gov/rwqcb5/water_issues/groundwater_quality/index.shtml

Table 2. Cumulative Temperature Measurements in degrees Celsius

° Celsius	° Fahrenheit
0	32
5	41
10	50
15	59
20	68
21	69.8
22	71.6
23	73.4
24	75.2

Groundwater Temperature - 2002 through 2010 (in degrees Celcius)

Sub-area	State Well Number	2002	2003	2004	2005	2006	2007	2008	2009	2010
Biggs-West Gridley	18NO2E35R01M	18.5	18.5	18.1	20.5	18.2	18.3	18.7	19.0	19.2
Cherokee	20N02E24QO1M	22.4	21.9	21.2	21.4	21.1	20.7	21.0	20.9	21.9
Chico Urban Area	22N02E17						18.4	20.1	18.2	18.8
Durham Dayton	21N01E15EO2M	18.8	19.9	21.8	20.4	17.4	n/a	19.3	n/a	18.9
Esquon	20N02E09M02M	19.7	18.9	19.6	20.1	20.7	19.0	19.6	19.0	19.1
Llano Seco								20.8	20.6	20.7
M & T	22N01E15DO2M	17.6	18.2	17.8	19.2	18.6	18.0	17.7	18.6	17.8
Pentz	21N03E29J003M						22.2	21.5	21.3	21.5
*Pentz-Butte Valley	21N03E26EO1M	27.0	26.4	26.7	23.2					
Thermalito	19NO4E06E02M	18.3	17.9	17.1	17.1	18.4	17.7	18.9	17.6	n/a
Thermalito domestic								19.4	19.4	19.4
Vina	23N01E29LO3M	19.6	20.3	19.2	19.2	19.6	18.9	19.6	18.9	18.8
Western Canal (east)	20N02E15RO1M	18.4	18.2	19.9	20.5	18.8	18.6	19.1	19.0	18.8
Western Canal (west)	20N01E15D01M	19.0	18.1	19.8	20.8	18.5	20.6	21.8	18.5	19.1

*The distance between the Pentz-Butte Valley well no longer monitored and the new Pentz well is approximately 2.4 miles.

Table 3. Average and Range of Temperature – 2002 through 2010

Sub-area	Average	Range
Biggs-West Gridley	18.8	18.1-20.5
Cherokee	21.4	20.7-22.4
Chico Urban Area	18.9	18.2-20.1
Durham Dayton	19.5	17.4-21.8
Esquon	19.5	18.9-20.7
M & T	18.2	17.6-19.2
Pentz	21.7	21.3-22.2
*Pentz-Butte Valley	25.8	23.2-27.0
Thermalito	17.9	17.1-18.9
Vina	19.3	18.8-20.3
Western Canal (east)	19.0	18.2-20.5
Western Canal (west)	19.6	18.1-21.8

Table 4. Cumulative pH Measurements in degrees Celsius

Groundwater pH - 2002 through 2010

Sub-area	State Well Number	2002	2003	2004	2005	2006	2007	2008	2009	2010
Biggs-West Gridley	18NO2E35R01M	7.60	7.50	7.50	7.04	7.60	7.64	7.72	7.88	7.86
Cherokee	20N02E24QO1M	7.50	7.50	7.10	7.40	7.40	7.30	7.30	7.30	7.23
Chico Urban Area	22N02E17						6.88	6.94	6.90	6.99
Durham Dayton	21N01E15EO2M	7.70	7.20	7.60	7.60	7.50	n/a	7.54	n/a	7.41
Esquon	20N02E09M02M	7.30	7.50	7.10	7.40	7.50	7.43	7.24	7.42	7.38
Llano Seco								7.90	8.07	8.15
M & T	22N01E15DO2M	7.20	7.50	6.90	7.80	7.90	7.62	7.68	7.62	7.62
Pentz	21N03E29J003						7.58	7.40	7.53	7.44
*Pentz-Butte Valley	21N03E26EO1M	7.10	6.90	7.29	6.24					
Thermalito	19NO4E06E02M	7.00	6.50	7.10	7.10	7.90	7.40	7.42	7.44	n/a
Thermalito domestic								7.73	7.84	7.71
Vina	23N01E29LO3M	7.50	7.60	6.90	6.20	7.70	7.54	7.51	7.39	7.57
Western Canal (east)	20N02E15RO1M	7.00	6.60	6.80	6.90	7.30	6.92	6.96	7.00	7.10
Western Canal (west)	20N01E15D01M	7.80	8.10	7.10	6.90	7.90	7.88	7.81	6.59	7.75

*The distance between the Pentz-Butte Valley well no longer monitored and the new Pentz well is approximately 2.4 miles.

Table 5. Average and Range of pH – 2002 through 2010

Sub-area	Average	Range
Biggs-West Gridley	7.59	7.0-7.7
Cherokee	7.34	7.1-7.5
Chico Urban Area	6.93	6.9
Durham Dayton	7.51	7.2-7.7
Esquon	7.36	7.1-7.5
M & T	7.54	6.9-7.9
Pentz	7.49	7.4-7.6
*Pentz-Butte Valley	6.88	6.2-7.3
Thermalito	7.23	6.5-7.9
Vina	7.32	6.2-7.7
Western Canal (east)	6.94	6.6-7.3
Western Canal (west)	7.41	6.6-8.1

Table 6. Cumulative EC Measurements in microsiemens

Groundwater EC - 2002 through 2010

Sub-area	State Well Number	2002	2003	2004	2005	2006	2007	2008	2009	2010
Biggs-West Gridley	18NO2E35R01M	346	370	323	361	351	382	354	331	343
Cherokee	20N02E24QO1M	222	232	215	266	242	267	268	243	270
Chico Urban Area	22N02E17						280	291	260	249
Durham Dayton	21N01E15EO2M	315	348	259	340	322	n/a	327	n/a	307
Esquon	20N02E09M02M	388	526	470	557	507	480	439	419	427
Llano Seco								204	195	196
M & T	22N01E15DO2M	418	551	678	504	465	451	667	445	592
Pentz	21N03E29J003						218	229	227	225
*Pentz-Butte Valley	21N03E26EO1M	195	186	211	240					
Thermalito	19NO4E06E02M	132	164	149	150	152	242	205	158	n/a
Thermalito domestic								374	350	354
Vina	23N01E29LO3M	197	225	180	216	192	224	203	200	199
Western Canal (east)	20N02E15RO1M	447	344	400	524	492	471	482	488	465
Western Canal (west)	20N01E15D01M	464	248	407	501	309	477	469	462	455

*The distance between the Pentz-Butte Valley well no longer monitored and the new Pentz well is approximately 2.4 miles.

Table 7. Average and Range of EC – 2002 through 2010

Sub-area	Average	Range
Biggs-West Gridley	351	323-370
Cherokee	247	215-268
Chico Urban Area	270	260-291
Durham Dayton	317	259-348
Esquon	468	388-557
M & T	530	418-667
Pentz	225	218-229
*Pentz-Butte Valley	208	186-240
Thermalito	169	132-242
Vina	204	180-225
Western Canal (east)	457	344-524
Western Canal (west)	421	248-501

Table 8. Cumulative TDS Measurements in mg/L (1 mg/L = 1 ppm for dilute aqueous solutions)

Groundwater TDS - 2002 through 2010

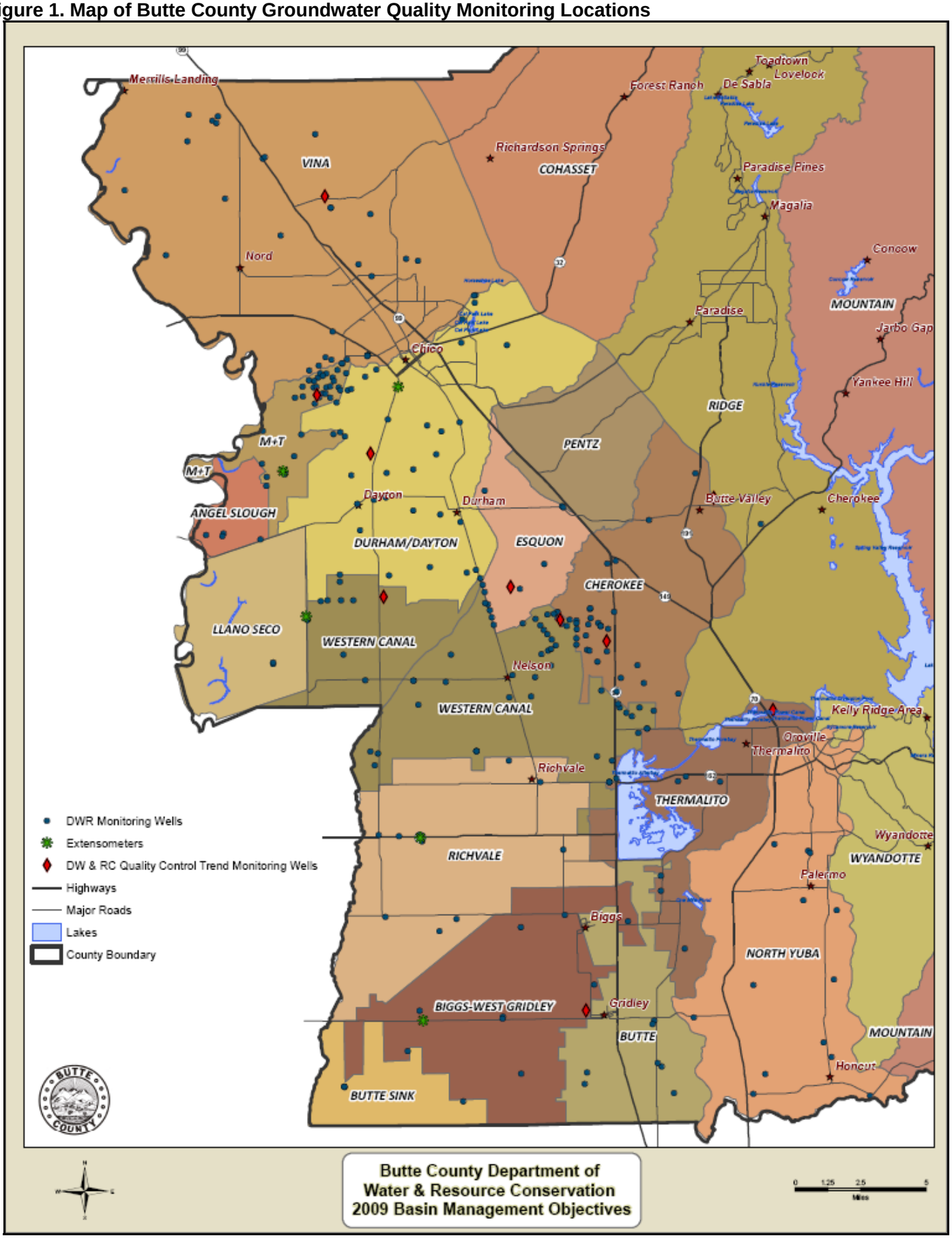
Sub-area	State Well Number	2002	2003	2004	2005	2006	2007	2008	2009	2010
Biggs-West Gridley	18NO2E35R01M	172.0	184.0	163.0	180.0	169.0	184.0	171.0	162.1	164.8
Cherokee	20N02E24QO1M	111.0	115.0	109.0	132.0	116.0	128.0	128.4	116.6	129.6
Chico Urban Area	22N02E17						136.0	139.8	124.3	118.3
Durham Dayton	21N01E15EO2M	161.0	175.0	130.0	169.0	155.0	n/a	157.4	n/a	147.5
Esquon	20N02E09M02M	194.0	265.0	235.0	278.0	244.0	232.0	212.0	203.0	206.0
Llano Seco								97.1	93.2	93.6
M & T	22N01E15DO2M	209.0	279.0	340.0	251.0	225.0	218.0	324.0	215.0	287.0
Pentz	21N03E29J003						105.0	109.8	108.8	107.7
*Pentz-Butte Valley	21N03E26EO1M	100.0	93.0	105.0	120.0					
Thermalito	19NO4E06E02M	67.0	82.0	73.0	75.0	73.0	116.0	98.3	75.6	n/a
Thermalito domestic								179.0	168.7	170.9
Vina	23N01E29LO3M	96.0	109.0	90.0	107.0	90.0	108.0	97.5	95.5	94.8
Western Canal (east)	20N02E15RO1M	223.0	172.0	203.0	262.0	246.0	228.0	233.0	237.0	223.0
Western Canal (west)	20N01E15D01M	232.0	123.0	206.0	250.0	155.0	230.0	227.0	224.0	221.0

*The distance between the Pentz-Butte Valley well no longer monitored and the new Pentz well is approximately 2.4 miles.

Table 9. Average and Range of TDS – 2002 through 2010

Sub-area	Average	Range
Biggs-West Gridley	172.2	162-184
Cherokee	120.6	109-132
Chico Urban Area	129.6	136-139.8
Durham Dayton	156.4	169-175
Esquon	229.9	194-278
M & T	260.9	209-340
Pentz	107.9	105-109.8
*Pentz-Butte Valley	104.5	93-120
Thermalito	82.5	67-116
Vina	98.7	90-109
Western Canal (east)	226.8	172-262
Western Canal (west)	207.9	123-250

Figure 1. Map of Butte County Groundwater Quality Monitoring Locations



Biggs-West Gridley

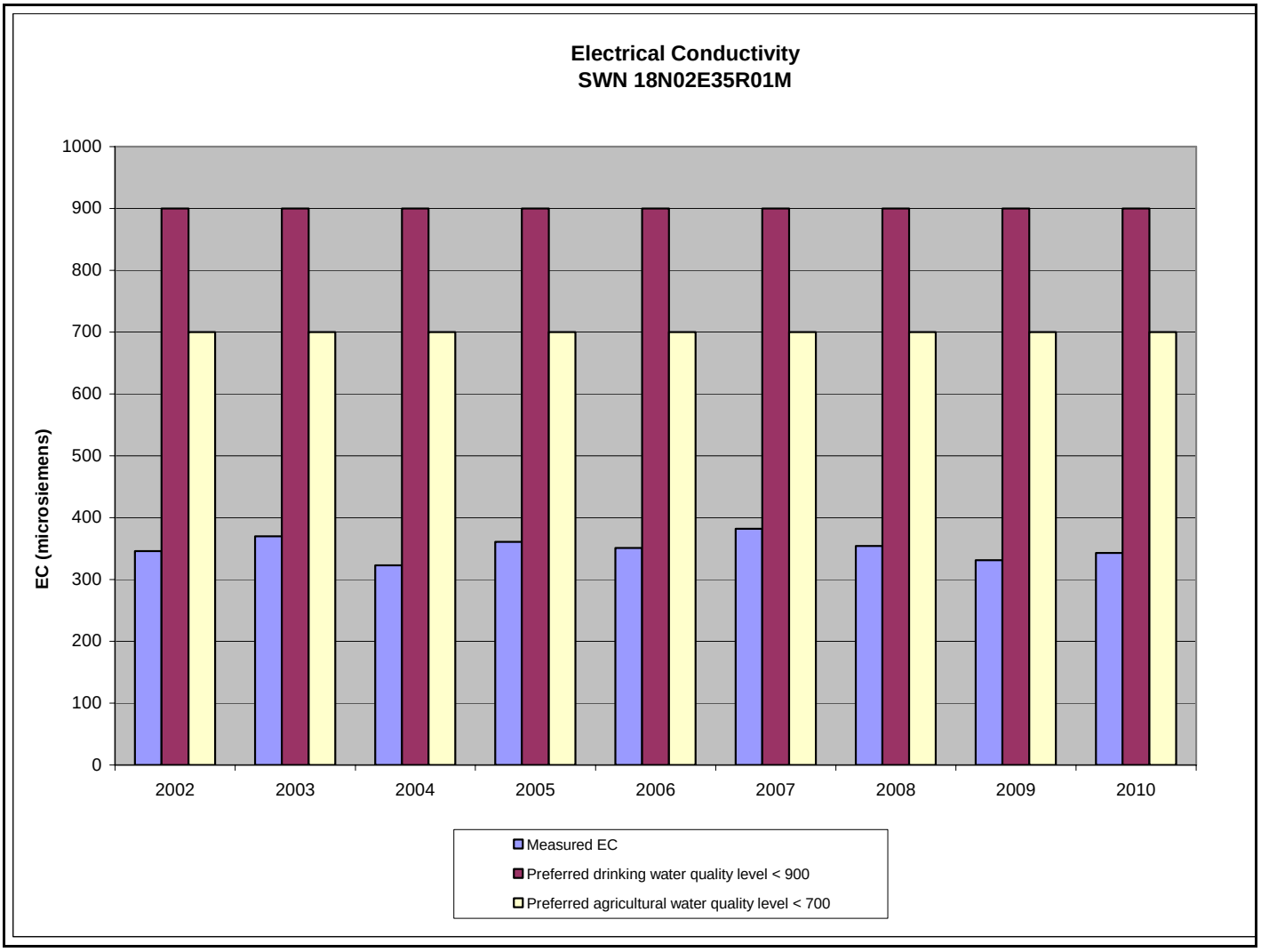


Figure 2. Biggs-West Gridley well monitored for EC

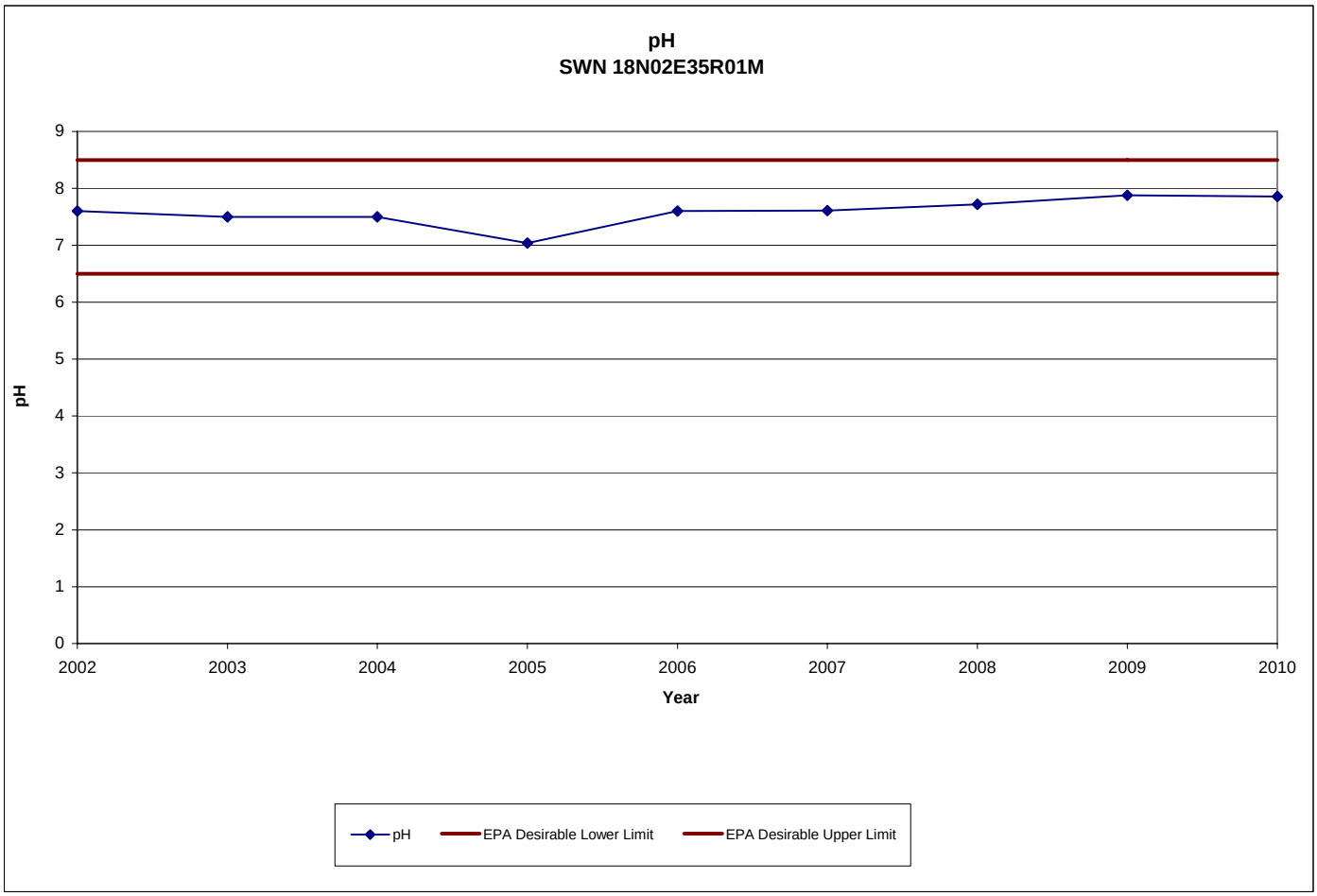


Figure 3. Biggs-West Gridley well monitored for pH

Cherokee

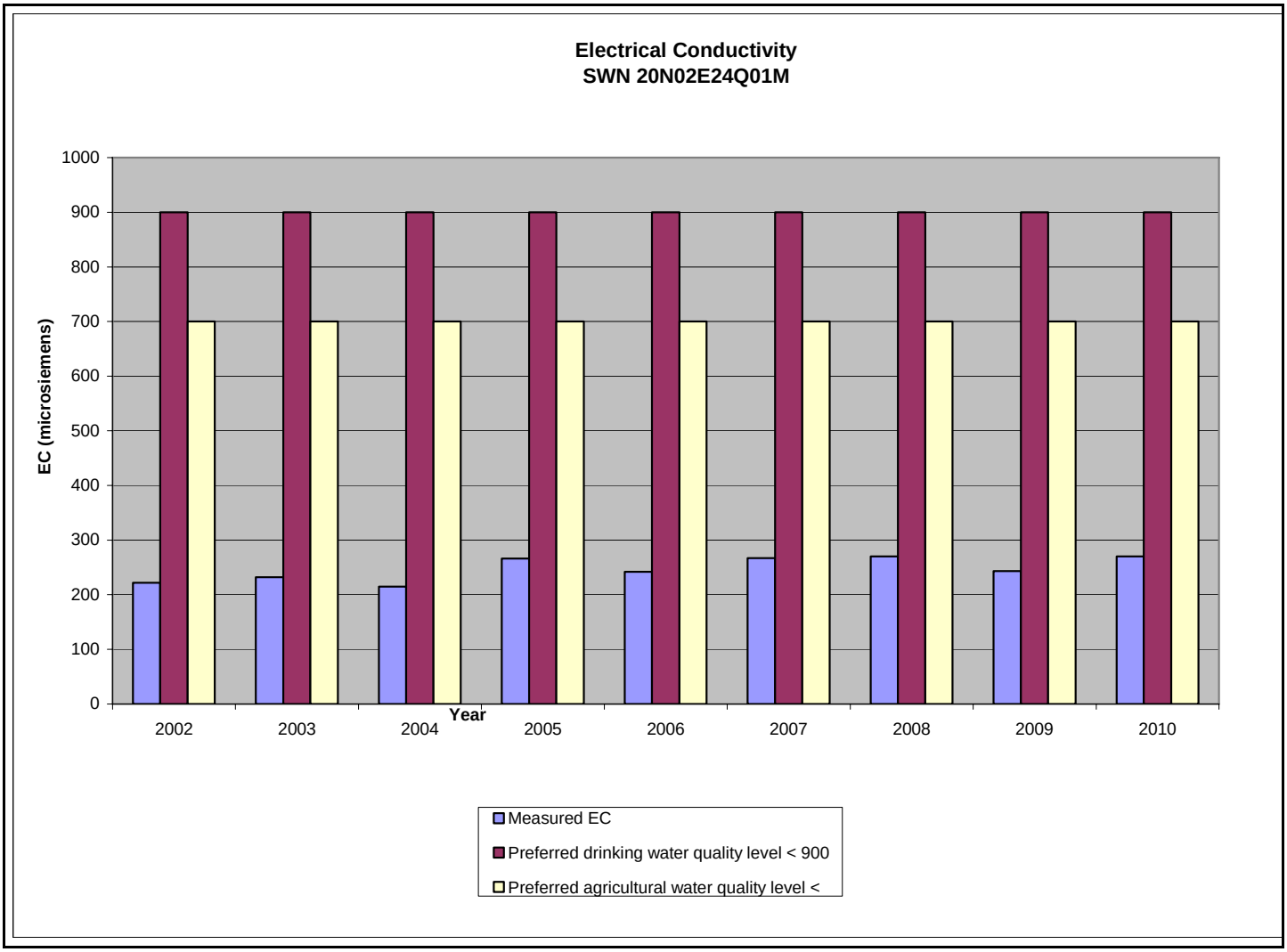


Figure 4. Cherokee well monitored for EC

Figure 5. Cherokee well monitored for pH

Chico Urban Area

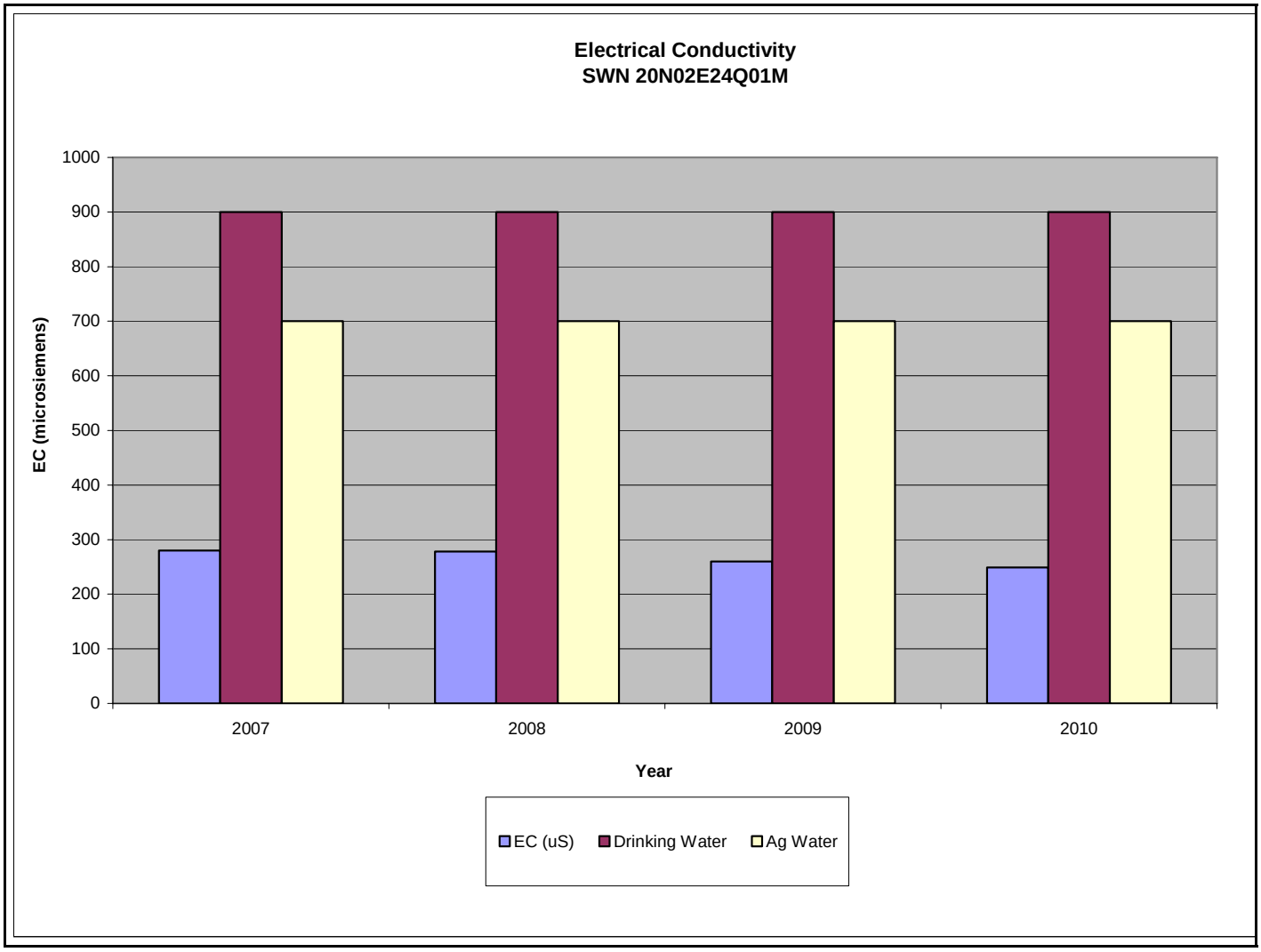


Figure 6. Chico Urban Area well monitored for EC

Figure 7. Chico Urban Area well monitored for pH

Durham-Dayton

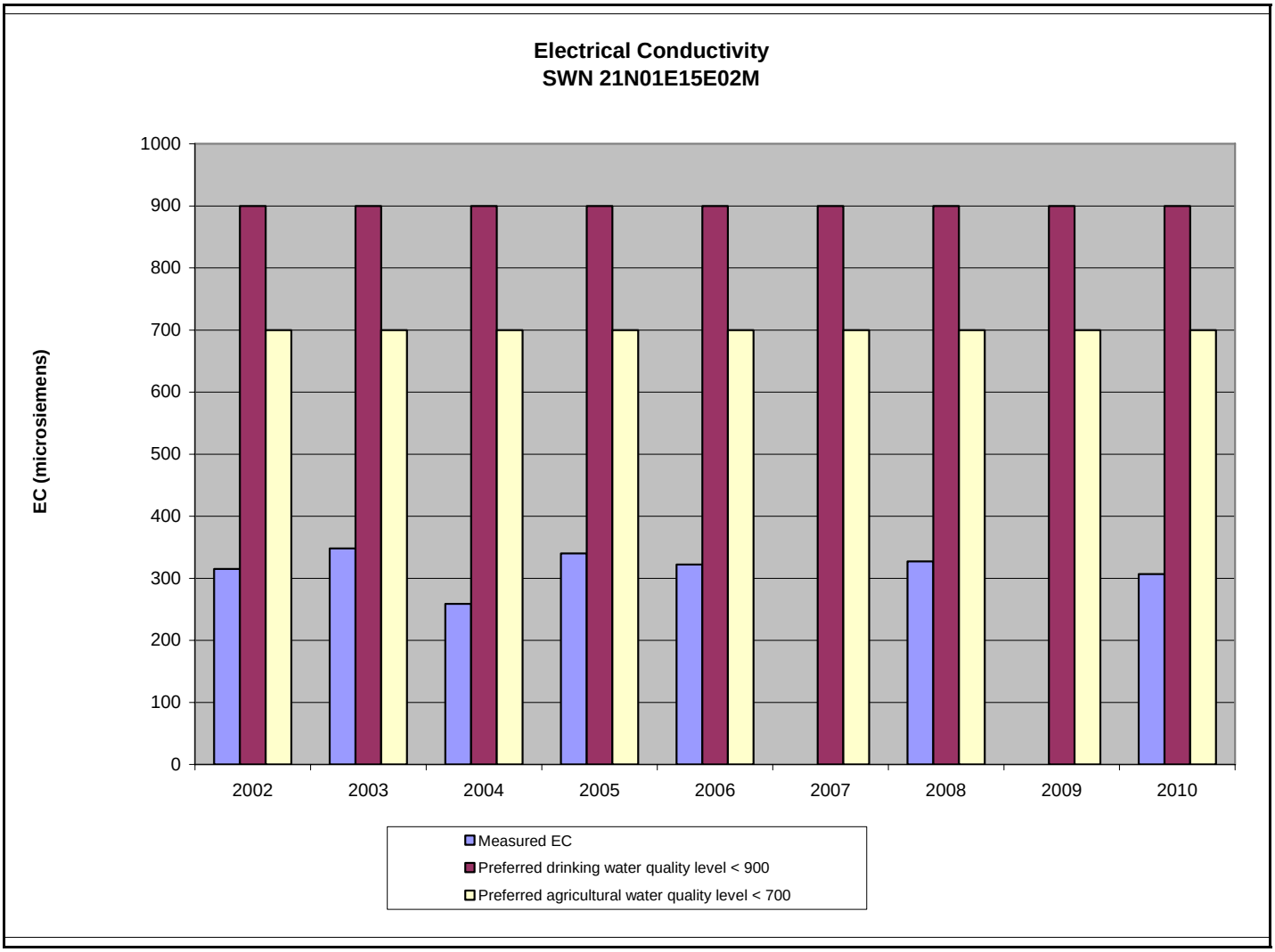


Figure 8. Durham Dayton well monitored for EC

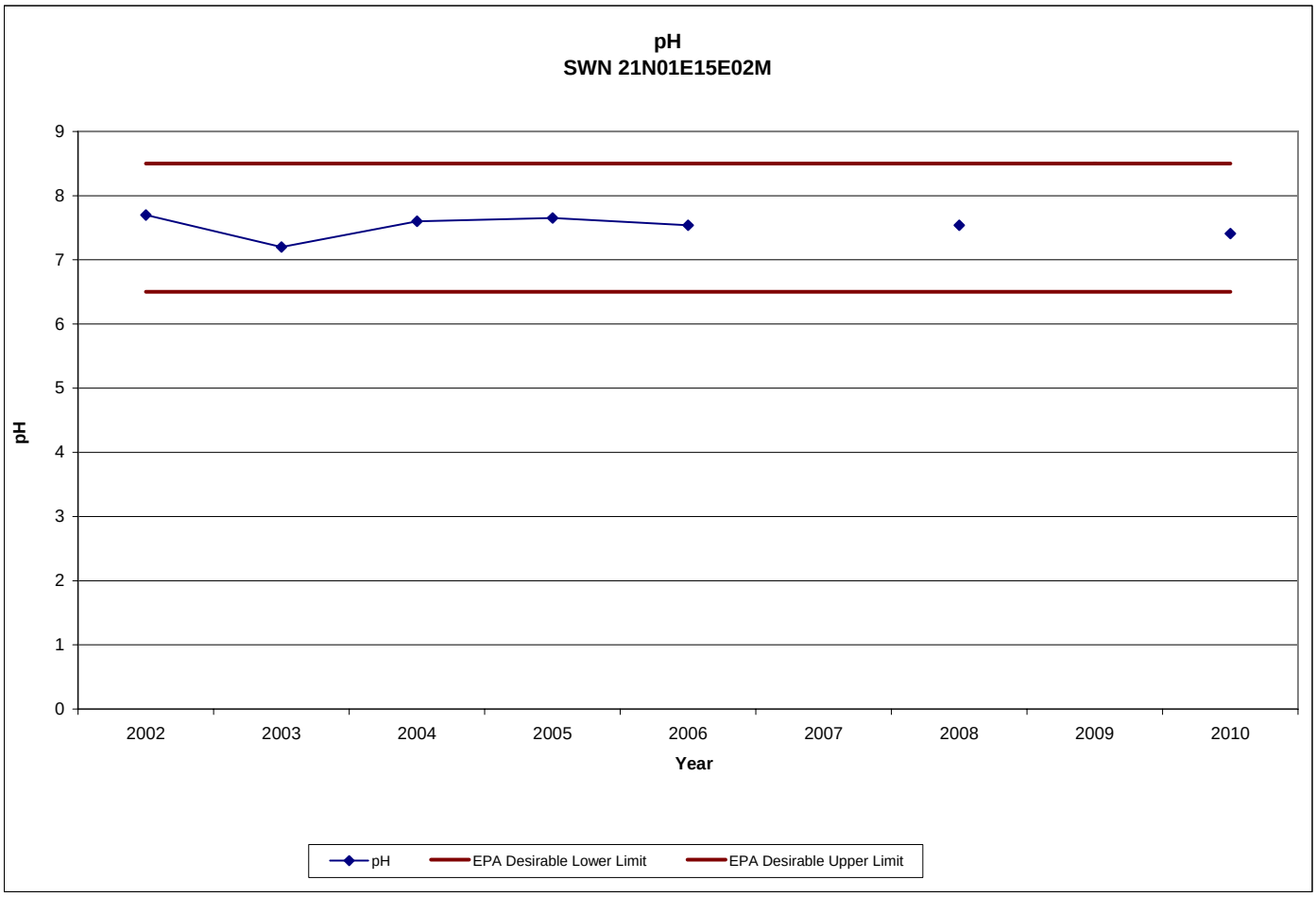


Figure 9. Durham Dayton well monitored for pH

Esquon

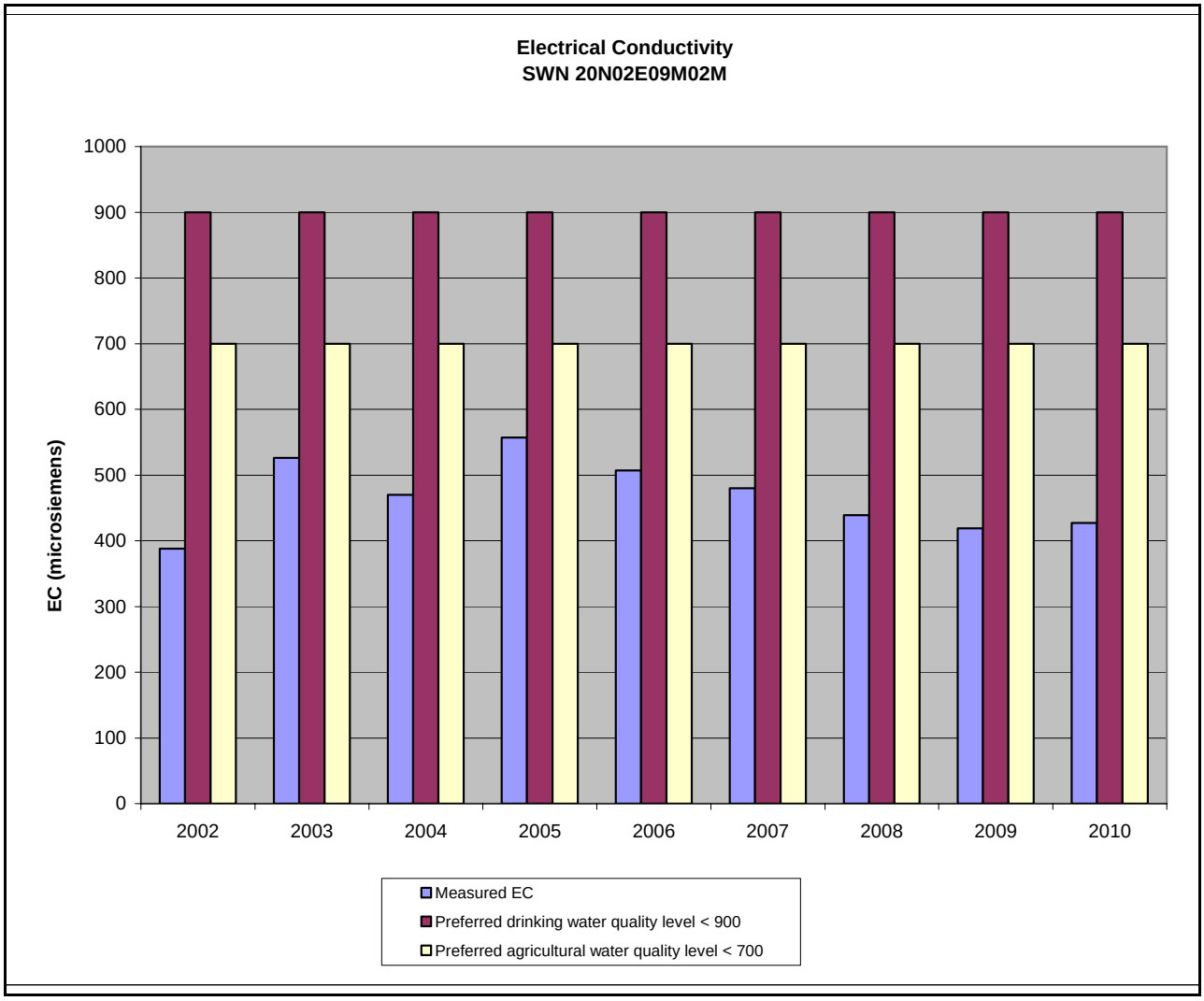


Figure 10. Esquon well monitored for EC

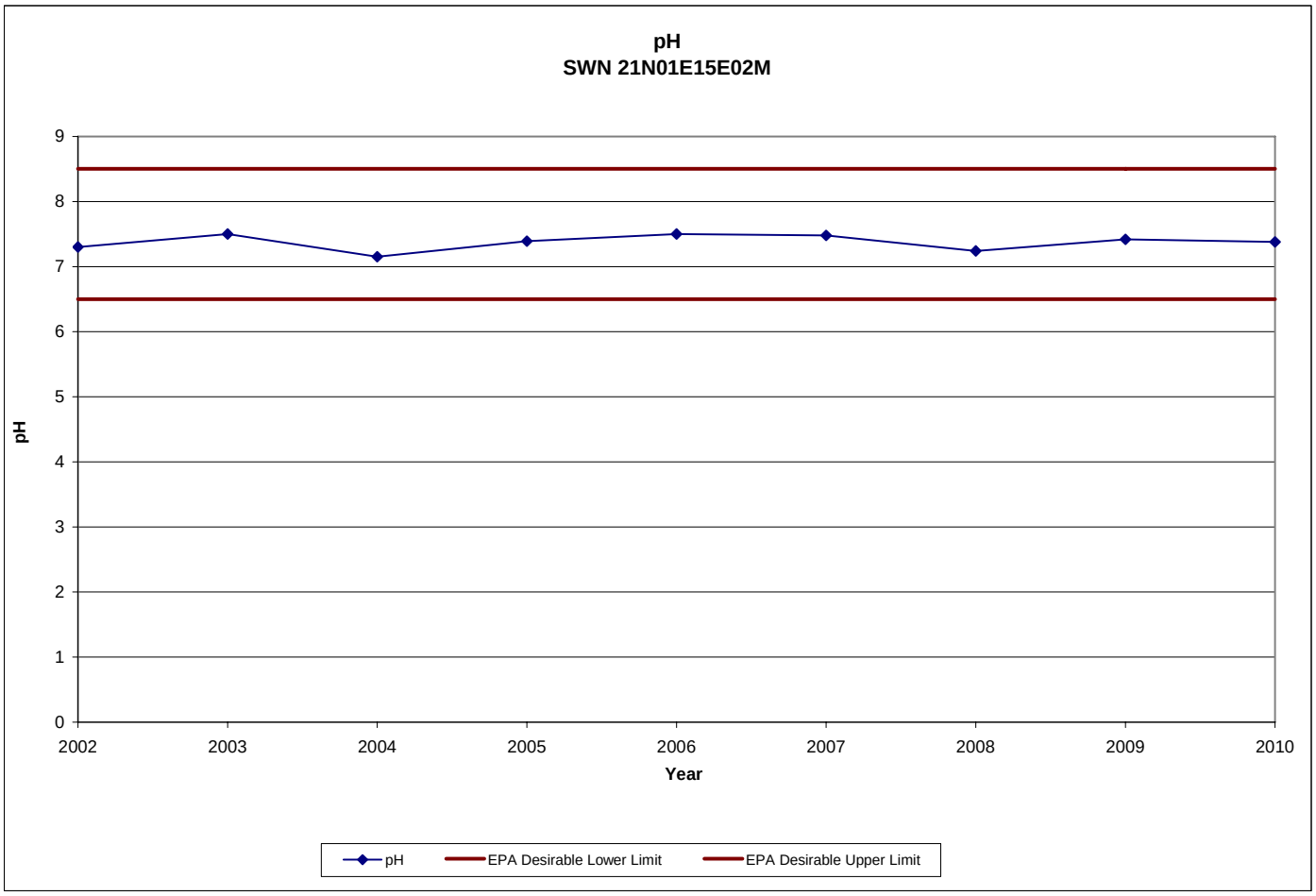


Figure 11. Esquon well monitored for pH

M&T

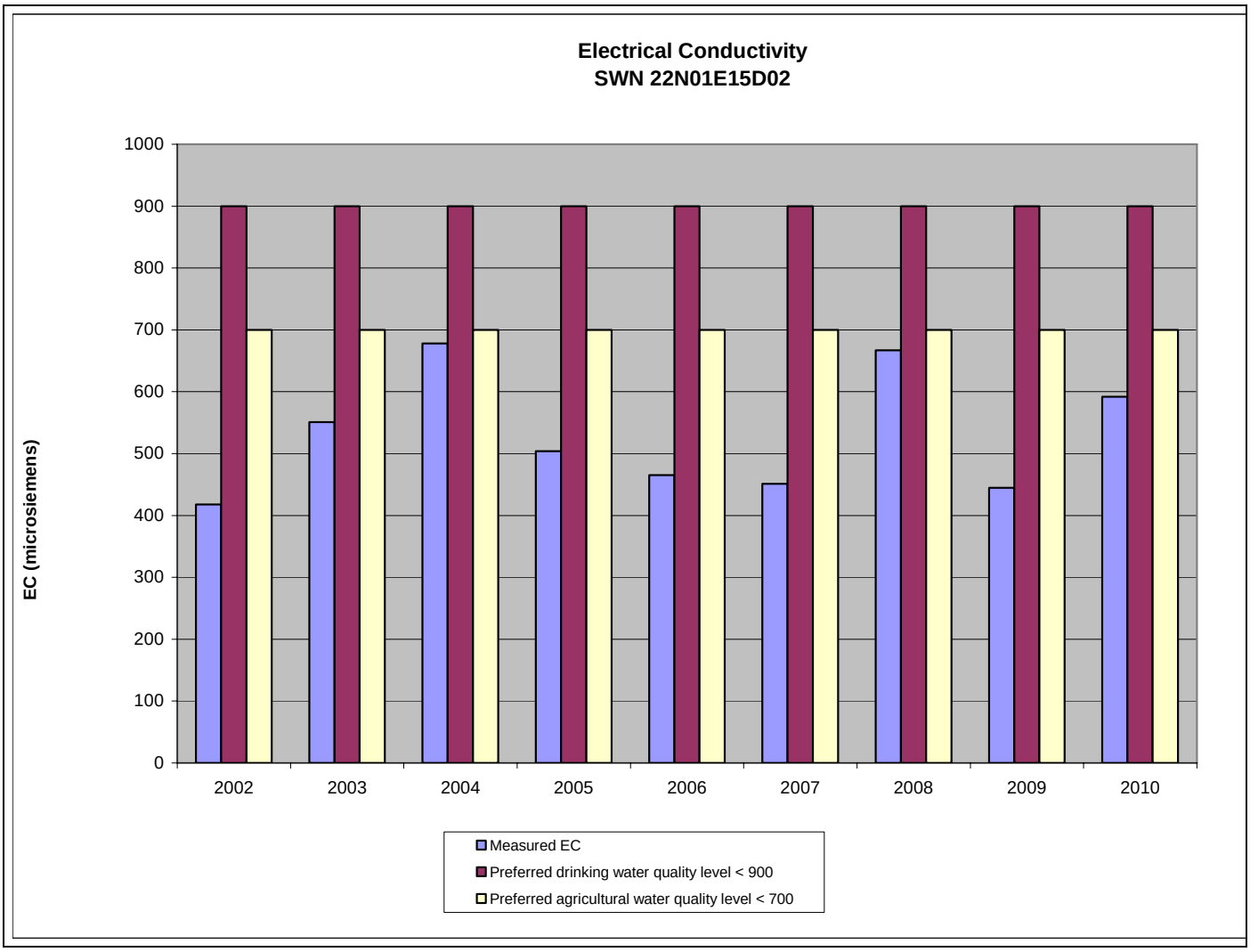


Figure 12. M&T well monitored for EC

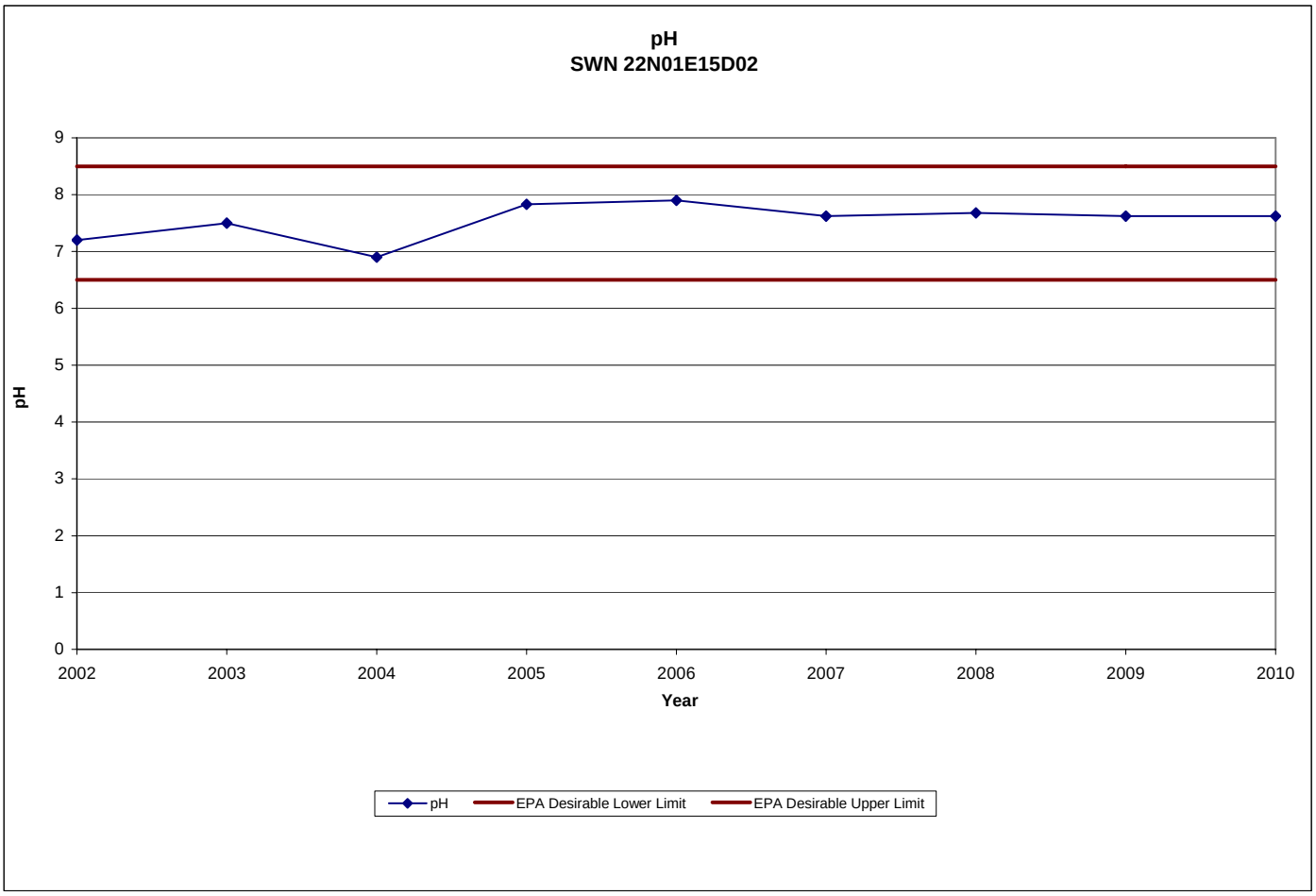


Figure 13. M&T well monitored for pH

Pentz

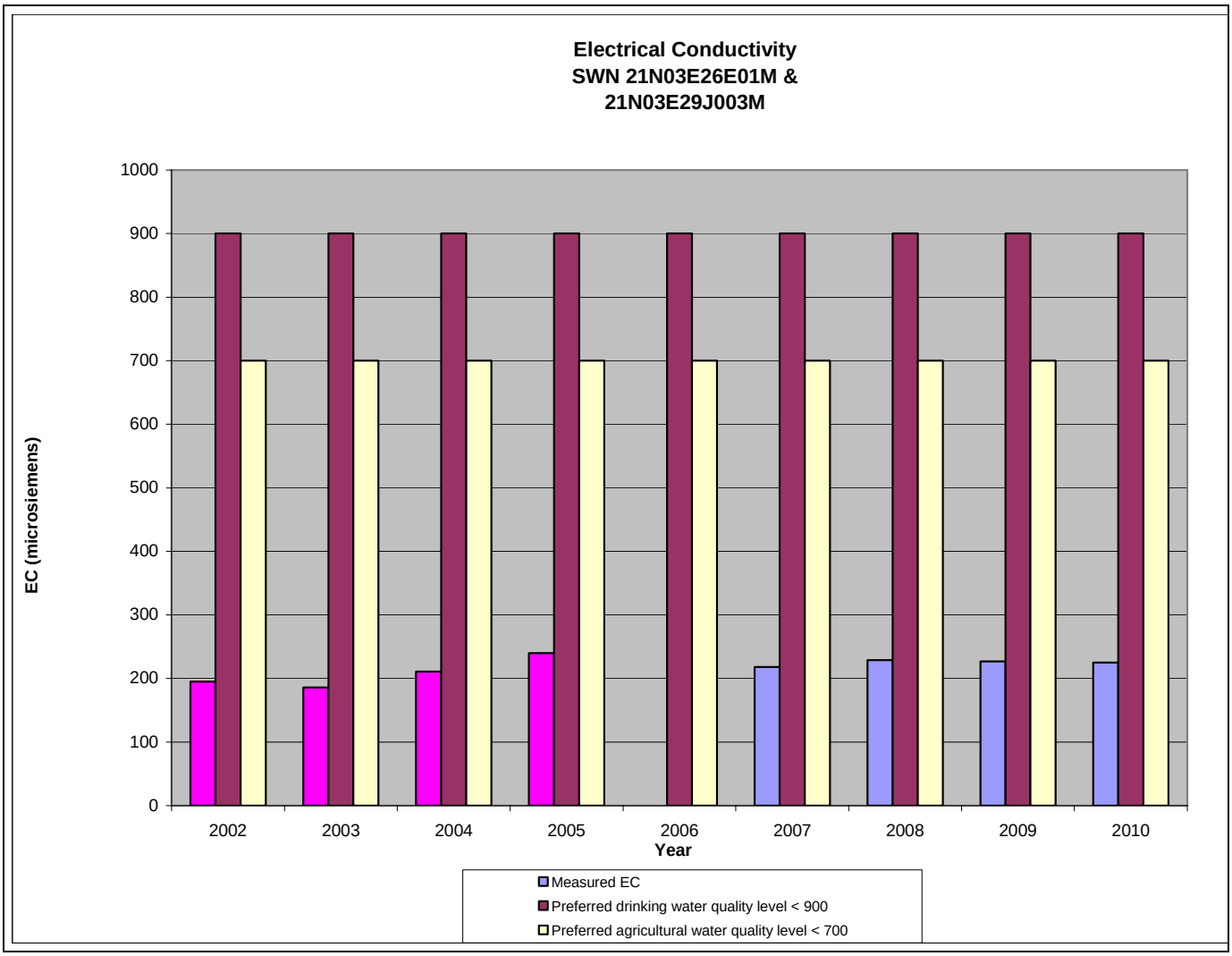


Figure 14. Pentz well monitored for EC

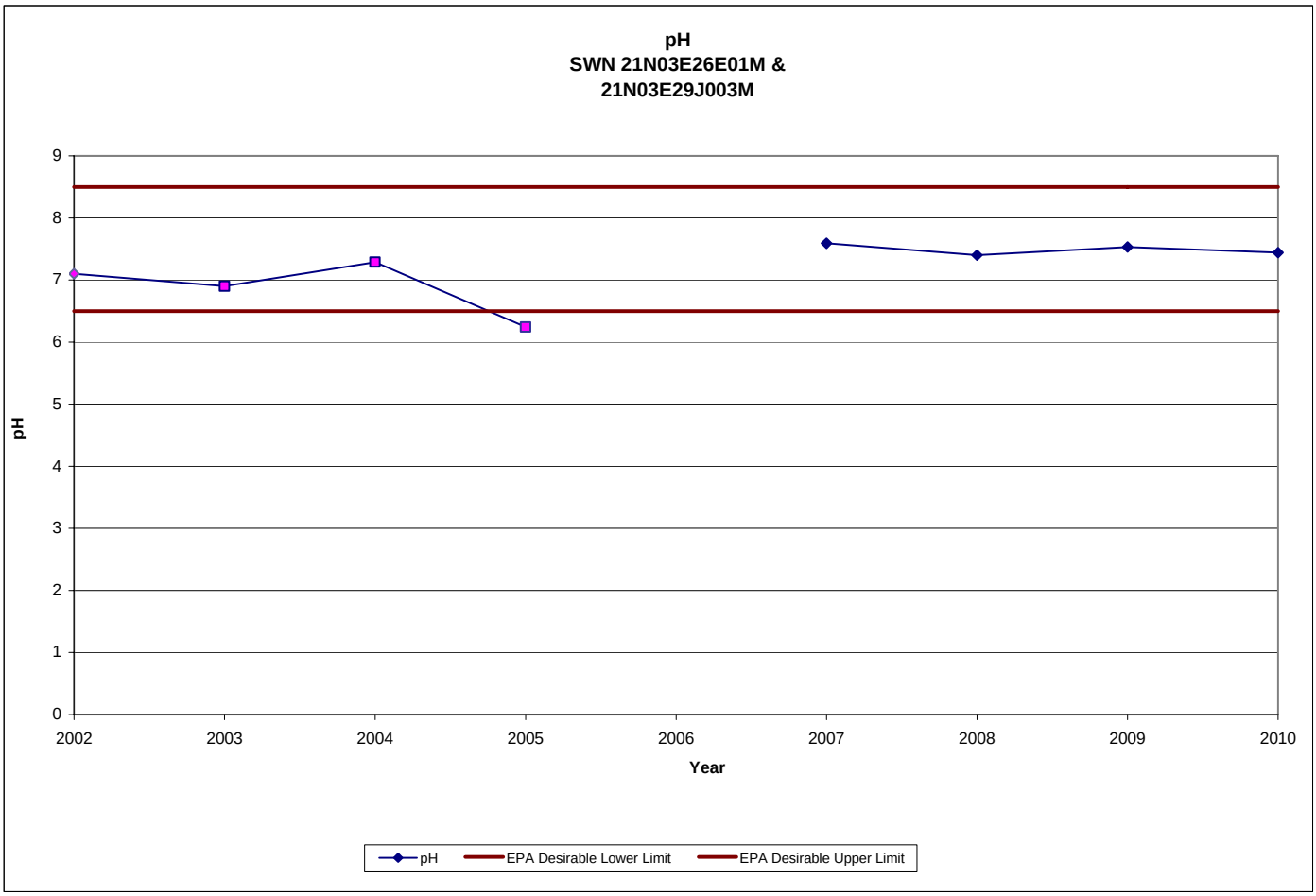


Figure 15. Pentz well monitored for pH

Thermalito

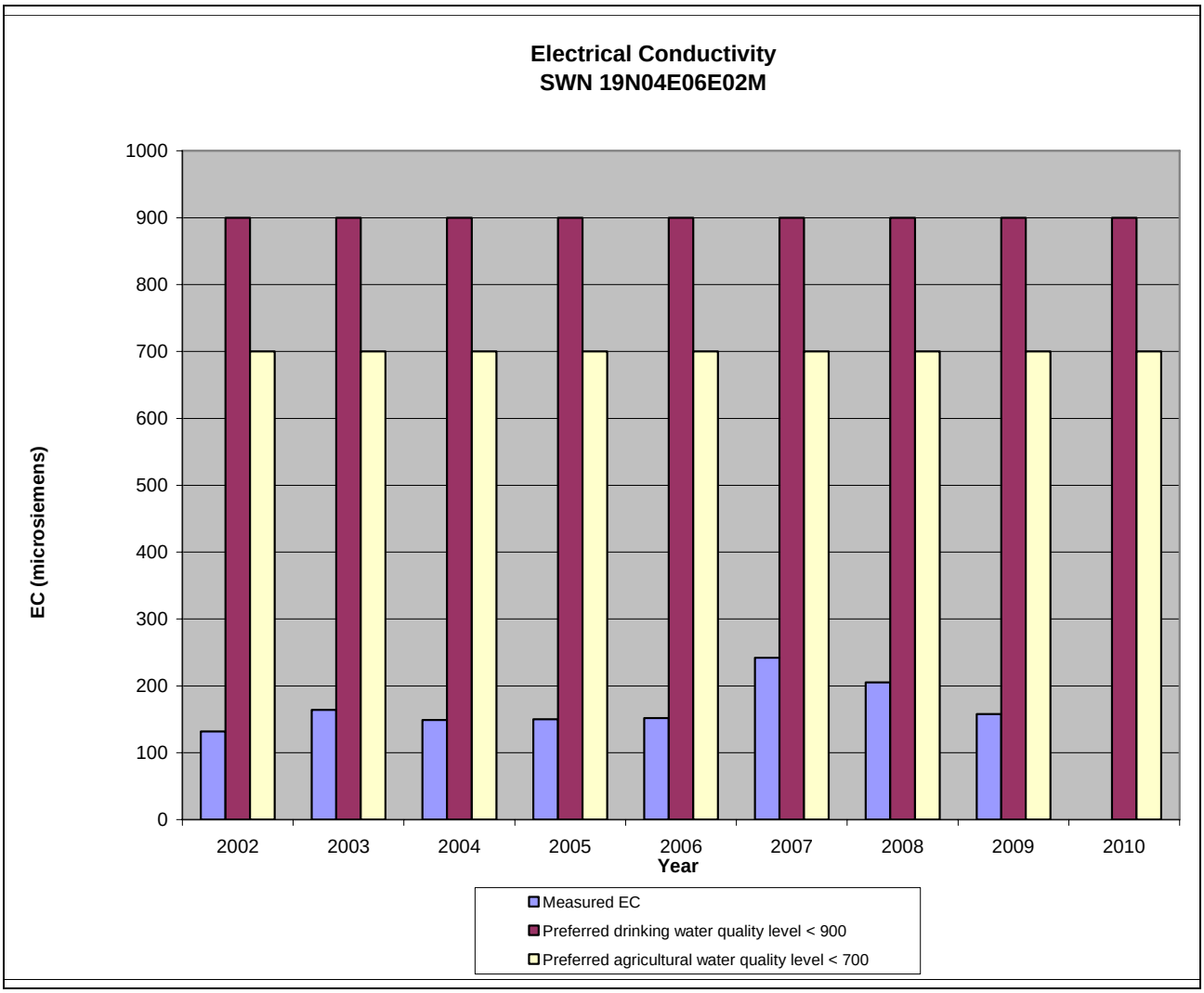


Figure 16. Thermalito well monitored for EC

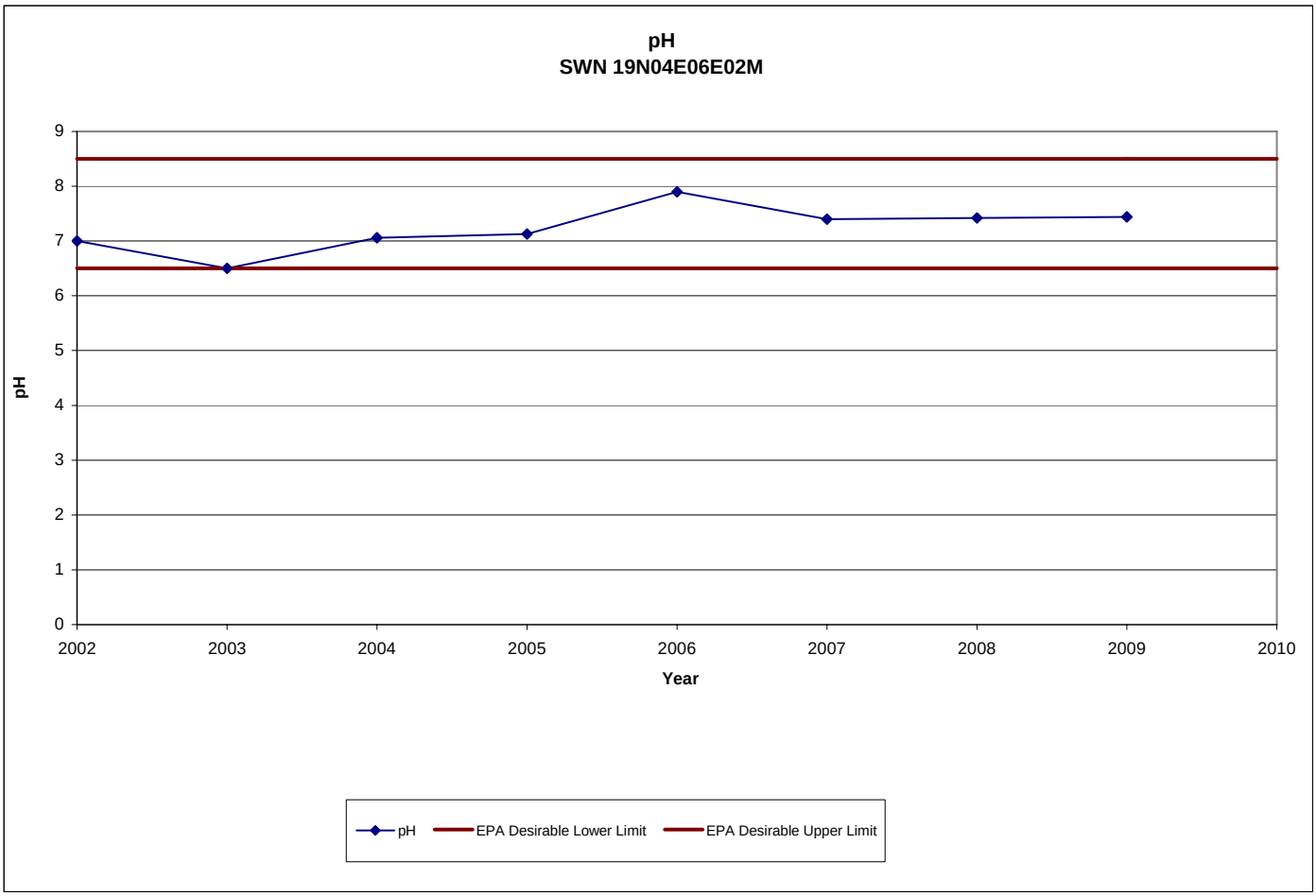


Figure 17. Thermalito well monitored for pH

Vina

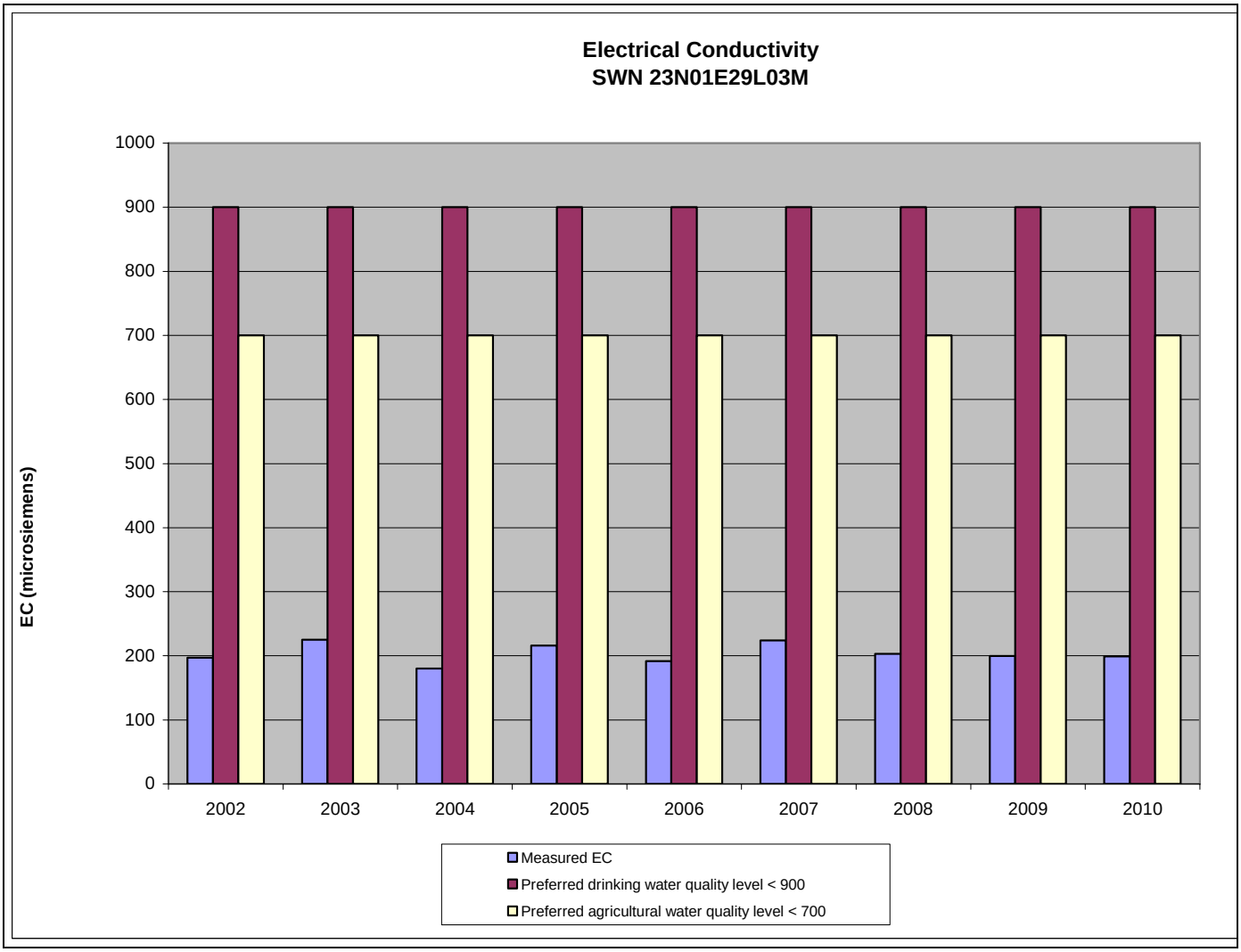


Figure 18. Vina well monitored for EC

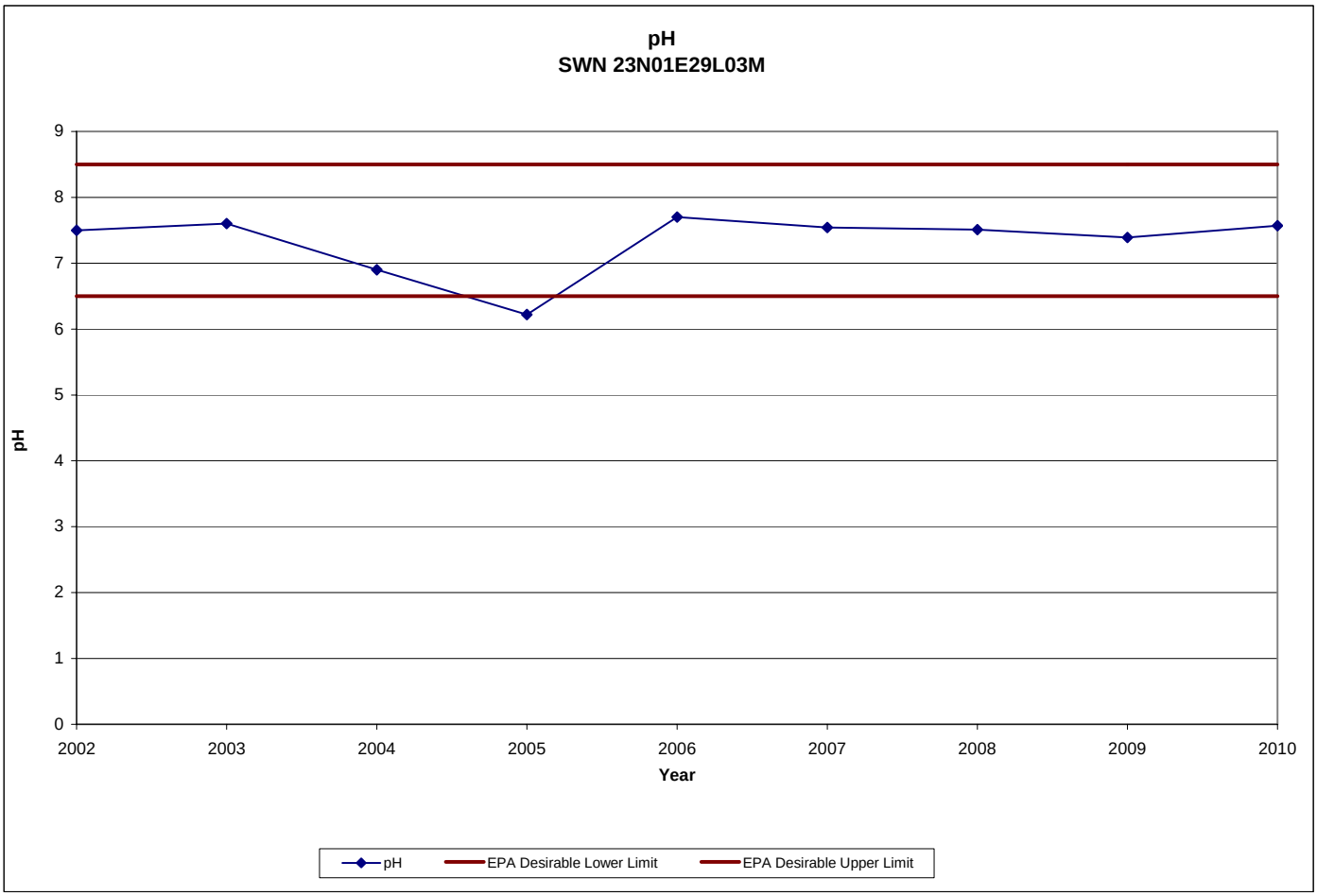


Figure 19. Vina well monitored for pH

Western Canal (east)

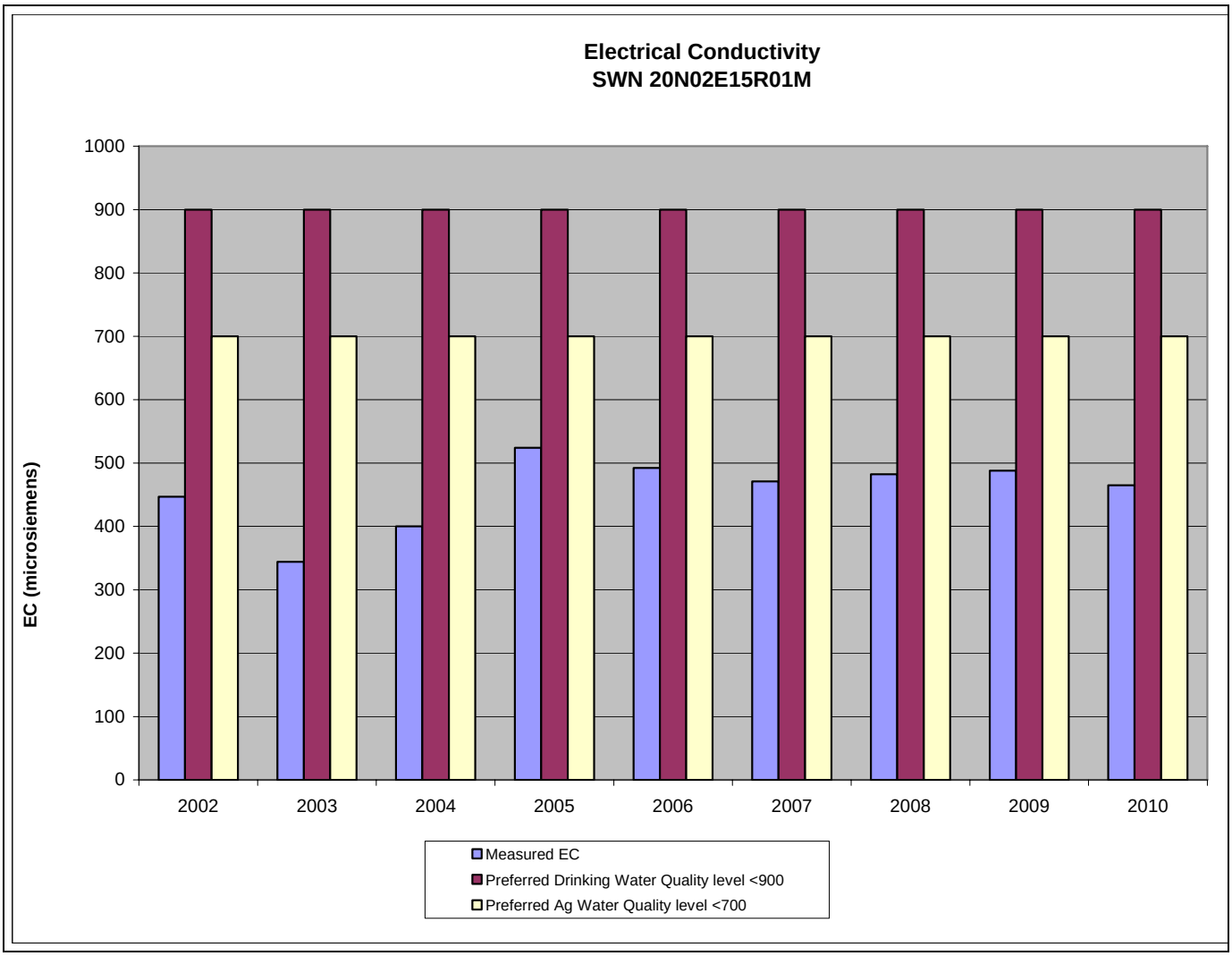


Figure 20. Western Canal (east) well monitored for EC

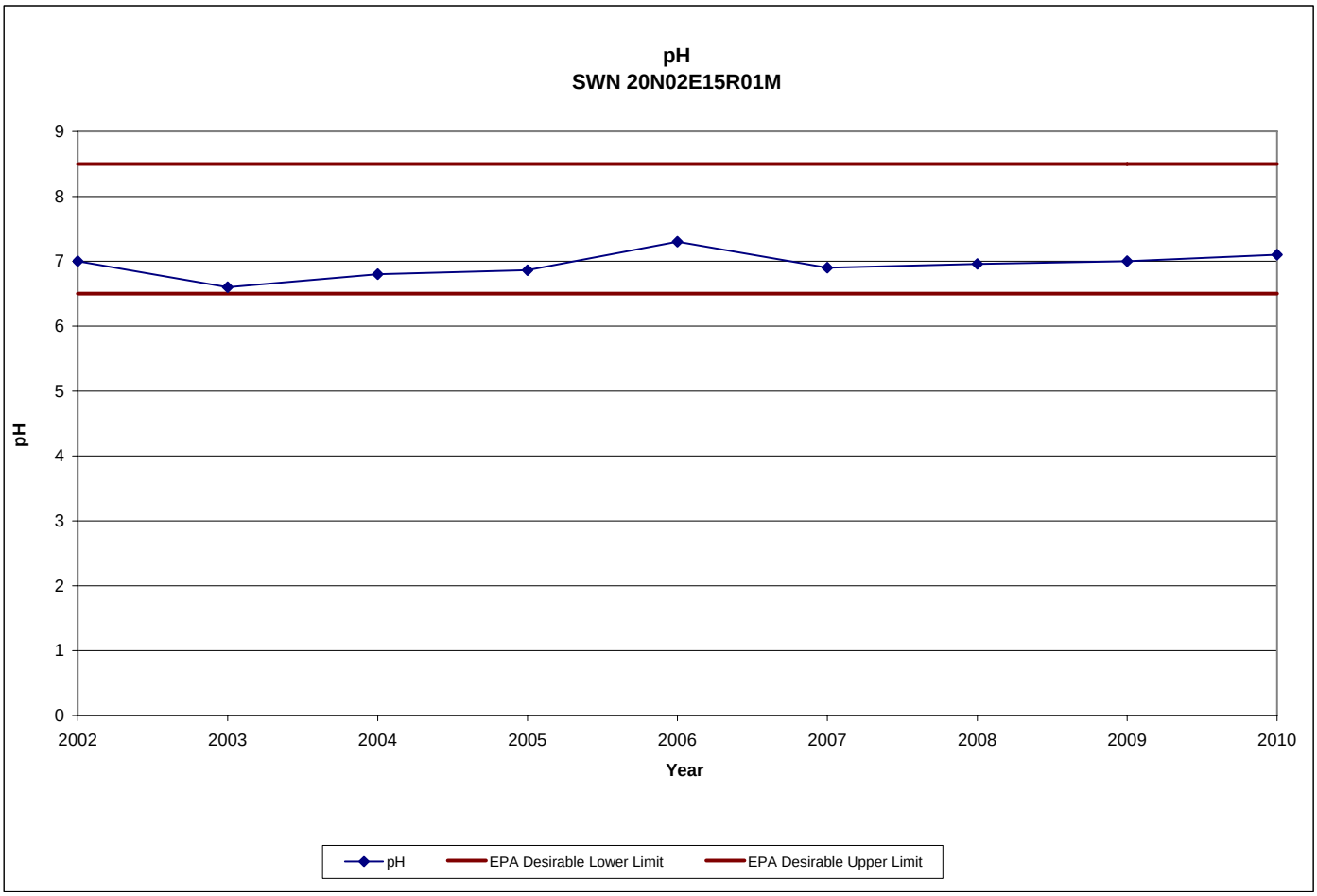


Figure 21. Western Canal (east) well monitored for pH

Western Canal (west)

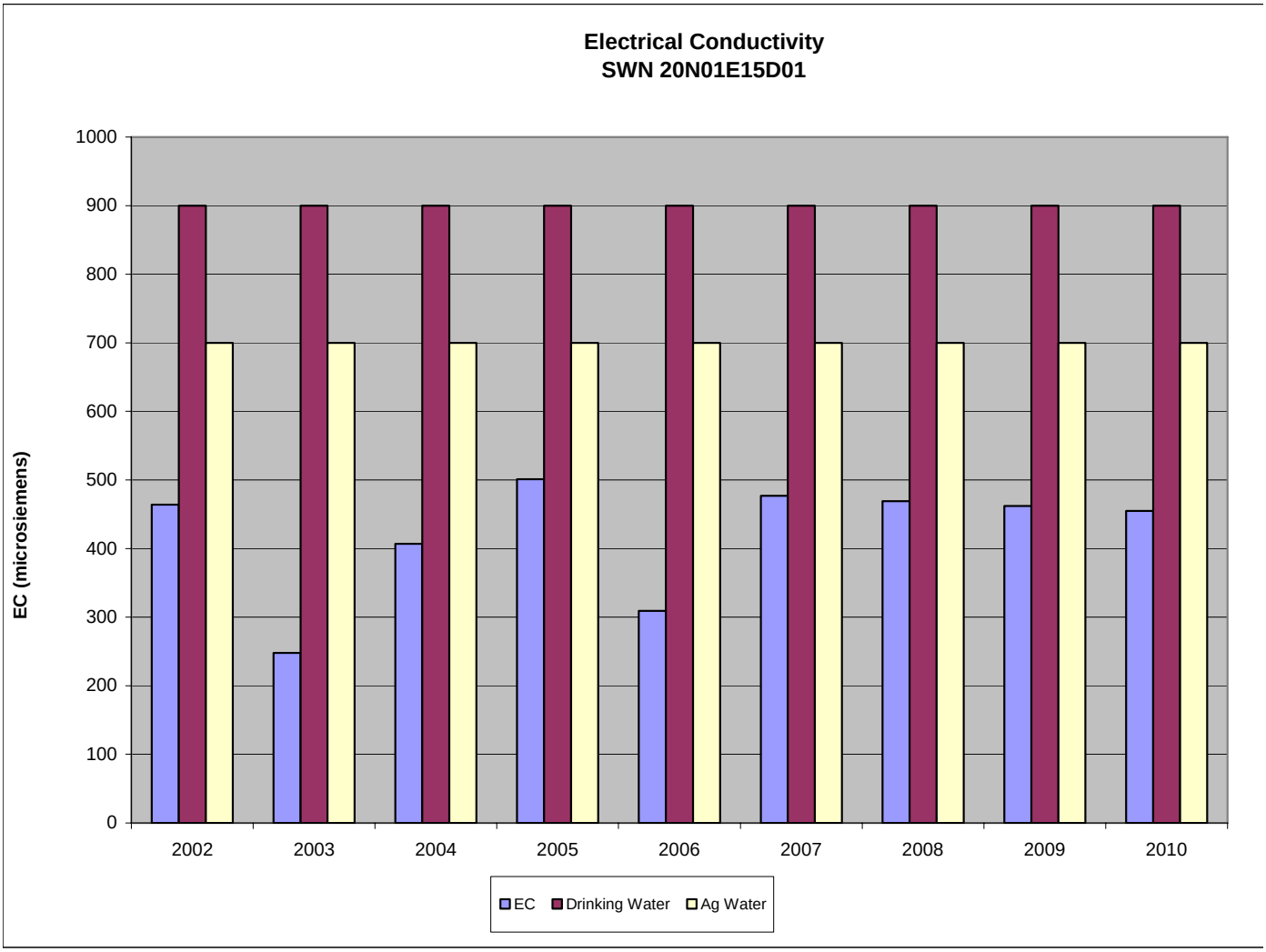


Figure 22. Western Canal (west) well monitored for EC

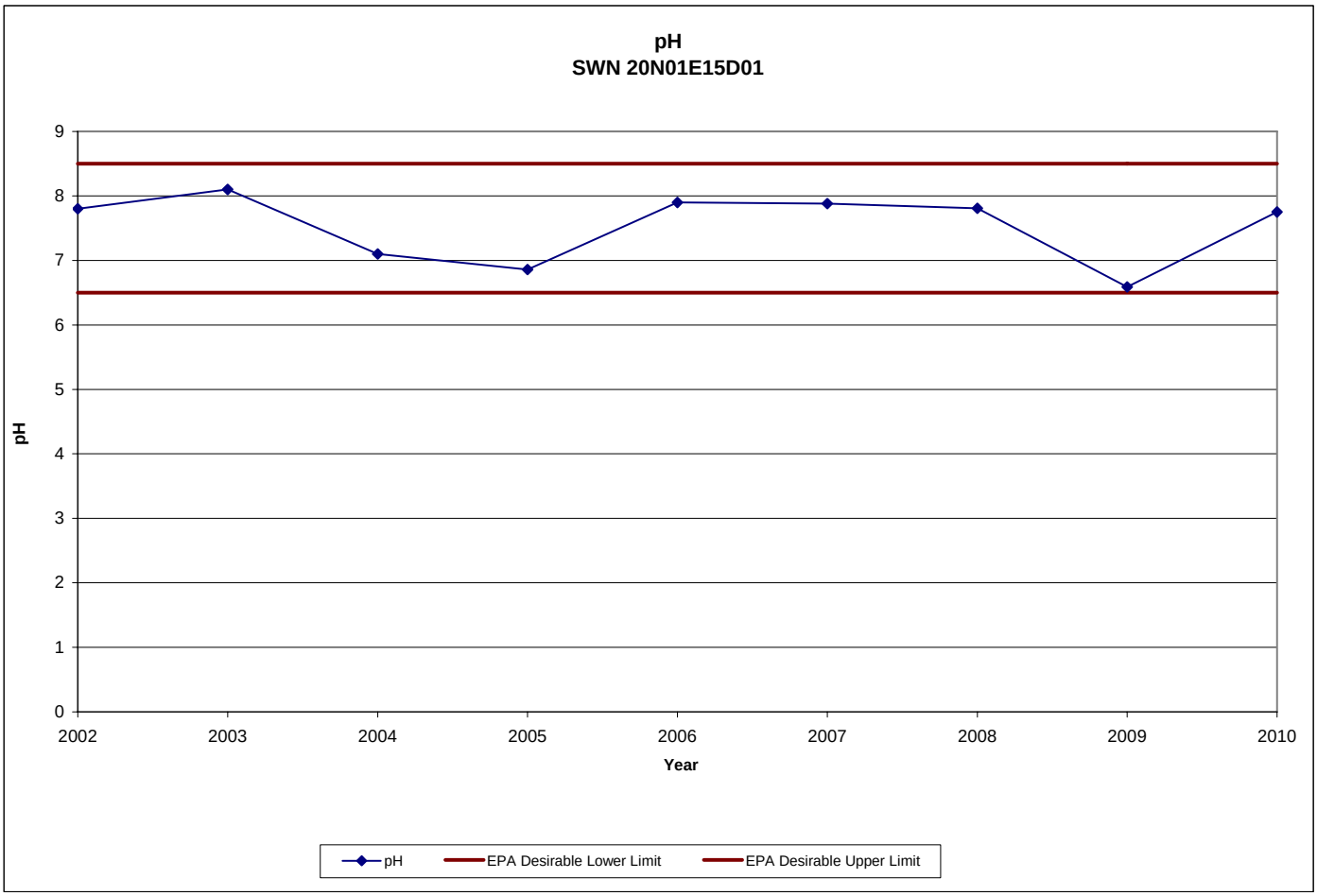


Figure 23. Western Canal (west) well monitored for pH

APPENDIX A

Federal, State and Local
Groundwater Quality Monitoring

Table 4 Groundwater Protection Programs

	Federal Agencies										State & Local Agencies																	Coalitions & Associations									
		BLM	BOR	Corps	Forest Service	National Parks Service	NRCS	US Fish and Wildlife Service	USEPA	USGS		Academia	CalRecycle	CDFA	Central Valley Water Board	Cities	Counties	CUPAs	DFG	DOGGR	DPH	DPR	DTSC	DWR	IRWM Groups	Resource Conservation Districts	Special Districts	State Water Board	Water Districts		Association of California Water Agencies	California Groundwater Assn	California Rural Water Assn	California Urban Water Agencies	CV-SALTS	Groundwater Resource	Irrigated Lands Coalitions	Rural Community Assistance Corporation
Groundwater Monitoring*				a					a/c	a		a		c	c	c/d	c/d				d	a	c	a	a			a	a							c	
Confined Animal Facilities									R					R	R																						
Drinking Water									R												R																
Education & Outreach					N	N						N	N	N	N				N		N	N	N	N				N						N	N		N
Groundwater Recharge																																					
Hazardous Waste									R						R		R	R					R														
Irrigation Runoff															R		R																			R	
Land Use Planning						R																			N												
Landfills													N		R		R																				
Mining		R			R										R																						
Pesticide Sales & Use																R	R					R					N		N		N						
Reclamation & Recycling																					R							R									
Research						N				N		N				R	R								N												
Septic Systems															R		R											R									
Site Assessment & Cleanup				R					R						R								R														
Storm water & Erosion Control					R	R			R						R													R									
Technical Assistance							N			N		N				N	N								N							N					N
Timber Harvest					R										R																						
Underground Injection Control Program									R											R						N				N				N			
Underground Storage Tanks															R			R																			
Waste Discharges to Land															R																						
Water Conservation		R							R															N				R									
Water Delivery			R	R													R							R									N				
Water Quantity & Quality Planning																R	R							N													
Water Well Permitting																								R													
Wetland Protection				R				R							R				R						N			R									

*Groundwater monitoring key
a = ambient monitoring
c = compliance monitoring
d = drinking water monitoring

R = regulatory
N = non-regulatory