INTERDEPARTMENTAL MEMORANDUM

TO: Butte County Water Commission

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

SUBJECT: Cumulative Groundwater Quality Trend Monitoring update

DATE: October 3, 2006

INTRODUCTION and BACKGROUND

The Butte County Department of Water and Resource Conservation (DW&RC), in conjunction with California Department of Water Resources (DWR) and Glenn County Agricultural Department, recently conducted groundwater quality trend monitoring of nine wells within the county. Unfortunately, we were unable to obtain a sample in the Pentz sub-unit this year, and staff is working to secure a sampling location for the 2007 measurements. As stated in 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.

METHODOLOGY and ANALYSIS

This year, we partnered with the Glenn County Water Advisory Committee (functioning under advisement of the Ag Department) to use their Hach sension sampling meter. This partnering effort is another component of cooperation under the Board adopted Four Counties MOU. We have worked in the past, and will continue to do so, in a cooperative manner so that there will be some consistency in data collection across County lines making data review more consistent. Staff from DW&RC collected groundwater samples and utilized the portable meter to directly take measurements at each well location. The sites visited were on private land and the wells are typically used for agricultural purposes (irrigating orchards, rice, or pasture). Again, the sampling grid spans from north of the Chico Urban Area (Vina sub-unit), west towards the Sacramento River (M & T sub-unit), east towards the foothills (Butte Valley-Pentz sub-unit), and south towards Gridley (Biggs-West Gridley sub-unit).

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 four preceding years. To date, temperature has been consistent in all wells. For example, the average observed water temperatures from our wells this summer was approximately 19 ^{o}C (66 ^{o}F). Temperature is an important parameter because it affects chemical reactions that may occur

in groundwater. Other parameters such as pH remained stable and rarely deviated more than a single pH unit.

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. 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 2006 Readings	Notes re: Butte County Study
pH	6.5 to 8.5	7.3 – 7.9	Within range of secondary water quality thresholds.
Total Dissolved Solids (TDS)	< 500 ppm – drinking water < 450 ppm – ag water	73 - 246	Within range of secondary water quality thresholds
Electrical Conductivity (EC)	< 900 uS – drinking water < 700 uS – ag water	152 - 507	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 is the fifth season the DW&RC collected groundwater quality information. At this time we do not have sufficient information to make valid assumptions regarding any trends in water quality changes. 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. This data will help the DW&RC in 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.

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. Otherwise, if you have questions please contact Kristen at 538-6265.

Table 2. Cumulative Temperature Measurements in degrees Celsius

Groundwater Temperature - 2002 through 2006						
Sub-area	**State Well Number**	**2002 Temp °C**	**2003 Temp °C**	**2004 Temp °C**	**2005 Temp °C**	**2006 Temp °C**
Biggs-West Gridley	18NO2E35R01M	18.5	18.5	18.1	20.5	18.2
Cherokee	20N02E24QO1M	22.4	21.9	21.2	21.4	21.1
Durham Dayton	21N01E15EO2M	18.8	19.9	21.8	20.4	17.4
Esquon	20N02E09M02M	19.7	18.9	19.6	20.1	20.7
M & T	22N01E15DO2M	17.6	18.2	17.8	19.2	18.6
Thermalito	19NO4E06E02M	18.3	17.9	17.1	17.1	18.4
Vina	23N01E29LO3M	19.6	20.3	19.2	19.2	19.6
Western Canal (east)	20N02E15RO1M	18.4	18.2	19.9	20.5	18.8
Western Canal (west)	20N01E15D01M	19	18.1	19.8	20.8	18.5

Table 3. Average and Range of Temperature – 2002 through 2006

Sub-area	Average	Range
Biggs-West Gridley	18.8	18.1 - 20.5
Cherokee	21.6	21.1 - 22.4
Durham Dayton	19.7	17.4 - 21.8
Esquon	19.8	18.9 - 20.7
M & T	18.3	17.6 - 19.2
Thermalito	17.8	17.1 - 18.4
Vina	19.6	19.2 - 20.3
Western Canal (east)	19.2	18.2 - 20.5
Western Canal (west)	19.2	18.1 - 20.8

Table 4. Cumulative pH Measurements

Groundwater pH - 2002 through 2006						
Sub-area	**State Well Number**	**2002 pH**	**2003 pH**	**2004 pH**	**2005 pH**	**2006 pH**
Biggs-West Gridley	18NO2E35R01M	7.6	7.5	7.5	7.1	7.6
Cherokee	20N02E24QO1M	7.5	7.5	7.1	7.4	7.4
Durham Dayton	21N01E15EO2M	7.7	7.2	7.6	7.6	7.5
Esquon	20N02E09M02M	7.3	7.5	7.1	7.4	7.5
M & T	22N01E15DO2M	7.2	7.5	6.9	7.8	7.9
Thermalito	19NO4E06E02M	7.0	6.5	7.1	7.1	7.9
Vina	23N01E29LO3M	7.5	7.6	6.9	6.2	7.7
Western Canal (east)	20N02E15RO1M	7.0	6.6	6.8	6.9	7.3
Western Canal (west)	20N01E15D01M	7.8	8.1	7.1	6.9	7.9

Table 5. Average and Range of pH – 2002 through 2006

Sub-area	Average	Range
Biggs-West Gridley	7.5	7.0 - 7.6
Cherokee	7.4	7.1 - 7.5
Durham Dayton	7.5	7.2 - 7.7
Esquon	7.4	7.1 - 7.5
M & T	7.7	6.9 - 7.9
Thermalito	7.5	6.5 - 7.9
Vina	7.4	6.2 - 7.7
Western Canal (east)	7.1	6.6 - 7.3
Western Canal (west)	7.7	6.9 - 8.1

Table 6. Cumulative EC Measurements in microsiemens

Groundwater EC - 2002 through 2006						
Sub-area	**State Well Number**	**2002 EC**	**2003 EC**	**2004 EC**	**2005 EC**	**2006 EC**
Biggs-West Gridley	18NO2E35R01M	346	370	323	361	351
Cherokee	20N02E24QO1M	222	232	215	266	242
Durham Dayton	21N01E15EO2M	315	348	259	340	322
Esquon	20N02E09M02M	388	526	470	557	507
M & T	22N01E15DO2M	418	551	678	504	465
Thermalito	19NO4E06E02M	132	164	149	150	152
Vina	23N01E29LO3M	197	225	180	216	192
Western Canal (east)	20N02E15RO1M	447	344	400	524	492
Western Canal (west)	20N01E15D01M	464	248	407	501	309

Table 7. Average and Range of EC – 2002 through 2006

Sub-area	Average	Range
Biggs-West Gridley	351	323 - 370
Cherokee	239	215 - 266
Durham Dayton	319	259 - 348
Esquon	498	388 - 557
M & T	494	418 - 678
Thermalito	151	132 - 164
Vina	197	180 - 225
Western Canal (east)	467	344 - 524
Western Canal (west)	347	248 - 501

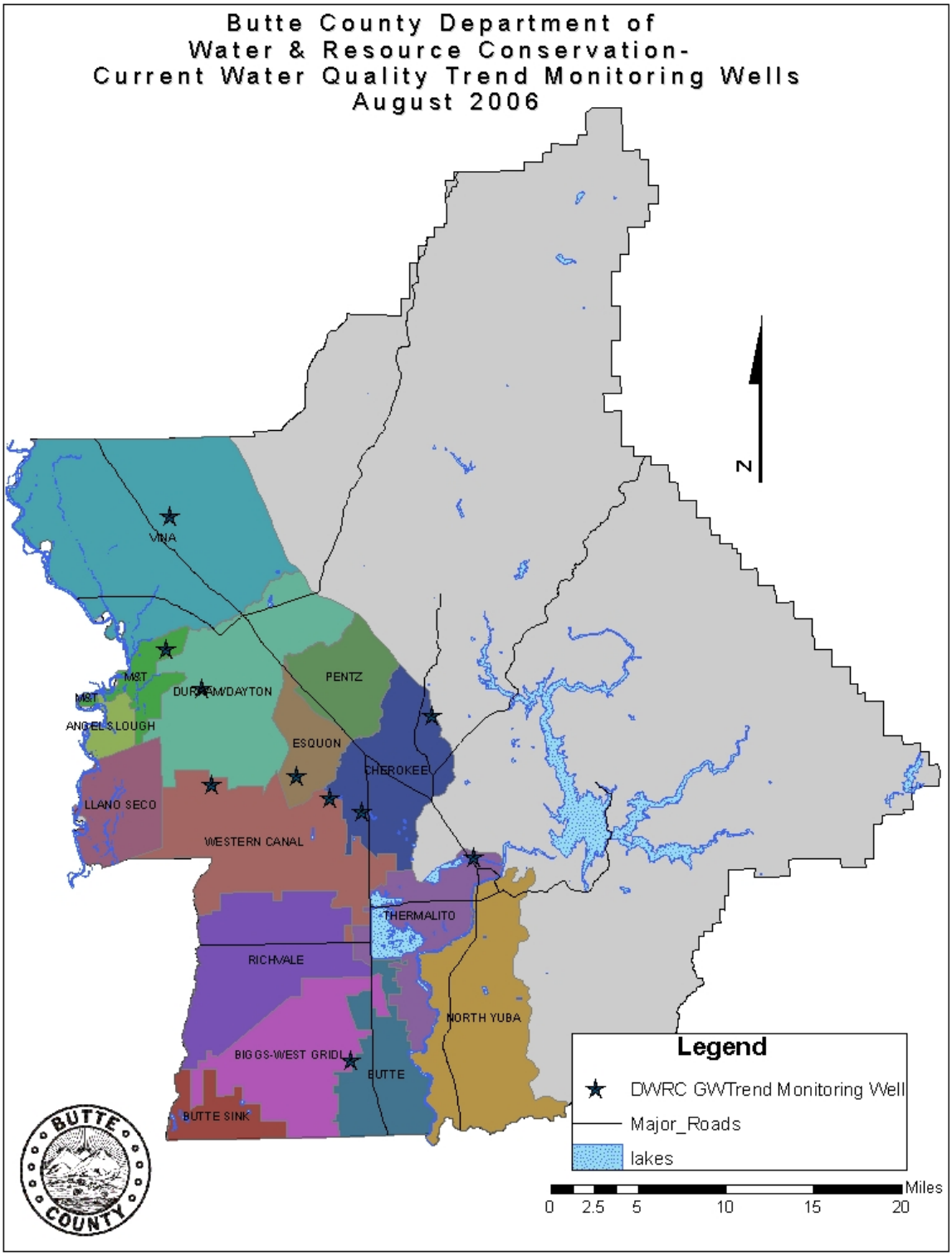
Table 8. Cumulative TDS Measurements in mg/L (1 mg/L = 1 ppm for dilute aqueous solutions)

Groundwater TDS - 2002 through 2006						
Sub-area	**State Well Number**	**2002 TDS**	**2003 TDS**	**2004 TDS**	**2005 TDS**	**2006 TDS**
Biggs-West Gridley	18NO2E35R01M	172	184	163	180	169
Cherokee	20N02E24QO1M	111	115	109	132	116
Durham Dayton	21N01E15EO2M	161	175	130	169	155
Esquon	20N02E09M02M	194	265	235	278	244
M & T	22N01E15DO2M	209	279	340	251	225
Thermalito	19NO4E06E02M	67	82	73	75	73
Vina	23N01E29LO3M	96	109	90	107	90
Western Canal (east)	20N02E15RO1M	223	172	203	262	246
Western Canal (west)	20N01E15D01M	232	123	206	250	155

Table 9. Average and Range of TDS – 2002 through 2006

Sub-area	Average	Range
Biggs-West Gridley	171	163 - 184
Cherokee	116	109 - 132
Durham Dayton	157	130 - 175
Esquon	244	194 - 278
M & T	243	209 - 340
Thermalito	74	67 - 82
Vina	94	90 - 190
Western Canal (east)	234	172 - 262
Western Canal (west)	174	123 - 250

Figure 1. Map of Butte County Groundwater Quality Monitoring Locations



Biggs-West Gridley

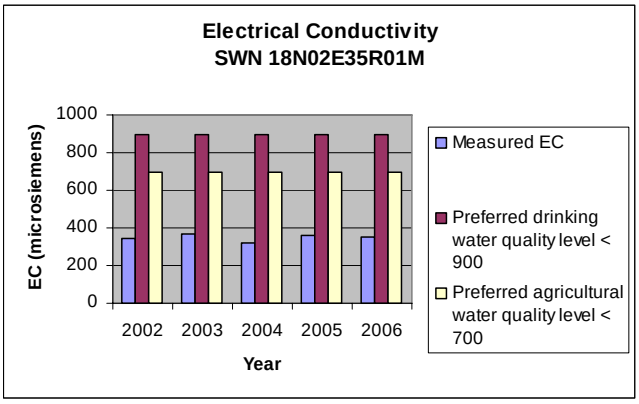


Figure 2. Biggs-West Gridley well monitored for EC by DW&RC

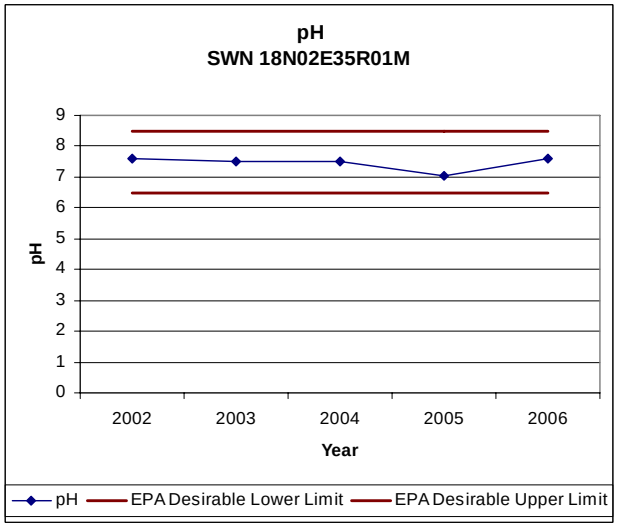


Figure 3. Biggs-West Gridley well monitored for pH by DW&RC

Thermalito

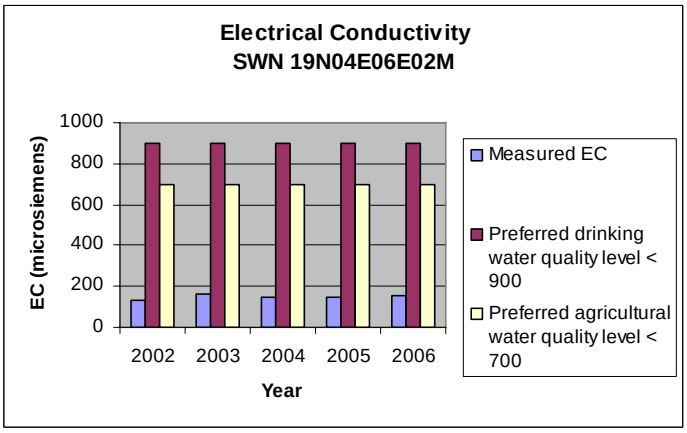


Figure 4. Thermalito well monitored for EC by DW&RC

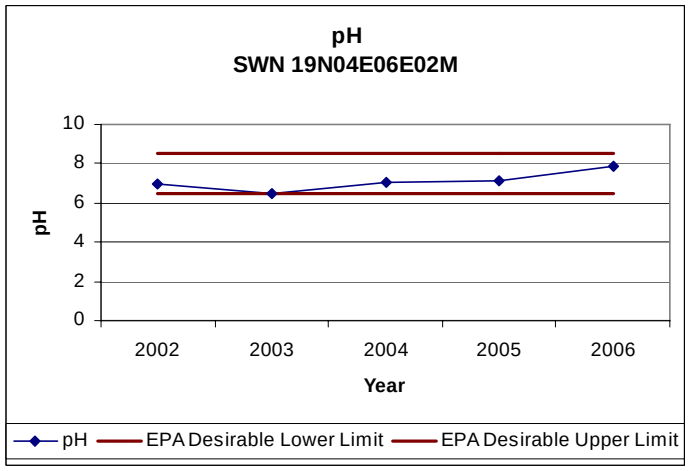


Figure 5. Thermalito well monitored for pH by DW&RC

Western Canal (west)

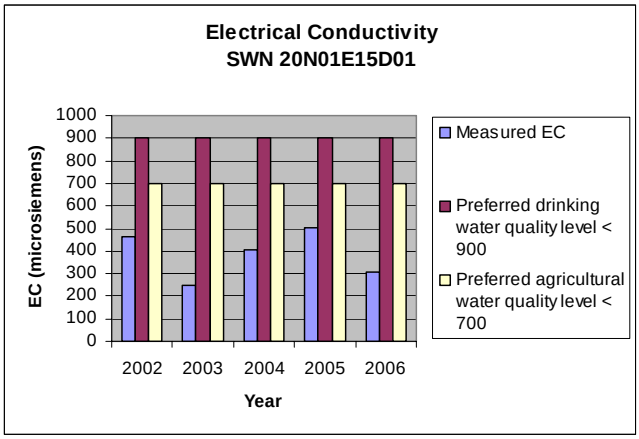


Figure 6. Western Canal (west) well monitored for EC by DW&RC

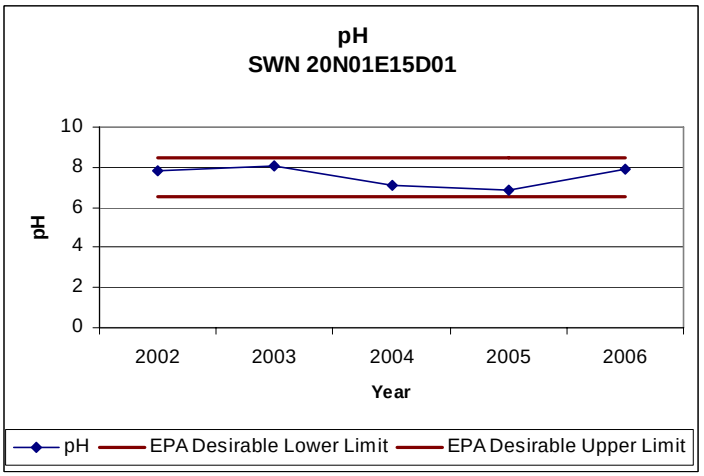


Figure 7. Western Canal (west) well monitored for pH by DW&RC

Esquon

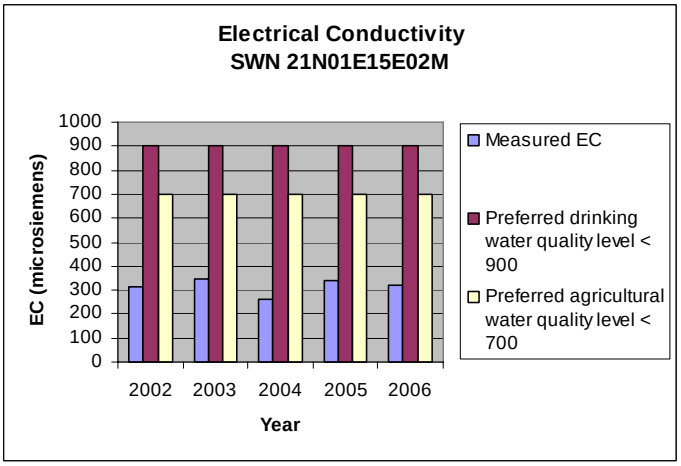


Figure 8. Esquon well monitored for EC by DW&RC

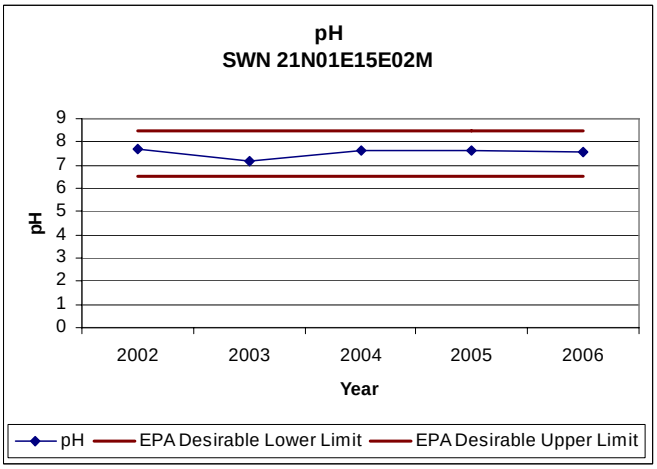


Figure 9. Esquon well monitored for pH by DW&RC

Western Canal (east)

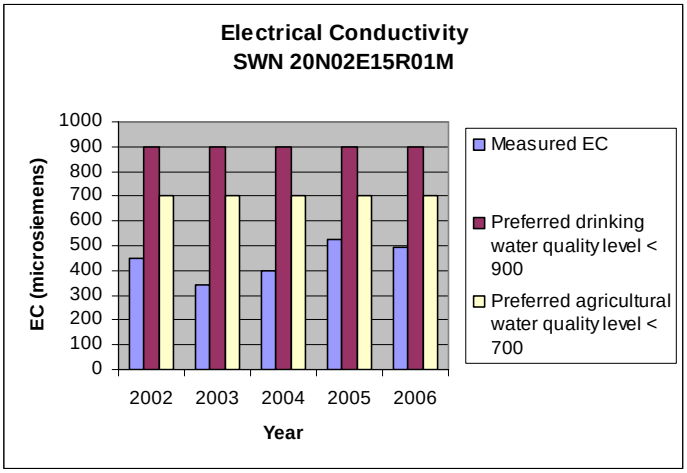


Figure 10. Western Canal (east) well monitored for EC by DW&RC

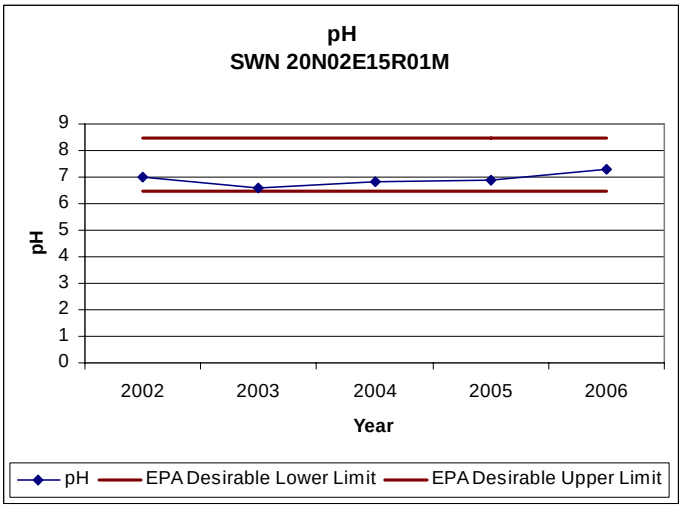


Figure 11. Western Canal (east) well monitored for pH by DW&RC

Cherokee

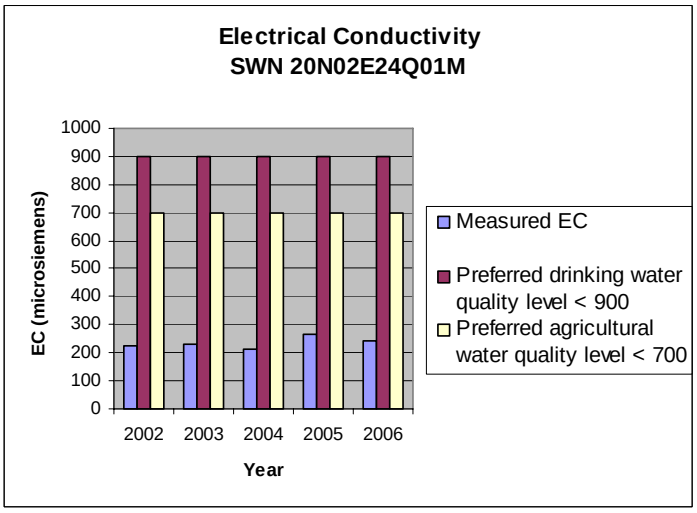


Figure 12. Cherokee well monitored for EC by DW&RC

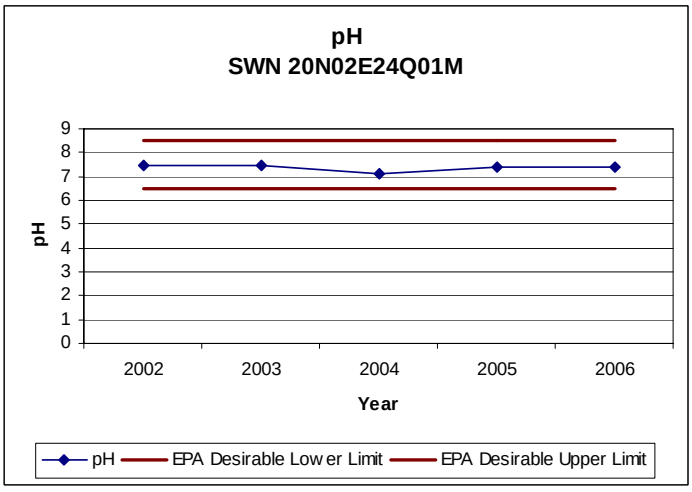


Figure 13. Cherokee well monitored for pH by DW&RC

Durham-Dayton

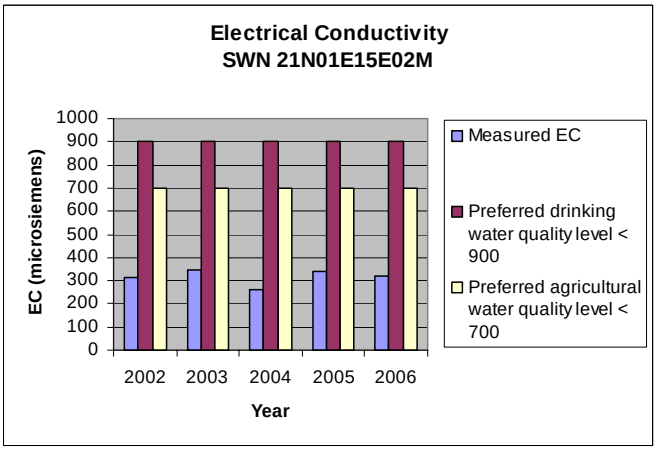


Figure 14. Durham Dayton well monitored for EC by DW&RC

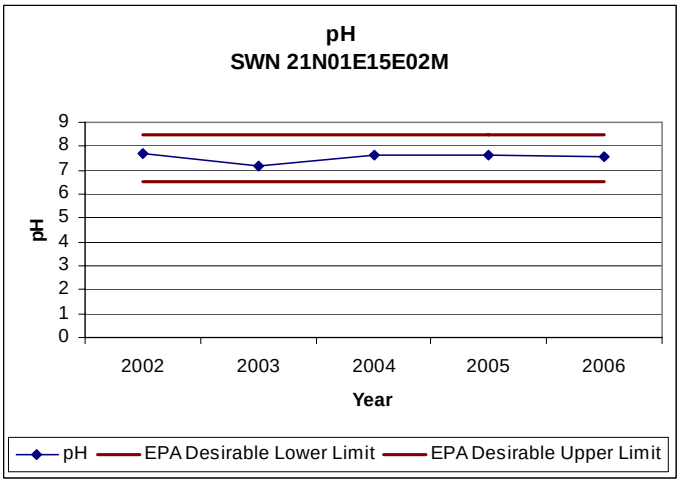


Figure 15. Durham Dayton well monitored for pH by DW&RC

Pentz

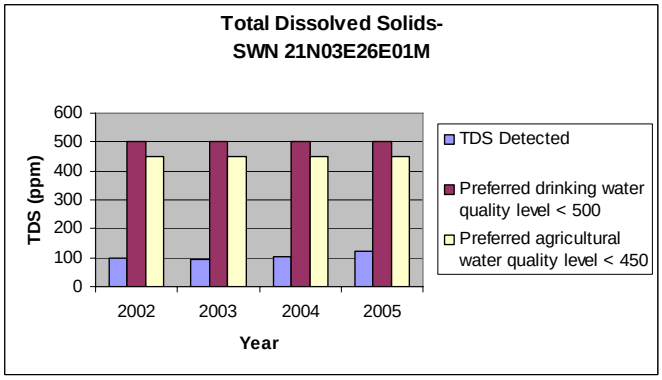


Figure 16. Pentz well monitored by DW&RC

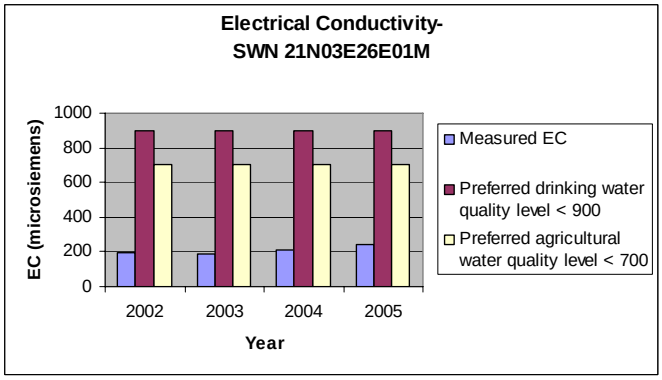


Figure 17. Pentz well monitored by DW&RC

M&T

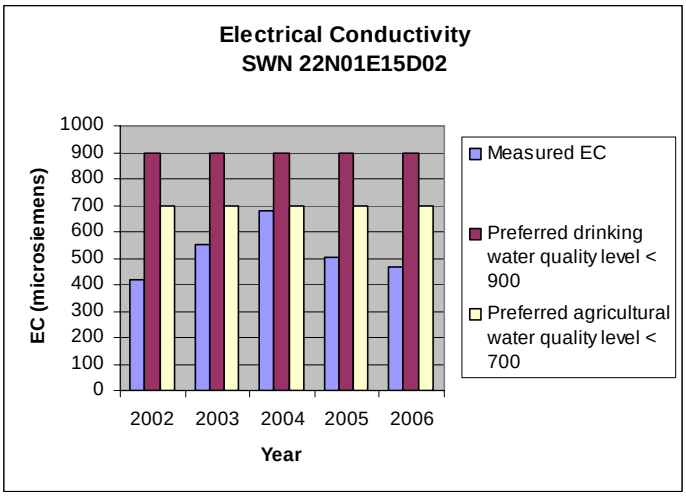


Figure 18. M&T well monitored for EC by DW&RC

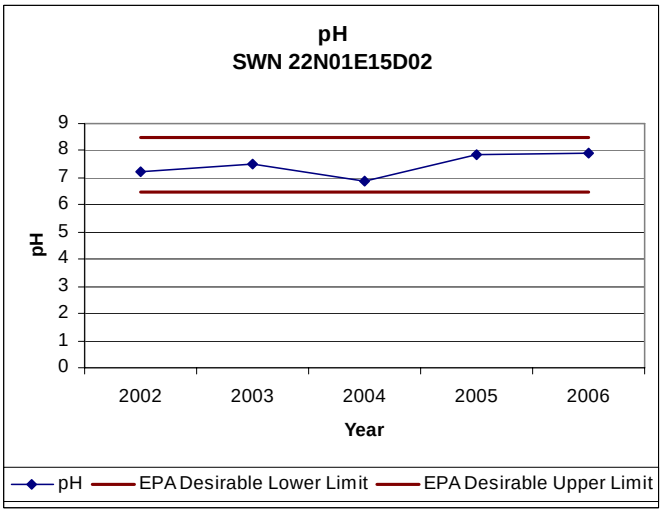


Figure 19. M&T well monitored for pH by DW&RC

Vina

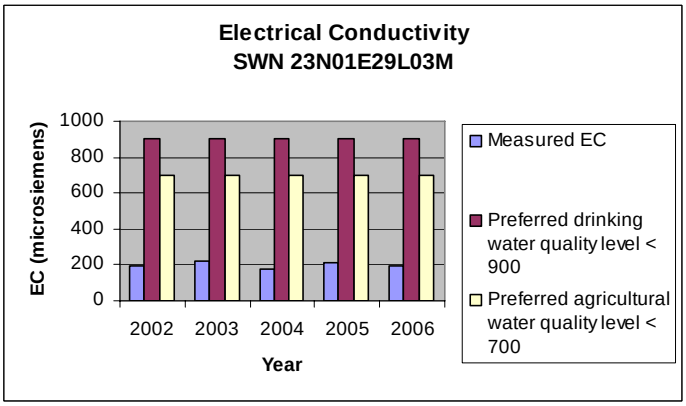


Figure 20. Vina well monitored for EC by DW&RC

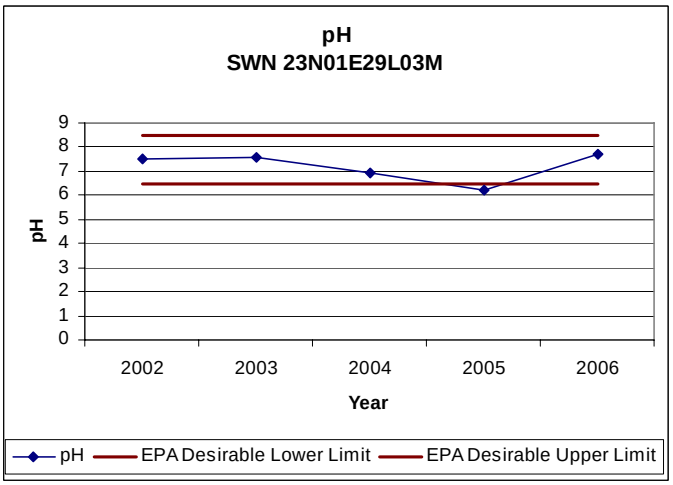


Figure 21. Vina well monitored for pH by DW&RC