

**Basin Management Objective  
Butte County  
Sub-Inventory Unit – THERMALITO  
Thermalito Water and Sewer District**

**Butte County Water Advisory Committee Member** – Michael Edwards

**Contact Information**

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**Description of the Thermalito Sub-Inventory Unit –**

The Thermalito Sub-inventory Unit (SIU) covers an area of about 25,500 acres. It is bordered by foothills to the north, the Feather River to the south and east, and the SIUs of Western Canal, Richvale, and Biggs/West Gridley to the west. The northwestern portion of the Thermalito SIU consists primarily of the Thermalito Afterbay and the surrounding native vegetation. To the northeast, the SIU encompasses portions of Oroville and the Thermalito Water and Sewer District and is characterized by urban, rural, and agricultural land uses. Land use within the southern portion of the SIU is primarily agricultural, consisting of orchards and rice production supported predominantly by groundwater. In a normal year, about 17% of the Thermalito SIU is in summer agricultural production supported by groundwater.

**Management Objective –**

To maintain sufficient volumes of groundwater in storage within all aquifer systems to provide an adequate and affordable domestic water supply of adequate quality for consumption, including periods of extended drought and to assure that groundwater in storage is not depleted over time. It is the intent of this management objective to assure a sustainable domestic water supply now and into the future and to assure the water supply can be utilized without injuring groundwater quality or inducing land subsidence.

**Geologic Formations Identified In Sub-Inventory Unit:**

Geologic formations in the Thermalito SIU, from youngest (shallowest) to oldest (deepest), include:

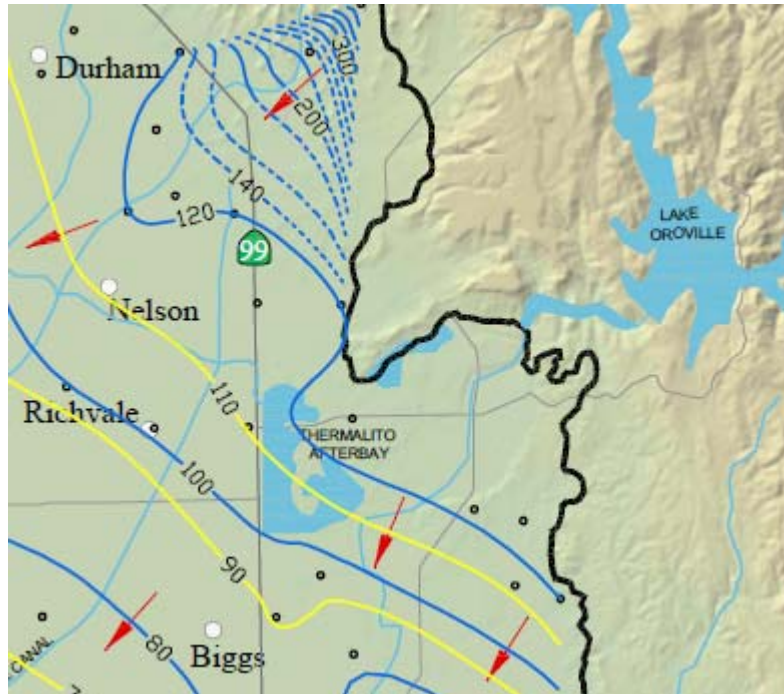
- Quaternary Alluvium
- Riverbank Formation
- Laguna Formation
- Tuscan Unit B (Lower Tuscan)

**Fresh Water-bearing Units.** In the Sacramento Valley Region of Butte County, fresh groundwater-bearing units include, from youngest (shallowest) to oldest (deepest), the Modesto, Riverbank, Laguna, Tehama and Tuscan Formations. Those included in the Thermalito SIU are:

- Riverbank Formation
- Laguna Formation
- Tuscan Unit B (Lower Tuscan)

**Groundwater Flow in the Thermalito Sub-Inventory Unit –**

The below figure is a cropped segment of a map prepared by DWR Northern District. It shows the groundwater elevation contours in your sub-inventory unit with arrows indicating the direction of groundwater movement. This graphic indicates that the regional pattern of spring groundwater movement in the Thermalito SIU is toward the south. Locally, groundwater mounding due to recharge from the Thermalito Afterbay causes groundwater to move in a southeasterly direction toward the Feather River and in a southwesterly direction toward the Butte SIU. The average groundwater gradient in the Thermalito SIU is about 5 feet per mile.



Arrows show the direction of groundwater movement.

2009 Groundwater contours were constructed using groundwater level measurements taken by the Department of Water Resources and Local Cooperators between March 1st and March 20th, 2009. Groundwater contours are based on groundwater level measurements taken from wells constructed within the middle portion of the aquifer system (100 to 400 feet deep). This portion of the aquifer supplies approximately 70% of all domestic, agricultural and municipal wells. Blue contour lines represent 20 foot intervals and yellow contour lines represent 10 foot intervals. Full size contour maps are included in the annual Groundwater Status Report posted on the Department of Water and Resource Conservation website.

**BMO Key Wells Selected for Groundwater Level Monitoring –  
SPRING**

Well ID	Well Type	Aquifer	Spring Stage 1 & 2 Alerts**		Stage 3 Alerts**	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
18N03E08B03	Laguna	Irrigation	98.0	13.4	94.1	17.3
18N03E21G01	Modesto	Irrigation	84.4	20.1	81.8	22.7
19N03E05N02	Laguna/Upper Tuscan	Domestic	112.1	29.4	94.2	47.3
19N03E16Q01	Laguna	Domestic	135.5	42.5	133.1	44.9

**FALL**

Well ID	Well Type	Aquifer	Spring Stage 1 & 2 Alerts**		Stage 3 Alerts**	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
18N03E08B03	Laguna	Irrigation	89.4	22.0	81.5	29.9
18N03E21G01	Modesto	Irrigation	81.2	23.3	78.9	25.6
19N03E05N02	Laguna/Upper Tuscan	Domestic	106.9	34.1	90.1	50.9
19N03E16Q01	Laguna	Domestic	134.0	44.0	130.7	47.3

**BMO Key Wells Selected for Groundwater Quality Monitoring–**

An additional domestic well in the Thermalito SIU was monitored during the 2008 annual trend monitoring sampling period. Results for this well will be published in future BMO documents when there is sufficient data for analysis.

**Groundwater Temperature - 2002 through 2009**

State Well Number	2002 Temp °C	2003 Temp °C	2004 Temp °C	2005 Temp °C	2006 Temp °C	2007 Temp °C	2008 Temp °C	2009 Temp °C
19NO4E06E02M	18.3	17.9	17.1	17.1	18.4	17.7	18.9	17.6

**Groundwater pH - 2002 through 2009**

State Well Number	2002 pH	2003 pH	2004 pH	2005 pH	2006 pH	2007 pH	2008 pH	2009 pH
19NO4E06E02M	7.0	6.5	7.1	7.1	7.9	7.4	7.4	7.4

**Groundwater EC - 2002 through 2009**

State Well Number	2002 EC	2003 EC	2004 EC	2005 EC	2006 EC	2007 EC	2008 EC	2009 EC
19NO4E06E02M	132.0	164.0	149.0	150.0	152.0	242.0	205.0	158.1

**BMO Key Well(s) Selected for Land Subsidence Monitoring–**

Land Subsidence is continuously monitored by the Department of Water Resources at the closest extensometer in the Western Canal Water SIU at SWN 20N01E18L03M.

Butte County staff participated in the Sacramento Valley Height Modernization Project during March 2008 as a means to enhance the subsidence monitoring program in the county and the region. This cooperative project between the Department of Water Resources (DWR), the Bureau of Reclamation and local County agencies helped to establish baseline ground elevations in Butte County and other portions of the valley. Land elevations were measured using Global Positioning System (GPS) survey equipment and survey monuments located on an approximate three to five mile grid. Re-observations are to be done in approximately three years, and will give measurements to compare against the baseline data in order to determine whether or not any subsidence has occurred.

**BMO Alert Stage Definitions and Compliance Methodologies–**

The Thermalito Sub-Inventory Unit will use the following guidelines in the management of the groundwater resources. The groundwater level and land subsidence management objectives

are intended to trigger predetermined voluntary Ground Water Management Actions, as defined in the accompanying Cover Report, to remedy declining ground water levels that are not recovering to compliance levels for the index well.

### **Groundwater Level –**

The Butte Basin Groundwater model uses the historical hydrology (e.g. precipitation pattern, stream inflows) from October 1970 through October 1999 in the base case simulation. Using historical hydrology allows for the assessment of water resources conditions based on a known range of hydrology, from wet to critical. Each hydrograph for the BMO process shows the static groundwater elevation measurements from the time period of 1970 to 2006, or as many recent years of data available for each selected key wells. The measurements taken during this 36 year window reflect periods of drought and recovery, as well as wet years. These methodologies will apply for both Spring and Fall analysis.

- A. For wells that have a period of record dating back to at least 1970, the subcommittee suggests that the range of measurements from the first year through 2006 be used in calculating Alert Stages 1 and 2 and the Historic Low will be used as the Alert Stage 3. Once the range is defined for each well, 20% of that range will be calculated and added to the Historic Low to establish Alert Stages 1 and 2. The measurements plotted after 2006 are for reference purposes only, and are not included in the calculation of the range.
- B. In the instances where the period of record does not date back to 1970, the Historic Low before 2006 will be used for Alert Stages 1 and 2, and the Historical Low minus the range of measurements shall be used for Alert Stage 3. The measurements plotted after 2006 are for reference purposes only, and are not included in the calculation of the range.

The methodology and Alert Stages will be set for any of the chosen Thermalito Water and Sewer District monitoring wells once the appropriate wells within the SIU have been selected.

### **Groundwater Quality –**

Any change that exceeds a 20 percent change from Butte County's 2009 water quality assessment done in August of each year will be cause for review and investigation by the Technical Advisory Committee.

### **Land Subsidence –**

Land Subsidence will be monitored at the closest extensometers located in the M&T and Western Canal sub inventory units. Maximum annual inelastic land subsidence shall not exceed 0.01 feet per year.

Stage 1: is reached when the annual elastic subsidence exceeds the average annual elastic subsidence measured over the period of record of the extensometer.

Stage 2: is reached when the annual elastic subsidence exceeds the maximum recorded elastic subsidence over the period of record for the extensometer.

Stage 3: is when inelastic subsidence is detected. Inelastic subsidence shall be detected by comparing reading from the extensometer taken on March 1 of each year against previous March 1 measurements.

**Future Monitoring Recommendations –**

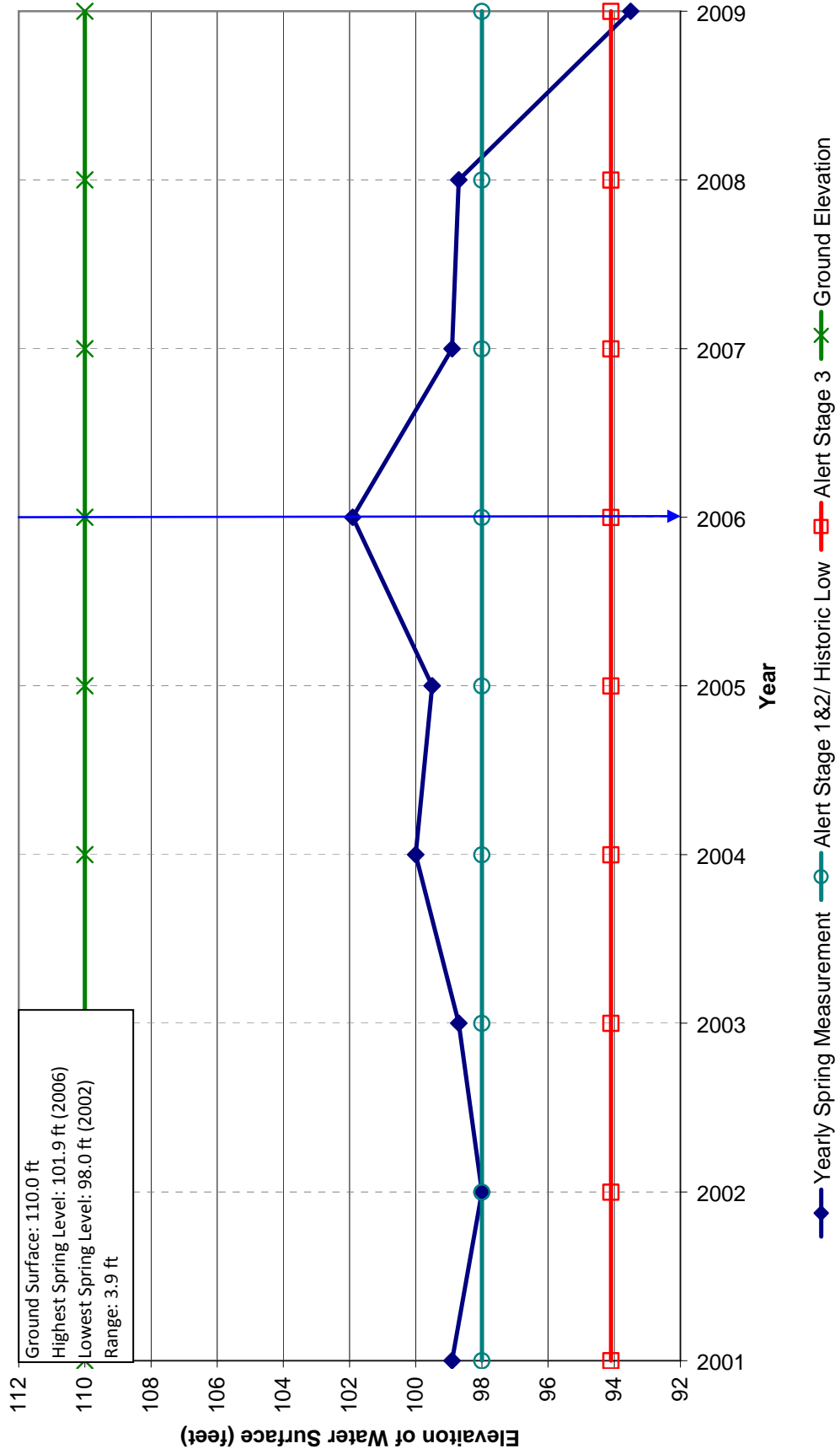
Efforts will be made to identify additional wells within the SIU and Thermalito Water and Sewer District service area that could be added to the existing monitoring well network in the sub-inventory unit. Well level measurements will be taken throughout the year once the appropriate wells have been selected.

**Supporting Data –**

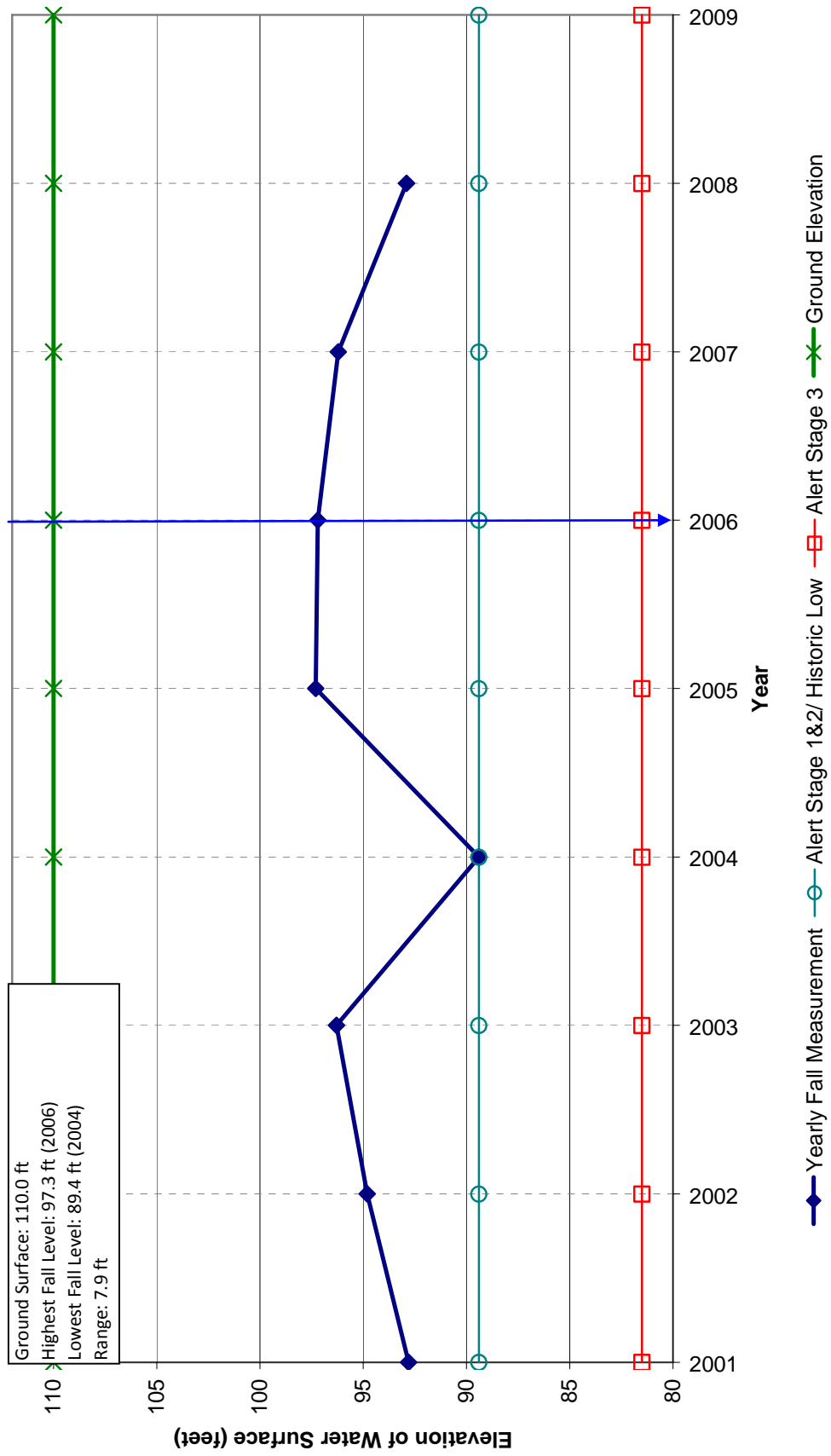
Hydrograph depicting yearly spring level measurements, including 2009 data, with established alert levels for calendar year 2010.

Summary charts of water quality monitoring.

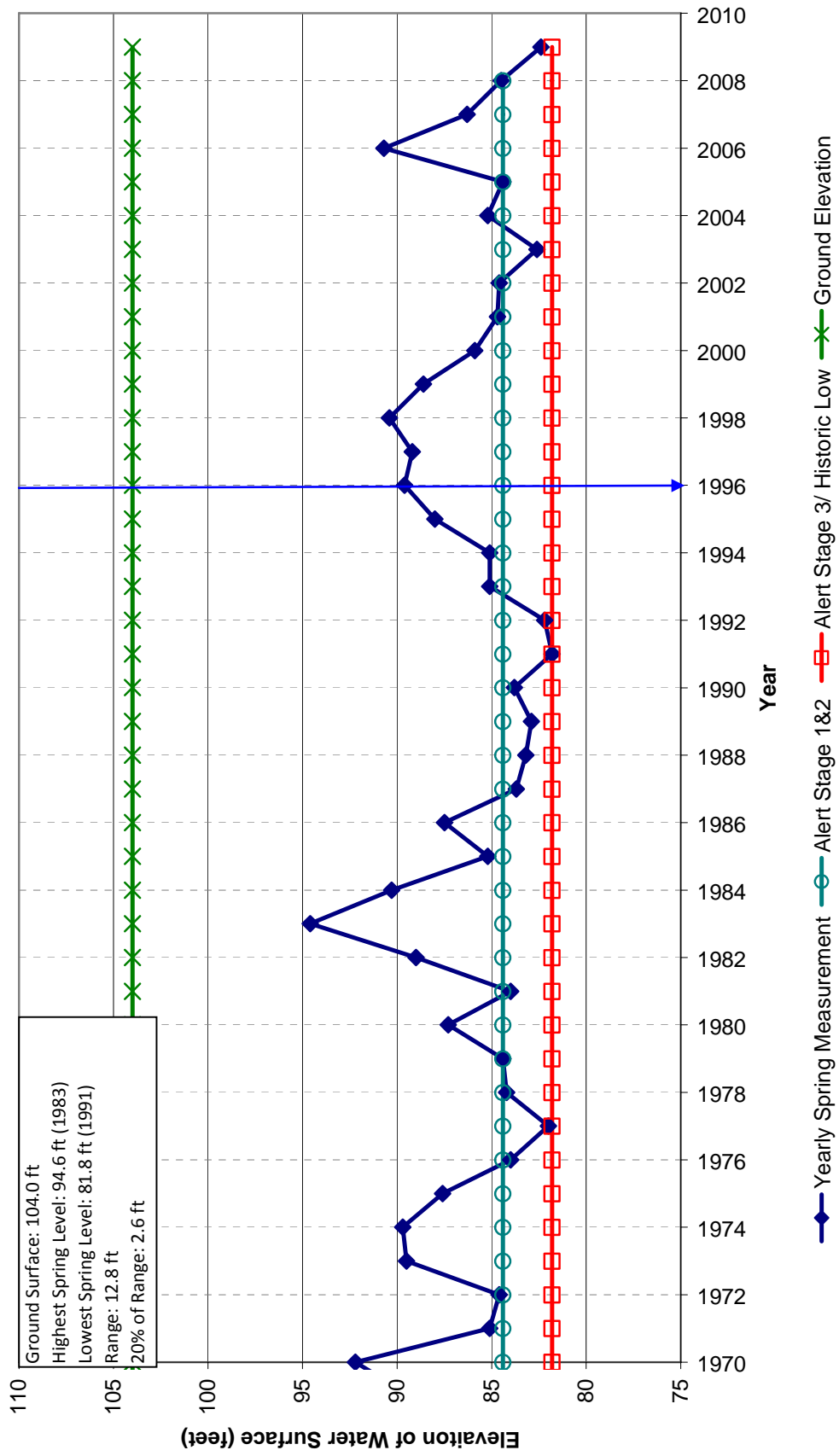
**Spring Groundwater Levels  
Thermalito - 18N03E08B03  
Range of Measurements 2001-2006**



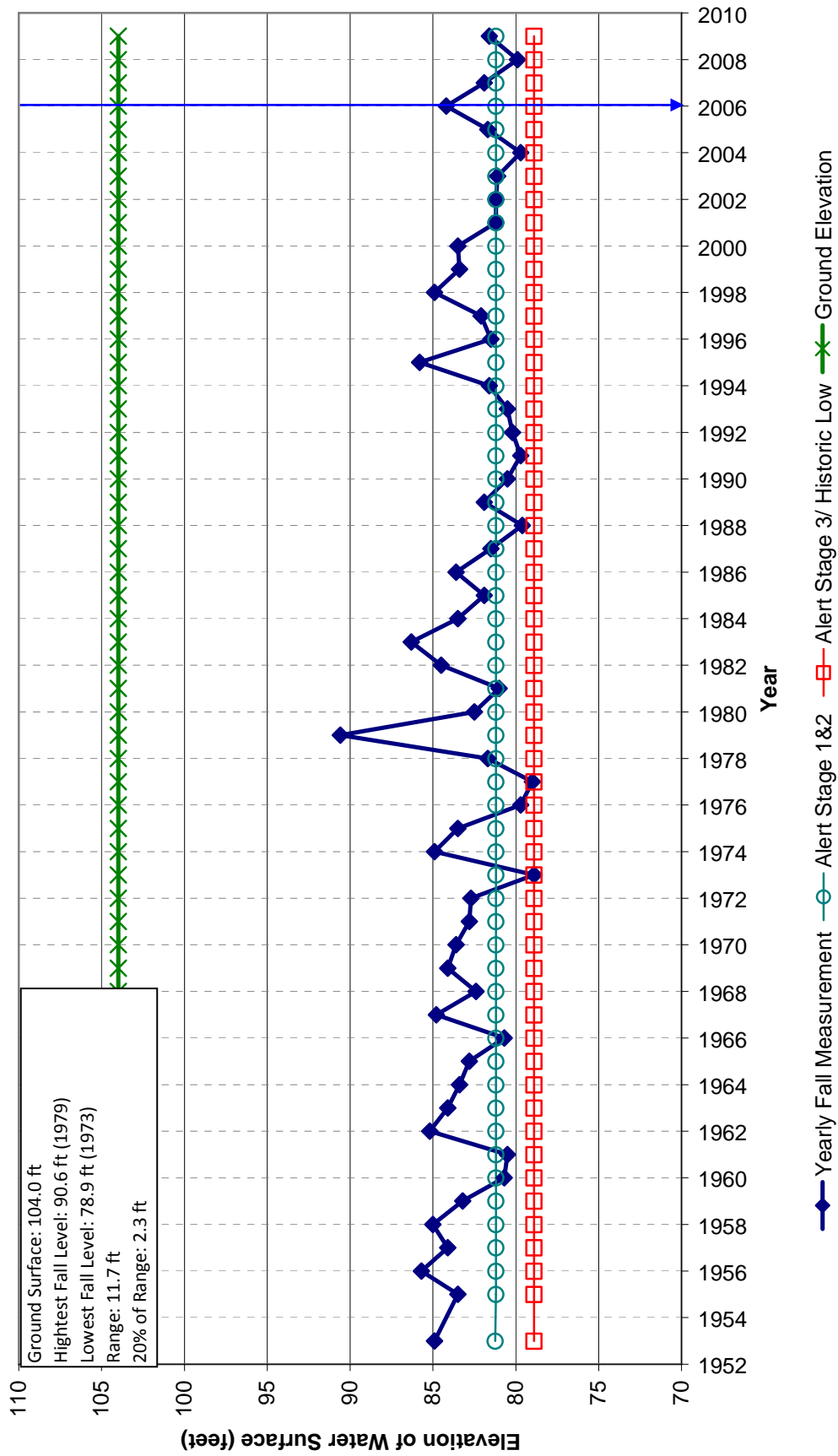
**Fall Groundwater Levels  
Thermalito - 18N03E08B03  
Range of Measurements 2001-2006**



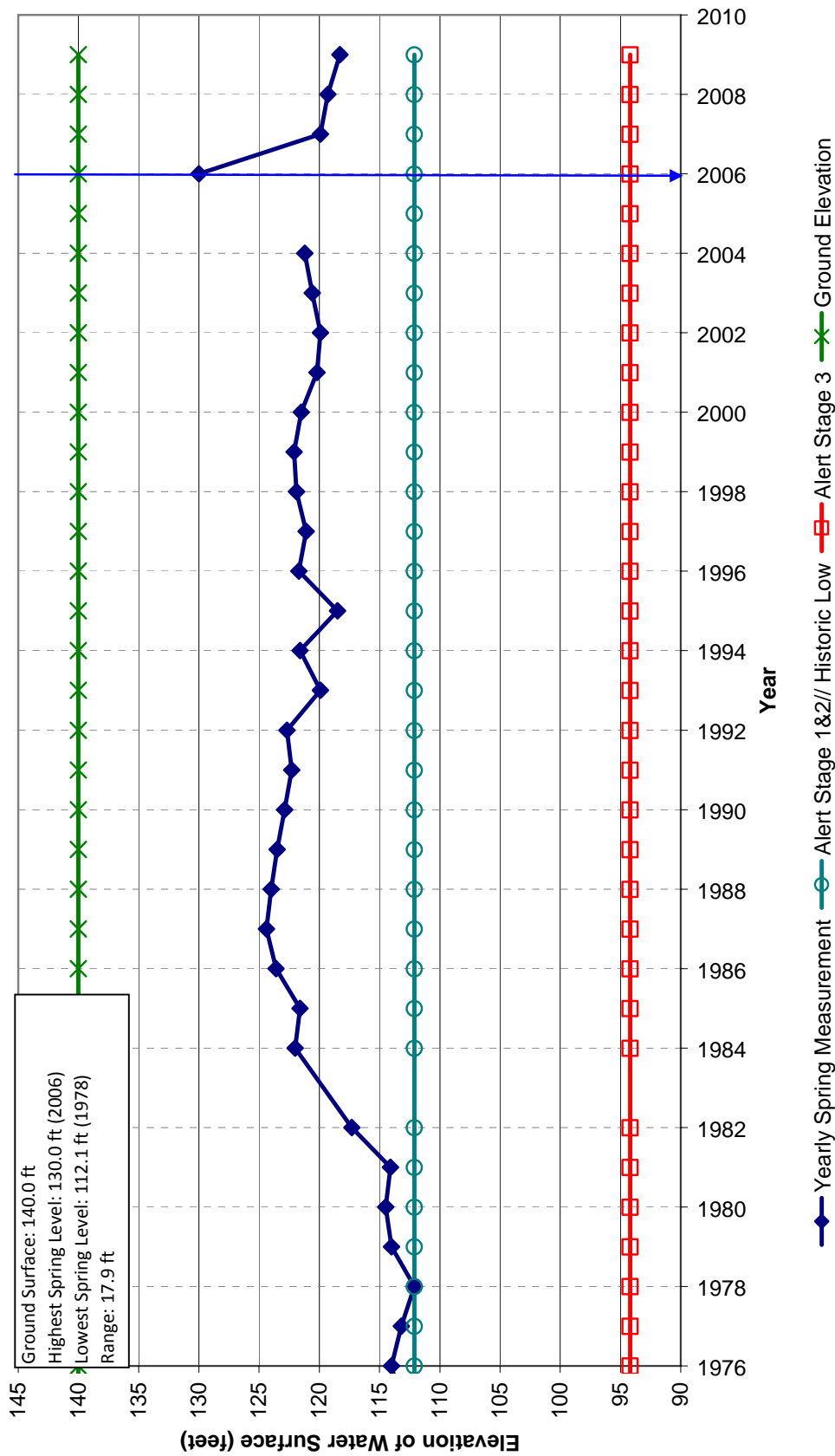
**Spring Groundwater Levels  
Thermalito - 18N01E21G01  
Range of Measurements 1970-2006**



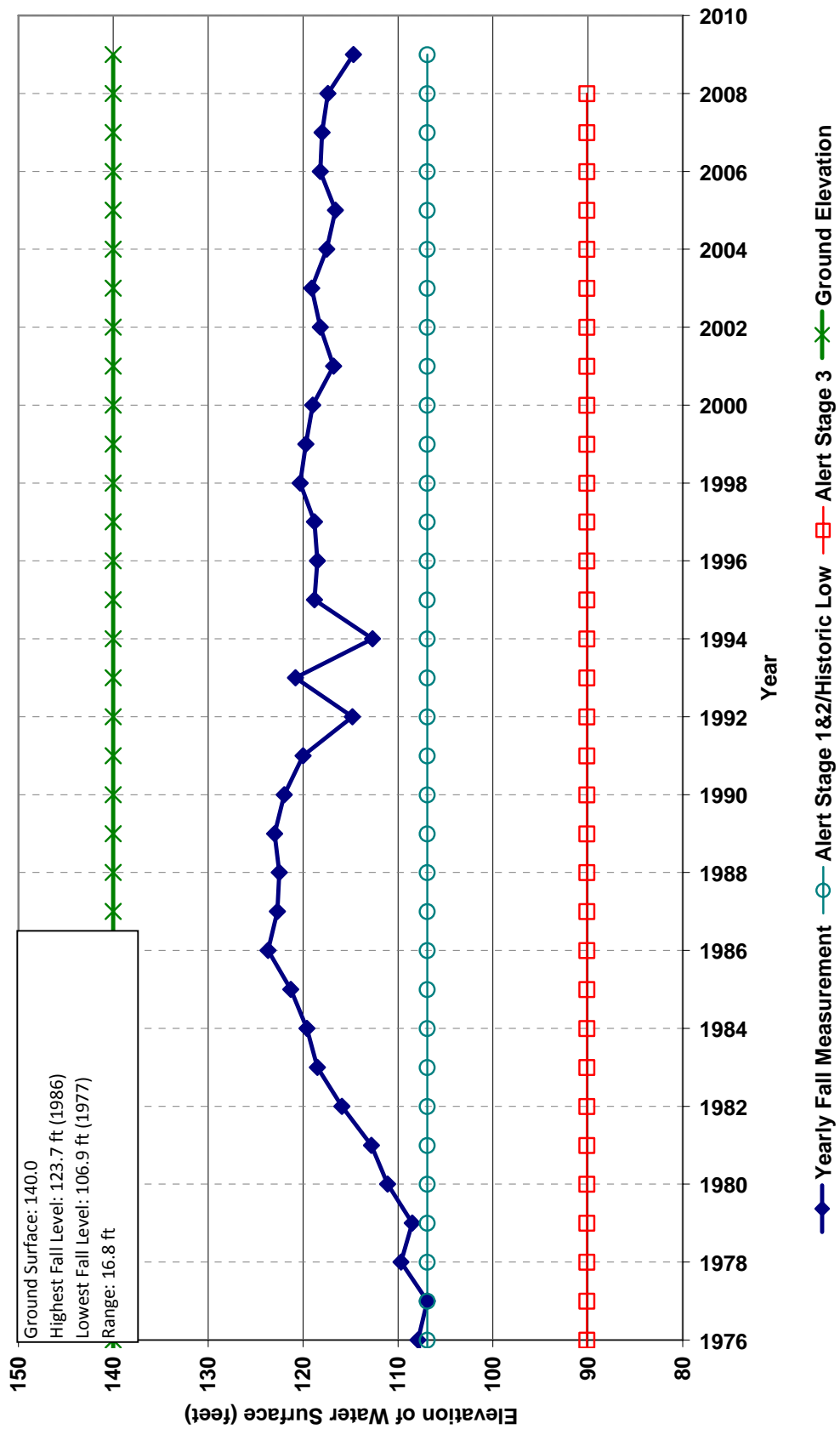
**Fall Groundwater Levels  
Thermalito - 18N01E21G01  
Range of Measurements 1970-2006**



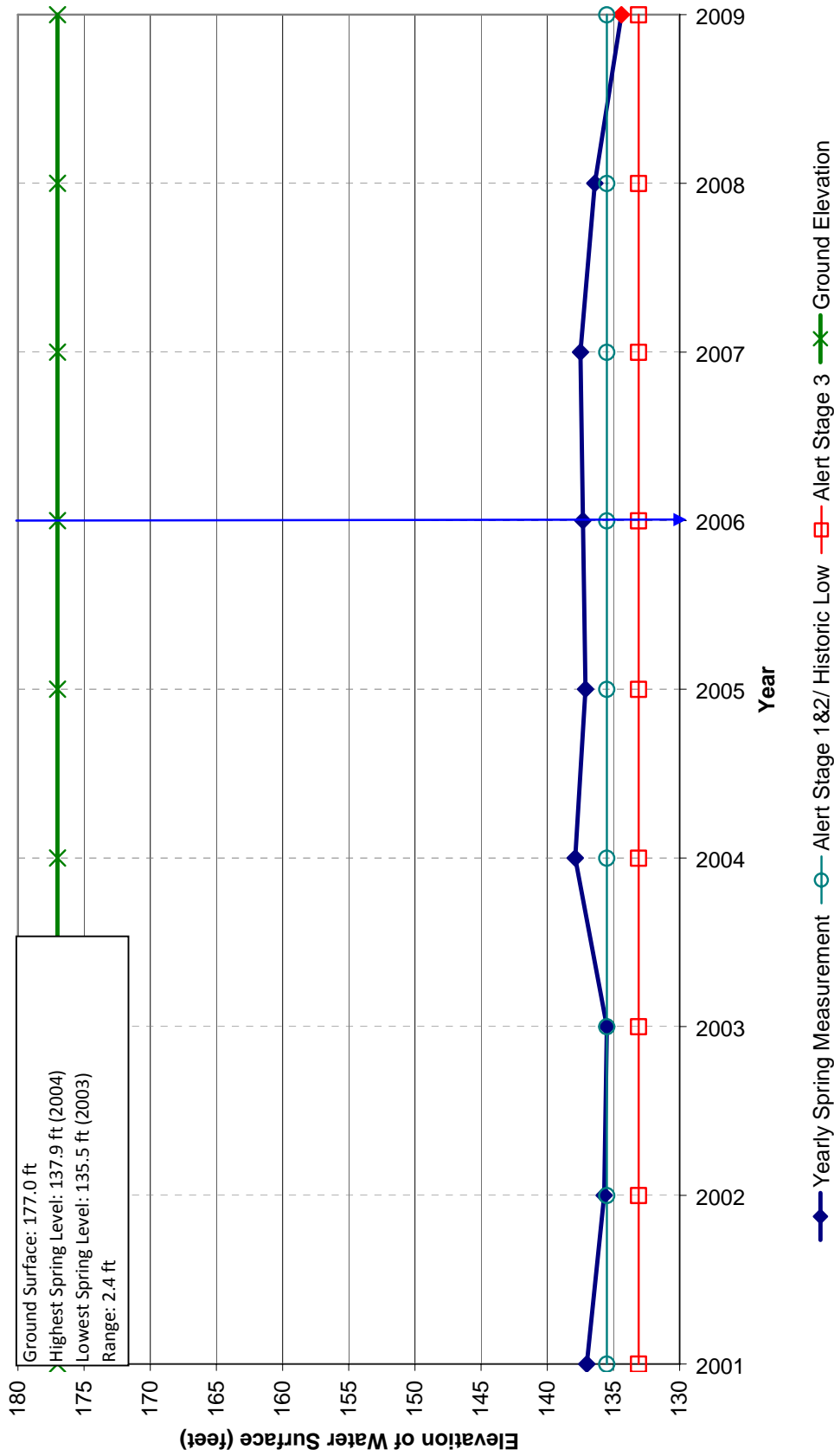
**Spring Groundwater Levels  
Thermalito - 19N03E05N02  
Range of Measurements 1976-2006**



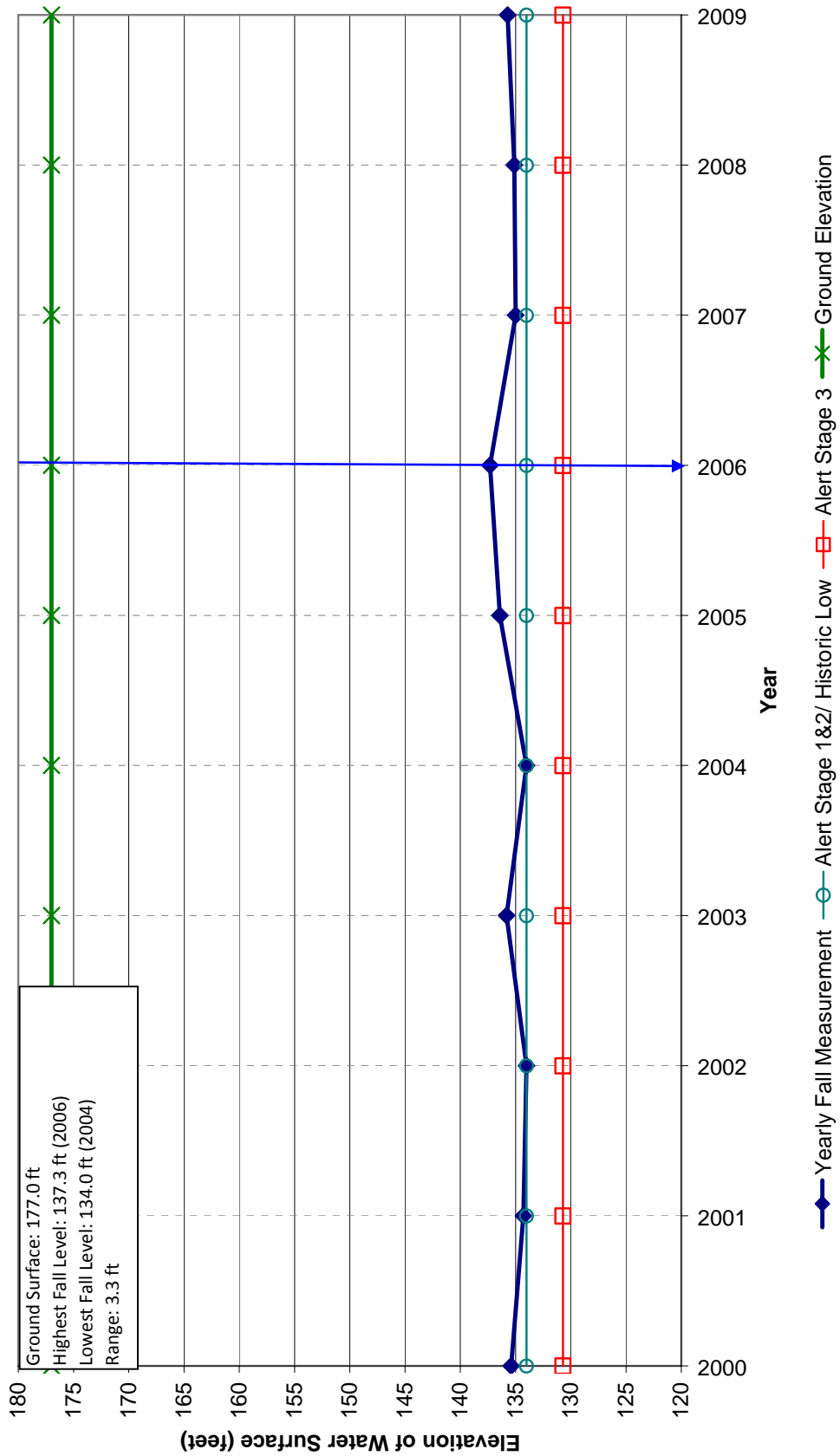
Fall Groundwater Levels  
 Thermalito - 19N03E05N02  
 Range of Measurements 1976-2006

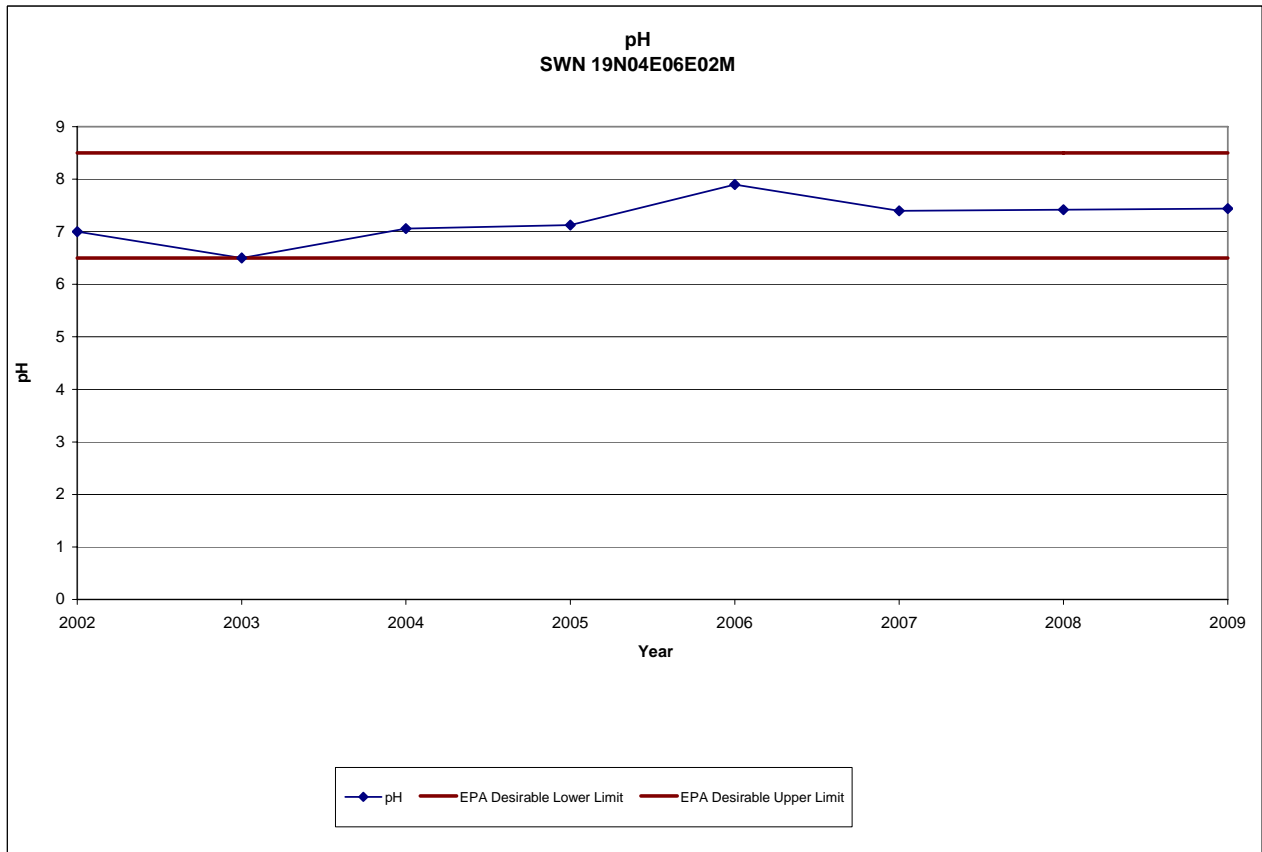
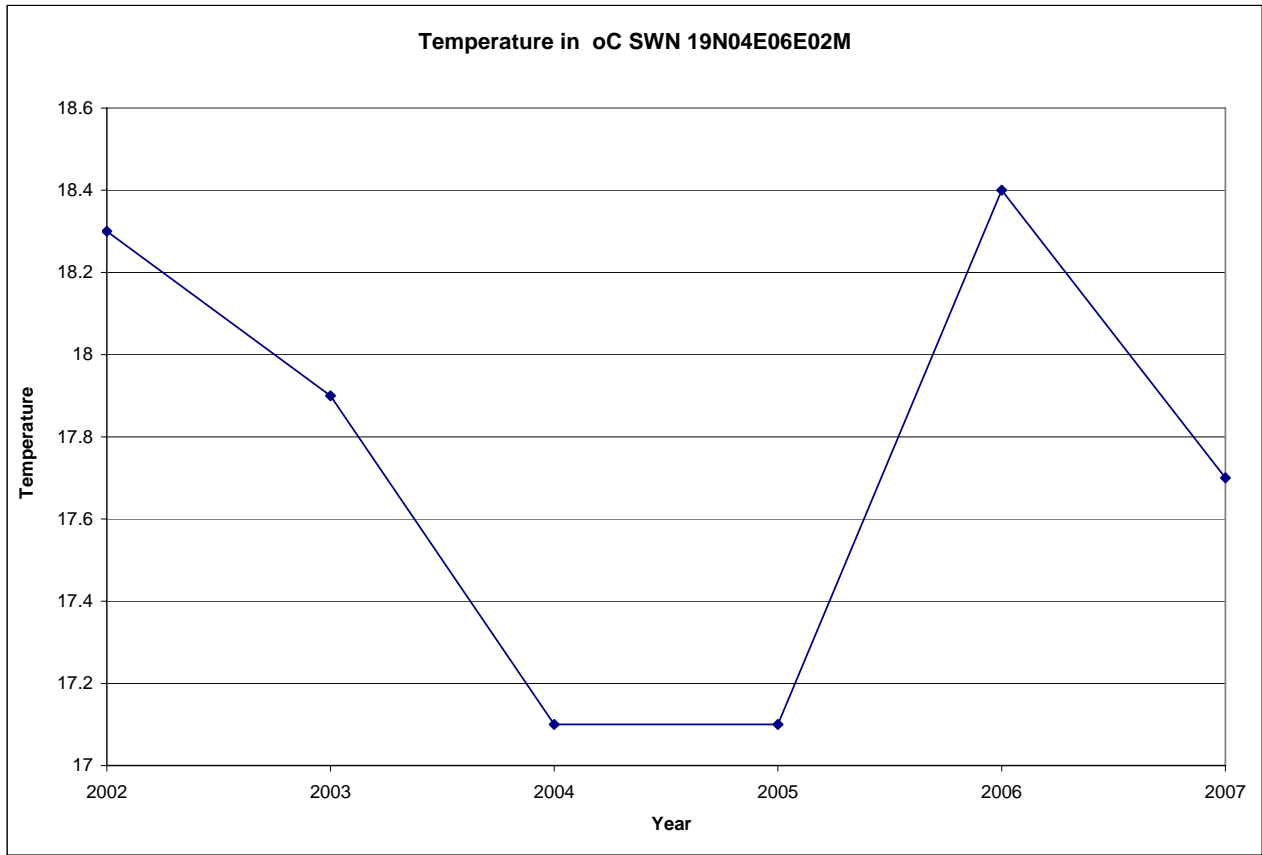


**Spring Groundwater Levels  
Thermalito - 19N03E16Q01  
Range of Measurements 2001-2006**



**Fall Groundwater Levels  
Thermalito - 19N03E16Q01  
Range of Measurements 2000-2006**





Electrical Conductivity  
SWN 19N04E06E02M

