

**Basin Management Objective
Butte County
Sub-Inventory Unit – WESTERN CANAL
Western Canal Water District**

Butte County Water Advisory Committee Member – Ted Trimble

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Description of the Western Canal Sub-Inventory Unit –

The Western Canal Sub-Inventory Unit (SIU) covers an area of about 44,750 acres. About one-third of the sub-inventory unit is in the West Butte Inventory Unit and the remainder is in the East Butte Inventory Unit. The Western Canal SIU corresponds roughly to the Butte County portion of the Western Canal Water District. A portion of the southwestern corner of the water district is in Glenn County. Agricultural production in the Western Canal SIU consists primarily of rice supported by surface water. In normal years, about 7% of the SIU is in summer agricultural production supported by groundwater. During drought years, the area of summer agricultural production supported by groundwater increases to about 13%. The data presented in this section includes the entire Butte County portion of the Western Canal SIU.

Management Objective –

To maintain sufficient volumes of groundwater in storage within the Upper and Lower Tuscan Formation aquifer systems to provide an adequate and affordable irrigation water supply, of adequate quality for agriculture purposes, including during 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 agricultural water supply now and into the future and to assure the water supply can be utilized without injuring groundwater quality or inducing land subsidence. The management objective is also to assure an adequate supply for groundwater from the alluvial aquifer system for all domestic users in the sub-inventory unit.

Geologic Formations Identified In Sub-Inventory Unit –

Geologic formations in the Western Canal SIU from youngest (shallowest) to oldest (deepest) include:

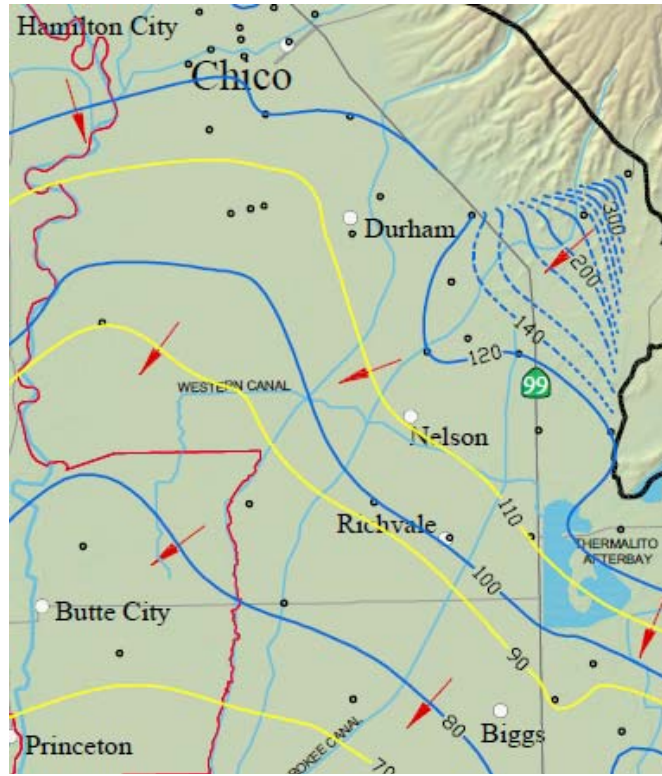
- Basin Deposits
- Laguna Formation
- Tuscan Unit C (Upper Tuscan)
- Tuscan Unit B (Lower Tuscan)

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 Western Canal SIU are:

- Laguna Formation
- Tuscan Unit C (Upper Tuscan)
- Tuscan Unit B (Lower Tuscan)

Groundwater Flow in the Western Canal 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 Western Canal SIU is in a southwesterly direction, at a gradient of about 5 feet per mile, toward the Sacramento River and adjacent to Butte Creek.



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	Aquifer System	Well Type	Stage 1 & 2 Alerts**		Stage 3 Alerts**	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
19N01E09Q01M	Lower Tuscan	Irrigation	82.1	10.6	77.1	15.6
20N01E18L01M	Lower Tuscan	Monitoring	103.3	8.9	98.3	13.9
20N01E18L02M	Upper Tuscan	Monitoring	103.9	10.0	93.9	15.0
20N01E18L03M	Alluvial	Monitoring	99.4	9.6	94.4	14.6
20N01E35C01M	Alluvial	Domestic	91.9	9.6	86.9	14.6
20N02E16P01M	Unknown	Irrigation	117.5	15.4	112.5	20.4

20N02E28N01M	Alluvial	Domestic	111.4	9.7	106.4	14.7
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BMO Key Wells Selected for Groundwater Level Monitoring – FALL

Well ID	Aquifer System	Well Type	Stage 1 & 2 Alerts**		Stage 3 Alerts**	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
19N01E09Q01M	Lower Tuscan	Irrigation	78.8	13.9	73.8	18.9
20N01E18L01M	Lower Tuscan	Monitoring	96.8	15.4	91.8	20.4
20N01E18L02M	Upper Tuscan	Monitoring	95.3	13.6	90.3	18.6
20N01E18L03M	Alluvial	Monitoring	97.1	11.9	92.1	16.9
20N01E35C01M	Alluvial	Domestic	91.1	10.4	86.1	15.4
20N02E16P01M	Unknown	Irrigation	110.0	22.9	105.0	27.9
20N02E28N01M	Alluvial	Domestic	110.2	10.9	105.2	15.9

BMO Key Wells Selected for Groundwater Quality Monitoring–

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
20N02E15RO1M	18.4	18.2	19.9	20.5	18.8	18.6	19.1	19.0
20N01E15D01M	19.0	18.1	19.8	20.8	18.5	20.6	21.8	18.5

Groundwater pH - 2002 through 2009

State Well Number	2002 pH	2003 pH	2004 pH	2005 pH	2006 pH	2007 pH	2008 pH	2009 pH
20N02E15RO1M	7.0	6.6	6.8	6.9	7.3	6.9	7.0	7.0
20N01E15D01M	7.8	8.1	7.1	6.9	7.9	7.9	7.8	6.6

Groundwater EC - 2002 through 2009

State Well Number	2002 EC	2003 EC	2004 EC	2005 EC	2006 EC	2007 EC	2008 EC	2009 EC
20N02E15RO1M	447.0	344.0	400.0	524.0	492.0	471.0	482.0	488.0
20N01E15D01M	464.0	248.0	407.0	501.0	309.0	477.0	469.0	462.0

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

State Well Number 20N01E18L03M. Maximum annual inelastic land subsidence shall not exceed 0.01 feet per year.

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 Western Canal 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 Cover Report, to remedy declining ground water levels that are not recovering to compliance levels for each index well.

Groundwater Levels – Specific Depth

The methodology for establishing the groundwater level Basin Management Objective in the Western Canal Sub-Inventory Unit was to utilize the spring and fall groundwater levels data from the wells identified above. From this data the average spring and fall groundwater levels were calculated.

Stage 1: The first year that spring or fall groundwater levels fall five feet below the average spring groundwater level established for the well.

Stage 2: Stage 2 is reached if spring or fall groundwater levels, for a second consecutive year, remain five feet below the average groundwater level established for the well.

Stage 3: Stage 3 is reached if the spring or fall groundwater levels fall ten feet below the average spring groundwater level established for the well.

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 –

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:

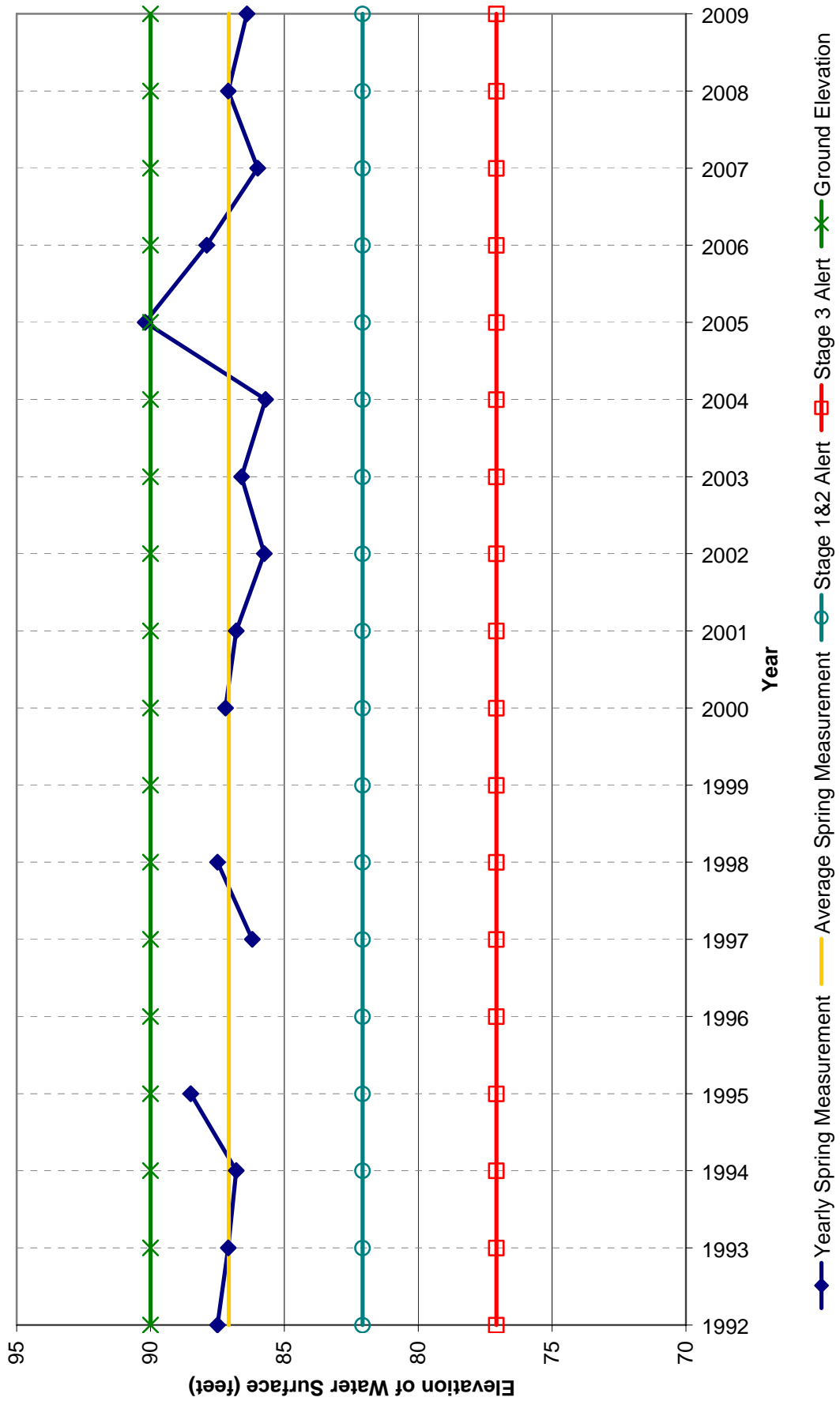
Efforts will be made to identify additional domestic wells that could be added to the existing monitoring well network in sub-inventory unit to allow development of management objectives for the alluvial aquifer system. Efforts will also be made to identify more wells in all aquifers which meet the criteria developed.

Supporting Data –

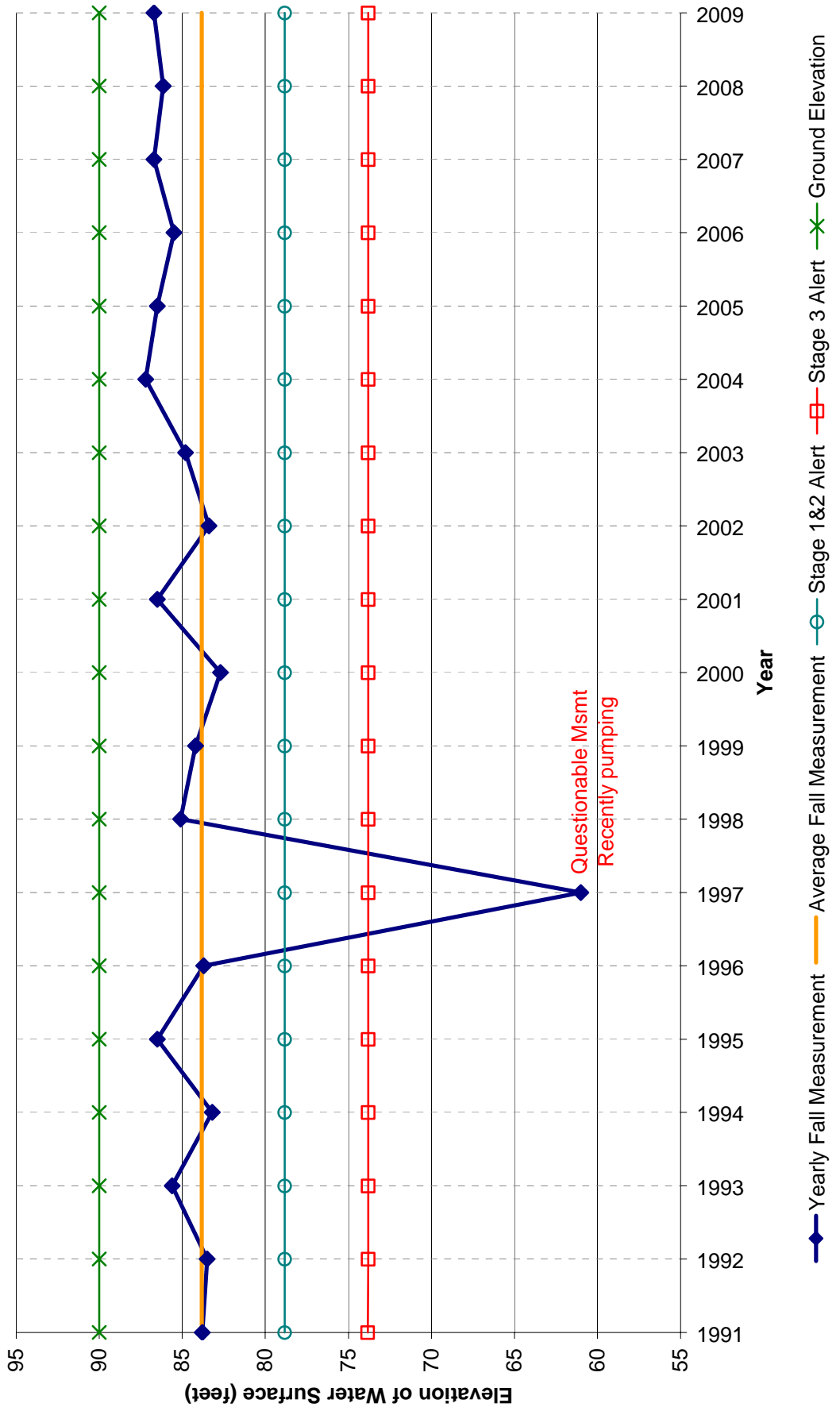
Hydrographs depicting yearly spring level measurements, including 2009 data, with established alert levels for calendar year 2010.

Summary charts of water quality monitoring.

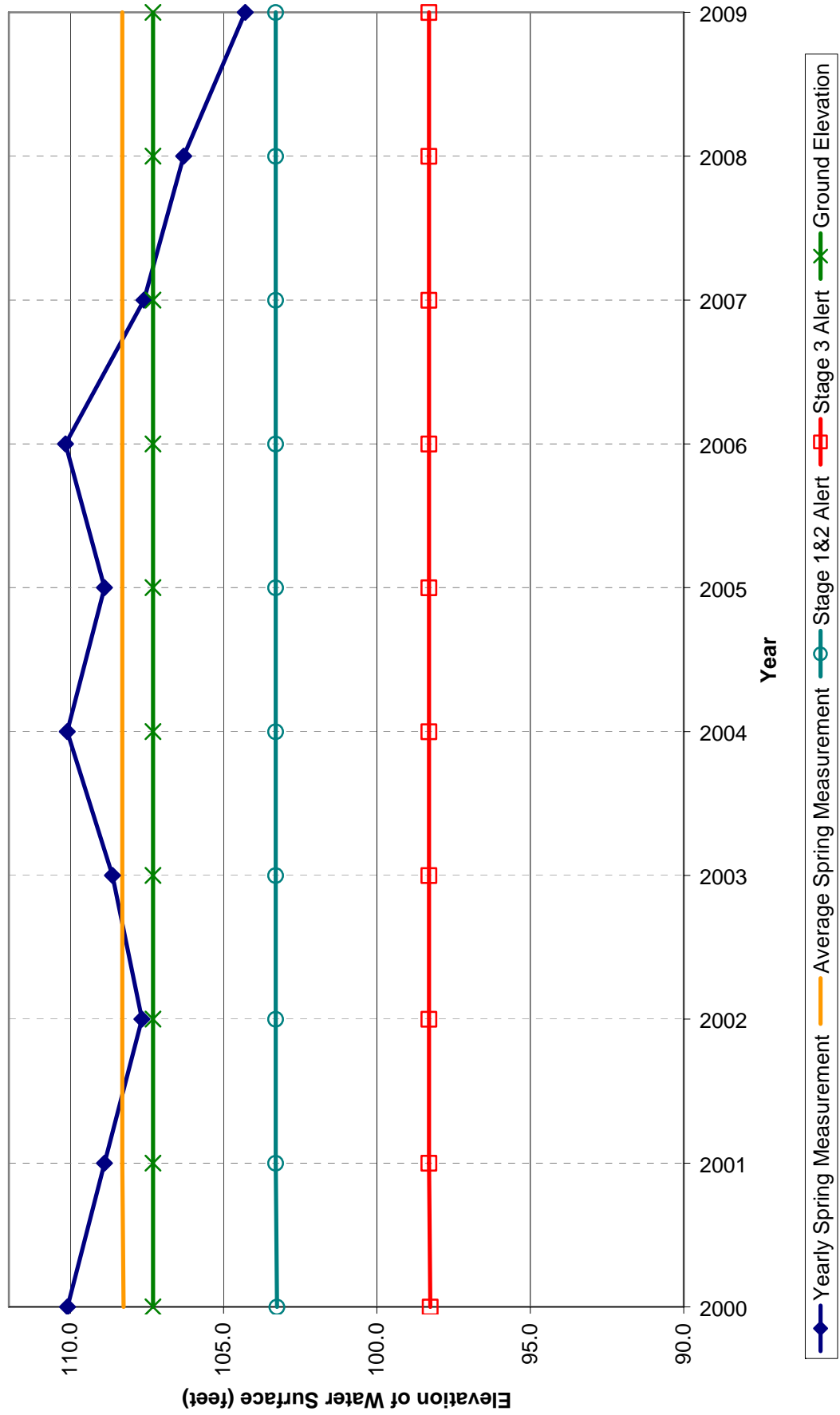
**Spring Groundwater Levels
Western Canal - 19N01E9Q01**



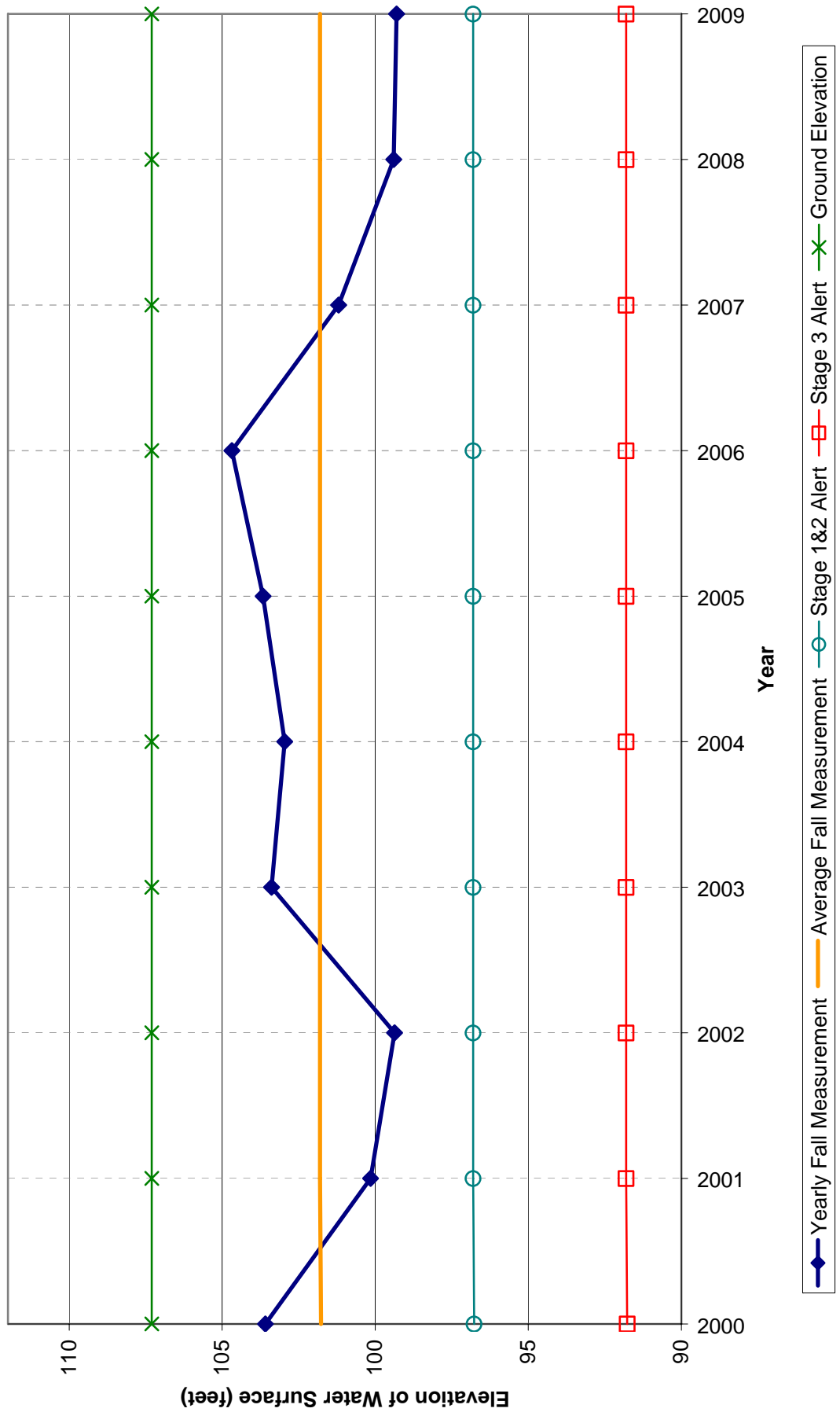
Fall Groundwater Levels Western Canal - 19N01E9Q01



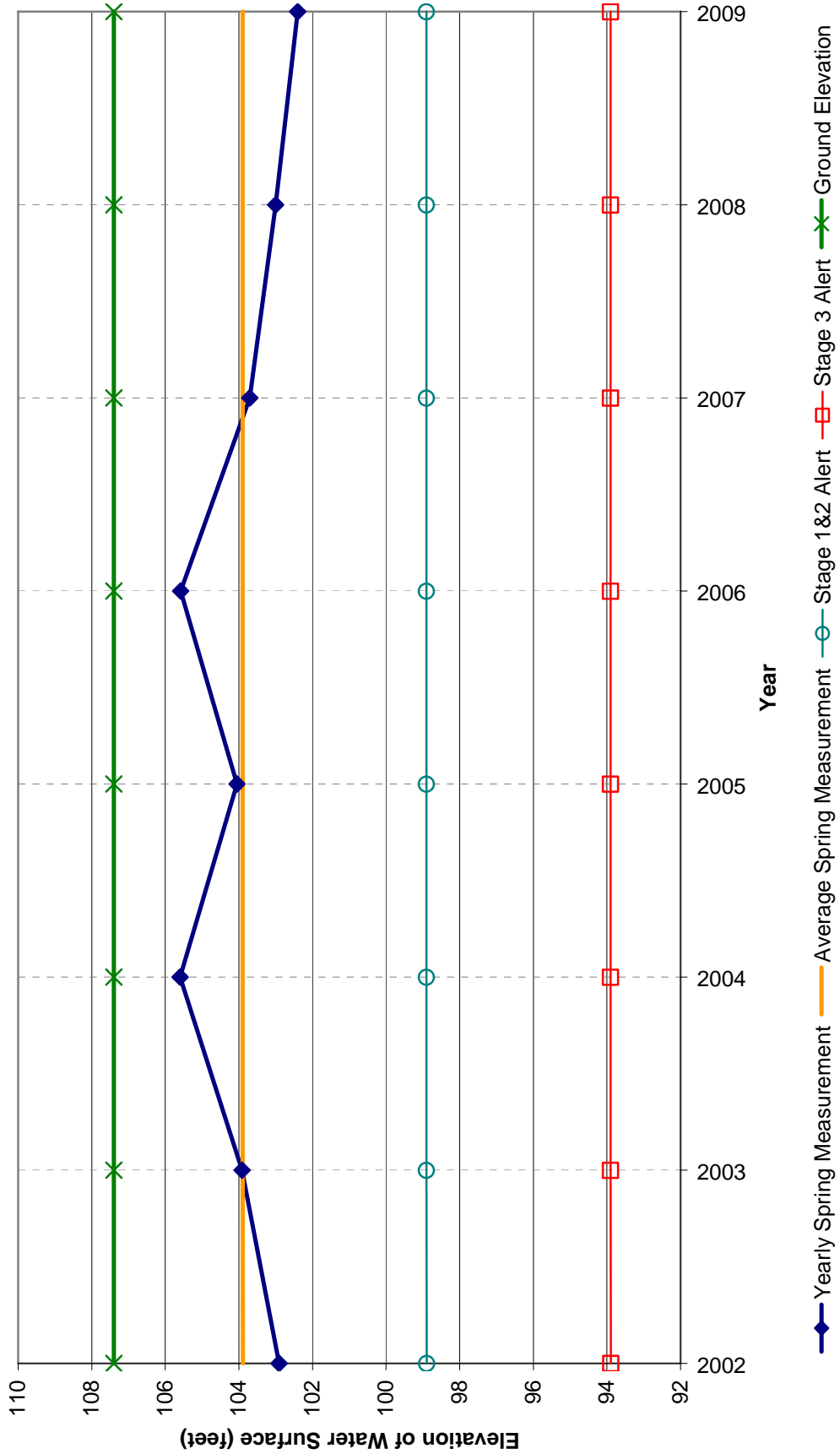
Spring Groundwater Levels
Western Canal - 20N01E18L01



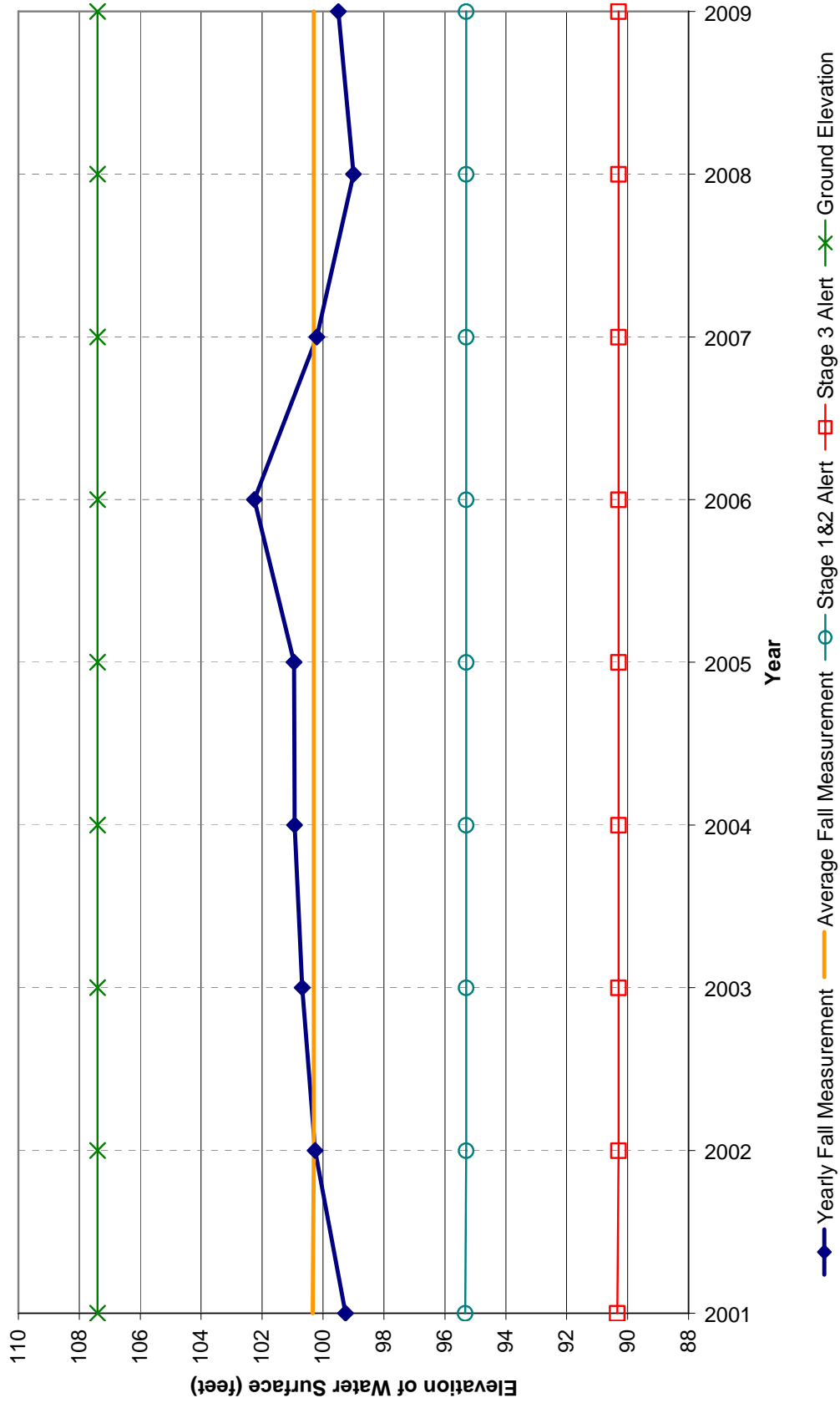
**Fall Groundwater Levels
Western Canal - 20N01E18L01**



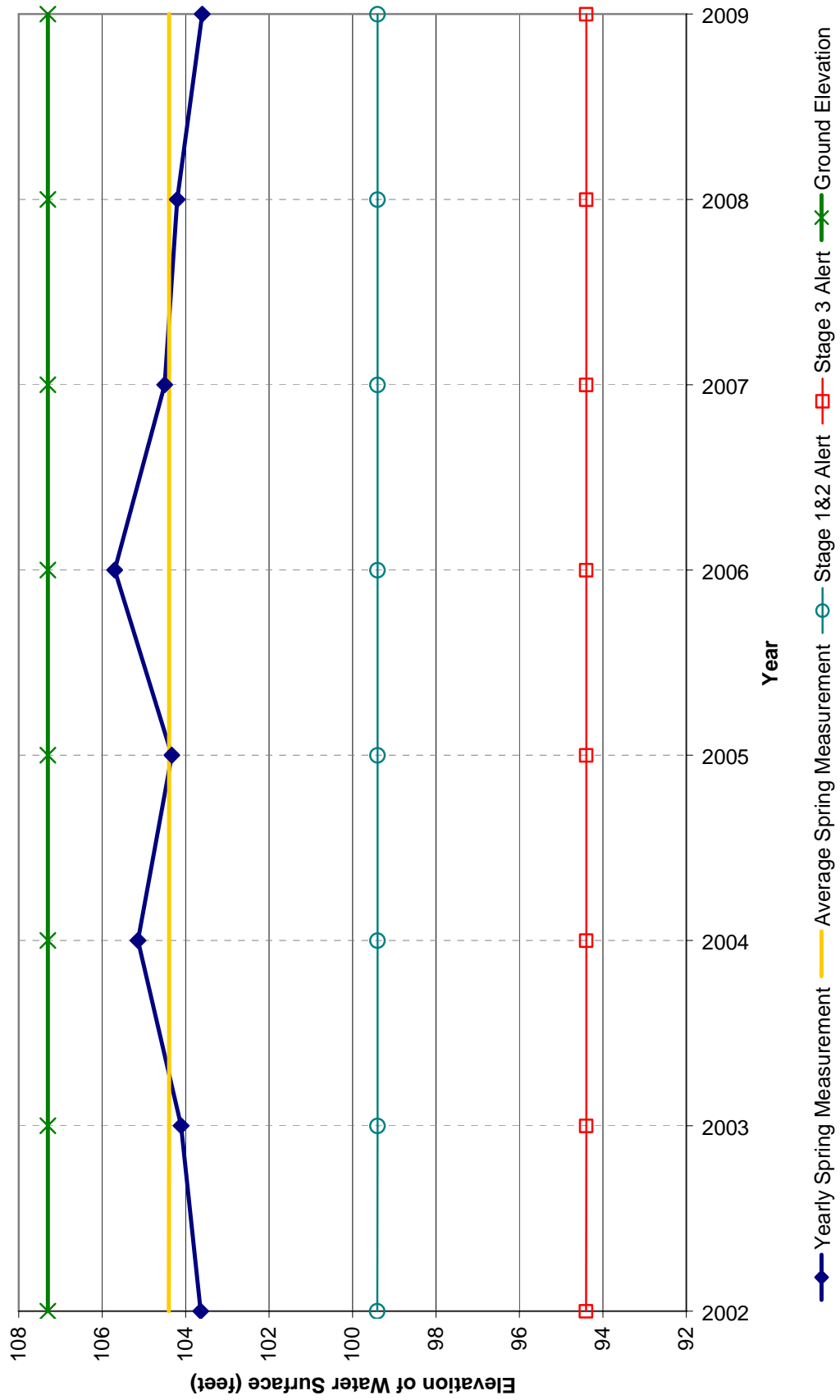
Spring Groundwater Levels Western Canal - 20N01E18L02



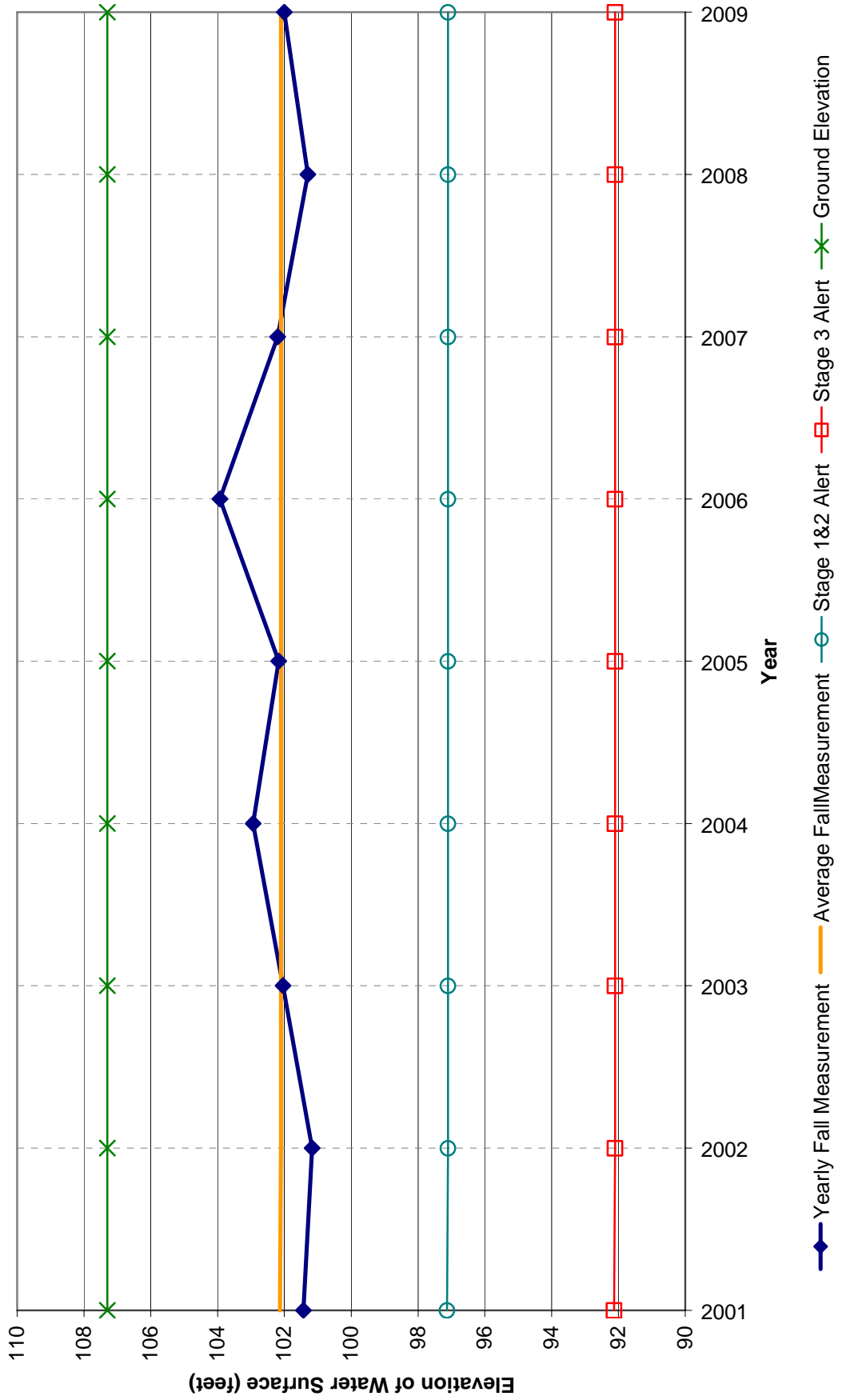
Fall Groundwater Levels
Western Canal - 20N01E18L02



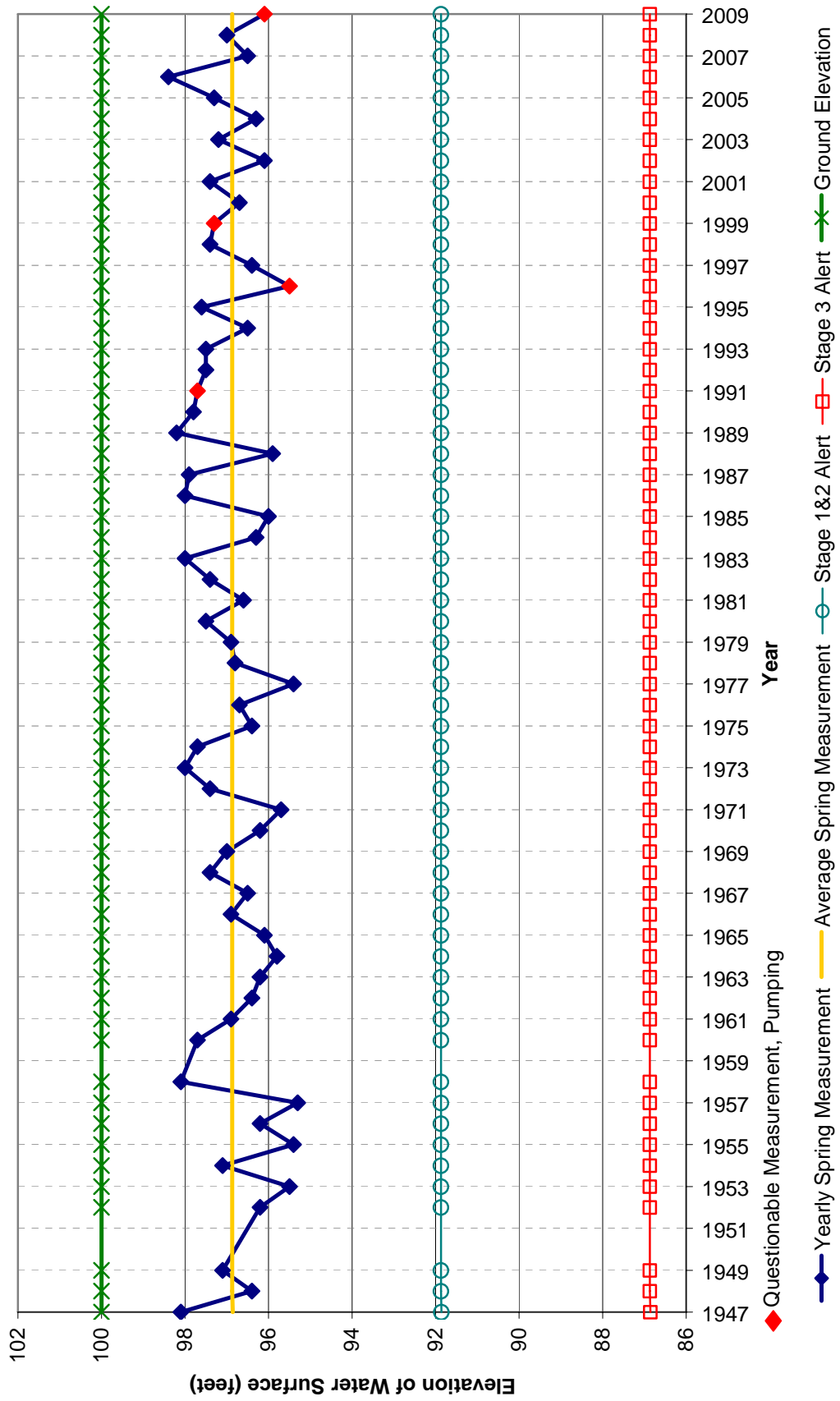
Spring Groundwater Levels
Western Canal - 20N01E18L03



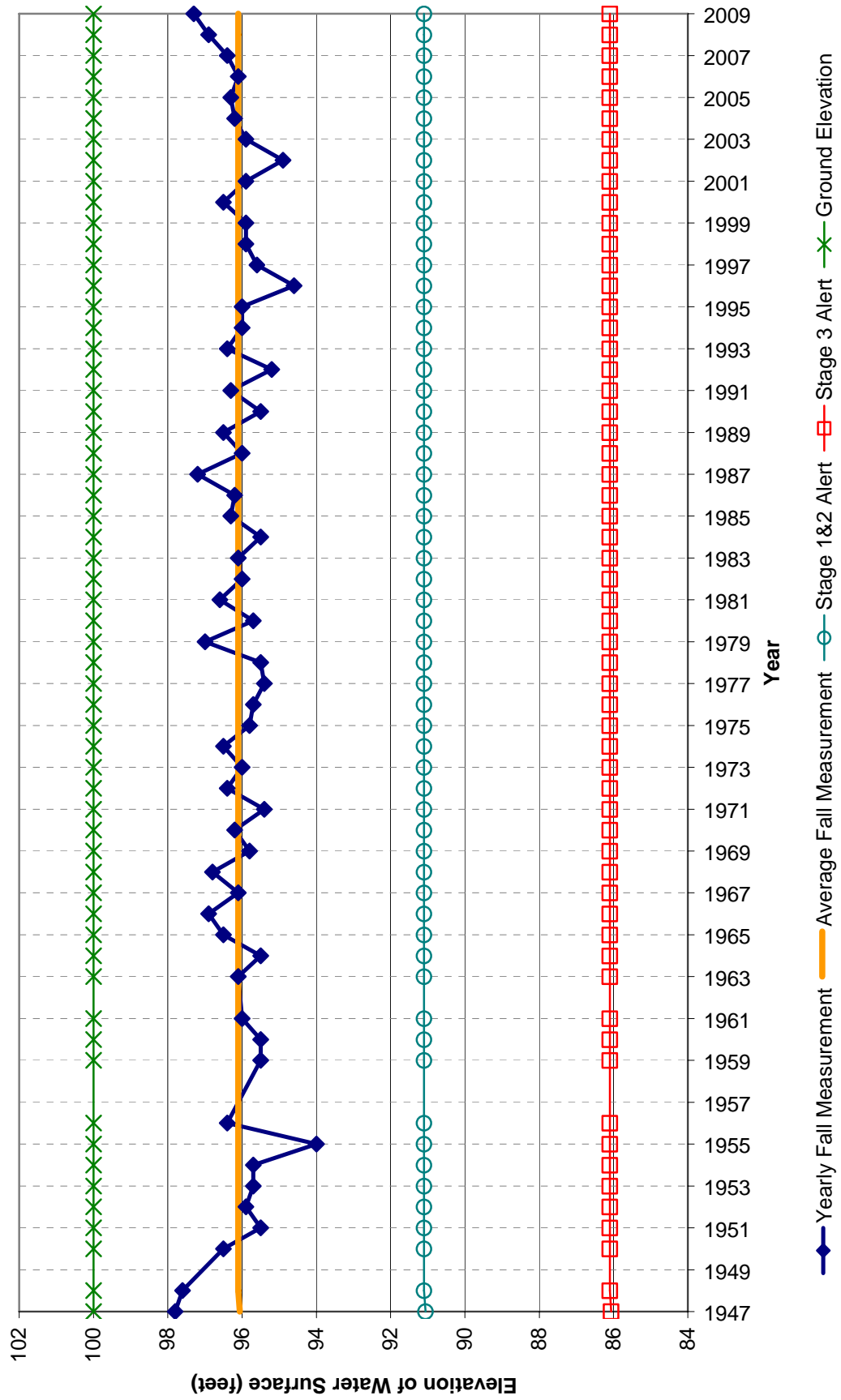
**Fall Groundwater Levels
Western Canal - 20N01E18L03**



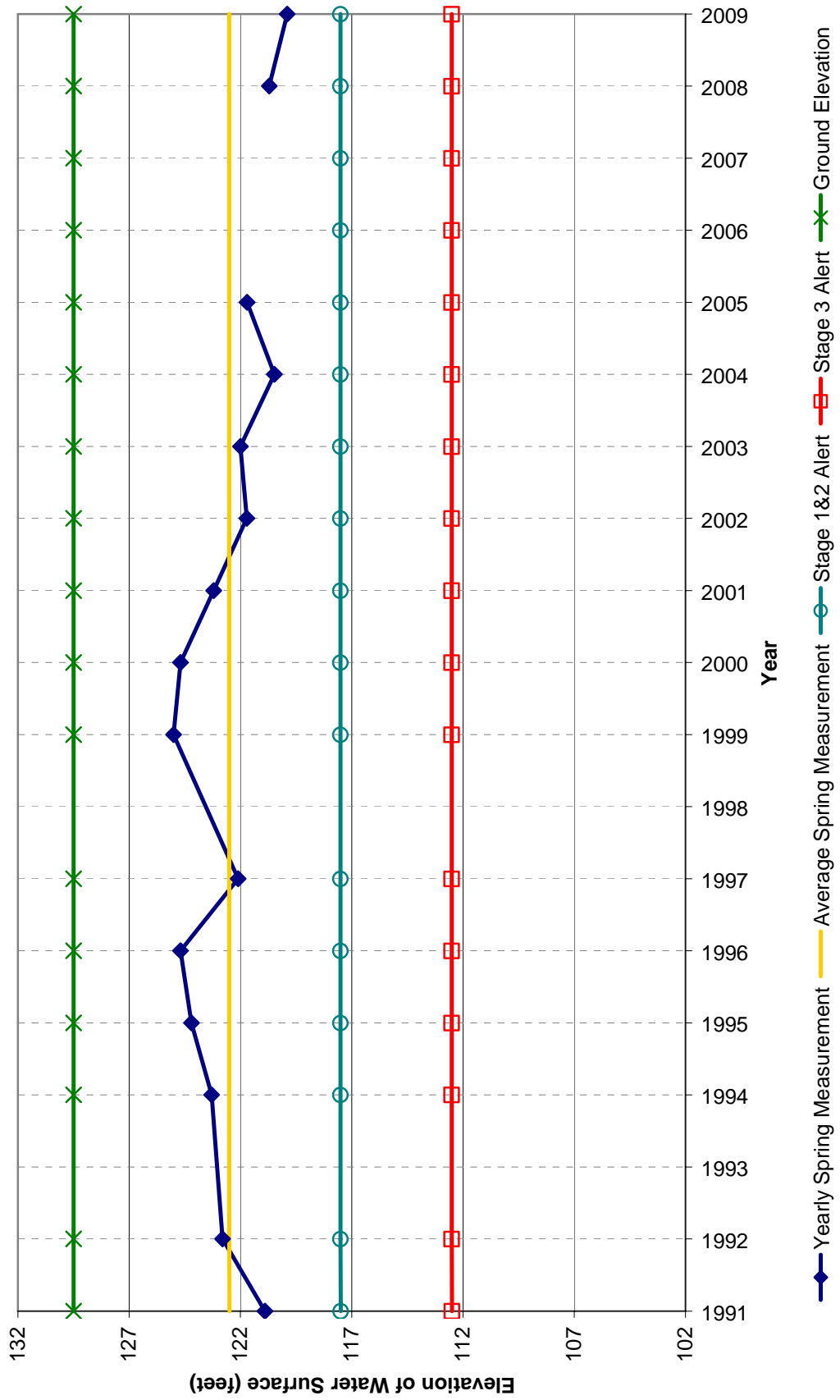
Spring Groundwater Levels
Western Canal - 20N01E35C01



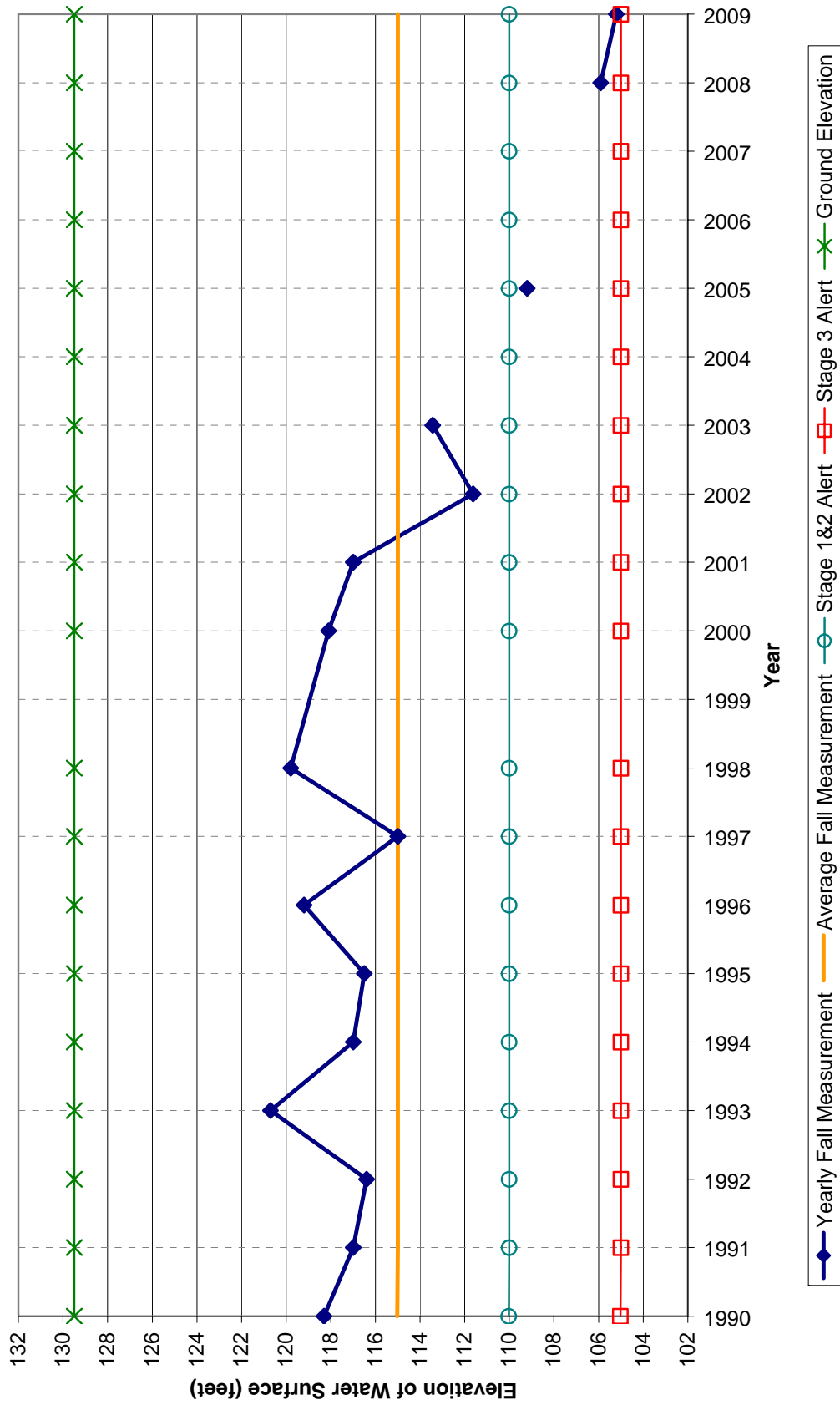
Fall Groundwater Levels
Western Canal - 20N01E35C01



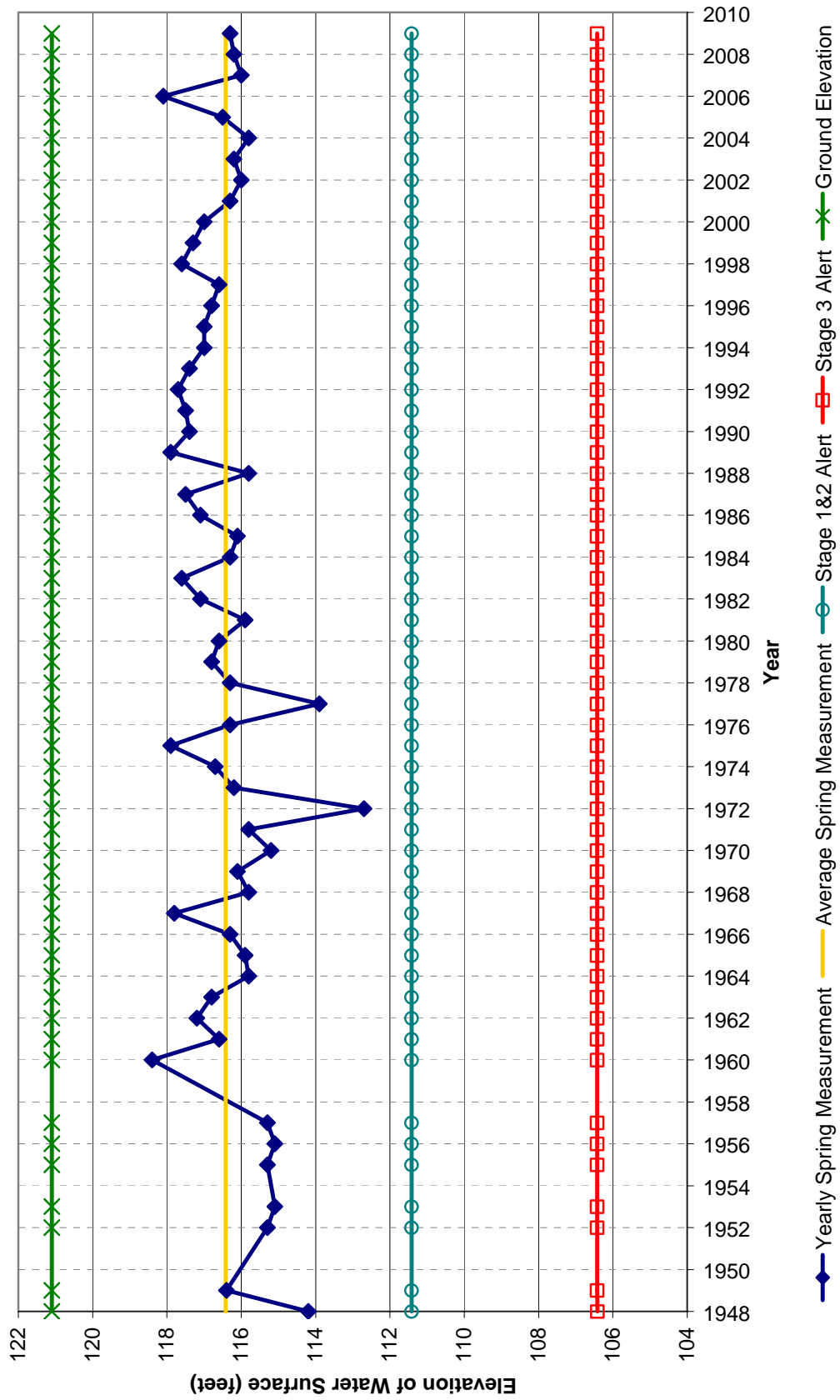
Spring Groundwater Levels
Western Canal - 20N02E16P01



Fall Groundwater Levels
Western Canal - 20N02E16P01



Spring Groundwater Levels
Western Canal - 20N02E28N01



**Fall Groundwater Levels
Western Canal - 20N02E28N01**

