Basin Management Objective (BMO) For Groundwater Surface Elevations In Glenn County, California

In Compliance with Groundwater Ordinance No. 1115

Glenn County
Glenn County Board of Supervisors

August 21, 2001

Glenn County Water Advisory Committee

720 North Colusa Street, P. O. Box 351, Willows, CA 95988
Phone: 530-934-6501 Fax: 530-934-6503

August 21, 2001

Glenn County Board of Supervisors
526 West Sycamore Street
P. O. Box 391
Willows, CA 95988

Subject: Ordinance No. 1115 – Adoption of Glenn County Basin Management Objectives

Dear Supervisors:

On behalf of the Glenn County Water Advisory Committee, I am pleased to submit the enclosed initial Glenn County Basin Management Objectives (BMOs) for groundwater levels pursuant to Ordinance No. 1115. Development of these initial BMOs represents an important milestone in implementing the ordinance. The BMOs are the result of a great deal of volunteer time and effort by members of the Water Advisory Committee and the Technical Advisory Committee with significant support from the California Department of Water Resources (DWR) and, especially, from Mr. Toccoy Dudley, Chief, Groundwater Section, Northern District of the DWR. Major assistance in gathering, assembling and producing the BMO document was provided by Mr. Roger Putty of Montgomery Watson Harza (MWH Americas, Inc.) through funding from the DWR.

Ordinance No. 1115 calls for the establishment of a monitoring network and BMOs to define acceptable groundwater levels, groundwater quality, and land subsidence. The monitoring network consists of selected wells representative of each sub-area. This network will be periodically reviewed and refined as necessary to assist in providing the most appropriate BMOs. Due to lack of data, we have not been able to establish specific BMOs for groundwater quality and land subsidence. As interim BMOs for these two factors, we recommend that there be no deterioration in groundwater quality from that which currently exists and that there be no additional land subsidence. We are in the process of developing a groundwater quality monitoring program and anticipate beginning water quality measurements next summer. We have successfully applied for a grant provided by AB 303 which will provide the means for measuring land subsidence for a few places within the county. Monitoring for land subsidence should be in place in 2002.

As stated in the Ordinance, the intent is to develop one countywide BMO, which incorporates individual BMOs for sub-areas within the County. We recommend that you adopt the enclosed sub-area BMOs as the countywide BMO for groundwater levels. We

recognize that the BMOs will change over time as we gain more data and experience. By your adopting the BMOs you will be taking one large step in achieving our vision that sufficient and affordable water of good quality be available on a sustainable basis to meet the needs of agricultural, industrial, recreational, environmental, residential, and municipal users within the County, both now and in the future.

Sincerely,

Judith Y. Brown
Chairman

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COVER REPORT

The Basin Management Objective, or BMO, concept was developed to overcome many of the usual problems of defining safe yield and overdraft in the Sacramento Valley. The California State Department of Water Resources (DWR), Northern District Groundwater Section formulated the concept when they assisted Glenn County in developing their groundwater management ordinance, Ordinance No. 1115. The BMO concept defines acceptable groundwater levels, groundwater quality, and land subsidence conditions required to meet management objectives. For a more detailed explanation see the BMO concept paper prepared by DWR and included here under Appendix A, Supporting Technical Documents.

The objective of these BMOs is to maintain the groundwater surface elevation at a level that will assure an adequate and affordable irrigation water supply. It is the intent of this objective to assure a sustainable agricultural water supply now and into the future. The objective also assures an adequate groundwater supply for all domestic users in Glenn County. Key BMO Wells are comprised of selected wells from water district and municipal independently monitored wells and DWR's groundwater level monitoring network. This summary document describes the BMOs for groundwater surface elevations at these BMO Key Wells.

METHODS FOR DETERMINING BMOs

There are various methods for determining the BMO for groundwater levels. There is no definitive method that should take precedence over the others because of the uncertainty in the data. However, some methods may be preferable based on variability of the data, simplicity, operating procedures, or availability of data. The methods used to calculate BMOs for Glenn County sub-areas are described below.

Method 1 – Regression Method (Used by Sub-areas 9 and 10)

All existing groundwater level monitoring wells within the BMO area were identified. For all wells with a record dating back to at least 1976[1], groundwater levels were obtained using the Department of Water Resources' groundwater level website (wwwdpla.water.ca.gov/nd). The surface water deliveries and annual precipitation data were also obtained from the appropriate websites and water districts. With the built-in correlation function in Microsoft Excel, the correlation between surface water deliveries plus precipitation was calculated. A scatter plot of groundwater elevation vs. surface water deliveries plus precipitation was created. A trendline was then added to create the Stage 1 & 2 alert line that was parallel to the trendline, but lower by half of the average deviation. The Stage 3 alert was determined as the minimum acceptable groundwater elevation, which is based on the level at which pumping efficiency is noticeably reduced.

[1] In 1976 the Tehama-Colusa Canal became operational, changing the relative surface water supply and groundwater supply mix in sub-areas served by the canal. The Glenn County Technical Advisory Committee concluded that groundwater levels from this date forward are representative of recent historical conditions and when possible this historical period of record should be used for developing groundwater level BMOs in these sub-areas.

Method 2 – Standard Deviation (Used by Sub-areas 5, 10, 15, and 17)

All existing groundwater level monitoring wells within the BMO area were identified. For all wells with a record dating back to at least 1976[1], groundwater levels were obtained using the Department of Water Resources' groundwater level website. The Spring data for groundwater surface elevation (WSE) was further analyzed. The average and standard deviation were then calculated for these data. The Stage 1 & 2 alerts were determined to be the average of the Spring data minus one standard deviation. The State 3 alert was the average minus two standard deviations.

Method 3 – (Used by Sub-area 11)

All existing groundwater level monitoring wells within the BMO area were identified. For all wells with a current record, groundwater levels were obtained using the Department of Water Resources' groundwater level website. The average and standard deviation were then calculated for the wells' entire period of record (using Spring and Fall data). The Stage 1 & 2 alerts were determined to be the average of the data minus one standard deviation. The State 3 alert was the lowest Spring record dating back to 1976.

Method 4 – 20% of Range (Used by Sub-area 8)

All existing groundwater level monitoring wells within the BMO area were identified. For all wells with a record dating back to at least 1976[1], groundwater levels were obtained using the Department of Water Resources' groundwater level website. The Spring data for groundwater surface elevation (WSE) was furthered analyzed. The Stage 1 & 2 alerts were determined to be the average of the data minus 20% of the range. The Stage 3 alert was the lowest Spring record dating back to 1976. However, one well had a Stage 3 alert that was not the lowest historical elevation due to data anomalies.

Method 5 – (Used by Sub-areas 12 and 14)

All existing groundwater level monitoring wells within or near the BMO area were identified. For all wells with a record dating back to at least 1976[1], groundwater levels were obtained using the Department of Water Resources' groundwater level website. The Spring data for groundwater surface elevation (WSE) was furthered analyzed. The Stage 1 & 2 alerts were determined to be the average of the Spring data. The State 3 alert was the lowest Spring record dating back to 1976.

Method 6 – (Used by Sub-area 13)

The groundwater surface elevation was obtained for the examined well dating back to 1983. The data are mostly from late summer and early fall. The Stage 1 & 2 alerts were determined to be the average of the data. The State 3 alert was the lowest record dating back to 1983.

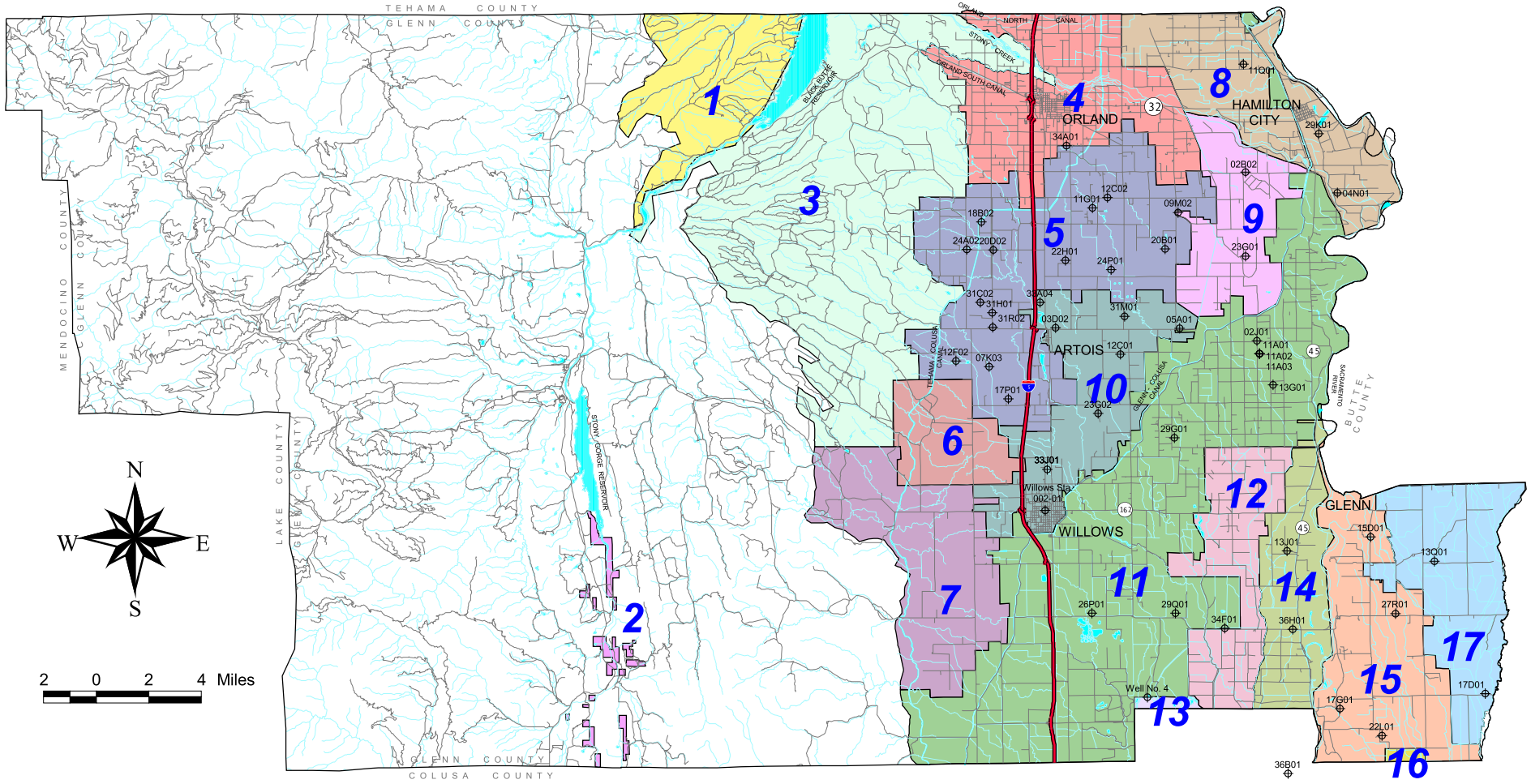
1. See previous page.

The following table summarizes the sub-areas and the method used to determine their respective groundwater level BMO. Each sub-area's groundwater level BMO is presented in standard format in the following sections. A map of Glenn County shows the sub-area boundaries and the locations of DWR monitoring wells on the following page (Exhibit A).

Sub-area No.	**Sub-area Name (see Exhibit A)**	**Method(s) for Calculating BMO**
1	West Corning Basin Private Pumpers Area	Not applicable (a)
2	Stony Creek Water District Area	Not applicable (a)
3	West Colusa Basin Private Pumpers Area	Not applicable (a)
4	Orland Unit Water Users' Association Area	Other (c)
5	Orland-Artois Water District Area	Method 2
6	Glide Water District Area	Other (c)
7	Kanawha Water District Area	Other (c)
8	East Corning Basin Private Pumpers Area	Method 4
9	Board of Supervisors District Five Private Pumpers Area	Method 1
10	Board of Supervisors District Three Private Pumpers Area	Method 1 and 2
11	Glenn-Colusa Irrigation District Area	Method 3
12	Provident Irrigation District Area	Method 5
13	Willow Creek Mutual Water Company Area	Method 6
14	Princeton-Codora-Glenn Irrigation District Area	Method 5
15	Reclamation District 2106 Area	Method 2
16	Reclamation District 1004 Area	Not applicable (b)
17	Western Canal Water District Area	Method 2 and Other (c)

(a) No monitored wells currently exist and no BMO has been established at this time.
(b) BMO's have not explicitly been developed at this time. Sub-area 15 and its BMO will serve as a surrogate BMO until a BMO is established.
(c) See the corresponding sub-area's BMO Standard Form for discussion of *Other* method used to determine the BMO.

EXHIBIT A



SUB-AREAS:
1. West Corning Basin Private Pumpers
2. Stony Creek Water District
3. West Colusa Basin Private Pumpers
4. Orland Unit Water Users' Association
5. Orland-Artois Water District
6. Glide Water District
7. Kanawha Water District
8. East Corning Basin Private Pumpers
9. Board of Supervisors District Five Private Pumpers
10. Board of Supervisors District Three Private Pumpers
11. Glenn-Colusa Irrigation District
12. Provident Irrigation District
13. Willow Creek Mutual Water Company
14. Princeton-Codora-Glenn Irrigation District
15. Reclamation District 2106
16. Reclamation District 1004
17. Western Canal Water District

Legend

⊕ - Wells used in BMO calculation

Glenn County Groundwater Management Ordinance No. 1115	**Basin Management Sub-Areas**	August 21, 2001

WELL NUMBERING SYSTEMS

To develop the groundwater level BMOs all existing monitoring wells were identified for each BMO sub-area. These wells are currently monitored either by public or private entities within a given sub-area, or they are monitored as part of the DWR, Northern District groundwater levels monitoring program. To distinguish and locate these monitored wells an alphanumeric name, or ID, is used. All BMO Key Wells identified for each sub-area are referenced by these unique ID's. Wells that are not part of the DWR monitoring network are typically assigned a local ID. Wells that are part of the DWR monitoring network are identified by the State Well Numbering System. This system is very useful in locating points on the ground, such as groundwater wells in areas with few identifying landmarks. Under this system, each well is assigned a unique number referred to as the State Well Number. This system is described further below.

State Well Numbering System

(Reference: Water Facts: Numbering Water Wells in California, No. 7, June 2000)

The State's well-numbering system is based on a rectangular system called the "United States System of Surveying in the Public Lands," commonly referred to as the "Public Lands Survey," established by the Continental Congress in 1784. The Public Lands Survey system has been employed by DWR, USGS, and other agencies for over 50 years. This system allows for a unique ID to be assigned to each well. These unique ID's are made up of several components, each of which is described below.

Initial Point, and Corresponding Base & Meridian Pair. Under this system all tracts of land are referenced to an Initial Point. This Initial Point is defined by the intersection of a north-south line called the Meridian and an east-west line called the Base. In California there are three Initial Points each with a corresponding Base and Meridian Pair. These three Initial Points are Mount Diablo Base and Meridian, San Bernardino Base and Meridian, and Humboldt Base and Meridian, and are identified by the letters M, S, and H, respectively. All of the BMO Key Wells are referenced to the Mt. Diablo Base and Meridian.

Range and Township Lines. Longitudinal lines are established at six-mile increments from the Initial Point and are east or west of the Meridian. These longitudinal lines are called Range Lines. Latitudinal lines also set at six-mile increments from the Initial Point are parallel to, and north or south of the Base. These latitudinal lines are known as Township Lines. This pattern of longitudinal and latitudinal lines defines a grid pattern consisting of 36-square-mile parcels of land. These 36-square-mile parcels are referred to as Townships. Each Township is referenced to an Initial Point by the number of 36-square-mile parcels and direction from that Initial Point. For example, Figure B-1 shows a Township that is three 36-square-mile parcels south of the San Bernardino Base and four 36-square-mile parcels east of the San Bernardino Meridian. This Township would be labeled as Township 03 South, Range 04 East, or in abbreviated form T3S/R4E.

Sections. Every Township is further divided in to 36 parts called Sections. A Section is a square parcel of land one-mile on a side, containing 640 acres. Numbering of these Sections is illustrated in Figure B-1.

Tract. Each Section is further divided into sixteen 40-acre parcels called Tracts. Each Tract is labeled with a letter as shown in Figure B-1. Once the well's location is established in the 40-acre Tract it is assigned a Sequence Number. These Sequence Numbers are assigned in chronological order (see Figure B-1).

State Well Number. The State Well Number is composed of the various components described above, including Township, Range, Section, Tract, Sequence Number, and Base & Meridian Pair. An example of the complete State Well Number is displayed in Figure B-2.

EXHIBIT B

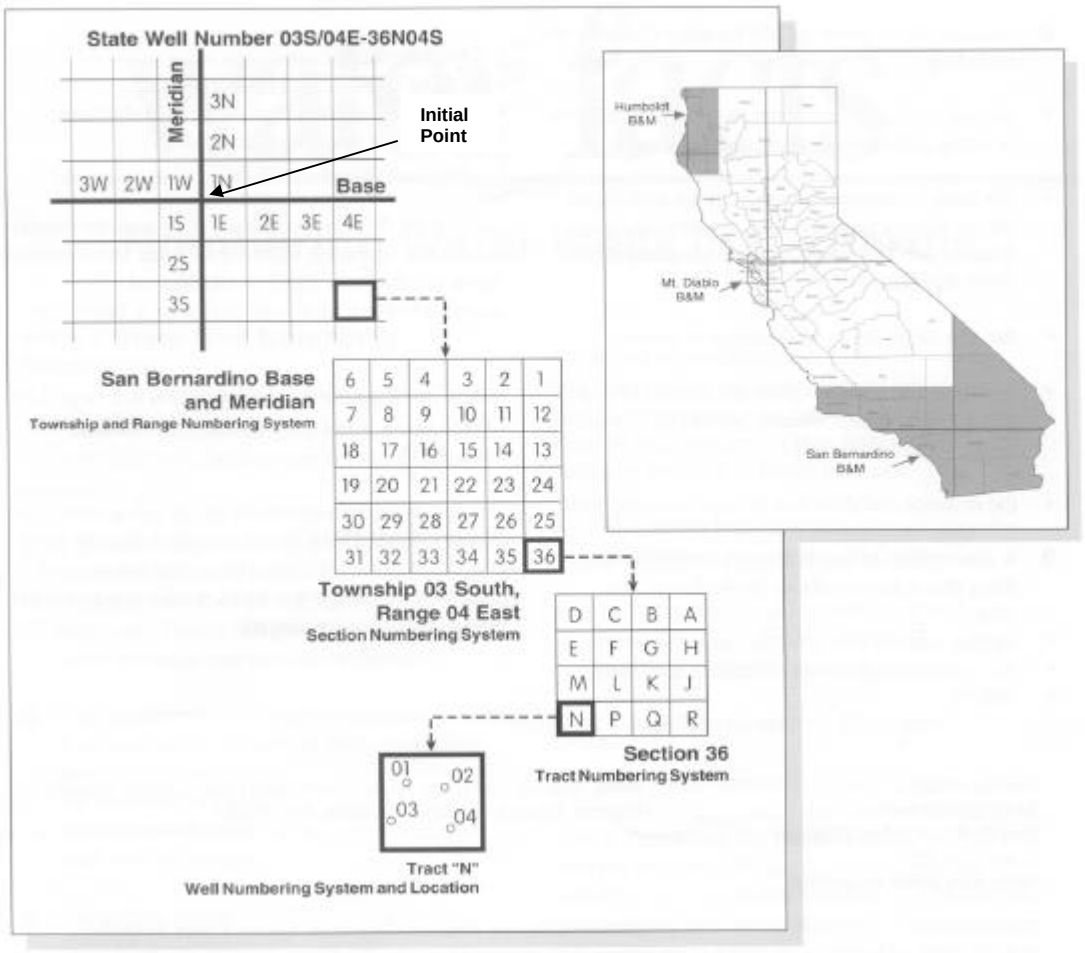


Figure B-1: State Well Numbering System Schematic

Nomenclature and Notation Examples

Example of a State Well Number: T3S/R4E/36N04S

Ignoring the slash and the hyphen, the well number's components are:

State Well Number	T3S	R4E	36	N	04	S
Township...../	/	/	/	/	/	/
Range...../	/	/	/	/	/	/
Section...../	/	/	/	/	/	/
40-Acre Tract...../	/	/	/	/	/	/
Sequence Number...../	/	/	/	/	/	/
Base & Meridian...../	/	/	/	/	/	/

- Township is the third 36-square-mile parcel of land (township) south of the initial point (T3S).
- Range is the fourth 36-square-mile parcel of land (township) east of the initial point (R4E).
- Section is that parcel of land one mile square numbered 36 in T3S/R4E.
- Tract is that 40-acre parcel of land in section 36 lettered "N".
- Sequence number 4 is the number assigned to this particular well in tract N of section 36 and it indicates that three other wells in this tract have been assigned numbers in the past.
- Base & Meridian is that particular initial point, baseline and principal meridian to which this well is referenced, in this case S, the San Bernardino Base and Meridian.

Figure B-2: Definition of State Well Number Components

Provisional Basin Management

Objective

Glenn County

Sub-area 1

West Corning Basin Private Pumpers

Provisional Basin Management Objective
Glenn County
Sub-area 1
West Corning Basin Private Pumpers

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: Vacant

Objective: To maintain the groundwater surface elevation at a level that will assure an adequate and affordable irrigation water supply. It is the intent of this objective to assure a sustainable agricultural water supply now and into the future. The objective is also to assure an adequate groundwater supply for all domestic users in the sub-area.

Location of BMO Key Wells: See sub-area 1 map on following page. No monitoring wells exist at this time.

Groundwater Level Monitoring Network: No monitoring wells exist at this time.

Groundwater Level Measurements By: See recommendations below.

Groundwater Level Monitoring Frequency:
Semiannual (proposed).
Spring (March-April)
Fall (October-November)

Groundwater Well Numbering System: No monitoring wells exist at this time.

BMO Key Wells and BMO Determination Methodology (See Cover Report for Discussion Of Numbered BMO Methodologies):

No monitoring wells exist at this time. See recommendations below.

BMO Alert Stage Definitions:

None at this time.

BMO Compliance Evaluation Procedure:

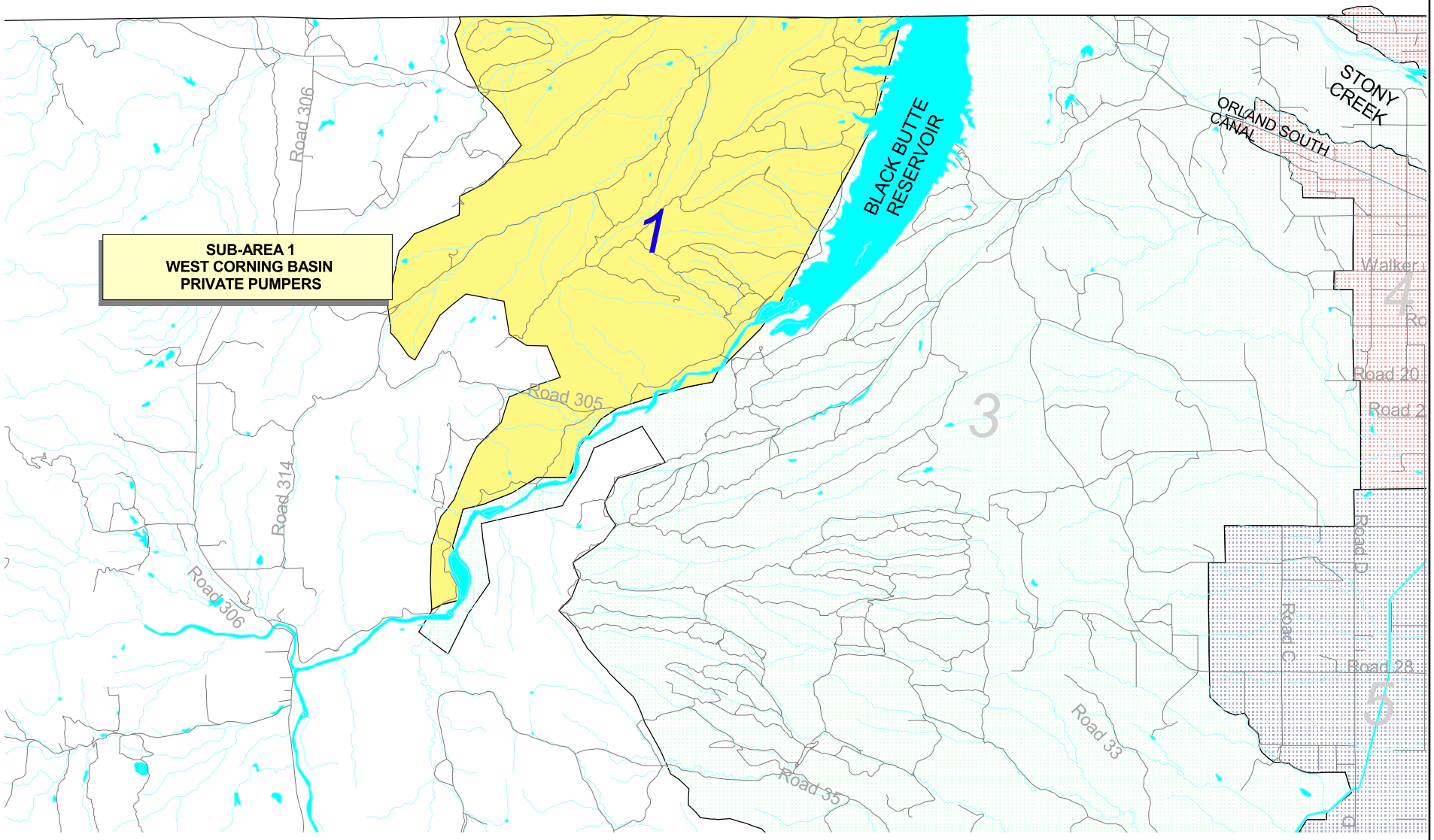
None at this time.

Monitoring Recommendations:

Five potential monitoring wells have been located for this area. It is recommended that at least one well be monitored on a twice yearly basis by DWR, beginning Summer 2001.

Supporting Data:

No monitored wells were found for this area, therefore no supporting data is available. As noted above, five potential monitoring wells have been located for this area. If at least one well is available for monitoring purposes it is recommended that monitoring begin Summer 2001. As data become available it will be evaluated and a BMO and alert levels developed for Sub-area 1.



Glenn County Groundwater Management Ordinance No. 1115	**Sub-Area 1** **West Corning Basin Private Pumpers**	August 21, 2001

Provisional Basin Management

Objective

Glenn County

Sub-area 2

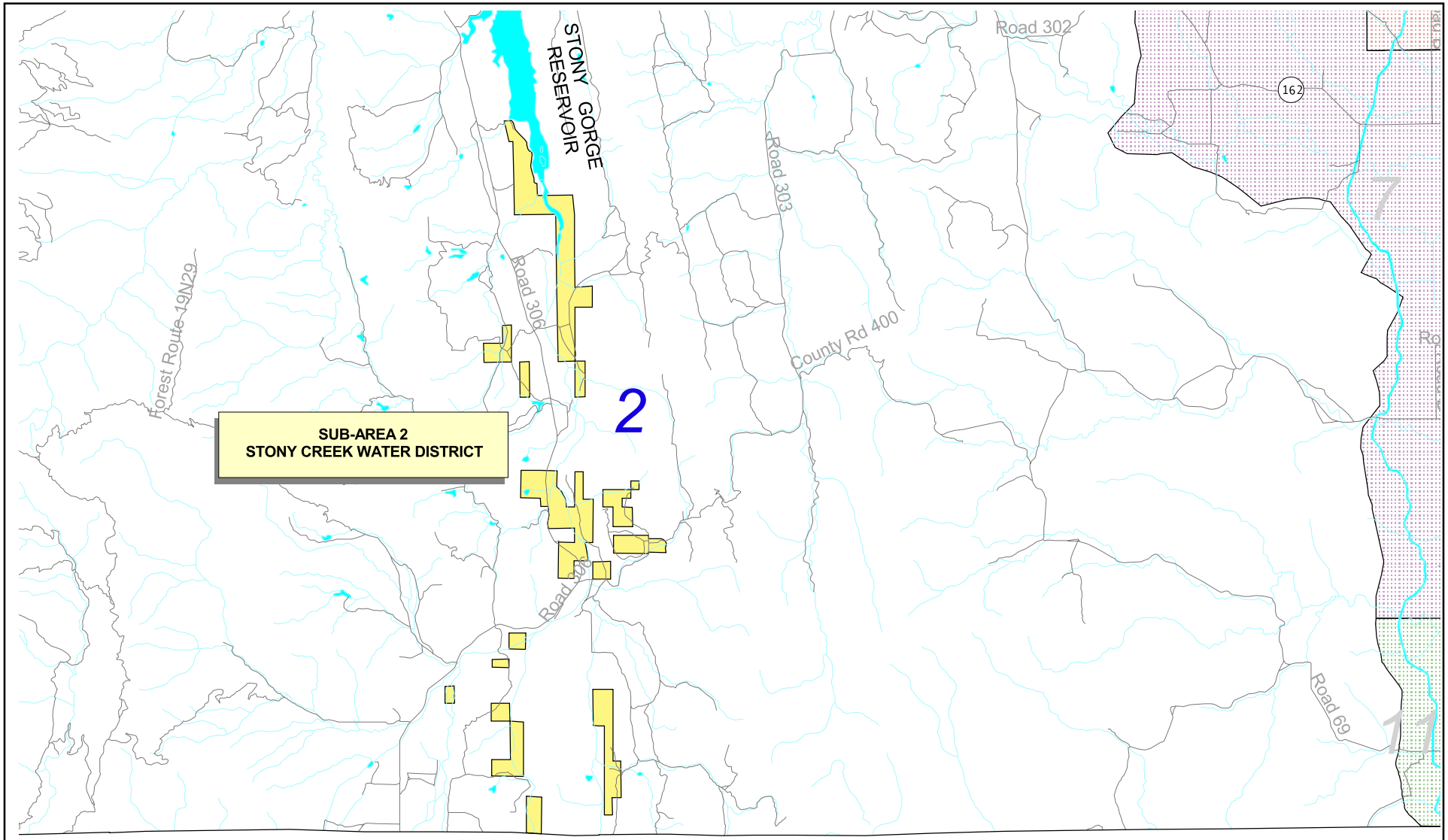
Stony Creek Water District

Provisional Basin Management Objective
Glenn County
Sub-area 2
Stony Creek Water District

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: Vacant

Special Circumstances: See sub-area 3 map on following page. No monitored wells were found for this sub-area. No BMO has been established at this time. Further consideration will be given to identify potential monitoring wells and a representative from Sub-area 2 with the intent of developing a BMO in the future.



N
W E
S

1 0 1 2 Miles

Legend

Wells used in BMO calculation (No BMO wells exist)

Glenn County Groundwater Management Ordinance No. 1115	**Sub-Area 2** **Stony Creek Water District**	August 21, 2001

Provisional Basin Management

Objective

Glenn County

Sub-area 3

West Colusa Basin Private Pumpers

Provisional Basin Management Objective
Glenn County
Sub-area 3
West Colusa Basin Private Pumpers

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: Del Reimers

Objective: To maintain the groundwater surface elevation at a level that will assure an adequate and affordable irrigation water supply. It is the intent of this objective to assure a sustainable agricultural water supply now and into the future. The objective is also to assure an adequate groundwater supply for all domestic users in the sub-area.

Location of BMO Key Wells: See sub-area 3 map on following page. No BMO Key wells have been selected due to limited data.

Groundwater Level Monitoring Network: No monitoring wells exist at this time.

Groundwater Level Measurements By: See recommendations below.

Groundwater Level Monitoring Frequency:
Semiannual (proposed).
Spring (March-April)
Fall (October-November)

Groundwater Well Numbering System: State

BMO Key Wells and BMO Determination Methodology (See Cover Report for Discussion Of Numbered BMO Methodologies):

Only one monitored well was found for this area, there was little data available and it was all prior to 1976.

BMO Alert Stage Definitions:

None at this time.

BMO Compliance Evaluation Procedure:

None at this time.

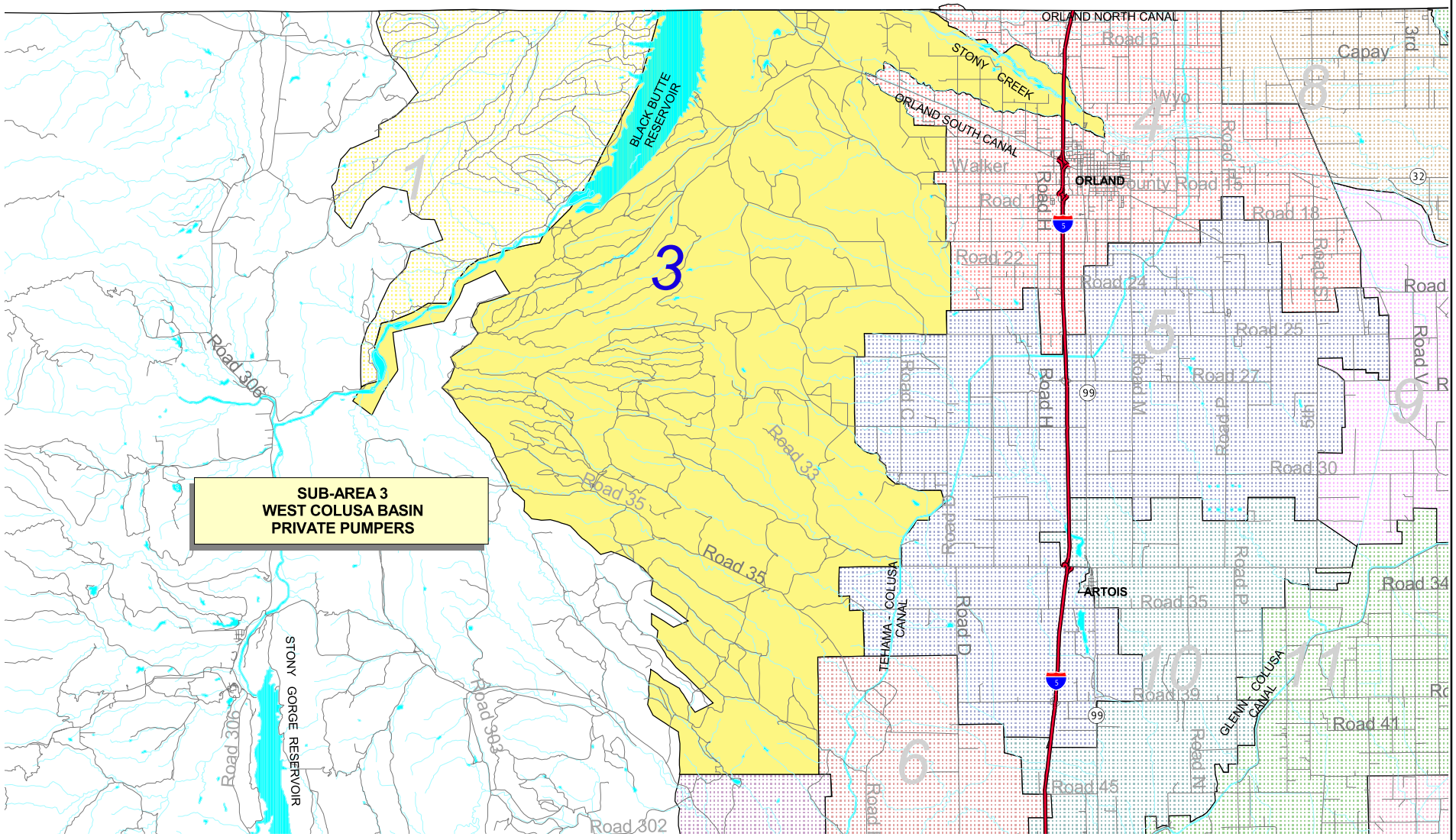
Monitoring Recommendations:

Forty-five potential monitoring wells have been located for this area. It is recommended that three to five of these wells be monitored on a twice-yearly basis. Well logs should be collected

and reviewed to determine which wells to choose. This effort is scheduled to begin July/August 2001. Development of a new monitoring well should be considered as part of the AB303 grant money recently awarded to Glenn County.

Supporting Data:

Only one monitored well was found for this area and the data was not sufficient to offer supporting data. As noted above, forty-five potential monitoring wells have been located for this area. If at least three wells are available for monitoring purposes it is recommended that monitoring begin Summer 2001. As data become available it will be evaluated and a BMO and alert levels developed for Sub-area 3.



Glenn County Groundwater Management Ordinance No. 1115	**Sub-Area 3** **West Colusa Basin Private Pumpers**	August 21, 2001

Basin Management Objective

Glenn County

Sub-area 4

Orland Unit Water Users' Association

ORLAND UNIT WATER USERS' ASSOCIATION
Telephone (530) 865-[illegible] 828 Eighth Street
ORLAND, CALIFORNIA 95963

March 27, 2001

Glenn County Board of Supervisors
P. O. Box 391
Willows, California 95988

RE: Basin Management Objective—Glenn County Ordinance No. 1115—Groundwater Management

Dear Honorable Supervisors:

In August 2000, the Orland Unit Water Users' Association established its Basin Management Objective in compliance with the Glenn County's Groundwater Management Ordinance. Although presented orally at the September 11, 2000, Water Advisory Committee meeting, this criteria was not formally presented in writing.

Please accept the enclosed Basin Management Objective for our sub-basin.

Sincerely,

Steve Butler, President

ORLAND UNIT WATER USERS' ASSOCIATION
Telephone (530) [illegible] 828 Eighth Street
ORLAND, California 95963

Basin Management Objective

The Orland Unit Water Users' Association, in compliance with Glenn County Ordinance No. 1115 (Groundwater Management Ordinance), hereby establish Basin Management Objective as described herein.

Groundwater levels—not to fall below a minimum depth of ten feet below the average level of the monitored wells as described as follows:

1. Those 25 wells lying within the Orland Project in which monitoring activity is recorded by California Department of Water Resources.
2. Other wells as designated as monitoring wells by the Orland Unit Water Users' Association.

Note—Monitoring wells are identified on a dynamic basis in which additional wells may be added at any time and wells not suited for monitoring may be deleted at any time.

Groundwater Quality—is of concern, however, no threshold requirements are identified at present time.

Land Subsidence—is not considered to be of issue at present and therefore not addressed.

Basin Management Objective
Glenn County
Sub-area 4
Orland Unit Water Users' Association

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: Steve Butler

Objective: To maintain the groundwater surface elevation at a level that will assure an adequate and affordable irrigation water supply. It is the intent of this objective to assure a sustainable agricultural water supply now and into the future. The objective is also to assure an adequate groundwater supply for all domestic users in the sub-area.

Location of BMO Key Wells: Orland Project Service Area. See sub-area 4 map on following page. Actual locations of BMO Key Wells not shown.

Groundwater Level Monitoring Network: Department of Water Resources – Northern District and Orland Unit Water Users' Association.

Groundwater Level Measurements By: Department of Water Resources – Northern District and Orland Unit Water Users' Association.

Groundwater Level Monitoring Frequency:
Semiannual.
Spring (March-April)
Fall (October-November)

Groundwater Well Numbering System: State and other (independent numbering system used by Orland Unit Water Users' Association).

BMO Key Wells and BMO Determination Methodology (See Cover Report for Discussion Of Numbered BMO Methodologies):

See Attached Letter.

BMO Alert Levels:

Groundwater levels – not to fall below a minimum depth of ten feet below the average level of the monitored wells as described as follows:

1. Those 25 wells lying within the Orland Project in which monitoring activity is recorded by California Department of Water Resources.
2. Other wells as designated as monitoring wells by Orland Unit Water Users' Association.

BMO Alert Stage Definitions:

See Attached Letter.

BMO Compliance Evaluation Procedure:

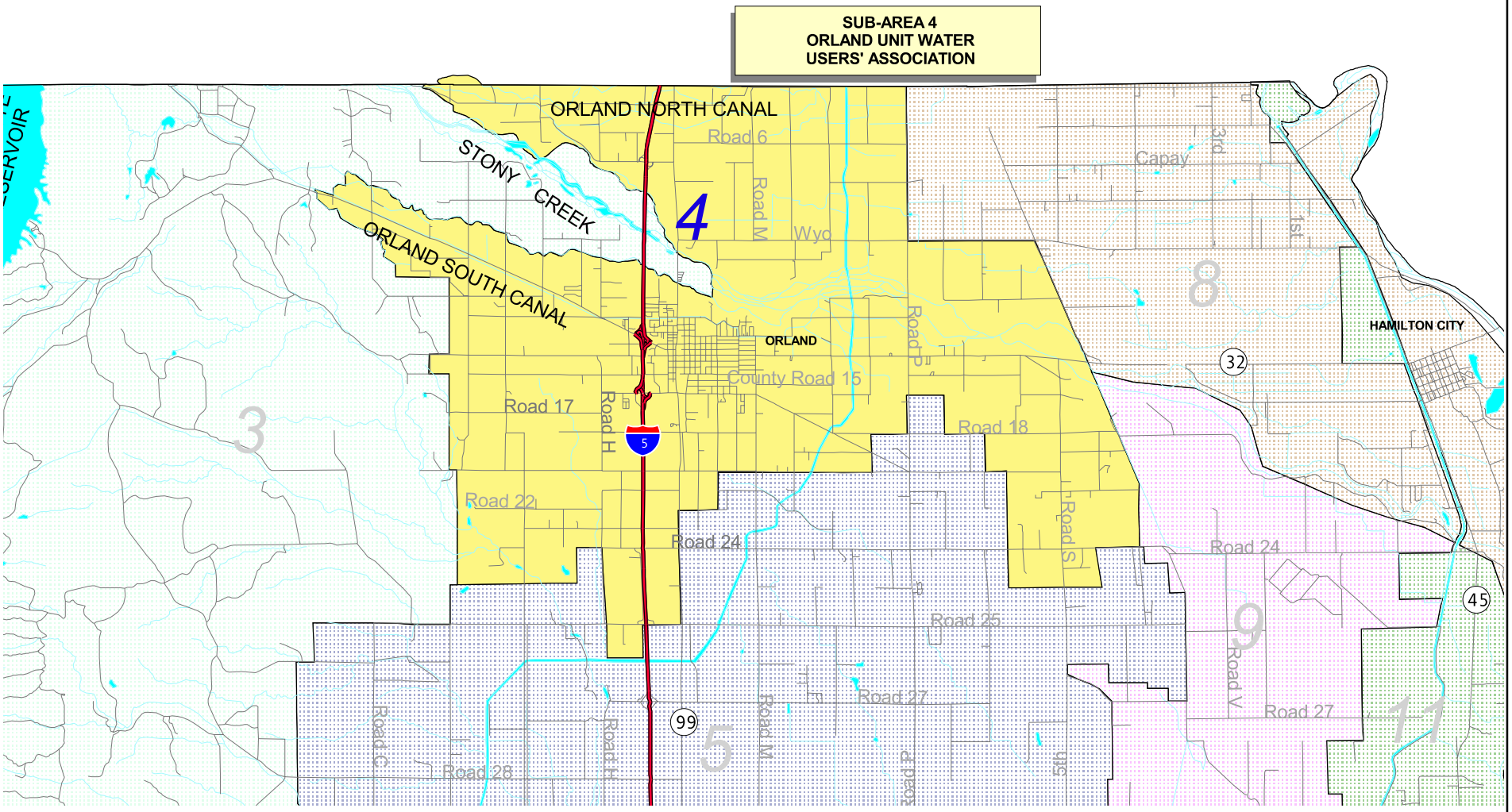
Compliance with the BMO will be determined following the spring measurement period. The groundwater surface elevations at each monitoring well will be compared against the corresponding compliance graph and stage definition criteria to determine if the groundwater surface elevations are above or below specific alert trigger levels. The Technical Advisory Committee of the Glenn County Water Advisory Committee will perform this evaluation and report the results of the evaluation to the WAC.

Monitoring Recommendations:

Efforts should be made to identify possible additional wells that could be added to the existing monitoring well network in the sub-area to improve the overall coverage within the region.

Supporting Data:

ATTACHED.



N
W E
S

1 0 1 2 Miles

Legend

⊕ Wells used in BMO calculation (BMO wells not shown)

Glenn County Groundwater Management Ordinance No. 1115	**Sub-Area 4** **Orland Unit Water Users' Association**	August 21, 2001

Basin Management Objective

Glenn County

Sub-area 5

Orland-Artois Water District

ORLAND-ARTOIS WATER DISTRICT
(A UNIT OF THE SACRAMENTO VALLEY CANALS)
P. O. BOX 218 • 6505 COUNTY ROAD 27
ORLAND, CALIFORNIA 95963
Telephone (530) 865-4304 • Fax (530) 865-8497

May 22, 2001

Glenn County Water Advisory Committee
C/O Public Works and Development Services Agency
P.O. Box 1070
777 N. Colusa Street
Willows, CA 95988

Attachment: Basin Management Objective – Glenn County Sub-Area 5

Dear Water Advisory Committee:

Orland Artois Water District is pleased to submit the Basin Management Objective for Sub-Area 5. The attached document was unanimously approved at the regular Board Meeting held on May 15, 2001. As the Management Objective matures, we will provide you with updates.

Sincerely,

John J. Vereschagin

John J. Vereschagin
President
Orland Artois Water District Board of Directors

Cc: Leigh McDaniel

Basin Management Objective
Glenn County
Sub-area 5
Orland-Artois Water District

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: Leigh McDaniel

Objective:
To monitor groundwater surface elevations within Orland-Artois Water District (OAWD). It is the intent of this objective to develop an understanding of groundwater levels in the Sub-area. As a database is established, the Basin Management Object will become more clearly defined and may define guidelines to maintain groundwater supplies. OAWD's goal is sustainable agricultural and domestic water supply now and into the future for the Sub-area and Glenn County.

Location of BMO Key Wells: See attached map.

Groundwater Level Monitoring Network:
Department of Water Resources – Northern District (Wells No. 1 through 16)
OAWD may develop other monitoring wells for use in the Sub-area and Glenn County.

Groundwater Level Measurements By:
Department of Water Resources – Northern District (Wells No. 1 through 16)
Other added wells to the BMO monitoring network may be measured by OAWD.

Groundwater Level Monitoring Frequency:
Three times per year, as required by Ordinance No. 1115
Spring (March-April)
Summer Peak Usage (June – August)*
Fall (October-November)
* Mid-Summer measurements may be delayed until funding is acquired.

Groundwater Well Numbering System:
State (Wells No. 1 through 16)
Other Wells – Independent numbering system used by Orland-Artois Water District

BMO Key Wells And BMO Determination Methodology (See Cover Report For Discussion Of Numbered BMO Methodologies):

Well No.	Well ID	Method *	Level of Line A: Average – One Standard Deviation **		Level of Line B: Average – Two Standard Deviations **	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
1	21N03W31H01M	2	123	64	103	84
2	20N03W07K03M	2	113	53	91	75
3	20N03W17P01M	2	120	33	103	50
4	20N04W12F02M	2	129	58	106	81
5	21N03W31R02M	2	119	64	98	85
6	21N03W18B02M	2	139	83	119	103
7	21N04W24A02M	2	129	101	111	119
8	21N03W20D02M	2	132	74	113	93
9	22N02W31C01M	2	183	20	176	27
10	21N03W12C02M	2	172	30	164	38
11	21N03W11G01M	2	170	30	162	38
12	22N03W34A01M	2	218	15	213	20
13	21N03W22H01M	2	150	52	139	63
14	21N02W09M02M	2	144	35	135	44
15	21N03W24P01M	2	137	41	124	54
16	21N02W20B01M	2	133	33	122	44

* - See Cover Report for description of method.
** - See attached hydrographs.

BMO Alert Stage Definitions:

Orland-Artois Water District may elect to establish Alert Stage definitions at a future date if necessary. The baseline BMO is a monitoring plan only. The plan will be reviewed annually. Alert Stages and consequences will only be developed if data indicates either OAWD or a neighboring Sub-area is being harmed.

BMO Compliance Evaluation Procedure:

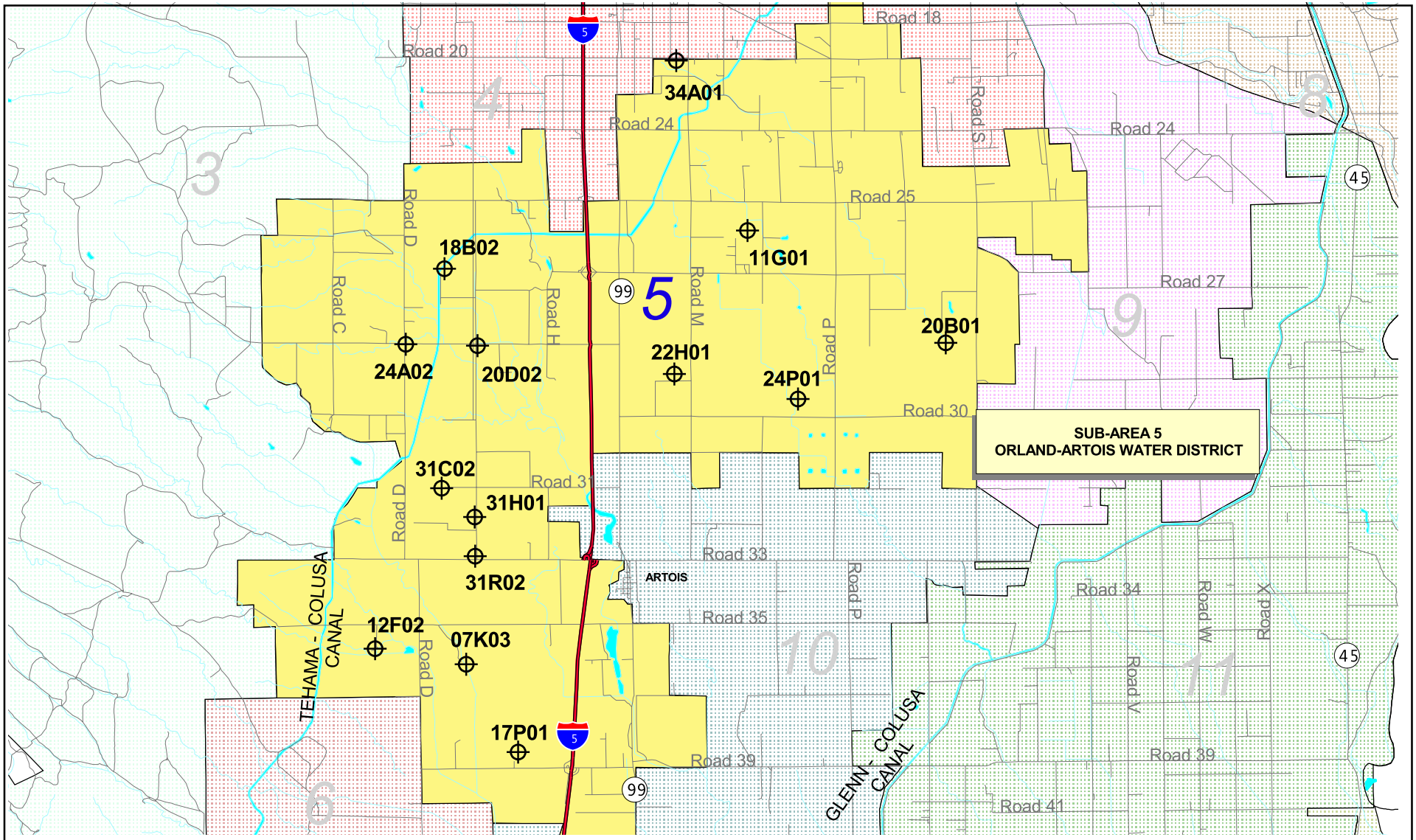
None. The plan will be reviewed annually and procedures developed in the future if necessary.

Monitoring Recommendations:

The network of groundwater level monitoring wells used to establish the BMO in Sub-area 5 is adequate for meeting the objectives described above. OAWD, with the assistance of the Glenn County Water Advisory Committee, will annually review the monitoring well network to determine if any unforeseen deficiencies have developed in the Sub-area BMO. Recommendations will be made for addressing these deficiencies if they exist.

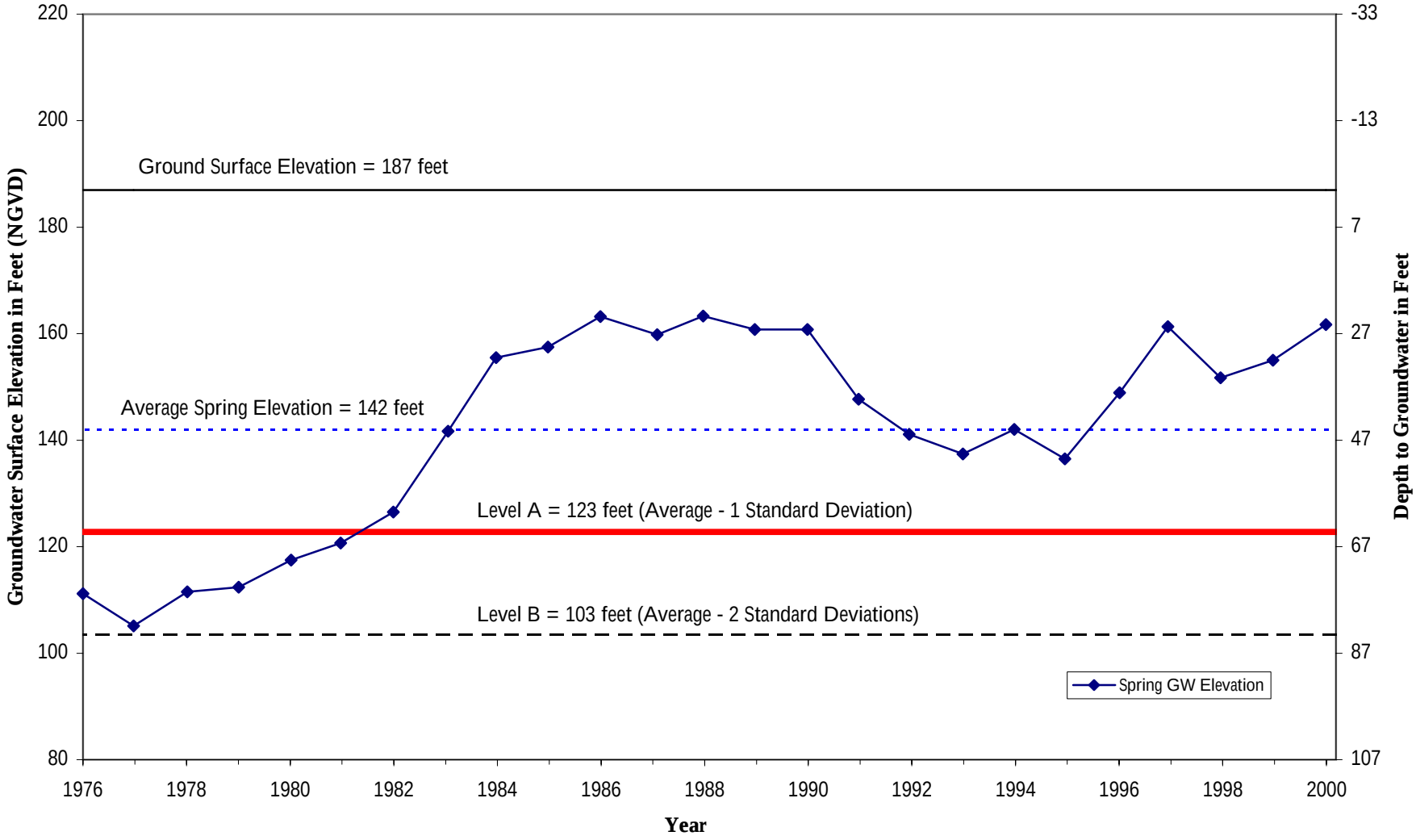
Supporting Data:

ATTACHED.

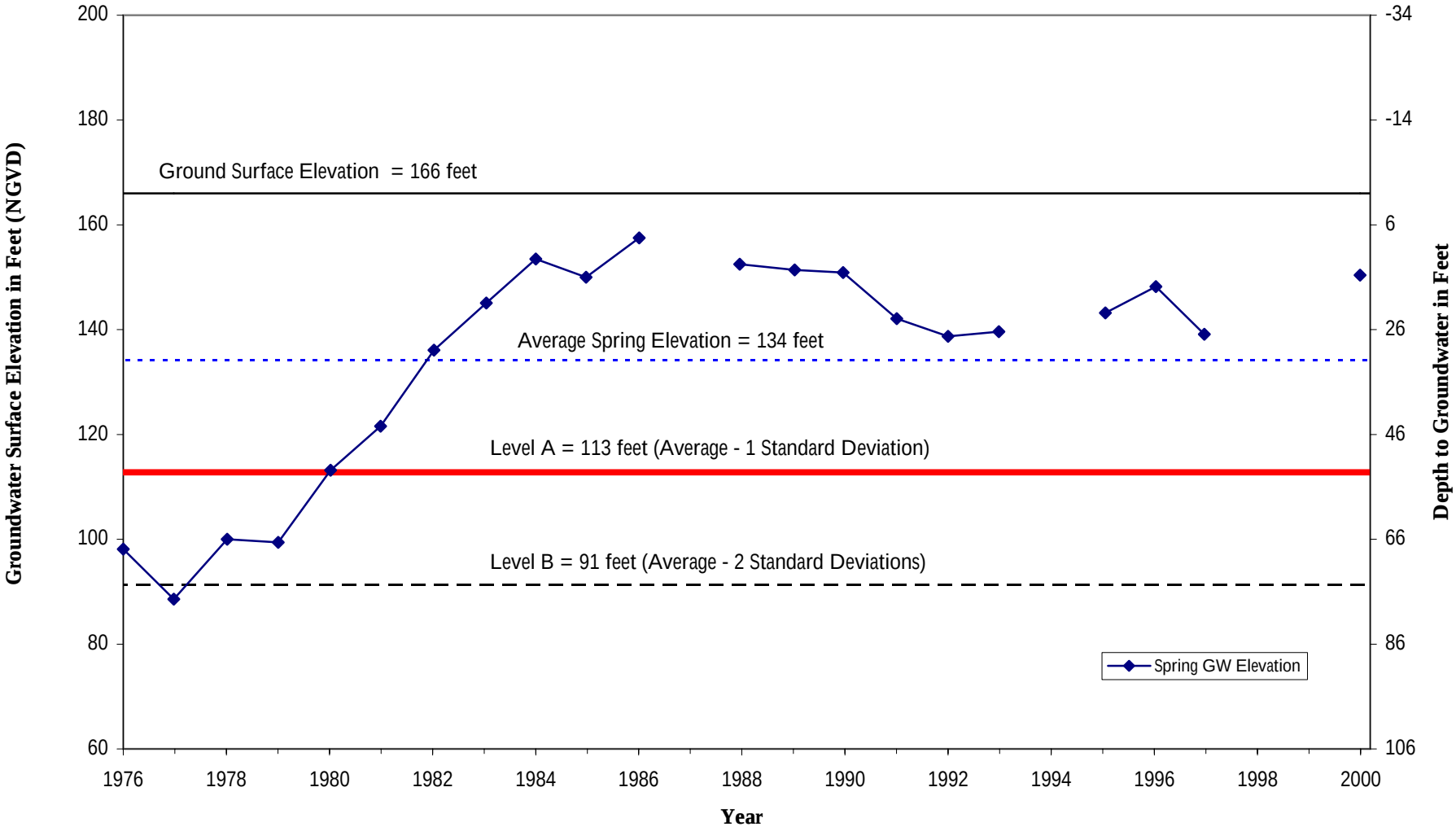


Glenn County Groundwater Management Ordinance No. 1115	**Sub-Area 5** **Orland-Artois Water District**	August 21, 2001

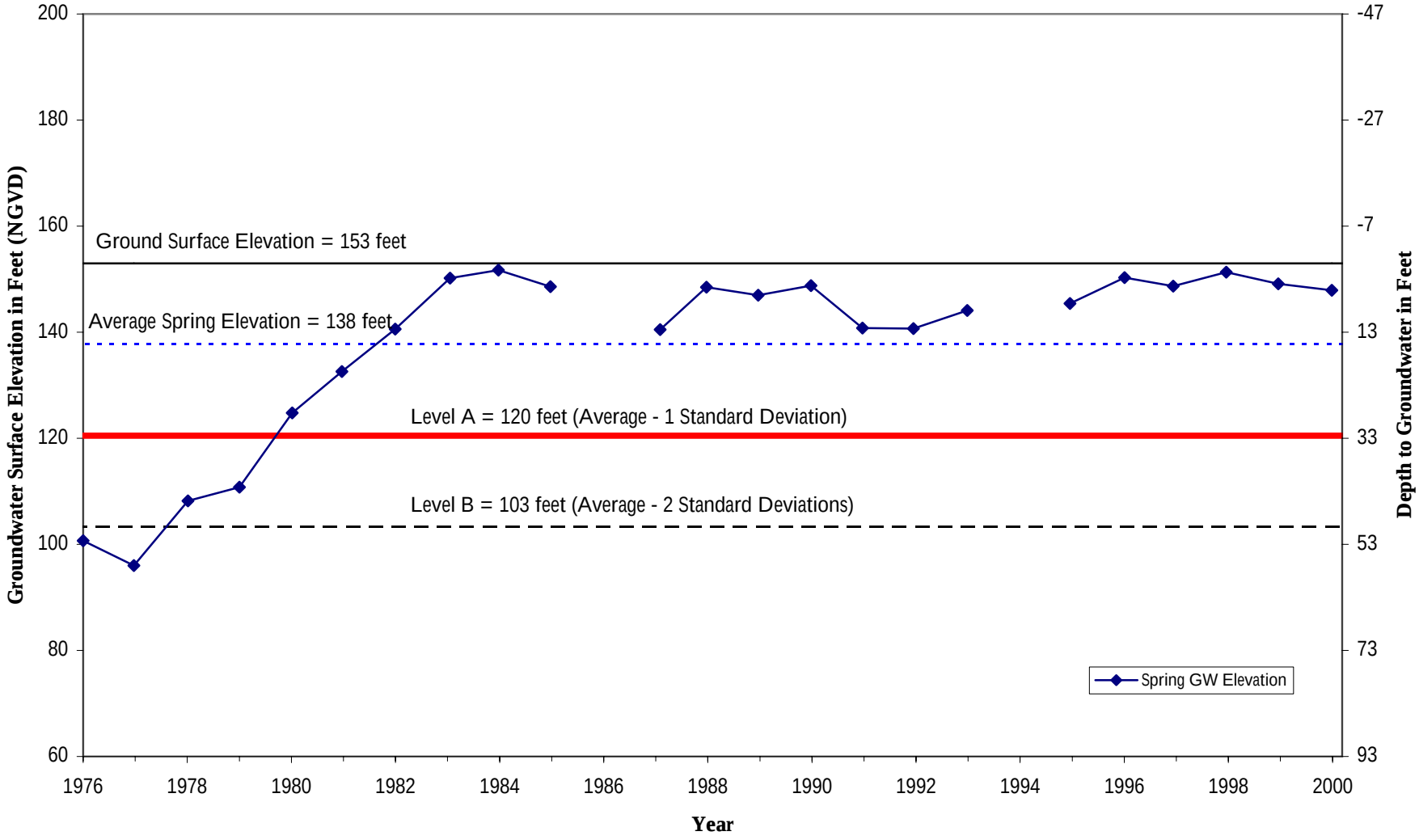
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 1 (Southwest)
Well #21N03W31H01M



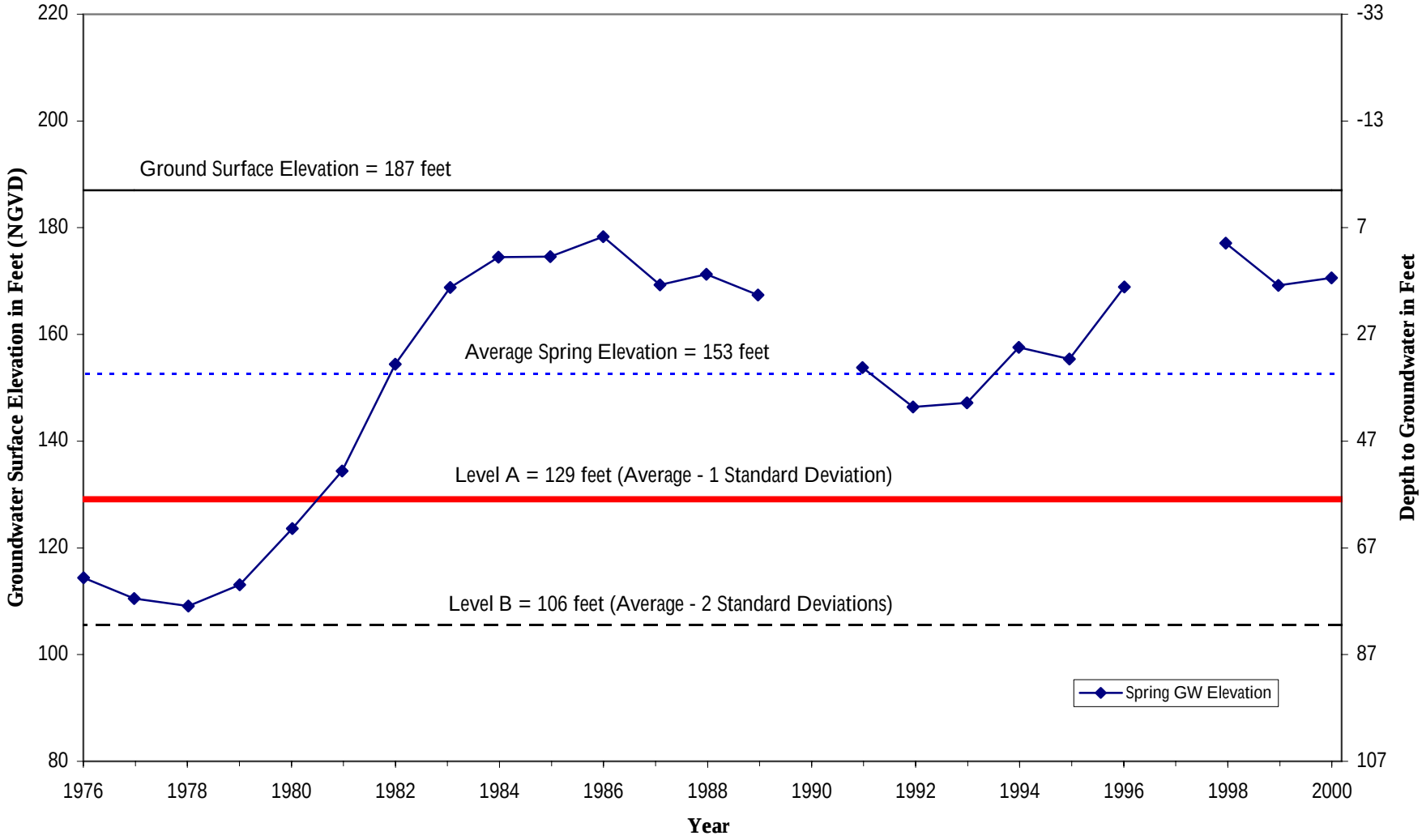
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 1 (Southwest)
Well #20N03W07K03M



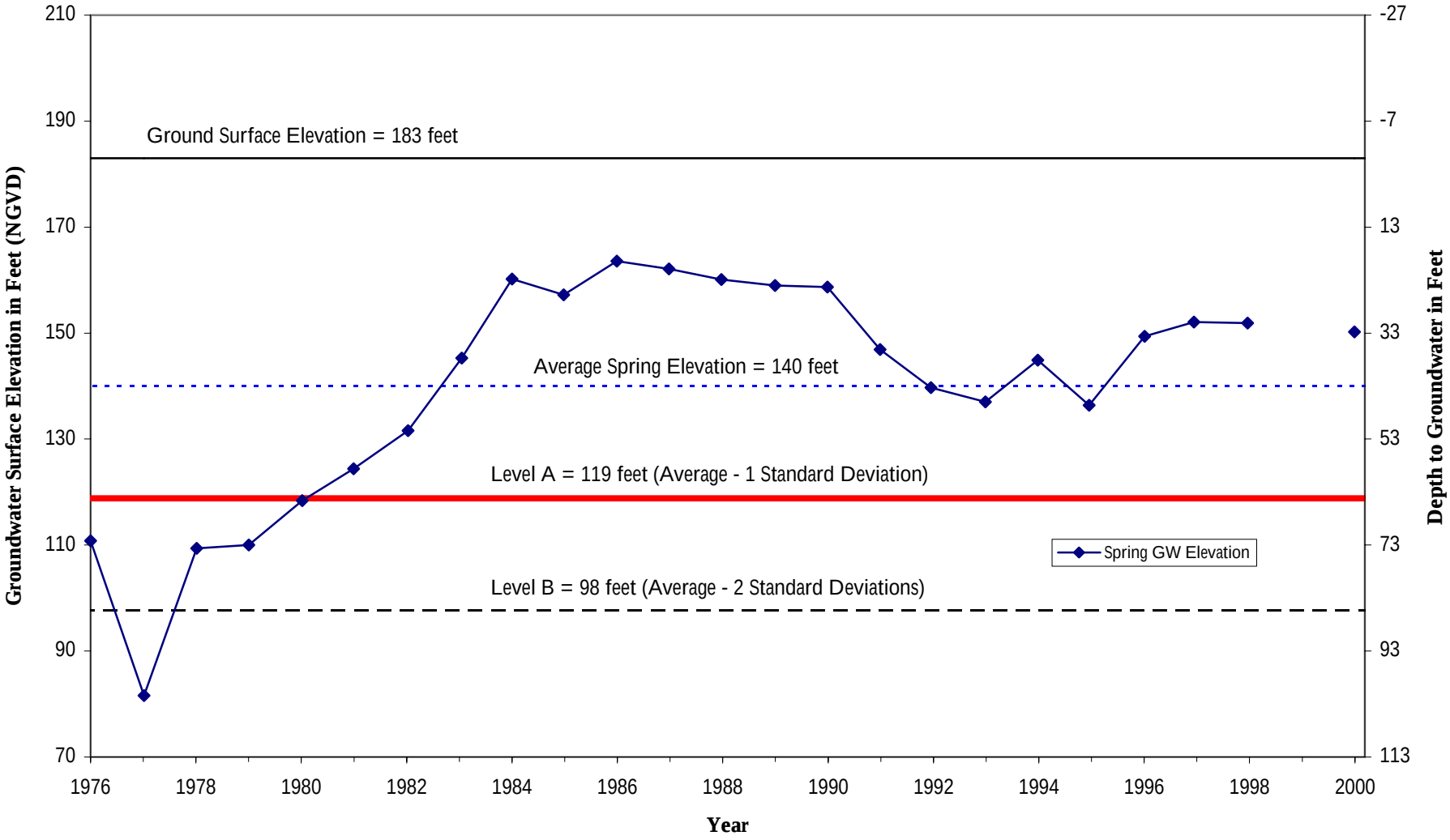
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 1 (Southwest)
Well #20N03W17P01M



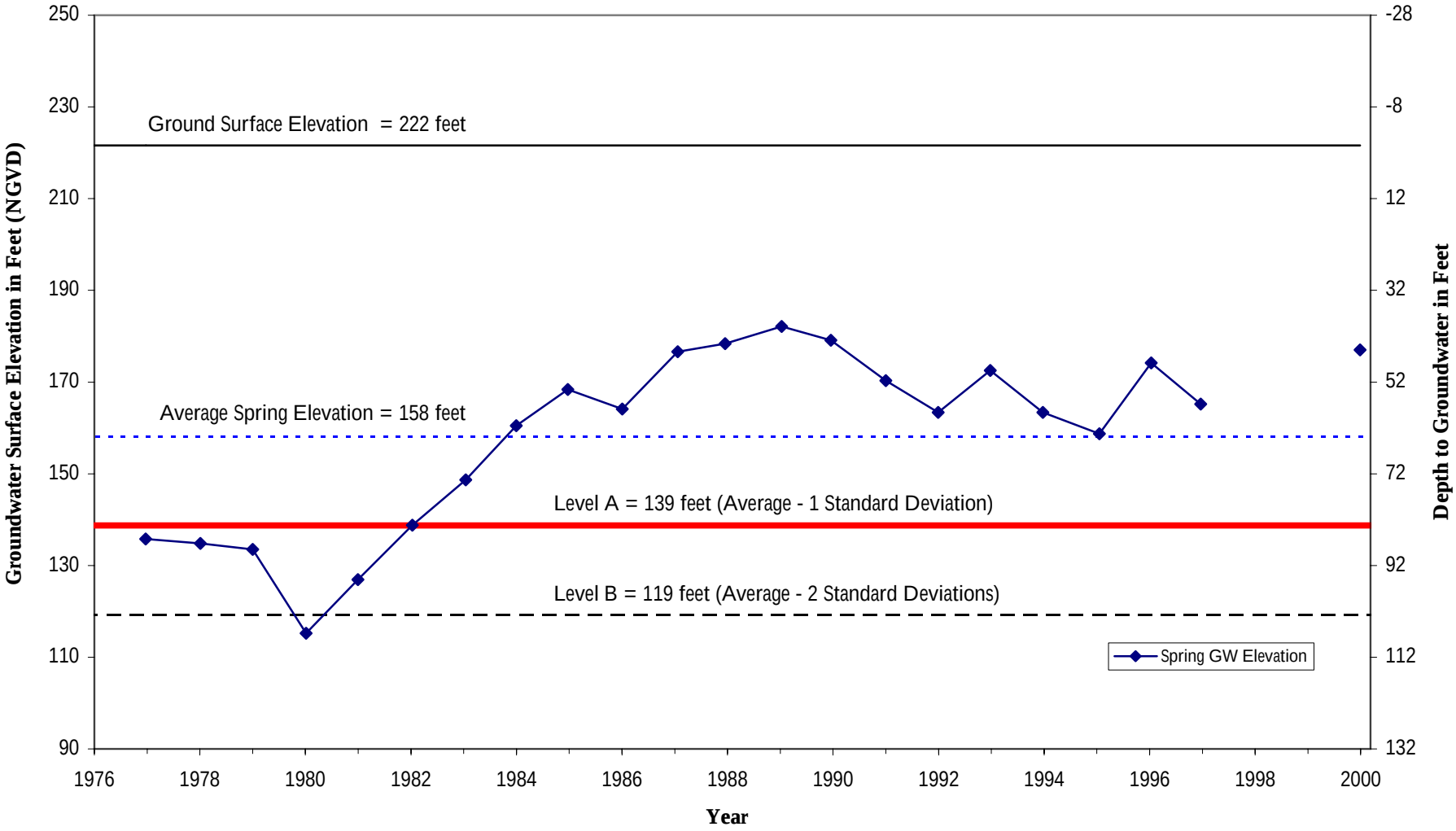
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 1 (Southwest)
Well #20N04W12F02M



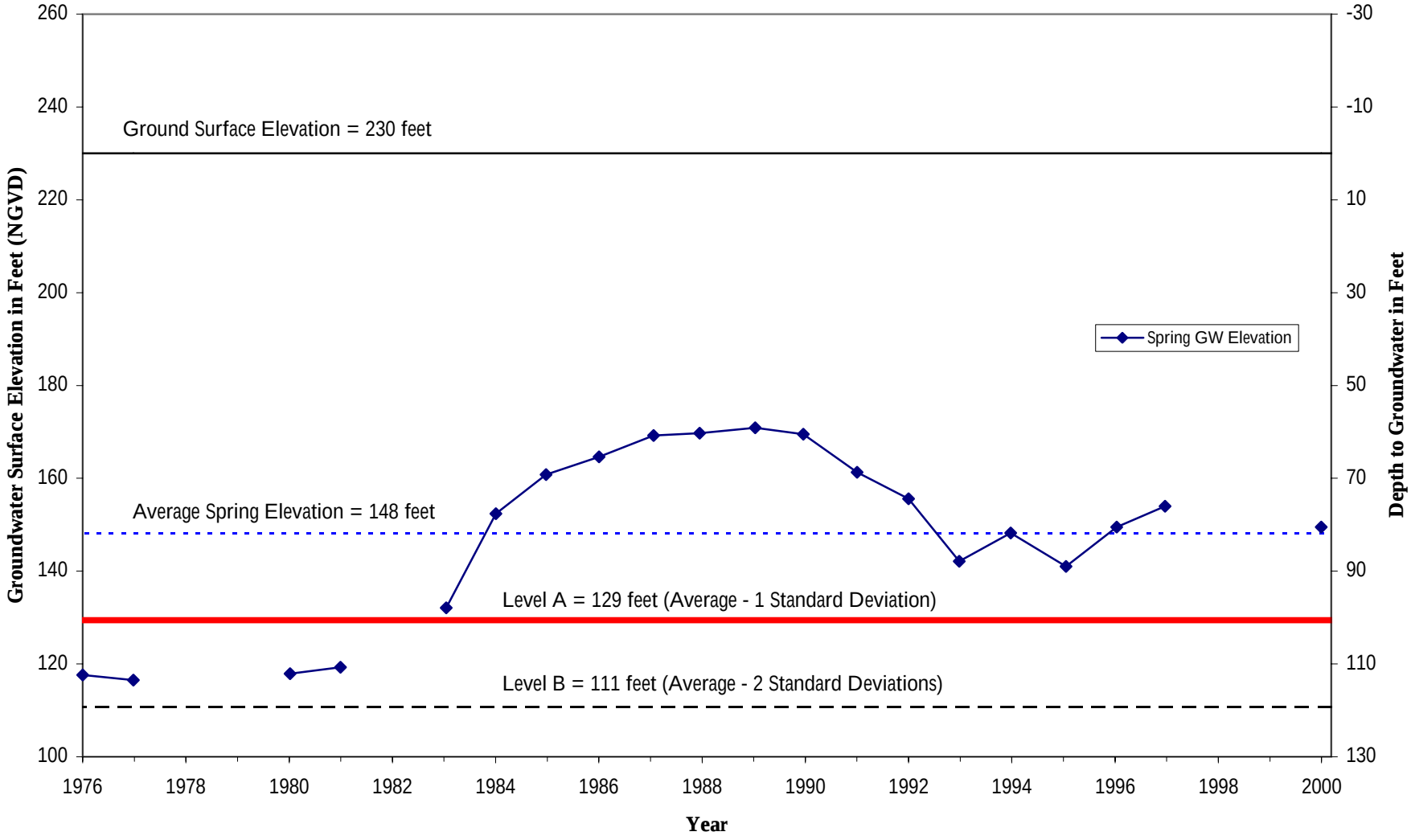
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 1 (Southwest)
Well #21N03W31R02M



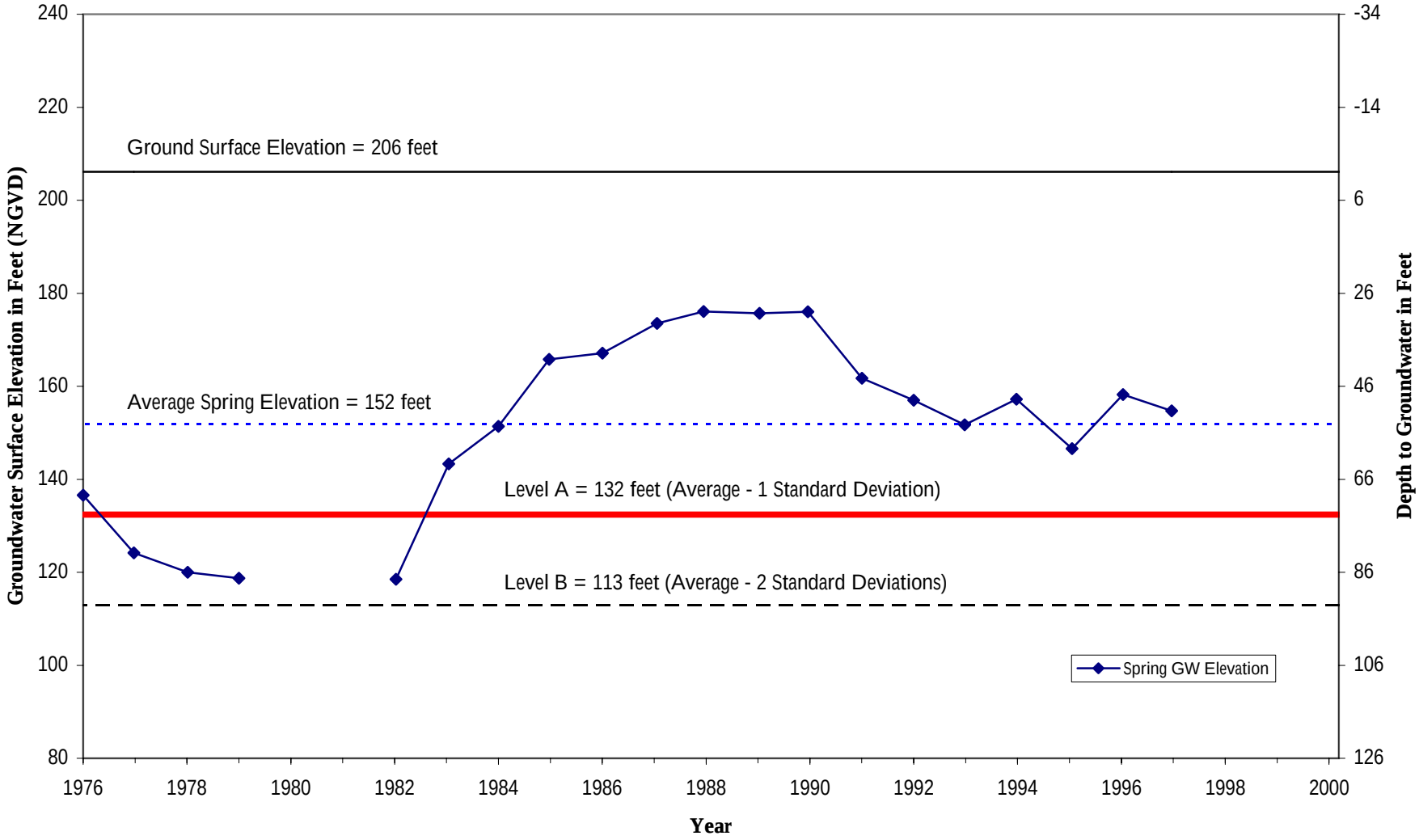
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 2 (Northwest)
Well #21N03W18B02M



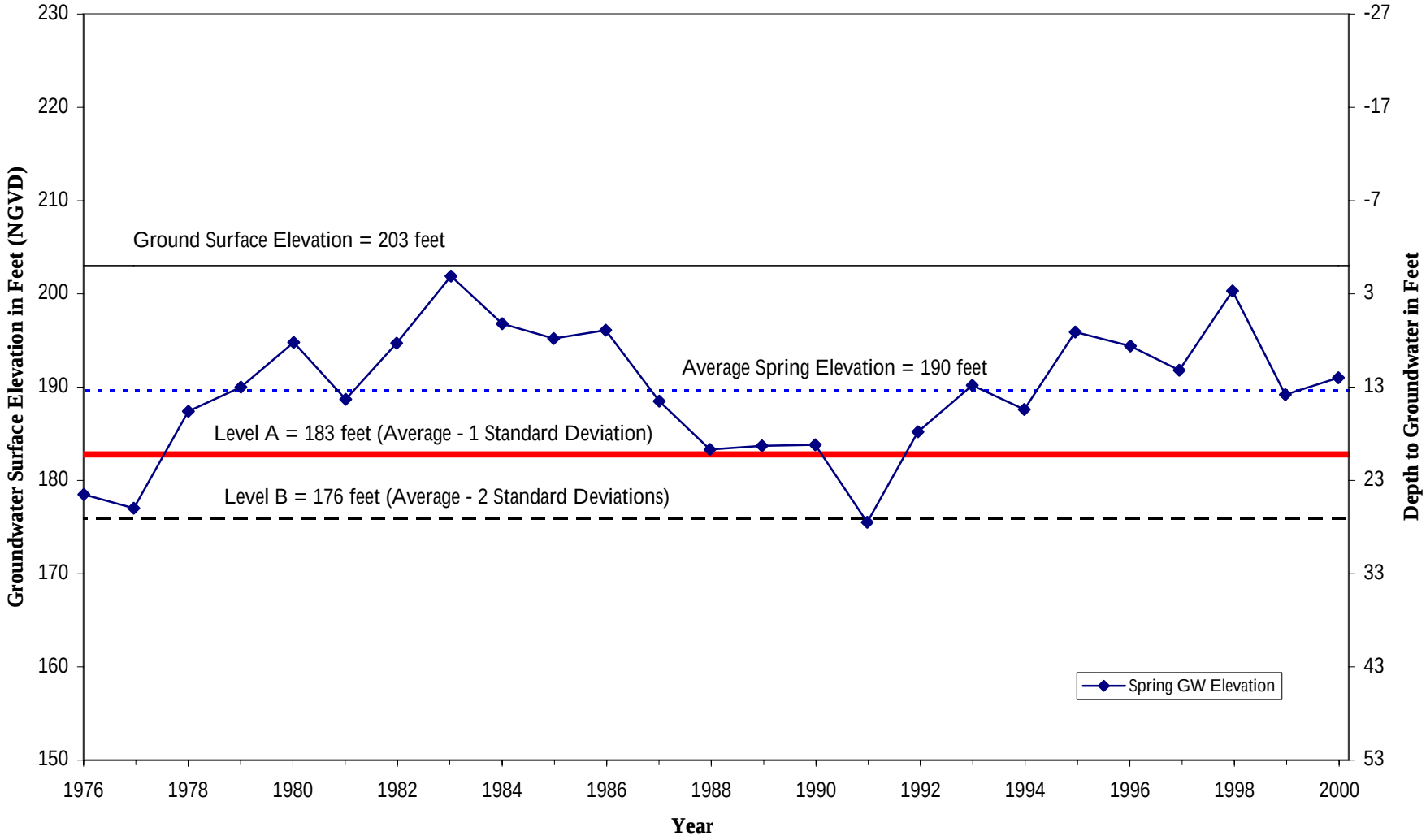
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 2 (Northwest)
Well #21N04W24A02M



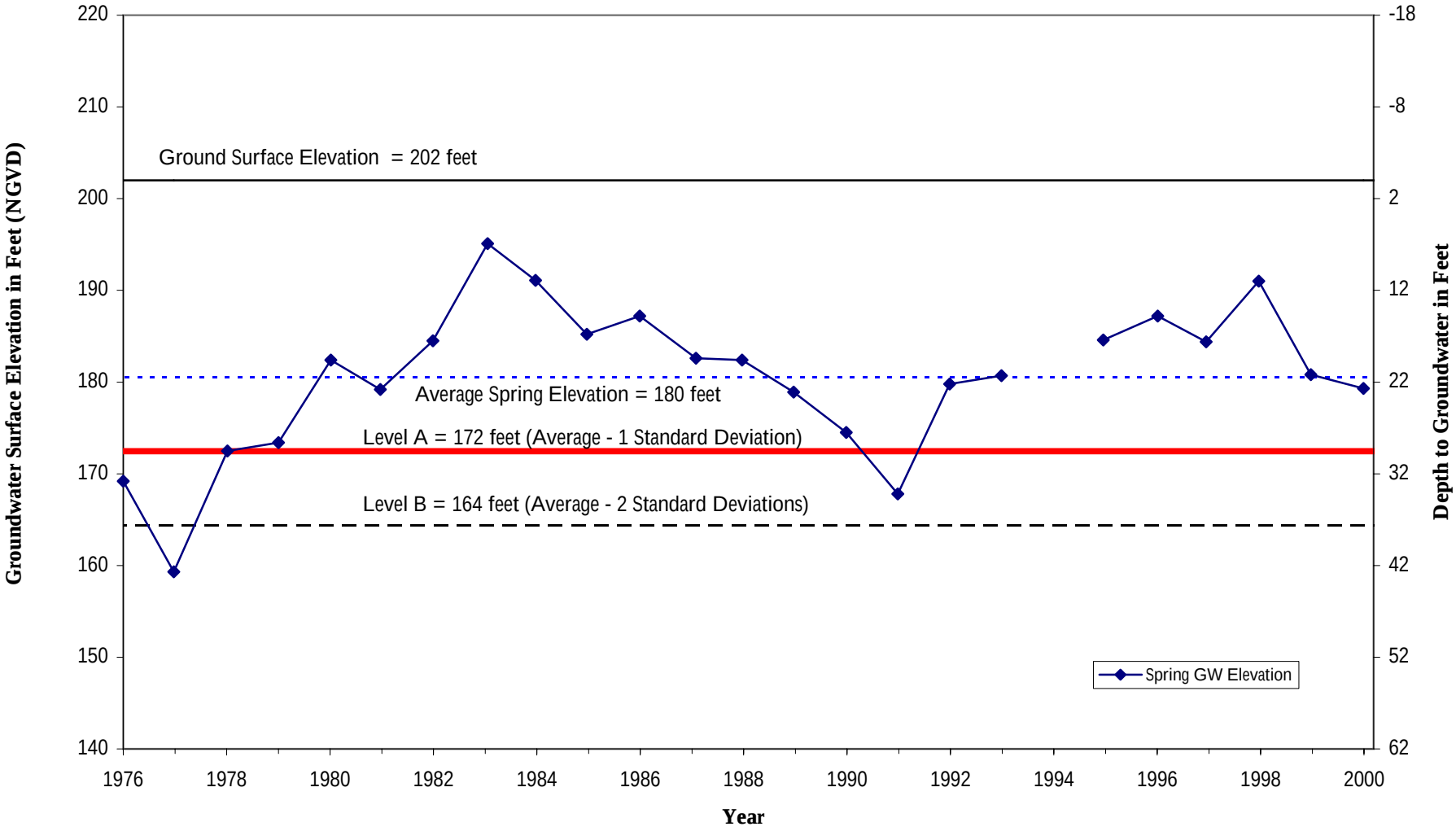
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 2 (Northwest)
Well #21N03W20D02M



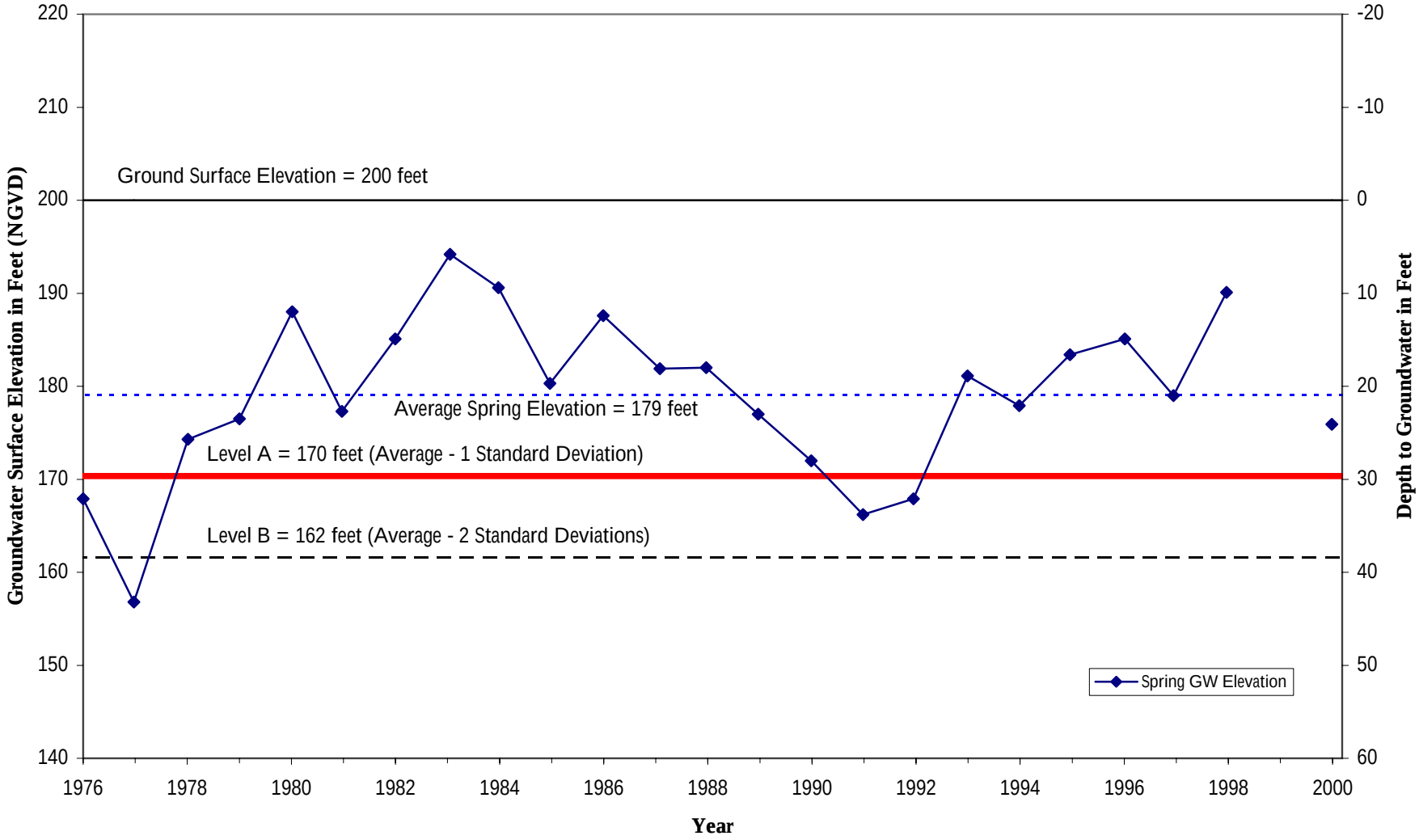
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 3 (Northeast)
Well #22N02W31C01M



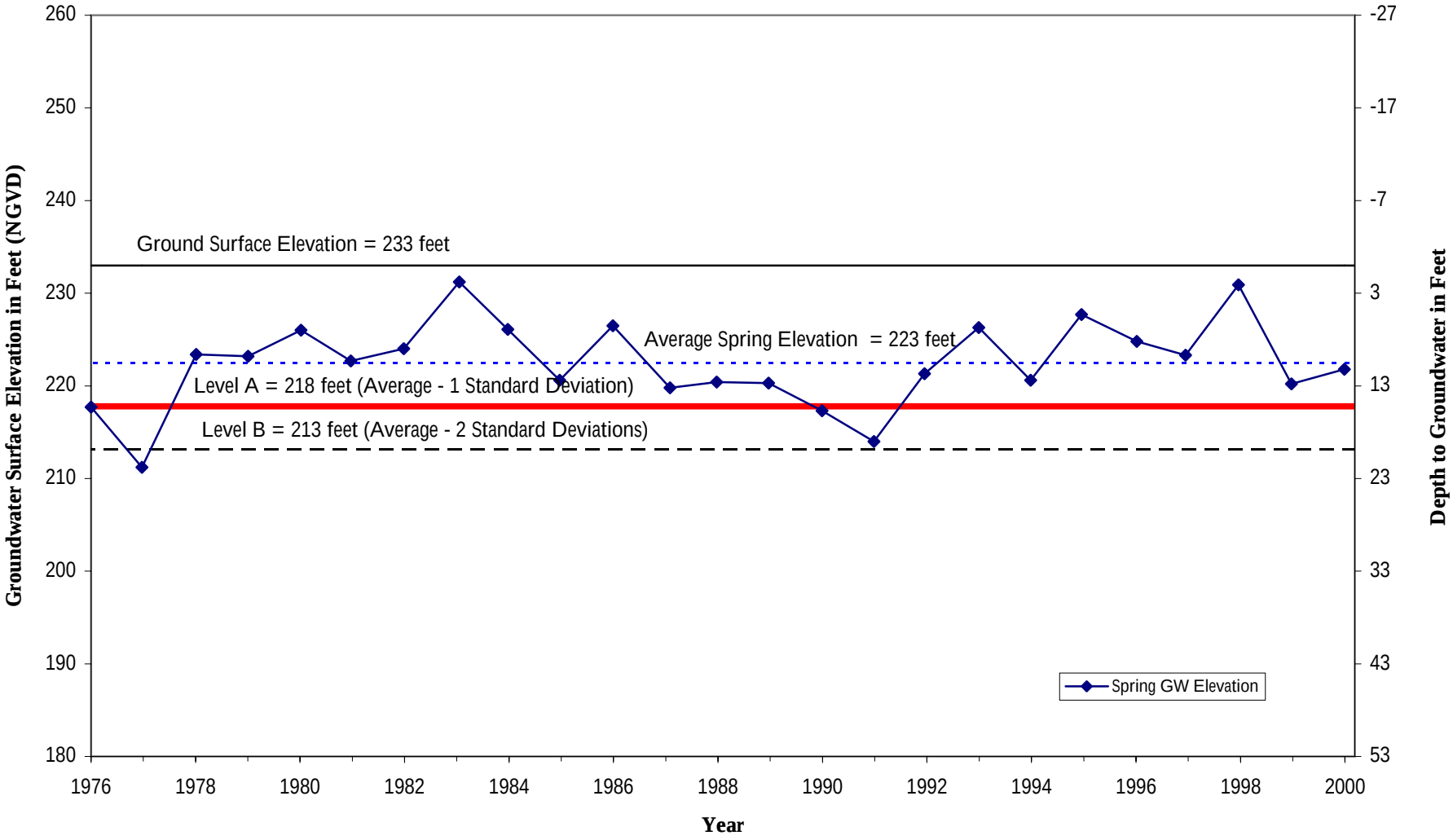
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 3 (Northeast)
Well #21N03W12C02M



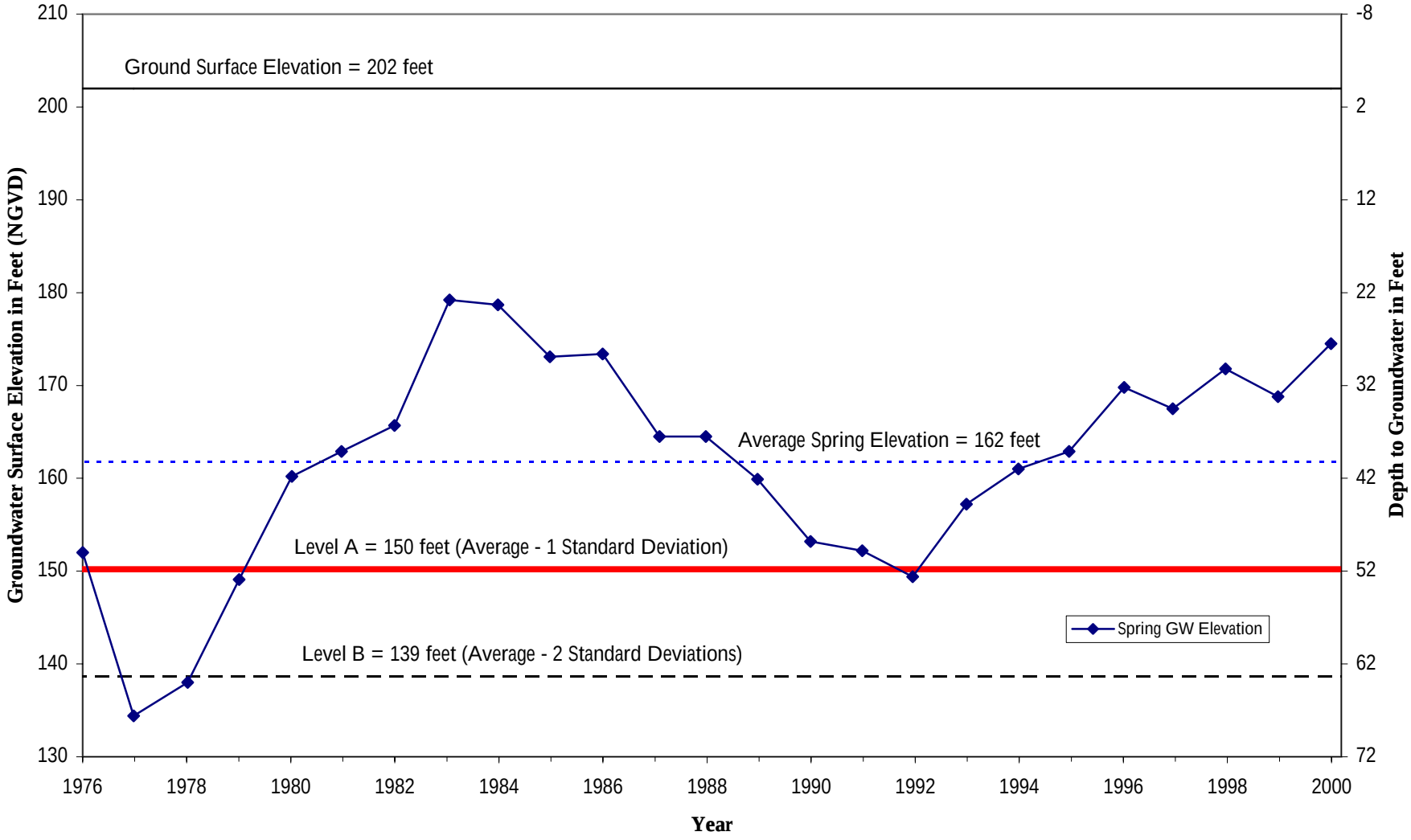
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 3 (Northeast)
Well #21N03W11G01M



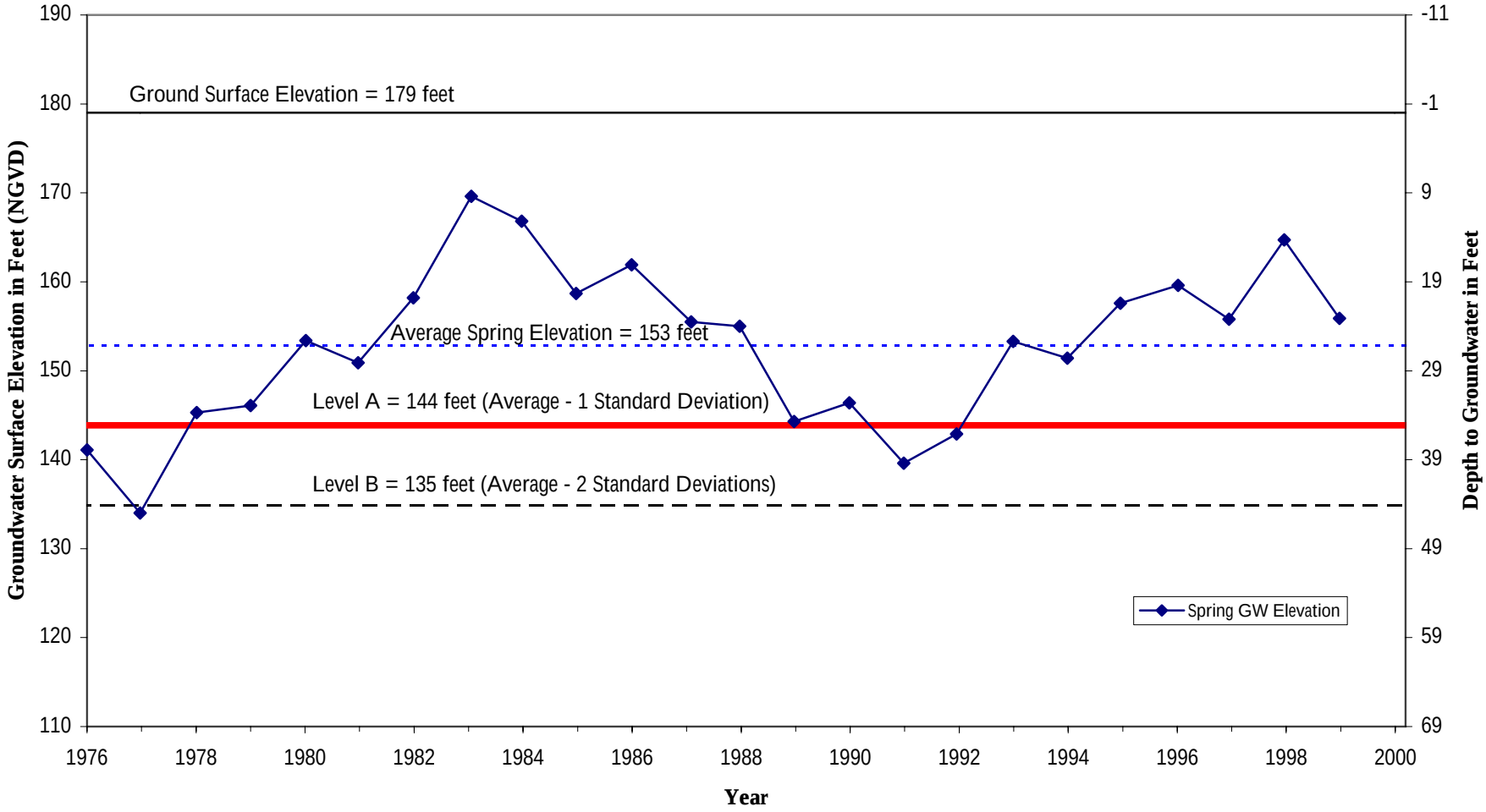
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 3 (Northeast)
Well #22N03W34A01M



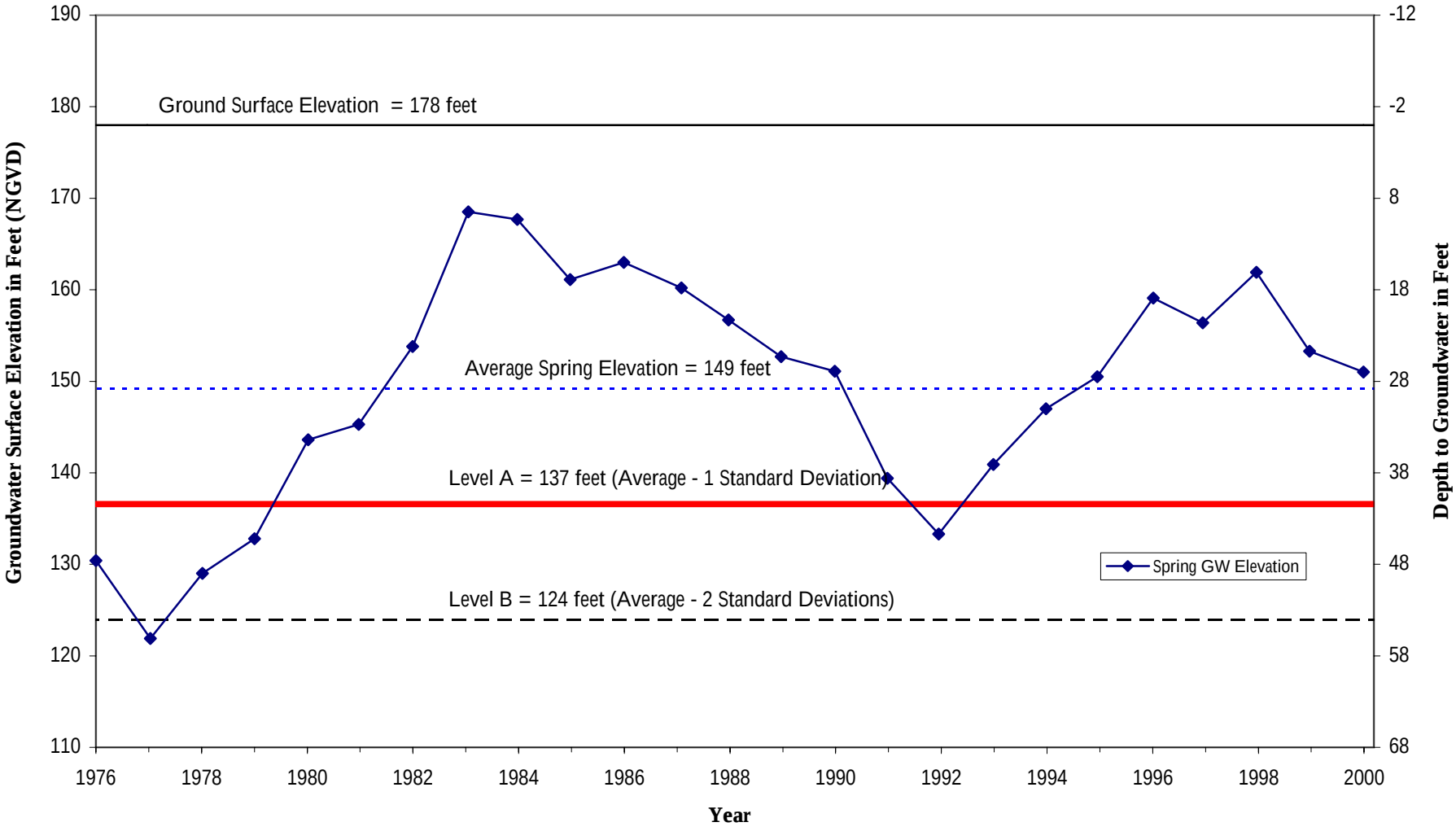
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 3 (Northeast)
Well #21N03W22H01M



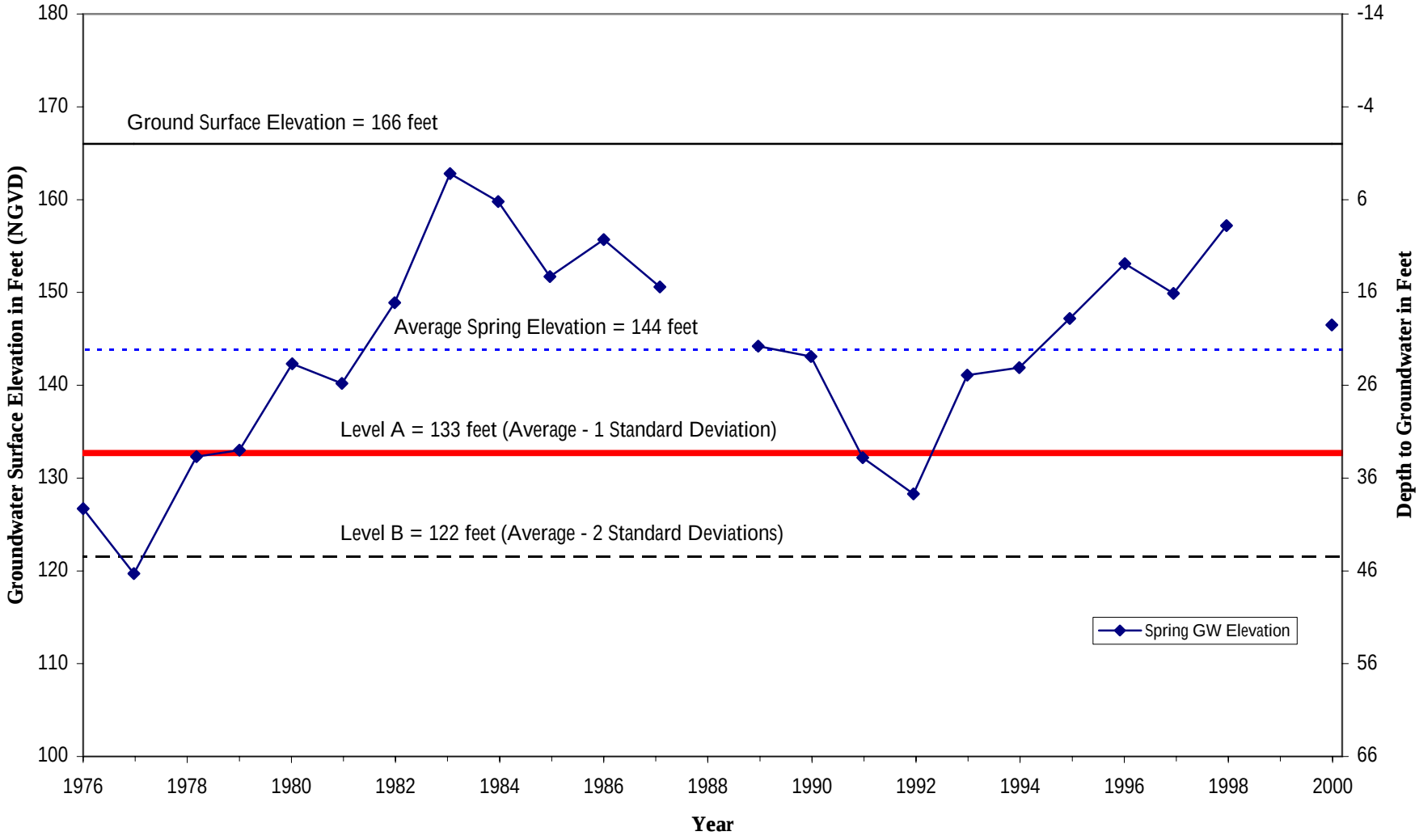
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 4 (Southeast)
Well #21N02W09M02M



Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 4 (Southeast)
Well #21N03W24P01M



Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 5 (Orland-Artois Water District) - Region 4 (Southeast)
Well #21N02W20B01M

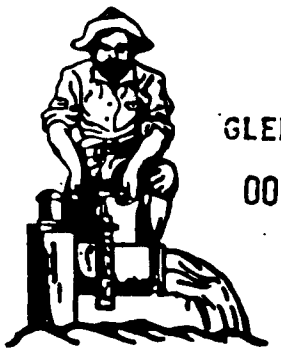


Basin Management Objective

Glenn County

Sub-area 6

Glide Water District



Glide Water District

P.O. BOX 1054, 360 N. COUNTY ROAD G • WILLOWS, CA 95988
PH. (530) 934-5476 • FAX (530) 934-7926

June 16, 2000

Glenn County Board of Supervisors
P.O. Box 391
Willows, CA 95988

Re: Groundwater Management Plan Basin Management Objective

Dear Board of Supervisors:

Glide Water District would like to submit the following as its Groundwater Management Plan Basin Management Objective.

1. Groundwater Levels – The District currently monitors 3 wells within the district on a monthly basis. An average reading for the 3 monitoring wells of 100' from ground surface to groundwater surface with wells not operating for a minimum of a 24-hour period would be the Basin Management Objective. . .
2. Groundwater Quality – The District has not established a baseline at this time.
3. Land Subsidence – No available data at this time.

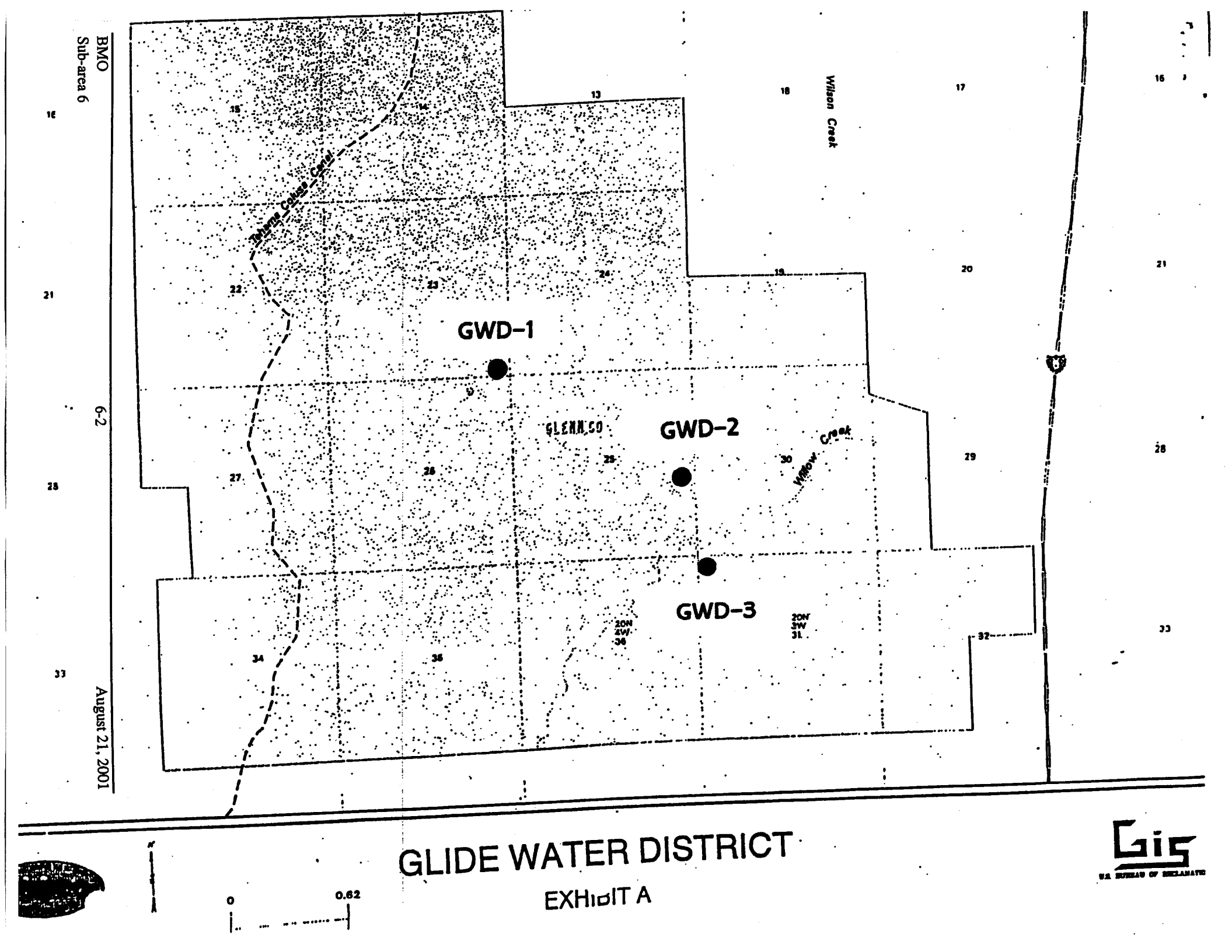
Sincerely yours,

Michael Alves

Michael Alves
Manager

cc: Noralu Michael

Tom Feeney


BMO
Sub-area 6
6-2
August 21, 2001
Wilson Creek
Tehama Colusa Canal
GWD-1
GWD-2
GWD-3
GLENN CO
Willow Creek
20N 4W 36
20N 3W 31
0
0.62
GLIDE WATER DISTRICT
EXHIBIT A
GIS
U.S. BUREAU OF RECLAMATION

Basin Management Objective
Glenn County
Sub-area 6
Glide Water District

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: Noralu Michael

Objective: To maintain the groundwater surface elevation at a level that will assure an adequate and affordable irrigation water supply. It is the intent of this objective to assure a sustainable agricultural water supply now and into the future. The objective is also to assure an adequate groundwater supply for all domestic users in the sub-area.

Location of BMO Key Wells: See map on following page for location of sub-area 6. See attached letter for location of BMO Key Wells.

Groundwater Level Monitoring Network: Glide Water District

Groundwater Level Measurements By: Glide Water District

Groundwater Level Monitoring Frequency: Monthly

Groundwater Well Numbering System:
Other – Independent numbering system used by Glide Water District

BMO Key Wells and BMO Determination Methodology (See Cover Report for Discussion Of Numbered BMO Methodologies):

Well No.	Well ID	Method*	Stage 1 & 2 Alerts (feet)	Stage 3 Alert (feet)
1	GWD-1	Other	See next section.	See next section.
2	GWD-2	Other		
3	GWD-3	Other		

* - See attached letter for description of method.

BMO Alert Levels:

The District currently monitors 3 wells within the district on a monthly basis. An average reading for the 3 monitoring wells of 100' from the ground surface to groundwater surface with wells not operating for a minimum of a 24-hour period would be the Basin Management Objective.

BMO Alert Stage Definitions:

None established.

BMO Compliance Evaluation Procedure:

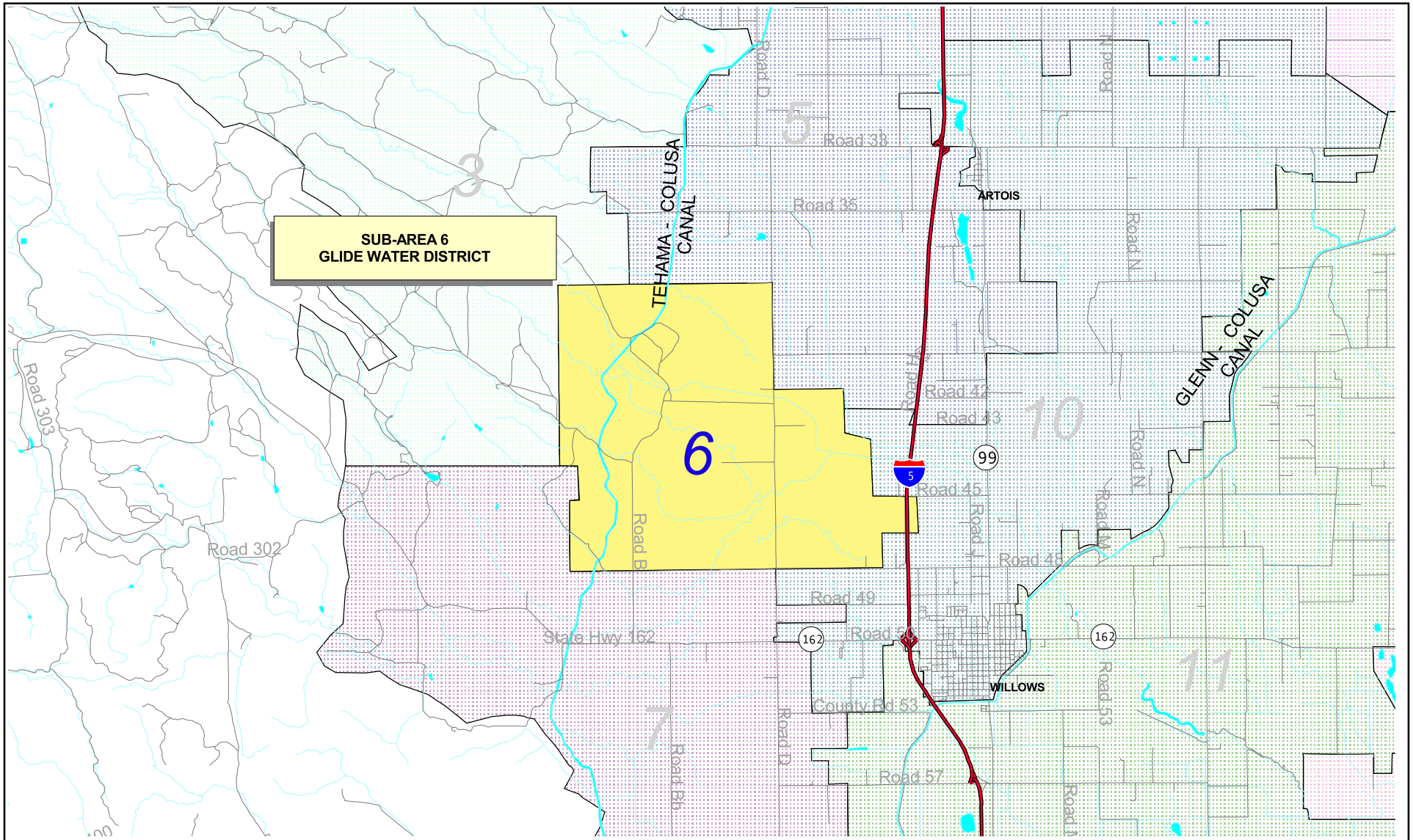
Groundwater levels are monitored and reviewed monthly. There is no BMO compliance evaluation procedure at this time.

Monitoring Recommendations:

Efforts should be made to identify possible additional wells that could be added to the existing monitoring well network in the sub-area to improve the overall coverage within the region.

Supporting Data:

See attached letter.



N
W E
S

1 0 1 2 Miles

Legend

Wells used in BMO calculation (BMO wells not shown)

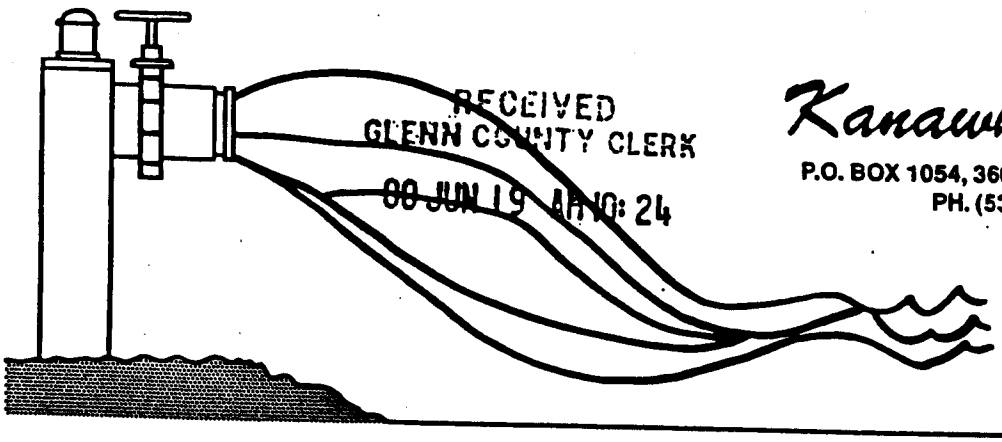
Glenn County Groundwater Management Ordinance No. 1115	**Sub-Area 6 Glide Water District**	August 21, 2001

Basin Management Objective

Glenn County

Sub-area 7

Kanawha Water District



Kanawha Water District
P.O. BOX 1054, 360 N. COUNTY ROAD G • WILLOWS, CA 95988
PH. (530) 934-5476 • FAX (530) 934-7926

June 8, 2000

Glenn County Board of Supervisors
P.O. Box 391
Willows, CA 95988

Re: Groundwater Management Plan Basin Management Objective

Dear Board of Supervisors:

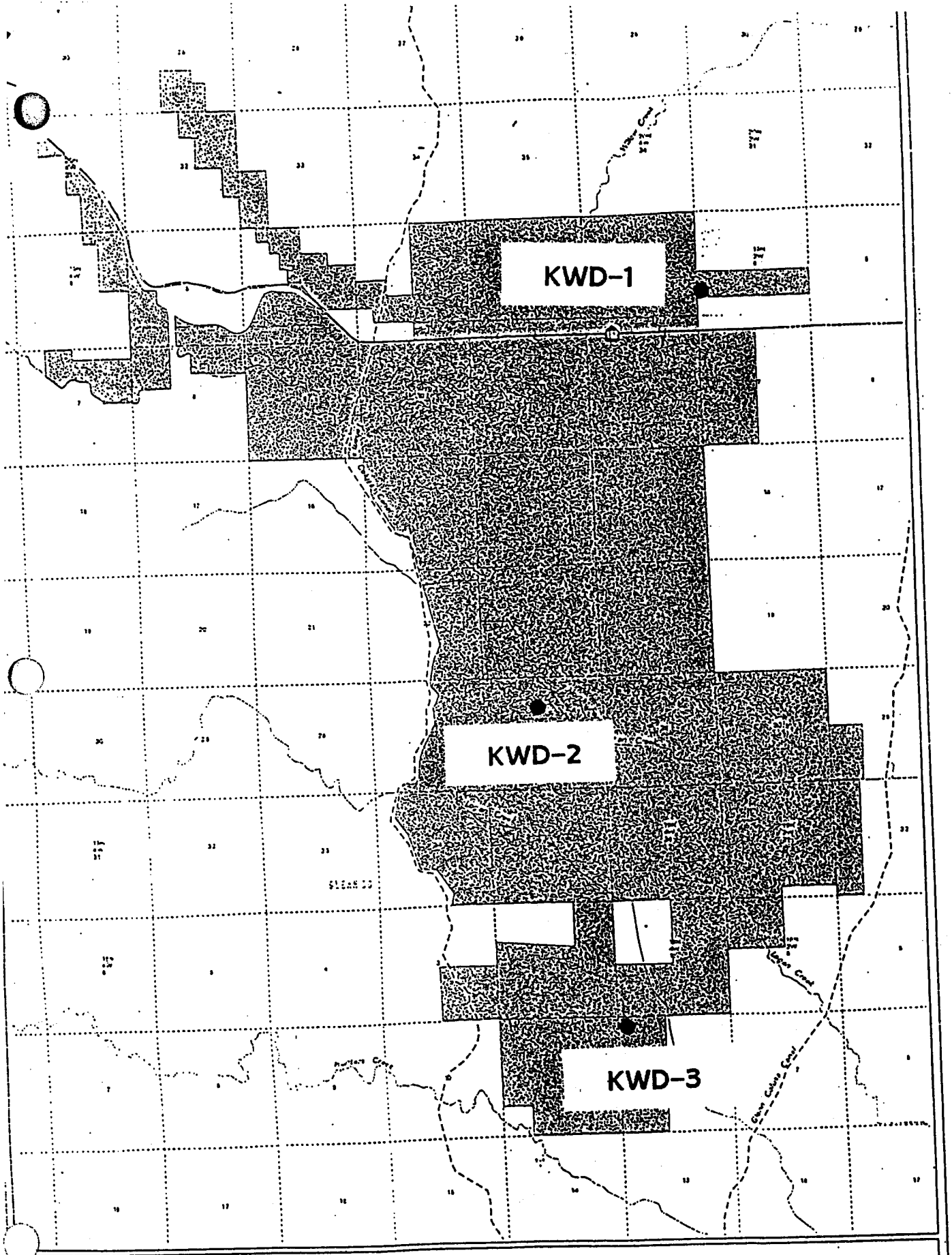
Kanawha Water District would like to submit the following as its Groundwater Management Plan Basin Management Objective.

1. Groundwater Levels – The District currently monitors 3 wells within the district on a monthly basis. An average reading for the 3 monitoring wells of 100' from ground surface to groundwater surface with wells not operating for a minimum of a 24-hour period would be the Basin Management Objective.
2. Groundwater Quality – The District has not established a baseline at this time.
3. Land Subsidence – No available data at this time.

Sincerely yours,

Michael Alves
Manager

cc: Wade Danley



KANAWHA WATER DISTRICT
EXHIBIT A

BMO
Sub-area 7

7-2

August 21, 2001

Basin Management Objective
Glenn County
Sub-area 7
Kanawha Water District

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: Wade Danley

Objective: To maintain the groundwater surface elevation at a level that will assure an adequate and affordable irrigation water supply. It is the intent of this objective to assure a sustainable agricultural water supply now and into the future. The objective is also to assure an adequate groundwater supply for all domestic users in the sub-area.

Location of BMO Key Wells: See map on following page for location of sub-area 7. See attached letter for location of BMO Key Wells.

Groundwater Level Monitoring Network: Kanawha Water District

Groundwater Level Measurements By: Kanawha Water District

Groundwater Level Monitoring Frequency: Monthly

Groundwater Well Numbering System:
Other – Independent numbering system used by Kanawha Water District

BMO Key Wells And BMO Determination Methodology (See Cover Report For Discussion Of Numbered BMO Methodologies):

Well No.	Well ID	Method*	Stage 1 & 2 Alerts (feet)	Stage 3 Alert (feet)
1	KWD-1	Other	See next section.	See next section.
2	KWD-2	Other		
3	KWD-3	Other		

* - See attached letter for description of method.

BMO Alert Levels:

The District currently monitors 3 wells within the district on a monthly basis. An average reading for the 3 monitoring wells of 100' from the ground surface to groundwater surface with wells not operating for a minimum of a 24-hour period would be the Basin Management Objective.

BMO Alert Stage Definitions:

None established.

BMO Compliance Evaluation Procedure:

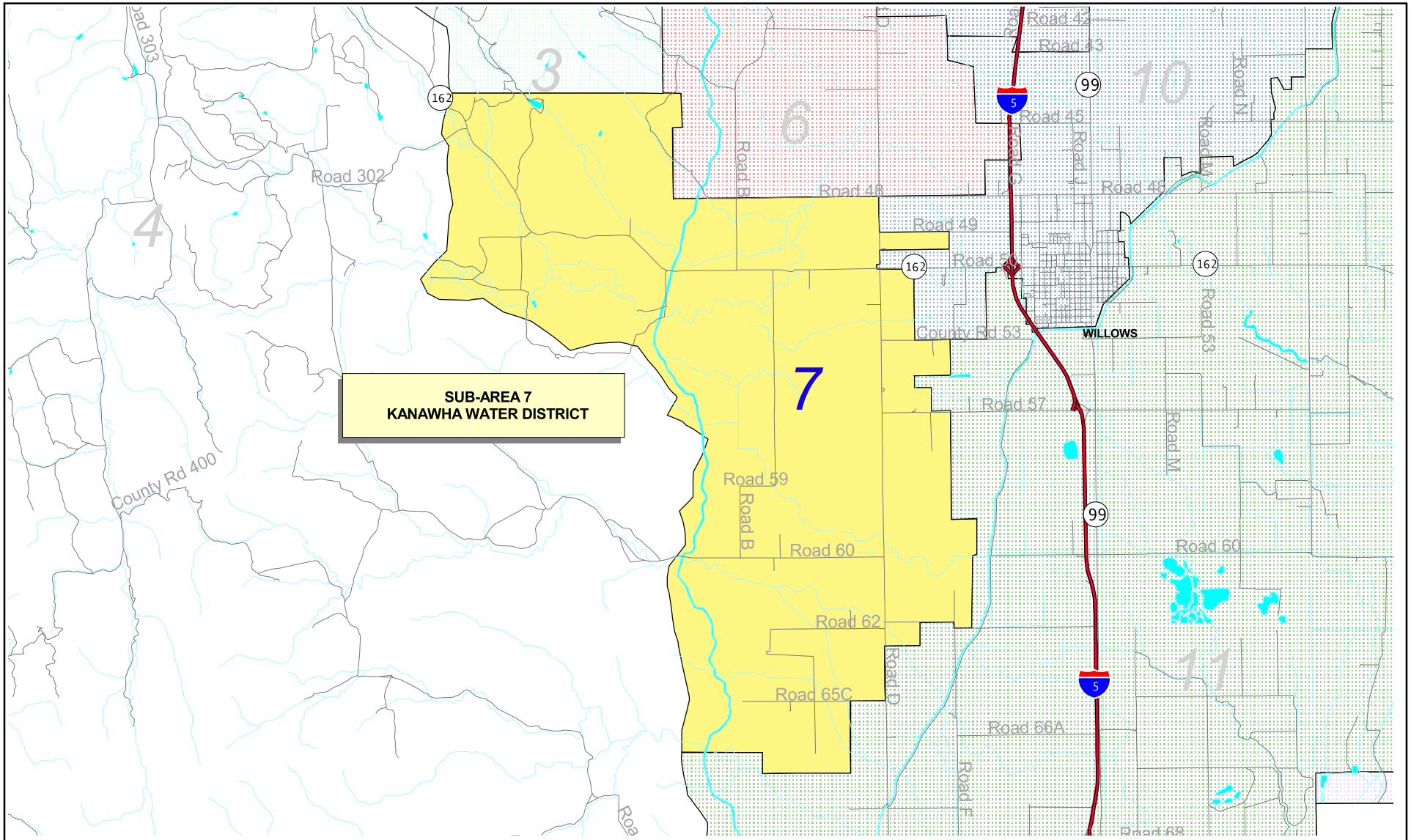
Groundwater levels are monitored and reviewed monthly. There is no BMO compliance evaluation procedure at this time.

Monitoring Recommendations:

Efforts should be made to identify possible additional wells that could be added to the existing monitoring well network in the sub-area to improve the overall coverage within the region.

Supporting Data:

See attached letter.



Glenn County Groundwater Management Ordinance No. 1115	**Sub-Area 7** **Kanawha Water District**	August 21, 2001

Basin Management Objective

Glenn County

Sub-area 8

East Corning Basin Private Pumpers

Basin Management Objective
Glenn County
Sub-area 8
East Corning Basin Private Pumpers

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: Scott Studybaker

Objective: To maintain the groundwater surface elevation at a level that will assure an adequate and affordable irrigation water supply. It is the intent of this objective to assure a sustainable agricultural water supply now and into the future. The objective is also to assure an adequate groundwater supply for all domestic users in the sub-area.

Location of BMO Key Wells: See attached map.

Groundwater Level Monitoring Network: Department of Water Resources – Northern District

Groundwater Level Measurements By: Department of Water Resources – Northern District

Groundwater Level Monitoring Frequency:
Semiannual.
Spring (March-April)
Fall (October-November)

Groundwater Well Numbering Systems: State

BMO Key Wells And BMO Determination Methodology (See Cover Report For Discussion Of Numbered BMO Methodologies):

Well No.	Well ID	Method*	Stage 1 & 2 Alerts**		Stage 3 Alerts**	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
1	21N01W04N01M	4	115	20	111.6	23.4
2	22N02W11Q01M	4	140	24	132.0	32
3	22N01W29K01M	4	120	22	114.0	28

* - See Cover Report for description of method.
** - See attached hydrographs.

BMO Alert Stage Definitions:

The Glenn County Water Advisory Committee (WAC) upon a recommendation of its Technical Advisory Committee shall declare a Stage 1, Stage 2, or Stage 3 Alert based on the technical criteria presented below. The technical criteria for the WAC to rescind the Stage 1, Stage 2, or Stage 3 Alert is also presented. The alert criteria are based on the recommended methodology developed by the Glenn County Water Advisory Committee – Technical Advisory Committee.

The results of the analysis are presented in the Supporting Data section of this summary. See BMO Methodology 2 in the Cover Report for a technical discussion of how the compliance lines A & B were developed.

A Stage 1 Alert will be declared when any measured Spring groundwater surface elevation is below Line A for the corresponding BMO Key Well.

A Stage 2 Alert will be declared on the second, and subsequent sequential years, when any measured Spring groundwater surface elevation is below Line A. The Glenn County Technical Advisory Committee may declare a Stage 2 Alert during the first year of noncompliance if the situation warrants.

A Stage 3 Alert will occur when any measured spring groundwater surface elevation is below the elevation specified by Line B for a corresponding BMO Key Well.

Stage 1 and 2 Alerts shall be rescinded by the WAC when all the measured Spring groundwater surface elevations return to an elevation above Line A for the corresponding BMO Key Wells.

The WAC shall rescind a Stage 3 Alert when the measured Spring groundwater surface elevations return to an elevation above Lines B and A for the corresponding BMO Key Wells. A Stage 3 Alert may be down-graded to a Stage 2 Alert if all the measured Spring groundwater surface elevations are above Line B but remain below the compliance elevation specified by Line A.

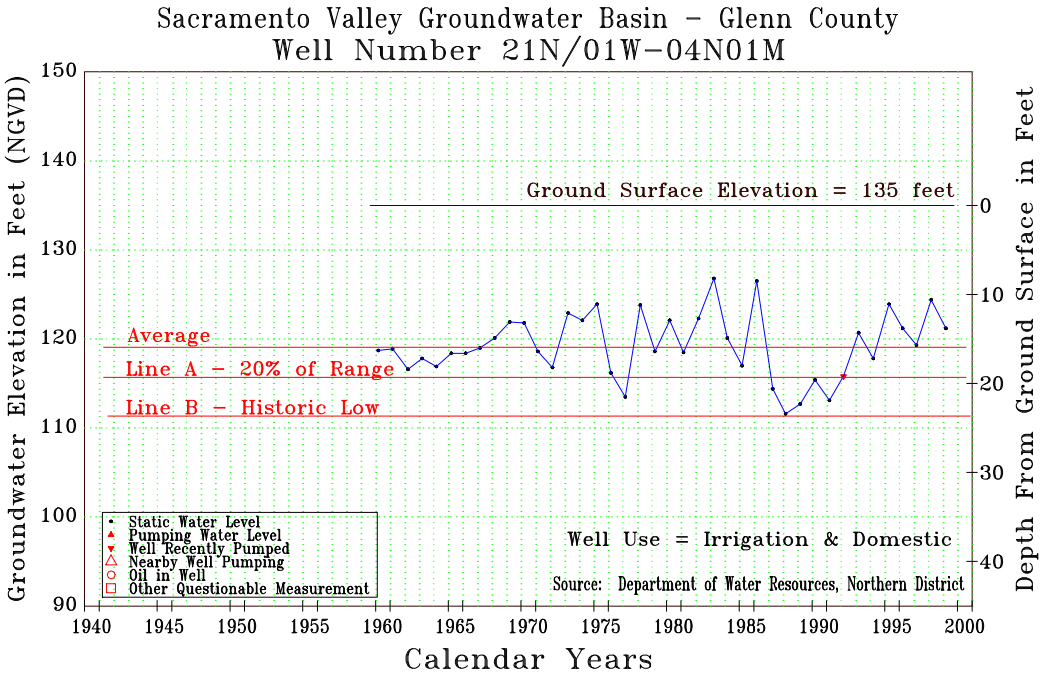
BMO Compliance Evaluation Procedure:

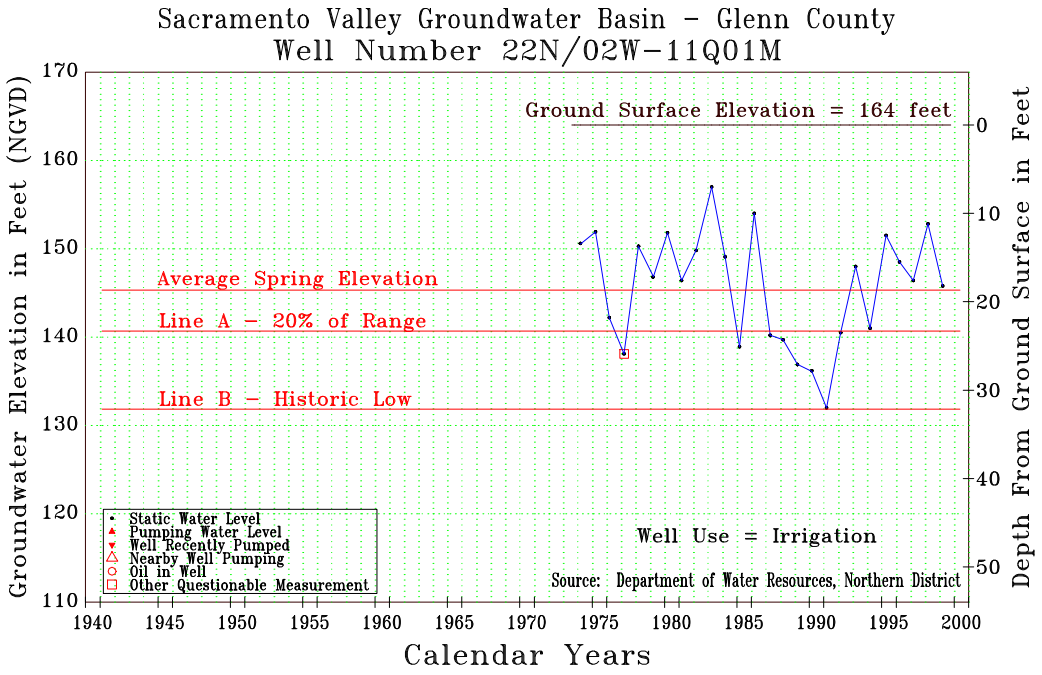
Compliance with the BMO will be determined following the spring measurement period. The groundwater surface elevations at each monitoring well will be compared against the corresponding compliance graph and stage definition criteria to determine if the groundwater surface elevations are above or below specific alert trigger levels. The Technical Advisory Committee of the Glenn County Water Advisory Committee will perform this evaluation and report the results of the evaluation to the WAC.

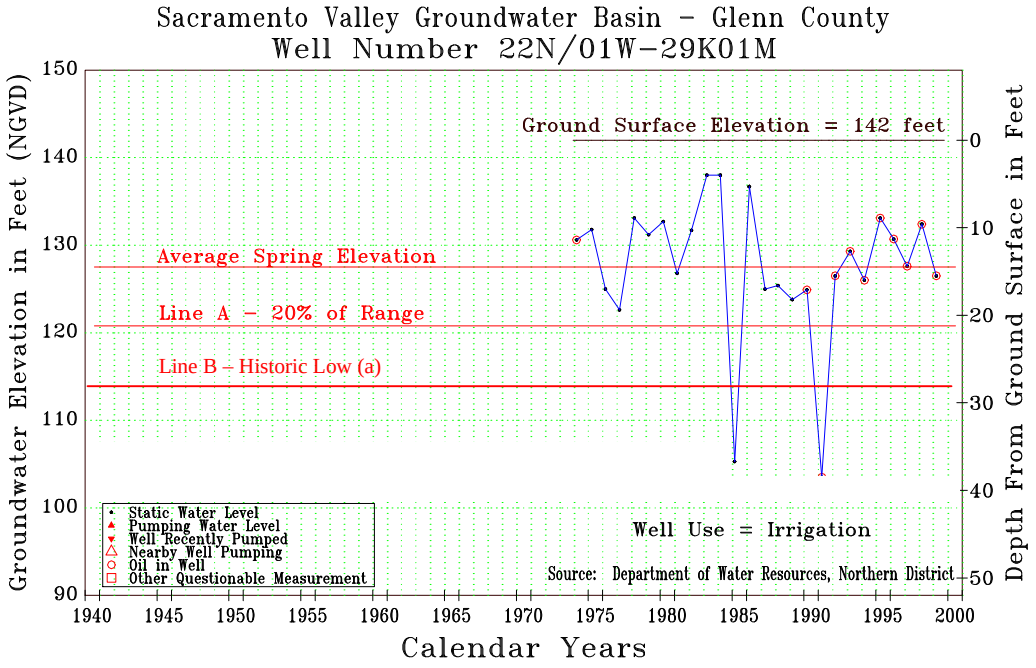
Monitoring Recommendations:

Efforts should be made to identify possible additional wells that could be added to the existing monitoring well network in the northwestern portion of the sub-area to improve the overall coverage within the region. Well logs should be collected and reviewed to determine which wells to choose. Development of a new monitoring well should be considered as part of the AB303 grant money recently awarded to Glenn County.

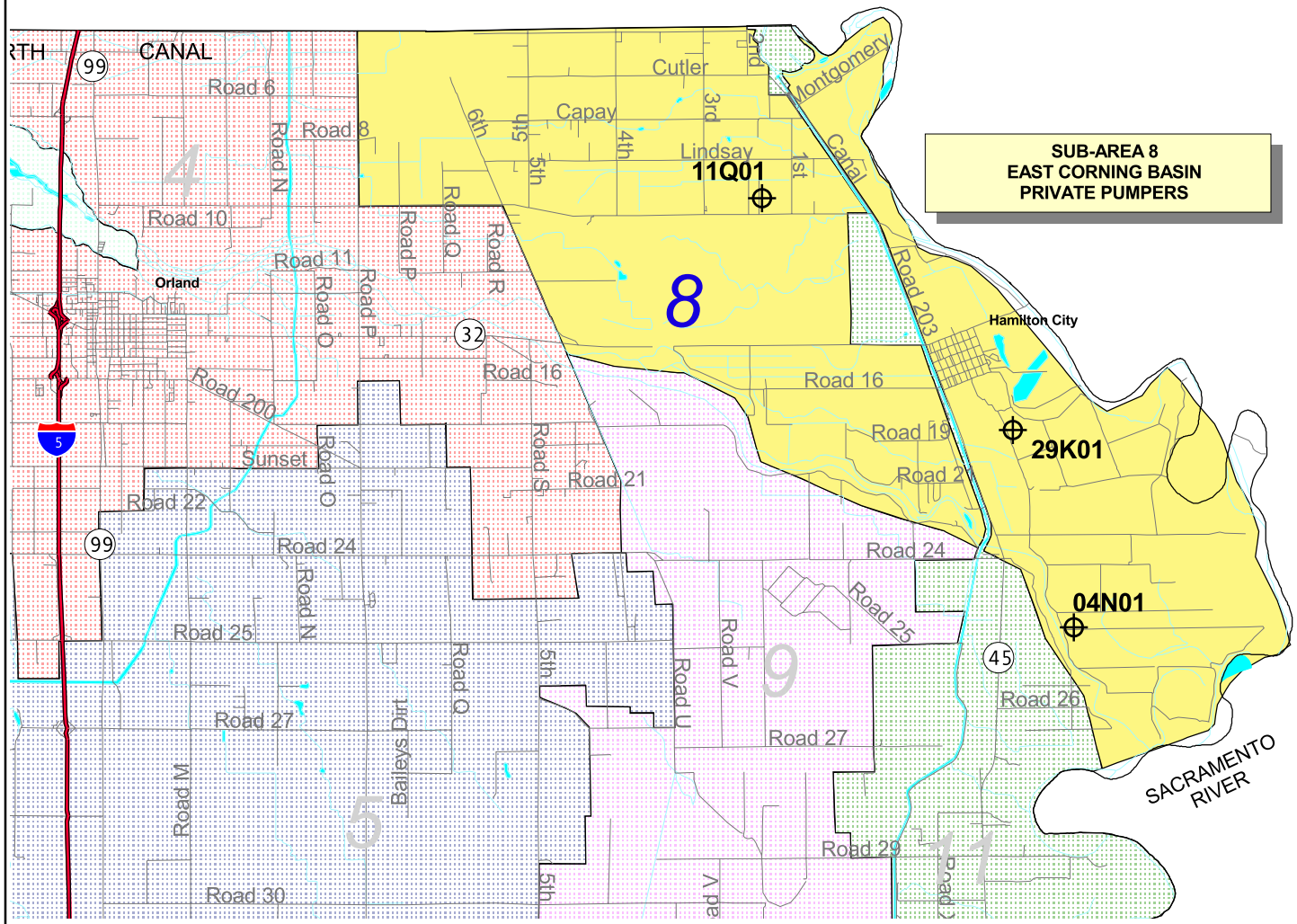
Supporting Data:







(a) The historical low was determined to be 28 feet (based on information provided by Sub-area 8 local representatives). Upon further review of this information the two data values that exceeded this historical low (1985 and 1991) were determined to be data anomalies.



Glenn County Groundwater Management Ordinance No. 1115	Sub-Area 8 East Corning Basin Private Pumpers	August 21, 2001

Basin Management Objective

Glenn County

Sub-area 9

Board of Supervisors District Five

Private Pumpers

Basin Management Objective
Glenn County
Sub-area 9
Board of Supervisors District Five Private Pumpers

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: Judy Brown

Objective: To maintain the groundwater surface elevation at a level that will assure an adequate and affordable irrigation water supply. It is the intent of this objective to assure a sustainable agricultural water supply now and into the future. The objective is also to assure an adequate groundwater supply for all domestic users in the sub-area.

Location of BMO Key Wells: See attached map.

Groundwater Level Monitoring Network: Department of Water Resources - Northern District

Groundwater Level Measurements By: Department of Water Resources - Northern District

Groundwater Level Monitoring Frequency:
Semiannual.
Spring (March-April)
Fall (October-November)

Groundwater Well Numbering System: State

BMO Key Wells And BMO Determination Methodology (See Cover Report For Discussion Of Numbered BMO Methodologies):

Well No.	Well ID	Method*	Stage 1 & 2 Alerts**		Stage 3 Alerts**	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
1	21N02W02B02M	1	Line A	Line A	121	40
2	21N02W09M02M	1	Line A	Line A	125	54
3	21N02W23G01M	1	Line A	Line A	117	35

* - See Cover Report for description of method.
** - See attached hydrographs.

BMO Alert Stage Definitions:

The Glenn County Water Advisory Committee (WAC) upon a recommendation of its Technical Advisory Committee shall declare a Stage 1, Stage 2, or Stage 3 Alert based on the technical criteria presented below. The technical criteria for the WAC to rescind the Stage 1, Stage 2, or Stage 3 Alert is also presented. The alert criteria are based on regression analyses of "Water Received" verses groundwater surface elevation for particular monitoring wells in the sub-area.

The regressions analyses are presented in the Supporting Data section of this summary. See BMO Methodology 1 in the Cover Report for a technical discussion of regression analysis and how the compliance lines A & B were developed.

A Stage 1 Alert will be declared when any measured Fall groundwater surface elevation is below Line A for the corresponding BMO Key Well.

A Stage 2 Alert will be declared on the second, and subsequent sequential years, when any measured Fall groundwater surface elevation is below Line A. The Glenn County Technical Advisory Committee may declare a Stage 2 Alert during the first year of noncompliance if a situation warrants.

A Stage 3 Alert will be declared when any measured Fall groundwater surface elevation is below the elevation specified by Line B for a corresponding BMO Key Well.

Stage 1 and 2 Alerts shall be rescinded by the WAC when the measured Fall groundwater surface elevations return to an elevation above Line A for the corresponding BMO Key Wells.

The WAC shall rescind a Stage 3 Alert when the measured Fall groundwater surface elevations return to an elevation above Lines B and A for the corresponding BMO Key Wells. A Stage 3 Alert may be down-graded to a Stage 2 Alert if the measured Fall groundwater surface elevation is above Line B but remains below the compliance elevation specified by Line A. A Stage 3 Alert also may be rescinded if the following Spring measurements indicate that the ground water surface elevation has recovered to the average Spring elevation for the corresponding BMO Key Well. A Stage 3 Alert may be downgraded to a Stage 2 Alert if the measured Spring groundwater surface elevation is above the average Spring elevation less 20% of the largest range in Spring to Fall groundwater surface elevations. See the Supporting Data for the elevations of these key spring measurements.

BMO Compliance Evaluation Procedure:

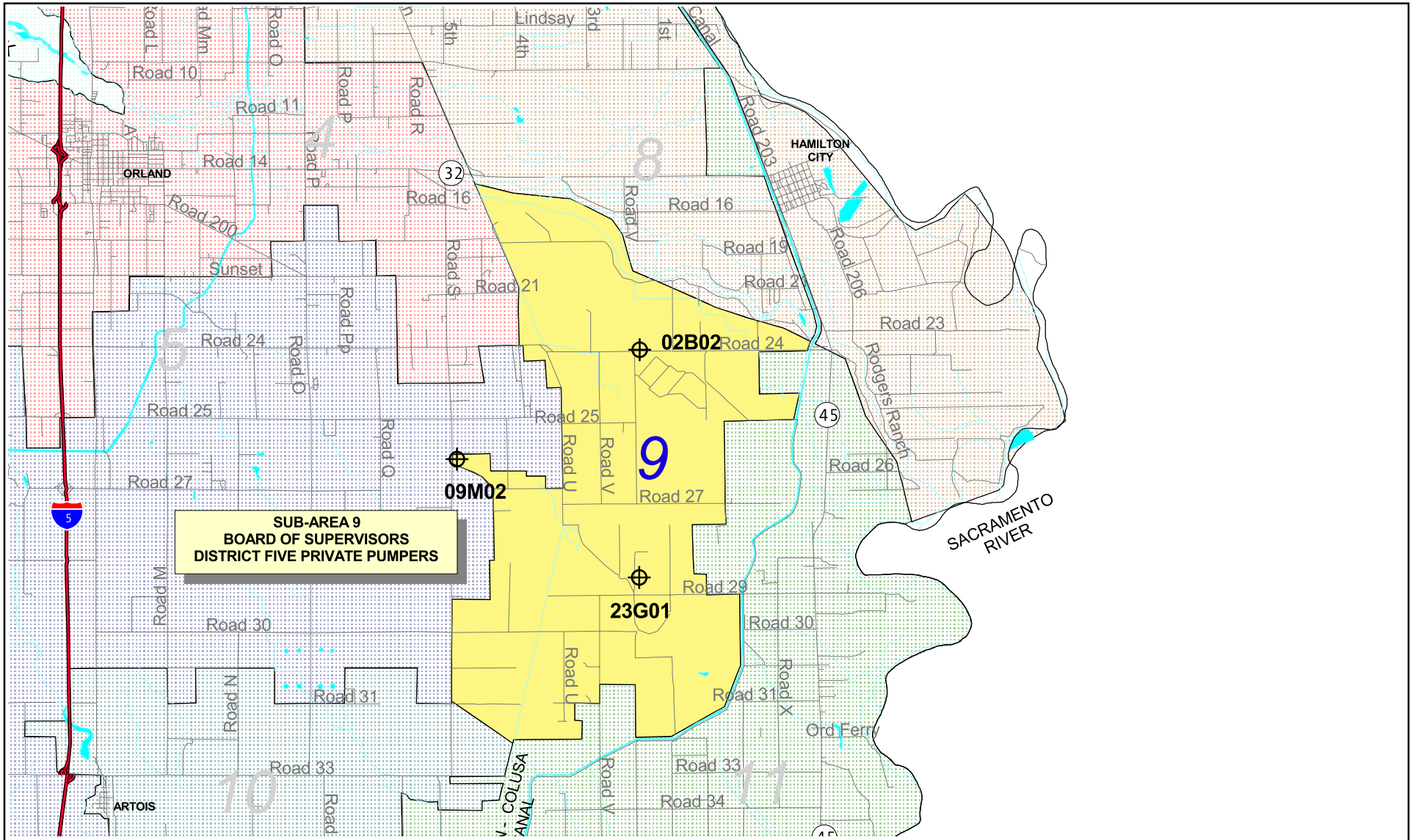
Compliance with the BMO will be determined following the Fall and Spring groundwater level measurement periods. The groundwater surface elevations at each monitoring well will be compared against the corresponding compliance graph and stage definition criteria to determine if the groundwater surface elevations are above or below specific alert trigger levels. The Technical Advisory Committee of the Glenn County Water Advisory Committee will perform this evaluation and report the results of the evaluation to the WAC.

Monitoring Recommendations:

Efforts should be made to identify possible additional wells that could be added to the existing monitoring well network in the northern and southern portions of the sub-area to improve the overall coverage within the region.

Supporting Data:

ATTACHED.



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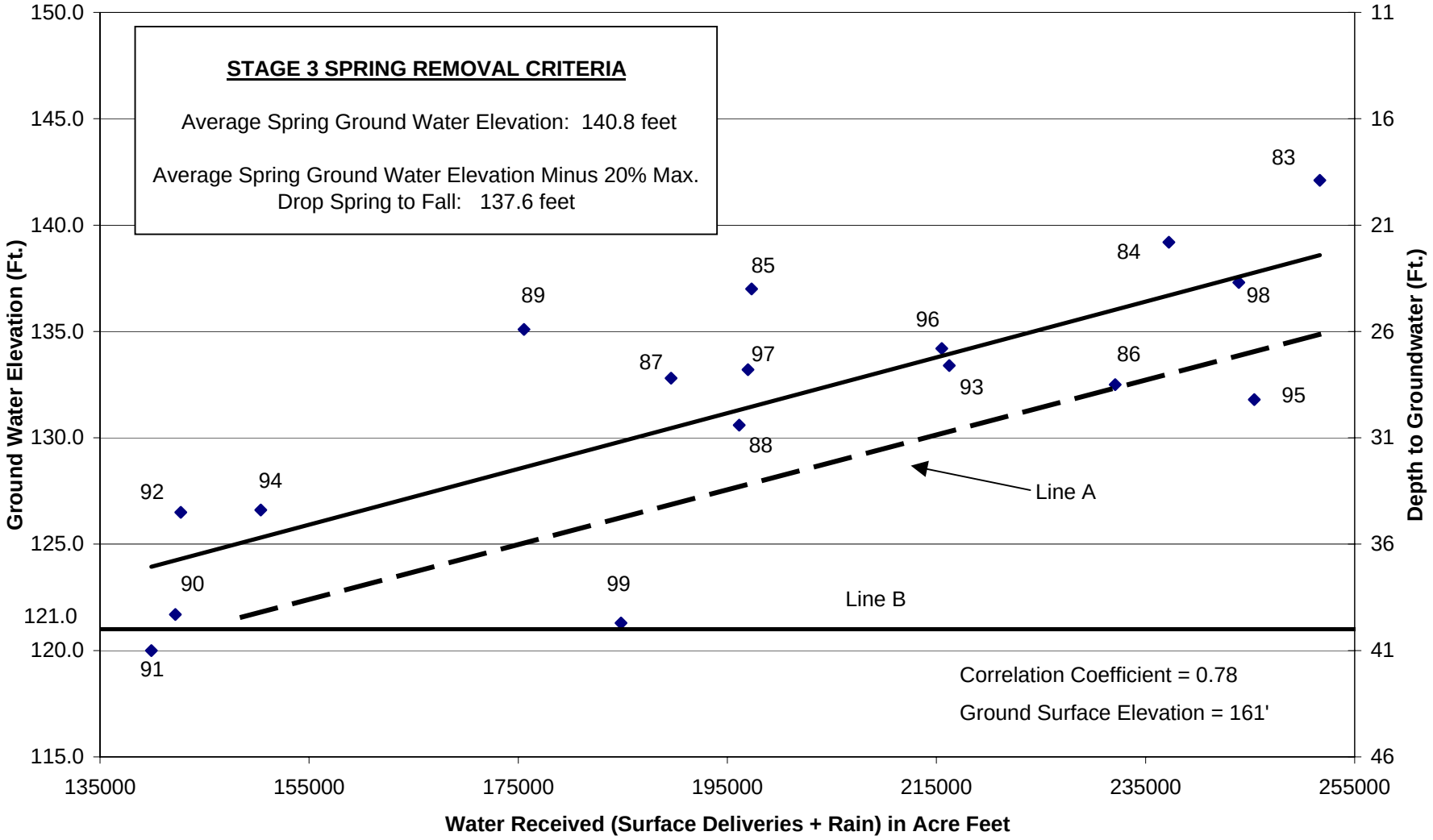
Legend

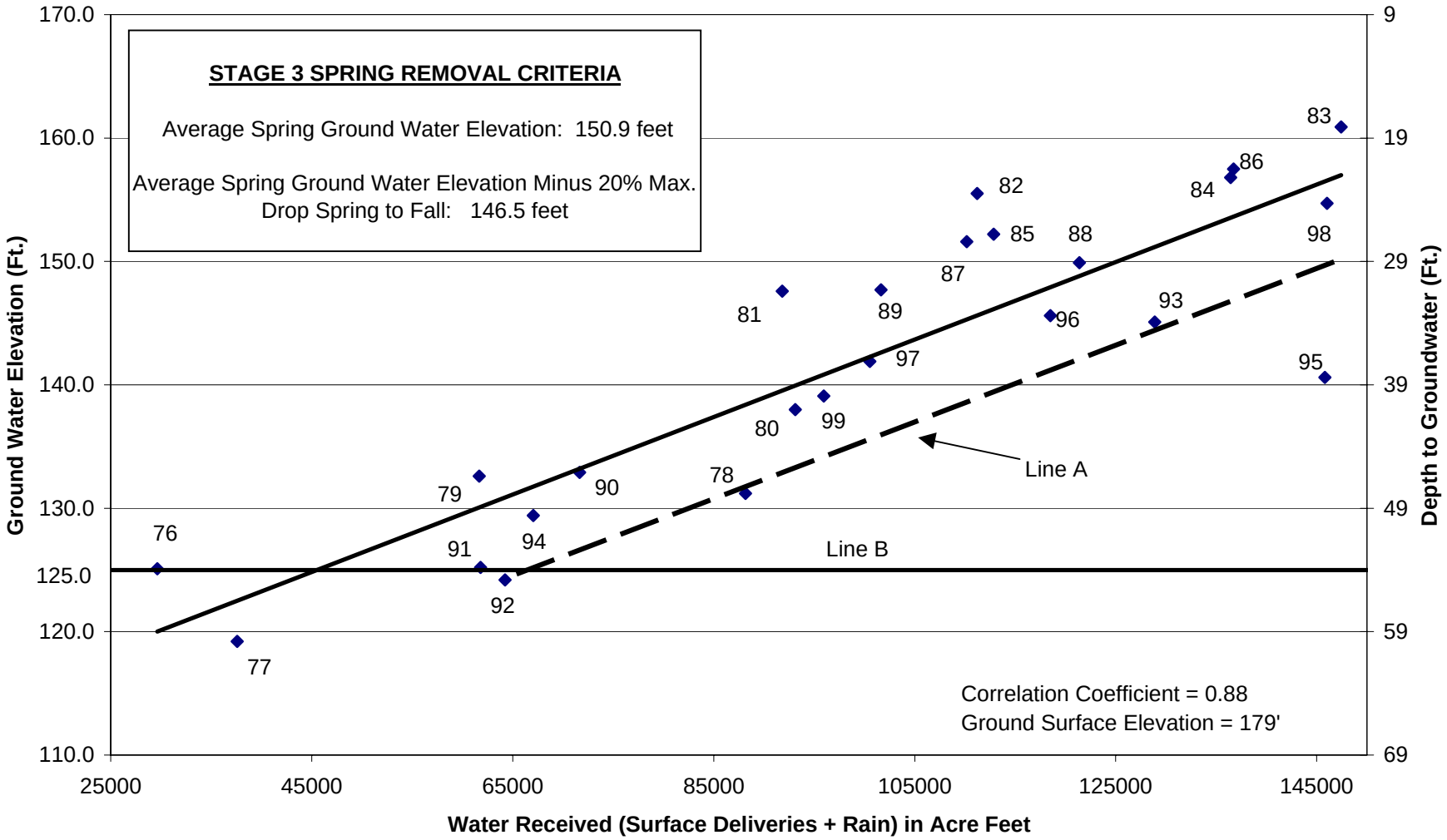
⊕ Wells used in BMO calculation

Glenn County Groundwater Management Ordinance No. 1115	**Sub-Area 9** **Board of Supervisors District Five Private Pumpers**	August 21, 2001

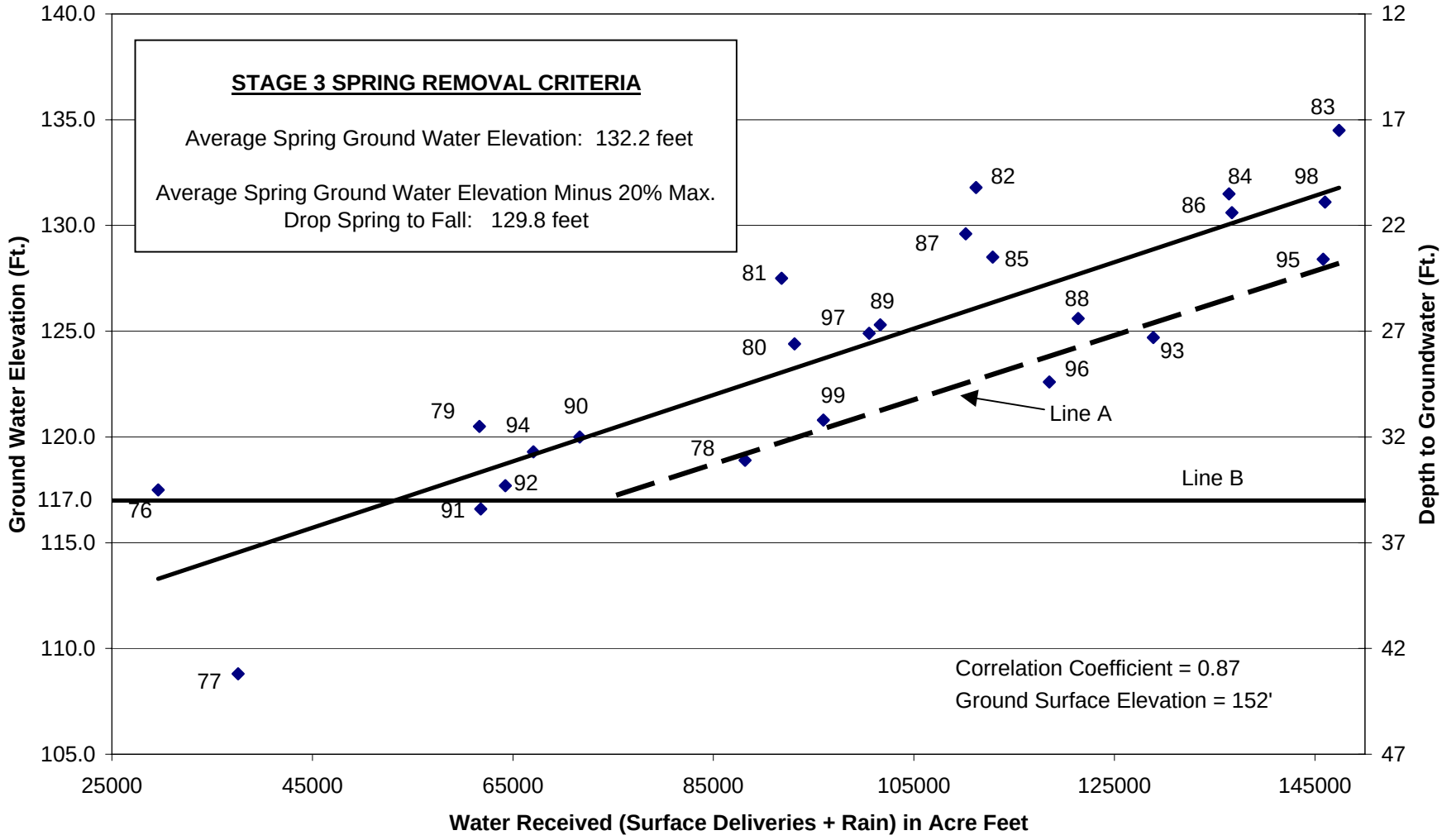
BASIN MANAGEMENT OBJECTIVE
Well 21N02W02B02, Area 9
Based on 1983-1999 Fall Measurements and Water Received in
Orland Artois Water District+Orland Unit Water Users Assn.,
South Canal Area



BASIN MANAGEMENT OBJECTIVE
Well 21N02W09M02, Area 9
Based on 1976-1999 Fall Measurements and Water Received in Orland Artois Water District



BASIN MANAGEMENT OBJECTIVE
Well 21N02W23G01, Area 9
Based on 1976-1999 Fall Measurements and Water Received in Orland Artois Water District



Basin Management Objective

Glenn County

Sub-area 10

Board of Supervisors District Three

Private Pumpers

Basin Management Objective
Glenn County
Sub-area 10
Board of Supervisors District Three Private Pumpers

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: Leonard Kaiser

Objective: To maintain the groundwater surface elevation at a level that will assure an adequate and affordable irrigation water supply. It is the intent of this objective to assure a sustainable agricultural water supply now and into the future. The objective is also to assure an adequate groundwater supply for all domestic users in the sub-area.

Location of BMO Key Wells: See attached map. (Location of Cal Water Well, Willows Station 002-01, approximated.)

Groundwater Level Monitoring Network: Department of Water Resources – Northern District

Groundwater Level Measurements By:

Department of Water Resources – Northern District (Wells No. 1 through 6)

California Water Service Company (Cal Water) (Well No. 7)

Groundwater Level Monitoring Frequency:

Semiannual.

Spring (March-April)

Fall (October-November)

Groundwater Well Numbering System:

State (Wells No. 1 through 6)

Other (Well No. 7) – Independent numbering system used by Cal Water

BMO Key Wells And BMO Determination Methodology (See Cover Letter For Discussion Of Numbered BMO Methodologies):

Well No.	Well ID	Method*	Stage 1 & 2 Alerts**		Stage 3 Alert**	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
1	21N03W33A04M	1	Line A	Line A	104	70
2	21N02W31M01M	1	Line A	Line A	115	46
3	20N03W03D02M	1	Line A	Line A	116	48
4	20N03W12C01M	1	Line A	Line A	115	44
5	20N03W23G02M	2	118.7	27.3	112.5	33.5
6	20N03W33J01M	2	114.4	21.6	104.3	31.7
7	CAL Water Well, Willows Stat. 002-01	2	116.1	17.9	111.4	22.6

* - See Cover Report for a description of Methods 1 and 2. The behavior of wells 1 through 4 is distinctly different from that of wells 5 through 7. For example, fluctuations from Spring to Fall are much more significant in wells 1 through 4. These fluctuations are due to a combination of factors, including pumping, surficial geologic and subsurface geologic conditions, well characteristics, and surrounding land and water use management practices. Another common feature to these four wells is they are located within the Stony Creek fan alluvium (sand and gravel deposits), and wells 5 through 7 are not. In light of these differences, Method 1 was chosen for wells 1 through 4. Method 1 is a regression-based method, and can take into consideration the factors that result in greater groundwater level fluctuations. This method does not incorporate all the factors previously discussed but it does include precipitation and nearby surface water use. These are key factors as evident by the high correlation observed between them and the groundwater levels. On the contrary, wells 5 through 7 did not show good correlation to these key factors, and Method 2 was found to be a suitable approach for determining the BMO groundwater levels for these wells. Additional study of the varied groundwater level behavior is recommended for future consideration of the BMO's in this sub-area. In particular, better understanding of the surface and subsurface characteristics, and the characteristics of these monitoring wells are required. Data to support this further study is not presently readily available, however several efforts by Glenn County in conjunction with DWR will be undertaken in the near future.

** - See attached hydrographs.

BMO Alert Stage Definitions:

The Glenn County Water Advisory Committee (WAC) upon a recommendation of its Technical Advisory Committee shall declare a Stage 1, Stage 2, or Stage 3 Alert based on the technical criteria presented below. The technical criteria for the WAC to rescind the Stage 1, Stage 2, or Stage 3 Alert is also presented. The alert criteria are based on the recommended methodology developed by the Glenn County Water Advisory Committee – Technical Advisory Committee. The results of the analysis are presented in the Supporting Data section of this summary. See BMO Methodology 1 and 2 in the Cover Report for a technical discussion of how the compliance lines A & B were developed.

BMO Alert Stage Definitions for Method 1. A Stage 1 Alert will be declared when any measured Fall groundwater surface elevation is below Line A for the corresponding BMO Key Well.

A Stage 2 Alert will be declared on the second, and subsequent sequential years, when any measured Fall groundwater surface elevation is below Line A. The Glenn County Technical Advisory Committee may declare a Stage 2 Alert during the first year of noncompliance if a situation warrants.

A Stage 3 Alert will occur when any measured Fall groundwater surface elevation is below the elevation specified by Line B for a corresponding BMO Key Well.

Stage 1 and 2 Alerts shall be rescinded by the WAC when all the measured Fall groundwater surface elevations return to an elevation above Line A for the corresponding BMO Key Wells.

The WAC shall rescind a Stage 3 Alert when the measured Fall groundwater surface elevations return to an elevation above Lines B and A for the corresponding BMO Key Wells. A Stage 3

Alert may be down-graded to a Stage 2 Alert if all the measured Spring groundwater surface elevation are above Line B but remains below the compliance elevation specified by Line A.

BMO Alert Stage Definitions for Method 2. A Stage 1 Alert will be declared when any measured Spring groundwater surface elevation is below Line A for the corresponding BMO Key Well.

A Stage 2 Alert will be declared on the second, and subsequent sequential years, when any measured Spring groundwater surface elevation is below Line A. The Glenn County Technical Advisory Committee may declare a Stage 2 Alert during the first year of noncompliance if a situation warrants.

A Stage 3 Alert will occur when any measured Spring groundwater surface elevation is below the elevation specified by Line B for a corresponding BMO Key Well.

Stage 1 and 2 Alerts shall be rescinded by the WAC when all the measured Fall groundwater surface elevations return to an elevation above Line A for the corresponding BMO Key Wells.

The WAC shall rescind a Stage 3 Alert when the measured Fall groundwater surface elevations return to an elevation above Lines B and A for the corresponding BMO Key Wells. A Stage 3 Alert may be down-graded to a Stage 2 Alert if all the measured Spring groundwater surface elevation are above Line B but remains below the compliance elevation specified by Line A.

BMO Compliance Evaluation Procedure:

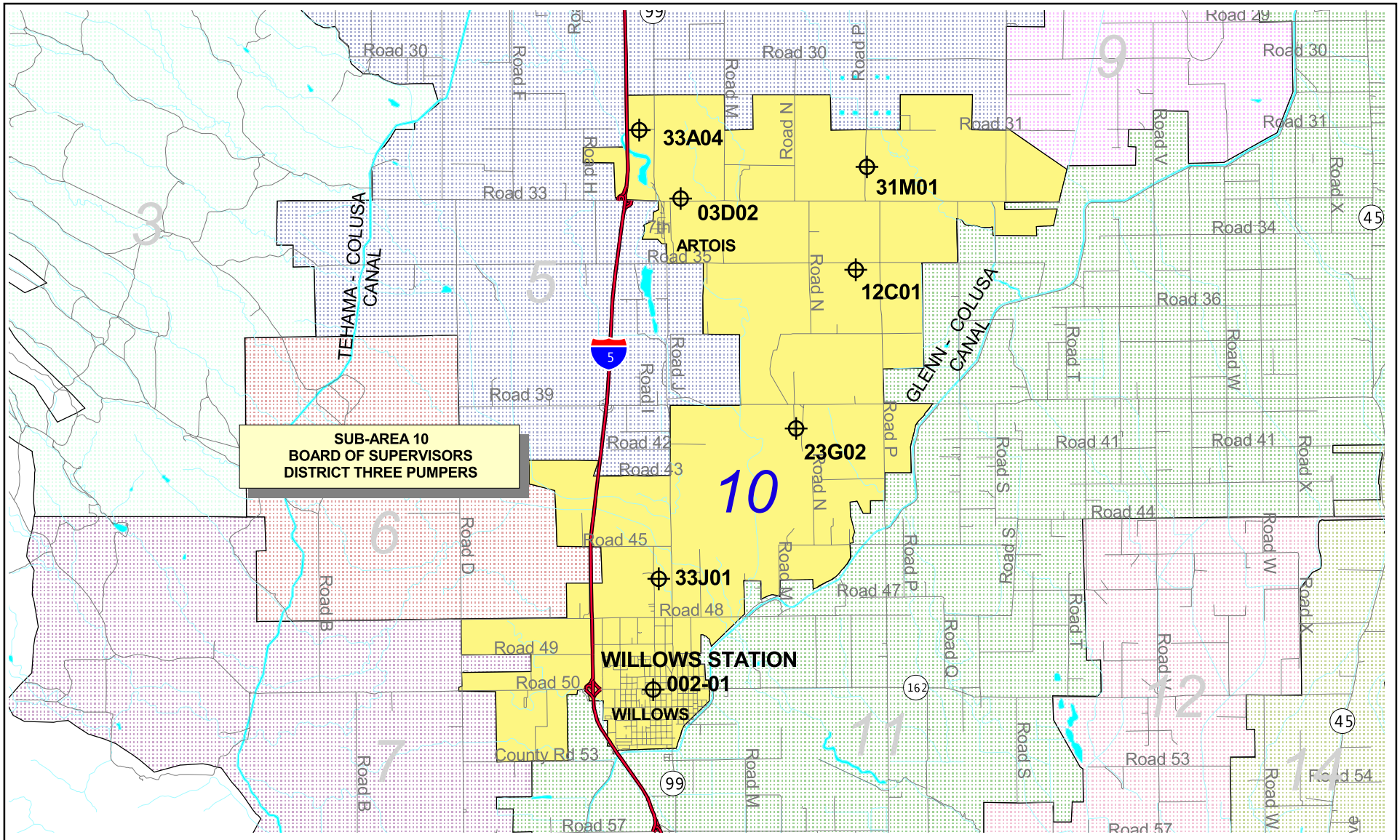
Compliance with the BMO will be determined following the Spring or Fall measurement period. The groundwater surface elevations at each monitoring well will be compared against the corresponding compliance graph and stage definition criteria to determine if the groundwater surface elevations are above or below specific alert trigger levels. The Technical Advisory Committee of the Glenn County Water Advisory Committee will perform this evaluation and report the results of the evaluation to the WAC.

Monitoring Recommendations:

Efforts should be made to identify possible additional wells that could be added to the existing monitoring well network in the sub-area to improve the overall coverage within the region.

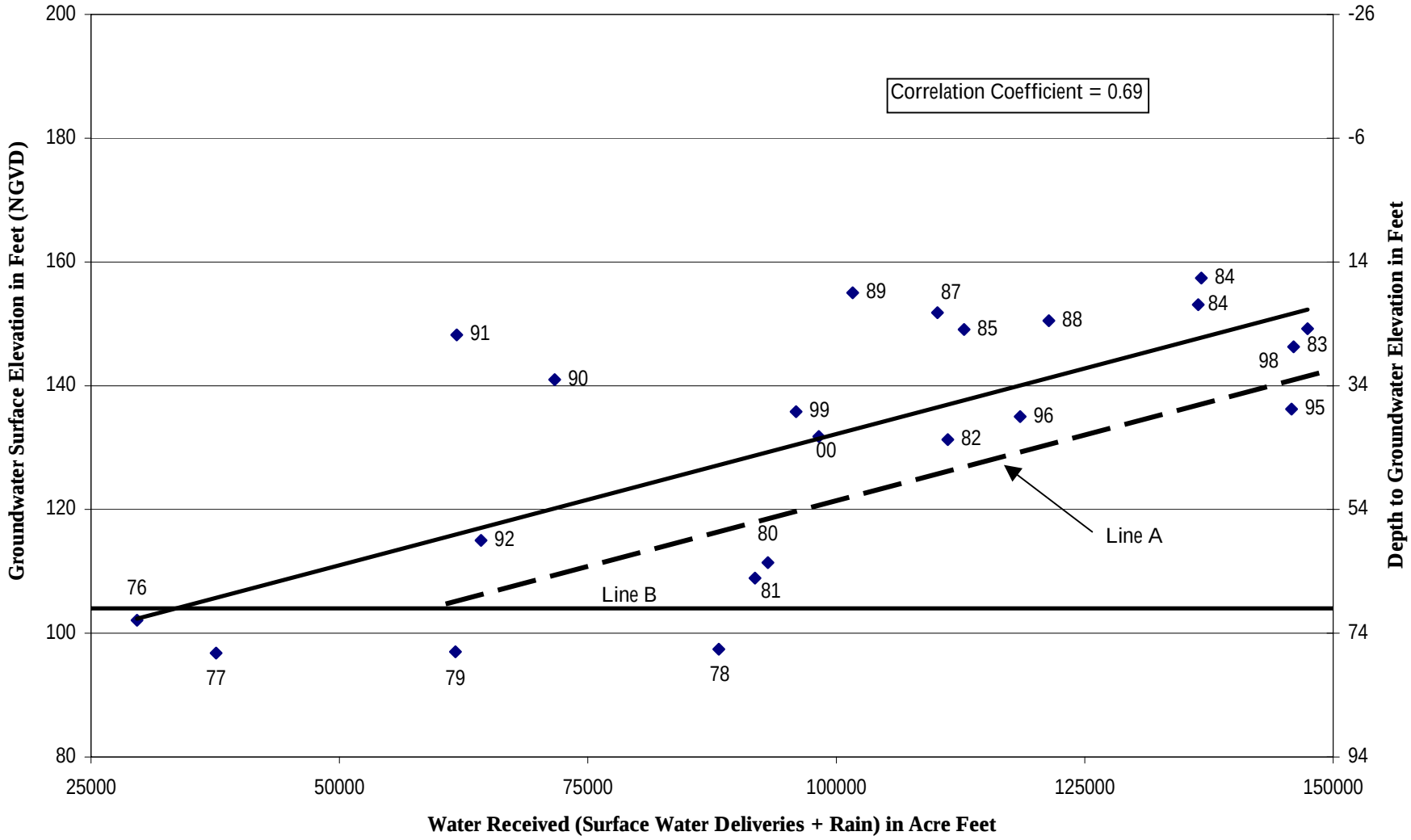
Supporting Data:

ATTACHED.

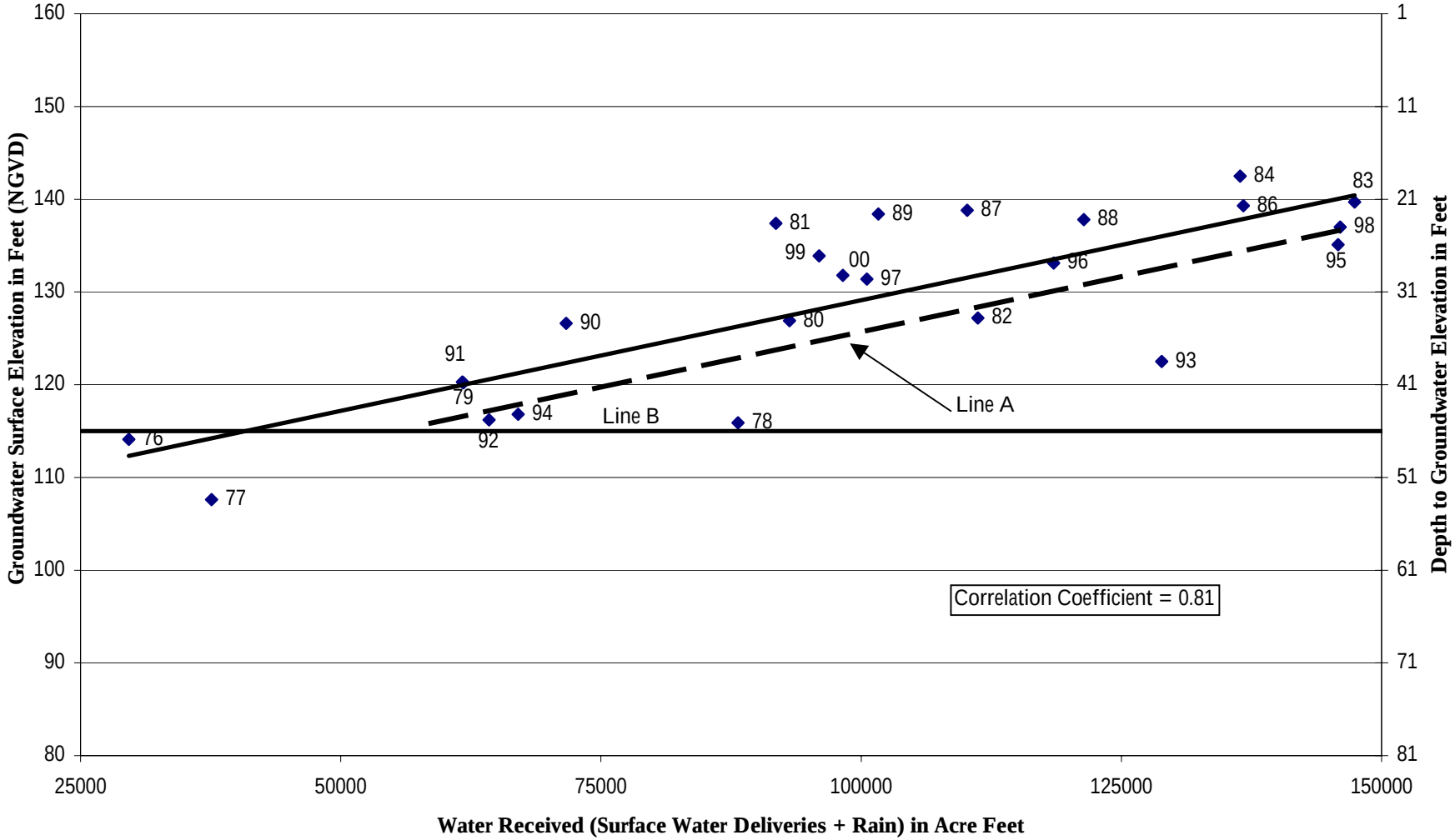


Glenn County Groundwater Management Ordinance No. 1115	**Sub-Area 10** **Board of Supervisors District Three Private Pumpers**	August 21, 2001

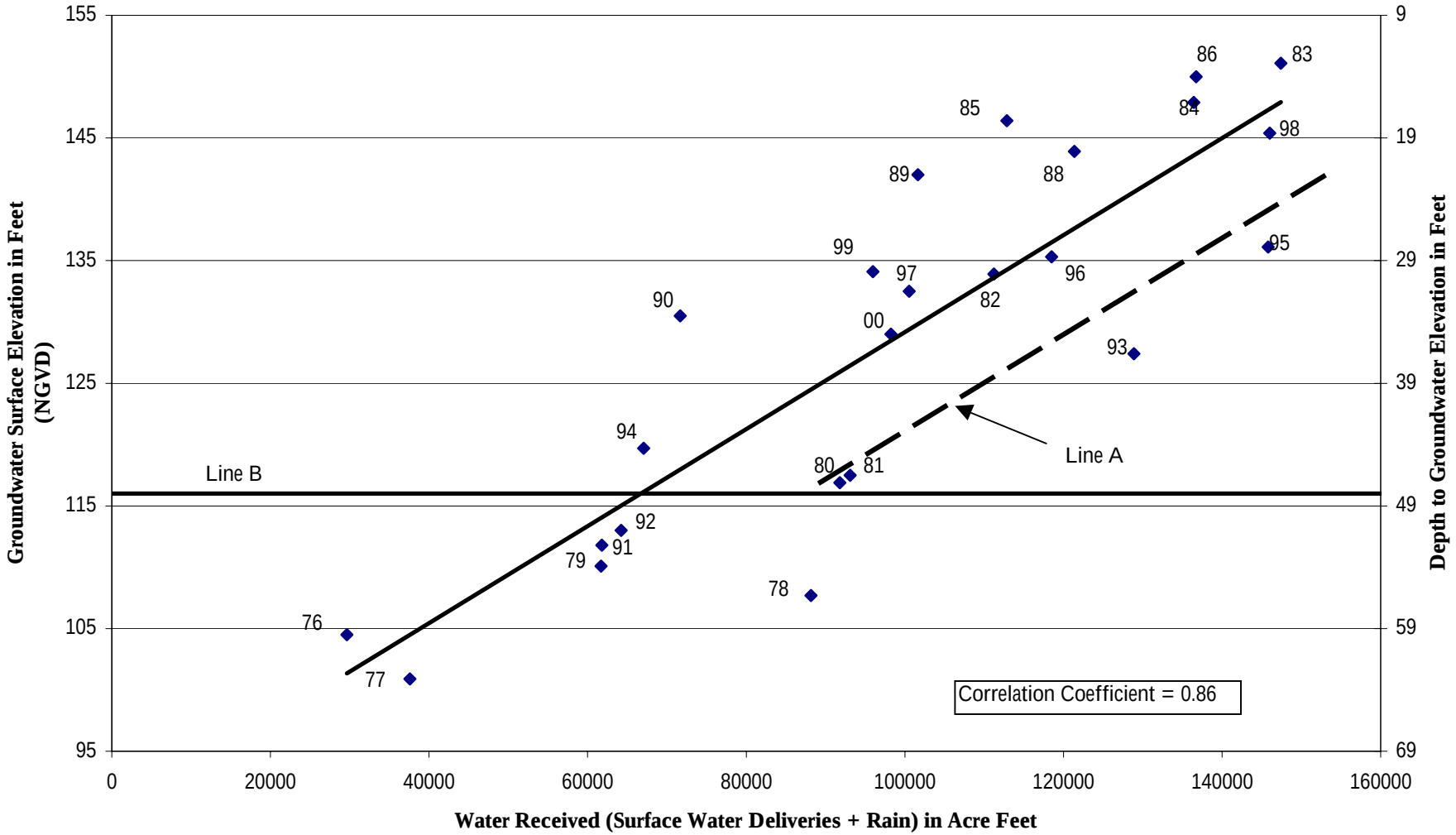
Basin Management Objective - Method 1
Well 21N03W33A04M, Area 10 (Bos District Three Pumpers)
Based on 1976-2000 Fall Measurements and
Water Received in Orland Artois Water District



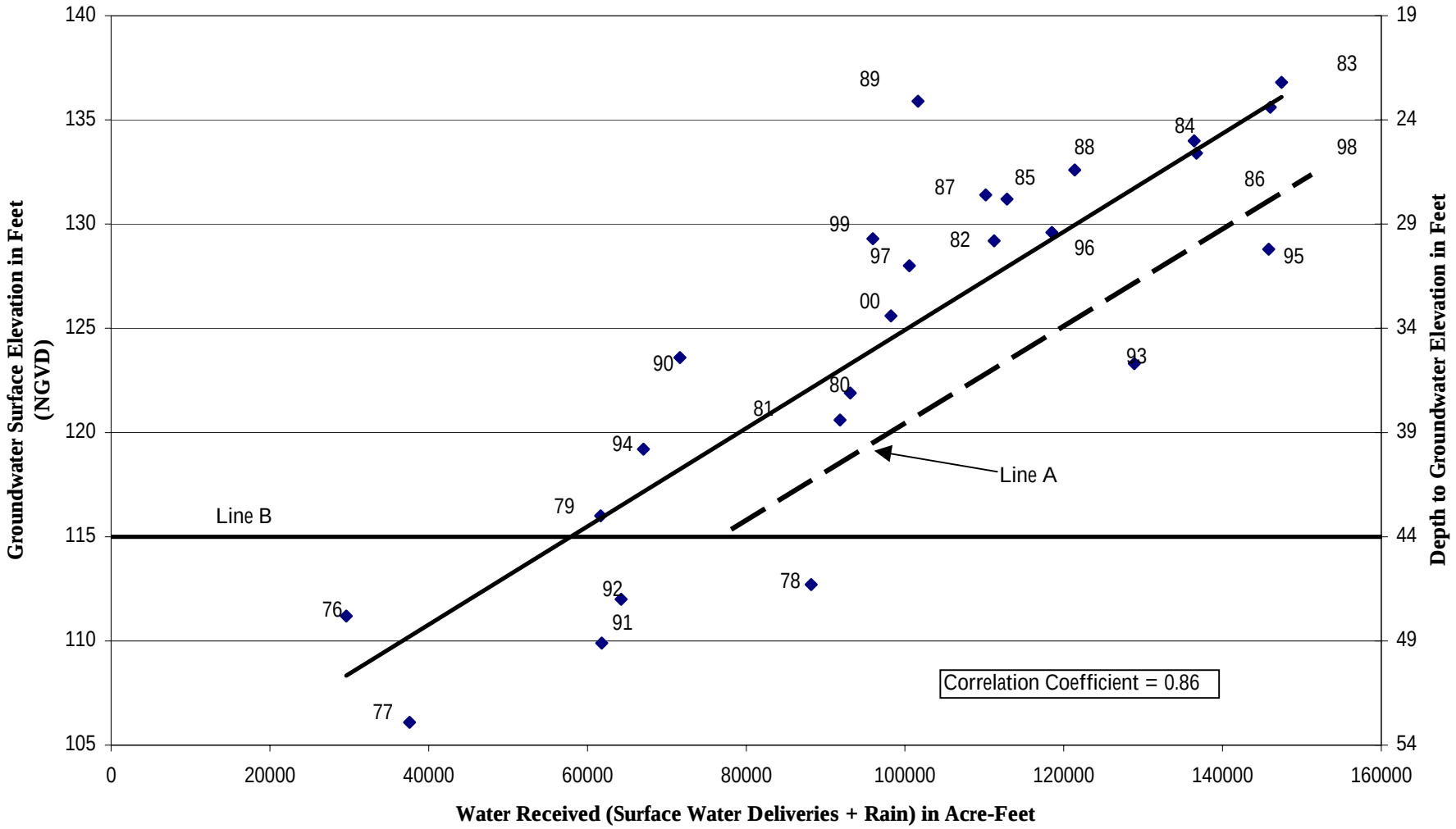
Basin Management Objective - Method 1
Well 21N03W31M01, Area 10 (Bos District Three Pumpers)
Based on 1976-2000 Fall Measurements and
Water Received in Orland Artois Water District



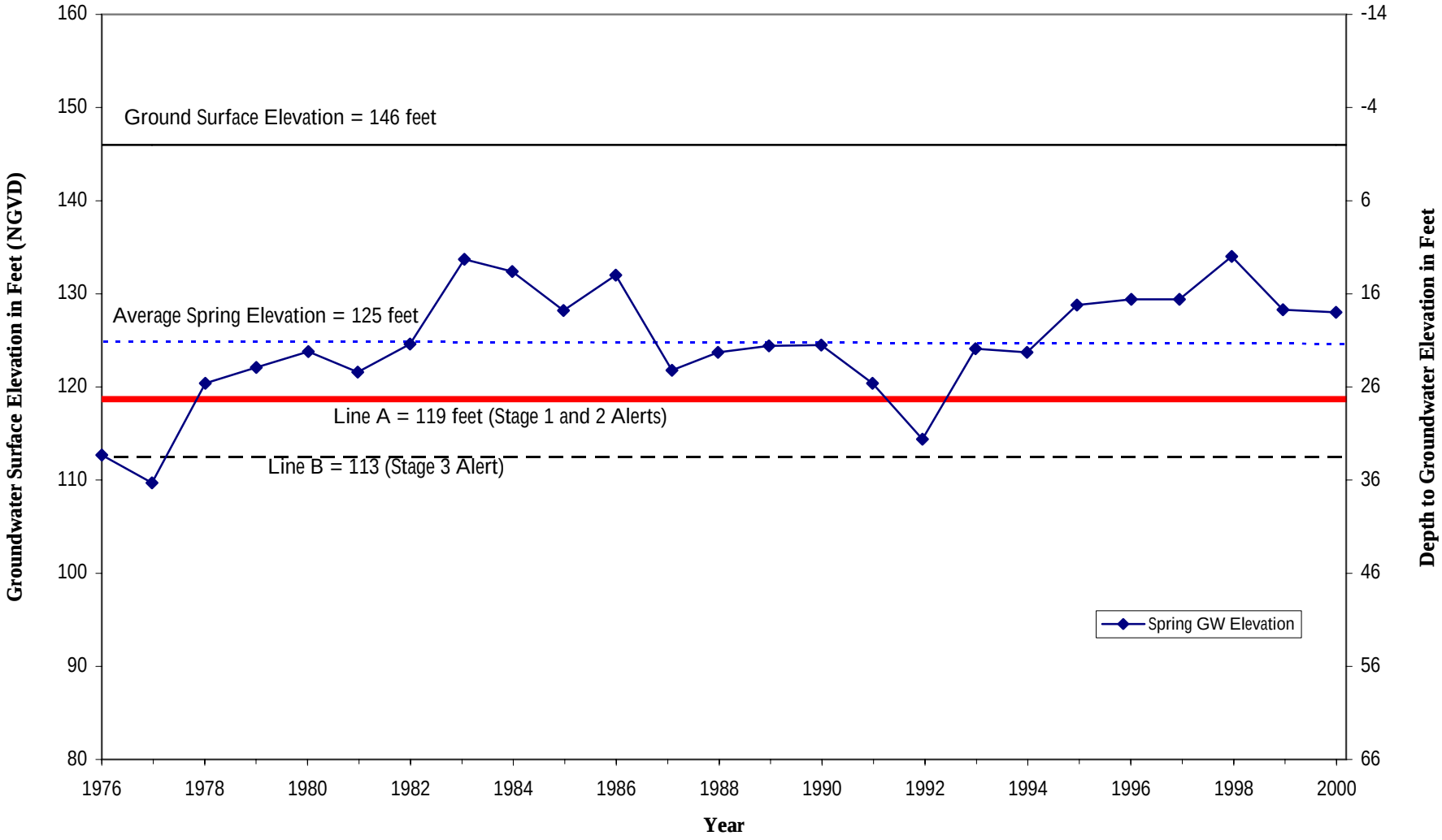
Basin Management Objective - Method 1
Well 20N03W03D02M, Area 10 (Bos District Three Pumpers)
Based on 1976-2000 Fall Measurements and
Water Received in Orland Artois Water District



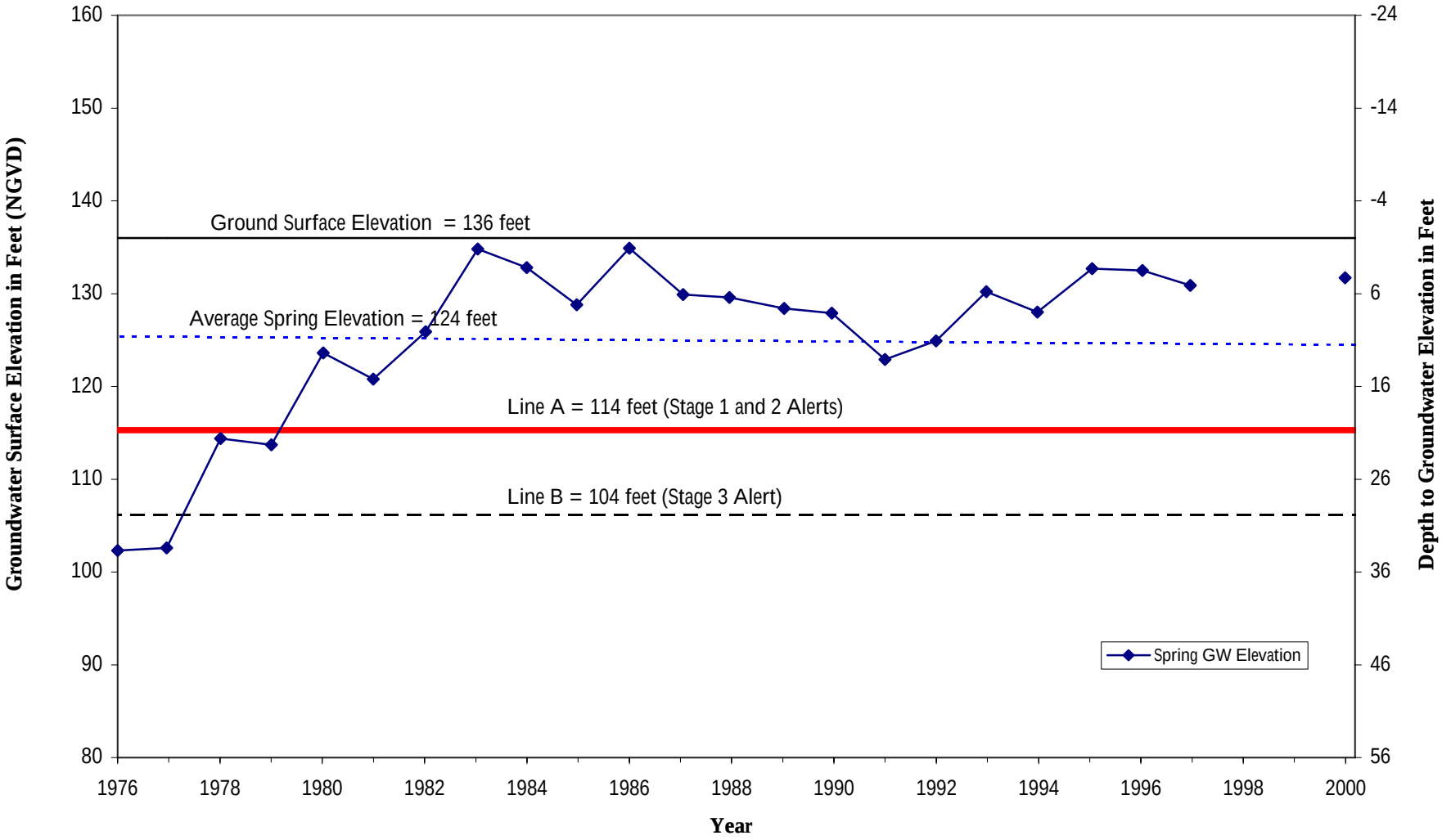
Basin Management Objective - Method 1
Well 20N03W12C01M, Area 10 (Bos District Three Pumpers)
Based on 1976-2000 Fall Measurements and
Water Received in Orland Artois Water District



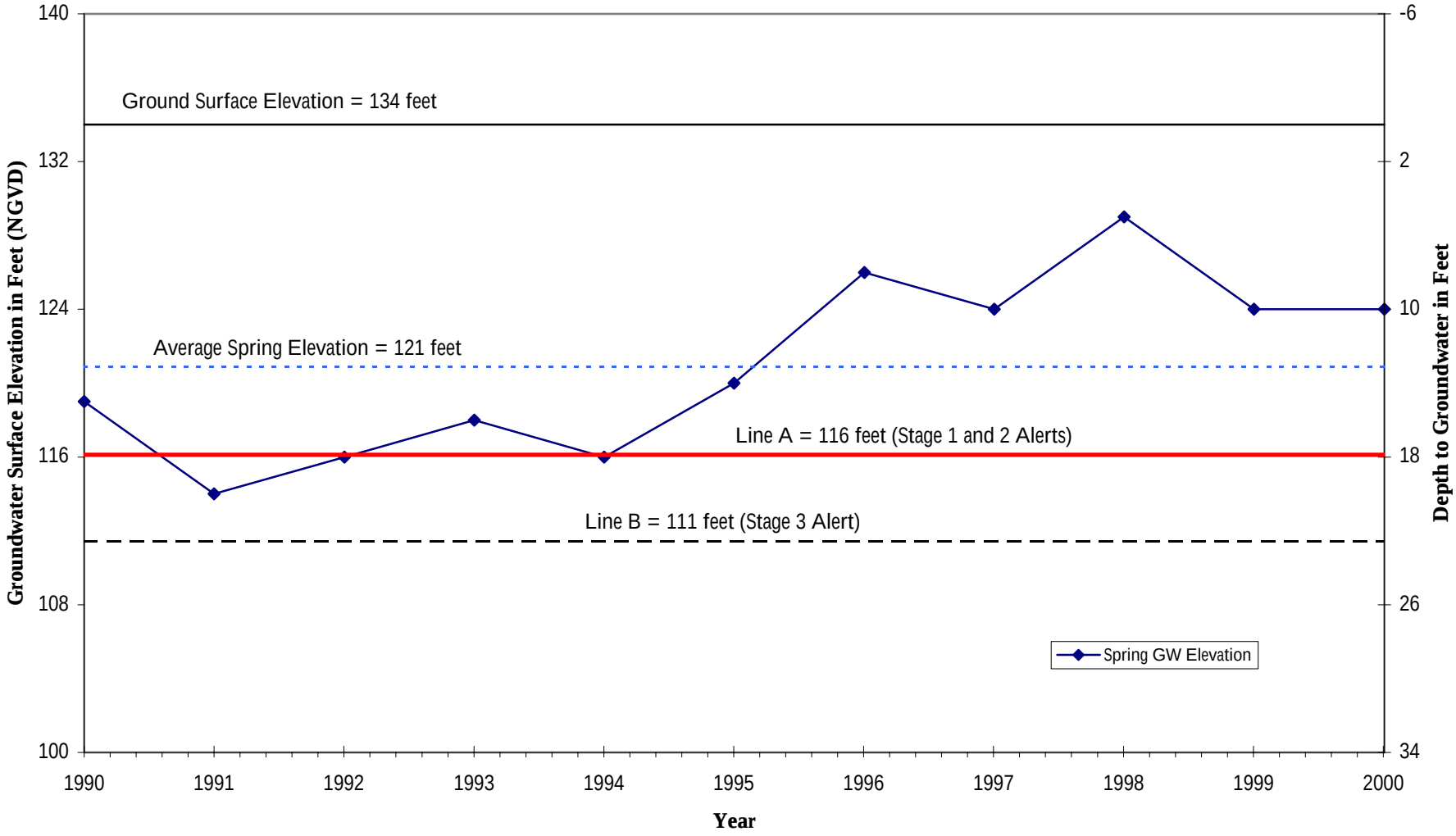
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 10 (Bos District Three Pumpers)
Well #20N03W23G02M



Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 10 (Bos District Three Pumpers)
Well #20N03W33J01M



Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 10 (Bos District Three Pumpers)
Well # Sta. 002-01 (Cal Water)



Basin Management Objective

Glenn County

Sub-area 11

Glenn-Colusa Irrigation District

Basin Management Objective
Glenn County
Sub-area 11
Glenn-Colusa Irrigation District

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: O.L. "Van" Tenney

Objective: To maintain the groundwater surface elevation at a level that will assure an adequate and affordable irrigation water supply. It is the intent of this objective to assure a sustainable agricultural water supply now and into the future. The objective is also to assure an adequate groundwater supply for all domestic users in the sub-area.

Location of BMO Key Wells: See attached map.

Groundwater Level Monitoring Network: Department of Water Resources – Northern District

Groundwater Level Measurements By: Department of Water Resources – Northern District

Groundwater Level Monitoring Frequency:
Semiannual.
Spring (March-April)
Fall (October-November)

Groundwater Well Numbering System: State

BMO Key Wells and BMO Determination Methodology (See Cover Report for Discussion Of Numbered BMO Methodologies):

Well No.	Well ID	Method*	Stage 1 & 2 Alerts**		Stage 3 Alerts**	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
1	19N02W29Q01M	3	85.1	4.9	75.1	14.9
2	19N03W26P01M	3	94.7	3.3	89.2	8.8
3	20N02W02J01M	3	115.9	9.1	112.4	12.6
4	20N02W05A01M	3	119.65	24.4	95.6	48.4
5	20N02W11A01M	3	114.6	8.4	108.0	15
6	20N02W11A02M	3	108.7	14.3	88.8	34.2
7	20N02W11A03M	3	96.5	26.5	72.7	50.3
8	20N02W13G01M	3	107.5	5.5	105.6	7.4
9	20N02W29G01M	3	109.2	7.8	107.5	9.5

* - See Cover Report for description of method.
** - See attached hydrographs.

BMO Alert Stage Definitions:

The Glenn County Water Advisory Committee (WAC) upon a recommendation of its Technical Advisory Committee shall declare a Stage 1, Stage 2, or Stage 3 Alert based on the technical criteria presented below. The technical criteria for the WAC to rescind the Stage 1, Stage 2, or Stage 3 Alert is also stated. The alert criteria are based on statistical data of the historic data for wells.

Basin Management Objective (BMO): Develop a 3 Stage Alert process for response to declining groundwater levels in the Central Region.

The BMO is intended to trigger predetermined voluntary Ground Water Management actions to remedy falling ground water levels that are not recovering to mean water levels specific to each "index" * well.
Falling groundwater levels and corresponding alert stages are defined as follows:

Stage 1: A Stage 1 alert occurs the first year that the Index well's fall groundwater level falls between one STANDARD DEVIATION below the mean water level and above the lowest level of record for that well. Stage 1 management actions may include increased monitoring frequency and distribution to determine if the problem is unique to the well or is regional. Well recovery is to be monitored during following spring.

Stage 2: A Stage 2 alert will occur the following year after a Stage 1 alert has been issued if one of the following events occurs.

- Spring water levels have not recovered to that of the previous spring level and the Sacramento River Index is less than or equal to 6.5 (Dry year) or surface water deliveries are forecast to be curtailed.

- The well's fall water level reading show continued decline beyond the previous falls water level.

Stage 2 management actions will include taking steps to investigate the extent of the problem (i.e. local or regional) and implement appropriate measures to reduce the negative impacts of the problem. Appropriate measures may include voluntary water conservation plans, "in-lieu" ground water recharge or other methods to reduce groundwater extraction until water levels recover.

Stage 3: A Stage 3 alert will occur in any year when the groundwater levels fall below the Lowest Historical Level since 1975 (when USBR westside deliveries commenced) after a Stage 2 alert has occurred.

Stage 3 management actions shall be more aggressive than previous stages and should include mandatory conservation measures, implementing active recharge programs or prohibiting any ground water export programs outside the basin.

* Index wells are those wells that have a long history of monitoring and have accurate well logs.

BMO Compliance Evaluation Procedure:

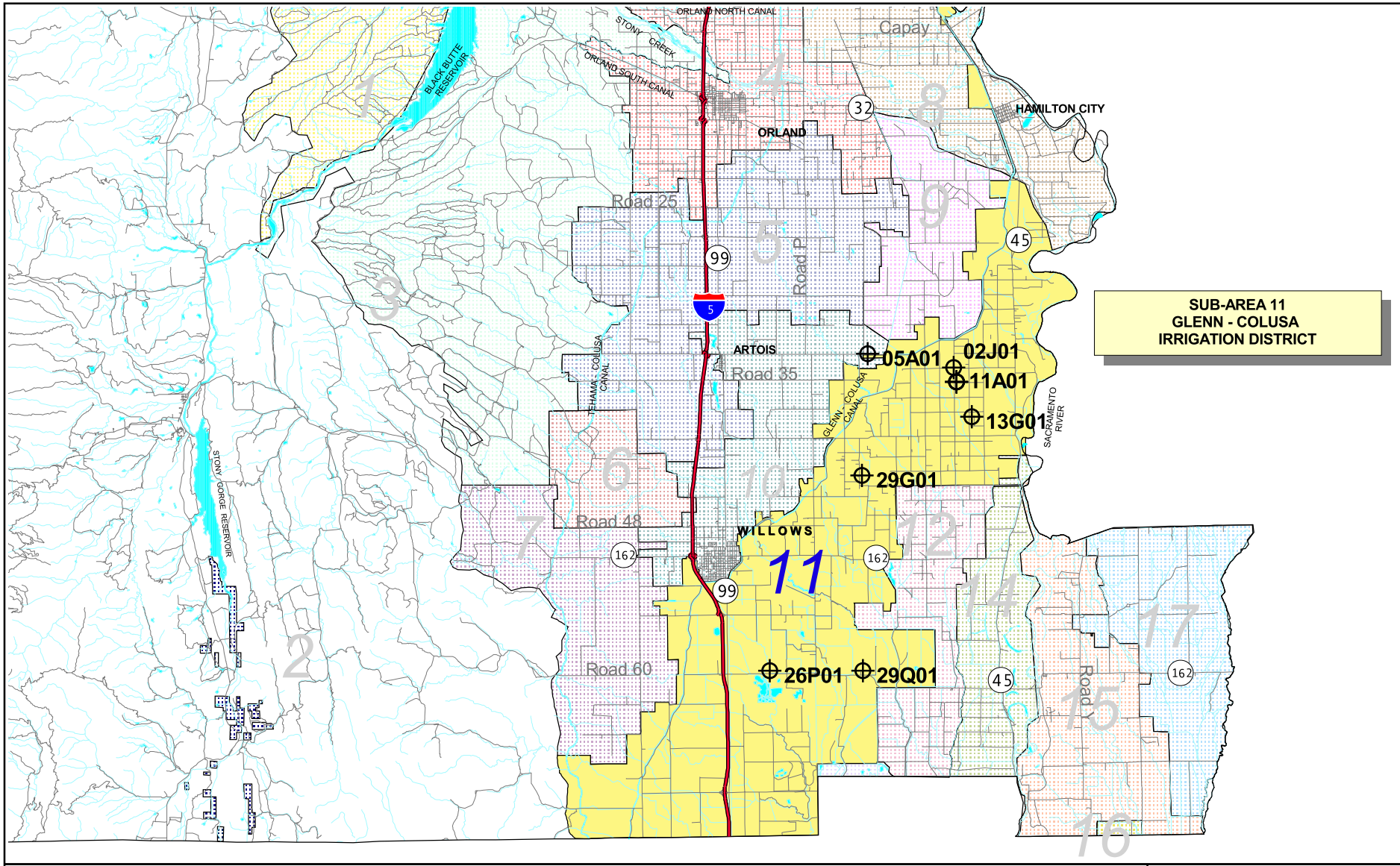
Compliance with the BMO will be determined following the Fall and Spring groundwater level measurement periods. The groundwater surface elevations at each monitoring well will be compared against the corresponding compliance graph and stage definition criteria to determine if the groundwater surface elevations are above or below specific alert trigger levels. The technical Advisory Committee of the Glenn County Water Advisory Committee will perform this evaluation and report the results of the evaluation to the WAC.

Monitoring Recommendations:

Efforts should be made to identify possible additional wells that could be added to the existing monitoring well network in the sub-area to improve the overall coverage within the region.

Supporting Data:

ATTACHED.



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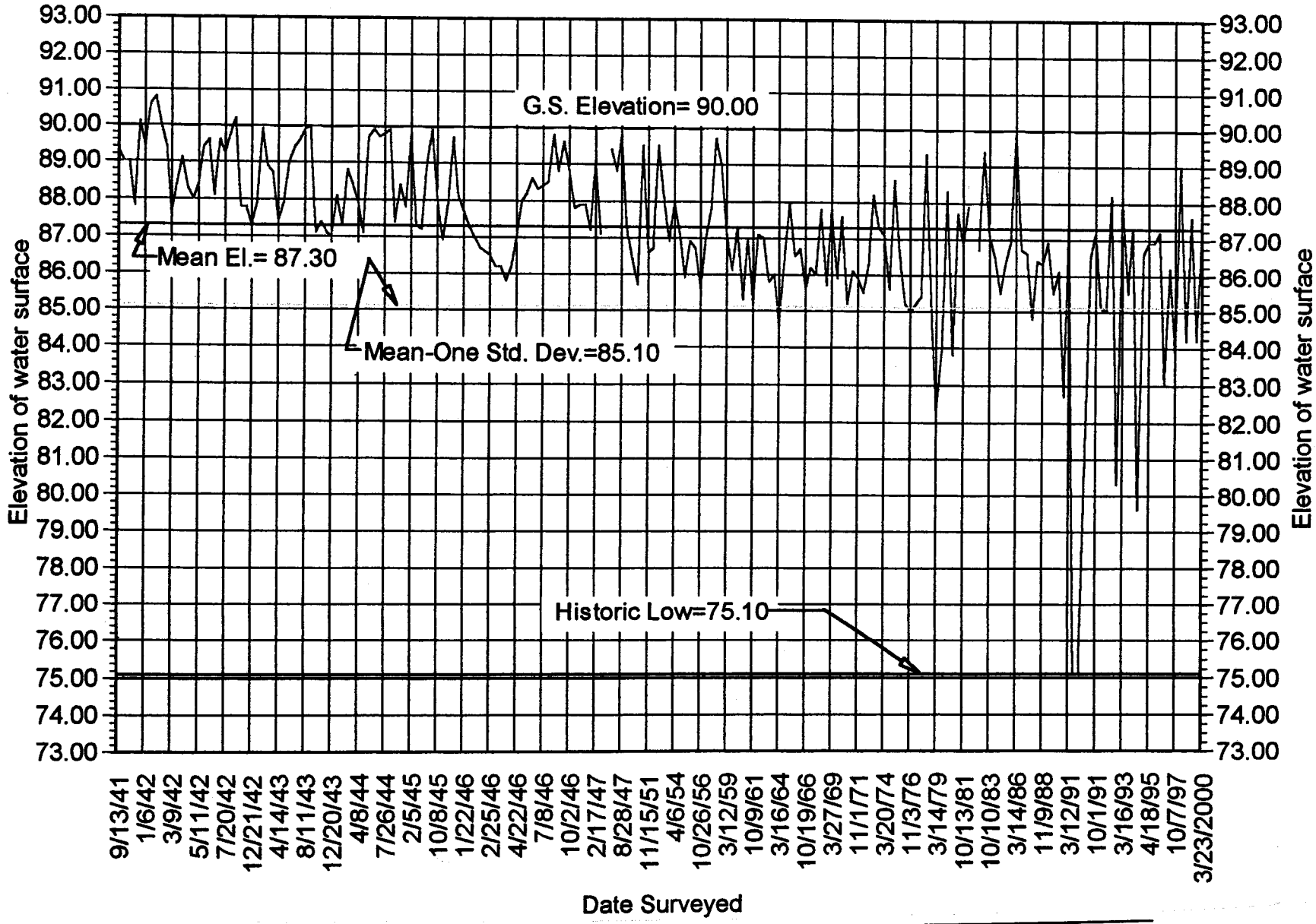
Legend

⊕ Wells used in BMO calculation

Glenn County Groundwater Management Ordinance No. 1115	**Sub-Area 11** **Glenn-Colusa Irrigation District**	August 21, 2001

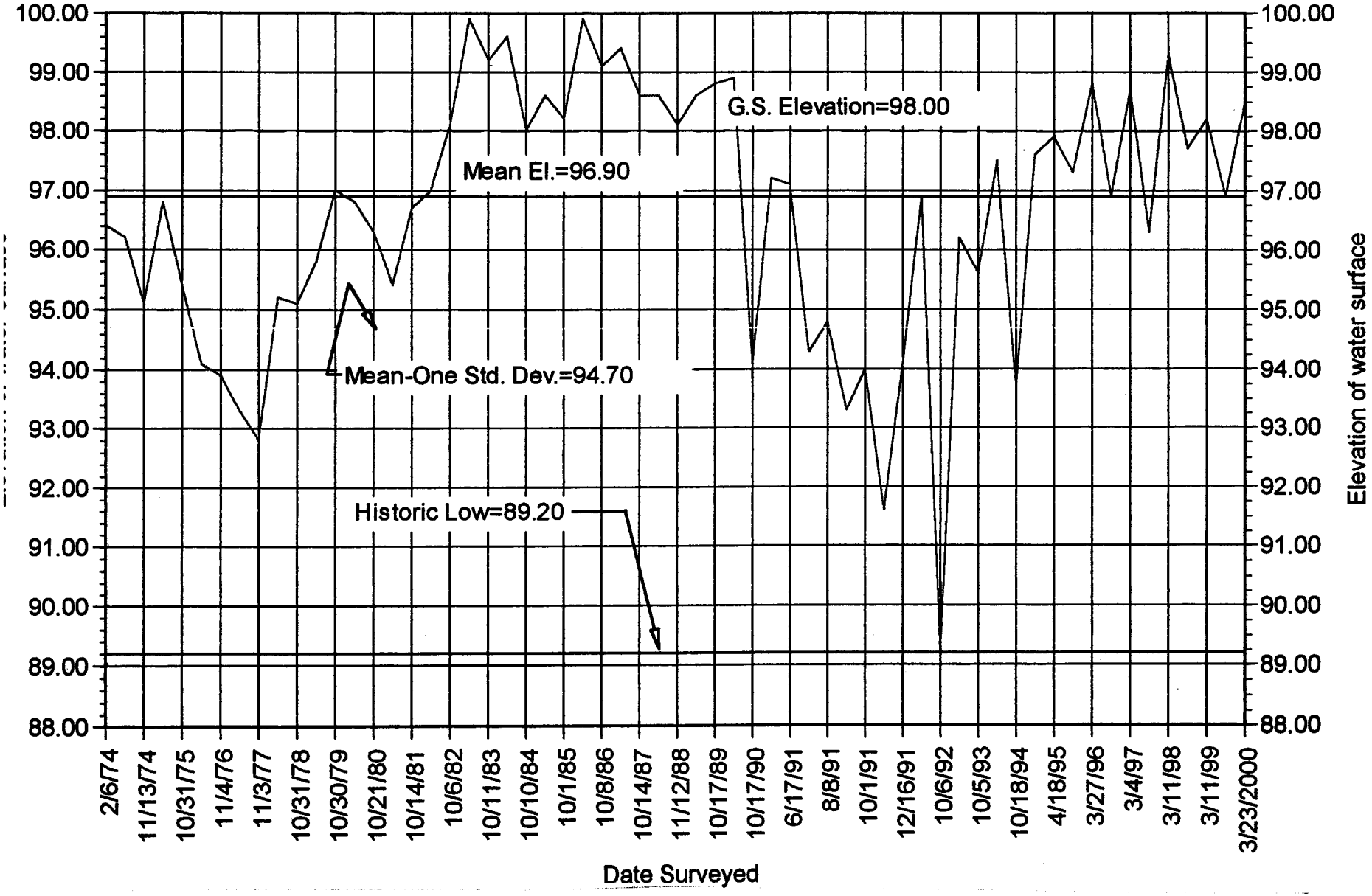
Ground Water Levels 19N02W29Q01M

Sacramento Valley (Glenn Co.)



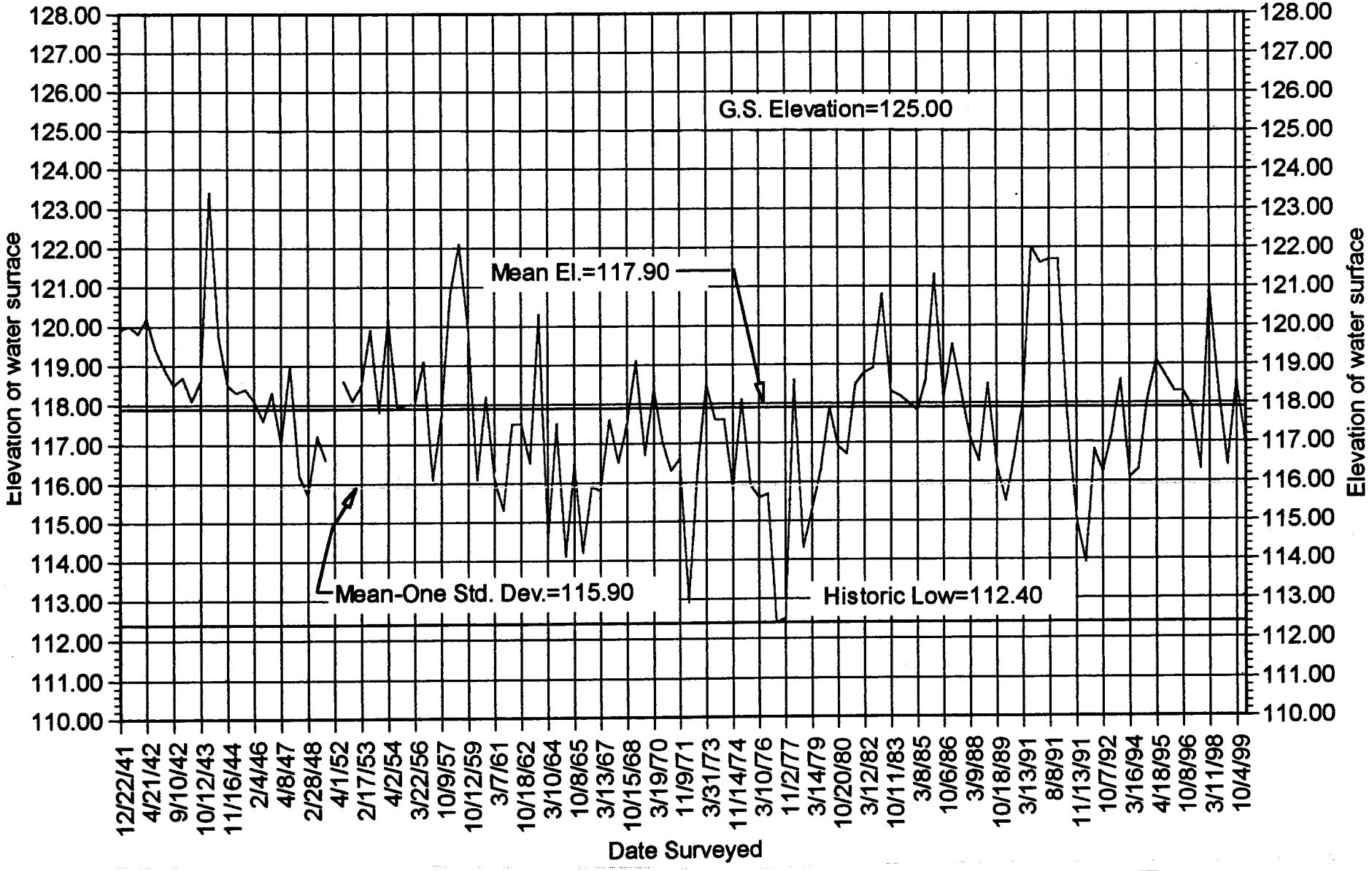
Ground Water Levels 19N03W26P01M

Sacramento Valley (Glenn Co.)



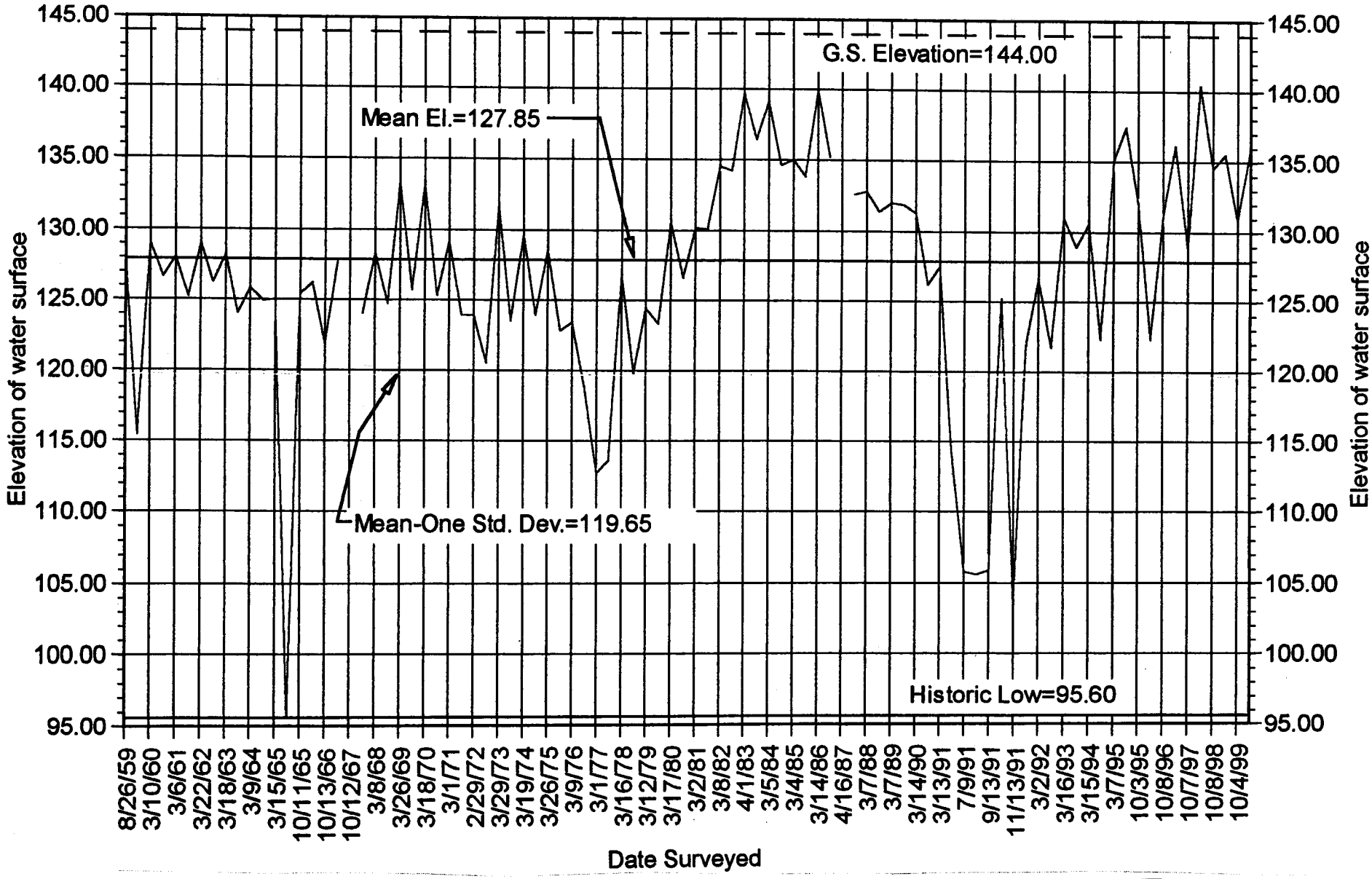
Ground Water Levels 20N02W02J01M

Sacramento Valley (Glenn Co.)



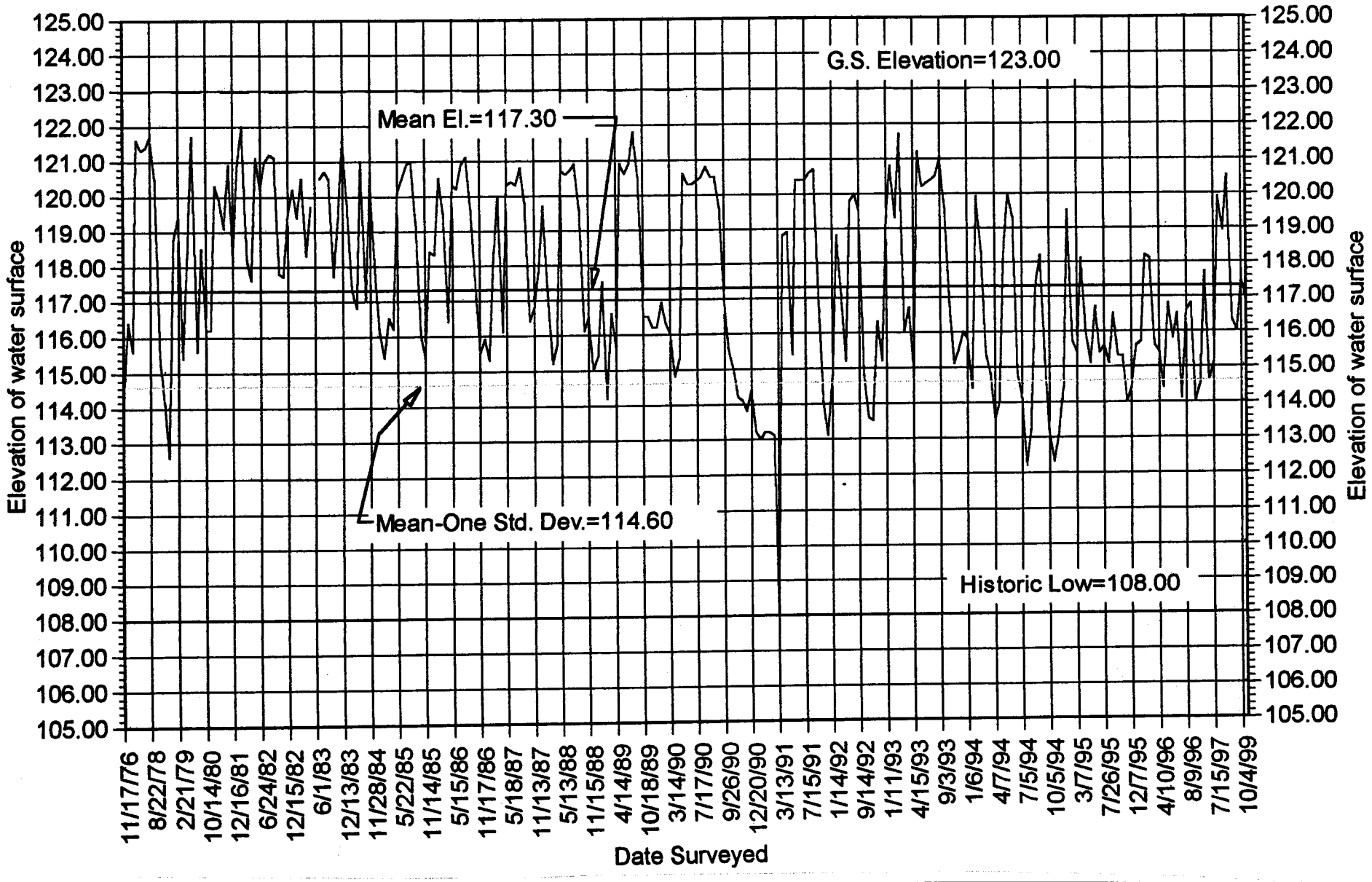
Ground Water Levels 20N02W05A01M

Sacramento Valley (Glenn Co.)



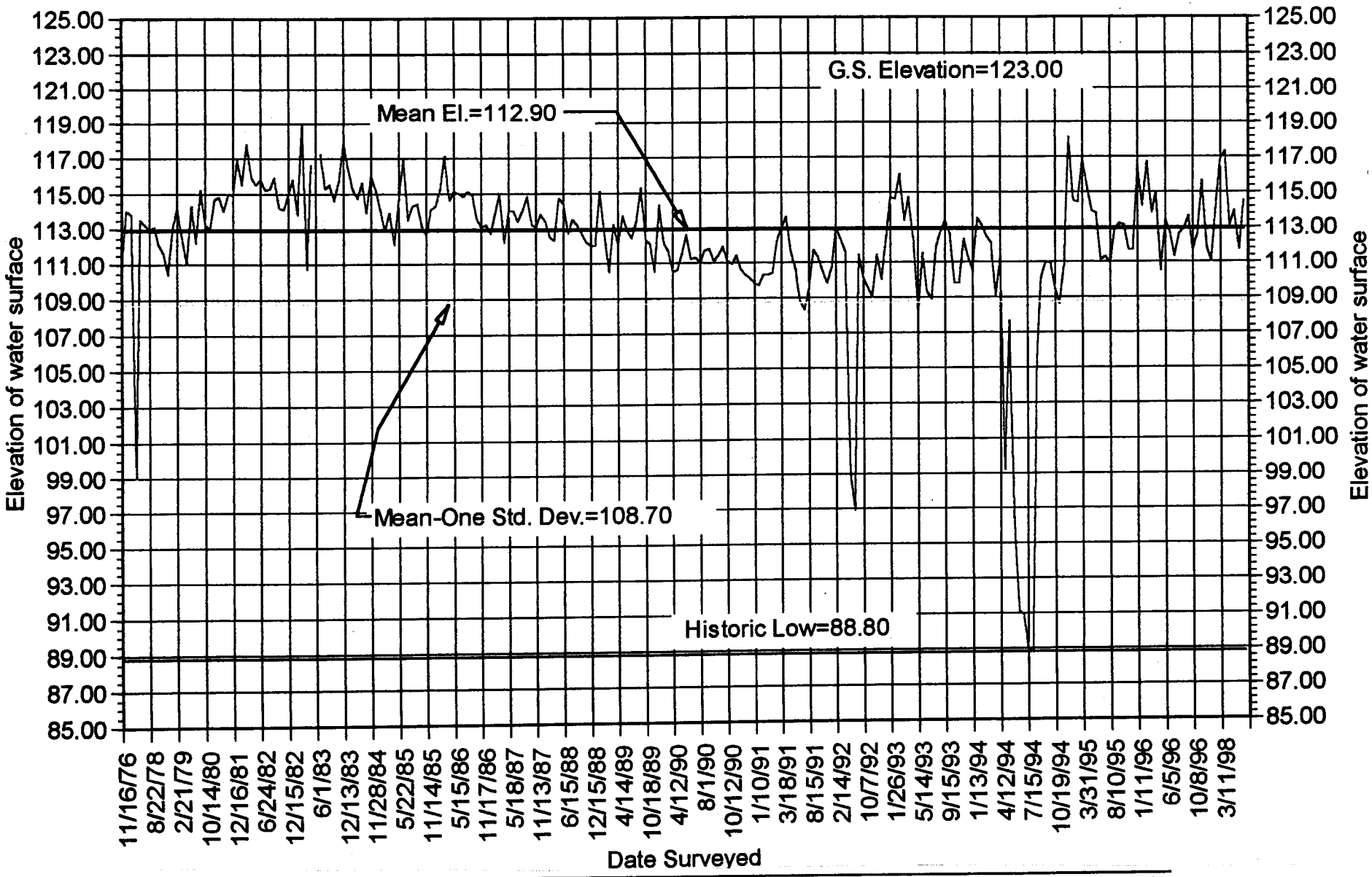
Ground Water Levels 20N02W11A01M

Sacramento Valley (Glenn Co.)



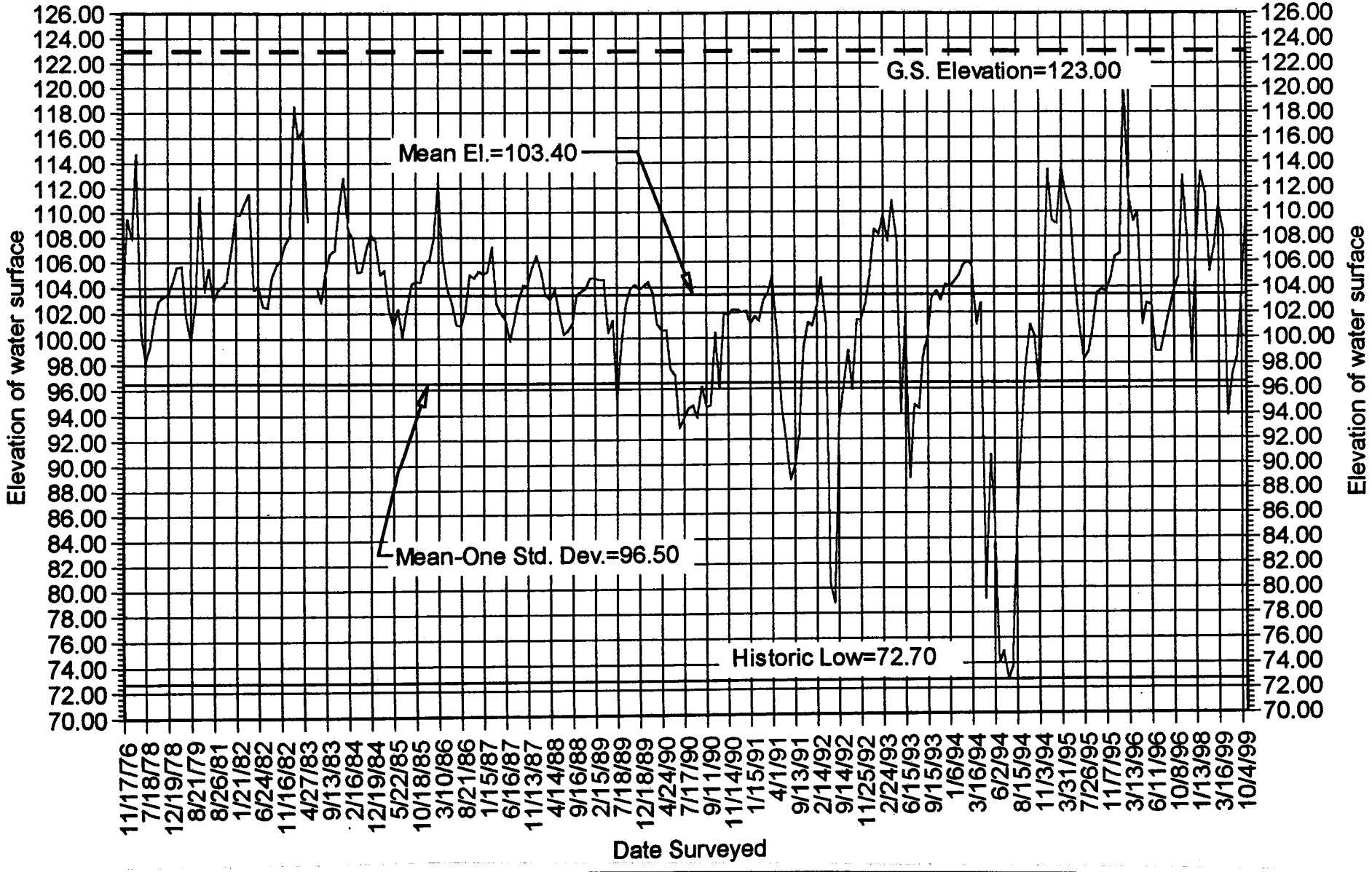
Ground Water Levels 20N02W11A02M

Sacramento Valley (Glenn Co.)



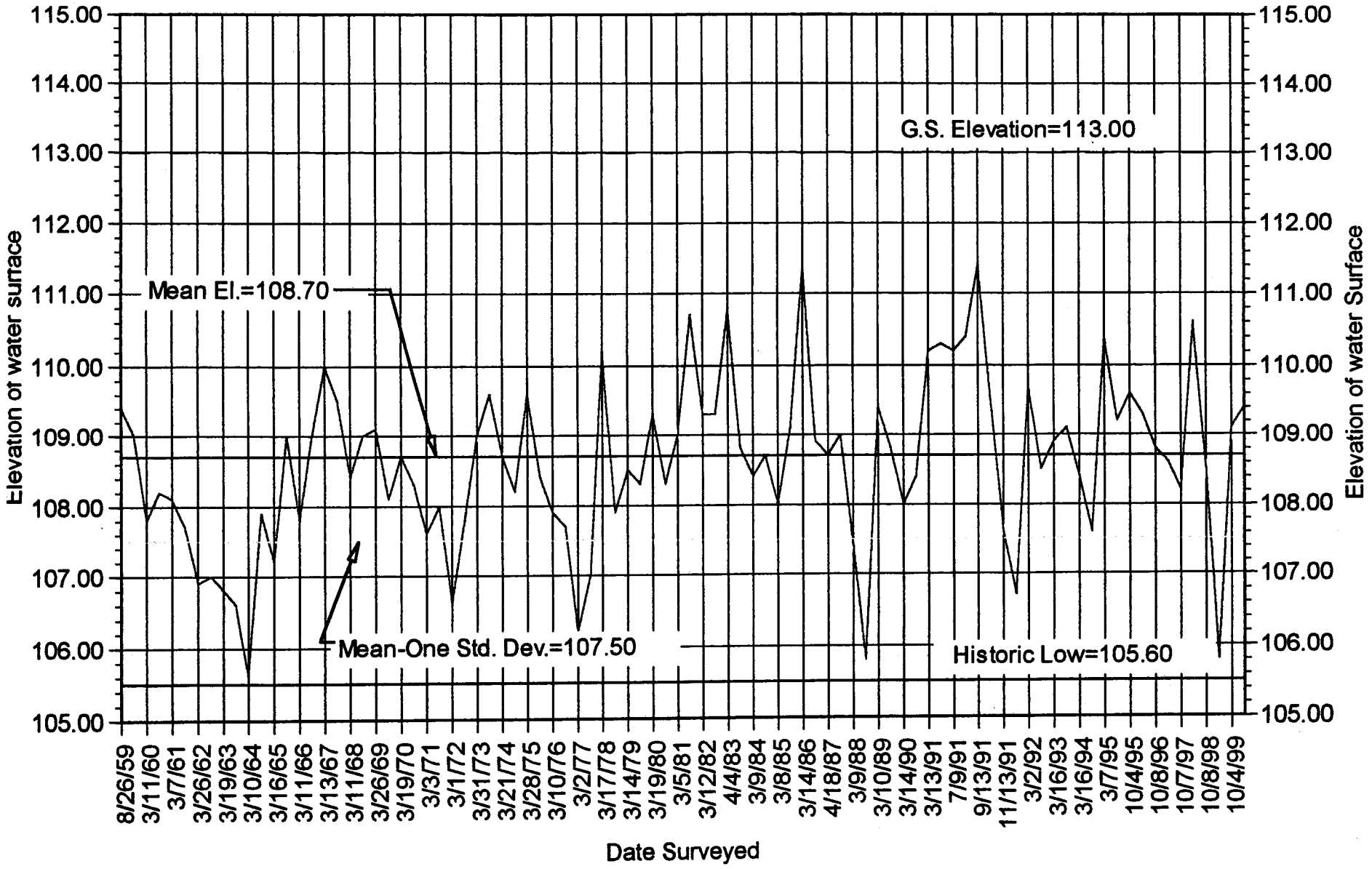
Ground Water Levels 20N02W11A03M

Sacramento Valley (Glenn Co.)



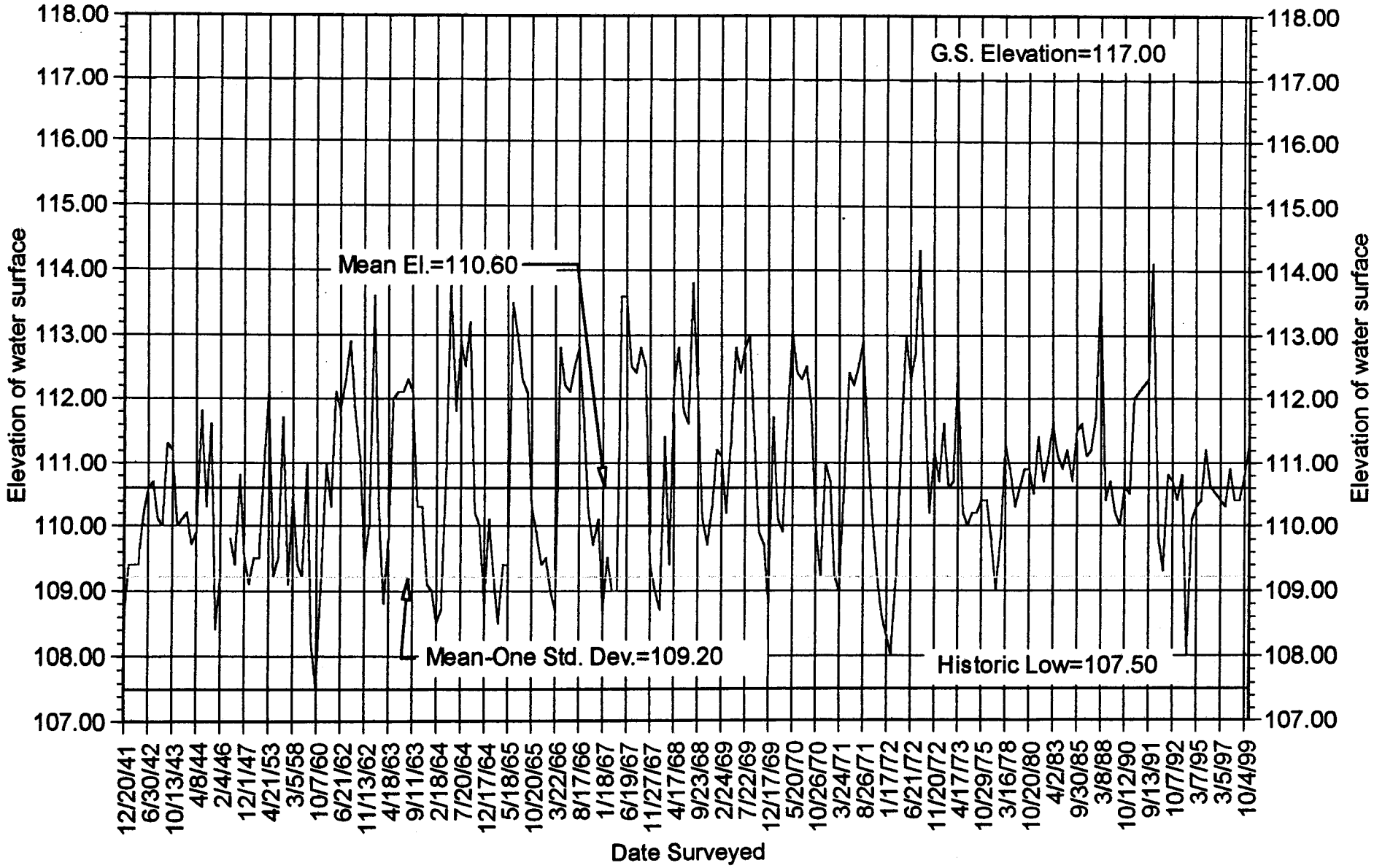
Ground Water Levels 20N02W13G01M

Sacramento Valley (Glenn Co.)



Ground Water Levels 20N02W29G01M

Sacramento Valley (Glenn Co.)



Basin Management Objective

Glenn County

Sub-area 12

Provident Irrigation District

Basin Management Objective
Glenn County
Sub-area 12
Provident Irrigation District

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: Elwood Weller

Objective: To maintain the groundwater surface elevation at a level that will assure an adequate and affordable irrigation water supply. It is the intent of this objective to assure a sustainable agricultural water supply now and into the future. The objective is also to assure an adequate groundwater supply for all domestic users in the sub-area.

Location of BMO Key Wells: See attached map.

Groundwater Level Monitoring Network: Department of Water Resources – Northern District

Groundwater Level Measurements By: Department of Water Resources – Northern District

Groundwater Level Monitoring Frequency:
Semiannual.
Spring (March-April)
Fall (October-November)

Groundwater Well Numbering System: State

BMO Key Wells and BMO Determination Methodology (See Cover Report for Discussion of Numbered BMO Methodologies):

Well No.	Well ID***	Method*	Stage 1 & 2 Alerts**		Stage 3 Alerts**	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
1	19N02W13J01M	5	78	8	72	14
2	18N02W36B01M	5	65	8	60	13
3	19N02W34F01M	5	79	4	76	7
4	19N02W36H01M	5	75	6.4	70	11.4

* - See Cover Report for description of method.
** - See attached hydrographs.
*** - BMO Key Wells are the same for Sub-area 12 and Sub-area 14. Well No. 2 is outside of Glenn County but provides representative groundwater level conditions in the southern portions of Sub-area 12 and Sub-area 14.

BMO Alert Stage Definitions:

The District will use the following guidelines in the management of our groundwater resources.

Stage 1: The first year that groundwater levels fall below the average groundwater level established for the well and still above the lowest record level for the well.

Stage 2: Stage 2 is reached if groundwater levels, for a second consecutive year, remain below the average groundwater level established for the well and still above the lowest record level for the well.

Stage 3: Stage 3 is reached if the groundwater levels fall below the lowest historic water level since 1975.

BMO Compliance Evaluation Procedure:

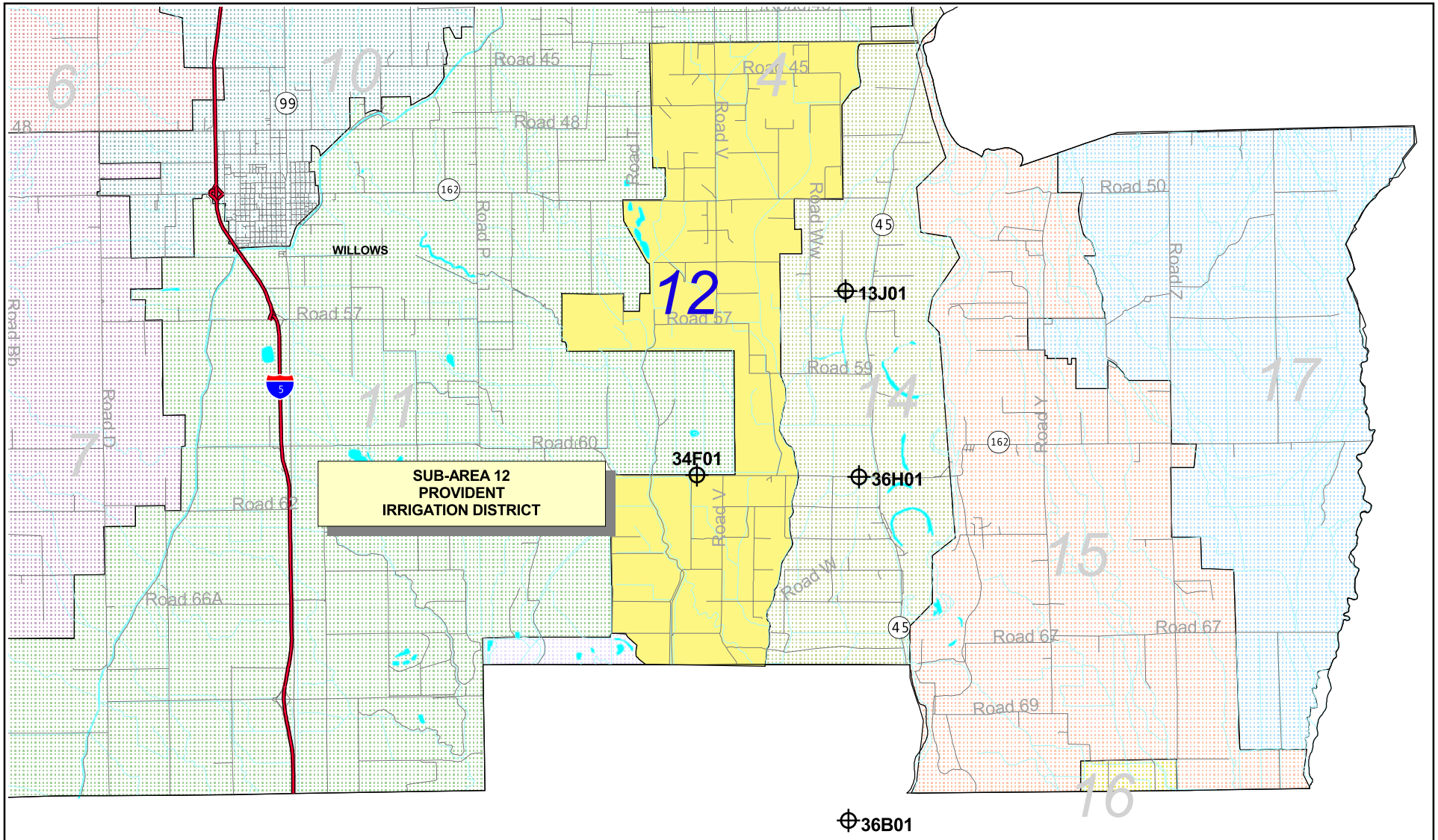
Compliance with the BMO will be determined following the spring measurement period. The groundwater surface elevations at each monitoring well will be compared against the corresponding compliance graph and stage definition criteria to determine if the groundwater surface elevations are above or below specific alert trigger levels. The Technical Advisory Committee of the Glenn County Water Advisory Committee will perform this evaluation and report the results of the evaluation to the WAC.

Monitoring Recommendations:

Efforts should be made to identify possible additional wells that could be added to the existing monitoring well network in sub-area to improve the overall coverage within the region.

Supporting Data:

ATTACHED.

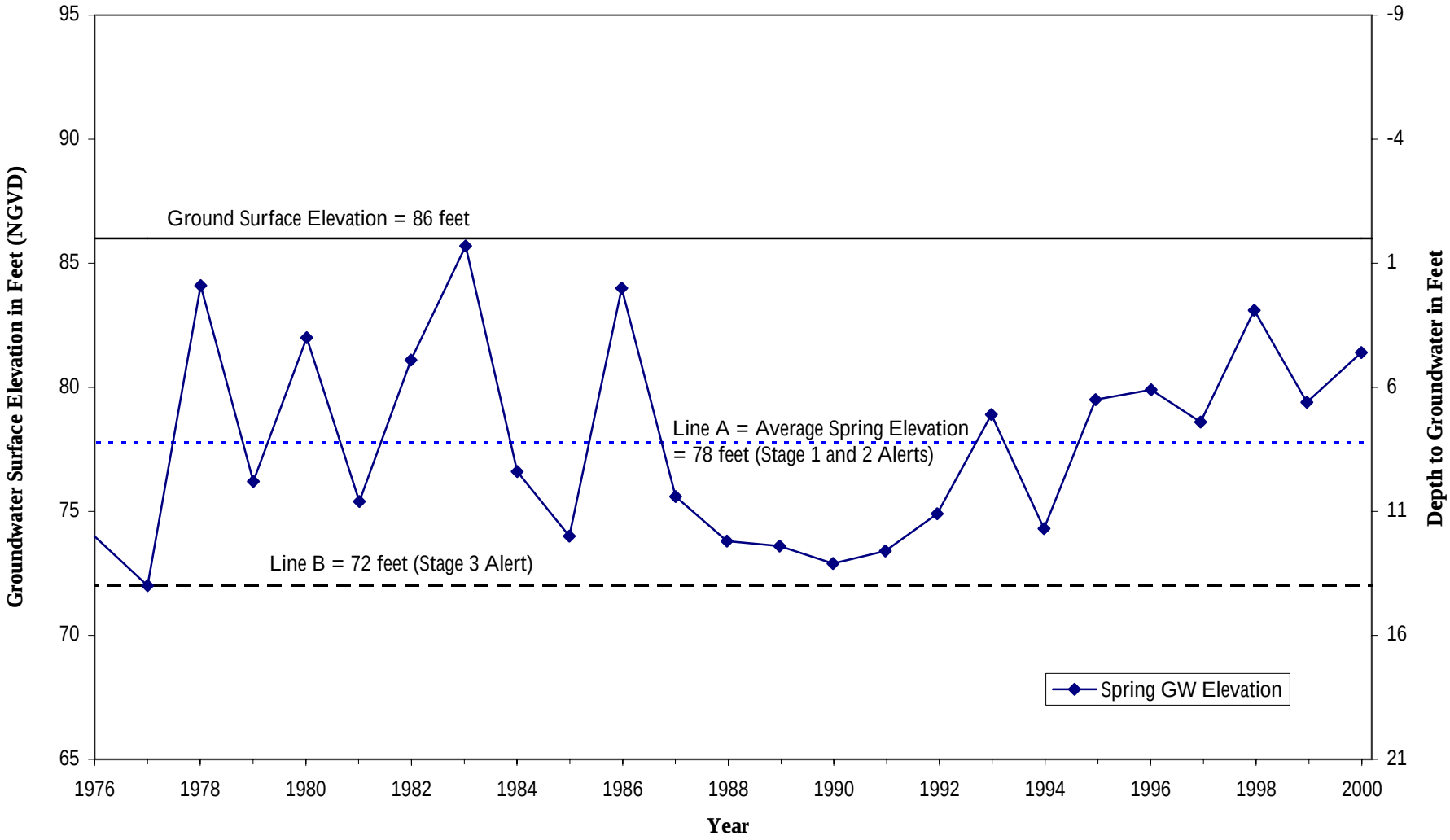


Glenn County Groundwater Management Ordinance No. 1115

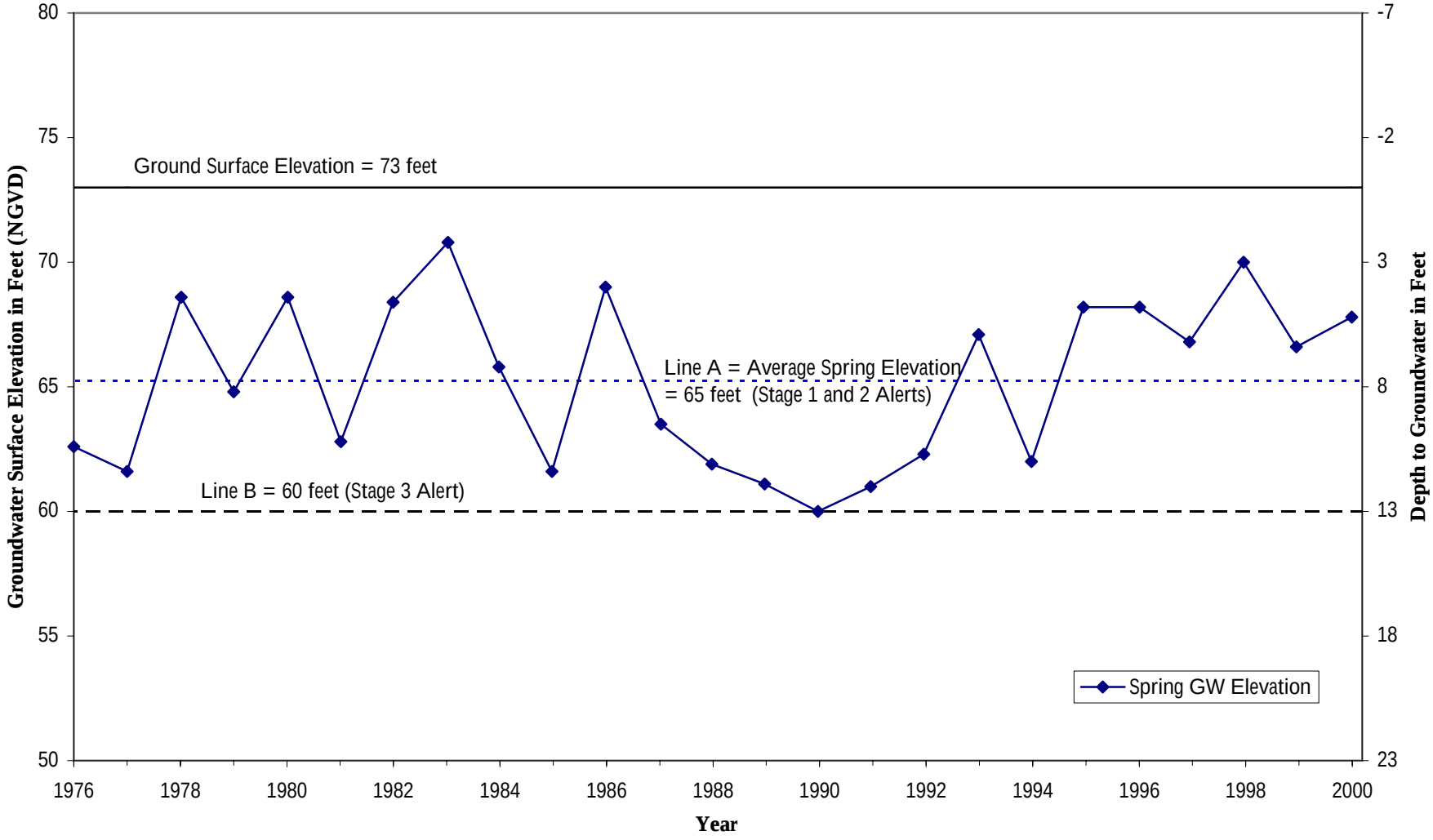
Sub-Area 12
Provident Irrigation District

August 21, 2001

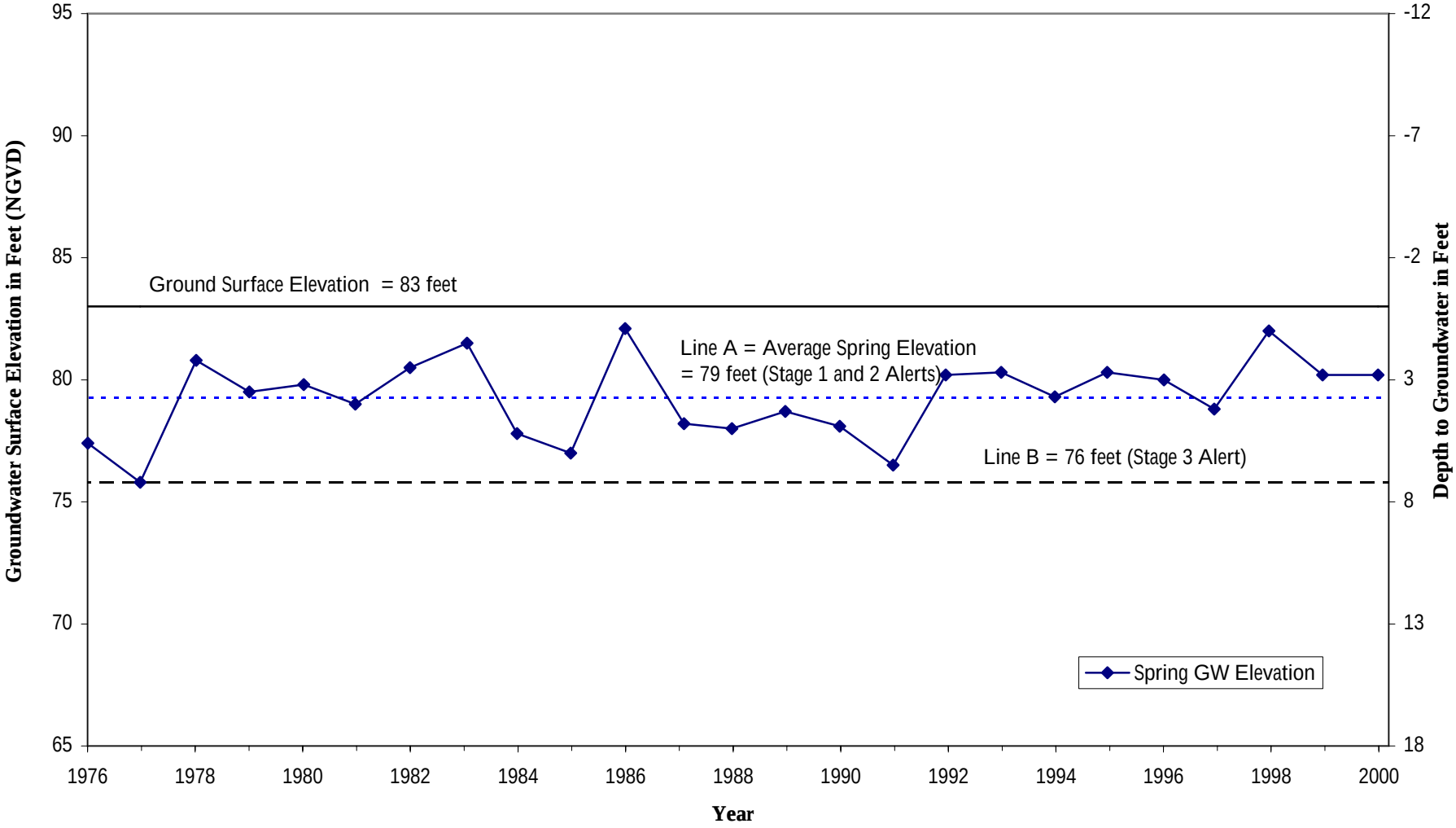
Basin Management Objective - Method 5
Sacramento Vally Groundwater Basin - Glenn County
Area 12 - Provident Irrigation District
Well #19N02W13J01M



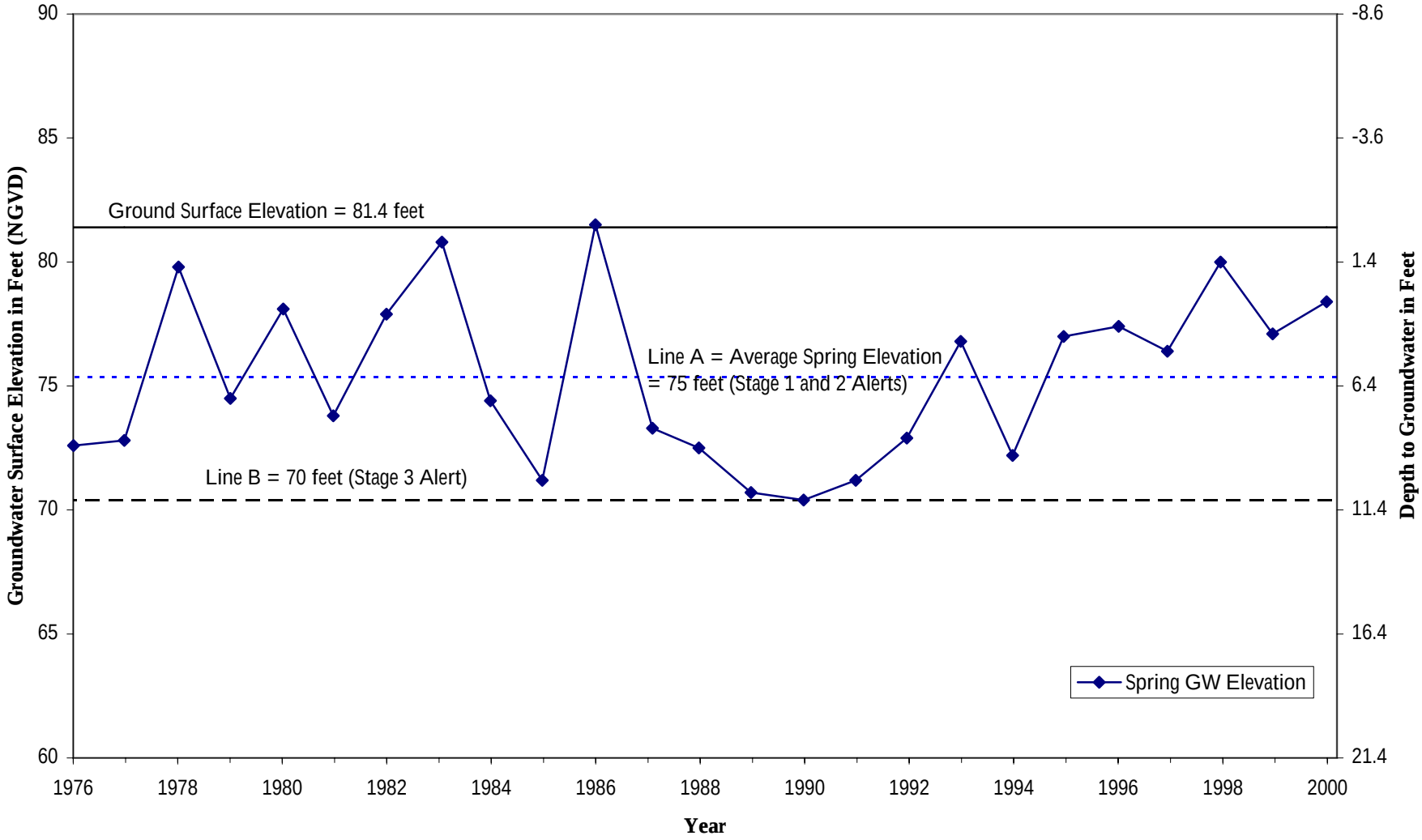
Basin Management Objective - Method 5
Sacramento Vally Groundwater Basin - Glenn County
Area 12 - Provident Irrigation District
Well #18N02W36B01M



Basin Management Objective - Method 5
Sacramento Vally Groundwater Basin - Glenn County
Area 12 - Provident Irrigation District
Well #19N02W34F01M



Basin Management Objective - Method 5
Sacramento Vally Groundwater Basin - Glenn County
Area 12 - Provident Irrigation District
Well #19N02W36H01M



Basin Management Objective

Glenn County

Sub-area 13

Willow Creek Mutual Water

Company

Basin Management Objective
Glenn County
Sub-area 13
Willow Creek Mutual Water Company

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: Frank Torres

Objective: To maintain the groundwater surface elevation at a level that will assure an adequate and affordable irrigation water supply. It is the intent of this objective to assure a sustainable agricultural water supply now and into the future. The objective is also to assure an adequate groundwater supply for all domestic users in the sub-area.

Location of BMO Key Wells: See attached map. (Location Willow Creek Mutual Water Company Well No. 4 approximated.)

Groundwater Level Monitoring Network: Willow Creek Mutual Water Company

Groundwater Level Measurements By: Willow Creek Mutual Water Company

Groundwater Level Monitoring Frequency:
Semiannual*.
Spring (March-April)
Fall (October-November)
*Historically, measurements in late Summer/early Fall.

Groundwater Well Numbering System: Willow Creek Mutual Water Company

BMO Key Wells and BMO Determination Methodology (See Cover Report for Discussion Of Numbered BMO Methodologies):

Well No.	Well ID	Method*	Stage 1 & 2 Alerts**		Stage 3 Alerts**	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
1	Well No. 4	6	80.5	14.5	61.5	33.5

* - See Cover Report for description of method.
** - See attached hydrographs.

BMO Alert Stage Definitions:

The District will use the following guidelines in the management of our groundwater resources.

Stage 1: The first year that groundwater levels fall below the average groundwater level established for the well and still above the lowest record level for the well.

Stage 2: Stage 2 is reached if groundwater levels, for a second consecutive year, remain below the average groundwater level established for the well and still above the lowest record level for the well.

Stage 3: Stage 3 is reached if the groundwater levels fall below the lowest historic water level.

BMO Compliance Evaluation Procedure:

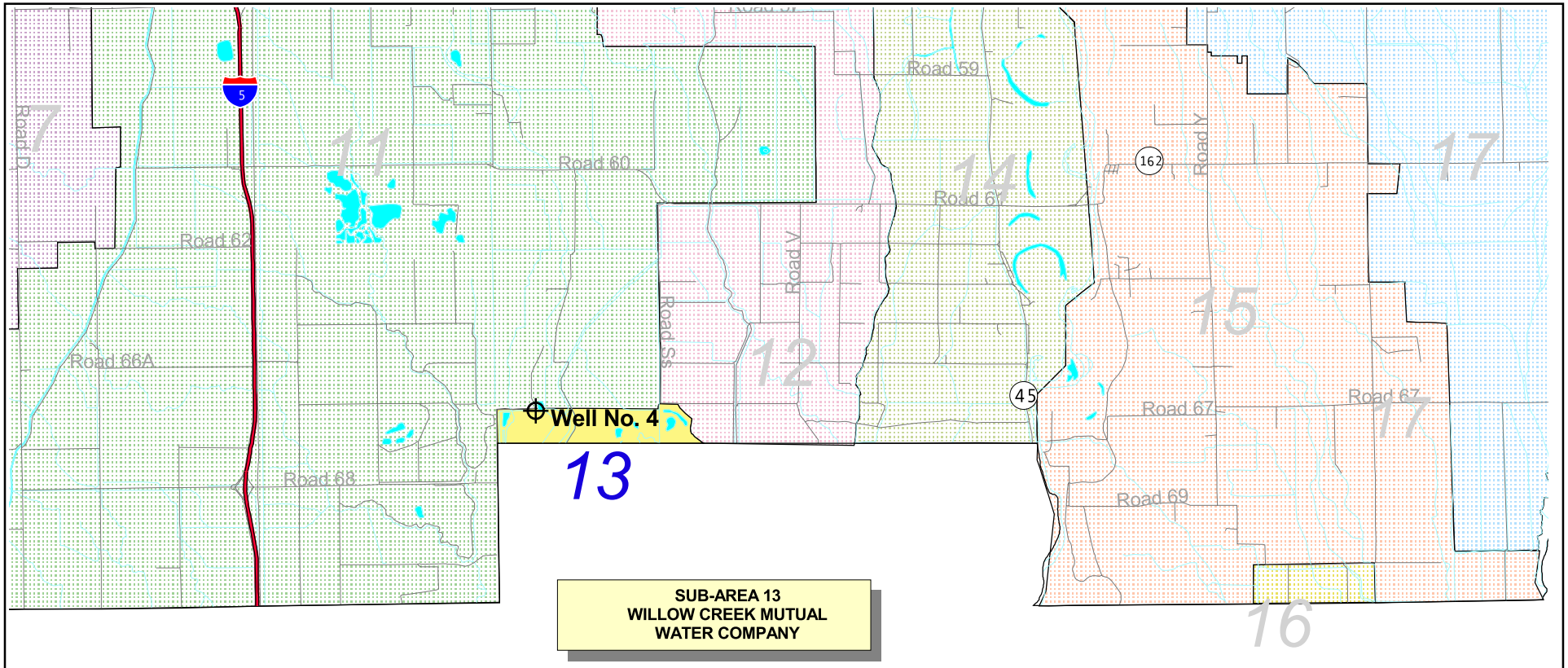
Compliance with the BMO will be determined following the summer/early fall measurement period. The groundwater surface elevations at each monitoring well will be compared against the corresponding compliance graph and stage definition criteria to determine if the groundwater surface elevations are above or below specific alert trigger levels. The Technical Advisory Committee of the Glenn County Water Advisory Committee will perform this evaluation and report the results of the evaluation to the WAC.

Monitoring Recommendations:

Efforts should be made to identify possible wells that could be added to the existing monitoring well network in the sub-area to improve the overall coverage within the region. Development of a new monitoring well should be considered as part of the AB303 grant money recently awarded to Glenn County.

Supporting Data:

Attached.



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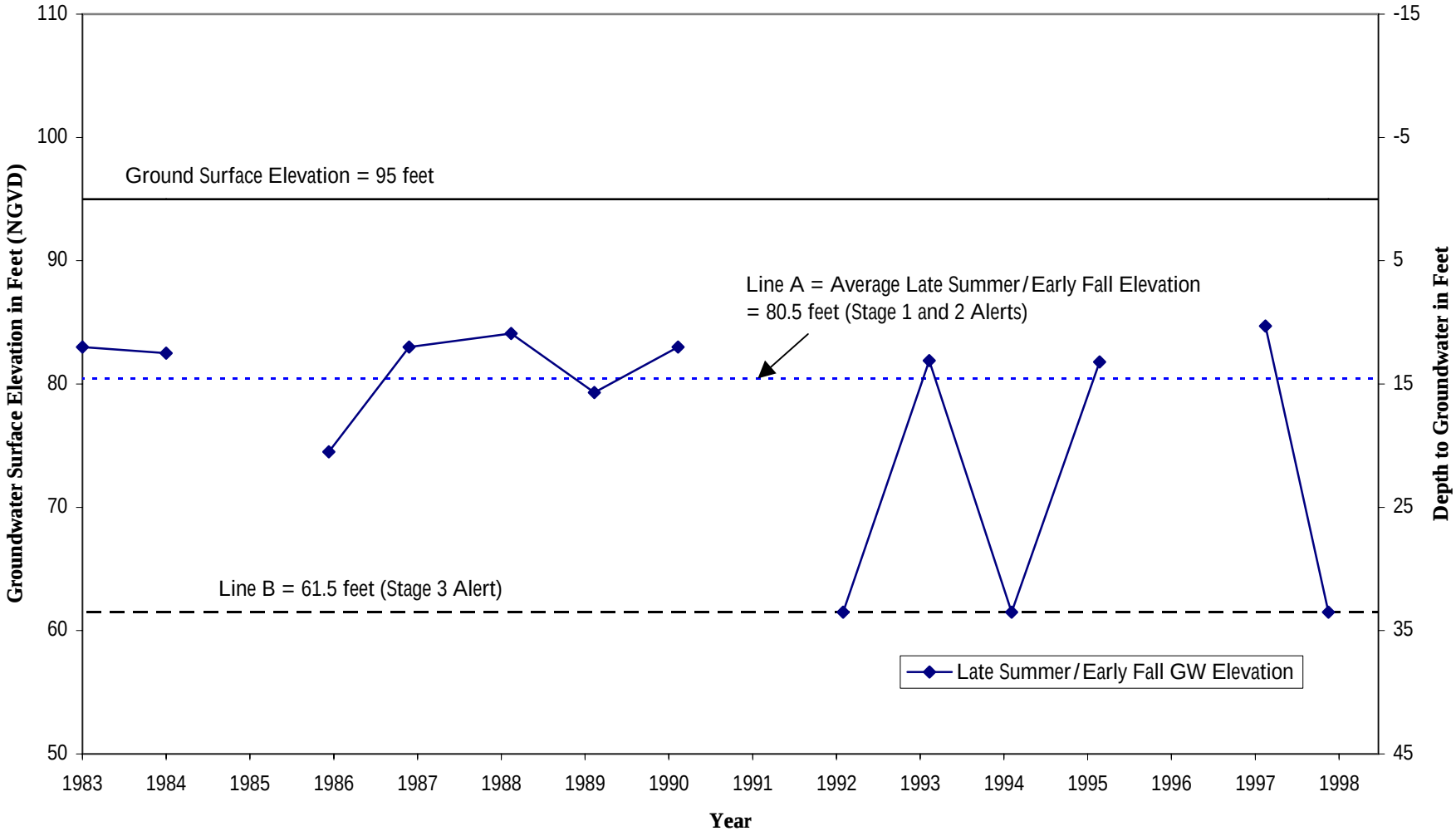
Legend

⊕ Wells used in BMO calculation

Glenn County Groundwater Management Ordinance No. 1115	**Sub-Area 13** **Willow Creek Mutual Water Company**	August 21, 2001

Basin Management Objective - Method 6
Sacramento Vally Groundwater Basin - Glenn County
Area 13 - Willow Creek Mutal Water Company
Well No.4



Basin Management Objective

Glenn County

Sub-area 14

Princeton-Codora-Glenn Irrigation

District

Basin Management Objective
Glenn County
Sub-area 14
Princeton-Codora-Glenn Irrigation District

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: David Alves

Objective: To maintain the groundwater surface elevation at a level that will assure an adequate and affordable irrigation water supply. It is the intent of this objective to assure a sustainable agricultural water supply now and into the future. The objective is also to assure an adequate groundwater supply for all domestic users in the sub-area.

Location of BMO Key Wells: See attached map.

Groundwater Level Monitoring Network: Department of Water Resources – Northern District

Groundwater Level Measurements By: Department of Water Resources – Northern District

Groundwater Level Monitoring Frequency:
Semiannual.
Spring (March-April)
Fall (October-November)

Groundwater Well Numbering System: State

BMO Key Wells and BMO Determination Methodology (See Cover Report for Discussion of Numbered BMO Methodologies):

Well No.	Well ID***	Method*	Stage 1 & 2 Alerts**		Stage 3 Alerts**	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
1	19N02W13J01M	5	78	8	72	14
2	18N02W36B01M	5	65	8	60	13
3	19N02W34F01M	5	79	4	76	7
4	19N02W36H01M	5	75	6.4	70	11.4

* - See Cover Report for description of method.
** - See attached hydrographs.
*** - BMO Key Wells are the same for Sub-area 12 and Sub-area 14. Well No. 2 is outside of GlennCounty but provides representative groundwater level conditions in the southern portions of Sub-area 12 and Sub-area 14.

BMO Alert Stage Definitions:

The District will use the following guidelines in the management of our groundwater resources.

Stage 1: The first year that groundwater levels fall below the average Spring groundwater level established for the well and still above the lowest record level for the well.

Stage 2: Stage 2 is reached if Spring groundwater levels, for a second consecutive year, remain below the average groundwater level established for the well and still above the lowest record level for the well.

Stage 3: Stage 3 is reached if the Spring groundwater levels fall below the lowest historic water level since 1975.

BMO Compliance Evaluation Procedure:

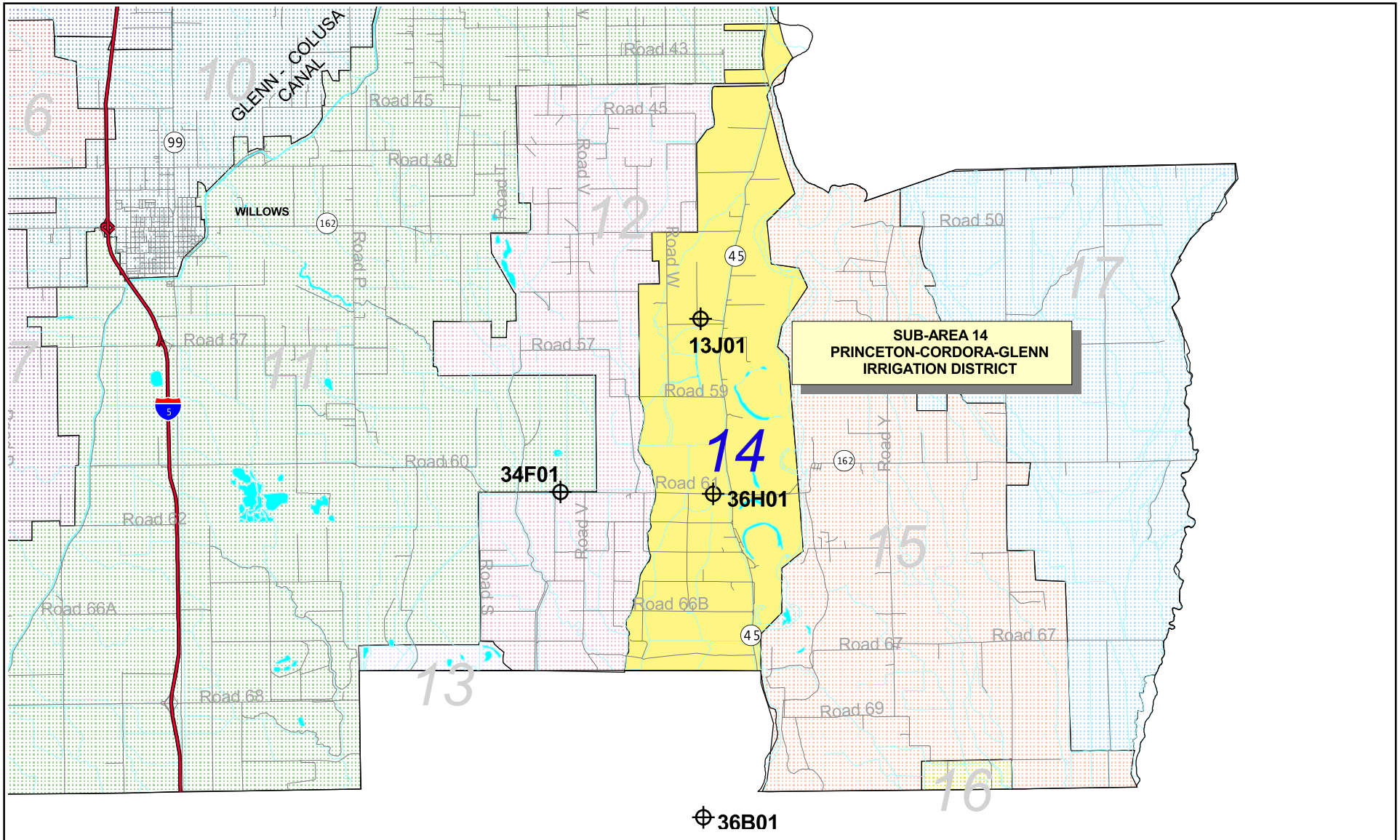
Compliance with the BMO will be determined following the spring measurement period. The groundwater surface elevations at each monitoring well will be compared against the corresponding compliance graph and stage definition criteria to determine if the groundwater surface elevations are above or below specific alert trigger levels. The Technical Advisory Committee of the Glenn County Water Advisory Committee will perform this evaluation and report the results of the evaluation to the WAC.

Monitoring Recommendations:

Efforts should be made to identify possible additional wells that could be added to the existing monitoring well network in the sub-area to improve the overall coverage within the region.

Supporting Data:

ATTACHED.



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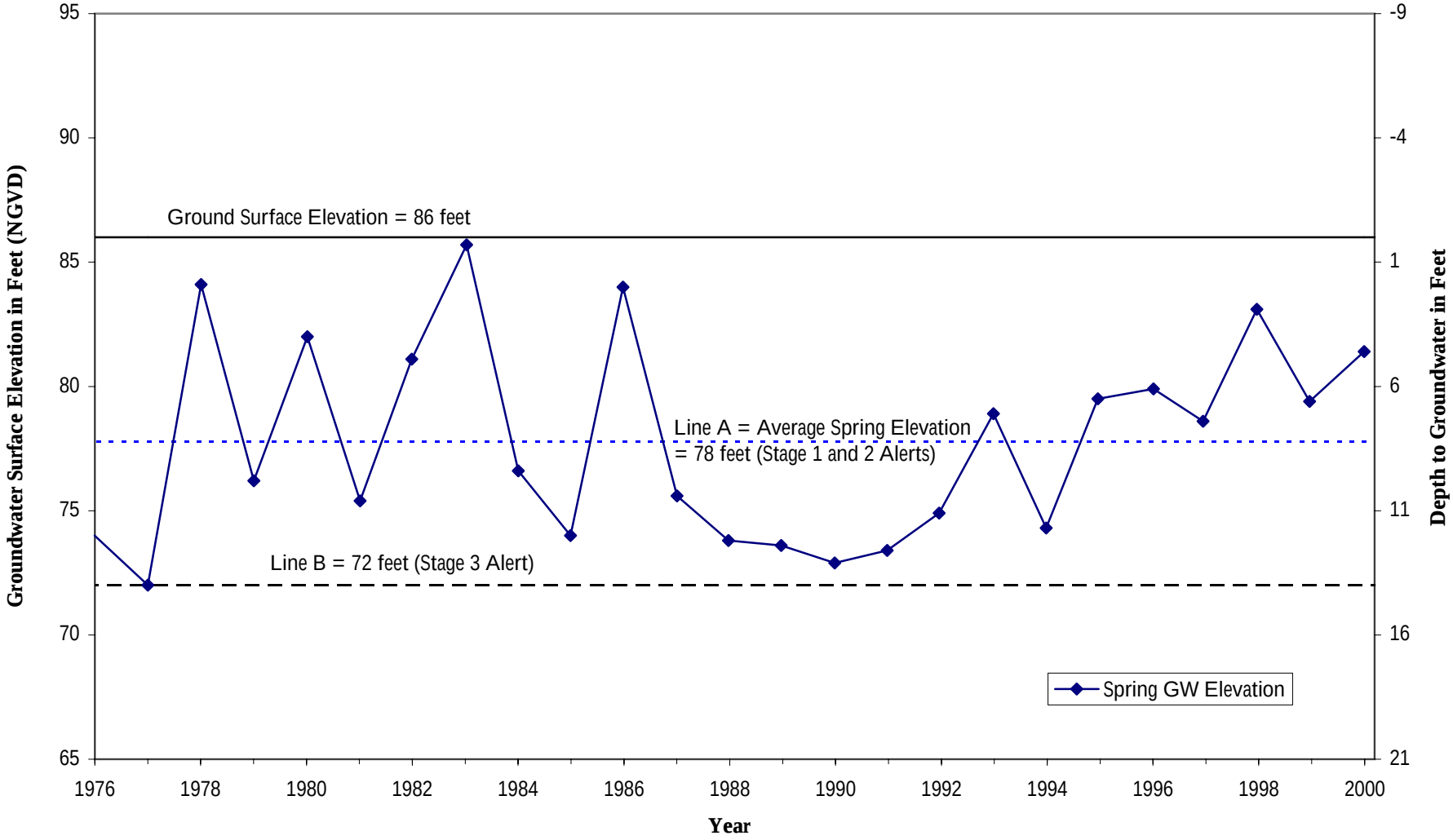
Legend

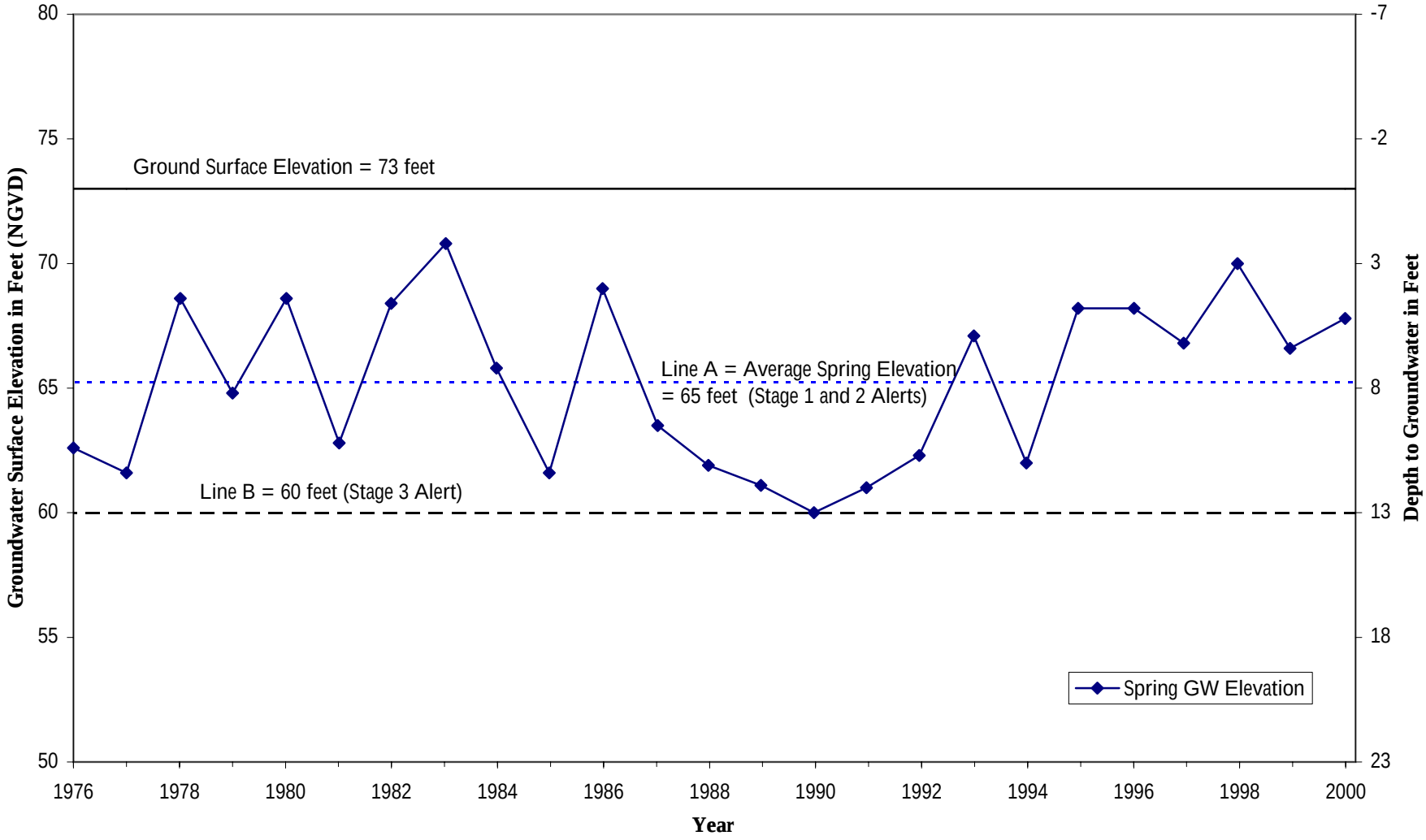
⊕ Wells used in BMO calculation

Glenn County Groundwater Management Ordinance No. 1115	**Sub-Area 14** **Princeton-Cordora-Glenn Irrigation District**	August 21, 2001

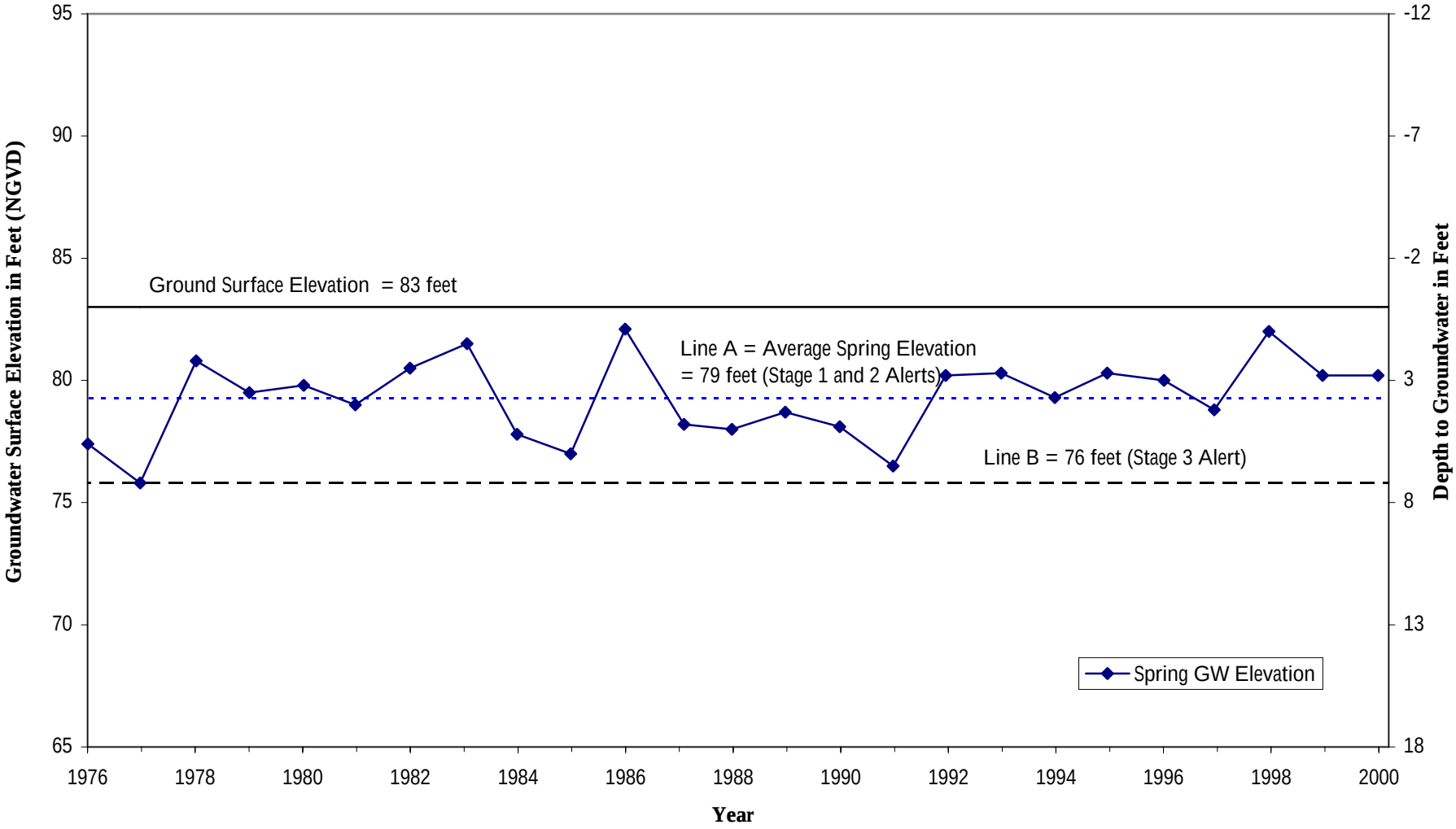
Basin Management Objective - Method 5
Sacramento Vally Groundwater Basin - Glenn County
Area 14 - Princeton-Codora-Glenn Irrigation District
Well #19N02W13J01M



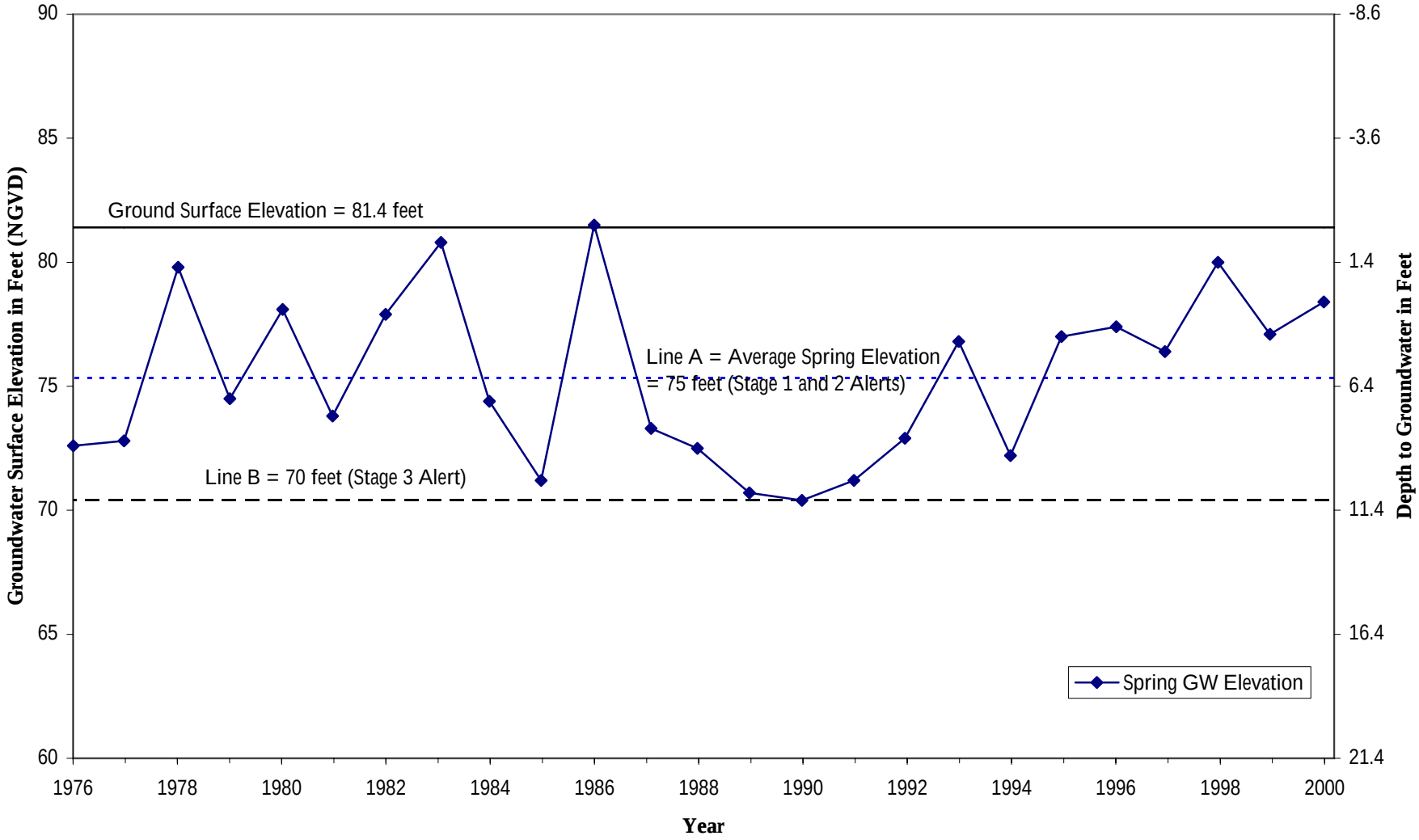
Basin Management Objective - Method 5
Sacramento Vally Groundwater Basin - Glenn County
Area 14 - Princeton-Codora-Glenn Irrigation District
Well #18N02W36B01M



Basin Management Objective - Method 5
Sacramento Vally Groundwater Basin - Glenn County
Area 14 - Princeton-Codora-Glenn Irrigation District
Well #19N02W34F01M



Basin Management Objective - Method 5
Sacramento Vally Groundwater Basin - Glenn County
Area 14 - Princeton-Codora-Glenn Irrigation District
Well #19N02W36H01M



Basin Management Objective

Glenn County

Sub-area 15

Reclamation District 2106

Basin Management Objective
Glenn County
Sub-area 15
Reclamation District 2106

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: Gene Clark

Objective: To maintain the groundwater surface elevation at a level that will assure an adequate and affordable irrigation water supply. It is the intent of this objective to assure a sustainable agricultural water supply now and into the future. The objective is also to assure an adequate groundwater supply for all domestic users in the sub-area.

Location of BMO Key Wells: See attached map.

Groundwater Level Monitoring Network: Department of Water Resources – Northern District

Groundwater Level Measurements by: Department of Water Resources – Northern District

Groundwater Level Monitoring Frequency:
Semiannual.
Spring (March-April)
Fall (October-November)

Groundwater Well Numbering System: State

BMO Key Wells and BMO Determination Methodology (See Cover Report for Discussion of Numbered BMO Methodologies):

Well No.	Well ID	Method*	Stage 1 & 2 Alerts**		Stage 3 Alerts**	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
1	19N01W15D01M	2	78	13	75	16
2	19N01W27R01M	2	67	14	63	18
3	18N01W17G01M	2	61	18	55	24
4	18N01W22L01M	2	63	7	61	9

* - See Cover Report for description of method.
** - See attached hydrographs.

BMO Alert Stage Definitions:

The Glenn County Water Advisory Committee (WAC) upon a recommendation of its Technical Advisory Committee shall declare a Stage 1, Stage 2, or Stage 3 Alert based on the technical criteria presented below. The technical criteria for the WAC to rescind the Stage 1, Stage 2, or Stage 3 Alert is also presented. The alert criteria are based on the recommended methodology

developed by the Glenn County Water Advisory Committee – Technical Advisory Committee. The results of the analysis are presented in the Supporting Data section of this summary. See BMO Methodology 2 in the Cover Report for a technical discussion of how the compliance lines A & B were developed.

A Stage 1 Alert will be declared when any measured Spring groundwater surface elevation is below Line A for the corresponding BMO Key Well.

A Stage 2 Alert will be declared on the second, and subsequent sequential years, when any measured Spring groundwater surface elevation is below Line A. The Glenn County Technical Advisory Committee may declare a Stage 2 Alert during the first year of noncompliance if the situation warrants.

A Stage 3 Alert will occur when any measured spring groundwater surface elevation is below the elevation specified by Line B for a corresponding BMO Key Well.

Stage 1 and 2 Alerts shall be rescinded by the WAC when all the measured Spring groundwater surface elevations return to an elevation above Line A for the corresponding BMO Key Wells.

The WAC shall rescind a Stage 3 Alert when the measured Spring groundwater surface elevations return to an elevation above Lines B and A for the corresponding BMO Key Wells. A Stage 3 Alert may be down-graded to a Stage 2 Alert if all the measured Spring groundwater surface elevations are above Line B but remain below the compliance elevation specified by Line A.

BMO Compliance Evaluation Procedure:

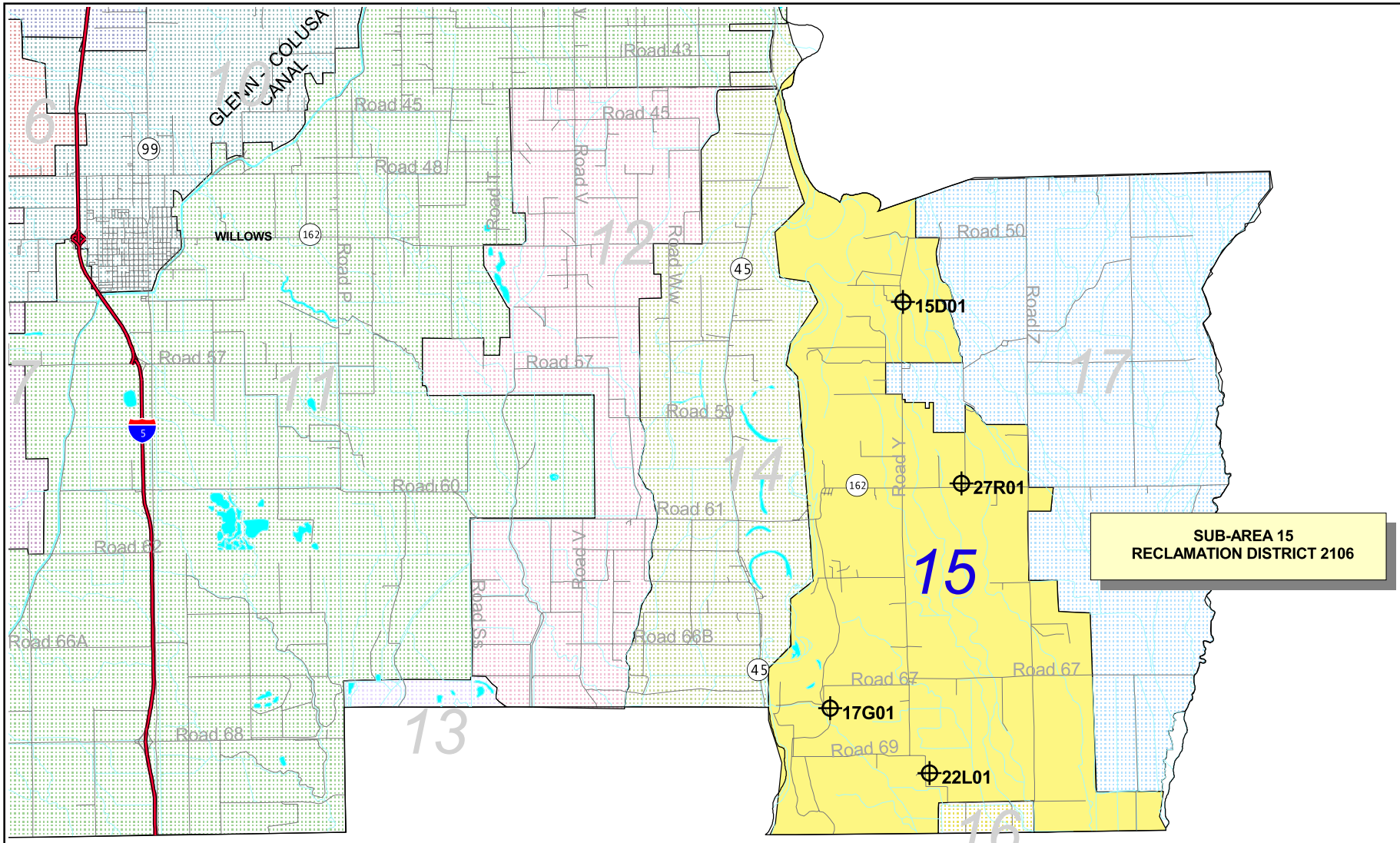
Compliance with the BMO will be determined following the spring measurement period. The groundwater surface elevations at each monitoring well will be compared against the corresponding compliance graph and stage definition criteria to determine if the groundwater surface elevations are above or below specific alert trigger levels. The Technical Advisory Committee of the Glenn County Water Advisory Committee will perform this evaluation and report the results of the evaluation to the WAC.

Monitoring Recommendations:

Efforts should be made to identify possible additional wells that could be added to the existing monitoring well network in the northwestern portion of the sub-area to improve the overall coverage within the region.

Supporting Data:

ATTACHED.



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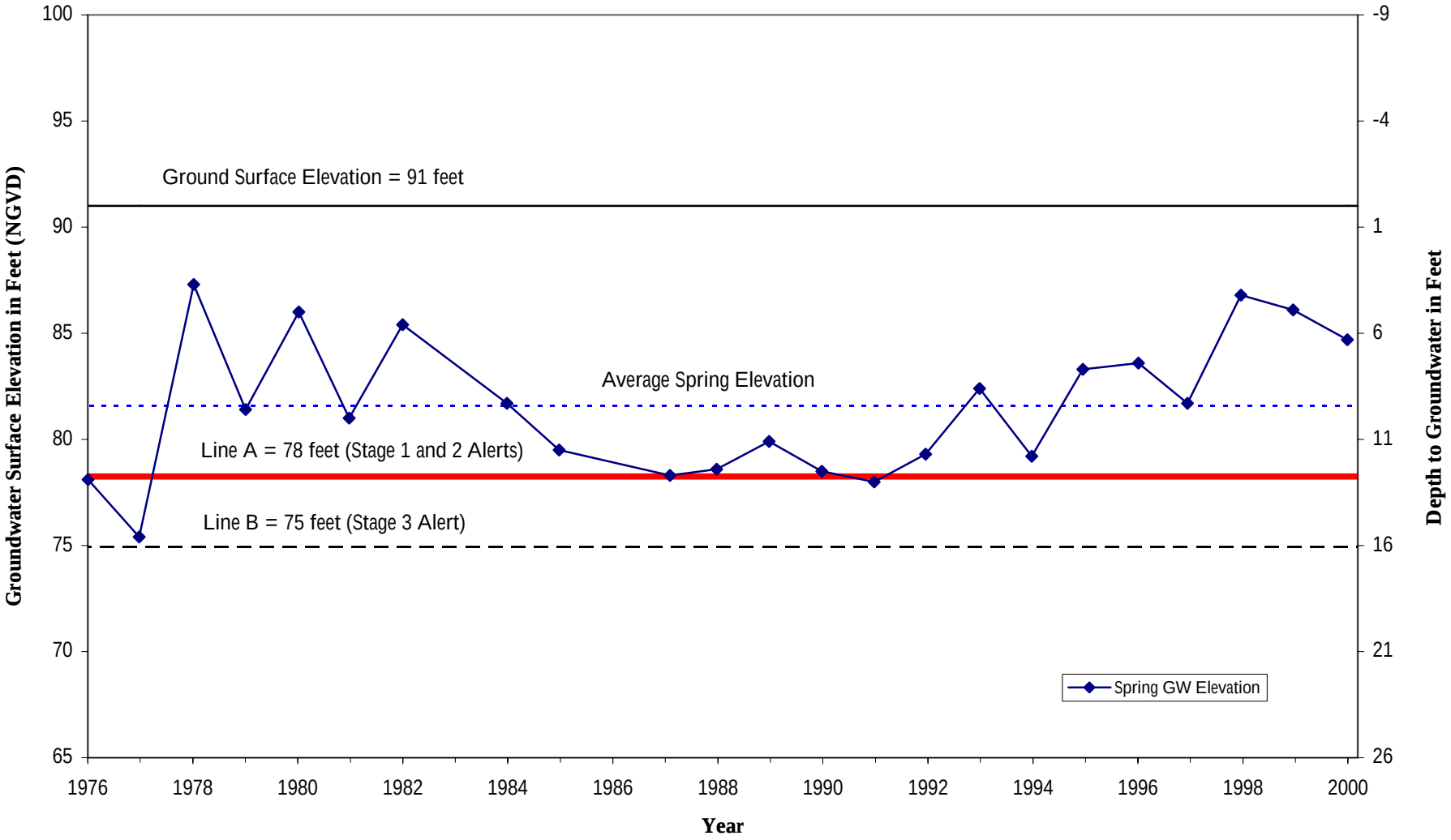
Legend

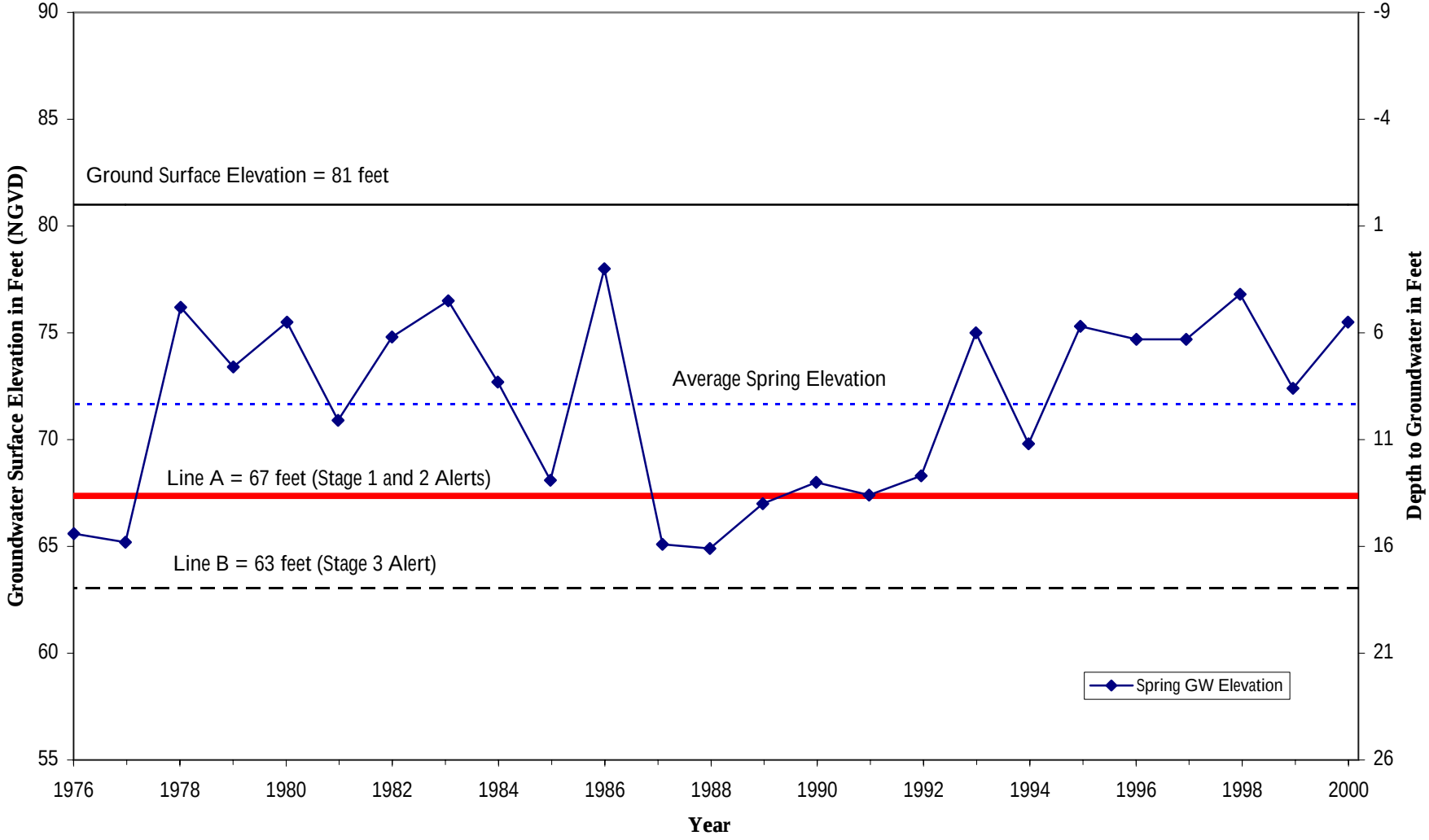
⊕ Wells used in BMO calculation

Glenn County Groundwater Management Ordinance No. 1115	**Sub-Area 15** **Reclamation District 2106**	August 21, 2001

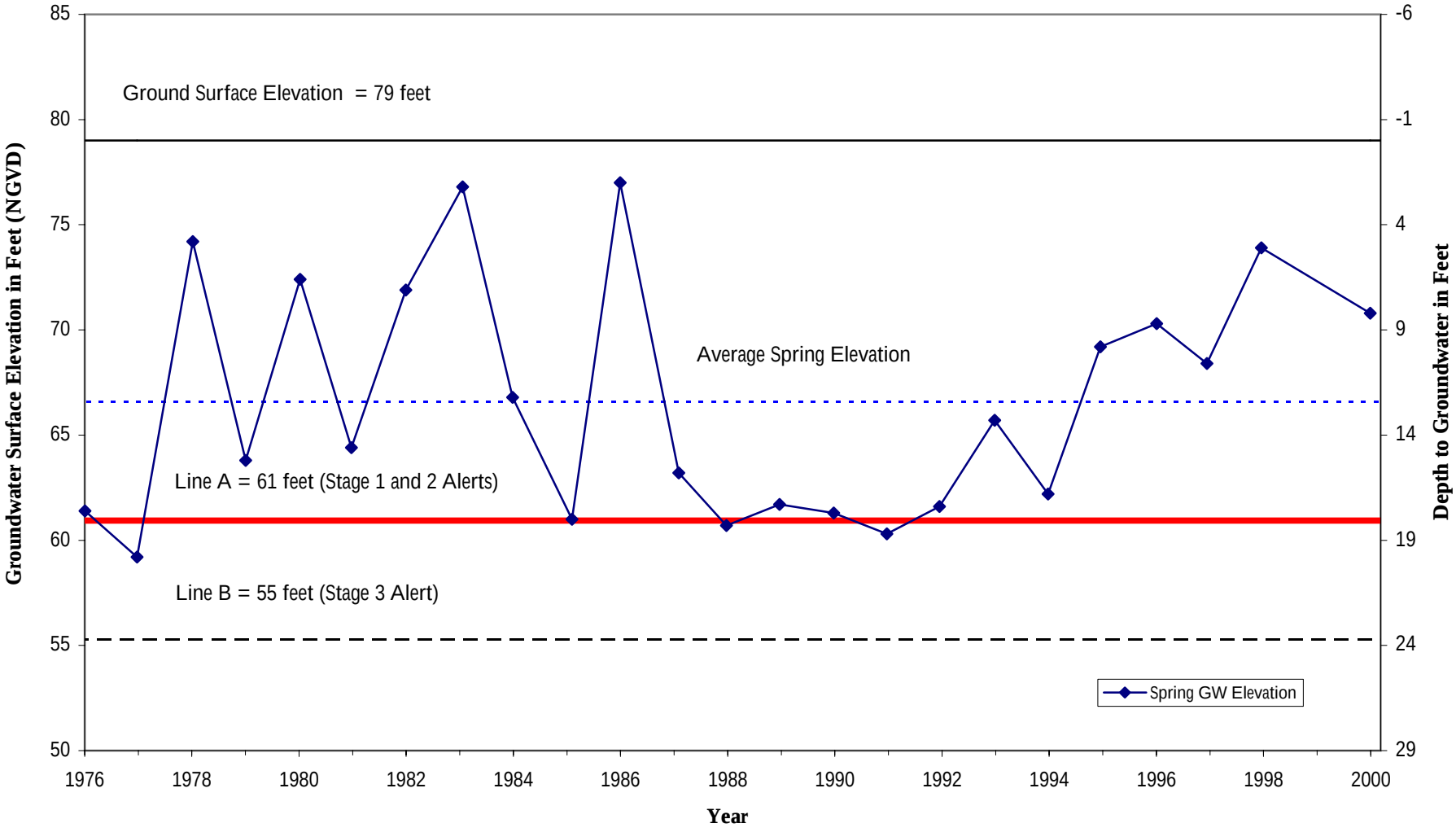
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 15 (Reclamation District 2106)
Well #19N01W15D01M



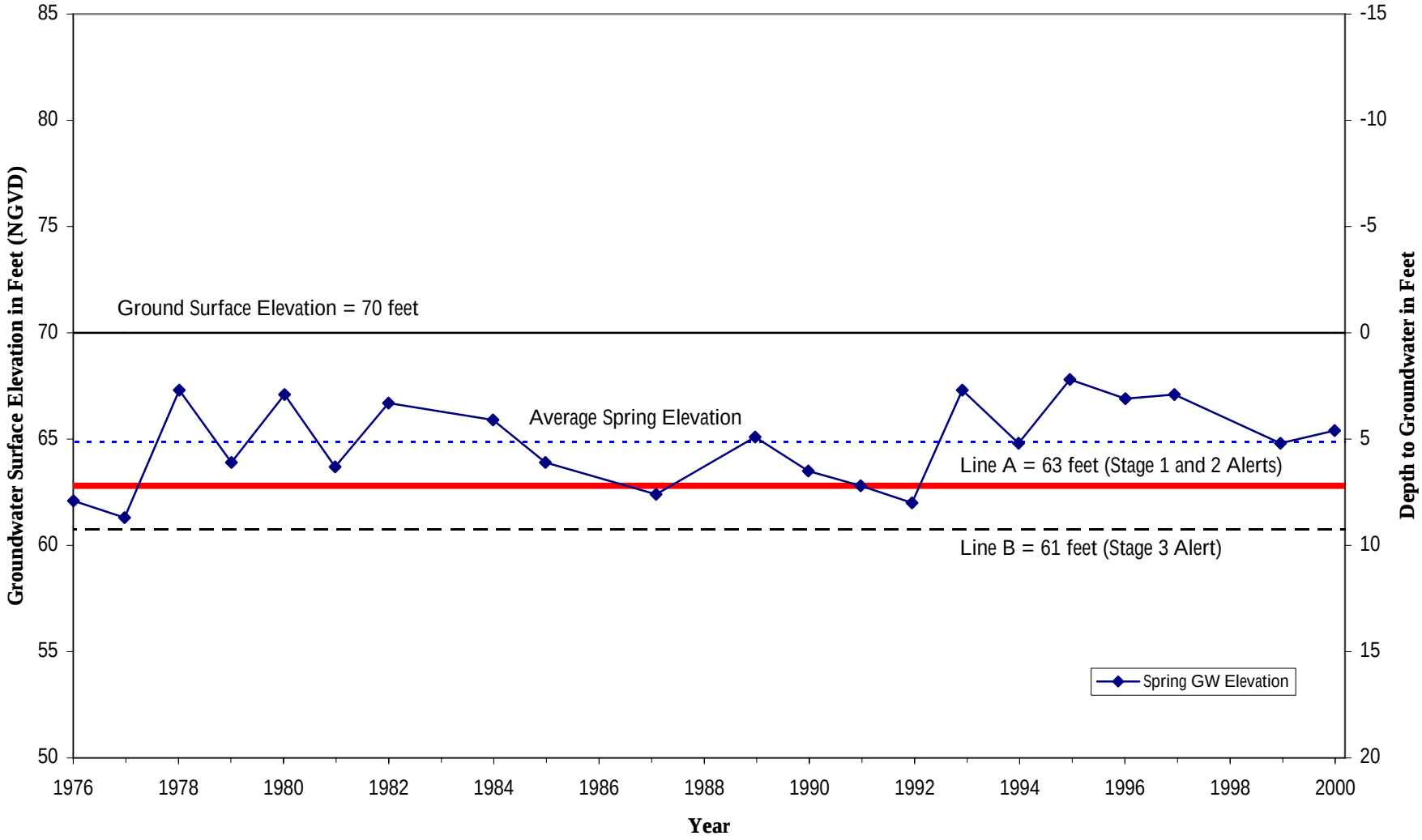
Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 15 (Reclamation District 2106)
Well #19N01W27R01M



Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 15 (Reclamation District 2106)
Well #18N01W17G01M



Basin Management Objective - Method 2
Sacramento Vally Groundwater Basin - Glenn County
Area 15 (Reclamation District 2106)
Well #18N01W22L01M



Provisional Basin Management

Objective

Glenn County

Sub-area 16

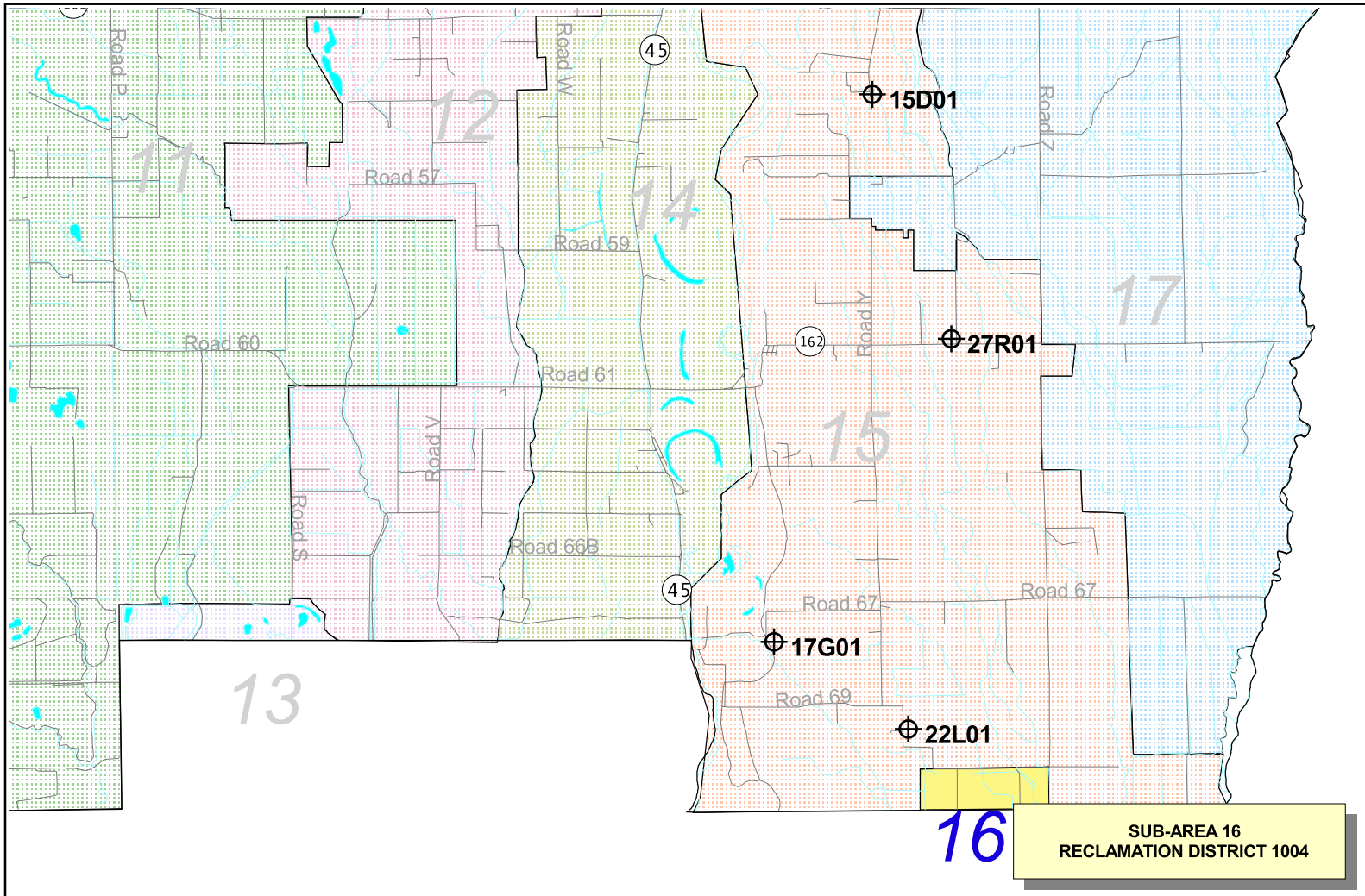
Reclamation District 1004

Provisional Basin Management Objective
Glenn County
Sub-area 16
Reclamation District 1004

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: Jack Baber

Special Circumstances: See sub-area 16 map on following page. No monitored wells were found for this sub-area. No BMO has been established at this time. BMO Key Wells for Sub-area 15 are located nearby most notably Well ID 18N01W22L01M. Sub-area 15 BMO's will serve as a surrogate for Sub-area 16 on a provisional basis, with the intent of developing a BMO in the future.



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Legend

Wells used in BMO calculation

Glenn County Groundwater Management Ordinance No. 1115	**Sub-Area 16** **Reclamation District 1004**	August 21, 2001

Basin Management Objective

Glenn County

Sub-area 17

Western Canal Water District

Basin Management Objective
Glenn County
Sub-area 17
Western Canal Water District

Calendar Year: 2001

Glenn County Water Advisory Committee Representative: Matt Colwell

Objective: To prevent long-term depletion of groundwater in storage and maintain adequate groundwater supply for all domestic users in the sub-area.

Location of BMO Key Wells: See attached map.

Groundwater Level Monitoring Network: Department of Water Resources – Northern District and Western Canal Water District

Groundwater Level Measurements By: Department of Water Resources – Northern District and Western Canal Water District

Groundwater Level Monitoring Frequency:
Semiannual.
Spring (March)
Fall (October)

Groundwater Well Numbering System: State

BMO Key Wells and BMO Determination Methodology (See Cover Report for Discussion Of Numbered BMO Methodologies):

Well No.	Well ID	Method*	Stage 1 & 2 Alerts**		Stage 3 Alerts**	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
1	18N01E17D01M	2	64	6.4	62	8.4
2	19N01W13Q01M	Other	78 (Avg. – 5')	7.9	73 (Avg. – 10')	12.9

* - See Cover Report for description of method.
** - See attached hydrographs.

BMO Alert Stage Definitions:

The Glenn County Water Advisory Committee (WAC) upon a recommendation of its Technical Advisory Committee shall declare a Stage 1, Stage 2, or Stage 3 Alert based on the technical criteria presented below. The technical criteria for the WAC to rescind the Stage 1, Stage 2, or Stage 3 Alert is also presented. The alert criteria are based on the recommended methodology developed by the Glenn County Water Advisory Committee -–Technical Advisory Committee. The results of the analysis are presented in the Supporting Data section of this summary. See

BMO Methodology in the Cover Report for a technical discussion of how the compliance lines A & B were developed.

A Stage I Alert will be declared when any measured Spring groundwater surface elevation is below Line A for the corresponding BMO Key Well.

A Stage II Alert will be declared on the second, and subsequent sequential years, when any measured Spring groundwater surface elevation is below Line A and below the previous Spring groundwater surface elevation. The Glenn County Technical Advisory Committee may declare a Stage II Alert during the first year of noncompliance if a situation warrants.

A Stage III Alert will occur when any measured spring groundwater surface elevation is below the elevation specified by Line B for a corresponding BMO Key Well.

Stage I and II Alerts shall be rescinded by the WAC when all the measured Spring groundwater surface elevations return to an elevation above Line A for the corresponding BMO Key Wells.

The WAC shall rescind a Stage III Alert when the measured Spring groundwater surface elevations return to an elevation above Lines B and A for the corresponding BMO Key Wells. A Stage III Alert may be down-graded to a Stage 2 Alert if all the measured Spring groundwater surface elevation are above Line B but remains below the compliance elevation specified by Line A.

BMO Compliance Evaluation Procedure:

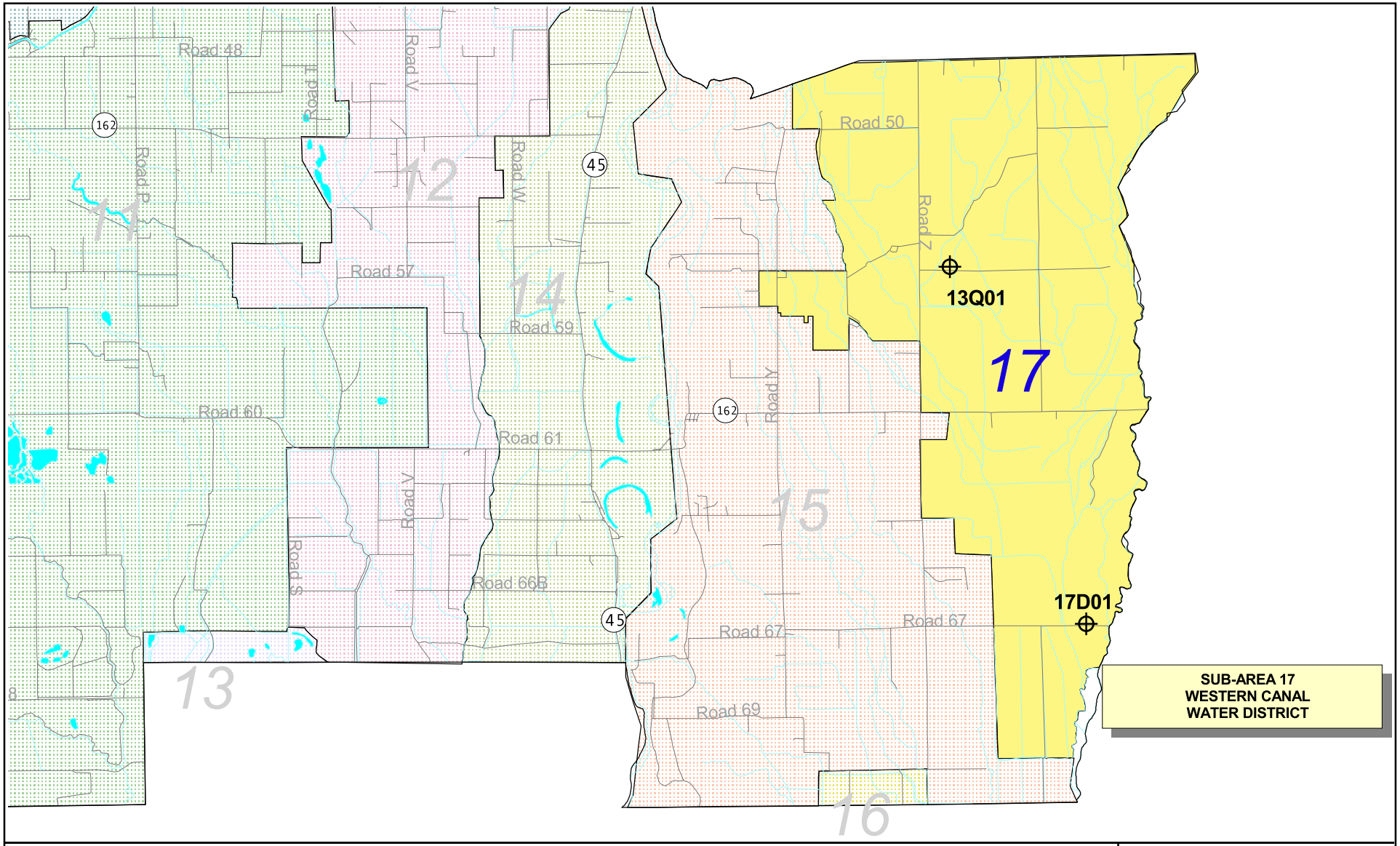
Compliance with the BMO will be determined following the spring measurement period. The groundwater surface elevations at each monitoring well will be compared against the corresponding compliance graph and stage definition criteria to determine if the groundwater surface elevation are above or below specific alert trigger levels. The Technical Advisory Committee of the Glenn County Water Advisory Committee will perform this evaluation and report the results of the evaluation to the WAC.

Monitoring Recommendations:

Additional monitoring wells have been added but lack historical data to be relevant at the present time.

Supporting Data:

ATTACHED.



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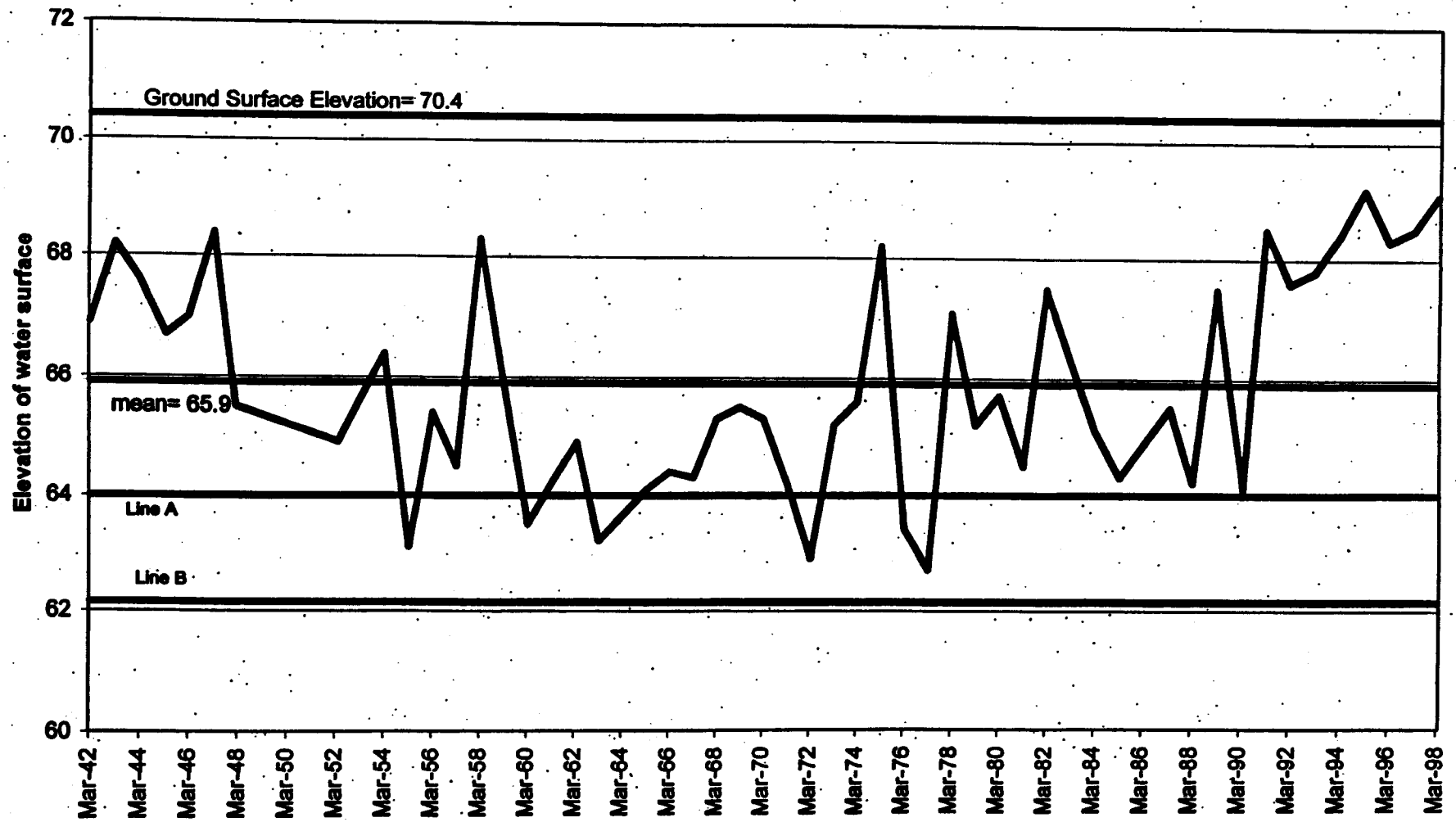
Legend

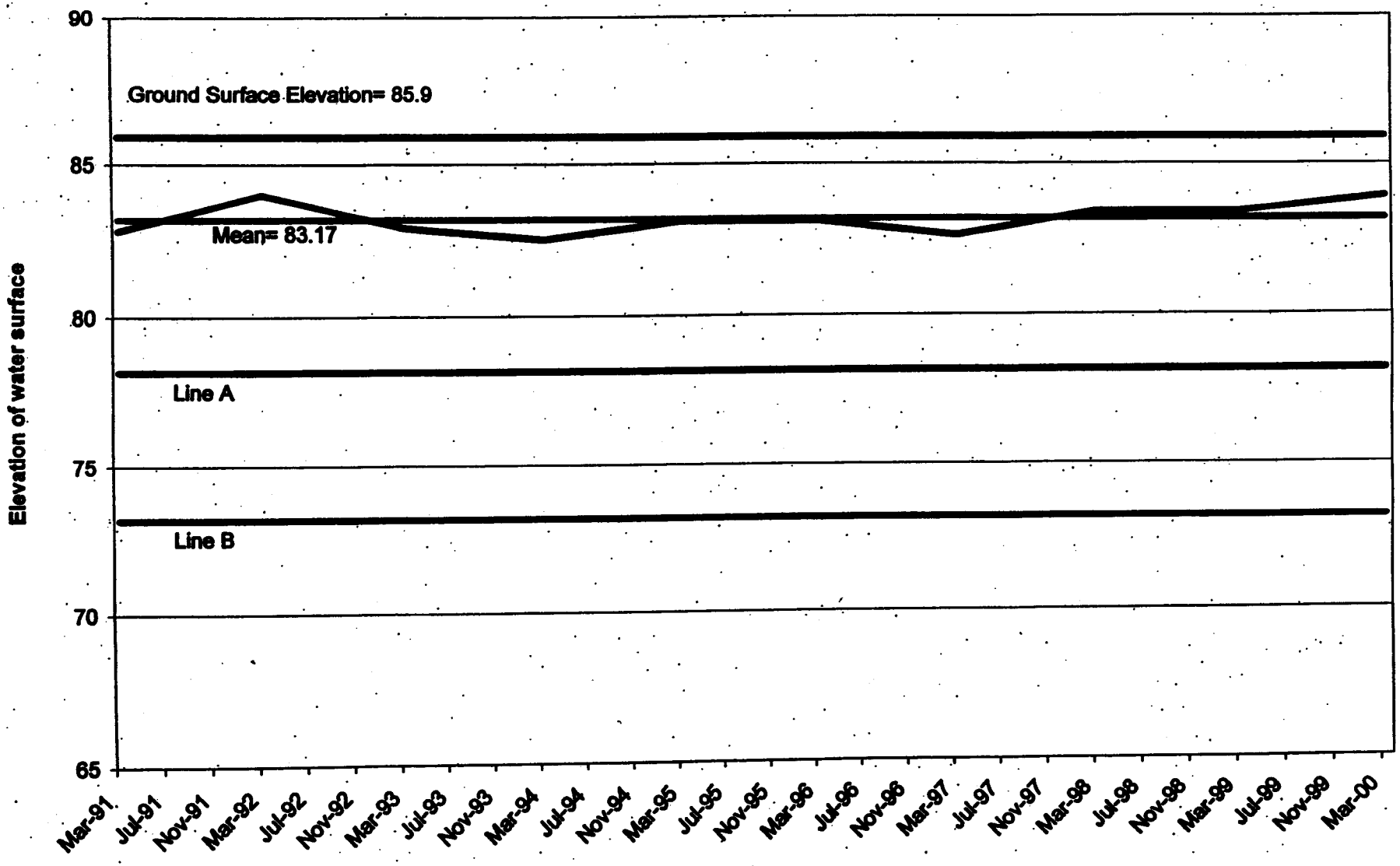
⊕ Wells used in BMO calculation

Glenn County Groundwater Management Ordinance No. 1115	**Sub-Area 17** **Western Canal Water District**	August 21, 2001

Spring Groundwater Elevations 18N01E17D01M



Spring Groundwater Elevations 19N01W13Q01M



Appendix A

Supporting Technical Documents

Attachment 1: Basin Management Objective (BMO) Method of Groundwater Basin Management

Basin Management Objective (BMO)
Method Of Groundwater Basin Management

Revised September 18, 2000
By: Toccoy Dudley
DWR, Northern District

Background

Future groundwater development in the Sacramento Valley will operate within the constraints of local groundwater management ordinances. Many of the existing ordinances, unfortunately, embrace a safe yield -- overdraft concept. Safe yield and overdraft have widespread intuitive appeal and acceptance with much of the water community. Very few, however, fully understand the concept at a technical level, and even fewer can explain it in detail. In other words, everyone knows what it is, but no one can describe it. Even worse, these terms have been used so loosely for so long that they have come to mean whatever anyone wants them to "... we must be in overdraft because I am having trouble with my well."

In many ordinances these two concepts are used in a circular reference, with overdraft defining safe yield, and safe yield defining overdraft. None of the existing ordinances detail a method for estimating safe yield and overdraft, or how it is measured. As a practical matter, estimating safe yield in the Sacramento Valley is nearly impossible.

Why is Safe Yield a Problem in the Sacramento Valley?

On a technical level, safe yield is typically determined by empirical studies that compare groundwater levels to groundwater use. This requires data on groundwater levels and estimates of annual groundwater extraction. There are reasonably good records of groundwater levels in the Sacramento Valley, however, groundwater extraction estimates can only be made with much uncertainty, because there is a general reluctance to meter and maintain good records of groundwater use in the agricultural community.

Another problem with the safe yield concept is that it is perceived in terms of groundwater levels, or changes in groundwater levels, but is defined in terms of groundwater use. For example, "the safe yield of a groundwater basin is 120,000 acre-feet", which is commonly interpreted to mean that the long-term groundwater levels in the groundwater basin will not decline if annual groundwater use remains below 120,000 acre-feet. Looking at this in terms of a

mass balance, what this really means is that the long-term annual recharge to the basin averages 120,000 acre-feet per year. So when the safe yield is expressed as a single number, which it typically is, then the basin recharge rate must remain nearly constant over-time. This is problematic in the Sacramento Valley because recharge rates are highly variable.

Why is Recharge in the Sacramento Valley Variable?

In the Sacramento Valley, and in other groundwater basins where the surface water and groundwater systems are interconnected, a major component of groundwater recharge is seepage from the surface water system. This recharge can either be positive, when surface water recharges the aquifer system, or negative, where the aquifer system discharges to the surface water system. The general principles governing recharge apply equally to both directions.

The amount of recharge that occurs between the surface water and groundwater systems is governed by the overall permeability of the aquifer system and the hydrologic gradient between the two water sources. The gradient is loosely defined as the slope of the water surface between the surface water and groundwater systems. It is more precisely defined as the change in head over a unit flow distance.

At any location in the basin, the gradient between the surface water and groundwater system is directly proportional to the head differences (water surface elevation difference) between the two hydrologic systems. The larger the head differences the higher the gradient and the higher the recharge rate. In addition, the gradient is also inversely proportional to the horizontal distance over which this head change occurs. The shorter the horizontal distance over which the head change occurs increases the recharge rate dramatically. An example of this would be pumping next to a river would induce a much higher recharge rate from the surface water system than the same pumping many miles away. Clearly this relationship is not constant or linear.

In the case of positive recharge, increased extraction causes the groundwater levels to decline, which increases the head difference between the groundwater and surface water systems, and consequently increases the gradient and recharge rate. In short, the more you pump, the more you can pump, to a point.

Practically, the gradient will increase to a point where the recharge will eventually become constant. This occurs when there is a transition from Darcy to non-Darcy flow, which occurs at very high gradients. This is when turbulent flow develops in the groundwater flow regime as a result of high groundwater flow velocities, or there is a transition between saturated to unsaturated flow. As a practical matter, this occurs when river seepage flows nearly vertical to the groundwater system. In the San Joaquin Valley this is a common occurrence. In the Sacramento Valley many of the existing water wells would be de-watered by

the time these high gradients were achieved. Remember that long-term recharge rate must be constant for the classical definition of safe yield to be applicable.

Basin Management Objectives (BMO)

The Basin Management Objective, or BMO, concept was developed to overcome many of the usual problems of defining safe yield and overdraft in the Sacramento Valley. The Department of Water Resources, Northern District Groundwater Section formulated the concept when they assisted Glenn County in developing their groundwater management ordinance. It became very apparent early in the process that the classical definitions of safe yield and overdraft would not work in Glenn County.

The overall BMO concept is outlined below. The discussion is divided into the following seven general concept categories:

- Management Areas and Sub-areas
- Key BMO Elements
- Public Input
- Monitoring
- Data Evaluation
- Adaptive Management
- Enforcement

In the discussion below an overview of each of the concept categories is broadly presented. The discussion also outlines how Glenn County chose to implement each of the six concept categories. It is important to realize that there are many ways in which these concept categories can be implemented, not just the way Glenn County implemented them. The concept categories must also be developed so they do not conflict with existing County or State regulations. All six-concept categories must be implemented in one fashion or another to properly manage the groundwater resource.

Management Areas and Sub-area - The management area encompasses the portion of the aquifer system where groundwater management will be established. The management area can be subdivided into smaller hydrologically similar regions based on local input and need. These may include individual groundwater basins, groundwater sub-basins, or hard rock groundwater areas. If there is a need, these areas can be further subdivided into smaller political sub-areas such as reclamation districts, irrigation districts, cities, or Supervisorial districts if more detailed management areas are needed.

In the case of Glenn County the management area was chosen to be the Sacramento Valley portion of the County. The sub-areas were then chosen as irrigation district by groundwater sub-basin by County Supervisor District. In the

non-district portions of the County the sub-areas were chosen as areas that have similar hydrology. These areas were then further subdivided on the basis of groundwater sub-basin and by County Supervisor District.

The underlying desire when defining sub-areas is to group those in the same management sub-area that have the same vested interest in maintaining the groundwater resource at mutually agreeable levels. These management boundaries can change over time to accommodate changes in basin hydrology, understanding of the basin hydrology, or if hydrologic information collected in the basin provides a justification for doing so. A critical concept of this process is that water management practices or activities in one management sub-area should not negatively impact the water management objectives of another.

Key BMO Elements - For each of the management sub-areas a management objective is established. The management objective defines the acceptable range of groundwater level fluctuations that should be allowed to occur within the management area, and the acceptable range of groundwater quality change. The management objective should also define the maximum amount of inelastic land subsidence that may occur. The management objective can be considered a set of trigger points where action will be taken if the BMO levels are exceeded.

Establishing how the BMO levels are defined is best left to the locals in each management sub-area. The groundwater level and quality management objectives can be based on levels from a network of monitoring wells, individual "key" wells, or it can be defined in more general terms. The subsidence management objective can be based on a defined subsidence monitoring benchmark network or by "key" extensometers. It is the intent that all of the management area objectives be combined into a single countywide or basin-wide objective.

The BMO levels are reevaluated and reestablished annually to respond to changes in the management area hydrology. In the case of Glenn County it was decided that the Board of Supervisors would provide general oversight to this process by approving the management objectives annually.

Public Input - Public input to the process is a critical factor for the successful implementation of this management strategy. The public input process must be tailored to fit each individual region where it is applied. It is important to accommodate, if at all possible, the needs and wishes of the local groundwater users in the area being managed.

In the case of Glenn County it was decided that the public input process would be through the Board of Supervisors and the Water Advisory Committee (WAC). The WAC committee is appointed by the Board of Supervisors and includes at least one representative from each of the management sub-areas in the County. The WAC representatives are not affiliated with the County or County

government. The WAC also includes representatives from county agencies and the Board of Supervisors. It is the primary responsibilities of each WAC representative to establish the management objectives for their corresponding management sub-area and to provide a communication path between the local groundwater users and the WAC and Board of Supervisors. It was decided in Glenn County that it would be the responsibility of each individual WAC representative to establish individual public input processes for establishment of the management objectives for his or her corresponding management sub-area.

In the case of Glenn County, the WAC also maintains a Technical Advisory Committee (TAC) that provides technical assistance and advises the WAC. The TAC reports directly to the Water Advisory Committee. This group includes technical representatives from appropriate Federal, State and local agencies, and the general public. The Board of Supervisors appoints the WAC representatives.

Monitoring - The key to the BMO concept is objective scientific monitoring and rapid dissemination of all data collected as part of this process. A regional monitoring network is established that includes sufficient data collection points to determine representative conditions in the aquifer system for each of the management areas. The networks may consist of existing wells for monitoring groundwater levels and groundwater quality. In areas where no wells exist or the existing coverage is poor, new dedicated monitoring wells may be installed. An important element in establishing this network is to assure that all participation by individual landowners is strictly voluntary.

A monitoring program should also include a subsidence-monitoring component if land subsidence is considered a potential problem. A subsidence-monitoring program might include the establishment of a network of benchmarks, which are differentially resurveyed at specified intervals using global position satellite (GPS) technology or conventional leveling. The GPS survey can achieve 2-centimeter vertical accuracy if done in accordance with NOS NGS-58 procedures. Subsidence can also be monitored with borehole extensometers, which are special wells that are instrumented for detecting subsidence. Pipe extensometers would be used when precision continuous monitoring is needed, otherwise the less expensive cable extensometers would provide sufficient continuous monitoring with acceptable accuracy.

In the case of Glenn County, it was decided to use the groundwater level and quality-monitoring networks of the Department of Water Resources initially to determine compliance with the management objectives. The DWR monitoring network was chosen to provide comparative history of groundwater levels and groundwater quality in the County over time. It is anticipated that additional wells will be added to the network to fill in areas where data is lacking, or in areas were more definition is needed. At the current time the County is assessing how best

to establish the land subsidence monitoring network portion of the program. It is anticipated that cable extensometers will be installed as resources permit.

All components of the overall monitoring network can increase, decrease or change to reflect a growing understanding of the groundwater system. In the case of Glenn County, the Board of Supervisors provides oversight to this process by requiring their approval for any changes to the monitoring network.

The frequency of monitoring is an important consideration in the overall monitoring program. The local organization that is formed to provide oversight to the process should carefully consider all the hydrologic factors that impact the groundwater resource and develop a monitoring frequency that is capable of tracking those factors. In the case of Glenn County the WAC and TAC establish the monitoring frequency for water levels, water quality, and subsidence.

At a minimum, it is suggested that groundwater levels be monitored at least three times a year:

- Once in the spring when groundwater levels are at their highest.
- Once in the summer during the peak irrigation season when groundwater levels are at their lowest.
- Once in the fall to assess the change in aquifer storage over the course of the irrigation season.

This measurement schedule corresponds to approximately April, July, and October. It is important that the fall measurements are made before the start of the rainy season. This measurement schedule may be different in other parts of the Sacramento Valley, or different parts of the State.

Water quality sampling should be done a minimum of once a year during the peak irrigation season, usually in July. At a minimum this would require measuring temperature, pH, and electric conductivity. Additional laboratory water quality analysis, such as total mineral and minor elements, or testing for particular contaminants may also be done if a need arises.

Subsidence monitoring can be done on a continuous basis with extensometers. GPS subsidence monitoring is usually done on a five or more year basis because of relative high cost. It is recommended that the GPS surveying be done in the spring prior to the start of the irrigation season.

As with all monitoring programs, quality assurance and quality control is a critical component of the overall monitoring program. This requires developing written detailed standards, protocols, and procedures for measuring groundwater levels in wells and sampling or testing groundwater from wells for water quality analysis. These procedures also need to include protocols for data reduction, computer data entry, and overall data dissemination. The procedures need to be

detailed in a document to assure consistency between those performing the various monitoring tasks and to assure a seamless transition between different data collectors. The QA/QC procedures and monitoring frequency can change over time as the need arises to better determine representative aquifer conditions.

In the case of Glenn County, the WAC and TAC will recommend quality assurance and quality control standards for all monitoring. The Board of Supervisors provides oversight to this process by approving the monitoring schedule and QA/QC standards prior to final adoption by the WAC.

Data Evaluation - Following the data collection there needs to be a process in place to analyze the data, and to report any findings or recommendations to the management authority. The management authority then can make sound adaptive management decisions based on the results of the monitoring.

In Glenn County the TAC is the management authority and reviews the data to assure that the groundwater levels, groundwater quality, and subsidence measurements are within the levels specified in the management objective. Under the BMO concept, the management area is within "safe yield" if the measured groundwater levels are above the management objective, as discussed earlier. Conversely, if groundwater levels fall below the management objective, the management area is in "overdraft". It is important to remember that in the context of the BMO concept that the classical definitions of safe yield and overdraft do not apply. The same principles also apply to changes in defined water quality and inelastic subsidence. It is possible to have some management sub-areas in overdraft while others are within safe yield even though they are in the same groundwater basin.

The BMO concept assumes that everyone participating in the process actually wants to properly manage the groundwater resource within his or her management sub-area. This concept allows locals to mismanage their groundwater resource if they choose. That is why the Board of Supervisors in Glenn County chose to provide oversight to the process by approving the management objective for each management sub-area on an annual basis.

The data collection and scientific analysis should be made available for full public disclosure. This can be in the form of press releases, public meetings, or on a World Wide Web site.

For this type of process to work, the results from the monitoring must be the sole basis for determining whether a management area is within acceptable management levels. The concept cannot work if complaints from individual well owners or small groups of well owners drive the process.

Adaptive Management - Groundwater management has not been too successful in California because no one wants to relinquish his or her control over the resource. For groundwater management to work properly there has to be some controlling authority that can take corrective action to resolve problems when they arise. This is often a contentious issue that can only be resolved at the local level, and only after much public input and discussion.

Glenn County resolved this contentious problem in a somewhat unique fashion. The structure of their management authority is such that the locals maintain control of the groundwater resource outside of County government, while at the same time having a mechanism in place that can utilize the police powers of the County if they ever become needed.

In the Glenn County structure, if a BMO threshold is exceeded, the process sets into motion a series of events. First the TAC reports on the regional extent and magnitude of the non-compliance to the WAC. The TAC then starts a fact-finding process to identify the cause(s) of the non-compliance and makes recommendations to the WAC on how to resolve the situation. The WAC then tries to resolve the problem in the effected area by negotiations with the locals if at all possible. Some of the possible actions that may be taken by the WAC might be to coordinate the following voluntary actions in the effected area:

- Rescheduling groundwater extractions
- Redistribute groundwater extractions
- Terminate groundwater substitution extractions
- Reduce groundwater extraction rates
- Terminate groundwater extractions
- Develop a groundwater recharge program
- Establish alternative BMO levels in management area
- Other

Enforcement - If the WAC cannot resolve the problem at the local level, it then makes recommendations to the Board of Supervisors on how to resolve the non-compliance. The Board of Supervisors may accept the recommendations from the WAC or take what enforcement action they deem necessary to correct the non-compliance. The enforcement may include the following actions within the management sub-area(s) where the non-compliance exists, or in adjacent management sub-areas if they are found to be the cause of the non-compliance:

- Reschedule groundwater extractions
- Redistribute groundwater extractions
- Redefine the management objectives
- Terminate groundwater extractions
- Other

If the noncompliance is the result of groundwater extraction as part of a groundwater substitution program, the Board of Supervisors has the power to reduce or terminate groundwater withdrawals from these wells before action is taken against other lawful groundwater users in a management area. If the Board of Supervisors takes such actions, such as requiring reductions in groundwater extractions, it does so under the County's police powers.

Final Thoughts

In conclusion, the BMO concept must be flexible to be workable. There is not a cookie-cutter approach to proper groundwater management. Groundwater management objectives can and will be different in different parts of the Sacramento Valley or in different parts of the State. A workable BMO approach can only be implemented after much public participation and input. In addition, there must be sufficient flexibility in the final process to respond to changes that certainly will occur. As more is learned about the aquifer system, changes to the overall program are inevitable. This is an adaptive and active management approach that requires public participation. This is not an approach that can be put on the shelf once it is implemented.

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