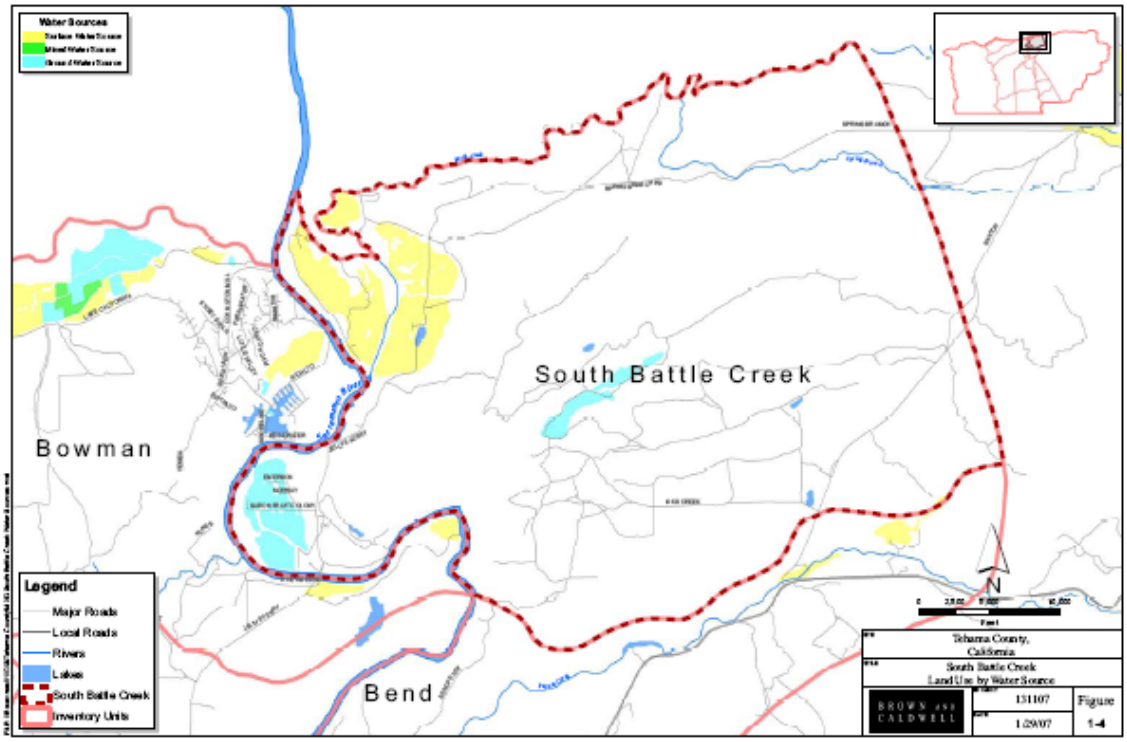
Tehama County AB-3030 Groundwater Management Plan

Technical Memorandum

For the South Battle Creek Sub-basin of Tehama County



Draft for Public Review and Comment

Proposed Groundwater Trigger Levels and Awareness Actions

July 1, 2008

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BROWN AND CALDWELL

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Technical Memorandum

DRAFT

Prepared for: Tehama County Flood Control and Water Conservation District

Project Title: BMO Trigger Level Development

Project No: 131107

Technical Memorandum

Subject: Proposed Groundwater Trigger Levels and Awareness Actions for the South Battle Creek Sub-basin

Date: July 1, 2008

To: Mr. Ernie Ohlin, Water Resources Manager

From: John Ayres, PG

Prepared by: John Ayres, PG

Reviewed by: Robert Vince, PG, CHG

INTRODUCTION

Groundwater trigger levels represent declines in groundwater levels that, when reached or exceeded, may cause some type of action such as public outreach, increased monitoring, or consideration of modifying the groundwater trigger level. Trigger Levels are developed through a five step process as described in Section 1. South Battle Creek does not have monitoring wells, and instead of developing trigger levels, will determine priority areas for future monitoring as described in Section 2.

The Tehama County Flood Control and Water Conservation District (District) cooperated with private landowners, County groups, and local agencies overlying the groundwater basin to develop a Groundwater Management Plan (Plan) focusing on groundwater resources protection and management. The Plan incorporated citizen input, review, and approval over a period of three years, Final adoption by the Tehama County FCWCD was achieved in 1998.

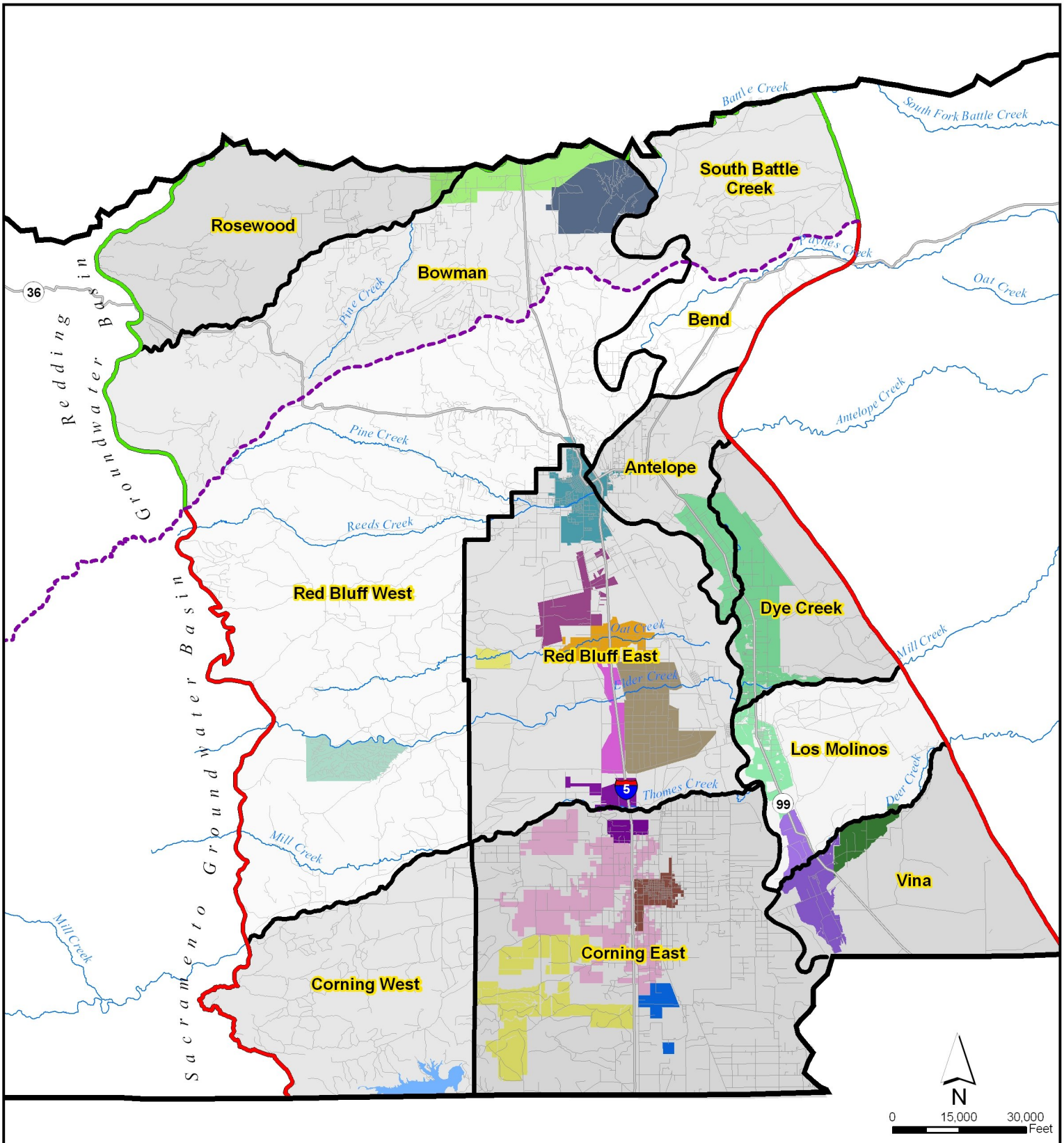
The Plan states that one of the District's functions under the Plan is to provide guidance in the development of groundwater trigger levels. The Plan defines trigger levels as increasing stages of groundwater decline that correspond with various trigger levels of increased groundwater discussion, investigation or local management actions.

Sections 325 through 329 of the Plan describe the trigger level concept and detail the District's role in trigger level development. The District, working with a Technical Advisory Committee (TAC) composed of local representatives, identified twelve groundwater sub-basins where trigger levels may be established (Figure 1-1).

This Technical Memorandum (TM) focuses on groundwater level trigger level development for the South Battle Creek sub-basin. Since its inception, the Plan has provided guidance related to groundwater activities. Landowners and water purveyors alike recognize the need to move forward with groundwater resource protection by developing measures (trigger levels) that determine the level of active management needed within each sub-basin. Trigger levels can be established for groundwater levels, groundwater quality, or inelastic land subsidence due to groundwater extraction. Section 1 of this TM describes the methodology used to develop trigger levels.

Because the South Battle Creek Sub-Basin does not have formal groundwater monitoring, such as a dedicated monitoring well or wells included in the Department of Water Resources (DWR) monitoring grid, Section 2 of this TM identifies potential areas for new groundwater monitoring within the South Battle Creek Sub-Basin.

Additional information on the trigger level development process and regional hydrogeology is available in the *Trigger Level Background Technical Memorandum,* available on the District's website at: http://www.tehamacountywater.ca.gov/ . Ultimately, it is the District's desire to have management objectives that are understood and supported by groundwater users in each sub-basin.



Irrigation Districts

- Aaction
- Anderson-Cottonwood
- City of Corning
- City of Red Bluff
- Corning WD
- Deer Creek
- El Camino ID
- Elder Creek ID
- Kirkwood ID
- LMMWC
- Proberta ID
- Rancho Tehama
- Rawson ID
- Rio Alto WD
- Stanford Vina
- Thomes Creek ID

Legend

- Red Bluff Arch
- Redding Groundwater Basin
- Sacramento Valley Groundwater Basin

BROWN AND CALDWELL

PROJECT	SITE	Figure
131107	Tehama County	1-1
DATE	TITLE	
1/18/07	Groundwater Sub-Basins	

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1. Groundwater Level Trigger Level Development Methodology

Groundwater trigger levels are derived through interpretation of historic groundwater levels. A series of awareness actions are proposed for each trigger level stage. Development of groundwater level triggers is a five-step process, listed below:

Step 1: Describe the trigger level's purpose.

Step 2: Select one or more key wells within the sub-basin.

Step 3: Designate the time of seasonal measurement.

Step 4: Establish trigger levels in the selected key wells.

Step 5: Define awareness actions associated with each trigger level.

Step 1: Describe the trigger level's purpose.

The trigger level's purpose describes the intent of the trigger levels in the area. The purpose may reflect the desire of sub-basin planners to protect historic groundwater uses, minimize long-term drawdown of groundwater levels, maintain springs and habitat, and/or protect groundwater supplies for domestic and irrigation uses.

Step 2: Select one or more key wells within the sub-basin.

Key wells are monitoring wells that are representative of groundwater conditions within a particular aquifer interval, or range of aquifer intervals underlying the sub-basin. Groundwater levels in key wells provide information necessary to initiate management activities. If no monitoring wells are available in a sub-basin, such as South Battle Creek, then locations for new monitoring wells should be selected.

When selecting new areas for monitoring, the choice should be guided by a number of criteria including land use, agricultural water source, existing well infrastructure, accessibility, and monitoring in adjacent sub-basins.

Land Use: Groundwater levels are more likely to be stressed in areas of active land use. Areas with fixed water demand crops such as orchards should be higher priority areas for monitoring.

Water Source: Groundwater supplies in areas irrigated with groundwater are more likely to be stressed during drought periods. Locating monitoring wells in areas reliant on groundwater would provide useful information for groundwater management, and should be higher priority areas for monitoring.

Existing Well Infrastructure: Well drilling records should be considered. The screened intervals of monitoring wells should be similar to the average screened interval of production wells in the area.

Accessibility: The monitoring well should be located in an accessible area to allow for monitoring activities. New monitoring should occur in areas with cooperative landowners that provide a right of entry to monitoring activities.

Monitoring in Adjacent Sub-Basins: A new monitoring well should not be sited near an existing monitoring well.

Once monitoring wells have been located and developed in an area, the remaining three trigger level steps can take place.

Step 3: Designate the time of seasonal measurement.

Groundwater levels fluctuate seasonally, and measurements from the different seasons provide different snapshots of groundwater conditions. Spring measurements provide information on whether the basin has recharged during the wet season to elevations observed in previous years. Typically, spring water levels are the highest water levels observed during the year. Summer and fall water level elevation measurements provide information about decreased water levels during groundwater pumping and illustrate the pumping impacts within a season.

The District suggests that spring measurements be used to set trigger levels with associated awareness actions, and late season measurements (summer and fall) be used to set an additional trigger level with associated awareness actions that is sensitive to groundwater levels during the seasons of heavy groundwater use that can provide a warning of potential issues such as increased groundwater demand.

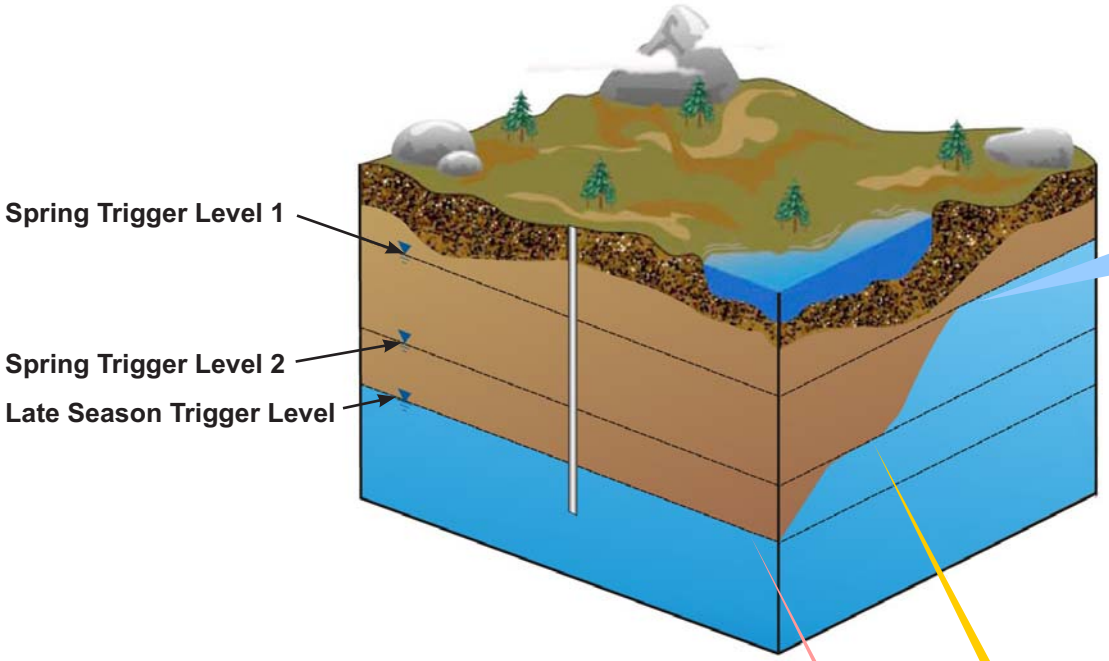
Steps 4 and 5: Establish trigger levels in selected key wells and define awareness actions associated with each trigger level.

Trigger levels act as an early warning system for identifying potential problems. A trigger level corresponds to a predetermined target groundwater level during a season of measurement. For example, if a trigger level is set at a water surface elevation of 50 feet below ground surface (bgs) in the spring, then only spring measurements should be compared to the trigger level. A spring measurement of 40 feet bgs would not require an awareness action in this case. A spring measurement of 60 feet bgs, on the other hand, would be below the trigger level, and should prompt awareness actions (Figure 1-2).

Sub-basin representatives review and provide input on the proposed trigger levels within their sub-basin and the awareness actions associated with each level. Potential trigger levels, and the accompanying awareness actions, may range from a small decrease in groundwater levels compared to historical levels, (indicating a need to disseminate information or further investigation of groundwater levels), to a larger change in groundwater levels, (indicating a need to take action to stop or reduce the lowering of groundwater levels).

For each trigger level, sub-basin representatives should work with local groundwater users and the District to implement the awareness actions associated with the trigger level. Management actions may include providing information on trigger level exceedance to the public, investigating the trigger level exceedance, and taking action to remedy the issue.

Suggested trigger levels and corresponding awareness actions were selected by the TAC and the District to provide the appropriate level of management in response to exceedance of trigger levels. The trigger levels and corresponding awareness actions should coincide with the severity of groundwater issues in the sub-basin. As an example, Figure 1-2 shows a diagram that details three suggested spring trigger levels and one suggested late season trigger level with corresponding actions. The methodology for the suggested trigger levels is provided in Table 1-1. A summary of associated awareness actions include:



AWARENESS ACTIONS

Spring Trigger Level 1 Awareness Actions

ONE YEAR BELOW TRIGGER LEVEL 1

- TAC meetings to address issues in the area
- Water user/stakeholder meeting for the subbasin
- Send mail to known water users in subbasin, notifying them about a overall decrease in water levels or quality in the subbasin
- Notify public of groundwater issue
  - County to make a press release
  - Updates to the District website
  - District to attend agriculturally related and city meetings
  - Site visits
- Review recent precipitation trends to look for drought trends

CONSECUTIVE YEARS BELOW TRIGGER LEVEL 1

- Continue to inform water users and general public
- Verify data
- Increase monitoring frequency in subbasin
- Add new monitoring location in subbasin
- Begin monitoring land subsidence
- Install data loggers
- Investigate cause of low groundwater levels

AWARENESS ACTIONS

Spring Trigger Level 2 Awareness Actions

- Continue Spring Trigger Level 1 Awareness Actions
- Solicit voluntary public involvement in resolving issues in the area
- Consider groundwater recharge efforts
- Review condition of approval for new development reliant on groundwater by the County
- Review of the County's approval process regarding water supply for development or additional groundwater pumping projects
- Increase land subsidence monitoring

AWARENESS ACTIONS

Late Summer Trigger Level Awareness Actions

- Perform Spring Trigger Level 1 and 2 Awareness Actions
- Investigate potential higher groundwater demand or other causes

Figure 1-2
Trigger Levels and Awareness Actions

Spring Trigger Level 1: The first trigger level would cause the dissemination of information to the public about the potential groundwater issue. Additional awareness actions are triggered by a second consecutive year of groundwater levels at or below Spring Groundwater Trigger Level 1.

Spring Trigger Level 2: The second and deeper spring groundwater trigger level would lead to increased monitoring activities and continued public information on the groundwater condition plus investigations and the development of actions to remedy the groundwater issue.

Late Season Trigger Level: The late season trigger level would cause the dissemination of information to the public and the beginning of investigations to understand the cause. Late season measurements are sensitive to groundwater levels during the seasons of heavy groundwater use and can provide a warning of potential issues such as increased groundwater demand.

2. South Battle Creek Trigger Level Development

Because South Battle Creek does not have monitoring wells, this section is focused on the implementation of the first two steps of the five step methodology:

Step 1: Describe the trigger level's purpose.

The South Battle Creek sub-basin is primarily a rural area, with agriculture in the western end of the sub-basin. Groundwater is used for agricultural and domestic purposes. There are no organized irrigation districts in the South Battle Creek sub-basin, as indicated in Figure 1-1. Additional water use information is available in the Tehama County Water Inventory and Analysis, available in PDF format at: http://www.tehamacountywater.ca.gov/grndwtr_inv_ana.htm. The trigger level's purpose in this sub-basin should reflect the needs of local water users. Some suggested trigger level purposes are:

Groundwater Use in South Battle Creek:	
Irrigation:	100% (2,100 acre-ft)
Municipal, and Industrial:	0% (0 acre-ft)
Number of wells by type in South Battle Creek:	
Irrigation:	5 wells
Domestic:	12 wells
Municipal and Industrial:	0 wells

- Maintain a stable trend of groundwater in storage to ensure adequate drinking water and agricultural supplies to protect supplies for current and future uses.
- Monitor groundwater levels to record and compare changes to aid in identifying conditions that cause declines in groundwater levels.

Step 2: Select one or more key wells within the sub-basin.

There are currently no monitoring wells located within the South Battle Creek sub-basin. According to the DWR database, there are 17 reported wells in South Battle Creek, none of which included in the DWR monitoring grid. Groundwater levels in key wells provide information necessary to initiate management activities. To begin the trigger level process, the District suggests that priority areas for new monitoring be selected in the South Battle Creek area.

When picking areas for monitoring wells in South Battle Creek, the choice should be guided by a number of criteria including land use, agricultural water source, existing well infrastructure, accessibility, and monitoring in adjacent sub-basins.

Land Use:. Figure 1-3 presents the land use in the South Battle Creek area. Agriculture in South Battle Creek is predominantly in the west, with orchards and pasture the predominant crop types. Future land use in South Battle Creek is anticipated to be similar to current land use. Additional land use information can be obtained by obtaining the zoning information for the South Battle Creek area.

Water Source: Figure 1-4 presents agricultural land use by water source in the South Battle Creek area. Figure 1-4 demonstrates that agriculture in the northwestern corner of South Battle Creek is irrigated with surface water, and that agriculture in the southwestern point of South Battle Creek is irrigated with groundwater.

Existing Well Infrastructure: There are 12 domestic wells and 5 irrigation wells in the South Battle Creek sub-basin. Fifty percent of the domestic wells are shallower than 113 feet deep, and fifty percent of the irrigation wells are shallower than 230 feet deep. Existing well infrastructure data was developed from DWR's well completion report database. DWR's database contains information on the majority of wells drilled after 1947, while wells drilled prior to 1947 are generally not included. Some wells drilled after 1947 may not have been reported to DWR (potentially up to 30%), and therefore are not included in the database.

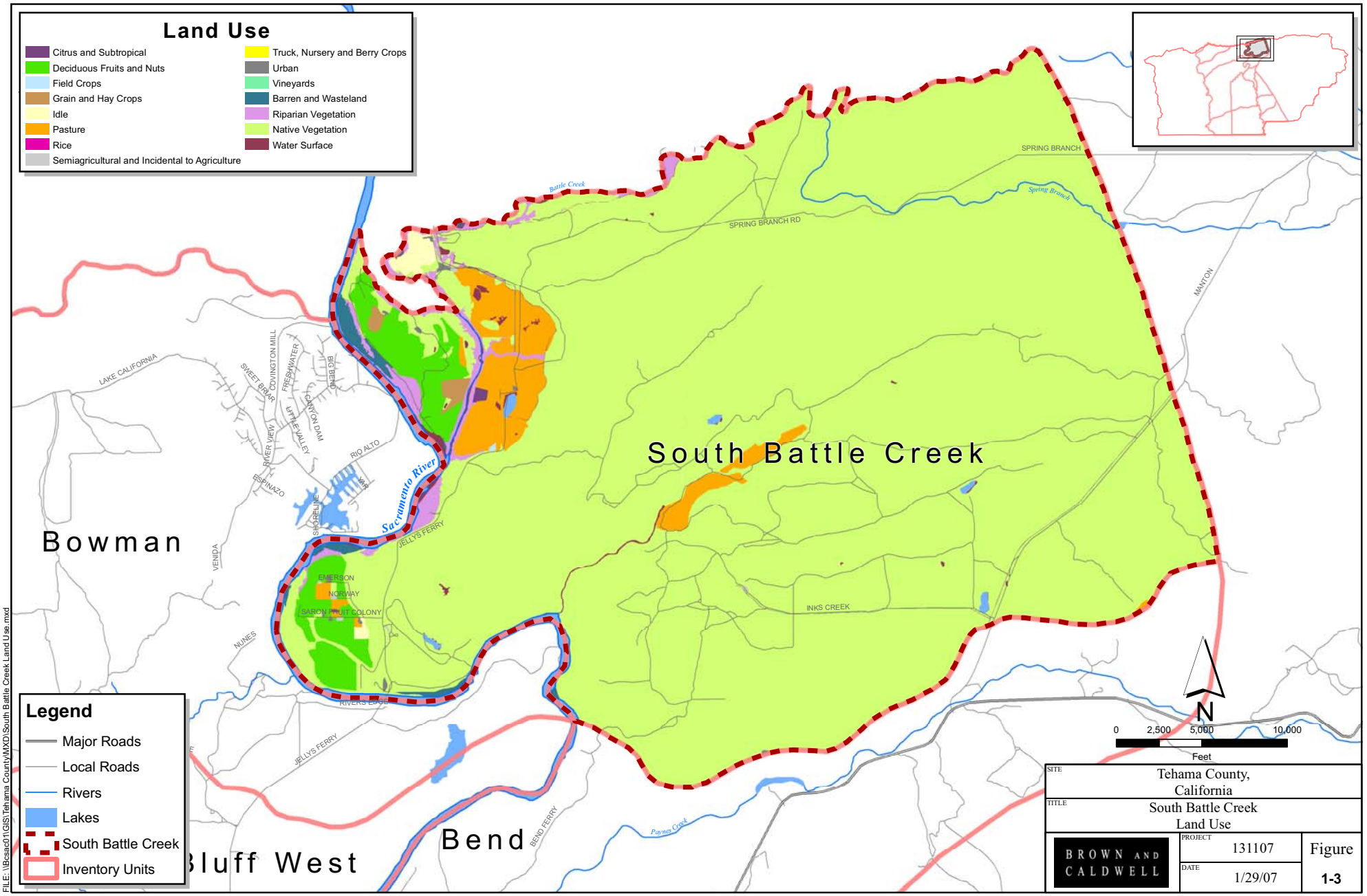
Accessibility: The monitoring well should be located in an accessible area to allow for monitoring activities. New monitoring should occur in areas with cooperative landowners that provide a right of entry to monitoring activities.

Monitoring in Adjacent Sub-Basins: A new monitoring well should not be sited near an existing monitoring well. Figure 1-4 shows the locations of any monitoring wells adjacent to South Battle Creek. As indicated by Figure 1-4, there are no monitoring wells near the boundary of South Battle Creek, and new monitoring wells can be sited near the boundary of the sub-basin.

Suggested Monitoring Well Areas:

There are four suggested areas for new monitoring wells in the South Battle Creek area which are indicated in Figure 1-5. Monitoring wells installed in the South Battle Creek area should be screened to monitor groundwater at depths similar to those used for production by domestic and irrigation wells. The majority of domestic and irrigation wells in South Battle Creek are screened between 100 and 250 feet below ground surface. The four suggested areas are listed below:

- The first suggested area (Area 1) is in the southwestern point of the sub-basin, and is a priority area of orchards that are irrigated with groundwater. Area 1 lies toward the center of the valley, and is not near other monitoring wells.
- The second suggested area (Area 2) is in the central portion of the sub-basin, and is a priority area of pasture that is irrigated by groundwater. Area 2 lies away from the center of the valley, and is not near other monitoring wells.
- The third suggested area (Area 3) is in the northwestern portion of the sub-basin, and is a priority area of orchards that are irrigated with surface water. Area 3 is close to the river, and separated from the rest of the sub-basin by a slough. Area 3 lies toward the center of the valley, and is not near other monitoring wells.


Land Use
Citrus and Subtropical
Deciduous Fruits and Nuts
Field Crops
Grain and Hay Crops
Idle
Pasture
Rice
Semiagricultural and Incidental to Agriculture
Truck, Nursery and Berry Crops
Urban
Vineyards
Barren and Wasteland
Riparian Vegetation
Native Vegetation
Water Surface
South Battle Creek
Bowman
Bend
Bluff West
Sacramento River
Battle Creek
Spring Branch
SPRING BRANCH
SPRING BRANCH RD
MANTON
LAKE CALIFORNIA
SWEET BRIAR
COVINGTON MILL
FRESHWATER
BIG BEND
CANYON DAM
LITTLE VALLEY
RIVER VIEW
ESPINAZO
RIO ALTO
VENIDA
SHORELINE
JELLYS FERRY
EMERSON
NORWAY
SARON FRUIT COLONY
NUNES
RIVERS EDGE
INKS CREEK
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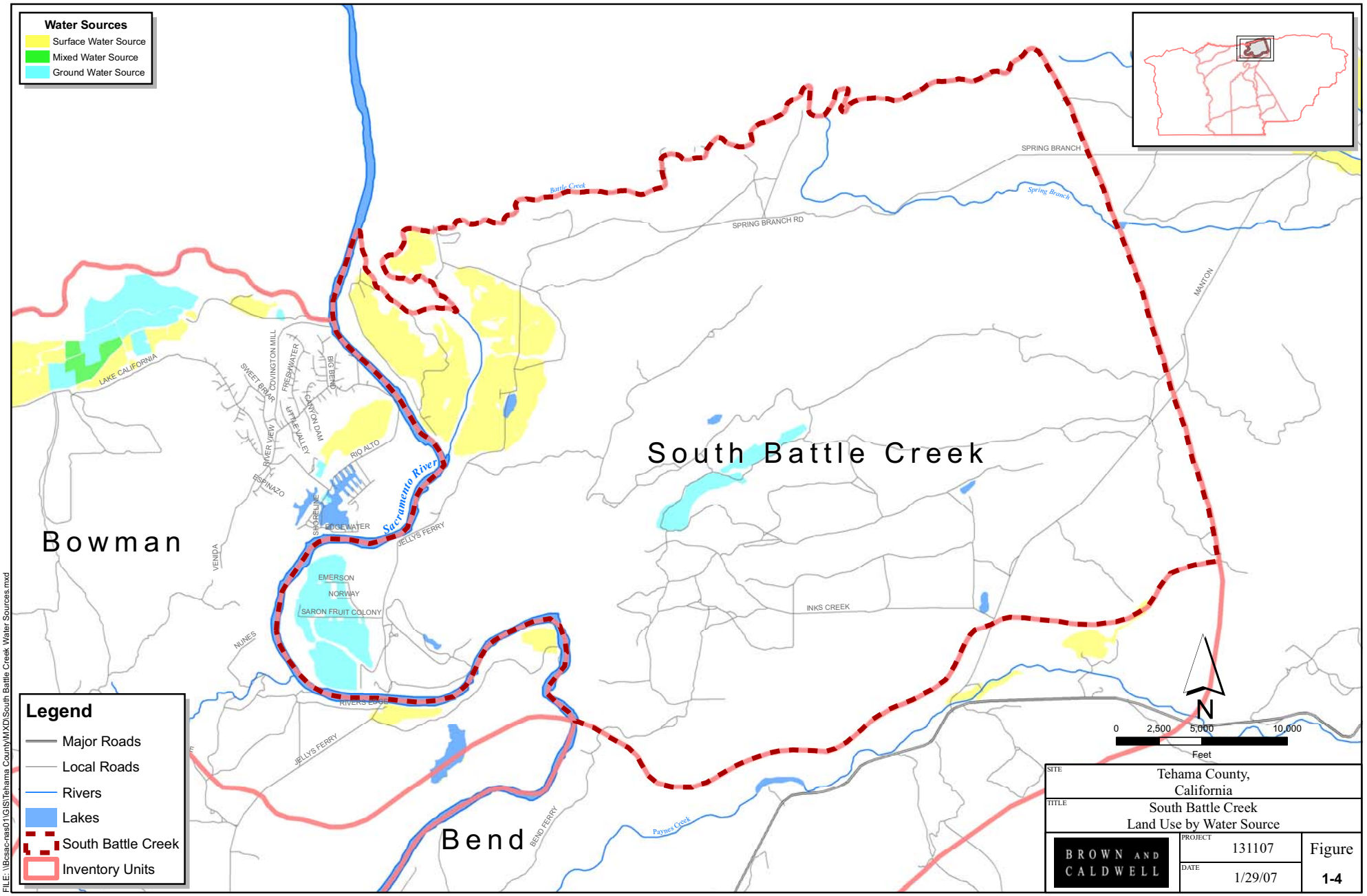
Water Sources
Surface Water Source
Mixed Water Source
Ground Water Source
South Battle Creek
Bowman
Bend
Sacramento River
Battle Creek
Spring Branch
SPRING BRANCH
SPRING BRANCH RD
MANTON
INKS CREEK
LAKE CALIFORNIA
SWEET BRIAR
COVINGTON MILL
FRESHWATER
BIG BEND
CANYON DAM
LITTLE VALLEY
RIVER VIEW
ESPINAZO
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EDGEWATER
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VENIDA
EMERSON
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SARON FRUIT COLONY
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South Battle Creek Land Use by Water Source
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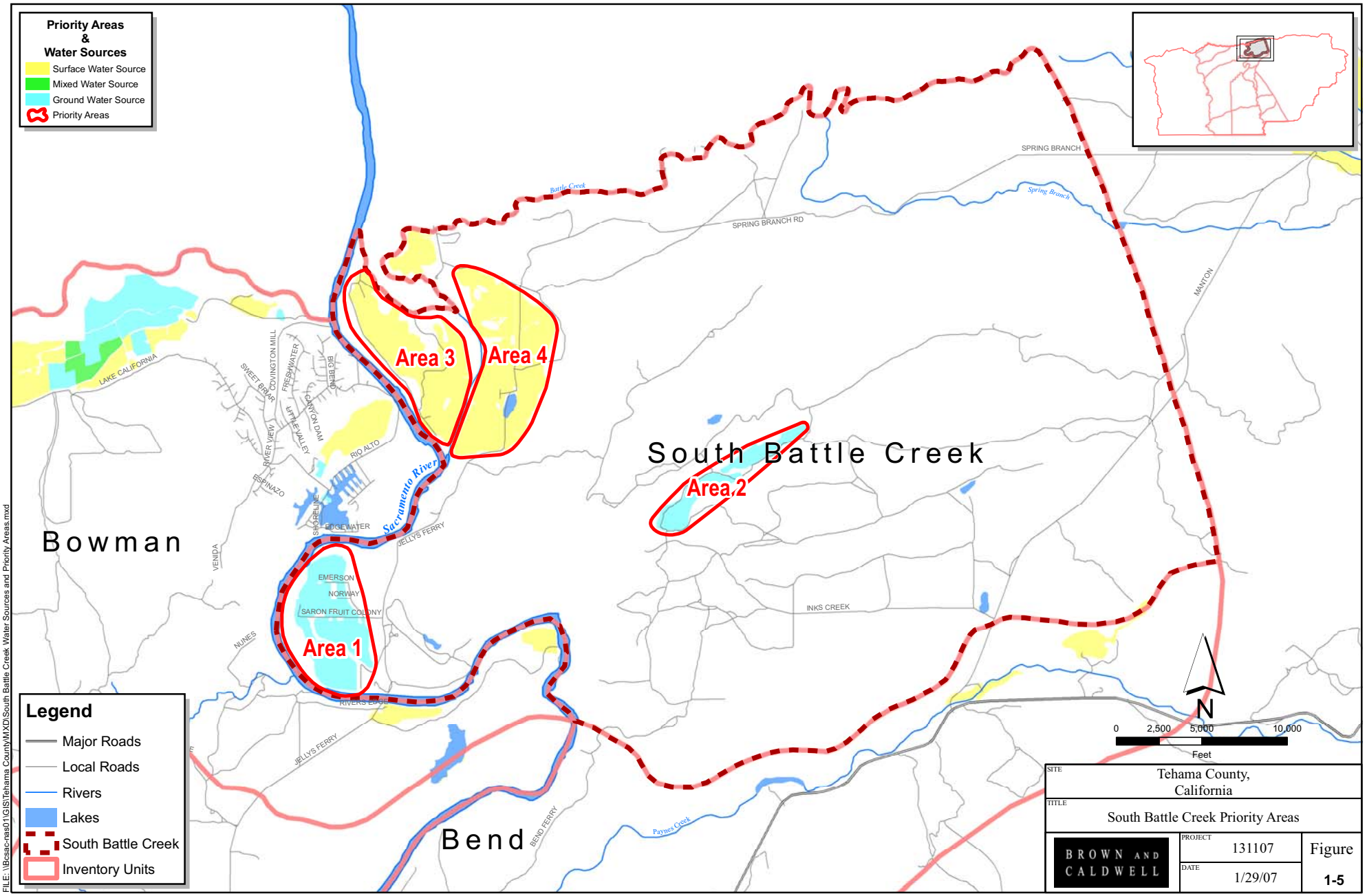
Priority Areas & Water Sources
Surface Water Source
Mixed Water Source
Ground Water Source
Priority Areas
Area 1
Area 2
Area 3
Area 4
South Battle Creek
Bowman
Bend
Sacramento River
Battle Creek
Spring Branch
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SPRING BRANCH RD
MANTON
INKS CREEK
LAKE CALIFORNIA
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COVINGTON MILL
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1-5
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- The fourth suggested area (Area 4) is in the northwestern portion of the sub-basin, and is a priority area of pasture that is irrigated with surface water from. Future land use trends include the possibility of this area being irrigated with groundwater. Area 4 lies toward the center of the valley, and is not near other monitoring wells.

3. Next Steps

Steps 1 and 2: With the proposed priority areas selected, the next step will be confirmation of priority areas with stakeholders. Once stakeholders have provided local information and input to priority area selection, the availability of existing wells for monitoring and the need for new monitoring wells can be assessed. As monitoring locations are selected and developed, the monitoring program for the South Battle Creek sub-basin can be implemented.

Steps 3, 4 and 5: Once the monitoring program is in place, steps 3 through 5 of the trigger level development process can be completed as described in the methodology section. Example trigger levels from the Bowman sub-basin are provided below.

Figures 1-6 through 1-8 present hydrographs and suggested trigger levels for an example key well located in the Bowman sub-basin. The figures are groundwater level hydrographs, demonstrating water level elevation measurements over the monitoring period of record and the suggested trigger levels during a particular season. The methodologies used to determine the suggested trigger levels for the example key well is provided in Table 1-1.

Table 1-1. Example Trigger Level Methodology

Groundwater Trigger Level and Awareness Action	Bowman Monitoring Well Number			
	28D01M	35B01M	15E02M	04P01M
Spring Trigger Level 1 – Notify and Inform Public	Historical low of spring measurements plus 20 % of the range of spring measurements			Historical low of spring measurements
Monitor and investigate Cause	Second consecutive year of groundwater levels at or below Spring Trigger Level 1			
Spring Trigger Level 2 – Consider Management Options	Historical low of spring measurements			Historical low of spring measurements minus the range of spring measurements
Late Season Trigger Level – Notify public and begin investigations	Historical low of late season groundwater measurements			
Data Anomalies	None	None	None	None

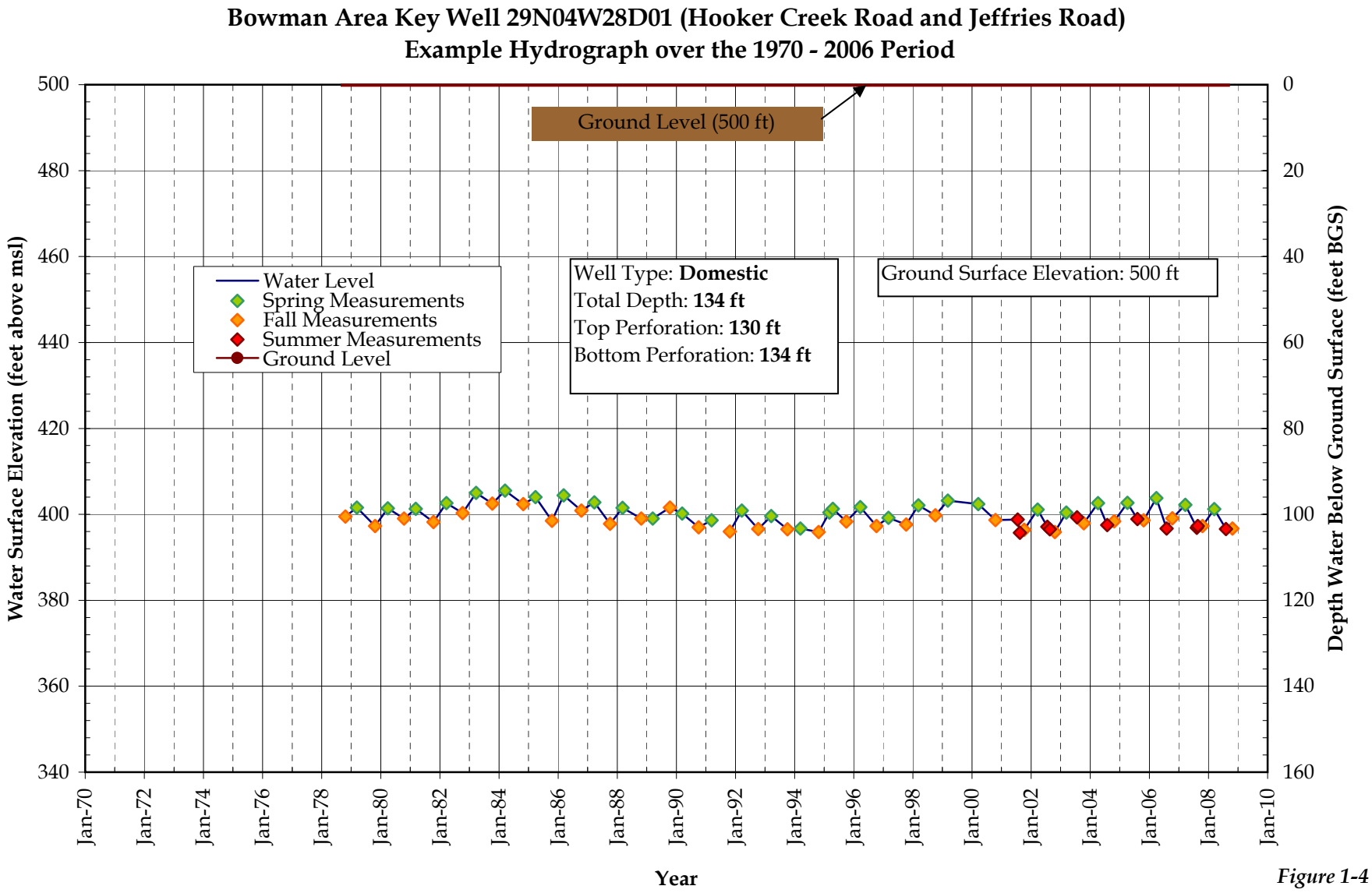

Figure 1-4
Hydrograph of Key Well 229N04W28D01

Updated 12-01-08

Bowman Area Key Well 29N04W28D01 (Hooker Creek Road and Jeffries Road)
Example Spring Level Hydrograph

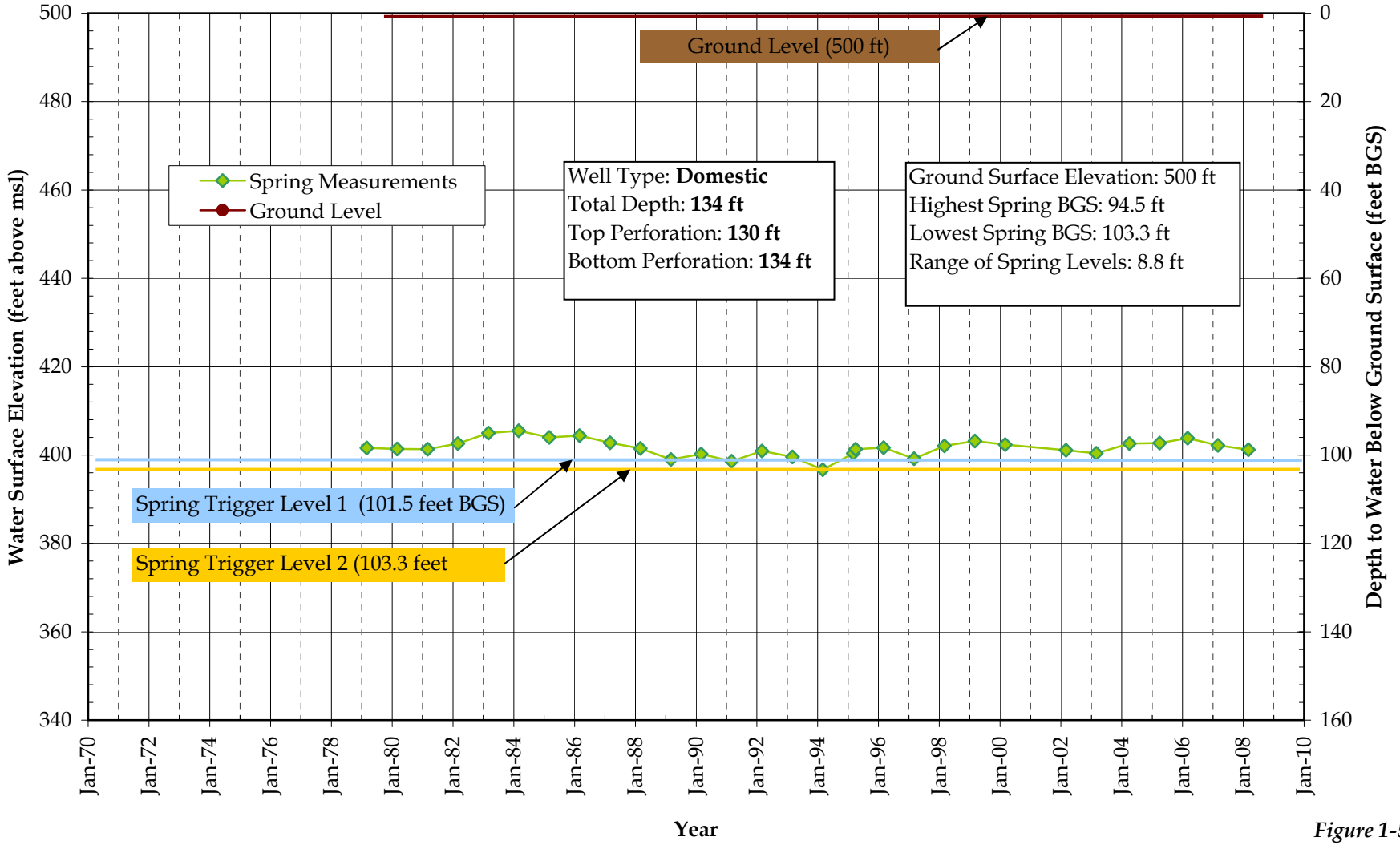

Figure 1-5
Spring Trigger Levels

Updated 12-01-08

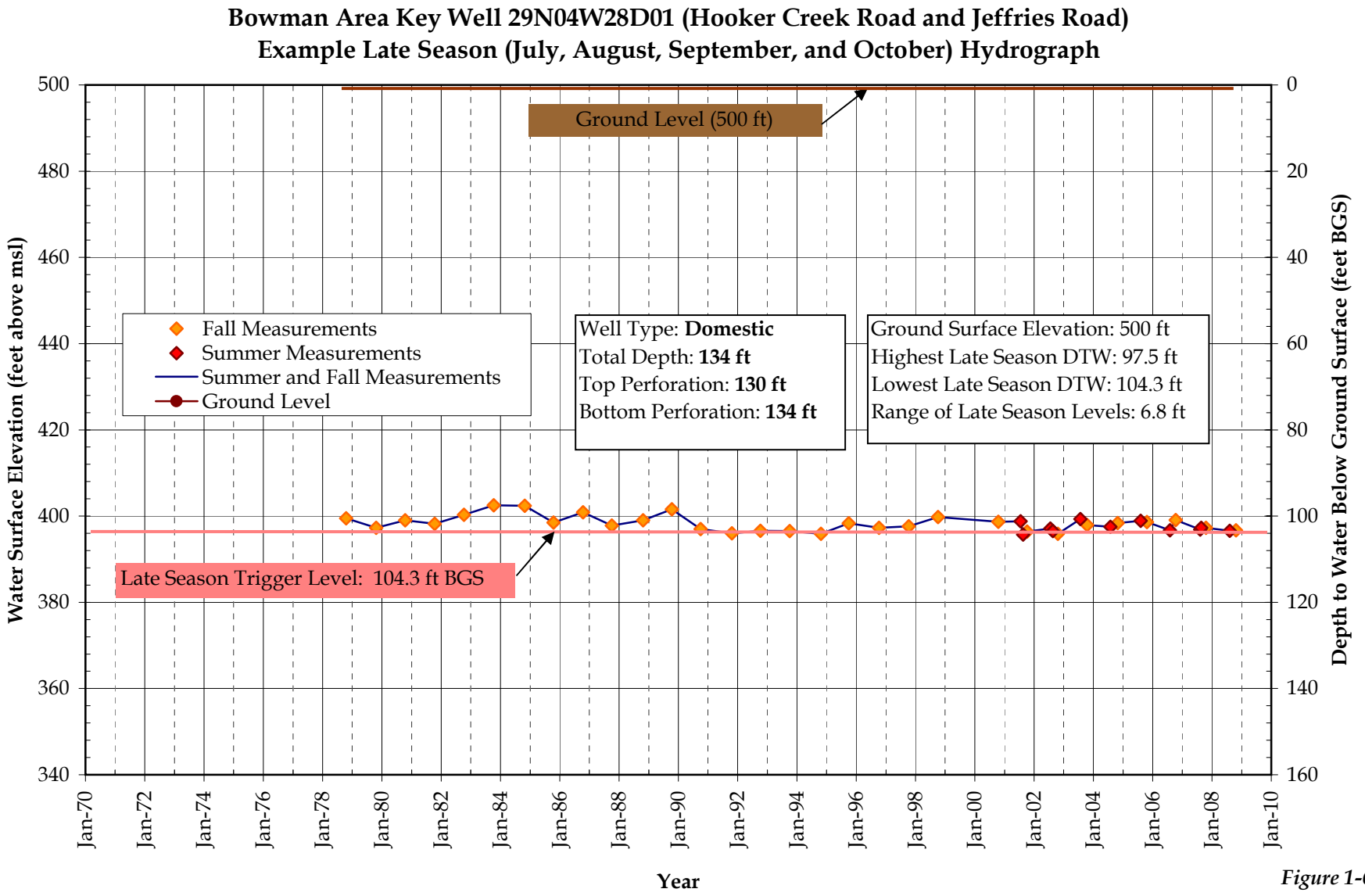

Figure 1-6
Late Season Trigger Level

Updated 12-01-08