

Appendix 6A

ANALYSIS STEPS TO DEVELOP PRELIMINARY MINIMUM THRESHOLDS AND MEASURABLE OBJECTIVES

APPENDIX 6A. ANALYSIS STEPS TO DEVELOP PRELIMINARY MINIMUM THRESHOLDS AND MEASURABLE OBJECTIVES

This appendix details the methodology used to establish preliminary groundwater elevation minimum thresholds and measurable objectives. These minimum thresholds and measurable objectives were set to address the beneficial uses and users in the subbasin and provide reasonable initial goals. The preliminary results were modified based on public input and CSAB reviews (Section 6.6).

Establish a List of Key Wells for Testing the SMC Methodology

The SMC general methodology largely follows a previous analysis conducted in Glenn and Tehama Counties during development of BMOs and potential triggers for groundwater management.

Fifteen wells were selected to test the methodology: 10 wells in Tehama County and 5 wells in Glenn County (Figure 6A-1).

- Ten wells were selected as a single observation well from a multi-well cluster (orange symbols). In general, this was the shallowest well in the cluster that was at least 100 feet deep.
- Five wells were domestic or irrigation wells from the Tehama County Groundwater Management Plan (TCFCWCD, 2012) (purple symbols).

Glenn County BMO wells were not used as key wells because most are in close proximity to more recently installed monitoring well clusters.

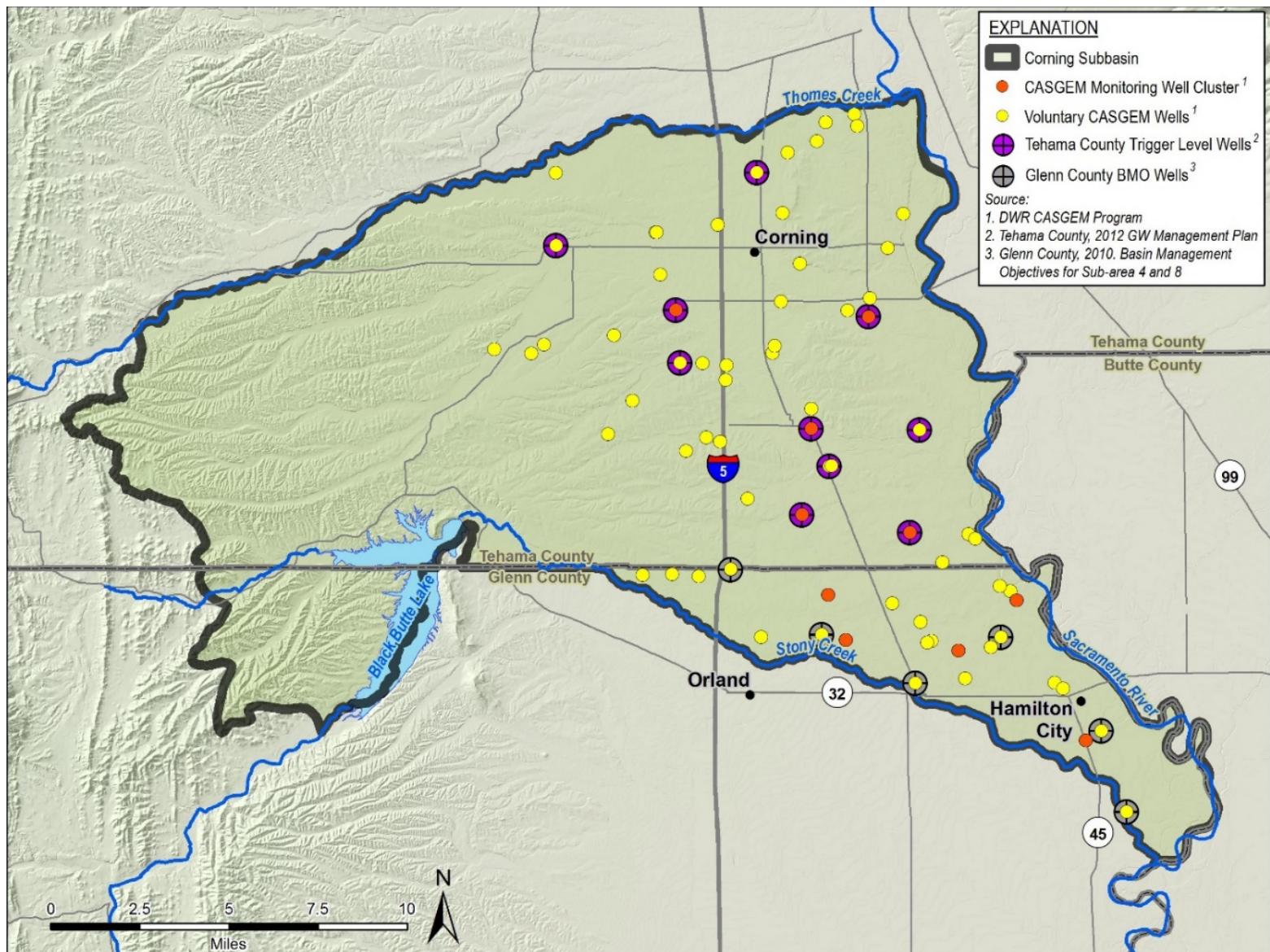


Figure 6A-1. Selection of Key Wells for Water Level Minimum Threshold Analysis

Verify Groundwater Elevations in Domestic Wells Near Key Wells

Domestic wells within a 2-mile radius of each key well were identified and are shown on Figure 6A-2. The casing depth for each domestic well was available for all wells, whereas other information such as well screen intervals was only available for some wells. Therefore, casing depth was used as a proxy for establishing whether low groundwater levels would impact the domestic well.

- Glenn County domestic well data were derived from the county DMS.
- Tehama County domestic well data were derived from the DWR well completion report database.
- Wells more than 30 years old were excluded because this is the anticipated lifespan of low carbon steel wells, which is the most common casing type used for domestic wells in this area.
- The depths of the shallowest 10% and 20% of domestic wells within 2 miles of each key well were deemed to be protective of relatively shallow domestic wells.
- A safety factor of 25 feet was subtracted from the shallow domestic well depths to maintain sufficient water in domestic wells to operate pumps.

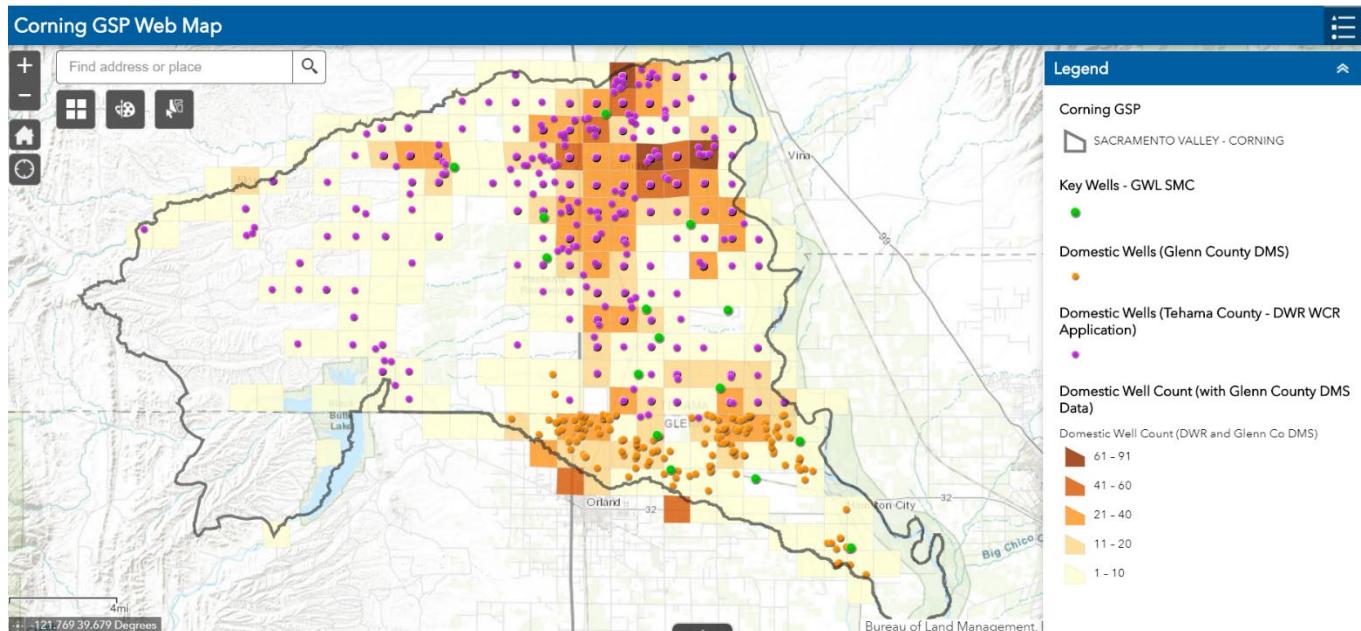


Figure 6A-2. Domestic Well Distribution in the Subbasin Relative to Key Wells

The following minimum threshold options were reviewed to assess if water level goals may cause domestic wells to go dry, as a protective level for domestic well users:

- Minimum water level measurement (Tehama Trigger Level Method)
 - All years from historical dataset
 - Specific year (2012, 2015, 2018)
- Average water level minus 2 times the standard deviation (Glenn BMO Method)
 - Comparable to minimum water level method but statistically removes outliers
- Water level linear trend of recent historical data extrapolated to 2042
 - Trend of all water level measurements
 - Annual minimum water level trend

The depth of 10% or 20% of the domestic wells within a 2-mile radius of the key well, plus a safety factor of 25 feet to maintain sufficient water in domestic wells to operate pumps, was assessed to establish a protective level for domestic well users.

Select Preliminary Minimum Thresholds and Measurable Objectives

The general methodology for selecting SMC for chronic lowering of groundwater levels was presented at the CSAB meeting on October 7, 2020. Feedback from CSAB members and the public was received at the meeting. CSAB members and other local stakeholders acknowledged that recent minimum groundwater levels caused domestic and shallow irrigation wells to go dry, requiring well replacement and deepening of well pumps. Based on this information the CSAB agreed that the current minimum (or fall 2019) groundwater levels were generally causing significant and unreasonable conditions in the Subbasin.

The preliminary measurable objective options considered were the minimum 2012 water level and the average water level between 2002 and 2012. In 2012, groundwater levels in most wells were higher than they were in 2019 at a level that would provide significant operational flexibility above the minimum threshold. The 2012 minimum water level was selected as a preliminary measurable objective for the Subbasin.

Refinement of Minimum Threshold and Measurable Objectives:

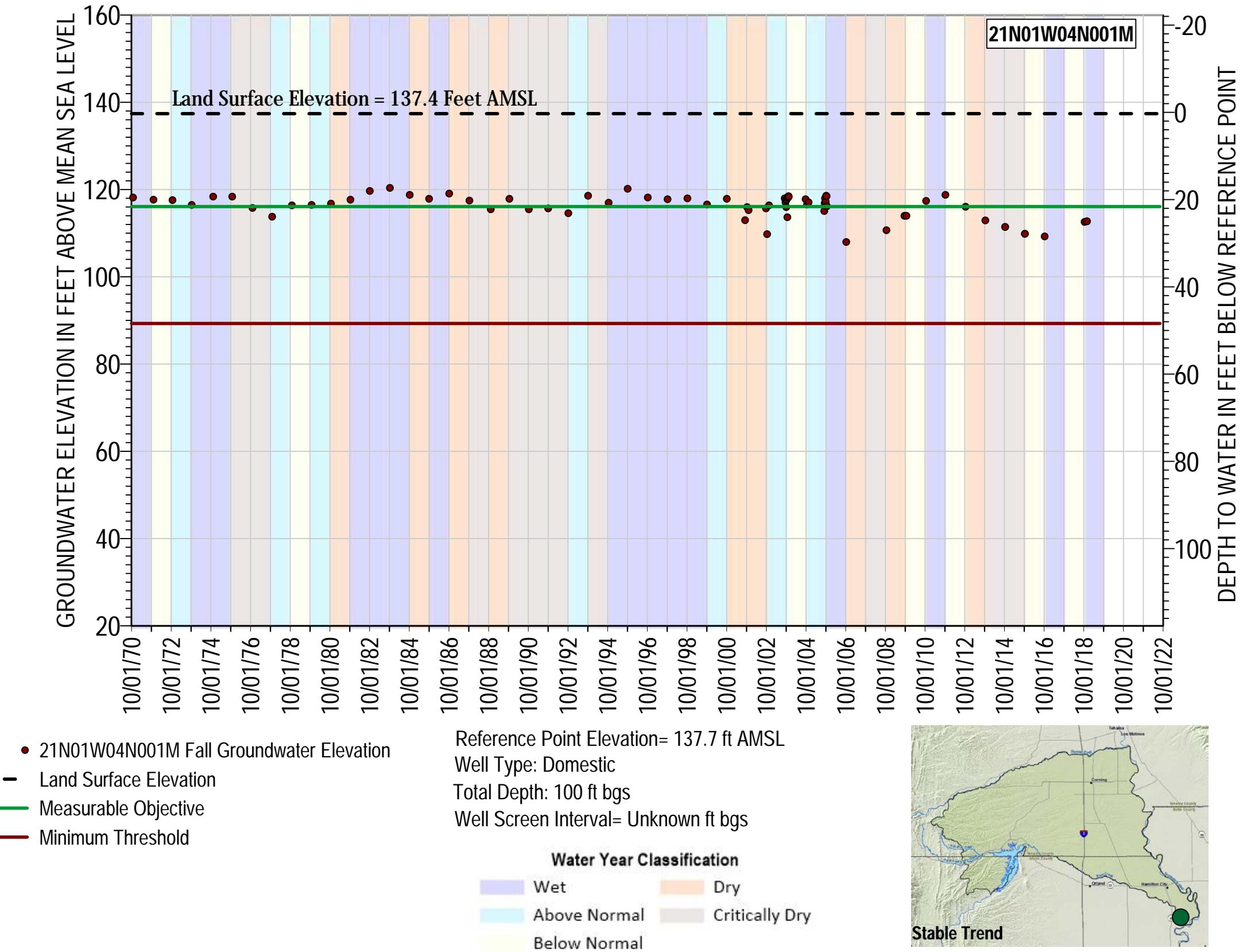
Hydrographs of groundwater levels over time for shallow and deep RMP wells were reviewed in order to refine minimum threshold and measurable objective options. Groundwater elevation trends in the Subbasin are described in more detail in Section 3.2. Upon further review, the late summer or fall minimum water level in 2018 was generally considered to be the lowest on record in more wells than in 2019, and consequently was considered more representative of the locally

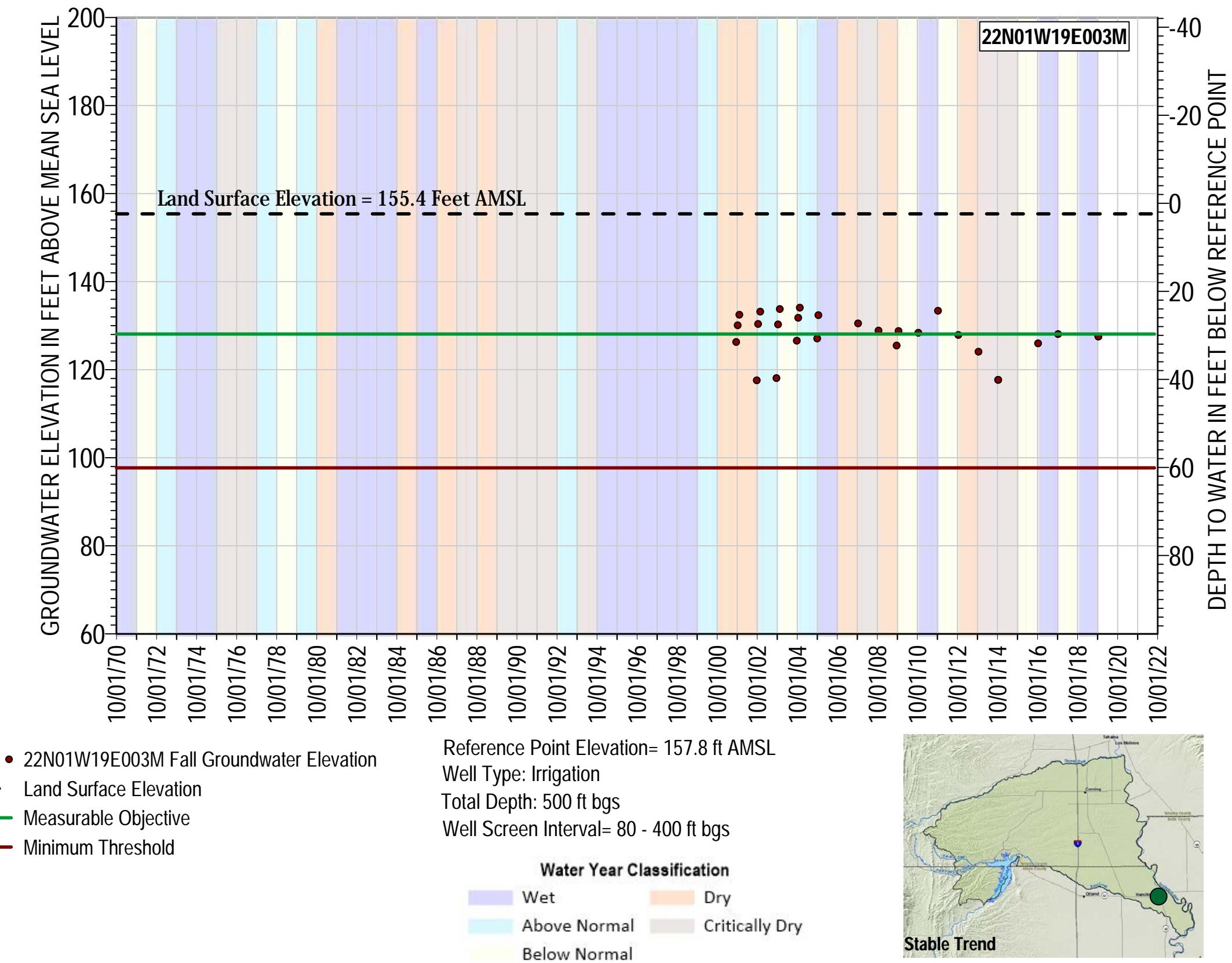
defined significant and unreasonable conditions in the Subbasin. The measurable objective was refined to be the maximum spring water level in 2012; this value provided more operational flexibility than the initial proposed 2012 minimum values.

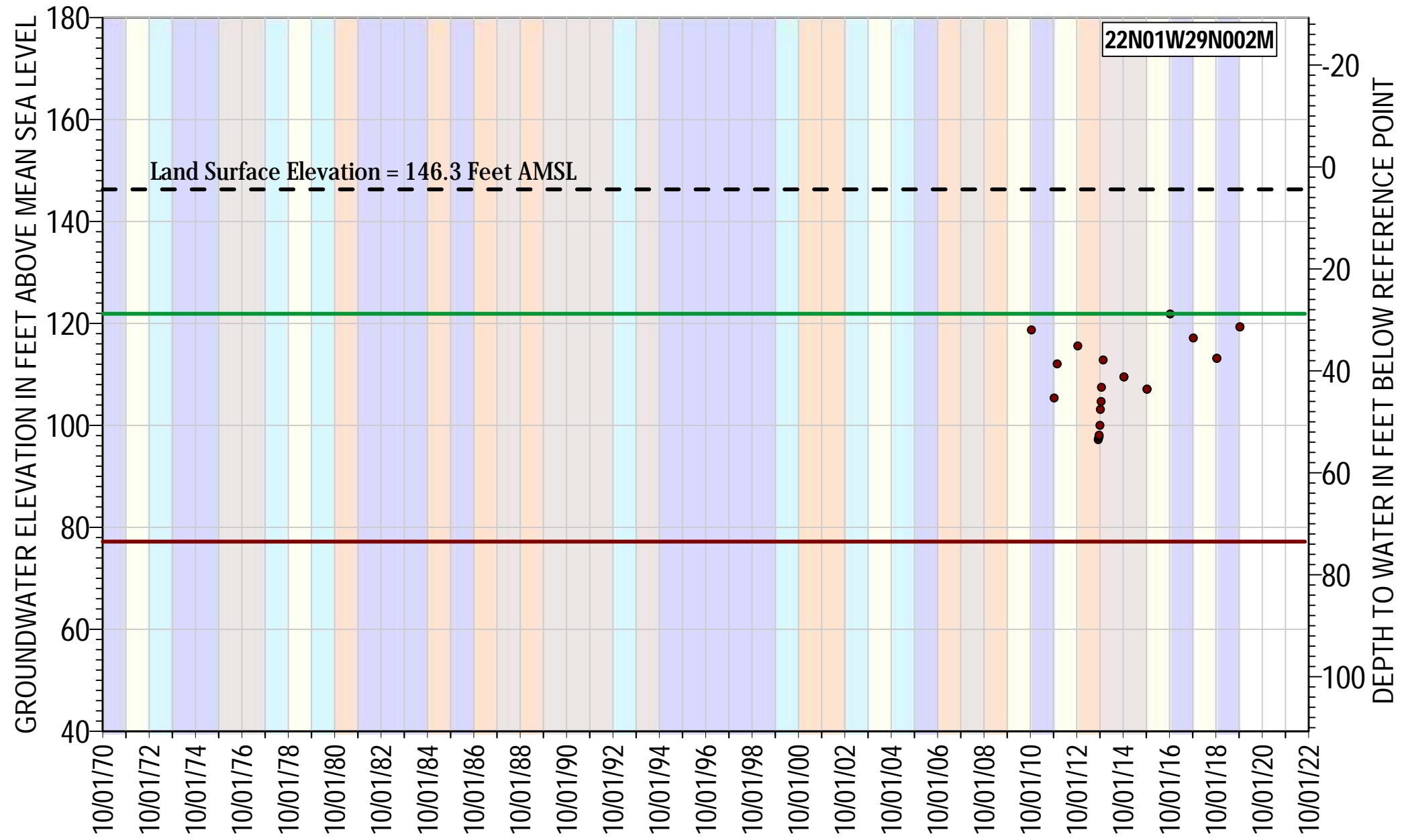
This approach was a good initial estimate to have discussions with stakeholders and identify potential significant and unreasonable conditions in the Subbasin, but did not take into account that current conditions are different than prior to the drought, when the original Glenn BMOs and Tehama trigger levels were developed. This, a more realistic approach was developed and is described in Section 6.6

Appendix 6B

RMP Hydrographs with SMC



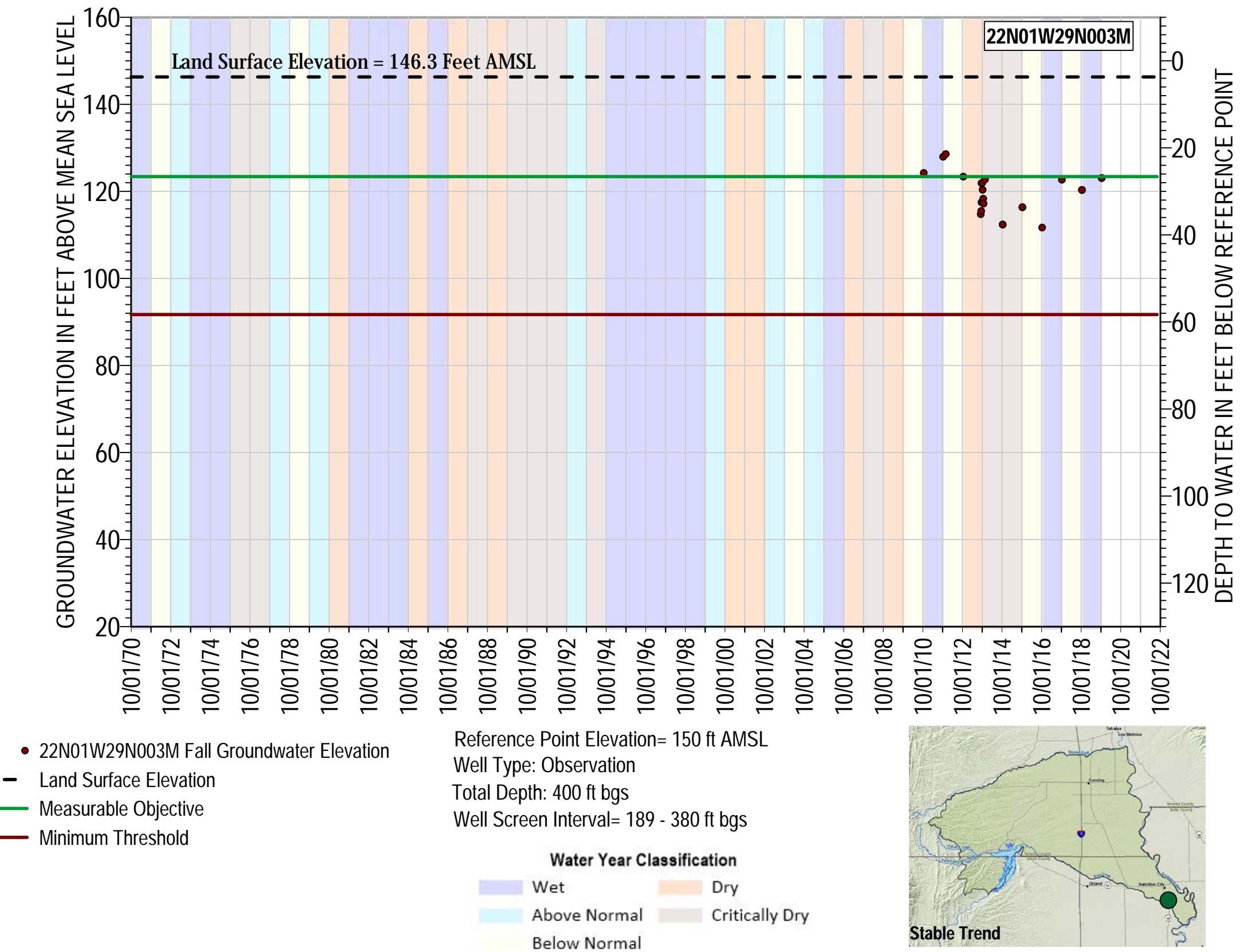


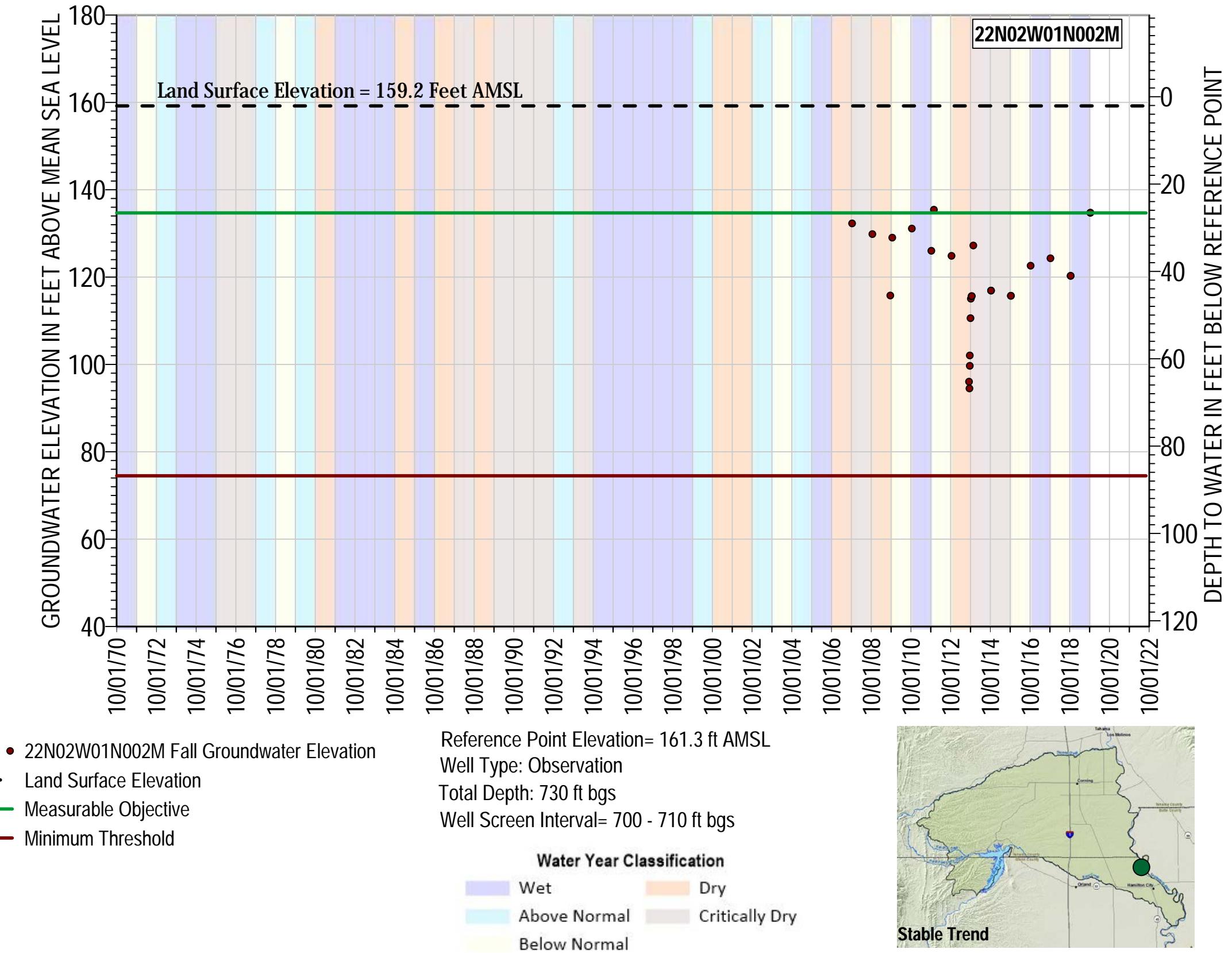


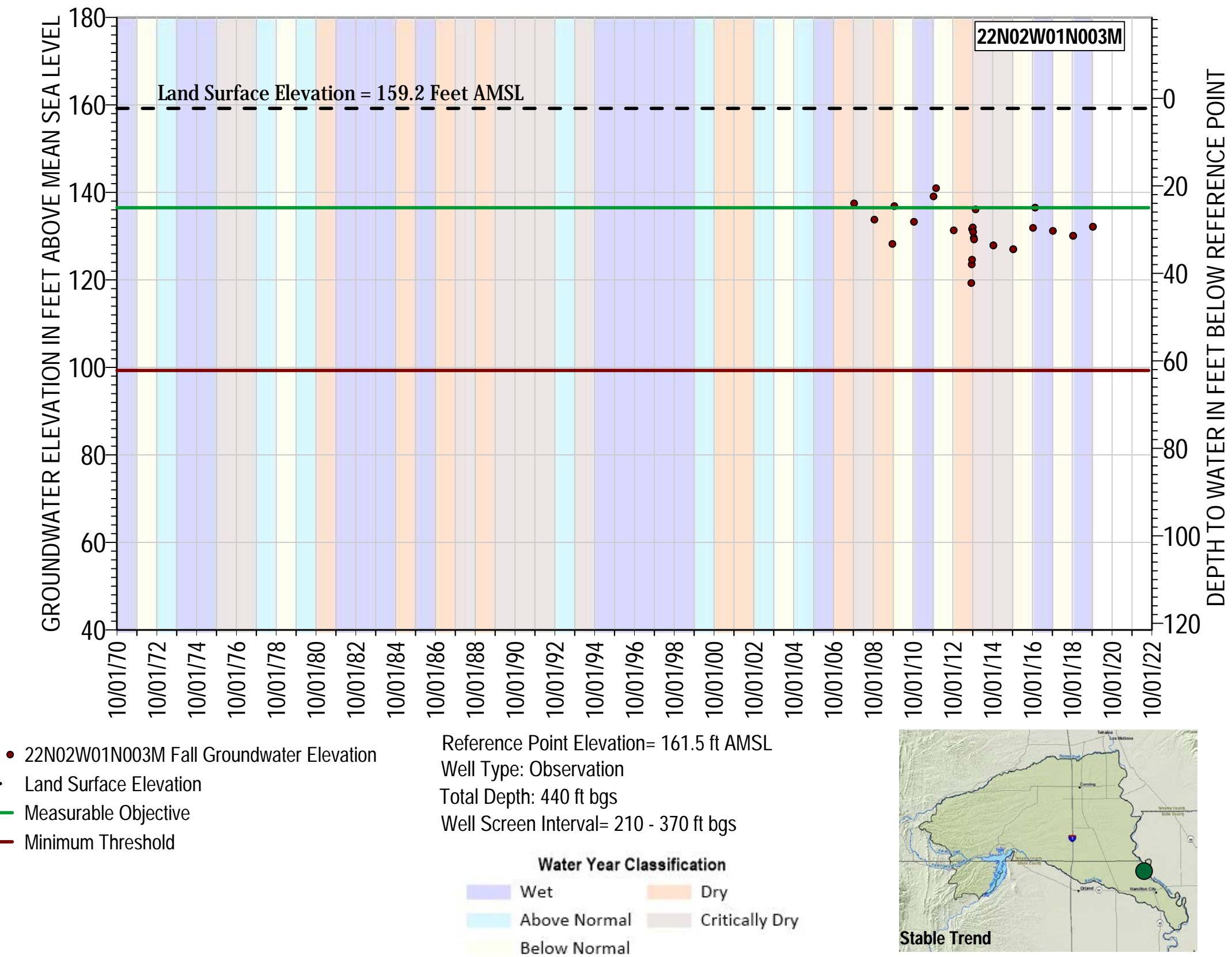
- 22N01W29N002M Fall Groundwater Elevation
- - Land Surface Elevation
- Measurable Objective
- Minimum Threshold

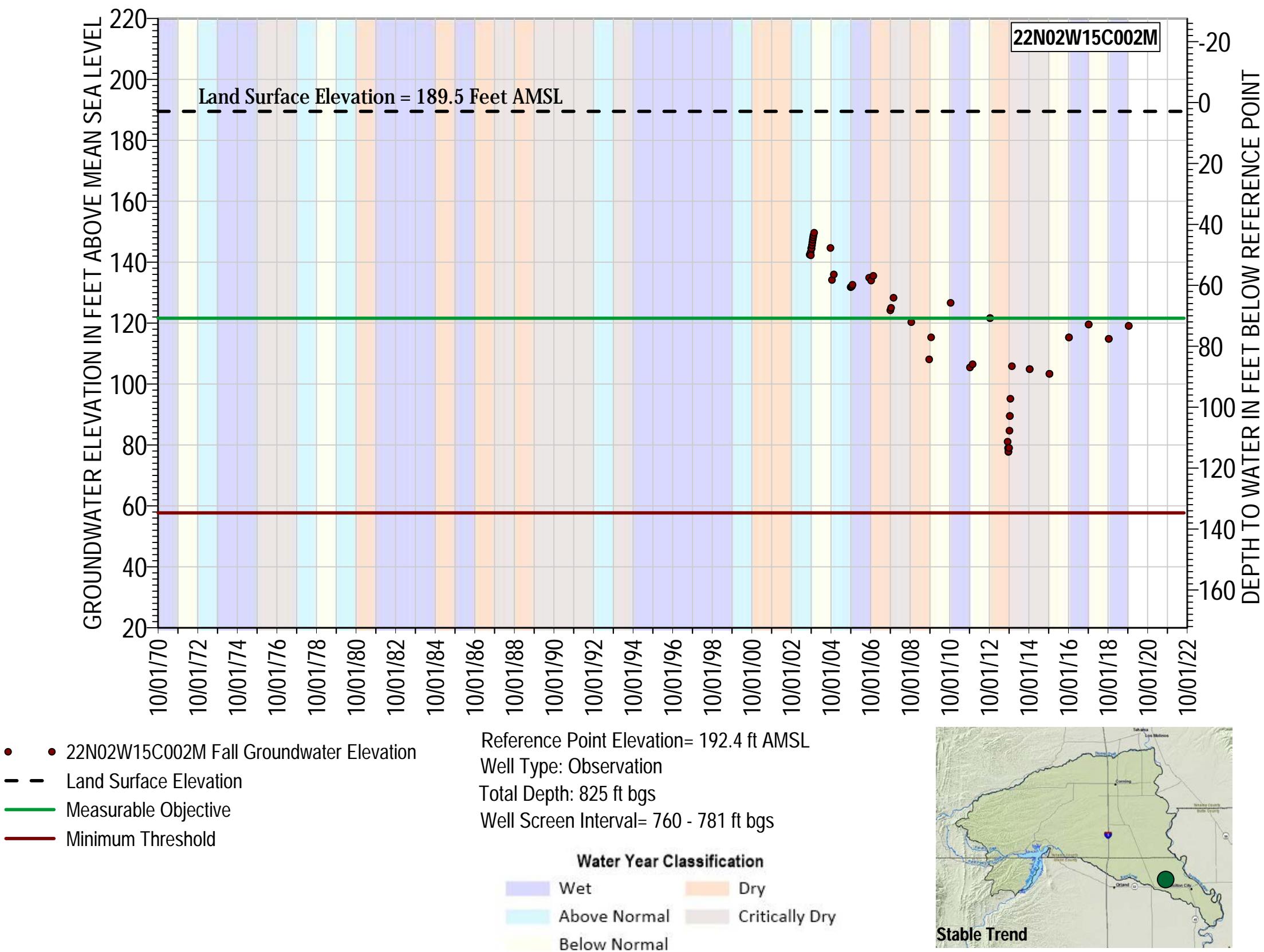
Reference Point Elevation= 150.7 ft AMSL
 Well Type: Observation
 Total Depth: 670 ft bgs
 Well Screen Interval= 549 - 641 ft bgs

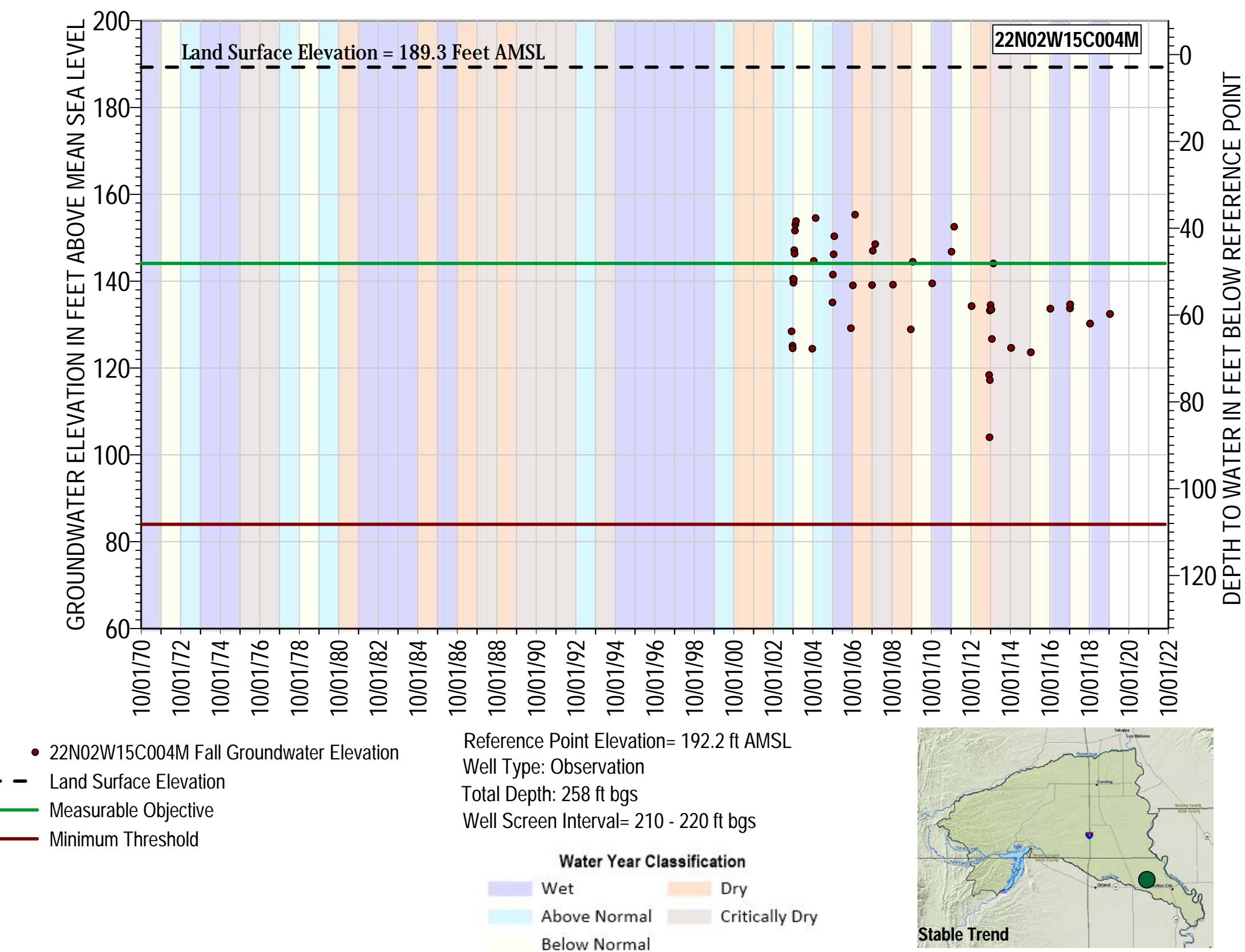


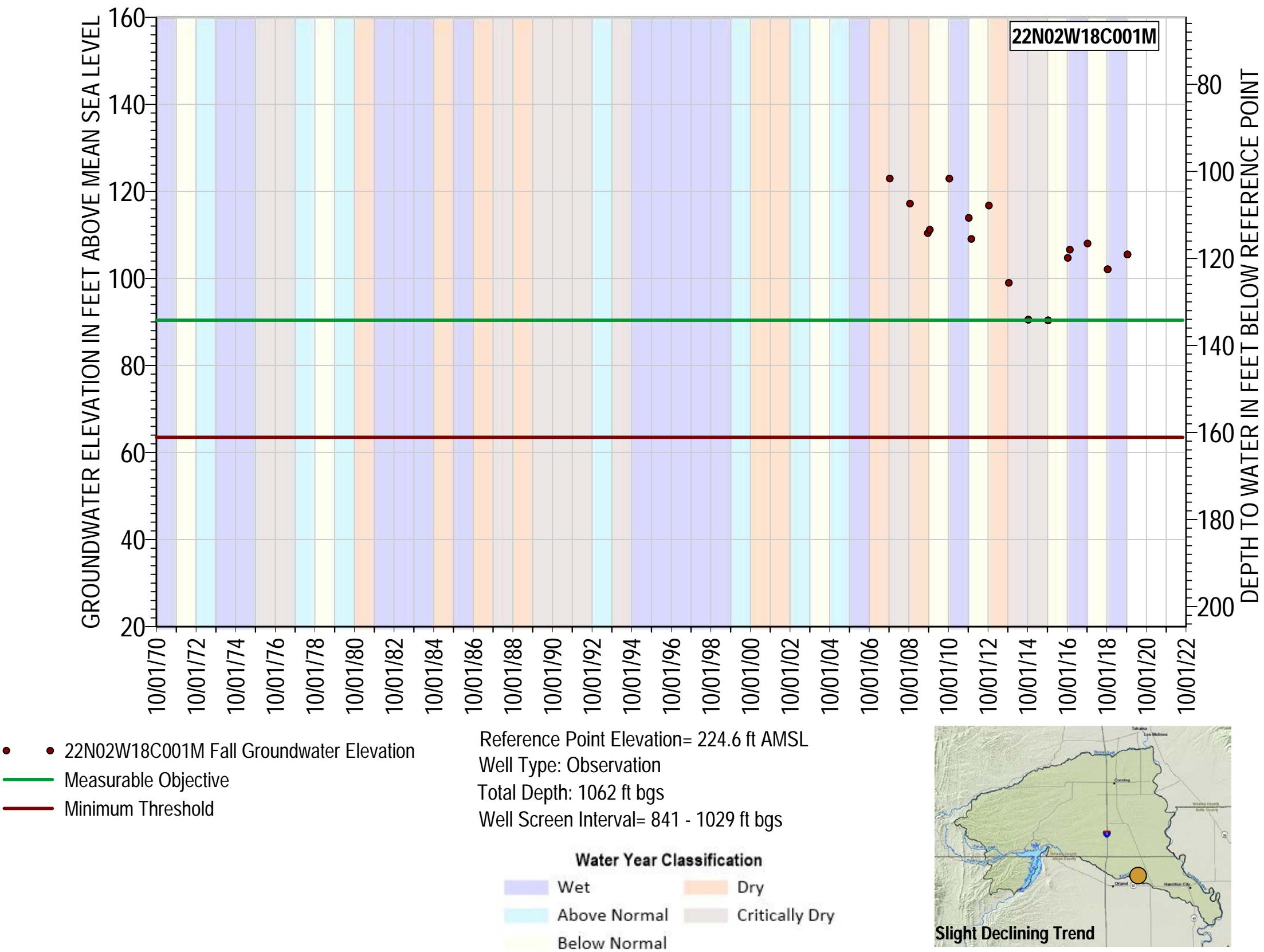


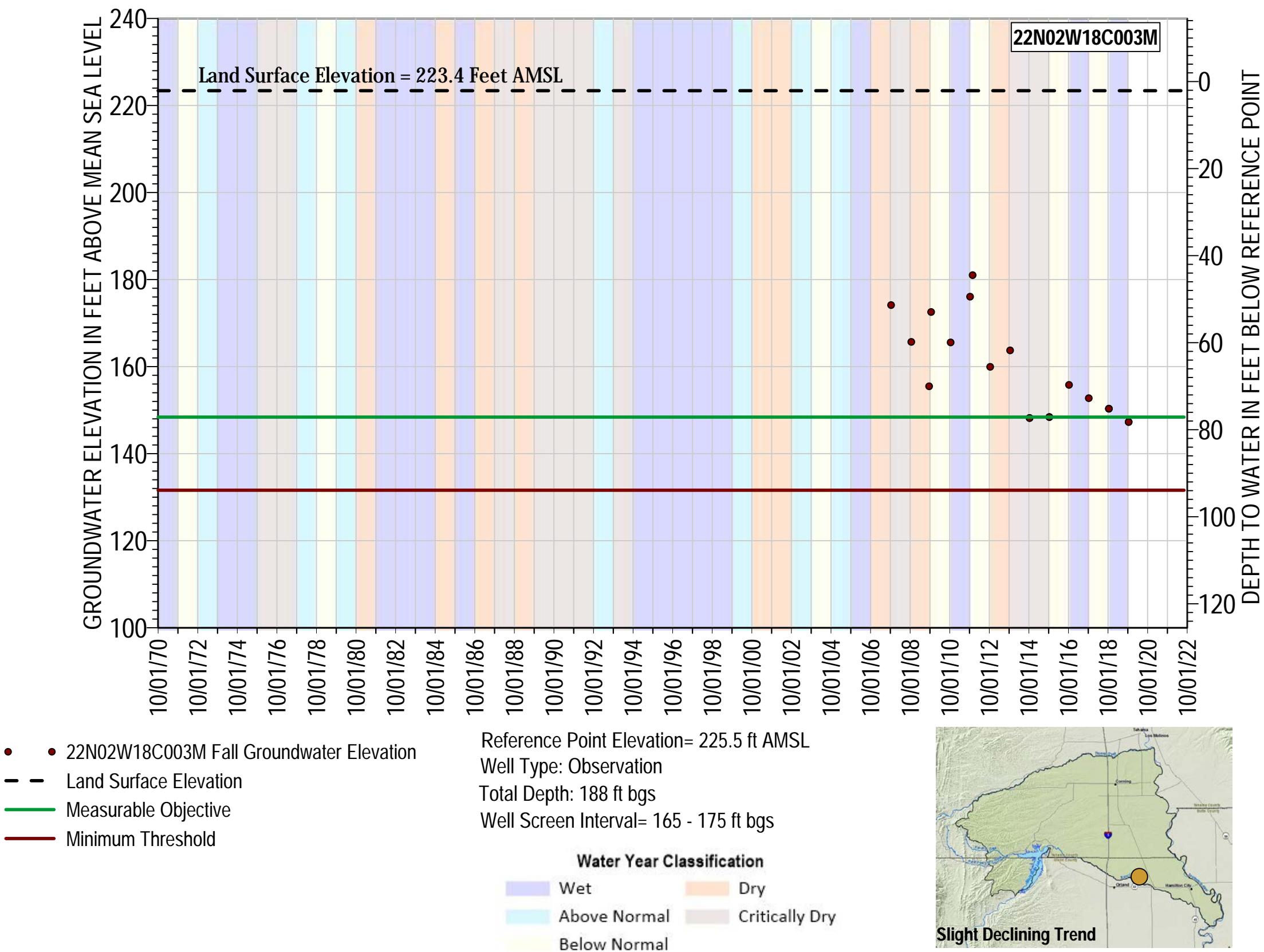


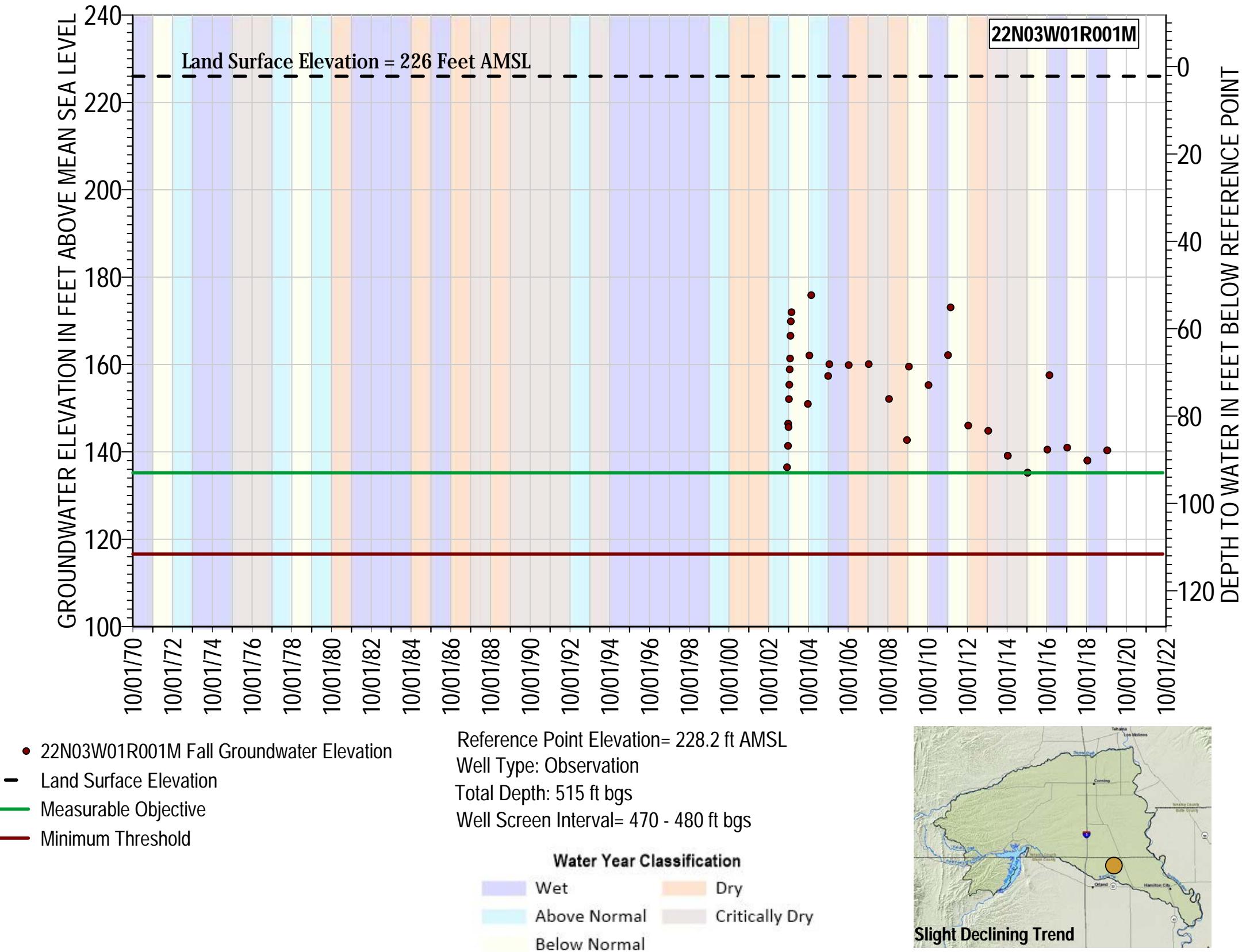


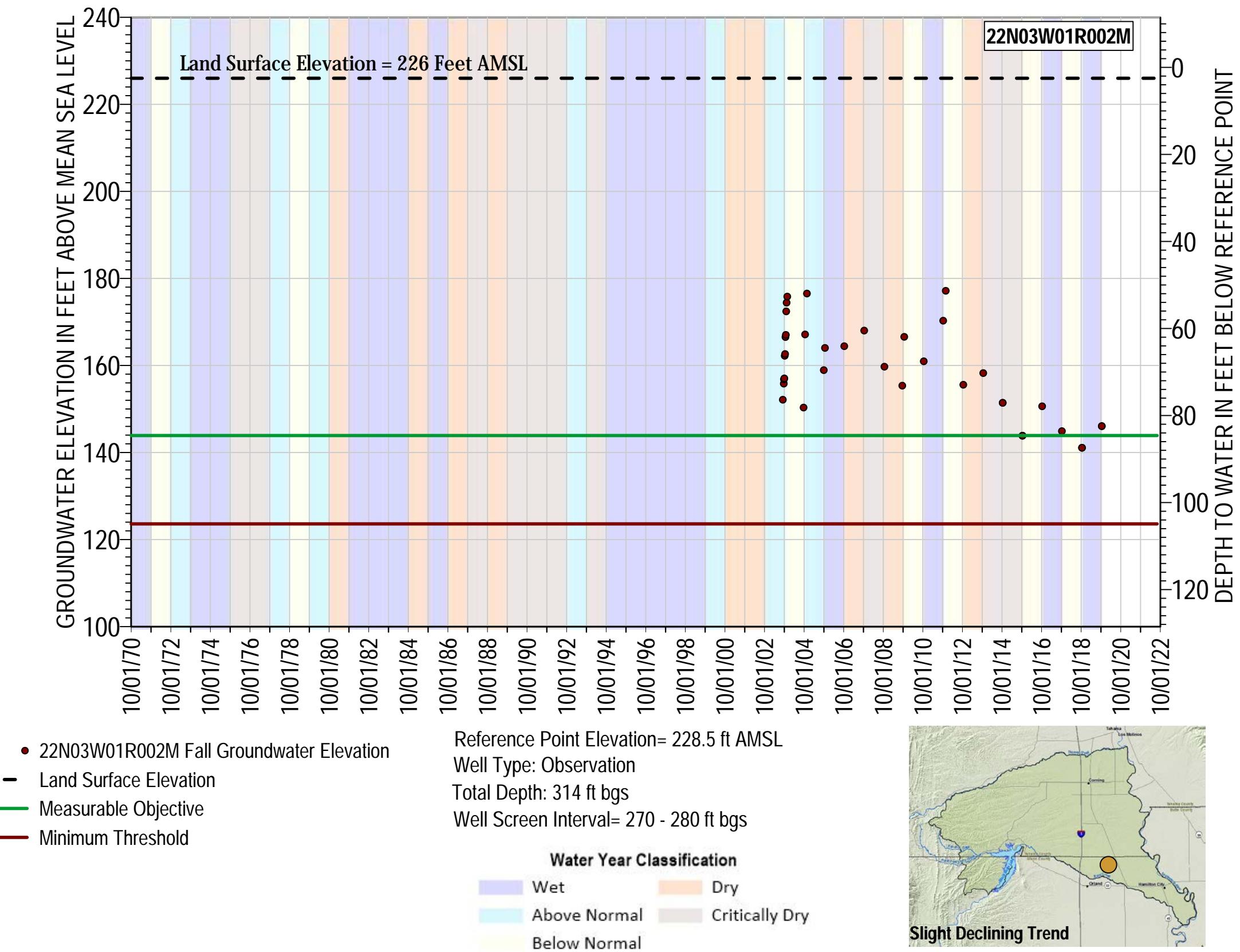


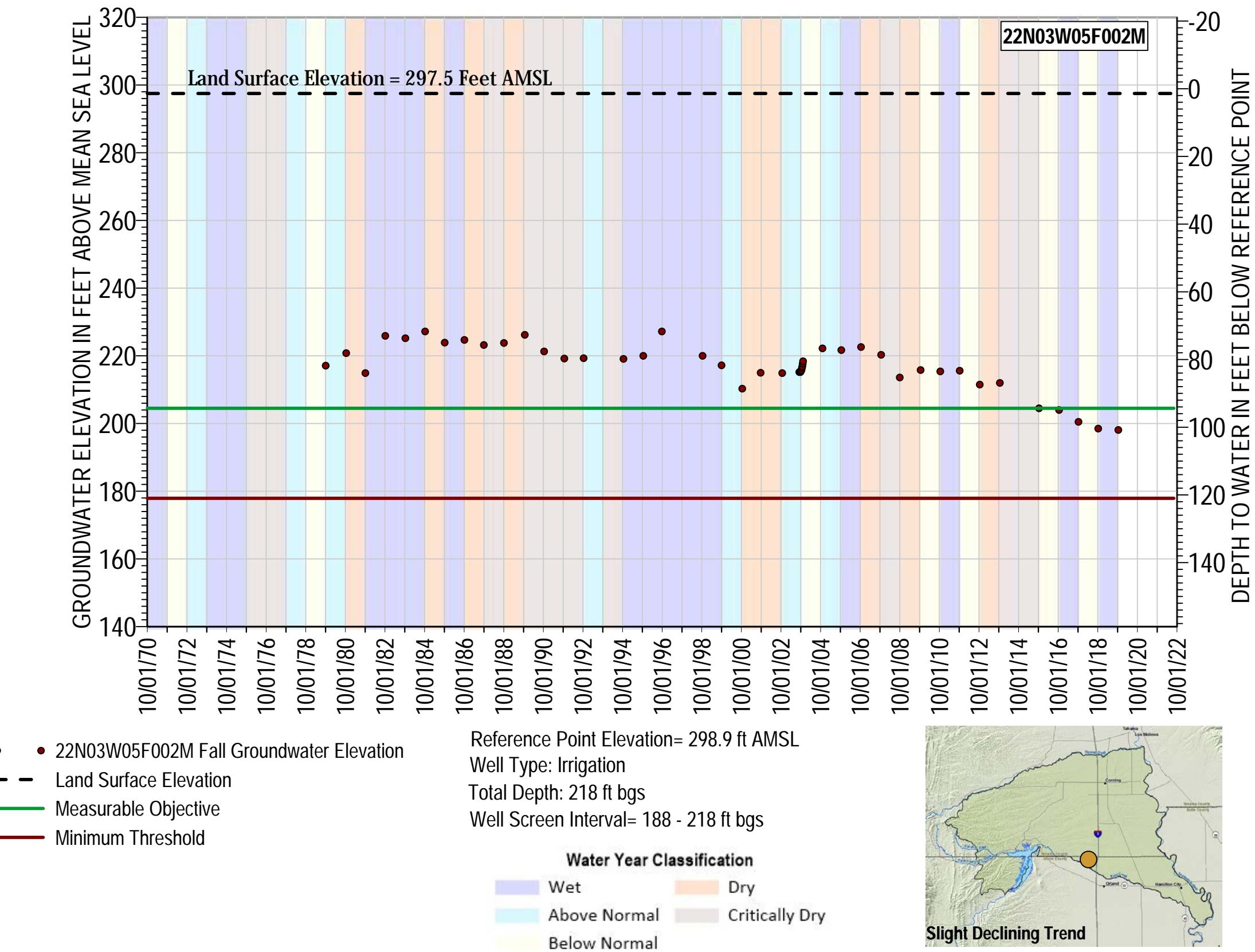


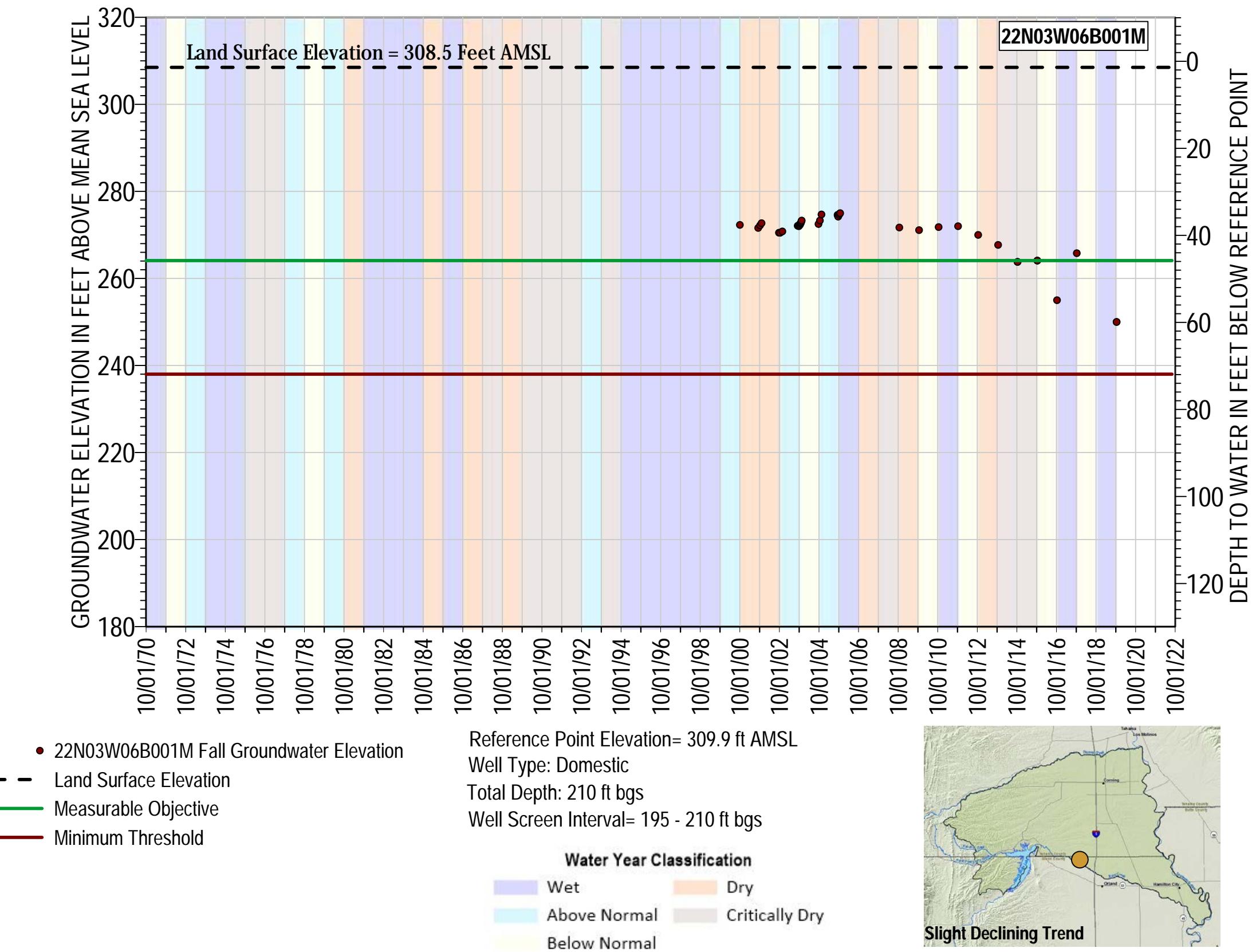


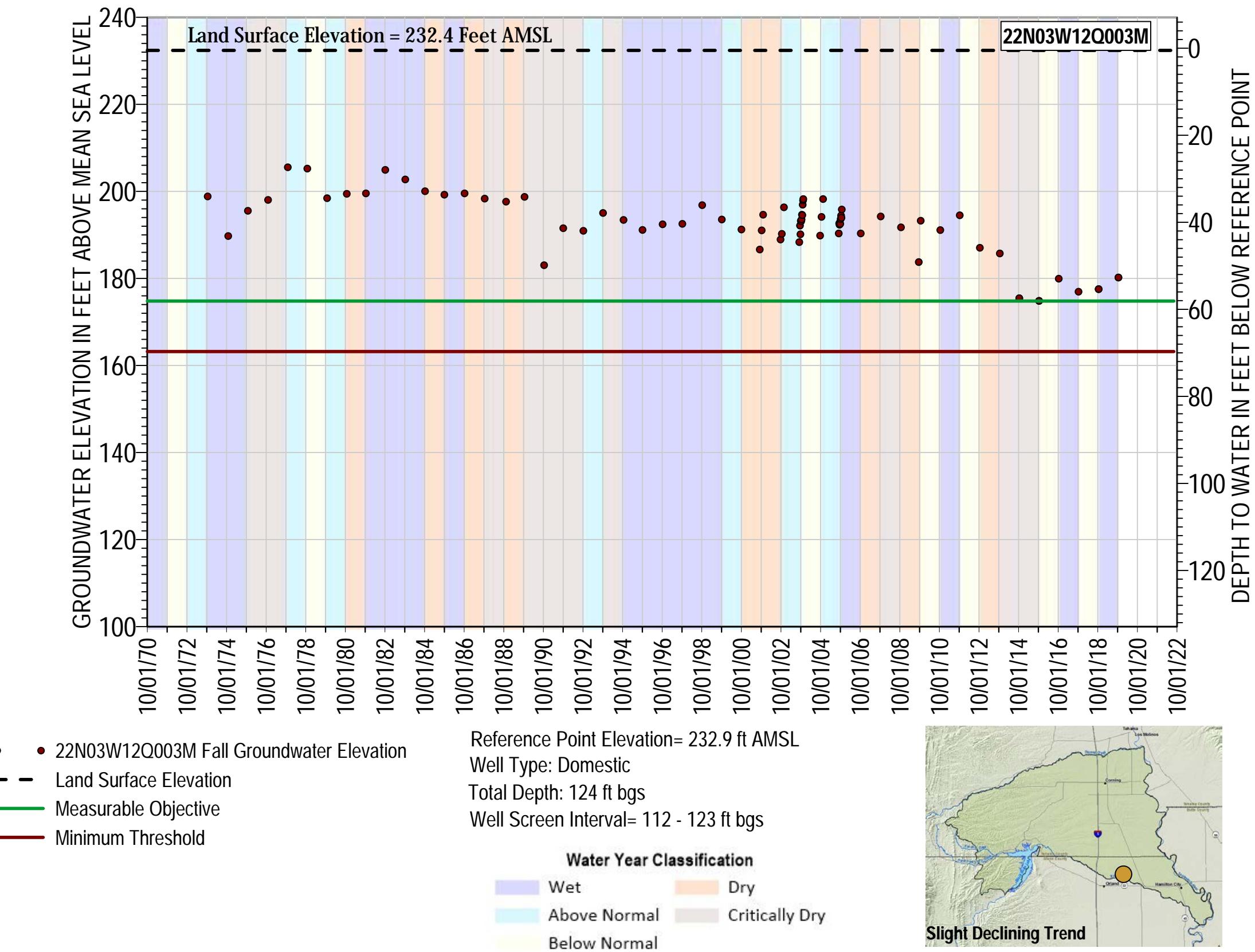


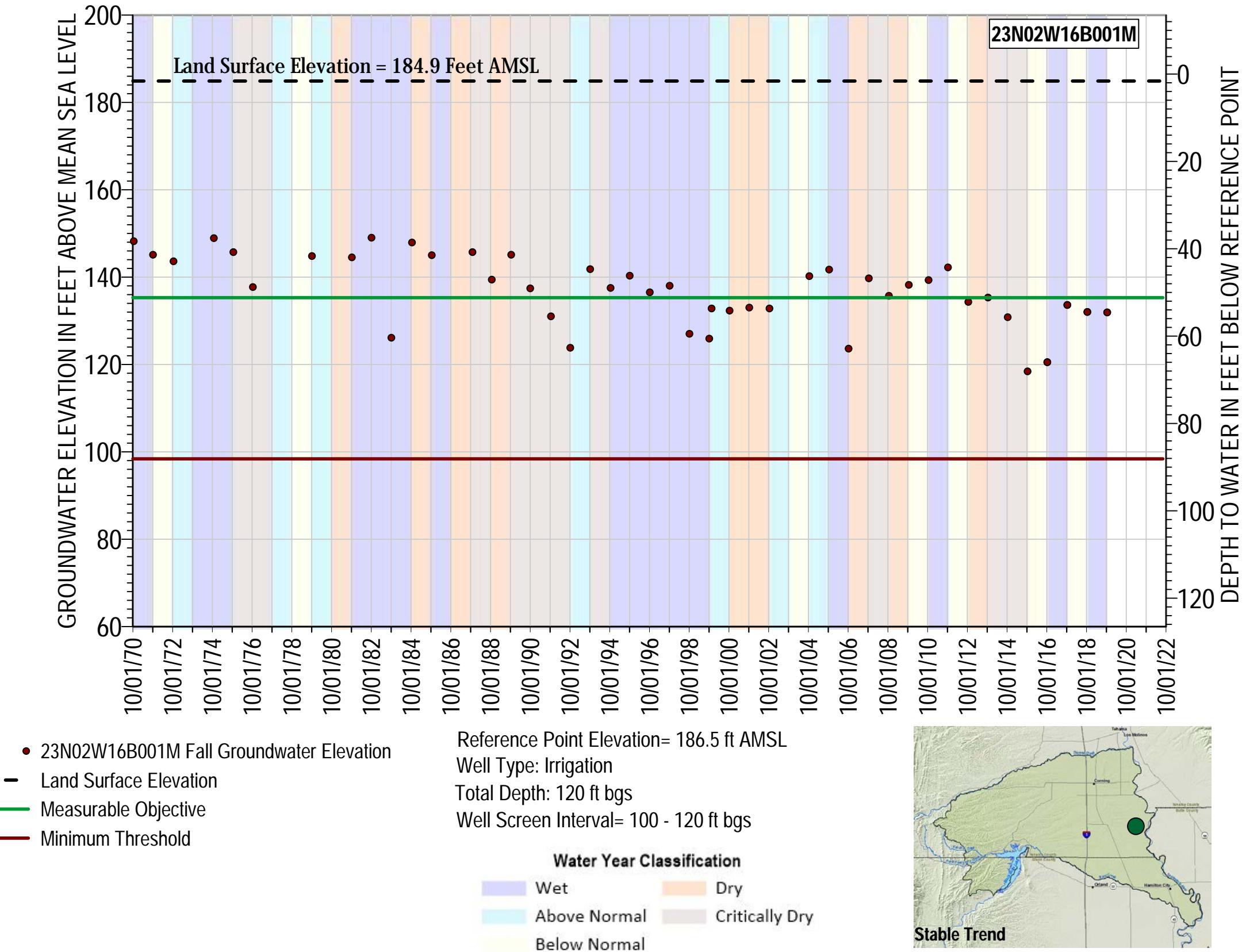


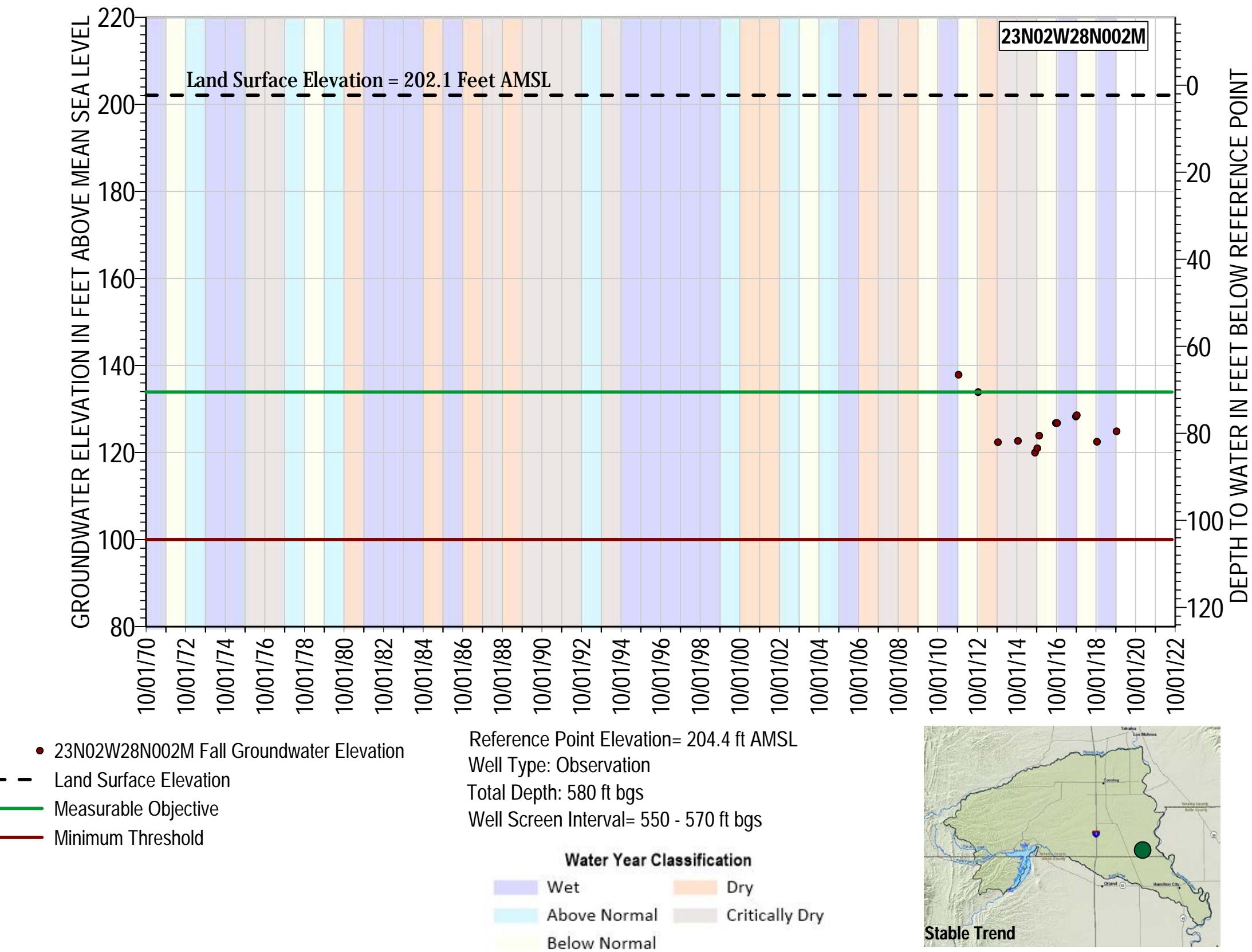


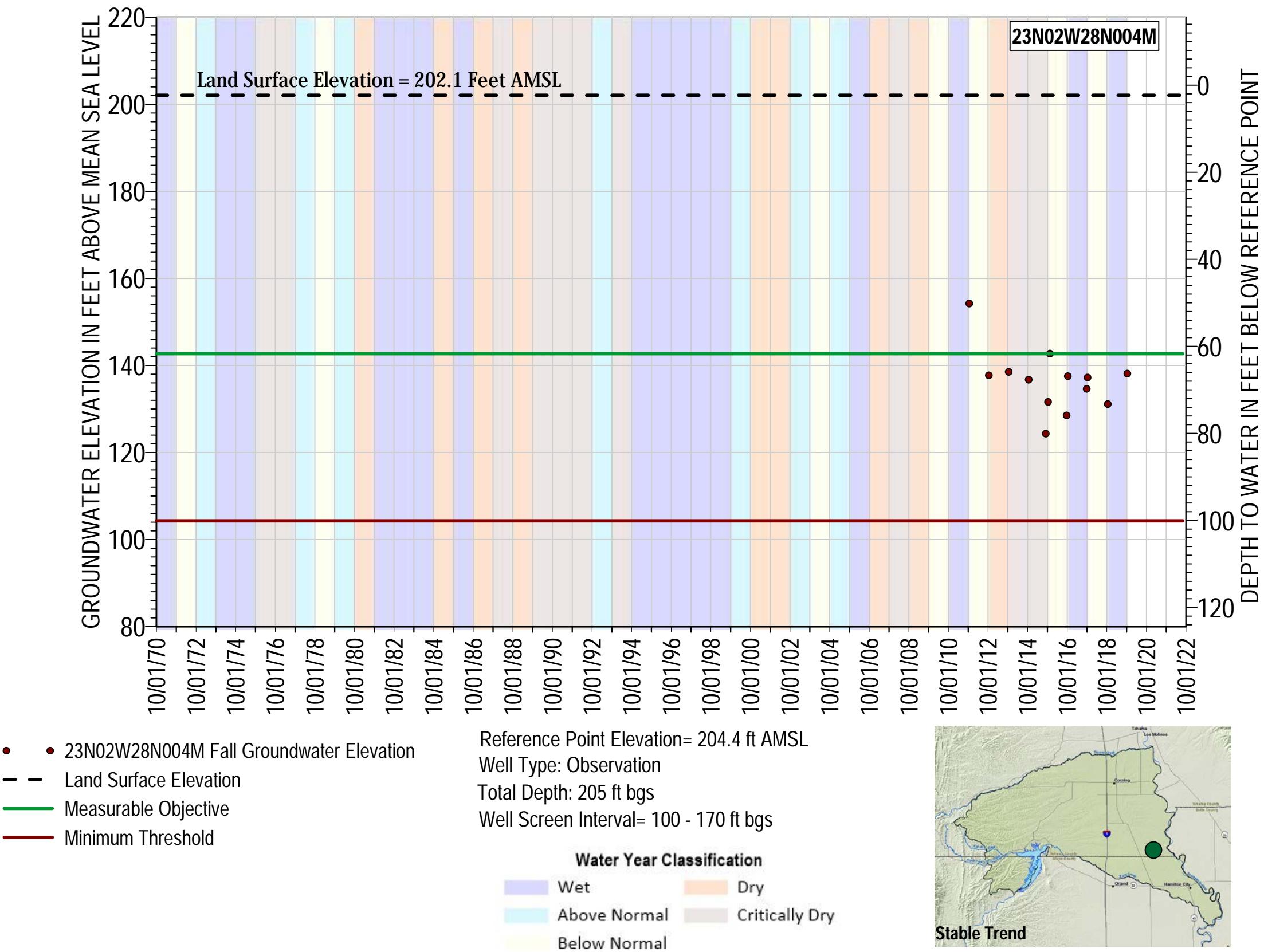


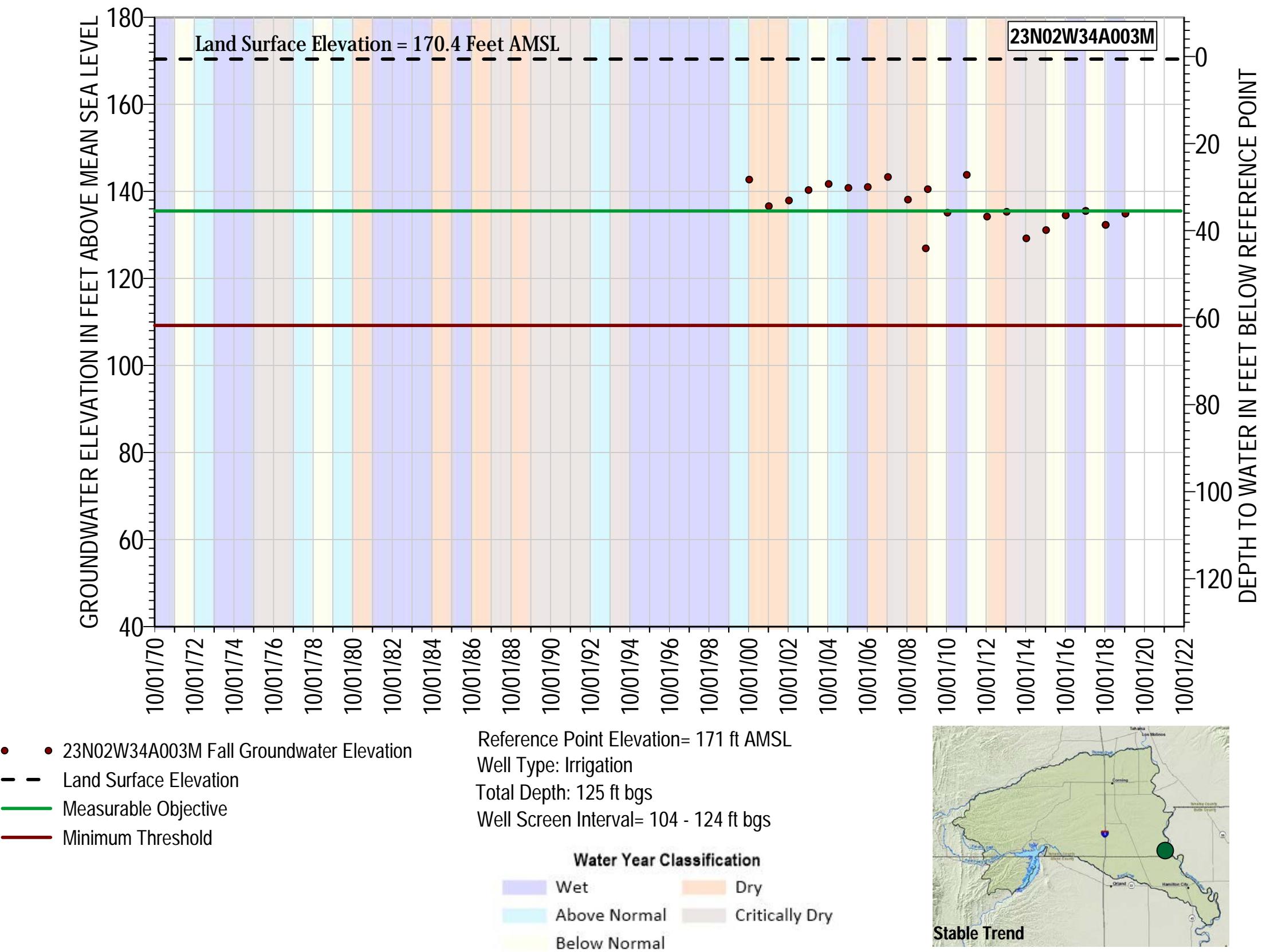


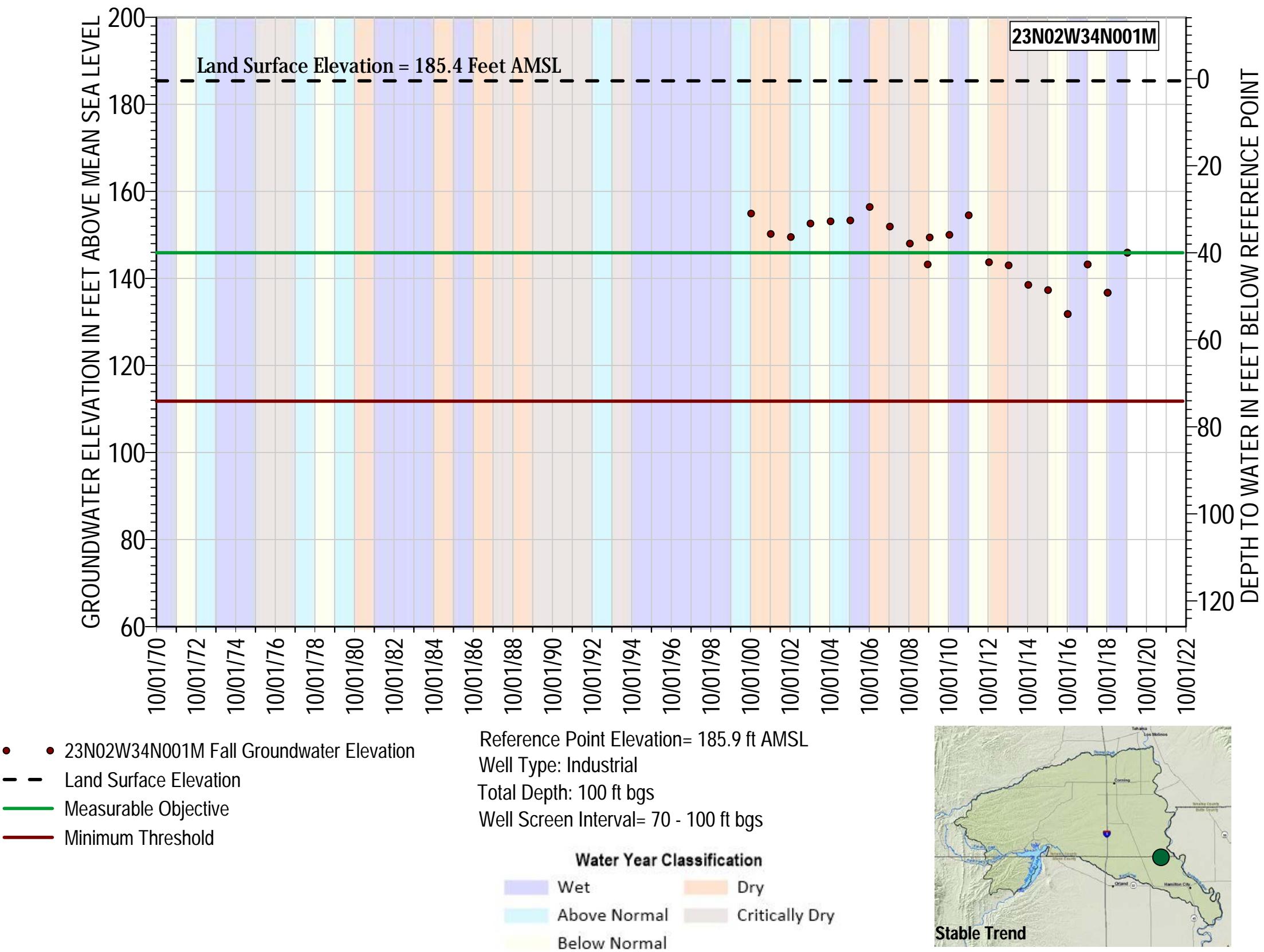


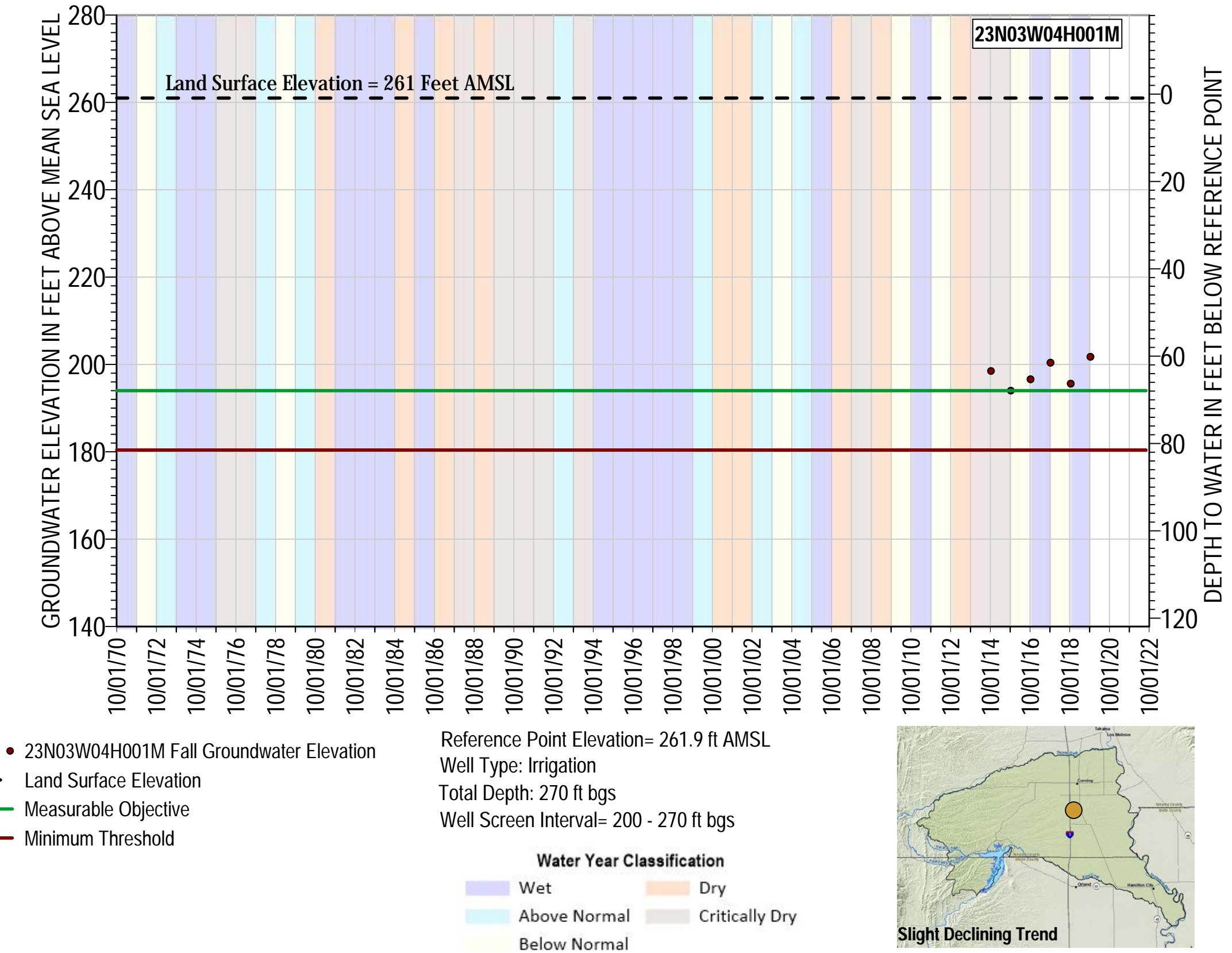


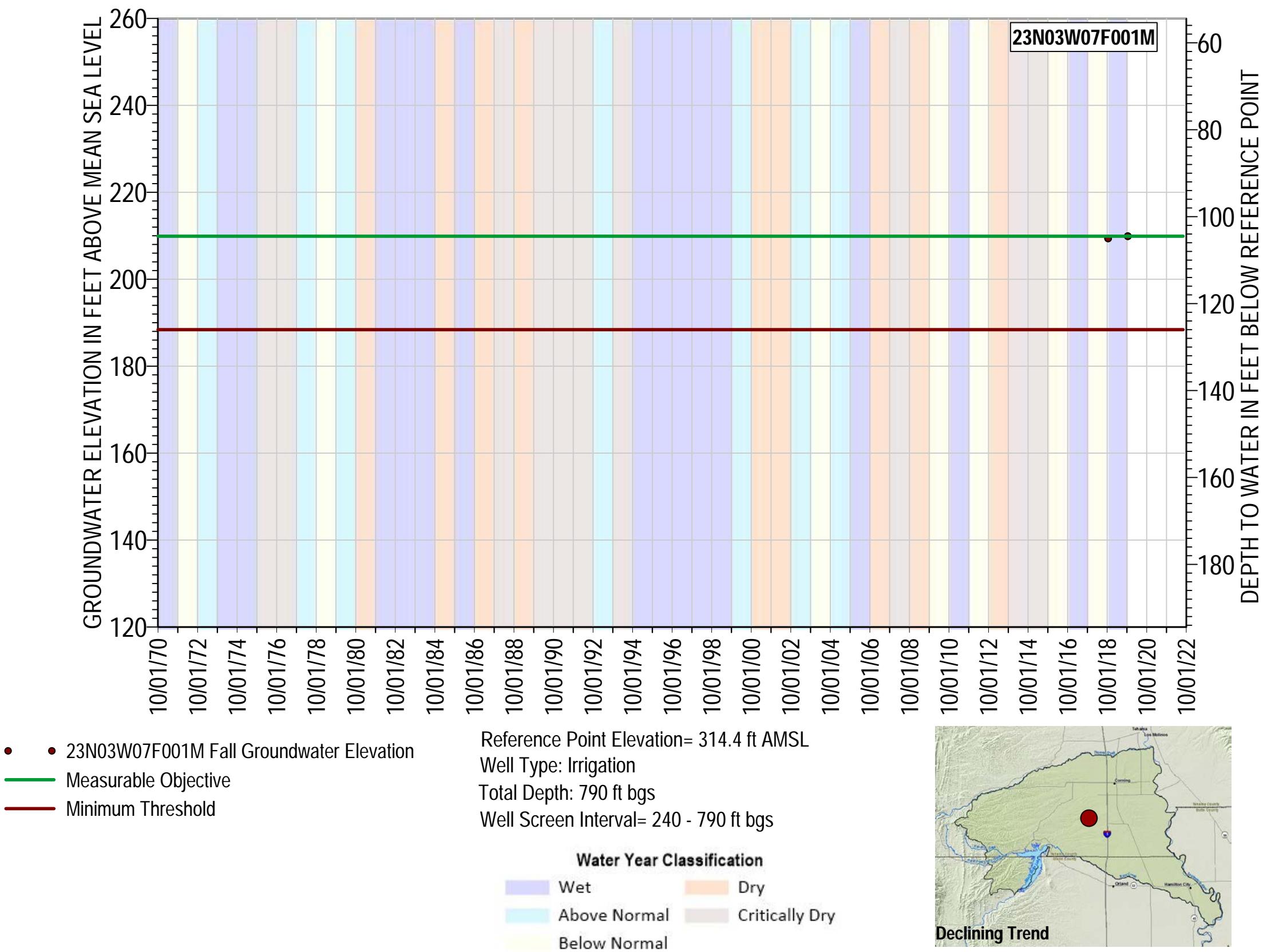


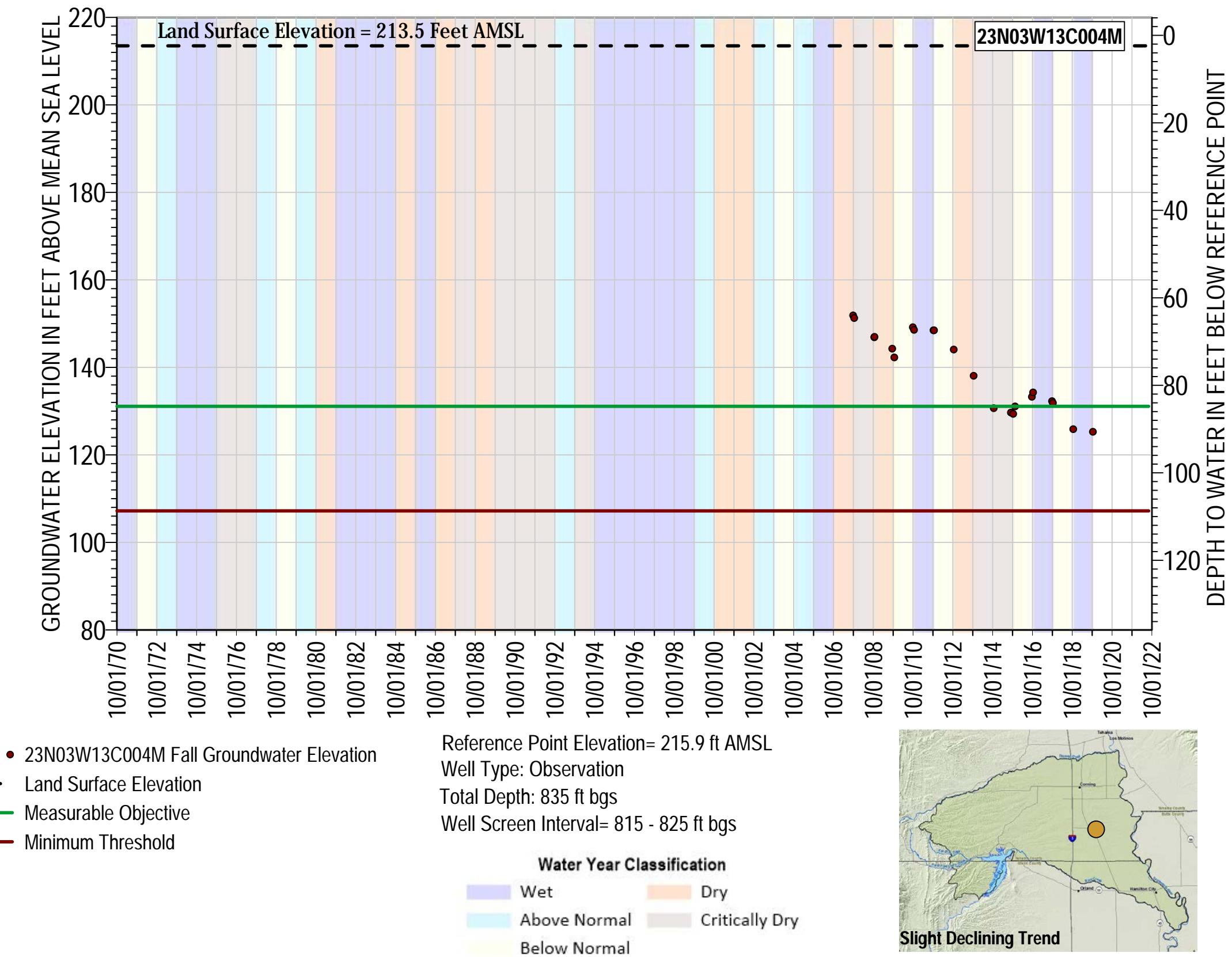


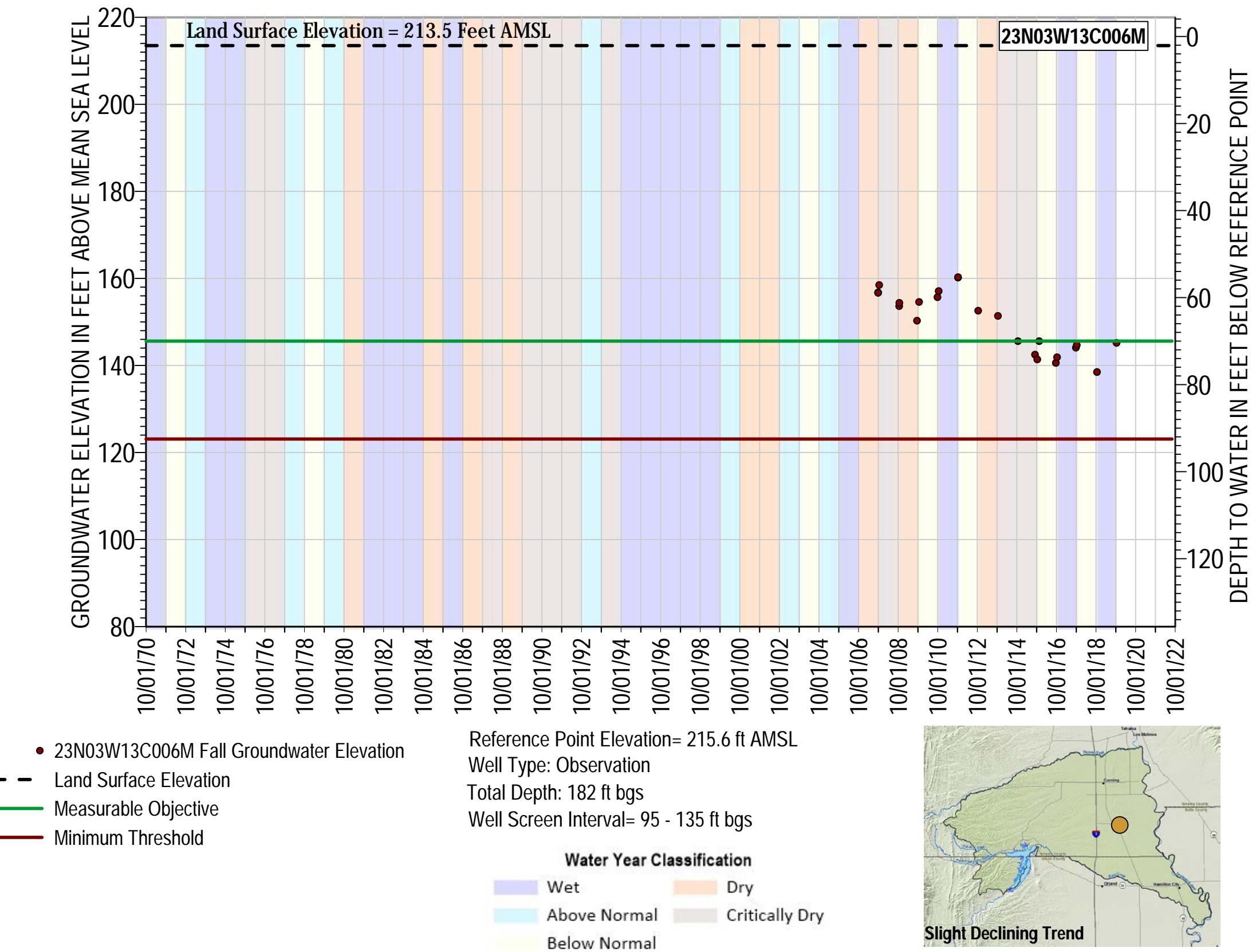


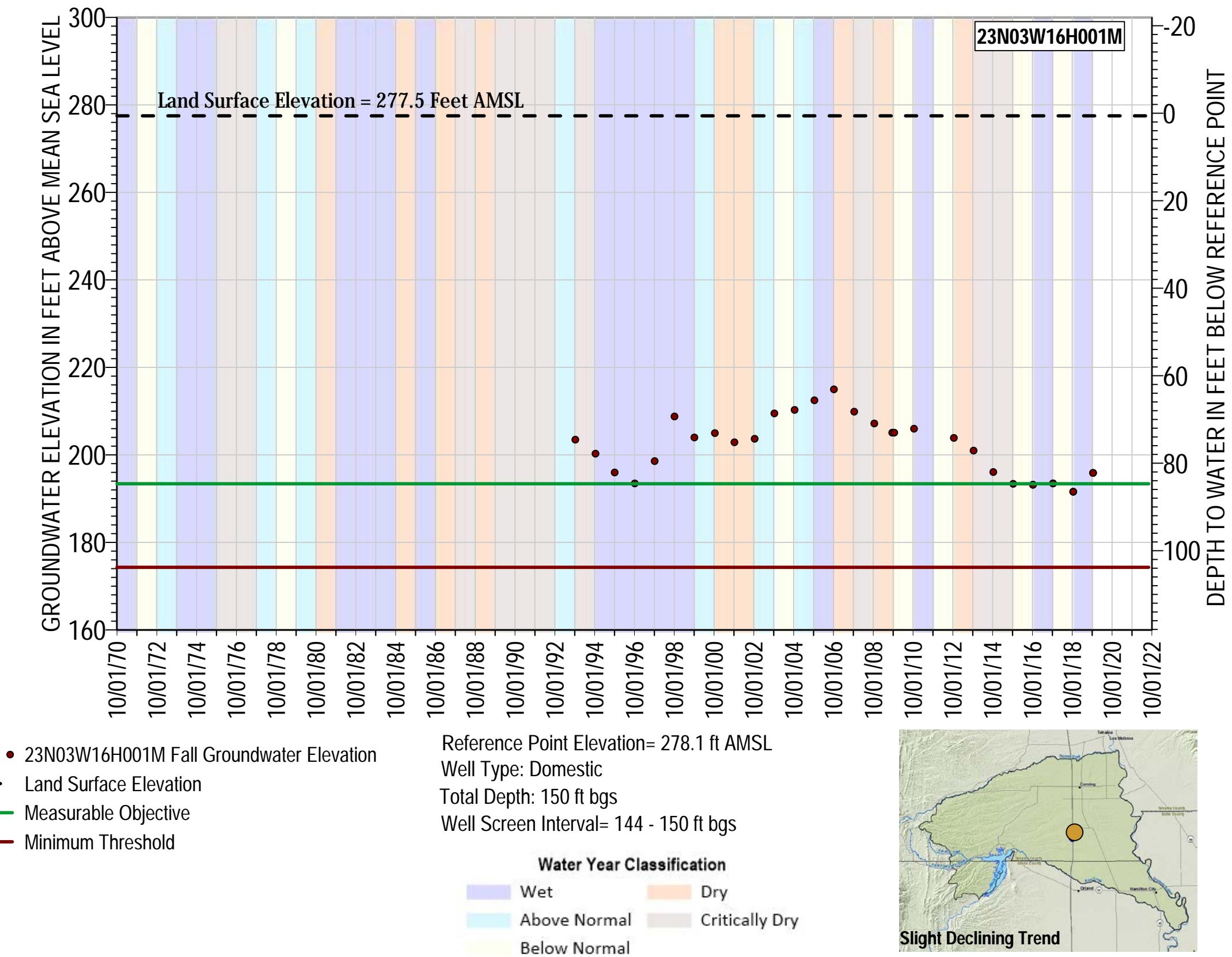


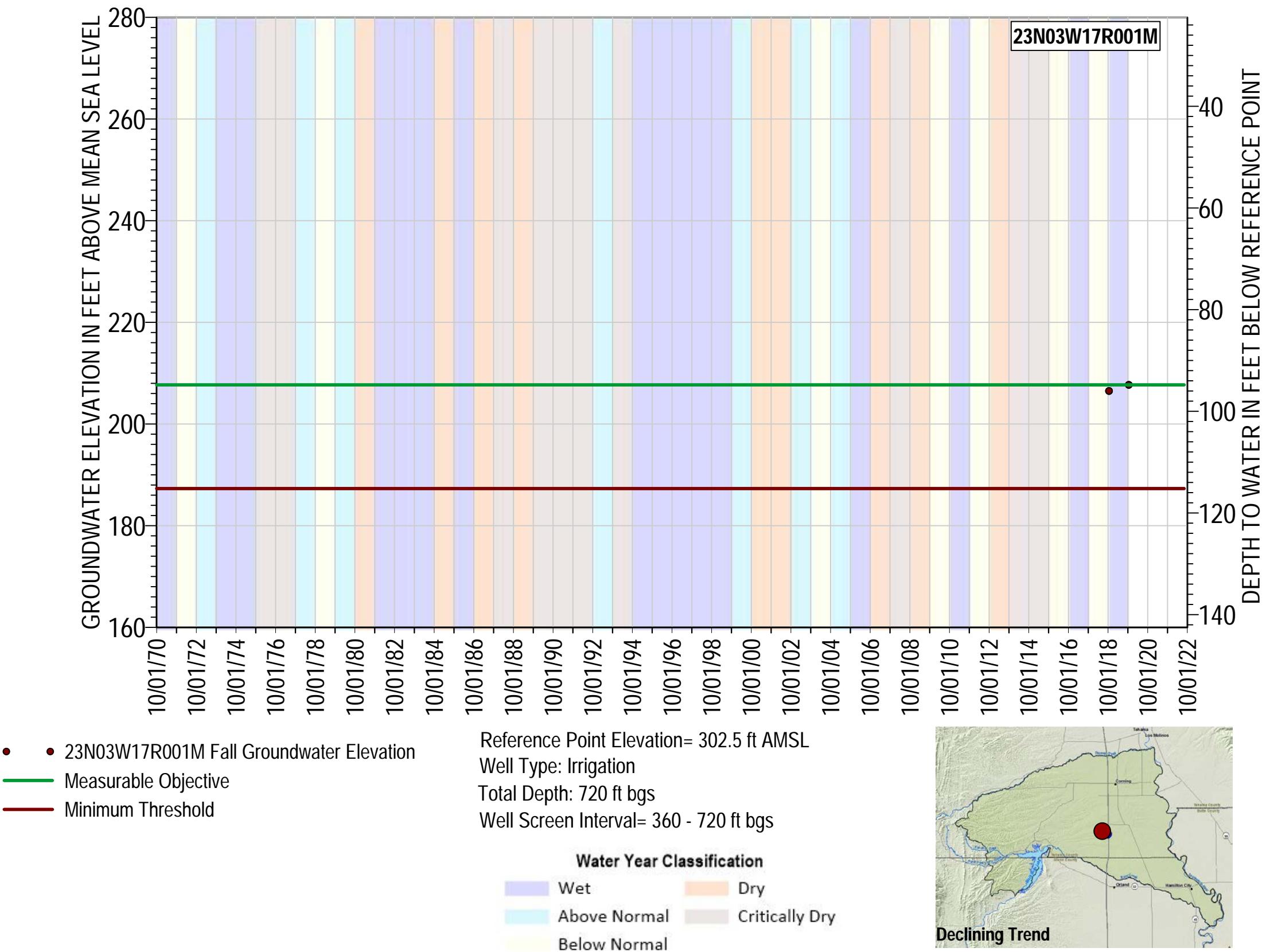


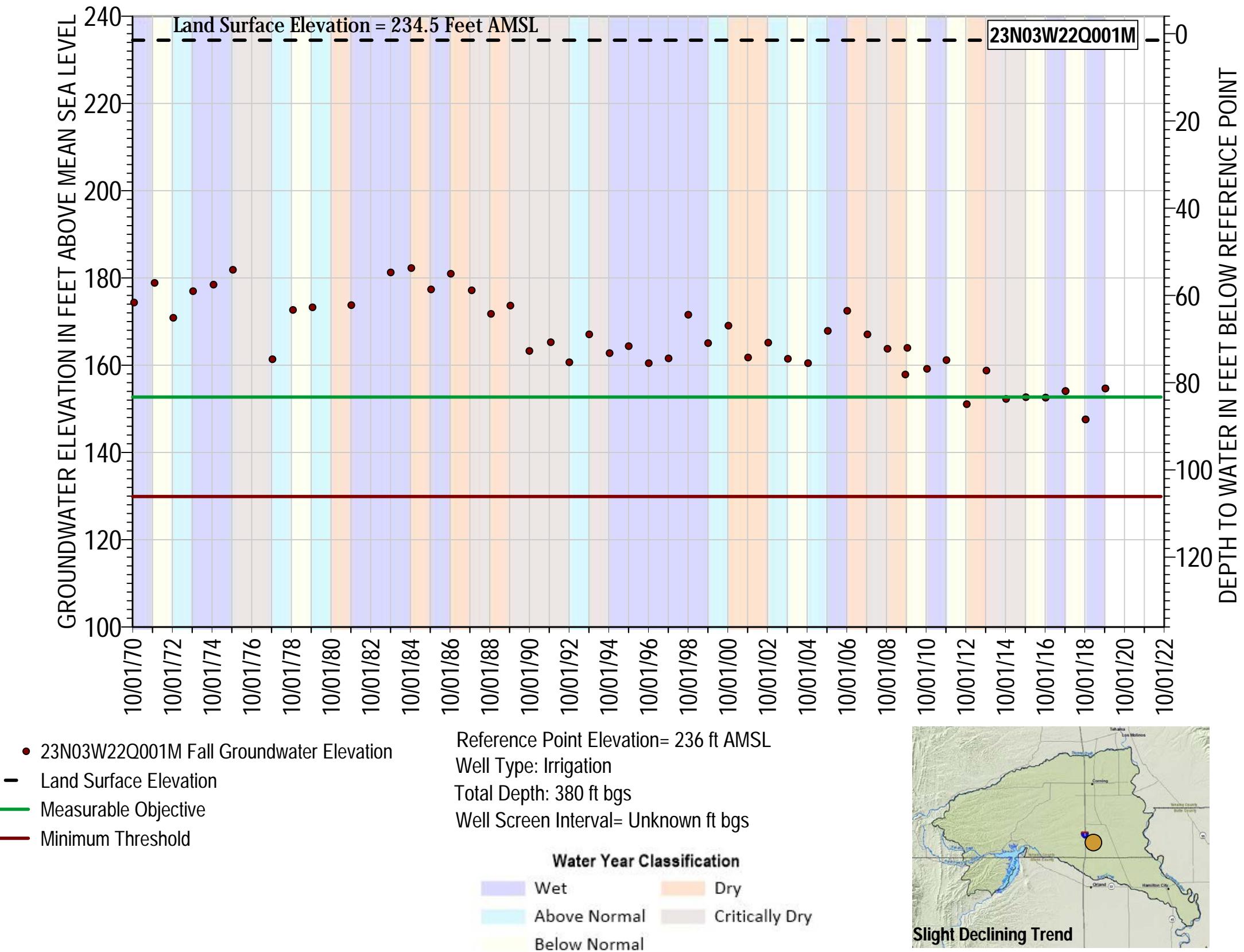


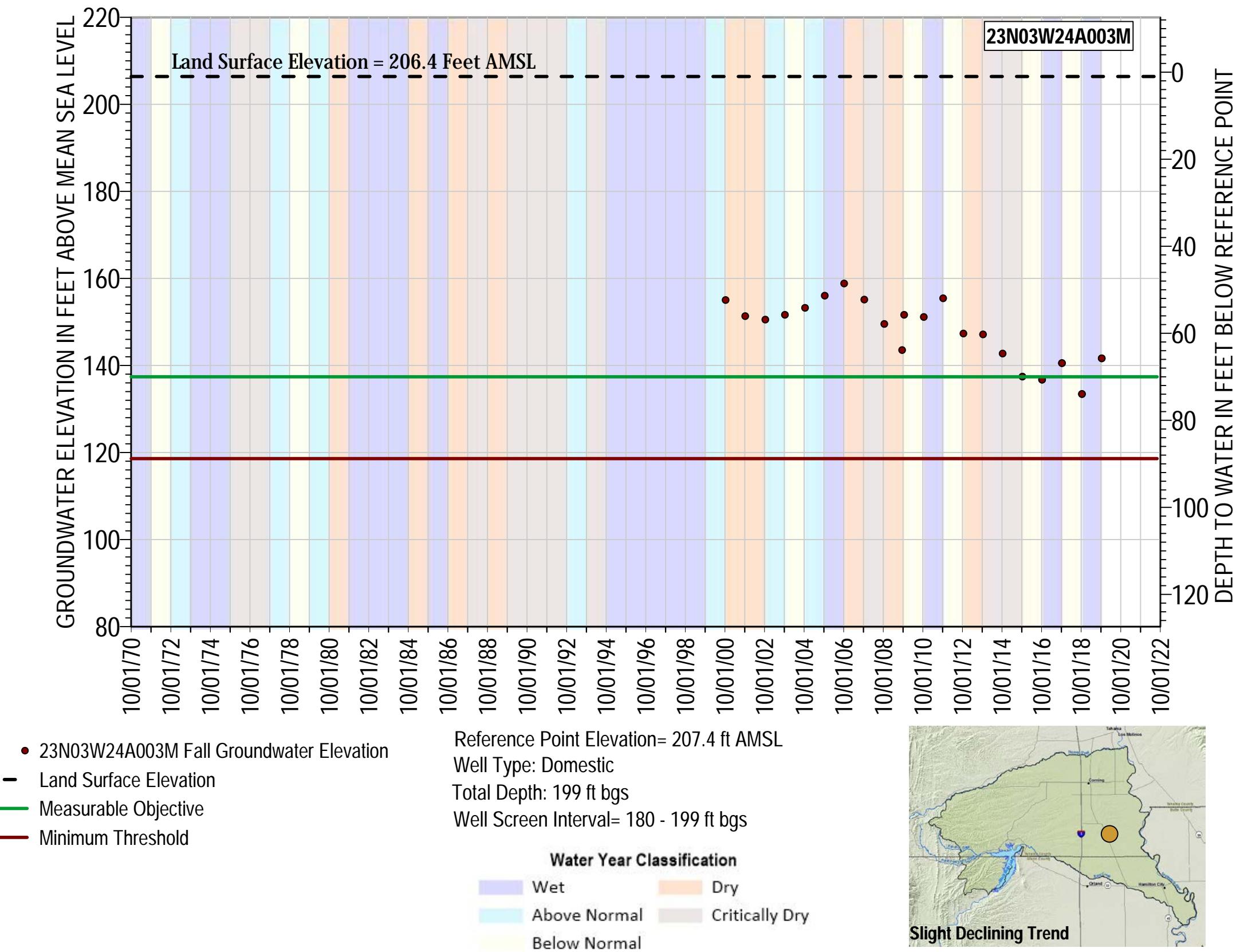


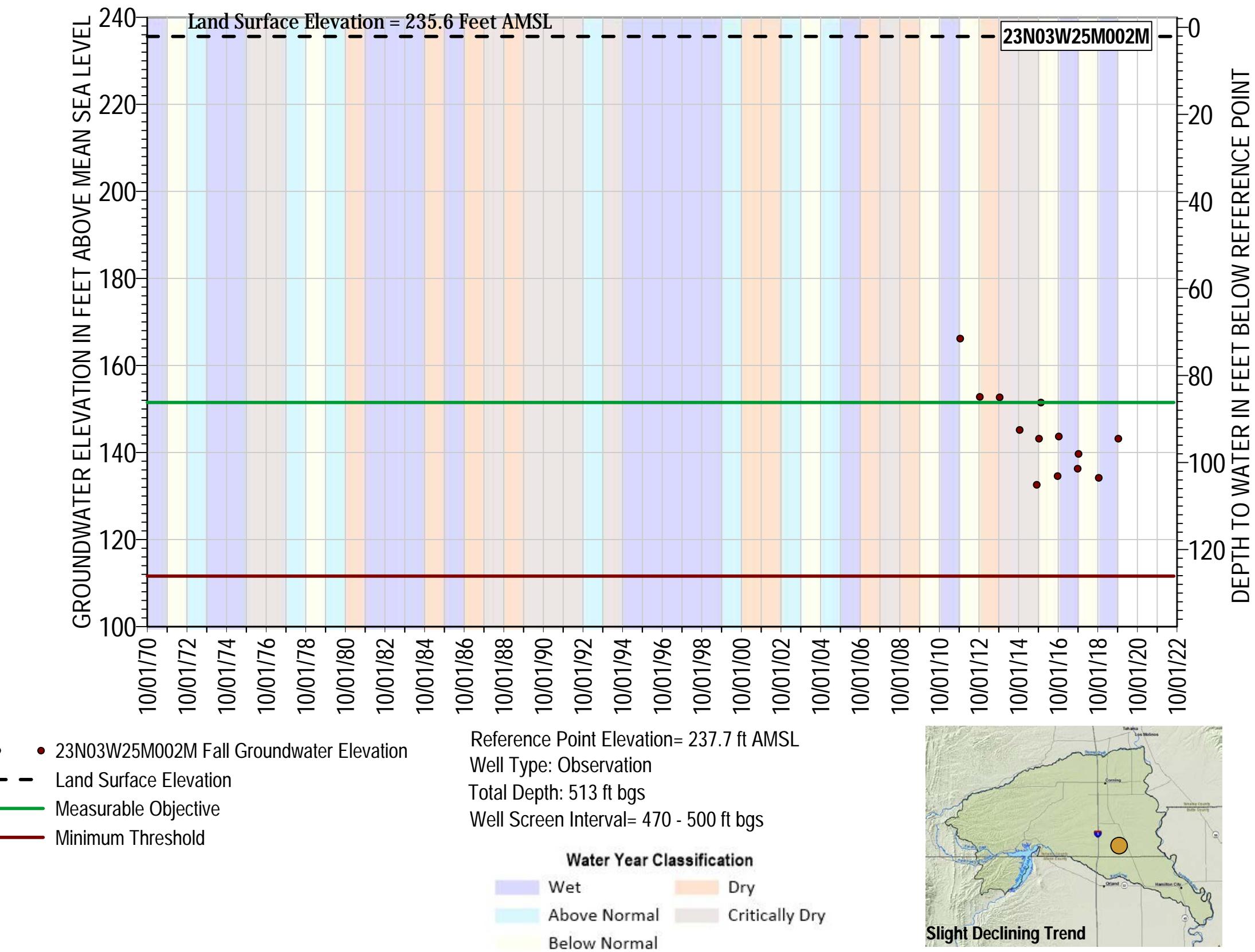


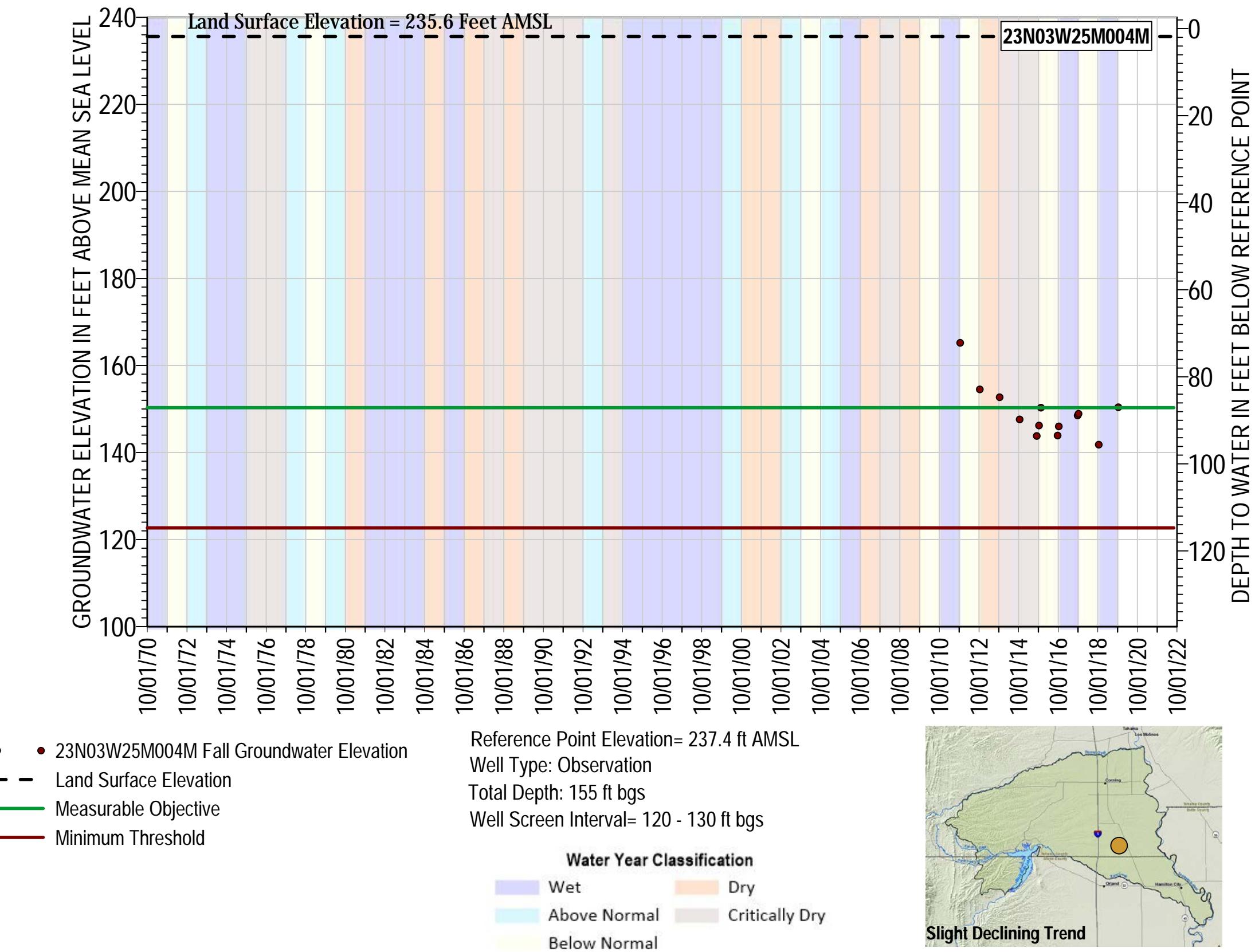


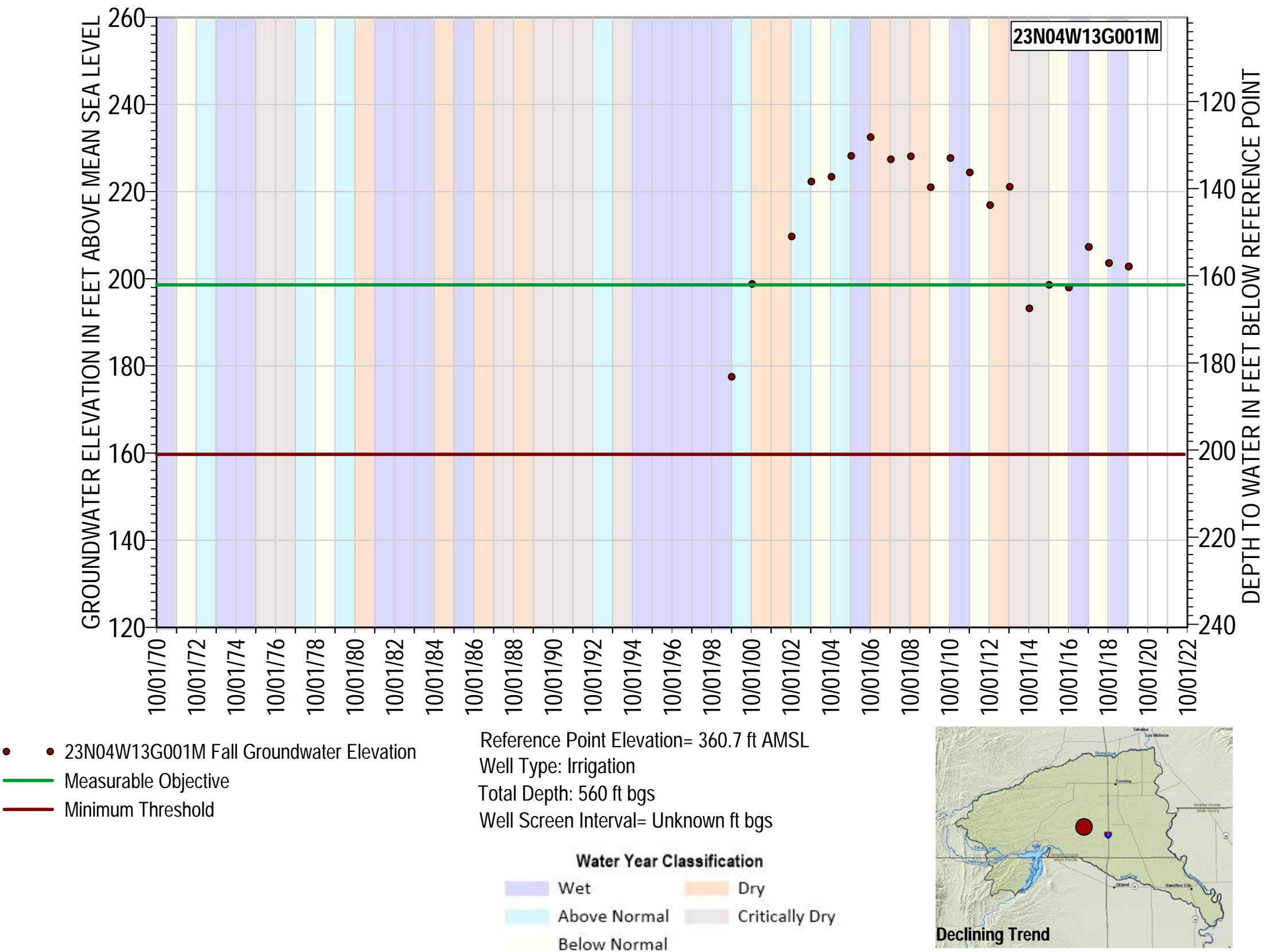


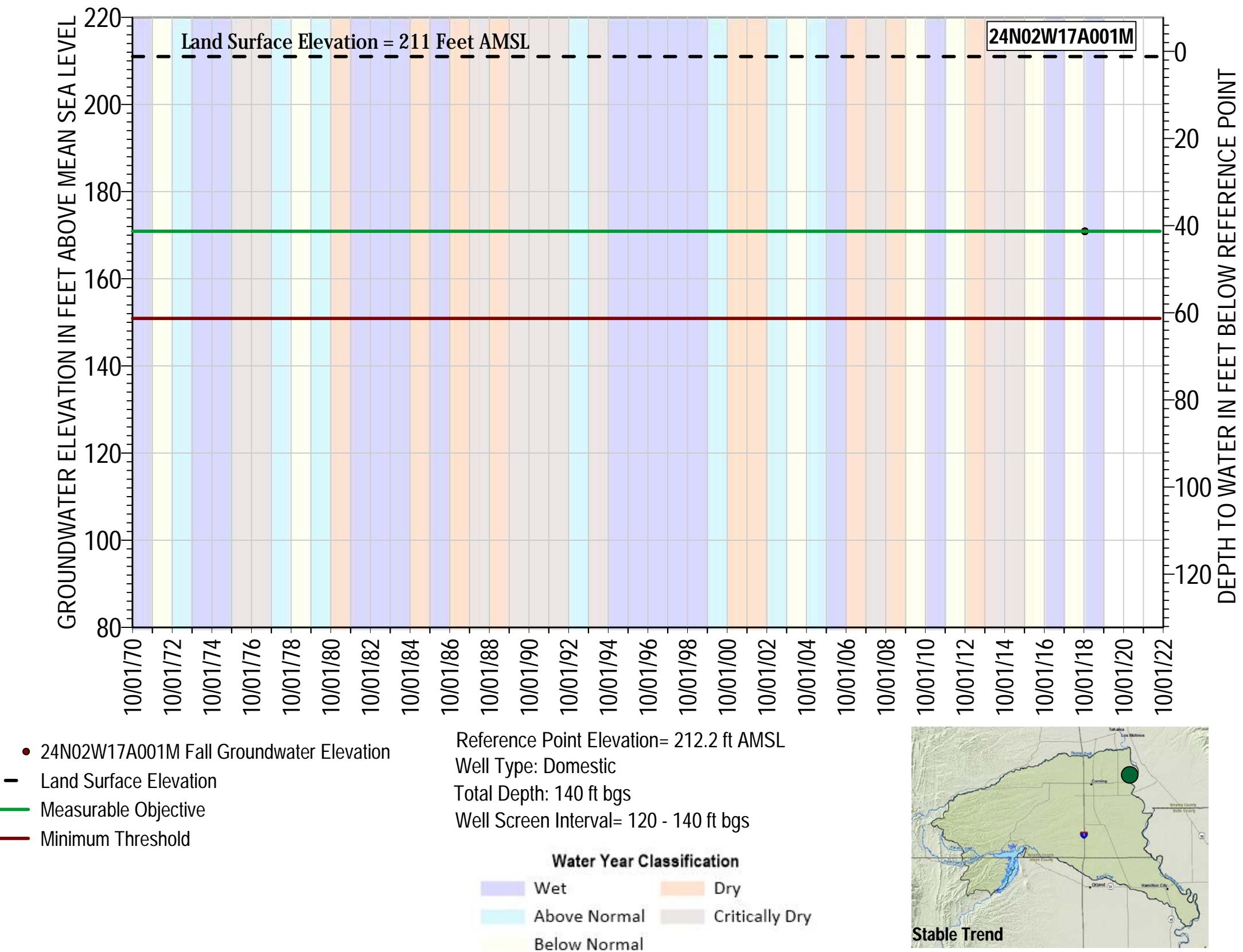


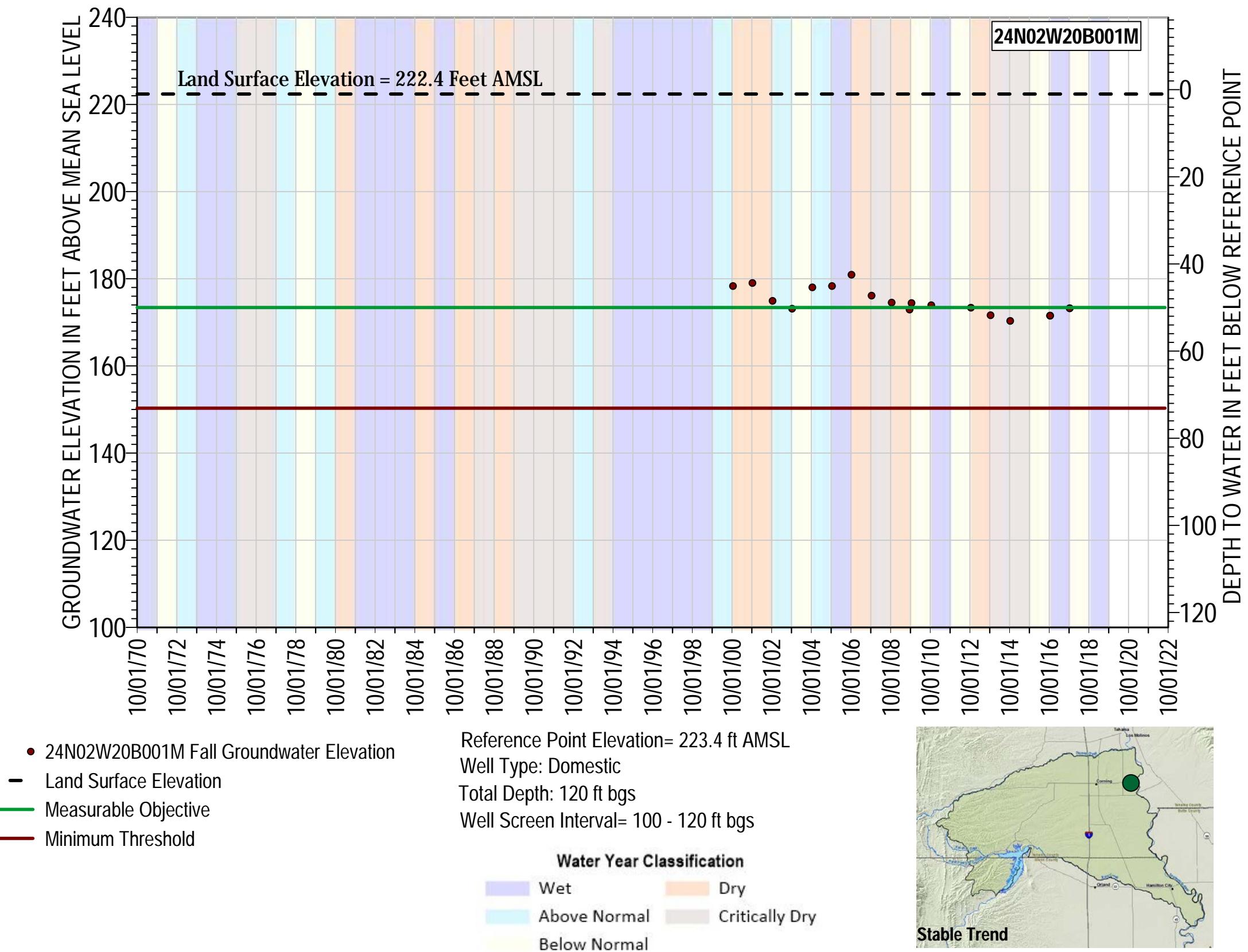


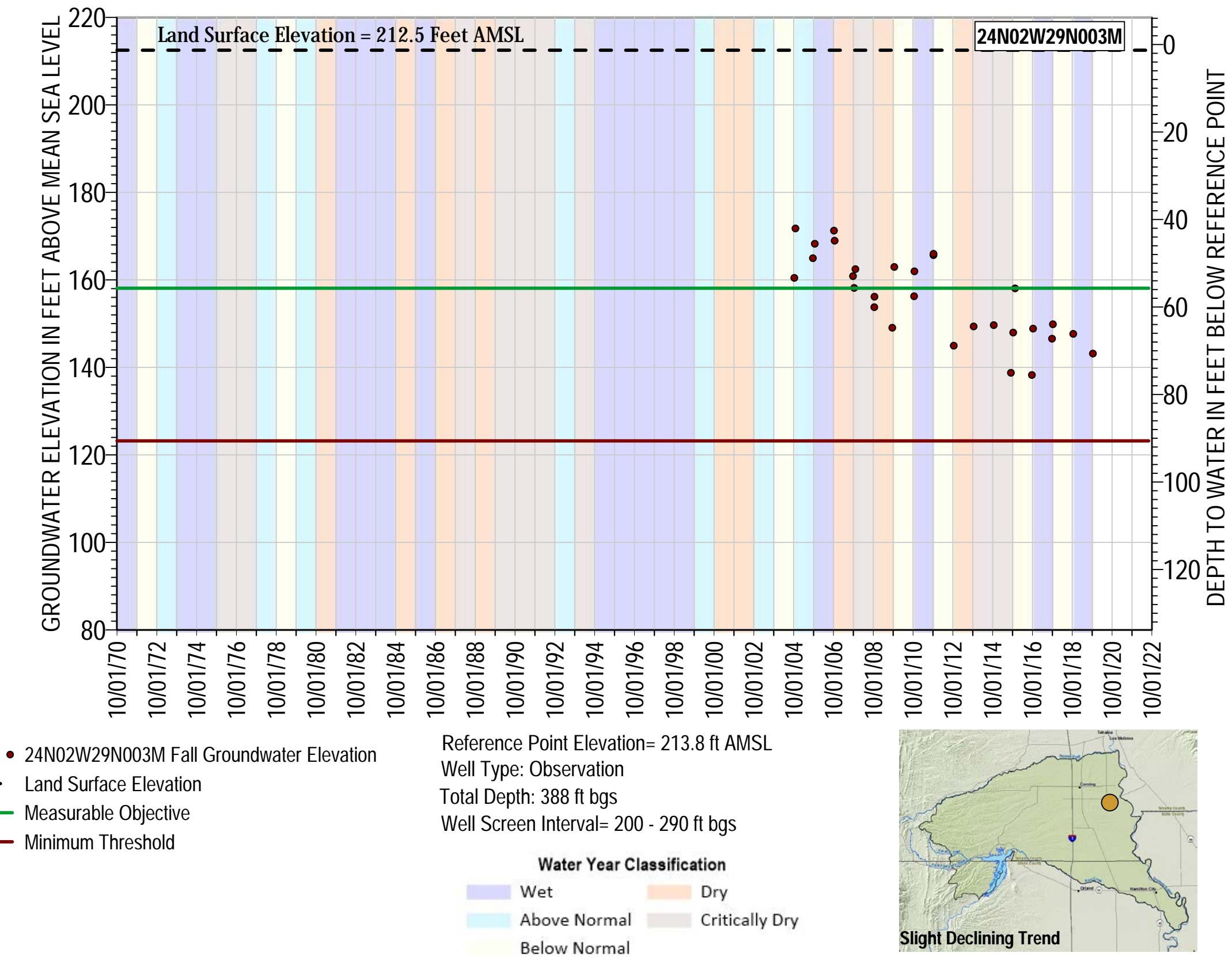


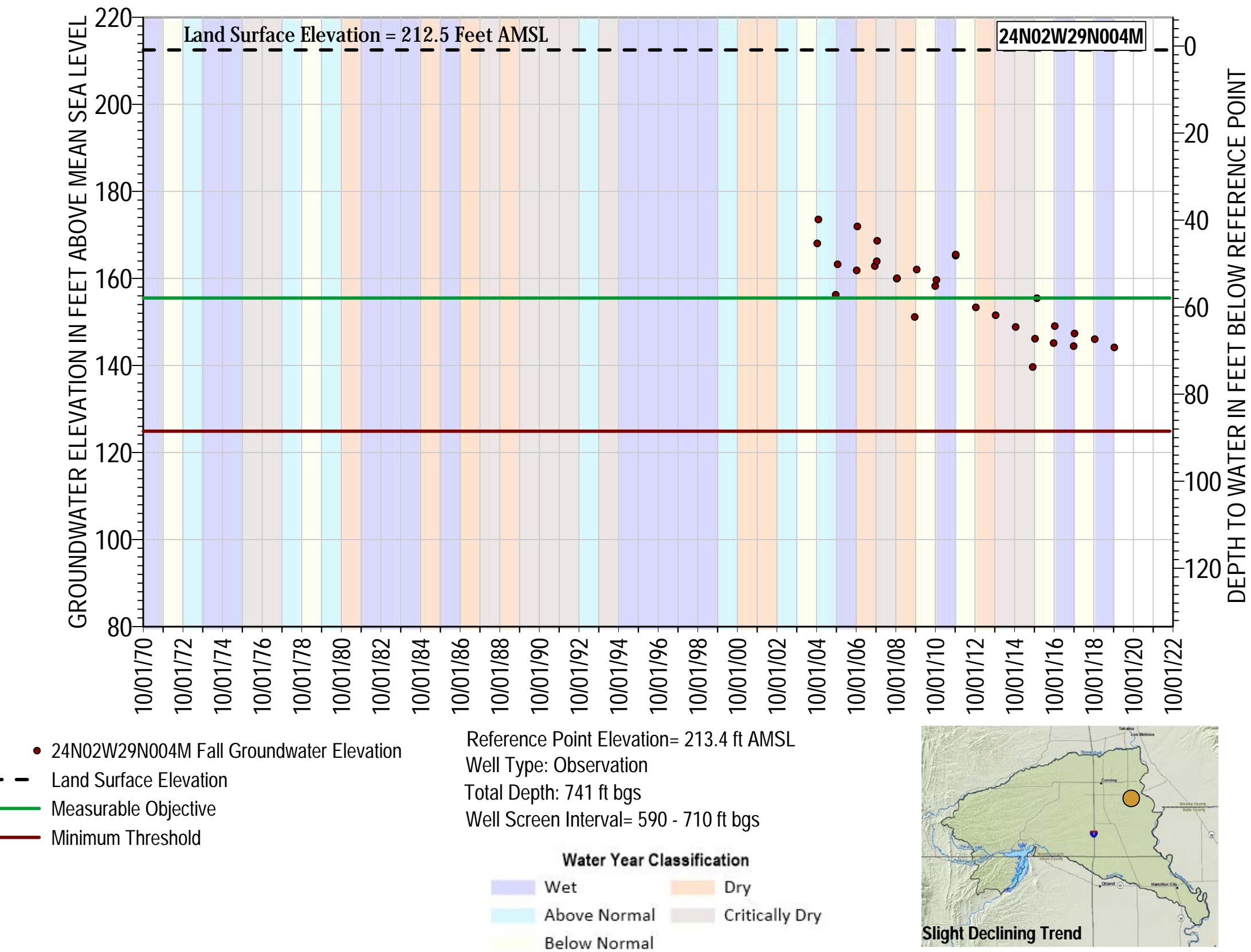


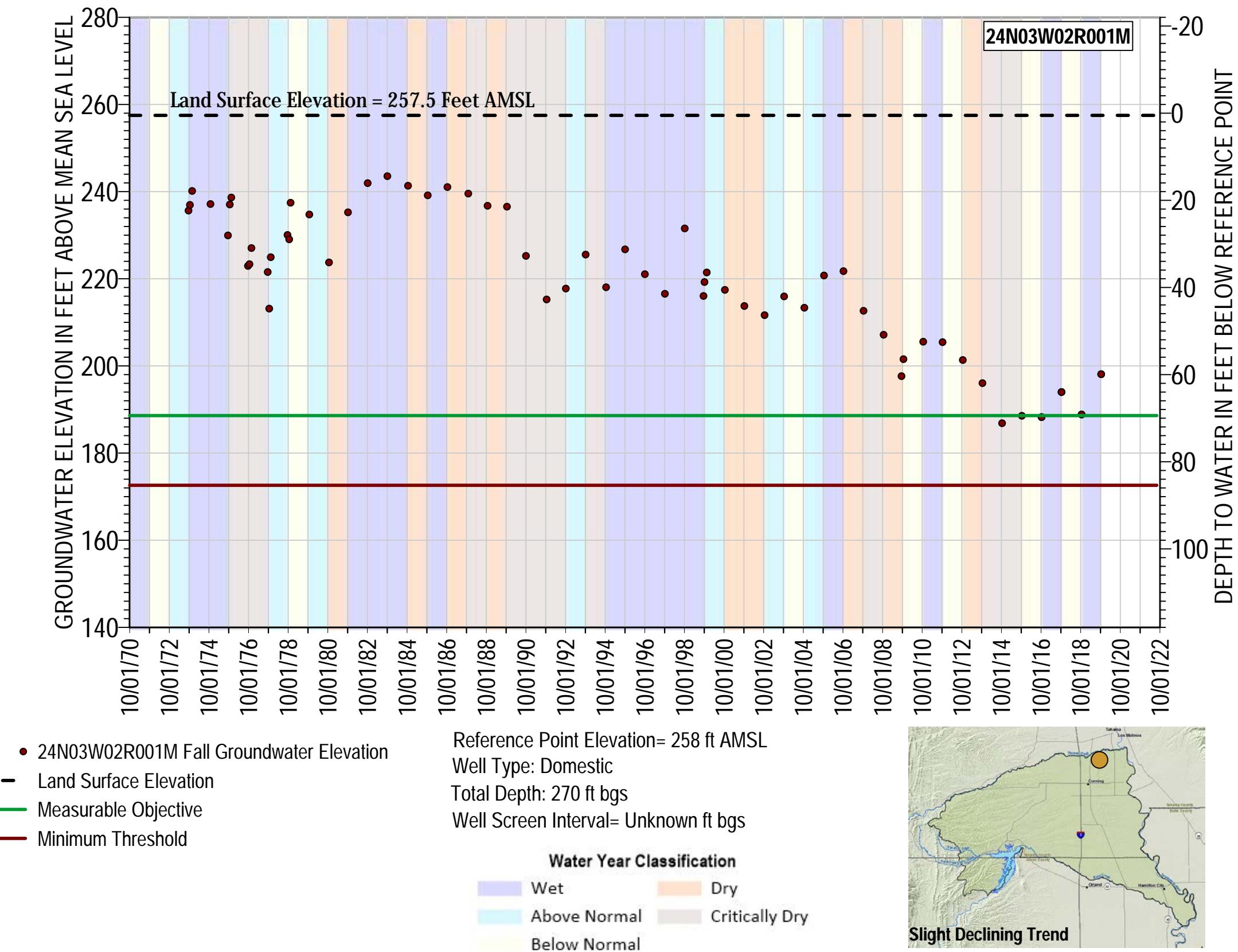


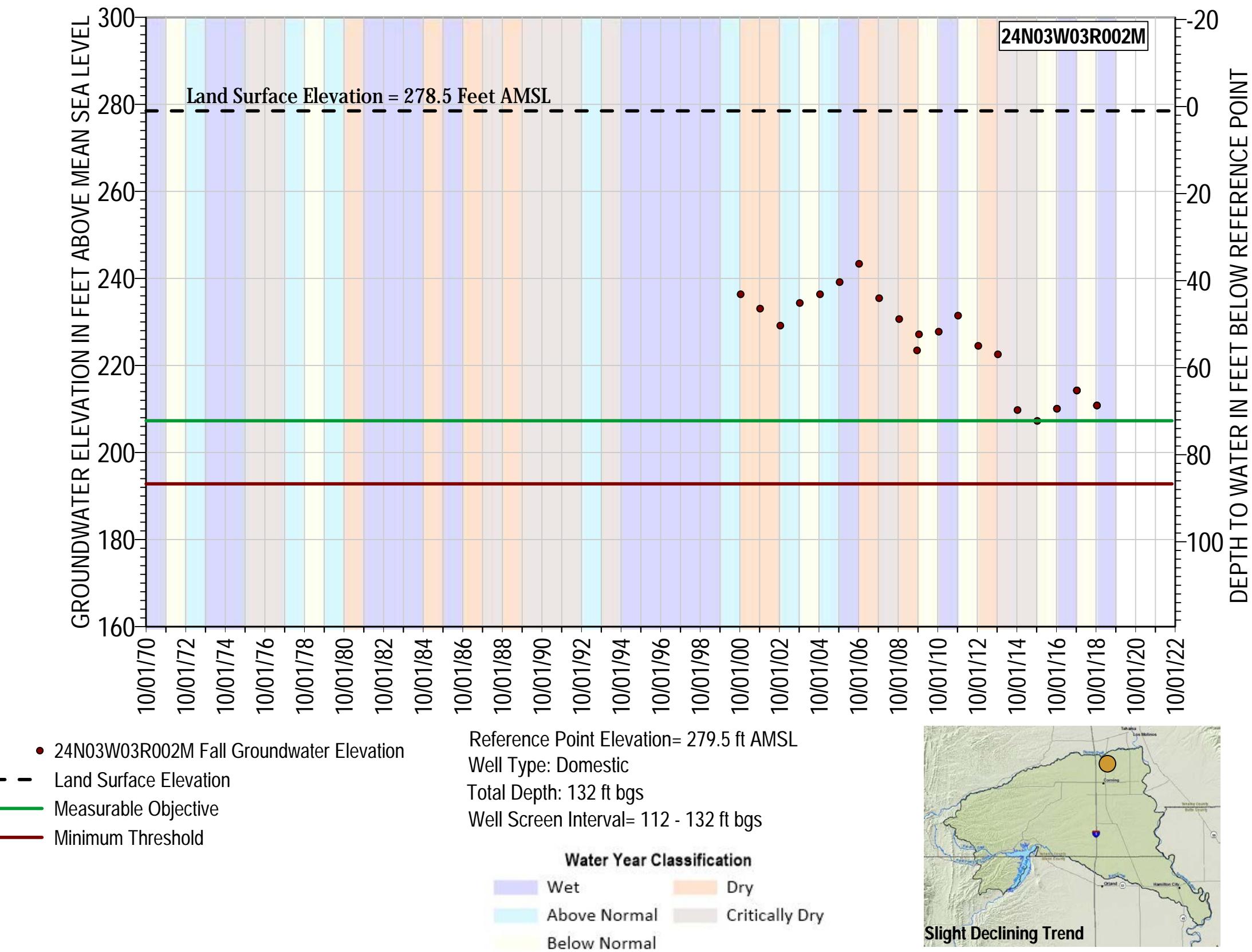


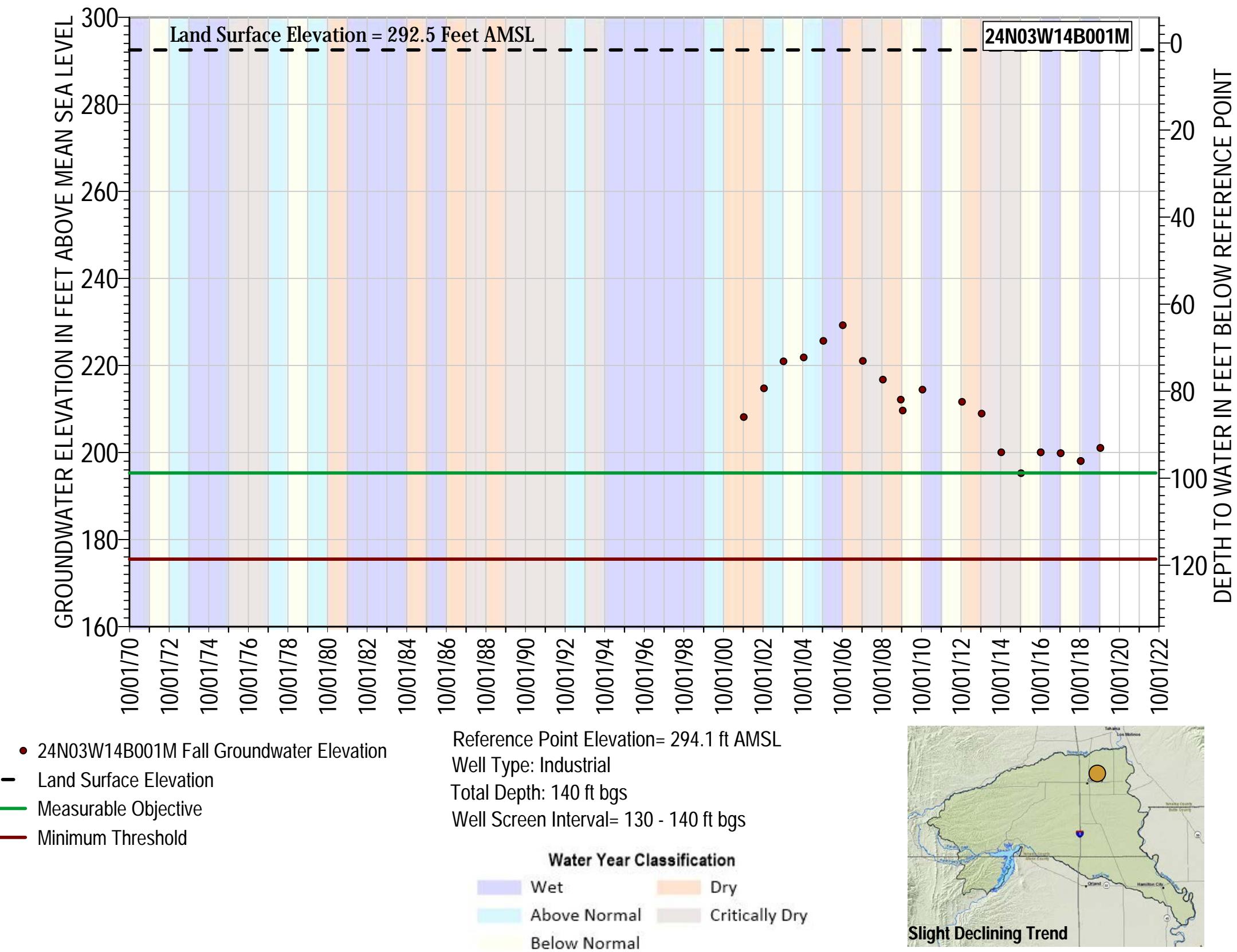


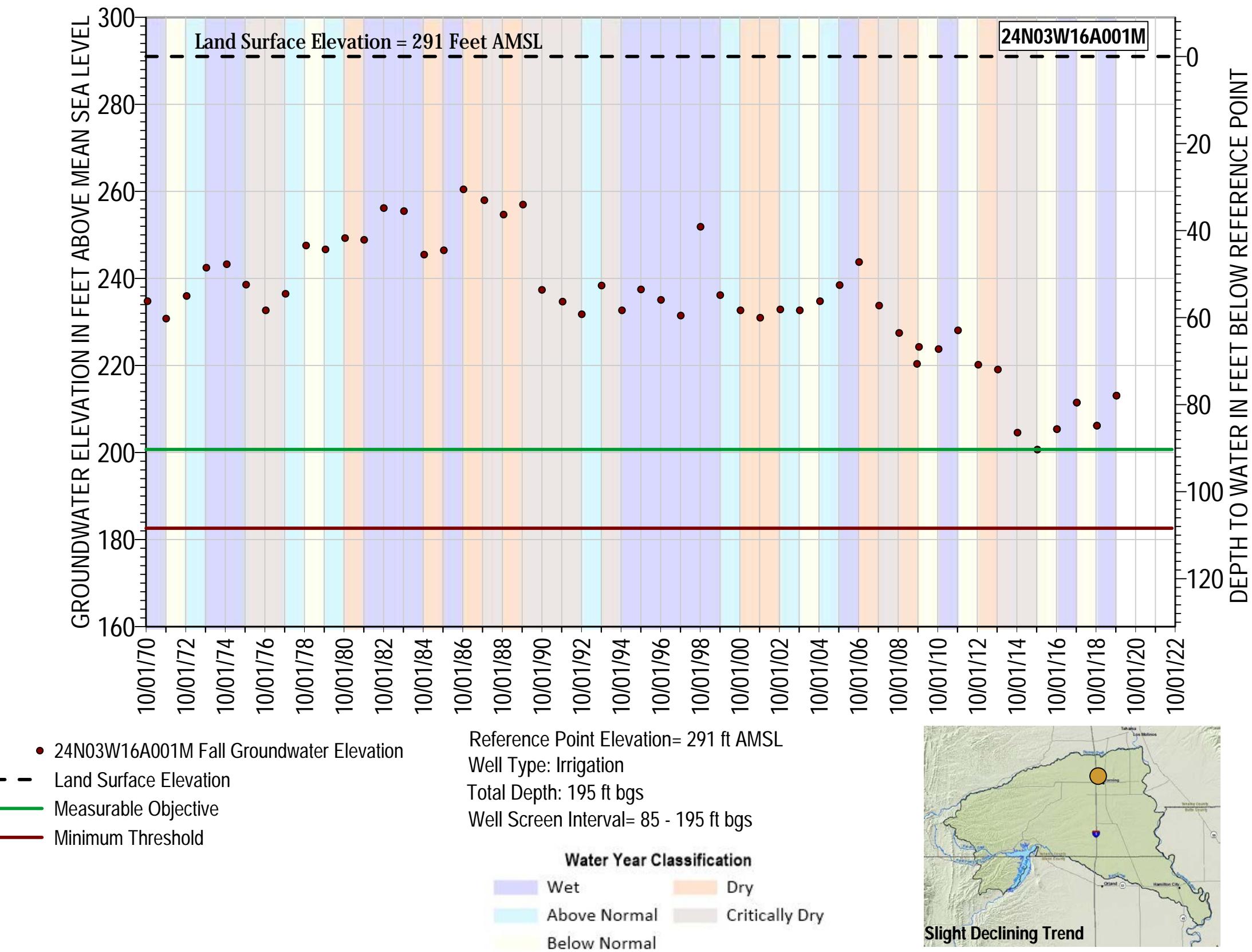


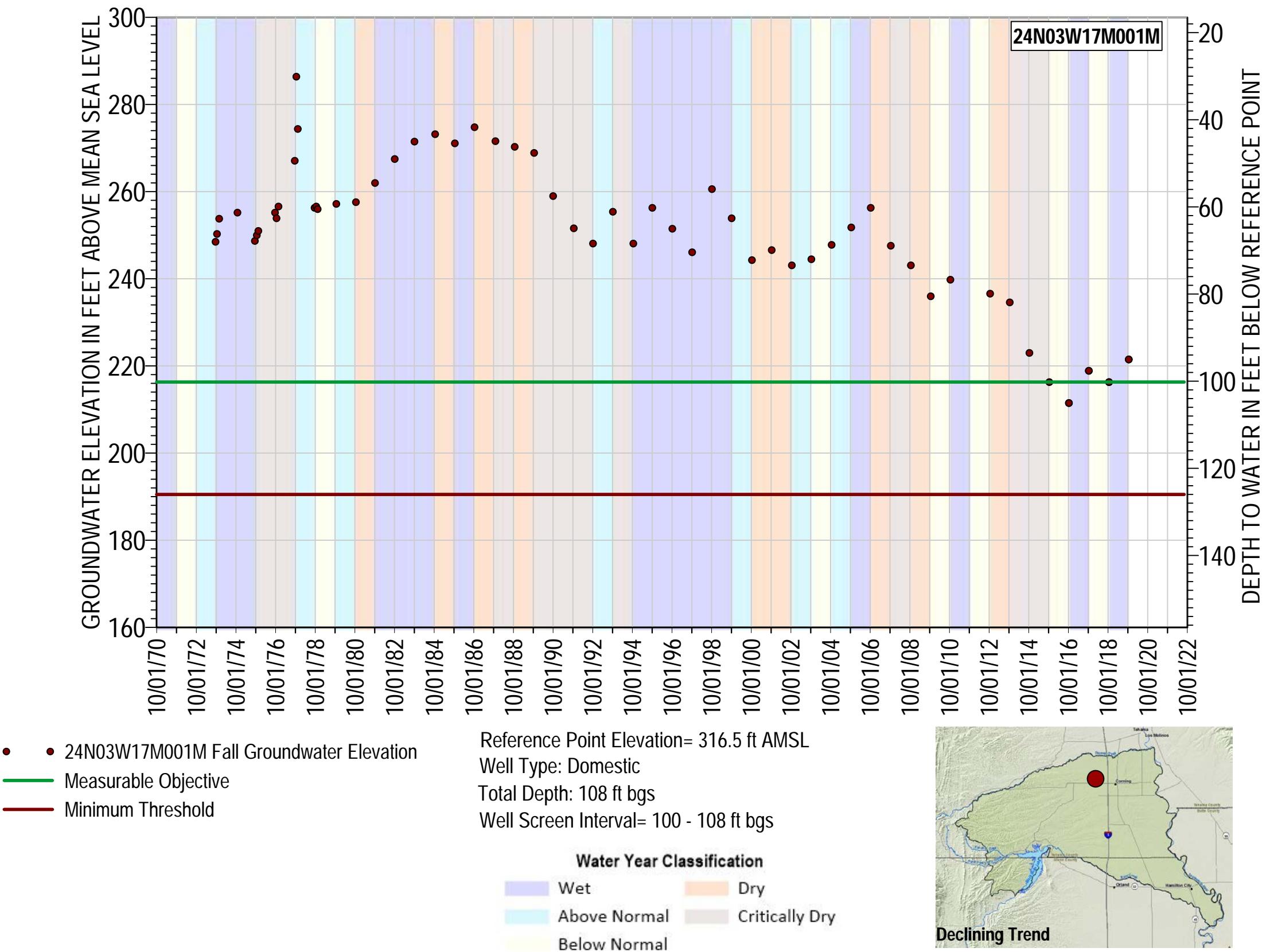


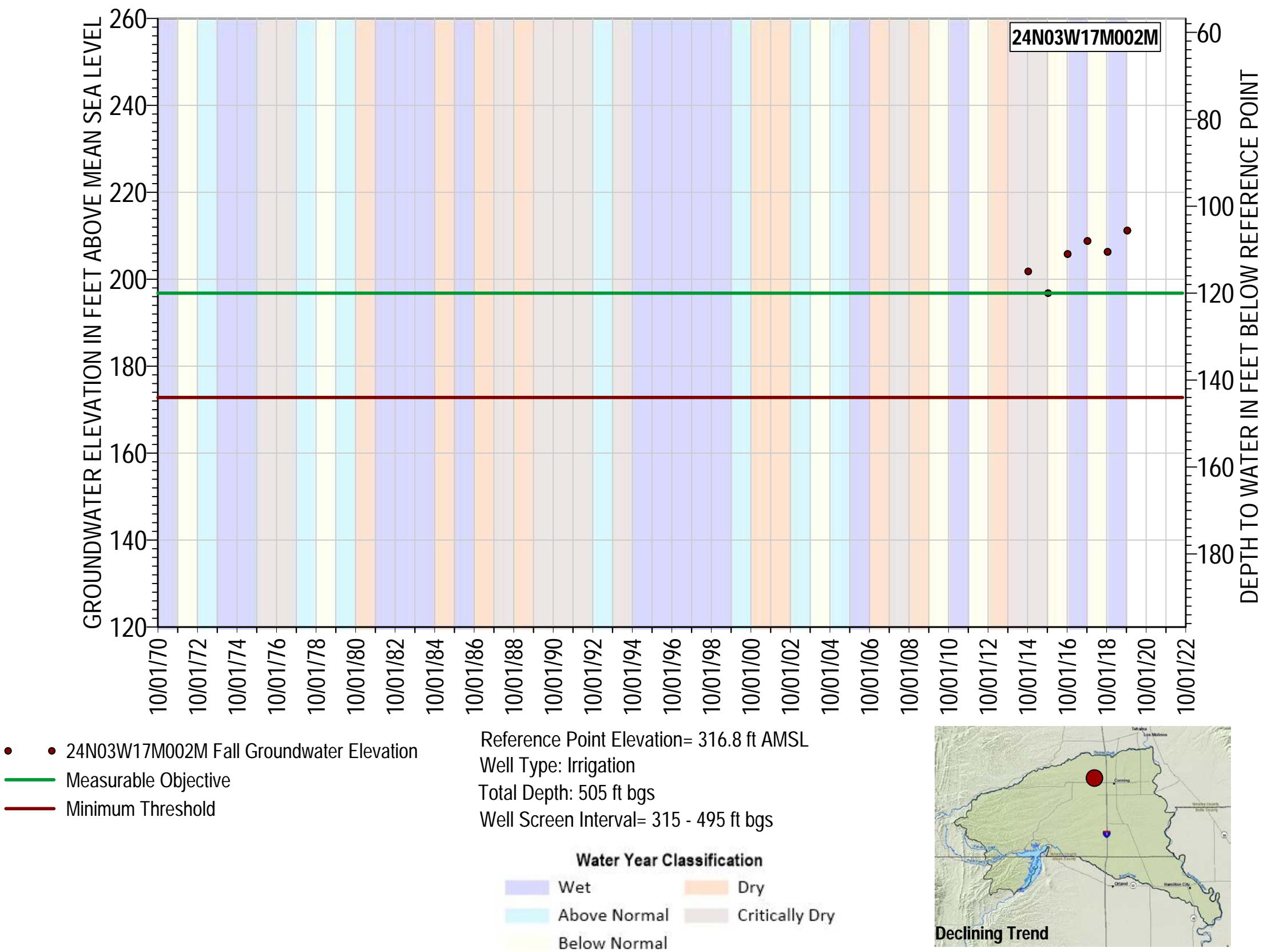


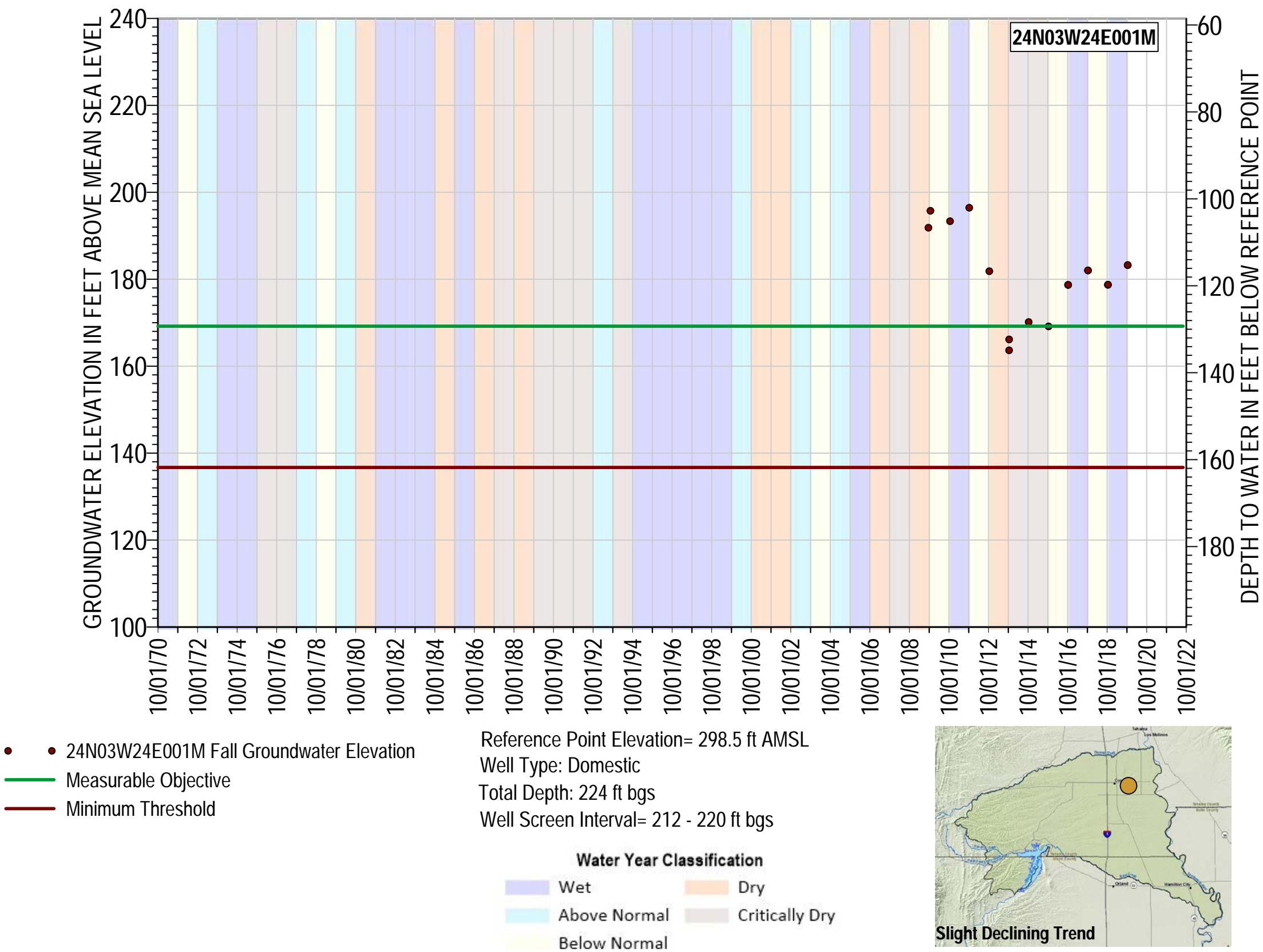


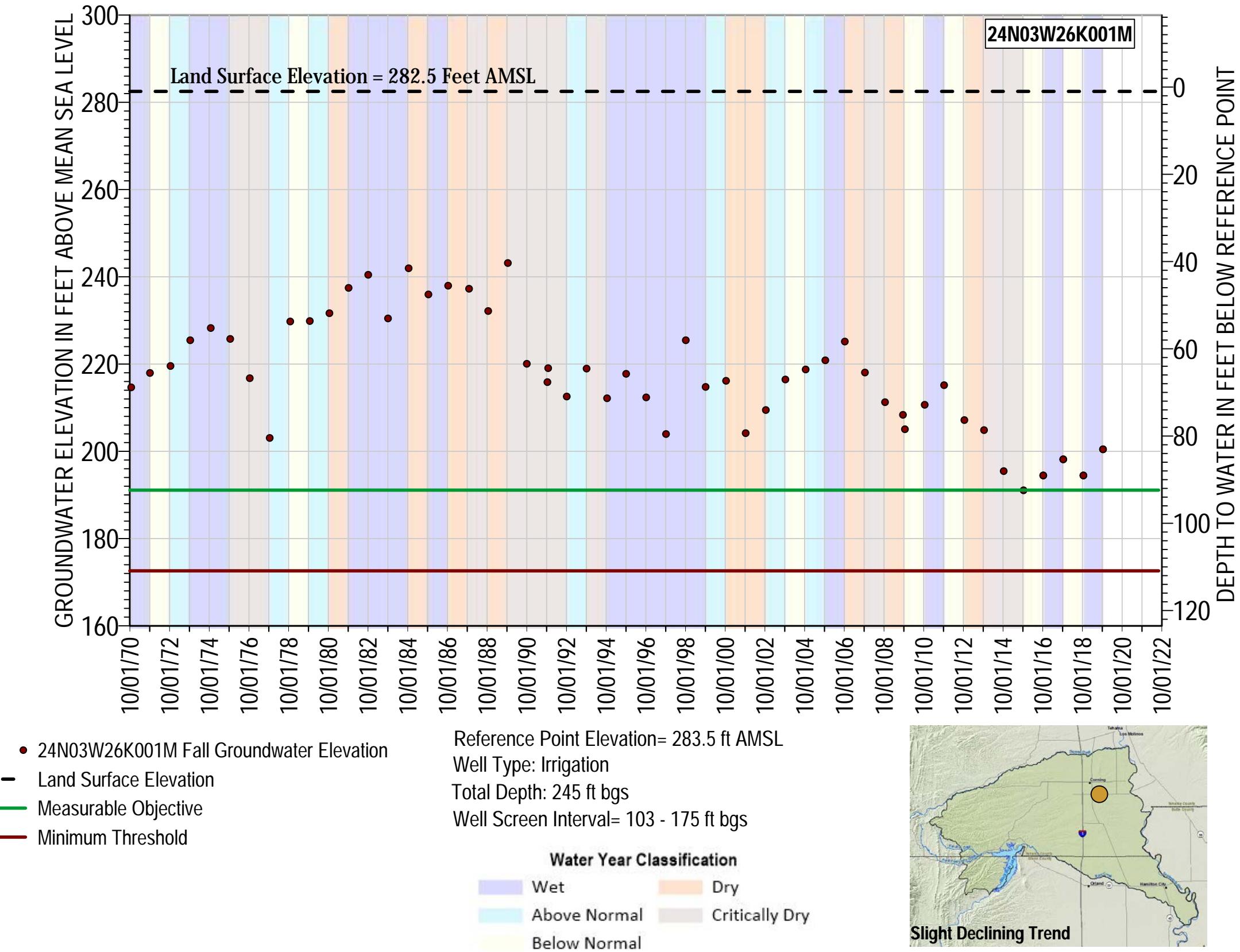


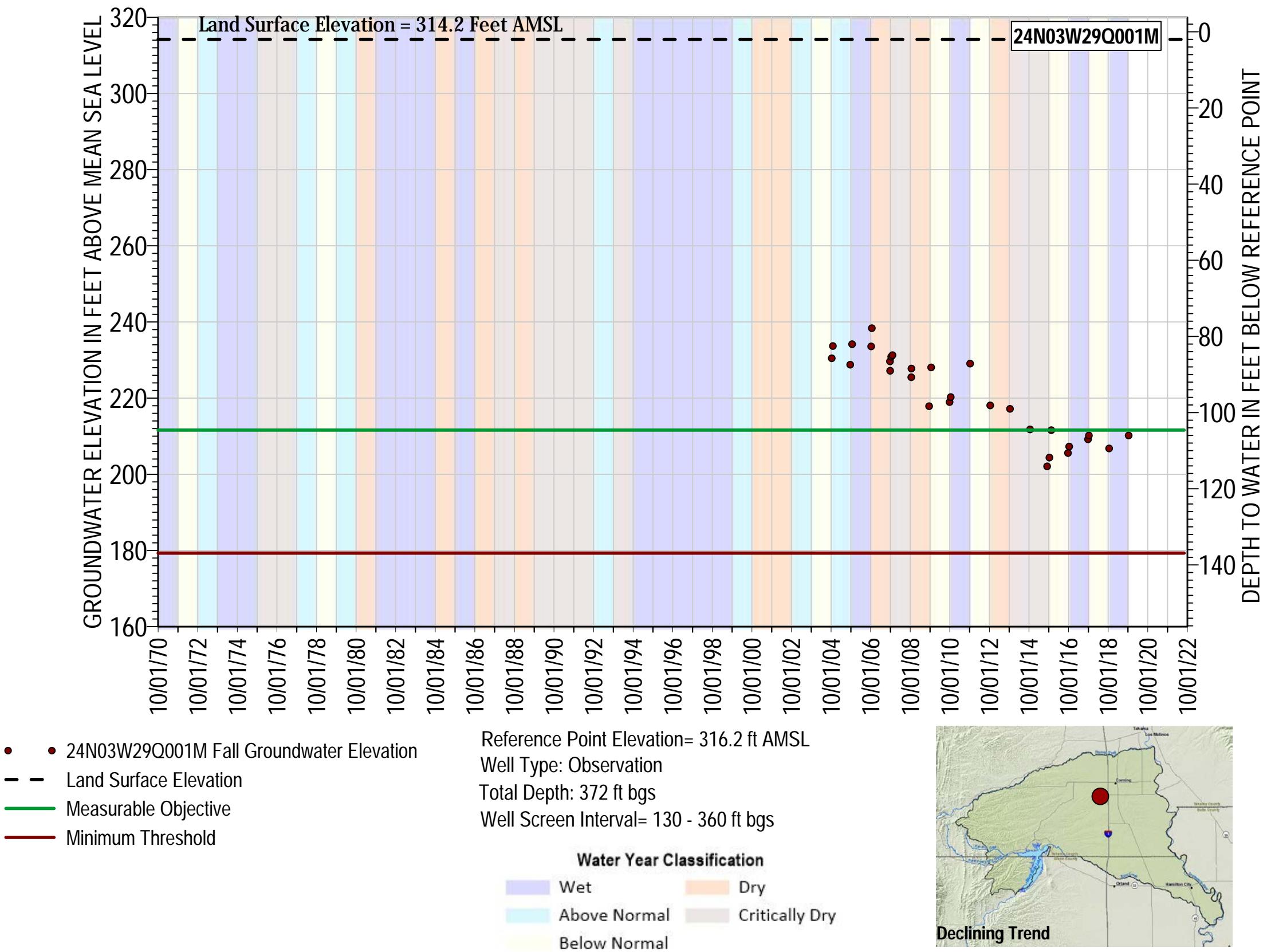


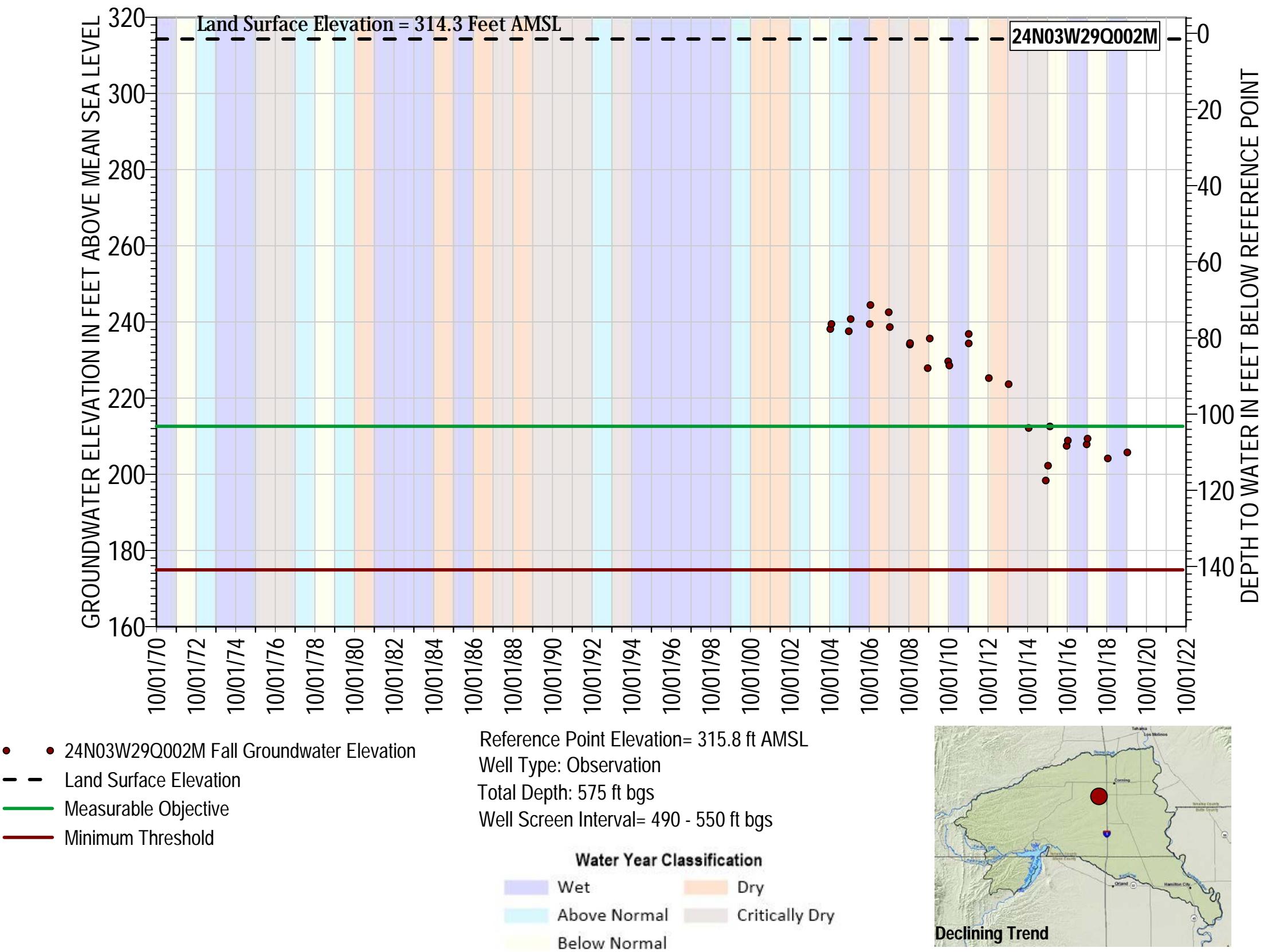


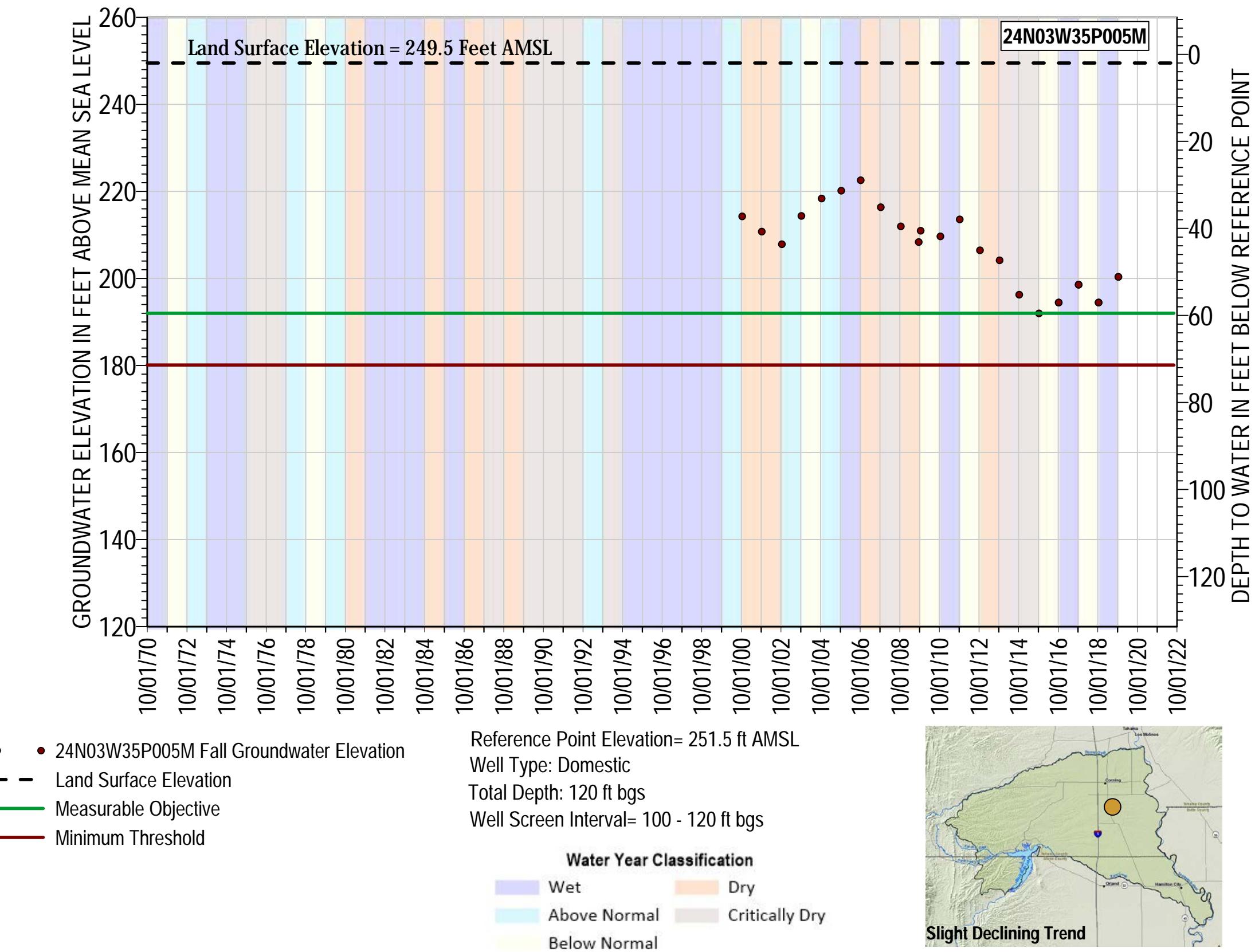


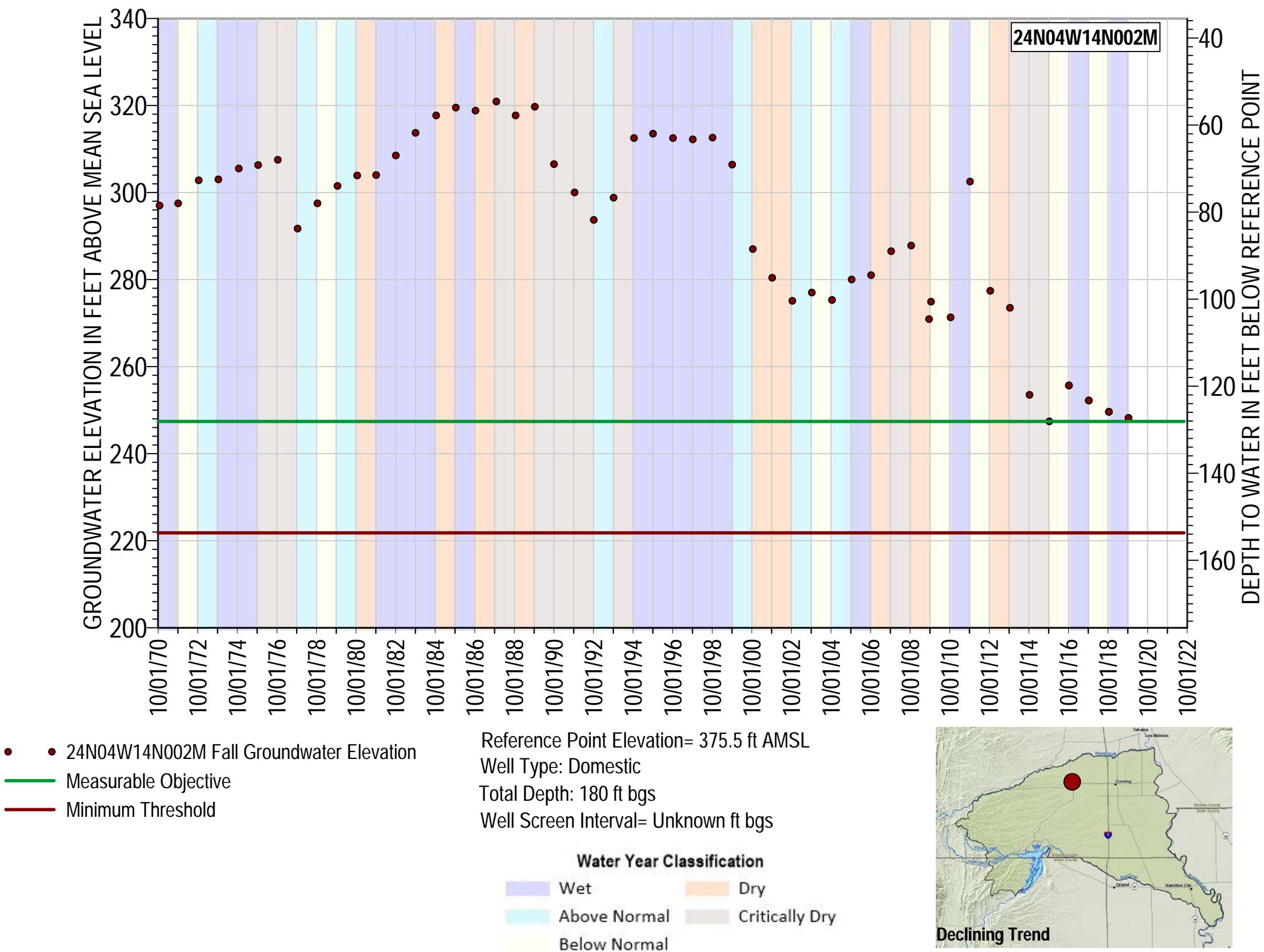


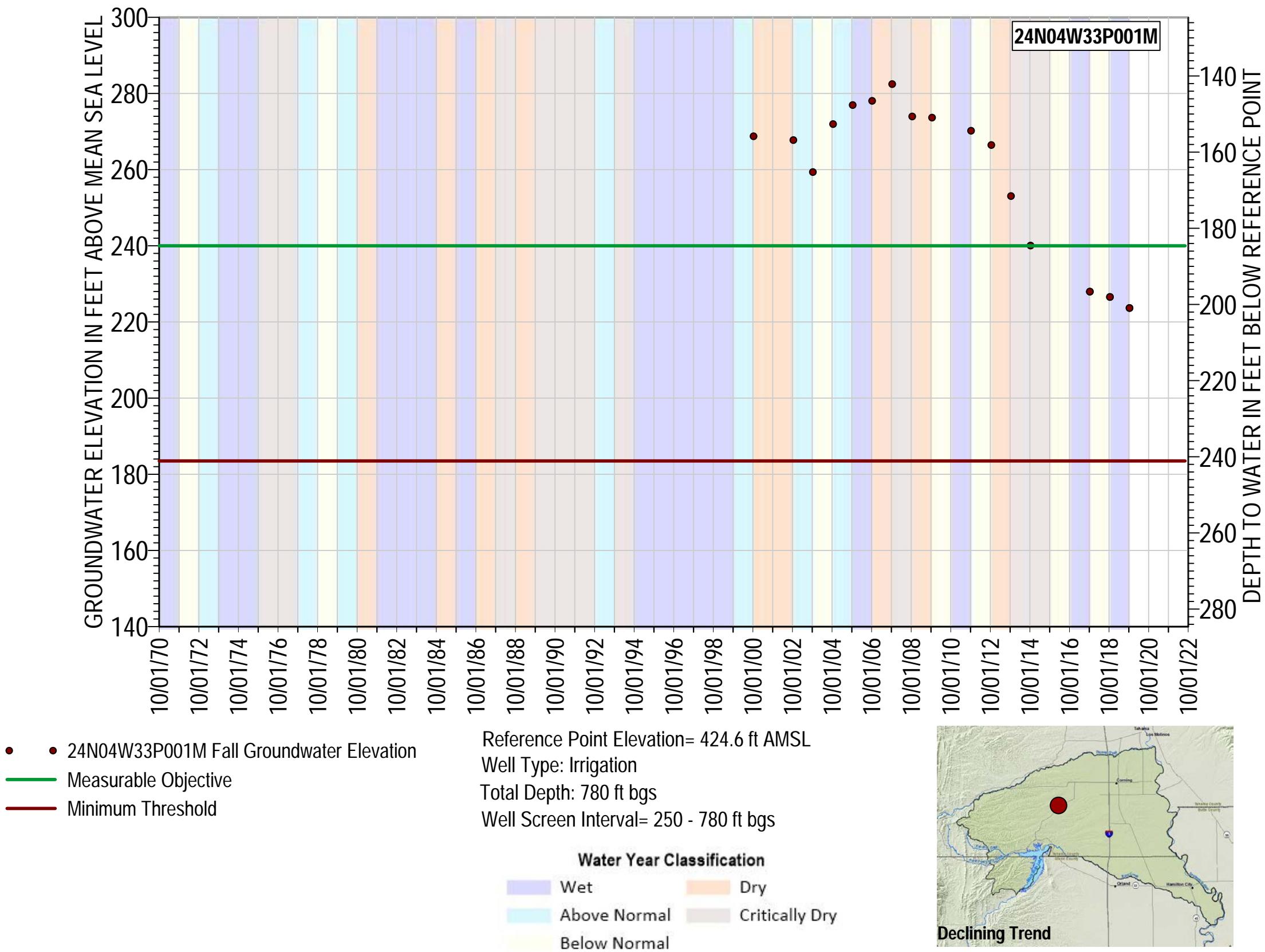












*Note: Insufficient Data - MO defined using 2014 max

