

Recommended Considerations/Methodology for Preliminary Measurable Objectives and Minimum Thresholds

Chronic Lowering of Groundwater Levels – Santa Rosa Plain Subbasin

This document presents recommended considerations and a recommended methodology for establishing Measurable Objectives and Minimum Thresholds for the Chronic Lowering of Groundwater Levels. It is important to note that these recommended initial Sustainable Management Criteria (SMC) will be re-assessed during later stages of the iterative SMC development process as additional information and tools are available, including future computer model projections, feasibility and cost of potential projects or actions, and integration of other Sustainability Indicators. Setting these preliminary measurable objectives and minimum thresholds will allow us to test the recommended considerations and methodology through future scenario modeling and comparison with other Sustainability Indicators.

The recommended considerations and methodology incorporates discussions and initial from the Advisory Committee's January 2020 meeting. Some of the main themes from that initial input reflected in the recommended considerations and methodology are (1) for areas with stable groundwater-level trends, to maintain groundwater levels within or near historical conditions while accounting for future droughts and climate variability and (2) for areas with historical declining trends and subsequent recovery, maintain groundwater levels above the historical lows. Additionally, the recommended methodology incorporates considerations for protecting existing water supply wells.

First described in the narrative below are the options and considerations, followed by the recommended methodology for measurable objectives and minimum thresholds for chronic lowering of groundwater levels.

Some questions to keep in mind as you review:

- Did historical low groundwater elevations experienced in areas of the basin cause significant and unreasonable effects?
- For areas with relatively stable groundwater levels, how much operational flexibility to account for climate variability and future demands should be incorporated into setting minimum thresholds?
- How can minimum thresholds be combined to define undesirable results? Define based on a certain percentage of exceedances or multiple years of exceedances?

Options and Considerations for Measurable Objective/Minimum Threshold Determinations

The methodology below incorporates some combination of the following three general types of considerations for measurable objective/minimum threshold determinations: Water Supply

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Well Depths, Historical Groundwater Conditions and Future Projected Groundwater Conditions. *Other considerations associated with impacts from Chronic Lowering of Groundwater levels, such as the estimated rooting depths of sensitive groundwater-dependent vegetation, will later be integrated as part of the Surface Water Depletion Sustainability Indicator (for the shallow aquifer system) as additional information is developed for this.* A description of each of the three general types of considerations along with potential modifiers for each are described below.

1. Water Supply Well Depths (based on available construction information for existing domestic, agricultural irrigation and public supply wells within vicinity area of each RMP)
 - 98th Percentile of Shallowest Well depth in Area with an operational factor (set at 50-feet above the bottom of the well) for wells within the Deep aquifer system to allow for a reasonable level of production. *A range of options (levels of protection) for incorporating Water Supply Well Depths can be considered to provide flexibility for this option (e.g., different percentiles of total depth, adding additional buffer to the total depth to account for well production needs).*
2. Historical Groundwater Conditions – for wells with limited historical data, trends from similar nearby monitoring wells will need to be extrapolated
 - Historical Lows – lowest groundwater-level on record minus some allowance for additional future climate variability (e.g., four-year drought calculated using annual decline of 50% of the average observed seasonal range over 4 consecutive years)
 - Historical Median (entire 20 year period, first 10 years and second 10 years)– range of options with different percentiles of average levels could be considered to provide flexibility for this option
 - Historical Condition Above Current Level (e.g., median level prior to recent drought) - range of options for selection of time period for historical conditions could be considered to provide flexibility for this option
3. Future Projected Conditions – 50-year projections incorporating climate change and future land use and water demand assumptions. *These are not yet available and will be developed based on future computer model scenarios.*
 - Future Projected Lows without Projects/Actions – Lowest future simulated elevation without projects and actions
 - Future Projected Averages with Projects/Actions – Average future elevation with proposed projects and actions. *A range of options with different percentiles of average levels could be considered to provide flexibility for this option*

Recommended (Strawman) Methodology for Measurable Objectives and Minimum Thresholds

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Different sets of methodology are proposed to address three general types of observed patterns in historical and recent groundwater-level trends, which are illustrated in Figures 1 through 3:

- Wells with relatively stable long-term groundwater-levels (less than 0.5 foot per year decline with evidence of recovery following wet years) (Figure 1);
- Wells with historical declines and subsequent recovery (Figure 2); and
- Wells with increasing groundwater-level trends (Figure 3).

The three example figures display hydrographs showing several options (dashed and dotted lines) for setting the SMCs and recommended Initial Measurable Objectives (green band) and Minimum Thresholds (pink band). Measured historical groundwater elevations are shown on each hydrograph using orange triangles and green squares. The orange triangles show fall groundwater elevations; and the green squares show spring groundwater elevations. The ground surface elevation is shown on each hydrograph with the brown line.

Recommendations for setting Preliminary Measurable Objectives and Minimum Thresholds at RMPs for each of the three patterns are provided below.

Wells with Relatively Stable Long-term Groundwater-Levels (Example Figure 1)

Measurable Objective: These measurable objectives are set to maintain groundwater levels within historical observed ranges. The recommended approach is:

For wells with relatively stable long-term groundwater levels, set preliminary measurable objectives to the historical median groundwater elevation, and reassess after future projections are complete.

Minimum Threshold: These minimum thresholds are set to maintain groundwater levels near historical observed ranges while accounting for future droughts and climate variability. The recommended approach is:

For wells with relatively stable long-term groundwater levels, set preliminary minimum threshold as the historical low elevation minus four-year drought calculated using annual decline of 50% of the average observed seasonal range over four consecutive years, and reassess after future projections are complete.

Wells with Historical Declines and Subsequent Recovery (Example Figure 2) and Wells with Increasing Trends (Example Figure 3)

Measurable Objective: These measurable objectives are set to maintain groundwater levels within recent (recovered) historical observed ranges. The recommended approach is:

For wells with historical declines and subsequent recovery, set preliminary measurable objectives to the recent (2010-2019) median groundwater elevation and reassess after future projections are complete.

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For wells with increasing trends, set preliminary measurable objectives to very recent (2016-2019) median groundwater elevation and reassess after future projections are complete.

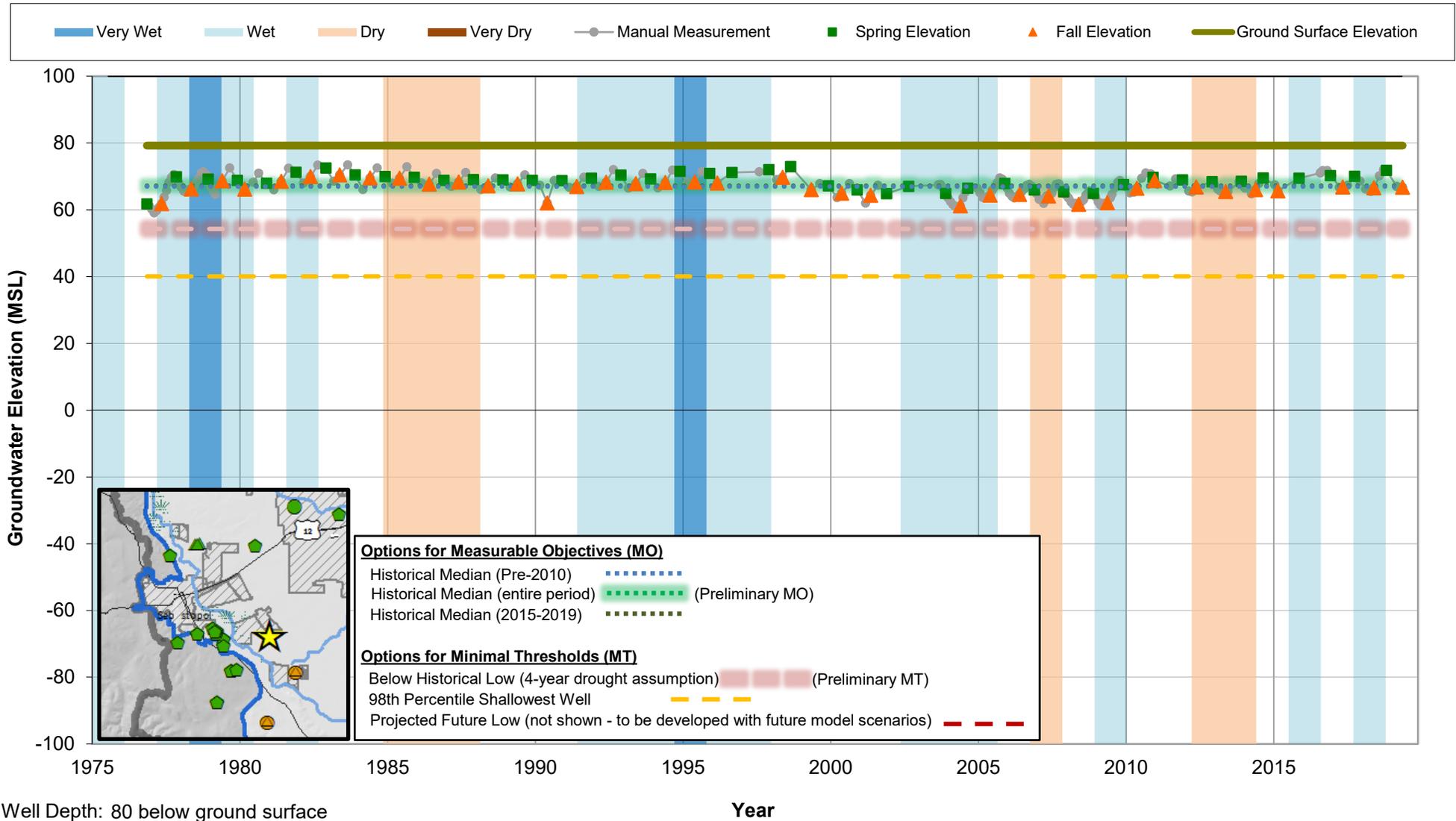
Minimum Threshold: These minimum thresholds are set to maintain groundwater levels above historical low elevations and protect at least 98% of nearby water supply wells. The recommended approach is:

For wells with historical declines and subsequent recovery, set preliminary minimum thresholds as the shallower (more protective) of historical low elevations or above the 98th percentile of nearby water supply well depths. These preliminary thresholds will be reassessed after future projections are complete.

For wells with increasing trends, set preliminary minimum thresholds as the shallower (more protective) of historical low elevations minus four-year drought calculated using annual decline of 50% of the average observed seasonal range over four consecutive years, and reassess after future projections are complete or above the 98th percentile of nearby water supply well depths. These preliminary thresholds will be reassessed after future projections are complete.

Figure 1

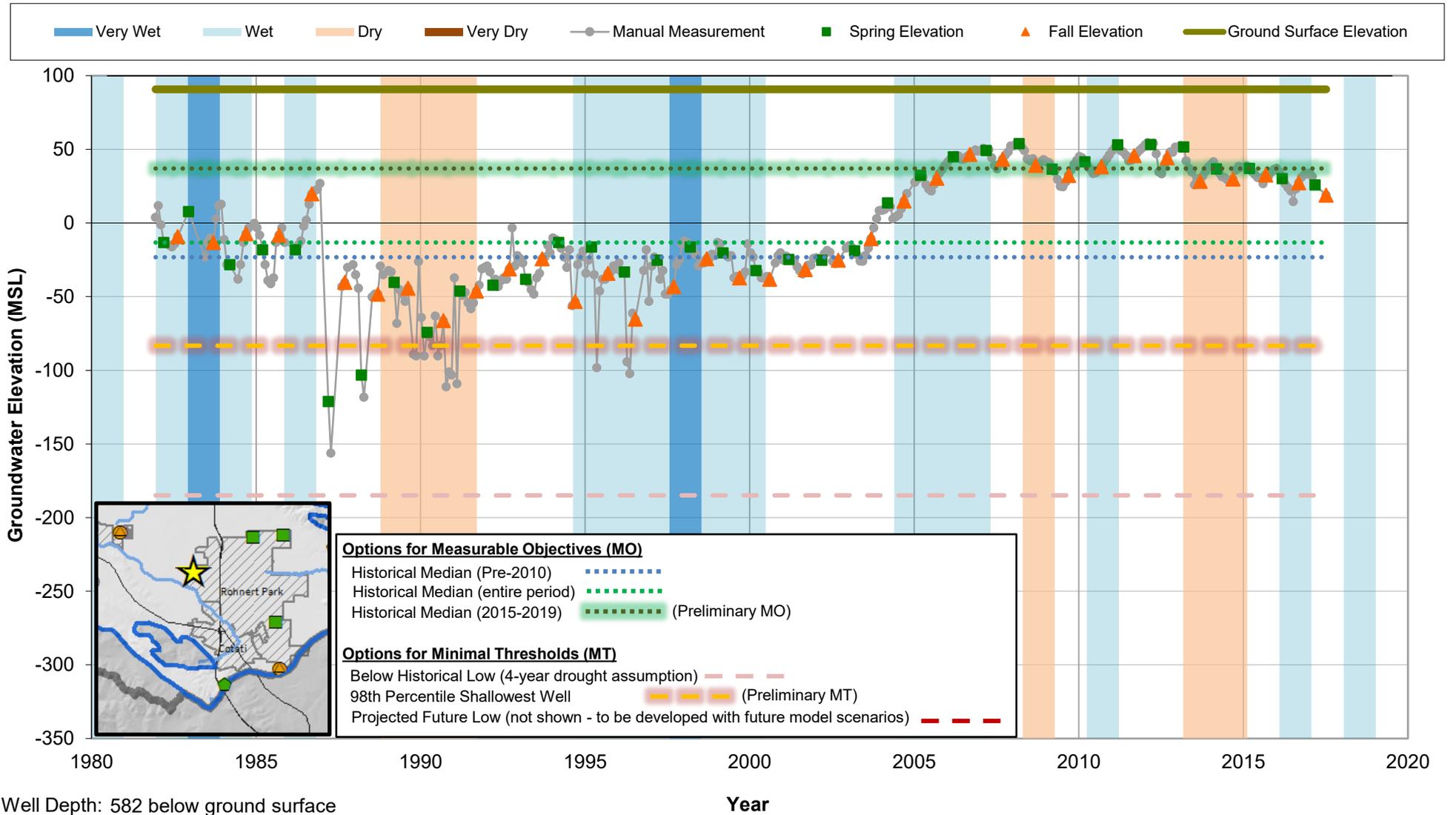
SRP0357, SCWA_TODD_RED



Well Depth: 80 below ground surface
 Screened Intervals: 60-80 below ground surface
 Type of Well: Observation
 Trend for Historical Record (ft/yr): -0.01
 Recent Trend (ft/yr): 0.31

Figure 2

SRP0243, SRP-H18-01



Well Depth: 582 below ground surface
 Screened Intervals: 258-582 below ground surface
 Type of Well: Municipal
 Trend for Historical Record (ft/yr): 3.14
 Recent Trend (ft/yr): -3.42

Figure 3

SRP0355, SCWA_SEB_MW_07

