Groundwater Sustainability Plan

Monterey Subbasin

Marina Coast Water District Groundwater Sustainability Agency

Salinas Valley Basin Groundwater Sustainability Agency

DRAFT Chapter 8

Sustainable Management Criteria

June 2021

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8 SUSTAINABLE MANAGEMENT CRITERIA

This chapter defines the conditions that constitute sustainable groundwater management; and establishes minimum thresholds, measurable objectives, and undesirable results for each sustainability indicator. This chapter includes adequate data to explain how sustainable management criteria (SMCs) were developed and how they influence all beneficial uses and users.

The chapter is structured to address all the Sustainable Groundwater Management Act (SGMA) regulations regarding SMCs. To retain an organized approach, the SMCs are grouped by sustainability indicator. The discussion of each sustainability indicator follows a consistent format that contains all information required by Section 354.22 *et. seq* of the regulations, and as further clarified in the SMCs BMP (DWR, 2017; CCR, 2016).

8.1 Definitions

The SGMA legislation and GSP Regulations contain terms relevant to SMCs. The definitions included in the GSP Regulations are repeated below. Where appropriate, additional explanatory text is added in italics. This explanatory text is not part of the official definitions of these terms.

- **Sustainability indicator** refers to any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results, as described in Water Code Section 10721(x).

  The six sustainability indicators relevant to this subbasin include chronic lowering of groundwater levels; reduction of groundwater storage; degraded water quality; land subsidence; seawater intrusion; and depletion of interconnected surface waters.

- **Undesirable Results** occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.

  The GSP Regulations requires that the description of undesirable results include (1) the cause of groundwater conditions that would lead to or has led to undesirable results; (2) a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the subbasin (i.e. the undesirable result criteria); and (3) potential effects that may occur or are occurring from undesirable results. An example undesirable result criteria could be defined as: more than 10% of the measured groundwater elevations being lower than the minimum thresholds.

- **Significant and Unreasonable Conditions**

  Significant and unreasonable is not defined in the Regulations. However, the definition of undesirable results states, "Undesirable results occur when significant and unreasonable effects … are caused by groundwater conditions…". The SGMA BMP states that "the GSAs must consider and document the conditions at which each of the six sustainability

indicators become significant and unreasonable, including reasons for justifying each particular threshold selected." Therefore, this GSP adopts the phrase significant and unreasonable conditions to be the qualitative description of conditions used to justify selected minimum thresholds and undesirable results criteria.

- **Measurable objectives** refer to specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin.

  Measurable objectives are goals that the GSP is designed to achieve.

- **Minimum threshold** refers to a numeric value for each sustainability indicator used to define undesirable results.

  Minimum thresholds are quantitative indicators of an unreasonable condition.

- **Interim milestone** refers to a target value representing measurable groundwater conditions, in increments of five years, set by an Agency as part of a Plan.

  Interim milestones are targets such as groundwater elevations that will be achieved every five years to demonstrate progress towards sustainability.

8.2 Sustainability Goal

The sustainability goal of the Monterey Subbasin is to manage groundwater resources for long-term community, financial, and environmental benefits to the Subbasin's residents and businesses. The goal of this GSP is to ensure long-term viable water supplies to local communities at a reasonable cost. In addition, because the Subbasin is hydrologically connected with other Salinas Valley Basin Subbasins, this GSP aims to develop a coordinated approach to groundwater management within this Subbasin and neighboring Subbasins. The Subbasin will achieve long-term sustainability through implementation of inter- and intra-basin coordination as well as projects and management actions.

Several projects and management actions are included in this GSP and detailed in Chapter 9. These projects and management actions will diversify the Subbasin' water supply portfolio, increase supply reliability, and protect the Subbasin's groundwater resources against seawater intrusion. The Subbasin's historical efforts to invest in water conservation will continue under SGMA.

These management actions and project types include:

Management Actions:

- [LIST TO BE ADDED AFTER CHAPTER 9 IS DEVELOPED]

Projects:

- [LIST TO BE ADDED AFTER CHAPTER 9 IS DEVELOPED]

8.3 Achieving Long-Term Sustainability

The GSP addresses long-term groundwater sustainability. Correspondingly, the Subbasin GSAs intend to develop SMCs to avoid undesirable results under future hydrogeologic conditions with long-term, deliberate management of groundwater. The Subbasin GSAs' best understanding of future conditions is based on historical precipitation, evapotranspiration, streamflow, and reasonable anticipated climate change and sea level rise, which have been estimated on the basis of the best available climate science (DWR, 2018). These parameters underpin the estimated future water budget over the planning horizon (see Section 6.X). Groundwater conditions that are the result of extreme climatic conditions, which are worse than those anticipated on the basis of best available climate science, do not constitute an undesirable result. As such, SMCs may be modified in the future to reflect observed future climate conditions.

The GSAs will track hydrologic conditions during GSP implementation. These observed hydrologic conditions will be compared to predicted future hydrologic conditions for the Subbasin as presented in this GSP. This information will be used to interpret the Subbasin's performance against SMCs.

Further, since the GSP addresses long-term groundwater sustainability, exceedance of some SMCs during an individual year does not constitute an undesirable result. Pursuant to SGMA regulations (California Water Code §10721(w)(1)), "Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods." Therefore, groundwater levels may temporarily exceed minimum thresholds during prolonged droughts, which could be more extreme than those that have been anticipated based on historical data and anticipated climate change conditions. Such temporary exceedances do not constitute an undesirable result.

The SMCs presented in this current draft Chapter 8 have been developed on the basis of historically observed hydrologic conditions and, in most cases, reasonably anticipated climate change. These SMCs may be updated in future drafts to reflect changes in anticipated climate conditions and climate change based upon groundwater modeling results.

8.4 Management Areas

As introduced in Section 1.4, this GSP establishes two management areas within the Subbasin including the Marina-Ord Area and the Corral de Tierra Area. These management areas have been developed to facilitate GSP implementation considering the differences in jurisdiction, water use sector, and principal aquifer characteristics described in Chapters 3 through 5.

Per GSP Emergency Regulations §354.20 (a), "[m]anagement areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin"; and §354.20

(b) "A basin that includes one or more management areas shall describe the following in the Plan… (2) The minimum thresholds and measurable objectives established for each management area and an explanation of the rationale for selecting those values, if different from the basin at large."

This chapter takes a basin-wide approach for establishing undesirable results and identifies the drivers of undesirable results within each management area. The drivers for undesirable results often differ between the management areas, which warrant selection of different minimum thresholds and measurable objectives. For example, the primary concern of groundwater management in the Marina-Ord Area is seawater intrusion. Due to the land use characteristics and groundwater conditions in this area, effects that are typically associated with chronic lowering of groundwater levels, such as dewatering of wells, are not likely to occur. However, groundwater elevation SMCs in the Marina-Ord Area need to be established at levels that can control seawater intrusion. The Corral de Tierra Area is generally located further inland where seawater intrusion not likely to occur. However, the area supports groundwater use by numerous municipal water systems, small water users, and domestic users where chronic lowering of groundwater levels may cause dewatering of wells, increased pumping costs, or reductions in storage that are significant and unreasonable. Therefore, groundwater elevation SMCs in the Corral de Tierra Area need to be established at levels that protect the ability to pump from domestic and small water system wells.

Minimum thresholds and measurable objectives defined in this chapter are developed through close coordination between the two subbasin GSAs to ensure the criteria within one management area does not cause undesirable results in the other. In addition, SMCs identified in this chapter consider SMCs and conditions identified in adjacent Subbasins, which are in direct hydraulic communication with the Monterey Subbasin as described in Chapters 4 and 5. Due to the interconnectivity between the Monterey Subbasin and adjacent subbasins, the Monterey Subbasin groundwater elevation minimum thresholds are intended to be consistent with adjacent subbasins and are based on the assumption that SMCs and sustainability goals will be met in the adjacent Subbasins. Therefore, continued coordination of SMCs and sustainability goals is critical, as each subbasin's ability to achieve sustainability is affected by the adjacent subbasins' ability to manage their groundwater sustainably. Through implementation, continued monitoring, data collection, additional analysis, and modeling will be used to validate the impact of the SMCs on the Monterey Subbasin and adjacent subbasins to inform the GSAs of compliance and needed adjustments.

Chapter 7 identifies the management area-specific monitoring networks that facilitate monitoring of SMCs defined in this chapter.

8.5 General Process for Establishing Sustainable Management Criteria

MCWD GSA and SVBGSA established a Technical Committee and a Steering Committee for the Monterey Subbasin to facilitate coordination between the two GSAs in development of this GSP.

These committees are established in accordance with the GSAs' Framework Agreement. The Technical Committee consists of GSA staff and consultants, and meets on a biweekly basis. The Technical Committee is the platform for coordinating technical analysis, data sharing, and communication in development of the GSP. The Steering Committee consists of one Board Member and the General Manager of each GSA. The purpose of the Steering Committee is to resolve any issues raised by the Technical Committee and reach consensus between the GSAs.

The SMCs presented in this chapter were developed using publicly available information, hydrogeologic analysis, feedback gathered during public meetings, and coordination between MCWD GSA and SVBGSA via the Monterey Subbasin Technical and Steering Committees.

The general process included:

- Establishing a procedure to SMCs development in the Technical Committee;
- Gathering input and develop preferences for establishing SMCs for each GSA's respective management area, including consultation with stakeholders and discussions within GSA staff;
- Reconciling management area-level input in the Technical Committee;
- Presenting proposed SMCs to GSA governing bodies and stakeholder groups;
- Modifying SMCs based on input from the public, GSA staff, and Board Members.

8.6 Sustainable Management Criteria Summary

Table 8-1 provides a summary of the SMCs for each of the six sustainability indicators. The rationale and background for developing these criteria are described in detail in the following sections. The SMCs presented in Table 8-1 are part of the GSA's 50-year management plan: SGMA allows for 20 years to reach sustainability, and requires the Subbasin have no undesirable results for the subsequent 30 years.

Table 8-1. Sustainable Management Criteria Summary

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result	Interim Milestones
Chronic lowering of groundwater levels	Measured through the groundwater elevation representative monitoring well network within each management area	**Marina-Ord Area:** Minimum groundwater elevations historically observed between 1995 and 2015 in the Dune Sand, 180-Foot, 400-Foot, and Deep Aquifers.	**Marina-Ord Area:** Groundwater elevations observed in 2004 in the Dune Sand, 180-Foot, 400-Foot, and Deep Aquifers.	Over the course of any one year, exceedance of more than 20% of groundwater level minimum thresholds in **either** (a) both the Dune Sand and upper 180-Foot Aquifers, or (b) both the lower 180-Foot and 400-Foot Aquifers, or (c) the Deep Aquifers, or (d) the El Toro Primary Aquifer System.	**Whole Subbasin:** Interim milestones are described in Table 8-3 for each RMS well that is defined in Chapter 7.
		Corral de Tierra Area: Groundwater elevations observed in 2015 in the El Toro Primary Aquifer System.	**Corral de Tierra Area:** Groundwater elevations observed in 2008 in the El Toro Primary Aquifer System.		

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result	Interim Milestones
Reduction in groundwater storage	Measured through the groundwater elevation and seawater intrusion representative monitoring well networks.	**Whole Subbasin:** Minimum thresholds for chronic lowering of groundwater levels and seawater intrusion will be used as a proxy for reduction of groundwater storage minimum threshold.	**Whole Subbasin:** Measurable objectives for chronic lowering of groundwater levels and seawater intrusion will be used as a proxy for reduction of groundwater storage measurable objective.	Over the course of any one year, (1) exceedance of more than 20% of groundwater level minimum thresholds in **either** (a) both the Dune Sand and upper 180-Foot Aquifers, or (b) both the lower 180-Foot and 400-Foot Aquifers, or (c) the Deep Aquifers, or (d) the El Toro Primary Aquifer System; OR (2) Exceedance of seawater intrusion minimum thresholds.	**Whole Subbasin:** Groundwater elevation and seawater intrusion interim milestones described respectively in Table 8-3 and Section 8.9.4.2 will serve as a proxy for reduction of groundwater storage interim milestones.

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result	Interim Milestones
Seawater intrusion	Measured through seawater intrusion representative monitoring well network.	**Whole Subbasin:** The approximate location in 2015 of the 500 mg/L chloride concentration isocontour in the lower 180-Foot and 400-Foot Aquifers; Approximately 3,500 feet from the coast in the Dune Sand Aquifer, upper 180-Foot Aquifer and Deep Aquifers. This distance is generally consistent with the location of Highway 1 in the Monterey Subbasin and seaward of groundwater extraction wells in the Subbasin. No seawater intrusion in the El Toro Primary Aquifer System.	**Whole Subbasin:** Measurable objective is identical to the minimum threshold.	Any exceedance of the minimum threshold is considered as an undesirable result.	**Whole Subbasin:** Identical to minimum thresholds and measurable objectives. No seawater intrusion above 500 mg/L chloride in RMS wells.

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result	Interim Milestones
Degraded groundwater quality	Groundwater quality data downloaded annually from state sources.	**Whole Subbasin:** No additional exceedances of drinking water standards in potable supply wells or Basin Plan water quality objectives for agricultural supply wells as a result of GSP implementation. Exceedances are only measured in public water system supply wells and domestic and agricultural (ILRP) wells. See Table 8-5 for the list of constituents.	**Whole Subbasin:** Measurable objective is identical to the minimum threshold.	Any exceedances of minimum thresholds during any one year as a direct result of projects or management actions conducted pursuant to GSP implementation is considered as an undesirable result.	**Whole Subbasin:** Identical to minimum thresholds and measurable objectives, which represent current conditions
Subsidence	Measured using DWR-provided InSAR data.	**Whole Subbasin:** Zero net long-term subsidence, with no more than 0.1 foot per year of measured vertical displacement between June of one year and June of the subsequent year to account for InSAR measurement errors.	**Whole Subbasin:** Measurable objective is identical to the minimum threshold.	Any exceedances of minimum thresholds during any one year due to lowered groundwater elevations is considered as an undesirable result.	**Whole Subbasin:** Identical to minimum thresholds and measurable objectives, which represent current conditions.

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result	Interim Milestones
Depletion of interconnected surface water (ISW)	Measured through shallow groundwater elevations as a proxy near potential locations of ISW in the ISW representative monitoring well network.	**Whole Subbasin:** Minimum shallow groundwater elevations historically observed between 1995 and 2015 near locations of interconnected surface water.	**Whole Subbasin:** Identical to minimum threshold shallow groundwater elevations.	Any minimum threshold exceeded in a shallow groundwater well near any location of ISW for more than two consecutive years.	**Whole Subbasin:** Identical to minimum thresholds and measurable objectives, which represent current conditions.

8.7 Chronic Lowering of Groundwater Levels SMCs

Chronic lowering of groundwater levels is arguably the most fundamental Sustainability Indicator, as it influences several other key Sustainability Indicators, including Seawater Intrusion, Reduction of Groundwater Storage, Land Subsidence, and Interconnected Surface Water. Groundwater levels are also some of the most readily available and measurable metrics of groundwater conditions, which allows for a systematic, data-driven approach to development of Sustainable Management Criteria.

8.7.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable groundwater elevations in the Marina-Ord and Corral de Tierra Areas are identified as follows.

Marina-Ord Area

Significant and unreasonable groundwater elevations in the Marina-Ord Area include:

- Groundwater elevations below those historically observed prior to 2015[1]:
    - Near the coast in the Dune Sand, 180-Foot, and 400-Foot Aquifers (where not seawater intruded),
    - Near the seawater intrusion front in the lower 180-Foot and 400-Foot Aquifers, and
    - Throughout the Deep Aquifers, because such groundwater elevations could cause lateral or vertical expansion of the existing seawater intrusion extent and/or eventual migration of saline water into Deep Aquifer wells.

As discussed in Section 3.1.6, groundwater use within the Marina-Ord Area is almost exclusively limited to generation of municipal supplies by MCWD. Groundwater elevations are significantly higher than municipal production well screen elevations in all aquifers in the Marina-Ord Area, and there is limited concern regarding the potential dewatering of groundwater production wells. Therefore, groundwater levels that could cause undesirable results associated with other locally relevant sustainability indicators, such as the lateral or vertical expansion of the existing seawater intrusion extent and/or eventual migration of saline water into Deep Aquifer wells, have been used to define groundwater level minimum thresholds in the Marina-Ord Area.

Corral de Tierra Area

Significant and unreasonable groundwater elevations in the Corral de Tierra Area include:

[1] Based upon the historical period (Water Year 2003 through 2017)

- Groundwater elevations at or below those observed in 2015. Lower groundwater elevations could lead to inadequate water production in a significant number of domestic and small water system wells.
- Groundwater elevations that cause undesirable results associated with other locally relevant sustainability indicators, including interconnected surface water, as described in Section 8.12 below.

These significant and unreasonable conditions were determined based on input collected during MCWD stakeholder meetings, SVBGSA Subbasin Planning Committee meetings, and discussions with GSA staff during Subbasin Technical Committee meetings.

8.7.2 Undesirable Results

Undesirable results have been defined within each management area. However, pursuant to the GSP Emergency Regulations, which state that Undesirable Results are to be defined consistently throughout the basin (23 CCR §354.20), the definitions of Undesirable Results have been coordinated between management areas by subbasin GSAs and are described below.

8.7.2.1 Criteria for Determining Undesirable Results

The chronic lowering of groundwater levels undesirable results is a quantitative combination of groundwater level minimum threshold exceedances. For the Subbasin, the undesirable result for chronic lowering of groundwater levels occurs when

> *Over the course of any one year, exceedance of more than 20% of the groundwater level minimum thresholds in either:*
>
> *a. both the Dune Sand Aquifer and Upper 180-Foot Aquifer, or*
> *b. both the Lower 180 Foot and 400 Foot aquifer, or*
> *c. the Deep Aquifers, or*
> *d. the El Toro Primary Aquifer System.*

Setting undesirable results based on an allowable percentage of minimum threshold exceedances provides flexibility in defining sustainability. Increasing the percentage of allowed minimum threshold exceedances allows for greater localized fluctuations in water levels but may lead to significant and unreasonable conditions for some beneficial users. Reducing the percentage of allowed minimum threshold exceedances ensures strict adherence to minimum thresholds but reduces operational flexibility due to unanticipated hydrogeologic conditions. The undesirable result is set at 20% within each principal aquifer or group of principal aquifers. The percentages balance the interests of beneficial users with the practical aspects of groundwater management under uncertainty and applies to both management areas.

This undesirable result definition refers to and relies on minimum thresholds established for each principal aquifer, or group of principal aquifers. As discussed further below and in Chapter 7, minimum thresholds for groundwater levels are set at 35 Representative Monitoring Sites in the

Marina-Ord Area and 13 Representative Monitoring Sites in the Corral de Tierra Area. Within the Marina-Ord Area and the Reservation Road portion of the Corral de Tierra Area where the hydrogeological setting is similar, it is considered an undesirable result for chronic lowering of groundwater levels if minimum thresholds are exceeded in 20% or more of the Representative Monitoring Sites within either (a) the Dune Sand and Upper 180-Foot Aquifer, or (b) the Lower 180-Foot and 400-Foot Aquifers, or (c) the Deep Aquifers. Undesirable results for chronic lowering of water levels within the Marina-Ord Area and the Reservation Road portion of the Corral de Tierra Area are set on the basis of minimum thresholds within these groups of aquifers, because of how they are hydraulicly connected near the coast where the greatest potential for additional seawater intrusion exists and the RMS networks are primarily focused. For example, groundwater levels within the Dune Sand Aquifer and Upper 180-Foot are very similar in coastal wells due to the pinching out of the Fort Ord Salinas Valley Aquitard (FO-SVA)[2]. Similarly, groundwater elevations in the Lower 180-Foot Aquifer are similar to those measured in the 400-Foot Aquifer across much of the Marina-Ord Area.

The 20% limit on minimum threshold exceedances in the undesirable result allows for:

(a) A total of 3 exceedance out of the 16 existing RMS wells within the Dune Sand Aquifer and upper 180-Foot Aquifer,

(b) A total of 2 exceedances out of the 9 existing RMS wells within the Lower 180-Foot Aquifer and 400-Foot Aquifer,

(c) A total of 2 exceedances out of the 10 existing RMS wells within the Deep Aquifer, and

(d) A total of 3 exceedances out of the 13 existing RMS wells within the El Toro Primary Aquifer System.

This number of exceedances is considered a reasonable given the hydrogeologic uncertainty of the Subbasin. As the monitoring system grows, additional exceedances will be allowed. One additional exceedance will be allowed for approximately every five new monitoring wells.

8.7.2.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result include the following:

- **Unsustainable groundwater management in adjacent subbasins**. Due to the hydrologic connectivity between the Subbasin and other Salinas Valley Basin Subbasins, increased groundwater extraction or reduced recharge in either the Subbasin or the greater Salinas Valley Basin may lead to undesirable results.
- **Localized pumping clusters**. Even if regional pumping is maintained within the sustainable yield, clusters of high-capacity wells may cause excessive localized drawdowns that lead to undesirable results.

[2] See discussion in Chapter 5

- **Expansion of *de minimis* pumping**. Individual *de minimis* pumpers do not have a significant impact on groundwater elevations. However, many *de minimis* pumpers are often clustered in specific residential areas. Pumping by these *de minimis* users is not regulated under this GSP. Adding additional domestic *de minimis* pumpers in these areas may result in excessive localized drawdowns and undesirable results.
- **Expansion of municipal or agricultural pumping**. Additional extractions for municipal or agricultural purposes, without an offsetting increase in recharge, cross-boundary flows and/or projects will reduce groundwater elevations.
- **Departure from the GSP's climatic assumptions, including extensive, unanticipated drought**. Minimum thresholds were established based on historical groundwater elevations and reasonable estimates of future climatic conditions and groundwater elevations. Departure from the GSP's climatic assumptions or extensive, unanticipated droughts may lead to excessively low groundwater elevations and undesirable results.

An undesirable result for chronic lowering of groundwater levels currently exists because during recent fall 2020 monitoring, or 2019 if fall 2020 was not available:

(1) groundwater elevations within the Marina-Ord Area exceeded minimum thresholds in

   a. 2 out of 9 existing RMS wells (22%) in the lower 180-Foot Aquifer, 400-Foot Aquifer, and

   b. 7 out of 10 existing RMS wells (70%) in the Deep Aquifers ; and

(2) Groundwater elevations within the Corral de Tierra Area exceeded minimum thresholds in 8 out of 13 existing RMS wells (61%).

8.7.2.3 Effects on Beneficial Users and Land Uses

As discussed in Section 3.1.6, groundwater use within the Marina-Ord Area is almost exclusively limited to generation of municipal supplies by MCWD. There are several recognized disadvantaged communities (DACs) within the Subbasin within the urban areas of the City of Marina. These communities rely on water services provided by MCWD.

As discussed above, undesirable results caused by chronic lowering of groundwater levels in the Marina-Ord Area are primarily associated with the expansion of seawater intrusion and other locally relevant sustainability indicators. These sustainability indicators have been considered when defining groundwater level minimum thresholds in the Marina-Ord Area.

The primary potential effects of undesirable results caused by chronic lowering of groundwater levels in the Corral de Tierra Area include dewatering of domestic and small water system wells, increased energy costs, or interference with other locally relevant sustainability indicators, which have been used to define groundwater level minimum thresholds in the Corral de Tierra Area. Allowing multiple exceedances can have detrimental effects on beneficial users if more than one exceedance take place in a small geographic area. Allowing 20% exceedances in the Corral de

Tierra Area are only reasonable if the exceedances are spread out across the management area, and as long as any one well does not regularly exceed its minimum threshold. If the exceedances are clustered in a small area, it will indicate that significant and unreasonable effects are being born by a localized group of landowners and water users and should be evaluated.

8.7.3 Minimum Thresholds

Minimum thresholds for chronic lowering of groundwater levels ("groundwater elevation minimum thresholds") in the **Marina-Ord Area** are defined as follows:

> *Minimum groundwater elevations historically observed between 1995 and 2015 in the Dune Sand, 180-Foot, 400-Foot, and Deep Aquifers.*

Groundwater elevation minimum thresholds in the **Corral de Tierra Area** are defined as follows:

> *Groundwater elevation observed in 2015 in the El Toro Primary Aquifer System.*

Groundwater elevation measurements collected during the fourth quarter (i.e., October, November, December) are used to establish minimum thresholds and measurable objectives in the Subbasin and will be used in the future for comparison to these thresholds. This methodology is (1) consistent with the methodology used in the adjacent 180/400-Foot Aquifer Subbasin; and (2) considers the existing monitoring schedule for the majority of RMS wells. The U.S. Army monitors 26 of the RMS wells once every quarter; MCWRA monitors 19 of the RMS wells between November and December as part of its annual groundwater elevation monitoring program; and the Seaside Watermaster has eight of the RMS wells monitored on a quarterly or more frequent basis.

Minimum thresholds for each well within the groundwater elevation representative monitoring network are provided in Table 8-2. Maps showing minimum thresholds and measurable objectives for each RMS are included in Appendix 8A.

Table 8-2. Chronic Lowering of Groundwater Elevations Minimum Thresholds and Measurable Objectives

Monitoring Site	Aquifer	Minimum Threshold (ft NAVD88)	Measurable Objective (ft NAVD88)
Marina-Ord Area			
MW-BW-28-A	Dune Sand Aquifer	63.7	70.3
MW-BW-49-A	Dune Sand Aquifer	8.9	11.3
MW-BW-81-A	Dune Sand Aquifer	8.2	10.0
MW-BW-82-A	Dune Sand Aquifer	7.9	9.5
MW-OU2-13-A	Dune Sand Aquifer	89.6	94.4
MW-OU2-32-A	Dune Sand Aquifer	7.2	8.1
MW-OU2-34-A	Dune Sand Aquifer	4.7	6.6
CDM MW-1 Beach	Upper 180-Foot Aquifer	3.3	3.3
MW-02-05-180	Upper 180-Foot Aquifer	6.5	8.4
MW-02-10-180	Upper 180-Foot Aquifer	6.5	7.3
MW-02-13-180M	Upper 180-Foot Aquifer	6.0	6.8
MW-02-13-180U	Upper 180-Foot Aquifer	6.8	7.3
MW-12-07-180	Upper 180-Foot Aquifer	6.1	7.0
MW-B-05-180	Upper 180-Foot Aquifer	-8.0	-3.4
MW-BW-55-180	Upper 180-Foot Aquifer	-6.4	-5.7
MW-OU2-29-180	Upper 180-Foot Aquifer	-9.0	-7.2
MW-12-12-180L	Lower 180-Foot Aquifer	3.3	3.8
MW-BW-04-180	Lower 180-Foot Aquifer	-11.0	-11.0
MW-OU2-66-180	Lower 180-Foot Aquifer	-10.0	-9.2
TEST2	Lower 180-Foot Aquifer	-11.9	-10.6
MP-BW-42-295	Lower 180-Foot, 400-Foot Aquifer	-13.3	-8.1
MP-BW-50-289	Lower 180-Foot, 400-Foot Aquifer	-8.4	-7.1
MPWMD#FO-10S	400-Foot Aquifer	-10.3	-0.1
MPWMD#FO-11S	400-Foot Aquifer	-25.9	-3.4
MW-OU2-07-400	400-Foot Aquifer	-6.6	-4.2
014S001E24L002M	Deep Aquifers	-29.6	-20.8
014S001E24L003M	Deep Aquifers	-6.8	3.5
014S001E24L004M	Deep Aquifers	-34.7	-21.1
014S001E24L005M	Deep Aquifers	-26.6	-6.0
14S02E33E01	Deep Aquifers	-43.8	-29.3
14S02E33E02	Deep Aquifers	-21.1	-13.9

Monitoring Site	Aquifer	Minimum Threshold (ft NAVD88)	Measurable Objective (ft NAVD88)
MPWMD#FO-10D	Deep Aquifers	-10.6	-0.9
MPWMD#FO-11D	Deep Aquifers	-4.8	6.2
PZ-FO-32-910	Deep Aquifers	-44.1	-19.7
Sentinel MW #1	Deep Aquifers	-25.4	-18.8
Corral de Tierra Area			
15S/02E-25C01	El Toro Primary Aquifer System	23.0	33.0
15S/03E-18P01	El Toro Primary Aquifer System	-46.4	-28.4
15S/03E-20R50	El Toro Primary Aquifer System	29.0	39.0
16S/02E-01M01	El Toro Primary Aquifer System	291.5	301.5
16S/02E-02G01	El Toro Primary Aquifer System	294.9	304.9
16S/02E-02H01	El Toro Primary Aquifer System	278.9	288.9
16S/02E-03A01	El Toro Primary Aquifer System	227.0	232.0
16S/02E-03F50	El Toro Primary Aquifer System	220.7	225.7
16S/02E-03H01	El Toro Primary Aquifer System	210.1	220.1
16S/02E-03H02	El Toro Primary Aquifer System	221.5	226.5
16S/02E-03J50	El Toro Primary Aquifer System	193.3	210.1
Robley Deep (South)	El Toro Primary Aquifer System	169.8	183.5
Robley Shallow (North)	El Toro Primary Aquifer System	245.2	255.2

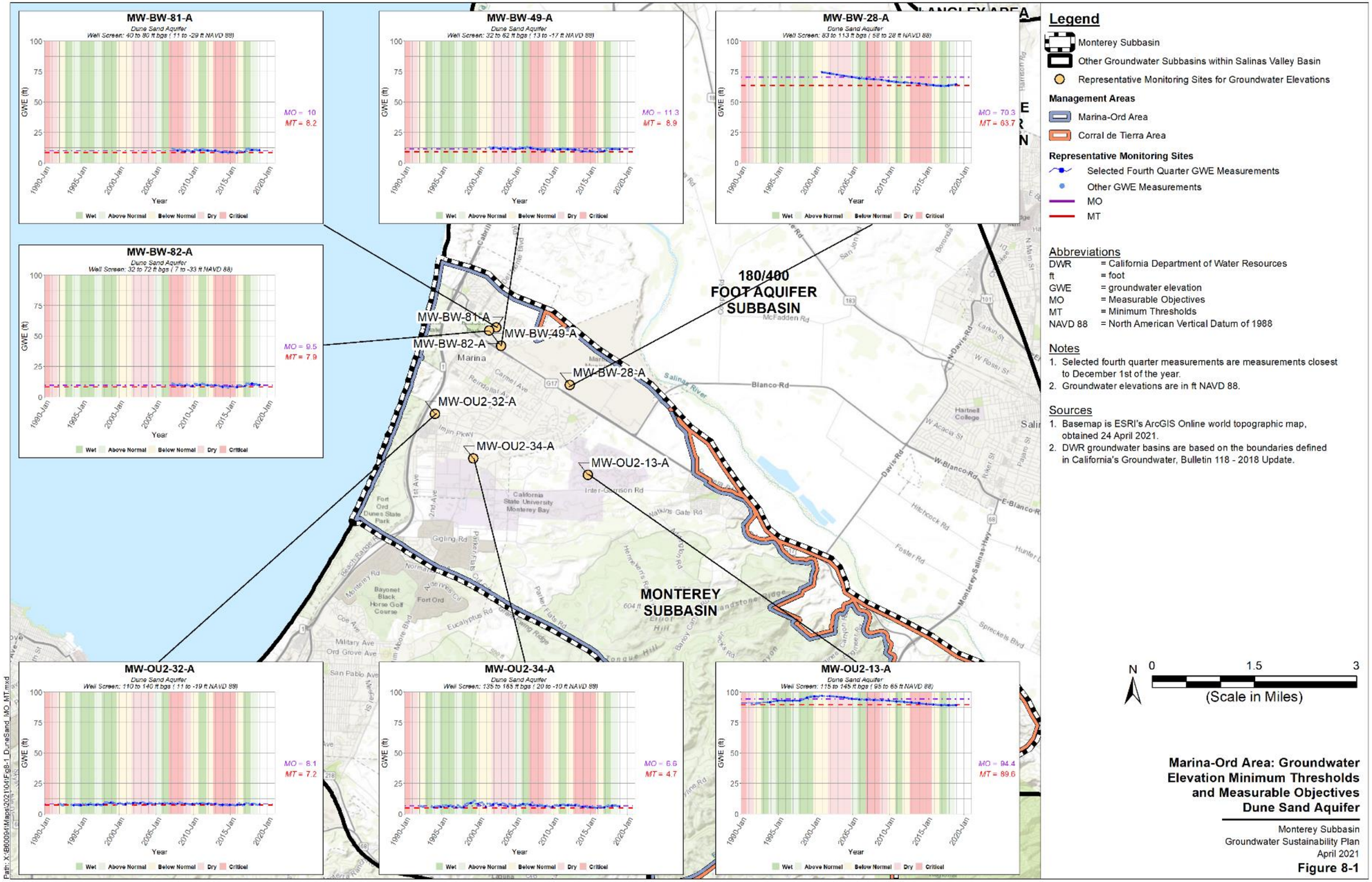
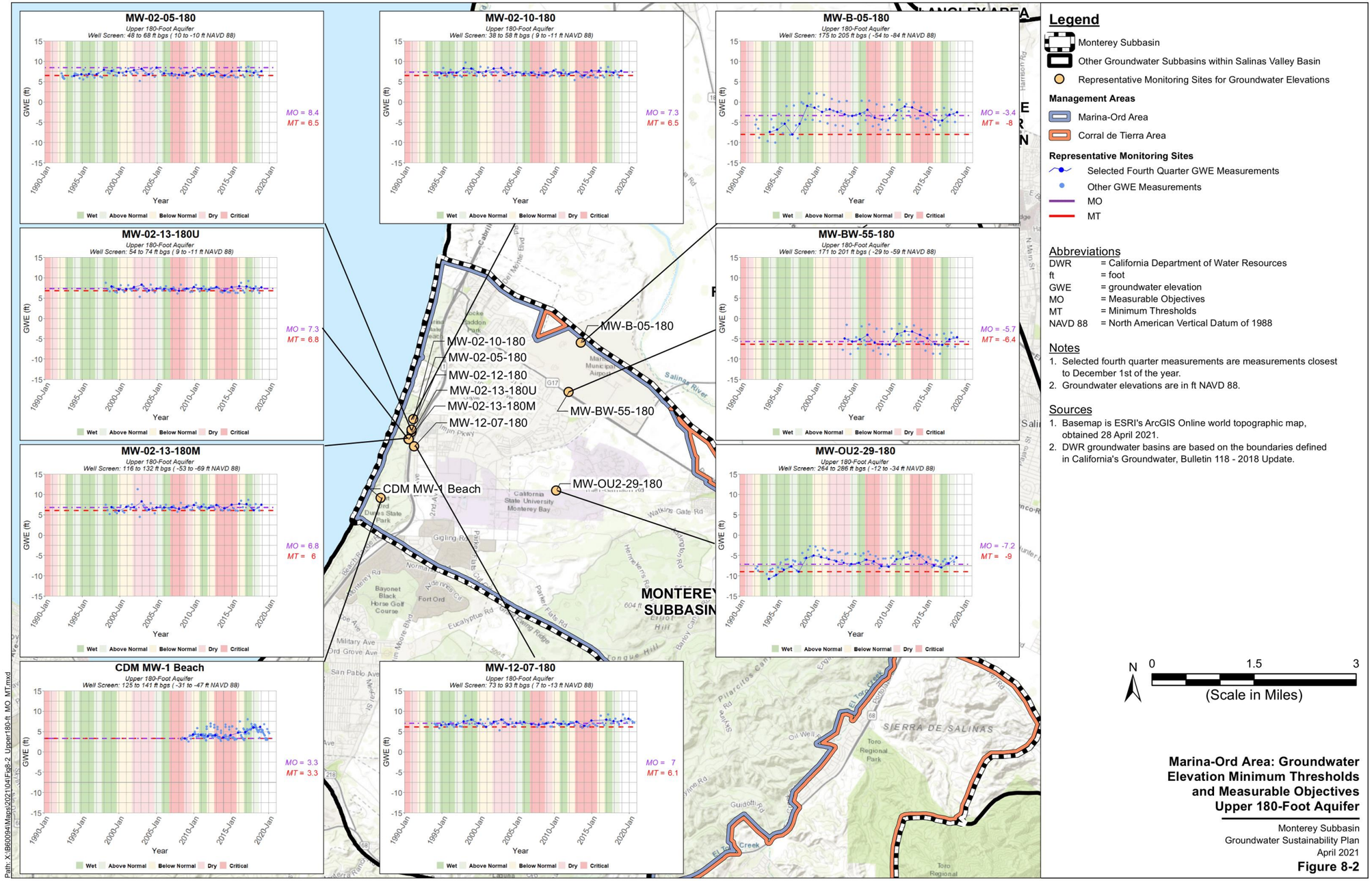


Figure 8-1. Marina-Ord Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives Dune Sand Aquifer



Legend

- Monterey Subbasin
- Other Groundwater Subbasins within Salinas Valley Basin
- Representative Monitoring Sites for Groundwater Elevations

Management Areas

- Marina-Ord Area
- Corral de Tierra Area

Representative Monitoring Sites

- Selected Fourth Quarter GWE Measurements
- Other GWE Measurements
- MO
- MT

Abbreviations

DWR	= California Department of Water Resources
ft	= foot
GWE	= groundwater elevation
MO	= Measurable Objectives
MT	= Minimum Thresholds
NAVD 88	= North American Vertical Datum of 1988

Notes

1. Selected fourth quarter measurements are measurements closest to December 1st of the year.
2. Groundwater elevations are in ft NAVD 88.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 28 April 2021.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.

N

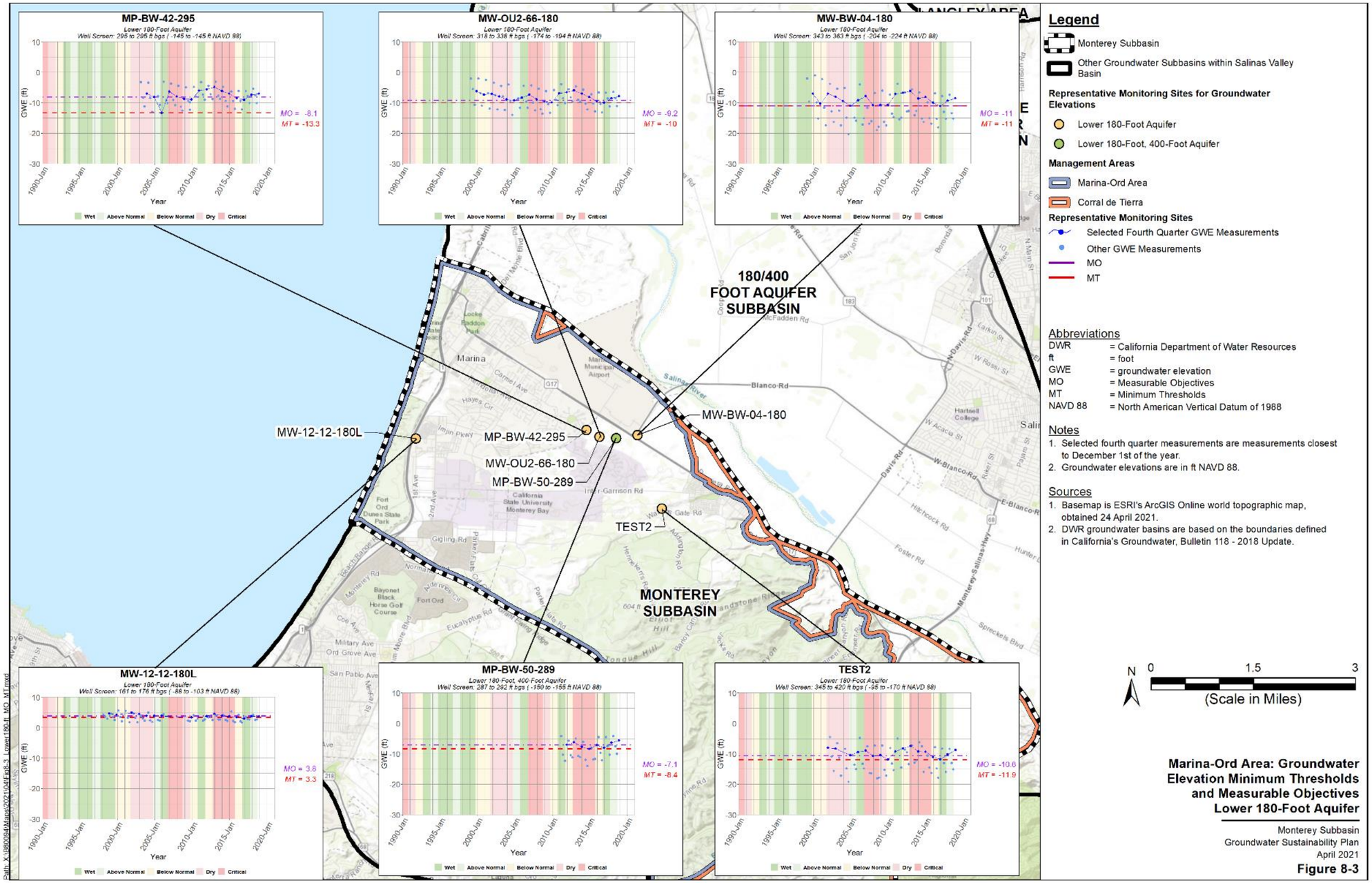
0 1.5 3

(Scale in Miles)

Marina-Ord Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives Upper 180-Foot Aquifer

Monterey Subbasin
Groundwater Sustainability Plan
April 2021
Figure 8-2

Figure 8-2. Marina-Ord Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives, Upper 180-Foot Aquifer



Legend

- Monterey Subbasin
- Other Groundwater Subbasins within Salinas Valley Basin

Representative Monitoring Sites for Groundwater Elevations

- Lower 180-Foot Aquifer
- Lower 180-Foot, 400-Foot Aquifer

Management Areas

- Marina-Ord Area
- Corral de Tierra

Representative Monitoring Sites

- Selected Fourth Quarter GWE Measurements
- Other GWE Measurements
- MO
- MT

Abbreviations

DWR	= California Department of Water Resources
ft	= foot
GWE	= groundwater elevation
MO	= Measurable Objectives
MT	= Minimum Thresholds
NAVD 88	= North American Vertical Datum of 1988

Notes

1. Selected fourth quarter measurements are measurements closest to December 1st of the year.
2. Groundwater elevations are in ft NAVD 88.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 24 April 2021.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.

N 0 1.5 3 (Scale in Miles)

Marina-Ord Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives Lower 180-Foot Aquifer

Monterey Subbasin
Groundwater Sustainability Plan
April 2021
Figure 8-3

Figure 8-3. Marina-Ord Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives, Lower 180-Foot Aquifer

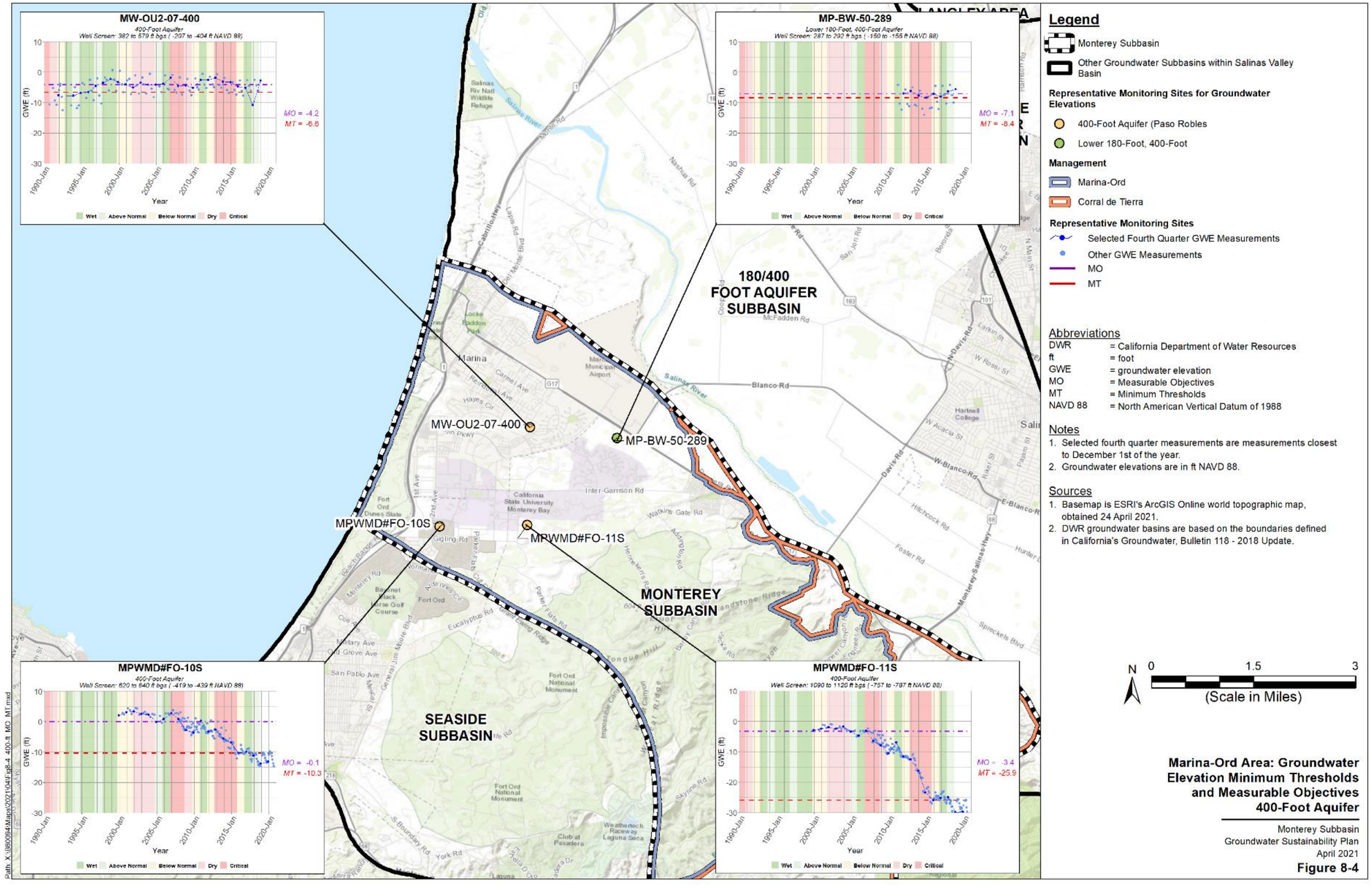


Figure 8-4. Marina-Ord Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives, 400-Foot Aquifer

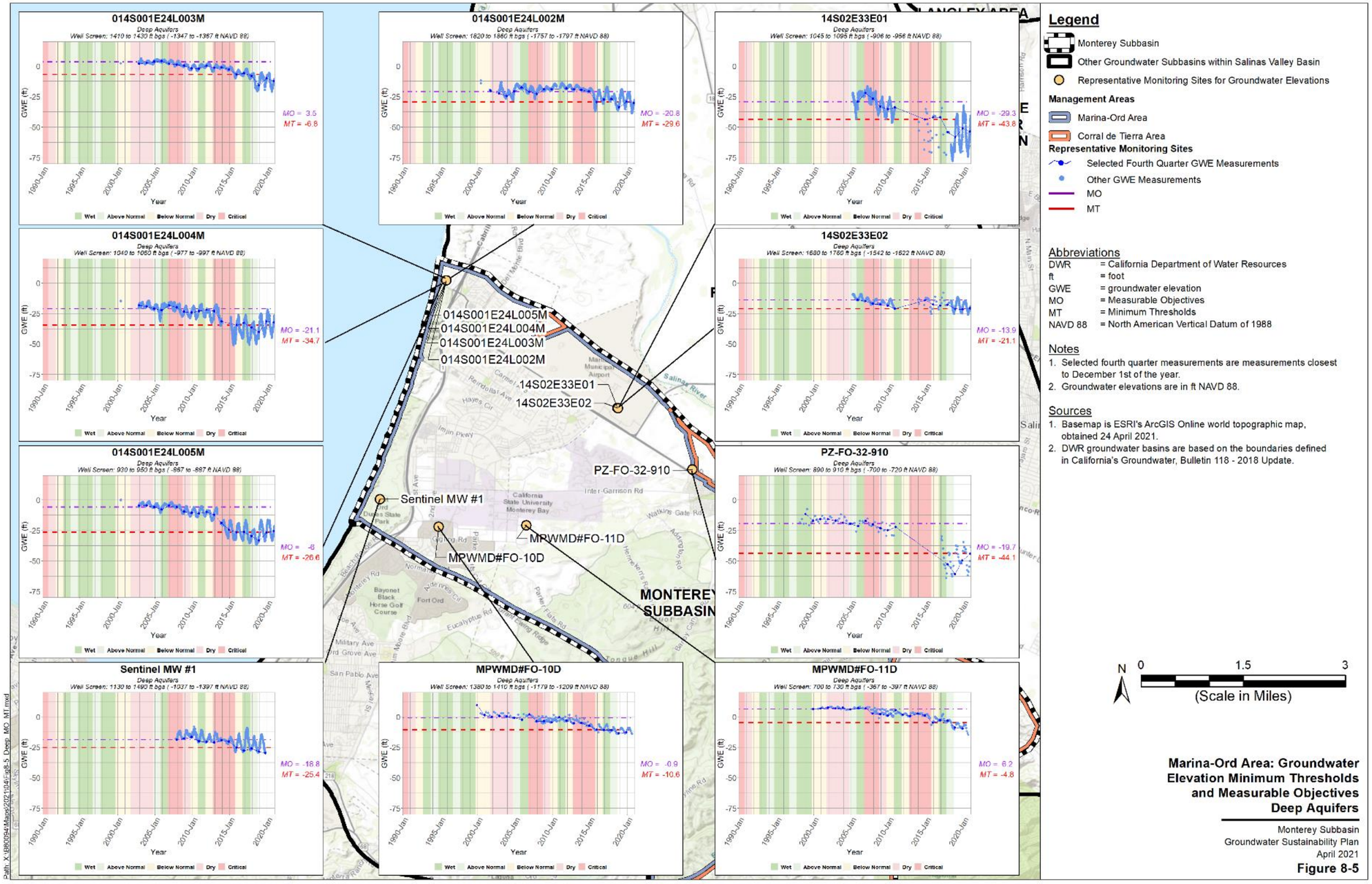


Figure 8-5. Marina-Ord Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives, Deep Aquifers

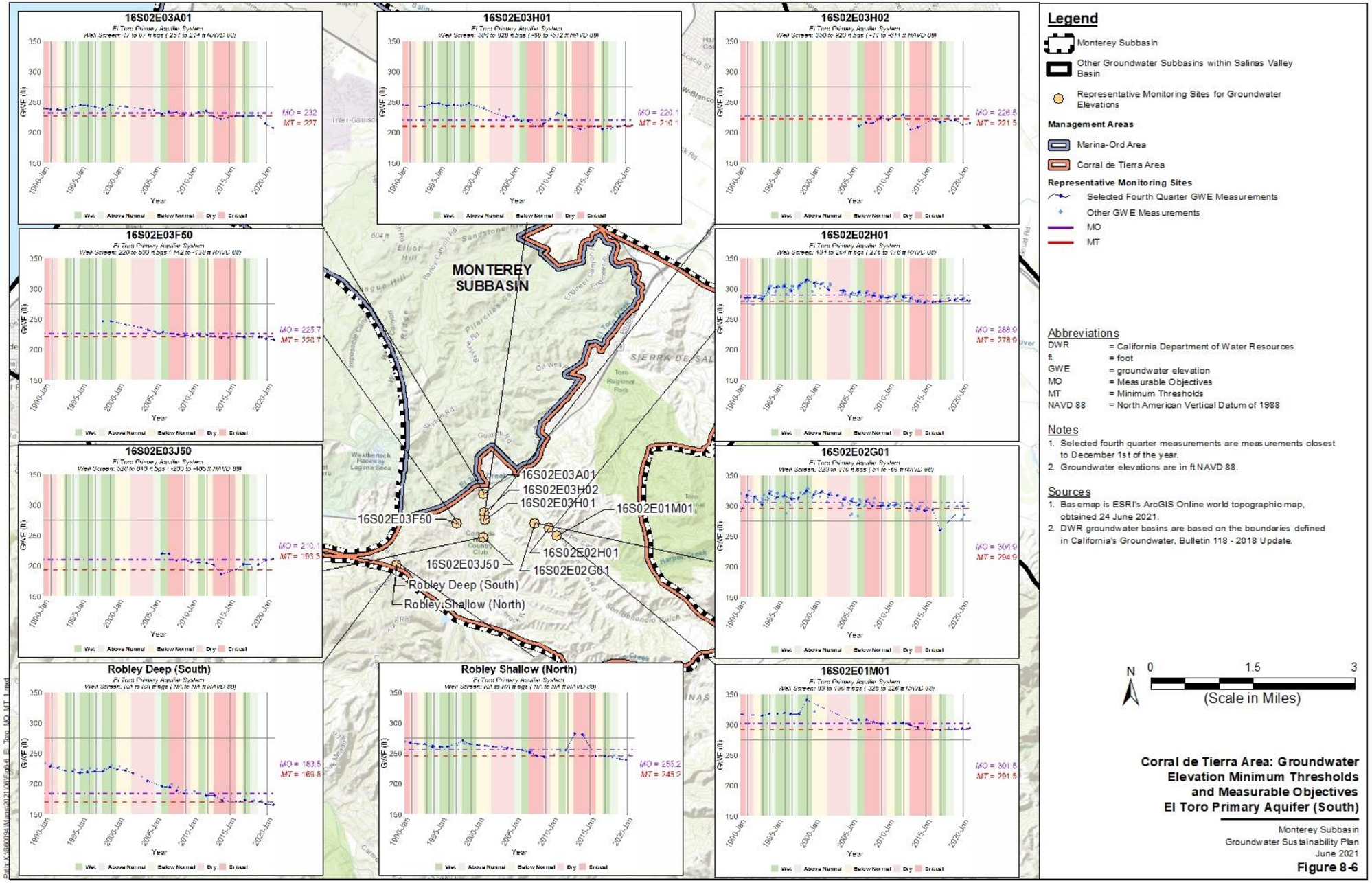


Figure 8-6. Corral de Tierra Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives, El Toro Primary Aquifer (South)

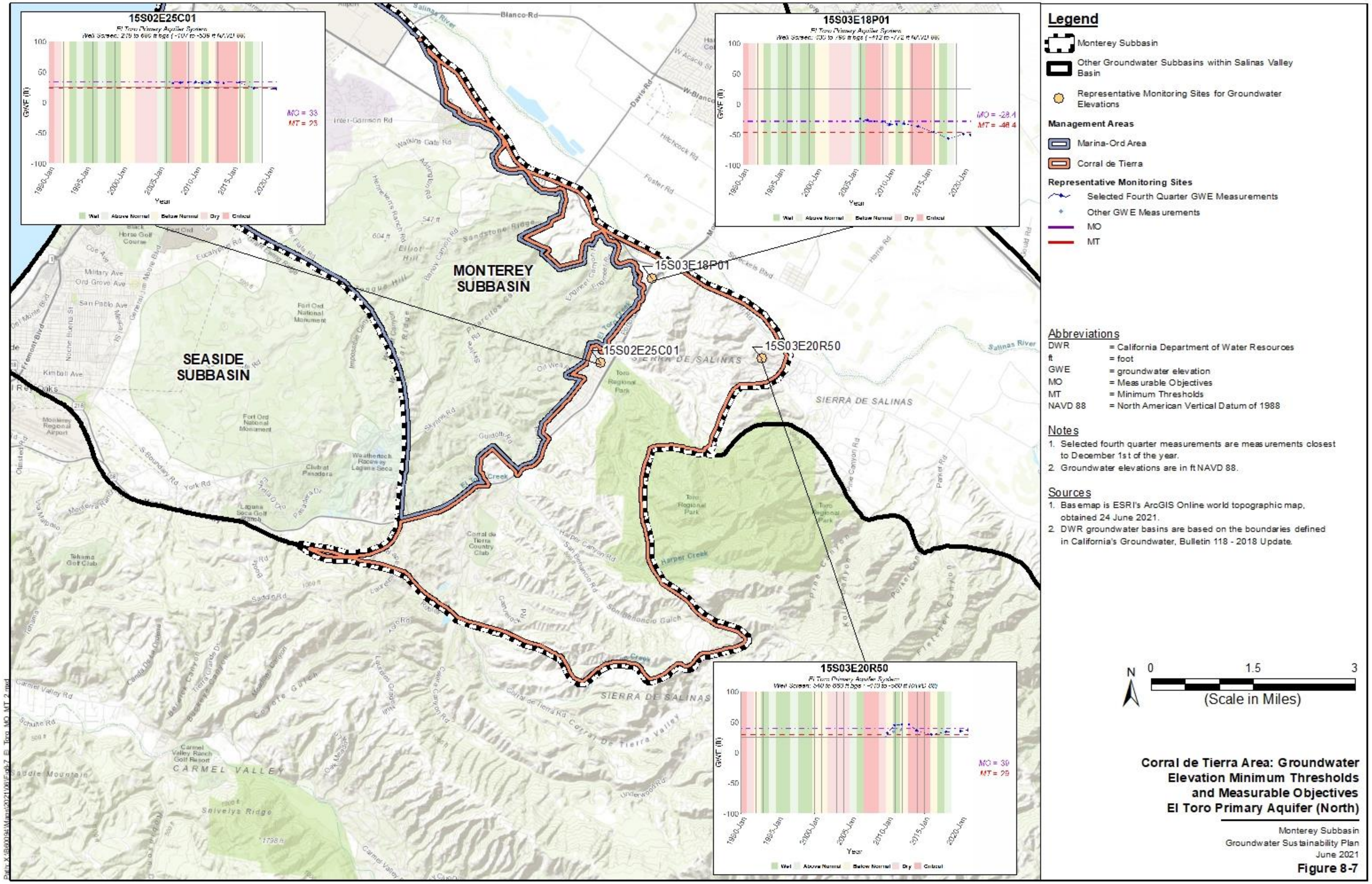


Figure 8-7. Corral de Tierra Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives, El Toro Primary Aquifer (North)

8.7.3.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

A similar process is used to develop minimum thresholds and measurable objectives for each Management Area.

Consistent with the GSP Emergency Regulations §354.28 (c), the definition of groundwater elevation minimum thresholds is based on considerations of historical groundwater elevation trends, water year types, projected water use in management areas, and relationships with other sustainability indicators.

The information and criteria relied on to establish minimum thresholds and measurable objectives in the Marina-Ord Area include:

- Historical water level data from the selected RMS wells, each of which has a long-term historical water level record;
- Proximity to the seawater intrusion extent for consideration of seawater intrusion impacts;
- Minimum thresholds or levels of management established in the adjacent subbasins; and
- Well construction information.

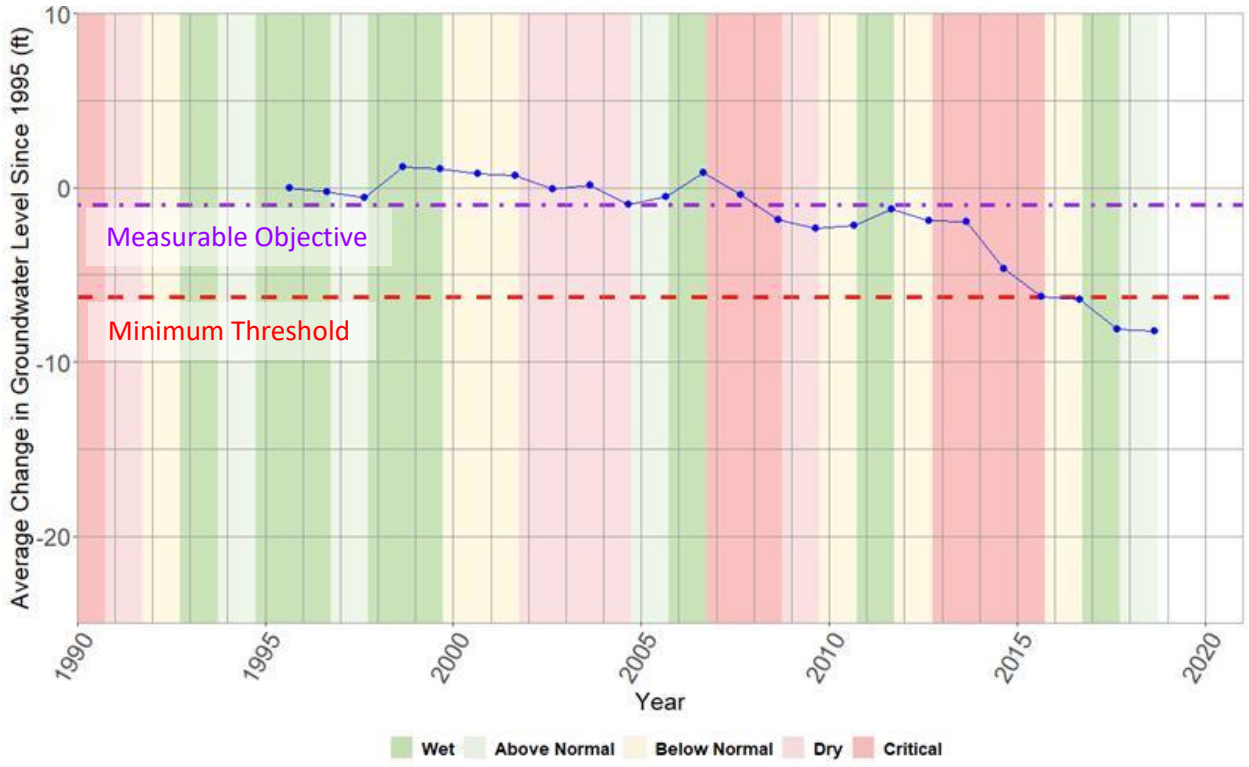
As discussed in the preceding sections, the potential effects of undesirable results caused by chronic lowering of groundwater levels in the Marina-Ord Area are primarily associated with the expansion of seawater intrusion. The observed lateral extent of seawater intrusion within the Subbasin appears to have been generally stable within the 180- and 400-Foot Aquifers between 1995 and 2015. As such, minimum thresholds have been set based upon minimum groundwater elevations observed between 1995 and 2015 in the 180- and 400 Foot aquifers.. Seawater intrusion is additionally monitored and managed pursuant to seawater intrusion SMCs (Section 8.9 below) to verify seawater intrusion does expand within the Subbasin due to sea-level rise and/or changes in the groundwater gradient.

Seawater intrusion has not been observed in the Deep Aquifer to date. However, groundwater elevations have been declining and are significantly below sea level. The declining groundwater elevations in the Deep Aquifer may be causing groundwater elevations to fall within the 400-Foot Aquifer in the southwestern portion of the Marina-Ord Area (i.e., near wells MPMWD#FO-10S and MPMWD#FO-11S). Although there is some uncertainty whether the Deep Aquifer is subject to seawater intrusion from the ocean, continued decline of groundwater elevations in the Deep Aquifers could increase the risk of seawater intrusion and may eventually cause vertical migration of saline water from overlying aquifers into the Deep Aquifers. As such, minimum thresholds for the Deep Aquifers are set to historically observed minimum groundwater elevations between 1995 and 2015, which is equivalent to the groundwater elevations observed in 2015 for most Deep Aquifer wells.

In order to evaluate the reasonableness of the proposed minimum thresholds and measurable objectives, the GSAs plotted these values on monitoring well hydrographs. They visually

inspected each hydrograph to check if the minimum thresholds and measurable objectives are appropriate. If a RMS well did not have measurements from 1995 through 2015, the SMCs were established considering groundwater elevations trends in the principal aquifers and the closest year when groundwater elevation data is available.

Figure 8-8 shows the cumulative average change in groundwater levels for all RMS wells in the Marina-Ord Area since 1995. Given that groundwater elevations have been steady in the shallower aquifers since 1995, averaged downward groundwater elevations trends in the Marina-Ord Area are primarily driven by downward elevation trends in the Deep Aquifers as wells as MPMWD#FO-10S and MPMWD#FO-11S located in the southwestern portion of the Marina-Ord Area that are potentially connected to the Deep Aquifers.



Note: Water year type designation based on PRISM climate data for the Monterey Subbasin, obtained from https://prism.oregonstate.edu/.

Figure 8-8. Cumulative Average Groundwater Elevation Change Since 1995 with Measurable Objective and Minimum Threshold for the Marina-Ord Area

As discussed in Chapter 5, conditions in the Deep Aquifers are closely connected to those in the adjacent 180/400-Foot Aquifer Subbasin where new production wells have been installed immediately north of the Marina-Ord Area. Rates of groundwater extraction from the Deep Aquifers by MCWD have been generally consistent since extraction from this aquifer was initiated in the late 1980s. After an initial drop in groundwater elevations within the Deep Aquifers at the initiation of groundwater extraction by MCWD, groundwater elevations in this aquifer stabilized

within the Monterey Subbasin through approximately 2004. However, increases in the total rate of groundwater extraction from the Deep Aquifers since 2004 have caused groundwater elevations in the Deep Aquifers to decline.

Due to the interconnectivity between the Marina-Ord Area and the 180/400-Foot Aquifer Subbasin principal aquifers, each subbasin's ability to achieve sustainability is also affected by the adjacent subbasins' ability to manage to their respective established minimum thresholds, measurable objectives, and groundwater sustainability goals. Therefore, the subbasins have taken a coordinated approach to SMCs development. However, no monitoring wells are currently identified in the Deep Aquifers immediately north of the Marina-Ord Area in the 180/400-Foot Aquifer GSP. SVBGSA is working to fill this data gap. As it does so, the minimum thresholds for additional Deep Aquifer monitoring sites should consider conditions and SMCs in the Monterey Subbasin. In addition, the direction of groundwater gradient along the seawater intrusion front in the Marina-Ord Area will be monitored and evaluated annually (see methodology in Chapter 7). Future modification of SMCs may be required in order for both subbasins to achieve sustainability.

The information and criteria relied on to establish the minimum thresholds and measurable objectives in the Corral de Tierra Area include:

- Feedback from discussions with the Subbasin Committee on challenges and goals
- Historical groundwater elevation data and hydrographs from wells monitored by the Monterey County Water Resources Agency (MCWRA)
- Maps of current and historical groundwater elevation data
- Analysis of the impact of groundwater elevations on domestic wells

The general steps for developing minimum thresholds and measurable objectives were:

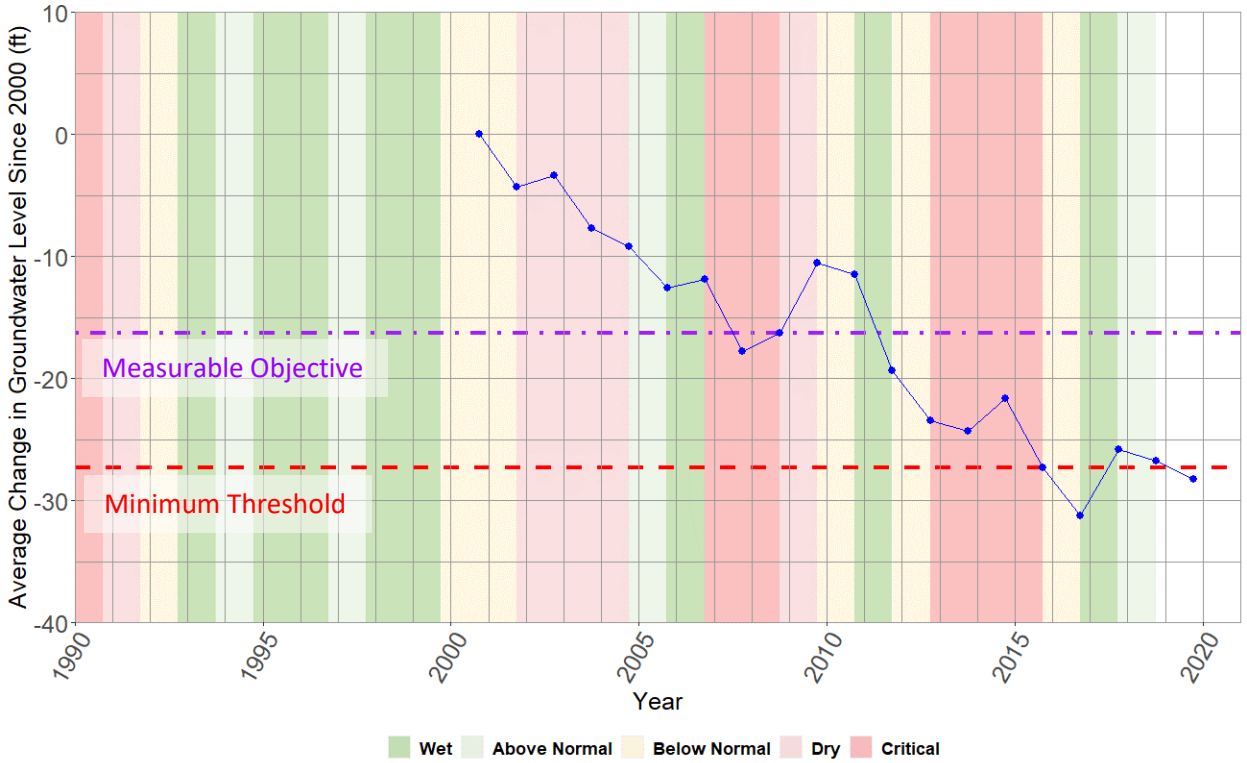
1. The Subbasin Planning Committee selected an approach and criteria for to setting the groundwater elevation minimum thresholds and measurable objectives.
2. SVBGSA developed an average groundwater elevation change hydrograph to select representative years that could define minimum thresholds and measurable objectives for the Corral de Tierra Area. Groundwater elevations like those experienced during the representative climatic cycle between 2000 and 2015 were used to identify minimum thresholds and measurable objectives to ensure that they were achievable under reasonably expected climatic conditions.

The average groundwater elevation change hydrograph with minimum threshold and measurable objectives lines for the Corral de Tierra Area are shown on Figure 8-9. The average 2015 groundwater elevations in the Corral de Tierra Area are considered significant and unreasonable. When looking at the cumulative groundwater elevation changes within the representative climatic cycle (Figure 8-9), the historical lowest elevations occurred in 2016, not in 2015. To avoid this extreme low, the minimum thresholds were therefore set to 2015

groundwater elevations. The measurable objective is set to 2008 groundwater elevations, which is an achievable goal for the Subbasin under reasonably expected climatic conditions.

SVBGSA identified the appropriate minimum thresholds and measurable objectives on the respective monitoring well hydrographs. Each hydrograph was visually inspected to check if the minimum threshold and measurable objective were reasonable. If an RMS did not have measurements from the minimum threshold or measurable objective years, the SMCs were interpolated from the groundwater elevation contours. The RMS location was intersected with groundwater elevation contour maps to estimate the minimum thresholds and measurable objectives. Moreover, if the SMCs seemed unreasonable for an RMS, they were adjusted based on historical water levels and on groundwater elevation trends seen in surrounding wells. The interpolated or adjusted minimum thresholds and measurable objectives are indicated by an asterisk in Table 8-2.

The minimum threshold contour map along with the monitoring network wells are shown on Figure 8-10 for the Corral de Tierra Area.



Note: Water year type designation based on PRISM climate data for the Monterey Subbasin, obtained from https://prism.oregonstate.edu/.

Figure 8-9. Cumulative Average Groundwater Elevation Change Since 2000 with Measurable Objective and Minimum Threshold for the Corral de Tierra Area

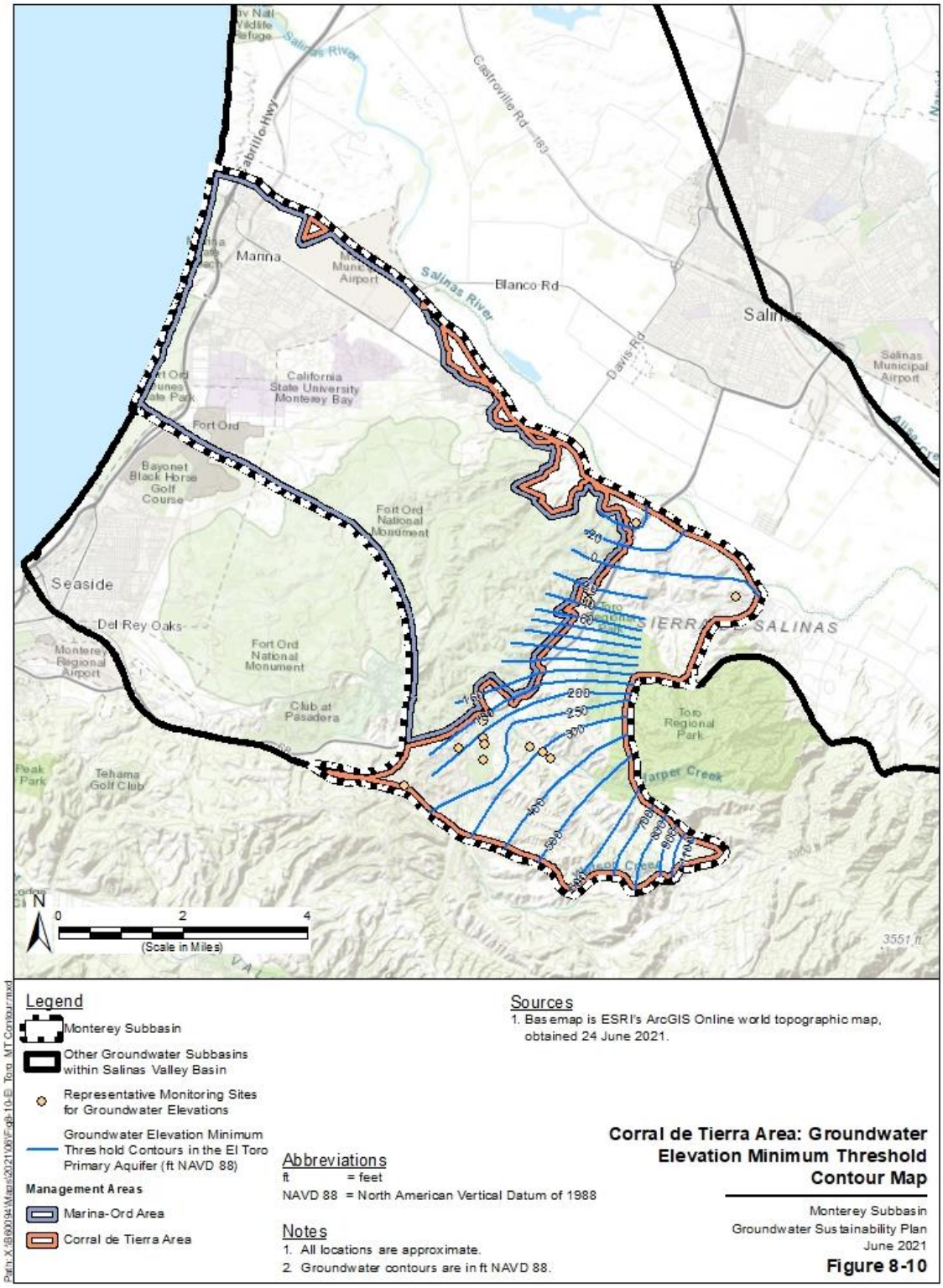


Figure 8-10. Corral de Tierra Area Groundwater Elevation Minimum Threshold Contour Map

8.7.3.2 Minimum Thresholds Impact on Domestic Wells

There is no known domestic use in the Marina-Ord Area. Land uses in this area are either urban, where well construction restrictions are imposed by the City of Marina and Monterey County, or open space. Additionally, groundwater elevation minimum thresholds in the shallower Dune Sand and 180-Foot Aquifers have been defined within their historical range of groundwater elevations, which has been steady for more than two decades. Therefore, minimum thresholds for groundwater elevation in the Marina-Ord Area are unlikely to impact domestic wells which are typically completed at shallower depths.

In the Corral de Tierra Area, groundwater elevation minimum thresholds are compared to the range of domestic well depths using DWR's Online System for Well Completion Reports (OSWCR) database. This check was done to assure that the minimum thresholds maintain operability in a reasonable percentage of domestic wells. The proposed minimum thresholds for groundwater elevation do not necessarily protect all domestic wells because it is impractical to manage a groundwater basin in a manner that fully protects the shallowest wells. The average computed depth of domestic wells in the Subbasin is 391.8 feet using data from the OSWCR database.

While this approach is reasonable, there are some errors that add inaccuracy to the analysis. These include:

- The OSWCR database may include wells that have been abandoned or destroyed, and therefore will have no detrimental impacts from lowered groundwater elevations.
- Domestic wells drilled prior to 1995 may no longer be in use, particularly if residents switched to small water systems.
- Some domestic wells may draw water from shallow, perched groundwater that is not managed in this GSP.
- Some wells in the OSWCR database are not accurately located, and therefore the estimated depth to water may not be accurate.
- The depth to water is derived from a smoothly interpolated groundwater elevation contour map. Errors in the map may result in errors in groundwater elevation at the selected domestic wells.

Given the limitations listed above, the analysis included 19 wells that had accurate locations and were drilled after 1994 out of the total 169 domestic wells in the OSWCR database for this area. In the Corral de Tierra Area, 100% of the domestic wells should have at least 25 feet of water in them to remain operable if groundwater elevations are at minimum thresholds. Therefore, the minimum thresholds appear to be reasonably protective for domestic users.

8.7.3.3 Relationship to Other Sustainability Indicators

Groundwater elevation minimum thresholds can influence other sustainability indicators. The subbasin GSAs reviewed the relationship between groundwater level minimum thresholds and

the other sustainability indicators and verified that these minimum thresholds will limit undesirable results for other sustainability indicators. As discussed above, the groundwater level minimum thresholds have primarily been established to limit seawater intrusion and maintain adequate groundwater storage within the Subbasin. These groundwater level minimum thresholds are also consistent with minimum thresholds established for:

- depletion of interconnected surface waters in wells proximate to such areas, and
- subsidence, as they are set above historical groundwater levels.

In this subbasin, there is no clear correlation between groundwater levels and groundwater quality.

8.7.3.4 Effects of Minimum Threshold between Management Areas

The minimum thresholds for each management area have been developed in a coordinated matter through discussions within the subbasin Technical Committee. Because the minimum thresholds in each management area are defined at levels generally representative of 2015 conditions in all areas where water levels are declining, they will not cause undesirable results in the other management area.

8.7.3.5 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Monterey Subbasin has two neighboring subbasins within the Salinas Valley Groundwater Basin:

- The 180/400-Foot Aquifer Subbasin to the north;
- The Seaside Subbasin to the south

The GSAs coordinating the Monterey Subbasin GSP are the same GSAs covering the adjacent 180/400-Foot Aquifer Subbasin. The GSAs have been coordinating the development of minimum thresholds and measurable objectives for the 180-Foot Aquifer and the 400-Foot Aquifer within the 180/400-Foot Aquifer Subbasin GSP, which was submitted to DWR in January 2020. Due to the interconnectivity between the Marina-Ord Area and the 180/400-Foot Aquifer Subbasin principal aquifers, the groundwater elevation minimum thresholds for the Marina-Ord Area are established to be consistent with the 180/400-Foot Aquifer Subbasin GSP and are based on the assumption that SMCs will be met in the adjacent Subbasin. However, the 180/400 Foot Aquifer Subbasin GSP does not establish minimum thresholds or measurable objectives for the Deep Aquifers. The establishment of SMCs for the Deep Aquifers will be conducted following completion of a Deep Aquifers Study. The impact of the Monterey Subbasin's minimum thresholds on the Deep Aquifers in the 180/400-Foot Aquifer Subbasin will be assessed after the Deep Aquifer SMCs are established. Continued GSA coordination of these SMCs is critical, as each subbasin's ability to achieve sustainability is affected by the adjacent subbasins' minimum thresholds, measurable objectives, and the ability to manage to these SMCs.

The Seaside Subbasin is an adjudicated basin and not subject to SGMA. The subbasin GSAs have and will continue to coordinate closely with the Seaside Watermaster to ensure that the

Monterey Subbasin minimum thresholds do not prevent the Seaside basin from meeting its adjudication requirements.

8.7.3.6 Effects on Beneficial Users and Land Uses

The groundwater elevation minimum thresholds may have several effects on beneficial users and land uses in the Subbasin and adjacent Subbasins.

Urban land uses and users. The groundwater elevation minimum thresholds may reduce the amount of groundwater pumping in the Subbasin or adjacent Subbasins, or result in obtaining alternative sources of water within the Monterey Subbasin or through regional efforts. This may result in higher water costs for water users.

Domestic land uses and users. The groundwater elevation minimum thresholds are intended to protect most domestic wells along with small state and small local system wells. Therefore, the minimum thresholds will likely have an overall beneficial effect on existing domestic land uses by protecting the ability to pump from domestic wells or be supplied by small systems. However, extremely shallow domestic wells may become dry as many have during extended dry periods, requiring owners to drill deeper wells. Additionally, the groundwater elevation minimum thresholds may limit the number of new domestic wells or small state and small local system wells that can be drilled to limit future declines in groundwater elevations as result of additional pumping that would come into production.

Agricultural land uses and users. The groundwater elevation minimum thresholds prevent continued lowering of groundwater elevations in the Subbasin. This may have the effect of limiting the amount of groundwater pumping in the Subbasin. Limiting the amount of groundwater pumping may limit the amount and type of crops that can be grown in the Subbasin. The groundwater elevation minimum thresholds could therefore limit expansion of the Subbasin's agricultural economy. This could have various effects on beneficial users and land uses:

- Agricultural land currently under irrigation may become more valuable as bringing new lands into irrigation becomes more difficult and expensive.
- Agricultural land not currently under irrigation may become less valuable because it may be too difficult and expensive to irrigate.

Ecological land uses and users. Groundwater elevation minimum thresholds may limit the amount of groundwater pumping in the Subbasin and may limit both urban and agricultural growth. This outcome may benefit ecological land uses and users by curtailing the conversion of native vegetation to agricultural or domestic uses, and by reducing pressure on existing ecological land caused by declining groundwater elevations.

8.7.3.7 Relevant Federal, State, or Local Standards

No federal, state, or local standards exist for chronic lowering of groundwater elevations.

8.7.3.8 Method for Quantitative Measurement of Minimum Thresholds

Groundwater elevation minimum thresholds will be directly measured from the RMS network in accordance with the monitoring plans outlined in Chapter 7. Furthermore, groundwater elevation monitoring will meet the requirements of the technical and reporting standards included in the GSP Regulations.

As noted in Chapter 7, the current groundwater elevation RMS network in the Subbasin across aquifers includes 35 wells. Data gaps were identified in Chapter 7 and will be resolved during implementation of this GSP.

8.7.4 Measurable Objectives

The measurable objectives for chronic lowering of groundwater levels ("groundwater elevation measurable objectives") represent target groundwater elevations that are higher than the minimum thresholds. These measurable objectives provide operational flexibility to ensure that the Subbasin can be managed sustainably over a reasonable range of hydrologic and climatic variability. Groundwater elevation measurable objectives are summarized in Table 8-2. The measurable objectives are also shown on the maps for each RMS in Appendix 8A and Figures 8-1 through 8-7 above.

8.7.4.1 Methodology for Setting Measurable Objectives

In the Marina-Ord Area, groundwater elevation measurable objectives are defined as follows:

> *Groundwater elevations observed in 2004 in the Dune Sand, 180-Foot, 400-Foot, and Deep Aquifers, prior to the decline of groundwater levels in the southwestern portion of the Marina-Ord Area;*

In the Marina-Ord Area, these measurable objectives are primarily set to further limit the potential for seawater intrusion within the Subbasin. Data collected by the Seaside Watermaster has shown a recent increase in chloride concentrations in MPMWD#FO-10S in the Monterey Subbasin, and MPMWD#FO-09S, a coastal Paso Robles Aquifer well located within the Seaside Subbasin[3]. These recent increases in chloride concentration indicate that groundwater elevations in the southwestern portion of the Marina-Ord Area may induce seawater intrusion in the 400-Foot and/or Deep Aquifers of the Monterey Subbasin and the Paso Robles Aquifer of the Seaside Subbasin. As discussed earlier in Chapters 4 and 5, there is uncertainty regarding hydrostratigraphy and the cause of groundwater elevation declines within this area. However,

[3] Chloride concentration measured from MPMWD#FO-10S and MPMWD#FO-09S in September 2020 were 89.9 mg/L and 90.4 mg/L, respectively. As of April 2021, the Seaside Watermaster is investigating whether increase in chloride concentrations in these wells are due to leakage in well casing. As part of GSP implementation, the Subbasin GSAs intend to investigate possible seawater intrusion near the southwestern portion of the Marina-Ord Area in collaboration of the Seaside Watermaster.

for this GSP, the representative year of 2004 is selected for measurable objectives, which is prior to recent groundwater declines in the Marina-Ord Area as shown on Figure 8-8.

These measurable objectives are generally consistent with those set for the 180- and 400-foot aquifers in the neighboring 180/400 Foot Aquifer Subbasin. Measurable objectives in the 180/400 Foot Aquifer Subbasin are set at 2003 levels. Measurable objectives for the Deep Aquifers have not been established within the 180/400 Foot Aquifer Subbasin.

In the Corral de Tierra Area, groundwater elevations from 2008 were selected as the measurable objectives to ensure that the objectives are achievable. Therefore, groundwater elevation measurable objectives in the Corral de Tierra area are defined as follows:

Groundwater elevations observed in 2008 in the El Toro Primary Aquifer System.

The measurable objective contour maps along with the monitoring network wells are shown on Figure 8-11 for the Corral de Tierra Area.

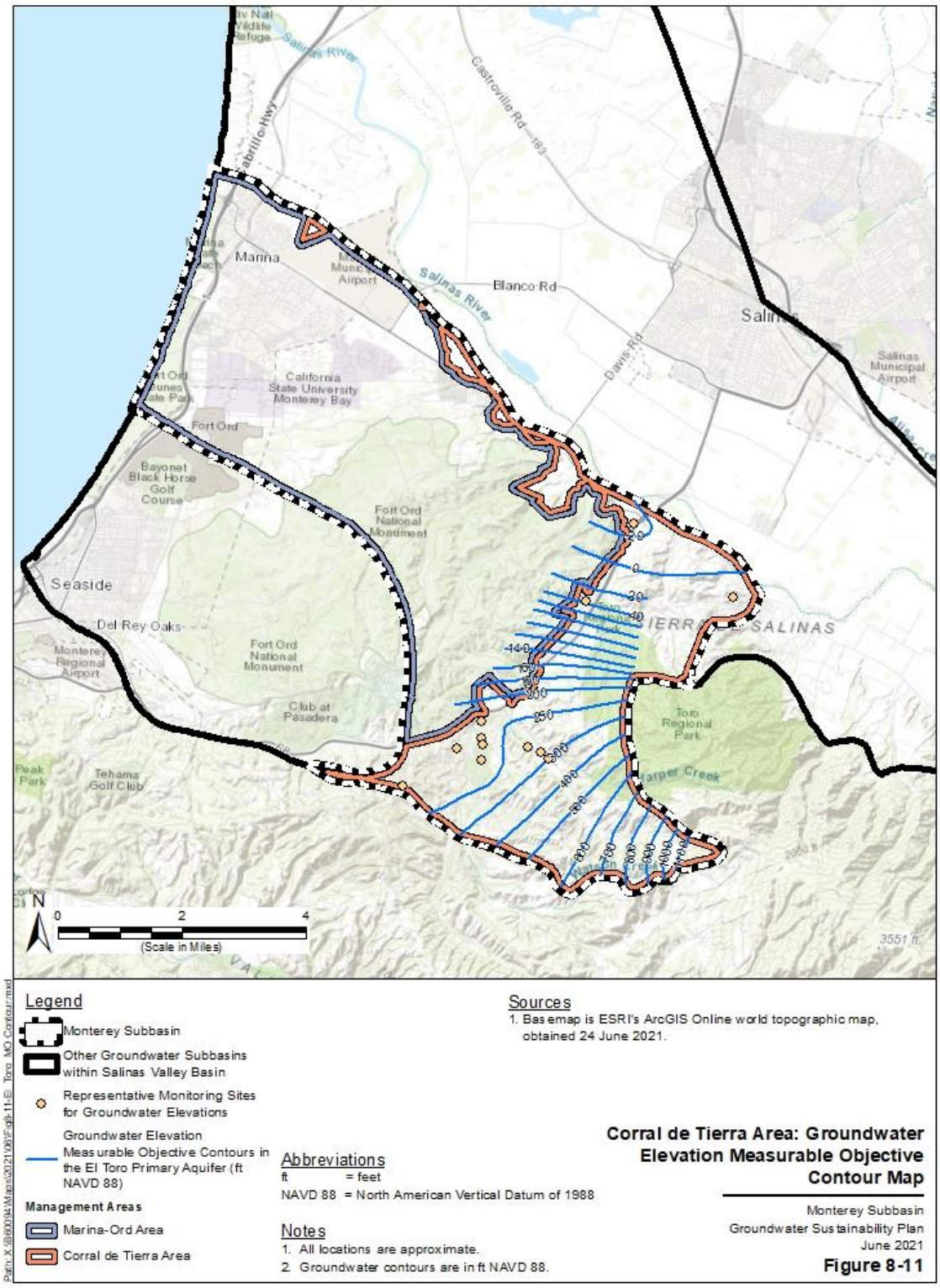


Figure 8-11. Corral de Tierra Area Groundwater Elevation Measurable Objective Contour Map

8.7.4.2 Interim Milestones

Chapter 9 identifies projects and management actions to address the Subbasin's overdraft conditions and meet measurable objectives established herein. These projects and management actions are early in their planning phases and will require coordination with adjacent Subbasins and collaborating partners. As such, time will be required to implement these projects and management actions, and begin monitoring for the expected benefits. Groundwater interim milestones are established to reflect the timeline for project implementation, and realization of project benefits over time.

Within the Monterey Subbasin, for wells in the 400-Foot Aquifer, Deep, and El Toro Primary Aquifer System Aquifers where groundwater levels have been declining, groundwater elevation interim milestones are defined based on a trajectory informed by current (fourth quarter of 2020) groundwater levels, historical groundwater elevation trends[4], and measurable objectives. This trajectory allows for and assumes a continuation of historical groundwater elevation trends during the first 5-year period of GSP implementation, a deviation from that trend over the second 5-year period, and a recovery towards the measurable objectives in the third and fourth (last) 5-year period. An example of the trajectory is shown on Figure 8-12 with a Marina-Ord well. As discussed below in Section 8.8.3.1, there are large volumes of freshwater in the Subbasin that provide additional time and flexibility to reach identified SMCs while projects and management actions are implemented. The temporary use of stored groundwater in the 400-Foot Aquifer, Deep, and El Toro Primary Aquifer Systems Aquifers is reflected in these groundwater elevation interim milestones.

Groundwater elevation interim milestones for wells in the Dune Sand, 180-Foot, and 400-Foot Aquifers, with stable groundwater elevations, are set at their respective measurable objectives. Groundwater elevation interim milestones for wells that have already exceeded their measurable objective also use the measurable objective in place of the interim milestones.

Interim milestones for groundwater elevations are shown in Table 8-3. Hydrographs showing minimum thresholds, measurable objectives, and interim milestones for each RMS are included in Appendix 8B.

[4] Calculated based on fourth quarter measurements over the historical period (i.e. 2004 to 2018).

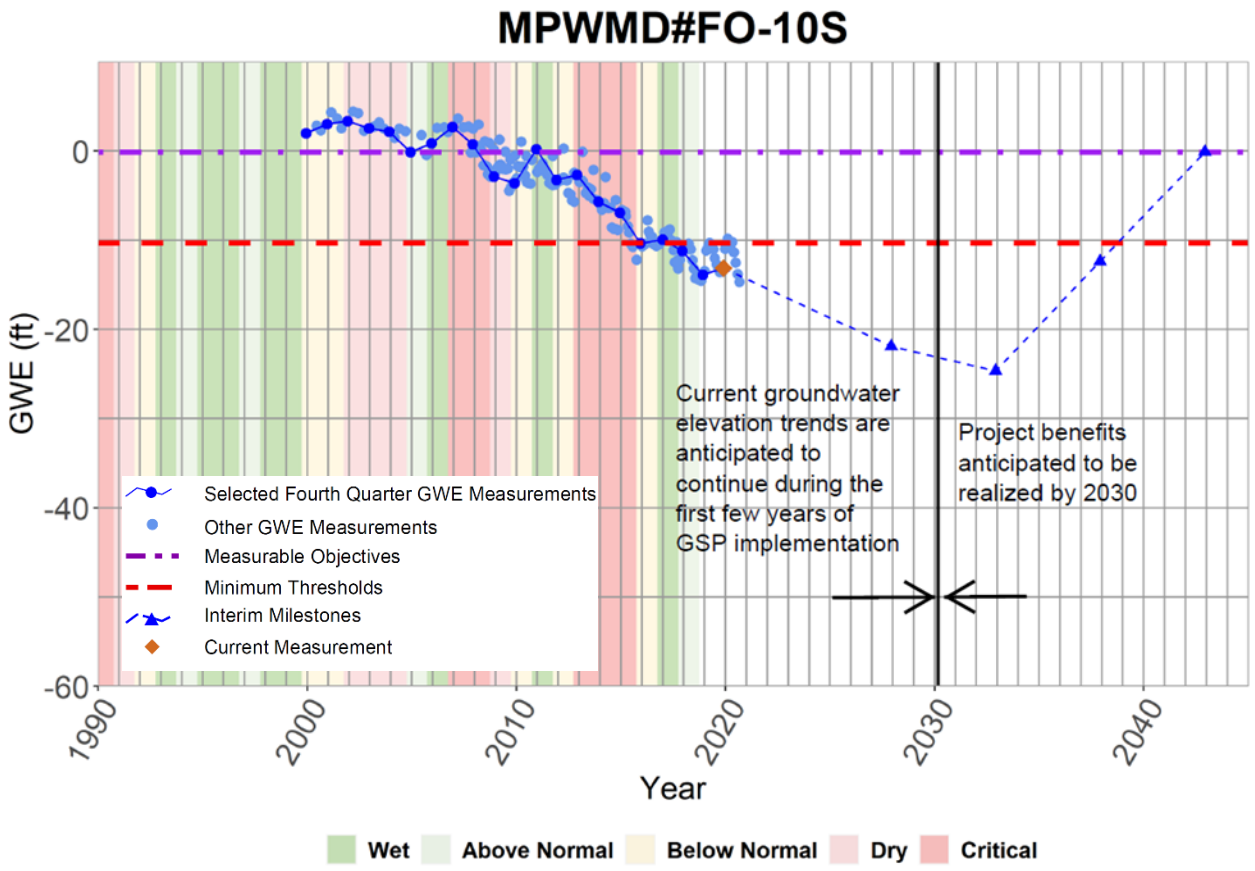


Figure 8-12. Example Trajectory for Groundwater Elevation Interim Milestones

Table 8-3. Groundwater Elevation Interim Milestones

Monitoring Site	Aquifer	Current Groundwater Elevation ft NAVD88 (assume at 2020)	Interim Milestone at Year 2027 (ft NAVD88)	Interim Milestone at Year 2032 (ft NAVD88)	Interim Milestone at Year 2037 (ft NAVD88)	Measurable Objective (ft NAVD88) (goal to reach at 2042)
Marina-Ord Area						
MW-BW-28-A	Dune Sand Aquifer	64.4 (a)	70.3	70.3	70.3	70.3
MW-BW-49-A	Dune Sand Aquifer	11.9 (a)	11.3	11.3	11.3	11.3
MW-BW-81-A	Dune Sand Aquifer	11 (a)	10.0	10.0	10.0	10
MW-BW-82-A	Dune Sand Aquifer	10.5 (a)	9.5	9.5	9.5	9.5
MW-OU2-13-A	Dune Sand Aquifer	89.3 (a)	94.4	94.4	94.4	94.4
MW-OU2-32-A	Dune Sand Aquifer	8.1 (a)	8.1	8.1	8.1	8.1
MW-OU2-34-A	Dune Sand Aquifer	7.1 (a)	6.6	6.6	6.6	6.6
CDM MW-1 Beach	Upper 180-Foot Aquifer	4.8 (a)	3.3	3.3	3.3	3.3
MW-02-05-180	Upper 180-Foot Aquifer	7.5 (a)	8.4	8.4	8.4	8.4
MW-02-10-180	Upper 180-Foot Aquifer	7.6 (a)	7.3	7.3	7.3	7.3
MW-02-13-180M	Upper 180-Foot Aquifer	7.5 (a)	6.8	6.8	6.8	6.8
MW-02-13-180U	Upper 180-Foot Aquifer	7.7 (a)	7.3	7.3	7.3	7.3
MW-12-07-180	Upper 180-Foot Aquifer	8.1 (a)	7.0	7.0	7.0	7
MW-B-05-180	Upper 180-Foot Aquifer	-2.3 (a)	-3.4	-3.4	-3.4	-3.4
MW-BW-55-180	Upper 180-Foot Aquifer	-4.2 (a)	-5.7	-5.7	-5.7	-5.7
MW-OU2-29-180	Upper 180-Foot Aquifer	-6.3 (a)	-7.2	-7.2	-7.2	-7.2

Monitoring Site	Aquifer	Current Groundwater Elevation ft NAVD88 (assume at 2020)	Interim Milestone at Year 2027 (ft NAVD88)	Interim Milestone at Year 2032 (ft NAVD88)	Interim Milestone at Year 2037 (ft NAVD88)	Measurable Objective (ft NAVD88) (goal to reach at 2042)
MW-12-12-180L	Lower 180-Foot Aquifer	4 (a)	3.8	3.8	3.8	3.8
MW-BW-04-180	Lower 180-Foot Aquifer	-8.2 (a)	-11.0	-11.0	-11.0	-11
MW-OU2-66-180	Lower 180-Foot Aquifer	-7.3 (a)	-9.2	-9.2	-9.2	-9.2
TEST2	Lower 180-Foot Aquifer	-8.5 (a)	-10.6	-10.6	-10.6	-10.6
MP-BW-42-295	Lower 180-Foot, 400-Foot Aquifer	-6.9 (a)	-8.1	-8.1	-8.1	-8.1
MP-BW-50-289	Lower 180-Foot, 400-Foot Aquifer	-7.9 (a)	-7.1	-7.1	-7.1	-7.1
MPWMD#FO-10S	400-Foot Aquifer	-13.1 (a)	-21.9	-24.7	-12.4	-0.1
MPWMD#FO-11S	400-Foot Aquifer	-29.8 (a)	-45.9	-50.9	-27.2	-3.4
MW-OU2-07-400	400-Foot Aquifer	-3.1 (a)	-4.2	-4.2	-4.2	-4.2
014S001E24L002M	Deep Aquifers	-30.3	-34.9	-36.6	-28.7	-20.8
014S001E24L003M	Deep Aquifers	-12.3	-18.9	-21.2	-8.9	3.5
014S001E24L004M	Deep Aquifers	-32.3	-41.6	-44.9	-33.0	-21.1
014S001E24L005M	Deep Aquifers	-25.6	-39.7	-44.8	-25.4	-6.0
14S02E33E01	Deep Aquifers	-53.7	-69.9	-75.6	-52.5	-29.3
14S02E33E02	Deep Aquifers	-20.8	-22.6	-23.3	-18.6	-13.9
MPWMD#FO-10D	Deep Aquifers	-12.7 (a)	-20.1	-22.5	-11.7	-0.9
MPWMD#FO-11D	Deep Aquifers	-9.7 (a)	-17.2	-19.5	-6.6	6.2
PZ-FO-32-910	Deep Aquifers	-44.3	-65.6	-73.2	-46.4	-19.7
Sentinel MW #1	Deep Aquifers	-29.9 (a)	-37.8	-40.3	-29.5	-18.8
Corral de Tierra Area						
15S/02E-25C01	El Toro Primary Aquifer System	22	21	21	26	33.0
15S/03E-18P01	El Toro Primary Aquifer System	-50.4	-53	-53	-42.9	-28.4
15S/03E-20R50	El Toro Primary Aquifer System	36.5	37	37.5	38	39.0
16S/02E-01M01	El Toro Primary Aquifer System	293.6	295.3	297.2	299	301.5

Monitoring Site	Aquifer	Current Groundwater Elevation ft NAVD88 (assume at 2020)	Interim Milestone at Year 2027 (ft NAVD88)	Interim Milestone at Year 2032 (ft NAVD88)	Interim Milestone at Year 2037 (ft NAVD88)	Measurable Objective (ft NAVD88) (goal to reach at 2042)
16S/02E-02G01	El Toro Primary Aquifer System	298.5	299.2	300.8	302.6	304.9
16S/02E-02H01	El Toro Primary Aquifer System	279.5	282	284	286.1	288.9
16S/02E-03A01	El Toro Primary Aquifer System	206.9	188	188	206.3	232
16S/02E-03F50	El Toro Primary Aquifer System	215.9	211	211	217.2	225.7
16S/02E-03H01	El Toro Primary Aquifer System	211.7	213.6	215.5	217.4	220.1
16S/02E-03H02	El Toro Primary Aquifer System	215	205	205	214	226.5
16S/02E-03J50	El Toro Primary Aquifer System	211.8	210.1	210.1	210.1	210.1
Robley Deep (South)	El Toro Primary Aquifer System	165.13	160.5	160.5	170	183.5
Robley Shallow (North)	El Toro Primary Aquifer System	238.64	230.7	230.7	240.8	255.2

(a) These current groundwater levels were taken in the fourth quarter of 2019 due to the lack of measurements in fourth quarter of 2020.

8.8 Reduction in Groundwater Storage SMC

8.8.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions in groundwater storage in the Subbasin are those that:

- Lead to chronic, long-term reduction in groundwater storage, or
- Interfere with other sustainability indicators

These significant and unreasonable conditions were determined based on input collected during MCWD stakeholder meetings, SVBGSA Subbasin Committee meetings, and discussions with GSA staff during Subbasin Technical Committee meetings.

8.8.2 Undesirable Results

8.8.2.1 Criteria for Defining Reduction in Groundwater Storage Undesirable Results

The criteria used to define undesirable results for reduction of groundwater storage are based on minimum thresholds established for chronic lowering of groundwater levels and seawater intrusion.

The undesirable result for reduction of groundwater storage is defined to be consistent with groundwater elevation and seawater intrusion undesirable results, as identified below:

> *Over the course of any one year, exceedance of more than 20% of the groundwater level minimum thresholds in either:*
>
> *a. both the Dune Sand Aquifer and Upper 180-Foot Aquifer, or*
> *b. both the Lower 180 Foot and 400 Foot aquifer, or*
> *c. the Deep Aquifers, or*
> *d. the El Toro Primary Aquifer System.*
>
> *OR*
>
> *a. Exceedance of seawater intrusion minimum thresholds.*

Within the Subbasin, groundwater elevations are typically well above production well screen elevations and therefore there is limited concern regarding available groundwater storage to withstand future droughts. The critical limiting factor associated with groundwater availability in the subbasin is further seawater intrusion and chronic decline in groundwater levels that can lead to seawater intrusion. As such, it is not necessary to define unique SMCs for reduction of groundwater storage.

There is adequate fresh groundwater in storage for beneficial uses and users within the Subbasin to withstand droughts when:

(a) groundwater elevations are equivalent to minimum thresholds established for chronic lowering of groundwater levels, and

(b) the extent of seawater intrusion, defined by the 500 mg/L chloride concentration isocontour, is equivalent to established seawater intrusion minimum thresholds.

Therefore, SMCs established for (a) chronic lowering of groundwater levels and (b) seawater intrusion are reasonable proxies for protection of groundwater storage.

8.8.2.2 Potential Causes of Undesirable Results

Reduction of groundwater storage is directly correlated to chronic lowering of groundwater levels and seawater intrusion. Therefore, the potential causes of undesirable results due to reduction of groundwater storage are the same as the potential causes listed for undesirable results due to chronic lowering of groundwater levels and seawater intrusion in Sections 8.7.2.2 and 8.9.2.2, respectively. As such, an undesirable result for reduction of groundwater storage will

not occur as long as undesirable results are avoided with regard to the chronic lowering of groundwater levels and seawater intrusion indicators.

8.8.2.3 Effects on Beneficial Users and Land Use

The undesirable result is designed to avoid dropping below the level of groundwater in storage during 2015 for long-term use. Therefore, the primary potential effect of this undesirable result is generally beneficial for the groundwater uses and users in the Subbasin.

8.8.3 Minimum Thresholds

The undesirable results definition for reduction of groundwater storage refers to a decrease in storage caused by (1) water levels declining below groundwater elevation minimum thresholds or (2) high salinity groundwater migrating beyond seawater intrusion minimum thresholds. It is logical to tie these sustainability indicators together, because the amount of groundwater in storage is directly related to groundwater elevations and the extent of seawater intrusion. The minimum thresholds for chronic lowering of groundwater level and seawater intrusion, therefore, will be used as proxies for reduction of groundwater storage.

8.8.3.1 Information and Methodology Used to Establish Minimum Thresholds

Pursuant to the GSP Emergency Regulations and as further described in the DWR Sustainable Management Criteria BMP (DWR, 2017), minimum thresholds for reduction of groundwater storage may be set by using groundwater levels as a proxy if it is demonstrated that a correlation exists between the two metrics. One approach to using groundwater levels as a proxy, described in the DWR Sustainable Management Criteria BMP, is to demonstrate that minimum thresholds for chronic lowering of groundwater levels are sufficiently protective to ensure prevention of significant and unreasonable occurrences of the Sustainability Indicator in question.

This GSP has adopted and extended this approach to use minimum thresholds defined for both the chronic lowering of groundwater level indicator and the seawater intrusion indicator as a proxy. As discussed above, the amount of groundwater in storage is directly related to groundwater elevations and the extent of seawater intrusion. As demonstrated in the calculation below, groundwater elevation and seawater intrusion minimum thresholds are sufficiently protective of the groundwater storage indicator. As shown in Table 8-4, the estimated fresh groundwater storage volume is calculated based on:

- The area of each principal aquifer outside its seawater intrusion minimum threshold,
- The saturated thickness of each principal aquifer[5]

[5] Saturated thickness is estimated by either (1) the difference between groundwater elevations in Fall 2015 and the bottom of the aquifer, or (2) the thickness of the aquifer, whichever is smaller. This method conservatively assumes that the confined storage within each aquifer is negligible compared to the drainable porosity.

- An estimated specific yield ranging between 0.1 and 0.2, based on typical values for sandy aquifers.

Table 8-4. Estimated Fresh Groundwater Storage in the Marina-Ord Area

Principal Aquifer	Estimated Fresh Groundwater Storage (AF)	
	Lower Range (Specific Yield at 0.1)	Upper Range (Specific Yield at 0.2)
Marina-Ord Area		
Dune Sand Aquifer	30,000	60,000
Upper 180-Foot Aquifer	50,000	100,000
Lower 180-Foot Aquifer	44,000	88,000
400-Foot Aquifer	134,000	268,000
Deep Aquifers	1,544,000	3,088,000

This calculation represents a theoretical estimate of the total volume of fresh groundwater that exists within the principal aquifers within the Subbasin. It should be noted however that not all fresh groundwater in storage can be practically accessed or used. Chronic declines in groundwater levels and the potential for increased seawater intrusion are the critical limiting factors associated with usable groundwater storage in the Subbasin. As such, minimum thresholds established for seawater intrusion and groundwater elevations are appropriate proxies for this sustainability indicator. However, the existence of such groundwater storage within the Subbasin provides additional time and flexibility to reach identified SMCs for chronic lowering of groundwater levels. Groundwater can temporarily be removed from storage until local and/or regional projects and/or management actions can be implemented. The temporary use of stored groundwater is reflected in interim milestones established for chronic lowering of groundwater levels within the Deep Aquifers, where no seawater intrusion has yet been identified. However, there is currently insufficient data to determine the vertical or lateral (i.e. seaward) location of the seawater intrusion front within the Deep Aquifers. This information has been identified as a data gap within Section 5.3.3 of the GSP, and will ultimately be used to determine the extent to which such temporary withdrawals of groundwater from storage can continue and water level elevation SMCs must be achieved.

8.8.3.2 Relationship to Other Sustainability Indicators

As discussed above, the groundwater storage minimum thresholds are set at a level consistent with groundwater elevation and seawater intrusion minimum thresholds, which are also consistent with other sustainability indicators, as described in Sections 8.7.3.3 and 8.9.3.2.

8.8.3.3 Effects of Minimum Threshold between Management Areas

The minimum thresholds for each management area have been developed in a coordinated manner through discussions within the subbasin Technical Committee. Because the minimum thresholds in each management area are defined similarly based on groundwater elevation and seawater intrusion minimum thresholds, they will not cause undesirable results in the other management area.

8.8.3.4 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Monterey Subbasin has two neighboring subbasins within the Salinas Valley Groundwater Basin:

- The 180/400-Foot Aquifer Subbasin to the north;
- The Seaside Subbasin to the south

The GSAs coordinating the Monterey Subbasin GSP are the same GSAs covering the adjacent 180/400-Foot Aquifer Subbasin. The GSAs have been coordinating the development of the minimum thresholds and measurable objectives within the 180/400-Foot Aquifer Subbasin GSP, which was submitted to DWR in January 2020. Because the minimum thresholds in both the Monterey Subbasin and 180/400-Foot Aquifer Subbasin have been developed by the same GSAs in a coordinated fashion, the minimum thresholds do not conflict with each other.

The Seaside Subbasin is an adjudicated basin and not subject to the Sustainable Groundwater Management Act's minimum threshold requirements. Because the minimum thresholds are set to avoid dropping below recent levels of storage, it is likely that the minimum thresholds will not prevent the Seaside Subbasin from meeting its adjudication requirements. The subbasin GSAs have and will continue to coordinate closely with the Seaside Watermaster to ensure that the Monterey Subbasin minimum thresholds do not prevent the Seaside basin from meeting its adjudication requirements.

8.8.3.5 Effect on Beneficial Uses and Users

Because the groundwater storage minimum thresholds are defined based on groundwater elevation and seawater intrusion minimum thresholds, the effects of groundwater storage minimum threshold on beneficial uses and users are similar to those described in Sections 8.7.3.6 and 8.9.3.4.

8.8.3.6 Relation to State, Federal, or Local Standards

No federal, state, or local standards exist for reductions in groundwater storage.

8.8.3.7 Method for Quantitative Measurement of Minimum Threshold

Because the groundwater elevation and seawater intrusion minimum thresholds will be used as a proxy for reduction of groundwater storage, the measurement of change in groundwater storage will be measured directly from the groundwater elevation and seawater intrusion monitoring networks described in Chapter 7.

8.8.4 Measurable Objectives

Because the close relationship between the reduction of groundwater storage and the chronic lowering of groundwater level and seawater intrusion sustainability indicators, the groundwater elevation and seawater intrusion measurable objectives serve as proxies for reduction of groundwater storage.

8.8.4.1 Method for Setting Measurable Objectives

This methodology is designed to represent groundwater in storage when groundwater elevations and the seawater intrusion extent are maintained at their respective measurable objectives. As stated above, the measurable objectives for chronic lowering of groundwater levels and seawater intrusion provide an adequate margin of operational flexibility.

8.8.4.2 Interim Milestones

The groundwater elevation and seawater intrusion interim milestones described respectively in Table 8-3 and Section 8.9.4.2 will serve as a proxy for reduction of groundwater storage.

8.9 Seawater Intrusion SMC

8.9.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable seawater intrusion in the Subbasin is defined as follows:

- Expansion of the 2015 seawater intruded area in the Subbasin, identified based upon the 500 mg/L chloride concentration isocontour.

The seawater intrusion SMCs apply to the whole Subbasin, as shown in Figure 8-13 and Figure 8-14.

These significant and unreasonable conditions were determined based on input collected during MCWD stakeholder meetings, SVBGSA Subbasin Committee meetings, and discussions with GSA staff during Subbasin Technical Committee meetings.

8.9.2 Undesirable Results

8.9.2.1 Criteria for Defining Seawater Intrusion Undesirable Results

The seawater intrusion undesirable result is a quantitative combination of chloride concentrations minimum threshold exceedances. As discussed below, there is one minimum threshold for each of the four principal aquifers within the Marina-Ord Area and Reservation Road portion of the Corral de Tierra Area where the hydrogeologic setting is the same as the Marina-Ord Area. Because even localized expansion of the seawater intrusion front is not acceptable, the undesirable result of seawater intrusion is:

Any exceedances of the minimum threshold is considered as an undesirable result.

This undesirable result may be modified as the projects and actions to address seawater intrusion are refined during implementation of this GSP.

8.9.2.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result for seawater intrusion include the following:

- **Decreases in groundwater levels near the coast in Monterey Subbasin and/or adjacent coastal subbasins (the adjudicated Seaside Basin and 180/400 Foot Aquifer Subbasin).** Decreases in groundwater levels near the coast could lead to further migration of seawater inland into the Monterey Subbasin.
- **Sea level rise**. Increase in sea level increases the driving force for seawater intrusion and can lead to further migration of seawater inland.

8.9.2.3 Effects on Beneficial Users and Land Use

The primary detrimental effect on beneficial users and land uses from allowing seawater intrusion to continue or occur in the future is that the pumped groundwater may become saltier and thus impact groundwater supply wells (i.e., MCWD production wells or agricultural wells) and associated land uses. This may force production wells move to further inland or to deeper aquifers, which will cause increase groundwater production costs, and reduce water supply reliability.

Allowing seawater intrusion to continue or occur in the future may also impact agriculture. Chloride moves readily within soil and water and is taken up by the roots of plants. It is then transported to the stems and leaves. Sensitive berry rootstocks can tolerate only up to 120 mg/L of chloride, while grapes can tolerate up to 700 mg/L or more (University of California Agriculture and Natural Resources, 2002).

Limiting seawater intrusion will benefit groundwater users because it will protect groundwater production wells within the Marina-Ord Area and Reservation Road portion of the Corral de Tierra Area, and maintain adequate storage in the basin. However, limitations on groundwater extraction and/or development of alternative water supplies may be required to achieve minimum thresholds, which will cause increased water production costs or a reduction in water supplies.

8.9.3 Minimum Thresholds

Pursuant to GSP Emergency Regulations §354.28, the seawater intrusion minimum threshold is defined by a chloride concentration isocontour for each principal aquifer.

Because further expansion of the seawater intruded area is significant and unreasonable, the seawater intrusion minimum threshold is defined as:

> *The approximate location in 2015 of the 500 mg/L chloride concentration isocontour in the lower 180-Foot and 400-Foot Aquifers;*

Approximately 3,500 feet from the coast in the Dune Sand Aquifer, upper 180-Foot Aquifer and Deep Aquifers. This distance is generally consistent with the location of Highway 1 in the Monterey Subbasin and seaward of groundwater extraction in the Subbasin.

The approximate line of Highway 1 is determined as the seawater intrusion minimum threshold in the Dune Sand Aquifer, upper 180-Foot Aquifer and Deep Aquifers, as there is very limited seawater intrusion observed in these aquifers currently. The intent of this is minimum threshold is to limit seawater from intruding into these aquifers. Such seawater intrusion could occur from the ocean and/or through vertical migrations from underlying or overlying aquifers which are currently seawater intruded.

Figure 8-13 presents the minimum threshold for seawater intrusion in the lower 180-Foot and 400-Foot Aquifers. Figure 8-14 presents the minimum threshold for seawater intrusion in the Dune Sand, upper 180-Foot, and Deep Aquifers.

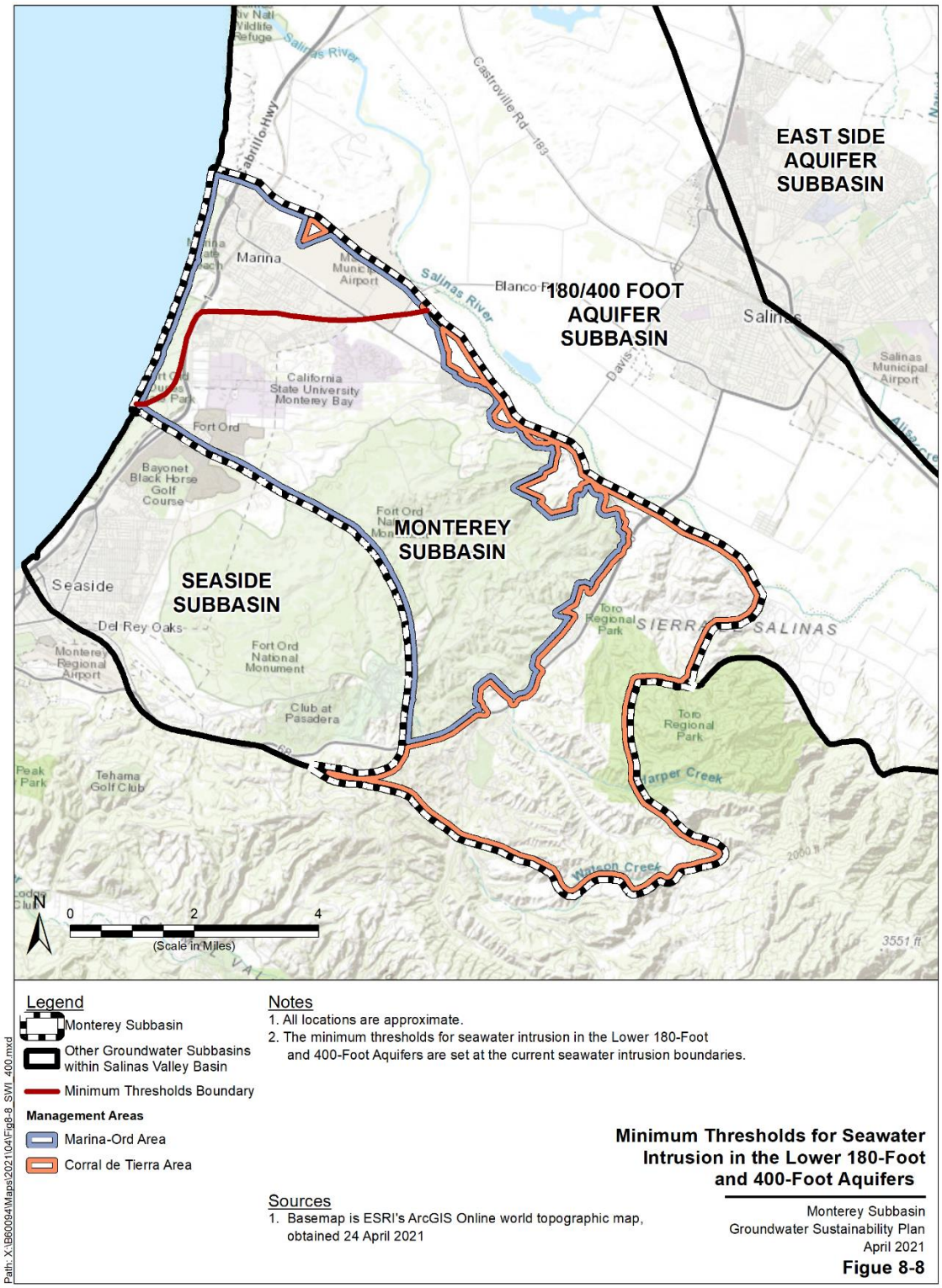


Figure 8-13. Minimum Thresholds for Seawater Intrusion in the Lower 180-Foot and 400-Foot Aquifer

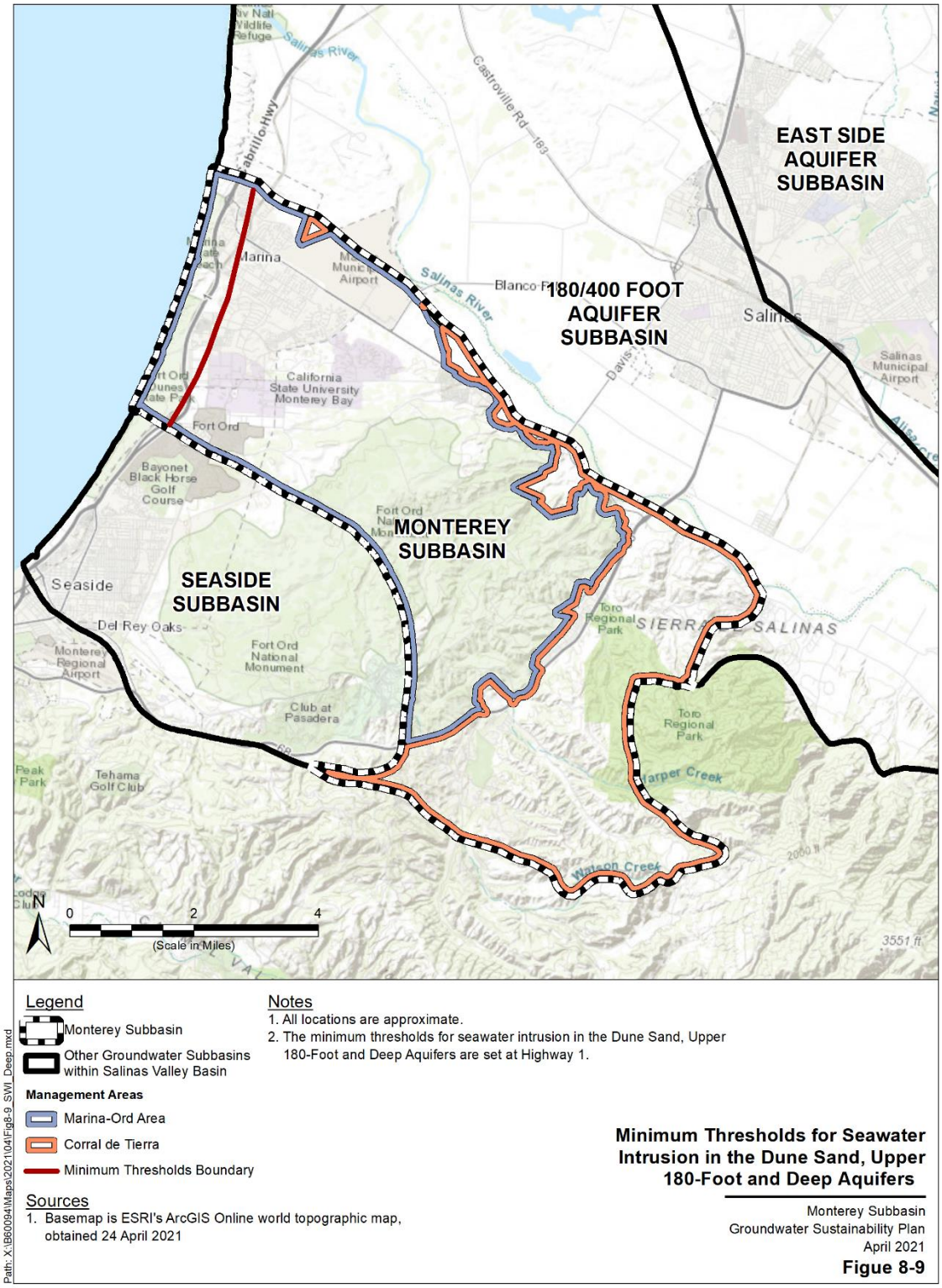


Figure 8-14. Minimum Thresholds for Seawater Intrusion in the Dune Sand, Upper 180-Foot, and Deep Aquifers

8.9.3.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

Consistent with GSP Emergency Regulations §354.28 (c), the definition of minimum thresholds for seawater intrusion is based on maps and cross-sections of the chloride concentration isocontour and how minimum thresholds will be affected by current and projected sea levels.

The seawater intrusion minimum thresholds are developed based on seawater intrusion maps and cross-sections included in Chapter 5 of this GSP. The maps identify the extent of seawater intrusion as the estimated location of the 500 mg/L chloride concentration isocontour line. The maps are developed through analysis of TDS and chloride measurements collected from monitoring wells near the coast, geophysical data, and the hydrogeological setting.

8.9.3.2 Relationship to Other Sustainability Indicators

As discussed above, minimum thresholds for seawater intrusion have been considered in the development of SMCs for related sustainability indicators including:

- groundwater level elevations SMCs, and
- depletion of groundwater storage SMCs.

Seawater intrusion is the primary driver used to set SMCs for these other sustainability indicators, which are also consistent with minimum thresholds established for:

- depletion of interconnected surface waters in wells proximate to such areas, and
- subsidence, as they are set above historical groundwater levels.

No conflict exists between seawater intrusion and degraded groundwater quality SMCs, beyond that caused by seawater intrusion itself, which increases chloride, sodium and TDS concentrations in groundwater wells (e.g., chloride, TDS).

8.9.3.3 Effect of Minimum Threshold on Neighboring Basins and Subbasin

The Monterey Subbasin has two neighboring subbasins within the Salinas Valley Groundwater Basin:

- The 180/400-Foot Aquifer Subbasin to the north;
- The Seaside Subbasin to the south

The GSAs coordinating the Monterey Subbasin GSP are the same GSAs covering the adjacent 180/400-Foot Aquifer Subbasin. The GSAs have been coordinating the development of the minimum thresholds and measurable objectives within the 180/400-Foot Aquifer Subbasin GSP, which was submitted to DWR in January 2020. Minimum thresholds for seawater intrusion are established consistent with the 180/400-Foot Aquifer Subbasin GSP.

The Seaside Subbasin is an adjudicated basin and not subject to SGMA. Because the minimum thresholds in the Monterey Subbasin are established to prevent expansion of the seawater intruded area in the Subbasin, it is likely that the minimum thresholds will not prevent the Seaside

Subbasin from meeting its adjudication requirements. The subbasin GSAs have and will continue to coordinate closely with the Seaside Watermaster to ensure that the Monterey Subbasin minimum thresholds do not prevent the Seaside basin from meeting its adjudication requirements.

8.9.3.4 Effects on Beneficial Users and Land Uses

Urban land uses and users. The seawater intrusion minimum thresholds will prevent high salinity levels from impacting water supply of urban land uses and users, along with agricultural uses and users. However, the seawater intrusion minimum threshold may (a) reduce the amount of allowable groundwater pumping within the Subbasin, or (b) require implementation of local or regional projects and/or management actions to augment existing water supplies within the Subbasin. This may result in higher water costs for water users.

Agricultural land uses and users. The seawater intrusion minimum thresholds generally provide positive benefits to the Subbasin's agricultural water users. Preventing additional seawater intrusion ensures that a supply of usable groundwater will exist for beneficial agricultural use..

On-farm domestic land uses and users. There are no known on-farm domestic groundwater users in the Marina-Ord Area, where SMCs are developed for seawater intrusion.

Ecological land uses and users. Although the seawater intrusion minimum threshold does not directly benefit ecological uses, it can be inferred that the seawater intrusion minimum thresholds provide generally positive benefits to the Subbasin's ecological water uses. Preventing seawater intrusion into the Subbasin will help prevent unwanted high salinity levels from impacting ecological groundwater uses.

8.9.3.5 Relevant Federal, State, or Local Standards

No federal, state, or local standards exist for seawater intrusion.

8.9.3.6 Method for Quantitative Measurement of Minimum Threshold

Chloride concentrations are measured in groundwater samples collected from the seawater intrusion monitoring network identified in Chapter 7. These samples are used to develop the approximate location of the 500 mg/L chloride isocontour. The methodology and protocols for collecting samples and developing the 500 mg/L concentration isocontour are detailed in Appendix 7C through Appendix 7E.

8.9.4 Measurable Objectives

In the Monterey Subbasin , the measurable objectives for the seawater intrusion are the same as the minimum thresholds:

> *The approximate location in 2015 of the 500 mg/L chloride concentration isocontour in the lower 180-Foot and 400-Foot Aquifers;*
>
> *Approximately 3,500 feet from the coast in the Dune Sand Aquifer, upper 180-Foot Aquifer and Deep Aquifers. This distance is generally consistent with the location of*

Highway 1 in the Monterey Subbasin and seaward of groundwater extraction wells in the Subbasin.

8.9.4.1 Method for Setting Measurable Objectives

As described above, measurable objectives are set to be identical to the minimum thresholds for the respective principal aquifers and therefore follow the same method as detailed in Section 8.9.3.1.

8.9.4.2 Interim Milestones

The interim milestones for seawater intrusion are the same as the measurable objective.

8.10 Degraded Water Quality SMC

8.10.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable changes in groundwater quality resulting from direct GSA action in the Subbasin are increases in a chemical constituent that either:

- Increase in number of potable supply wells in which concentrations of constituents of concern exceed Title 22 California Code of Regulations (Title 22) drinking water standards (i.e., maximum contaminant levels (MCLs) or secondary maximum contaminant levels (SMCLs), or
- Increase in the number of agricultural supply wells in which constituents of concern exceed concentrations that may lead to reduced crop production.

These significant and unreasonable conditions were determined based on input collected during MCWD stakeholder meetings, SVBGSA Subbasin Committee meetings, and discussions with GSA staff during Subbasin Technical Committee meetings.

8.10.2 Undesirable Results

8.10.2.1 Criteria for Defining Undesirable Results

For the Subbasin, any groundwater quality degradation that leads to an exceedance of MCLs or SMCLs in potable water supply wells or a reduction in crop production in agricultural wells that is a direct result of GSP implementation is unacceptable. Some groundwater quality changes are expected to occur independent of SGMA activities; because these changes are not related to SGMA activities they do not constitute an undesirable result. Therefore, the degradation of groundwater quality undesirable result is:

Any exceedances of minimum thresholds during any one year as a direct result of projects or management actions conducted pursuant to GSP implementation is considered as an undesirable result.

8.10.2.2 Potential Causes of Undesirable Results

As shown in Chapter 5, the known groundwater quality issues within the Marina-Ord Area are caused by legacy Fort Ord contamination. To date, no constituents of concern are detected above drinking water standards in any Marina-Ord Area groundwater supply wells (i.e., MCWD production wells). The U.S. Army is responsible for remediation of groundwater contamination associated with historical releases at the former Army base. This remediation is being conducted under the oversight of the US Armed Forces, US EPA, and the CCRWQCB.

High arsenic concentrations are known to occur within the El Toro Primary Aquifer System within the Corral de Tierra Area; these concentrations are naturally occurring. There is also no clear correlation that can be established between groundwater levels and groundwater quality at this time.

Conditions that may lead to an undesirable result in the Marina-Ord-Area or the Corral de Tierra Area include the following:

- **Required Changes to Subbasin Pumping**. If the location and rates of groundwater pumping change as a result of projects implemented under the GSP, these changes could alter hydraulic gradients and associated flow directions, and cause movement of constituents of concern towards a supply well at concentrations that exceed relevant standards.
- **Groundwater Recharge**. Active recharge of imported water or captured runoff could modify groundwater gradients and move constituents of concern towards a supply well in concentrations that exceed relevant limits.
- **Recharge of Poor-Quality Water**. Recharging the Subbasin with water that exceeds an MCL, SMCL, or level that reduces crop production could lead to an undesirable result.

County Ordinance No. 04011 (see Section 3.4) restricts well construction in areas that may interfere with contamination plumes at the former Fort Ord. Therefore, the potential for GSP projects to impact legacy contamination at Fort Ord within the Marina-Ord Area are unlikely.

8.10.2.3 Effects on Beneficial Users and Land Use

Avoiding groundwater quality degradation at potable and agricultural wells due to actions directly resulting from GSP implementation will positively effect beneficial users as it will limit the need for potential groundwater treatment. However, this SMC will limit implementation of selected projects and in the vicinity of Fort Ord until legacy contaminants have been remediated. Remediation of legacy Ford Ord contamination is required pursuant to the Records of Decision, entered into by the Army and overseeing regulatory agencies.

8.10.3 Minimum Thresholds

The minimum threshold for degraded water quality ("water quality minimum threshold") for the Monterey Subbasin is defined as:

No additional exceedances of Title 22 drinking water standards in potable supply wells or Basin Plan water quality objectives in agricultural supply wells as a result of GSP implementation.

Minimum thresholds for DDW public water system supply wells and ILRP on-farm domestic wells are based on Title 22 drinking water standards (i.e., MCLs and SMCLs). Minimum thresholds for agricultural supply wells are based on the water quality objectives listed in the Basin Plan (CCRWQCB, 2019) (Agricultural Water Quality Objectives). These drinking water and agricultural water quality criteria are jointly defined herein as "Regulatory Water Quality Standards". The minimum threshold values for constituents of concern identified for each management area are provided in Table 8-5. The selection criteria for constituents of concern are detailed in Section 8.10.3.1.

Because the minimum thresholds reflect no additional exceedances of Regulatory Water Quality Standards, the minimum thresholds are set to the number of existing exceedances. Surpassing the number of existing exceedances of Regulatory Water Quality Standards for any of the listed constituents as a result of GSP implementation will lead to an undesirable result. There are no current exceedances of Title 22 drinking water standards in Marina-Ord Area water supply wells. Additionally as shown in Table 8-5, no constituents of concern exceed Agricultural Water Quality Objectives in agricultural supply wells in the Corral de Tierra Area. The subbasin GSAs will continue to monitor water quality in the water quality monitoring network to ensure future exceedances are not due to GSP implementation. Not all wells in the monitoring network are sampled for every constituent of concern.

Table 8-5. Groundwater Quality Minimum Thresholds and Measurable Objectives

Constituent of Concern	Minimum Threshold/ Measurable Objective – Number of Wells Exceeding Regulatory Water Quality Standard (based on most recent sample)
Marina-Ord Area	
DDW Public Water System Supply Wells	
Carbon Tetrachloride	0
Trichloroethane	0
Corral de Tierra Area	
DDW Public Water System Supply Wells	
Arsenic	7
Benzo(a)Pyrene	1
Chromium	2
1,2 Dibromo-3-chloropropane	2
Dinoseb	3
Iron	13
Hexachlorobenzene	1
Manganese	11
Nickel	1
Specific Conductance	2
1,2,3-Trichloropropane	1
Total Dissolved Solids	2
Vinyl Chloride	3
Zinc	1
ILRP On-Farm Domestic Wells	
Total Dissolved Solids	1

8.10.3.1 Information and Methodology Used to Establish Water Quality Minimum Thresholds and Measurable Objectives

The powers granted to GSAs to effect sustainable groundwater management under SGMA generally revolve around managing the quantity, location, and timing of groundwater pumping. SGMA does not empower GSAs to develop or enforce water quality standards; that authority rests with the SWRCB Division of Drinking Water and Monterey County. Because of the limited purview of GSAs with respect to water quality, and the rightful emphasis on those constituents that may be related to groundwater quantity management activities.

Therefore, this GSP is designed to avoid taking any action that may inadvertently move groundwater constituents already in the Subbasin in such a way that the constituents have a

significant and unreasonable impact that would not otherwise occur. Constituents of concern must meet two criteria:

1. They must have a Regulatory Water Quality Standard.
2. They must have been detected in groundwater within the Subbasin at levels above the Regulatory Water Quality Standard.

Based on the review of groundwater quality data discussed in Chapter 5, the constituents of concern that exceed Title 22 drinking water standards and may affect drinking water supply wells in the Marina-Ord Area include:

- Trichloroethylene (TCE)
- Carbon Tetrachloride (CT)
- TDS
- Chloride

TCE and CT are being remediated by the Army at the former Fort Ord. Although currently not detected above their respective MCLs within Marina-Ord Area water supply wells, these compounds are identified as constituents of concern because they are detected above their respective MCLs in groundwater monitoring wells in the vicinity of water supply wells. TDS and chloride are also detected in groundwater above their respective SMCLs in the Marina-Ord Area primarily as a result of seawater intrusion.

Minimum thresholds are established so that no exceedance of Title 22 drinking water standards for these constituents of concern in water supply wells occur as a result of GSP implementation.

Other constituents and associated beneficial uses within the Marina-Ord Area are managed through existing management and regulatory programs under the U.S. Army, CCRWQCB, and SWRCB. New projects and management actions that could impact groundwater quality will require associated monitoring and permitting by the SWRCB and RWQCB.

There are no domestic or agricultural wells within the Marina Ord-Area. However, there was one ILRP on-farm domestic well with a TDS concentration that exceeded Title 22 drinking water standards between 2013-2019 in the Reservation Road portion of the Corral de Tierra Area, which is in the same hydrogeologic setting as the Marina-Ord Area. There were no exceedances of Agricultural Water Quality Objectives in ILRP irrigation wells in this area.

Based on the review of groundwater quality in Chapter 5 the constituents of concern (COCs) that may affect drinking water supply wells in the Corral de Tierra Area include (Table 8-5) [Analysis in Chapter 5 to be updated]:

- Arsenic
- Benzo(a)Pyrene
- Chromium

- 1,2 Dibromo-3-chloropropane
- Dinoseb
- Iron
- Hexachlorobenzene
- Manganese
- Nickel
- Specific Conductance
- 1,2,3-Trichloropropane
- Total Dissolved Solids
- Vinyl Chloride
- Zinc

As discussed in Chapter 7, wells for three separate water quality monitoring networks were reviewed and used for developing SMCs:

- Public water system supply wells regulated by the SWRCB Division of Drinking Water.
- On-Farm Domestic wells monitored as part of ILRP. This dataset was obtained from the SWRCB through the GeoTracker GAMA online portal. The ILRP data were separated into two data sets, one for domestic wells and the other for agricultural wells (discussed below) for purposes of developing initial draft minimum thresholds and measurable objectives for each type of well. The monitoring well network for the ILRP will change in 2020 once monitoring is established and results are published under Ag Order 4.0. At that time, the new ILRP on-farm domestic monitoring network will be incorporated into this GSP, replacing the current network, for water quality monitoring.
- Agricultural supply wells monitored as part of ILRP. As mentioned above, this dataset was obtained from the SWRCB through the GeoTracker GAMA online portal. Like the on-farm domestic well dataset, the IRLP agricultural monitoring well network will change with the adoption of Ag Order 4.0.

Each of these well networks are monitored for a different set of water quality parameters. Furthermore, some groundwater quality impacts are detrimental to only certain networks. For example, high nitrates are detrimental to public water system supply wells and domestic wells but are not detrimental to agricultural irrigation wells. The constituents monitored in each well network are indicated by an X in Table 8-6. An X does not necessarily indicate that the constituents have been found above the Regulatory Water Quality Standard for that monitoring network.

Table 8-6. Monitored Constituents in Monitoring Well Networks

Constituent	Public Water System Supply	On-Farm Domestic[1]	Agricultural Supply
Chloride	X	X	X
Nitrate + Nitrite (sum as nitrogen)		X	X
Sulfate	X	X	X
Total Dissolved Solids	X	X	X
Nitrite	X	X	
Nitrate (as nitrogen)	X	X	
Specific Conductance	X	X	
Silver	X		
Aluminum	X		
Alachlor	X		
Arsenic	X		
Atrazine	X		
Boron	X		
Barium	X		
Beryllium	X		
Lindane	X		
Di(2-ethylhexyl)phthalate	X		
Bentazon	X		
Benzene	X		
Benzo(a)Pyrene	X		
Toluene	X		
Cadmium	X		
Chlordane	X		
Chlorobenzene	X		
Cyanide	X		
Chromium	X		
Carbofuran	X		
Carbon Tetrachloride	X		
Copper	X		
Dalapon	X		
1,2 Dibromo-3-chloropropane	X		
1,1-Dichloroethane	X		
1,2-Dichloroethane	X		
1,2-Dichlorobenzene	X		
1,4-Dichlorobenzene	X		
1,1-Dichloroethylene	X		
cis-1,2-Dichloroethylene	X		
trans-1,2-Dichloroethylene	X		

Constituent	Public Water System Supply	On-Farm Domestic[1]	Agricultural Supply
Dichloromethane (a.k.a. methylene chloride)	X		
1,2-Dichloropropane	X		
Dinoseb	X		
Diquat	X		
Di(2-ethylhexyl)adipate	X		
Ethylbenzene	X		
Endrin	X		
Fluoride	X		
Trichlorofluoromethane	X		
1,1,2-Trichloro-1,2,2-Trifluoroethane	X		
Iron	X		
Foaming Agents (MBAS)	X		
Glyphosate	X		
Hexachlorocyclopentadiene	X		
Hexachlorobenzene	X		
Heptachlor	X		
Mercury	X		
Manganese	X		
Molinate	X		
Methyl-tert-butyl ether (MTBE)	X		
Methoxychlor	X		
Nickel	X		
Oxamyl	X		
1,1,2,2-Tetrachloroethane	X		
Perchlorate	X		
Polychlorinated Biphenyls	X		
Tetrachloroethene	X		
Pentachlorophenol	X		
Picloram	X		
Antimony	X		
Selenium	X		
2,4,5-TP (Silvex)	X		
Simazine	X		
Styrene	X		
1,1,1-Trichloroethane	X		
1,1,2-Trichloroethane	X		
1,2,4-Trichlorobenzene	X		
Trichloroethene	X		
1,2,3-Trichloropropane	X		

Constituent	Public Water System Supply	On-Farm Domestic[1]	Agricultural Supply
Thiobencarb	X		
Thallium	X		
Toxaphene	X		
Vinyl Chloride	X		
Xylenes	X		
Zinc	X		

[1]Basin plan states domestic wells are monitored for Title 22 constituents; however, GeoTracker GAMA only provides data for the constituents listed above.

8.10.3.2 Relationship to Other Sustainability Indicators

Preventing migration of groundwater of poor water quality may limit activities needed to avoid exceeding minimum thresholds for other sustainability indicators. For example, groundwater quality minimum thresholds could influence the types and locations of projects needed to attain groundwater elevation minimum thresholds and seawater intrusion minimum thresholds by

- limiting the types of water that can be used for recharge to raise groundwater elevations, and
- limiting the locations where such recharge can occur due to legacy Fort Ord contamination.

8.10.3.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The anticipated effect of the degraded groundwater quality minimum thresholds on each of the neighboring subbasins is addressed below.

The Monterey Subbasin has two neighboring subbasins within the Salinas Valley Groundwater Basin:

- The 180/400-Foot Aquifer Subbasin to the north;
- The Seaside Subbasin to the south

The GSAs coordinating the Monterey Subbasin GSP are the same GSAs covering the adjacent 180/400-Foot Aquifer Subbasin. The GSAs have been coordinating the development of the minimum thresholds and measurable objectives within the 180/400-Foot Aquifer Subbasin GSP, which was submitted to DWR in January 2020. The groundwater quality minimum threshold defined herein are consistent with the minimum threshold defined in the 180/400-Foot Aquifer Subbasin GSP.

The Seaside Subbasin is an adjudicated basin and not subject to SGMA. Because the minimum threshold in the Monterey Subbasin is no additional exceedance of regulatory standards, it is likely that the minimum thresholds will not prevent the Seaside Subbasin from meeting its adjudication requirements. The subbasin GSAs have and will continue to coordinate closely with

the Seaside Watermaster to ensure that the Monterey Subbasin minimum thresholds do not prevent the Seaside basin from meeting its adjudication requirements.

8.10.3.4 Effect on Beneficial Uses and Users

Urban land uses and users. The groundwater quality minimum thresholds generally provide positive benefits to the Subbasin's urban water users. Preventing any GSA actions that would result in in additional drinking water supply wells exceeding MCLs or SMCLs ensures adequate groundwater quality for public water system supplies.

Agricultural land uses and users. The groundwater quality minimum thresholds generally provide positive benefits to the Subbasin's agricultural water users. Preventing any GSA actions that would result in additional agricultural supply wells from exceeding levels that could reduce crop production ensures that a supply of usable groundwater will exist for beneficial agricultural use.

Domestic land uses and users. The groundwater quality minimum thresholds generally provide positive benefits to the Subbasin's domestic water users. Preventing any GSA actions that would result in constituents of concern in additional drinking water supply wells from exceeding MCLs or SMCLs ensures adequate groundwater quality for domestic supplies.

Ecological land uses and users. Although the groundwater quality minimum thresholds do not directly benefit ecological uses, it can be inferred that the degradation of groundwater quality minimum thresholds provide generally positive benefits to the Subbasin's ecological water uses. Preventing any GSA actions that would result in constituents of concern from migrating will prevent unwanted contaminants from impacting ecological groundwater uses.

8.10.3.5 Relation to State, Federal, or Local Standards

The groundwater quality minimum thresholds are set at the Subbasin's water supply wells and specifically incorporate state and federal standards for drinking water.

8.10.3.6 Method for Quantitative Measurement of Minimum Thresholds

Degradation of groundwater quality minimum thresholds will be directly measured from existing public water system supply wells, domestic wells, or agricultural supply wells. Groundwater quality will be measured through existing monitoring programs.

- Exceedances of MCLs and SMCLs in public water system wells will be monitored from annual water quality reports submitted to the California Division of Drinking Water and the County of Monterey.
- Exceedances of MCLs and SMCLs in on-farm domestic wells will be monitored from the ILRP data as discussed in Chapter 7. Exceedances of Agricultural Water Quality Objectives for crop production will be monitored from the ILRP data as discussed in Chapter 7.

Initially, review of data relative to MCLs, SMCLs, and Agricultural Water Quality Objectives will be centered around the constituents of concern identified above. If during review of the water quality data additional constituents appear to exceed MCLs, SMCLs, or Agricultural Water Quality

Objectives minimum thresholds and measurable objectives will be developed for these additional constituents.

8.10.4 Measurable Objectives

The measurable objectives for degradation of groundwater quality represent target groundwater quality distributions in the Subbasin. SGMA does not mandate the improvement of groundwater quality. Therefore, measurable objectives have been set to be identical to the minimum thresholds, as defined in Table 8-5.

8.10.4.1 Method for Setting Measurable Objectives

As described above, measurable objectives are set to be identical to the minimum thresholds and therefore follow the same method as detailed in Section 8.10.3.1.

8.10.4.2 Interim Milestones

Interim milestones show how the GSAs anticipate the Subbasin will gradually move from current conditions to meeting the measurable objectives over the next 20 years of implementation. Interim milestones are set for each five-year interval following GSP adoption.

There is no anticipated degradation of groundwater quality during GSP implementation that results from the implementation of projects and actions as described in Chapter 9. Therefore, the expected interim milestones are identical to minimum thresholds and measurable objectives, which represent current conditions.

8.11 Subsidence SMC

8.11.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable subsidence in the Subbasin is defined as follows:

- Any inelastic land subsidence that is caused by lowering of groundwater elevations occurring in the Subbasin is significant and unreasonable.

Subsidence can be elastic or inelastic. Elastic subsidence is the small, reversible lowering and rising of the ground surface. Inelastic subsidence is generally irreversible. This set of SMCs only concerns inelastic subsidence.

8.11.2 Undesirable Results

8.11.2.1 Criteria for Defining Undesirable Results

By regulation, the ground surface subsidence undesirable result is a quantitative combination of subsidence minimum threshold exceedances. For the Monterey Subbasin, no long-term subsidence is acceptable. Therefore, the ground surface subsidence undesirable result is:

> *Any exceedances of minimum thresholds during any one year due to lowered groundwater elevations is considered as an undesirable result.*

As discussed below, the subsidence minimum thresholds allow for measurement error in the InSAR data of 0.1 foot per year. Should potential subsidence be observed, the subbasin GSAs will first assess whether the subsidence may be due to elastic subsidence. If the subsidence is not elastic, the GSAs will undertake a program to assess whether the subsidence is caused by lowered groundwater elevations. The first step in the assessment will be to check if groundwater elevations have dropped below historical lows. If groundwater elevations remain above historical lows, the GSAs shall assume that any observed subsidence was not caused by lowered groundwater levels. If groundwater levels have dropped below historical lows, the GSAs will attempt to correlate the observed subsidence with measured groundwater elevations.

8.11.2.2 Potential Causes of Undesirable Results

As shown in Chapter 5, no land subsidence has been observed within the Subbasin. It is unlikely that land subsidence will occur within the Subbasin because of its proximity to the ocean. However, the GSAs have established SMCs for this sustainability indicator and will continue to monitor InSAR data.

8.11.2.3 Effects on Beneficial Users and Land Use

The undesirable result for subsidence does not allow any subsidence to occur in the Subbasin. Therefore, there is no negative effect on any beneficial uses and users.

8.11.3 Minimum Thresholds

The minimum threshold for subsidence is defined as:

> *Zero net long-term subsidence, with no more than 0.1 foot per year of measured vertical displacement between June of one year and June of the subsequent year to account for InSAR measurement errors.*

8.11.3.1 Information Used and Methodology for Establishing Subsidence Minimum Thresholds

The minimum threshold was established using InSAR data available from DWR. The minimum threshold is no long-term irreversible subsidence in the Subbasin. The InSAR data provided by DWR, however, is subject to measurement error. DWR stated that, on a statewide level, for the total vertical displacement measurements between June 2015 and June 2019, the errors are as follows (Brezing, personal communication):

1. The error between InSAR data and continuous GPS data is 16 mm (0.052 feet) with a 95% confidence level.
2. The measurement accuracy when converting from the raw InSAR data to the maps provided by DWR is 0.048 feet with 95% confidence level.

By adding errors 1 and 2, the combined error is 0.1 foot. While this methodology is not a robust statistical analysis, it does provide an estimate of the potential error in the InSAR maps provided by DWR.

Additionally, the InSAR data provided by DWR reflects both elastic and inelastic subsidence. While it is difficult to compensate for elastic subsidence, visual inspection of monthly changes in ground elevations suggest that elastic subsidence is largely seasonal. To minimize the influence of elastic subsidence on the assessment of long-term, permanent subsidence, changes in ground level will only be measured annually from June of one year to June of the following year.

8.11.3.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The subsidence minimum threshold has little or no impact on other minimum thresholds as there has been no observed subsidence observed to date. Therefore, the SMCs for subsidence should not trigger greater extraction or the implementation any of any projects and/or management actions in the Subbasin which could affect other sustainability indicators.

8.11.3.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Monterey Subbasin has two neighboring subbasins within the Salinas Valley Groundwater Basin:

- The 180/400-Foot Aquifer Subbasin to the north;
- The Seaside Subbasin to the south

The GSAs coordinating the Monterey Subbasin GSP are the same GSAs covering the adjacent 180/400-Foot Aquifer Subbasin. The GSAs have been coordinating the development of the minimum thresholds and measurable objectives within the 180/400-Foot Aquifer Subbasin GSP, which was submitted to DWR in January 2020. The land subsidence minimum threshold defined herein are consistent with the minimum threshold defined in the 180/400-Foot Aquifer Subbasin GSP.

The Seaside Subbasin is adjudicated not subject to SGMA. Because the minimum threshold in the Monterey Subbasin is zero subsidence, it is likely that the minimum thresholds will not prevent the Seaside Subbasin from meeting its adjudication requirements. The subbasin GSAs have and will continue to coordinate closely with the Seaside Watermaster to ensure that the Monterey Subbasin minimum thresholds do not prevent the Seaside basin from meeting its adjudication requirements.

8.11.3.4 Effects on Beneficial Uses and Users

The subsidence minimum threshold is set to prevent any long-term inelastic subsidence. Available data indicate that there is currently no long-term subsidence occurring in the Subbasin, and pumping limits are already required by minimum thresholds for other sustainability indicators. Therefore, the subsidence minimum threshold does not require any additional reductions in pumping and there is no negative impact on any beneficial user.

8.11.3.5 Relation to State, Federal, or Local Standards

There are no federal, state, or local regulations related to subsidence.

8.11.3.6 Method for Quantitative Measurement of Minimum Threshold

Minimum thresholds will be assessed using DWR-supplied InSAR data.

8.11.4 Measurable Objectives

The measurable objective for ground surface subsidence represents target subsidence rates in the Subbasin. Because the minimum threshold of zero net long-term subsidence is the best achievable outcome, the measurable objective is identical to the minimum threshold.

8.11.4.1 Method for Setting Measurable Objectives

The measurable objective will be assessed using DWR-supplied InSAR data.

8.11.4.2 Interim Milestones

The subsidence measurable objective is set at zero net long-term subsidence, which is consistent with current conditions. Therefore, there is no change between current conditions and sustainable conditions and interim milestones are identical to current conditions.

8.12 Depletion of Interconnected Surface Water SMC

Areas with interconnected surface water occur where shallow groundwater may be connected to the surface water system. This set of SMCs only applies to locations of potential interconnected surface water, as shown in panel A and panel B of Figure 8-15.

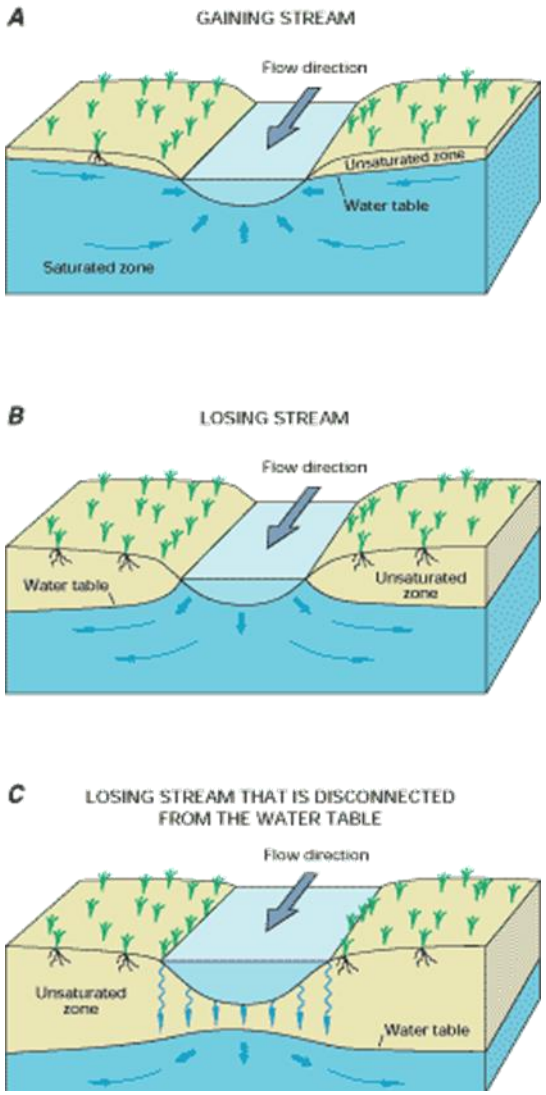


Figure 8-15. Conceptual Representation of Interconnected Surface Water (Winter, et al., 1999)

8.12.1 Locally Defined Significant and Unreasonable Conditions

The Monterey Subbasin generally does not have large areas where interconnected surface water occurs. As shown in Chapter 5, four potential locations of interconnected surface water are identified in the Subbasin: the Marina vernal ponds, the lower reaches of El Toro Creek, and two stretches of the Salinas River. The Salinas River supports surface water rights holders and has ecological flow requirements. Additionally, all surface water bodies identified are located within areas of potential groundwater dependent ecosystems (GDEs). Therefore, the management of interconnected surface water within the Monterey Subbasin is also focused on managing groundwater impacts on GDEs.

Locally defined significant and unreasonable depletion of interconnected surface water in the Subbasin is defined as:

- Depletions that would result in an unreasonable impact on other beneficial uses and users of surface water, such as groundwater dependent ecosystems.

These significant and unreasonable conditions were determined based on input collected during MCWD stakeholder meetings, SVBGSA Subbasin Committee meetings, and discussions with GSA staff during Subbasin Technical Committee meetings.

8.12.2 Undesirable Results

8.12.2.1 Criteria for Defining Undesirable Results

By regulation, the depletion of interconnected surface water undesirable result is a quantitative combination of minimum threshold exceedances. Shallow groundwater elevations near the locations of potentially interconnected surface water will be used as a proxy for minimum thresholds and measurable objectives. Since there is likely to be a limited number of shallow groundwater wells by each location of interconnected surface water, more than one minimum threshold exceedance by a location of interconnected surface water would cause an undesirable result.

Therefore, for the Monterey Subbasin, the undesirable result for depletion of interconnected surface water is:

> *Any minimum threshold exceeded in a shallow groundwater well near any location of interconnected surface water for more than two consecutive years.*

The undesirable result is established based on historically observed hydrologic conditions observed between 1995 and 2005 during which period no significant or unreasonable depletion of interconnected surface water had occurred. However, future climate change and extreme droughts may cause shallow groundwater elevation declines and further depletions of interconnected surface water irrespective of groundwater pumping. The exceedance of minimum thresholds near locations of interconnected surface water due to naturally occurring, extreme drought conditions may not be considered an undesirable result. This methodology

aligns with the SMCs BMP (DWR, 2017) which states, "Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods." Additionally, the GSAs will continue to evaluate the effects of future climate change on groundwater conditions and may reevaluate SMCs when more information is available.

8.12.2.2 Potential Causes of Undesirable Results

Depletion of interconnected surface water is generally correlated to chronic lowering of groundwater levels in an interconnected groundwater aquifer system.

Conditions that may lead to an undesirable result for the depletion of interconnected surface waters in the Marina-Ord Area include the following:

- **Potential projects that would create groundwater declines in shallow groundwater.** There is currently no groundwater extraction in the Dune Sand Aquifer or the underlying 180-Foot Aquifer near locations of interconnected surface water within the Marina-Ord Area However, future projects near interconnected surface water bodies within the Monterey Subbasin or adjacent Subbasins could reduce shallow groundwater elevations.

Conditions that may lead to an undesirable result for the depletion of interconnected surface waters in the Corral de Tierra Area include the following:

- **Localized pumping increases**. Even if the Subbasin is adequately managed at the Subbasin scale, increases in localized pumping of shallow groundwater near interconnected surface water bodies could reduce shallow groundwater elevations.
- **Expansion of riparian water rights**. Riparian water rights holders often pump from wells adjacent to streams. Pumping by these riparian water rights holder users is not regulated under this GSP. Additional riparian pumpers near interconnected reaches of rivers and streams may result in excessive localized surface water depletion.
- **Departure from the GSP's climatic assumptions, including extensive, unanticipated drought**. Minimum thresholds were established based on anticipated future climatic conditions. Departure from the GSP's climatic assumptions or extensive, unanticipated droughts may lead to excessively low groundwater elevations that increase surface water depletion rates.
- **Changes in Nacimiento and San Antonio Reservoir Releases.** Since the Salinas River is dependent on reservoir releases for sustained summer flows, when diversions are at the highest level, any decrease in reservoir flows during that time could affect interconnected surface waters by increases in depletions and could cause undesirable results to beneficial users.

8.12.2.3 Effects on Beneficial Users and Land Use

Potential effects of undesirable results of depletion of interconnected surface water in the Marina-Ord Area may include reduced surface water to support GDEs.

Potential effects of undesirable results of depletion of interconnected surface water in the Corral de Tierra may include reduced surface water flows to support downstream or in-stream uses, and to support riparian habitat or associated GDEs.

The depletion of interconnected surface water undesirable result is to have no net change in surface water depletion during average hydrologic conditions and over the long-term, as determined by shallow groundwater elevations. Therefore, during average long-term hydrologic conditions, the undesirable result will not have a negative effect on the beneficial users and uses of groundwater. However, pumping of shallow groundwater during dry years could temporarily increase rates of surface water depletions. Therefore, there could be short-term impacts on all beneficial users and uses of the surface water during dry years.

8.12.3 Minimum Thresholds

The minimum threshold for depletion of interconnected surface water is set to:

> *Minimum shallow groundwater elevations historically observed between 1995 and 2015 near locations of interconnected surface water.*

Figure 8-16 shows locations of potentially interconnected surface water and shallow groundwater level minimum thresholds established in the Marina-Ord Area.

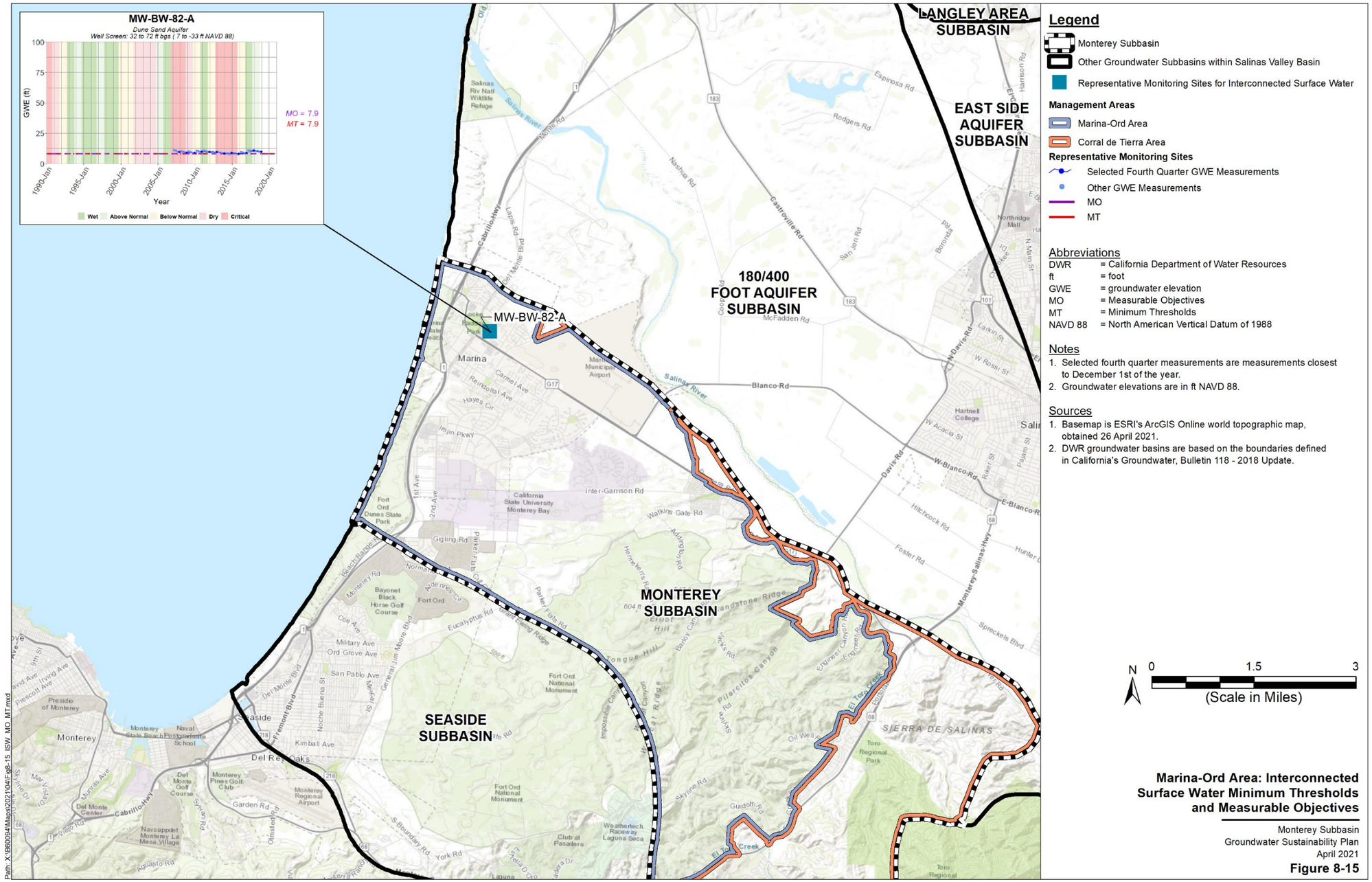


Figure 8-16. Marina-Ord Area: Interconnected Surface Water Minimum Thresholds and Measurable Objectives

8.12.3.1 Information Used and Methodology for Establishing Depletion of Interconnected Surface Water Minimum Thresholds

The various beneficial uses and users of surface waters were addressed when setting interconnected surface water depletion minimum thresholds. The classes of beneficial uses and users that were reviewed include riparian rights holders, appropriative rights holders, ecological surface water users, and recreational surface water users. This evaluation is not a formal analysis of public trust doctrine, but provides a reasonable review all uses and users in an attempt to balance all interests. This evaluation does not assess what constitutes a reasonable beneficial use under Article X, Section 2 of the California Constitution.

The minimum thresholds for depletion of interconnected surface waters are developed using the definition of significant and unreasonable conditions described above, public information about critical habitat, public information about water rights described below, and the Subbasin water budget analysis.

Riparian water rights holders

There are no active riparian water rights holders within the Subbasin, including riparian water rights holders for the sections of the Salinas River where it enters the Subbasin. The diversion data were obtained from queries of the SWRCB eWRIMS water rights management system.

The SVBGSA is not aware of any current riparian water rights litigation or water rights enforcement acts along the Salinas River in the Subbasin. Therefore, SVBGSA assumes that the current level of depletion has not injured any riparian water rights holders in the Subbasin.

Appropriative water rights holders

There are no appropriative water rights holders within the Subbasin.

Ecological surface water users

Within the Marina-Ord Area, groundwater elevations within the shallow-most aquifer, the Dune Sand Aquifer, have been stable for over two decades. In 2020, the City of Marina determined that the groundwater dependent ecosystems associated with the Marina vernal ponds are in "good condition". Given the stable groundwater patterns in the Dune Sand Aquifer and the good condition of the groundwater dependent ecosystems, there is no significant and unreasonable depletion of interconnected surface water under current conditions.

There are no known flow prescriptions on the El Toro Creek or any tributaries in the Corral de Tierra Area. Therefore, the current level of depletion has not violated any ecological flow requirements. This conclusion is not meant to imply that depletions do not impact potential species living in or near surface water bodies in the Corral de Tierra Area. However, any impacts that may be occurring have not risen to a level that triggers regulatory intervention. Therefore, the impacts from current rates of depletion on ecological surface water users adjacent to the El Toro Creek are not unreasonable.

Review of MCWRA's Nacimiento Dam Operation Policy and MCWRA's water rights indicates MCWRA operates the Dam in a manner that meets downstream Salinas River demands and considers ecological surface water users. Since the reservoir operations consider ecological surface water users and reflect reasonable existing surface water depletion rates, this GSP infers that stream depletion from existing groundwater pumping is not unreasonable. If further river management guidelines are developed to protect ecological surface water users, the SMC in this GSP will be revisited.

Recreational surface water users

No recreational activities such as boating regularly occur on surface water bodies in the Subbasin.

As shown by the analysis above, the current rate of surface water depletion is not having an unreasonable impact on the various surface water uses and other users in the Subbasin. Therefore, the minimum thresholds are set based on historical minimum groundwater elevations observed between 1995 and 2005.

8.12.3.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The minimum threshold for depletion of surface water is set near the locations of interconnected surface water above historical and current groundwater elevations. The minimum thresholds reference the same historical years with consideration of fluctuations in aquifers that has steady groundwater elevations over the past two decades. Therefore, no conflict exists between minimum thresholds measured at various locations within the Subbasin.

As discussed above, SMCs for depletion of interconnected surface water minimum threshold are consistent with those established for chronic lowering of groundwater levels, change in groundwater storage, and seawater intrusion SMCs. There is no know relationship between these SMCs and groundwater quality or subsidence.

8.12.3.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Monterey Subbasin has two neighboring subbasins within the Salinas Valley Groundwater Basin:

- The 180/400-Foot Aquifer Subbasin to the north;
- The Seaside Subbasin to the south

The GSAs coordinating the Monterey Subbasin GSP are the same GSAs covering the adjacent 180/400-Foot Aquifer Subbasin. The GSAs have been coordinating the development of the minimum thresholds and measurable objectives within the 180/400-Foot Aquifer Subbasin GSP, which was submitted to DWR in January 2020. Because the minimum thresholds in both the Monterey Subbasin and 180/400-Foot Aquifer Subbasin have been developed by the same GSAs in a coordinated fashion, the minimum thresholds do not conflict with each other.

The Seaside Subbasin is an adjudicated basin and not subject to SGMA. Because there are no interconnected surface water bodies that crosses the Monterey and the Seaside Subbasin, it is likely that the minimum thresholds will not prevent the Seaside Subbasin from meeting its adjudication requirements. The subbasin GSAs have and will continue to coordinate closely with the Seaside Watermaster to ensure that the Monterey Subbasin minimum thresholds do not prevent the Seaside basin from meeting its adjudication requirements.

8.12.3.4 Effect on Beneficial Uses and Users

Table 3-9 of the Salinas River Long-Term Management Plan (MCWRA, 2019) includes a list of 18 different designated beneficial uses on certain reaches of the river. In general, the major beneficial uses on the Salinas River are:

- Surface water diversions for agricultural, urban/industrial and domestic supply
- Groundwater pumping from recharged surface water
- Freshwater habitat
- Rare, threated or endangered species, such as the Steelhead Trout
- CSIP diversions

The depletion of surface water minimum thresholds may have varied effects on beneficial users and land uses in the Subbasin.

Urban land uses and users. The depletion of surface water minimum threshold prevents lowering of shallow groundwater elevations adjacent to groundwater dependent ecosystems and certain parts of streams. This may limit the amount of urban pumping near these areas, which could limit urban growth in these areas and implementation of projects that extract groundwater from these shallow aquifers. Also, if pumping is limited, municipalities may have to obtain alternative sources of water to achieve urban growth goals. If this occurs, this may result in higher water costs for municipal water users.

Domestic land uses and users. The depletion of surface water minimum threshold may benefit existing domestic land users and uses by maintaining shallow groundwater elevations near streams and groundwater dependent ecosystems protecting the operability of relatively shallow domestic wells. However, these minimum thresholds may limit the number of new domestic wells that can be installed near such areas to limit the additional drawdown from the new wells.

Agricultural land uses and users. The depletion of surface water minimum threshold prevents lowering of shallow groundwater elevations adjacent to certain parts of streams and groundwater dependent ecosystems. This has the effect of limiting the amount of groundwater pumping in these areas. Limiting the amount of groundwater pumping may limit the quantity and type of crops that can be grown in these adjacent to streams and rivers.

Ecological land uses and users. The depletion of surface water minimum thresholds likely benefits ecological uses and users by preventing further degradation of ecological impacts from

groundwater pumping. Additionally, by setting future groundwater levels at or above recent lows, there should be less impact to GDEs than has been seen to date. Therefore, GDEs are protected from future significant and unreasonable impacts due to low groundwater levels, regardless of the GDE location.

8.12.3.5 Relation to State, Federal, or Local Standards

The minimum thresholds are developed in accordance with NMFS streamflow requirements. There are no NMFS streamflow requirements and known water rights litigation and enforcement complaints for the non-Salinas River surface water bodies within the Monterey Subbasin.

8.12.3.6 Method for Quantitative Measurement of Minimum Threshold

Groundwater elevations measured in shallow wells adjacent to potentially interconnected surface water bodies will serve as the primary approach for monitoring depletion of surface water. The Monterey Subbasin Model will serve as the secondary approach for monitoring depletion of surface water when it becomes available. At a minimum, the model will be updated every 5 years and the amount of surface water depletion that occurred in the previous 5 years will be estimated.

As discussed in Chapter 7, one shallow groundwater well is included in the monitoring network within the Marina-Ord Area. In the event that future groundwater activities in the Subbasin or the adjacent 180/400-Foot Aquifer Subbasin may influence the condition of these vernal ponds, the GSAs will work with project proponents to install additional shallow groundwater monitoring well. New projects or management actions that could impact groundwater conditions near the coastal areas of the City of Marina will require associated permitting by the City of Marina, the County of Monterey, and the California Coastal Commission per land use restrictions discussed in Chapter 3.

No shallow groundwater wells are currently identified in the Corral de Tierra Area. As discussed in Chapter 7, SVBGSA will incorporate one existing shallow well along Toro Creek near the USGS gauge into the interconnected surface water monitoring network and will work with USGS to reactivate the stream gauge along Toro Creek during GSP implementation for conjunctive data collection.

8.12.4 Measurable Objectives

The measurable objective for depletion of interconnected surface water is the same as the minimum threshold.

8.12.4.1 Method for Setting Measurable Objectives

Depletion of interconnected surface water measurable objectives are set at conditions identified with the historical minimum shallow groundwater elevations between 1995 and 2015. Therefore, there is no need to set a measurable objective different than the minimum threshold.

Discussions with GSA staff and stakeholders suggested that stakeholders acknowledge El Toro Creek is the main stream that drains into the neighboring 180/400-Foot Aquifer Subbasin. The Corral de Tierra Area generally does not have large areas where interconnected surface water potentially occurs; however, further analyses and model results are needed to establish this relationship. Therefore, there is no need to set a measurable objective different than the minimum threshold.

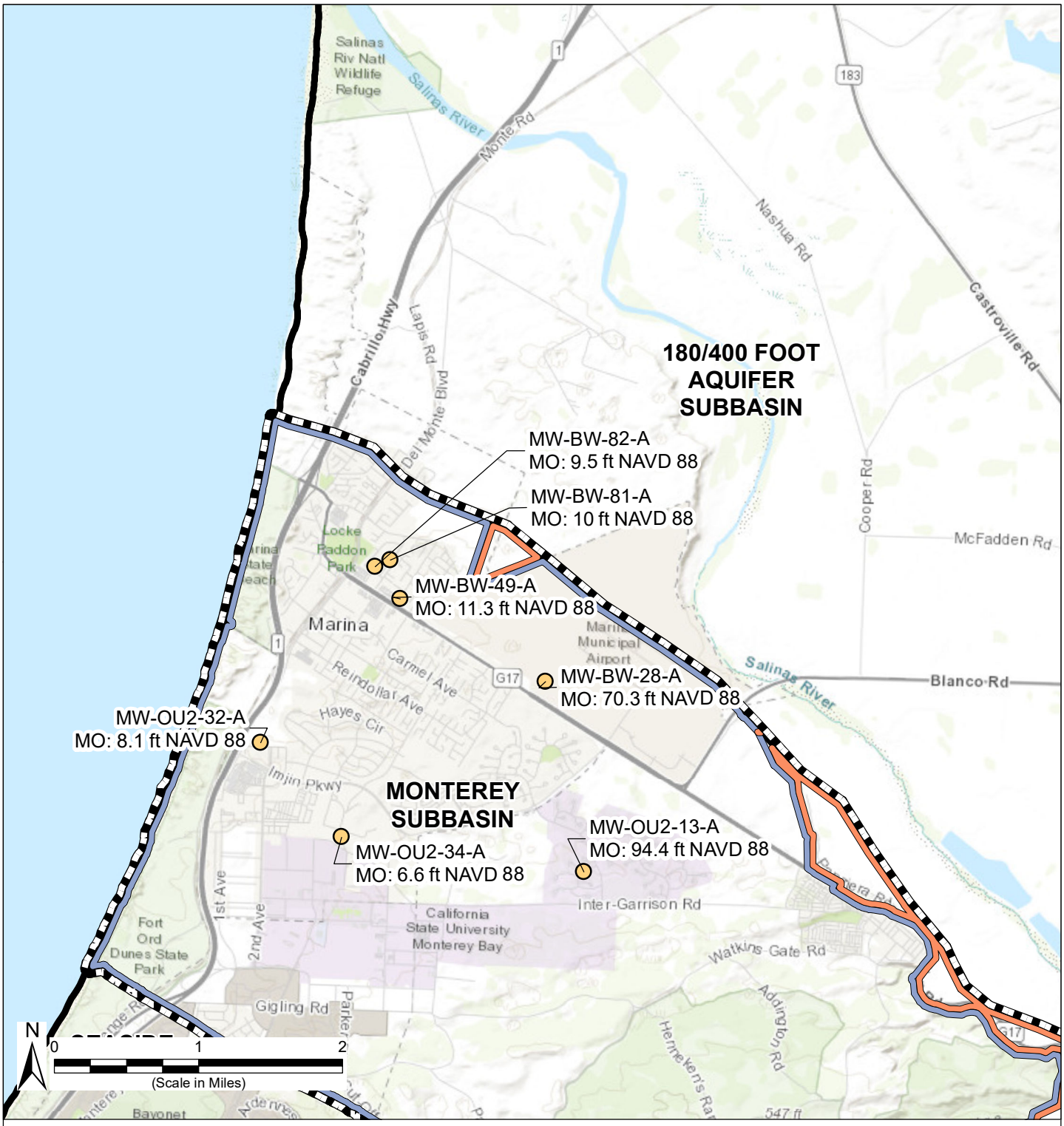
Salinas River flows are meant in part to intentionally recharge the groundwater basin. Therefore, there is no need to set a measurable objective different than the minimum threshold.

8.12.4.2 Interim Milestones

Depletion of interconnected surface water minimum thresholds and measurable objectives are set at conditions identified with the historical minimum shallow groundwater elevations between 1995 and 2015; there is no anticipated increase or decrease in surface water depletion during GSP implementation. The expected interim milestones are identical to the minimum threshold and measurable objectives shown on Figure 8-16. Figure 8-16 shows the identified historical minimum shallow groundwater elevations observed between 1995 and 2015.

Appendix 8A

Groundwater Elevation SMCs



Legend

- Monterey Subbasin
- Other Groundwater Subbasins within Salinas Valley Basin
- Representative Monitoring Sites for Groundwater Elevations

Management Areas

- Marina-Ord Area
- Corral de Tierra

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 30 April 2021.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.

Abbreviations

MO = Measurable Objectives

Notes

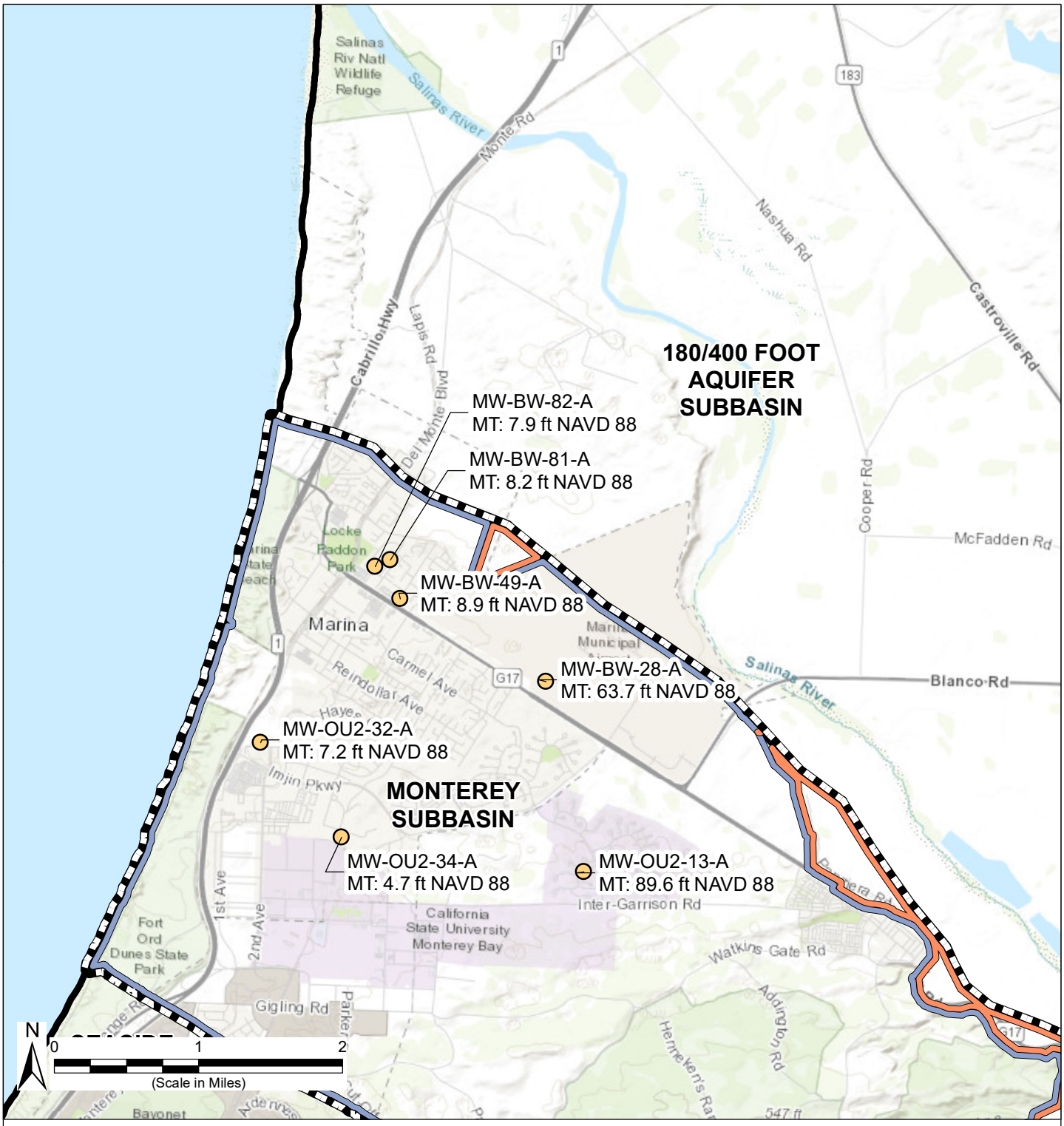
1. All locations are approximate.

Groundwater Elevation Measurable Objectives Dune Sand Aquifer

Monterey Subbasin
Groundwater Sustainability Plan
April 2021

Figure 8A-1

Path: X:\B60094\Maps\2021\04\Fig8B-1_DuneSand_MO.mxd



Legend

- Monterey Subbasin
- Other Groundwater Subbasins within Salinas Valley Basin
- Representative Monitoring Sites for Groundwater Elevations

Management Areas

- Marina-Ord Area
- Corral de Tierra

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 30 April 2021.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.

Abbreviations

MT = Minimum Thresholds

Notes

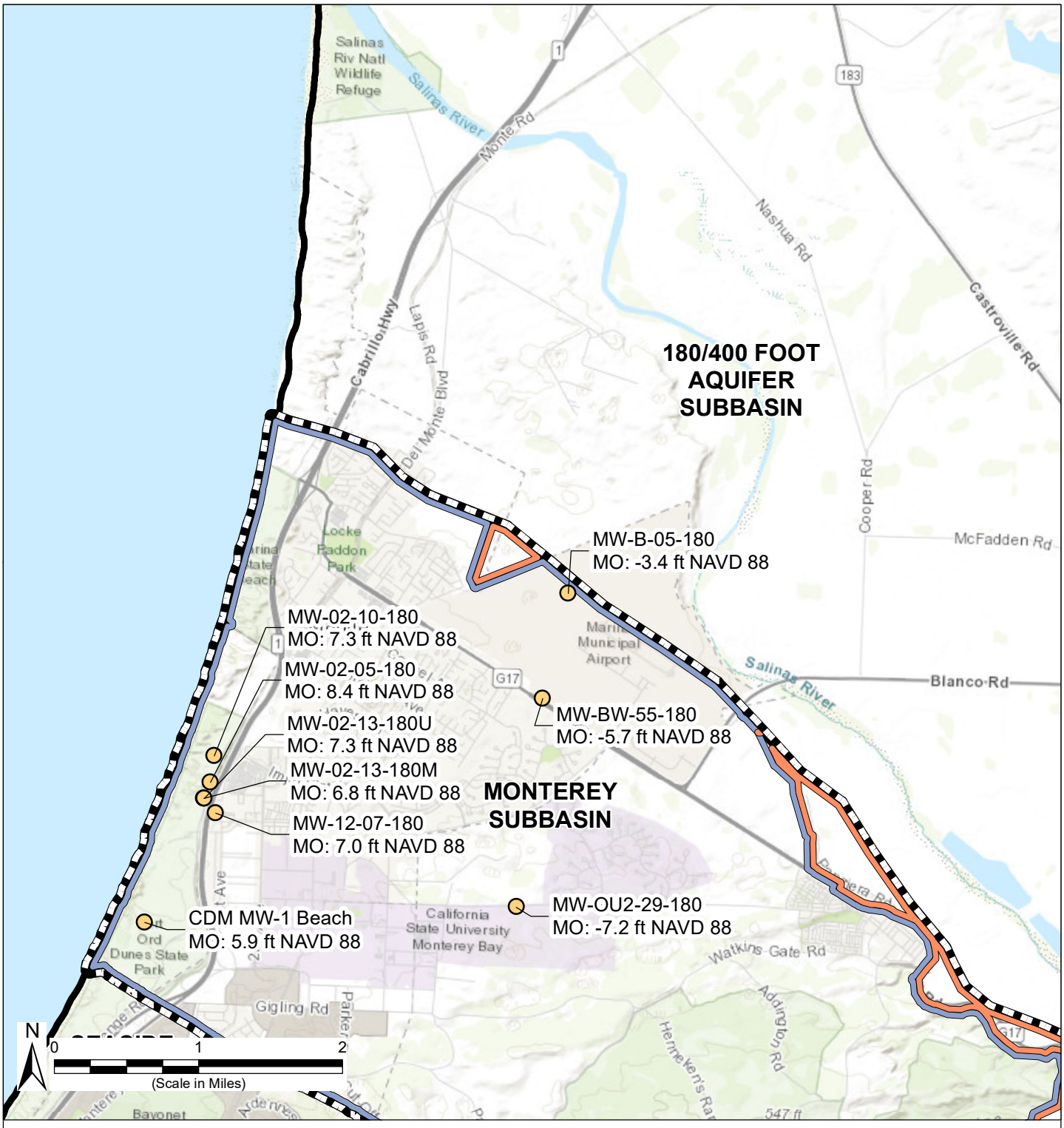
1. All locations are approximate.

Groundwater Elevation Minimum Thresholds Dune Sand Aquifer

Monterey Subbasin
Groundwater Sustainability Plan
April 2021

Figure 8A-2

Path: X:\B60094\Maps\2021\04\Fig8B-2_DuneSand_MT.mxd



Legend

- Monterey Subbasin
- Other Groundwater Subbasins within Salinas Valley Basin
- Representative Monitoring Sites for Groundwater Elevations

Management Areas

- Marina-Ord Area
- Corral de Tierra Area

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 30 April 2021.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.

Abbreviations

MO = Measurable Objectives

Notes

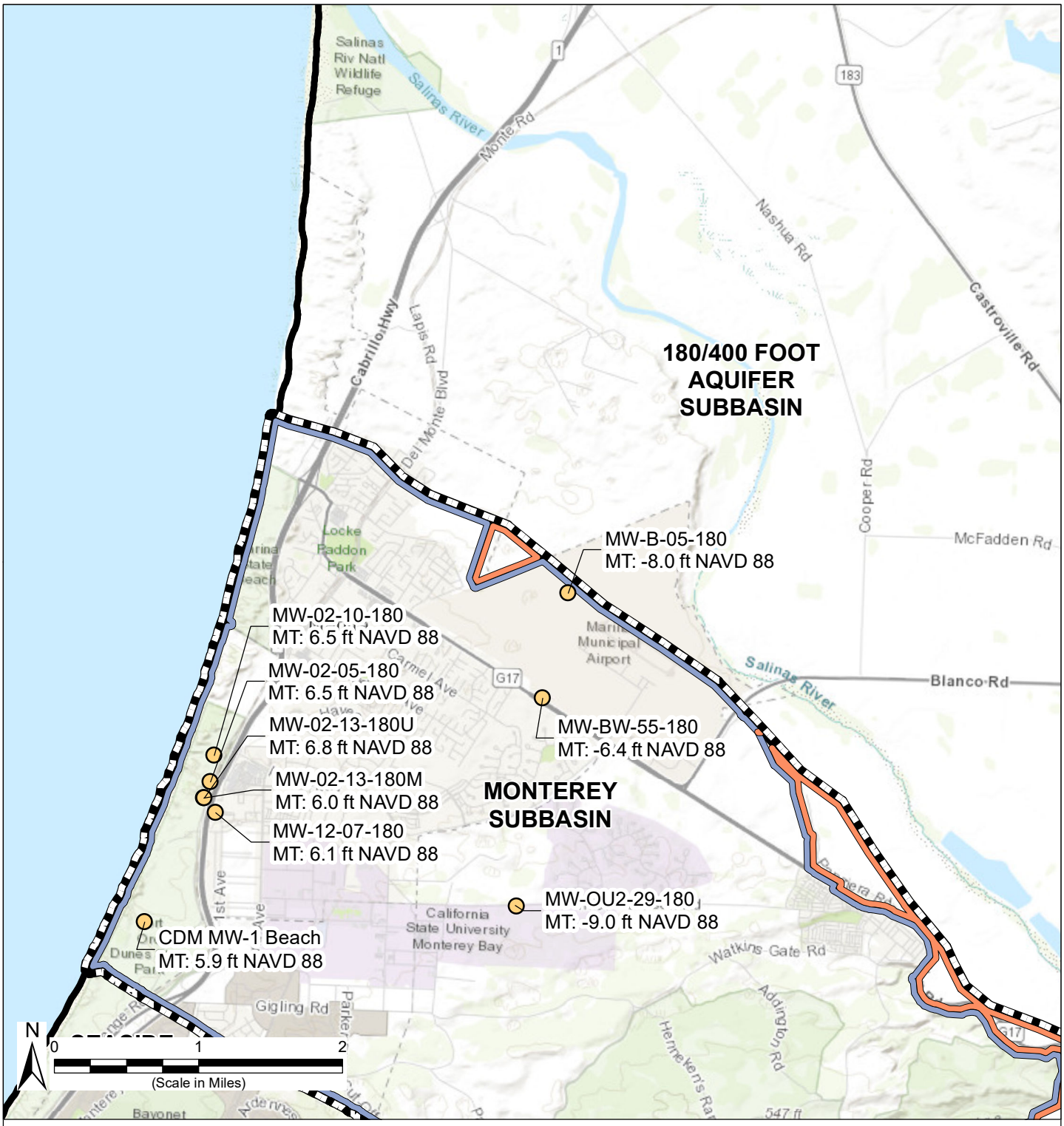
1. All locations are approximate.

Groundwater Elevation Measurable Objectives Upper 180-Foot Aquifer

Monterey Subbasin
Groundwater Sustainability Plan
April 2021

Figure 8A-3

Path: X:\B60094\Maps\2021\04\Fig8B-3_Upper180-ft_MO.mxd



Legend

- Monterey Subbasin
- Other Groundwater Subbasins within Salinas Valley Basin
- Representative Monitoring Sites for Groundwater Elevations

Management Areas

- Marina-Ord Area
- Corral de Tierra

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 30 April 2021.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.

Abbreviations

MT = Minimum Thresholds

Notes

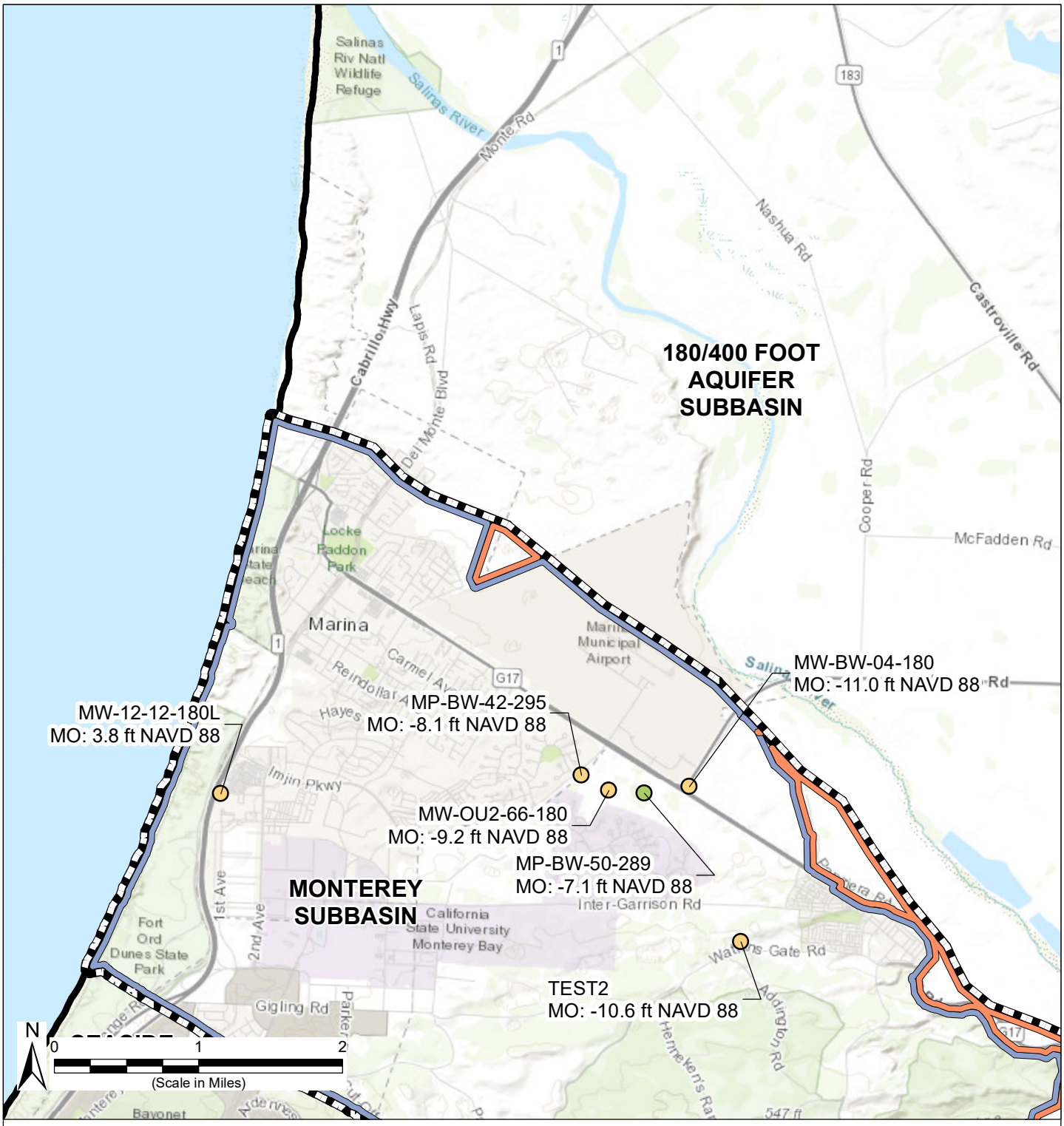
1. All locations are approximate.

Groundwater Elevation Minimum Thresholds Upper 180-Foot Aquifer

Monterey Subbasin
Groundwater Sustainability Plan
April 2021

Figure 8A-4

Path: X:\B60094\Maps\2021\04\Fig8B-4_Upper180-ft_MT.mxd



Legend

- Monterey Subbasin
- Other Groundwater Subbasins within Salinas Valley Basin

Representative Monitoring Sites for Groundwater Elevations

- Lower 180-Foot Aquifer
- Lower 180-Foot, 400-Foot Aquifer

Management Areas

- Marina-Ord Area
- Corral de Tierra Area

Abbreviations

MO = Measurable Objectives

Notes

1. All locations are approximate.

Sources

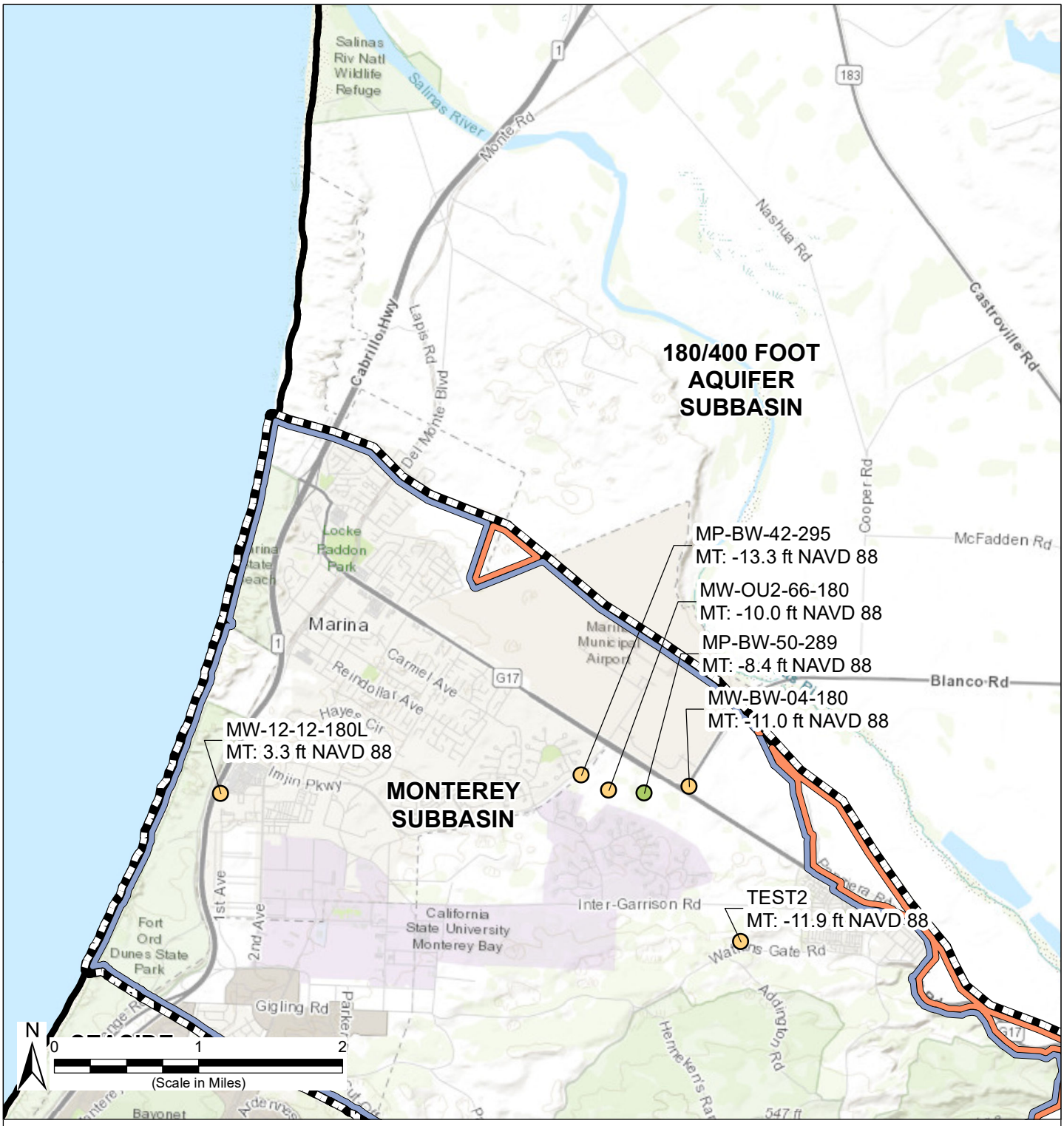
1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 30 April 2021.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.

Groundwater Elevation Measurable Objectives Lower 180-Foot Aquifer

Monterey Subbasin
Groundwater Sustainability Plan
April 2021

Figure 8A-5

Path: X:\B60094\Maps\2021\04\Fig8B-5_Lower180-ft_MO.mxd



Legend

- Monterey Subbasin
- Other Groundwater Subbasins within Salinas Valley Basin

Representative Monitoring Sites for Groundwater Elevations

- Lower 180-Foot
- Lower 180-Foot, 400-Foot

Management Areas

- Marina-Ord
- Corral de Tierra

Abbreviations

MT = Minimum Thresholds

Notes

1. All locations are approximate.

Sources

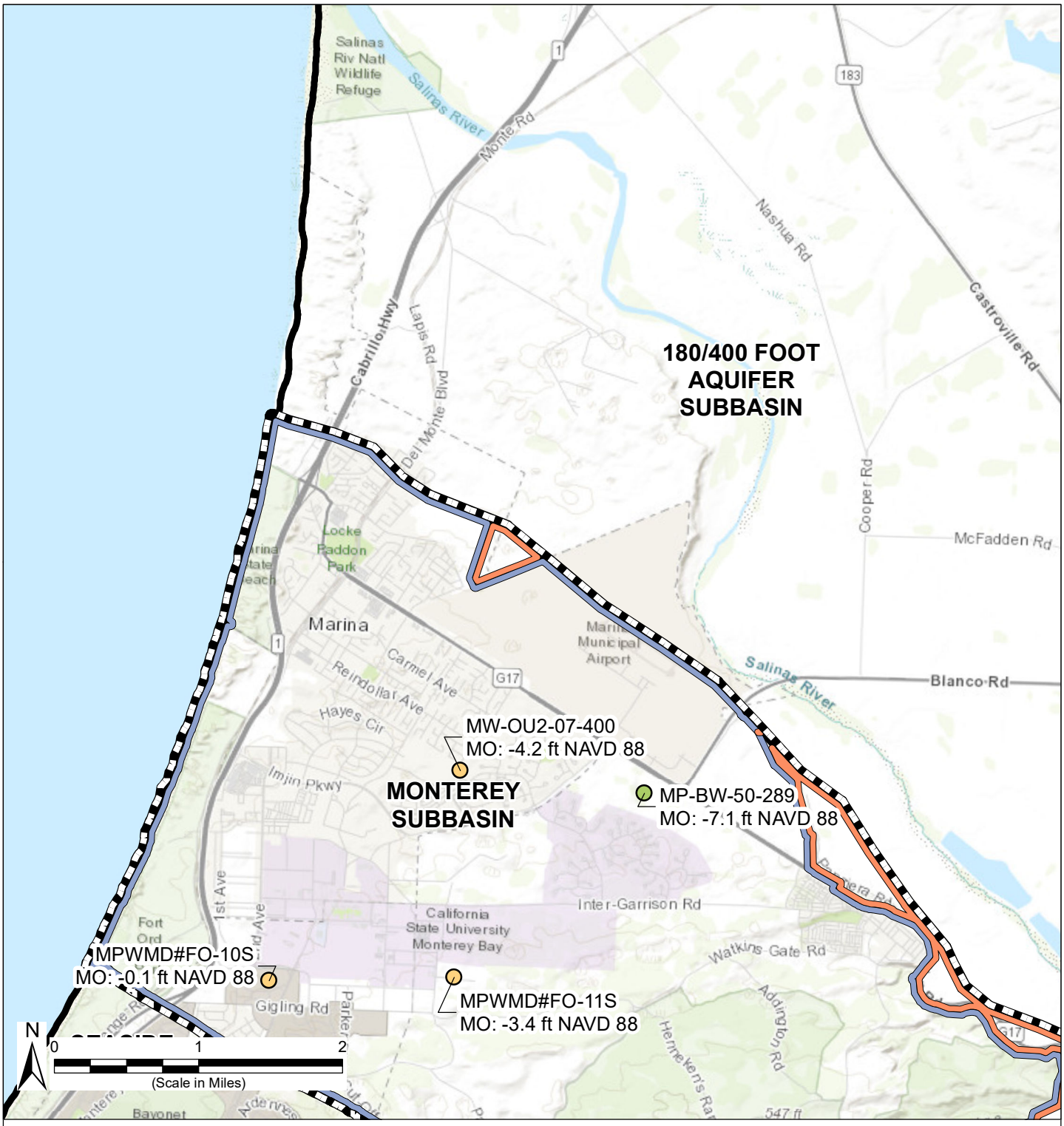
1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 30 April 2021.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.

Groundwater Elevation Minimum Thresholds Lower 180-Foot Aquifer

Monterey Subbasin
Groundwater Sustainability Plan
April 2021

Figure 8A-6

Path: X:\B60094\Maps\2021\04\Fig8B-6_Lower180-ft_MT.mxd



Legend

- Monterey Subbasin
- Other Groundwater Subbasins within Salinas Valley Basin

Management Areas

- Marina-Ord
- Corral de Tierra

Representative Monitoring Sites for Groundwater Elevations

- 400-Foot Aquifer (Paso Robles Aquifer)
- Lower 180-Foot, 400-Foot

Abbreviations

MO = Measurable Objectives

Notes

1. All locations are approximate.

Sources

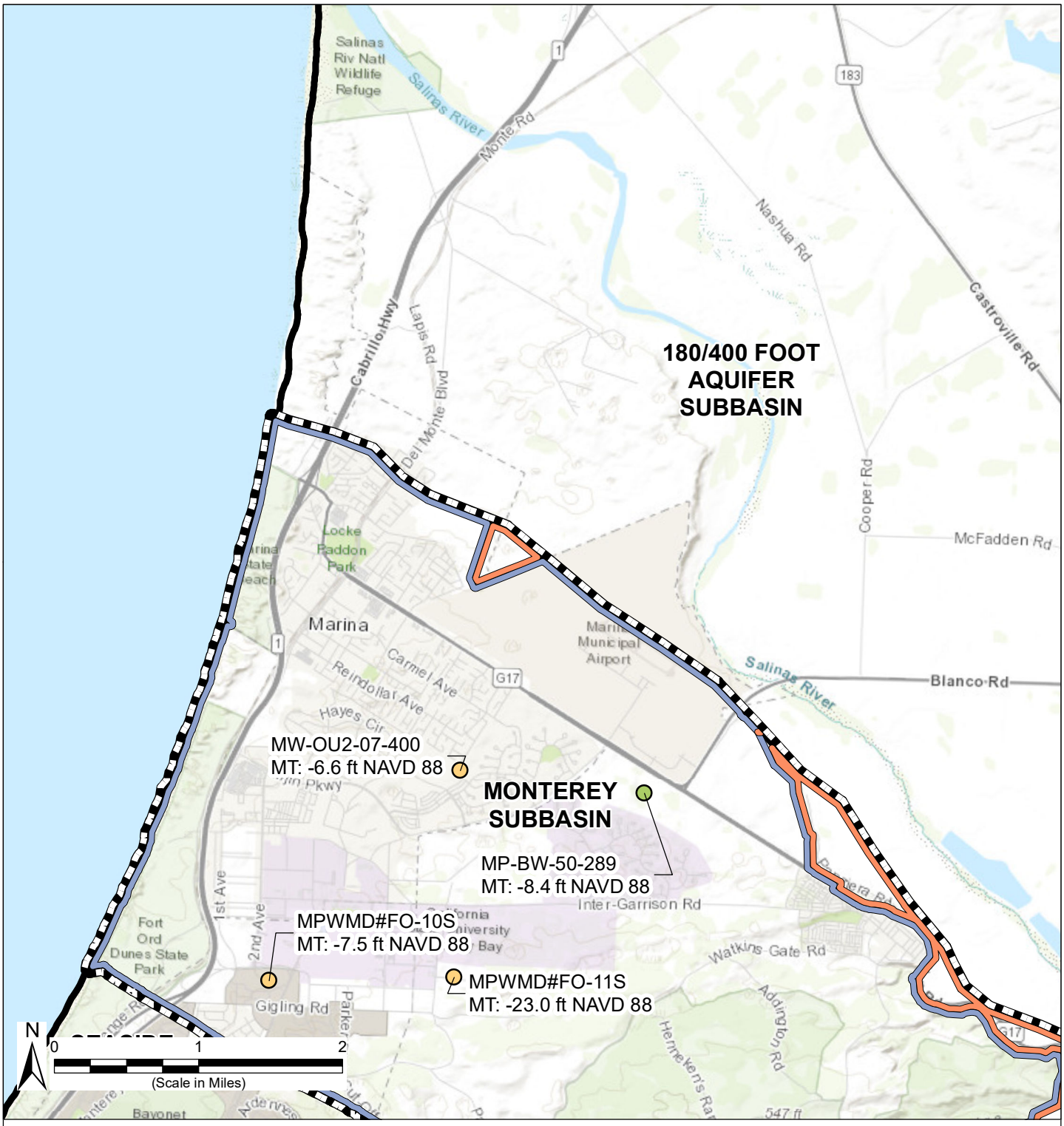
1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 30 April 2021.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.

Groundwater Elevation Measurable Objectives 400-Foot Aquifer

Monterey Subbasin
Groundwater Sustainability Plan
April 2021

Figure 8A-7

Path: X:\B60094\Maps\2021\04\Fig8B-7_400-ft_MO.mxd



Legend

- Monterey Subbasin
- Other Groundwater Subbasins within Salinas Valley Basin

Representative Monitoring Sites for Groundwater Elevations

- 400-Foot Aquifer (Paso Robles Aquifer)
- Lower 180-Foot, 400-Foot

Management Areas

- Marina-Ord
- Corral de Tierra

Abbreviations

MT = Minimum Thresholds

Notes

1. All locations are approximate.

Sources

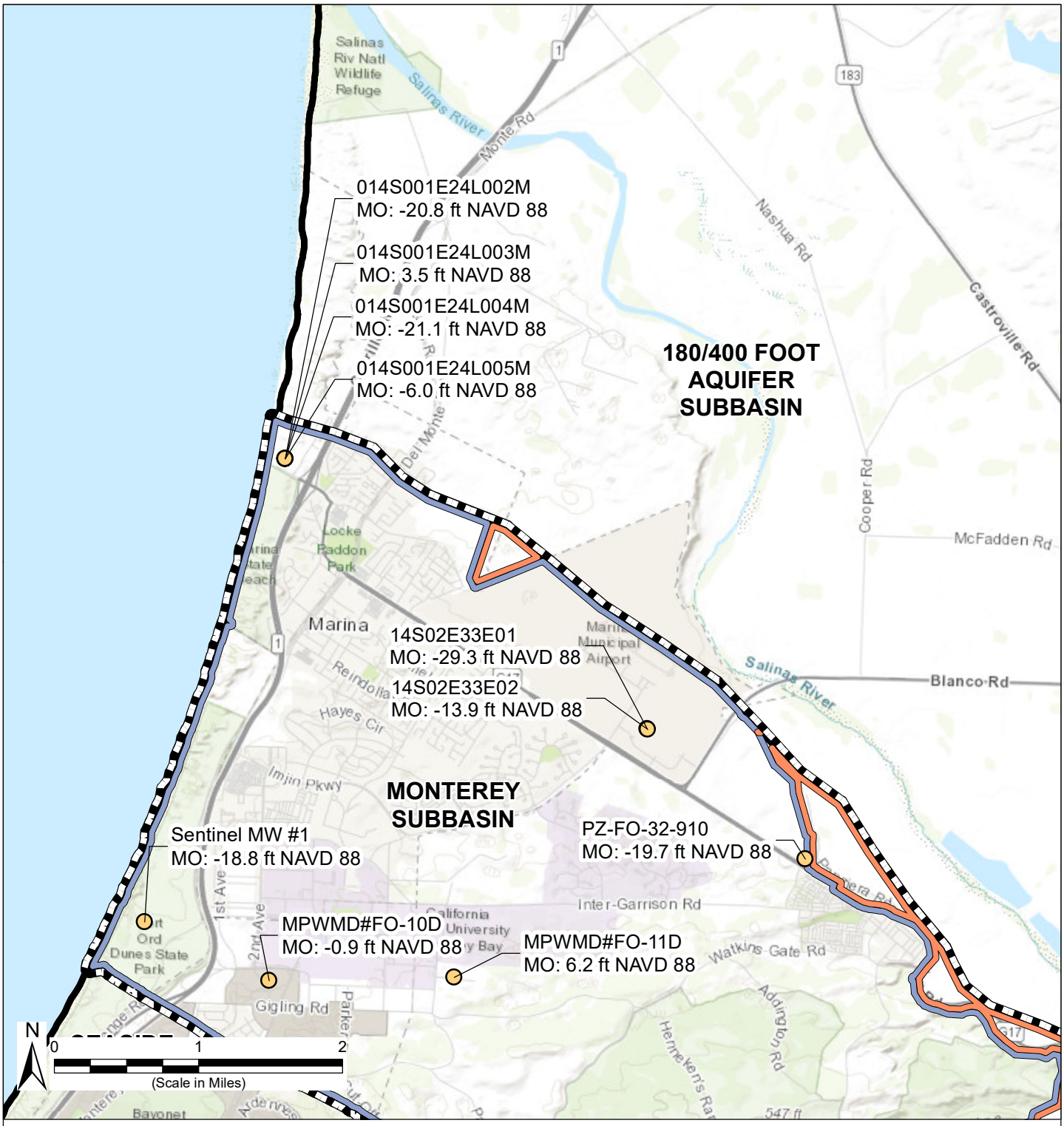
1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 30 April 2021.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.

Groundwater Elevation Minimum Thresholds 400-Foot Aquifer

Monterey Subbasin
Groundwater Sustainability Plan
April 2021

Figure 8A-8

Path: X:\B60094\Maps\2021\04\Fig8B-8_400-ft_MT.mxd



Legend

- Monterey Subbasin
- Other Groundwater Subbasins within Salinas Valley Basin
- Representative Monitoring Sites for Groundwater Elevations

Management Areas

- Marina-Ord Area
- Corral de Tierra

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 30 April 2021.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.

Abbreviations

MO = Measurable Objectives

Notes

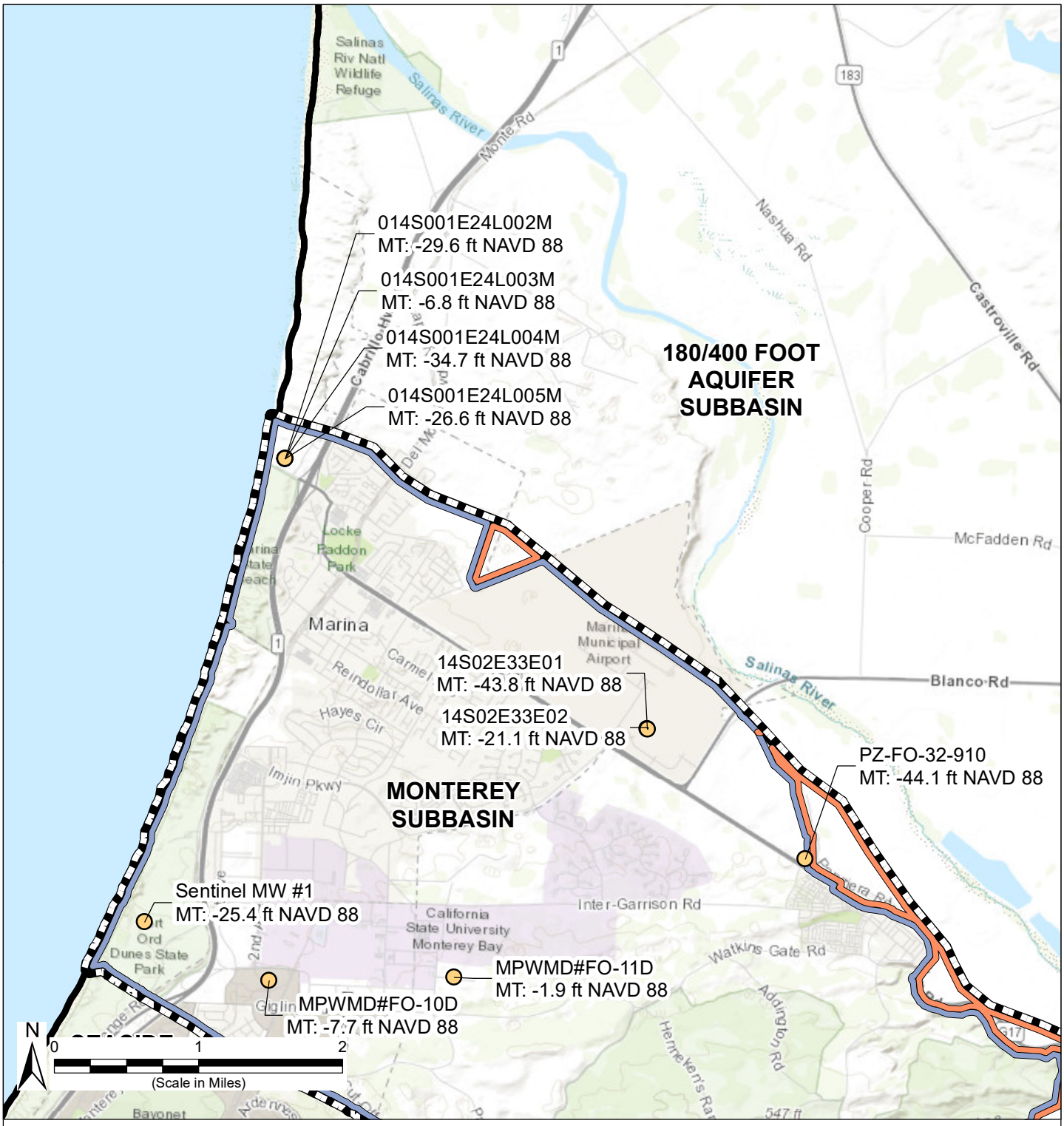
1. All locations are approximate.

Groundwater Elevation Measurable Objectives Deep Aquifers

Monterey Subbasin
Groundwater Sustainability Plan
April 2021

Figure 8A-9

Path: X:\B60094\Maps\2021\04\Fig8B-9_Deep_MO.mxd



Legend

- Monterey Subbasin
- Other Groundwater Subbasins within Salinas Valley Basin
- Representative Monitoring Sites for Groundwater Elevations

Management

- Marina-Ord
- Corral de Tierra

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 30 April 2021.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.

Abbreviations

MT = Minimum Thresholds

Notes

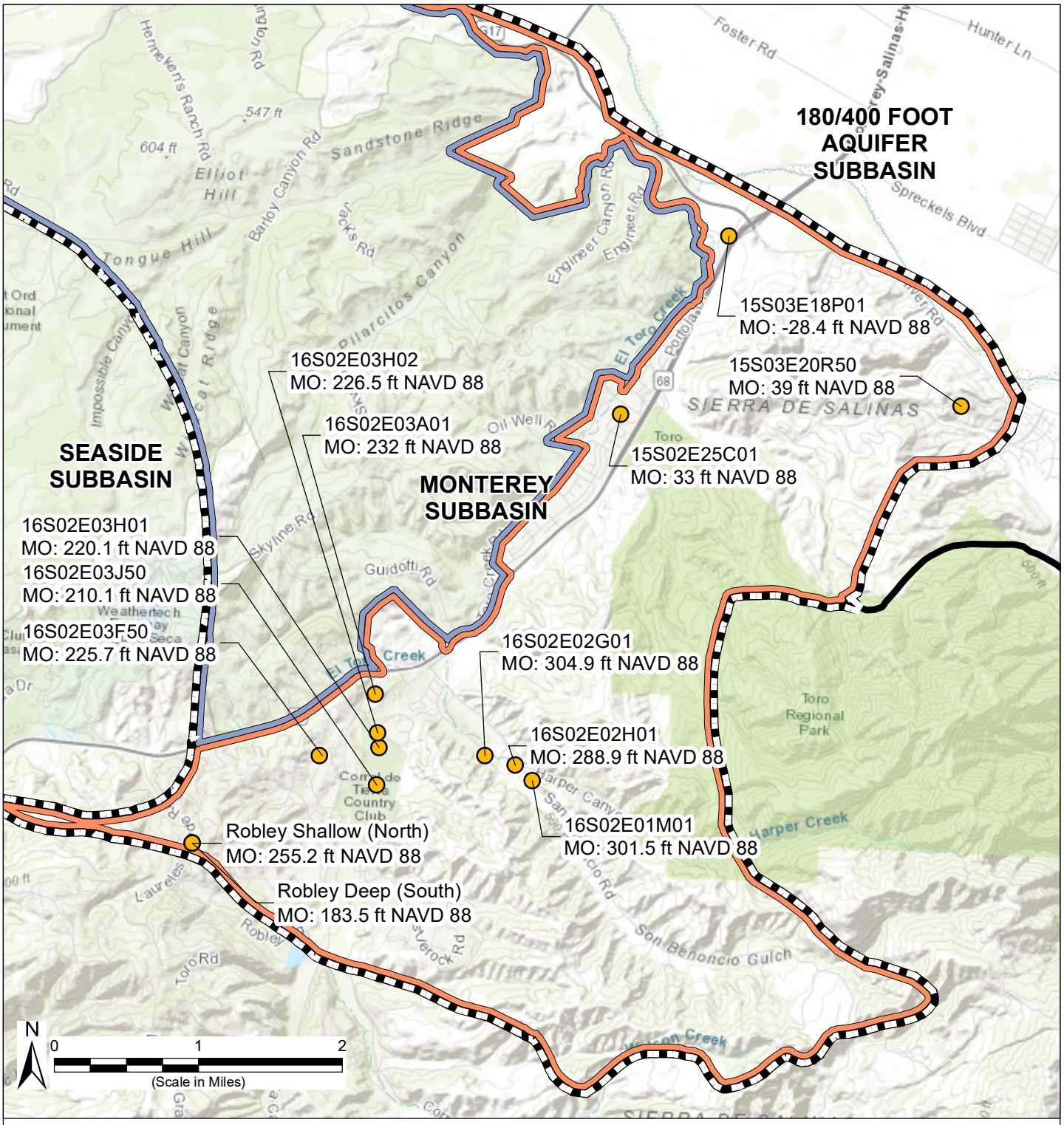
1. All locations are approximate.

Groundwater Elevation Minimum Thresholds Deep Aquifers

Monterey Subbasin
Groundwater Sustainability Plan
April 2021

Figure 8A-10

Path: X:\B60094\Maps\2021\04\Fig8B-10_Deep_MT.mxd



Legend

- Monterey Subbasin
- Other Groundwater Subbasins within Salinas Valley Basin
- Representative Monitoring Sites for Groundwater Elevations

Management Areas

- Marina-Ord Area
- Corral de Tierra Area

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 24 June 2021.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.

Abbreviations

MO = Measurable Objectives

Notes

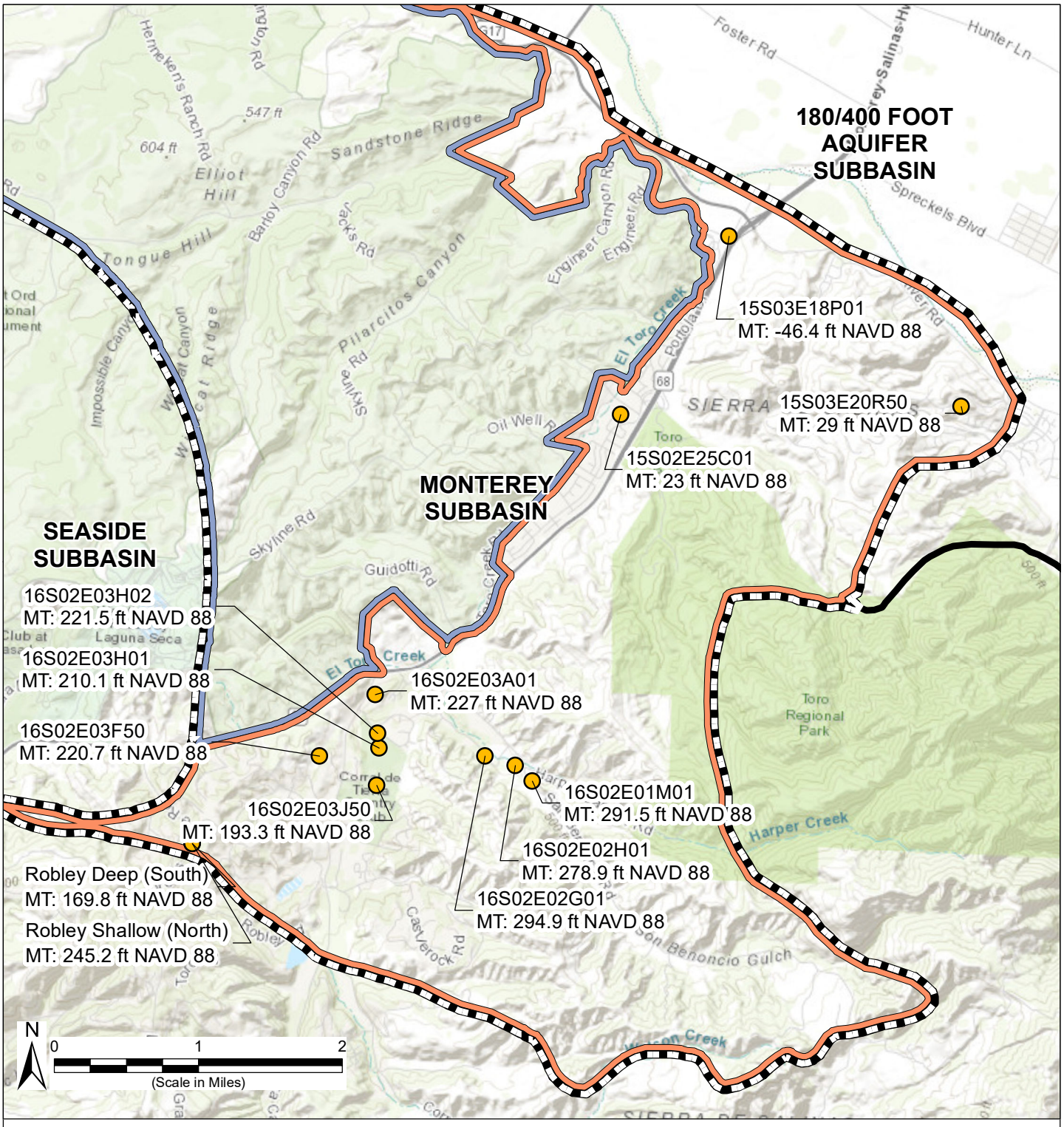
1. All locations are approximate.

Groundwater Elevation Measurable Objectives El Toro Primary Aquifer

Monterey Subbasin
Groundwater Sustainability Plan
June 2021

Figure 8A-11

Path: X:\B60094\Maps\2021\06\Fig8B-11_El_Toro_MO.mxd



Legend

- Monterey Subbasin
- Other Groundwater Subbasins within Salinas Valley Basin
- Representative Monitoring Sites for Groundwater Elevations

Management Areas

- Marina-Ord Area
- Corral de Tierra Area

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 24 June 2021.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.

Abbreviations

MT = Minimum Thresholds

Notes

1. All locations are approximate.

Groundwater Elevation Minimum Thresholds El Toro Primary Aquifer

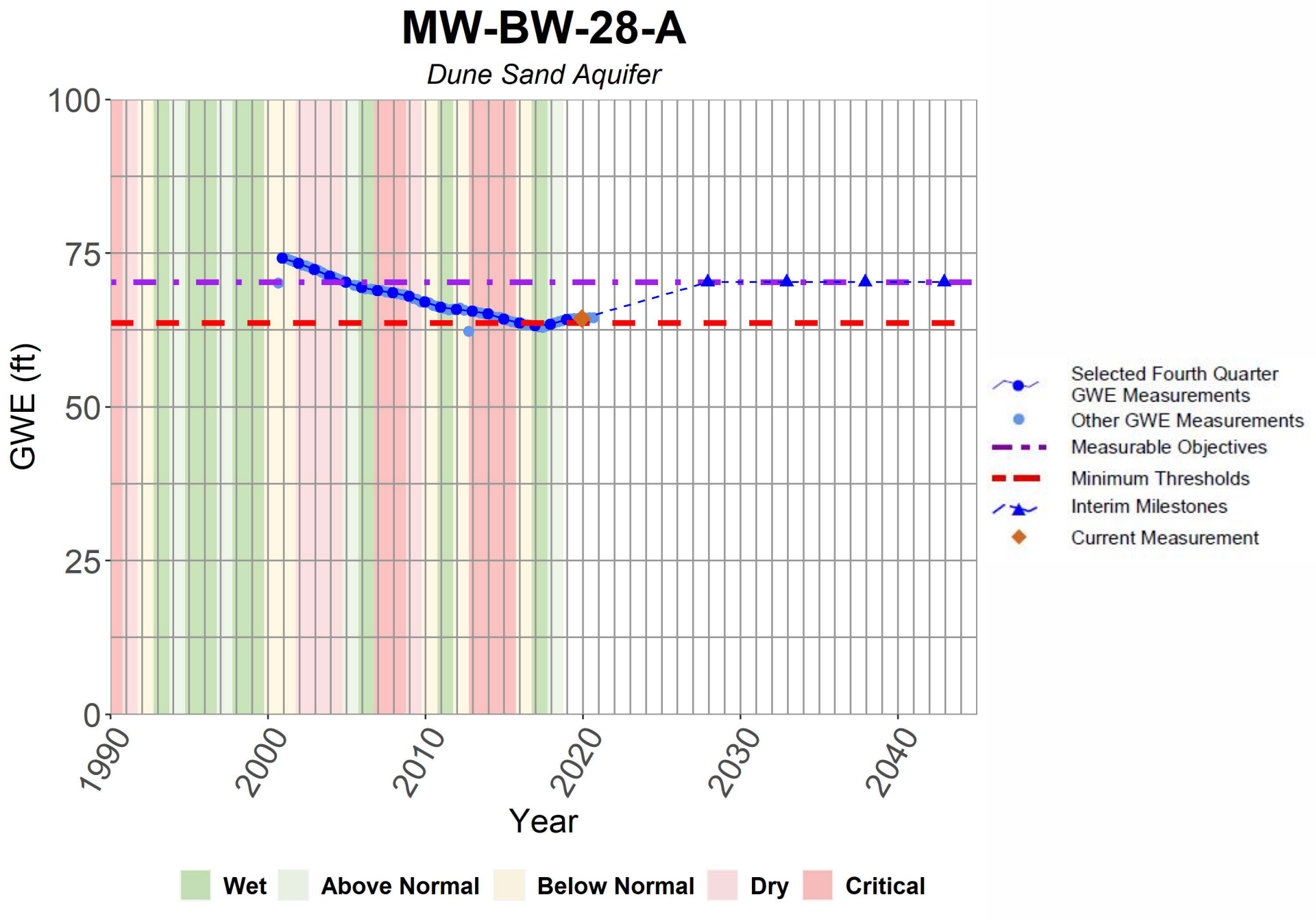
Monterey Subbasin
Groundwater Sustainability Plan
June 2021

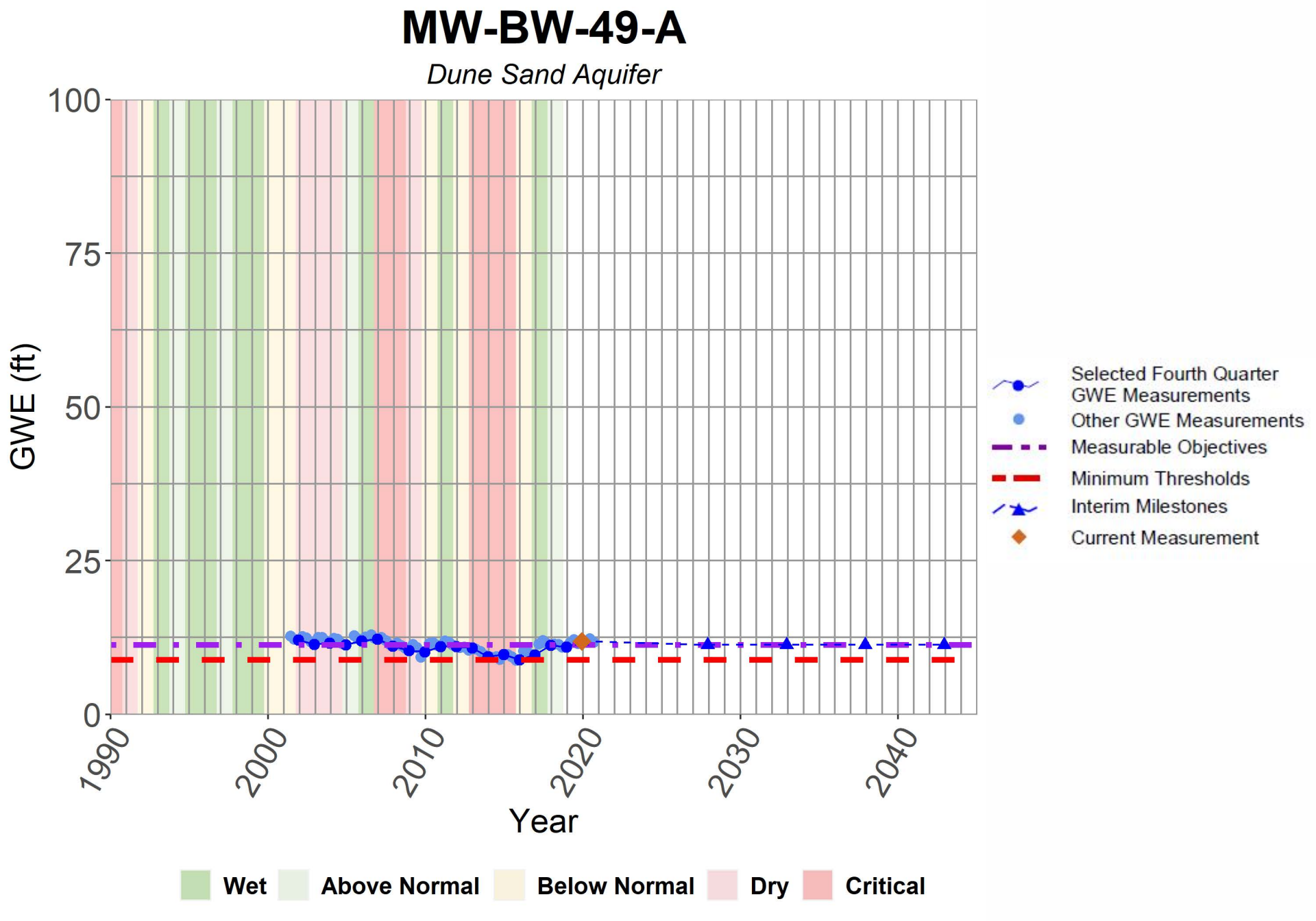
Figure 8A-12

Path: X:\B60094\Maps\2021\06\Fig8B-12_El_Toro_MT.mxd

Appendix 8B

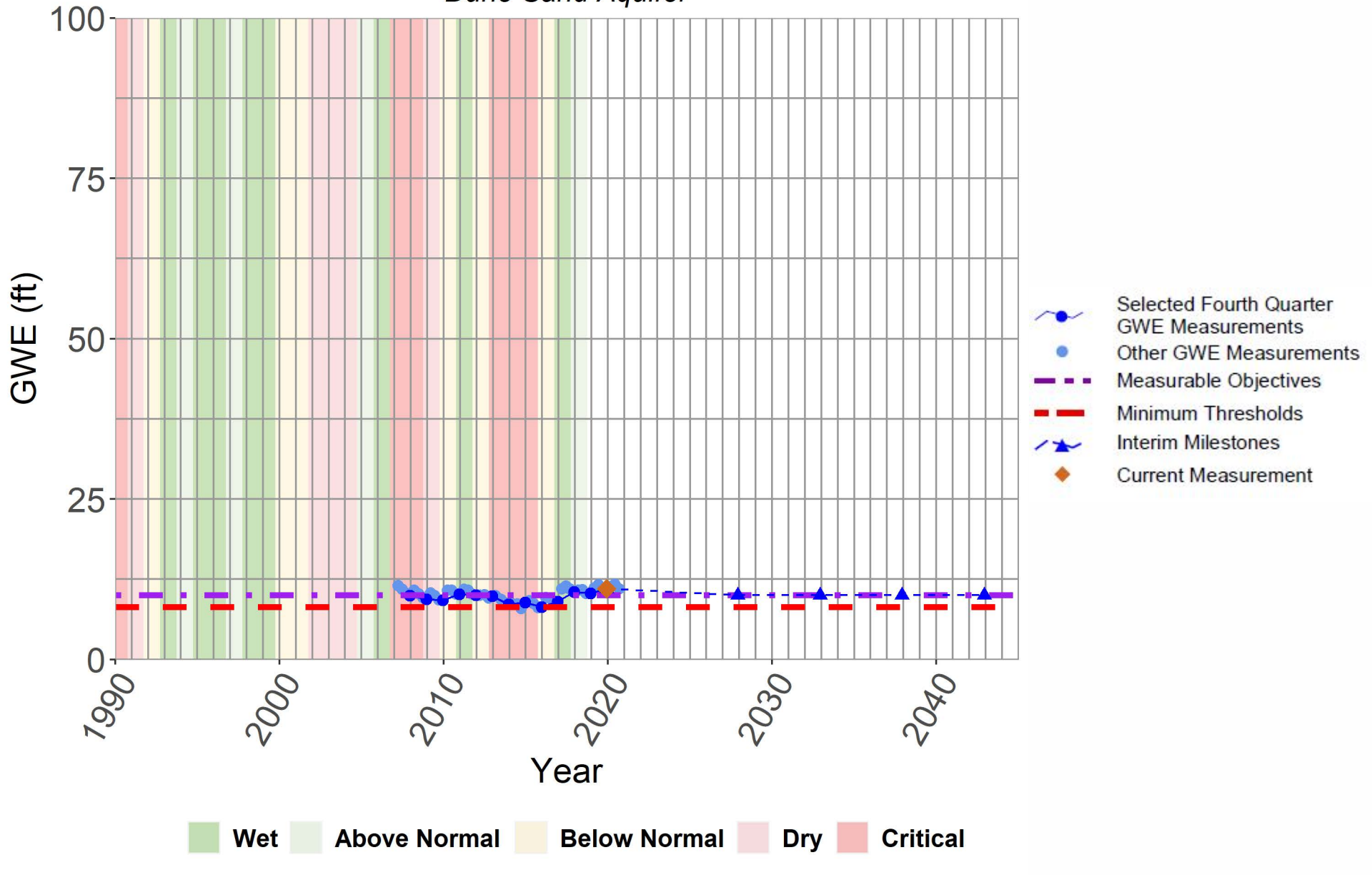
Groundwater Elevation Interim Milestones


MW-BW-28-A
Dune Sand Aquifer
GWE (ft)
100
75
50
25
0
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical


MW-BW-49-A
Dune Sand Aquifer
GWE (ft)
100
75
50
25
0
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

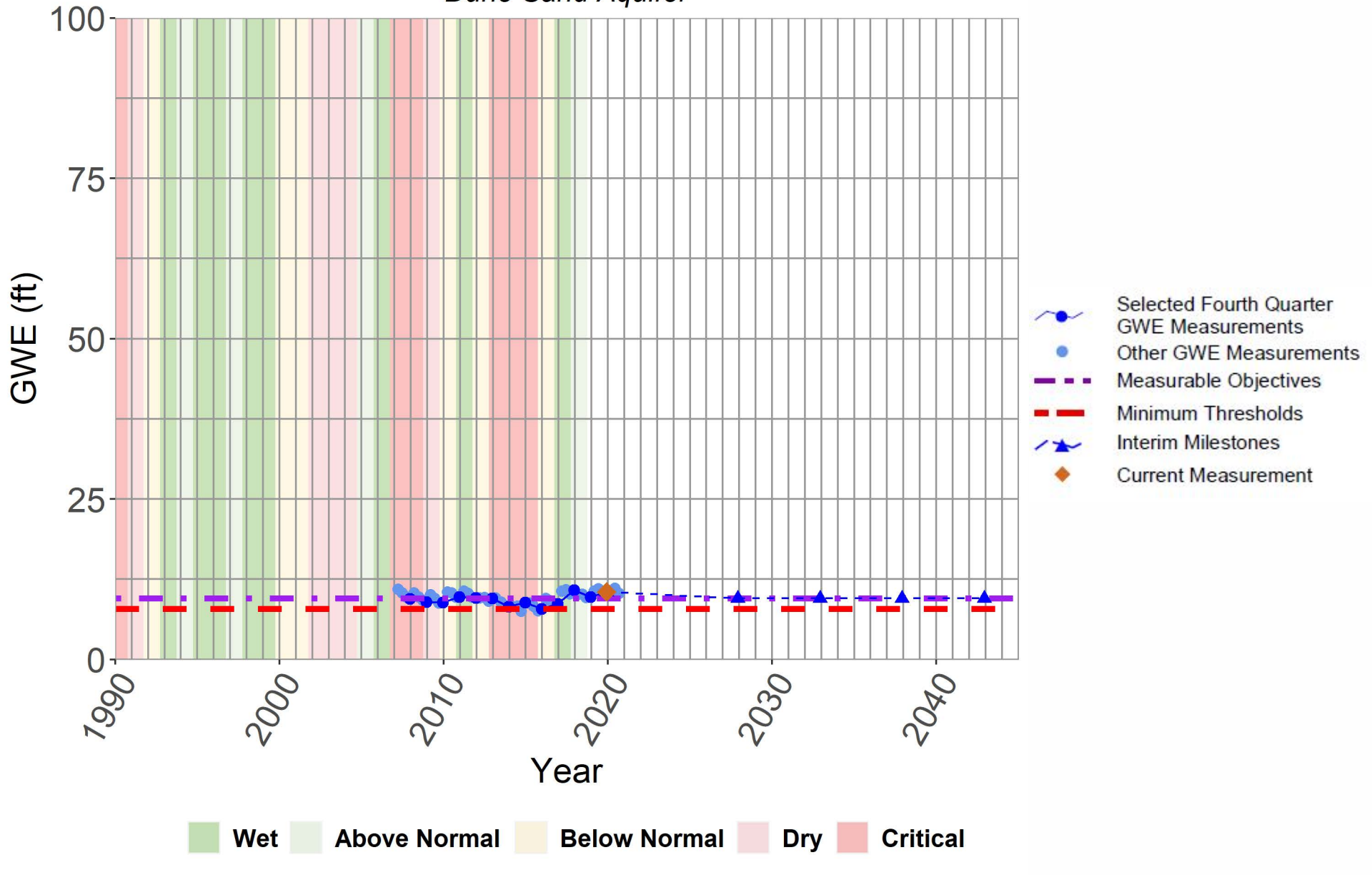
MW-BW-81-A

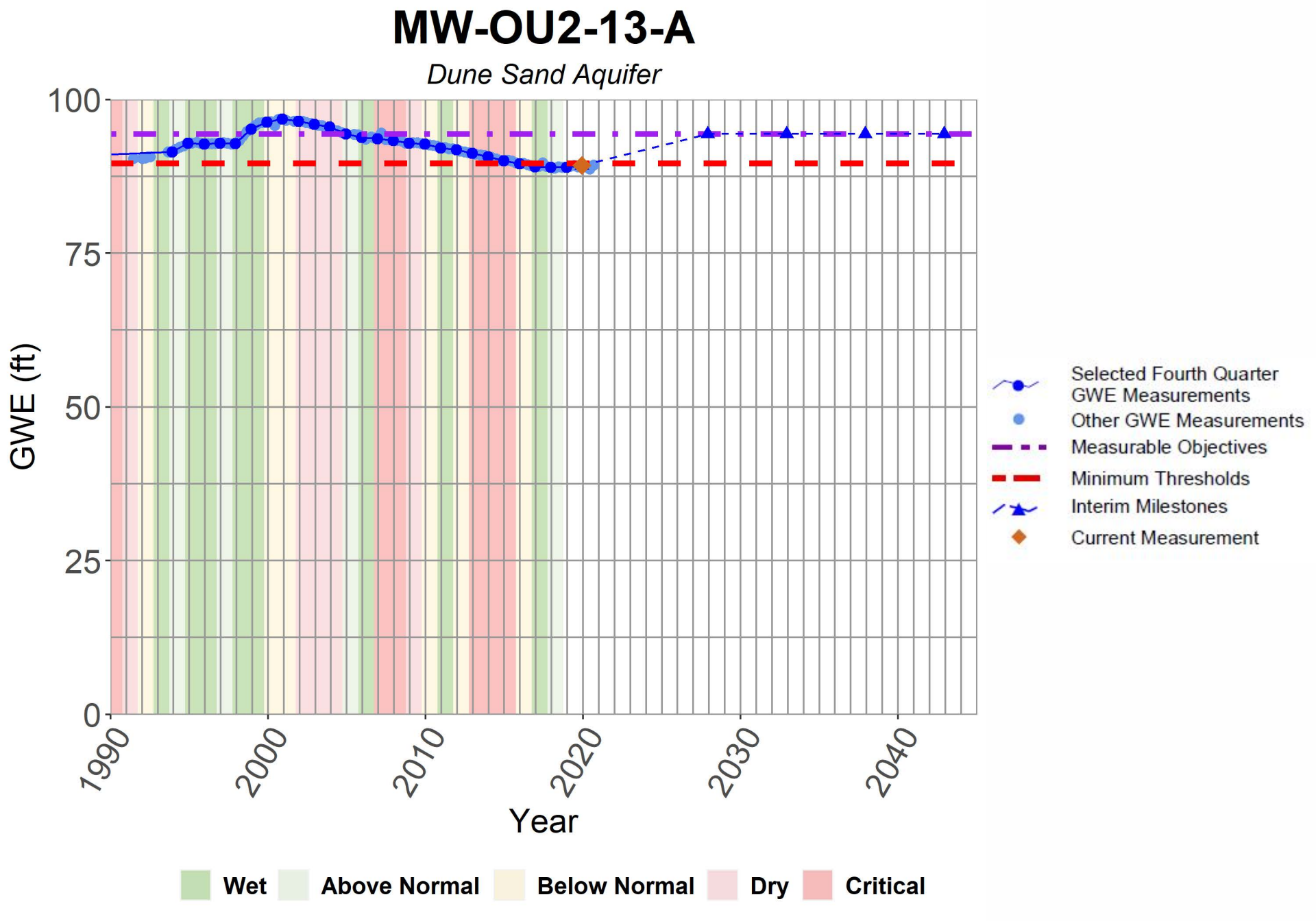
Dune Sand Aquifer

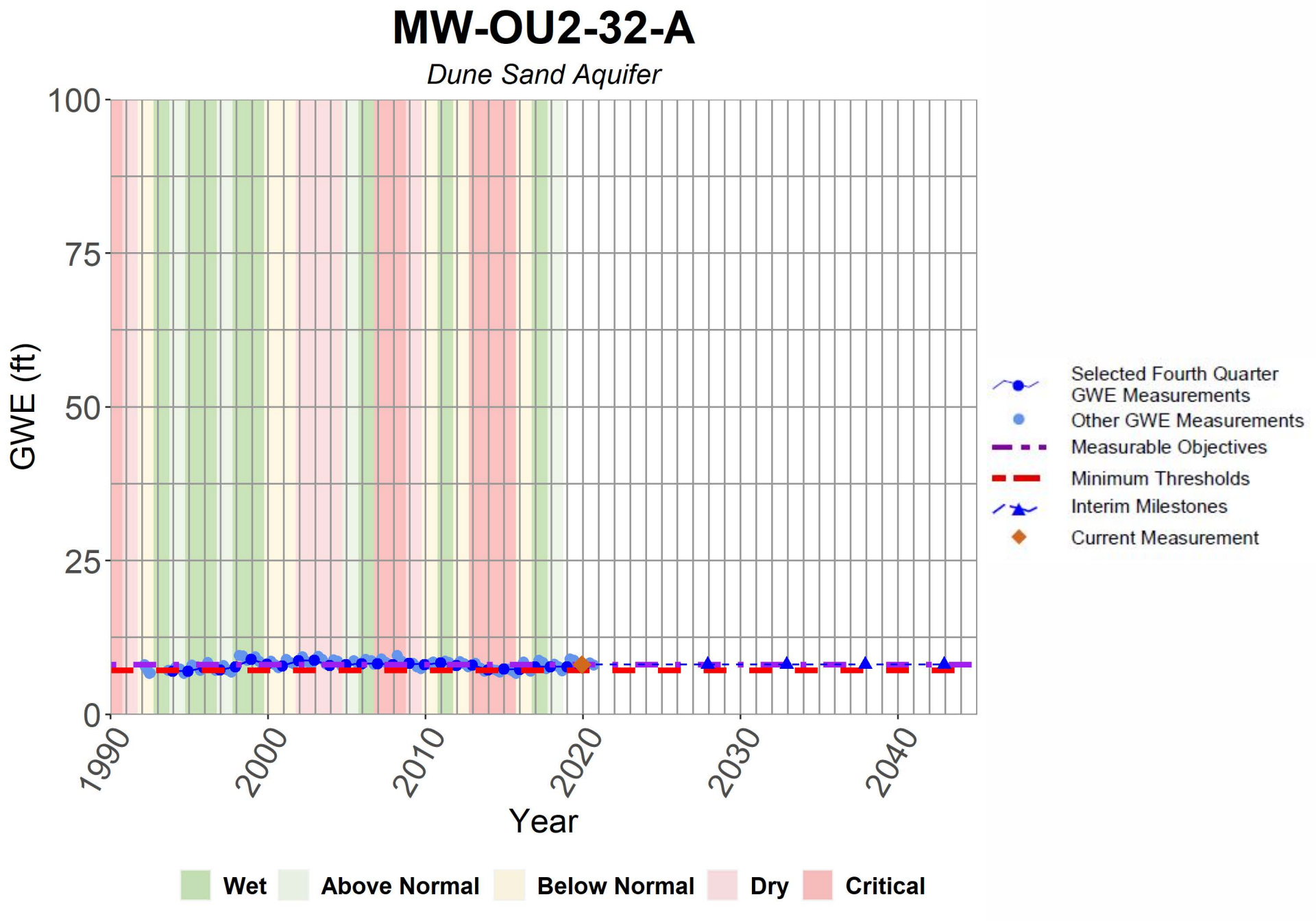


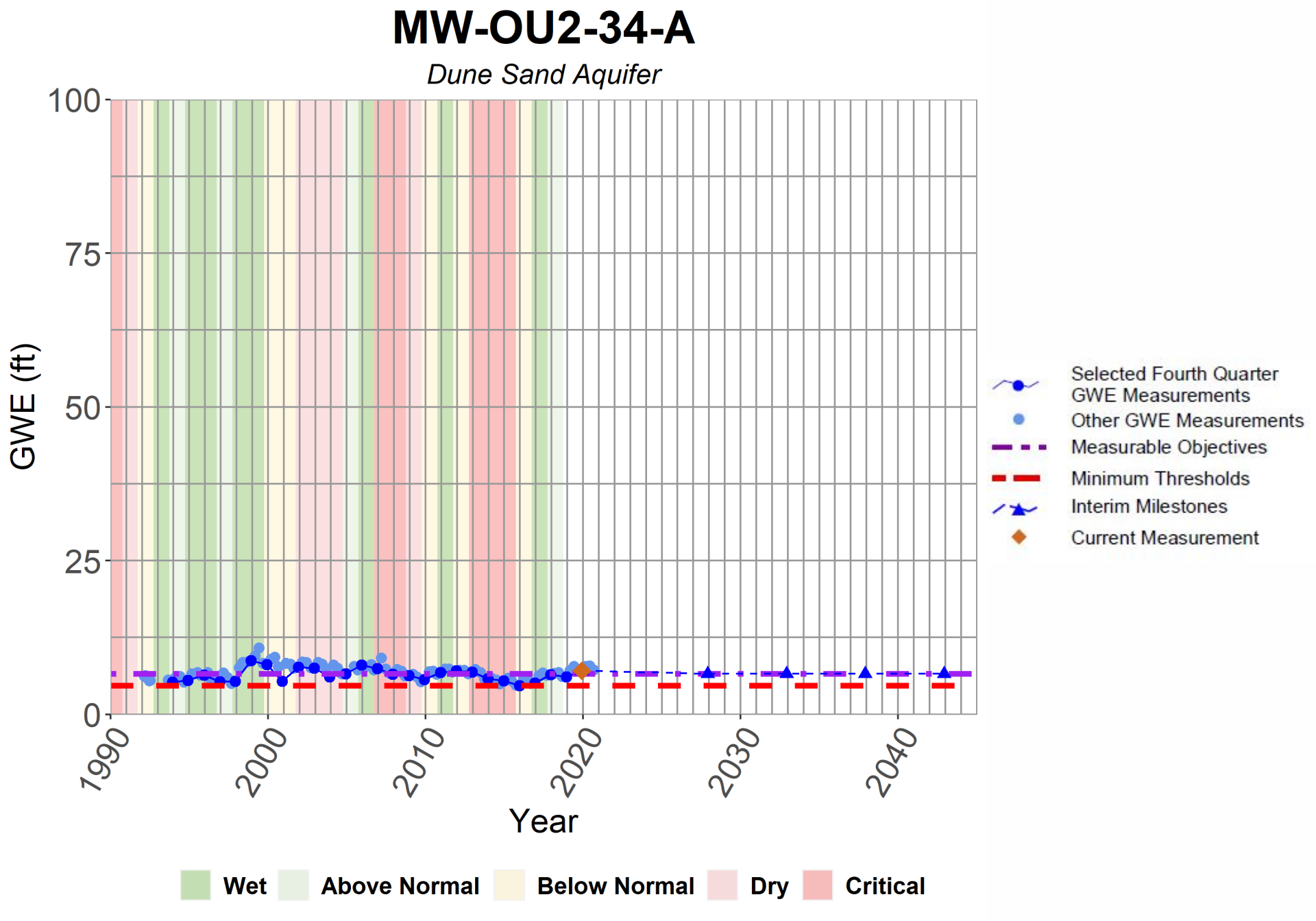
MW-BW-82-A

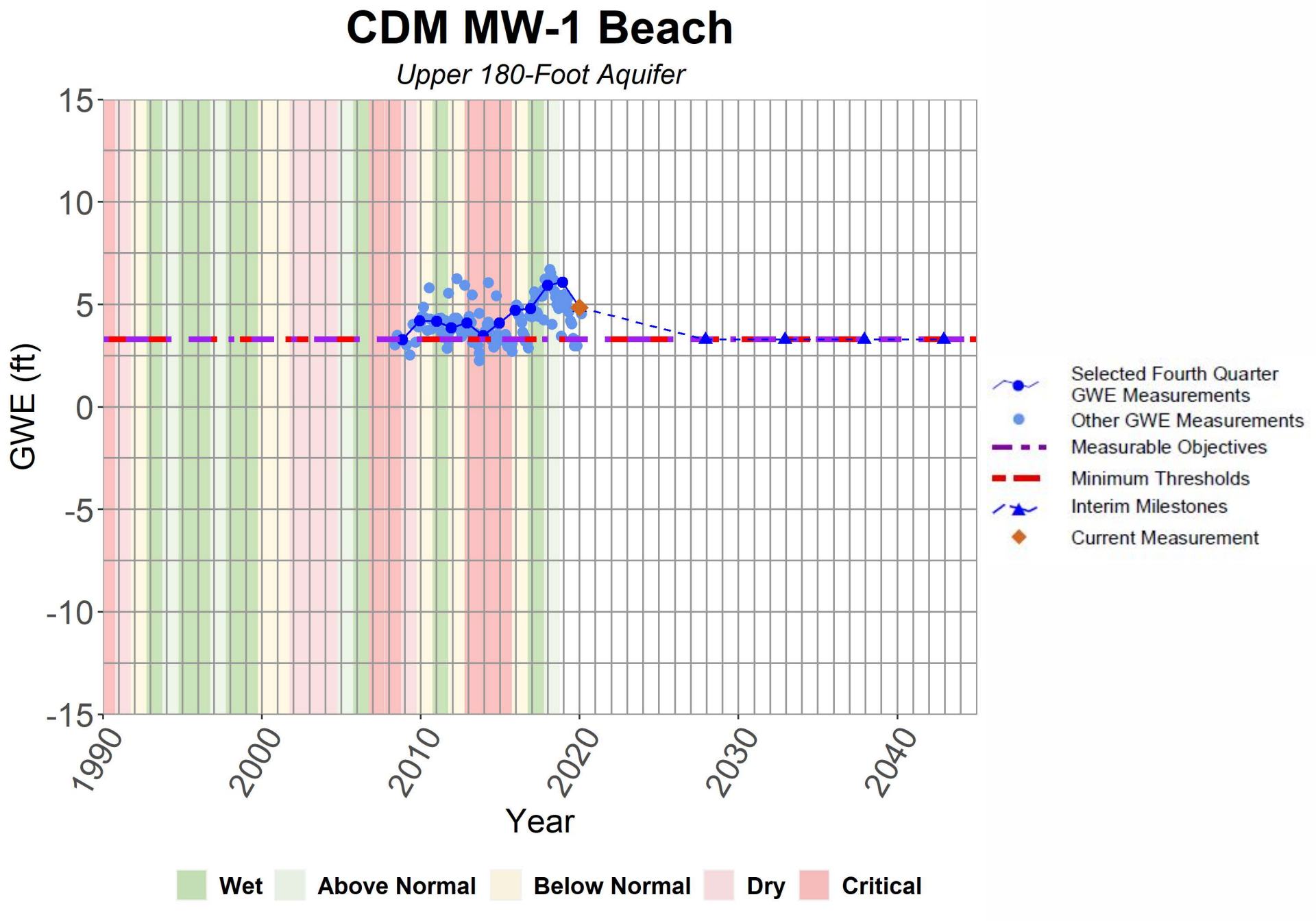
Dune Sand Aquifer

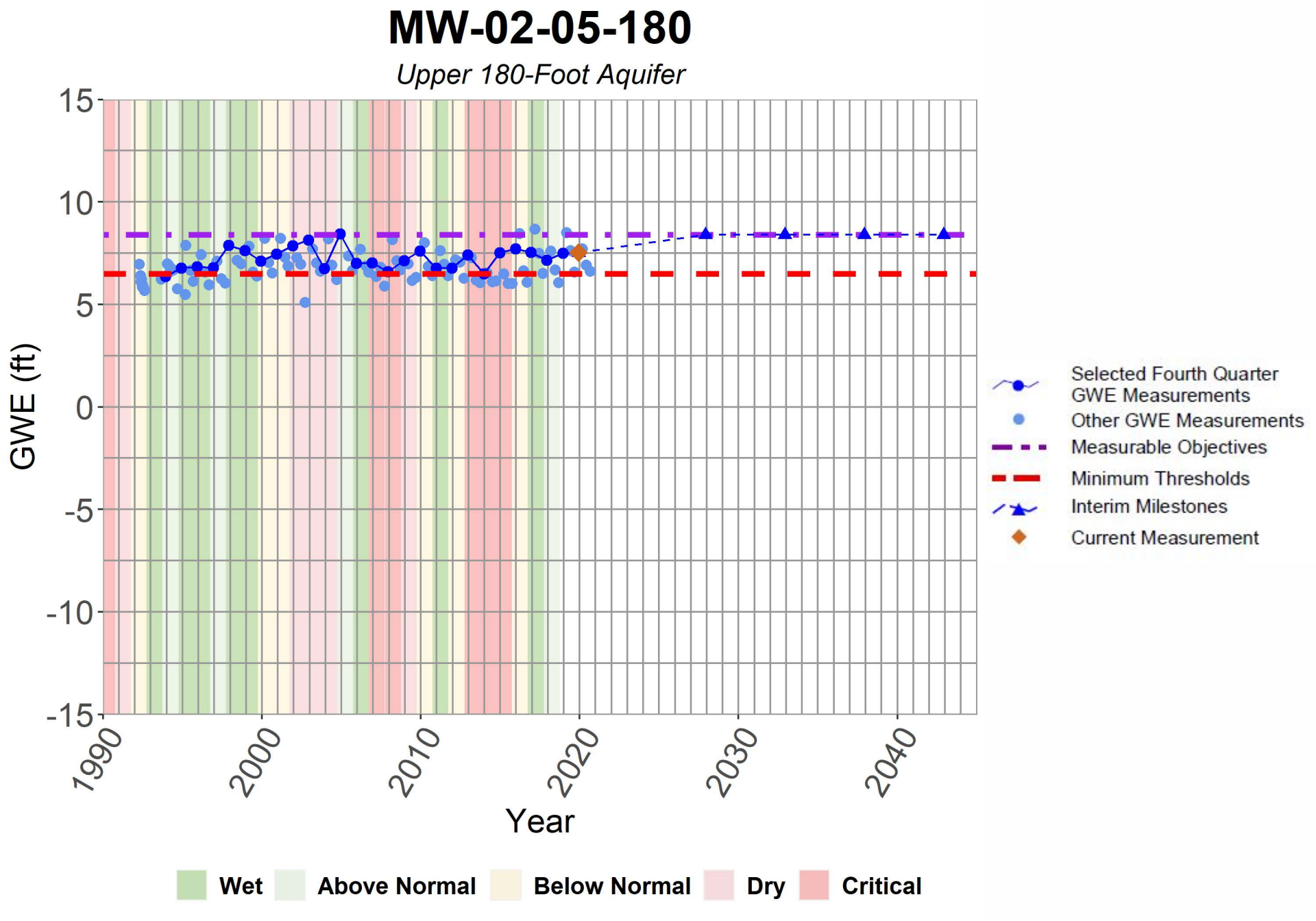


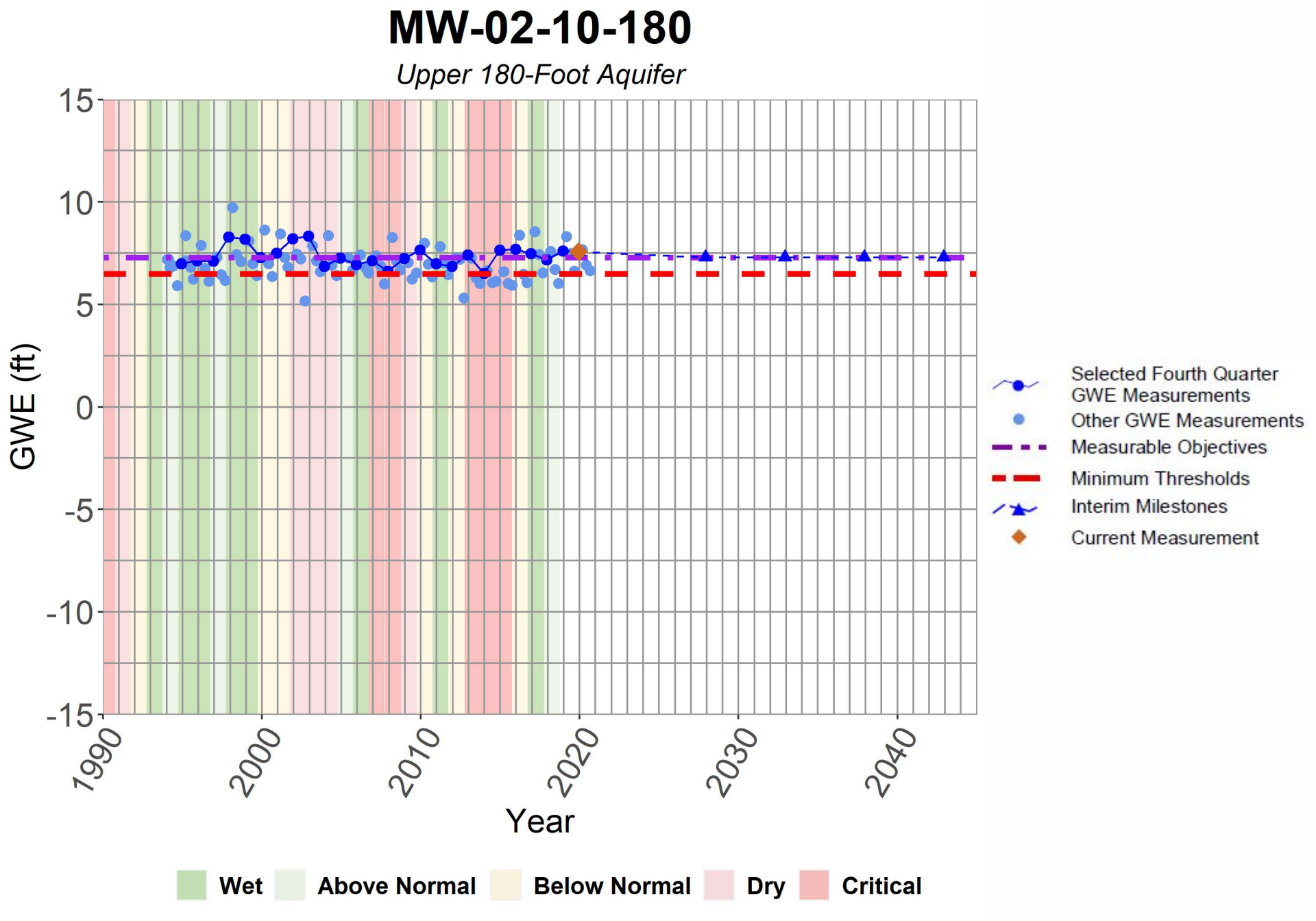

MW-OU2-13-A
Dune Sand Aquifer
GWE (ft)
100
75
50
25
0
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

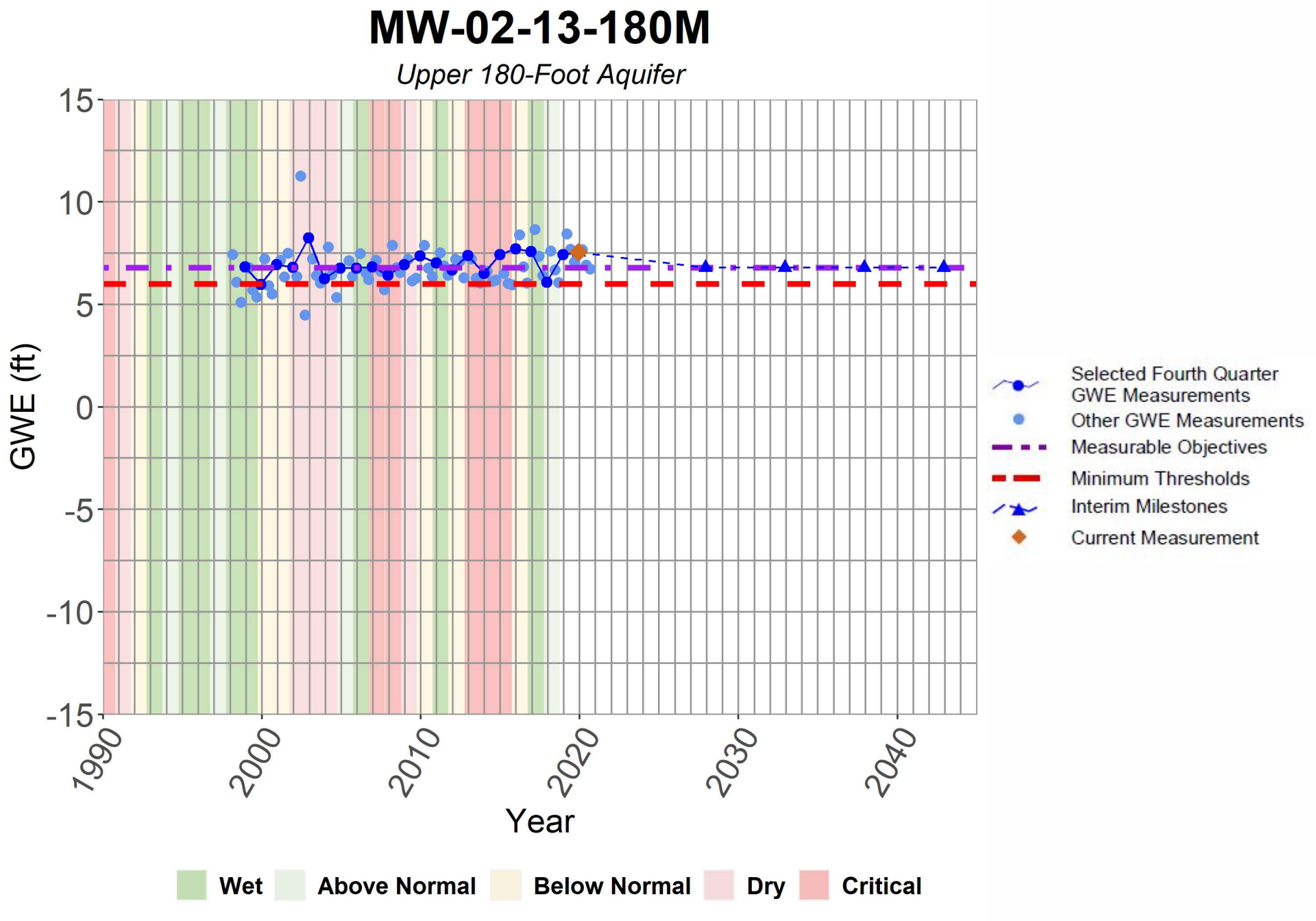

MW-OU2-32-A
Dune Sand Aquifer
GWE (ft)
100
75
50
25
0
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

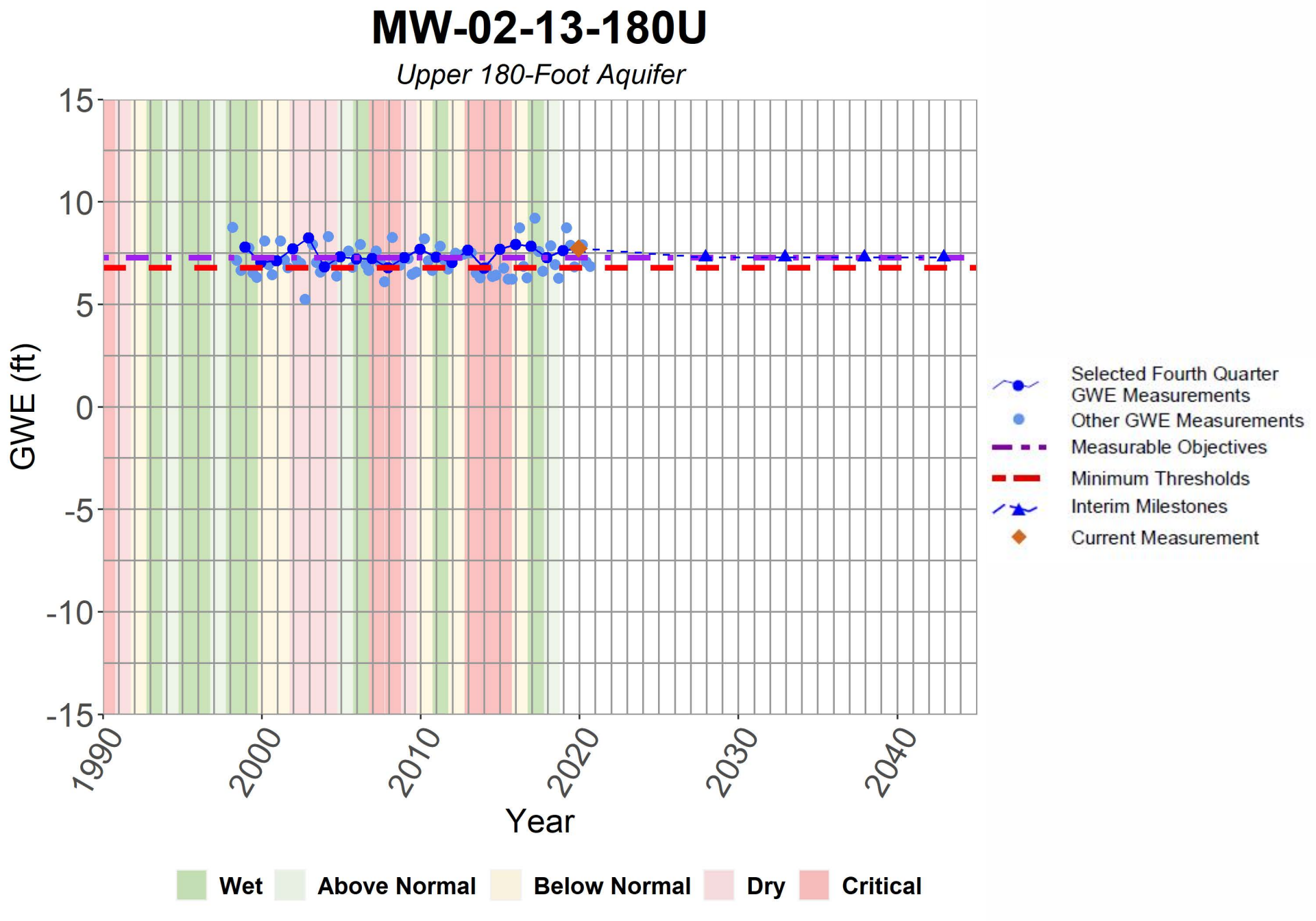

MW-OU2-34-A
Dune Sand Aquifer
GWE (ft)
100
75
50
25
0
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

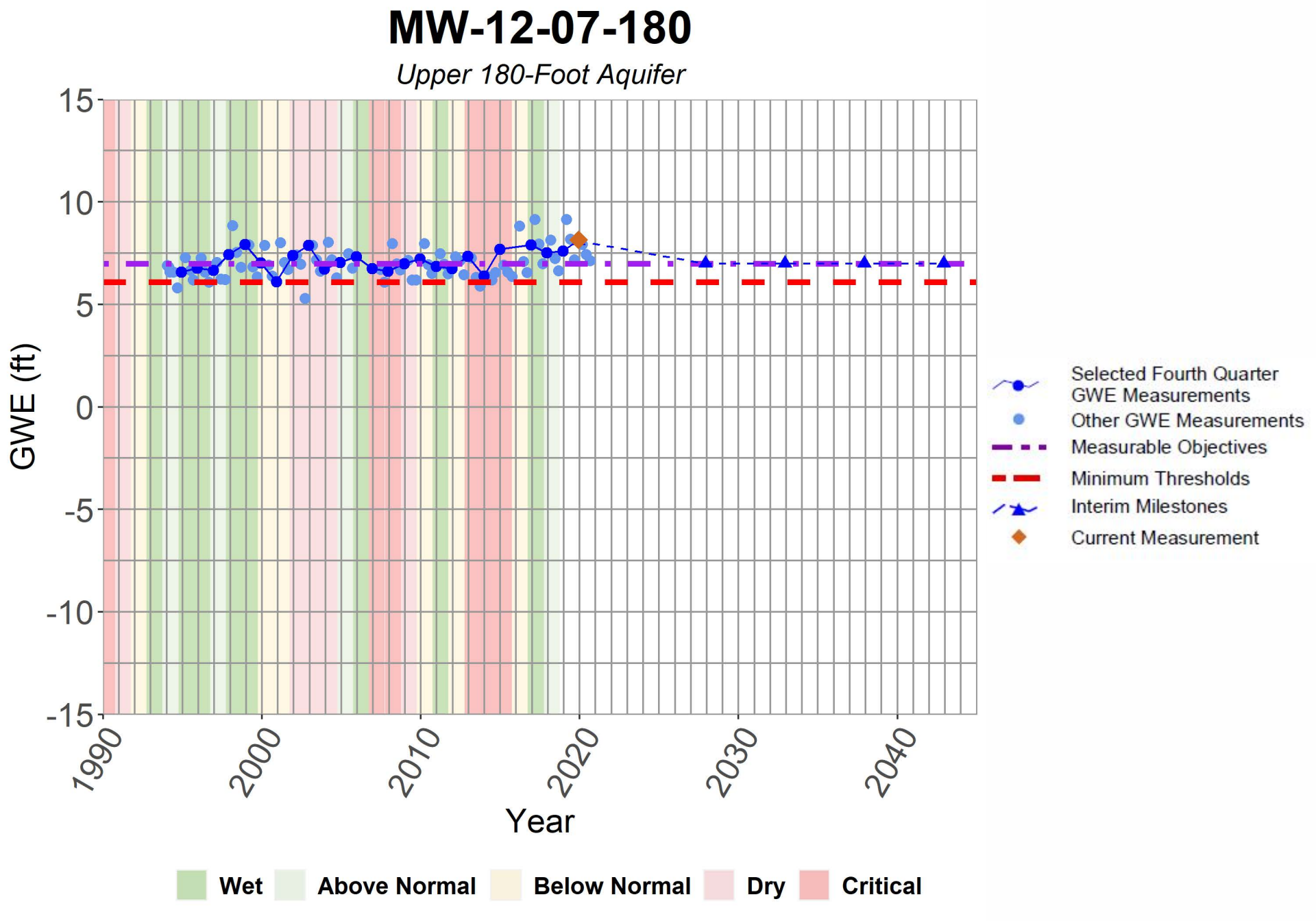

CDM MW-1 Beach
Upper 180-Foot Aquifer
GWE (ft)
15
10
5
0
-5
-10
-15
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

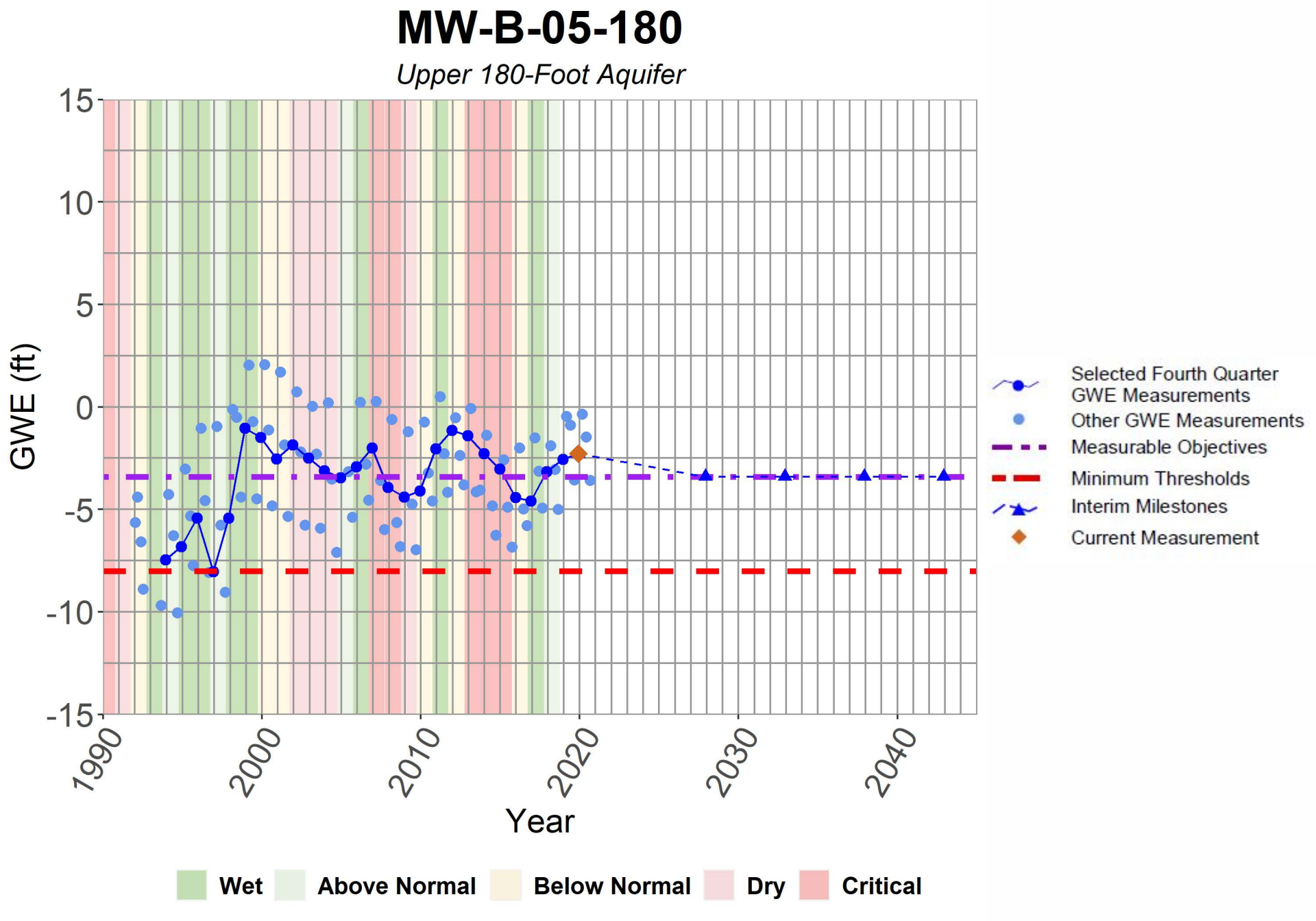

MW-02-05-180
Upper 180-Foot Aquifer
GWE (ft)
15
10
5
0
-5
-10
-15
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

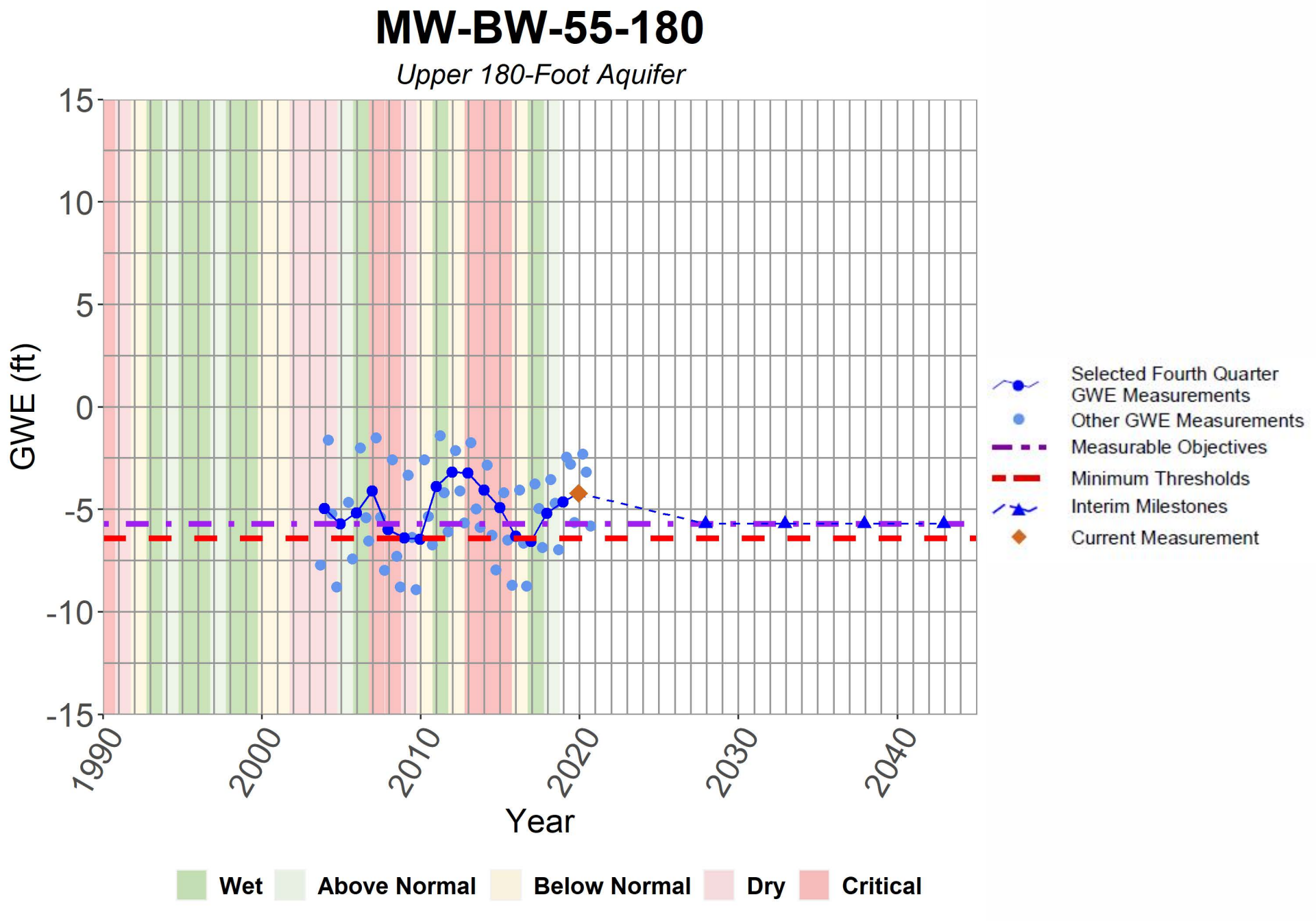

MW-02-10-180
Upper 180-Foot Aquifer
GWE (ft)
15
10
5
0
-5
-10
-15
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

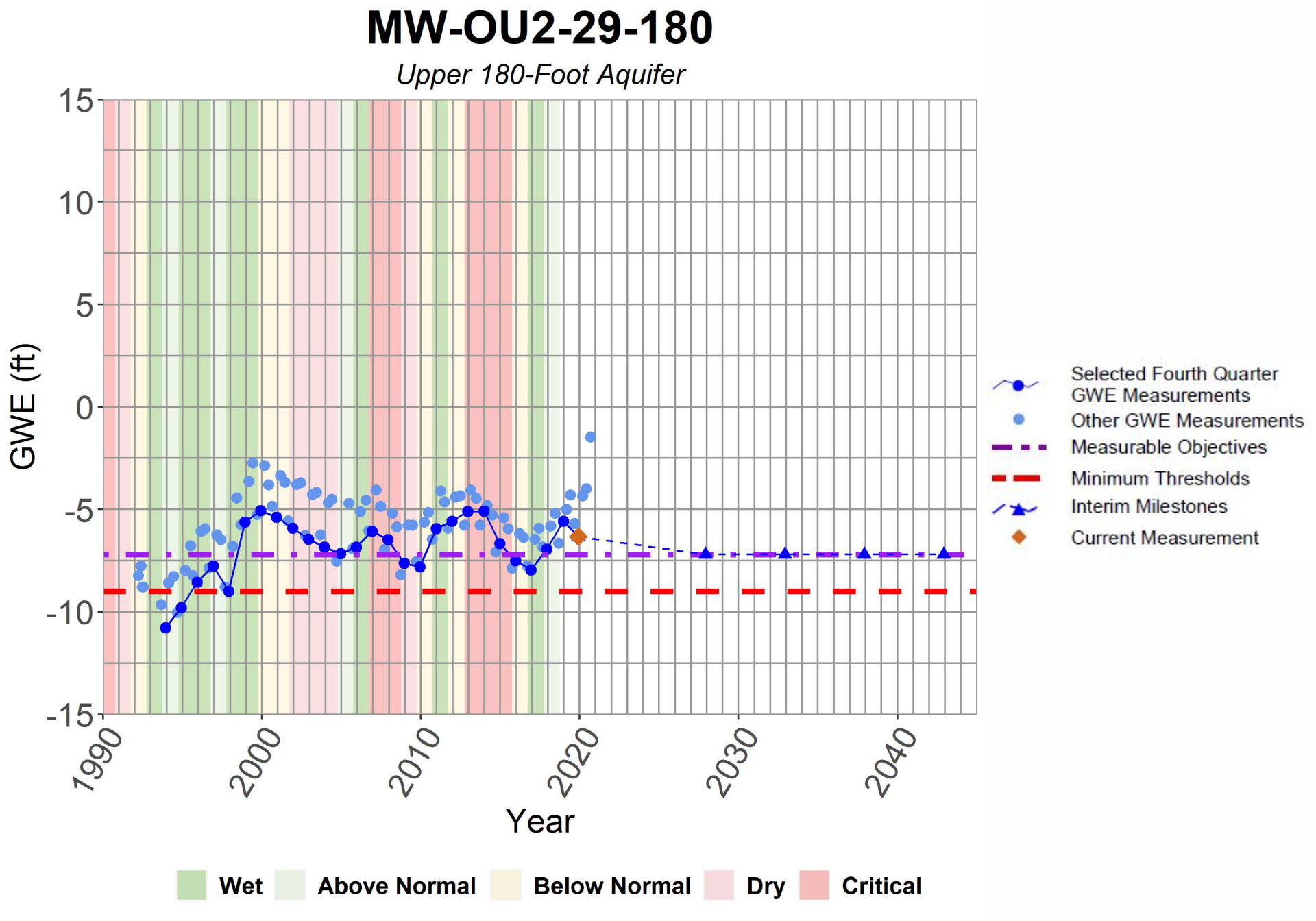

MW-02-13-180M
Upper 180-Foot Aquifer
GWE (ft)
15
10
5
0
-5
-10
-15
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

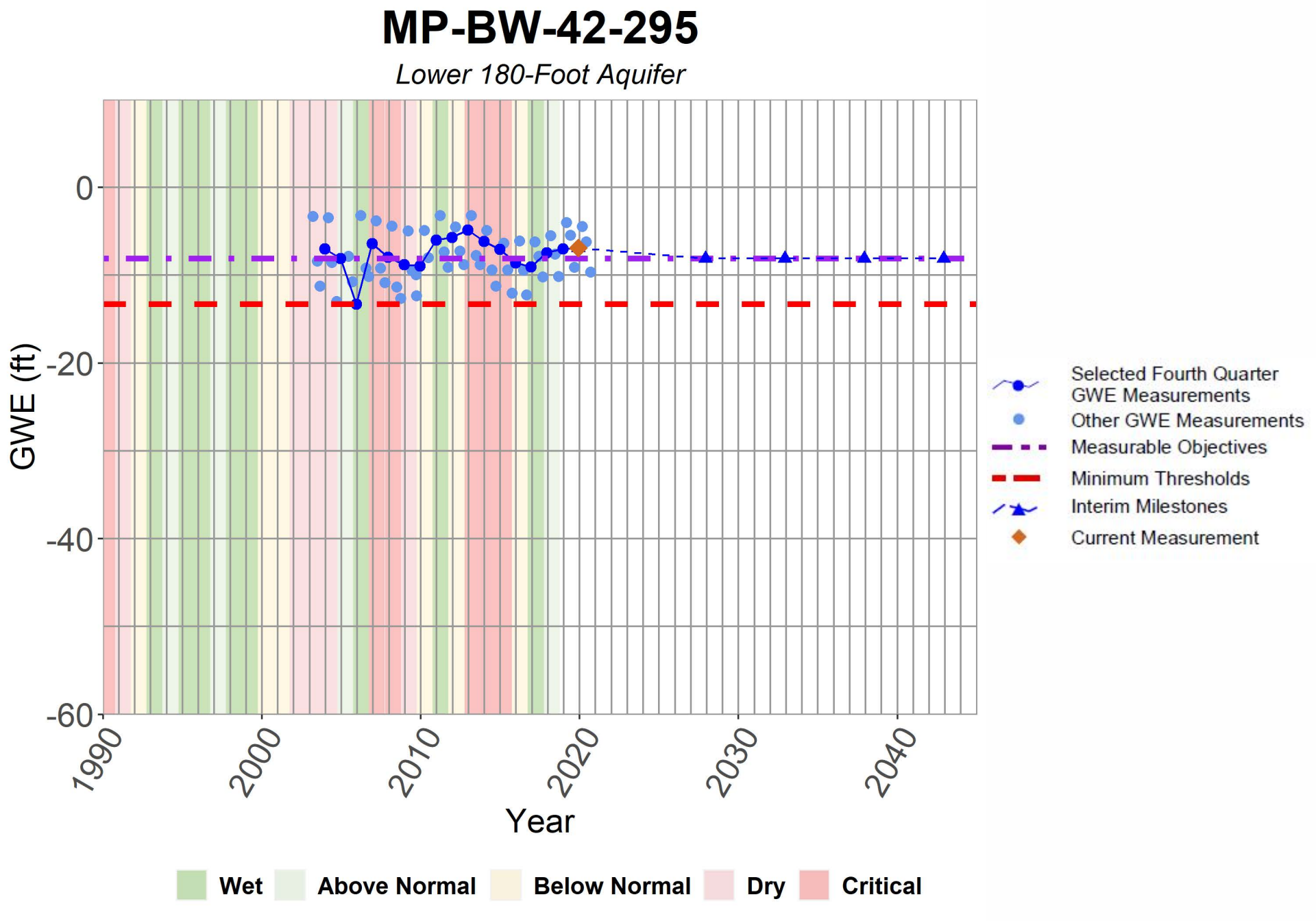

MW-02-13-180U
Upper 180-Foot Aquifer
GWE (ft)
15
10
5
0
-5
-10
-15
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical


MW-12-07-180
Upper 180-Foot Aquifer
GWE (ft)
15
10
5
0
-5
-10
-15
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical


MW-B-05-180
Upper 180-Foot Aquifer
GWE (ft)
15
10
5
0
-5
-10
-15
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

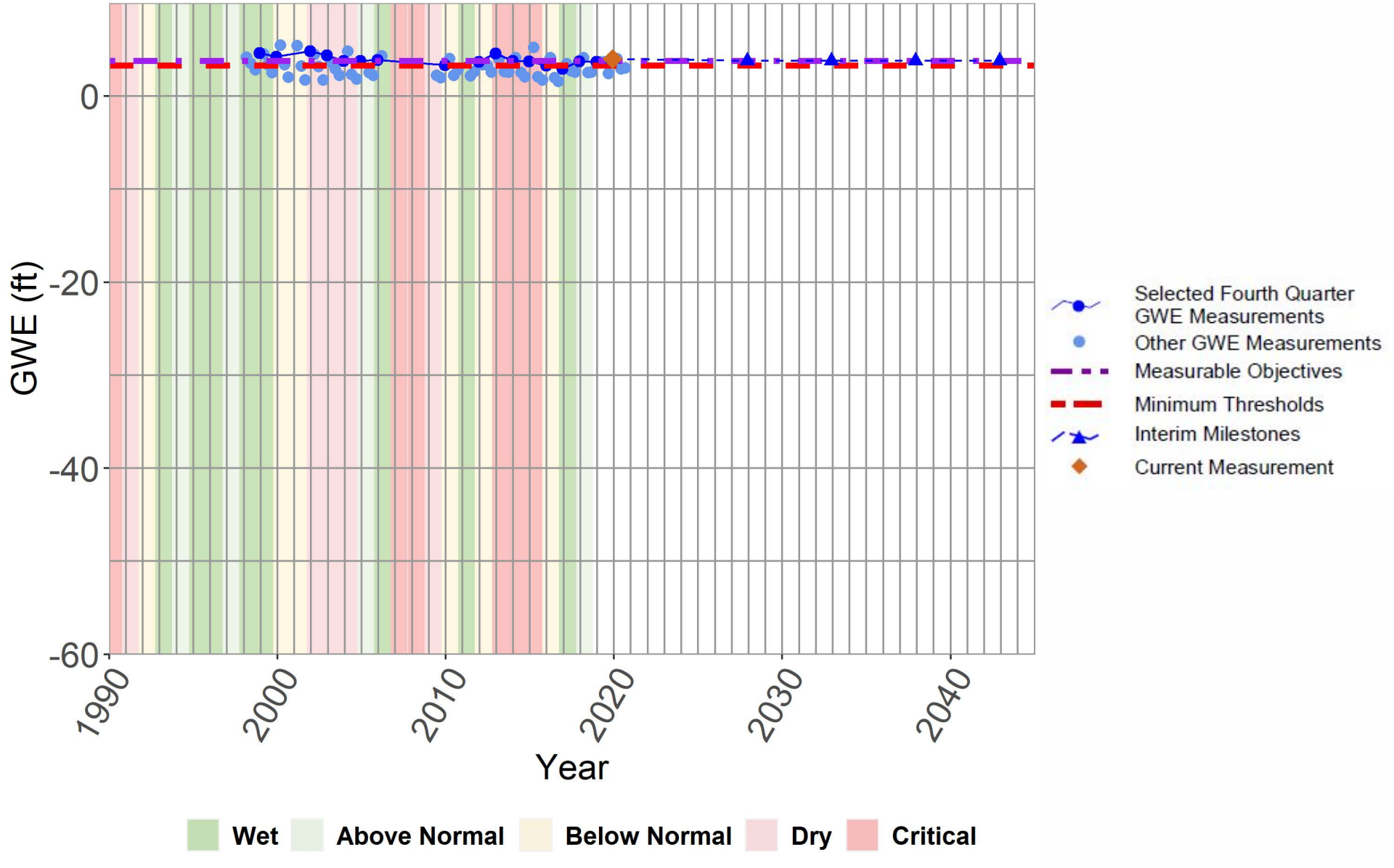

MW-BW-55-180
Upper 180-Foot Aquifer
GWE (ft)
15
10
5
0
-5
-10
-15
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical


MW-OU2-29-180
Upper 180-Foot Aquifer
GWE (ft)
15
10
5
0
-5
-10
-15
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical


MP-BW-42-295
Lower 180-Foot Aquifer
GWE (ft)
0
-20
-40
-60
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

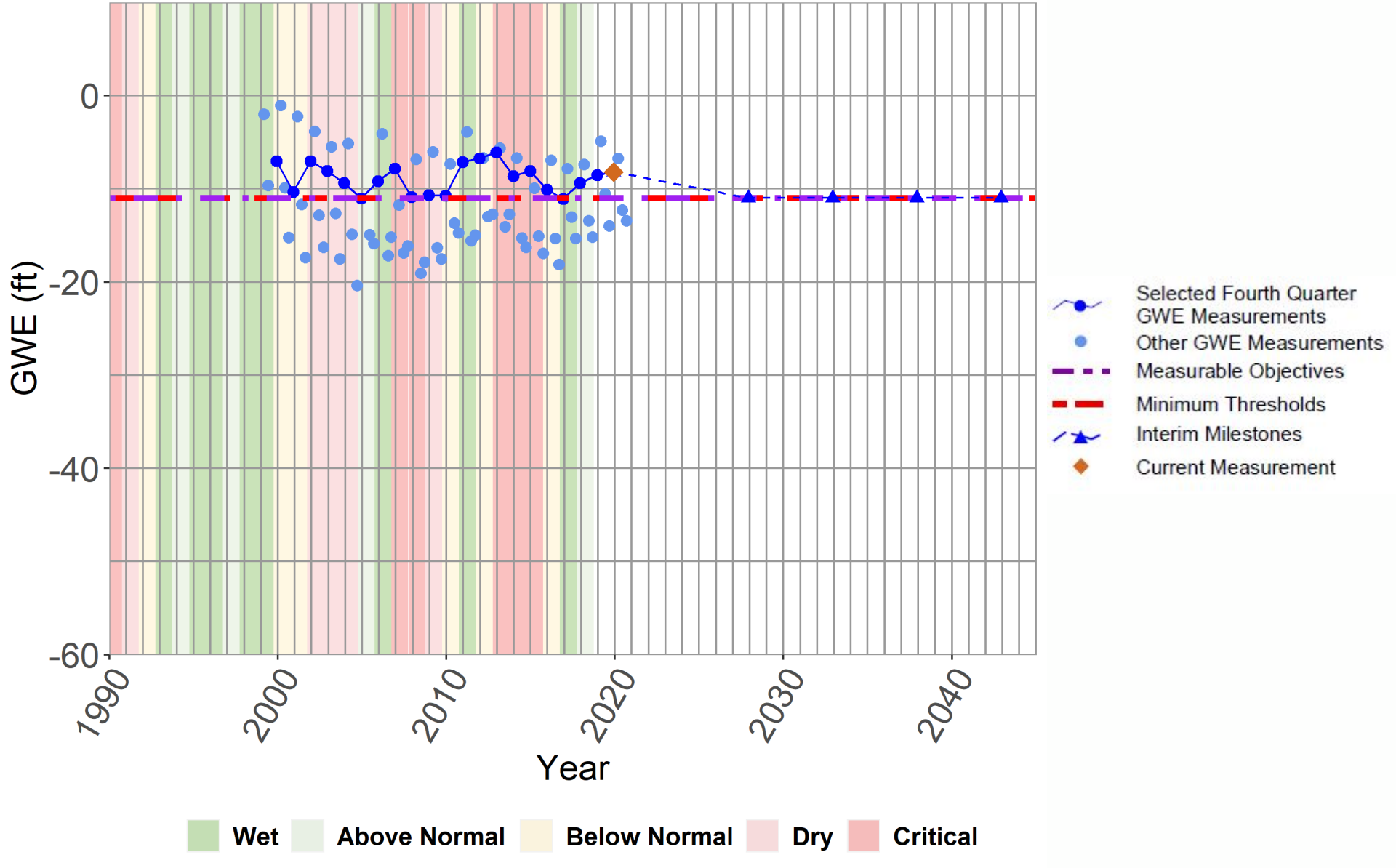
MW-12-12-180L

Lower 180-Foot Aquifer



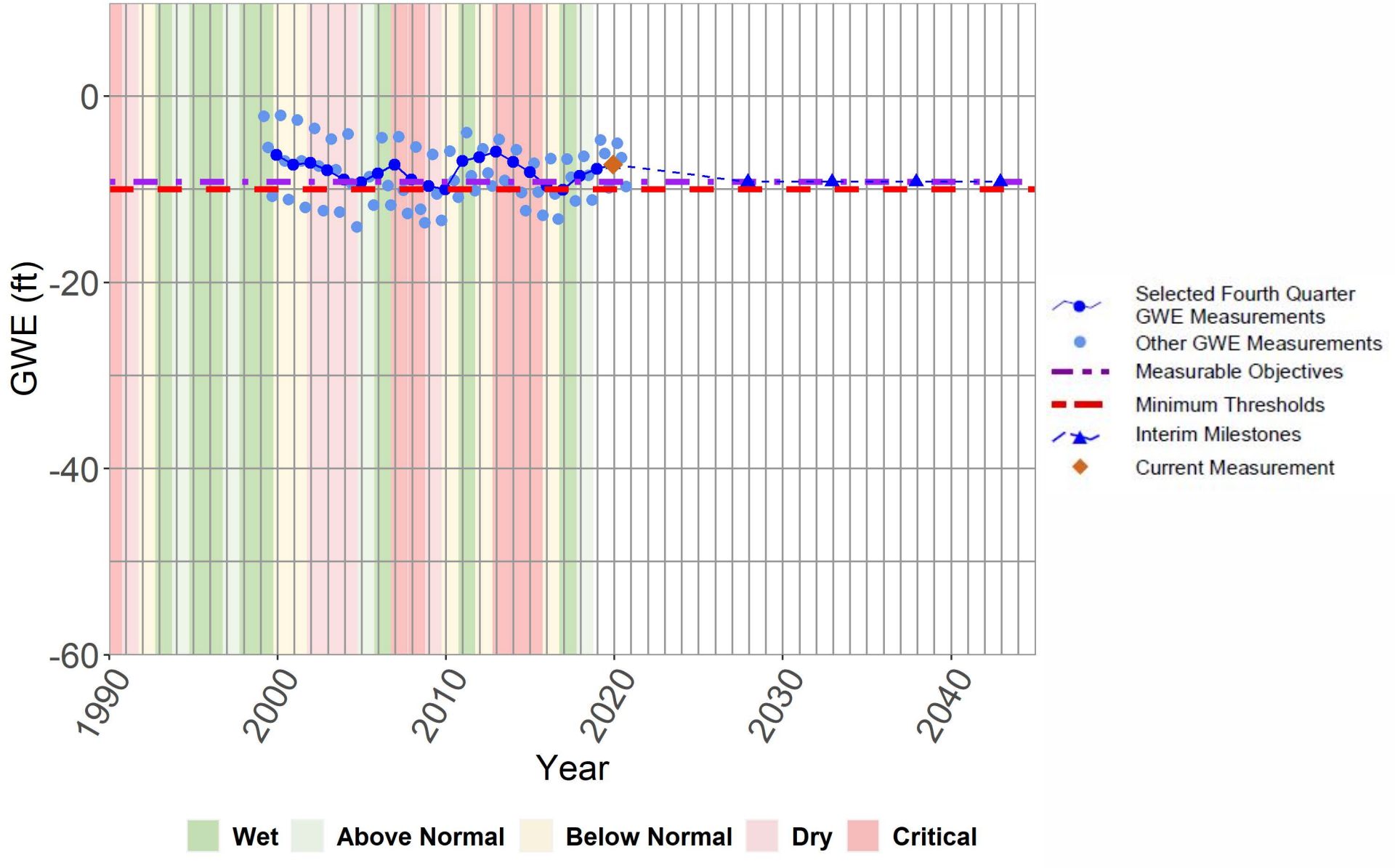
MW-BW-04-180

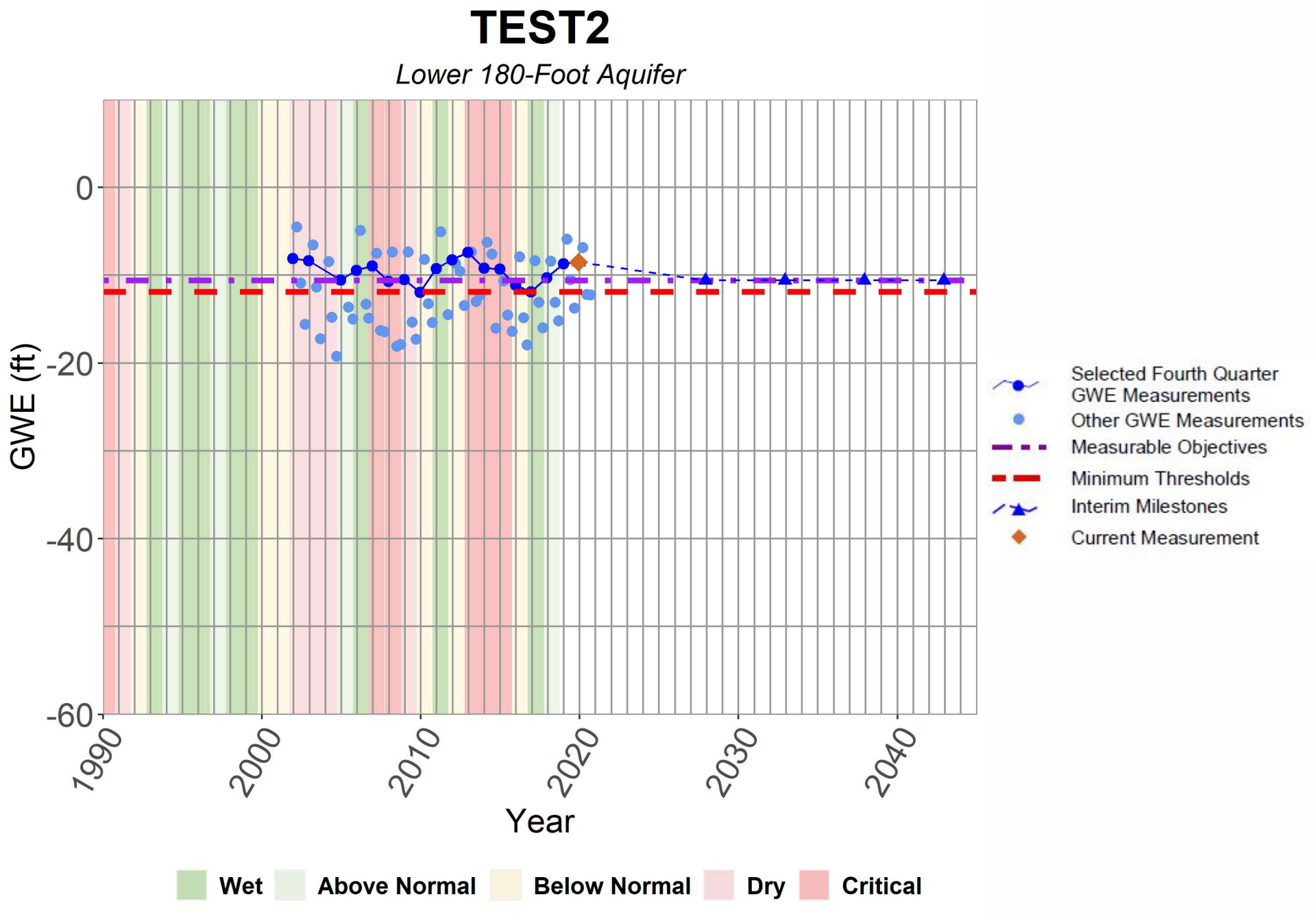
Lower 180-Foot Aquifer

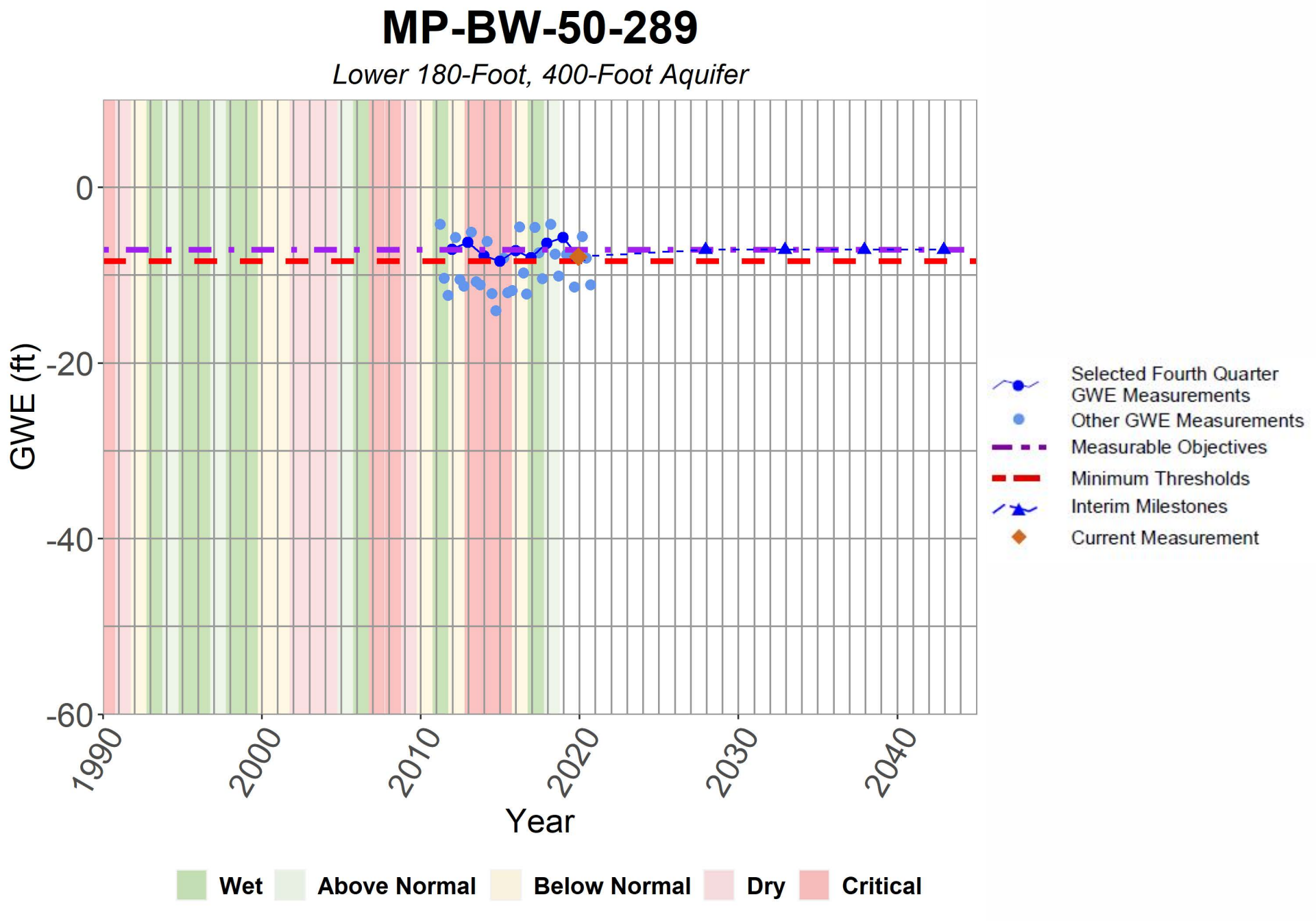


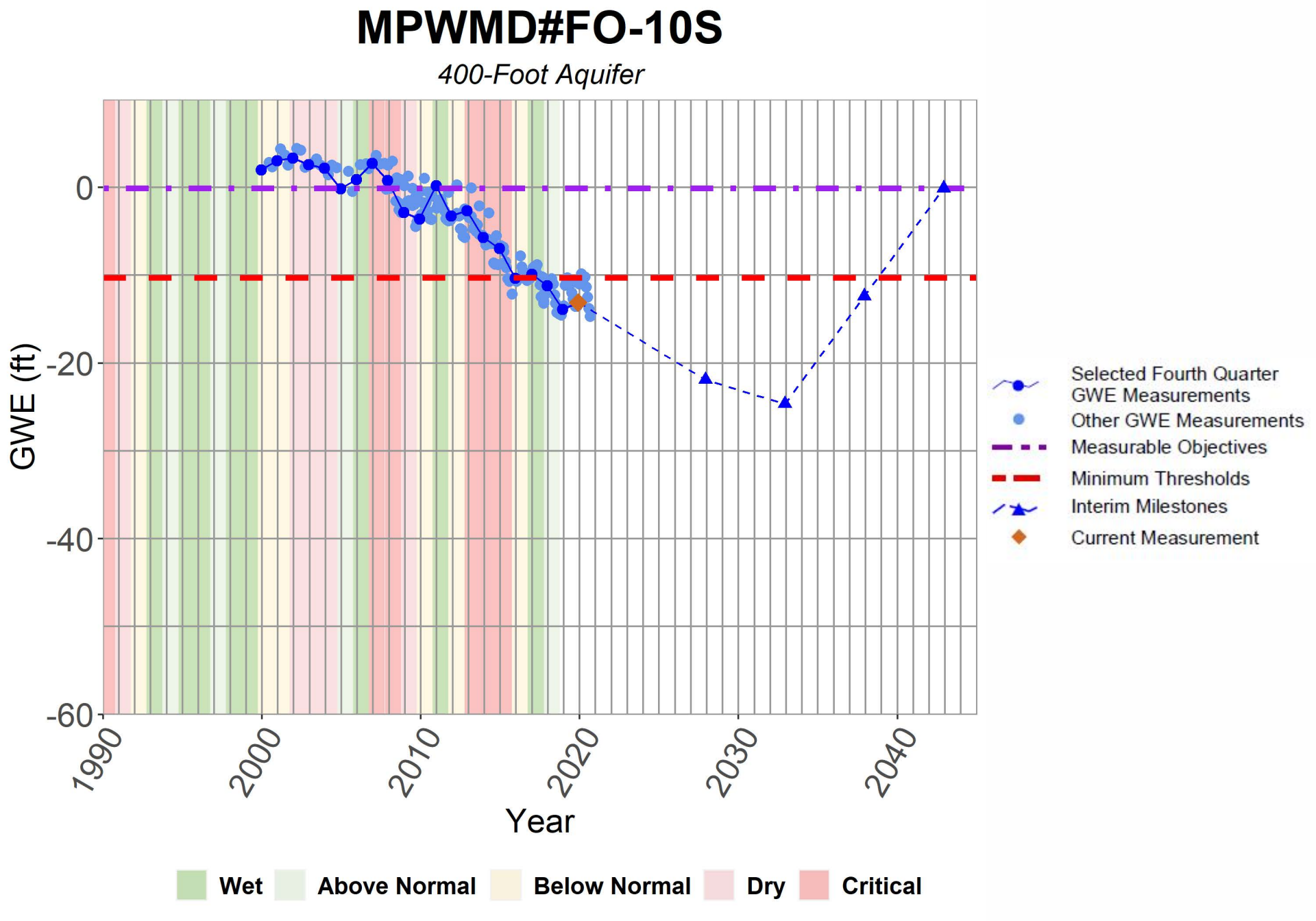
MW-OU2-66-180

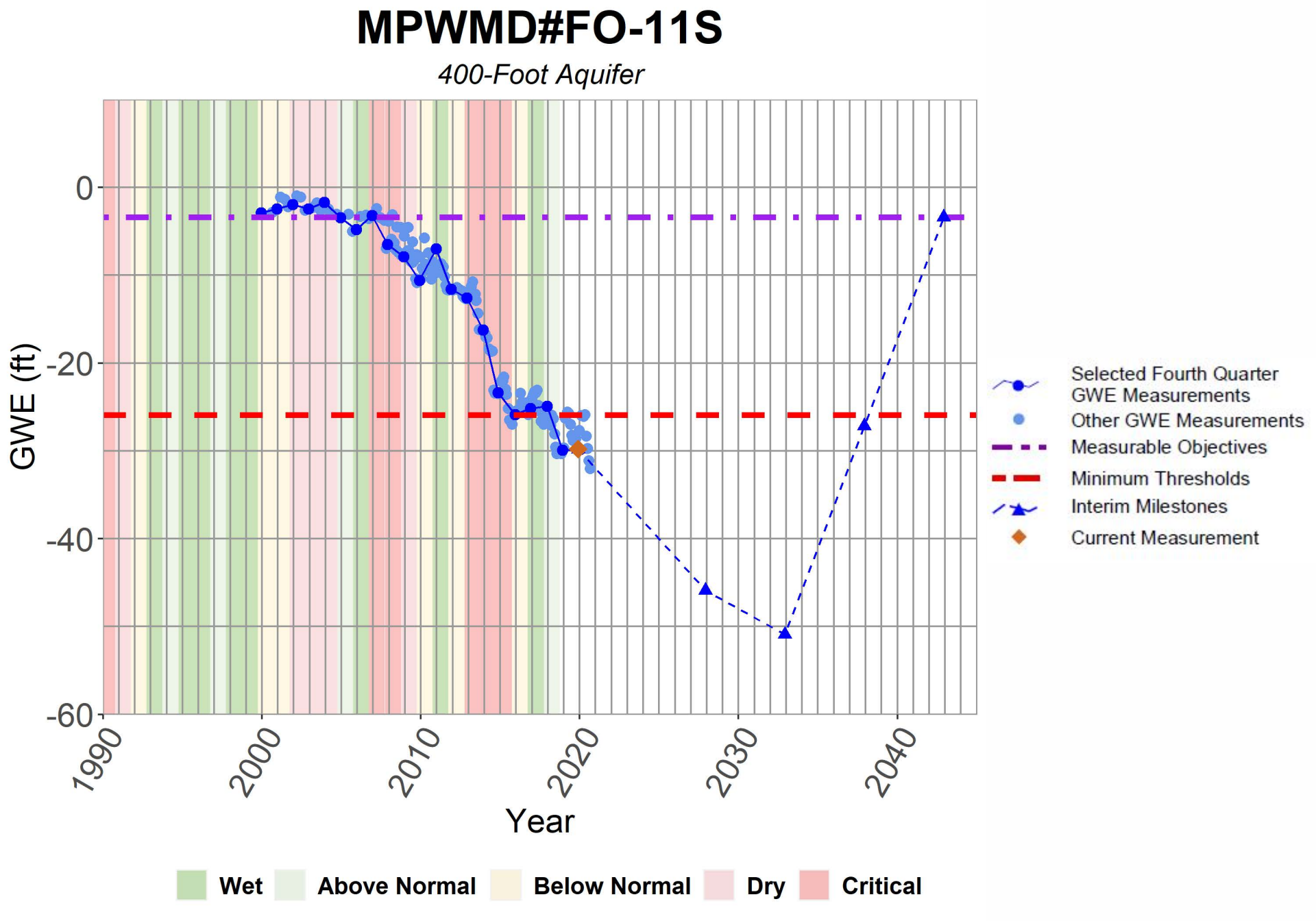
Lower 180-Foot Aquifer

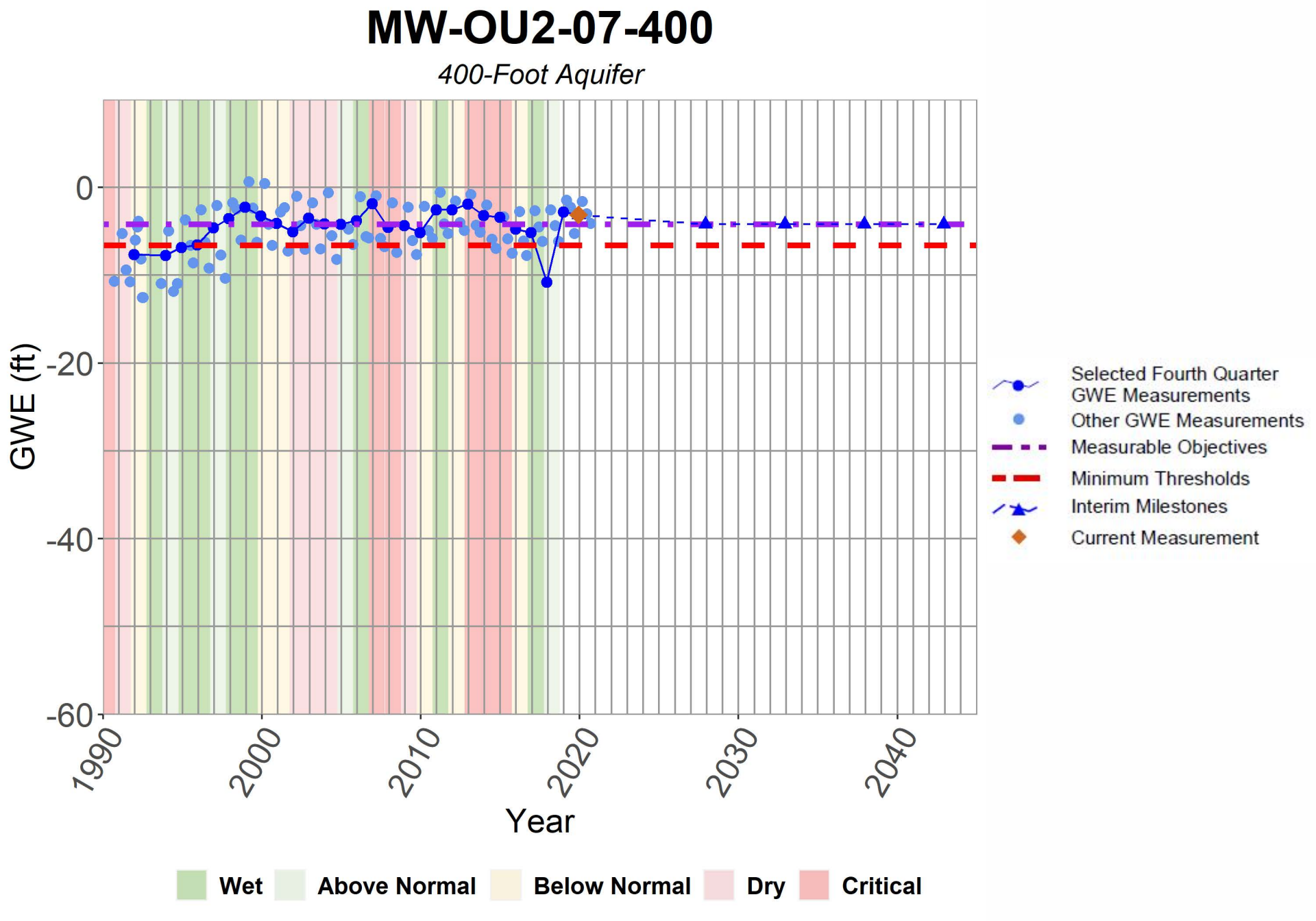


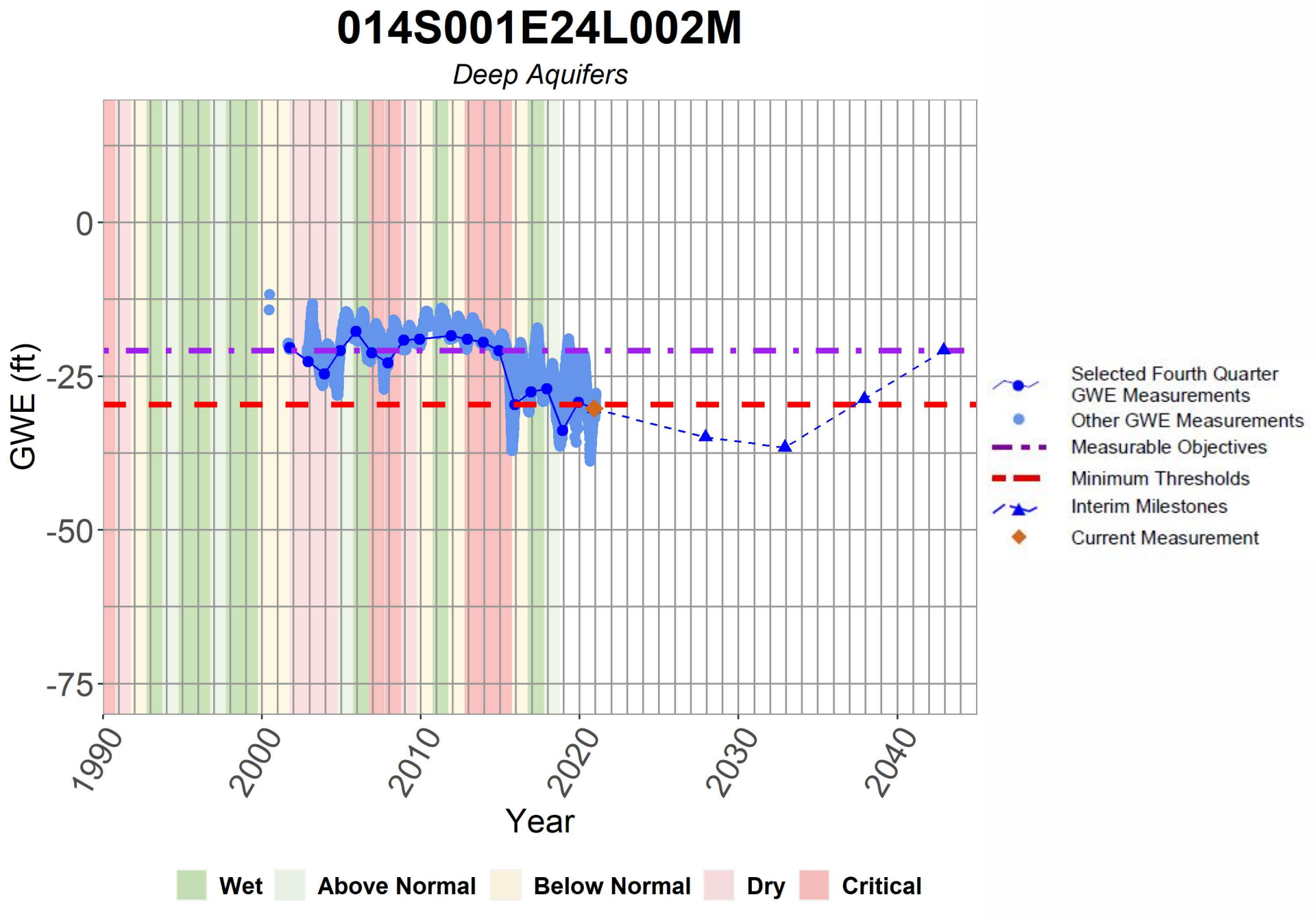

TEST2
Lower 180-Foot Aquifer
GWE (ft)
0
-20
-40
-60
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical


MP-BW-50-289
Lower 180-Foot, 400-Foot Aquifer
GWE (ft)
0
-20
-40
-60
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical


MPWMD#FO-10S
400-Foot Aquifer
GWE (ft)
0
-20
-40
-60
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

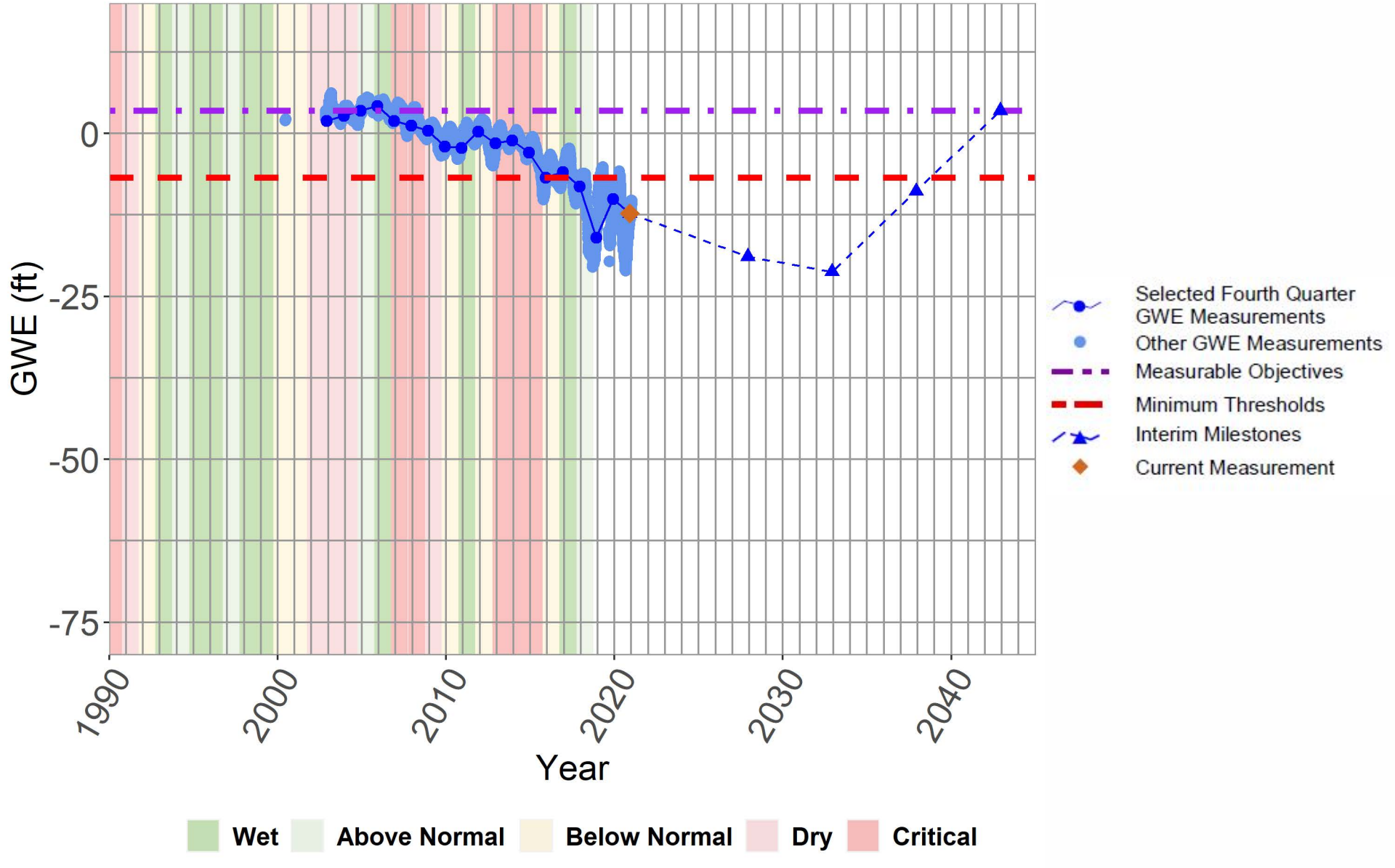

MPWMD#FO-11S
400-Foot Aquifer
GWE (ft)
0
-20
-40
-60
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

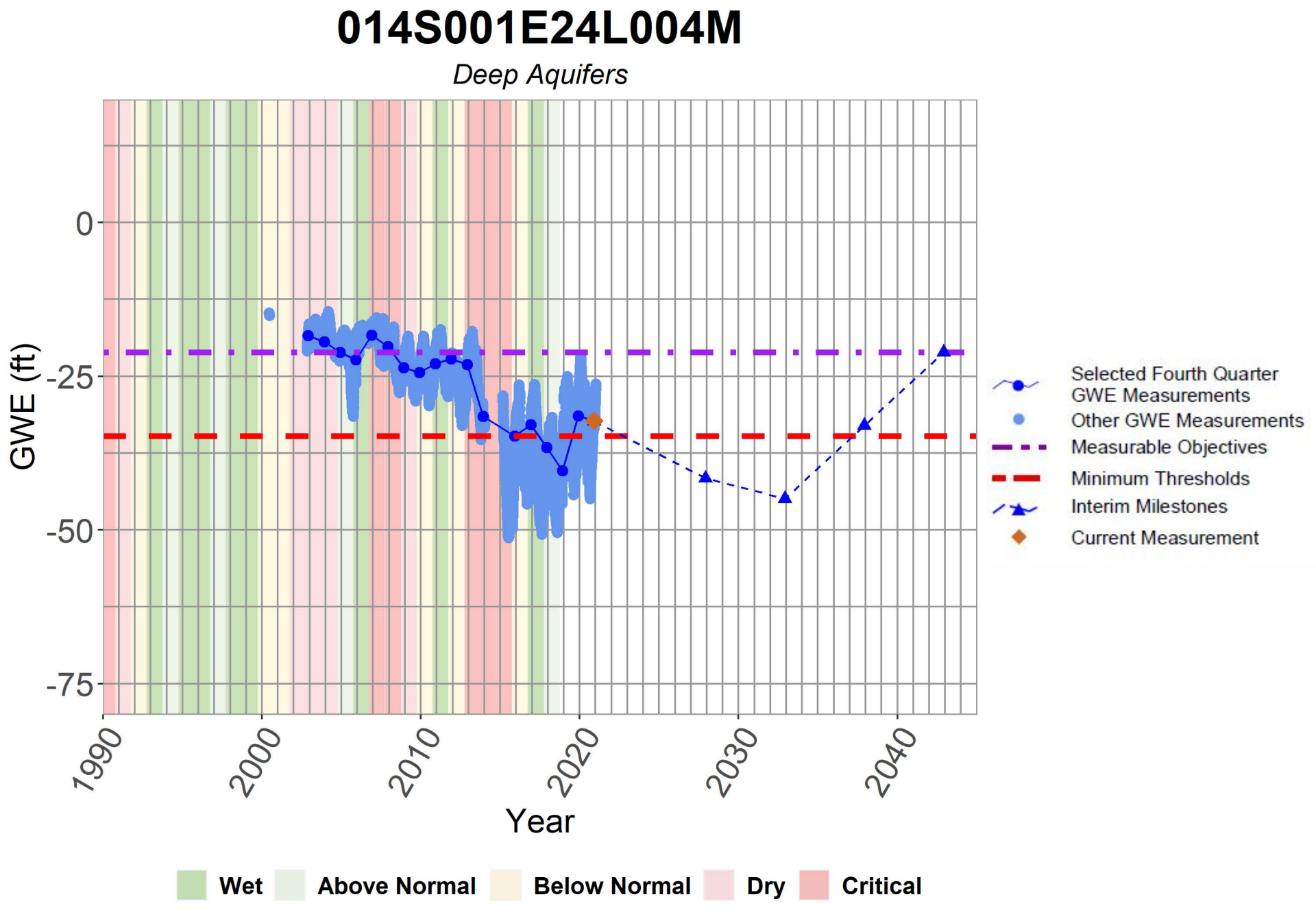

MW-OU2-07-400
400-Foot Aquifer
GWE (ft)
0
-20
-40
-60
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

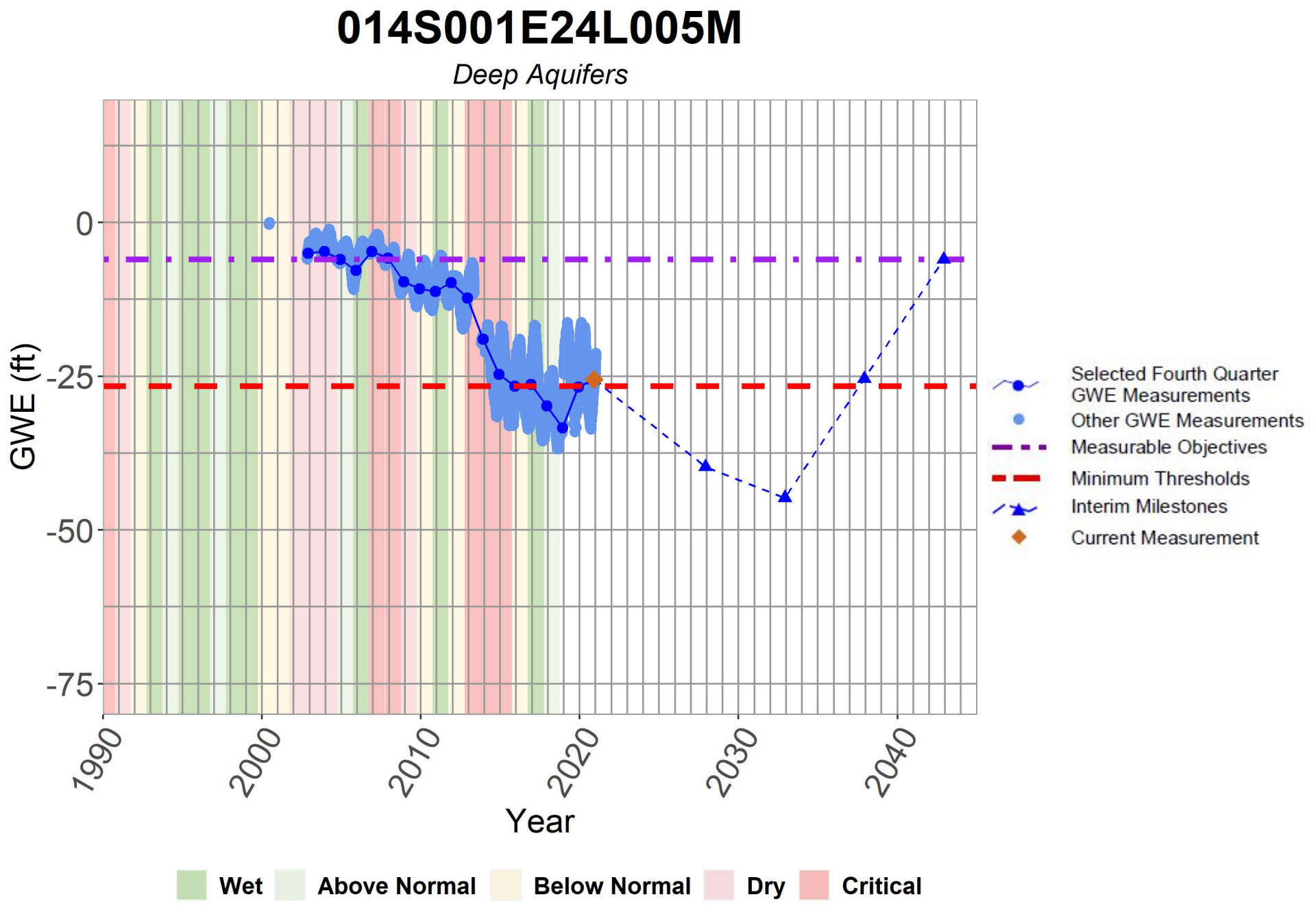

014S001E24L002M
Deep Aquifers
GWE (ft)
0
-25
-50
-75
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

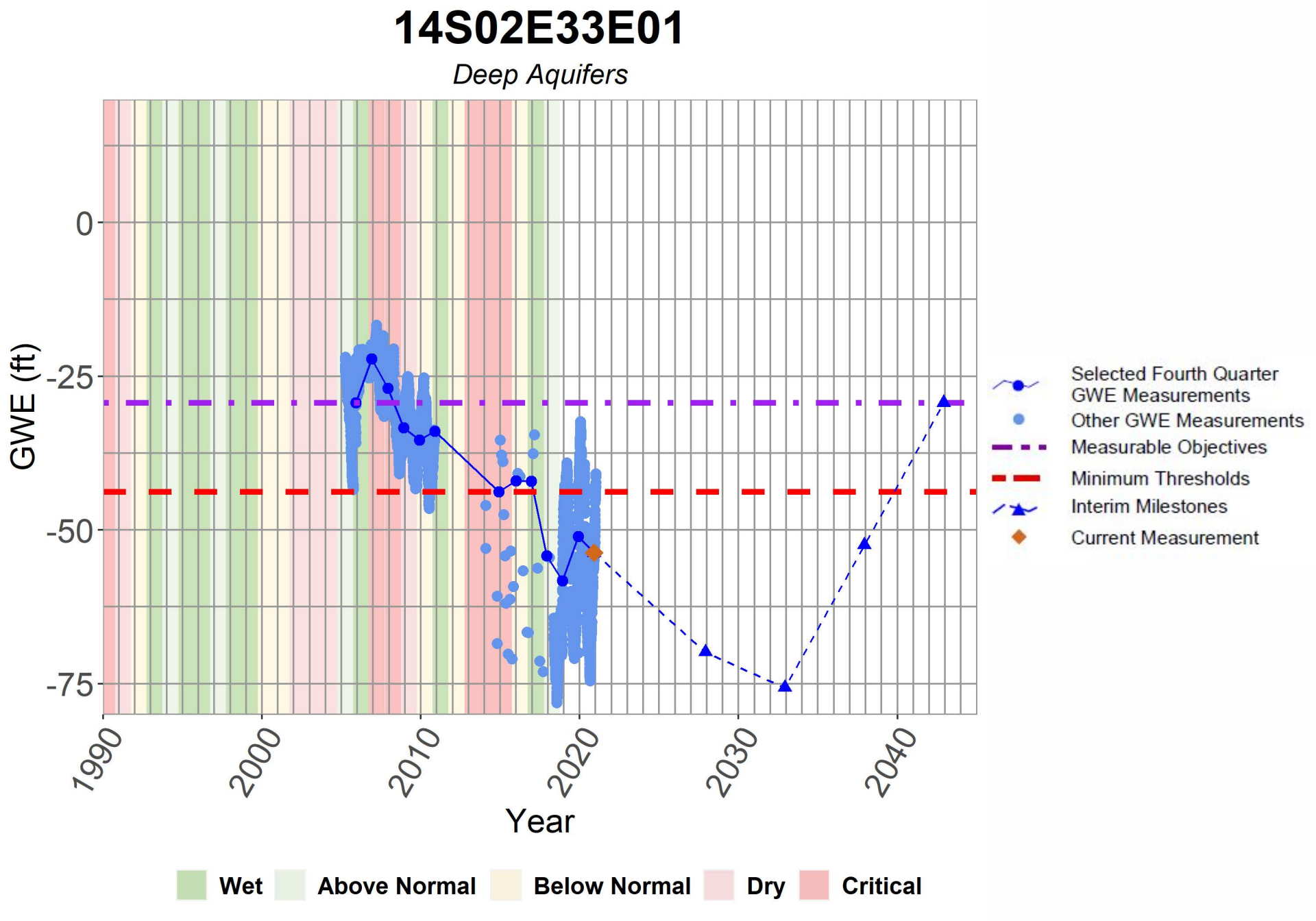
014S001E24L003M

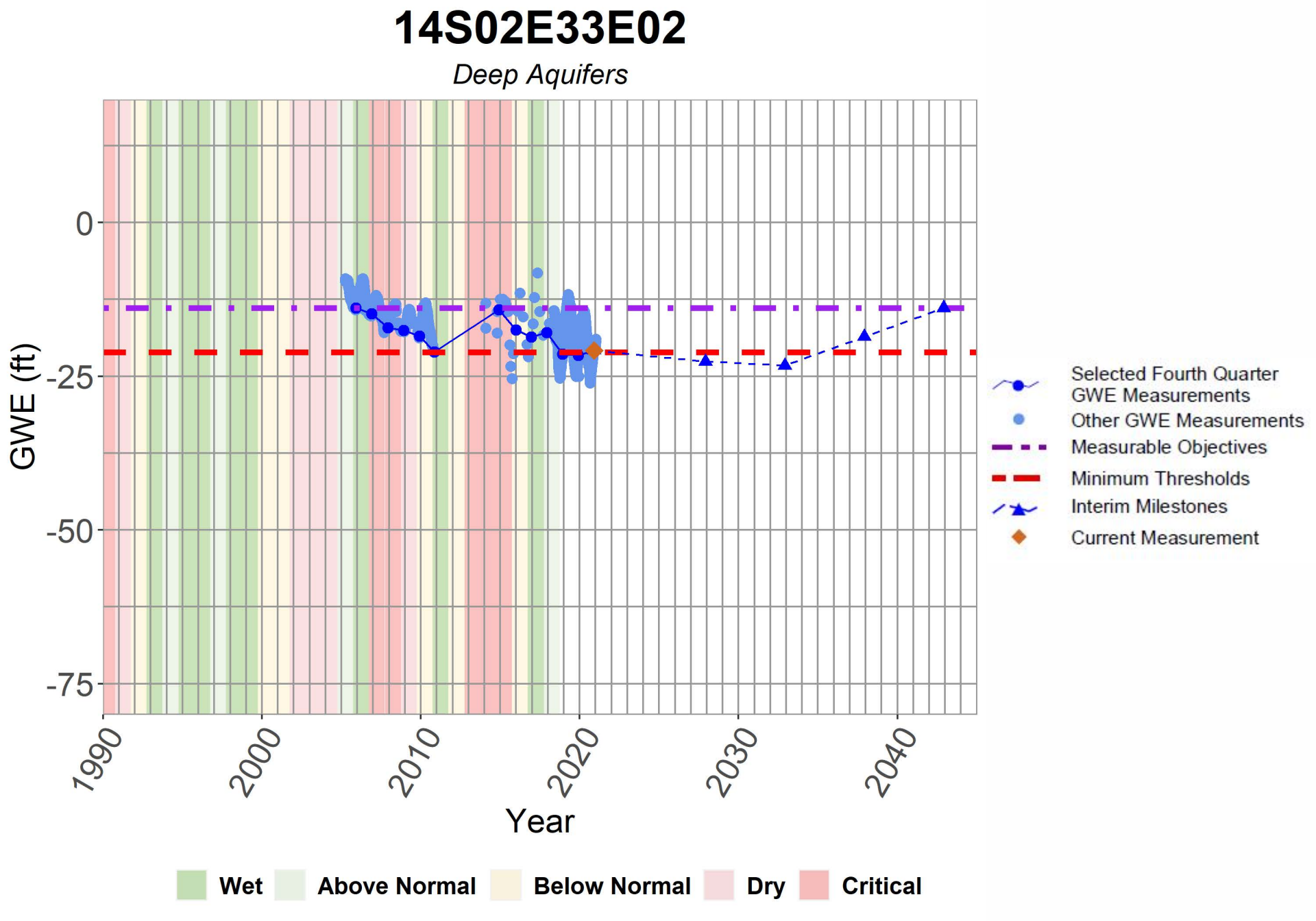
Deep Aquifers

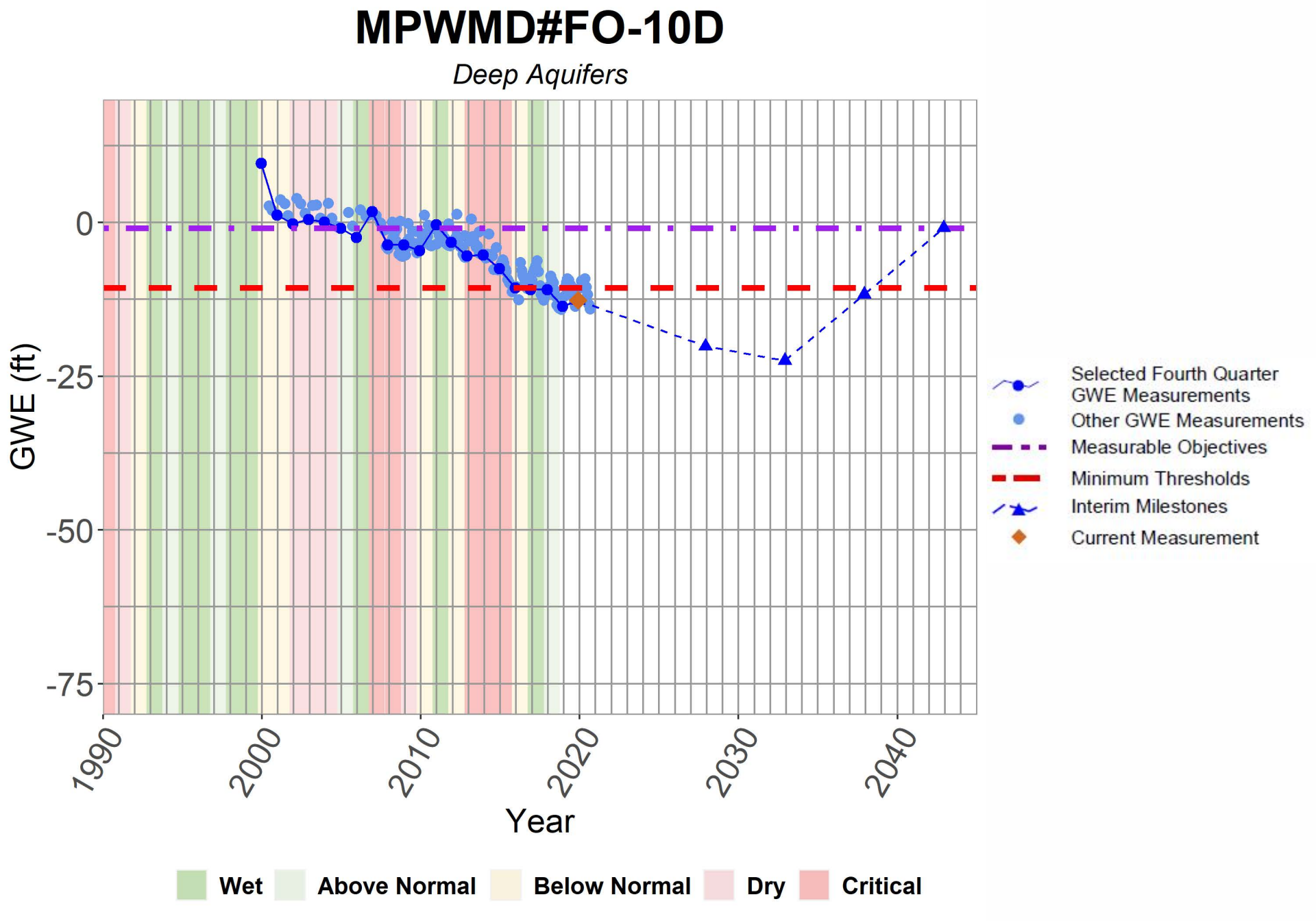


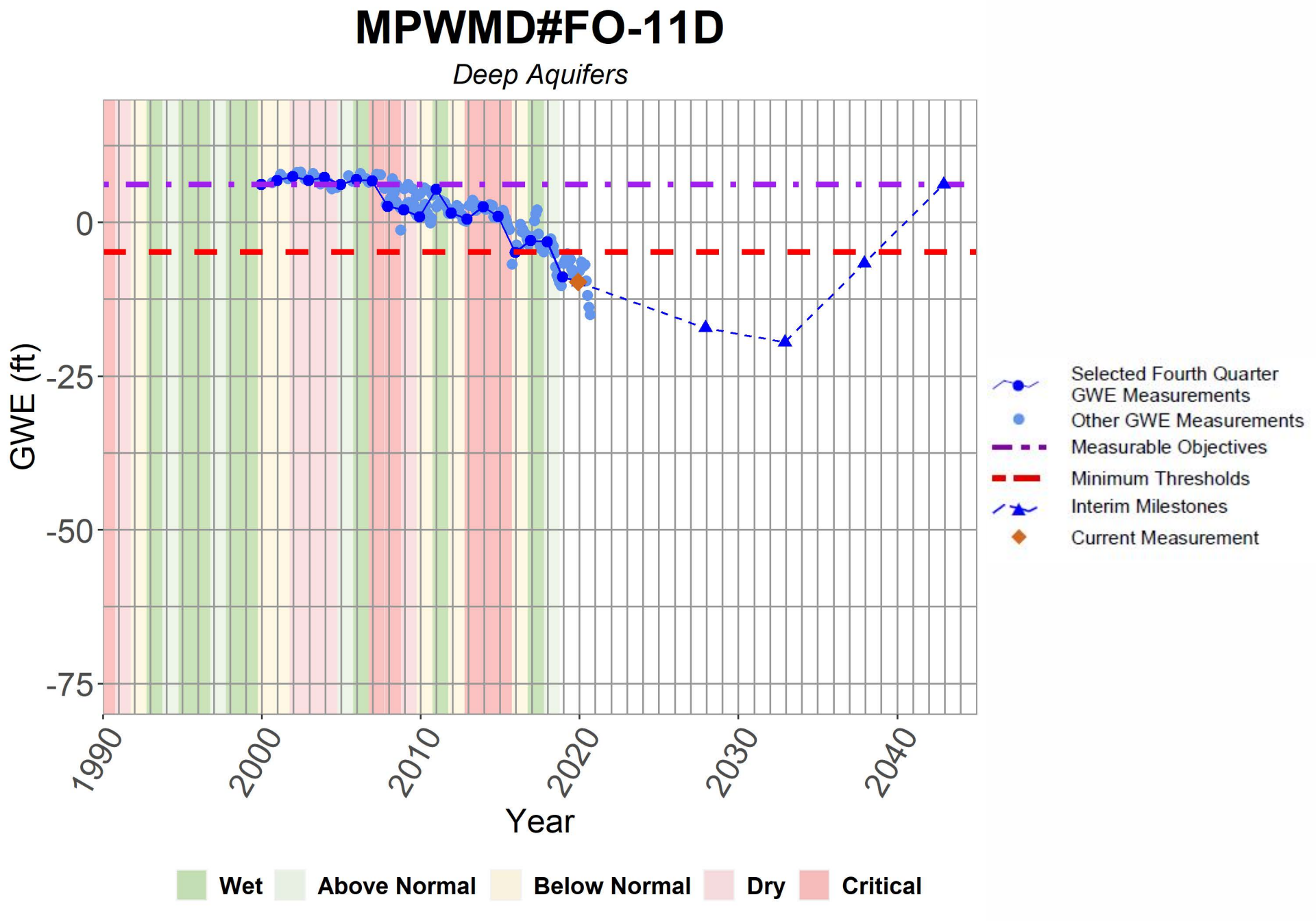

014S001E24L004M
Deep Aquifers
GWE (ft)
0
-25
-50
-75
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

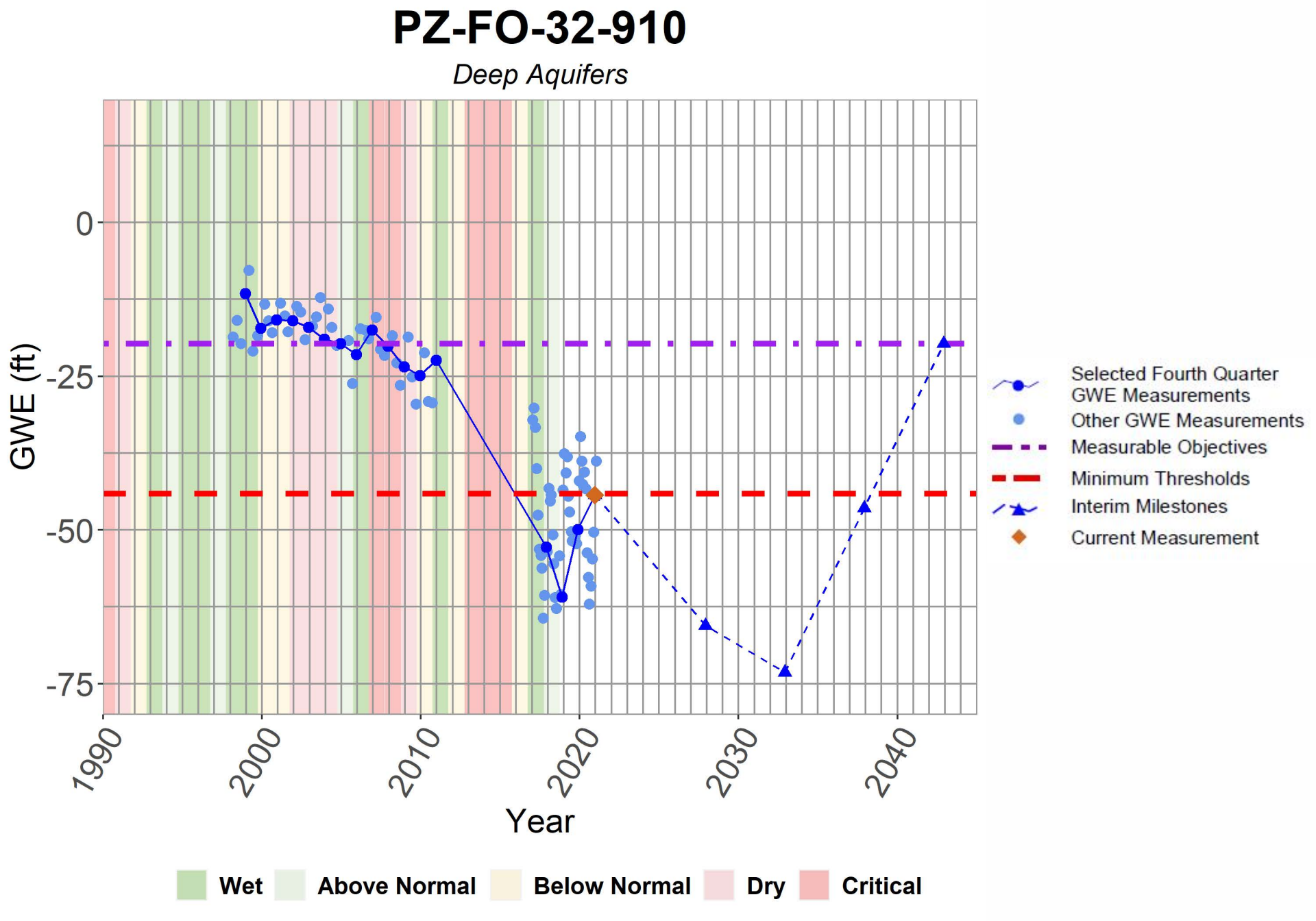

014S001E24L005M
Deep Aquifers
GWE (ft)
0
-25
-50
-75
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

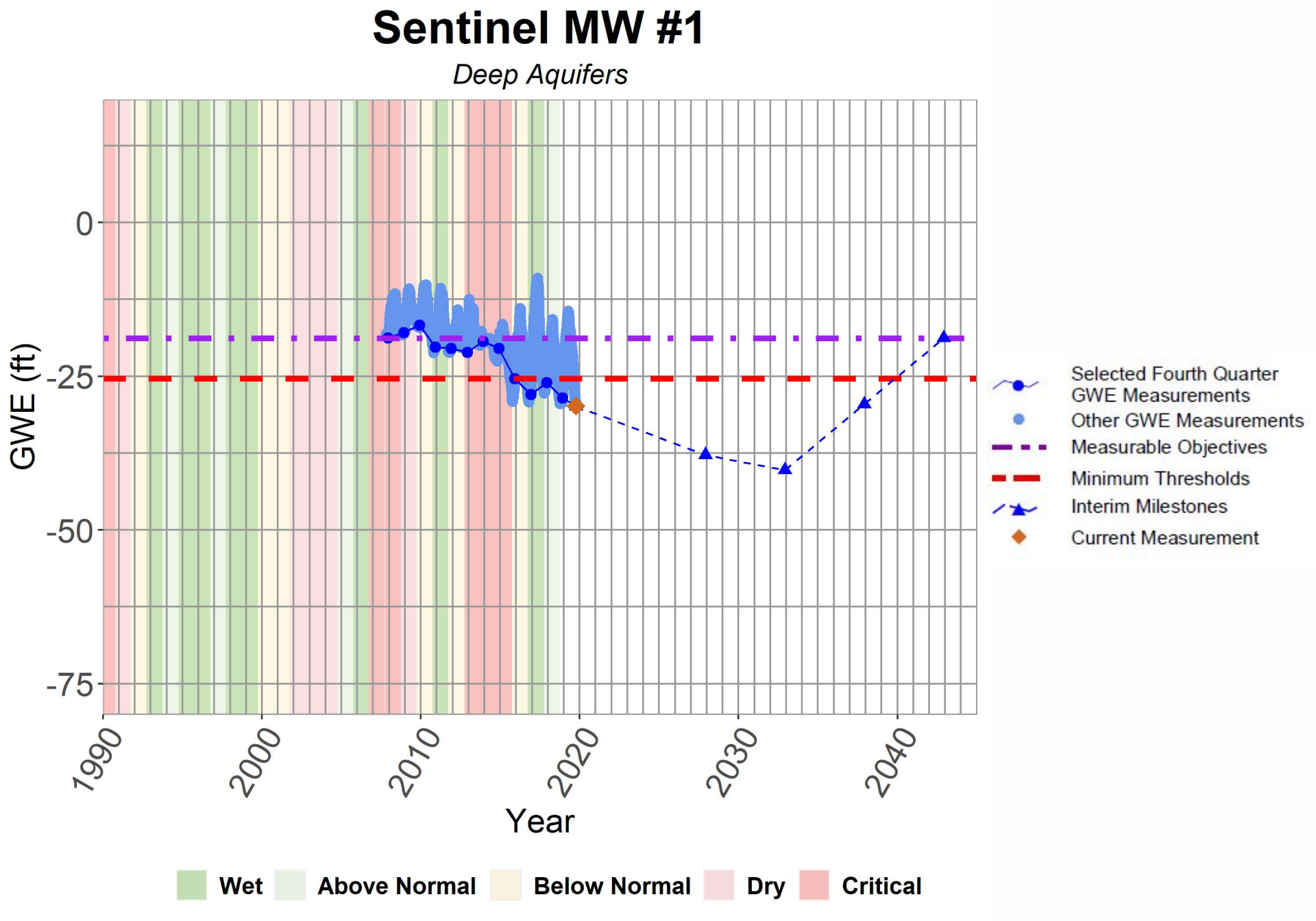

14S02E33E01
Deep Aquifers
GWE (ft)
0
-25
-50
-75
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical


14S02E33E02
Deep Aquifers
GWE (ft)
0
-25
-50
-75
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical


MPWMD#FO-10D
Deep Aquifers
GWE (ft)
0
-25
-50
-75
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

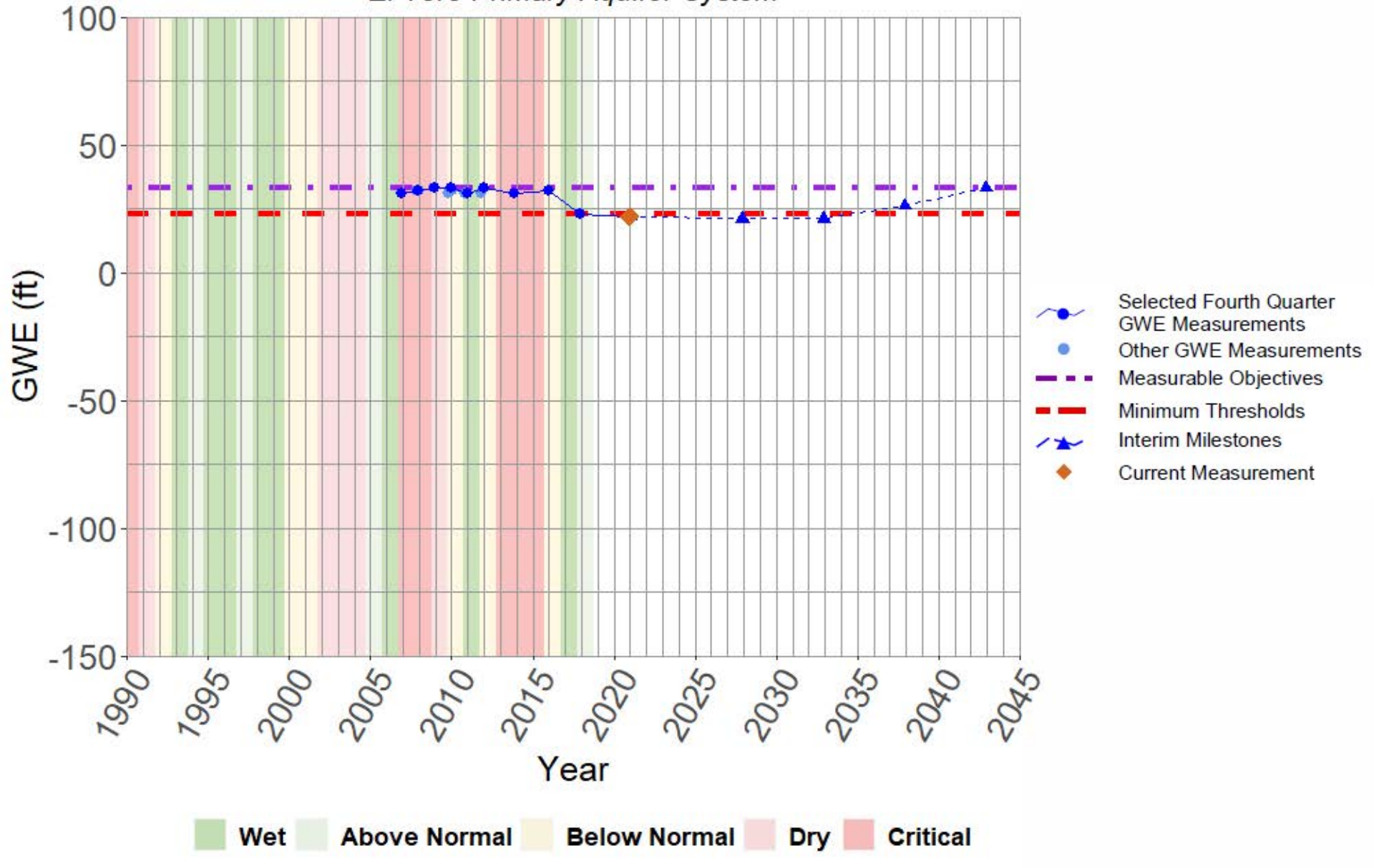

MPWMD#FO-11D
Deep Aquifers
GWE (ft)
0
-25
-50
-75
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical


PZ-FO-32-910
Deep Aquifers
GWE (ft)
0
-25
-50
-75
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical


Sentinel MW #1
Deep Aquifers
GWE (ft)
0
-25
-50
-75
1990
2000
2010
2020
2030
2040
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

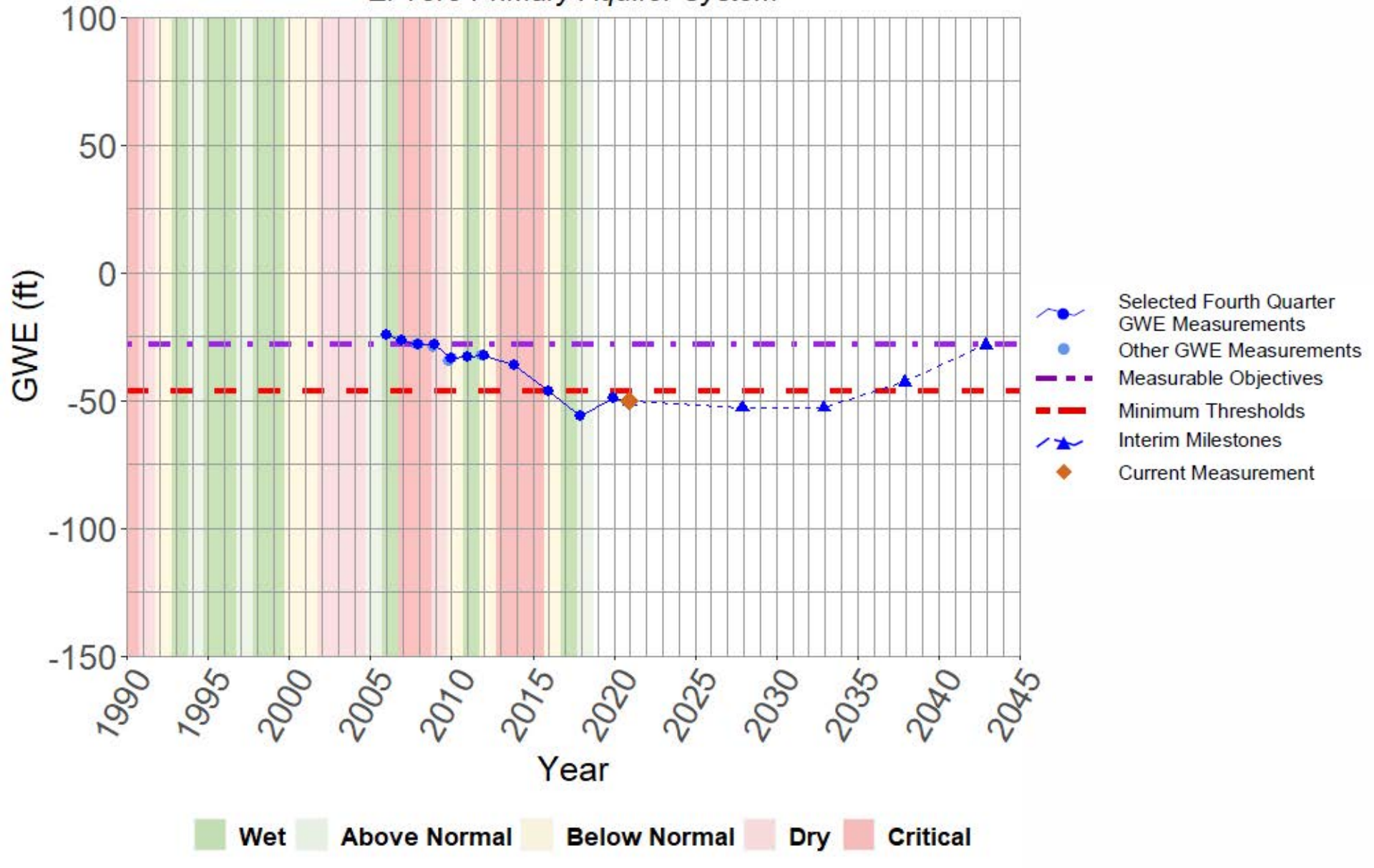
15S02E25C01

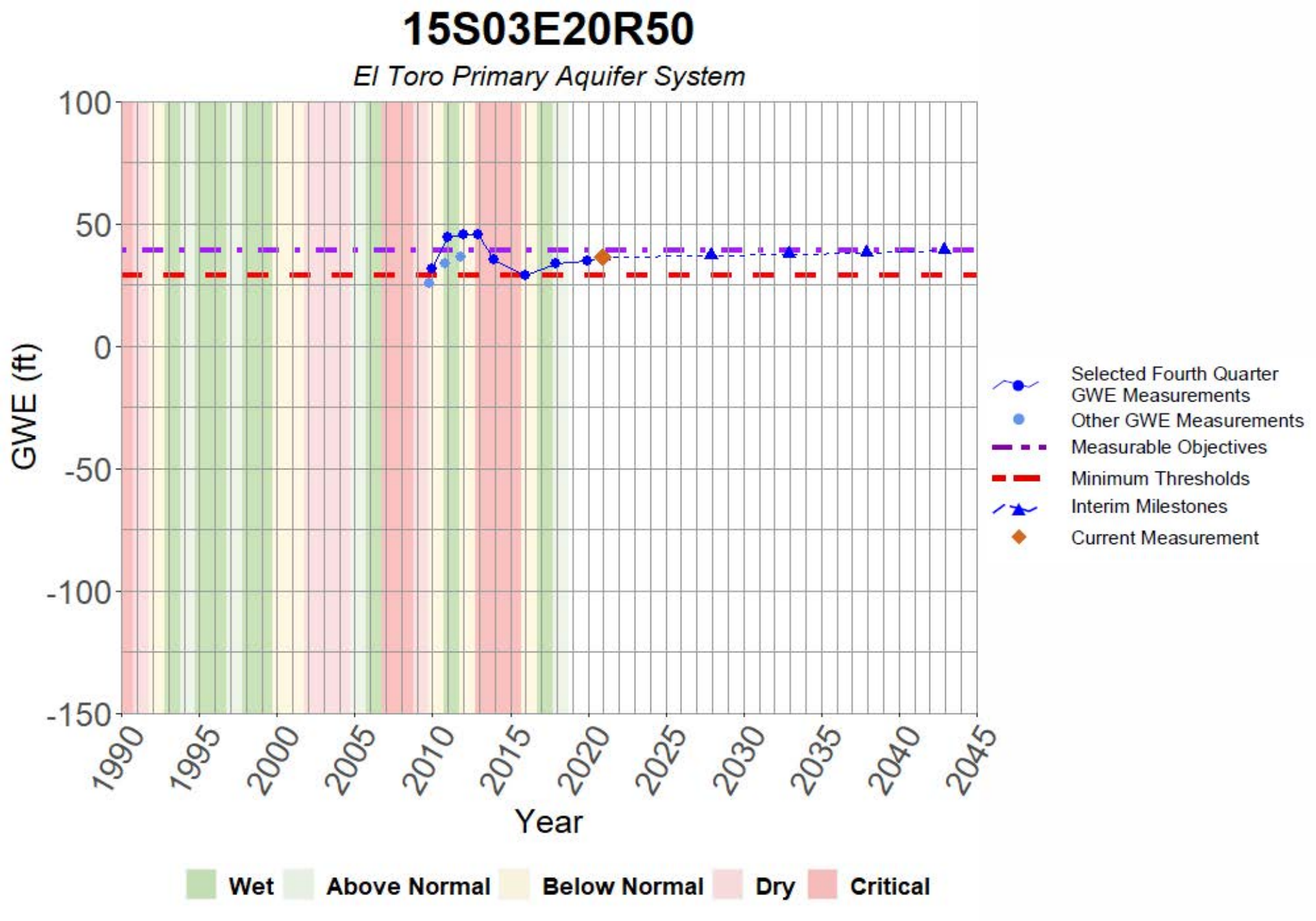
El Toro Primary Aquifer System



15S03E18P01

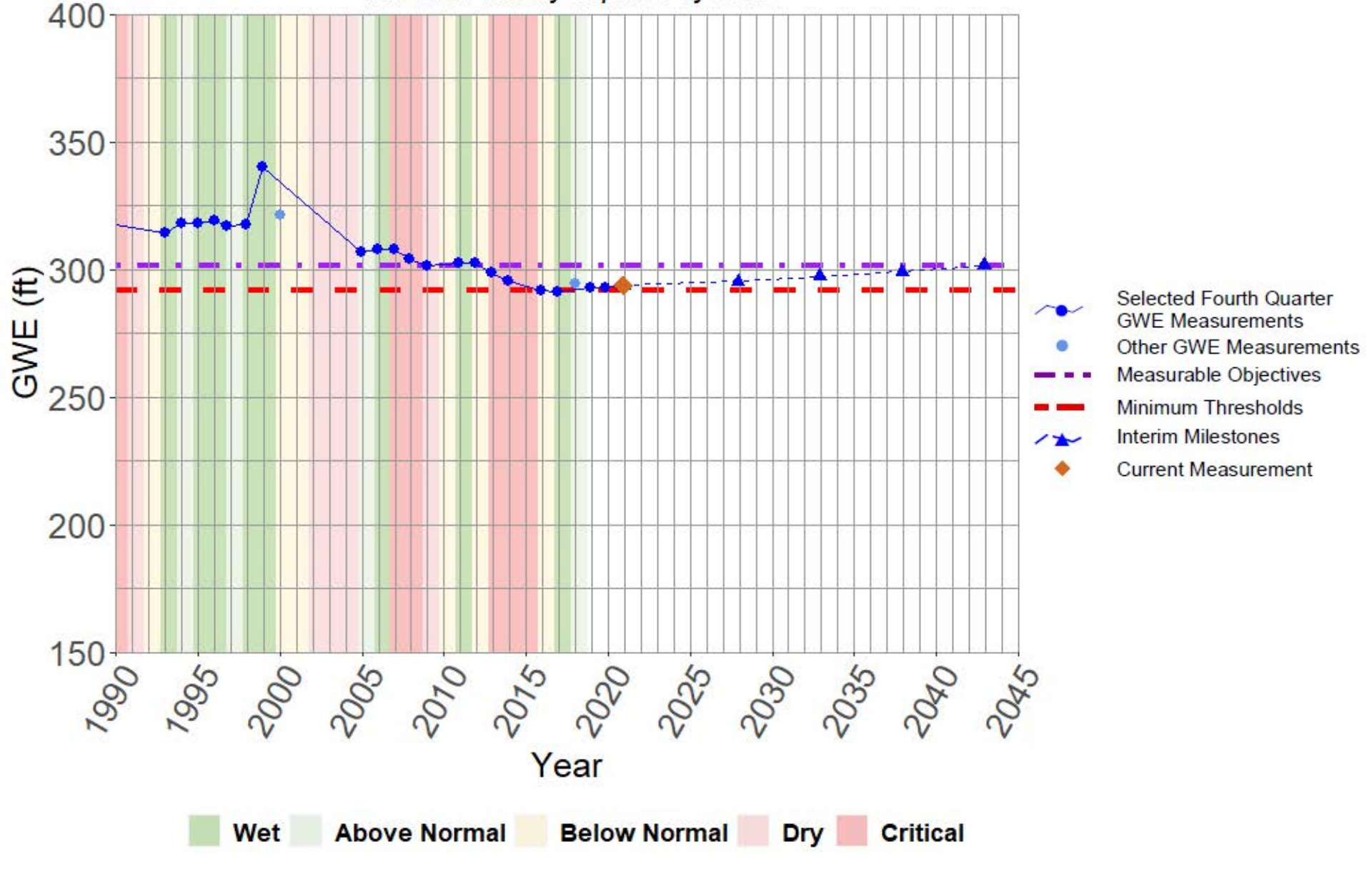
El Toro Primary Aquifer System




15S03E20R50
El Toro Primary Aquifer System
GWE (ft)
100
50
0
-50
-100
-150
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
Year
Selected Fourth Quarter GWE Measurements
Other GWE Measurements
Measurable Objectives
Minimum Thresholds
Interim Milestones
Current Measurement
Wet
Above Normal
Below Normal
Dry
Critical

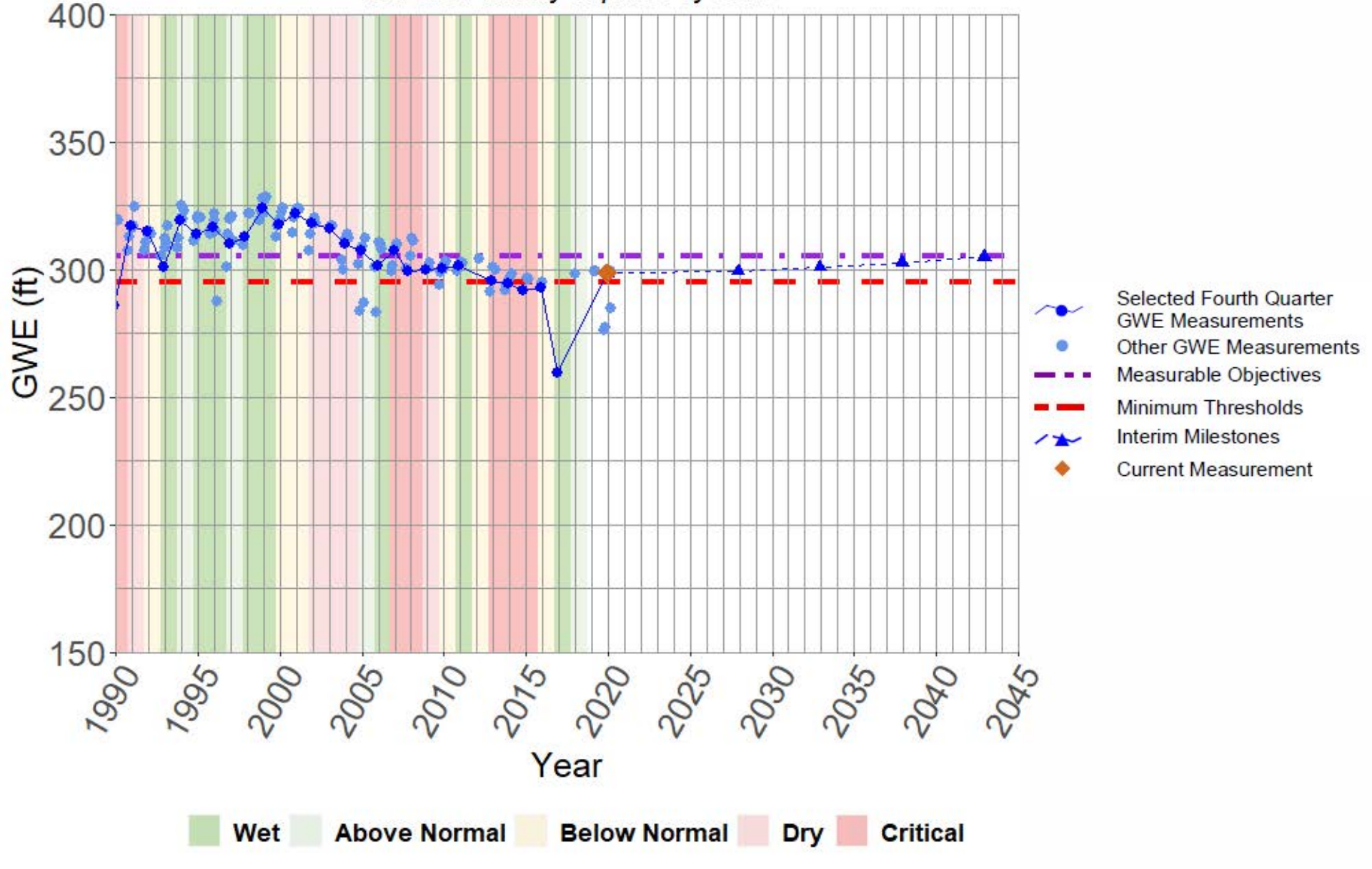
16S02E01M01

El Toro Primary Aquifer System



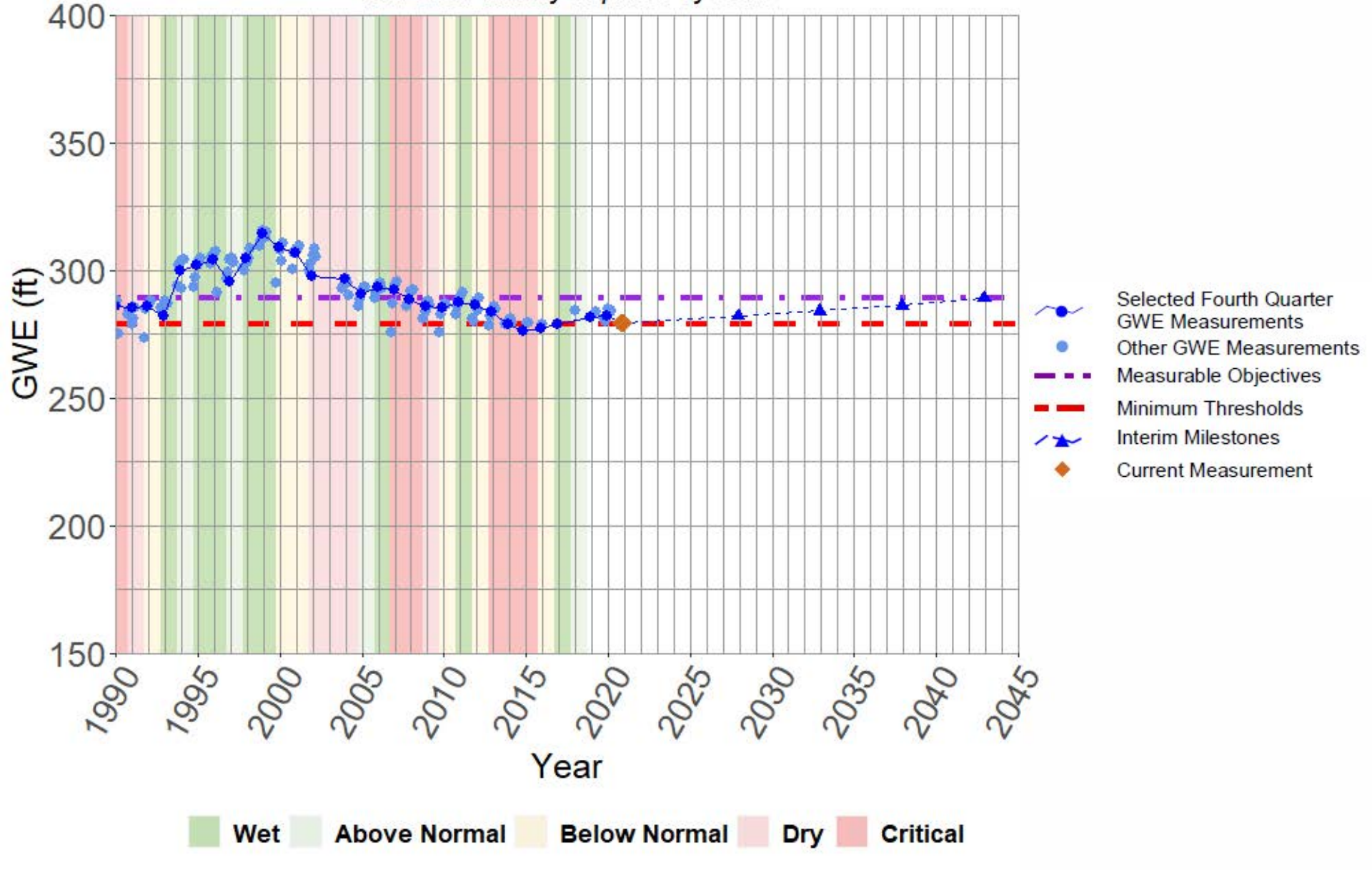
16S02E02G01

El Toro Primary Aquifer System



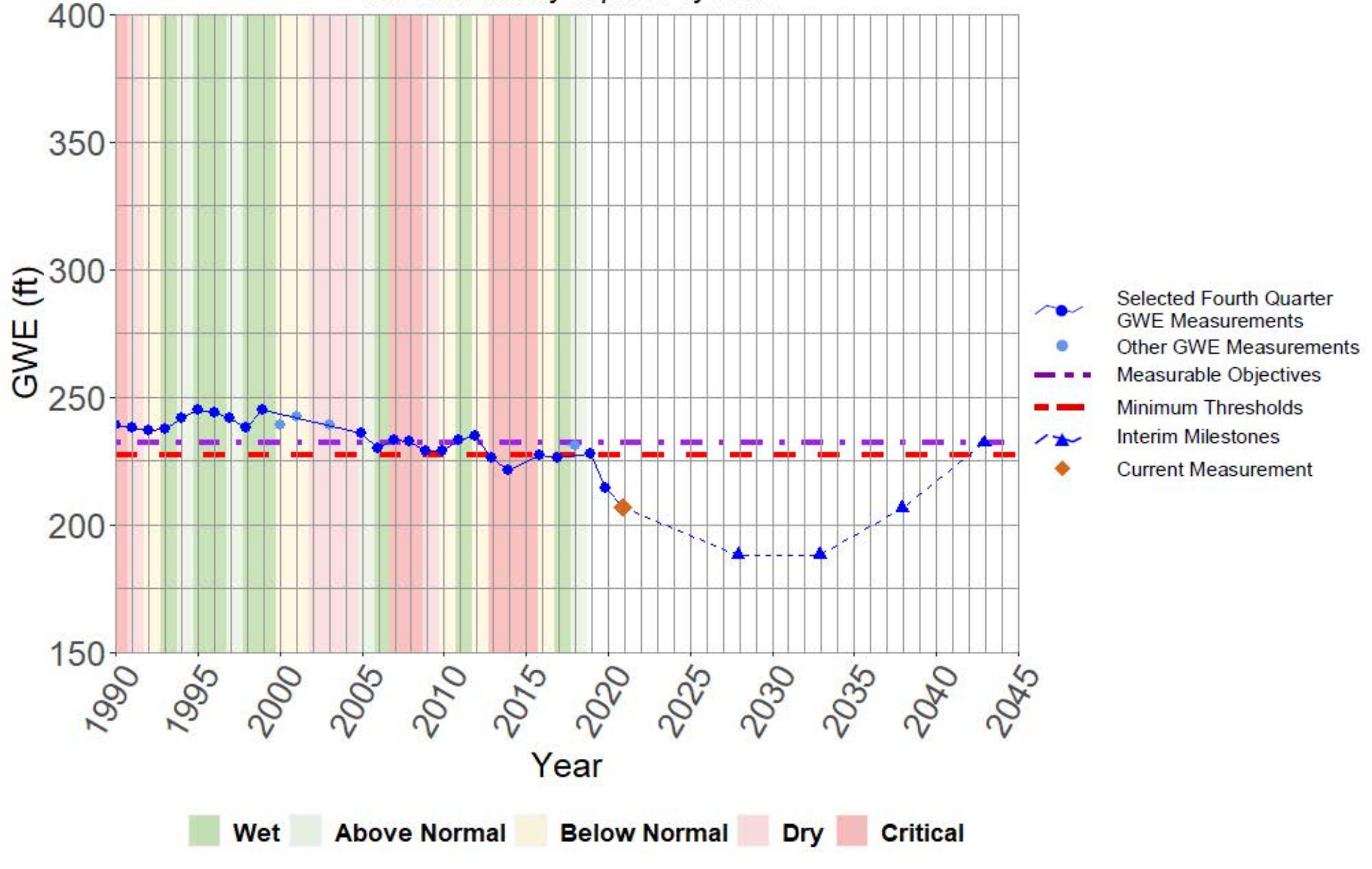
16S02E02H01

El Toro Primary Aquifer System



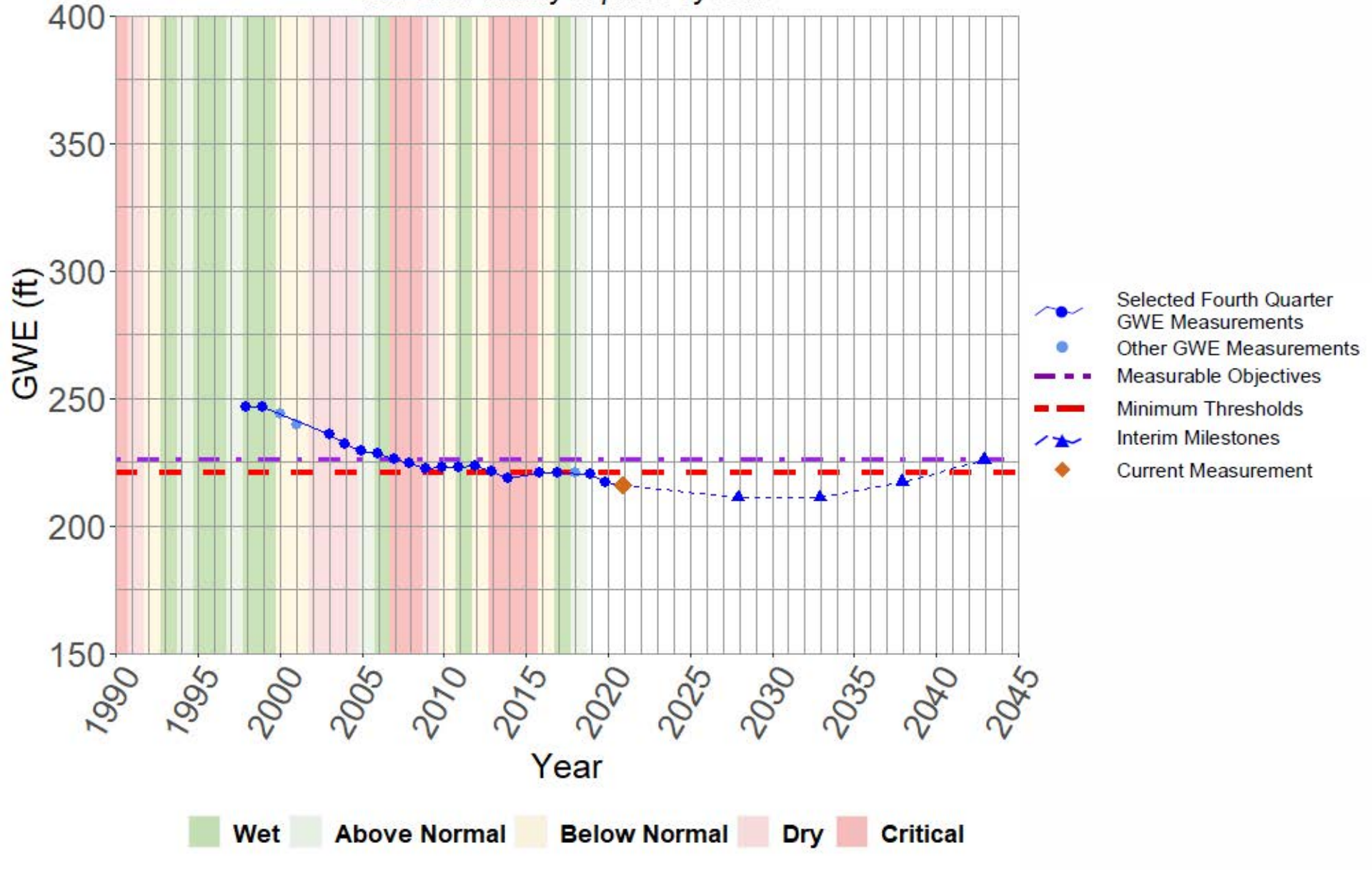
16S02E03A01

El Toro Primary Aquifer System



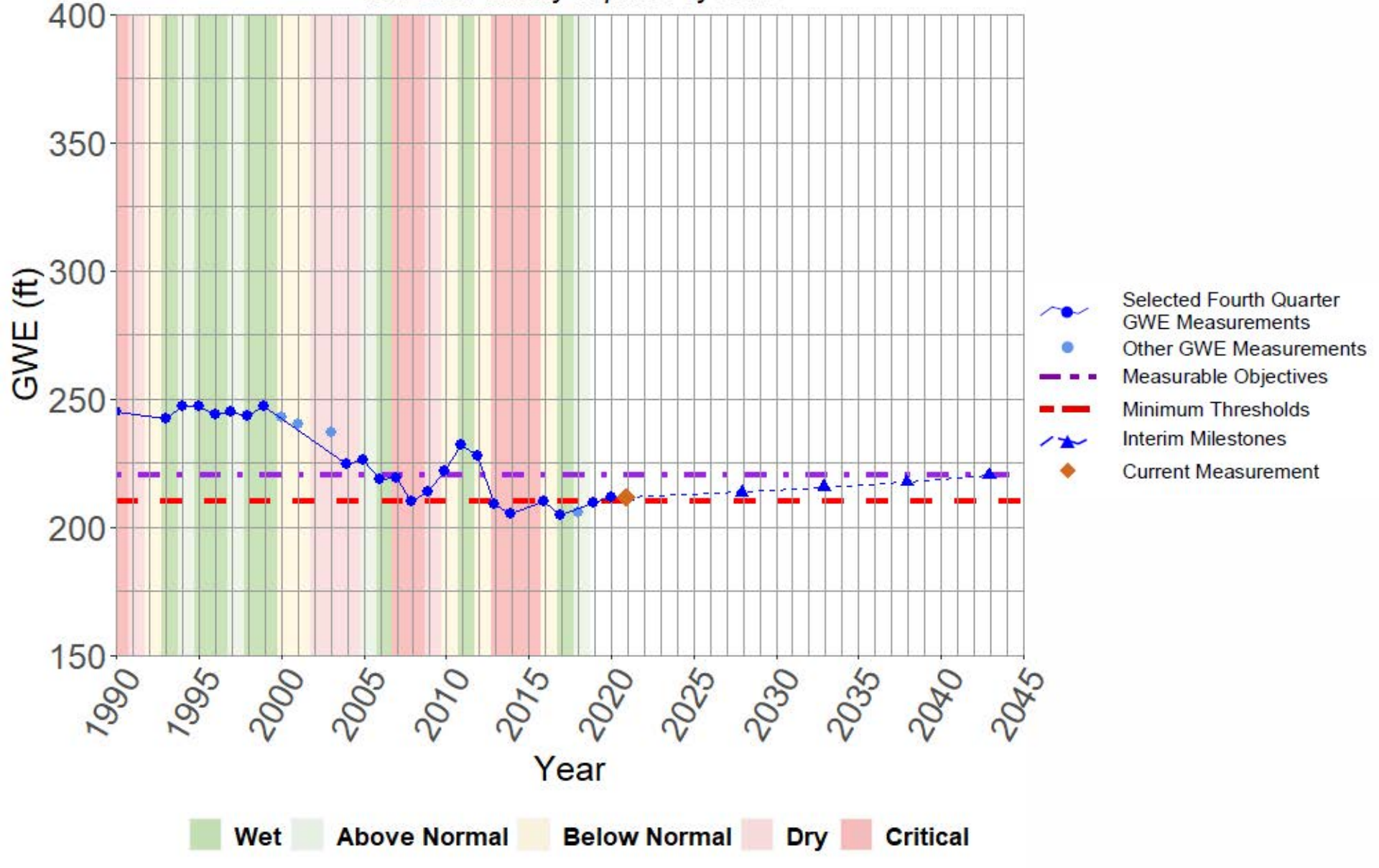
16S02E03F50

El Toro Primary Aquifer System



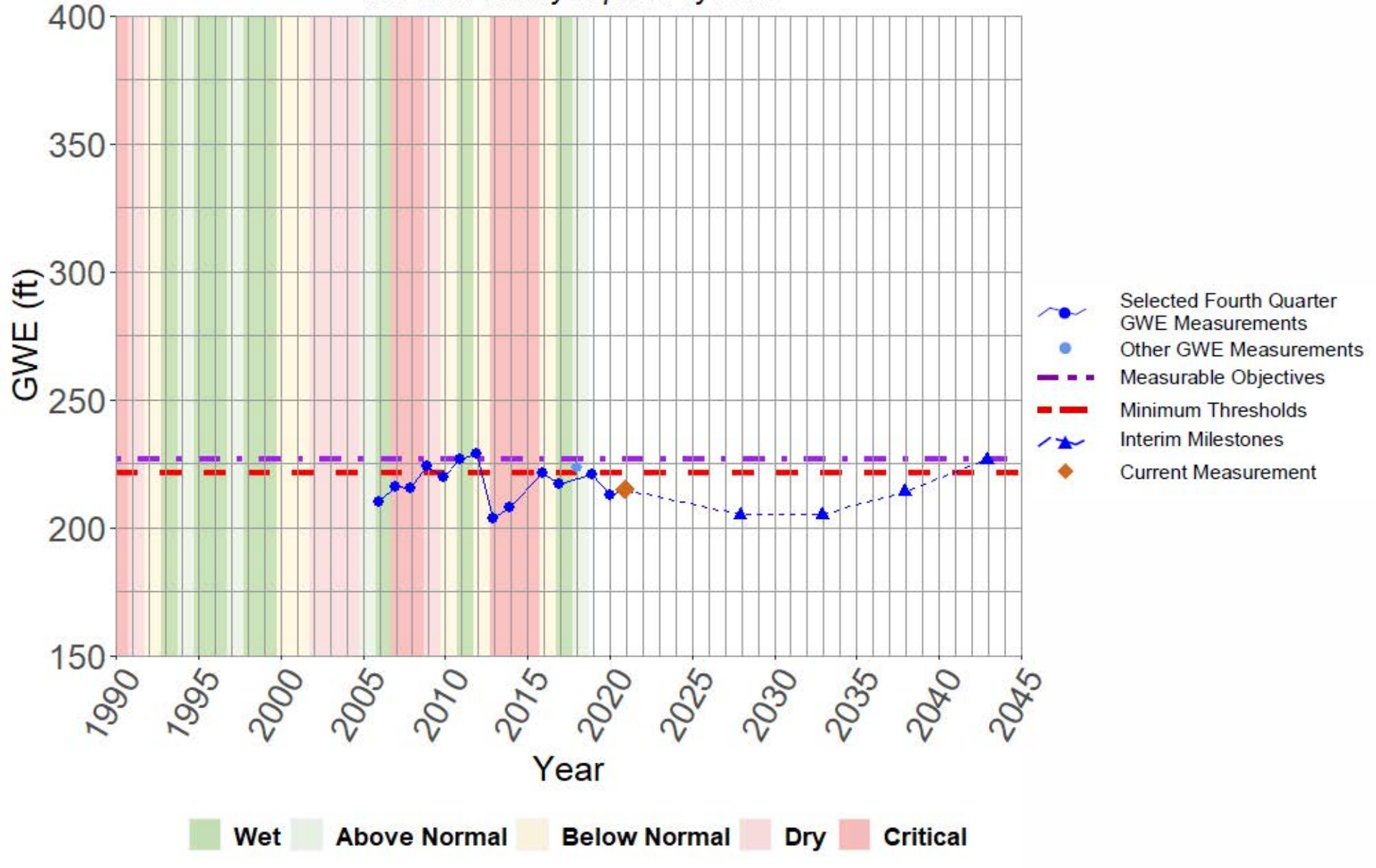
16S02E03H01

El Toro Primary Aquifer System



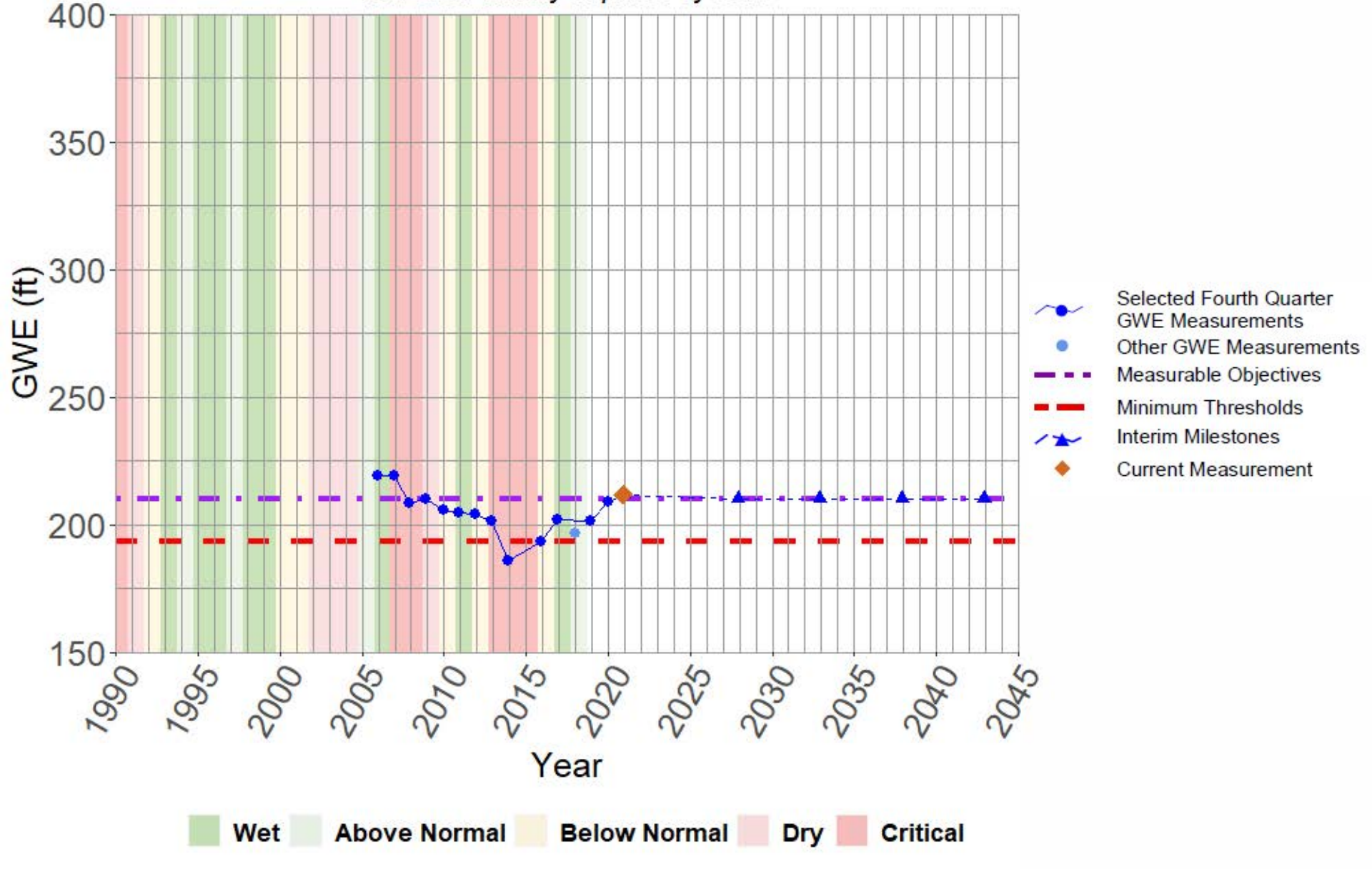
16S02E03H02

El Toro Primary Aquifer System



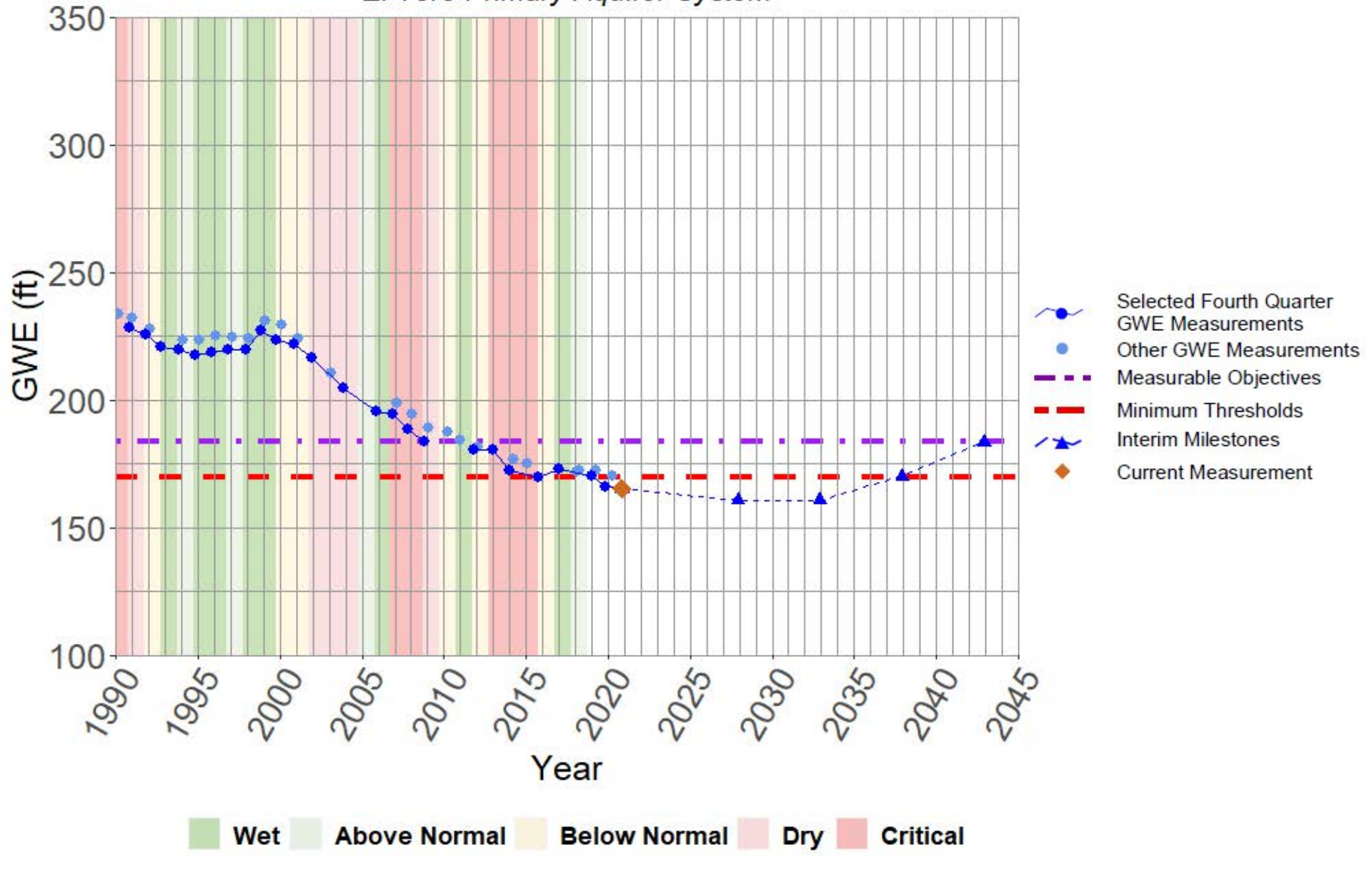
16S02E03J50

El Toro Primary Aquifer System



Robley Deep (South)

El Toro Primary Aquifer System



Robley Shallow (North)

El Toro Primary Aquifer System