



September 27, 2017

FINAL MEMORANDUM

To: Antelope Valley Watermaster

From: Chad Taylor, PG, CHG and Phyllis Stanin, PG, CHG
Todd Groundwater, Watermaster Engineer

Re: Recommendations for Meter Requirements
Antelope Valley Watermaster Rules and Regulations

According to the Final Judgment for the Antelope Valley Groundwater Cases, the Watermaster Engineer is mandated to propose requirements for devices and methods for measuring groundwater production (herein, "meters"). These requirements are to be approved and adopted by the Watermaster into its rules and regulations and submitted to the Court for approval. Meters are required to be installed on all production wells (except for the Small Pumper Class wells) by December 23, 2017. The goal of the metering is to provide accurate reporting of the amount of groundwater produced from the basin.

To ensure that these requirements are workable for the Producers in the Antelope Valley, we discussed preliminary and draft meter requirements with the Advisory Committee on May 31 and July 19, 2017. We have also consulted the Advisory Committee's technical advisor, Larry Rottman, to better understand local well conditions. We have incorporated comments received during Advisory Committee meetings, as well as numerous verbal and email comments from various parties to the Judgment. In addition, we have considered state and federal standards, as well as manufacturer specifications, for meter installation and operation.

The final draft requirements were presented to the Advisory Committee on August 16, 2017. Additional comments and requests for revisions were made at that meeting; these requests have been considered and incorporated into this final memorandum. The Advisory Committee unanimously approved the final draft on September 21, 2017.

The final draft meter requirements were posted to the Watermaster website on August 25, 2017 to coincide with a 30-day notice of a public hearing at the September 27, 2017 Watermaster Board Meeting. At the hearing, the Watermaster Engineer discussed the development of the requirements, along with final edits. After considering comments at the public hearing and approving the final edits, the Board adopted Resolution R-17-07, which approved the revised meter requirements on September 27, 2017. Given the impending deadline, and noting that rules and regulations must be approved by the Court, we recognize the urgency for Board and Court approval of these requirements.

ARTICLE 1 – MONITORING

1.1 Production Monitoring

By December 23, 2017, all parties other than the Small Pumper Class shall install meters on their wells for monitoring production and submit proof thereof to the Watermaster (¶18.1 of the Judgment). Each party shall bear the cost of installing its meter(s) (¶18.1). The Watermaster Engineer shall propose, and the Watermaster shall adopt and maintain, rules and regulations regarding determination of Production amounts and installation of individual water meters (¶18.5.5). The rules and regulations shall set forth approved devices or methods to measure or estimate Production (¶18.5.5). Producers who meter Production on the date of entry of this Judgment shall continue to meter Production (¶18.5.5).

Meter installations are also required for any member of the Non-Pumper Class who has complied with the New Production Application Procedure specified in ¶18.5.13 of the Judgment. Producing Non-Pumper Class members shall report production to the Watermaster, and prior to the commencement of production, shall install a meter consistent with the requirement of these Rules and Regulations (¶9.2.2).

All references to annual or quarterly reports herein are based on a calendar year (January 1 through December 31).

1.2 Approved Meter Installer and Tester

Meters shall be installed, tested, or repaired by pre-qualified persons, firms, or corporations shown to be qualified for installing, repairing and/or testing water measuring devices. Such persons, firms, or corporations must submit their qualifications to the Watermaster Engineer for approval and inclusion on the Pre-Qualified Meter Installer list maintained by the Watermaster. The list will include the name, address, and telephone number of all Watermaster-approved meter installers and testers. Persons, firms, or corporations will only be approved for installing and or testing the type(s) of meters for which they can demonstrate experience to the Watermaster Engineer. Persons, firms, or corporations may also be approved for field calibration of meters after demonstrating sufficient experience and expertise.

All approved persons, firms, or corporations will be instructed in the expectations for meter selection, installation, and documentation and testing. For meter testing, the Watermaster Engineer shall either instruct approved testers on appropriate testing tools and techniques or coordinate with approved testers to confirm that their standard approach is satisfactory to the Watermaster Engineer. The Watermaster shall provide forms to submit documentation of meter installation and testing.

The Watermaster shall make the list of approved persons, firms, and corporations available at the office of Watermaster and on the Watermaster's website.

1.3 Acceptable Meter Types

Each water production well of all parties other than the Small Pumper Class shall be equipped with a meter. Acceptable meters shall be of the singlejet, multijet, turbine, propeller, venturi, electromagnetic, or transit-time ultrasonic type as described in American Water Works Association (AWWA) standards M6 and M33. Other types of meter or variations on the types listed above may be considered if specifically requested in writing to the Watermaster Engineer prior to installation. Requests for meter type variances shall include documentation of meter specifications from the manufacturer, including installation requirements.

All meters shall be equipped with totalizers sufficient to capture at least five months of anticipated production volume. All meters shall be new or factory refurbished and calibrated within a year prior to installation. All meter installations must be documented to the satisfaction of the Watermaster Engineer, as described below in Section 1.6.

1.4 Meter Selection

All meters shall be appropriate for the individual application. Meter selection should consider size, range, accuracy, error, maintenance, and longevity and other factors described in AWWA M6 and M33 and all other applicable AWWA standards¹. At a minimum:

- Each meter must be appropriately sized for the production rate and discharge piping of the well.
- Each meter must have a measurement range that matches the expected range of production rates from the well on which it is to be installed.
- The error in the reading of each meter shall be no greater than two (2) percent of rate or full scale, whichever is less.

It shall be the responsibility of each party to work with their selected approved meter installer to ensure selection of appropriate meters. Selected meters shall be of one of the types described in Section 1.3. If a party wishes to employ an alternative meter type, they must submit a request for a variance to the Watermaster Engineer as described in Section 1.3.

Some parties may choose to employ more than one meter for a single well as backup or secondary meters for use during regular meter maintenance or recalibration. This is acceptable so long as the meters are of the same type, manufacture, and model.

¹ Different AWWA standards are developed for specific meter types; please refer to all standards regarding the specific meter being used. A list of potentially applicable AWWA standards is provided at the end of these requirements.

1.5 Meter Installation

Meters must be installed in strict adherence to all applicable manufacturer recommendations, AWWA standards, and industry norms regarding the proper installation of flowmeters in closed piping systems.

Meters have limitations related to piping configurations; upstream and downstream pipe diameter and length are important considerations. Meters are calibrated with a uniform velocity profile distribution such as the one produced by a long length of undisturbed upstream and downstream conditions.

Each meter type measures a specific parameter (e.g., number of revolutions of a propeller or pressure differential) – referred to in AWWA standards as the “influenced parameter” – that is converted into a flow rate. A mathematical relationship between the influenced parameter and flow is fixed based on a certain factor or function derived from calibration test data. This mathematical relationship dictates the accuracy of the flowmeter. A skewed or distorted velocity profile will cause the influenced parameter to become less stable and the calibration factor or function to become either partially or fully inapplicable; this increases the flowmeter’s error, often in a considerable and unpredictable manner. Therefore, meters should not be placed in close proximity to a bend, valve, or other fitting that is likely to disturb the velocity profile at the meter. Such disturbances are magnified if the bends or fittings are out of plane in such a manner as to cause a swirl or crossflow.

The industry standard minimum is straight pipe upstream of the meter that is 10 pipe diameters in length and straight pipe downstream of the meter that is 5 pipe diameters in length; the straight pipe shall have no valves, angled or reducing/enlarging fittings, or other obstructions. Meters shall be installed to meet both manufacturers recommendations and this industry standard. If the manufacturers recommendations for installation are less stringent than this industry standard, the party and the approved installer shall request a variance from the Watermaster Engineer prior to installation of any such meter. Requests for variances are discussed below.

The Watermaster Engineer may consider a variance to these specifications if it can be demonstrated that accurate readings will be achieved. If it is unfeasible to achieve the standard or manufacturer recommended straight pipe intervals before and after a meter, flow straighteners or flow conditioners may be used with prior approval from the Watermaster Engineer. To apply for a variance to use a flow straightener, flow conditioner, or manufacturers recommendations that are less stringent than the industry standard, the party or the approved installer must submit a request to the Watermaster Engineer. Requests for variances to allow flow conditioners, flow straighteners, or less stringent installation standards shall be made in writing and shall include details regarding the reason the variance is required, the manufacturer of the proposed meter and/or flow conditioner/straightener, and the proposed installation specifics. The Watermaster Engineer will review and evaluate such requests for variances and no flow conditioners, flow straighteners, or less stringent installation standards shall be employed without written approval from the Watermaster Engineer.

All new or existing meters shall be calibrated prior to first use. Calibration may be performed by the manufacturer (factory calibration) or in the field, as appropriate for the type of meter. A record of calibration shall be submitted to the Watermaster Engineer in accordance with the documentation requirements in Section 1.6.

All existing, new, or replacement meter installations shall be documented in accordance with Section 1.6. In addition, any changes to the pump or equipment of a metered well must be reported to the Watermaster Engineer within 30 days in accordance with requirements in Section 1.6. Meter details and configurations do not need to be re-documented if the meter is not being replaced.

Some parties may choose to employ more than one meter for a single well as backup or secondary meters for use during regular meter maintenance or recalibration. This is acceptable so long as each meter is documented individually.

1.6 Documentation and Records

Each existing, new, or replacement meter must be documented and recorded with the Watermaster Engineer. Documentation shall consist of all pertinent details regarding each meter, records of calibration, specifics regarding installation, and initial meter readings. The following specific documentation will be provided to the Watermaster Engineer:

1. Production rate or range of production rates for well as currently equipped.
2. Identification (name or number) of well and map showing location of well with sufficient detail to allow the Watermaster Engineer to locate the well.
3. Manufacturers specifications exactly matching the make and model of the installed meter. These specifications shall include:
 - a. Manufacturer name
 - b. Meter type
 - c. Manufacturer model number
 - d. Meter number
 - e. Meter accuracy
 - f. Meter flow range
4. Date of manufacture or date of original purchase of the meter.
5. Proof of most-recent meter calibration from the manufacturer or an approved meter installer with qualifying expertise.
6. Manufacturer's requirements or recommendations for installation of meters. At a minimum, this shall include the specifications for flow conditions leading to and from the meter.
7. As built drawings (computer generated or hand drawn) showing relative locations of wellhead, meter, and all flow restrictions (e.g., valves, elbows, reducers, etc.) and dimensions (lengths and diameters) of all pipes, fittings, valves, and meters.
8. Volumetric units of the totalizer.
9. At least one photograph showing the installed meter and associated piping from the wellhead.
10. At least one readable photograph showing the installed meter totalizer face.

The Watermaster Engineer shall review and assess the completeness of each documentation submittal. Upon establishing that meter documentation is complete, the Watermaster Engineer will assign each installed meter a unique identifying number in our database for internal tracking. The unique meter number from the manufacturer will also be recorded in the database for communications with the meter owner. The unique number on the meter will be used to refer to the meter for reporting production, recalibration, or maintenance. The Watermaster Engineer shall maintain the documentation records for each installed meter and shall use these records for cross-checking production reports and tracking compliance with the Judgement.

Any time the pumping equipment or plumbing within 10 pipe diameters upstream and 5 pipe diameters downstream of the meter at the well associated with a documented meter is changed, the responsible party will resubmit documentation identifying all changes to the Watermaster Engineer within 30 days.

1.7 Regular Meter Testing and/or Calibration

All meters shall be maintained to meet or exceed the accuracy requirements indicated in Section 1.4. Each meter shall either be tested or calibrated regularly to ensure that it meets measurement error and accuracy requirements of these Rules and Regulations. All meters associated with parties that produce over 10 acre-feet per year (AFY) on aggregate shall be tested at least once per calendar year or calibrated at least every three (3) calendar years. All meters associated with parties that produce up to and including 10 AFY shall be tested at least once every two (2) calendar years or calibrated at least every five (5) calendar years. It shall be the responsibility of each party to ensure that each of their meters are either tested or calibrated in accordance with this schedule. Meters need not be calibrated so long as annual testing demonstrates that they are within the accuracy requirements in Section 1.4.

Meter testing shall be conducted by an approved meter tester (as described in Section 1.2) employing tools and techniques pre-approved by the Watermaster Engineer. Responsibility for coordination and costs of meter testing shall be borne by each party that owns the well meter. Meter testing shall be reported to the Watermaster Engineer using Watermaster-supplied forms within 10 days of each test. If the results of any testing event indicate that any meter is operating outside of the accuracy range indicated in Section 1.4, the party shall have the meter repaired or calibrated within 30 days of the date of the test report. If the meter is repaired or replaced, see additional requirements in Section 1.8. For each calibration resulting from a failed meter test, the party shall submit documentation of calibration to the Watermaster Engineer. This documentation shall include identification of the individual or organization that performed the meter calibration. Calibration and documentation of calibration shall conform to the requirements identified in Section 1.6.

If a party chooses to forgo meter testing for any or all of their meters, then the party shall calibrate each meter every three (3) calendar years for parties that produce more than 10 AFY on aggregate or every five (5) calendar years for parties that produce up to and including 10 AFY on aggregate. More frequent meter calibration shall be required if recommended by the manufacturer for the meter type and application. Calibration will be

performed according to the meter manufacturer recommendations by either the manufacturer or pre-qualified meter installer. Following each calibration, the party shall submit documentation of calibration, including the individual or entity performing the calibration, to the Watermaster Engineer. Calibration and documentation of calibration shall conform to the requirements identified in Section 1.6.

If a backup or secondary meter is installed during regular meter calibration, the date on which the meters were switched, the ending totalizer reading for the outgoing meter, and the beginning totalizer reading for the incoming meter must be recorded and submitted to the Watermaster along with the next scheduled production report. If the backup meter is a meter loaned from the manufacturer, it must be an in-kind meter as the one being replaced; the loaned meter must also be documented with the Watermaster Engineer, including the dates used to record production. Use of an over- or under-sized meter shall be avoided.

It is the responsibility of each party to ensure that all their meters have been appropriately tested or calibrated in accordance with this section.

1.8 Repair or Replacement of Inaccurate Meters

Should a party discover that the meter which measures the water Production from the party's well is measuring inaccurately, the party must notify the Watermaster Engineer within 10 days of the problem, and have the meter repaired or replaced. Defective or inaccurate meters shall be repaired or replaced within thirty (30) calendar days after discovery of the problem. The tolerance standard for repairing each meter shall be to return the meter to an error of not more than two (2) percent of the instantaneous rate reading. Upon completion of such repair, said repaired meter shall be tested by any meter tester authorized by the Watermaster Engineer. Results of such meter tests shall be furnished to the Watermaster Engineer within ten (10) business days after testing.

If a backup or secondary meter is installed during meter repair or off-site calibration, the date on which the meters were switched and the ending and beginning totalizer readings for each meter must be recorded and submitted to the Watermaster Engineer along with the next scheduled production report. If the backup meter is a meter loaned from the manufacturer, it must be an in-kind meter as the one being replaced; the loaned meter must be documented with the Watermaster Engineer including the dates used to record production. Use of an over- or under-sized meter shall be avoided.

If defective or inaccurate meters are not repaired within the prescribed time limit, the violator will be provided notification to appear before the Watermaster to discuss remedy². In the event the violator and the Watermaster cannot reach a mutually agreeable solution within forty-five (45) days thereafter, the Watermaster shall obtain the Court's permission to allow the Watermaster Engineer or its representative to enter onto the violator's property to repair or replace the defective or inaccurate meter. All costs incurred by the Watermaster to repair or replace the defective or inaccurate meter, including the legal fees

² Information in this paragraph may be subject to legal review.

and costs to obtain the Court's permission to enter the violator's property, shall be billed and collected from the violator within fifteen (15) days after receipt of the Watermaster's bill for such costs.

1.9 Estimation of Production Due to Lack of Accurate Meter Measurements

When Production must be estimated due to lack of accurate meter measurements for any reason including a defective or inaccurate meter or a meter removed for off-site calibration, and a back-up or secondary meter has not been used, the Watermaster Engineer must approve the method of estimation. A copy of the estimate calculations shall be supplied to the Watermaster Engineer.

1.10 Small Pumper Class Monitoring

The primary means for monitoring the Small Pumper Class Member groundwater use will be based on physical inspection and other means by the Watermaster Engineer, including the use of aerial photographs, land use maps, and/or satellite imagery. Should the Watermaster Engineer develop a reasonable professional opinion that a Small Pumper Class Member household is using more than 3 acre-feet per year, a meter may be required on the Small Pumper Class Member wells at the Small Pumper Class Member's expense (§15.1.3.2).

ARTICLE 2 – PRODUCTION REPORTS

Each party to the Judgment shall monitor and record production volumes from each of their wells and report production volumes from each well to the Watermaster Engineer. Parties that produce more than 10 AFY on aggregate shall monitor and record production volumes monthly and report groundwater production volumes from each well to the Watermaster Engineer quarterly. Parties that produce up to and including 10 AFY on aggregate shall monitor and record production volumes at least quarterly and shall report these values to the Watermaster Engineer quarterly; monthly monitoring and recording is preferred for all parties. Production from each well can be listed on one Production Report form, provided by the Watermaster. Administrative Staff will provide the report to the Watermaster Engineer for review and recordation. Each report shall include:

- Identification of the Party
- County in which the property is located
- Well coordinates
- Assessor's Parcel Number (APN) of the parcel on which each well is located
- APN(s) for the parcel(s) on which the water is used for Overlying Production parties (Exhibit 4), if not previously provided³³

³³ The Watermaster Engineer is compiling APNs applicable for each of the Overlying parties listed in Exhibit 4 of the Judgment. If a party has not already supplied APNs to the Watermaster for parcels on which produced groundwater will be used, those APNs are requested on this Production Report. For Non-Overlying parties on Exhibit 3, produced water is assumed to be used within the respective

- Unique meter number (see Section 1.6)
- Date and time for each meter reading
- Totalizer value and units for each meter reading
- A readable photograph of the totalizer readout corresponding to the last monthly measurement collected each quarter.

Reports of monthly groundwater production for the previous quarter will be submitted to the Watermaster Engineer electronically via email by the end of the first month of each quarter. Reports shall therefore be due to the Watermaster Engineer no later than January 31, April 30, July 31, and October 31 for production in the previous quarter.

service area. If produced groundwater is used outside of the service areas of Exhibit 3 parties, or outside of parcels owned by the reporting Exhibit 4 party, APNs of those areas are required.

APPLICABLE AWWA STANDARDS:

AWWA C700-15 Cold-Water Meters—Displacement Type, Metal Alloy Main Case
AWWA C701-15 Cold-Water Meters—Turbine Type, for Customer Service
AWWA C702-15 Cold Water Meters—Compound Type
AWWA C704-15 Propeller-Type Meters for Waterworks Applications
AWWA C708-15 Cold-Water Meters—Multijet Type
AWWA C712-15 Cold-Water Meters, Singlejet Type
AWWA C750-16 Transit-Time Flowmeters in Full Closed Conduits
M6 Water Meters—Selection, Installation, Testing and Maintenance, Fifth Edition
M33 Flowmeters in Water Supply, Second Edition