DATE: April 28, 2010

TO: Approved Well Testers

FROM: Matthew Hardesty, Assistant Division Engineer
Division of Water Resources, Division 3

SUBJECT: Measurement Rule Policy Effective 5/2010 for Rules Governing the Measurement of Ground Water Diversions Located in Water Division No. 3, The Rio Grande Basin (05CW12)

EFFECTIVE DATE: May 1, 2010

Rule 3.1.1 of Rules Governing the Measurement of Ground Water Diversions Located in Water Division No. 3, The Rio Grande Basin (Rules), states that "the State Engineer may adopt written standards and specifications for the installation, calibration, testing, repair, and maintenance of meters." This policy document is intended to provide such written standards and clarifications. In particular, this policy is intended to clarify items discussed in **Rule 3 – Measurement Devices** and **Rule 7 – Inactive Wells**.

Rule 3.1 (Totalizing Flow Meter Policies)

Rule 3.1.2 states that "Totalizing flow meters shall be properly verified in the field to be in accurate working condition." Division of Water Resources Division 3 requires that for a totalizing flow meter (TFM) to be verified in the field, the following minimum requirements must be met and adequately documented on Form 3.1 submitted to our office.

In particular, the following items are intended to clarify items discussed in Rule 3.1.1, Rule 3.1.2 and Rule 3.1.4 of the Rules.

TFM and Installation Requirements

- State Statute authorizes Division Staff to access all Measuring Devices to monitor compliance with the Rules. Therefore, in addition to the basic requirements stated in Rule 3.1, all TFM registers including serial and seal numbers must be accessible and readable when an inspection is made. The TFM register must be clearly visible without having to open or otherwise access electrical control cabinets and or appliances.
- For ultrasonic- and magnetic-type TFM the totalizing readout shall display to two decimal places or one-hundredth of an acre-foot (0000.01 acre-feet)
- Totalizing flow meters shall contain sufficient recording digits to assure that "rollover" to zero does not occur within three years. The "roll over" frequency of a totalizing register is based on **actual** use, not maximum potential use.
- Installations of an electrically powered TFM dependent upon batteries as their principal source of power are not allowed.
    - Batteries may serve as a backup power source only.
- Artesian wells, or any well not requiring electrical power to supply the pump, must be equipped with a mechanical TFM or have a continuous power supply to the TFM register at **all** times whether or not the well/pump is flowing/running.

- TFM dependent upon electricity for operation must be hardwired to the same electric panel box as the well that the TFM measures.
    - There can be no splices, disconnects or switches between the TFM and the electric box.
    - The wire between the electric box and the TFM must be encased in conduit or otherwise routed and attached in such a manner as to prevent breakage from livestock, wildlife and the elements.
- Any wire between a TFM and a remote register:
    - Must be a continuous wire with neither splices or disconnects.
    - Must be encased in conduit or otherwise routed and attached in such a manner as to prevent breakage from livestock, wildlife and the elements.
- If a previously verified TFM is used to measure a different well due to relocation of an entire center pivot assembly and TFM assembly, the TFM is required to be re-certified to assure meter accuracy in its modified location and configuration.
- If a previously verified TFM is used to measure the well for which it was verified but has been placed in new piping such as a new center pivot riser pipe, for example, the TFM is required to be re-certified to assure the meter accuracy in its final installed configuration.

Multiple Operating Conditions

TFM accuracy shall be verified for all operating conditions. This may require multiple documented test conditions. For example:

- For a TFM measuring wells with artesian flow (water flowing without the use of a pump) that can also be pumped, it is necessary to confirm that a full-pipe condition at the TFM is maintained **and** that the TFM is accurate under both artesian and pumping conditions.
- For a TFM measuring wells with multiple discharge conditions such as a pressurized discharge to a pond or sprinkler system as well as an open discharge, it is necessary to confirm that a full-pipe condition at the TFM is maintained **and** that the TFM is accurate under all operating conditions.
- For a TFM measuring the flow from more than one well, it is necessary to confirm that a full-pipe condition at the TFM is maintained **and** that the TFM is accurate under all operating conditions. For example:
    - First well on, second well off
    - Both wells on
    - First well off, second well on
- For a TFM measuring multiple wells, observations of the installed flow meter shall be made to correspond with each individual well test and observations shall be made to verify that the pumping rates are steady within 2.5% of discharge throughout the duration of the test.

Mechanical TFM Register (Readout) Replacement Requirements

Anytime a register is changed on a previously verified mechanical TFM, the following procedure must be followed:

- Replacement of a TFM register must be performed by the manufacturer or the manufacturer's representative or by an Approved Well Tester.
- Before a register is changed, the manufacturer must be contacted to determine the proper gear ratio (mechanical flow meters) so that the installation is in compliance with manufacturer's recommendations and with the measurement rules and measurement policies regarding accuracy.

- A verification of the TFM with the new register in place must be performed before any water is diverted by the well/pump. Additionally, form 3.1 – Notice of Totalizing Flow Meter Verification, Re-Verification, or Replacement must be submitted to Division of Water Resources, Division 3 before any water is diverted.
- Mechanical TFM registers must at all times be secured with a tamper-resistant cover. The tamper-resistant cover shall be "sealed" in place by means of a factory seal or a wire cable secured in place by a clamp or other mechanism. If a factory seal is replaced with a wire and seal clamp, the seal clamp shall be appropriate for outdoor use and be pre-printed with a five to seven digit numeric identifier to be recorded on Form 3.1. In order for the cover and seal to be considered tamper-resistant by the Division of Water Resources, it must not allow any modifications to the of the flow meter without the breakage of the seal.
- In addition to Form 3.1, the well tester or the well owner/user must supply the following information to DWR:
    - Notification of intent to remove the factory seal prior to commencement of work;
    - The name of the person performing the replacement, along with a brief statement of that person's qualifications if not an approved well tester;
    - Documentation of manufacturer's recommendations and certification that those recommendations were followed and
    - Reading from the TFM register being replaced (if possible) and the beginning reading of the new register on the submitted Form 3.1.

General Test Procedures

- All wells shall be pumped continuously a minimum of 15 minutes before any TFM verification measurement readings are recorded (start-up time).
- A minimum of three separate volume readings, each spanning a minimum of 5 minutes **or** a single volume reading spanning a minimum of 15 minutes from both the installed and test meter**s** totalizing feature **(excluding Collins Meter)** must be obtained for a test to be considered valid.
- All time increments, including start-up time, must be documented on Form 3.1 for test to be considered valid.
- The smallest allowable increment for the readings from the totalizing feature is at least one revolution of the smallest moveable digit. (For example: if the smallest digit recorded by the totalizing feature is 0.1 acre-feet, the smallest allowable volume reading for each of the three separate readings is the time for 0.1 acre-feet to be recorded.)
- The calculated flow rate (volume/time) shall not change more than 2.5% between any readings.
- All calculations should be adequately documented on Form 3.1 including, but not limited to, beginning and ending totalizer reading on both installed and test meters with corresponding start and finish times.

Mechanical TFM Test Procedures

- For field verification of a mechanical TFM, **instantaneous readings are not allowed.**
- For field verification of a mechanical TFM, the totalizing feature of both the installed and test meters must be used.

Magnetic- or Ultrasonic-Type TFM Test Procedures

- For field verification of a magnetic- or ultrasonic-type TFM, the totalizing feature of both the installed and test meters must be used **unless** the time for the totalizing feature on the installed

flow meter to advance the smallest increment exceeds 15 minutes. In such case, instantaneous readings of the installed TFM may be allowed in-lieu of the totalizing feature readings. The TFM instantaneous flow readings must consist of a minimum of 10 separate instantaneous readings taken at documented even intervals over a minimum time period of 15 minutes not including the start-up time. The instantaneous flow rates taken shall not vary by more than 2.5% between any readings. The Totalizing feature of the test meter **must** be used (no instantaneous observations will be allowed).

- For tests utilizing instantaneous readings, the test meter reading shall span the concurrent time interval as the installed meter test.

Collins-Type Meter Test Procedures

- A Two-Point Test shall be accomplished by taking a front and back reading on both sides of the pipe at a distance equal to 0.354 * I.D (inside diameter) from the center of the pipe. The readings from each side of the pipe shall be averaged separately. If the difference between the average velocities from each side of the pipe is greater than one foot per second (1 fps), a Ten-Point Test **must** be performed. A Two-Point Test **will not** be accepted.
- Collins Meter tests shall be performed a minimum of three pipe diameters upstream or one pipe diameter downstream of the existing installed flow meter. Written documentation on Form 3.1 of flow rate recorded by the installed TFM should be made after the removal of the Collins Tube to confirm that the Collins Tube obstruction during the test does not cause inaccuracies to the installed flow meter.
- If the Collins Meter is located less than 3 pipe diameters from any obstruction (i.e. flow meter, bend, valve, reduction, etc.) a Ten-Point Test is required.
- For Flow Constants (gallons/minute/foot/seconds) not listed on the Collins Meter chart the appropriate equation below should be used. (Note: The following equations can always be used):
    - Pipe sizes up to 10-inch NPS: $\boldsymbol{(2.55 * D^2) - D}$
    - Pipe sizes over 10-inch NPS: $\boldsymbol{(D^2 * 2.45)}$
    - *Where D = Inside Diameter (inches)*

Volumetric Test Procedures

- Volumetric tests (i.e. bucket tests) should be considered a "last resort" measurement technique when no other reasonable measurement means exists. Use of volumetric test will be considered on a case by case basis. Any Tester that proposes to utilize a volumetric test must contact the Division of Water Resources prior to commencement of the test to propose measurement technique. Failure to obtain preliminary approval may result in denial of test and require re-testing. The following guidelines are recommended:
    - A minimum test time of one minute is required for a single volumetric measurement. This means that the minimum volume allowable in gallons is equal to the well flow rate in gallons per minute (gpm). For example, a 50 gpm well would require a minimum single vessel volume of 50 gallons for a one minute test.
    - The volumetric vessel shall be calibrated by weight using the value of 8.34 lbs per gallon for cool water or dimensionally using the value of 7.48 gallons per cubic foot.
    - The scale used for vessel calibration shall be accurate for the calibrated weight of water and shall be documented on Form 3.1. Any available scale certification documentation such as scale tickets should be submitted with Form 3.1.

Tamper-Resistant Seals

- Register (Readout) Seals
    - **All programmable** TFM registers must at all times be secured with a tamper-resistant cover. The tamper-resistant cover shall be "sealed" in place by means of a wire cable that is threaded through cross-drilled holes in at least four cover bolts and secured in place by a clamp or other mechanism. The seal clamp shall appropriate for outdoor use and be pre-printed with a five to seven digit numeric identifier to be recorded on Form 3.1. In order for the cover and seal to be considered tamper-resistant by the Division of Water Resources, it must not allow any modifications to the programmable functions of the flow meter without the breakage of the seal.
    - **All mechanical TFM registers** must at all times be secured with a tamper-resistant cover. The tamper-resistant cover shall be "sealed" in place by means of a factory seal or a wire cable secured in place by a clamp or other mechanism. If a factory seal is replaced with a wire and seal clamp, the seal clamp shall appropriate for outdoor use and be pre-printed with a five to seven digit numeric identifier to be recorded on Form 3.1. In order for the cover and seal to be considered tamper-resistant by the Division of Water Resources, it must not allow any modifications to flow meter without the breakage of the seal.
- Saddle- or Insert-Type Meter/Sensor Seals
    - All saddle- or insert-type mechanical meters and magnetic/ultrasonic sensors must at all times be secured in place with a tamper resistant seal around the pipe including numeric identifier as described above.
    - Meters that are temporarily removed and replaced in the same pipe and pipe configuration can be sealed with a new seal without re-testing the meter. Form 3.1 shall be submitted indicating type of meter for which seal was replaced, new seal number, old seal number and the TFM reading. No water shall be diverted while meter is removed.
- Broken register seals can be replaced by a Certified Well Tester without re-testing the well by submitting Form 3.1. This will be allowed when the seal breaks due to environmental conditions (i.e. wire fatigue associated with wind or thermal expansion/contraction).
- For programmable register seal replacement, submittal of the meter k factor will be required as part of the 3.1 submittal. Meter verification (Form 3.1) will not be considered complete by the Division of Water Resources unless all new and removed seal numbers and k-factor (when applicable) are provided on Page 1 of Form 3.1. Tester verification signature block on Page 5 of Form 3.1 must also be completed.
- Any seal that is replaced for any reason (meter replacement, meter verification, etc.) should be documented as described above on Form 3.1 by checking all boxes that apply. For example, for a re-verification of a previously verified TFM that requires removal of the register seal, check the box for "Re-verify Previously Verified TFM" and also the box for "Register seal replaced due to:" and include new and old seal numbers.

Form 3.1 Completion

- **All tests completed after May 1, 2010 must be submitted on Form 3.1 with the text Effective 5/2010 located in the lower right-hand corner of Form 3.1.**
- All fields that are applicable to the subject well being tested must be completed and correct on Form 3.1 to be considered a valid verification test.
- If a test fails and the TFM is recalibrated in the field, the failing and passing test must both be submitted together. If applicable, the k-factor setting for both the failing and passing test must be included in the Installed Meter Calculations section of page 2 of Form 3.1.

- All work must be documented on the form and correct for the verification test to be considered acceptable. Any incomplete or incorrect Forms will be denied and returned.
- A meter verification (Form 3.1) will NOT be considered complete by the Division of Water Resources unless the new and removed Seal Number are provided on Page 1 of the Form, verifying that the flow meter was "re-programmed".

Calibration Coefficient (Correction Factor) Variance

Division of Water Resources, Division 3 may grant a request for a variance to allow the use of a correction factor computed by a Qualified Well Tester for totalizing flow meters that measure within plus or minus 5 % up to 8% of an independent field measurement made using calibrated test equipment.

A variance will not be allowed for a TFM correction factor in the range of 5-8% if TFM inaccuracy is due to intentional damage or modification of TFM and/or appurtenances by the owner and/or user of the well.

- The following limitations are placed on use of a correction factor:
    - The variance to allow use of a correction factor computed by a Qualified Well Tester is valid for a maximum of one year.
    - A new variance including new correction factor computed by a Qualified Well Tester shall be required each year thereafter.
    - A variance will only be allowed for a TFM for a maximum of three years. After three years the TFM must be repaired or replaced and working within the required plus or minus 5%.
    - Current correction factor will be applied to all use records for the TFM for a period of one year following the date of the field test unless the TFM is repaired or replaced.

- The procedure for requesting a variance to allow the use of a correction factor computed by a Qualified Well Tester is summarized below:
    - Complete and submit Form 3.1 – Meter Verification, Re-verification, New Meter Installation. This form will provide the results of a field test by a Qualified Well Tester including the meter accuracy and correction factor.
    - The portion of Form 3.1 – Variance Request To Use Correction Factor For TFM Between 5-8% (Variance Requests Only) located on Page 5 must be completed by the Well Owner and/or User.
    - If the request for a variance to use a correction factor is made after the submittal of Form 3.1, the request can be made by submitting Form 11.0 – Variance Request. All required information shall be included on Form 11.0 to be considered valid.
    - All requirements and terms outlined in Policy Memorandum 2006-1 issued by the State Engineer, dated July 26, 2006 shall be applicable to variance requests.

- Following is a summary of the variance policy for TFM correction factors:

Installed TFM Accuracy	Correction Factor	Action Required
0.0% to ±5.00%	0.950 to 1.050	No action required.
±5.00% to ±8.00%	0.920 to 0.950 OR 1.050 to 1.080	Request for Variance must be on Form 3.1 AND Correction Factor will be applied to all use records
More than ±8.00%	<0.920 or >1.080	Unacceptable. Test will be rejected. Installed TFM must be repaired or replaced and the system retested (See Rule 3.1.3).

Rule 7 (Inactive Wells Policy)

Rule 7 of the Rules states that permanently "Inactive Wells are excluded from these rules. Once an Inactive Well affidavit is filed ... no further filings are required under these rules unless the owner wishes to change the Well from inactive status to active status."

This policy is intended to differentiate and clarify requirements for categories of inactive wells including the annual renewal of certain categories of inactive wells. This policy also addresses inactive requirements of artesian wells.

Permanent Well Inactivation

Wells that do not divert water for any purpose (including artesian flow) that are permanently disabled are required to file an affidavit (Form 7 – Inactivation) with DWR. Wells that exhibit **artesian flow** during all or a portion of the year are considered to divert and are **not** eligible for permanent inactivation (see requirements below).

- To be considered permanently disabled the Well must have **no artesian flow** and meet one of the following conditions as indicated on page 1 of Form 7:
  - Well has no pump
    OR
  - Well has electrically powered pump, but service has been disconnected by electric service provider
- Wells that are permanently disabled, as outlined above, are considered Inactive and are **not** required to file any additional affidavit unless the Owner or User desires to change an inactive Well to an active Well (re-activate). In order to re-activate an inactive well the Owner and/or User must accomplish the following:
  - Have a TFM installed and verified by a certified well tester that the TFM is in accurate operating condition (Form 3.1 – Notice of Totalizing Flow Meter Verification, Re-Verification, Or Replacement; AND
  - Submit Form 3.1 to DWR.
- The well **cannot** be used or water withdrawn until the wellhead order posted is removed by DWR (if wellhead order was posted).

Well Annual Inactivation Variance

Wells that do not divert water for any purposes but are **not** permanently disabled or wells that have artesian flow are required to file an affidavit (Form 7 – Inactivation) **annually** with DWR. This includes Wells that are inactive but are **not** disconnected from power or are not powered by means of an electrical connection as indicated on page 2 of Form 7 as referenced below:

- Well has artesian flow all or part of the year (Artesian flow must be less than 50 gpm during all flow conditions with discharge less than 2" in diameter used for domestic purposes including in-house use, irrigation of less than 1-acre and domestic stock watering).
  OR
- Well has active service at the electric meter, but the pump is the only electrical device on that electric meter
  OR
- Well has active service at the electric meter, but the pump is <u>not</u> the only electrical device on that electric meter
  OR
- Pump does not have electrical service (e.g., solar energy, propane, gasoline, etc.)

- Wells that are not permanently disabled, as outlined above, must submit a new Form 7 **annually.** These Wells are considered inactive and cannot divert water as such unless the Owner or User desires to change an inactive Well to an active Well (Re-Activate). In order to Re-Activate an Inactive Well the Owner and/or User must accomplish the following:

  - Have a TFM installed and verified by a certified well tester that the TFM is in accurate operating condition (Form 3.1 – Notice of Totalizing Flow Meter Verification, Re-Verification, Or Replacement; AND
  - Submit Form 3.1 to DWR.

- The well **cannot** be used or water withdrawn until the wellhead order posted is removed by DWR (if wellhead order was posted).