

Discussion Paper: Draft Range of Options for Agricultural Water Measurement

[Note: This paper represents a draft proposal on agricultural water measurement that reflects discussion at the September 22, 2010 ASC meeting. An initial outline of the elements of a regulation are presented in Attachment 3 to this document. On-going refinements to this document and reflections of discussion at the ASC meeting are presented as highlighted text throughout this paper. The continued refinement of this paper and the initial outline of the draft regulation (as presented in Attachment 3), is provided to assist the ASC in its discussions. The draft should be viewed as a work in progress, based upon preliminary understanding of provisions in the Water Conservation Act of 2009, referred to below as SBx7-7. It should not be viewed as DWR's official position. DWR invites comment and input on the draft and identified questions as presented in this paper. DWR also will form an ASC subcommittee focused on the topic of options for water measurement that will provide additional input. Comments should be submitted to DWR staff at agwue@water.ca.gov.]

SBx7-7, enacted in November of 2009, includes provisions on water conservation, measurement, and reporting activities for agricultural water suppliers. DWR is coordinating with the Agricultural Water Management Council and a stakeholder committee in advance of developing a regulation for a range of agricultural water measurement options that water suppliers may use to measure water delivered to customers.

1.0 Provisions Related to Agricultural Water Measurement

Paragraph 10608.48(i)(1) of SBx7-7 states:

The department shall adopt regulations that provide for a range of options that agricultural water suppliers may use or implement to comply with the measurement requirement in paragraph (1) of subdivision (b).

That paragraph refers to 10608.48(b) of SBx7-7:

Agricultural water suppliers shall implement all of the following critical efficient management practices:

(1) Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10 and to implement paragraph (2).

(2) Adopt a pricing structure for water customers based at least in part on quantity delivered.

Section 10813 defines customer as "a purchaser of water from a water supplier who uses water for agricultural purposes." Note however, that Section 10813 provides definitions for Part 2.8, Agricultural Water Management Planning, but not specifically for Part 2.55 of SBx7-7 which includes the paragraphs on water measurement.

Section 531.10 of the California Water Code requires that:

1 (a) An agricultural water supplier shall submit an annual report to the
2 department that summarizes aggregated farm-gate delivery data, on a
3 monthly or bi-monthly basis, using best professional practices.

4 (b) Nothing in this article shall be construed to require the
5 implementation of water measurement programs or practices that are not
6 locally cost effective.

7 Note also that Section 531 defines a lower size threshold for aggregate reporting
8 purposes than SBx7-7 specifies for its measurement regulations.

9 Paragraph 10608.12 (a) of SBx7-7 states:

10 *"Agricultural water supplier" means a water supplier, either publicly or*
11 *privately owned, providing water to 10,000 or more irrigated acres,*
12 *excluding recycled water. "Agricultural water supplier" includes a*
13 *supplier or contractor for water, regardless of the basis of right, that*
14 *distributes or sells water for ultimate resale to customers. "Agricultural*
15 *water supplier" does not include the department.*

16 Further, agricultural water suppliers that provide water to less than 25,000 acres
17 only need to comply if funding is provided to cover additional costs imposed
18 (see section 10853).

19 In contrast, Section 531 of the Water Code states:

20 531(b) *"Agricultural water supplier" means a supplier either publicly or*
21 *privately owned, supplying 2,000 acre-feet or more of surface water*
22 *annually for agricultural purposes or serving 2,000 or more acres of*
23 *agricultural land. An agricultural water supplier includes supplier or*
24 *contractor for water, regardless of the basis of right, which distributes or*
25 *sells water for ultimate resale to customers.*

26 2.0 Timeline for Agricultural Water Suppliers to Comply with 27 Measurement Requirements

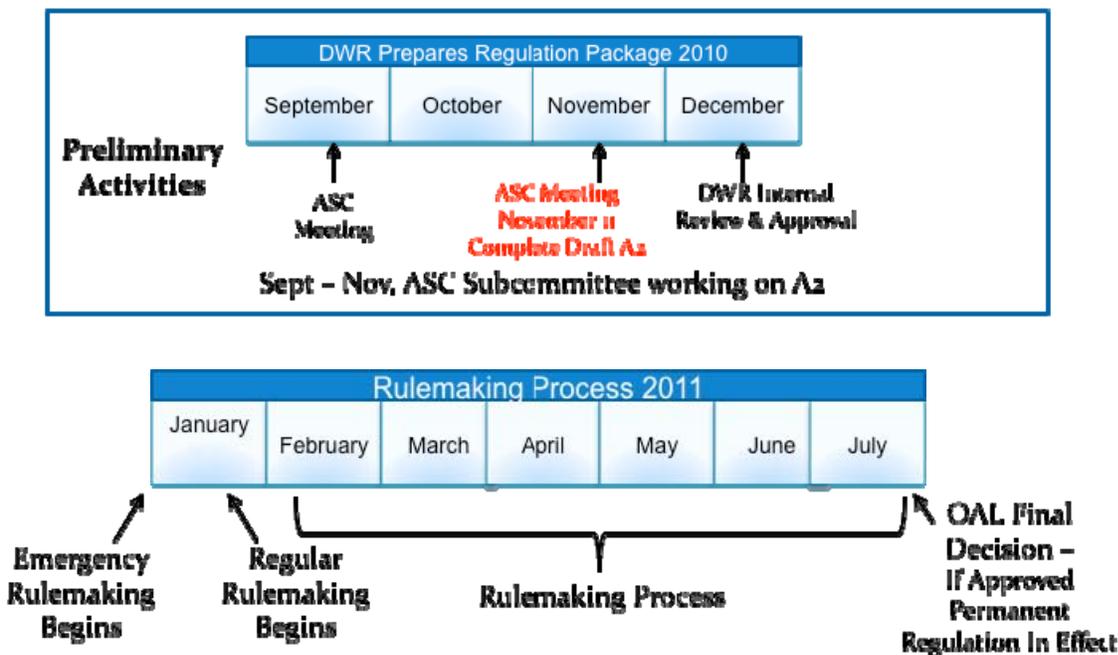
28 DWR is authorized to issue an emergency regulation to provide for a range of measurement
29 options. The emergency regulation will be followed by a permanent regulation. DWR intends to
30 issue the emergency regulation by January, 2011 and the permanent regulation by July 2011 to
31 allow time for agricultural water suppliers to plan and implement the water measurement and
32 water pricing requirements of SBX7-7. Several sections of SBx7-7 determine the date by which
33 agricultural water suppliers must comply with the measurement requirements. These are:

- 34 • Paragraph 10608.48(a) of SBx7-7 sets July 31, 2012 as the date by which agricultural
35 water suppliers shall implement efficient water management practices that include
36 measuring the volume of water delivered to customers.
- 37 • Notwithstanding the July 31, 2012 date stated in paragraph 10608.48(a), SBx7-7
38 paragraph 10608.56 (b) establishes the onset of the grant and loan eligibility test to be
39 July 1, 2013:

1 *On and after July 1, 2013, an agricultural water supplier is not eligible*
 2 *for a water grant or loan awarded or administered by the state unless the*
 3 *supplier complies with this part.*

- 4 • Agricultural water suppliers will still be eligible for grants and loans if the supplier has
 5 submitted to DWR for approval a schedule, financing plan, and budget, to be included
 6 in the grant or loan agreement, for implementation of the efficient water management
 7 practices (paragraph 10608.56 (d)).

8 Based on the dates that apply to agricultural water suppliers above, DWR staff has defined a
 9 timeline to develop and adopt its emergency and permanent regulations. DWR anticipates
 10 submitting its text of the emergency regulation to the Office of Administrative Law (OAL) in
 11 early January of 2011. Additional steps and dates are reflected in Figure 1.



12

13 3.0 Applicability

14 Only agricultural water suppliers that provide water to more than 10,000 irrigated acres are
 15 subject to the water measurement regulations (section 10608 (a)). Further, agricultural water
 16 suppliers that provide water to more than 10,000 irrigated acres but less than 25,000 acres only
 17 must comply with water measurement requirements if sufficient funding is provided
 18 specifically for that purpose (section 10853).

19 Both of these acreage thresholds exclude acreage served by recycled water. Recycled water
 20 means municipal or industrial wastewater that has been treated for waste and is thus usable for
 21 irrigation (section 13050 (n) of the California Water Code). It does not mean untreated return
 22 flow from other irrigated lands.

23 It is important to distinguish between the acreage thresholds for reporting purposes under
 24 Section 531, and the acreage thresholds for the measurement requirements. All agricultural

1 water suppliers “supplying 2,000 acre-feet or more of surface water annually for agricultural
2 purposes or serving 2,000 or more acres of agricultural land” must meet the reporting
3 requirements of Section 531.10(a). The following summarizes how the Section 10608 (a) water
4 measurement requirements will apply to agricultural water suppliers depending on the size of
5 the agricultural water supplier’s irrigated area.

- 6 • **Agricultural water suppliers that serve less than 10,000 irrigated acres** are not subject
7 to the water measurement requirements. They remain subject to measurement
8 requirements of Section 531 of the Water Code if they deliver more than 2000 acre feet of
9 water or irrigate 2000 or more acres of land.
- 10 • **Agricultural water suppliers serving 10,000 or more irrigated acres but less than 25,000**
11 **irrigated acres** are not required to implement the water measurement requirements
12 unless sufficient funding is provided specifically for that purpose.
- 13 • **Agricultural water suppliers serving 25,000 irrigated acres or more** shall measure water
14 deliveries consistent with the water measurement requirements.

15 Any agricultural water supplier that meets the water measurement requirements developed
16 under paragraph 10608.48(i)(1) of SBx7-7, and submits an annual report to the Department that
17 summarizes aggregated farm-gate delivery data on a monthly or bi-monthly basis, will also be
18 deemed to comply with the reporting and measurement requirements of section 531.10 of the
19 Water Code.

20 Agricultural water suppliers include both retail and wholesale water suppliers. Wholesale
21 water suppliers include entities responsible for conveyance and delivery of agricultural water,
22 provided that they meet the size thresholds described above. This latter category includes but
23 is not limited to, authorities that operate canals or other water conveyance and delivery
24 facilities. DWR is specifically excluded from the definition of an agricultural water supplier.
25 Federal agencies, such as the U.S. Bureau of Reclamation, are also excluded. (Need to check: are
26 Indian tribal agencies also exempt?)

27 Paragraph 10608.8 (d) also excludes from the measurement requirement any agricultural water
28 supplier “that is a party to the Quantification Settlement Agreement, as defined in subdivision
29 (a) of Section 1 of Chapter 617 of the Statutes of 2002, during the period within which the
30 Quantification Settlement Agreement remains in effect.” Water suppliers that are excluded by
31 this provision are Imperial Irrigation District, Coachella Valley Water District, and Metropolitan
32 Water District (Need to check: are San Diego County Water Agency or other agencies
33 technically parties to the QSA?).

Over what period of time should a water supplier’s irrigated acreage be calculated? For
example, averaged over 3 years, or 5 years? [See revised definition of irrigated acres in
Attachment 1, Glossary.]

What lands should and should not be included in irrigated acreage? Discussion: lands
within state or federal refuges are generally not included. Should private lands
receiving water to irrigate forage for wildlife be included? [See revised definition in
Attachment 1-needs further discussion]

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1 3.1 Applicability to Wholesale Suppliers

2 A wholesale supplier or other, non-retail entity subject to the water measurement requirements
3 must measure deliveries to its customers only. It is not required to measure deliveries that its
4 retail customers make to their customers. For example, if a wholesale supplier delivers water
5 only to ten retail agricultural water suppliers, and those retail suppliers serve a total of more
6 than 25,000 irrigated acres, the wholesale supplier must measure deliveries to each of the ten
7 retail suppliers, but not to the individual customers served by each of the ten retail suppliers. If
8 the wholesale supplier also delivers water to final agricultural customers, it must also measure
9 deliveries to each of those customers.

10 To determine whether it meets acreage thresholds for compliance, the wholesale water supplier
11 or other entity must include all customers' irrigated acres that fall within the service boundary
12 of the wholesale supplier.

13 4.0 Requirements and Criteria

14 The following requirements and criteria apply to the agricultural water suppliers.

- 15 • Suppliers must measure water delivered to customers. The measurement must be
16 accurate enough to allow the water supplier to charge its customers at least in part based
17 on volume of water delivered (section 10608.48(b)(1));
- 18 • Measurement in 10608.48(i)(1) refers only to water delivered to customers by an
19 agricultural water supplier. It does not include groundwater pumped from private wells
20 even though the groundwater may be managed by a public agency. Groundwater
21 pumped by wells owned by the agricultural water supplier and provided to customers
22 as part of its delivered irrigation water is subject to the requirements. Irrigation return
23 flow leaving fields, farms, or water supplier boundaries is not subject to the
24 measurement requirements, except if it is collected by the water supplier and provided
25 as irrigation delivery to other customers.
- 26 • Measurement in 10608.48(i)(1) refers only to water delivered under the control of the
27 water supplier. For example, water delivered by the retail supplier to a customer at a
28 turnout is subject to the measurement requirements; however, the customer may route
29 that delivery to one or more fields on his or her farm, and delivery to each of those fields
30 would not be subject to the measurement requirements. Similarly, a wholesale supplier
31 must measure the delivery to its customers. The wholesale supplier is not responsible
32 for measuring water delivered to each of the retail supplier's customers.
- 33 • A customer is defined in section 10813 as a "purchaser of water from a water supplier
34 who uses water for agricultural purposes."
- 35 • In most cases a water supplier's customers would correspond to its billing accounts.
36 Nevertheless, measurement must occur at discrete physical locations, so if a supplier
37 delivers water to one customer at more than one location, the measurement
38 requirements apply at each of those delivery locations.

Should customers include only those who pay the supplier for water? Discussion: some users may receive delivery at no cost, for example if they held a pre-existing water right. [There was limited discussion at the ASC meeting. This was seen as a detailed topic for discussion at the subcommittee level that would be relevant once the broader development of the applicability of the new regulations.]

How should “agricultural purposes” be defined? Discussion: irrigation water for crop production is included. Other possibilities: dairies, feedlots, and other livestock facilities; water used to irrigate forage for wildlife on private lands, such as for hunting clubs. [See note above.]

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5.0 Water Measurement Range of Options

DWR is required by 10608.48(i)(1) to develop and adopt a regulation that provides for a range of measurement options. These options allow for a range of conditions and delivery system configurations, including pressurized pipe delivery, non-pressurized pipe delivery, and open-channel delivery.

There are two primary approaches for water measurement requirements:

- (1) Create a list of acceptable measurement devices maintained in defined manners to achieve desired accuracy, or
- (2) Specify measurement accuracy standards that could be met by a range of devices. Included under this option would be requirements defining standards for device rating or calibration and setting minimum standards for frequency of measurement and quality control.

DWR staff proposes that the requirements be based on the second approach – defining a measurement accuracy standard(s).

The use of accuracy standards rather than specifying measurement devices is believed to meet the intent of the legislation in the most flexible and cost-effective manner, because:

- Dictating specific devices can unintentionally constrain suppliers or impose unreasonable or unnecessary costs to accommodate the defined devices.
- Measurement requirements are to assure agricultural water suppliers are able to meet 10608.48(b), which states “Measure the volume of water delivered to customers with sufficient accuracy...” The paragraph is stated in terms of measurement accuracy, not specific devices or technologies.

Attachment 2 provides examples of accuracy standards developed by USBR and other western states. It is worth noting that, of the six states (Arizona, Colorado, Idaho, Kansas, Oregon, and Washington) surveyed for the CALFED report only one, Arizona, had numerical accuracy standards for points of irrigation water delivery by suppliers to individual customers. None of those surveyed required specific hardware devices (though some included examples of devices that would comply).

Are there other approaches that DWR should consider to provide for a range of water measurement options besides the two listed above? [Discussion at the September 22, 2010 ASC included two significant suggestions: (1) allow measurement to occur at a location that represents a more aggregated level than an individual customer, and (2) set a “performance standard” rather than require a specified device. This latter point is believed by DWR staff to be consistent with the idea of an accuracy standard, as is being proposed. See Attachment 3 for further discussion.]

1 5.1 Water Measurement Options

2 The water measurement requirements encompass establishing several elements including: (1)
3 accuracy standards, (2) allowable exceptions, (3) device accuracy rating criteria, and (4) data
4 management, and quality control.

5 5.1.1 Accuracy Standards

6 All measurement devices used by agricultural water suppliers shall meet minimum standards
7 for accuracy of measured delivery. Accuracy is defined as the range of measured delivered
8 volume or flow rate relative to the actual delivered volume, expressed as a percent. Accuracy by
9 volume would be calculated as:

10
$$100 \times (\text{measured volume} - \text{actual volume}) / \text{actual volume}$$

11 Suppliers shall use devices that comply with the standard and are installed and maintained
12 using best professional practices such that each device meets the accuracy standard under most
13 normal operating conditions.

14 The accuracy standard applies to normal operating conditions during the irrigation season.

15 The accuracy standard would be stated as follows:

16 "Agricultural water suppliers, as defined by 10608.12(a), must
17 measure flows during the irrigation season with devices that are
18 operated and maintained to a reasonable degree of accuracy,
19 under most conditions, to +/- ___ percent by volume or flow
20 rate."

21

Does the definition provide enough detail? Discussion: This definition is similar to USBR's, and also to other western states' level of detail. "Accuracy", "irrigation season", "under most conditions" need to be defined (also see below).

[Discussions at the September 22, 2010 ASC meeting highlighted the need to recognize the difference in measuring "volume" (over time) and "flow rate," which is an instantaneous value used to calculate volume (generally used in non-pressurized systems). DWR staff has revised the text to include flow rate standard as another way to rate measurement device accuracy. Please see the revised text above and in Attachment 3.]

Is the formula for calculating accuracy the best one to use? Discussion: Accuracy could be defined as +/- volume rather than percent. Other definitions are also possible, but probably best to stay consistent with accepted definitions used by manufacturers and test labs. [Discussion at ASC meeting seemed to accept the percent range. Need to verify this with the subcommittee. Also, see note above re: volume versus flow rate.]

How should the "irrigation season" be defined for an agricultural water supplier? Discussion: Many water suppliers also deliver significantly reduced quantities during "off-season" months for such purposes as pre-irrigation, rice decomposition, or other uses. Irrigation flows during these or other periods may be substantially less than flows during normal irrigation events, and may be too small for otherwise compliant devices (that meet the accuracy standard) to meet the accuracy standard. [There was no discussion at the ASC meeting. Rather this was seen as a detailed topic for discussion at the subcommittee level that would be relevant once the broader definition of the accuracy standard is developed.]

Should open channel delivery systems have a different accuracy standard than pressurized piped delivery systems? Discussion: A different set of possible devices may apply, but USBR and other western states have set one accuracy standard for all. If requirements are designed solely to meet the two objectives of volumetric pricing and aggregate reporting, is there a reason to have different standards? [This is related to the question above regarding flow rate versus volume standard discussed above. Although the standard could be different for flow rate than for volume, ASC discussion questioned why DWR should set a tighter standard for one than the other. This will be discussed further by the subcommittee.]

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2 5.2 Potentially Allowable Exceptions

3 Because of the diversity in existing water supplier delivery systems throughout the state,
4 exceptions to the defined accuracy standard may be needed in some cases. Exceptions may also

- 1 be reasonable for suppliers with federal contracts, where standards may already exist. DWR
2 staff poses the following questions for discussion:

Should DWR define a measurement requirement different than what CVP requires of its water service contractors? Discussion: The U.S. Bureau of Reclamation's Mid-Pacific Region has developed measurement standards as part of the criteria for Water Management Plans (2008 Conservation and Efficiency Criteria, Reclamation, 2008). The criteria state that Reclamation's CVP contractors must "measure flows with devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 6 percent by volume." The criteria apply to any CVP contractor that is required to submit a Water Management Plan (WMP) in order to satisfy the terms of its contract. Per section 10608.48(f), WMPs approved by USBR are by default accepted under SBX7-7; the same automatic compliance could also apply to the measurement requirement. [DWR is proposing several options, one of which would define the state standard to be the same as that applied by USBR for CVP contractors. See Attachment 3 for further discussion.]

What other specific exceptions might DWR need to consider in the regulation? Discussion: The regulation could simply set up a process for exceptions or it could provide rules on when an exception might be allowed. [The ASC discussed whether certain minimum thresholds should be set on the size of customers that need to be measured. DWR staff understands many suppliers also serve small rural customers with non-potable water supplies that account for small percentages of the total volume served by a supplier. Approaches to address this and other potential exceptions will be discussed at the subcommittee.]

3
4 **5.3 Device Accuracy Ratings Criteria**

5 To comply with the regulations, agricultural water suppliers must determine the accuracy
6 ratings of each device used to measure water deliveries to customers. The following identifies
7 the acceptable methods and frequency associated with determining a device's accuracy rating.

8 **5.3.1 Initial Device Rating**

9 Devices that are less than 5 years old, properly installed, and calibrated, may rely on the
10 manufacturer's accuracy rating. For the manufacturer's rating to be valid, however, the
11 manufacturer must follow best industry practices, including but not limited to, allowing device
12 calibration at third-party testing facilities. Accuracy is typically defined as the range, expressed
13 as a percent, within which all or a large proportion, such as 95%, of delivered flow or volume
14 measurements fall relative to the actual flow or volume. For example, if testing indicates that a
15 calibrated measuring device produces 95% of its measurements within +/- A% of the actual
16 volume, its accuracy would be stated as +/- A%.

Is 5 years an appropriate interval of time to rely on the manufacturer's rating?

[The ASC did not provide much direction, but generally noted that manufactures and several academic institutions provide reasonable methods to set accuracy standards. The subcommittee will further discuss this question.]

How should manufacturer's accuracy rating methods be judged for purposes of meeting the requirements? Discussion: Manufacturers' ratings need to be held to some industry standard so that ratings are deemed to be credible. Can a third-party such as a university or other independent testing lab verify a manufacturer's methods? [Note: the DWR water transfer programs had a process and form for accepting the calibrated metering of groundwater wells involved in groundwater substitution transfers. Should this be reviewed and potentially adopted?] [See note above.]

1

2 For field-built devices, initial rating must be determined by field testing.

3 5.3.2 Recalibration Criteria

4 Each measurement device used by an agricultural water supplier to measure water deliveries to
5 customers must be recalibrated every five years or less to assure continued accuracy of
6 measurement readings. Devices not recalibrated within five years will be considered to have an
7 "expired" accuracy rating and no longer compliant with the criteria. This period of time is
8 established to reflect the typical life cycle associated with the initial manufacturer's rating or a
9 previous recalibration. It also establishes a routine and timely practice for recalibration that
10 correlates with an agricultural water supplier's need to prepare and submit an Agricultural
11 Water Management Plan every five years.

Is 5 years an appropriate interval of time for recalibration? [The ASC noted that the term "recalibration" may not represent what DWR is describing. Rather, it was suggested to refer to the necessary action of assuring continued accuracy by performing period "flow checks" for non-pressurized systems and "maintenance programs" for pressurized and non-pressurized systems. Further discussion will be held in the subcommittee to define on-going demonstration of compliance.]

How should methods be established to assure use of best practices by those performing the recalibration? Discussion: Devices will need periodic recalibration to help suppliers demonstrate the delivery, both for customer billing and to indicate compliance with measurement requirements. For suppliers with many hundreds of devices, recalibration will be a significant and costly effort. Some suppliers may be able to perform the recalibration more efficiently with internal staff. In some cases, specialized equipment and expertise may be needed to test equipment and modify equations, factors, etc. [See note above.]

12

Should an example list be developed by DWR? Discussion: DWR's list would not be part of the regulation, but rather be available for suppliers who are investigating options. The State of Arizona initially included both an accuracy standard and a list of devices in its measurement requirements, but has since abandoned the list of devices. [Noone at the ASC argued in favor of DWR developing a list. Therefore, DWR staff is proposing to drop this as part of the measurement requirements.]

1

2

3 5.5 Data Management, Quality Control, and Reporting

4 Water suppliers will provide a summary of the accuracy ratings for installed measurement
5 devices as part of their Agricultural Water Management Plans (see Section 10826 (a)). These
6 Plans are submitted every five years by an agricultural water supplier (see California Water
7 Code Section 10800). Reporting will include the following information, summarized by major
8 categories of measurement device:

9 • Category of Device

10 • Dates, methods, and entities used for the testing, flow checks, and recalibration

11 • Number of measurement devices that meet or exceed the accuracy standard.

12 • Number of devices that do not meet the standard after testing and calibration. The supplier
13 must provide a plan and schedule for recalibration, repair, or replacement of devices not
14 meeting the standard.

15

How would DWR require reporting of measurement accuracy? Discussion: SBX7-7 requires agricultural water suppliers to measure volume of water with sufficient accuracy to comply with section 531.10 and for pricing structure. Is reporting in Water Management Plans every 5 years an appropriate means for providing evidence of compliance? [The ASC did not specifically discuss reporting requirements. This discussion will occur within the subcommittee.]

16

17 [Note: Data management and quality control to be developed]

Attachment 1 – Glossary (Partial Draft)

The following definitions are used for water measurement options. They define words and phrases that DWR uses in developing and describing measurement options and requirements. Words and phrases that are already defined within the legislation are noted as such.

This list is a work in progress. Existing definitions may be revised and new definitions will be added.

DEFINITIONS IN THIS GLOSSARY WILL BE INCORPORATED AS NEEDED INTO THE DEFINITIONS SECTION OF THE PROPOSED REGULATION.

Accuracy – For purposes of the requirements, measurement accuracy is defined as the range, expressed as a percent, within which all or a large proportion (say 95%) of delivered volume **or flow rate** measurements are expected to fall relative to the actual volume **or flow rate**. For example, if testing indicates that a calibrated measuring device produces 95% of its measurements within +/- X% of the actual volume, its accuracy would be stated as +/- X%. The percent shall be calculated as: $100 \times (\text{actual} - \text{measured}) / \text{measured}$.

Accuracy standard – The specific measurement requirement stated in the adopted regulation, including the numerical value of measurement accuracy.

Aggregate farm-gate delivery –

Agricultural purposes – [directly related to defining “irrigated acres”]

Agricultural water supplier – This is defined in the legislation as: “a water supplier, either publicly or privately owned, providing water to 10,000 or more irrigated acres, excluding recycled water. “Agricultural water supplier” includes a supplier or contractor for water, regardless of the basis of right, that distributes or sells water for ultimate resale to customers. “Agricultural water supplier” does not include the department.”

Best professional practices –

Calibration – This is a procedure to improve the accuracy of a measurement device. It can include physical adjustments to the device itself or revising the numerical factors used in equations that calculate volume based on flow rate, head, depth, and duration.

Customer – This is defined in **Section 10813 of the** legislation as: “a purchaser of water from a water supplier who uses water for agricultural purposes.”

Delivery – The volume of water that the water supplier provides to the customer for agricultural use during a specified period of time. The point of delivery is the physical location at which control of the water is transferred from the supplier to the customer.

Device rating – Measurement devices may be rated for accuracy. Rating may be done by the manufacturer, by an independent testing laboratory, or by the field personnel after installation. If the manufacturer uses an independent testing laboratory, the measurement and reporting of the rating will be standardized and comparable across devices. Accuracy of a device typically depends on operating conditions, so the rating may be expressed as a schedule or equation related to flow rate, head difference, or other important factor affecting the device's accuracy.

Irrigated acres – the acreage, calculated using the last 5 years of available data, of land within the agricultural water supplier's service area that is used for agricultural purposes and has received irrigation water at some time during the 5-year period. Alternatively, if an agricultural water supplier reports irrigated acres in an AWMP approved by DWR or a Water Conservation Plan approved by USBR, it may use that value.

Irrigation return flow –

Irrigation season –

Measurement device – The physical means by which the water supplier measures the water delivered to a customer. Measurement devices generally fall into two categories: totalizing and non-totalizing. Totalizing devices provide a direct measurement of volume delivered, and include most meters, such as propeller meters. Non-totalizing devices require a combination of measurements, such as flow rate and duration or head difference and duration, in order to calculate volume delivered.

Meter – A measurement device installed specifically to measure the flow rate or volume of water passing a point. A meter typically provides its own mechanical or digital readout, such as instantaneous flow or volume totaled over some period of time. Meters may be installed permanently in a pipe or at a turnout, or they can be portable.

Recycled water - Municipal or industrial wastewater that has been treated for waste and is thus usable for irrigation (see Section 13050 (n) of the California Water Code). It does not mean untreated return flow from other irrigated lands.

Retail water supplier – Any agricultural water supplier that sells water directly to customers for irrigation or other agricultural use.

Volumetric pricing – A revenue mechanism by which a water supplier recovers at least part of its total operations cost by charging customers based on volume of water actually delivered. The volumetric charge must be based on measured volume of delivery, and not on a proxy such as acreage or crop type.

Wholesale water supplier – Any agricultural water supplier that sells water to at least one other agricultural water supplier (*need additional qualifier to exempt water transfers from one retail supplier to another*). A wholesale water supplier may also act as a retail supplier to some of its customers. Canal operating authorities and other entities that convey or distribute water to other agricultural water suppliers are considered wholesale water suppliers.

Attachment 2 – Examples of Measurement Standards

USBR's Mid-Pacific Region has developed accuracy standards for measurement of water delivered by agricultural water suppliers to customers. Its 2008 Conservation and Efficiency Criteria (USBR, 2008) state that agricultural contractors must implement (or show a plan for implementing) certain BMPs, including one for measurement of water delivered to each customer.

- *Agricultural contractors must "measure flows with devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 6 percent by volume."*
- *The Water Conservation Criteria provide categories of measurement devices and provide examples of devices in each category. USBR does not specify particular devices that must be used or that it presumes will satisfy the accuracy standard.*

Other States. The following information is from Appendix C of the Final Report of the Independent Panel on Appropriate Measurement of Agricultural Water Use (CALFED, 2003).

The State of Arizona requires that water suppliers or other responsible parties that are subject to its measurement regulations must measure irrigation water delivered. Approved measuring devices must be installed as close as possible to the wellhead or point of delivery which the device is intended to measure.

- *Entities required to measure must use a device that meets an accuracy standard of +/-10%.*
- *At one time, Arizona maintained a list of approved devices that met the standard, but changes in technology, requests for additions to or deletions from the list, and other factors led it to abandon an "approved" list as too burdensome.*

The State of Oregon may require measurement of delivery as a condition of some water rights permits. There appears to be no universal accuracy standard for such permit restrictions. However, governmental entities are required to measure and report diversions of water.

- *Governmental entities in Oregon must measure to an accuracy of +/- 15%. No specific measurement devices are required or pre-approved.*

The State of Washington has adopted a regulation (Washington Administrative Code Chapter 173-173) for measuring diversions from surface water and groundwater. The measurement requirement "is not intended to apply to customers of a municipality or public water supply system or members of an irrigation district or similar secondary users."

- *The combined measuring device and data recording system must measure to an accuracy of +/- 10%.*
- *Washington's regulation allows for a range of devices, and identifies the USBR Water Measurement Manual (2001) and manufacturers' ratings as reference information for determining accuracy of measurement devices.*

Attachment 3 - Range of Options for Agricultural Water Measurement

The water measurement regulation encompasses establishing several elements including: (1) accuracy standards, (2) allowable exceptions, (3) device accuracy rating, and (4) data management, and quality control. In addition, the regulation will include a list of definitions.

Elements of the Regulation

The following is an outline of the sections to be included in the measurement regulation:

Statement of Purpose

Applicability

- Size thresholds

- Exceptions on suppliers including CVP contractors, USBR, and DWR

- Exceptions on individual customers' size/annual volume

Requirements and Criteria

Definitions

Provisions for Agricultural Water Suppliers

- Accuracy standard

- Demonstration of compliance

- Reporting

- Enforcement

Statement of Purpose

The purpose, applicability, and requirements will be developed based on the sections in the main section of this Discussion Paper, as revised through further.

Definitions

The glossary (Attachment 1) will be adapted to form the list of definitions to be included in the regulation.

Provisions

Accuracy Standards

The accuracy standard applies to normal operating conditions during the irrigation season. It would be stated as follows:

"Agricultural water suppliers, as defined by 10608.12(a), must measure flows during the irrigation season with devices that are

operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- ___ percent by volume or flow rate."

Options below focus on three components: the numerical value of accuracy; whether it is applied to volume or flow rate or both; and the protocol for device check and recalibration. In addition, Option 3 provides the option for measuring at aggregate delivery points in addition to final delivery to customers. Option 4 is a brief description of a basin-level or supplier-level water balance approach.

Option 1: Adopt USBR's range for the numerical accuracy standard

The U.S. Bureau of Reclamation's Mid-Pacific Region has developed measurement standards as part of the criteria for Water Management Plans (2008 Conservation and Efficiency Criteria, Reclamation, 2008). The criteria state that Reclamation contractors must "measure flows with devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 6 percent by volume." The criteria apply to any CVP contractor that is required to submit a Water Management Plan (WMP) in order to satisfy the terms of its contract. Because WMPs approved by USBR are by default accepted under SBX7-7, therefore the CVP contractors will meet the requirements of water measurement unless CVP modifies its Criteria.

Using this as a model, the proposed numerical standard under SBx7-7 would be:

"Agricultural water suppliers, as defined by 10608.12(a), must measure flows during the irrigation season with devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 6 percent by volume or flow rate."

By setting a relatively narrow range of acceptable measurement accuracy, the periodic device checks and recalibration can follow a cost-effective sampling procedure and schedule (work with subcommittee is needed to develop appropriate program).

Option 2: Adopt a wider range for the numerical standard that meets the two purposes

SBx7-7 states that suppliers must "Measure the volume of water delivered to customers with sufficient accuracy" to:

Comply with subdivision (a) of Section 531.10 (the annual aggregate reporting requirement); and

Adopt a pricing structure for water customers based at least in part on quantity delivered.

This option would set the numerical standard based on the minimum accuracy needed to achieve those two purposes. Many water suppliers in the state price water to customers at least in part by volume, and keep records of delivery that are adequate or better for reporting aggregate delivery on an annual basis. For example, Imperial Irrigation District (IID) has been pricing water volumetrically for many years, based on its Zanjeros' recordings of flow rates and durations. IID assesses this approach to provide delivery accuracy at +/-15 percent (reference provided by Anisa Devine/IID).

The Final Report of the Independent Panel on Appropriate Measurement of Agricultural Water Use (CALFED, 2003) also concluded that measurement accuracy of +/- 15 percent,

which it described as the “basic” level of farm gate measurement, would be adequate for incentive-based water pricing (see page 24 of the Final Report). The Final Report also recommended that higher levels of (i.e., more accurate) measurement might be justified for an individual supplier, based on its circumstances and objectives. For example, a supplier providing higher-cost water may find it necessary to improve measurement accuracy so that both it and its customers have greater confidence that billing matches with the water actually delivered.

The proposed numerical standard under SBx7-7 would be:

“Agricultural water suppliers, as defined by 10608.12(a), must measure flows during the irrigation season with devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 15 percent by volume or flow rate.”

By setting a wider range of acceptable measurement accuracy, greater care could be given to assure that all measurement devices provide unbiased results when totaled over a reporting and billing period. A program of relatively frequent (as compared to Option 1) measurement device checking could be instituted. A device check is defined here as comparison of the device’s measured volume or flow rate against a more accurate device such as a portable meter, at a flow rate that is typical for normal irrigation events. For example, the regulation could require a higher sampling rate per year of device checks, or it could set a schedule of time within which all devices must undergo a check.

Option 3: Same as Option 2 plus allow measurement at lateral

A group of agricultural stakeholders convened by the California Farm Water Coalition developed a set of options for agricultural water measurement and submitted them for discussion by the ASC. The options included a proposal for measurement at delivery laterals, with additional accounting of water used by individual customers. The concept was described as follows:

“This method will quantify the volume of water used in a specific reach of canal or pipeline system where there is a specified beginning point (head gate) and an end point (spillway or terminus) and link such water supply with the on---farm user of water. With a means to measure such volume of water, volumetric pricing of water can also be implemented. This form of measurement should be cost effective and allows an agricultural water supplier time to begin taking steps to ultimately measure water at the farm-gate level within a reasonable period of time, i.e., five years.”

“Daily measurements would be taken of water to and from each lateral, i.e., canal or pipeline. By comparing such use with evapotranspiration (ET) and a factor for in-lieu recharge, depending on soil type, a measured volume of water can be determined. Individual, unmeasured turnouts would need to be linked to parcels that receive surface water. There would need to be a daily accounting for water deliveries to turnouts, thus determining what parcels were using water. As a result, measured water use per day, per parcel could be accounted for on a daily basis. Such measured water would need to be reconciled with crop consumptive-use on a seasonal basis to validate reasonable crop use rates with measured applied rates prior to billing for water use and reporting of aggregate

water use as required under current law. Landowners shall be noticed of annual water use with a thirty-day protest period and public hearing to address concerns prior to billing and reporting.”

Option 4: Basin-wide Analysis with Service Area or Supplier-Level Water Balance

A group of agricultural stakeholders convened by the California Farm Water Coalition developed a set of options for agricultural water measurement and submitted them for discussion by the ASC. The options included a proposal for using a basin-level or supplier-level water balance to estimate delivery to customers. The concept was described as follows:

“This analysis combines the total developed/dedicated supplies, uses, and operational characteristics and can be evaluated for a service area that has similar characteristics, a water agency, or a hydrologic basin. The benefit of this analysis is that it evaluates the efficiency of entire surface and groundwater system providing an overall assessment, whereas, a field assessment or a turnout measurement cannot. Such an approach is also consistent with the water management planning process, which requires a water balance be developed and analyzed. For 2009 California Water Plan Update, the Department of Water Resources is now evaluating water supply and demand for the state and regions, using a water balance approach.”

The proposal is conceptual and does not describe how to use the water balance information to measure or estimate water delivered to customers.

Table 1 below provides a summary comparison of the options described above, using a set of comparison features and criteria.

THIS TABLE AND ITS ENTRIES ARE PROVIDED FOR DISCUSSION PURPOSES ONLY. IT DOES NOT INDICATE DWR'S FINAL JUDGEMENT ON ANY OF THE OPTIONS. OTHER OPTIONS AND COMPARISON CRITERIA MAY BE ADDED, AND THE ENTRIES IN THE TABLE MAY BE MODIFIED BASED ON DISCUSSION WITH ASC MEMBERS AND ADDITIONAL INFORMATION.

Table 1. Summary of Features

	Accuracy	Checks and Calibration	Location	Cost of Devices	Able to provide Aggregate Reporting?	Able to Support Volumetric Pricing?
Option 1	+/-6%	Less frequent	Point of control transfer	Low for suppliers already compliant; high for others	Yes	Yes
Option 2	+/-15%	More frequent to demonstrate unbiased over time.	Point of control transfer	Low for suppliers already compliant; moderate for others	Yes	Yes
Option 3	+/-15% at delivery; or +/-6(?)% at lateral	More frequent to demonstrate unbiased over time.	Msmt at lateral; estimate at individual customer	Low for suppliers already compliant; moderate for others	Yes	?
Option 4	tbd	tbd	Msmt. at supplier level; estimate at individual customer	tbd	tbd	tbd
Other Option(s)						