

## Irrigation District Flow Metering<sup>1</sup>

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Most readers of this publication are probably somewhat familiar with USBR Reclamation Reform Act requirements for measurement of water deliveries to farm turnouts, in cases where the water is supplied by Reclamation facilities. Basically, volumes within the Mid-Pacific Region are supposed to be measured within  $\pm 6\%$ . This sounds like a fairly straightforward requirement, but the reality is anything but simple.

California is presently struggling to create its own agricultural water delivery measurement regulations, which are intended to apply to all (not only Reclamation) agricultural irrigation districts in the state. A California senate bill (SBx7) contains a mandate that the California Dept. of Water Resources (DWR) must adopt regulations providing a range of options that agricultural water suppliers may use or implement to comply with various measurement requirements. Additionally, the California Water Code now requires that agricultural water suppliers:

- Adopt a pricing structure for water customers at least partially based on the quantity of water delivered, and
- Submit an annual report to DWR that summarizes aggregated farm-gate delivery data, on a monthly or bi-monthly basis, using best professional practices.

The devil is in the details, of course. DWR staff have organized a variety of technical and stakeholder committees with numerous drafts, hearings, etc. while attempting to define the regulations. As of the date of writing this article, the regulations are still in flux and will eventually need to be approved. In the meantime, all parties affected by this legislation are raising concerns and issues that will need to be addressed. Some of these are very strong opinions from several different sides, and DWR (or any other regulation-forming body) will have to deal with them.

This article will provide background on some of the issues that have been raised by various interested parties, and is intended to stimulate discussion – especially for other areas of the US and internationally. The categories below illustrate two of the more vocal perspectives on the current debate, and the claims listed are examples of those heard both in public and in side conversations.

Category #1: This is crazy. Why are we even talking about this? (Note: These statements have usually been heard from those representing irrigation districts.)

- *Claim/Issue #1:* DWR is interpreting this legislation (SBx7) too stringently. It must be understood that this is just one section in a huge piece of legislation that was part of compromise wording late at night before a Senate vote.
- *Claim/Issue #2:* Water rights in California have been adjudicated for many years. So irrigation districts have the right to divert and deliver a specified quantity of water at specified times. Why are DWR and the state legislature getting into micro-management at the turnout level?
- *Claim/Issue #3:* Irrigation/water districts are generally public entities that cannot earn a profit. So if the farmers are happy with the present level of service and don't want to spend more money, isn't that sufficient?
- *Claim/Issue #4:* Yes, we hear the arguments from those outside of the districts that farmers want equitable water delivery service – but improvements come at a cost. And if farmers don't like the present equity, they can vote out the current board members and change things.

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- *Claim/Issue #5:* OK – so the state senators voted for improvement. But who’s going to pay for this? “Best professional practice” incorporates the concept of economic justification. And since farmers are reasonably intelligent, don’t you think that they would already have better flow measurement if they were convinced it was economically justifiable?
- *Claim/Issue #6:* This legislation makes no sense from a water conservation standpoint. We know that there is serious groundwater overdraft in the San Joaquin Valley, and there is no live river leaving the southern part of the San Joaquin Valley. So any “wasted water” (with the exception of some local salt sink destinations) is merely recirculated. If one irrigation district wants to waste its water, it’s just to the benefit of neighbors. It is similar in the Sacramento Valley, where water just recirculates – typically on the surface. Yes, the Imperial Valley is different hydrologically. But they have San Diego to pay for new turnouts – while others don’t have that luxury.
- *Claim/Issue #7:* More recently constructed irrigation districts have pressurized pipeline deliveries, with standard propeller meters built into the turnout designs. But the older districts – often with low-value crops – have open delivery systems with dirty water, minimal head at the turnouts, and widely varying flows at different times of the year (especially with rice). These older districts have substantial financial and technical challenges.
- *Claim/Issue #8:* There are some irrigation districts that are right on the verge of going bankrupt. Requiring that they fork out a huge sum of money for this will certainly ruin them.
- *Claim/Issue #9:* Many irrigation districts in California must recharge the groundwater during wet years, and that groundwater is subsequently pumped during dry years. Why do we care how much is delivered to an individual field if the objective during wet years is to recharge the regional groundwater as much as possible?
- *Claim/Issue #10:* This completely misses the point. The water rights are held by the districts, not by the farmers. So the only important measurement is at the entry point to the district – not at individual field turnouts.

Category #2 – This legislation is definitely the first step in the “right” direction. (Note: This category of statements usually comes from persons who are not agricultural water suppliers.)

- *Claim/Issue #1:* It is commonly known that agriculture uses and wastes a huge amount of water. Until there is verification and accountability, we will never get out of the water shortage situation.
- *Claim/Issue #2:* Water rights to irrigation districts are superseded by the “Public Trust Doctrine”, which clearly states that water rights are only held in trust for the public good. And if irrigation wastes water, that is not for the public good.
- *Claim/Issue #3:* Even if the water wasted by agriculture isn’t huge on a basin-wide basis, the lack of good control and measurement causes a host of other negative consequences such as excess river diversions, leaching of fertilizers due to excessive field-level irrigations, and excess pumping and energy consumption. And until there is good control and measurement, the agricultural community will never seriously attempt to solve those problems.
- *Claim/Issue #4:* We know that for regional planning and control of water resources, it’s important to know exactly how much water goes where, and when. How we will collect that information, and how it will be used, can be discussed at a later date.
- *Claim/Issue #5:* Agriculture is, in the end, not as important as the environment, wildlife refuges, etc. And the legislation is one important step in ensuring that those areas will get that water.

The first meetings are typically filled with Category #1 and Category #2 statements or thoughts. Whether they are verbalized or not is almost beside the point – they control the atmosphere of first meetings.

The next step in the process is the understanding by everyone that:

- The legislation has already been approved. So the only choice is to try to craft regulations that make sense.
- The technical situation is not simple.
- Unless the regulations are reasonable, they will either be ignored or taken to court.
- Whether correct or not, arguing over the issues listed above will not lead to any sort of positive solution.

Once people (at least most of them) have reached this understanding, there are a variety details that must be addressed. They include:

- *Verification.* There is no state budget that accompanies the legislation. Therefore, DWR will not likely have the funds to provide extensive verification of compliance. So are there ways to craft the regulations so compliance is relatively easy to verify?
- *Overlap.* USBR already has its rules under the Reclamation Reform Act. Should those rules be sufficient for Reclamation districts, and other rules apply to all others? Or are Reclamation rules insufficient? Or too restrictive?
- *Well water.* The legislation dealt with surface water deliveries to irrigation districts. But how can other details such as internal irrigation district recirculation of drainage water, and internal well pumping into canals, be handled?
- *Size.* Should regulations be applied differently to small districts, as opposed to larger districts?
- *Community Ditches.* Some irrigation districts in California have a main conveyance and delivery system, but the deliveries to many of the individual fields is through community ditches or pipelines. The public irrigation districts have no authority in those areas. Should the delivery to the head of a community ditch be considered the “turnout”?
- *Aggregated deliveries.* Some irrigation districts have procedures in which they measure the delivery to the head of a lateral and then “properly” distribute water to individual field turnouts. Or perhaps in reality, the farmers handle those distributions. Shouldn’t this be considered to be the same as a delivery to a community ditch? How far back to the source can this “hand-off” point be moved?
- *Implementation timeline.* How should progress be measured, and on what timeline? Five years? Twenty years?

Finally, there are the technical details. The first thing to realize is that most of the people around the table do not share a common technical understanding of flow measurement. Many people do not know what typical turnouts look like, how flow is measured, what turnout designs are available, and what the difference is between flow measurement and volumetric measurement. Yet knowledge of those details is crucial for developing good regulations.

This lack of a good technical understanding is even present among some of the people who have the intention of representing the interests of the agricultural irrigation districts. For example, a “long crested weir” was proposed as a good flow measurement device and remained on the list of options for several technical meetings. A long crested weir is a device used for water level control, it is located in the canal itself (rather than being a turnout device), and would be an absolutely horrible flow measurement device because the whole idea behind it is to have a relatively small change in head with a large change in flow.

As a simple indication of the challenges, one might take the wording that devices must be within “ $\pm 6\%$  accuracy”. This can be (and is) interpreted many different ways. Consider these points:

- Most people think of devices in terms of flow rate measurement, although to meet perceived objectives under the legislation the discussion might correctly be focused on volumetric measurement. But the gap between the two concepts is huge technically.
- Is the  $\pm 6\%$  on an individual event basis, or over the whole irrigation season?
- Is the  $\pm 6\%$  for every single individual turnout? Or is it the average? And if it is the average, what coefficient of variation (standard deviation, divided by mean) is acceptable? For the readers, I can guarantee that at this point almost everyone’s eyes are glazed over. But this is the reality of statistics.
- How about those cases of plugged propeller meters or damaged turnouts when one goes out to the field for verification? What % is acceptable? Wow – this gets huge. Now the discussion turns to how big of a sample size is required. And this also implies field verification of individual turnout flow rate accuracy. How will that be done?
- Back to flow measurement versus volume – is the  $\pm 6\%$  for flow rate or volume? And how will volume be verified? Verifying volumetric accuracy on a turnout is not a one-time field verification step, since water levels maybe continually changing.
- Yes, it is true that there are many devices that claim to provide  $\pm 6\%$  accuracy in volumetric measurement. But it is also common knowledge that:
  - Some of those claims are false.
  - Some devices require electricity, which is often not available unless solar is installed. And vandalism is a major problem in some areas.
  - Most of these devices are quite expensive – often in the zone of \$10,000 - \$40,000 per site, which is more than a bit pricey for individual turnouts.
  - There are still technical uncertainties for some devices.
  - Many of the devices do not work well with very a low head drop across the turnout, and with dirty water – which is the main challenge.
  - Sophisticated devices have sensors and electronics. It is not a question of “if” they will fail, but “when”. And who will diagnose and solve the problems?
  - All devices are subject to strange conditions in the field, errors in installation and calibration, etc.

Personally, I believe that we need excellent control and measurement of water for good management. And excellent management is becoming more important as water and energy become scarcer, and issues become more complicated. But that said, there are limitations to technology and funding, and there are hydrologic realities that limit the effectiveness of measurements at certain levels within the water distribution system. There are also limitations to how fast people can adopt new technologies and procedures. Additionally, there will always be philosophic arguments regarding how far government regulations should burrow down into the inner workings of irrigation districts. It all adds up to quite a challenge in developing reasonable regulations and guidelines.