Agriculture Notes

Guide to Installing Testwells

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Andrew McAllister, Tatura

Testwells indicate the depth to the watertable. By monitoring watertables over time you can determine whether they are rising and are likely to cause future salinity problems.

High watertables can lead to reduced plant growth through waterlogging and by allowing surface evaporation to draw salty water into the rootzone. Watertable levels become critical for pasture when they rise to within 1-2 m of the surface.

Are watertable robbing you of production? Do you know the depth of the watertable on your farm? Do you know how salty the water is?

If you don't have answers to these questions, then now is the time to act!

Placement of testwells

Watertables in any area can be highly variable because they are affected by soil type, rainfall, topography, land use and irrigation. When locating testwells on a property, be clear on the specific aims. There are two reasons for locating and installing testwells.

i. as an educational tool, aimed at increasing knowledge of the interactions between watertable and farm activities (such as irrigation), land use, soil types and even, the effects of remedial strategies (ie. groundwater pumping); and,

ii. for the purpose of community awareness involving Landcare Groups and aimed at highlighting the problem with highly visible locations.

Some guidelines for placing testwells (in order of importance)

1. Identify an area which is representative of the surrounding land use. Ensure testwells are more than 30 m from the following:
   - permanent or semi-permanent water bodies (ie. dams, reuse systems. supply or local channels, blocked roadside table drains)
   - dairy or other buildings
   - mature tree(s)
   - the spears of a spear point pump.

If possible, try to avoid locating near farm drains and channels, as they tend to produce high local watertables when they are holding water. However, when these are dry, the testwell readings will return to a representative watertable level

1. Try to install the testwells in areas of easy access (fencelines or permanent checkbanks are ideal) and where stock will cause minimal damage. Protection from stock can be achieved by using either two wire loops attached to an electric fence, or barbwire with two steel posts. If located on fencelines, they may not require protection.
2. Select a fenceline which is not suitable for tree planting (eg. next to powerlines).
3. Watertables are generally closest to the surface in topographically low areas, associated with heavy soils. These areas will normally show the first signs of salinity. If winter flooding occurs, select a site 30 m up from the high water mark. When installing testwells, work from areas of low topography up. Higher areas on the farm have typically light soils and are less prone to salinity by having lower watertables. However, even these high areas can have potential salt problems and should be included in testwell monitoring.
4. If a range of land uses exist on a property (eg. permanent summer pasture, sub-clover, cropping, tomatoes etc.), it is a good idea to install testwells on all of these areas. In horticultural areas, install testwells between trees and drop $CuSO_4$ tablets down the testwells to stop roots growing into them.
5. It will also be valuable to install testwells at varying distances away from areas influenced by remedial strategies. such as groundwater pumps, tile drains, land-forming, or large tree plantings. By monitoring these testwells, it will be possible to gauge the effectiveness of these strategies over time and their area of influence.
6. If possible, it is also interesting to locate a testwell next to a piezometer (which measures the pressure level of the groundwater in an underground streambed or aquifer). Because the groundwater in these aquifers is under pressure, the level of water in the piezometer may be shallower than the watertable level in the

testwell. From a salinity point of view, it is better if the groundwater level is deeper in the piezometer.

7. On an average 50 ha farm with two land uses (permanent and annual pasture), the minimum number of testwells to be installed is four. If there are two distinct soil types on the property, then the number of testwells should be doubled.
8. If the intention is to install a network of testwells across several farms, for the purposes of mapping the watertable, then it is important to avoid large areas without a testwell.
9. If installing a network it is advisable to appoint one or two people to install or oversee the installation of the network. This will ensure testwells are installed in a consistent manner.

Installation of testwells

Once a decision has been made on the correct locations for the testwells, the next step is to install them. The following items are required for this:

- 3 m of 40 mm PVC class 6 pipe (standard Watertable Watch flags are 2.7 m long)
- 2 buckets (each of 2t) litres / 5 gallons) of coarse sand or gravel (5 mm)
- a 100 mm auger (and extensions)
- a tape measure
- a shovel
- a hacksaw
- a Watertable Watch Flag (optional, as perhaps only 1 available per farm).

Now, begin by:

a. Using the 100 mm auger to dig a hole to 2.8 m below normal ground surface.

b. Seal off the bottom of the pipe by making 40 mm long vertical cuts with a hacksaw and applying heat so that these can be folded over (or alternatively, you can place a PVC cap on the end).

c. Slot the bottom 1.8 m section of pipe by making a number of 40 mm long horizontal slots (approximately 20 mm apart) on either side of the pipe using the hacksaw. This will leave 1.2 m of unslotted pipe (including the 20 mm that will sit out of the ground).

d. Place the pipe in the hole.

e. Backfill the hole with the coarse sand until it covers all of the slotted section of pipe (ie. this should be within 1 m of the ground surface). Wriggle the pipe to settle the sand.

f. Backfill the rest of the hole with the subsoil extracted from the hole, ensuring that it is well compacted. If available, dry clay or bentonite is very good for this purpose. This process seals the hole and is extremely important to stop leakage which will cause misleading results.

g. Form a dome of soil around top of the testwell (as the pipe should be protruding 20 mm above the ground surface) to prevent water seeping down the outside.

h. Construct a guard to protect the testwell from stock. if required.

i. Insert a Watertable Watch flag (which will take a couple of days to settle). These flags are designed to give a rough visual estimate of the watertable depth. If accurate measurements are required, the flag must be removed from the testwell, left for at least 1 day, and then read using a fox whistle (see section "Additional monitoring equipment").

j. It is a good idea to bail the testwell in the fortnight following installation to remove fine sediment and allow any disturbed soil to settle prior to reading.

k. Upon installation completion. it is important to record the location of the testwell on a 1:25 000 scale map or by using a Global Positioning System. This will help locate the testwells for monitoring purposes and in the production of groundwater maps, if required. General information relating to site position provides a useful reference for interpreting testwell data. A data sheet is provided which gives an indication of the main information that needs to be recorded.

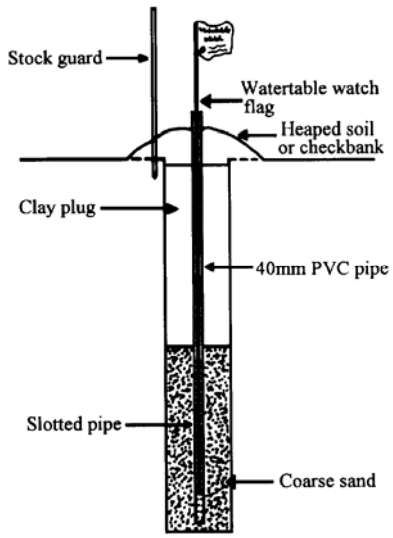

Figure 1. The finished testwell should look like this

Monitoring testwells

Watertable levels in irrigation areas normally fall over summer and rise during wet autumn, winter and spring periods. To gain an appreciation of yearly watertable trends, it is recommended to take measurements every month. During the irrigation season, measurements in irrigated pastures should be taken just before an irrigation cycle commences. This will reduce the risk of irrigation water seeping into the testwell and distorting the reading. The following steps are recommended:

1. Set a regular time of the month to monitor the testwells (being aware of irrigation events). If the testwell is dry. then the watertable is obviously deeper than 2.8 m.

2. If water samples are being collected to measure salinity, the testwells should be bailed beforehand. Irrigation water and rainfall, along with groundwater that has concentrated in the testwell through evaporation, can significantly alter the salinity level of the groundwater.
   To gather a fresh sample, remove all groundwater from the testwell using a bailer (see section "Additional monitoring equipment"). Allow 4 days for the water in the testwell to return to its static level, before measuring the watertable level and taking a water sample for analysis.
3. Record the watertable level reading and the groundwater salinity in your Watertable Watch record book. for later reference. These are available free of charge from offices of DPI.

Additional monitoring equipment

When monitoring testwells for watertable level and salinity, there are two more pieces of equipment that will be required;

(i) A fox whistle (see Figure 2)

A fox whistle tape will accurately measure the depth of the watertable in a testwell. The materials needed to make a fox whistle tape include:

- a 100 mm length of copper tubing (30 mm diameter)
- a fox whistle
- thin metal rod
- a tape (anything longer than 3 m)
- solder or bronze weld.

To make a fox whistle

Simply solder or bronze the fox whistle onto one end of the copper tubing. Bend the metal rod into a half circle and also solder this onto the whistle. Now taking the tape, loop the end of it around the soldered rod in such a way that when attached, the bottom of the copper tubing represents 0 mm (see Figure 2). Secure the looped end of the tape by stapling (or sewing) and covering with insulation tape.

To use a fox whistle

Simply lower the fox whistle slowly down the testwell until you first hear the whistle sound. If you have secured the tape to the fox whistle so that the bottom of the copper tubing represents 0 mm, then you can simply read the depth to the watertable directly off the tape. To get a true measurement of the watertable below the natural ground surface, remove the height that the testwell sits above the ground (especially if located on a checkbank). It is worthwhile noting this height difference on the testwell with a permanent texta to remind you to always remove it from your testwell reading.

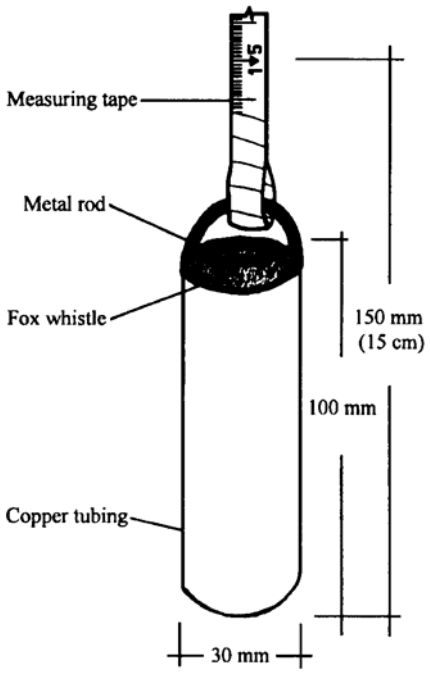

Figure 2. The finished fox whistle should look like this

(ii) A bailer (see Figure 3)

A bailer is used to remove the stagnant groundwater from a testwell and for collecting a sample of the "fresh" groundwater once the watertable has recovered (ie. after 4 days). The necessary materials to make a bailer include:

- 2 m of 25 mm PVC class 12 pipe (class 12 PVC is more durable but not mandatory)
- 1 marble or ball-bearing (medium size diameter of approximately 24 mm)
- 1 bolt (3 mm × 35 mm) and nut
- 1 PVC reducer fitting (25 mm × 20 mm)
- tin of PVC cement (glue)
- 2 m of twine or fine rope

To make a bailer

Heat one end of the pipe and push the PVC reducer fitting in. ensuring both surfaces are covered with the cement (glue). Place the marble or ball-bearing in the pipe from the other end and tip it up so that it is sitting on the fitting. Drill a hole for the bolt approximately 100 mm from this end (ie. the bottom end with the PVC reducer fitting), insert the bolt and secure with the nut. Finally, drill a hole through the pipe at the other end (the top) and secure the twine/rope through this.

To use a bailer

Simply lower it completely into the testwell and jiggle it up and down. Remove, pour out the water and repeat the exercise. When collecting the water sample 4 days later to measure its salinity, lower the bailer deep into the testwell and when pouring the water into the containers allow it to overflow to maximise mixing of the sample.

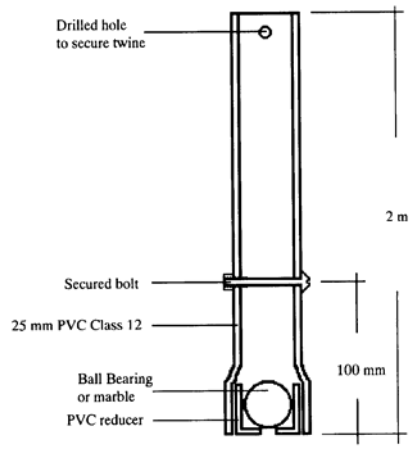

Figure 3. The finished bailer should look like this

Important points to remember

1. Be clear of your aims for installing a network of testwells.
2. Install testwells more than 30 m from water bodies, buildings, trees and spear points (groundwater pumps).
3. You should install at least 4 testwells on a 50 ha farm with two major land uses.
4. When backfilling your testwell hole, ensure the clay (or bentonite) is well compacted to stop leakage.
5. If you have a watertable watch flag, this must be removed from the testwell at least 1 day prior to reading the watertable level with a fox whistle.
6. Watertable levels should be read at least monthly to gain a good picture of yearly trends, but be aware of rainfall and irrigation events prior to taking measurements.
7. When measuring the watertable level with a fox whistle the correct level is the reading on the tape as soon as the first whistle sound is heard.
8. To gain a true measurement of the watertable below the natural ground surface, you will need to remove the height that the testwell is above the ground (especially if it is located on a checkbank).
9. Your testwells should be bailed at least 4 days prior to collecting a groundwater sample for measuring salinity.

Further reading

McFarlane, G.B. (Ed.),(1994) *Watertable Watch Program - community awareness to action on watertable.* Salt Action Victoria.

This Information Note was originally developed by C. Norman, A. McAllister and R Turnour and was previously published in December 1997

WATERTABLE TESTWELL INSTALLATION DATA SHEET

Farmer Name: .....

Organisation/Group: .....

Date (day/month/year): .....

Site Location:

Site ID (Well No.)

X - Coordinate [1]: .....

Y - Coordinate [2]: .....

Nearest Town: .....

Mapsheet Name [3]: .....

Mapscale: .....

Testwell Information:

Well Depth (m): .....

Watertable Watch Flag:

Yes ☐ No ☐

Position in farm [Select box(s)]:

Fenceline: ☐

Checkbank: ☐

Track Side: ☐

Road Side: ☐

Other: .....

Major Land Cover [Select box(s)]:

Irrigated:

- Annual Pasture ☐
- Permanent Pasture ☐
- Lucerne ☐
- Winter Crop ☐
- Summer crop ☐
- Fallow ☐
- Tree Plantation ☐
- Tomatoes ☐
- Orchard ☐
- Other .....

Position in Paddock/Bay [Select box(s)]:

Upper Section: ☐

Middle Section: ☐

Lower Section: ☐

Non-Irrigated:

- Lucerne ☐
- Pasture ☐
- Fallow ☐
- Bare Soil (degraded) ☐
- Woodland ☐
- School Yard ☐
- Other .....

Position in Landscape [Select box(s)]:

Crest: ☐

Slope - Upper: ☐

- Middle: ☐
- Lower: ☐

Flat: ☐

Depression: ☐

Other: .....

Soil Texture [code box(s)]: Clay [*c*] Loam [*l*] Sandy Loam [*sl*]

Depth (m)	0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0
	☐	☐	☐	☐	☐	☐

1. X-coordinate can either be an AMG (Australian Map Grid) easting obtainable from 1:25 000 maps or a longitude reading from map or GPS.
2. Y-coordinate can either be an AMG (Australian Map Grid) easting obtainable from 1:25 000 maps or a longitude reading from map or GPS.
3. Mapsheet name and scale are printed on the map used for location of wells.