

Section 4: Underground Water

TR14-145-150

39. Underground water possibilities, Longford Abattoir Company

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The company is planning to install a condenser for which a supply of water of up to 10,000 gal/hr will be required for about ten hours each day. The company enquired whether underground water supplies would be sufficient to yield this amount.

The meatworks is situated in the northern part of Longford and its property extends about $\frac{1}{2}$ -mile N of the plant and E to the South Esk River (fig 44). A small creek just W of the meatworks property runs approximately due N, and the surrounding flood plain extends to part of the meatworks property.

GEOLOGY

The area is one of subdued topography and there are few exposures of bedrock. The area forms part of a large basin filled with sediments of Tertiary age consisting mainly of clay, sandy clay and sand beds with abundant lignitic material at some horizons. Gravel beds are of restricted extent. Rounded-quartz gravel beds overlie the Tertiary beds. These are variable in thickness: sections of up to 20 ft have been exposed in excavations. They are poorly sorted and have zones cemented by limonite and can be seen to outcrop at higher levels around Longford.

Recent deposits of gravel mainly made up of pisolitic limonite fragments, weathered from partly lateritised Tertiary clay beds together with occasional quartz fragments occur around the small creek which runs near the meatworks. These gravels are of fairly uniform grain size: their thickness is unknown. Excavations of the meatworks show that the quartz gravel occurs at lower levels than the Recent gravel around the creek.

HYDROLOGY

There are two possible sources of underground water supplies: from surface gravel and from deeper sand with possible gravel beds. It cannot be said without testing whether either would supply the desired quantities of water.

Some excavations around the meatworks have encountered quartz gravel beds to a depth of 20 ft but in others, sand beds have been struck indicating that the gravel beds are lenticular. In digging these excavations, trouble has been experienced in keeping them free from water even with the use of powerful pumps. Similar problems with water in the gravel, were encountered during trenching operations for the installation of sewerage mains around Longford township. It is thought that these gravels vary considerably in thickness and that the thicker portions might be in isolated areas only. If this proved to be the case water supplies could be limited.

The gravels surrounding the creek could also provide a possible source of water as the catchment area for this creek is large. In an effort to determine the thickness of this gravel or the combined thickness of the Recent and the quartz gravel which possibly underlies it, resistivity probing was carried out in

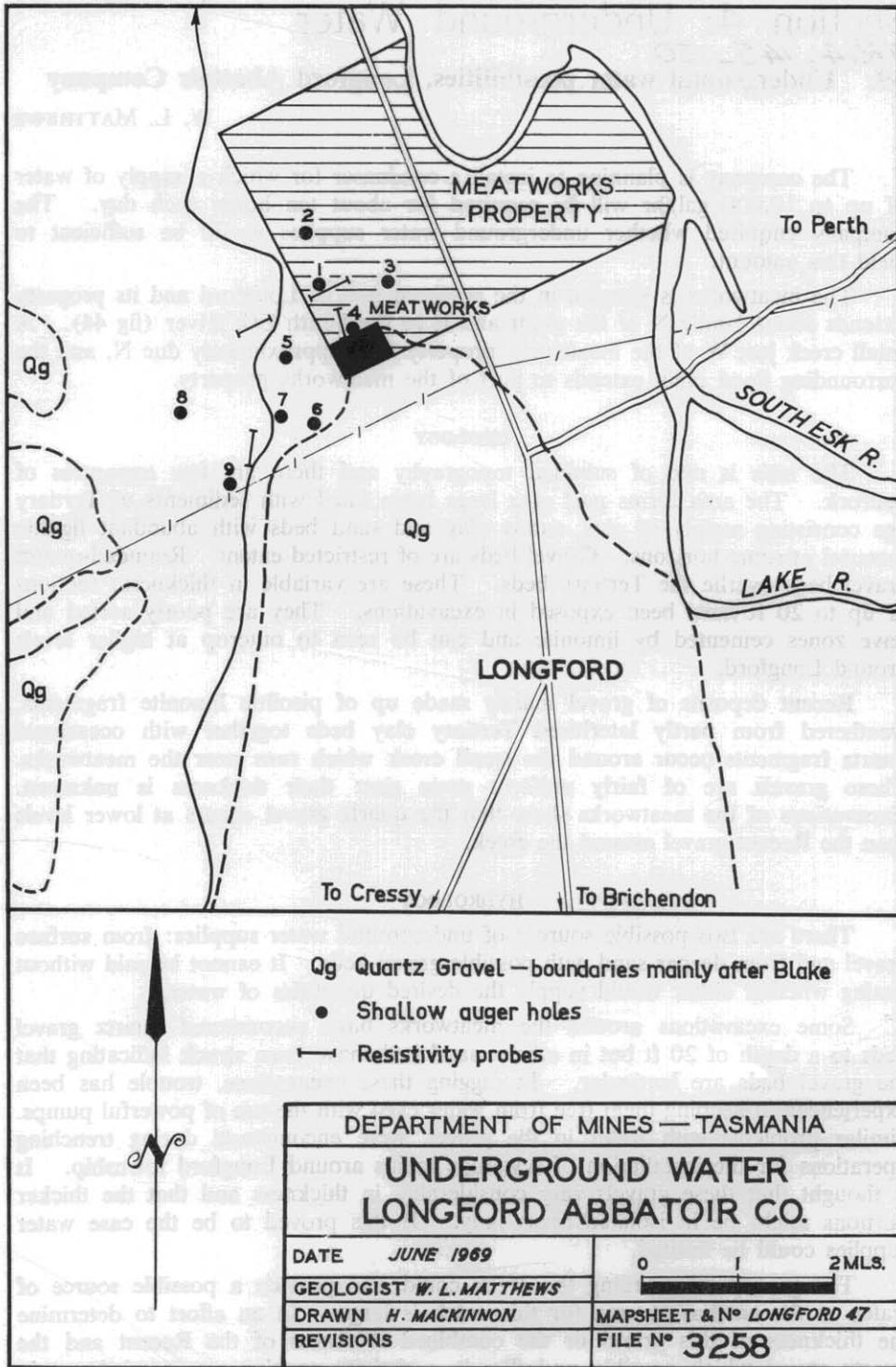
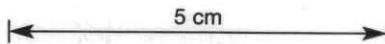


FIGURE 44



the four areas shown on the plan. It is expected that Tertiary clay underlies the gravel and resistivity of the gravel beds, under most circumstances, would be very different to that of clay beds. The depth of probing was 150 ft in each case. Results from this work were not very conclusive and the expected marked change in resistivity with depth did not occur. This might be explained by either of two factors:

- (1) The gravel contains a lot of clay which would give it a similar resistivity to the clay underneath.
- (2) The water in the gravel is saline, which again could cause the resistivity in both beds to be similar.

Shallow auger drilling at various localities around the meatworks and sampling of the water struck, suggested the former possibility as the most likely, as the water quality proved to be relatively good. The probe nearest the meatworks however is near an area where it is known that there is 20 ft of gravel and results of probes away from this area indicate a potential at least the equal of that in the meatworks area.

Results of $\frac{1}{2}$ -inch auger holes were as follows (fig. 44):

Hole 1

ft	in	ft	in	
0	0	3	0	Brown clay.
3	0	5	0	Ironstone gravel.
5	0	6	0	Brown plastic clay.

Water was struck at 3 ft, standing water level 1 ft 6 in. Total dissolved solids, measured with a salinity meter, 700 ppm.

Hole 2

ft	in	ft	in	
0	0	3	0	Ironstone gravel and clay.
3	0	6	0	Fine sand, a little clay.

Water struck at 3 ft and rose to 1 ft from the surface. Total dissolved solids 660 ppm.

Hole 3

ft	in	ft	in	
0	0	1	6	Dark brown clay.
1	6	4	6	Ironstone gravel and clay.
4	6	6	0	Sandy clay.

Water struck at 4 ft 6 in, standing level about 1 ft 6 in. Total dissolved solids 800 ppm.

Hole 4

ft	in	ft	in	
0	0	1	0	Clay.
1	0	4	0	Ironstone gravel with some clay.

Water struck at 2 ft. Total dissolved solids 730 ppm.

Hole 5

ft	in	ft	in	
0	0	0	9	Clay.
0	9	4	6	Ironstone gravel.
4	6	6	0	Clayey sand.

Water struck at 2 ft 3 in. Total dissolved solids 430 ppm.

Hole 6

ft	in	ft	in	
0	0	2	0	Brown to dark grey clay.
2	0	4	0	Ironstone gravel in clay.
4	0	6	0	Clay.

Water struck at 3 ft. Total dissolved solids 370 ppm.

Hole 7

ft in ft in
 0 0 - 4 6 Ironstone gravel.
 Water too muddy to measure quality.

Hole 8

ft in ft in
 0 0 - 3 0 Ironstone gravel and clay.
 Hole stopped due to hardness.

Hole 9

ft in ft in
 0 0 - 5 6 Ironstone gravel and clay.
 Water struck at about 3 ft.

Although these holes were only shallow, they indicate the variability of the near-surface material. The quartz gravel appears to be continuous over wide areas but is probably variable in thickness.

In a number of areas these surface gravels contain water. However it cannot be said with certainty that with sustained pumping at the rate required, a supply would always be available. If it is planned to utilise this supply, probably the best scheme would be to dig a trench, deep into the gravels and form a collection chamber from which water could be pumped. Test pumping during a dry period on a small pit would be required before it would be advisable for such a scheme to be installed. If the supply is proved to be insufficient, it might be possible to devise a recycling scheme.

Test drilling to assess the underground water potential of the Longford area has been in progress for some time. The three holes nearest to the meatworks have met with mixed success. A hole to 500 ft about 2 miles S of the meatworks passed through clay and sandy clay for the whole depth and yielded only about 20 gal/hr when pump tested. About 1½ miles WNW of the factory, a test hole (A) struck fine gravel (mainly quartz) from 30-55 ft and again from 85-105 ft mainly ironstone). At lower levels sand and fine grit beds separated by clay beds were encountered to 500 ft. The hole was pumped at 2,000 gal/hr (the maximum capacity of the pump) for six hours with a maximum drawdown of about 38 ft. It is likely that the bore was capable of a much larger output than the tested rate.

Another test hole (B) 3 miles SW of the meatworks encountered some fine grit at 80-90 ft; sand beds were encountered at various intervals below this to a final depth of 1,000 ft. This hole was pump tested at 1,800 gal/hr with a drawdown of 126 ft. There was a small artesian flow from this hole. As only the top aquifers were tested this bore would probably yield a larger quantity of water if all aquifers were developed. Chemical analyses of the water from these last two holes are as follows:

	Hole A	Hole B
pH	6.0	6.0
	ppm	ppm
CO ₂	nil	—
HCO ₃	29	72
Cl	376	105
SO ₄	39	11
F	nil	trace
SiO ₂	31	13
Ca	8	6

	Hole A ppm	Hole B ppm
Mg	26	5
Fe	nil	trace
Al	nil	—
K	4	3
Na	218	78
T.D.S.	705	341
Total hardness (as CaCO ₃)	127	36
Temporary hardness	24	59

During 1951 three holes were drilled at locations much closer to the meatworks than the above-mentioned test holes. The drilling was carried to a shallower depth but they struck gravel beds at various intervals down to about 90 ft. One of these holes was drilled $\frac{3}{4}$ -mile SW of the meatworks and the other two between $\frac{1}{2}$ -mile and 1 mile NW of the meatworks; the last two holes had small artesian flows. They were only recorded as yielding 250-300 gal/hr but these figures would be based on a bailing test and would be limited by the capacity of the machine and the drawdown in the hole.

The chances of striking gravel at fairly shallow depth at the meatworks are reasonably good and other possible aquifers might occur at lower levels. If these lower aquifers consist of fine sand beds there could be some difficulty in extracting the water without disturbing the sand. There should be little difficulty in extracting water from gravel and grit beds.

The lower sand aquifers, though extensive, are often covered by up to 200 ft of clay, and may be depleted by pumping over extended periods. The comparative purity of the water obtained from these beds suggests that some recharge is taking place. Depletion is not expected to be a serious problem unless use of underground water in the Longford area becomes widespread.

To determine whether water of the required quantity could be obtained from these deeper sources it would be necessary to drill a small diameter hole and pump test any aquifers encountered. If these pump tests proved encouraging a larger diameter hole could be drilled and gravel packed and/or screened. Pump testing over long periods (several days) should be undertaken to determine whether the supply will be permanent and also whether the aquifer is stabilised so that sand does not enter the bore.

CONCLUSIONS

There are two possible sources of an underground water supply, each of which would need testing before permanent schemes were installed:

- (1) From surface gravel around the meatworks. Pump tests from a pit or trench should be carried out during a dry period before any plans are made for a permanent scheme using this source as a supply.
- (2) From deeper gravel and sand beds which have been encountered during test drilling and drilling operations in 1951. It would be advisable to drill a small diameter hole to determine whether installation of a permanent scheme is justified.

The quality of the underground water should be examined to determine whether it would have corrosion or encrustation effects on the condenser as either of these effects would reduce the efficiency of the condenser. The material from which the condenser is made would have a bearing on these factors becoming important.

A careful examination should be made of the costs of installing either the schemes outlined above in comparison with the cost of either getting a supply direct from the South Esk River or recirculating water stored in surface ponds or reservoirs.

During 1951 three holes were drilled in the area of the condenser. The first was drilled to a depth of 100 ft. The second was drilled to a depth of 150 ft. The third was drilled to a depth of 200 ft. The first two holes were drilled in the area of the condenser and the other two were drilled in the area of the reservoir. The first two holes had small diameter holes. They were only recorded as being 2 1/2-3 1/2 gal/min but these figures would be based on a falling test and would be limited by the capacity of the machine and the drawdown in the hole.

The chances of striking gravel at fairly shallow depth at the reservoir are reasonably good and other possible aquifers might occur at lower levels. If these lower aquifers consist of the sand beds there could be some difficulty in extracting the water without disturbing the sand. There should be little difficulty in extracting water from gravel and silt beds.

The lower sand aquifer, though extensive, is often covered by up to 200 ft of clay and may be depleted by pumping over extended periods. The composition of the water in the sand aquifer is not known but it is likely to be of a similar quality to the water in the gravel and silt beds.

To determine whether water of the required quality could be obtained from these deeper aquifers it would be necessary to drill a small diameter hole and pump test any aquifers encountered. If these pump tests proved encouraging a larger diameter hole could be drilled and gravel packed and or screened. Pumping over long periods (several days) should be undertaken to determine whether the supply will be permanent and also whether the aquifer is saturated so that sand does not enter the bore.

CONCLUSION

There are several sources of an underground water supply, each of which would require different treatment schemes were installed:

- (1) From surface ground around the metaworks. Pump tests from a pit or trench should be carried out during a dry period before any plans are made for a permanent scheme using this source as a supply.
- (2) From deeper gravel and sand beds which have been encountered during the drilling and dewatering operations in 1951. It would be desirable to drill a small diameter hole to determine whether installation of a permanent scheme is justified.