

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Section ✓
Rept. Bk. 58/149
G.S. 2894
D.M. 1222/62
Hyd. 1579

REPORT ON
CONSTRUCTION AND CONTROL OF ARTESIAN BORES
IN NEW SOUTH WALES AND QUEENSLAND.

INTRODUCTION:

Several days were spent in Sydney and in Brisbane for discussions with the Water Conservation and Irrigation Commission of New South Wales and the Irrigation and Water Supply Commission of Queensland. The purpose of these visits was to ascertain the current practice with regard to methods of construction and control of artesian bores, referring particularly to the Great Artesian Basin.

NEW SOUTH WALES:

1. General

There are approximately 640 flowing bores in the New South Wales portion of the Great Artesian Basin and 6 men are employed full time in measuring the flow, pressure and temperature of these bores. Each bore is measured once in 12 months. Maximum temperature recorded in N.S.W. is reported to be 142° F. Reductions in flow have been noted in a number of areas; one example given was in the area west of Moree where the original flow from a bore in 1912 was about 400,000 gallons per day. The flow is now approximately 140,000 gallons per day, with a corresponding reduction in pressure. The work of reconditioning old bores in this state is now well advanced; all these are pressure cemented. In addition a considerable amount of work has been done on bore drains and construction of distribution systems in the vicinity of flowing bores. Photographs showing drains and distribution systems are included herewith.

The Water Conservation and Irrigation Commission construct bores in the Artesian Basin for owners or occupiers of land. At present the Commission has 22 cable tool drilling plants and the minimum cost for drilling is £2.2.0 per foot plus casing.

Structures for the distribution of the water are also built by the Commission.

For drilling purposes the Commission is granted £200,000 per year; this covers drilling in the Artesian Basin and also exploratory drilling in other basins. This amount is granted each year regardless of any profit which may be obtained from drilling operations. It is reported that in certain years such profit may be quite substantial. For private hirers up to 10 years are allowed for payment of an Artesian bore; occasionally longer periods are allowed.

An example was given of a bore to 4,000 feet costing £23,000, for which the landholder was allowed 15 years to pay.

METHODS OF CONSTRUCTION OF ARTESIAN BORES:

Bores are drilled either by the Commission or by private drillers. In the latter case a licence for the bore must be obtained before drilling is commenced. All private drillers must also be licenced and are required to send weekly returns to the Commission giving all details of the bore.

Conditions under which licences are issued are laid down in Part V of the Water Act of N.S.W. (1912-1955), a copy of which is included.

Specifications for the construction of an Artesian Bore are laid down by the Commission and must be adhered to by the licencees. Penalties exist for contravention of the regulations, as stated in the Act.

Bores are normally commenced for 8" casing, the length of which is fixed by the Commission and is designed to shut off any upper saline water. The 8" casing is cemented in place and after allowing to set for 24 hours, drilling is continued for 6" casing. This is continued for the full depth of the bore after which the 6" casing is withdrawn to between 1 and 4 feet above the top of the artesian aquifer. The open hole in the aquifer is then mudded off, bridged or backfilled, and the 6" casing is cemented from shoe to surface, either by positive or reverse circulation.

After allowing a period of 72 hours for the cement to set the backfilling in the aquifer is drilled out and flow restored. Normally a 5" slotted liner is placed in the bottom of the bore and extends up to at least 10 feet above the 6" casing shoe.

CONTROL AND DISTRIBUTION OF ARTESIAN WATER:

The licensee is obliged to fit closing gear similar in principle to that designed by the Commission. A plan of this design is sent to the licensee. Copy attached.

Normally, if the flow is large, an orifice plate is included in the headworks. This is designed to restrict the flow to a maximum of 8,000 gallons per day per mile of drain. For a bore where no drains have been constructed, the maximum daily flow allowed is 5,000 gallons.

However, variations in these flow rates may be allowed, but may not exceed actual requirements. Larger rates of flow are normally allowed for in longer drain systems but more than 8,000 gallons per day per mile is rarely permitted.

The licensee must also supply the Commission with levels, gradients and locations of proposed drains. Control and maintenance of these drains must also be done by the licensee.

The Commission has the power to direct the closing or partial closing of an artesian bore if it considers that water from such a bore is being wastefully or improperly used.

SUMMARY:

The Commission may drill artesian bores, construct distribution systems and drains in any district which would benefit from the increased water, provided that a petition signed by at least two-thirds of the owners or occupiers of the land is presented to the Land Board.

The landholders are then charged annually after completion of the work; such charges do not include maintenance of the drains. However, the landholder is obliged to keep the drains and other works in good condition, otherwise he is liable

to a penalty of not more than £50.

Private landholders may apply to the Commission for a licence to drill a bore in the Artesian basin. If approved, a private driller who must be licenced, may do the work. The licensee and driller are obliged to follow specifications laid down by the Commission and must send in weekly returns showing all drilling details. The licensee (or driller) must fit closing gear and orifice plate to control the flow from the bore, usually to a maximum of 8,000 gallons per day per mile of drain.

QUEENSLAND:

GENERAL:

There were more than 9,000 sub-artesian and about 2500 artesian bores in Queensland and approximately one third of the latter have ceased to flow over the past 50 years. It has been suggested that if no steps are taken to conserve supplies, then another third would cease flowing.

Within the basin, flow, pressure and temperature of selected bores are taken annually. Such bores which are a minority, are scattered through the basin. Readings are taken on most of bores at the completion of drilling, after 1 year, at the end of 10 years and thereafter at 10 year intervals.

Artesian flows have fallen considerably in individual bores; flow in Lenglands bore near the Warrego River has declined from 1,900,000 gallons per day in 1911 to about 450,000 g.p.d. at present. In 1911, total flow from 14 bores in that area was 14 million gallons per day; at present 19 bores in the same area discharge only 8 million g.p.d., which is an average reduction in flow of almost 60%.

Little work has been done in reconditioning old bores in this state in contrast to N.S.W., where it is well advanced. A considerable amount of work is done annually on maintenance of bore drains, but the aim is to reduce the number of drains and eventually eliminate them. For new bores, P.V.C. piping is

being used to distribute the water to tanks and troughs which are fitted with ball valves. This is expected to considerably reduce losses through evaporation and seepage.

All private drillers in Queensland must be licenced and, as in N.S.W., they are obliged to send in weekly returns giving all available data on the progress of the bore.

Sludge samples of the more important bores are examined by the geologists of the Geological Survey and logs are sent to the Irrigation and Water Supply Commission. For a great number of bores, no samples were available and it is necessary to rely on drillers' logs. A card system is then compiled showing logs and history of artesian bores. All artesian bores have a registered number which is painted on the north side of the casing and are plotted on 4 mile military sheets; the legend showing whether the bore is artesian, sub-artesian, has ceased to flow or is abandoned.

The Artesian Bore Summary Card is of interest in that there is provision for a graphic log of the borehole, and also a pressure and flow graph. Details of sub-artesian bores are also provided on summary cards. As in N.S.W., the landholder must have a licence in order to have an artesian bore drilled.

Outside of the Great Artesian Basin there are certain proclaimed areas where drilling is controlled and if disputes arise concerning the underground water, the Commission would be called on to adjudicate.

METHODS OF CONSTRUCTION OF ARTESIAN BORES:

In general the methods used in Queensland appear to be similar to those of N.S.W., but the regulations are apparently not so rigidly enforced.

Licences for new artesian bores stipulate that there must be an outer string of casing, pressure cemented on the outside from shoe to surface. An inner string of casing must be inserted from surface to bottom of the hole and slotted in the aquifer. Cementing of the inner casing is not mentioned and is apparently not required.

CONTROL AND DISTRIBUTION OF ARTESIAN WATER:

The total length of bore drains in the Artesian Basin in Queensland is about 17,000 miles; some of these require cleaning out at intervals of 2-3 months, but the majority of drains are

done at yearly intervals or longer. Average usage in 1954 was calculated at about 14,000 gallons per day per mile of drain.

At present, in new bores, flow is controlled by head works and orifice plate to a maximum of 10,000 gallons per day per mile of drain. For short drains the flow may be restricted to 5,000 gallons per day per mile. The water allowance is therefore more flexible than in N.S.W. and is apparently determined by the length of drain and area of country to be served.

Water losses in drains are considerable: In 1952, it was recorded that the average drain loss per mile by seepage, evaporation and stock use was 15,400 gallons per day. Stock use would probably not amount to 10% of this total.

Since 1935, no licences have been issued for an artesian bore without provision of a control valve, but in 1954, it was recorded that 26% of the flowing bores in Queensland were not equipped with control valves. Many equipped bores were also reported to be ineffective.

Water loss from old bores was, and apparently still is, quite considerable. Over a period of 40 years from 1914 to 1954, total flow from artesian bores in Queensland decreased from 351 million gallons per day to 211 m.g.p.d.

As in N.S.W. the Commission has the power to direct the closing or partial closing of an artesian bore if it considered that water is being wastefully or improperly used. This is being done in new bores but many old bores which require reconditioning and the fitting of headworks, are apparently a source of considerable waste.

A number of bores are incorporated into what are known as Trust Areas. There are 70 such areas which may include several pastoral holdings. One bore serves each area thus avoiding the necessity for individual landholders to sink bores. This is stated to reduce wastage when combined with an efficient bore drain system. It is claimed that Trust bores use on an average 4,900 gallons per day per mile less than the average for drains serving private bores.

There have been several reports on the problem of diminishing supply in the Queensland portion of the Artesian Basin. In 1954, a report by the Committee appointed to investigate the problem, concluded that although decreasing artesian supplies in Queensland "constitutes a disability, its incidence, particularly from the economic viewpoint is far less serious than was feared in many quarters when the investigation commenced."

It was also concluded that, "As bores cease to flow, adequate supplies of water can in general be made available by pumping from the bore which has ceased to flow and by the provision of other artesian or sub-artesian bores or excavated tanks." It was considered that, "The chief problem for the Government is to ensure that the flowing supplies are utilized in the best interests of all concerned."

In the recommendations of that Committee, it was stated that the issue of licences must be in accord with the Water Act. Applications for licences should be investigated to determine the manner in which the land may be most effectively and economically watered.

Flows should be controlled to actual requirements and the volume that may be used should be stipulated. Preference would be given to distribution of the water by pipe lines or short drains. It was also recommended "that a general programme for the strict conservation of flows from existing artesian bores be not undertaken."

SUMMARY:

Bores in the Artesian Basin in Queensland are drilled by private drillers who must be licenced, but only after a licence has been granted to the landholder by the Irrigation and Water Supply Commission.

For all new bores, the licensee is required to fit closing gear and orifice plate to control the flow to a maximum of 10,000 gallons per day per mile of drain, depending on length of drain and area of country to be served. There is increasing use of P.V.C. piping to distribute water to tanks and troughs, thus reducing evaporation considerably.

New bores must be fitted with an outer string of casing, generally 8", which must be pressure cemented, to a depth of 200-500 feet, depending on the occurrence of upper saline water. An inner 6" casing is inserted from surface to bottom of hole and slotted in situ.

The Commission may direct the closing or partial closing of any bore if it considers that water is being wastefully or improperly used.

Trust areas, which may include a number of pastoral holdings have been set up in Queensland. These areas are each served by one bore and this system reduces waste considerably. There is considerable waste of water in drains serving old private bores, many of which apparently flow uncontrolled.

CONCLUSIONS:

The Water Act of New South Wales adequately covers the issue of licences, regulations for drilling of artesian bores and the use and control of underground water. In that State, the Act is strongly enforced and most of the old bores have now been reconditioned and their flow controlled.

The Water Act of Queensland is apparently similar to that of N.S.W., but is less rigidly enforced, with the result that there is considerable wastage of water from old artesian bores.

In the 1954 report, stringent conservation of artesian supplies in Queensland was not recommended as the Committee was of the opinion, "That the benefits which would result from a stringent conservation programme are not sufficiently great nor sufficiently concrete to justify a recommendation that such a programme be undertaken." Elsewhere in the same report (page 8), it has been suggested that if no special measures are taken to conserve supplies, permanently flowing bores in Queensland would be reduced to about 500 in 60 years, with a total daily flow of about 110 million gallons. By 1952, 2,309 artesian bores had been drilled and of these 828 had ceased to flow; at this time total flow was about 230 million gallons per day. Two years later, in

1954, 2,338 artesian bores had been drilled and 935 had ceased to flow; by this time total flow had been reduced to 211 m. gallons per day. Over this 2 year period, 29 new artesian bores were drilled and 107 ceased to flow.

This indicates the need for control of all flowing bores and yet the Committee in its report stated that, "It was reluctant to recommend a policy which would mean that in some instances, surplus water will continue to run to waste, but after full consideration of all factors it concluded that the resultant benefits were insufficient to outweigh the cost and the many difficulties involved in the implementation of a programme which could be expected to meet with strenuous opposition from the majority of the owners who would be required to carry it out."

From this it appears that little will be done to recondition old private bores and conserve supplies, particularly where the owner must bear the cost. The Committee stated in its recommendations that the regulations under the Water Act should be enforced in all cases where regulation and control of flow could be effected without cost to the owner. It was also recommended, "That when it is necessary for an owner to carry out improvements to his bore so that the flow can be controlled and regulated to reasonable requirements, the owners of neighbouring bores should contribute towards the cost of the improvements to the bore to be regulated in those cases where it can be definitely established that such control and regulation will benefit the neighbouring bore owners." There is, therefore, a considerable difference in the enforcement of the Water Act of New South Wales and Queensland. In the former State, there is almost complete control of artesian bores while in Queensland, control is only partial and generally restricted to bores drilled since 1935. Although vast quantities of water are available from the Artesian Basin, this does not mean that it should be

wasted on a very considerable scale as is happening at present, particularly in South Australia and Queensland. If control of artesian bores is rigidly enforced in one state, it seems reasonable that such control should extend over the whole basin.

R. G. SHEPHERD,
ASSIST. SENIOR GEOLOGIST,
HYDROLOGY.

R. R. HANCOCK,
DRILLING ENGINEER.

RGS;RRH;EMD
11.6.64.

1.

NEW SOUTH WALES

Old System - bore flows into pool which then
discharges into drains.



13098



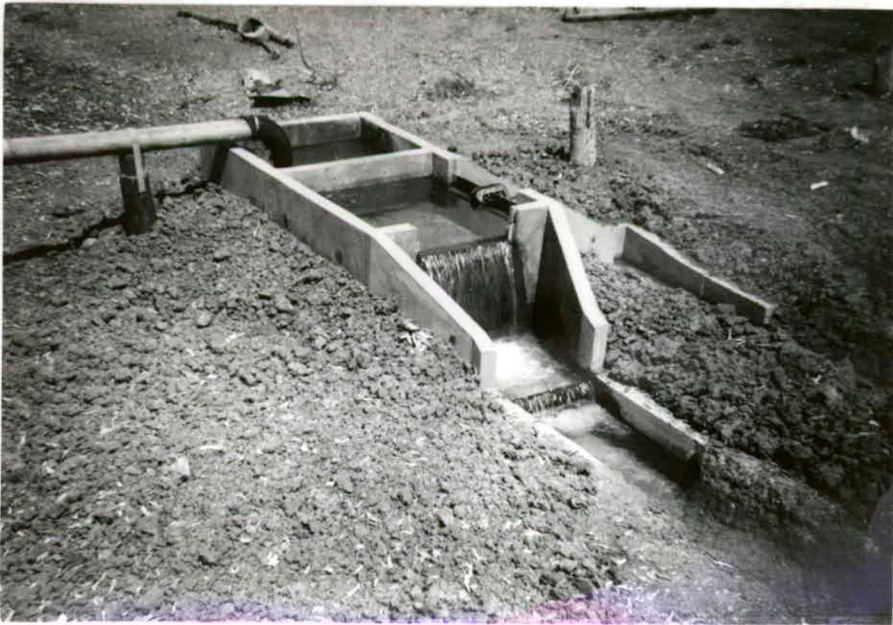
N.13099

New concrete distribution structure
in use



N. 13100

Cementing operations - reconditioning an
old bore



N. 13101

Typical distribution system and bore drain



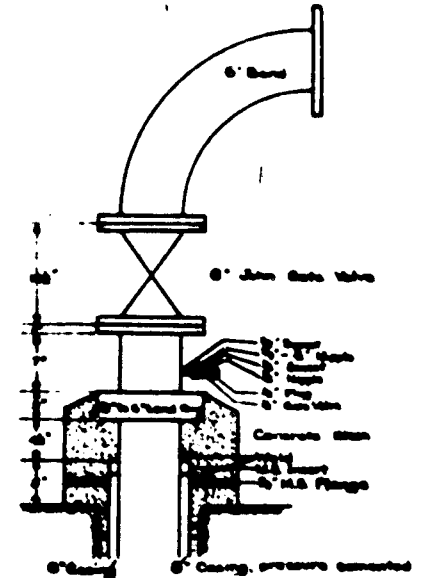
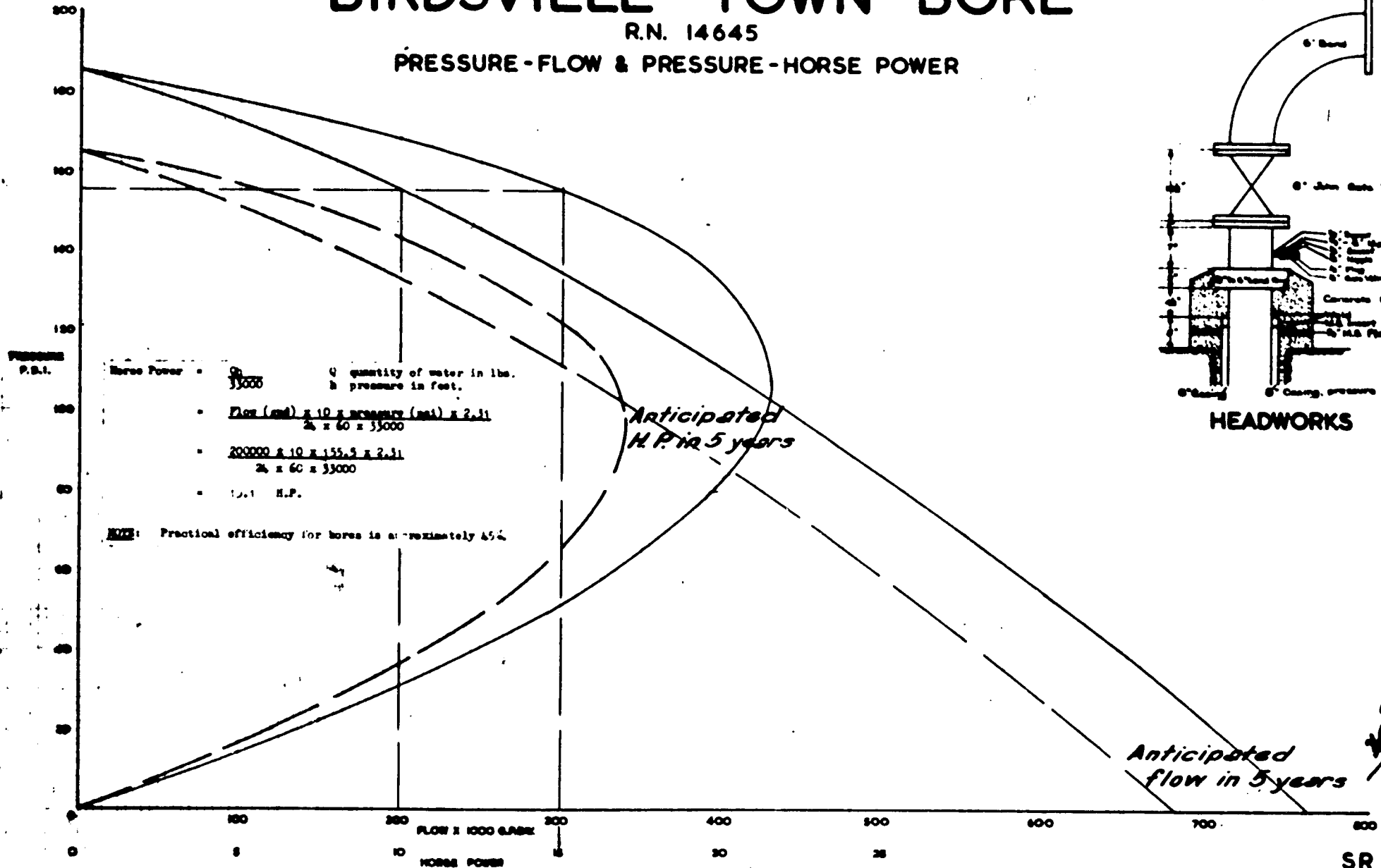
N. 13102

Typical bore drain

BIRDSTOWN BORE

R.N. 14645

PRESSURE-FLOW & PRESSURE-HORSE POWER



HEADWORKS