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DEPARTMENT OF MINES

SOUTH AUSTRALIA

GEOLOGICAL SURVEY

ENGINEERING DIVISION

DRAINAGE WELLS IN THE MURRAY BRIDGE AREA

by

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CONTENTS

FIGURES

TABLES

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ABSTRACT

A survey of drainage wells has shown that most are being used to dispose of street runoff and parkland drainage. Silt traps currently in use are poorly designed and not adequately maintained. Best drainage occurs on the northern side of the town where the Mannum Formation (limestone) is more permeable due to the presence of small solution channels.

Disposal of wastewaters underground causes saline groundwater to be displaced into the River Murray and should not be encouraged for this reason. Rooftop runoff should be diverted to domestic rainwater tanks and the reticulated sewerage system could be expanded to incorporate all of the township area. Silt trap design should be improved and silt traps maintained to maximise drainage efficiency.

INTRODUCTION

A survey of drainage wells at Murray Bridge commenced as a result of an enquiry from the South Australian Housing Trust on subsurface drainage in the Murray Bridge South area. Sheet-like calcrete often occurs close to the surface in this area, causing problems when excavating shallow trenches for a reticulated drainage scheme.

The aims of this work were to locate drainage wells to determine the standing water level, the general design of silt traps, the type of waste liquids, the general reasons for disposal well failure and finally the areas where the best drainage was obtained.

This survey was conducted in early January 1977 so that the water level in the drainage wells disposing of stormwater runoff should have stabilized. N. Taylor (Technical Assistant) located the wells and a backhoe was hired from Murray Bridge to lift concrete slabs which commonly covered the silt traps. Some recently drilled observation wells and a number of farmers' wells were incorporated in this survey to complete the groundwater contour map. All wells were levelled by J. Erklens from the Survey Branch.

HYDROGEOLOGY

Murray Bridge is located close to the western edge of the Murray Basin. Only the more recent deposits of the Murray Basin occur beneath Murray Bridge Township.

The basal Tertiary deposit in this area is the Ettrick Formation which is a greenish grey marl with alternating fossiliferous limestone bands. Overlying this unit is the permeable fossiliferous limestone of the Mannum Formation. This formation is thought to be at least 50 m thick and is currently being utilized as a disposal aquifer. Saline groundwater of 12 000 mg/l to 20 000 mg/l is found in these formations. The Parilla Sand of Pliocene age overlies the Mannum Formation. It is a variable fluviatile clayey sand with alternating clay lenses, such that vertical permeability is very low.

Subcropping throughout much of Murray Bridge is the impermeable, grey and red mottled Blanchetown Clay of Pleistocene age. Sheetlike calcrete of the Bakara Soil overlies the clay and outcrops throughout most of the area.

Crawford (1959) reported on drainage problems in the Murray Bridge township. At this time the main drainage problem was caused by effluent from septic tanks which was being disposed of into the Blanchetown Clay or Parilla Sand. These formations were apparently able to accept limited quantities, but as the town expanded it reached a situation where many septic pits were overflowing. Crawford attributed the rapid rise of the perched water table to heavy garden watering. He concluded that no adequate drainage could be expected at shallow depth and recommended that deep drainage wells be drilled.

Many drainage wells have been drilled for street runoff and parkland drainage, and some Government Departments have drilled wells for septic tank effluent drainage. The effectiveness of these drainage wells have varied with location and often with time. Most householders could not afford the expense of a drainage well for septic tank overflow and roof runoff, however the introduction of a reticulated sewerage system has alleviated this problem.

SURVEY RESULTS

Figure 1 is a plan of the Murray Bridge area showing the location of the wells inspected in this survey. Table 1 is a summary of these wells, giving the standing water levels, salinity, well-use and description of well location. Groundwater contours are shown on Figure 1. Some drainage wells at Murray Bridge have been abandoned, some could not be located in the field, some were not checked as they were very close to another well and some were blocked with the water level above the top of the casing.

This survey is thought to be a representative guide to the type of disposal material and the existing construction of drainage wells.

Disposal Materials

In the township of Murray Bridge, most of the disposal water is urban runoff from street drainage, rooftop runoff or parkland drainage. Most of these disposal wells were drilled for Public Buildings Department (school grounds) S.A. Housing Trust (parkland drainage and rooftop runoff) and the Corporation of Murray Bridge (street drainage).

To the north of the township, the Murray Bridge Abattoirs have four disposal wells. These were used to dispose of about 800 kl per day of a blood/water mixture but this process ceased in 1976 when an irrigation system of disposal was introduced (Johnson 1977). These wells are now used only as a backup to the irrigation system.

Scattered throughout the town are a number of drainage wells which are disposing of septic tank overflow. However these volumes are thought to be fairly minor compared with urban runoff.

Silt Traps

Silt traps are necessary over drainage wells to separate any solid matter from the disposal water. Solid matter which enters the wells gradually blocks the pore spaces in the aquifer and continuously reduces the permeability until the aquifer becomes completely clogged. Some form of rehabilitation is then required to clean out the well. Consequently, the better the silt trap, the more efficient is the drainage well.

Silt traps currently in use are shown in Figure 2. The most common design is two concrete tanks with a 'gooseneck' fitted to the drainage well. Both designs do not work well when large volumes of disposal water are involved (for example after heavy rains) as the solids are washed into the disposal well. Some type of settling pond is needed to temporarily hold the runoff so that at least the sand and silt settle before the water enters the drainage well. This is quite practical in parkland areas where temporary flooding causes minimal damage and inconvenience. In other areas, it may prove practical to design a series of sieves to fit on the top of the casing so that all materials coarser than silt size are filtered out. These sieves would require regular maintenance but would maintain drainage efficiency. The need still remains for improved silt trap designs.

MAINTENANCE-REHABILITATION

It appears that there has been negligible maintenance of silt traps at Murray Bridge. This was obvious for the street runoff drainage wells where in some instances, it was not possible to remove the concrete covers, even with the assistance of a backhoe. Consequently, many of these silt traps are not being regularly cleaned out so that the silt trap ceases to perform its function within a year or so. These drainage wells then require expensive rehabilitation probably on a regular basis to maintain drainage efficiency. It is recommended that all silt traps be cleaned out at least twice a year.

Techniques of rehabilitation generally require the services of a cable tool drilling rig for a least one day per drainage well. Various techniques include calgon treatment, acid treatment, explosives, surging or bailing. A combination of surging and bailing is probably most effective however other techniques are more useful in improving drainage when permeability was originally too low. Providing the slit trap is working properly, the best drainage would be achieved by leaving the hole uncased through the aquifer, assuming it is strong enough to stay open. When hole caving is expected, slotted casing is used, for the aquifer interval.

THE BEST DISPOSAL AREAS

In Figure 1 the hydraulic gradient is very flat north of Murray Bridge, indicating that the aquifer here can dissipate the groundwater faster than on the southern side of the town. The higher transmissivity in the north is due to either a thicker limestone aquifer or a more permeable limestone aquifer of similar thickness. Along the lower reaches of Preamimma Creek, the limestone contains myriads of small solution channels. However in the limestone quarry to the south of Murray Bridge the permeability of the limestone aquifer depends mainly on joints and bedding-plane partings and hence is comparatively low in this area.

It therefore appears that the solution channels (and hence drainage capabilities) in the limestone are less common in this southern region. Drainage wells in this area were not properly tested on the completion of drilling but it is expected that they could accept at least 4.5 kl per hour. On the northern side of Murray Bridge, some drainage wells can accept up to 90 kl/hr.

From these indications, it seems that aquifer permeability (and hence drainage potential) is quite variable in the southern area and consistently high in the north.

CONCLUSIONS AND RECOMMENDATIONS

Survey results have led to the following conclusions:

.....Most drainage wells are being used to dispose of street runoff and parkland drainage.

.....Silt traps currently in use are poorly designed and not adequately maintained. Such drainage wells would require regular, expensive rehabilitation to maintain drainage efficiency.

.....The Mannum Formation is significantly more permeable on the northern side of town as myriads of small solution channels have developed in the limestone in this area. It appears that solution channels are less common on the south side of town so that the aquifer permeability (and hence drainage capability) is quite variable in this area.

It is recommended that:

.....The disposal of wastewaters into the Mannum Formation should not be encouraged as this causes saline groundwater to be displaced into the River Murray (see bulge in 2.0 m contour in Fig. 1).

.....Rooftop runoff should be diverted to domestic rainwater tanks rather than to drainage wells.

.....The reticulated sewerage system should be expanded to incorporate all of the Murray Bridge township area.

.....An effort should be made to improve silt trap design and silt traps should be regularly maintained to minimise rehabilitation costs and maximize drainage efficiency.

.....An adequate drainage test should be carried out on all new wells so that the initial drainage capability is determined. Later tests will then indicate the operating efficiency of the well.

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REFERENCES

Crawford, C. 1959; Report on Rising Water Table, Town of Murray Bridge. South Aust Dept. Mines unpub. R.B. 49/49.

Johnson, P.D. 1977; Murray Bridge Abattoir. Pollution Assessment. Final Report. South Aust. Dept. Mines unpub. R.B. 77/92.

<u>TABLE 1</u>

<u>Murray Bridge Area</u>

<u>Well Summary Sheet</u>

PROJECT WELL NO.	STATE NO./UNIT NO.	REFERENCE ELEV$^{n.}$	SWL	ELEV$^{n.}$ S.W.L.	SALINITY (mg/l)	USE	LOCATION DESCRIPTION
1	503002001	47.024	43.74	3.28		Stock	Windmill at edge of scrub.
2	6727080WW00613	52.545	47.87	4.68		Stock	Broken windmill in front of house and sheds, Sec. 205.
3	6727080WW00620	25.007	21.85	3.16	9653	Stock	Windmill, Sec. 173.
4	6727080WW00626	46.024	42.84	3.18	1240	Stock	Windmill, Sec. 221.
5	6727080WW00619	47.663	45.49	2.17(?)		Stock	Broken windmill, Sec. 201 (Incorrect level?)
6	6727080WW00611	45.247	Dry at 35.0m	10.3		Not used	In centre paddock, Sec. 196, 4" casing at ground level.
7	6727080WW00278	24.000	21.16	2.84	20 000	Observation bore MRH2	In Preamimma Creek bed, Sec. 186.
8	6727080WW00632	5.015	2.50	2.52	12 000	Stock	Well and windmill in Preamimma Creek bed, Sec. 82.
9	503060701	29.141	26.71	2.43	13 000	Observation bore MBA5	On hill, 100 m S from house.
10	503029401	14.247	11.76	2.49	17 300	Observation bore MBA4	In clump of trees between two roads.
11	503062201	3.558	1.77	1.79	20 000	Observation bore MBA6	On edge of road near gum tree.
12	503050801	22.648	19.45	3.20	11 800	Observation bore MDC1	On edge of road, fitted with automatic recorder.
13	503034601	19.539	16.71	2.83	15 000	Not used	S.E. of sheds towards creek under large rock.
14	503031201	14.697	12.28	2.42		Drainage bore	Murray Bridge Abattoir effluent drainage bore on hill.
15	503031202	13.694	10.82	2.87		Drainage bore	Murray Bridge Abattoir effluent drainage bore on hill.
16	503031401	15.620	13.34	2.28		Drainage bore	Murray Bridge Abattoir effluent drainage bore on hill.
17	503036002	7.476	4.97	2.51	15 000	Observation bore MBA3A	On edge of road near Rocky Gully Creek.
18	503099101	4.178	2.46	1.76	13 600	Observation bore MBA1	On L.H. edge of road before bridge.
19	503007609	8.358	6.09	2.27	19 000	Observation bore MBA2	On northern side of railway line, behind houses.
20	503007607	27.393	17.64	9.75	670	Drainage bore	New Highways Department building beside front door under steel plate (runoff)
21	503099902	21.608	19.30	2.31	416	Drainage bore	On Library lawn, covered by concrete slab (septic?).
22	503011409	25.438	23.20	2.24	20 000	Observation bore MRH1	On intersection, N.E. corner.
23	503007201	30.556	28.31	2.25	940	Drainage bore	Clara Street runoff, covered by concrete slab.
24	503007204	35.862	33.59	2.27	2 255	Drainage bore	Totness Park stormwater runoff.
25	503098601	31.853	29.59	2.27	380	Drainage bore	Swimming Pool stormwater runoff.
26	503006703	17.617	Dry at 15.90	1.7		Not used	Adult Education Centre at back of buildings.
27	503092001	31.519	29.14	2.38	241	Drainage bore	Western end of main cemetery - stormwater runoff.
28	503041301	33.173 33.173	30.65 orig. 13.75	2.52 orig. 19.42	755	Drainage bore	PMG Depot behind brick wall, under steel plate (septic) partially blocked.
29	503007901	31.714	29.40	2.31	262	Drainage bore	In Golf Links, near road (street runoff).
30	503007702	31.329	29.23	2.10	945	Drainage bore	Weigall Park stormwater runoff, under concrete slab.
31	503007501	29.549	26.38	3.17	435	Drainage bore	Fraser Park stormwater runoff.

Elevation Datum: M.S.L. at Port Adelaide

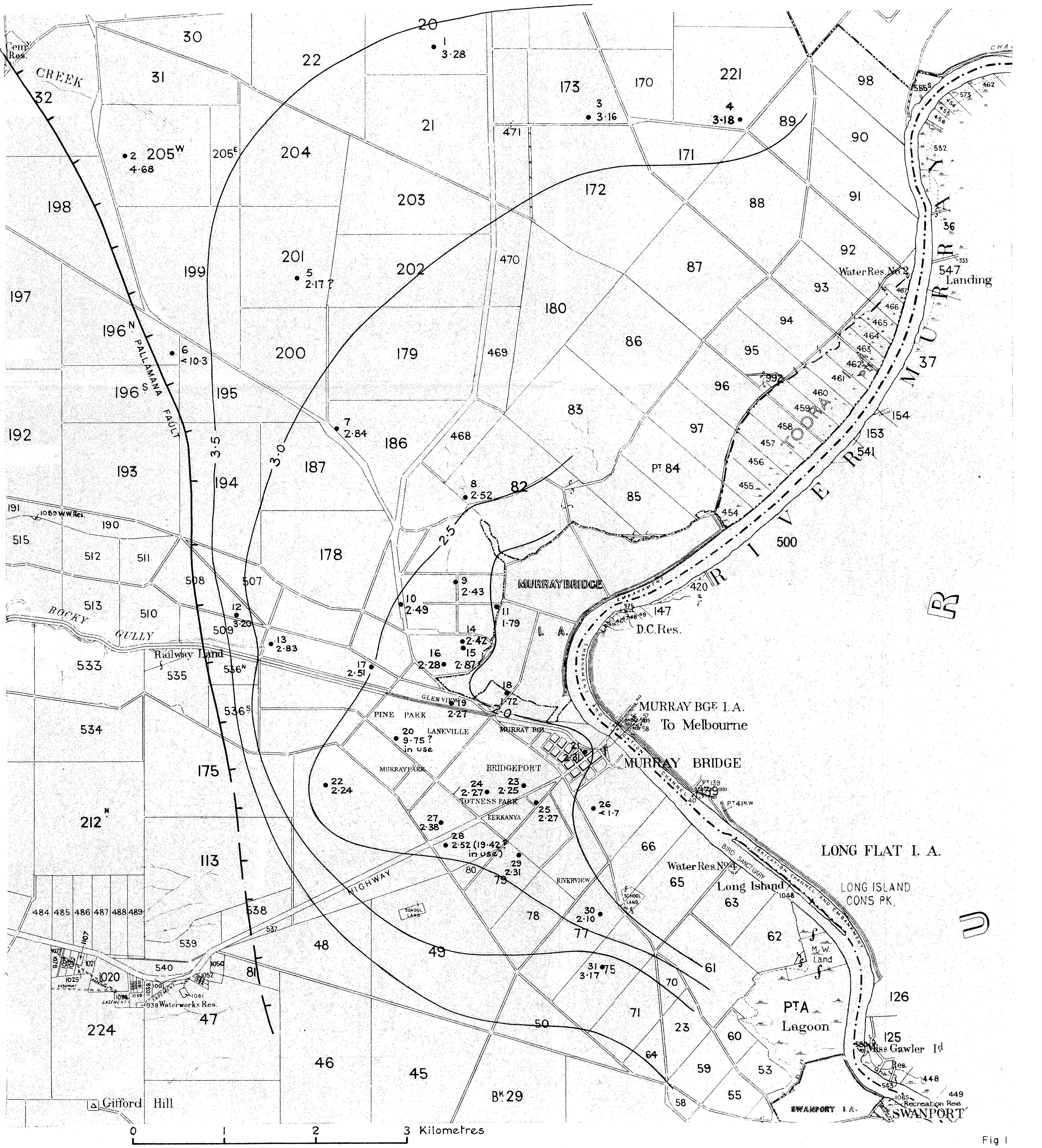

Fig I

7 ● 2·84 Well and number
Elevation of water level (m)

—2·5— Groundwater contour (m)

	DEPARTMENT OF MINES–SOUTH AUSTRALIA	SCALE 1:31,680
COMPILED: P.J.	MURRAY BRIDGE DRAINAGE WELLS	DATE: OCT. 77
DRN: M.W. CKD. R.H.	WELL LOCATIONS AND GROUNDWATER CONTOURS	PLAN NUMBER: 77-912

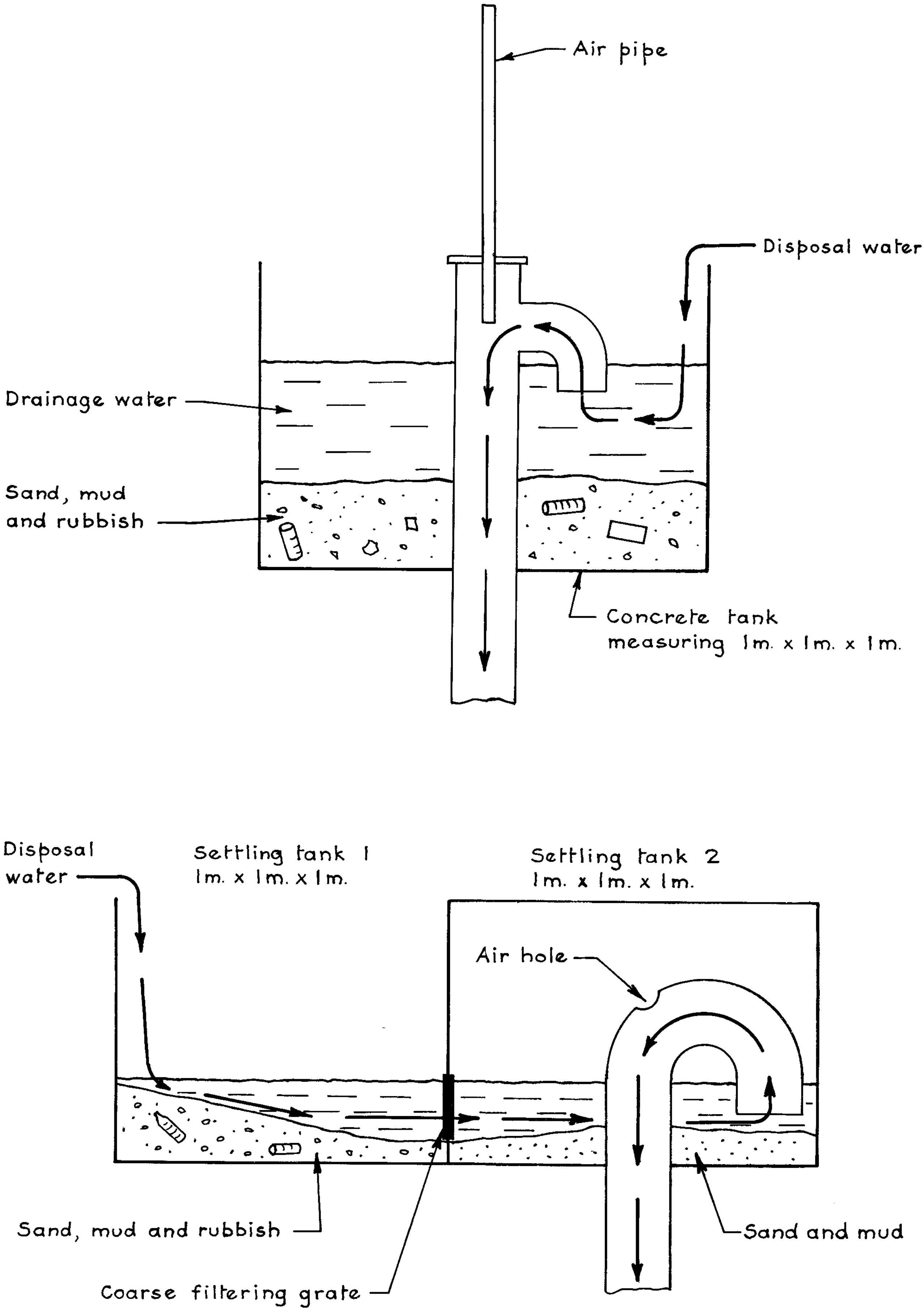

Fig 2

	DEPARTMENT OF MINES—SOUTH AUSTRALIA	SCALE —
COMPILED P. J.	MURRAY BRIDGE DRAINAGE WELLS	DATE OCT. 77
DRN M. W. CKD R.H.	COMMON SILT TRAPS	PLAN NUMBER S 13076