LAND and WATER CONSERVATION

NEW SOUTH WALES GOVERNMENT

AUSTRALIAN NEWSPRINT MILLS WASTEWATER MANAGEMENT PLAN

DELANEYS QUARRY

MARYVALE, N.S.W.

JULY 1995

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REFERENCES:

Guttridge, Haskins and Davey, Hydrogeological Assessment, May 1993.
Coffey Partners International Pty. Ltd., Geotechnical Investigation and Raising Proposal, November 1994.

1.0 INTRODUCTION

This report presents the results of an investigation into the wastewater management system at Delaney's Quarry, approximately 12km north of Albury. The site is used for sludge disposal from the nearby ANM Paper Mill at Maryvale. Previous investigations of various aspects of the site have been conducted by Gutteridge, Haskins and Davey (GHD) and Coffey Partners International Pty. Ltd.

2.0 SITE LAYOUT

Exhibits 1 and 2, taken from the GHD report "Hydrogeological Assessment", show the site layout. It is proposed that existing Dams A and B serve as leachate and surface runoff collection ponds and that overflows be directed to existing Dam D which will be enlarged.

An irrigation pump, located at Dam D, will be used to apply runoff through a sprinkler irrigation system to the irrigation area shown in Exhibit 2.

3.0 WASTEWATER MANAGEMENT SYSTEM

The design principles considered in developing the Wastewater Management Plan were:

I) Diversion of clean run-on water around the land fill site and irrigation area.

ii) Collection of runoff and leachate from the site for irrigation reuse.

iii) Providing sufficient wet weather storage capacity to contain runoff when it is not possible to irrigate.

iv) Providing a "first-flush" collection system from the irrigation area for recycling via the main collection storage, Dam D.

3.1 *Diversion of Clean Run-on Flows*

It is proposed that all clean run-on water be diverted around both the landfill site and around the irrigation area. Run-on water from the hills to the east of the landfill site will be diverted via the table drain on the eastern side of the main access road to Area A. The table drain in this area is relatively stable because it has washed onto bedrock in most sections. The culvert at "A" will need replacing to ensure that run-on water is safely carried across the main road.

As land fill areas are progressively capped and rehabilitated further opportunity will exist to divert surface runoff to the east and into the table drain/clean water system.

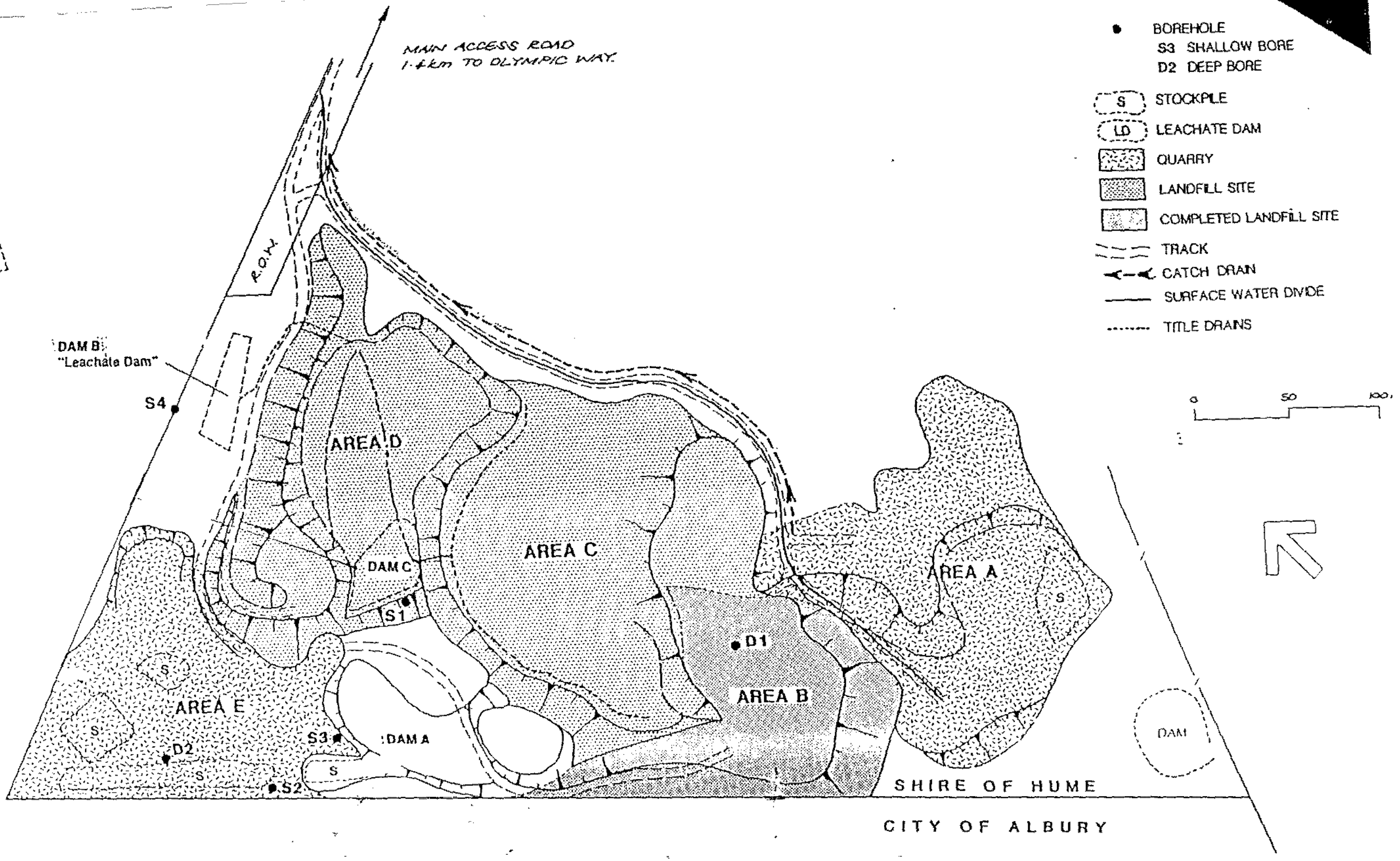

Figure 3
EXISTING LANDFILL

ANM NEWSPRINT MILLS, ALBURY
DELANEY'S QUARRY .
HYDROGEOLOGICAL ASSESSMENT

EXHIBIT 1

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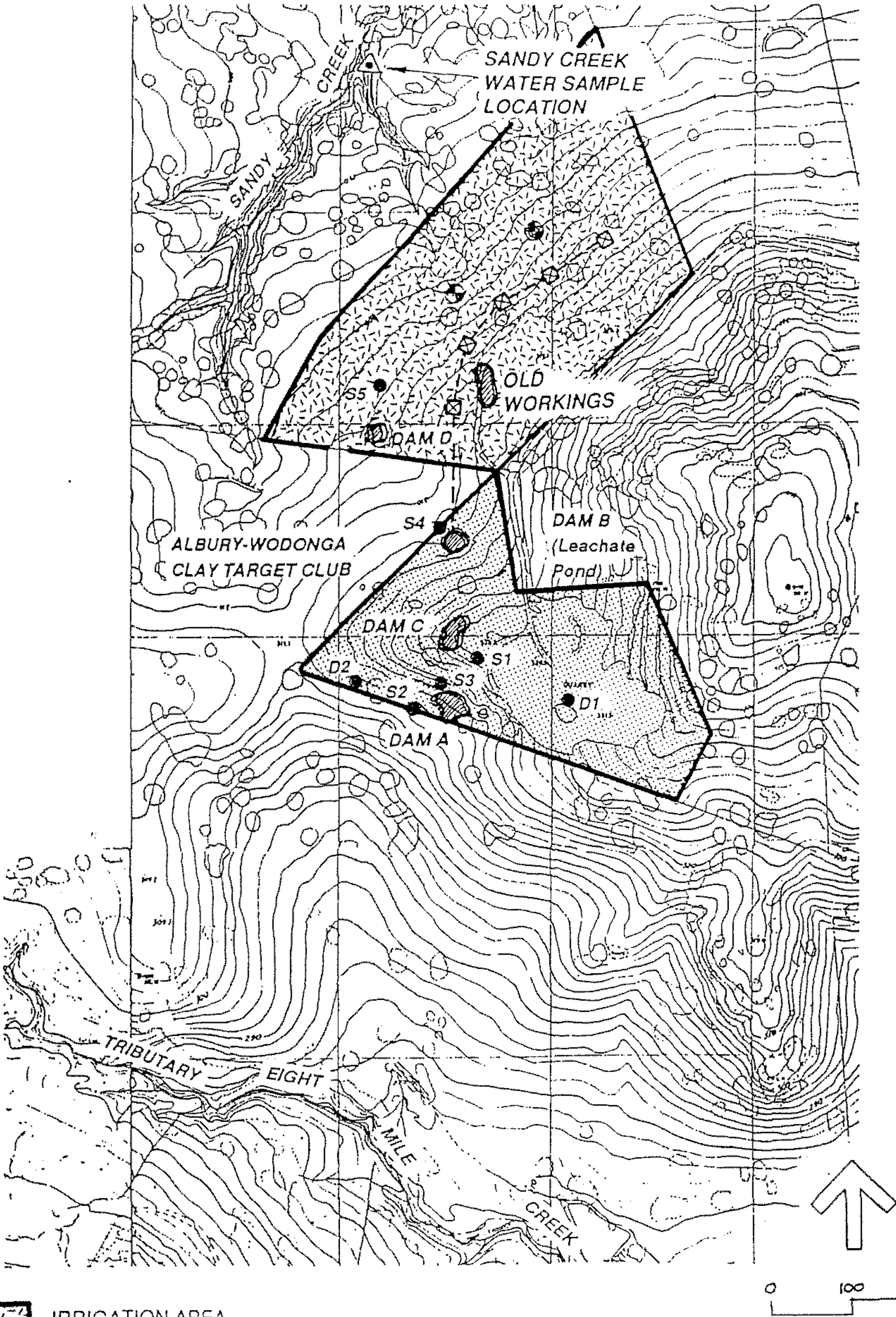

IRRIGATION AREA

LANDFILL AREA

PROPOSED SHALLOW BORES

S2 SHALLOW BORE

D2 DEEP BORE

DAMS

SPRINKLER SYSTEM (LEACHATE)

EXHIBIT 2

Figure 4

LANDFILL & IRRIGATION AREA SITE PLAN

ANM NEWSPRINT MILLS, ALBURY
DELANEY'S QUARRY
HYDROGEOLOGICAL ASSESSMENT

GHD

DO

Run-on water to the irrigation area is controlled by the main access road. The table drain on the south eastern edge of this road will need shaping and deepening to ensure that run-on water is directed to Culvert "B". A drop inlet structure will be required on the inlet of this culvert to prevent erosion along the table drain. A short diversion bank and waterway along the eastern edge of the irrigation bay will convey water around the irrigation area. Run-on water entering the irrigation area through Culvert "A" and from the adjoining paddock (Gun Club) will be diverted around the area by a diversion bank and waterway as shown on Drawing Nº W191/1, below Dam D.

3.2 Collection of Surface Runoff and Leachate

There are two components of inflow to the wastewater collection storage:

- surface runoff from active landfill sites
- leachate from all landfill areas.

3.2.1 Surface Runoff

A main collection point is recommended for directing surface runoff from active landfill areas, as shown on Coffey Partners Drawing Nº M2703/1-1. A drop inlet structure is proposed, with a 600m diameter outlet pipe discharging to an open drain which may require stabilisation to prevent scour. Minor earth banks may be required to direct surface flows into the structure. As recommended by Coffey's, the finished landfill surface should be graded towards the structure.

As mentioned previously, surface runoff from capped and revegetated areas can be considered "clean" and should be directed to the run-on diversion system described in Section 4.0. Proposed works as shown on Drawing Nº W191/1 attached.

In order to estimate the volume of surface runoff, it was assumed that 25% of annual rainfall would contribute to runoff, with the balance being used by vegetation or stored in the sludge dump. This is probably an overestimate as it is equivalent to the annual runoff from a bare shale soil or clay pan.

Assuming that around 8ha of the total 12ha will be contributing to wastewater runoff, with the remaining 4ha redirected to the clean run-on diversion system, the volume of surface runoff in a 1 in 10 wet year (recommended EPA design criteria) would be:

$$\begin{aligned} \textit{Annual Runoff Volume } (m^3) &= 9^{th} \textit{ Decline Rainfall x Runoff \% x Catchment Area} \\ &= 0.9m \times 0.25 \times (8 \times 10^4)\ m^2 \\ &= 18{,}000m^3\ (18Ml) \end{aligned}$$

3.2.2 Leachate

The hydraulic conductivity of the deposited sludge has not been measured in this investigation but visual observation and anecdotal information suggests it is quite low. Two holes drilled by hand in the sludge dump produced moisture inflow at shallow depths, indicating that the material retains moisture.

According to local sources, the sludge remains saturated for many years after being dumped. Observed outflow from the existing subsurface drainage system is minimal even though the sludge is saturated. The graph of watertable levels in the shallow and deep monitoring bores in Figure 3 shows little variation over a 15 month period, supporting the assumption of low permeability within the landfill.

Based on this evidence, it has been assumed that the sludge will retain most of its moisture content and rainfall will only percolate into the upper zone of the fill, corresponding to the vegetative root zone. Potential evapotranspiration by vegetation, using a crop factor of 0.8 times pan evaporation, is around 1100mm/annum. Average annual rainfall is around 700mm, leaving a moisture deficit of 400mm.

Based on these estimates and assumptions, the likely magnitude of leachate flows compared to surface runoff flows will be minimal and can be ignored in estimating required storage capacities. A sophisticated subsurface leachate collection system therefore seems unnecessary. Minor seepage flows should escape into Dam B through the proposed rockfill toe shown on Coffey Partners Drawing Nº M2703/1-1.

3.3 Wet Weather Storage Capacity

A water balance was prepared for the site (Table 1) using climatic data from the GHD report. For the 9th decile (1 in 10) wet year, the results show that irrigation will only be possible for 6 months of the year. From April to September inclusive, rainfall exceeds potential evapotranspiration and runoff from the landfill must be stored.

In Table 2, the required wet weather storage size is estimated to be 11,600m^3. Assuming the capacity of Dams A and B is 1000m^3 each, then the required capacity of Dam D is 9,600m^3, say 10,000m^3.

ANM - Delaney's Quarry, Maryvale

TABLE 1: Water balance for 9th Decile (1 in 10) wet year

Month	Rainfall (mm)	Evap. (mm)	Crop Factor	Potential E/T(mm)	E/T - rain (mm)	Max. effluent applied(mm)
Jan	55	229	0.8	183	128	128
Feb	51	194	0.8	155	104	104
Mar	61	155	0.8	124	63	63
Apr	67	79	0.8	63	-4	0
May	81	43	0.8	34	-47	0
Jun	99	27	0.8	22	-77	0
Jul	101	29	0.8	23	-78	0
Aug	97	43	0.8	34	-63	0
Sept	79	65	0.8	52	-27	0
Oct	90	117	0.8	94	4	4
Nov	62	167	0.8	134	72	72
Dec	62	209	0.8	167	105	105
TOTAL	905	1357		1086		476

(Note: Climatic data from GHD report, May 1993

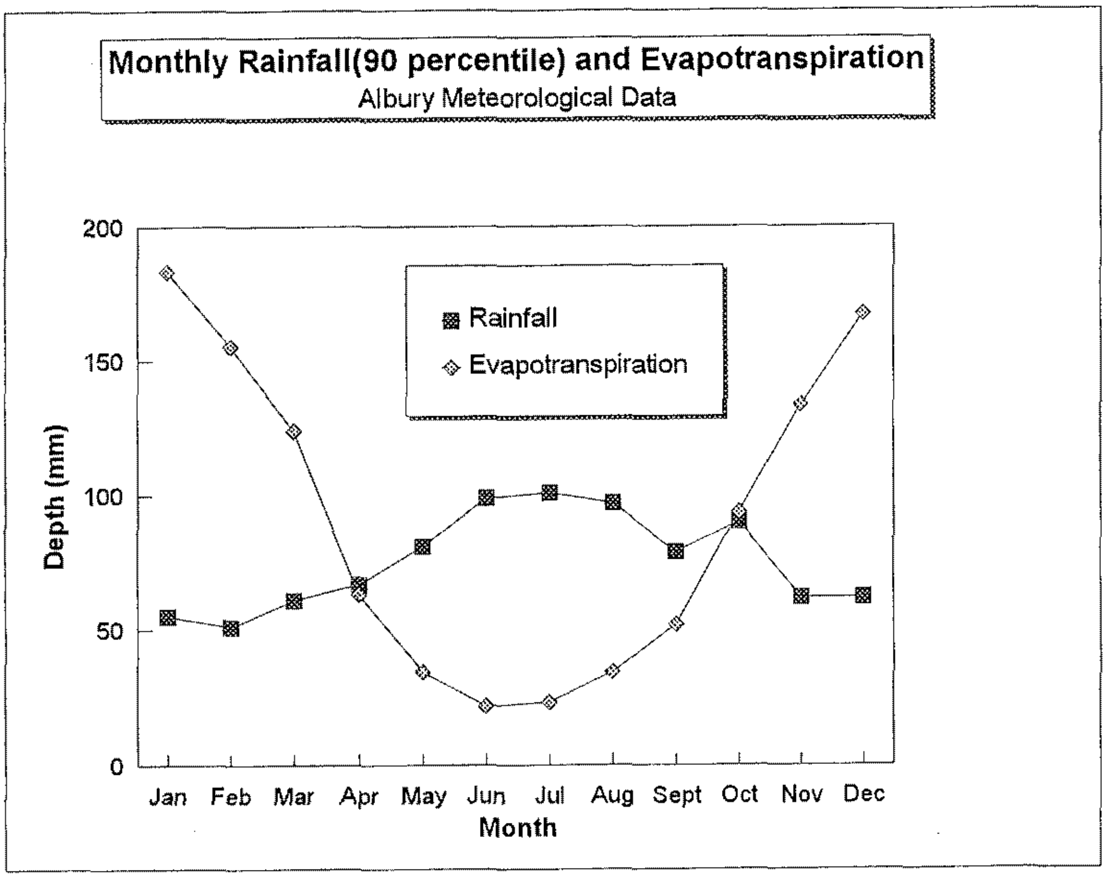

Figure 1

ANM - Delaney's Quarry, Maryvale
TABLE 2: Calculation of Wet Weather Storage Capacity for 9th Decile Rainfall

Month	Rainfall (mm)	C/ment Area (ha)	Runoff Co-eff.	Volume of Runoff(m3)	Max.Depth Effluent Applied(mm)	Irrigation Area (ha)	Max. Volume irrigated (m3)	Excess Runoff to be stored(m3)	Volume in Storage(m3)
Jan	55	8	0.25	1100	128	8	10240	0	0
Feb	51	8	0.25	1020	104	8	8320	0	0
Mar	61	8	0.25	1220	63	8	5040	0	0
Apr	67	8	0.25	1340	0	8	0	1340	1340
May	81	8	0.25	1620	0	8	0	1620	2960
Jun	99	8	0.25	1980	0	8	0	1980	4940
Jul	101	8	0.25	2020	0	8	0	2020	6960
Aug	97	8	0.25	1940	0	8	0	1940	8900
Sept	79	8	0.25	1580	0	8	0	1580	10480
Oct	90	8	0.25	1800	4	8	320	1480	11640
Nov	62	8	0.25	1240	72	8	5760	0	5880
Dec	62	8	0.25	1240	105	8	8400	0	0
TOTAL	905			18100	476		38080	11960	

Notes: 1. Climatic data from GHD report , May 1993
2. Leachate volumes ignored
3. Maximum depth of effluent applied is taken from Table 1.

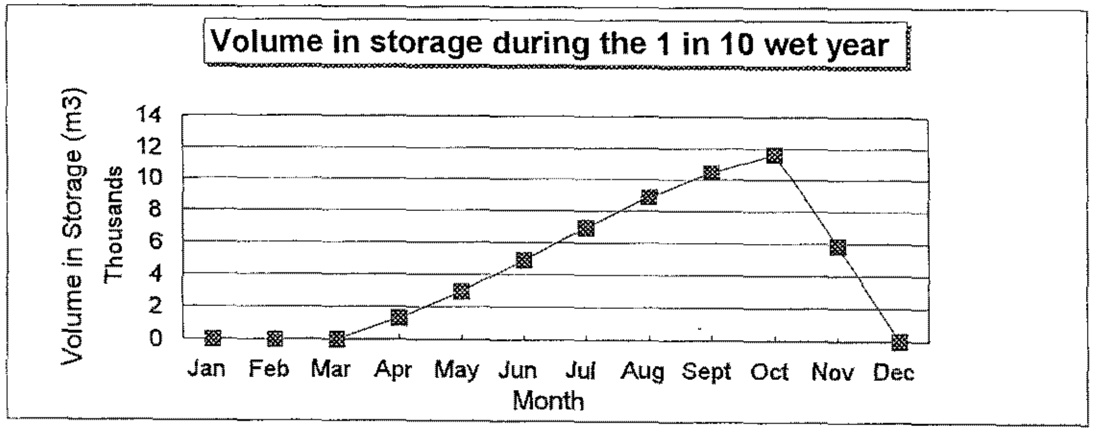

Figure 2

4.0 PROPOSED WORKS

The proposed works are shown on Drawing Nº W191/1. Leachate and surface runoff will be collected in Dams A and B and transferred by gravity flow through a pipeline to Dam D. The outlet will be fitted with a float valve so that Dam D fills before A and B. A waterway below Dam D will carry any overflow resulting from storm events which exceed the design capacity of the storages.

Evidence of seepage from Dam B and the presence of gravel and sand seams in Dam D, suggest that impermeable linings will be required to prevent leakage. Either clay or plastic lining would be acceptable provided the clay material is tested and meets required standards.

The irrigation system has not been designed but would presumably involve either a travelling irrigator or some other form of sprinkler irrigation (either fixed or portable). Earthworks associated with the irrigation area are shown on the drawing and include a runoff diversion bank and terminal pond. This pond would be emptied via a portable pump and pipeline back to Dam D. This would be required every time the pond filled after an irrigation.

In Figures 3 and 4, electrical conductivity readings for the bores and dams is presented. Most results are in the 1500µS/cm to 2500µS/cm range. Dam D is generally less than 500µS/cm as it mainly receives catchment runoff at present. Dams A and B collect leachate and surface runoff from the landfill, and have conductivities generally in the 1000 to 2000µS/cm range. This falls within the "high salinity" classification for irrigation water and is not recommended for use on poorly drained soils or low salt tolerant crops.

The estimated irrigation application of 2.5 Ml/ha/annum (18Ml over 8 hectares) is relatively low and should be sustainable on a medium salt tolerant pasture or crop, such as rye grass, fescue, cocksfoot, lucerne and phalaris . Natural leaching of any accumulated salts should occur due to rainfall. Regular soil monitoring for nutrients, pH and electrical conductivity is recommended.

Overflow from the terminal pond would spill onto a grassed waterway as shown on the drawing. Works required to divert clean run-on water around the site are also shown. They include upgrading culverts and constructing diversion banks and a waterway along the northern boundary of the irrigation area.

An alternative to irrigation, which is being considered for feedlot effluent, is disposal via evaporation. Provided they can be economically sealed, a series of evaporation ponds with a large surface area to volume ratio, constructed such that each one automatically spills into the next basin below, is much easier to manage than an irrigation system. A water balance study would be needed to evaluate this alternative.

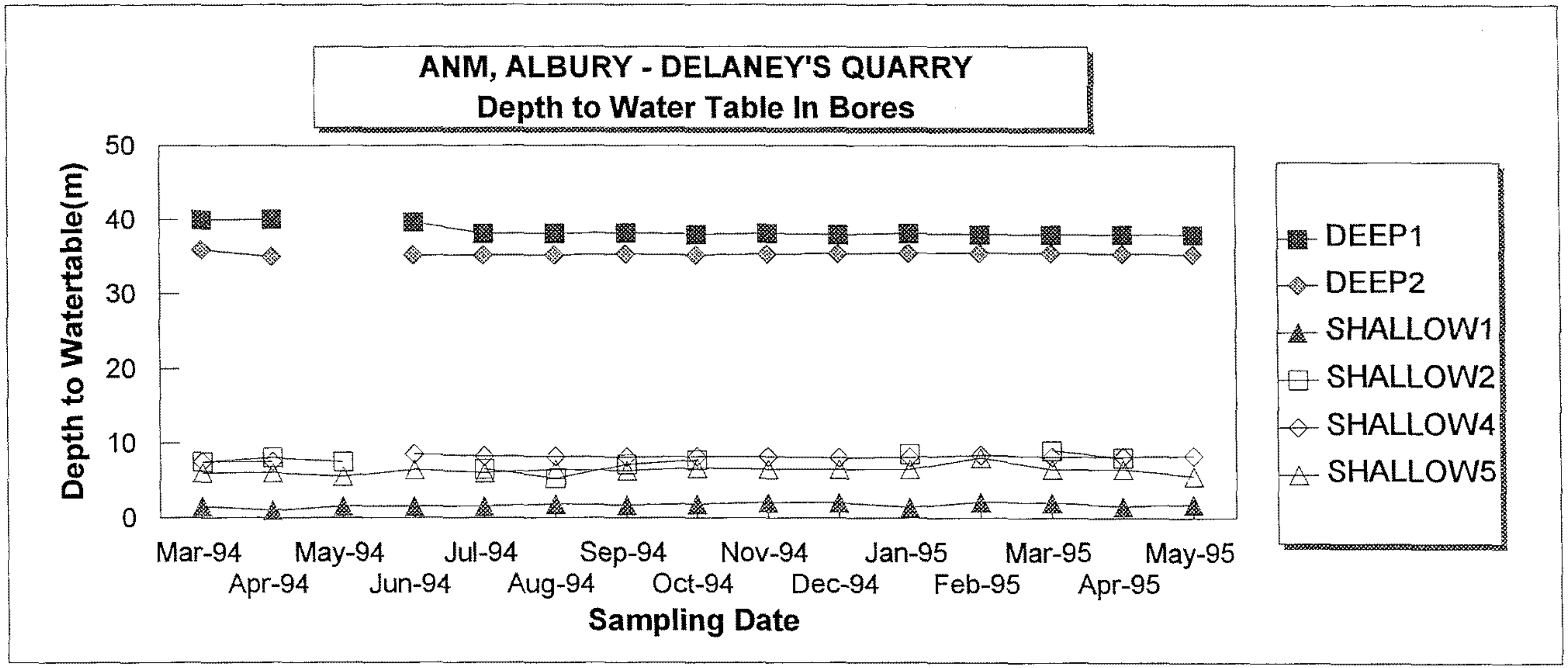

Figure 3

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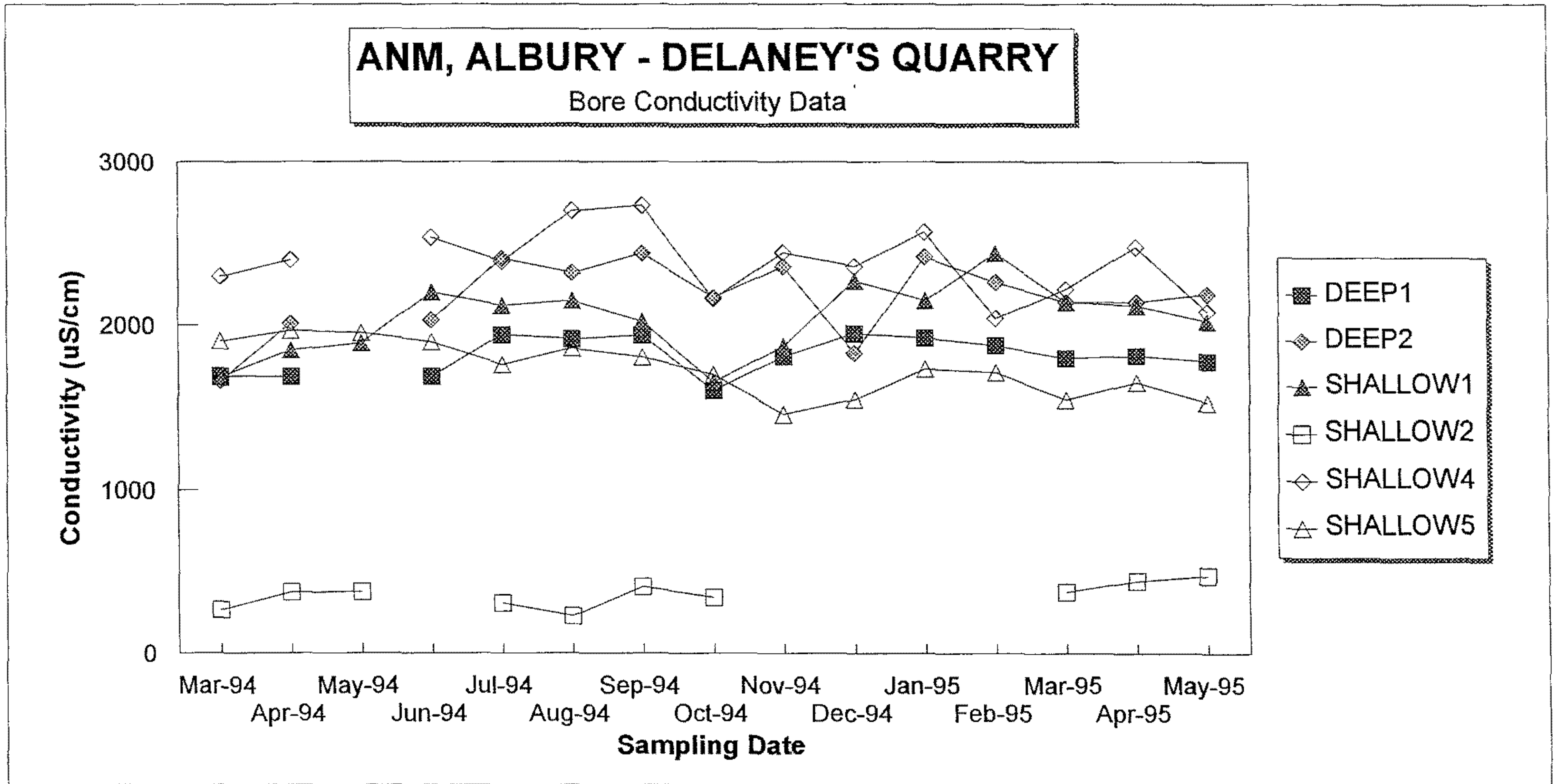

ANM, ALBURY - DELANEY'S QUARRY
Bore Conductivity Data
3000
2000
1000
0
Conductivity (uS/cm)
Mar-94
Apr-94
May-94
Jun-94
Jul-94
Aug-94
Sep-94
Oct-94
Nov-94
Dec-94
Jan-95
Feb-95
Mar-95
Apr-95
May-95
Sampling Date
DEEP1
DEEP2
SHALLOW1
SHALLOW2
SHALLOW4
SHALLOW5

Figure 4

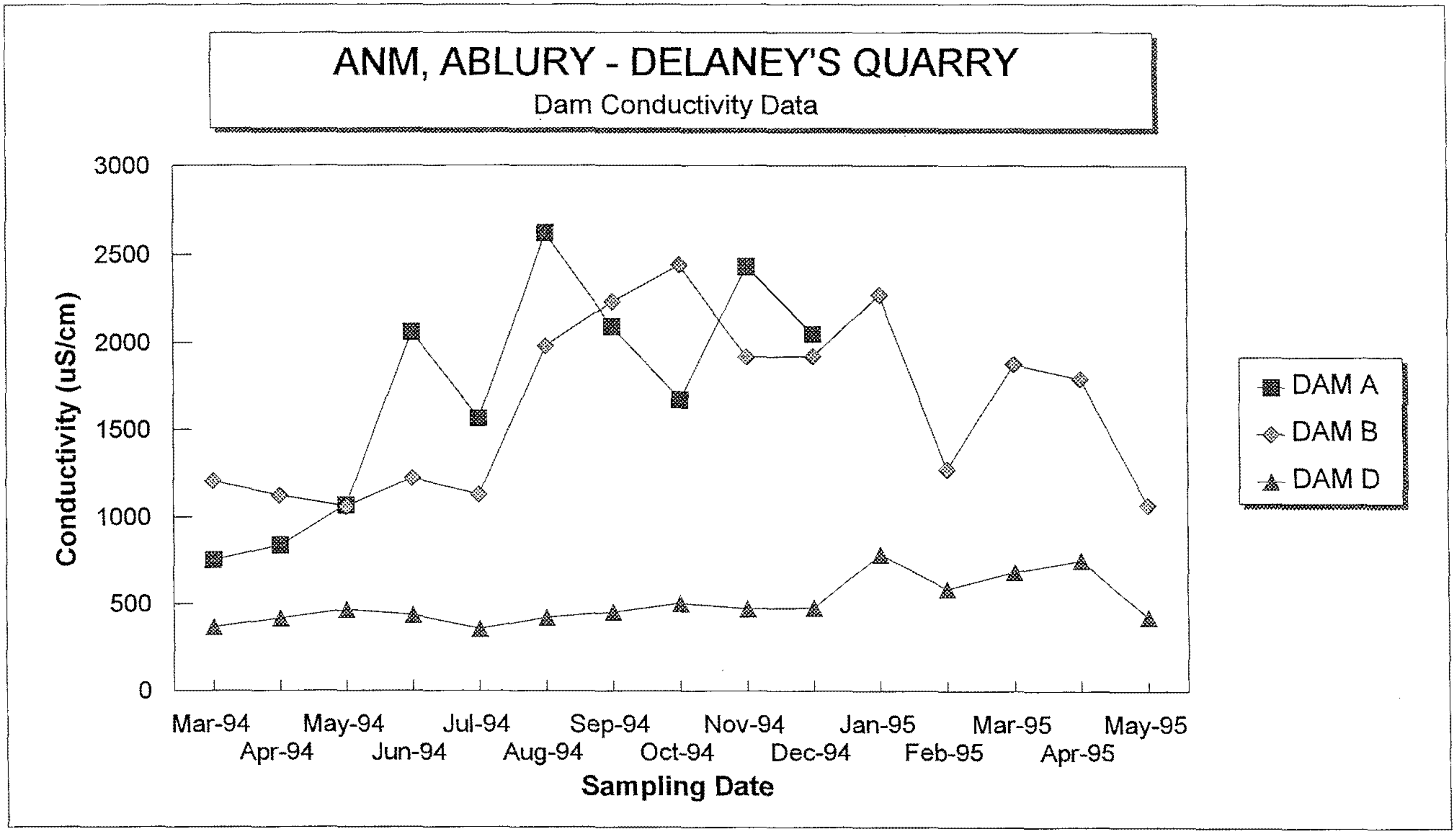

Figure 5

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5.0 ESTIMATED COSTS

An estimate of costs for the works, excluding the irrigation system, is given in Table 3. These costs are approximate only and are subject to detailed survey and design. Lining the storages has not been included in the estimates but is a major cost which will be significantly reduced if suitable local clay material is available rather than using plastic liners.

6.0 SUMMARY

A Wastewater Management Plan has been prepared for the sludge disposal site, based on assumptions about the volume of surface runoff and leachate flows that can be expected. Actual runoff volumes should be monitored and if the assumptions are proved incorrect, then additional storage may be required. This could be achieved by increasing the size of Dam D.

Conductivity measurements from observation bores and existing leachate dams on the site indicate salinity levels of 1500 to 2500μS/cm approximately. This is classed as high salinity water which is not recommended for use on soils with restricted drainage or low salt tolerant crops. Wastewater collected in the storages may be somewhat less saline but should be monitored, along with soil salinity levels in the irrigation area. Monitoring requirements will be specified by the E.P.A. as licence conditions.

Disposal via evaporation basins, rather than irrigation, may be a feasible alternative. A water balance study would be required to determine the total basin area, and a detailed site investigation to determine possible leakage from the basins. This method is gaining increasing acceptance in intensive agriculture industries because it is easier to manage than an irrigation system, has almost no operation costs and effluent is confined within the basins rather than being spread over a large area. A method of disposing of accumulated material from the basins, which could be highly saline, would have to be approved by EPA.