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**A COMPILATION OF
HISTORICAL WATER LEVEL DATA
FOR WETLANDS IN THE
PERTH METROPOLITAN AREA.**

by

Jodi Cake

for

The Department of Conservation and Land Management

January 1998

The following research is on historical water levels for eleven named wetlands around the Perth Metropolitan Area in Western Australia. It has been prepared by Jodi Cake for the Department of Conservation and Land Management. The purpose of compiling this data was to increase the accessibility of this information and to provide baseline information against which future changes may be assessed.

CONTENTS

	Page
INTRODUCTION	1
1.1 INTRODUCTION	1
1.2 MONITORING SOURCES	2
1.2.1 The Water And Rivers Commission	2
1.2.2 The Department Of Conservation And Land Management	3
1.2.3 Summary Of Monitoring Sources	3
BACKGROUND INFORMATION	4
2.1 WETLAND BACKGROUND	4
2.1.1 Northern Wetlands	4
2.1.2 Southern Wetlands	7
RESULTS	10
3.1 RESULTS	10
3.2 SUMMARY TRENDS OF EACH HYDROGRAPH	10
3.2.1 Wannamal Lake	10
3.2.2 Yeal Lake	10
3.2.3 Lake Bambun	10
3.2.4 Loch McNess	11
3.2.5 Lake Nowergup	11
3.2.6 Lake Jandabup	11
3.2.7 Lake Joondalup	11
3.2.8 Balannup Lake	11
3.2.9 Thomsons Lake	11
3.2.10 Gibbs Road Swamp	11
3.2.11 Forrestdale Lake	12
3.3 SIMILARITIES BETWEEN HYDROGRAPHS	12
3.4 CORRELATION BETWEEN THE HYDROGRAPHS AND THE RAINFALL DATA	12
3.4.1 Wannamal Lake	12
3.4.2 Yeal Lake	12
3.4.3 Lake Bambun	12
3.4.4 Loch McNess	13
3.4.5 Lake Nowergup	13
3.4.6 Lake Jandabup	13

3.4.7	Lake Joondalup	13
3.4.8	Balannup Lake	13
3.4.9	Thomsons Lake	13
3.4.10	Gibbs Road Swamp	13
3.4.11	Forrestdale Lake	14
3.4.12	Gnangara Mound Monitor	14
DISCUSSION		15
4.1	BACKGROUND	15
4.2	INCREASED RECHARGE TO WETLANDS	15
4.3	IMPACTS OF GROUNDWATER ABSTRACTION	16
4.4	WETLAND MANAGEMENT	16
4.5	MANAGEMENT OF WATER LEVELS	17
4.6	MONITORING DETAILS	17
4.7	IMPACTS ON PERTH'S WATER SUPPLY	17
4.8	SUMMARY OF NORTHERN WETLANDS	18
4.8.1	Wannamal Lake	18
4.8.2	Yeal Lake	19
4.8.3	Lake Bambun	19
4.8.4	Loch McNess	19
4.8.5	Lake Nowergup	19
4.8.6	Lake Jandabup	19
4.8.7	Lake Joondalup	20
4.9	SUMMARY OF SOUTHERN WETLANDS	20
4.9.1	Balannup Lake	20
4.9.2	Thomsons Lake	20
4.9.3	Gibbs Road Swamp	21
4.9.4	Forrestdale Lake	21
4.10	CONCLUSIONS	21
ACKNOWLEDGEMENTS		22
REFERENCES		23
APPENDICES		
APPENDIX A	Rainfall Data	A
APPENDIX B	CALM Supplied Wetland Water Level Data	B
APPENDIX C	Water and Rivers Commission Supplied Wetland Water Level Data	C
APPENDIX D	Maps of Wetlands	D

INTRODUCTION

1.1 INTRODUCTION

The definition of wetlands has been accepted by the Wetlands Advisory Committee (Payne, 1993) as follows: Wetlands are "areas of permanent, seasonal or intermittent inundation, whether natural or otherwise; fresh, brackish or saline; static or flowing" (EPA, 1990). They are surface expressions of the water table and therefore water levels respond to groundwater level changes (WAWA, 1986a). Wetlands are the most biologically productive areas of the Swan Coastal Plain and directly or indirectly support most of the wildlife (Seddon, 1972).

The wetlands of the Swan Coastal Plain can be divided into two broad categories - those that contain water permanently, and those that are seasonally dry (Balla and Davis, 1993). There have been some differing opinions of the northern and southern boundaries of the Swan Coastal Plain in various sources of literature, but the accepted definition for this project was that of Halse (1989) which states: "The Swan Coastal Plain ... is ... regarded as the area west of the Darling Scarp between Lancelin to the north and Bunbury to the south". The 11 wetlands studied in this project are within these boundaries.

Below the Swan Coastal Plain lies a heterogenous, unconfined aquifer which varies in composition both vertically and laterally. It is recharged by rainfall with the buildup of water forming groundwater mounds in the sediments. There are two large mounds present in the urban region of Western Australia - the Gnangara Mound and the Jandakot Mound, which lie north and south of the Swan River respectively. The Gnangara Mound reaches an elevation of approximately 70m above sea level, whereas the water table at the Jandakot Mound reaches an elevation of about 25m above sea level. Elsewhere, the water table has a slope generally to the west towards the sea or to major rivers (Balla and Davis, 1993). Therefore, "[t]he configuration of the water table is a subdued reflection of the regional topography". The water table has a low gradient for 3 to 4km inland from the coast, then rises steeply immediately west of the linear lakes, such as Lake Joondalup (Bowman, Bishaw and Gorham, 1994).

The Swan Coastal Plain has a Mediterranean climate with hot, dry summers and cool, wet winters (Davis and Rolls, 1987; Davis *et al.*, 1993). The annual rainfall recorded for Perth is highly variable (Davis and Rolls, 1987) but it is distinctly seasonal with approximately 90% of the rain falling between the months of April and October (WAWA, 1986a; Davis and Rolls, 1987). Consequently, wetlands experience a strongly seasonal hydrological cycle (Davis *et al.*, 1993). Excluding May to August, evaporation exceeds precipitation throughout the year (Davis and Rolls, 1987).

Groundwater levels decline during summer and are at a minimum in March to April (Bowman, Bishaw and Gorham, 1994), then rise quickly after the start of the winter rain to peak in September-October (WAWA, 1986a; Balla and Davis, 1993). The timing of the drying of a wetland is primarily a response to the volume of rainfall which has fallen, whereas the timing of the refill of a wetland is in response to the timing of the rainfall (Balla and Davis, 1993).

Most recharge to the Gnangara and Jandakot Mounds occurs during June to September. In the case of the Gnangara Mound for example, this is accompanied by a rise in the water table of about 0.2m in the coastal belt and up to 4.5m beneath the Pinjarra Plain (Bowman, Bishaw and Gorham, 1994).

It has become clear that a great deal of wetland information exists and many on-going research projects on various aspects of wetlands are presently being undertaken by government departments, universities and others. The purpose of this project was to find and compile all available data on historical water levels and identify ongoing water level monitoring programs as a source of ongoing data for the Department of Conservation and

Land Management managers of the 11 wetlands studied in this report. Many aspects of wetlands can be studied, such as hydrology, geology, ecology, biology and recreational use. The only parameter examined for this project was water level changes.

Factors affecting water levels include:

- Climate and recharge;
- Abstraction - private and public, and
- Vegetation cover and land use changes (WAWA, 1986a).

It is these factors which must be controlled to maintain the health and survival of these wetlands around Perth.

The 11 wetlands studied, include 7 north of Perth and 4 south of Perth. In geographical order from the most northern to the most southern, they are: Wannamal Lake, Yeal Lake, Lake Bambun, Loch McNess, Nowergup Lake, Lake Jandabup, Lake Joondalup, Balannup Lake, Thomsons Lake, Gibbs Road Swamp and Forrestdale Lake. By dividing them into the two broad categories of wetlands, as described previously, there are four permanent wetlands :-

- Wannamal Lake;
- Loch McNess;
- Nowergup Lake; and
- Lake Joondalup;

and seven seasonally dry wetlands :-

- Yeal Lake;
- Lake Bambun;
- Lake Jandabup;
- Balannup Lake;
- Thomsons Lake;
- Gibbs Road Swamp; and
- Forrestdale Lake.

NOTE: *Wannamal Lake was classified according to Australian Nature Conservation Agency (1996). Information regarding the inundation of the other ten wetlands was derived from Davis et al. (1993).*

1.2 MONITORING SOURCES

Two sources for the ongoing data of water levels in these eleven wetlands are included in this report. They are:

- the Water and Rivers Commission, and
- the Department of Conservation and Land Management.

The Water and Rivers Commission provided water level data for eight of the eleven wetlands - Loch McNess, Nowergup Lake, Lake Jandabup, Lake Joondalup, Balannup Lake, Thomsons Lake, Gibbs Road Swamp and Forrestdale Lake, as well as information regarding Yeal Lake. The Department of Conservation and Land Management provided water level data for the remaining two wetlands - Wannamal Lake and Lake Bambun.

1.2.1 The Water And Rivers Commission

The monitoring of water levels by the Water and Rivers Commission takes place monthly with measurements being taken by regional field staff. This monthly monitoring program began in the 1970s. The wetlands are checked more frequently if required - for example if a wetland were close to breaching the minimum water level criteria as set by the responsible

authority. The water level information is expected to continue and is accessible to staff from the Department of Conservation and Land Management (Jeff Kite, pers. comm., 1997).

The monitoring program is as follows:

Regional field staff check the depth gauges at the numerous wetlands monitored around Perth monthly, unless otherwise stated.

The contact for this data is :

Jeff Kite
Water and Rivers Commission
Hyatt Centre
3 Plain Street
EAST PERTH WA 6004

1.2.2 The Department Of Conservation And Land Management

The monitoring of wetlands through the Department of Conservation and Land Management, which began in 1978, organised by Jim Lane, was originally established to provide information for duck refuge sites for the duck seasons. Water levels were taken every two months. After duck shooting was banned after the 1990 season, Jim Lane continued this monitoring. It is the longest continuous water level monitoring program in Western Australia and it will continue. The water levels since 1985 have been checked every September and November. The September levels provide the approximate maximum of water levels expected and the November levels are used to make predictions as to how quickly the lakes will dry over the following summer (Grant Pearson, pers. comm., 1997). Since the water level data was measured by the Department of Conservation and Land Management, it is accessible to all staff as required.

The monitoring program is as follows :

Water levels are taken from depth gauges. Salinity and pH are also measured and are available.

The contact for this data is :

Dr Jim Lane
CALM Busselton Research
14 Queen Street
BUSSELTON WA 6280

1.2.3 Summary Of Monitoring Sources

The water level data collected from the two sources mentioned, the Water and Rivers Commission and the Department of Conservation and Land Management were comprehensive. Hydrographs, as well as raw data were provided by the Water and Rivers Commission, whereas only the raw data of the water levels were provided by the Department of Conservation and Land Management. All the wetland water level data for these 11 wetlands are available through these sources and the sources consulted are expected to continue for the foreseeable future.

BACKGROUND INFORMATION

Presented in this report is background information on each wetland, a summary of the results of the historical water levels and discussion concerning the changes in water levels, as well as land use changes. For the location of the wetlands on the Swan Coastal Plain see Appendix D.

2.1 WETLAND BACKGROUND

The following information provides details on the eleven wetlands studied, such as location, area, water supply, inundation, salinity, the source of water level information, water depths, vegetation and disturbance of the wetlands. Again, the wetlands are arranged in geographical order, from the most northern to the most southern. It was discovered that there is more information on some wetlands than others. This may be due to easier accessibility of some wetlands or potential concerns about particular wetlands which lead to increased monitoring.

2.1.1 Northern Wetlands

2.1.1.1 Wannamal Lake

- Location: 31°08'S, 116°03'E.
- Shire: Gingin, along Bindoon-Moorra Road.
- Area: 90ha.
- Water supply: Inflow is received from Mogumber Swamp, from four creeks each originating 1km east and from a creek originating 9km east. There is also some groundwater seepage on the west side.
- Inundation: Permanent. It is filled by natural winter rains each year.
- Salinity: It is poikilohaline, meaning the water is of variable salinity, fluctuating from one salinity field to another (Payne, 1993b). It is also hyposaline, due to the extensive clearing of surrounding catchments (Australian Nature Conservation Agency, 1996).
- Water level information: Provided by Jim Lane from CALM Busselton.
- Water depth: Maximum 1.86m in September 1987. September mean 1.44m (Australian Nature Conservation Agency, 1996).

2.1.1.2 Yeal Lake

- Location: 31°24'S, 115°49'E, NW of Lake Bambun. It is north-east of the Yanchep and Pinjar pine plantations (CALM Wanneroo maps). It must not be confused with Yeal Swamp, located at 31°28'S, 115°46'E, which is mostly dry.
- Shire: Gingin.
- Area: 42ha.
- Inundation: Seasonal. It is dry in January, but flowing and flooding in August-September (CALM Wanneroo files).
- Water level information: A depth gauge is installed (Jeff Kite, pers. comm., 1997), but no regular monitoring exists because of the difficulty of access to this site.

2.1.1.3 Lake Bambun

- Location: 31°26'S, 115°53'E. It is the largest of the three wetlands which together make up the Bampanup Nature Reserve. The other two are Lake Nambung and Lake Mungala. It is east of the Yanchep pine plantation (CALM Wanneroo maps).

- Shire: Gingin (WAWA, 1986a).
- Area: 42.5ha.
- Inundation: Seasonal.
- Salinity: Fresh (Halse *et al.*, 1993).
- Water level information: Provided by Jim Lane from CALM Busselton.

2.1.1.4 *Loch McNess*

- Location: 31°32'S, 115°41'E. West of the Pinjar pine plantation, planted in 1979 (CALM Wanneroo maps).
- Shire: City of Wanneroo (WAWA, 1986b).
- Area: 255ha, which includes 150ha of sedgeland (Davis *et al.*, 1993).
- Water supply: Inflow from groundwater, springs on the west and south sides, and some drainage off nearby parkland.
- Inundation: Permanent (Davis *et al.*, 1993).
- Salinity: Fresh and stasohaline, which means that the water is of relatively constant salinity, remaining in a given salinity field (Payne, 1993b).
- Water level information: Monitoring by Water and Rivers Commission since 1973.
- Water depth: A mean depth of 1.94m was recorded in south basin from 1990-1992. Annual fluctuation in the lake is only about 20 cm and it is the only major wetland of the Swan Coastal Plain that is known to naturally exhibit a relatively small annual depth fluctuation (Halse *et al.*, 1993).
- Vegetation and disturbance: It is a slightly disturbed wetland (Halse, 1989) with 80% of the perimeter surrounded with vegetation, mainly sedges (Davis *et al.*, 1993).

2.1.1.5 *Nowergup Lake*

- Location: 31°38'S, 115°44'E. 4km west of the southern end of the Pinjar pine plantation, planted in 1964 (CALM Wanneroo maps). It is on the steepest gradient of the Gnangara Mound groundwater flow system (Balla and Davis, 1993).
- Shire: City of Wanneroo (WAWA, 1986b).
- Area: 58ha with 34ha open water (Balla and Davis, 1993; Davis *et al.*, 1993).
- Water supply: Outflow from Lake Pinjar becomes inflow to Nowergup Lake (Townley *et al.*, 1993). Water levels are artificially maintained by WAWA who pump groundwater into the wetland during summer. This is intended to improve lake water quality (Townley *et al.*, 1993).
- Inundation: Permanent.
- Nutrient status: It is a hypertrophic wetland, meaning it has high nutrient levels (Balla and Davis, 1993).
- Water level information: Monitoring by Water and Rivers Commission since 1973.
- Water depth: A maximum of 17.72m AHD (Australian Height Datum) was recorded in 1974 and a minimum of 16.31m AHD was recorded in 1980. It has not completely dried up since records began (Balla and Davis, 1993).
- Vegetation and disturbance: 90% of the perimeter is undisturbed, being surrounded by woodlands with *Melaleucas*, *Eucalyptus rudis*, *Banksias*, sedges and tuarts (Davis *et al.*, 1993). However, around the rest of the lake are horticultural areas and farmland. There is a piggery to the east with direct runoff from this to the wetland (Balla and Davis, 1993). *Typha* is also present in the wetland (Davis *et al.*, 1993).

2.1.1.6 *Lake Jandabup*

- Location: 31°45'S, 115°50'E. It is one of the Eastern Wanneroo wetlands, which lies in the interface between the Bassendean and Spearwood dune systems (Davis and Rolls,

1987; Arnold, 1990a). It is just west (1km) of the Gngangara pine plantation. The pine seedlings were planted from 1963-1968, but cleared in 1963 (CALM Wanneroo maps; WAWA, 1986a).

- Shire: City of Wanneroo, in the rural zone (WAWA, 1986b).
- Area: 110ha of open water (Davis *et al.*, 1993) surrounded by sedgeland 134ha in area (Davis and Rolls, 1987; Arnold, 1990a; Bowman, Bishaw and Gorham, 1994). It is a typical circular wetland (WAWA, 1986a).
- Water supply: Its water supply is derived from rainfall on the immediate surface and groundwater inflow from the eastern side (Davis and Rolls, 1987; Arnold, 1990a; Bowman, Bishaw and Gorham, 1994). The wetland is primarily maintained by groundwater inflow (WAWA, 1986a; WAWA, 1986b; Davis and Rolls, 1987; Arnold, 1990a). However, about 90% of the groundwater inflow and rainfall is lost by evaporation (Davis and Rolls, 1987).
- Inundation: Seasonal (WAWA, 1986a; Davis *et al.*, 1993). It is a shallow (< 1.5m deep) wetland (WAWA, 1986a; Davis and Rolls, 1987) and therefore a lowering of the water table results in reduction of wetland area and inundation.
- Salinity: Fresh (Halse *et al.*, 1993).
- Water level information: Monitored by Water and Rivers Commission since 1954, although monthly records did not commence until 1971. Lake levels are dropping (WAWA, 1986b).
- Water depth: There are distinguishable former shorelines 3 to 4m above the present shoreline, which indicates the lake has been somewhat higher in the past. It has also been determined that the lake has been at lower levels than at present because of the age of lake deposits. The maximum winter water level was 46.8m AHD in 1968 and the minimum summer water level was 45.5m AHD in 1985 (Arnold, 1990a; Bowman, Bishaw and Gorham, 1994). Maximum levels in recent years have fallen within the ranges of minimum levels prior to 1976 (Arnold, 1990a). For this reason, WAWA has made efforts to reduce pumping from production bores near the lake to minimise drawdown (Arnold, 1990a).
- Vegetation and disturbance: It is a C Class reserve (Davis and Rolls, 1987). It has only a little fringing vegetation of flooded gum, heath and *Melaleuca teretifolia*, but extensive areas of *Baumea articulata* (jointed twig rush) (Davis *et al.*, 1993). It is surrounded by farmland and horticultural areas, with only 25% of the perimeter undisturbed (Davis *et al.*, 1993). There is expanding horticulture on the west and some relatively intense agricultural activity on the lake margin (SE sector), which is long-standing. Agriculture in general has intensified around the lake since 1980. Vegetation buffers have been lost from the lake margins, as a result of agriculture expansion into the sedgelands and grazing of the sedgelands by stock from adjoining holdings (Arnold, 1990a; Bowman, Bishaw and Gorham, 1994). 21% of this lake is privately owned. There was previously a waste disposal site in private land on the western side. There is subdivision of land on the eastern side (Bowman, Bishaw and Gorham, 1994). Also, off-road vehicle tracks can be seen on the dry lake bed towards the end of summer. This promotes the invasion of weed species (Arnold, 1990a).

2.1.1.7 Lake Joondalup

- Location: 31°45'S, 115°47'E. One of a series of lakes within the Spearwood Dune system forming a chain of wetlands parallel to the coast (Davis and Rolls, 1987). It lies west of the Gngangara pine plantation (CALM Wanneroo maps).
- Shire: City of Wanneroo (WAWA, 1986b).
- Area: 590ha, which includes 450ha of open water (Davis *et al.*, 1993), 80ha of sedgeland and 60ha of paperbark woodland.
- Water supply: The lake is a surface expression of the Gngangara Mound unconfined aquifer but also gains substantial surface inflow from wetlands to the south in winter (Davis and Rolls, 1987) and from stormwater drains originating in surrounding urban

areas, with some groundwater seepage on the eastern and western sides (Congdon, 1985).

- Inundation: Permanent (Davis *et al.*, 1993). Large areas of soft sediment become exposed in summer-autumn of drier years. The largest permanent freshwater lake in the Perth Metropolitan Area (Halse *et al.*, 1993).
- Salinity: Fresh, poikilohaline, meaning the water is of variable salinity, fluctuating from one salinity field to another (Payne, 1993b).
- Water level information: Water and Rivers Commission have monitored since 1954, although monthly records did not commence until 1971.
- Water depth: Maximum was 3.28m in September 1991; September mean 3.04m. It is a typical linear lake and therefore is deep and steep-sided. The water contours rise steeply to the east of this wetland and therefore the lake levels are less susceptible to reductions in groundwater levels to the east. This lake has been only minimally affected by the recent dry years (WAWA, 1986a). Groundwater extraction by the Water Authority of Western Australia is a potential threat to the wetland. Consequently, minimum water levels have been set (Halse *et al.*, 1993).
- Vegetation and disturbance: A class reserve (Davis and Rolls, 1987). It is surrounded by woodlands, urban areas and horticulture, with about 50% of the perimeter undisturbed. The fringing vegetation includes Melaleucas and sedges (Davis *et al.*, 1993). It is slightly disturbed. Over the last 30 years, the clearing of native vegetation and urbanisation around the lake has increased surface runoff and decreased groundwater losses by evapotranspiration, which has led to a rise in water levels (WAWA, 1986a).

2.1.2 Southern Wetlands

2.1.2.1 Balannup Lake

- Location: 32°07'S, 115°57'E. It is found on Bassendean dunes over quartz sands or clay overlying quartz sands.
- Shire: City of Armadale and extends into the City of Gosnells.
- Area: 46.5ha with 8ha of open water (Davis *et al.*, 1993).
- Water supply: It is filled by rainfall. It is ponded by clay lenses in the sub-surface (Payne, 1993).
- Inundation: It is a seasonally inundated basin wetland (Davis *et al.*, 1993; Payne, 1993b).
- Water level information: Monitoring by Water and Rivers Commission. Data from 1973 onwards.
- Vegetation and disturbance: 85% of the perimeter still vegetated. It is privately owned. It is surrounded by woodlands and semi-rural land. There are extensive areas of closed canopy Melaleucas and flooded gums (Davis *et al.*, 1993). There are ongoing problems with rubbish dumping. Also, severe and repeated fires in the summer of 1991 promoted growth of fire-prone introduced grasses (Payne, 1993).

2.1.2.2 Thomsons Lake

- Location: 32°09'S, 115°50'E. It is within the greater Perth Metropolitan Area.
- Shire: City of Cockburn.
- Area: 252ha. It comprises approximately 151ha of open water and 101ha of sedges (Davis *et al.*, 1993). It is the largest of the lakes within the Cockburn wetlands chain. It is almost circular (Davis and Rolls, 1987).
- Water supply: Similar to all wetlands in this chain, it is an expression of the Jandakot flow system (Davis and Rolls, 1987). It is filled mainly by groundwater, flowing west from the top of the Jandakot mound. There is also inflow via a drain from Kogolup

Lake and a drain from extensively cleared (partly agricultural) areas 1 - 2km east south-east.

- Inundation: Seasonal (Davis *et al.*, 1993), although it did not dry out in five of fourteen years, from 1962 to 1986. It is a shallow wetland (Davis and Rolls, 1987; Davis *et al.*, 1993).
- Salinity: It is subhaline, which means it has a salinity between 1000 and 3000 mg/L (Payne, 1993b) and it is poikilohaline, meaning the water is of variable salinity, fluctuating from one salinity field to another (Payne, 1993b).
- Water level information: The Water and Rivers Commission has provided records from 1952 onwards, although monthly records did not commence until 1971.
- Water depth: Maximum 1.53m in November 1988, 3.6m in October 1968. September mean 1.04m. Seasonal wetlands are important links in the wetland chain (WAWA, 1986b). There has been a continuing increase in urban and rural development around the wetland in recent years (Balla and Davis, 1993).
- Vegetation and disturbance: It lies in an A Class reserve, managed by the Department of Conservation and Land Management (Davis and Rolls, 1987; Davis *et al.*, 1993), and is part of Thomsons Lake Nature Reserve (A15556, created in 1955) (WAWA, 1991). It is surrounded by woodlands and horticultural areas. Greater than 95% of the perimeter is still vegetated. There are some fringing trees but extensive areas of *Baumea* and *Typha* have increased in recent years (Davis *et al.*, 1993). Thomsons Lake has experienced long periods of disturbance from rural uses nearby (WAWA, 1991).

2.1.2.3 Gibbs Road Swamp

- Location: 32°09'S, 115°55'E. It is within the greater Perth Metropolitan Area. It is near the top of Jandakot groundwater mound (Davis *et al.*, 1993). It is found on Bassendean dunes over peat or peaty sand or humic sand overlying quartz sand (Payne, 1993).
- Shire: City of Armadale and Cockburn (Payne, 1993a; Payne, 1993b).
- Area: 20ha.
- Water supply: Primarily groundwater. Gibbs Road Swamp has limited outflow via small inefficient drains (Davis *et al.*, 1993). Water accumulates from local runoff and rainfall. Its position on the Mound contributes significantly to its recharge (CALM Wanneroo files).
- Inundation: It is a sumpland, ie. a seasonally inundated basin wetland (Payne, 1993a; Payne, 1993b). Usually dries for a few months in summer-autumn.
- Salinity: Fresh and poikilohaline, meaning the water is of variable salinity, fluctuating from one salinity field to another (Payne, 1993b).
- Water level information: Water and Rivers Commission installed a depth gauge in 1991 and monitoring has continued from then on. A shallow groundwater monitoring well was also installed (Payne, 1993).
- Water depth: Mean September depth exceeds 1m.
- Vegetation and disturbance: It is surrounded by woodlands, semi-rural and horticultural areas with 90% of the perimeter still vegetated. An extensive fringing *Melaleuca* woodland is present (Davis *et al.*, 1993). It is a fairly small closed canopy paperbark swamp and is the only known nesting site of the freckled duck, an endangered species (Payne, 1993). Altered hydrological regimes exist due to groundwater abstraction.

2.1.2.4 Forrestdale Lake

- Location: 32°10'S, 115°56'E. It is within the greater Perth Metropolitan Area. It is on Bassendean dunes over quartz sands or clay overlying quartz sand (Payne, 1993). Gibbs Rd Swamp is 1km west and Thomsons Lake is 9km west.
- Shire: City of Armadale.

- Area: 199.6ha to the maximum high water mark.
- Water supply: Groundwater from Jandakot mound and from the Armadale system flowing west. It is a surface expression of the groundwater system. Rainfall is ponded by clay lenses in the sub-surface (Payne, 1993). There is inflow via 3 minor artificial drains: 2 from farmlands in the west and 1 from the Forrestdale townsite. It has also been found that it is a basin into which stormwater drains flow. Outflow is from a drain on the east side.
- Inundation: Seasonal wetland (Davis *et al.*, 1993). It dries for 1-3 months during summer to autumn because it is shallow. During times when the lake dried up, the groundwater level was determined by excavating a hole in the base of the lake. These levels are also included in the hydrograph.
- Salinity: Brackish.
- Water level information: Provided by Water and Rivers Commission since 1952, although monthly records did not commence until 1971.
- Water depth: Maximum level of 24.164m AHD September 1963. Minimum level of 21.220m AHD February 1984.
- Vegetation and disturbance: Forrestdale Lake is an 'A' Class reserve, managed by the Department of Conservation and Land Management (Davis *et al.*, 1993), and also part of Forrestdale Lake Nature Reserve (A24781, created in 1957) (WAWA, 1991). It is surrounded by sedgeland. Greater than 95% of the perimeter is still vegetated. The wetland is surrounded by woodlands, farmland and urban areas. There are quite extensive areas of *Melaleuca*, *Banksia* and *Acacia*. However, there are also increasing amounts of *Typha* in the sedgelands (Davis *et al.*, 1993).

RESULTS

3.1 RESULTS

Monthly rainfall data from the Perth Airport and Lancelin stations were obtained from Gary McCall (Bureau of Meteorology, pers. comm., 1997). Graphs of the annual rainfall data have been constructed and are shown in *Figures 3.1 and 3.2*. The raw data can be found in Appendix A. The Perth airport station opened in 1944 and is still open. The rainfall records provided span 49 years, from 1948. They show that Perth has an average annual rainfall of 800.9mm, with over 90% of it falling between April and October. Lancelin station, which opened in 1965, shows similar results in the sense that over 90% of the rain falls between April and October. However, there is an average annual total of only 633.8mm at Lancelin.

The Water and Rivers Commission provided monthly data records and hydrographs of this data for eight of the eleven wetlands, as mentioned previously. The hydrographs for this data are shown in *Figures 3.5 to 3.12*. The raw data for these hydrographs can be found in Appendix C. Yeal Lake has no water level data available. The Department of Conservation and Land Management provided the water level records for Wannamal Lake and Lake Bambun. Hydrographs have been constructed for these two wetlands. The hydrographs are shown in *Figures 3.3 and 3.4*. The raw data has been attached to this report in Appendix B.

3.2 SUMMARY TRENDS OF EACH HYDROGRAPH

The water level changes of each wetland can be summarised by the pattern of the levels over time. The hydrographs for each wetland excluding Yeal Lake, in geographical order are found in *Figures 3.3 to 3.12*.

3.2.1 Wannamal Lake

Wannamal Lake seems fairly consistent in the changing of its water level over the years. The available water level data at the time of this project was from 1978 to 1997 through the Department of Conservation and Land Management. From 1978 to 1984 there were large changes of approximately 1m within each year, but the annual minimum also seemed to be increasing slightly. Records since 1987 are only every September and November. The variation between September and November water levels is within 1m. The minimum depth recorded was 0.2m in May 1980. The maximum depth so far was 1.86m in September 1987.

3.2.2 Yeal Lake

Yeal Lake has no water level data available.

3.2.3 Lake Bambun

Lake Bambun has water level data available every two months from 1979 until 1985 when it changed to September and November measurements only. The records have continued until 1997. This data is available from the Department of Conservation and Land Management. Lake Bambun also seems fairly consistent with a change of approximately 1.5m over each year. The variation between September and November water levels after 1985 is also only within 1m. The minimum depth recorded was 1.06m in May 1983 and the maximum was 2.65m in September 1986.

3.2.4 Loch McNess

Loch McNess has had very small changes, within 0.5m over 20 years from the earliest data in 1973 until 1992. Water level data for this wetland was available from 1973 to 1997 through the Water and Rivers Commission. It is very consistent but also seasonal.

3.2.5 Lake Nowergup

Lake Nowergup has had large changes, with levels mostly between 16 and 18m AHD. There was a gradual decrease from 1972-1992 with water level minimums decreasing from 17-16.25m. However since then, the levels have settled to 16.5-17m AHD. Water level data for this wetland was available from 1973 to 1997 through the Water and Rivers Commission.

3.2.6 Lake Jandabup

Lake Jandabup has had levels ranging from 43.5-47m AHD, during the period in which data is available. The changes over time have been large, and the levels dramatically dropped between 1969 and 1979. The current trend is difficult to determine, but the levels appear to have settled out somewhat since 1980. Water level data for this wetland was available from 1954 to 1997 through the Water and Rivers Commission.

3.2.7 Lake Joondalup

Lake Joondalup has had reasonable changes over the years. Its range has been between 15.7 and 18.3m AHD. The water level changes in this wetland seem very similar to that of Lake Jandabup, however the scale of each change is smaller. There seems to be a slight increase in the water levels during the period from 1991 to 1994, but then it appears they have subsequently declined. The current trend is difficult to determine, but appears to be relatively constant from one year to the next. Water level data for this wetland was available from 1954 to 1997 through the Water and Rivers Commission.

3.2.8 Balannup Lake

Balannup Lake has large annual changes of about 2.5m, but the pattern over 20 years is very consistent. It ranges from 20-23m AHD. Water level data for this wetland was available from 1973 to 1997 through the Water and Rivers Commission.

3.2.9 Thomsons Lake

Thomsons Lake has huge changes, ranging from 10.5 to 15.5m AHD. During the years between 1968 and 1978 there was a huge drop from 15.5m AHD to 10.5m AHD. This was followed by a rise over the years from 1979 to 1989. Between 1989 and 1992, there was a slight decrease. Following this, there was a rise in the years 1992 to 1994. Since 1994, the water levels have again decreased. Water level data for this wetland was available from 1952 to 1997 through the Water and Rivers Commission.

3.2.10 Gibbs Road Swamp

Gibbs Road Swamp has had a consistent but seasonal pattern over 6 years. There are small annual changes of approximately 0.5m. The lake is dry for 7 months of the year. It is approximately 24m AHD from January to June, and 24.5m AHD from July to December. Water level data for this wetland was available from 1991 to 1997 through the Water and Rivers Commission.

3.2.11 Forrestdale Lake

Forrestdale Lake has been quite variable over the years. Levels have ranged from 21.2-24m AHD. The water level changes in this wetland seem very similar to that of Thomsons Lake, however the scale of each change is smaller. There was a drop from 24m AHD to 21.5m AHD from 1963 to 1973. The levels increased from 1973-1974, then dropped 2m, from 23.5 to 21.5m AHD, between 1974 and 1977. The water levels were variable between 1977 and 1992, but there seemed to be a gradual increase to 1992. There was a drop of almost 2m from 1992 to 1994, but since 1994 the water levels have remained reasonably steady and consistent. Water level data for this wetland was available from 1952 to 1997 through the Water and Rivers Commission.

In comparison, the Gngangara Mound Monitor, used as a reflection of groundwater behaviour, increased from 1977 to 1987, with a dramatic increase from April 1986 to October 1987, peaking at 49.4m. From 1987-1997, the levels have decreased progressively to 47.6m AHD. The current levels are similar to those of the early to mid 1980s, before the increase in levels began.

Not one of these 11 wetlands is undisturbed. All have undergone human influences or urban pressures. Disturbances include such things as :

- the removal of fringing vegetation;
- pesticide applications;
- encroaching land uses - urban development, market gardens and rubbish tips; and
- the use of wetlands as drainage basins.

3.3 SIMILARITIES BETWEEN HYDROGRAPHS

Lake Jandabup and Lake Joondalup show similar patterns, as do Thomsons Lake and Forrestdale Lake. Each of these pairs of lakes have a similar latitude and are reasonably close to each other. Lake Jandabup is 4km east of Lake Joondalup, and Forrestdale Lake is 8km east of Thomsons Lake. Lake Joondalup is permanent, whereas the other three are seasonally dry.

Most of the other wetlands do not show much correlation with each other. They are each unique in their combination of inundation, water level trends in general, and seasonal fluctuations.

3.4 CORRELATION BETWEEN THE HYDROGRAPHS AND THE RAINFALL DATA

3.4.1 Wannamal Lake

Wannamal Lake water levels were compared to the rainfall data from Lancelin rather than Perth because they are closer in proximity to Lancelin than Perth. In examining these graphs, there were noticeably lower water levels in Wannamal Lake in 1985. This corresponds to a much lower than average rainfall in that year of 479.8mm. In contrast, 1986 showed above average rainfall of 753.8mm and for that year Wannamal Lake and Lake Bambun had higher water levels.

3.4.2 Yeal Lake

There was no water level data to interpret for Yeal Lake.

3.4.3 Lake Bambun

The water levels of Lake Bambun, like Wannamal Lake, were compared to the rainfall data from Lancelin because they are closer in proximity to Lancelin than Perth. These graphs showed noticeably lower water levels in Lake Bambun in 1985. This corresponds to a much

lower than average rainfall in 1985 of 479.8mm. In contrast, 1986 showed above average rainfall of 753.8mm and for that year Lake Bambun also showed higher water levels.

3.4.4 Loch McNess

Loch McNess seemed mostly unchanged by the drier years, with the water level changes very similar between years.

3.4.5 Nowergup Lake

Nowergup Lake changed throughout the years, showing a slight correlation with rainfall, however the changes were quite small. Since 1973, there appears to have been a progressive downward trend in the annual water level minimum. In March 1973, the minimum water level was 16.87m AHD, whereas the last recorded level in March 1997 was 16.15m AHD. (In 1975 the water levels were high, peaking at over 17.5m AHD. The rainfall levels had been high the previous year. The levels then decreased over the following years. In 1980 there was a very low minimum, which occurred the year after low rainfall. The water levels have gradually increased since then, peaking in 1995.

3.4.6 Lake Jandabup

When the water levels at Lake Jandabup dramatically dropped between 1969 and 1979, there was a corresponding drier period in the rainfall. The water levels then began to increase with obvious peaks in 1986 and 1987 after the higher rainfall in 1986, and similarly in 1991 and 1992 after the rainfall in those years was higher than the preceding two years.

3.4.7 Lake Joondalup

Lake Joondalup, similar to Lake Jandabup, had decreasing water levels from 1969 to 1973 with lower than average rainfall over most of those years. The levels increased in 1975 and 1976 after the above average rainfall in 1973 and 1974. They decreased again over a period with correspondingly lower rainfall until reaching a low minimum in 1980. After this levels increased slowly with a peak in 1993 after an above average rainfall in 1992.

3.4.8 Balannup Lake

The relationship between water levels in Balannup Lake and the annual rainfall is difficult to determine because the water level data was graphed with one outlier which changed the scale of the graph dramatically. Although there are changes of about 2m, there seems to be no particular differences for drier as compared to wetter years.

3.4.9 Thomsons Lake

With Thomsons Lake it seems that rainfall is not the dominant factor affecting the water levels because the levels often show a decrease after high rainfall years, for example in 1992 and an increase after low rainfall years, for example in 1994.

Thomsons Lake has had large changes in its water levels, ranging from 10.8m to 15.5 m AHD during the period 1952-1997. This large range was the result of a huge drop from a peak of 15.5m AHD to a minimum of 10.8m AHD, between the years 1968 and 1978. This was followed by a gradual rise over the years from 1979 to 1993. In the last four years the levels have undergone another period of decline.

3.4.10 Gibbs Road Swamp

Gibbs Road Swamp is quite seasonal however there does appear to be quite high water levels in 1991 and 1992 when the rainfall was higher in those years than previous years.

3.4.11 Forrestdale Lake

Forrestdale Lake water levels had a peak in 1974 as rainfall levels were also high in that year. Subsequently, both the water levels and the rainfall, decreased. In 1988, there was another peak of high rainfall similar to that of 1974. The water levels of Forrestdale Lake also had a peak at this time. Then they dropped and rose again in 1992, another high rainfall year. This was followed by a drop to 1994, before flattening out to steady water levels.

3.4.12 Gngangara Mound Monitor

The Gngangara Mound Monitor provides a reflection of the rainfall in that area. For example, there was a gradual decline in water levels from 1966-1973, at the same time that there was low rainfall. Similarly, there was a small and gradual rise from 1980-1986, when there was near average rainfall (WAWA, 1986a).

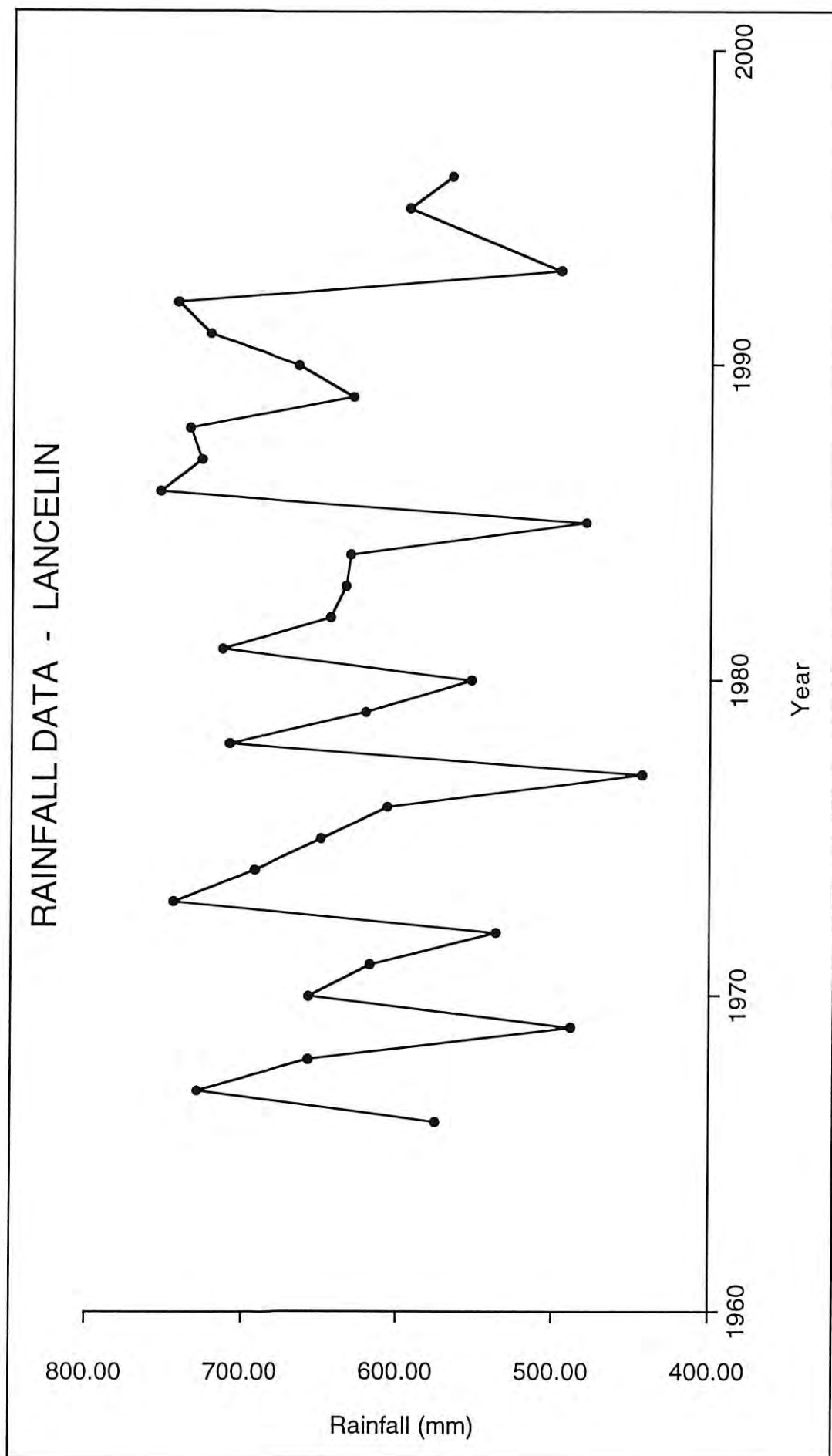


Figure 3.1 Rainfall Lancelin

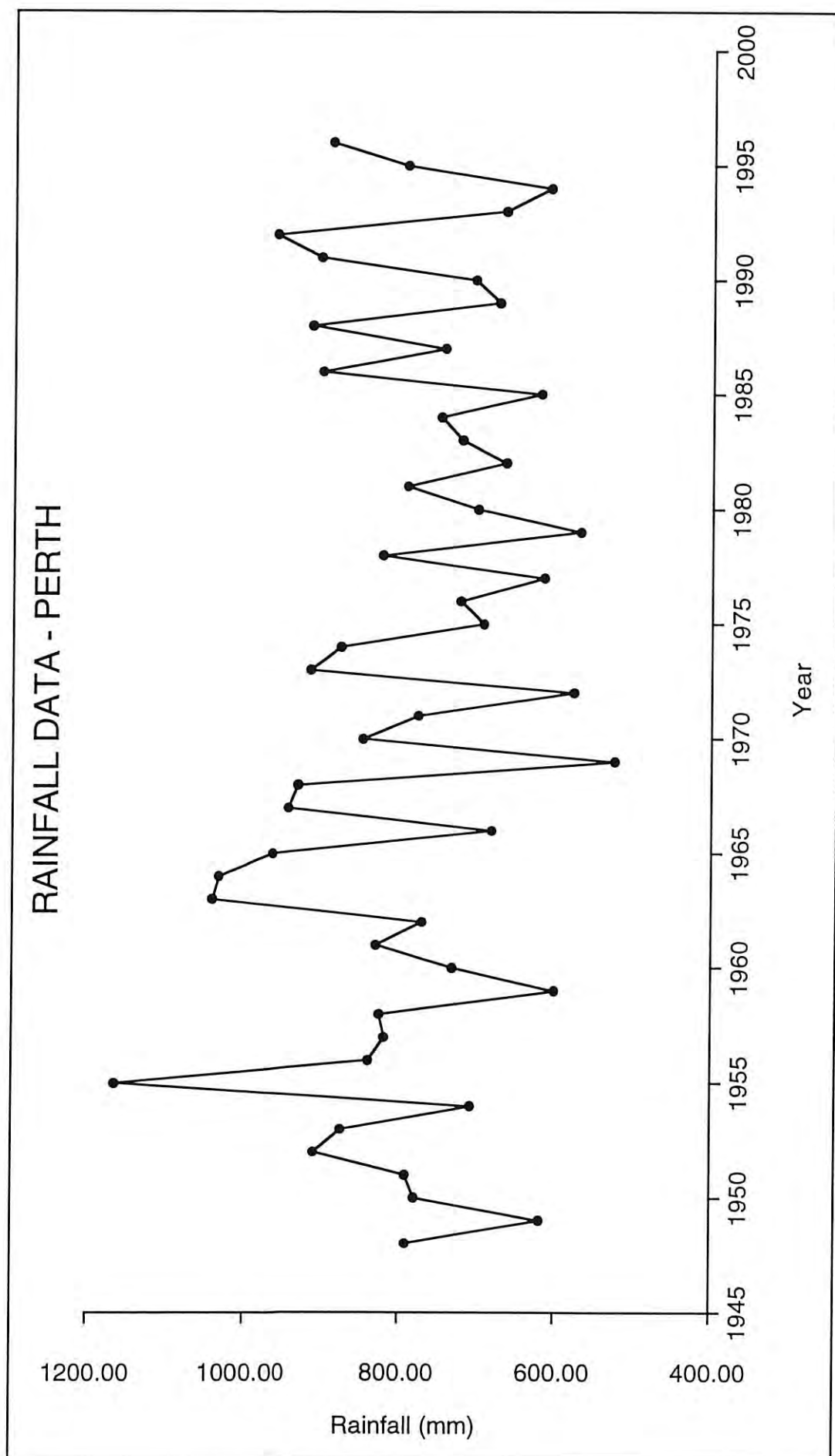


Figure 3.2 Rainfall Perth

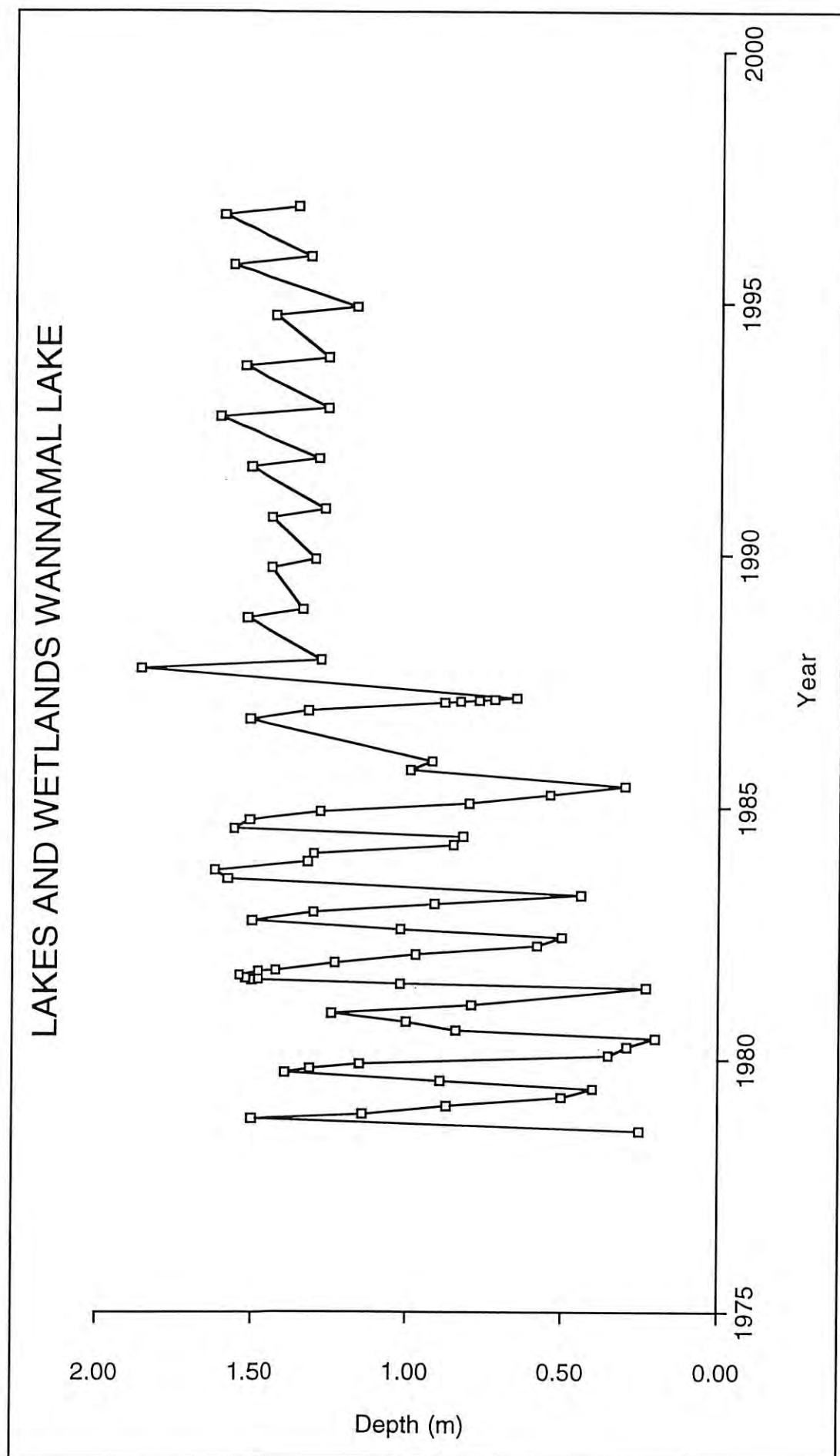


Figure 3.3 Hydrograph for Wannamal Lake

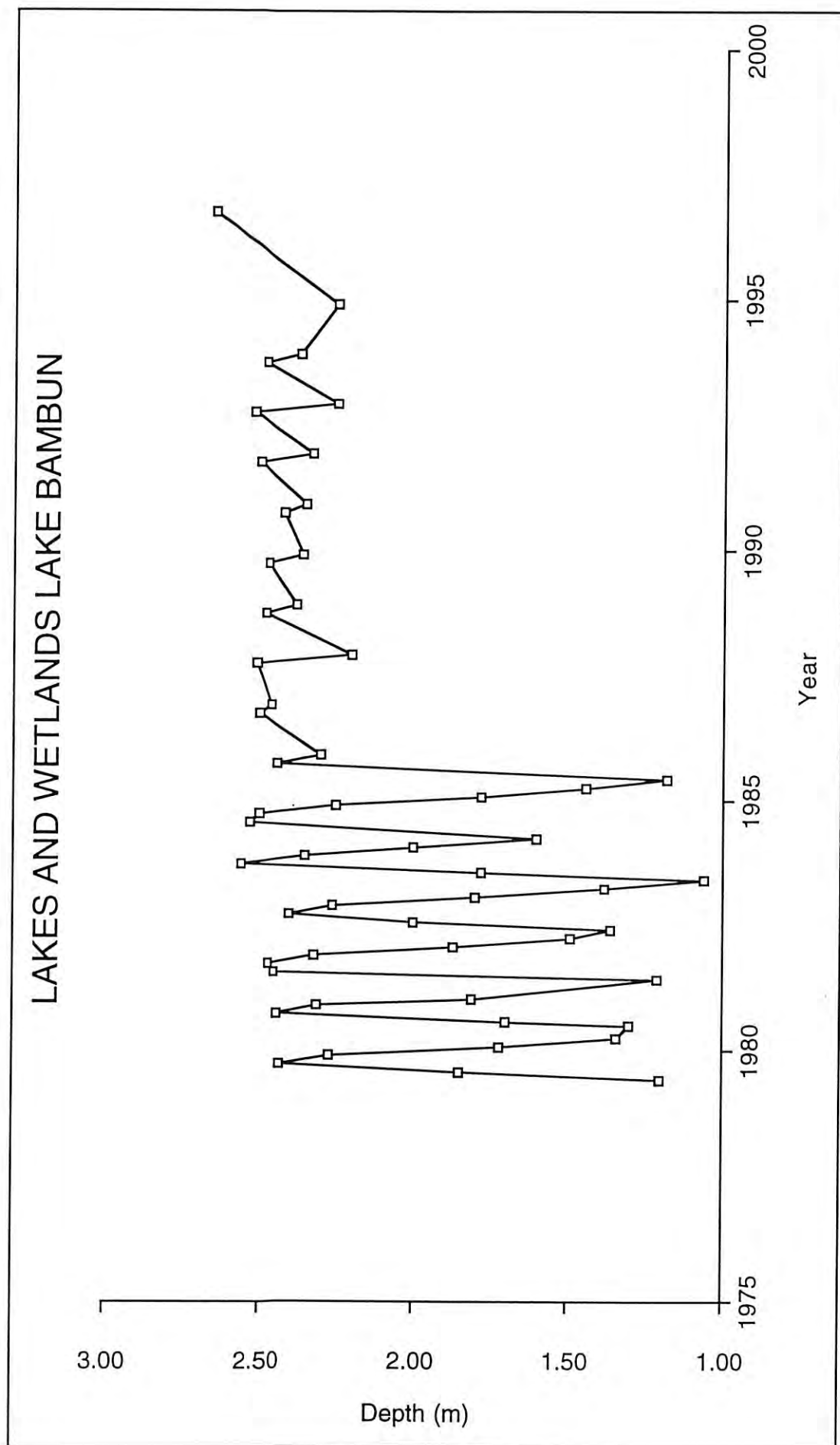


Figure 3.4 Hydrograph for Lake Bambun

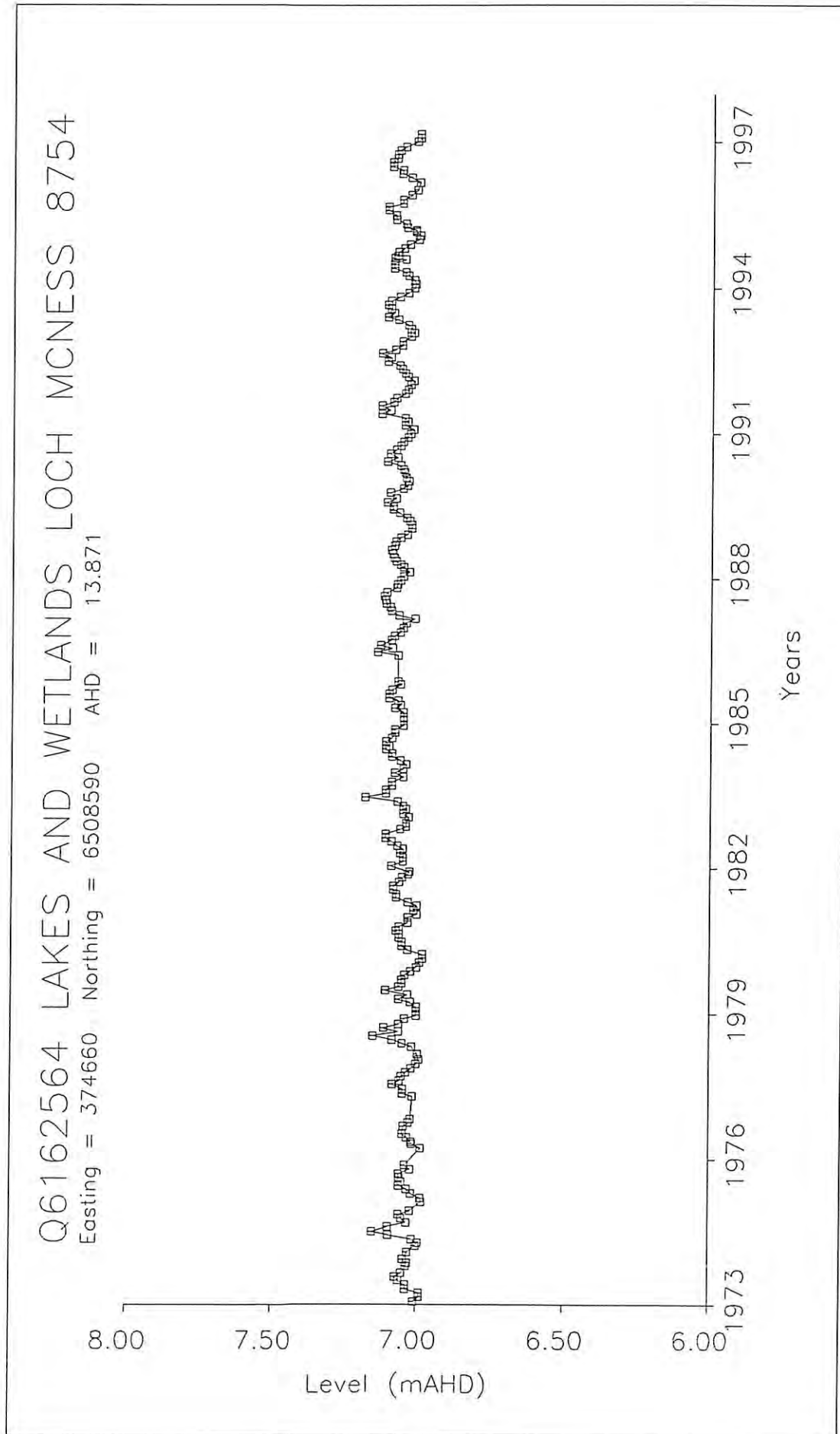


Figure 3.5 Hydrograph for Loch McNess

Q6162567 LAKES AND WETLANDS LAKE NOWERGUP 8756

Easting = 379600 Northing = 6499640 AHD = 20.145

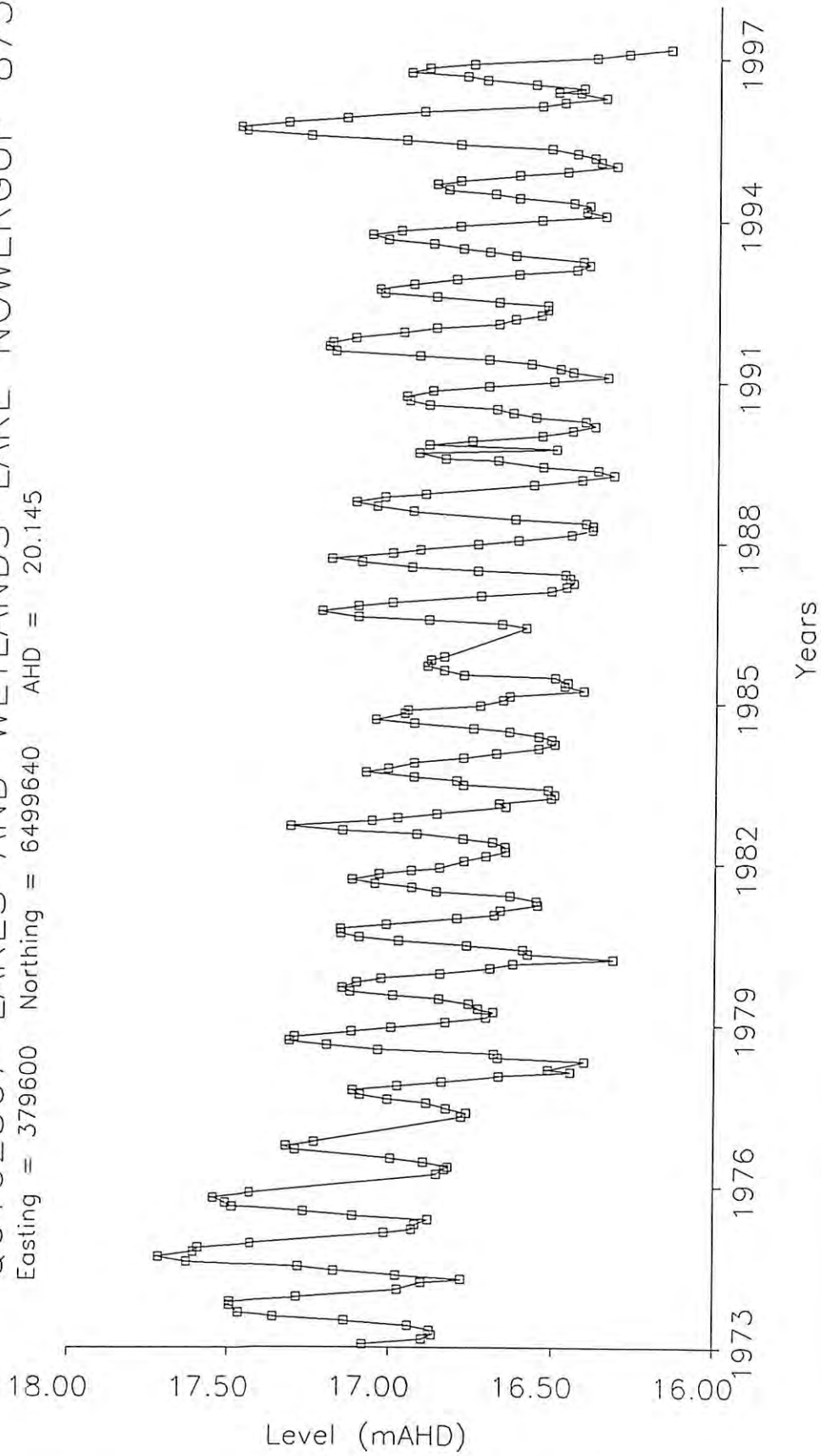


Figure 3.6 Hydrograph for Nowergup Lake

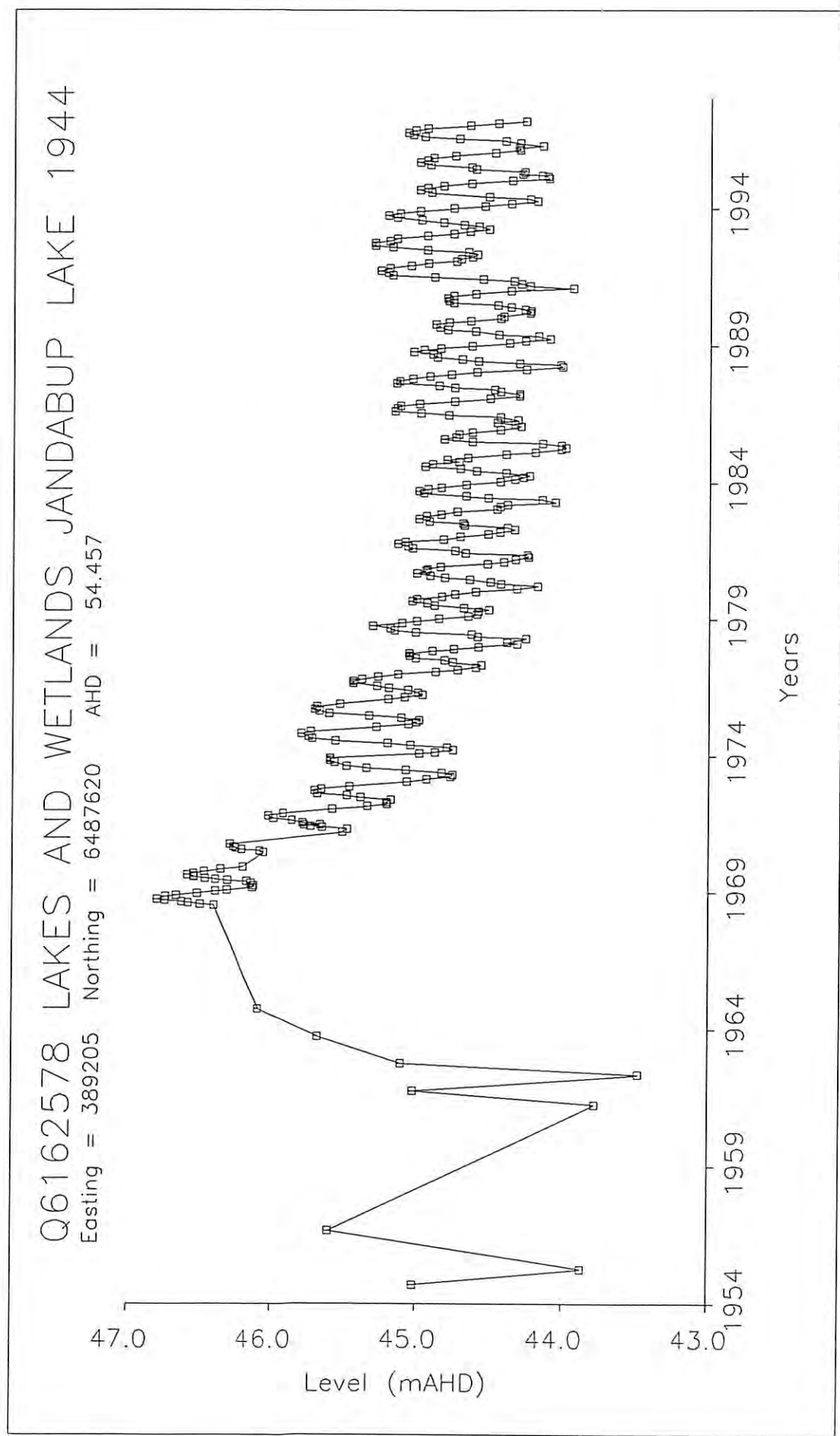


Figure 3.7 Hydrograph for Lake Jandabup

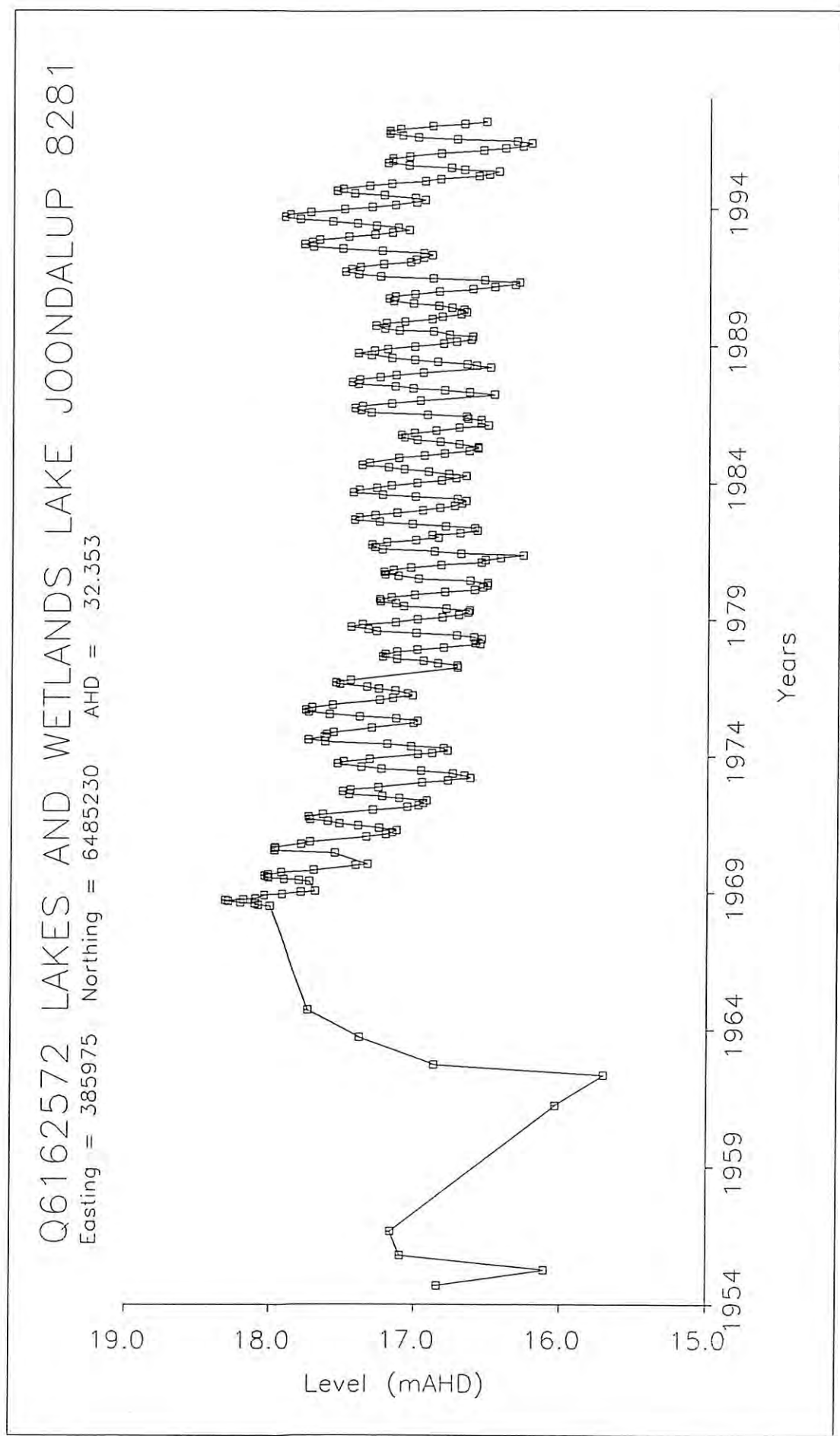


Figure 3.8 Hydrograph for Lake Joondalup

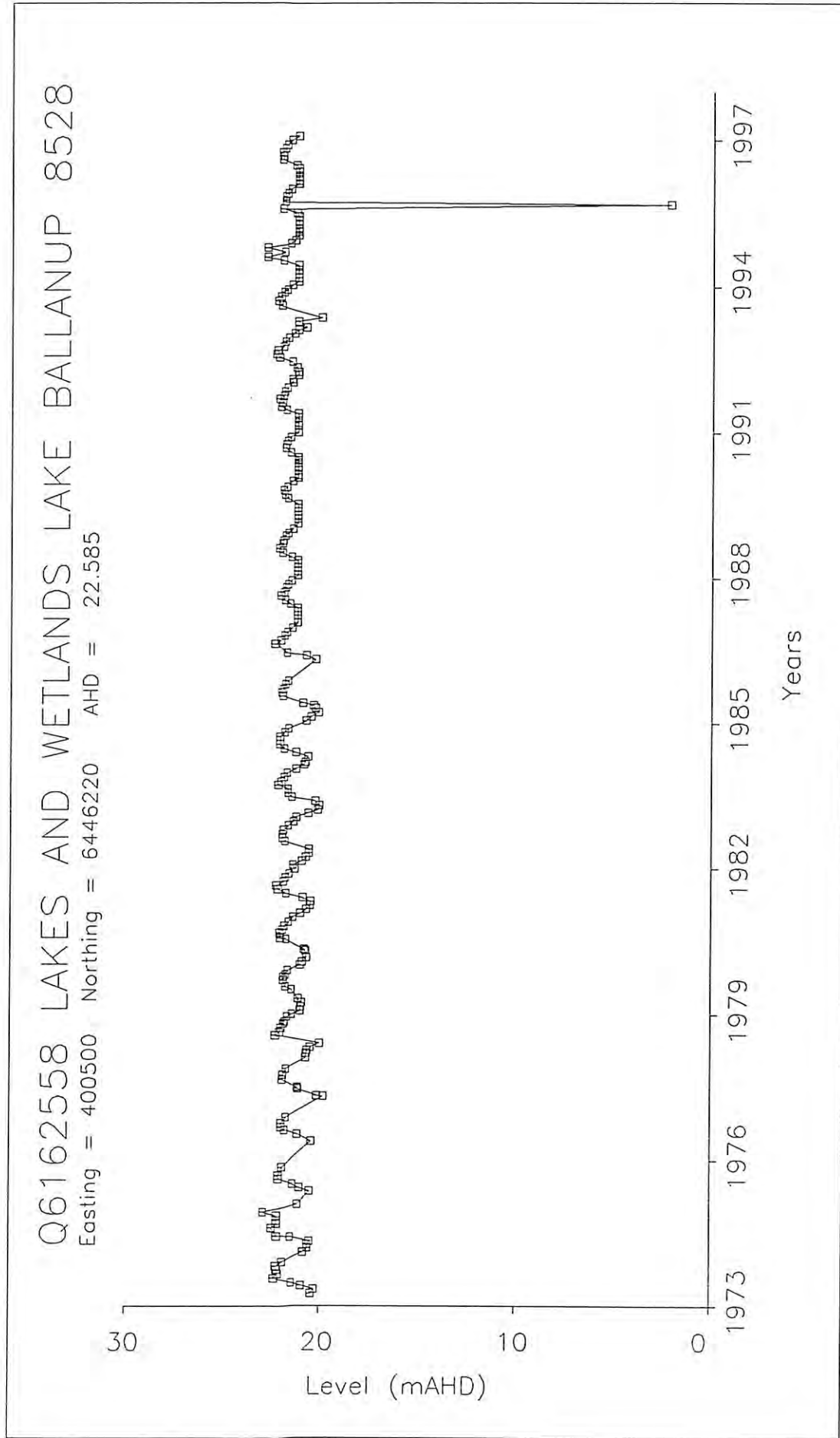


Figure 3.9 Hydrograph for Balannup Lake

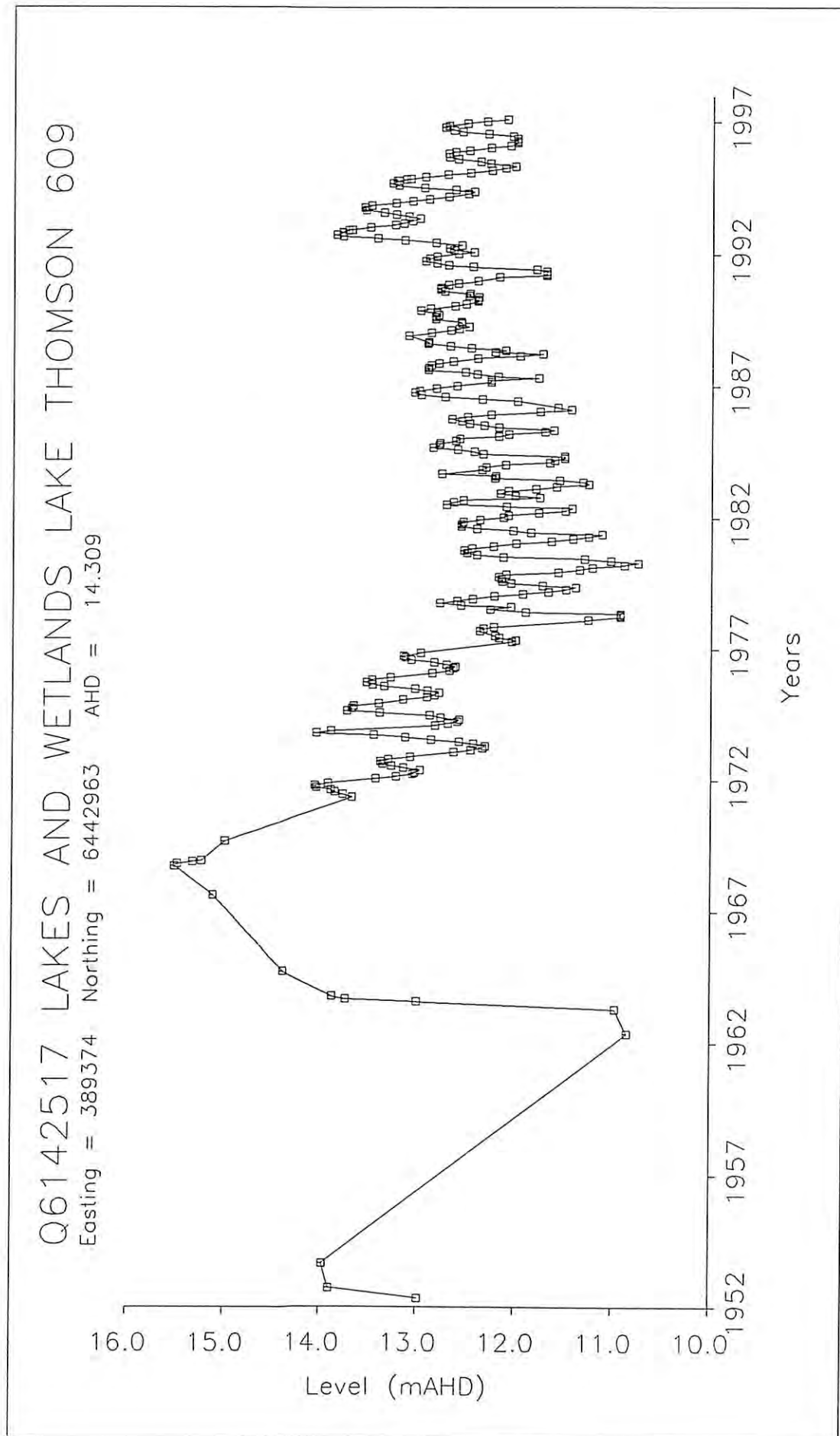


Figure 3.10 Hydrograph for Thomson's Lake

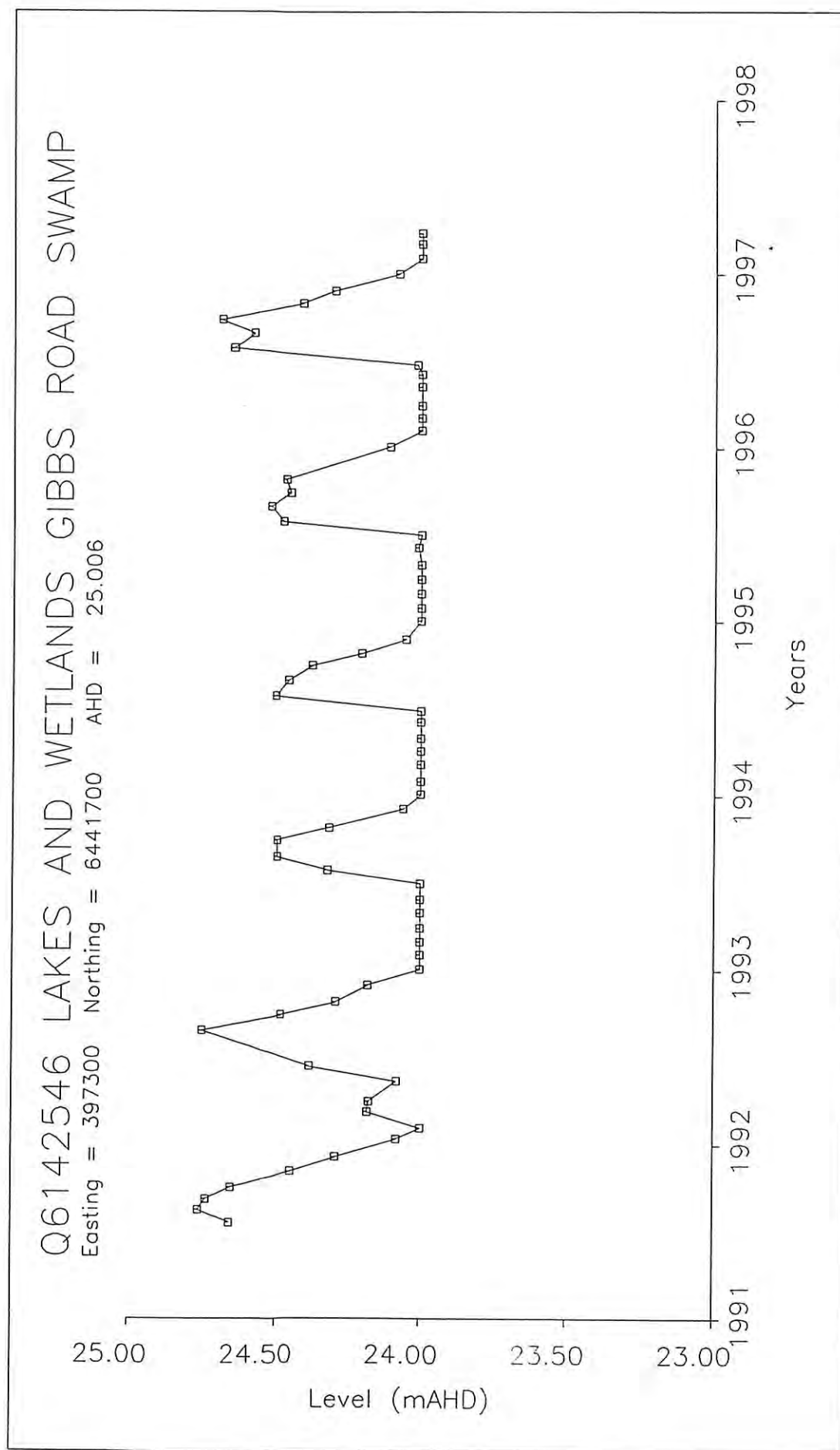


Figure 3.11 Hydrograph for Gibbs Road Swamp

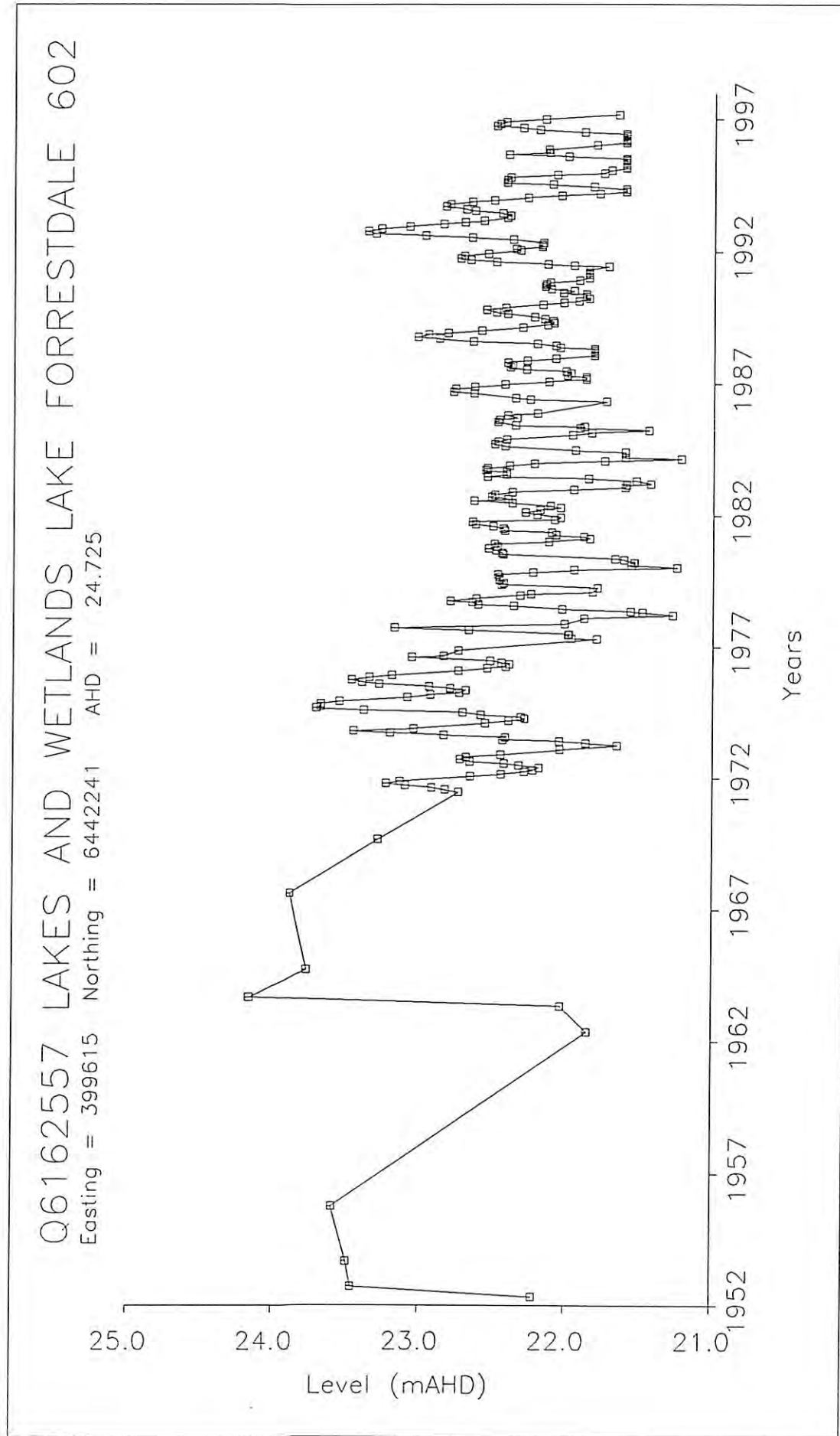


Figure 3.12 Hydrograph for Forrestdale Lake

DISCUSSION

4.1 BACKGROUND

Wetlands are surface expressions of the water table (WAWA, 1986a), with groundwater inflow being the dominant component of water inputs (Bowman, Bishaw and Gorham, 1994). Therefore, to manage wetland water levels, the management of the groundwater resources must first be addressed. The groundwater resources of the Gngangara and Jandakot Mounds are maintained primarily by rainfall. However, the amount of rainfall which becomes groundwater recharge is dependent upon several factors. Some of these factors are natural and include :

- the amount, intensity and duration of rainfall;
- interception and evapotranspiration by vegetation;
- soil characteristics; and
- the depth to the water table.

These factors cannot be directly changed, however increased groundwater abstraction can lead to a lowering of the water table and consequently, depth to the water table. This, in turn results in a reduction in the area of wetlands (Bowman, Bishaw and Gorham, 1994).

Many wetlands, having once existed on the Swan Coastal Plain, have been filled, drained or cleared of vegetation, and as urban and rural areas continue to spread, more wetlands are pressured by nutrient enrichment, groundwater extraction or vegetation clearing (WAWA, 1986a; Townley *et al.*, 1993). It has therefore become apparent that, as well as natural factors which affect the amount of rainfall becoming groundwater recharge, there are also a range of human activities which contribute to this. Several of these factors result in an increase in the water available to wetlands, whereas there are other factors which decrease the amount of available wetland water.

4.2 INCREASED RECHARGE TO WETLANDS

Those factors which result in increased recharge include:

- clearing of vegetation;
- irrigation;
- urbanisation and runoff; and
- silvicultural management (Bowman, Bishaw and Gorham, 1994).

NOTE: *Information regarding irrigation, and urbanisation and runoff was derived additionally from Balla and Davis (1993).*

Clearing of vegetation results in increased recharge because there is lower transpiration, as well as decreased interception of the rainfall by vegetation. Irrigation results in the addition of imported waters. Urbanisation, leading to increased runoff can flow from roads, paths and roofs (Balla and Davis, 1993).

Increased recharge to a wetland can be achieved by silvicultural management if thinning of an adjacent pine plantation is undertaken. Thinning of pine plantations is carried out as softwood trees mature to maximise growth of these high value products, thus maintaining their timber quality. This decreases interception and direct transpiration of stored soil moisture. Recharge can also be further improved by removal of dead thinned material, known as slash, from the ground surface. Fire management in the plantations can be used to safely eliminate this slash. Therefore, thinning results in improved sawlog quality, benefitting timber production, and groundwater utilisation. Proposed public water supply developments should be suggested in pine forests because this will reduce the effects of drawdown on conservation areas and potential conflict with private users (WAWA, 1986a).

Groundwater abstraction by the Water Authority of Western Australia, for public water supply and private use, leads to a decrease in the amount of water available to wetlands (Bowman, Bishaw and Gorham, 1994).

4.3 IMPACTS OF GROUNDWATER ABSTRACTION

Groundwater abstraction can result in tree mortality and a shift of vegetation from tree and shrub species in moister soil to those tolerant of drier conditions. For example, it is possible that *Banksia ilicifolia* might replace *Banksia littoralis* (WAWA, 1986b).

The vegetation on the Northern Swan Coastal Plain is determined mainly by:

- soil conditions;
- climatic conditions;
- depth to groundwater; and
- human influences.

Rises in water levels, as well as declines, may occur naturally. The deep-rooting species are more likely to be dependent on the water table and the adjacent moist soil layer. On the other hand, shallow-rooted species are less affected by groundwater changes. Pumping of shallow aquifers when plant stress is high and groundwater levels are naturally low, "may alter water availability and effect transpiration rates, thereby inducing mortality in trees close to the wells" (WAWA, 1986b). In general, most species can tolerate some water level decline on a regional basis, but the rate of withdrawal of water is critical. Limited time to adjust to the lowered soil moisture levels may lead to increased deaths and more shifts of distribution.

The impacts of groundwater abstraction are greatest in low lying wetlands over shallow water tables. Drier sites are less likely to be influenced by pumping due to the substantial depths to the water table. Wetlands vulnerable to a lowering of the water table should be protected from any impact of groundwater abstraction. For example, the Gnangara Mound is one of the major sources of groundwater supplying the Metropolitan area. Alternative pumping areas should be sought if there is a chance of detrimental effects on the nature reserves within the Gnangara Mound (WAWA, 1986b).

Abstraction doesn't affect all wetlands equally because it produces localised rather than widespread effects. Artificial maintenance wells already exist adjacent to Lake Jandabup (commissioned in 1988) and Nowergup Lake (commissioned in 1990). This is used to prevent water levels from dropping below their statutory minimums. In Lake Jandabup artificial maintenance prevents the wetland drying by maintaining a shallow pool of water during autumn. However this is of little value to the aquatic fauna because of large temperature fluctuations and no vegetation (Balla and Davis, 1993).

4.4 WETLAND MANAGEMENT

Clearly, wetland management must be developed, such as by groundwater management strategies which will mitigate impacts on sensitive wetlands (WAWA, 1986a; Townley *et al.*, 1993). In this way, manipulation of recharge, as well as abstraction, facilitates better overall management of the water resource. This resource is manipulated particularly by managing :

- public abstraction;
- private abstraction; and
- forest density (WAWA, 1986a).

Effective water management relies on integration with land management (WAWA, 1986a). Swamp vegetation is adapted to wide fluctuations. Drawdowns of about 0.5m are not

expected to affect it greatly. *Typha* is able to invade wetlands if they have less than 1m in winter and are dry in summer (WAWA, 1986a).

Three of the wetlands studied are conservation reserves. This means they are management priority areas and are of high biological value. They are Thomsons Lake and Lake Jandabup which are seasonally dry, and Nowergup Lake which is permanent. Lake Jandabup is near the Pinjar groundwater scheme: Stage 1 Phase 1. Lake Jandabup and Nowergup Lake receive groundwater inputs from specially constructed bores to maintain water levels (Balla and Davis, 1993).

The seasonal hydrological cycle of wetlands must be maintained to preserve and rehabilitate these precious habitats (Davis *et al.*, 1993).

4.5 MANAGEMENT OF WATER LEVELS

"Water levels in wetlands are particularly significant since they have a strong influence on the vegetation and thus on the value of the habitat to wildlife as well as the value of the species-composition to man. They also determine which waterbirds can feed" (WAWA, 1991).

Water level fluctuations are natural in our Mediterranean climate, and are even necessary for the health of some ecological systems, because it can lead to improved water quality. The rate of change of the water is just as important as the total magnitude of the change. Lake levels respond immediately to the addition of pumped groundwater. Pumping at a distance from a lake, horizontally or vertically, will reduce the immediate impact of the pumping on lake water levels. Average groundwater and lake levels depend on long-term average recharge, whereas seasonal fluctuations depend on the differences between fluctuating recharge and long-term average (Townley *et al.*, 1993).

In general, the shallow wetlands, such as Lake Jandabup, Thomsons Lake and Forrestdale Lake have a strongly seasonal hydrological cycle because they are in direct hydraulic connection with the unconfined aquifer (Bowman, Bishaw and Gorham, 1994).

4.6 MONITORING DETAILS

The Water and Rivers Commission:

Monthly measurements have occurred for years and this frequency highlights water level trends clearly. It has been previously suggested that perhaps monthly data is excessive and quarterly would be sufficient, but despite these suggestions, the measurement interval has not changed.

The scale on the hydrographs for each wetland was inconsistent. Any further graphing of this data should if possible be graphed on the same scale. This assists the interpretation of the water level trends.

The Department of Conservation and Land Management:

With only September and November water levels, the annual seasonal fluctuations are not clearly shown. More frequent data could show actual minimums for each year.

4.7 IMPACTS ON PERTH'S WATER SUPPLY

The unconfined aquifer supplies water to Perth city in conjunction with streams flowing from the Darling Scarp. The growth of Perth thus increases the demand for water (WAWA, 1986a). In 1993, groundwater contributed one third of the total water supply for Perth. This

is expected to rise to 60% by the year 2000. With increased groundwater abstraction, the water table level drops and wetlands become shallow (WAWA, 1986a; Balla and Davis, 1993).

The use of groundwater to provide water for Perth's use still has advantages over surface water sources. They are as follows, as obtained from Balla and Davis (1993) :

- There is a low capital cost compared with dams because construction is more easily staged and no long, expensive transmission of pipelines is required.
- It is more reliable in times of prolonged drought.
- The losses from groundwater storage are less than with surface reservoirs. The disadvantage however is the high operating costs.

Groundwater abstraction and urbanisation have the potential to significantly alter nutrient levels, fringing vegetation, and of particular interest in this report is water levels. This can be minimised by management of volume and rates of extraction and design of urban drainage systems to exclude wetlands as endpoints for stormwater input (Balla and Davis, 1993).

Future water supply options for Perth involve increased costs:

- economic; and
- environmental.

Environmental costs include the resultant lower wetland water levels and loss of wetland area. However, the Water Authority, or other responsible authorities, should manage the wetlands with the concept of sustainable yield. Presently, there are statutory minimum water levels set in some wetlands, although in 1993 these had no scientific basis (Balla and Davis, 1993).

At present, extraction has a more significant impact on groundwater and wetland water levels on the Gngangara Mound than on the Jandakot Mound. This is because the depth to the groundwater is greater on the Gngangara Mound. Stage 2 at the Jandakot Mound will increase the impact on groundwater levels. The overall impact of this stage will be reductions of 0.1-1.1m in the water table. Declines in groundwater levels on the Gngangara Mound are between 1 and 2.5m (Balla and Davis, 1993).

4.8 SUMMARY OF NORTHERN WETLANDS

The Gngangara Mound has suffered water table decline since the commencement of the Water Authority Scheme production in 1976. These declines were highlighted by below average rainfall from 1969-1988. In addition, unthinned pine forests on the Gngangara Mound resulted in lower recharge of the aquifer (Balla and Davis, 1993).

The groundwater resources of the Gngangara Mound include shallow unconfined aquifers, which are directly recharged from rainfall. The series of wetlands on the Northern Swan Coastal Plain reflect the proximity of these shallow aquifers to the soil surface. A lowering of the water table by abstraction will result in a general lowering of unconfined groundwater levels, superimposed on the natural seasonal fluctuation in levels. Those wetlands on the Gngangara Mound, that are included in this report are: Wannamal Lake, Yeal Lake, Lake Bambun, Loch McNess, Lake Nowergup, Lake Jandabup and Lake Joondalup.

4.8.1 Wannamal Lake

Water levels for Wannamal Lake from Jim Lane (CALM Busselton). As this is the only continuous source of monitoring since its commencement in 1978, the twice yearly monitoring by the Department of Conservation and Land Management should continue.

4.8.2 Yeal Lake

No water level data exists for Yeal Lake. If possible, monitoring on this wetland should begin. The monitoring possibility should be dependent only on its current accessibility.

4.8.3 Lake Bambun

Water levels for Lake Bambun from Jim Lane (CALM Busselton). As this is the only continuous source of monitoring since its commencement in 1979, the twice yearly monitoring by the Department of Conservation and Land Management should continue.

4.8.4 Loch McNess

Loch McNess shows very consistent water levels over the years. This must be monitored in the future to ensure this consistency is maintained.

4.8.5 Nowergup Lake

Water levels at Nowergup Lake have decreased due to increased private groundwater abstraction (WAWA, 1986a). Consequently, the water levels should be monitored to ensure these levels do not continue to fall to dangerous levels for maintaining the health of the wetland.

4.8.6 Lake Jandabup

Circular lakes, such as Lake Jandabup are more susceptible to water level changes than linear lakes because, not only are they shallow, but they have gently sloping floors. This means a fall in water level in a circular lake exposes a wider fringe than the same fall in a linear lake (WAWA, 1986a). There is significant stress on this lake because of a changing regional water balance, due to the combined effects of groundwater abstraction, pine plantations and low rainfall.

There are numerous examples of intensification of land use, which are degrading this wetland. However, Coffey (1990) states Lake Jandabup is a scarce wetland form or type, has limited important features and is diverse. Therefore, care must be taken to avoid further alteration and degradation of this important wetland.

Lake Jandabup is situated next to a pine plantation planted in the 1960s. An initial rise in water levels of about 2-3m is likely to have resulted from clearing and above average rainfall at that time. The falling trend in groundwater levels for 17 years from the late 1960s (Arnold, 1990a; Bowman, Bishaw and Gorham, 1994), has led to a decline in water levels. This is in response to increased interception of water by more mature pines and lower annual rainfall (WAWA, 1986a; Bowman, Bishaw and Gorham, 1994). Pumping for public and private water supplies has also affected lake levels, although the regional rainfall trends and land use changes have probably been the dominant influence (Bowman, Bishaw and Gorham, 1994). A lowering of the water table would result in reduction of the wetland area because it is a shallow wetland (WAWA, 1986a; Davis and Rolls, 1987).

Declining water levels in Lake Jandabup are due to below average rainfall and increased evapotranspiration from the adjacent pine plantation. It is thus suggested that the pine plantations east of Jandabup are regularly thinned. The thinning of pine trees increases infiltration of rainfall to groundwater, thus reducing the usual effects of pine plantations (Arnold, 1990a). It was pumping from superficial formations for private and public supplies near Lake Jandabup that led to water level declines of 0.15m from 1976-1985 (WAWA, 1986a). The current efforts by the Water Authority of Western Australia to manage groundwater abstraction to protect the conservation value of the lake should be continued. It must be maintained to keep some water in the lake at all times. 44m is the absolute minimum, but 44.25m AHD is the preferred minimum.

4.8.7 Lake Joondalup

Linear lakes, such as Lake Joondalup are less prone to drying than circular lakes, such as Lake Jandabup because of their depth. In general, linear lakes are also further from the groundwater abstraction zones and therefore are less affected by pumping (WAWA, 1986a).

Coffey (1990) states Lake Joondalup is permanent, is a scarce wetland form or type, has important features, is diverse, is moderately altered and has a moderate threat of wetland degradation due to manageable land use changes.

Lake Joondalup has dried up during the drought periods. Water levels were 1m higher in the early 1960s than now. The rise in the 1960s was due to climatic factors, as well as clearing of native woodlands for agriculture and urbanisation. These levels declined in 1969. Since 1978 minimum levels made a gradual recovery (WAWA, 1986a).

Lake Joondalup must be monitored to avoid significant degradation which would be a potential threat to the health of the wetland.

4.9 SUMMARY OF SOUTHERN WETLANDS

"The shallow groundwater of the Jandakot Mound is recharged directly from rainfall. The quantity of recharge depends on rainfall, evaporation and water use by vegetation" (WAWA, 1991), all of which are seasonal. Therefore, wetlands and groundwater respond seasonally, as well as in response to long term rainfall trends. Summer/autumn has the lowest water levels and the highest demand for water use, and wetlands are very sensitive to these low water levels (WAWA, 1991).

In the Jandakot area, the groundwater forms a regional mound of shallow groundwater called the Jandakot Mound, which has a volume of 2700 million cubic metres. The water table is up to 27m above sea level at the crest of the Mound. Groundwater flow from the Mound is mainly "westward to the sea with some northerly and north-easterly flow to the Swan and Canning rivers" (WAWA, 1991). Those wetlands on the Jandakot Mound, that are included in this report are: Balannup Lake, Thomsons Lake, Gibbs Road Swamp and Forrestdale Lake.

4.9.1 Balannup Lake

Most of the owners of Balannup Lake are private and thus managing the area as a whole, functioning wetland has become difficult. Ranford Road must not be widened. If traffic increases this demand, additional roads must be introduced to divert traffic around this wetland. This valuable wetland would be severely impacted if the road were widened. This was also suggested by Payne (1993b).

The hydrograph supplied for Balannup Lake made interpretation of the water level trends difficult. If possible, further data should be obtained for this wetland to examine the trends more closely. In the interim, the wetland must be monitored to ensure water levels continue to follow their reasonably consistent seasonal hydrological cycle.

4.9.2 Thomsons Lake

Thomsons Lake has a high diversity of bird species, is an important breeding ground, and has a high degree of naturalness. CALM's objectives for the wetland are that water levels should reflect rainfall and follow natural seasonal fluctuations. There should be minimal increase due to artificial water sources, arising from urban development and a nutrient excess should be prevented (Balla and Davis, 1993). The water levels in Thomsons Lake have increased by an estimated 0.5m because of inflow from a rural drain (WAWA, 1991).

Thomsons Lake has criteria set by the Department of Conservation and Land Management because it is an 'A' Class reserve. This criteria can be found in detail in the EPA Bulletin 371 (Environmental Protection Authority, 1989; WAWA, 1991 - pp.44-45). It is recommended that this criteria should be followed as closely as possible.

4.9.3 Gibbs Road Swamp

Monitoring of Gibbs Road Swamp must continue because it is the only known nesting site of the freckled duck. Additionally, the hydrology has been altered due to groundwater abstraction. Monitoring must ensure that the seasonal water level pattern does not change dramatically.

4.9.4 Forrestdale Lake

Long term trends in Lake Forrestdale water levels generally follow trends in other lakes along the Swan Coastal Plain which have exhibited peaks in water level corresponding with periods of high rainfall and low levels corresponding with periods of low rainfall.

Forrestdale Lake has criteria set by the Department of Conservation and Land Management because it is an 'A' Class reserve. This criteria can be found in detail in the EPA Bulletin 371 (Environmental Protection Authority, 1989; WAWA, 1991 - pp.44-45). It is recommended that this criteria should be followed as closely as possible.

Forrestdale Lake has reduced water levels of about 0.3m from the Forrestdale main drainage system which drains land to the north-east of Forrestdale Lake (WAWA, 1991). The Forrestdale Lake Nature Reserve Management Plan (Bartle *et al.*, 1987) states that WAWA (or whoever is the responsible authority) should attempt to achieve a peak of at least 0.9m in late spring of each year. The natural filling and drying cycle should be allowed to continue (Bartle *et al.*, 1987). Increased groundwater abstraction from surrounding bores will lead to more rapid and earlier drying of the lake. Flooding or deepening the lake to maintain an aesthetically pleasing depth should be discouraged.

4.10 CONCLUSIONS

The purpose of this project was:

- to identify ongoing water level monitoring programs as a source of ongoing data for the Department of Conservation and Land Management managers of the eleven specific wetlands studied in this report; and
- to find and compile all available historical water level data for these wetlands.

The Water and Rivers Commission and the Department of Conservation and Land Management have been found to undertake ongoing water level monitoring programs, which can be used as an ongoing source of water level data, as described in the Introduction. All the historical water level data found as part of this report has been included as hydrographs, and in raw data in the Results and Appendix sections. In addition, the water levels have been analysed to highlight the relationship with rainfall and to specify that monitoring in all wetlands must take place. Possible reasons for the long-term trends of wetlands have been posed, such as increased recharge to wetlands or decreased water levels due to groundwater abstraction. The importance of wetland management, as well as water level management is also discussed.

A wide variation in information and research has been found between the various wetlands under review. For example, much more information was found on Lake Jandabup, see 4.8.6, than Yeal Lake, see 4.8.2. There is obviously much more monitoring to be undertaken in relation to these topics in order to adequately protect the wetlands to ensure a sustainable environment for future generations.

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REFERENCES

1. Australian Nature Conservation Agency (1996) *A Directory of Important Wetlands in Australia, 2nd Edition*. Australian Nature Conservation Agency, Canberra.
2. Arnold, J. (1990a) *Jenny Arnold's Perth Wetlands Resource Book. Bulletin 266 - Chapter 5-6: Wetlands of the Northern and Eastern Gnangara Mound and Eastern Wanneroo Wetlands*. Environmental Protection Authority and the Water Authority of Western Australia.
3. Arnold, J. (1990b) *Jenny Arnold's Perth Wetlands Resource Book. Bulletin 266 - Chapter 7: Wanneroo Linear Lakes*. Environmental Protection Authority and the Water Authority of Western Australia.
4. Balla, S.A. and Davis, J.A. (1993) *Wetlands of the Swan Coastal Plain - Volume 5: Managing Perth's Wetlands to Conserve the Aquatic Fauna*. Water Authority of Western Australia and the Environmental Protection Authority.
5. Bartle, J., Graham, G., Lane, J., Moore, S. (1987) *Forrestdale Lake Nature Reserve Management Plan 1987-1992*. Department of Conservation and Land Management, Perth.
6. Bowman, Bishaw and Gorham (1994) *East Wanneroo Wetlands Natural Resource Mapping Study*. The Department of Planning and Urban Development, Perth.
7. Chiffings, A.W. (1977) *An Inventory of Research and Available Information on Wetlands in Western Australia*. Department of Conservation and Environment, Perth, W.A.
8. Coffey, P. (1990) *Report on an Investigation into Scientific and Educational Values of Wetlands and Rivers in the Perth-Bunbury Region*. Western Australian Water Resources Council, Perth, W.A.
9. Congdon, R.A. (1985) *The Water Balance of Lake Joondalup*. Bulletin 183. Department of Conservation and Environment, Perth.
10. Davis, J.A. and Rolls, S.W. (1987) *A Baseline Biological Monitoring Programme for the Urban Wetlands of the Swan Coastal Plain, Western Australia. Bulletin 265*. Environmental Protection Authority with conjunction with The Water Authority of Western Australia, Perth.
11. Davis, J.A., Rosich, R.S., Bradley, J.S., Growns, J.E., Schmidt, L.G. and Cheal, F. (1993) *Wetlands of the Swan Coastal Plain - Volume 6: Wetland Classification on the Basis of Water Quality and Invertebrate Community Data*. Water Authority of Western Australia and the Environmental Protection Authority.
12. Environmental Protection Authority (1989) *Drainage Management in South Jandakot and for the Beelie Wetlands. Report to the EPA by a technical advisory group. Bulletin 371*. Environmental Protection Authority, Perth.
13. Environmental Protection Authority (1990) *A Guide to Wetland Management in Perth. Bulletin 374*. Environmental Protection Authority, Perth, W.A.
14. Halse, S.A. (1989) *Wetlands of the Swan Coastal Plain - Past and Present* In: Lowe, G. (ed.) *Swan Coastal Plain Groundwater Management Conference - Proceedings*. Western Australian Water Resources Council, Leederville, W.A. pp. 105-119.

15. Halse, S.A., Pearson, G.B. and Patrick, S. (1993) *Vegetation of depth-gauged wetlands in nature reserves of south-west Western Australia - Technical Report No. 30*. Department of Conservation and Land Management, Como, W.A.
16. Martin, A.L. (1994) *South Jandakot EMP Wetlands Monitoring - Data Collection Annual Report 1992/1993*. Water Authority of Western Australia - Perth South Region, Water Resources, W.A.
17. Payne, J. (1993a) *Wetlands in the City of Armadale - A Report to the Water Authority of Western Australia and Environmental Protection Authority*. Water Authority of Western Australia, Leederville, W.A.
18. Payne, J. (1993b) *Wetlands in the City of Gosnells - A Report to the Water Authority of Western Australia and Environmental Protection Authority*. Water Authority of Western Australia, Leederville, W.A.
19. Seddon, G. (1972) *Sense of place*. UWA Press, Nedlands, W.A.
20. Townley, L.R., Turner, J.V., Barr, A.D., Trefry, M.G., Wright, K.D., Gailitis, V., Harris, C.J. and Johnston, C.D. (1993) *Wetlands of the Swan Coastal Plain - Volume 3: Interaction between Lakes, Wetlands and Unconfined Aquifers*. Water Authority of Western Australia and the Environmental Protection Authority.
21. Water Authority of Western Australia (1986a) *Gnangara Mound Groundwater Resources - Environmental Review and Management Programme*. Water Authority of Western Australia, Leederville, W.A.
22. Water Authority of Western Australia (1986b) *Gnangara Mound Groundwater Resources - Environmental Review and Management Programme - Appendices*. Water Authority of Western Australia, Leederville, W.A.
23. Water Authority of Western Australia (1991) *Jandakot Groundwater Scheme Stage 2 - Public Environmental Review - Volume 1*. Water Authority of Western Australia, Leederville, W.A.

APPENDICES

APPENDIX A

Rainfall Data

Data - Rainfall Lancelin

	1	2
	Year	Rainfall (mm)
1	1966	575.2
2	1967	728.7
3	1968	656.9
4	1969	488.4
5	1970	656.7
6	1971	617.7
7	1972	536.7
8	1973	744.1
9	1974	692.1
10	1975	649.3
11	1976	606.7
12	1977	443.3
13	1978	708.5
14	1979	620.9
15	1980	552.8
16	1981	713.4
17	1982	643.9
18	1983	634.0
19	1984	631.2
20	1985	479.8
21	1986	753.8
22	1987	727.3
23	1988	735.0
24	1989	629.8
25	1990	664.8
26	1991	722.1
27	1992	742.9
28	1993	496.5
29	1994	
30	1995	594.0
31	1996	566.4

Monthly Data for LANCELIN

Site Number C09114 Latitude 31°01'05"S Longitude 115°19'44"E Elevation 4 metres Opened Jan 1965 Still Open

Total Monthly Precipitation (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1965											44.0	11.7	
1966	1.1	15.2	3.9	37.5	69.8	142.4	126.5	58.0	68.8	45.2	5.4	3.6	575.2
1967	2.3	0.0	11.2	50.1	173.0	154.6	159.7	95.3	21.3	23.2	7.8	30.2	728.7
1968	25.2	10.0	44.3	45.4	27.0	179.0	116.7	101.9	67.4	28.1	8.9	3.0	656.8
1969	2.3	0.0	13.8	37.7	57.4	180.5	112.1	48.3	13.3	4.1	14.4	6.4	488.4
1970	0.0	53.4	1.6	49.8	63.9	186.5	106.1	70.2	81.4	20.9	5.7	7.2	656.7
1971	4.7	6.6	69.1	3.1	102.3	86.7	104.6	80.4	67.6	68.8	24.9	0.9	617.7
1972	2.3	1.3	2.3	32.6	32.5	151.8	83.8	152.9	30.6	42.5	4.1	0.0	536.7
1973	9.3	0.3	1.6	53.5	85.8	150.8	203.5	98.8	108.4	22.5	11.0	0.5	744.1
1974	1.6	1.0	2.4	123.8	164.1	87.5	183.8	61.9	22.2	56.6	5.8	1.6	692.1
1975	0.2	0.1	8.4	39.3	66.4	143.4	185.4	84.2	45.3	46.8	28.6	3.2	649.3
1976	18.0	47.0	0.0	38.0	81.0	69.0	98.4	125.3	63.8	25.8	36.2	4.2	606.7
1977	2.2	0.0	2.4	0.6	63.8	92.6	47.0	112.8	24.1	86.6	6.6	4.6	443.3
1978	1.8	20.8	1.0	25.2	91.5	219.2	184.2	17.6	104.4	17.4	6.4	19.2	706.5
1979	1.0	2.2	25.6	59.8	116.9	157.6	81.4	87.4	32.8	19.0	36.2	1.0	620.9
1980	0.4	3.4	1.8	51.2	70.8	90.8	156.6	93.8	42.4	22.2	11.8	7.8	552.8
1981	0.0	4.2	3.4	14.8	152.8	177.6	119.6	97.2	43.0	22.4	70.8	7.6	713.4
1982	73.5	10.6	12.4	2.2	82.6	137.2	109.4	112.4	78.0	20.6	2.6	2.4	643.9
1983	0.0	10.4	1.0	25.0	16.4	197.2	112.4	99.6	73.2	8.4	68.8	21.8	634.0
1984	1.2	4.6	31.4	38.6	167.8	82.8	69.8	122.0	43.8	34.0	48.8	8.4	631.2
1985	0.0	9.8	5.4	21.2	16.8	53.8	148.0	100.4	98.0	12.6	14.6	1.2	479.8
1986	3.0	92.8	15.0	14.0	131.2	151.0	132.2	130.8	48.0	28.8	5.6	1.4	753.8
1987	1.0	0.0	24.0	56.8	100.8	156.4	193.9	89.6	48.0	13.4	41.8	1.8	727.3
1988	3.2	0.0	20.4	38.0	158.0	131.2	171.0	103.8	31.4	22.6	40.2	15.2	736.0
1989	10.6	34.2	0.4	26.2	96.8	74.4	194.4	71.6	43.6	65.8	8.2	5.6	629.8
1990	101.4	5.0	14.6	33.8	83.0	92.4	169.2	82.6	39.2	34.2	7.0	2.4	664.8
1991	0.4	24.4	10.2	30.4	88.2	211.6	127.9	54.4	61.4	30.0	69.4	33.8	722.1
1992	4.6	67.0	45.8	37.6	43.2	126.2	105.0	187.0	55.6	23.6	39.9	7.4	742.9
1993	0.2	8.0	13.0	7.0	90.3	96.2	93.0	85.0	58.0	22.4	21.0	2.4	496.5
1994	0.4	0.0	1.2	2.6	132.6	76.7	101.2		34.8	21.0	1.6	0.0	
1995	0.6	0.6	9.8	22.0	81.5	123.5	175.2	48.0	49.2	60.8	15.4	6.4	594.0
1996	1.2	0.0	3.0	5.8	37.6	121.8	144.2	88.0	98.8	21.6	30.4	14.0	566.4
1997	0.0	4.8	3.2	29.2									

Summary of Total Monthly Precipitation using available data between 1965 and 1997

Mean	8.5	13.7	12.6	32.8	87.9	132.0	132.1	91.9	54.7	31.3	23.2	7.4	633.8
Median	1.4	4.6	5.9	33.2	82.6	137.2	126.5	91.7	48.0	23.2	14.5	4.4	639.0
Highest	101.4	92.8	69.1	123.8	173.0	219.2	203.5	187.0	108.4	86.6	70.8	33.8	753.8
Lowest	0.0	0.0	0.0	0.6	16.4	53.8	47.0	17.6	13.3	4.1	1.6	0.0	443.3
Number	32	32	32	32	31	31	31	30	31	31	32	32	30



	1	2
	Year	Rainfall (mm)
1	1948	790.7
2	1949	618.7
3	1950	779.2
4	1951	791.2
5	1952	908.5
6	1953	874.0
7	1954	707.3
8	1955	1164.7
9	1956	839.4
10	1957	819.0
11	1958	825.6
12	1959	600.9
13	1960	731.5
14	1961	830.1
15	1962	770.7
16	1963	1040.6
17	1964	1032.5
18	1965	963.1
19	1966	681.2
20	1967	942.2
21	1968	930.2
22	1969	523.8
23	1970	847.5
24	1971	776.0
25	1972	576.8
26	1973	914.6
27	1974	875.8
28	1975	692.4
29	1976	722.0
30	1977	615.1
31	1978	822.9
32	1979	569.0
33	1980	700.1
34	1981	791.4
35	1982	664.8
36	1983	720.6
37	1984	748.2
38	1985	620.2
39	1986	901.0
40	1987	743.4
41	1988	914.4
42	1989	674.0
43	1990	704.8
44	1991	903.8
45	1992	960.0
46	1993	666.0
47	1994	609.0
48	1995	793.2
49	1996	889.2

Monthly Data for PERTH AIRPORT MO

Site Number 009021 Latitude 31°56'29"S Longitude 115°57'55"E Elevation 20 metres Opened Jan 1944 Still Open

Total Monthly Precipitation (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1948	0.0	0.0	14.8	35.8	24.3	170.1	179.2	136.8	122.0	36.4	54.1	17.2	790.7
1949	4.9	8.4	17.8	48.8	15.2	80.6	152.1	152.3	38.7	69.1	30.8	0.0	618.7
1950	3.1	1.8	0.0	0.8	167.6	182.5	159.3	72.6	93.0	52.6	38.3	7.6	779.2
1951	1.5	28.0	2.4	113.3	53.3	222.3	76.1	124.5	38.3	50.2	15.8	65.5	791.2
1952	3.6	4.8	29.4	9.8	121.7	224.0	204.1	95.1	87.4	68.8	19.6	46.2	908.5
1953	0.8	33.4	4.4	28.5	165.9	227.5	153.2	84.2	55.1	83.8	36.9	0.3	874.0
1954	14.3	0.5	0.8	29.4	125.1	118.0	168.5	156.4	40.4	19.9	25.0	9.0	707.3
1955	3.1	120.7	6.3	68.8	107.5	107.1	162.9	340.3	104.2	124.5	6.7	12.6	1164.7
1956	0.0	1.3	31.6	50.8	220.9	181.3	202.2	29.7	53.5	28.3	35.2	4.6	839.4
1957	10.9	0.5	5.1	64.0	94.5	301.2	100.2	151.0	38.2	50.0	1.3	2.1	819.0
1958	10.2	0.6	0.5	12.6	111.2	65.3	446.7	48.8	33.4	71.2	15.2	9.9	825.6
1959	4.1	3.4	12.2	28.3	33.7	197.7	63.8	123.6	28.7	60.5	31.1	13.8	600.9
1960	22.9	7.2	54.8	23.2	144.6	124.2	195.5	53.9	66.8	23.1	6.9	8.4	731.5
1961	11.0	5.5	43.4	95.5	48.6	192.1	161.3	181.2	57.7	36.1	2.0	15.8	830.1
1962	0.8	4.4	0.0	12.5	170.6	169.6	172.5	76.2	56.6	47.9	45.8	13.8	770.7
1963	10.9	14.5	18.7	50.8	225.0	230.6	186.3	185.2	76.8	36.3	4.9	0.8	1040.6
1964	0.3	6.4	6.2	71.8	15.0	318.4	248.1	164.9	95.2	69.1	8.1	28.0	1032.5
1965	2.3	1.0	8.5	21.8	144.2	217.4	160.0	173.5	66.0	103.5	50.8	24.1	963.1
1966	2.9	2.9	5.7	35.9	61.7	173.7	197.2	69.2	75.2	37.1	7.7	12.0	681.2
1967	1.8	7.6	7.6	74.9	229.0	242.7	166.1	89.3	36.1	34.4	16.5	26.2	942.2
1968	17.1	19.4	61.9	74.8	63.1	226.5	185.1	94.7	129.7	47.8	6.9	3.1	930.2
1969	5.1	0.3	16.2	51.8	58.1	208.1	88.1	52.2	11.5	1.3	23.9	9.2	523.8
1970	1.3	46.3	1.6	89.7	155.0	229.8	132.0	79.3	76.0	39.8	12.1	4.6	847.5
1971	17.6	8.4	54.1	22.8	83.1	93.7	108.4	83.2	163.0	124.8	14.6	2.3	776.0
1972	0.0	0.0	4.9	28.3	23.1	135.1	142.8	154.7	36.6	47.1	2.9	1.3	576.8
1973	13.2	0.5	0.0	63.7	108.6	188.2	219.6	107.2	144.0	55.6	13.0	0.0	914.6
1974	0.4	13.7	0.2	80.2	201.6	92.5	234.0	130.2	27.9	69.3	25.6	0.2	875.8
1975	0.3	0.0	17.4	32.8	67.3	156.4	208.6	84.4	58.6	46.9	18.9	0.8	692.4
1976	23.8	34.7	0.8	76.2	69.8	87.6	102.8	145.1	72.2	46.2	55.0	7.8	722.0
1977	5.0	10.8	6.2	1.2	110.9	86.0	84.8	193.2	29.8	75.2	11.5	0.6	615.1
1978	3.4	32.2	16.4	18.2	123.4	185.4	235.8	23.2	101.0	42.4	19.8	11.7	822.9
1979	0.2	12.2	20.2	40.5	67.6	145.2	76.4	89.3	37.4	24.2	51.2	4.6	589.0
1980	0.6	13.8	1.8	76.6	86.7	135.6	157.4	108.2	68.2	36.0	11.6	13.6	700.1
1981	1.0	11.8	6.4	32.2	160.2	159.2	152.8	131.8	67.6	34.8	35.2	8.6	791.4
1982	72.8	6.6	16.6	0.0	55.8	168.6	152.6	74.0	84.4	26.2	2.4	5.0	664.8
1983	1.2	21.6	3.8	15.8	23.4	232.2	113.8	138.0	100.4	8.6	45.0	16.8	720.6
1984	0.8	3.6	29.2	59.6	143.4	114.4	82.2	112.4	102.8	25.8	61.2	12.8	748.2
1985	1.0	1.8	4.6	46.8	74.6	82.2	154.2	145.0	54.2	22.6	25.0	8.2	620.2
1986	2.4	93.0	28.8	1.4	152.2	193.0	198.4	119.2	52.0	40.8	19.6	0.2	901.0
1987	1.6	0.0	15.4	58.8	80.2	195.2	189.8	84.2	42.2	22.4	30.8	23.0	743.4
1988	0.2	0.0	11.8	89.4	125.0	229.4	158.4	92.2	110.8	52.0	33.8	11.4	814.4
1989	15.2	30.2	0.4	44.8	116.4	66.4	154.6	82.4	67.0	81.0	8.0	7.6	674.0
1990	62.6	19.8	58.8	67.6	59.4	76.8	138.4	86.0	56.2	48.8	21.6	6.8	704.8
1991	0.0	16.4	2.5	58.6	106.8	246.6	160.2	95.6	83.2	36.8	66.4	30.4	903.8
1992	4.0	150.4	31.8	16.8	65.0	226.4	113.0	193.2	57.4	23.6	75.8	2.6	960.0
1993	0.8	35.4	5.6	14.4	114.4	81.8	134.2	149.2	91.8	31.2	6.4	0.8	666.0
1994	0.0	0.2	2.0	3.4	86.4	150.0	153.2	131.4	68.0	10.8	5.4	0.2	609.0
1995	0.0	20.6	15.4	10.8	138.6	122.8	217.6	76.0	55.4	87.2	46.6	2.4	793.2
1996	1.8	0.4	4.8	16.8	50.0	232.0	217.6	117.8	133.6	53.2	44.6	16.8	889.2
1997	0.8	7.8	27.6	26.4									

Summary of Total Monthly Precipitation using available data between 1944 and 1997

Mean	6.9	16.4	14.7	42.3	106.2	175.3	163.8	117.7	69.6	47.5	26.5	11.7	800.9
Median	1.8	6.6	8.5	35.9	107.5	181.3	158.5	108.9	58.6	42.4	23.9	8.6	791.3
Highest	72.6	150.4	61.9	113.3	229.0	424.1	446.7	340.3	163.0	124.8	80.7	65.5	1164.7
Lowest	0.0	0.0	0.0	0.0	15.0	65.3	63.8	29.2	11.5	1.3	1.3	0.0	523.8
Number	53	53	53	53	53	53	53	53	53	53	53	53	52



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Contact us by phone on (09) 263 2222, by fax on (09) 263 2233, or by email on climate.wa@bom.gov.au

APPENDIX B

CALM Supplied Wetland Water Level Data

	1	2
	Year	Depth (m)
1	1978	
2	1978.58	0.25
3	1978.83	1.5
4	1978.92	1.14
5	1979	
6	1979.08	0.87
7	1979.25	0.5
8	1979.42	0.4
9	1979.58	0.89
10	1979.75	1.39
11	1979.83	1.31
12	1979.92	1.15
13	1980	
14	1980.08	0.35
15	1980.25	0.29
16	1980.42	0.2
17	1980.58	0.84
18	1980.75	1
19	1980.92	1.24
20	1981	
21	1981.08	0.79
22	1981.42	0.23
23	1981.5	1.02
24	1981.58	1.5
25	1981.6	1.48
26	1981.62	1.52
27	1981.67	1.54
28	1981.75	1.48
29	1981.77	1.42
30	1981.92	1.23
31	1982	
32	1982.08	0.97
33	1982.25	0.58
34	1982.42	0.5
35	1982.58	1.02
36	1982.75	1.5
37	1982.92	1.3
38	1983	
39	1983.08	0.91
40	1983.25	0.44
41	1983.42	
42	1983.58	1.58
43	1983.75	1.62
44	1983.92	1.32
45	1984	
46	1984.08	1.3
47	1984.25	0.85
48	1984.42	0.82
49	1984.58	1.56
50	1984.75	1.51
51	1984.92	1.28

	1	2
	Year	Depth (m)
5 2	1985	
5 3	1985.08	0.8
5 4	1985.25	0.54
5 5	1985.42	0.3
5 6	1985.75	0.99
5 7	1985.92	0.92
5 8	1986	
5 9	1986.75	1.51
6 0	1986.92	1.32
6 1	1987	
6 2	1987.08	0.88
6 3	1987.1	0.83
6 4	1987.12	0.77
6 5	1987.14	0.72
6 6	1987.17	0.65
6 7	1987.75	1.86
6 8	1987.92	1.28
6 9	1988	
7 0	1988.75	1.52
7 1	1988.92	1.34
7 2	1989	
7 3	1989.75	1.44
7 4	1989.92	1.3
7 5	1990	
7 6	1990.75	1.44
7 7	1990.92	1.27
7 8	1991	
7 9	1991.75	1.51
8 0	1991.92	1.29
8 1	1992	
8 2	1992.75	1.61
8 3	1992.92	1.26
8 4	1993	
8 5	1993.75	1.53
8 6	1993.92	1.26
8 7	1994	
8 8	1994.75	1.43
8 9	1994.92	1.17
9 0	1995	
9 1	1995.75	1.57
9 2	1995.92	1.32
9 3	1996	
9 4	1996.75	1.6
9 5	1996.92	1.36

	1	2
	Year	Depth (m)
1	1979	
2	1979.42	1.2
3	1979.58	1.85
4	1979.75	2.43
5	1979.92	2.27
6	1980	
7	1980.08	1.72
8	1980.25	1.34
9	1980.5	1.3
10	1980.58	1.7
11	1980.75	2.44
12	1980.92	2.31
13	1981	
14	1981.03	1.81
15	1981.42	1.21
16	1981.58	2.45
17	1981.75	2.47
18	1981.92	2.32
19	1982	
20	1982.08	1.87
21	1982.25	1.49
22	1982.42	1.36
23	1982.58	2
24	1982.75	2.4
25	1982.92	2.26
26	1983	
27	1983.08	1.8
28	1983.25	1.38
29	1983.42	1.06
30	1983.58	1.78
31	1983.75	2.56
32	1983.92	2.35
33	1984	
34	1984.08	2
35	1984.25	1.6
36	1984.42	
37	1984.58	2.53
38	1984.75	2.5
39	1984.92	2.25
40	1985	
41	1985.08	1.78
42	1985.25	1.44
43	1985.42	1.18
44	1985.75	2.44
45	1985.92	2.3
46	1986	
47	1986.75	2.5
48	1986.92	2.46
49	1987	
50	1987.75	2.51
51	1987.92	2.2

	1	2
	Year	Depth (m)
5 2	1988	
5 3	1988.75	2.48
5 4	1988.92	2.38
5 5	1989	
5 6	1989.75	2.47
5 7	1989.92	2.36
5 8	1990	
5 9	1990.75	2.42
6 0	1990.92	2.35
6 1	1991	
6 2	1991.75	2.5
6 3	1991.92	2.33
6 4	1992	
6 5	1992.75	2.52
6 6	1992.92	2.25
6 7	1993	
6 8	1993.75	2.48
6 9	1993.92	2.37
7 0	1994	
7 1	1994.75	
7 2	1994.92	2.25
7 3	1995	
7 4	1995.75	
7 5	1995.92	
7 6	1996	
7 7	1996.75	2.65
7 8	1996.92	

Edit Current Wetland Data

Wcode	Sdate	ID	Scode	Sheet	Lessthan	Depth	Dry	Sal	pH	Survey	Group
BAMB	31/05/79	174	MDA		N	1.20	N	1.700	.	1	C
BAMB	17/07/79	175	MDA		N	1.85	N	1.300	.	1	C
BAMB	11/09/79	178	PGA		N	2.43	N	1.300	.	1	C
BAMB	06/11/79	176	MDA		N	2.27	N	1.250	.	1	C
BAMB	20/01/80	179	HRA		N	1.72	N	1.612	9.2	1	W
BAMB	10/03/80	173	LJA		N	1.34	N	2.100	.	1	C
BAMB	10/06/80	177	MDA		N	1.30	N	1.970	8.8	2	C
BAMB	17/07/80	172	PGA		N	1.70	N	1.6	.	1	C
BAMB	22/09/80	180	PGA		N	2.44	N	1.3	.	1	C
BAMB	06/11/80	182	MDA		N	2.31	N	1.4	.	1	C
BAMB	12/01/81	181	LJA		N	1.81	N	2.5	.	1	C
BAMB	12/05/81	183	LJA		N	1.21	N	2.85	.	1	C
BAMB	13/07/81	184	MDA	108	N	2.45	N	1.50	.	1	C
BAMB	20/09/81	185	MDA	113	N	2.47	N	1.3	.	1	C
BAMB	07/11/81	186	PGA	123	N	2.32	N	1.5	8.2	1	C
BAMB	10/01/82	187	PGA	132	N	1.87	N	1.75	8.6	1	C
BAMB	15/03/82	188	PGA	145	N	1.49	N	2.25	9.9	1	C
BAMB	08/05/82	189	MRA	155	N	1.36	N	1.7	.	1	W

Browse|| || Indexed || No Carry|| Record 174/6223 || || ||

Edit Current Wetland Data

Wcode	Sdate	ID	Scode	Sheet	Lessthan	Depth	Dry	Sal	pH	Survey	Group
BAMB	09/07/82	190	KRA	171	N	2.00	N	2.35	.	1	W
BAMB	10/09/82	191	KRA	186	N	2.40	N	1.50	.	1	W
BAMB	07/11/82	192	MDA	191	N	2.26	N	1.70	8.9	1	C
BAMB	08/01/83	194	MRA	203	N	1.80	N	1.50	.	1	W
BAMB	18/03/83	193	LJA	209	N	1.38	N	2.20	9.1	1	C
BAMB	16/05/83	195	KRA	217	N	1.06	N	2.75	.	1	W
BAMB	12/07/83	196	PGA	230	N	1.78	N	1.60	8.9	1	C
BAMB	17/09/83	198	KRA	245	N	2.56	N	1.215	.	1	W
BAMB	06/11/83	197	MDA	264	N	2.35	N	1.538	8.2	1	C
BAMB	21/01/84	199	KRA	275	N	2.00	N	1.95	.	1	W
BAMB	15/03/84	200	MDA	286	N	1.60	N	2.05	9.7	1	C
BAMB	13/05/84	201	KRA	301	N	.	N	.	.	1	W
BAMB	17/07/84	202	PGA	306	N	2.53	N	1.316	7.8	1	C
BAMB	16/09/84	203	KRA	320	N	2.50	N	1.123	.	1	W
BAMB	04/11/84	204	MDA	330	N	2.25	N	1.888	7.2	1	C
BAMB	17/01/85	206	LJA	342	N	1.78	N	1.725	7.9	1	C
BAMB	11/03/85	205	PGA	356	N	1.44	N	2.11	.	1	C
BAMB	19/05/85	207	MRA	363	N	1.18	N	2.50	.	1	W

Browse|| || Indexed || No Carry|| Record 190/6223 || || ||

Edit Current Wetland Data

Wcode	Sdate	ID	Scode	Sheet	Lessthan	Depth	Dry	Sal	pH	Survey	Group
BAMB	20/09/85	208	LJA	358	N	2.44	N	1.168	7.6	1	C
BAMB	03/11/85	209	PGA	385	N	2.30	N	1.215	.	1	C
BAMB	18/09/86	4150	PGA	391	N	2.50	N	0.840	6.9	1	C
BAMB	04/11/86	4234	LJA	397	N	2.46	N	0.86	7.0	1	C
BAMB	14/09/87	4349	MDA	408	N	2.51	N	0.98	7.7	1	C
BAMB	12/11/87	4434	PGA	413	N	2.20	N	1.01	8.5	1	C
BAMB	12/09/88	4567	MDA	424	N	2.48	N	0.87	6.7	1	C
BAMB	07/11/88	4811	LJA	431	N	2.38	N	0.855	7.7	1	C

09/00	97 MON 10:10	FAX 09/ 521432	CALM BUSSELIUM										004
BAMB	11/09/89	4841	PGA	439	N	2.47	N	0.76	9.2	1	C		
BAMB	09/11/89	5179	LJA	444	N	2.36	N	0.80	8.1	1	C		
BAMB	16/09/90	5238	MDA	451	N	2.42	N	0.80	8.1	1	C		
BAMB	08/11/90	5306	PGA	460	N	2.35	N	0.84	9.9	1	C		
BAMB	16/09/91	5412	MJA	470	N	2.50	N	.81	8.8	1	C		
BAMB	02/11/91	5539	MJA	485	N	2.33	N	0.85	8.2	1	C		
BAMB	12/09/92	5643	LJA	512	N	2.52	N	0.94	7.6	1	C		
BAMB	09/11/92	5729	LJA	524	N	2.25	N	1.10	8.5	1	C		
BAMB	14/09/93	5672	PGA	546	N	2.48	N	0.6	7.6	1	C		
BAMB	07/11/93	5859	PGA	552	N	2.37	N	1.126	10.6	1	C		

Browse|| || Indexed || No Carry|| Record 208/6223 || || ||

Edit Current Wetland Data

Wcode	Sdate	ID	Scode	Sheet	Lessthan	Depth	Dry	Sal	pH	Survey	Group
BAMB	12/09/88	4567	MDA	424	N	2.48	N	0.87	6.7	1	C
BAMB	07/11/88	4811	LJA	431	N	2.38	N	0.855	7.7	1	C
BAMB	11/09/89	4841	PGA	439	N	2.47	N	0.76	9.2	1	C
BAMB	09/11/89	5179	LJA	444	N	2.36	N	0.80	8.1	1	C
BAMB	16/09/90	5238	MDA	451	N	2.42	N	0.80	8.1	1	C
BAMB	08/11/90	5306	PGA	460	N	2.35	N	0.84	9.9	1	C
BAMB	16/09/91	5412	MJA	470	N	2.50	N	.81	8.8	1	C
BAMB	02/11/91	5539	MJA	485	N	2.33	N	0.85	8.2	1	C
BAMB	12/09/92	5643	LJA	512	N	2.52	N	0.94	7.6	1	C
BAMB	09/11/92	5729	LJA	524	N	2.25	N	1.10	8.5	1	C
BAMB	14/09/93	5672	PGA	546	N	2.48	N	0.6	7.6	1	C
BAMB	07/11/93	5859	PGA	552	N	2.37	N	1.126	10.6	1	C
BAMB	08/11/94	5951	PGA		N	2.25	N	0.94	9.0	1	C
BAMB	14/09/95	6085	CAA		N	.	N	0.768	9.5	1	C
BAMB	10/11/95	6038	CAA		N	.	N	0.855	8.4	1	C
BAMB	18/09/96	6179	CAA		N	2.65	N	.740	7.6	1	C
BAMB	04/11/96	6205	CAA		N	.	N	0.801	8.9	1	C
BENN	17/09/92	5613	PGA	515	N	.	N	15.1	8.2	1	C

Browse|| || Indexed || No Carry|| Record 4564/6223 || || ||

Edit Current Wetland Data

Wcode	Sdate	ID	Scode	Sheet	Lessthan	Depth	Dry	Sal	pH	Survey	Group
WALY	02/11/91	5547	MJA	485	N	1.23	N	24.4	10.0	1	C
WANN	06/07/78	3695	MDA		N	0.25	N	.	.	2	C
WANN	03/10/78	3696	MDA		N	1.50	N	48.000	.	2	C
WANN	17/11/78	3686	PGA		N	1.14	N	6.700	.	1	C
WANN	14/01/79	3688	MDA		N	0.87	N	12.700	.	1	C
WANN	20/03/79	3689	MDA		N	0.50	N	22.800	.	1	C
WANN	15/05/79	3692	LJA		N	0.40	N	30.600	.	1	C
WANN	18/07/79	3690	MDA		N	0.89	N	10.350	.	1	C
WANN	10/09/79	3687	PGA		N	1.39	N	8.000	.	1	C
WANN	02/10/79	3693	LJA		N	1.31	N	.	.	2	C
WANN	06/11/79	3691	MDA		N	1.15	N	10.350	.	1	C
WANN	20/01/80	3697	DRB		N	0.35	N	24.090	.	1	W
WANN	10/03/80	3694	LJA		N	0.29	N	70.800	.	1	C
WANN	25/05/80	3698	DRB		N	0.20	N	32.076	.	1	W
WANN	18/07/80	3685	PGA		N	0.84	N	9.0	.	1	C
WANN	21/09/80	3700	DRB		N	1.00	N	8.398	.	1	W
WANN	06/11/80	3701	MDA		N	1.24	N	9.3	.	1	C
WANN	12/01/81	3699	LJA		N	0.79	N	16.9	.	1	C

Browse|| || Indexed || No Carry|| Record 5540/6223 || || ||

Edit Current Wetland Data

Wcode	Sdate	ID	Scode	Sheet	Lessthan	Depth	Dry	Sal	pH	Survey	Group
WANN	12/05/81	3702	LJA		Y	0.23	N	96.58	.	1	C
WANN	14/06/81	3704	LJA	105	N	1.02	N	.	.	2	C
WANN	12/07/81	3703	BRA	102	N	1.50	N	.	.	2	W
WANN	14/07/81	3705	MDA	108	N	1.48	N	6.00	.	1	C
WANN	18/07/81	3706	BRA	111	N	1.52	N	5.4	7.0	2	W
WANN	30/08/81	3707	BRA	111	N	1.54	N	2.3	9.0	2	W
WANN	05/09/81	3708	BRA	111	N	1.48	N	.	.	2	W
WANN	17/09/81	3709	JRA	117	N	1.42	N	3.10	.	1	O
WANN	08/11/81	3710	PGA	123	N	1.23	N	4.3	9.8	1	C
WANN	11/01/82	3711	PGA	132	N	0.97	N	7.3	8.7	1	C
WANN	18/03/82	3712	PGA	145	N	0.58	N	16.1	8.3	1	C
WANN	16/05/82	3713	DRB	152	N	0.50	N	24.0	.	1	W
WANN	11/07/82	3714	DRB	174	N	1.02	N	7.30	.	1	W
WANN	19/09/82	3715	DGB	185	N	1.50	N	6.95	.	1	W
WANN	07/11/82	3716	MDA	191	N	1.30	N	9.25	8.8	1	C
WANN	08/01/83	3717	PGA	202	N	0.91	N	13.80	9.3	1	C
WANN	13/03/83	3718	BRA	216	N	0.44	N	38.90	8.0	1	W
WANN	22/05/83	3719	DRB	223	N	.	Y	.	.	1	W

Browse|| ||Indexed ||No Carry||Record 3701/6223 || || ||

Edit Current Wetland Data

Wcode	Sdate	ID	Scode	Sheet	Lessthan	Depth	Dry	Sal	pH	Survey	Group
WANN	16/07/83	3720	BRA	238	N	1.58	N	5.70	8.0	1	W
WANN	17/09/83	3721	BRA	244	N	1.62	N	4.900	8.1	1	W
WANN	05/11/83	3722	BRA	263	N	1.32	N	3.85	9.0	1	W
WANN	18/01/84	3723	DRB	274	N	1.30	N	6.00	.	1	W
WANN	15/03/84	3724	MDA	285	N	0.85	N	10.50	8.6	1	C
WANN	13/05/84	3725	BRA	298	N	0.82	N	10.50	.	1	W
WANN	17/07/84	3726	PGA	306	N	1.56	N	6.80	8.4	1	C
WANN	16/09/84	3727	DRB	319	N	1.51	N	8.50	8.7	1	W
WANN	04/11/84	3728	MDA	330	N	1.28	N	8.15	8.8	1	C
WANN	16/01/85	3730	DRB	341	N	0.80	N	14.70	.	1	W
WANN	11/03/85	3729	PGA	356	N	0.54	N	26.5	.	1	C
WANN	19/05/85	3731	DRB	365	N	0.30	N	52.0	.	1	W
WANN	20/09/85	3732	LJA	358	N	0.99	N	11.70	9.2	1	C
WANN	03/11/85	3733	PGA	385	N	0.92	N	16.00	9.1	1	C
WANN	14/09/86	4151	PGA	391	N	1.51	N	4.800	8.7	1	C
WANN	04/11/86	4235	LJA	397	N	1.32	N	6.20	9.4	1	C
WANN	10/01/87	4515	LJA	405	N	0.88	N	12.7	10.1	2	C
WANN	16/01/87	4516	LJA	405	N	0.83	N	.	.	2	C

Browse|| ||Indexed ||No Carry||Record 3719/6223 || || ||

Edit Current Wetland Data

Wcode	Sdate	ID	Scode	Sheet	Lessthan	Depth	Dry	Sal	pH	Survey	Group
WANN	25/01/87	4517	LJA	405	N	0.77	N	14.0	.	2	C
WANN	31/01/87	4518	LJA	405	N	0.72	N	.	.	2	C
WANN	08/02/87	4522	LJA	405	N	0.65	N	18.1	.	2	C
WANN	14/09/87	4350	MDA	408	N	1.86	N	3.80	7.5	1	C
WANN	12/11/87	4435	PGA	413	N	1.28	N	4.2	7.7	1	C
WANN	15/09/88	4568	MDA	424	N	1.52	N	4.0	9.7	1	C
WANN	08/11/88	4812	LJA	431	N	1.34	N	6.1	9.6	1	C
WANN	11/09/89	4843	PGA	439	N	1.44	N	8.0	9.5	1	C
WANN	09/11/89	5180	LJA	444	N	1.30	N	10.0	9.3	1	C
WANN	08/09/90	5219	PGA	452	N	1.44	N	9.30	9.2	1	C

09/00	97 MON 18:21	FAA 09/ 521432	CALM BUSSELTUN				006				
WANN	08/11/90	5307	PGA	460	N	1.27	N	12.0	10.2	1	C
WANN	16/09/91	5413	MJA	470	N	1.51	N	6.90	9.7	1	C
WANN	02/11/91	5540	MJA	485	N	1.29	N	8.5	10.7	1	C
WANN	13/09/92	5644	LJA	512	N	1.61	N	.	9.8	1	C
WANN	10/11/92	5730	LJA	524	N	1.26	N	8.50	9.4	1	C
WANN	14/09/93	5673	PGA	546	N	1.53	N	7.8	10.0	1	C
WANN	14/11/93	5860	PGA	552	N	1.26	N	9.41	10.0	1	C
WANN	13/09/94	5905	PGA		N	1.43	N	8.7	10.0	1	C

Browse|| ||Indexed ||No Carry||Record 4516/6223 || || ||

Edit Current Wetland Data

Wcode	Sdate	ID	Scode	Sheet	Lessthan	Depth	Dry	Sal	pH	Survey	Group
WANN	08/11/88	4812	LJA	431	N	1.34	N	6.1	9.6	1	C
WANN	11/09/89	4843	PGA	439	N	1.44	N	8.0	9.5	1	C
WANN	09/11/89	5180	LJA	444	N	1.30	N	10.0	9.3	1	C
WANN	08/09/90	5219	PGA	452	N	1.44	N	9.30	9.2	1	C
WANN	08/11/90	5307	PGA	460	N	1.27	N	12.0	10.2	1	C
WANN	16/09/91	5413	MJA	470	N	1.51	N	6.90	9.7	1	C
WANN	02/11/91	5540	MJA	485	N	1.29	N	8.5	10.7	1	C
WANN	13/09/92	5644	LJA	512	N	1.61	N	.	9.8	1	C
WANN	10/11/92	5730	LJA	524	N	1.26	N	8.50	9.4	1	C
WANN	14/09/93	5673	PGA	546	N	1.53	N	7.8	10.0	1	C
WANN	14/11/93	5860	PGA	552	N	1.26	N	9.41	10.0	1	C
WANN	13/09/94	5905	PGA		N	1.43	N	8.7	10.0	1	C
WANN	08/11/94	5952	PGA		N	1.17	N	12.2	10.2	1	C
WANN	14/09/95	6086	CAA		N	1.57	N	8.28	9.3	1	C
WANN	10/11/95	6037	CAA		N	1.32	N	5.14	10.1	1	C
WANN	18/09/96	6174	CAA		N	1.60	N	6.05	9.3	1	C
WANN	07/11/96	6220	CAA		N	1.36	N	7.62	9.8	1	C
WARD	08/11/79	3738	PGA		N	1.53	N	27.200	.	1	C

Browse|| ||Indexed ||No Carry||Record 4807/6223 || || ||

APPENDIX C

Water and Rivers Commission Supplied Water Level Data

61710053 GNANGARA MOUND MONITOR GA10

M 50 382335 6517936 57.421

	Date	Level (mAHD)
21	7 1977	47.7100 0
17	8 1977	47.7200 0
21	9 1977	47.7700 0
24	10 1977	47.7200 0
24	11 1977	47.6800 0
29	12 1977	47.6400 0
24	1 1978	47.6200 0
23	2 1978	47.6100 0
30	3 1978	47.5500 0
4	5 1978	47.4800 0
30	5 1978	47.4700 0
27	6 1978	47.5000 0
31	7 1978	47.8500 0
29	8 1978	48.0800 0
25	9 1978	48.1500 0
26	10 1978	48.2100 0
28	12 1978	48.0600 0
23	1 1979	48.0200 0
26	2 1979	47.8700 0
27	3 1979	47.8000 0
27	4 1979	47.7200 0
30	5 1979	47.6800 0
27	6 1979	47.6600 0
30	7 1979	47.7700 0
28	8 1979	47.8600 0
28	9 1979	47.9300 0
26	10 1979	47.9200 0
28	11 1979	47.8600 0
30	1 1980	47.6800 0
29	3 1980	47.6000 0
30	4 1980	47.4800 0
30	5 1980	47.4700 0
27	7 1980	47.5200 0
26	8 1980	47.5600 0
24	9 1980	47.6700 0
30	10 1980	47.6200 0
27	11 1980	47.6200 0
23	12 1980	47.5500 0
30	1 1981	47.4600 0
24	2 1981	47.4300 0
31	3 1981	47.3300 0
30	4 1981	47.2800 0
28	5 1981	47.3800 0
30	6 1981	47.4200 0
30	7 1981	47.5400 0
31	8 1981	47.5900 0
30	9 1981	48.0100 0
30	10 1981	48.0600 0
30	11 1981	47.9700 0
23	12 1981	47.8700 0
27	1 1982	47.8200 0
24	2 1982	47.7300 0
31	3 1982	47.6600 0
22	4 1982	47.5900 0
28	5 1982	47.5400 0
30	6 1982	47.5400 0
30	7 1982	47.6200 0
31	8 1982	47.7300 0
30	9 1982	47.8100 0
29	10 1982	47.7800 0
26	11 1982	47.7700 0

30	12	1982	47.6800	0
26	1	1983	47.6200	0
22	2	1983	47.5600	0
28	3	1983	47.5400	0
29	4	1983	47.4100	0
30	5	1983	47.3600	0
28	6	1983	47.3400	0
27	7	1983	47.3900	0
29	8	1983	47.5300	0
29	9	1983	47.8300	0
26	10	1983	47.9300	0
28	11	1983	47.9200	0
28	12	1983	47.8500	0
27	1	1984	47.7700	0
29	3	1984	47.6100	0
18	4	1984	47.5900	0
28	5	1984	47.5500	0
28	6	1984	47.5200	0
27	7	1984	47.7000	0
29	8	1984	47.8100	0
25	9	1984	47.9500	0
29	10	1984	48.0300	0
26	11	1984	48.0400	0
31	12	1984	48.0400	0
30	1	1985	47.8300	0
26	2	1985	47.7500	0
28	3	1985	47.6800	0
24	4	1985	47.6400	0
21	5	1985	47.6100	0
24	6	1985	47.5700	0
18	7	1985	47.6900	0
23	8	1985	47.8500	0
24	9	1985	48.0200	0
22	10	1985	48.0800	0
21	11	1985	48.0700	0
24	12	1985	48.0010	0
30	1	1986	47.8910	0
24	2	1986	47.8710	0
23	4	1986	47.8710	0
13	5	1986	47.9310	0
9	7	1986	48.1210	0
4	8	1986	48.5410	0
26	8	1986	48.8260	0
19	9	1986	48.9910	0
21	10	1986	49.0710	0
10	11	1986	49.0710	0
9	12	1986	49.0110	0
14	1	1987	48.8910	0
5	2	1987	48.8010	0
25	2	1987	48.7260	0
23	4	1987	48.7110	0
7	5	1987	48.5210	0
12	6	1987	48.5810	0
7	7	1987	48.8510	0
4	8	1987	49.1110	0
3	9	1987	49.3260	0
12	10	1987	49.4010	0
5	11	1987	49.3310	0
17	12	1987	49.3210	0
10	2	1988	48.9510	0
10	3	1988	48.8210	0
12	4	1988	48.7010	0
3	5	1988	48.6310	0
28	6	1988	48.7110	0

8	7	1988	48.7410	0
5	8	1988	48.9510	0
2	9	1988	49.1210	0
5	10	1988	49.1810	0
4	11	1988	49.1910	0
27	1	1989	48.8510	0
14	4	1989	48.5610	0
20	7	1989	48.4610	0
9	10	1989	48.6710	0
4	1	1990	48.4910	0
23	4	1990	48.3010	0
19	7	1990	48.2210	0
23	10	1990	48.4210	0
16	1	1991	48.2110	0
24	4	1991	47.9810	0
15	7	1991	48.2010	0
16	10	1991	48.8110	0
20	1	1992	48.5210	0
16	4	1992	48.2810	0
28	7	1992	48.2710	0
26	10	1992	48.5910	0
22	1	1993	48.3010	0
23	4	1993	47.9810	0
21	7	1993	47.9810	0
20	10	1993	48.3010	0
20	1	1994	48.0510	0
26	4	1994	47.7510	0
22	7	1994	47.7410	0
24	10	1994	47.8010	1
27	1	1995	47.5610	1
19	4	1995	47.4110	1
27	7	1995	47.4610	1
17	10	1995	47.7210	1
25	1	1996	47.5410	1
9	5	1996	47.2710	1
23	7	1996	47.2010	1
16	10	1996	47.6810	1
28	1	1997	47.5510	1

6162557 LAKES AND WETLANDS
Date Level (mAHD)

LAKE FORRESTDAL U 50 399615 6442241 24.725

28	4	1952	22.2170	0
25	9	1952	23.4570	0
8	9	1953	23.4910	0
7	10	1955	23.5920	0
14	5	1962	21.8510	0
6	5	1963	22.0310	0
12	9	1963	24.1640	0
1	10	1964	23.7680	0
24	8	1967	23.8840	0
15	9	1969	23.2840	0
30	6	1971	22.7320	0
3	8	1971	22.8260	0
2	9	1971	22.9180	0
4	10	1971	23.1010	0
3	11	1971	23.2320	0
2	12	1971	23.1370	0
3	2	1972	22.6530	0
2	3	1972	22.4420	0
6	4	1972	22.2840	0
26	4	1972	22.2260	0
31	5	1972	22.1830	0
4	7	1972	22.3210	0
1	8	1972	22.4210	0
30	8	1972	22.6560	0

2	10	1972	22.7230	0
31	10	1972	22.6800	0
4	12	1972	22.4450	0
5	2	1973	22.0400	0
4	4	1973	21.6500	0
8	5	1973	21.8630	0
5	6	1973	22.0460	0
27	6	1973	22.4300	0
31	7	1973	22.4160	0
4	9	1973	22.8360	0
5	10	1973	23.2040	0
2	11	1973	23.4540	0
3	12	1973	23.0440	0
13	2	1974	22.5530	0
13	3	1974	22.3910	0
9	4	1974	22.2830	0
3	5	1974	22.3090	0
7	6	1974	22.5830	0
11	7	1974	22.7050	0
14	8	1974	23.3840	0
16	9	1974	23.7070	0
11	10	1974	23.6770	0
15	11	1974	23.6770	0
16	12	1974	23.5520	0
6	2	1975	23.0870	0
13	3	1975	22.9270	0
9	4	1975	22.7270	0
15	5	1975	22.6840	0
12	6	1975	22.7930	0
8	7	1975	22.9390	0
14	8	1975	23.2830	0
10	9	1975	23.3970	0
10	10	1975	23.4670	0
14	11	1975	23.3470	0
12	12	1975	23.1940	0
11	2	1976	22.7340	0
16	3	1976	22.5370	0
6	4	1976	22.4120	0
12	5	1976	22.3870	0
1	6	1976	22.4420	0
1	7	1976	22.5170	0
19	8	1976	23.0570	0
8	9	1976	22.8370	0
23	11	1976	22.7340	0
21	4	1977	21.7910	0
3	5	1977	21.9630	0
15	6	1977	21.9890	0
4	7	1977	21.9800	0
2	9	1977	22.6640	0
6	10	1977	23.1780	0
24	11	1977	22.0110	0
7	2	1978	21.8770	0
16	3	1978	21.2750	0
24	4	1978	21.4820	0
12	5	1978	21.5620	0
15	6	1978	22.0270	0
31	7	1978	22.3570	0
22	8	1978	22.6020	0
26	9	1978	22.6400	0
13	10	1978	22.7900	0
15	11	1978	22.6150	0
27	12	1978	22.3150	0
10	1	1979	22.2400	0
7	2	1979	21.8200	0

4	4	1979	21.7870	0
23	5	1979	22.4420	0
8	6	1979	22.4270	0
20	7	1979	22.4570	0
8	8	1979	22.4570	0
10	9	1979	22.4570	0
11	10	1979	22.4690	0
9	11	1979	22.2270	0
12	12	1979	21.9470	0
10	1	1980	21.2470	0
10	2	1980	21.5570	0
14	3	1980	21.5370	0
28	4	1980	21.6070	0
12	5	1980	21.6670	0
16	7	1980	22.4300	0
12	8	1980	22.4400	0
10	9	1980	22.4800	0
10	10	1980	22.5300	0
6	11	1980	22.4700	0
10	12	1980	22.4900	0
5	1	1981	22.1200	0
17	2	1981	21.8400	0
11	3	1981	21.8800	0
7	4	1981	22.0700	0
15	5	1981	22.1000	0
10	6	1981	22.4200	0
10	7	1981	22.4300	0
11	8	1981	22.5000	0
10	9	1981	22.6200	0
15	10	1981	22.6400	0
9	11	1981	22.0800	0
10	12	1981	22.0400	0
18	1	1982	22.2000	0
17	2	1982	22.2800	0
23	3	1982	22.1800	0
19	4	1982	22.0400	0
17	5	1982	22.1100	0
30	6	1982	22.3700	0
30	7	1982	22.6300	0
25	8	1982	22.4000	0
24	9	1982	22.5100	0
25	10	1982	22.4900	0
29	11	1982	22.3700	0
30	12	1982	21.9500	0
28	1	1983	21.6000	0
28	2	1983	21.5900	0
16	3	1983	21.4260	0
27	4	1983	21.5260	0
30	5	1983	21.8500	0
30	6	1983	22.5400	0
28	7	1983	22.4100	0
31	8	1983	22.4100	0
28	9	1983	22.5500	0
26	10	1983	22.5400	0
29	11	1983	22.3900	0
30	12	1983	22.2200	0
27	1	1984	21.7400	0
29	2	1984	21.2200	0
19	3	1984	21.6000	0
31	5	1984	21.6000	0
28	6	1984	21.9400	0
27	8	1984	22.4200	0
28	9	1984	22.4900	0
31	10	1984	22.4700	0

29	11	1984	22.4100	0
24	1	1985	21.9600	0
25	2	1985	21.8300	0
28	3	1985	21.4400	0
30	4	1985	21.9100	0
20	5	1985	21.8800	0
10	6	1985	22.3500	0
30	7	1985	22.4700	0
28	8	1985	22.4620	0
23	9	1985	22.3400	0
29	10	1985	22.4040	0
25	11	1985	22.2000	0
2	5	1986	21.7300	0
5	6	1986	22.2500	0
23	6	1986	22.3500	0
28	8	1986	22.6340	0
24	9	1986	22.7750	0
30	10	1986	22.7600	0
27	11	1986	22.6330	0
30	12	1986	22.4240	0
5	2	1987	22.1240	0
5	3	1987	21.8710	0
31	3	1987	21.8710	10
29	4	1987	21.9970	0
26	5	1987	21.9760	0
26	6	1987	22.0080	0
23	7	1987	22.2780	0
27	8	1987	22.3880	0
22	9	1987	22.3750	0
29	10	1987	22.4050	0
23	11	1987	22.2760	0
22	12	1987	22.0770	0
28	1	1988	21.8150	0
1	3	1988	21.8150	10
29	3	1988	21.8150	10
29	4	1988	21.8150	10
19	5	1988	22.0480	0
15	6	1988	22.0770	0
14	7	1988	22.2040	0
17	8	1988	22.6410	0
27	9	1988	22.8750	0
18	10	1988	23.0260	0
23	11	1988	22.9500	0
12	12	1988	22.8140	0
12	1	1989	22.5860	0
24	2	1989	22.3040	0
29	3	1989	22.1330	0
26	4	1989	22.0920	0
22	5	1989	22.0980	0
20	6	1989	22.1540	0
19	7	1989	22.2230	0
31	8	1989	22.4070	0
28	9	1989	22.4860	0
2	11	1989	22.5510	0
27	11	1989	22.4220	0
5	1	1990	22.1690	0
31	1	1990	22.0260	0
21	2	1990	21.9200	0
23	3	1990	21.8500	10
23	4	1990	21.8700	0
24	5	1990	21.8700	10
15	6	1990	22.0290	0
10	7	1990	21.9560	0
13	8	1990	22.1110	0

13	9	1990	22.1520	0
11	10	1990	22.1450	0
7	11	1990	22.1180	0
7	12	1990	21.9180	0
8	1	1991	21.8500	0
26	2	1991	21.8500	10
19	3	1991	21.8500	10
29	4	1991	21.8500	10
11	6	1991	21.7190	0
26	6	1991	21.9560	0
18	7	1991	22.1340	0
21	8	1991	22.4840	0
18	9	1991	22.6610	0
10	10	1991	22.7270	0
13	11	1991	22.7060	0
12	12	1991	22.5420	0
20	1	1992	22.3200	0
12	2	1992	22.3520	0
12	3	1992	22.1740	1
7	4	1992	22.1750	1
8	5	1992	22.1650	0
23	6	1992	22.3710	0
23	7	1992	22.6500	0
19	8	1992	22.9760	0
15	9	1992	23.3140	0
16	10	1992	23.3700	1
23	11	1992	23.2800	0
21	12	1992	23.0850	1
21	1	1993	22.8470	0
15	2	1993	22.7020	1
5	3	1993	22.5710	1
21	4	1993	22.4130	1
19	5	1993	22.3900	1
23	6	1993	22.4450	1
21	7	1993	22.6300	1
17	8	1993	22.6900	1
23	9	1993	22.8300	1
25	10	1993	22.8000	1
29	11	1993	22.6500	1
16	12	1993	22.5000	1
18	1	1994	22.2700	1
16	2	1994	22.0400	1
10	3	1994	21.7800	1
11	4	1994	21.6000	10
10	5	1994	21.6000	10
16	6	1994	21.8200	0
20	7	1994	22.1000	0
15	8	1994	22.4150	0
22	9	1994	22.4100	1
27	10	1994	22.3900	0
29	11	1994	22.0720	1
22	12	1994	21.7500	3
25	1	1995	21.7000	10
24	2	1995	21.6000	1
10	3	1995	21.6000	10
13	4	1995	21.6000	10
11	5	1995	21.6000	10
16	6	1995	21.6000	10
6	7	1995	21.6000	10
9	8	1995	21.9950	1
8	9	1995	22.4000	1
5	10	1995	22.1250	1
13	11	1995	22.1300	1
9	1	1996	21.8000	3

14	2	1996	21.6000	10
8	3	1996	21.6000	10
2	4	1996	21.6000	10
14	5	1996	21.6000	10
12	6	1996	21.6000	10
4	7	1996	21.8850	1
12	8	1996	22.1900	1
9	9	1996	22.3050	1
4	10	1996	22.4850	1
6	11	1996	22.4600	0
2	12	1996	22.4200	1
2	1	1997	22.1500	1
4	3	1997	21.6500	1

6162558 LAKES AND WETLANDS
Date Level (mAHD)

4	4	1973	20.4030	0
8	5	1973	20.2600	0
5	6	1973	20.9060	0
28	6	1973	21.4520	0
30	7	1973	22.3760	0
4	9	1973	22.1910	0
5	10	1973	22.2380	0
2	11	1973	22.2680	0
3	12	1973	21.9600	0
13	2	1974	20.8050	0
13	3	1974	20.5790	0
9	4	1974	20.5790	0
3	5	1974	20.4790	0
7	6	1974	21.5090	0
11	6	1974	22.2300	0
14	8	1974	22.4800	0
16	9	1974	22.2400	0
9	10	1974	22.2400	0
14	11	1974	22.2450	0
12	12	1974	22.9400	0
6	2	1975	21.1050	0
15	5	1975	20.4850	0
12	6	1975	21.0150	0
9	7	1975	21.3950	0
15	8	1975	22.1600	0
11	9	1975	22.1700	0
14	11	1975	21.9800	0
27	5	1976	20.4260	0
19	7	1976	21.1400	0
19	8	1976	21.8700	0
8	9	1976	22.0300	0
8	10	1976	22.0500	0
23	11	1976	21.7880	0
28	4	1977	19.8220	0
3	5	1977	20.1290	0
24	6	1977	21.1160	0
4	7	1977	21.1460	0
2	9	1977	21.9900	0
6	10	1977	21.9570	0
24	11	1977	21.7780	0
13	2	1978	20.7070	0
15	3	1978	20.6950	0
7	4	1978	20.6350	0
1	5	1978	20.4850	0
1	6	1978	20.0050	0
31	7	1978	22.3400	0
22	8	1978	22.1500	0
26	9	1978	22.0600	0
30	10	1978	21.9300	0

LAKE BALLANUP 852 U 50 400500 6446220 22.585

15	11	1978	21.8700	0
19	12	1978	21.7500	0
3	1	1979	21.4700	0
1	2	1979	21.0050	0
1	3	1979	20.9950	0
2	4	1979	20.9350	0
1	5	1979	21.1250	0
11	7	1979	21.4800	0
1	8	1979	21.8500	0
21	9	1979	21.9610	0
16	10	1979	21.9360	0
1	11	1979	21.8360	0
3	12	1979	21.7110	0
10	1	1980	21.0150	0
3	2	1980	20.9050	0
6	3	1980	20.6950	0
28	4	1980	20.7450	0
7	5	1980	20.8050	0
24	7	1980	21.8110	0
1	8	1980	22.1110	0
10	9	1980	22.1510	0
3	10	1980	22.0110	0
3	11	1980	21.9110	0
1	12	1980	21.6610	0
5	1	1981	21.4110	0
3	2	1981	21.0050	0
3	3	1981	20.7050	0
3	4	1981	20.5250	0
3	5	1981	20.4850	0
2	6	1981	20.8950	0
2	7	1981	21.8110	0
4	8	1981	22.2310	0
1	9	1981	22.3210	0
1	10	1981	21.9600	0
2	11	1981	21.8600	0
2	12	1981	21.6500	0
4	1	1982	21.3200	0
4	2	1982	21.4100	0
2	3	1982	20.9400	0
1	4	1982	20.7300	0
3	5	1982	20.5900	0
3	6	1982	20.5800	0
30	7	1982	21.8900	0
25	8	1982	22.0150	0
24	9	1982	22.0330	0
25	10	1982	21.9600	0
29	11	1982	21.6800	0
30	12	1982	21.3800	0
28	1	1983	21.2400	0
28	2	1983	20.6200	0
23	3	1983	20.1360	0
26	4	1983	20.0600	0
31	5	1983	20.2700	0
30	6	1983	21.5000	0
28	7	1983	21.7200	0
31	8	1983	21.7230	0
28	9	1983	22.2400	0
26	10	1983	22.1000	0
29	11	1983	21.9400	0
30	12	1983	21.7600	0
27	1	1984	21.2700	0
29	2	1984	20.8500	0
19	3	1984	20.7700	0
30	4	1984	20.6400	0

31	5	1984	21.2700	0
28	6	1984	21.9300	0
31	7	1984	22.1600	0
28	9	1984	22.1600	0
31	10	1984	21.9200	0
30	11	1984	21.7000	0
24	1	1985	20.7500	0
25	2	1985	20.4900	0
28	3	1985	20.1100	0
30	4	1985	20.2700	0
20	5	1985	20.3600	0
10	6	1985	20.9100	0
30	7	1985	22.0100	0
28	8	1985	22.0900	0
23	9	1985	21.9870	0
29	10	1985	21.8700	0
25	11	1985	21.7100	0
2	5	1986	20.2700	0
5	6	1986	20.7460	0
23	6	1986	21.8020	0
28	8	1986	22.4040	0
24	9	1986	22.1460	0
30	10	1986	21.9490	0
27	11	1986	21.7780	0
30	12	1986	21.4920	0
5	2	1987	21.2050	10
30	3	1987	21.2050	10
28	4	1987	21.2050	10
26	5	1987	21.2050	10
26	6	1987	21.6120	0
23	7	1987	21.9220	0
27	8	1987	22.1310	0
22	9	1987	21.9530	0
29	10	1987	21.8690	0
23	11	1987	21.7420	0
22	12	1987	21.5490	0
28	1	1988	21.2050	10
29	2	1988	21.2050	10
29	3	1988	21.2050	10
28	4	1988	21.2050	10
19	5	1988	21.2050	10
15	6	1988	21.5350	0
14	7	1988	22.0540	0
17	8	1988	22.2180	0
27	9	1988	22.0540	0
18	10	1988	22.0180	0
23	11	1988	21.8910	0
12	12	1988	21.7430	0
12	1	1989	21.4710	0
24	2	1989	21.2050	10
29	3	1989	21.2050	10
26	4	1989	21.2050	10
22	5	1989	21.2050	10
19	6	1989	21.2050	10
18	7	1989	21.2050	10
31	8	1989	21.7540	0
28	9	1989	21.9430	0
2	11	1989	22.0050	0
27	11	1989	21.8260	0
5	1	1990	21.5020	0
31	1	1990	21.2050	10
21	2	1990	21.2050	10
28	3	1990	21.2050	10
23	4	1990	21.2050	10

24	5	1990	21.2050	10
13	6	1990	21.2050	10
5	7	1990	21.2050	10
13	8	1990	21.6140	0
13	9	1990	21.9070	0
11	10	1990	21.8880	0
8	11	1990	21.7950	0
7	12	1990	21.6070	0
8	1	1991	21.2050	10
26	2	1991	21.2050	10
19	3	1991	21.2050	10
29	4	1991	21.2050	10
28	5	1991	21.2050	10
26	6	1991	21.8630	0
18	7	1991	22.1530	0
21	8	1991	22.0820	0
18	9	1991	22.2430	0
10	10	1991	22.0470	0
13	11	1991	21.9610	0
12	12	1991	21.8030	0
20	1	1992	21.4950	0
12	2	1992	21.5450	0
12	3	1992	21.2050	1
7	4	1992	21.1900	2
8	5	1992	21.2810	0
23	6	1992	21.5520	0
23	7	1992	22.2730	0
19	8	1992	22.3860	0
15	9	1992	22.3300	0
16	10	1992	22.0420	1
23	11	1992	21.9300	0
21	12	1992	21.7330	1
21	1	1993	21.4150	0
15	2	1993	21.2050	10
5	3	1993	20.7950	1
21	4	1993	21.2050	10
19	5	1993	20.0050	1
17	8	1993	22.1500	1
23	9	1993	22.3200	1
25	10	1993	22.1980	1
29	11	1993	22.0200	1
16	12	1993	21.8500	1
18	1	1994	21.5400	1
16	2	1994	21.2200	10
10	3	1994	21.2200	10
11	4	1994	21.2200	10
10	5	1994	21.2200	10
16	6	1994	21.2200	0
20	7	1994	22.0600	0
15	8	1994	22.8750	0
22	9	1994	22.0000	1
27	10	1994	22.8750	0
29	11	1994	21.6340	1
23	12	1994	21.3900	1
25	1	1995	21.2200	10
24	2	1995	21.2200	10
10	3	1995	21.2200	10
13	4	1995	21.2200	1
11	5	1995	21.2200	10
16	6	1995	21.2200	10
13	7	1995	21.3100	1
10	8	1995	22.0800	1
11	9	1995	22.1870	1
6	10	1995	21.9750	1

14	11	1995	21.9500	1
6	12	1995	21.8100	1
5	1	1996	21.6100	1
14	2	1996	21.2200	10
8	3	1996	21.2200	10
2	4	1996	21.2200	10
14	5	1996	21.2200	10
12	6	1996	21.2200	10
4	7	1996	21.3350	1
12	8	1996	22.1050	1
9	9	1996	22.0750	1
4	10	1996	22.1450	1
8	11	1996	21.9650	1
4	12	1996	21.8500	1
7	1	1997	21.5850	1
7	2	1997	21.2200	10

6162564 LAKES AND WETLANDS
Date Level (mAHD)

22	1	1973	7.0070	0
26	2	1973	6.9890	0
29	3	1973	6.9890	0
27	4	1973	7.0350	0
29	5	1973	7.0350	0
2	7	1973	7.0590	0
1	8	1973	7.0710	0
29	8	1973	7.0490	0
23	10	1973	7.0340	0
13	11	1973	7.0290	0
12	12	1973	7.0440	0
31	1	1974	7.0290	0
20	3	1974	7.0010	0
10	4	1974	6.9940	0
7	5	1974	7.0140	0
10	6	1974	7.0940	0
4	7	1974	7.1500	0
13	8	1974	7.0960	0
13	9	1974	7.0330	0
17	10	1974	7.0500	0
14	11	1974	7.0600	0
12	12	1974	7.0200	0
14	2	1975	6.9820	0
14	3	1975	6.9860	0
17	4	1975	7.0170	0
20	5	1975	7.0320	0
17	6	1975	7.0590	0
16	7	1975	7.0500	0
20	8	1975	7.0570	0
15	9	1975	7.0600	0
20	10	1975	7.0200	0
21	11	1975	7.0400	0
23	3	1976	6.9850	0
27	4	1976	7.0150	0
11	5	1976	7.0180	0
14	6	1976	7.0320	0
12	7	1976	7.0480	0
9	9	1976	7.0440	0
4	10	1976	7.0270	0
3	11	1976	7.0200	0
18	4	1977	7.0140	0
10	5	1977	7.0480	0
13	6	1977	7.0470	0
20	7	1977	7.0820	0
15	8	1977	7.0590	0
19	9	1977	7.0530	0

LOCH MCNESS 8754 U 50 374660 6508590 13.871

20	10	1977	7.0370	0
17	11	1977	7.0190	0
21	12	1977	7.0020	0
19	1	1978	6.9930	0
3	3	1978	6.9980	0
28	4	1978	7.0170	0
23	5	1978	7.0500	0
19	6	1978	7.0840	0
19	7	1978	7.1500	0
21	8	1978	7.0630	0
20	9	1978	7.1130	0
17	10	1978	7.0630	0
30	11	1978	7.0430	0
20	12	1978	7.0030	0
18	1	1979	7.0030	0
22	2	1979	7.0030	0
29	3	1979	7.0230	0
20	4	1979	7.0630	0
25	5	1979	7.0330	0
29	6	1979	7.1080	0
23	7	1979	7.0630	0
22	8	1979	7.0530	0
18	9	1979	7.0530	0
22	10	1979	7.0430	0
20	11	1979	7.0230	0
20	12	1979	7.0030	0
22	1	1980	6.9930	0
19	2	1980	6.9830	0
24	3	1980	6.9830	0
28	4	1980	7.0330	0
27	5	1980	7.0530	0
27	6	1980	7.0530	0
29	7	1980	7.0630	0
25	8	1980	7.0630	0
22	9	1980	7.0730	0
22	10	1980	7.0630	0
20	11	1980	7.0330	0
31	12	1980	7.0330	0
21	1	1981	7.0030	0
18	2	1981	7.0130	0
27	3	1981	7.0030	0
24	4	1981	7.0330	0
29	5	1981	7.0730	0
23	6	1981	7.0730	0
29	7	1981	7.0830	0
25	8	1981	7.0830	0
24	9	1981	7.0630	0
30	10	1981	7.0530	0
23	11	1981	7.0330	0
11	12	1981	7.0280	0
22	1	1982	7.0900	0
24	2	1982	7.0500	0
24	3	1982	7.0500	0
30	4	1982	7.0600	0
31	5	1982	7.0500	0
24	6	1982	7.0700	0
29	7	1982	7.0900	0
23	8	1982	7.1100	0
24	9	1982	7.1100	0
29	10	1982	7.0600	0
18	11	1982	7.0400	0
15	12	1982	7.0400	0
24	1	1983	7.0300	0
21	2	1983	7.0500	0

28	3	1983	7.0400	0
18	4	1983	7.0500	0
24	5	1983	7.0700	0
28	6	1983	7.1800	0
27	7	1983	7.1100	0
22	8	1983	7.1100	0
26	9	1983	7.0900	0
21	10	1983	7.0900	0
29	11	1983	7.0500	0
30	12	1983	7.0800	0
25	1	1984	7.0500	0
29	2	1984	7.0400	0
30	3	1984	7.0600	0
30	4	1984	7.0900	0
23	5	1984	7.0900	0
25	6	1984	7.1100	0
18	7	1984	7.1000	0
23	8	1984	7.1100	0
20	9	1984	7.0900	0
30	10	1984	7.0800	0
22	11	1984	7.0800	0
24	12	1984	7.0500	0
24	1	1985	7.0500	0
21	2	1985	7.0500	0
28	3	1985	7.0500	0
30	4	1985	7.0800	0
23	5	1985	7.0600	0
28	6	1985	7.0700	0
17	7	1985	7.1000	0
19	8	1985	7.1000	0
17	9	1985	7.0900	0
31	10	1985	7.0600	0
20	11	1985	7.0700	0
4	6	1986	7.0700	0
30	6	1986	7.1400	0
28	7	1986	7.0900	0
21	8	1986	7.1300	0
2	10	1986	7.0930	0
31	10	1986	7.0830	0
28	11	1986	7.0630	0
31	12	1986	7.0530	0
3	2	1987	7.0430	0
6	3	1987	7.0130	0
2	4	1987	7.0680	0
5	5	1987	7.0930	0
4	6	1987	7.0980	0
30	6	1987	7.1110	0
28	7	1987	7.1130	0
26	8	1987	7.1170	0
25	9	1987	7.1090	0
29	10	1987	7.0760	0
27	11	1987	7.0730	0
24	12	1987	7.0630	0
22	1	1988	7.0530	0
25	2	1988	7.0330	0
30	3	1988	7.0530	0
19	4	1988	7.0630	0
16	5	1988	7.0780	0
13	6	1988	7.0850	0
11	7	1988	7.0900	0
10	8	1988	7.0950	0
14	9	1988	7.0850	0
14	10	1988	7.0800	0
14	11	1988	7.0620	0

7	12	1988	7.0400	0
19	1	1989	7.0250	0
14	2	1989	7.0250	0
13	3	1989	7.0330	0
7	4	1989	7.0430	0
16	5	1989	7.0680	0
12	6	1989	7.0900	0
3	7	1989	7.0900	0
4	8	1989	7.1100	0
6	9	1989	7.0800	0
18	10	1989	7.1000	0
21	11	1989	7.0550	0
11	12	1989	7.0400	0
10	1	1990	7.0350	0
6	2	1990	7.0450	0
15	3	1990	7.0500	0
9	4	1990	7.0550	0
8	5	1990	7.0650	0
8	6	1990	7.1100	0
9	7	1990	7.0750	0
8	8	1990	7.1000	0
6	9	1990	7.0800	0
8	10	1990	7.0650	0
8	11	1990	7.0550	0
11	12	1990	7.0400	0
2	1	1991	7.0300	0
6	2	1991	7.0200	0
7	3	1991	7.0500	0
3	4	1991	7.0400	0
1	5	1991	7.0500	0
5	6	1991	7.1300	0
1	7	1991	7.1000	0
5	8	1991	7.1300	0
2	9	1991	7.0900	0
1	10	1991	7.0800	0
4	11	1991	7.0500	0
4	12	1991	7.0400	0
7	1	1992	7.0300	0
5	2	1992	7.0200	0
5	3	1992	7.0400	0
1	4	1992	7.0500	0
5	5	1992	7.0600	0
3	6	1992	7.0700	0
3	7	1992	7.1100	0
4	8	1992	7.1000	0
3	9	1992	7.1300	0
2	10	1992	7.0850	0
3	11	1992	7.0600	0
2	12	1992	7.0600	0
6	1	1993	7.0300	0
3	2	1993	7.0200	0
3	3	1993	7.0300	0
1	4	1993	7.0400	0
10	5	1993	7.0750	0
2	6	1993	7.1100	0
1	7	1993	7.0900	0
3	8	1993	7.1000	0
2	9	1993	7.1100	0
1	10	1993	7.1000	0
2	11	1993	7.0700	0
3	12	1993	7.0400	0
5	1	1994	7.0200	0
3	2	1994	7.0150	0
2	3	1994	7.0200	0

6	4	1994	7.0400	0
2	5	1994	7.0500	0
2	6	1994	7.0900	0
7	7	1994	7.0900	1
8	8	1994	7.0500	1
19	8	1994	7.0880	0
7	9	1994	7.0800	1
4	10	1994	7.0750	1
1	11	1994	7.0550	1
1	12	1994	7.0350	1
4	1	1995	7.0050	1
1	2	1995	7.0000	1
1	3	1995	7.0150	1
14	3	1995	7.0150	1
30	3	1995	7.0450	1
1	5	1995	7.0500	1
2	6	1995	7.0820	1
6	7	1995	7.0850	1
14	8	1995	7.1100	1
7	9	1995	7.1100	1
4	10	1995	7.0600	1
1	11	1995	7.0600	1
7	12	1995	7.0300	1
9	1	1996	7.0100	1
6	3	1996	7.0020	0
12	4	1996	7.0300	1
10	5	1996	7.0620	1
6	6	1996	7.0600	1
2	7	1996	7.0950	1
8	8	1996	7.0950	1
5	9	1996	7.0800	1
4	10	1996	7.0780	1
6	11	1996	7.0700	1
2	12	1996	7.0500	1
6	1	1997	7.0100	1
4	2	1997	7.0000	1
4	3	1997	7.0000	1

6162567 LAKES AND WETLANDS

LAKE NOWERGUP 875 U 50 379600 6499640 20.145

Date Level (mAHD)

22	1	1973	17.0810	0
26	2	1973	16.8980	0
29	3	1973	16.8680	0
27	4	1973	16.8740	0
29	5	1973	16.9410	0
2	7	1973	17.1360	0
1	8	1973	17.3560	0
29	8	1973	17.4680	0
23	10	1973	17.4940	0
13	11	1973	17.4940	0
12	12	1973	17.2840	0
31	1	1974	16.9740	0
18	3	1974	16.9010	0
10	4	1974	16.7790	0
7	5	1974	16.9790	0
7	6	1974	17.1700	0
4	7	1974	17.2800	0
8	8	1974	17.6310	0
13	9	1974	17.7180	0
17	10	1974	17.6100	0
14	11	1974	17.5950	0
12	12	1974	17.4300	0
19	2	1975	17.0150	0
12	3	1975	16.9300	0
15	4	1975	16.9210	0

19	5	1975	16.8810	0
17	6	1975	17.1130	0
16	7	1975	17.2650	0
20	8	1975	17.4900	0
15	9	1975	17.5100	0
20	10	1975	17.5500	0
21	11	1975	17.4330	0
23	3	1976	16.8550	0
27	4	1976	16.8310	0
11	5	1976	16.8200	0
14	6	1976	16.8960	0
12	7	1976	16.9980	0
9	9	1976	17.2910	0
4	10	1976	17.3200	0
3	11	1976	17.2330	0
18	4	1977	16.7810	0
12	5	1977	16.7650	0
13	6	1977	16.8270	0
20	7	1977	16.8870	0
16	8	1977	17.0080	0
19	9	1977	17.0920	0
20	10	1977	17.1140	0
17	11	1977	16.9780	0
13	12	1977	16.8400	0
18	1	1978	16.6680	0
17	2	1978	16.4460	0
3	3	1978	16.5160	0
28	4	1978	16.4030	0
23	5	1978	16.6710	0
19	6	1978	16.6830	0
19	7	1978	17.0370	0
21	8	1978	17.1950	0
20	9	1978	17.3100	0
17	10	1978	17.2940	0
24	11	1978	17.1200	0
20	12	1978	16.9980	0
19	1	1979	16.8300	0
22	2	1979	16.7070	0
29	3	1979	16.6860	0
20	4	1979	16.7320	0
25	5	1979	16.7600	0
29	6	1979	16.8500	0
23	7	1979	16.9930	0
22	8	1979	17.1240	0
18	9	1979	17.1480	0
22	10	1979	17.1040	0
20	11	1979	17.0290	0
20	12	1979	16.8470	0
22	1	1980	16.6950	0
19	2	1980	16.6250	0
21	3	1980	16.3140	0
28	4	1980	16.5810	0
27	5	1980	16.5950	0
27	6	1980	16.7680	0
29	7	1980	16.9750	0
25	8	1980	17.0970	0
22	9	1980	17.1520	0
22	10	1980	17.1550	0
20	11	1980	17.0140	0
31	12	1980	16.7980	0
21	1	1981	16.6840	0
18	2	1981	16.6650	0
27	3	1981	16.5500	0
24	4	1981	16.5550	0

29	5	1981	16.6350	0
30	6	1981	16.8610	0
29	7	1981	16.9350	0
25	8	1981	17.0500	0
24	9	1981	17.1200	0
30	10	1981	17.0380	0
23	11	1981	16.9370	0
11	12	1981	16.8500	0
22	1	1982	16.7770	0
24	2	1982	16.7110	0
24	3	1982	16.6500	0
30	4	1982	16.6530	0
31	5	1982	16.6900	0
24	6	1982	16.7800	0
29	7	1982	16.9200	0
23	8	1982	17.1500	0
24	9	1982	17.3100	0
29	10	1982	17.0600	0
18	11	1982	16.9800	0
15	12	1982	16.8600	0
26	1	1983	16.6500	0
21	2	1983	16.6700	0
28	3	1983	16.5100	0
18	4	1983	16.5000	0
24	5	1983	16.5200	0
28	6	1983	16.7800	0
27	7	1983	16.8000	0
22	8	1983	16.9300	0
26	9	1983	17.0800	0
21	10	1983	17.0100	0
29	11	1983	16.9300	0
30	12	1983	16.7800	0
25	1	1984	16.6800	0
29	2	1984	16.5500	0
30	3	1984	16.5000	0
30	4	1984	16.5100	0
23	5	1984	16.5500	0
25	6	1984	16.6400	0
18	7	1984	16.7500	0
23	8	1984	16.9300	0
20	9	1984	17.0500	0
31	10	1984	16.9600	0
22	11	1984	16.9500	0
24	12	1984	16.7300	0
24	1	1985	16.6600	0
21	2	1985	16.6400	0
28	3	1985	16.4100	0
30	4	1985	16.4700	0
23	5	1985	16.4600	0
28	6	1985	16.5000	0
17	7	1985	16.7800	0
19	8	1985	16.8400	0
17	9	1985	16.8900	0
31	10	1985	16.8800	0
20	11	1985	16.8400	0
4	6	1986	16.5900	0
30	6	1986	16.6650	0
28	7	1986	16.8870	0
21	8	1986	17.1060	0
1	10	1986	17.2160	0
4	11	1986	17.1060	0
27	11	1986	17.0010	0
7	1	1987	16.7300	0
10	2	1987	16.5140	0

6	3	1987	16.4670	0
1	4	1987	16.4440	0
4	5	1987	16.4550	0
3	6	1987	16.4700	0
29	6	1987	16.7410	0
24	7	1987	16.9400	0
31	8	1987	17.0960	0
24	9	1987	17.1870	0
30	10	1987	17.0010	0
23	11	1987	16.9160	0
28	12	1987	16.7400	0
20	1	1988	16.6180	0
29	2	1988	16.4530	0
30	3	1988	16.3870	0
26	4	1988	16.3860	0
16	5	1988	16.4080	0
15	6	1988	16.6280	0
9	8	1988	16.9380	0
15	9	1988	17.0500	0
14	10	1988	17.1150	0
16	11	1988	17.0250	0
6	12	1988	16.9000	3
2	2	1989	16.5700	2
8	3	1989	16.4200	0
5	4	1989	16.3200	3
10	5	1989	16.3700	0
6	6	1989	16.5430	0
19	7	1989	16.6800	0
1	8	1989	16.8400	0
12	9	1989	16.9200	0
6	10	1989	16.5000	0
8	11	1989	16.8900	0
4	12	1989	16.7600	0
4	1	1990	16.5450	0
7	2	1990	16.4500	0
7	3	1990	16.3800	0
10	4	1990	16.4100	0
9	5	1990	16.5650	0
7	6	1990	16.6350	0
6	7	1990	16.6850	0
3	8	1990	16.8900	0
5	9	1990	16.9500	0
3	10	1990	16.9600	0
9	11	1990	16.8800	0
10	12	1990	16.7100	0
7	1	1991	16.5100	0
5	2	1991	16.3400	0
12	3	1991	16.4500	0
4	4	1991	16.4900	0
8	5	1991	16.5800	0
6	6	1991	16.7100	0
2	7	1991	16.9200	0
7	8	1991	17.1800	0
10	9	1991	17.2000	0
4	10	1991	17.1900	0
6	11	1991	17.1200	0
11	12	1991	16.9700	0
7	1	1992	16.8700	0
4	2	1992	16.6800	0
5	3	1992	16.6300	0
1	4	1992	16.5500	4
8	5	1992	16.5300	0
8	6	1992	16.5300	0
3	7	1992	16.6800	0

7	8	1992	16.8700	0
3	9	1992	17.0300	0
2	10	1992	17.0450	0
3	11	1992	16.9400	0
7	12	1992	16.8100	0
6	1	1993	16.6200	0
4	2	1993	16.4400	0
5	3	1993	16.4000	0
2	4	1993	16.4200	0
13	5	1993	16.6300	0
9	6	1993	16.7100	0
1	7	1993	16.7900	0
3	8	1993	16.8800	0
3	9	1993	17.0200	0
5	10	1993	17.0700	0
2	11	1993	16.9800	0
3	12	1993	16.8000	0
6	1	1994	16.5500	0
4	2	1994	16.3500	0
4	3	1994	16.4100	0
13	4	1994	16.4000	0
4	5	1994	16.4500	0
8	6	1994	16.6200	0
5	7	1994	16.6940	0
4	8	1994	16.8360	1
12	9	1994	16.8700	1
4	10	1994	16.8000	1
11	11	1994	16.6200	1
6	12	1994	16.4700	1
5	1	1995	16.3180	1
1	2	1995	16.3650	1
2	3	1995	16.3850	1
30	3	1995	16.4400	1
4	5	1995	16.5200	1
6	6	1995	16.8000	1
4	7	1995	16.9650	1
9	8	1995	17.2600	1
11	9	1995	17.4600	1
5	10	1995	17.4800	1
8	11	1995	17.3300	1
7	12	1995	17.1500	1
11	1	1996	16.9100	1
19	2	1996	16.5500	1
13	3	1996	16.4800	1
10	4	1996	16.3500	1
17	5	1996	16.4300	1
22	5	1996	16.5000	0
17	6	1996	16.4200	1
15	7	1996	16.5700	1
15	8	1996	16.7200	1
11	9	1996	16.7800	1
7	10	1996	16.9500	2
6	11	1996	16.8950	1
2	12	1996	16.7600	1
8	1	1997	16.3800	1
4	2	1997	16.2800	1
4	3	1997	16.1500	1

6162572 LAKES AND WETLANDS
Date Level (mAHD)

13	9	1954	16.8400	0
6	4	1955	16.1090	0
18	10	1955	17.0990	0
6	9	1956	17.1660	0
5	4	1961	16.0360	0

LAKE JOONDALUP 82 U 50 385975 6485230 32.353

9	5	1962	15.7030	0
8	10	1962	16.8680	0
8	10	1963	17.3830	0
6	10	1964	17.7360	0
22	7	1968	18.0040	0
4	8	1968	18.0900	0
26	8	1968	18.1110	0
9	9	1968	18.2090	0
23	9	1968	18.2970	0
7	10	1968	18.3120	0
18	10	1968	18.1900	0
2	11	1968	18.1080	0
16	12	1968	18.0440	0
30	12	1968	17.9220	0
24	1	1969	17.7850	0
7	2	1969	17.6900	0
17	6	1969	17.7270	0
3	7	1969	17.8000	0
18	7	1969	17.9100	0
5	8	1969	18.0140	0
19	8	1969	18.0260	0
3	9	1969	18.0410	0
17	9	1969	18.0200	0
16	10	1969	17.9280	0
18	11	1969	17.6970	0
17	1	1970	17.4130	0
2	2	1970	17.3280	0
30	6	1970	17.5560	0
3	8	1970	17.9740	0
31	8	1970	17.9770	0
16	9	1970	17.9710	0
3	11	1970	17.7850	0
1	12	1970	17.7240	0
5	2	1971	17.3370	0
4	3	1971	17.2060	0
29	3	1971	17.1630	0
30	4	1971	17.1330	0
31	5	1971	17.2520	0
1	7	1971	17.3950	0
2	8	1971	17.5260	0
30	8	1971	17.6050	0
1	10	1971	17.7240	0
2	11	1971	17.7360	0
1	12	1971	17.6390	0
26	1	1972	17.2940	0
3	3	1972	17.0570	0
29	3	1972	16.9800	0
28	4	1972	16.9470	0
29	5	1972	16.9260	0
3	7	1972	17.1150	0
28	7	1972	17.2330	0
28	8	1972	17.4590	0
3	10	1972	17.5020	0
27	10	1972	17.4470	0
29	11	1972	17.2580	0
26	1	1973	16.9590	0
26	2	1973	16.7790	0
28	3	1973	16.6240	0
27	4	1973	16.6660	0
28	5	1973	16.7460	0
2	7	1973	16.9650	0
1	8	1973	17.2400	0
29	8	1973	17.3760	0
12	10	1973	17.5400	0

7	11	1973	17.5000	0
11	12	1973	17.3200	0
8	2	1974	16.9880	0
26	2	1974	16.8880	0
29	3	1974	16.7830	0
1	5	1974	16.8090	0
28	5	1974	17.0340	0
27	6	1974	17.1990	0
31	7	1974	17.6240	0
30	8	1974	17.7390	0
4	10	1974	17.6290	0
8	11	1974	17.6140	0
3	12	1974	17.5690	0
29	1	1975	17.3040	0
3	4	1975	17.0190	0
1	5	1975	16.9910	0
3	6	1975	17.1390	0
1	7	1975	17.3890	0
4	8	1975	17.5950	0
1	9	1975	17.7370	0
2	10	1975	17.7550	0
3	11	1975	17.7140	0
8	12	1975	17.5760	0
4	2	1976	17.2520	0
4	3	1976	17.1620	0
5	4	1976	17.0250	0
4	5	1976	17.0590	0
8	6	1976	17.1440	0
6	7	1976	17.2590	0
5	8	1976	17.3390	0
9	9	1976	17.5240	0
4	10	1976	17.5520	0
2	11	1976	17.4520	0
15	4	1977	16.7160	0
10	5	1977	16.7170	0
13	6	1977	16.8510	0
15	7	1977	16.9530	0
10	8	1977	17.1360	0
14	9	1977	17.2310	0
14	10	1977	17.2140	0
17	11	1977	17.1340	0
13	12	1977	16.9940	0
6	1	1978	16.8120	0
20	2	1978	16.5610	0
2	3	1978	16.5940	0
28	4	1978	16.5510	0
23	5	1978	16.6040	0
19	6	1978	16.7210	0
19	7	1978	17.0020	0
18	8	1978	17.2740	0
15	9	1978	17.3320	0
16	10	1978	17.4490	0
15	11	1978	17.3710	0
15	12	1978	17.1440	0
15	1	1979	16.9960	0
15	2	1979	16.8220	0
15	3	1979	16.7090	0
17	4	1979	16.6450	0
15	5	1979	16.6340	0
15	6	1979	16.7960	0
16	7	1979	17.0890	0
22	8	1979	17.1460	0
17	9	1979	17.2490	0
15	10	1979	17.2540	0

15	11	1979	17.1760	0
17	12	1979	17.0140	0
16	1	1980	16.8040	0
14	2	1980	16.6030	0
17	3	1980	16.5440	0
15	4	1980	16.5140	0
15	5	1980	16.5120	0
16	6	1980	16.6310	0
15	7	1980	16.9890	0
25	8	1980	17.1280	0
15	9	1980	17.2180	0
15	10	1980	17.2260	0
14	11	1980	17.1620	0
15	12	1980	17.0430	0
15	1	1981	16.8310	0
16	2	1981	16.5560	0
16	3	1981	16.5290	0
16	4	1981	16.4240	0
18	5	1981	16.2670	0
16	6	1981	16.6940	0
16	7	1981	16.8790	0
14	8	1981	17.2390	0
15	9	1981	17.2890	0
16	10	1981	17.3090	0
17	11	1981	17.2070	0
16	12	1981	17.0090	0
15	1	1982	16.8500	0
15	2	1982	16.8950	0
15	3	1982	16.7000	0
15	4	1982	16.5850	0
18	5	1982	16.6000	0
15	6	1982	16.8000	0
15	7	1982	17.0300	0
16	8	1982	17.2600	0
15	9	1982	17.4300	0
18	10	1982	17.4000	0
15	11	1982	17.2900	0
16	12	1982	17.1400	0
17	1	1983	16.9600	0
15	2	1983	16.8400	0
15	3	1983	16.7400	0
18	4	1983	16.6900	0
16	5	1983	16.6600	0
15	6	1983	16.7200	0
15	7	1983	17.0100	0
16	8	1983	17.2400	0
15	9	1983	17.4400	0
17	10	1983	17.4000	0
15	11	1983	17.2800	0
16	12	1983	17.1800	0
16	1	1984	17.0000	0
15	2	1984	16.8300	0
19	3	1984	16.7300	0
16	4	1984	16.6600	0
9	5	1984	16.7800	0
15	6	1984	16.9200	0
16	7	1984	17.0900	0
15	8	1984	17.2000	0
17	9	1984	17.3800	0
15	10	1984	17.3300	0
19	12	1984	17.1300	0
15	1	1985	16.9500	0
14	2	1985	16.8100	0
14	3	1985	16.6400	0

17	4	1985	16.5800	0
9	5	1985	16.5800	0
17	6	1985	16.7100	0
17	7	1985	16.8400	0
14	8	1985	17.0000	0
16	9	1985	17.0900	0
17	10	1985	17.1100	0
15	11	1985	17.0200	0
16	12	1985	16.8700	0
20	1	1986	16.7100	0
17	2	1986	16.5100	0
17	3	1986	16.5600	0
29	4	1986	16.5600	0
20	5	1986	16.6500	0
17	6	1986	16.6600	0
15	7	1986	16.9300	0
14	8	1986	17.3200	0
15	9	1986	17.3900	0
15	10	1986	17.4300	0
12	11	1986	17.3800	2
15	12	1986	17.1800	0
15	1	1987	16.9800	0
2	4	1987	16.4700	0
5	5	1987	16.6400	0
4	6	1987	16.8100	0
30	6	1987	17.0300	0
28	7	1987	17.1550	0
26	8	1987	17.4100	0
25	9	1987	17.4470	0
29	10	1987	17.3980	0
27	11	1987	17.2600	0
24	12	1987	17.1500	0
22	1	1988	16.9600	0
30	3	1988	16.4970	0
26	4	1988	16.5960	0
17	5	1988	16.6580	0
16	6	1988	16.8620	0
13	7	1988	17.0200	0
10	8	1988	17.1800	0
20	9	1988	17.3200	0
14	10	1988	17.4100	0
17	11	1988	17.3000	2
7	12	1988	17.2100	2
6	1	1989	17.0200	2
15	2	1989	16.8200	0
9	3	1989	16.7300	2
6	4	1989	16.6300	2
17	5	1989	16.6200	0
13	6	1989	16.7800	0
29	7	1989	16.8900	0
7	8	1989	17.1300	0
7	9	1989	17.2300	0
17	10	1989	17.2900	0
17	11	1989	17.2200	0
7	12	1989	17.0900	0
8	1	1990	16.9000	2
6	2	1990	16.8300	0
9	3	1990	16.7000	0
9	4	1990	16.6650	0
7	5	1990	16.6800	0
6	6	1990	16.7650	0
4	7	1990	16.8550	0
1	8	1990	17.0300	0
4	9	1990	17.1700	0

8	10	1990	17.2000	0
7	11	1990	17.1600	0
5	12	1990	17.0200	0
3	1	1991	16.8500	0
5	2	1991	16.6200	0
5	3	1991	16.4700	0
3	4	1991	16.3300	0
2	5	1991	16.3000	0
4	6	1991	16.5400	0
1	7	1991	16.8950	0
1	8	1991	17.2600	0
3	9	1991	17.4100	0
1	10	1991	17.5000	0
5	11	1991	17.4600	0
3	12	1991	17.4000	0
6	1	1992	17.2400	0
3	2	1992	17.0500	0
3	3	1992	17.0150	0
1	4	1992	16.9600	0
4	5	1992	16.9000	0
2	6	1992	16.9600	0
1	7	1992	17.2500	0
5	8	1992	17.5200	0
2	9	1992	17.7200	0
1	10	1992	17.7800	0
2	11	1992	17.7300	0
1	12	1992	17.6800	0
5	1	1993	17.4800	0
2	2	1993	17.3000	0
2	3	1993	17.1800	0
1	4	1993	17.0600	0
6	5	1993	17.1400	0
3	6	1993	17.2900	0
1	7	1993	17.4200	0
2	8	1993	17.5900	0
1	9	1993	17.8100	0
1	10	1993	17.9200	0
1	11	1993	17.8800	0
1	12	1993	17.7400	0
5	1	1994	17.5100	0
2	2	1994	17.3200	0
1	3	1994	17.1600	0
5	4	1994	17.0100	0
3	5	1994	16.9500	0
1	6	1994	17.0200	0
8	7	1994	17.2350	1
5	8	1994	17.4400	0
12	9	1994	17.5600	0
6	10	1994	17.5200	1
17	11	1994	17.3350	1
12	12	1994	17.1860	1
9	1	1995	16.9500	1
7	2	1995	16.8450	1
14	3	1995	16.5800	1
3	4	1995	16.5100	1
9	5	1995	16.4450	1
8	6	1995	16.6800	1
4	7	1995	16.7700	1
8	8	1995	17.0650	1
11	9	1995	17.2100	1
5	10	1995	17.1800	1
8	11	1995	17.1800	1
6	12	1995	17.0600	1
11	1	1996	16.8400	1

19	2	1996	16.5500	1
13	3	1996	16.4000	1
10	4	1996	16.2800	1
17	5	1996	16.2200	1
17	6	1996	16.3200	1
15	7	1996	16.7300	1
15	8	1996	17.0000	1
11	9	1996	17.1100	1
7	10	1996	17.2000	2
6	11	1996	17.1980	1
2	12	1996	17.1250	1
6	1	1997	16.9000	1
4	2	1997	16.6800	1
4	3	1997	16.5300	1

6162578 LAKES AND WETLANDS

	Date	Level (mAHD)	
13	9 1954	45.0180	0
6	4 1955	43.8700	0
6	9 1956	45.5980	0
5	4 1961	43.7780	0
10	10 1961	45.0220	0
9	5 1962	43.4770	0
12	10 1962	45.1040	0
9	10 1963	45.6740	0
7	10 1964	46.0980	0
22	7 1968	46.4060	0
4	8 1968	46.5030	0
26	8 1968	46.5860	0
9	9 1968	46.6310	0
23	9 1968	46.7470	0
7	10 1968	46.8020	0
18	11 1968	46.7440	0
2	12 1968	46.6680	0
30	12 1968	46.5220	0
24	1 1969	46.3970	0
7	2 1969	46.3140	0
13	3 1969	46.1380	0
10	4 1969	46.1320	0
9	5 1969	46.1500	0
4	6 1969	46.1740	0
17	6 1969	46.3110	0
3	7 1969	46.3940	0
18	7 1969	46.4700	0
5	8 1969	46.5460	0
19	8 1969	46.5460	0
3	9 1969	46.5920	0
17	9 1969	46.5490	0
16	10 1969	46.4760	0
18	11 1969	46.3600	0
16	12 1969	46.2020	0
29	6 1970	46.0580	0
16	7 1970	46.0890	0
4	8 1970	46.2110	0
26	8 1970	46.2570	0
16	9 1970	46.2720	0
16	10 1970	46.2960	0
24	3 1971	45.5100	0
5	5 1971	45.4760	0
2	6 1971	45.6500	0
16	6 1971	45.7260	0
2	7 1971	45.7720	0
6	7 1971	45.6620	0
2	8 1971	45.7810	0
31	8 1971	45.8600	0

JANDABUP LAKE 194 U 50 389205 6487620 54.457

1	10	1971	45.9910	0
2	11	1971	46.0250	0
1	12	1971	45.9270	0
26	1	1972	45.5800	0
3	3	1972	45.3390	0
5	4	1972	45.2050	0
27	4	1972	45.2080	0
29	5	1972	45.1770	0
3	7	1972	45.3850	0
28	7	1972	45.4790	0
28	8	1972	45.6830	0
3	10	1972	45.6990	0
26	10	1972	45.6560	0
29	11	1972	45.4610	0
26	1	1973	45.0680	0
1	3	1973	44.9340	0
2	4	1973	44.7720	0
30	4	1973	44.7570	0
28	5	1973	44.8300	0
3	7	1973	45.0740	0
1	8	1973	45.3440	0
29	8	1973	45.4830	0
17	10	1973	45.5640	0
13	11	1973	45.5940	0
11	12	1973	45.5940	0
8	2	1974	44.9840	0
27	2	1974	44.8790	0
29	3	1974	44.7560	0
2	5	1974	44.7960	0
29	5	1974	45.0460	0
27	6	1974	45.2020	0
1	8	1974	45.5600	0
3	9	1974	45.7200	0
3	10	1974	45.7420	0
8	11	1974	45.7920	0
5	12	1974	45.7270	0
30	1	1975	45.2770	0
5	3	1975	45.0570	0
3	4	1975	45.0040	0
1	5	1975	44.9870	0
3	6	1975	45.1070	0
1	7	1975	45.3270	0
4	8	1975	45.6030	0
1	9	1975	45.6670	0
2	10	1975	45.6980	0
3	11	1975	45.6850	0
8	12	1975	45.5280	0
4	2	1976	45.1990	0
4	3	1976	45.0840	0
5	4	1976	44.9640	0
4	5	1976	44.9940	0
8	6	1976	45.0620	0
6	7	1976	45.1940	0
5	8	1976	45.2740	0
9	9	1976	45.4390	0
5	10	1976	45.4370	0
2	11	1976	45.3790	0
6	12	1976	45.2680	0
5	1	1977	45.1330	0
8	2	1977	44.8760	0
3	3	1977	44.7260	0
6	4	1977	44.6010	0
6	5	1977	44.5660	0
15	6	1977	44.7580	0

15	7	1977	44.8160	0
11	8	1977	45.0110	0
14	9	1977	45.0510	0
14	10	1977	45.0560	0
17	11	1977	44.8980	0
12	12	1977	44.7510	0
6	1	1978	44.5840	0
16	2	1978	44.3200	0
3	3	1978	44.3910	0
27	4	1978	44.2610	0
22	5	1978	44.5930	0
22	6	1978	44.6320	0
19	7	1978	45.0100	0
18	8	1978	45.1580	0
14	9	1978	45.1850	0
17	10	1978	45.3050	0
27	11	1978	45.1050	0
19	12	1978	45.0050	0
16	1	1979	44.8550	0
20	2	1979	44.6550	0
16	3	1979	44.5950	0
24	4	1979	44.5850	0
16	5	1979	44.5150	0
13	6	1979	44.6850	0
17	7	1979	44.8850	0
16	8	1979	44.9350	0
11	9	1979	45.0350	0
12	10	1979	45.0050	0
12	11	1979	44.8350	0
14	12	1979	44.7450	0
15	1	1980	44.6050	0
19	2	1980	44.3250	0
24	3	1980	44.1810	0
28	4	1980	44.4350	0
22	5	1980	44.5050	0
27	6	1980	44.6450	0
22	7	1980	44.8150	0
19	8	1980	44.9150	0
18	9	1980	45.0050	0
20	10	1980	44.9450	0
13	11	1980	44.9350	0
16	12	1980	44.8450	0
22	1	1981	44.5250	0
13	2	1981	44.4150	0
18	3	1981	44.3350	0
21	4	1981	44.2450	0
19	5	1981	44.2550	0
15	6	1981	44.6750	0
17	7	1981	44.7450	0
17	8	1981	45.0350	0
16	9	1981	45.0650	0
20	10	1981	45.1350	0
16	11	1981	45.0850	0
15	12	1981	44.8250	0
18	1	1982	44.7100	0
23	2	1982	44.5200	0
17	3	1982	44.4400	0
20	4	1982	44.3400	0
19	5	1982	44.3900	0
23	6	1982	44.6800	0
14	7	1982	44.6900	0
13	8	1982	44.9200	0
17	9	1982	44.9900	0
22	10	1982	44.9400	0

15	11	1982	44.8400	0
20	12	1982	44.7300	0
19	1	1983	44.4600	0
22	2	1983	44.4400	0
18	3	1983	44.3900	0
20	4	1983	44.0600	0
27	5	1983	44.1500	0
20	6	1983	44.5200	0
14	7	1983	44.6700	0
23	8	1983	44.9600	0
20	9	1983	44.9900	0
17	10	1983	44.9300	0
10	11	1983	44.8400	0
19	12	1983	44.6700	0
23	1	1984	44.4400	0
21	2	1984	44.3400	0
21	3	1984	44.2800	0
12	4	1984	44.2400	0
16	5	1984	44.4000	0
14	6	1984	44.6000	0
17	7	1984	44.7100	0
16	8	1984	44.9500	0
17	9	1984	44.9000	0
18	10	1984	44.7200	0
14	11	1984	44.8000	0
13	12	1984	44.6600	0
23	1	1985	44.4000	0
19	2	1985	44.2000	0
25	3	1985	44.0200	0
18	4	1985	43.9900	0
17	5	1985	44.0200	0
18	6	1985	44.1500	0
11	7	1985	44.6300	0
15	8	1985	44.8200	0
12	9	1985	44.7400	0
18	10	1985	44.7200	0
14	11	1985	44.6300	0
17	12	1985	44.4400	0
28	1	1986	44.3000	0
21	2	1986	44.3400	0
20	3	1986	44.4600	0
23	4	1986	44.3200	0
4	6	1986	44.4400	0
30	6	1986	44.7900	0
28	7	1986	44.9800	0
21	8	1986	45.1600	0
2	10	1986	45.1420	0
31	10	1986	45.1220	0
28	11	1986	44.9920	0
31	12	1986	44.7520	0
3	2	1987	44.5120	0
6	3	1987	44.3120	0
2	4	1987	44.3120	10
5	5	1987	44.4400	0
4	6	1987	44.4820	0
30	6	1987	44.7500	0
28	7	1987	44.8590	0
26	8	1987	45.1480	0
25	9	1987	45.1280	0
29	10	1987	45.0370	0
27	11	1987	44.9220	0
24	12	1987	44.7750	0
22	1	1988	44.6000	0
25	2	1988	44.2660	0

30	3	1988	44.0160	0
26	4	1988	44.0290	0
16	5	1988	44.3120	0
16	6	1988	44.5900	0
12	7	1988	44.7000	0
10	8	1988	44.8700	0
19	9	1988	44.9000	0
24	10	1988	45.0300	0
17	11	1988	44.9600	0
7	12	1988	44.8480	0
4	1	1989	44.6350	2
13	2	1989	44.3800	0
9	3	1989	44.2720	0
5	4	1989	44.1000	10
12	5	1989	44.1800	0
7	6	1989	44.4550	0
19	7	1989	44.6100	0
10	8	1989	44.8000	0
13	9	1989	44.8550	0
24	10	1989	44.8800	2
17	11	1989	44.7900	0
7	12	1989	44.6450	0
5	1	1990	44.4400	0
2	2	1990	44.4200	0
14	3	1990	44.2400	0
10	4	1990	44.2350	0
3	5	1990	44.2750	0
5	6	1990	44.3700	0
4	7	1990	44.4600	0
1	8	1990	44.7600	0
3	9	1990	44.7900	0
4	10	1990	44.8000	0
5	11	1990	44.7600	0
3	12	1990	44.6100	0
3	1	1991	44.3700	0
6	2	1991	43.9400	0
11	3	1991	44.2400	0
9	4	1991	44.3000	0
13	5	1991	44.3500	0
11	6	1991	44.5600	0
8	7	1991	44.8900	0
5	8	1991	45.1800	0
4	9	1991	45.2100	0
2	10	1991	45.2600	0
6	11	1991	45.2000	0
10	12	1991	45.0500	0
7	1	1992	44.9350	0
5	2	1992	44.7400	0
5	3	1992	44.7100	0
1	4	1992	44.6350	0
5	5	1992	44.6000	0
4	6	1992	44.6600	0
3	7	1992	44.9400	0
10	8	1992	45.1800	0
3	9	1992	45.3000	0
5	10	1992	45.3000	0
3	11	1992	45.2000	0
3	12	1992	45.1500	0
6	1	1993	44.9400	0
4	2	1993	44.7600	0
3	3	1993	44.6500	0
2	4	1993	44.5200	0
12	5	1993	44.5900	0
2	6	1993	44.6900	0

2	7	1993	44.8300	0
3	8	1993	44.9800	0
6	9	1993	45.1500	0
6	10	1993	45.2100	0
2	11	1993	45.1300	0
3	12	1993	44.9900	0
6	1	1994	44.7600	0
4	2	1994	44.5500	0
3	3	1994	44.3700	0
7	4	1994	44.1900	0
5	5	1994	44.2400	0
7	6	1994	44.5200	0
5	8	1994	44.9140	1
12	9	1994	44.9900	1
5	10	1994	44.9400	1
2	11	1994	44.8300	1
5	12	1994	44.6400	1
6	1	1995	44.3650	1
2	2	1995	44.1100	1
1	3	1995	44.1200	1
16	3	1995	44.1600	1
4	4	1995	44.2950	1
2	5	1995	44.2800	1
8	6	1995	44.6100	1
4	7	1995	44.6400	1
9	8	1995	44.9200	1
11	9	1995	44.9900	1
5	10	1995	44.9400	1
8	11	1995	44.9000	1
6	12	1995	44.7520	1
11	1	1996	44.4800	1
20	2	1996	44.3100	1
13	3	1996	44.3200	1
10	4	1996	44.1550	1
17	5	1996	44.3100	1
17	6	1996	44.4100	1
15	7	1996	44.7250	1
15	8	1996	44.9600	1
11	9	1996	45.0400	1
7	10	1996	45.0700	1
6	11	1996	45.0250	1
2	12	1996	44.9400	1
6	1	1997	44.6500	1
4	2	1997	44.4600	1
4	3	1997	44.2700	1

6142517 LAKES AND WETLANDS

LAKE THOMSON 609 U 50 389374 6442963 14.309

	Date	Level (mAHD)	
2	5 1952	12.9810	0
26	9 1952	13.8990	0
2	9 1953	13.9690	0
15	5 1962	10.8480	0
18	4 1963	10.9730	0
7	8 1963	13.0000	0
13	9 1963	13.7400	0
23	10 1963	13.8780	0
29	9 1964	14.3990	0
22	8 1967	15.1180	0
3	10 1968	15.5110	0
6	11 1968	15.4870	0
5	12 1968	15.3280	0
17	12 1968	15.2400	0
15	9 1969	14.9990	0
21	5 1971	13.6760	0
30	6 1971	13.7740	0
3	8 1971	13.8560	0
2	9 1971	13.8960	0
4	10 1971	14.0480	0
3	11 1971	14.0630	0
2	12 1971	13.9260	0
3	2 1972	13.4330	0
2	3 1972	13.2220	0
6	4 1972	13.0520	0
26	4 1972	13.0300	0
30	5 1972	12.9780	0
4	7 1972	13.1460	0
1	8 1972	13.2710	0
30	8 1972	13.3650	0
4	10 1972	13.3840	0
1	11 1972	13.3010	0
5	12 1972	13.0760	0
7	2 1973	12.6340	0
6	3 1973	12.4570	0
5	4 1973	12.3350	0
2	5 1973	12.3140	0
1	6 1973	12.4330	0
28	6 1973	12.5760	0
30	7 1973	12.8630	0
3	9 1973	13.1260	0
4	10 1973	13.4550	0
1	11 1973	14.0500	0
30	11 1973	13.9000	0
12	2 1974	12.8210	0
11	3 1974	12.6910	0
8	4 1974	12.5990	0
2	5 1974	12.5790	0
31	5 1974	12.7690	0
4	7 1974	12.8790	0
9	8 1974	13.3920	0
4	9 1974	13.7340	0
7	10 1974	13.6840	0
12	11 1974	13.6640	0
17	12 1974	13.4040	0
5	2 1975	13.1540	0
12	3 1975	12.9090	0
9	4 1975	12.8290	0
14	5 1975	12.7840	0
10	6 1975	12.9010	0
7	7 1975	13.0270	0

12	8	1975	13.3490	0
5	9	1975	13.4690	4
9	10	1975	13.5290	0
11	11	1975	13.4750	0
12	12	1975	13.2840	0
11	2	1976	12.8500	0
18	3	1976	12.6790	0
22	4	1976	12.6390	0
10	5	1976	12.6190	0
10	6	1976	12.7090	0
13	7	1976	12.8340	0
17	8	1976	13.0690	0
20	9	1976	13.1290	0
8	10	1976	13.1490	0
22	11	1976	12.9720	0
21	4	1977	12.0400	0
11	5	1977	12.0040	0
17	6	1977	12.1720	0
14	7	1977	12.2120	0
21	9	1977	12.3690	0
24	10	1977	12.3320	0
17	11	1977	12.2290	0
17	2	1978	11.2640	0
28	3	1978	10.9340	0
21	4	1978	10.9340	0
12	5	1978	10.9340	0
9	6	1978	11.9040	0
19	7	1978	12.2640	0
22	8	1978	12.0500	0
15	9	1978	12.5640	0
16	10	1978	12.7790	0
15	11	1978	12.6040	0
15	12	1978	12.4440	0
16	1	1979	12.2240	0
15	2	1979	11.9340	0
15	3	1979	11.6740	0
18	4	1979	11.4940	0
17	5	1979	11.3940	0
14	6	1979	11.7340	0
16	7	1979	12.0540	0
15	8	1979	12.1440	0
17	9	1979	12.1540	0
15	10	1979	12.1790	0
15	11	1979	12.1040	0
17	12	1979	11.5740	0
16	1	1980	11.3540	0
15	2	1980	11.2240	0
17	3	1980	10.8940	0
15	4	1980	10.7490	0
15	5	1980	11.0340	0
16	6	1980	11.3040	0
15	7	1980	12.1340	0
15	8	1980	12.4040	0
15	9	1980	12.5040	0
15	10	1980	12.5340	0
14	11	1980	12.4540	0
15	12	1980	12.2340	0
15	1	1981	12.0040	0
16	2	1981	11.6440	0
16	3	1981	11.4240	0
16	4	1981	11.2640	0
18	5	1981	11.1240	0
16	6	1981	11.8540	0
16	7	1981	12.0340	0

14	8	1981	12.4040	0
15	9	1981	12.5640	0
16	10	1981	12.5640	0
17	11	1981	12.5440	0
16	12	1981	12.3740	0
15	1	1982	12.1340	0
15	2	1982	12.0840	0
15	3	1982	11.7740	0
15	4	1982	11.5040	0
18	5	1982	11.4300	0
15	6	1982	12.1040	0
15	7	1982	12.7140	0
16	8	1982	12.6440	0
15	9	1982	12.5440	0
18	10	1982	11.7600	0
15	11	1982	12.0140	0
16	12	1982	12.1600	0
17	1	1983	12.0800	0
15	2	1983	11.8000	0
15	3	1983	11.5920	0
18	4	1983	11.2600	0
16	5	1983	11.3200	0
15	6	1983	11.5600	0
15	7	1983	12.2200	0
16	8	1983	12.2100	0
15	9	1983	12.7600	0
15	11	1983	12.3500	0
16	12	1983	12.3100	0
16	1	1984	12.1100	0
15	2	1984	11.6600	0
19	3	1984	11.6100	0
16	4	1984	11.5100	0
9	5	1984	11.5100	0
15	6	1984	12.3400	0
16	7	1984	12.4300	0
15	8	1984	12.6000	0
17	9	1984	12.8500	0
15	10	1984	12.7900	0
15	11	1984	12.7800	0
19	12	1984	12.6200	0
15	1	1985	12.5800	0
14	2	1985	12.1800	0
14	3	1985	12.0800	0
17	4	1985	11.7100	0
9	5	1985	11.6200	0
17	6	1985	12.1800	0
17	7	1985	12.3300	0
14	8	1985	12.4800	0
16	9	1985	12.5600	0
17	10	1985	12.6600	0
15	11	1985	12.5000	0
16	12	1985	12.2600	0
20	1	1986	11.7600	0
17	2	1986	11.4400	0
17	3	1986	11.5800	0
17	6	1986	11.9900	0
15	7	1986	12.3500	0
14	8	1986	12.7300	0
15	9	1986	12.9750	0
15	10	1986	13.0410	0
12	11	1986	12.9950	2
15	12	1986	12.8240	0
15	1	1987	12.6100	0
5	3	1987	12.2640	10

31	3	1987	12.2640	10
29	4	1987	11.7790	10
25	5	1987	12.1920	0
26	6	1987	12.4070	0
23	7	1987	12.5250	0
26	8	1987	12.9060	0
22	9	1987	12.9010	0
29	10	1987	12.8790	0
23	11	1987	12.7950	0
22	12	1987	12.6520	0
1	2	1988	12.4000	0
1	3	1988	11.9650	3
29	3	1988	11.7350	0
29	4	1988	12.2200	0
19	5	1988	12.1150	0
22	6	1988	12.4670	0
21	7	1988	12.6840	0
23	8	1988	12.9100	0
13	9	1988	12.9000	0
13	12	1988	13.1050	0
17	1	1989	12.8790	0
22	2	1989	12.6760	0
15	3	1989	12.5900	0
10	4	1989	12.4910	0
1	6	1989	12.5680	0
19	6	1989	12.5730	0
27	7	1989	12.8340	0
29	8	1989	12.8300	0
22	9	1989	12.8000	0
20	10	1989	12.8210	0
24	11	1989	12.9880	0
22	12	1989	12.8880	0
25	1	1990	12.6350	0
20	2	1990	12.5210	0
28	3	1990	12.4000	0
20	4	1990	12.4000	0
23	5	1990	12.3910	0
15	6	1990	12.4900	0
11	7	1990	12.4800	0
20	8	1990	12.7400	0
17	9	1990	12.7800	0
5	10	1990	12.7800	0
13	11	1990	12.7000	0
4	12	1990	12.6000	0
3	1	1991	12.4000	0
27	2	1991	12.1800	0
20	3	1991	11.7000	10
10	4	1991	11.7000	0
16	5	1991	11.7000	10
12	6	1991	11.8000	0
22	7	1991	12.4500	0
12	8	1991	12.7000	0
12	9	1991	12.8200	0
8	10	1991	12.9380	0
11	11	1991	12.8950	0
11	12	1991	12.8200	0
15	1	1992	12.6000	0
6	2	1992	12.4420	0
11	3	1992	12.6500	1
3	4	1992	12.6930	1
15	5	1992	12.5650	1
17	6	1992	12.8300	1
23	7	1992	13.1520	1
19	8	1992	13.4340	1

15	9	1992	13.7910	1
5	10	1992	13.8590	0
5	11	1992	13.7990	1
12	11	1992	13.7970	1
9	12	1992	13.7390	1
17	12	1992	13.6970	1
14	1	1993	13.5070	1
18	2	1993	13.2540	1
9	3	1993	13.1640	1
14	4	1993	13.0700	1
13	5	1993	12.9970	0
16	6	1993	13.1100	1
12	7	1993	13.2450	1
9	8	1993	13.3700	1
13	9	1993	13.5550	1
13	10	1993	13.5700	0
16	11	1993	13.5000	0
20	12	1993	13.2500	1
12	1	1994	13.0700	1
8	2	1994	12.9000	1
8	3	1994	12.7000	0
20	4	1994	12.5000	1
18	5	1994	12.4400	0
14	6	1994	12.6300	0
12	7	1994	12.9500	0
16	8	1994	13.2200	1
13	9	1994	13.2800	1
17	10	1994	13.2400	1
19	10	1994	13.2200	1
8	11	1994	13.1400	1
15	11	1994	13.0900	0
13	12	1994	12.9400	1
10	1	1995	12.7100	1
7	2	1995	12.4800	0
9	3	1995	12.2600	1
11	4	1995	12.1200	1
5	5	1995	12.0200	1
13	6	1995	12.2750	1
13	7	1995	12.3770	1
16	8	1995	12.6050	1
12	9	1995	12.6950	1
31	10	1995	12.7000	1
22	11	1995	12.6380	1
12	12	1995	12.4900	1
17	1	1996	12.2700	1
14	2	1996	12.0700	1
25	3	1996	12.0000	10
16	4	1996	12.0000	10
17	5	1996	12.0000	10
27	6	1996	12.0450	1
26	7	1996	12.2950	1
26	8	1996	12.5600	1
19	9	1996	12.6500	1
30	10	1996	12.7380	1
19	11	1996	12.7000	1
23	12	1996	12.5100	1
16	1	1997	12.3100	1
11	2	1997	12.1000	1

6142546 LAKES AND WETLANDS

GIBBS ROAD SWAMP U 50 397300 6441700 25.006

Date	Level (mAHD)
22 7 1991	24.6540 0
19 8 1991	24.7610 0
12 9 1991	24.7350 0
7 10 1991	24.6500 0
11 11 1991	24.4430 0
11 12 1991	24.2900 0
14 1 1992	24.0800 0
6 2 1992	23.9970 0
11 3 1992	24.1800 1
3 4 1992	24.1750 1
15 5 1992	24.0800 1
17 6 1992	24.3800 1
2 9 1992	24.7500 1
5 10 1992	24.4790 1
2 11 1992	24.2900 1
7 12 1992	24.1800 1
5 1 1993	24.0000 10
5 2 1993	24.0000 1
2 3 1993	24.0000 10
1 4 1993	24.0000 10
3 5 1993	24.0000 10
1 6 1993	24.0000 10
5 7 1993	24.0000 10
3 8 1993	24.3200 0
1 9 1993	24.4950 1
5 10 1993	24.4950 1
1 11 1993	24.3150 1
10 12 1993	24.0600 1
5 1 1994	24.0000 10
2 2 1994	24.0000 1
8 3 1994	24.0000 10
6 4 1994	24.0000 10
3 5 1994	24.0000 1
7 6 1994	24.0000 10
30 6 1994	24.0000 1
2 8 1994	24.5010 1
5 9 1994	24.4550 1
6 10 1994	24.3750 1
31 10 1994	24.2050 1
1 12 1994	24.0530 1
4 1 1995	24.0000 10
1 2 1995	24.0000 10
1 3 1995	24.0000 10
31 3 1995	24.0000 10
1 5 1995	24.0000 1
8 6 1995	24.0100 1
4 7 1995	24.0000 10
3 8 1995	24.4750 1
4 9 1995	24.5210 1
3 10 1995	24.4500 1
1 11 1995	24.4650 1
5 1 1996	24.1100 1
9 2 1996	24.0000 10
5 3 1996	24.0000 1
1 4 1996	24.0000 1
10 5 1996	24.0000 10
6 6 1996	24.0000 1
26 6 1996	24.0150 1
2 8 1996	24.6480 1
3 9 1996	24.5800 1
1 10 1996	24.6900 1

code 10 = w/c Below
bottom of Staff Gauge
(probably dry).

6 11 1996 24.4100 0
2 12 1996 24.3000 1
2 1 1997 24.0800 1
4 2 1997 24.0000 10
4 3 1997 24.0000 10
27 3 1997 24.0000 1

APPENDIX D

Maps showing the eleven wetlands studied in this report.
The maps were obtained from the Department of Environmental Protection.

