(1251)

4. POPULATION AND WATER NEEDS

4(1) WATER SUPPLY AND ALTERNATIVE SOURCES

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Introduction

This paper presents an overview of the major water resources available in the south-west region of the State and possible demands on them. Surface and underground water resources are identified and the costs of these sources and possible alternatives considered.

The water resources of the region are limited and could well impose a restriction on future development. Therefore, although this symposium is to discuss the groundwater resources of the Swan Coastal Plain, it is important when considering water supply and alternative sources for this area, to take a broader view and consider the requirements of urban needs, industry, agriculture and the environment in the whole region.

Any realistic projection of the demand for water in the Perth sub-region will show that the conventional resources within the sub-region will be fully committed well before the turn of the century. This further emphasises the need for an overall view when planning the water resources of the whole region.

This paper is aimed solely at providing background information and general observations on possible future resources and demands. The demands given are not part of any definite prediction, nor do the figures imply the existence of a specific regional water development programme, they are used to demonstrate a possible situation and how the resources of the State may be able to meet the requirements.

The South West Regional Water Planning Study

Objectives and Scope

A framework study has been undertaken jointly by the Public Works Department of Western Australia and the Perth Metropolitan Water Board as a preliminary planning study of water use in the region up to the year 2000. The study is the first round of an iterative programme of regional water planning studies each of which updates and refines previous work and incorporates feed back information on related issues.

In this preliminary round the principal objectives were:

(i) Development of an improved perspective into future water use alternatives;

(ii) Assessment of the broad roles of specific water resources and their relative potentials;

(iii) Identification and clarification of issues and problems needing further investigation;

(iv) Generation of feedback from sectors of interest not represented in the study team;

(v) Assessment of the magnitude of future cash flow requirements for water supply purposes.

This phase of the study was undertaken within the water authorities, with the benefit of some discussions with other parties. As work progresses to later rounds, representation on the study team will increase. Eventually, work should proceed within a broad framework of land use planning for the region.

Method of Attack

The planning study proceeded along the lines of:-

(i) Preparing basin by basin resource inventories;

(ii) Preparing basin by basin demand projections for alternative patterns of growth:

(iii) Displaying the future relationships between demand and resources;

(iv) Calculating basin water balances for differing regional development scenarios and strategies of resource development. The basin balances relate demand, supply and water transfers from adjacent basins;

(v) Costing alternative regional schemes.

The Region

Boundaries

The regional boundaries have not been rigidly defined in the study. The area of consideration has been within the south-west perimeter strip from Albany to Geraldton and Agricultural Water Supply and the Great Southern Towns Water Supply in the hinterland.

The subdivision of the Region into sub-regions (or Basins) A to 0 on Fig. 4(2) has followed selected watershed lines which were chosen for their relation to patterns of water development.

Within the greater region, interest has focussed down on the sector between Jurien Bay and Walpole (Sub-regions B to M on Fig. 4(2)). Studies indicate that in planning water developments for around the year 2 000, designs for water schemes in this sector become interdependent although generally independent of sub-regions A, N and 0.

Throughout this paper discussion and tables will relate to the more restricted definition of the region, namely the area between Jurien and Walpole. However with the exception of Fig. 4(2) the maps and diagrams are illustrative of the greater region.

Principal Zones of Water Resources and Supply Development.

From North to South the region can be regarded as composing four distinct zones in terms of water resources and water supply development (Fig. 4(1)).

The Northern most area, the Moore Zone, is as yet virtually unexploited as a water source but has significant reserves of underground water.

Immediately southwards is the Perth Metropolitan Zone where surface sources have been heavily exploited and supplemented by underground water as a source of urban supplies. Metropolitan sources also supply the Goldfields and Agricultural Water Supply Scheme for piping water to towns and farms of the hinterland and to mining communities some 500 and 600 km inland.

Further southwards is the Irrigation Zone where surface resources have been partly developed for irrigation purposes and supply of the Great Southern Town Water Supply Scheme. The dominant use is summer watering of pasture for a dairy industry. Towns in this region create a relatively small demand and are supplied predominantly from underground.

The Southern Zone is the most water-abundant area of the region and contains a relatively large quantity of unexploited surface water as well as relatively large underground water resources on the coastal plain. Some small scale irrigation development is centred at Manjimup.

The water usage of the South-West Region is dominated by the Metropolitan Sub-region and the Irrigation District.

Resource Inventory

Basis

An inventory of the usable component of surface and underground water resources has been prepared basin by basin for 16 resource basins. These basins are shown in Fig. 4(2).

Environmental Considerations

The estimates of usable resources include all known prospects for development with only limited regard to practical constraints which may arise in the future. In particular, it has been assumed in the basic inventory that environmental factors do not reduce the usable resources. This is an optimistic assumption unless environmental needs are treated as a component of demand.

Underground Water

The underground water inventory is based on reconnaissance estimates prepared by T.T. Bestow of the Geological Survey Branch of the Mines Department of Western Australia. Yields of the underground water sources have been based on the estimated average recharge.

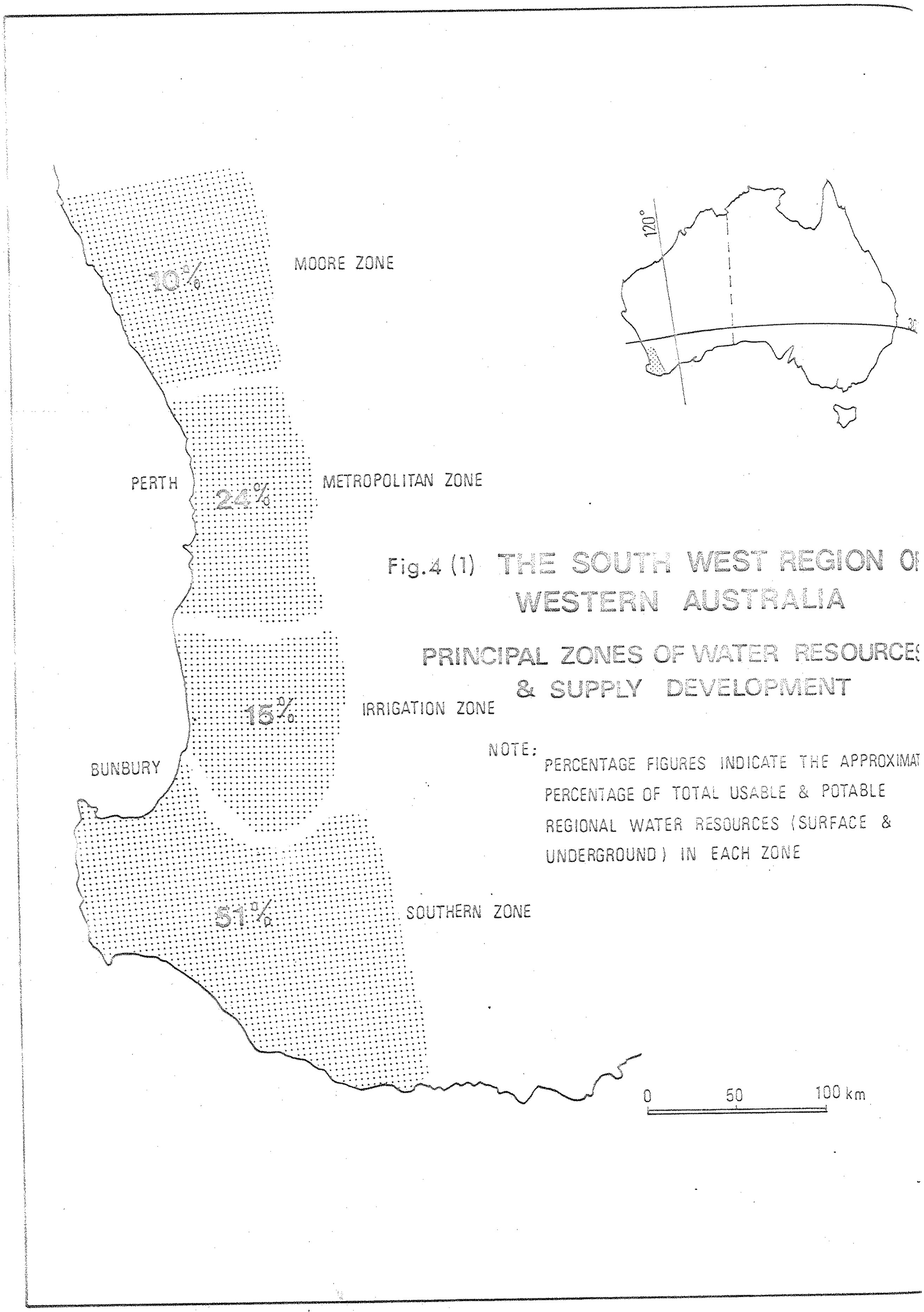

Fig.4 (1) THE SOUTH WEST REGION O
WESTERN AUSTRALIA

PRINCIPAL ZONES OF WATER RESOURCE
& SUPPLY DEVELOPMENT

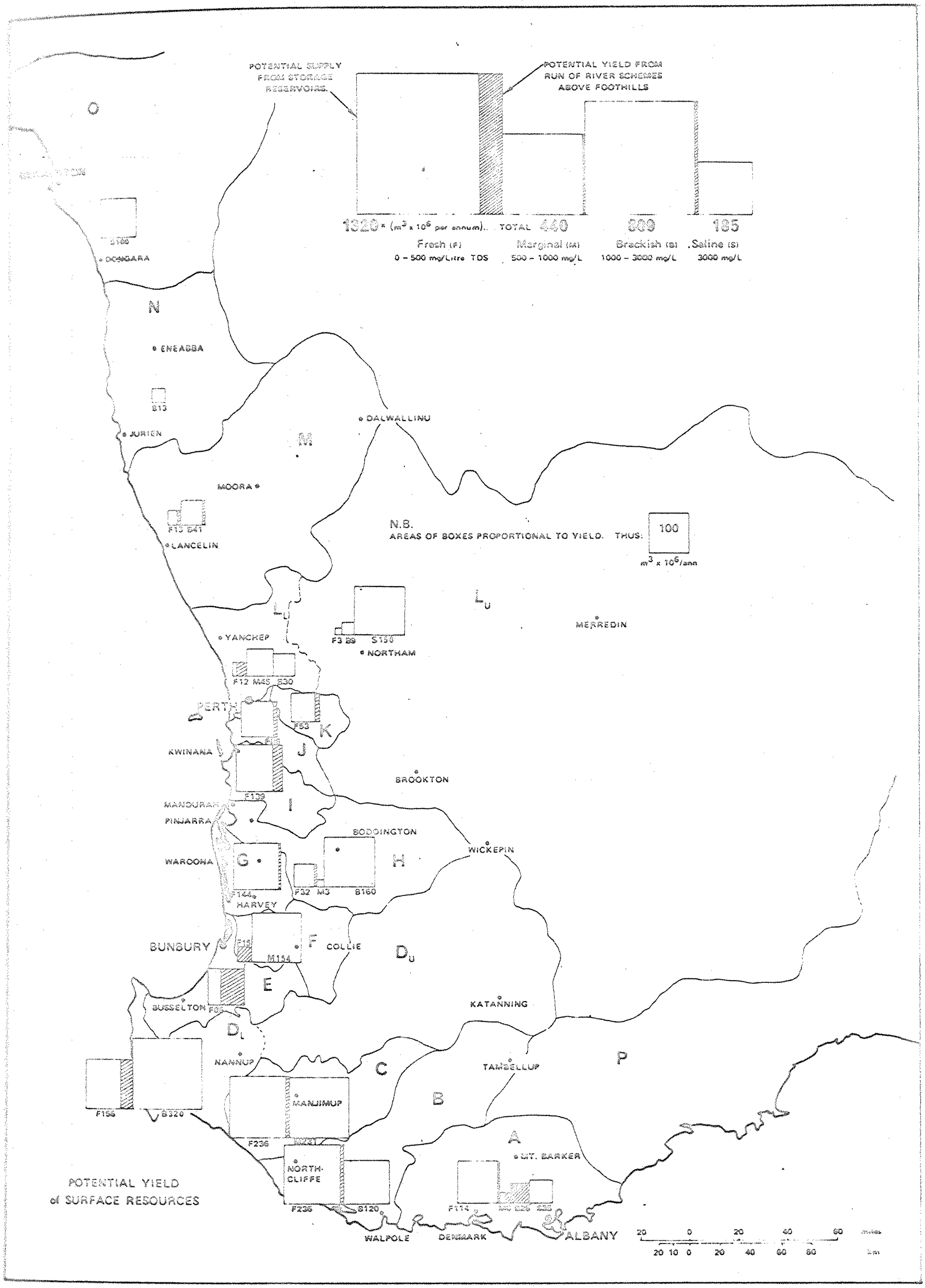

Fig. 4(2). Total potential yield of S.W. surface water including run of river and key to sub regional diagrams.

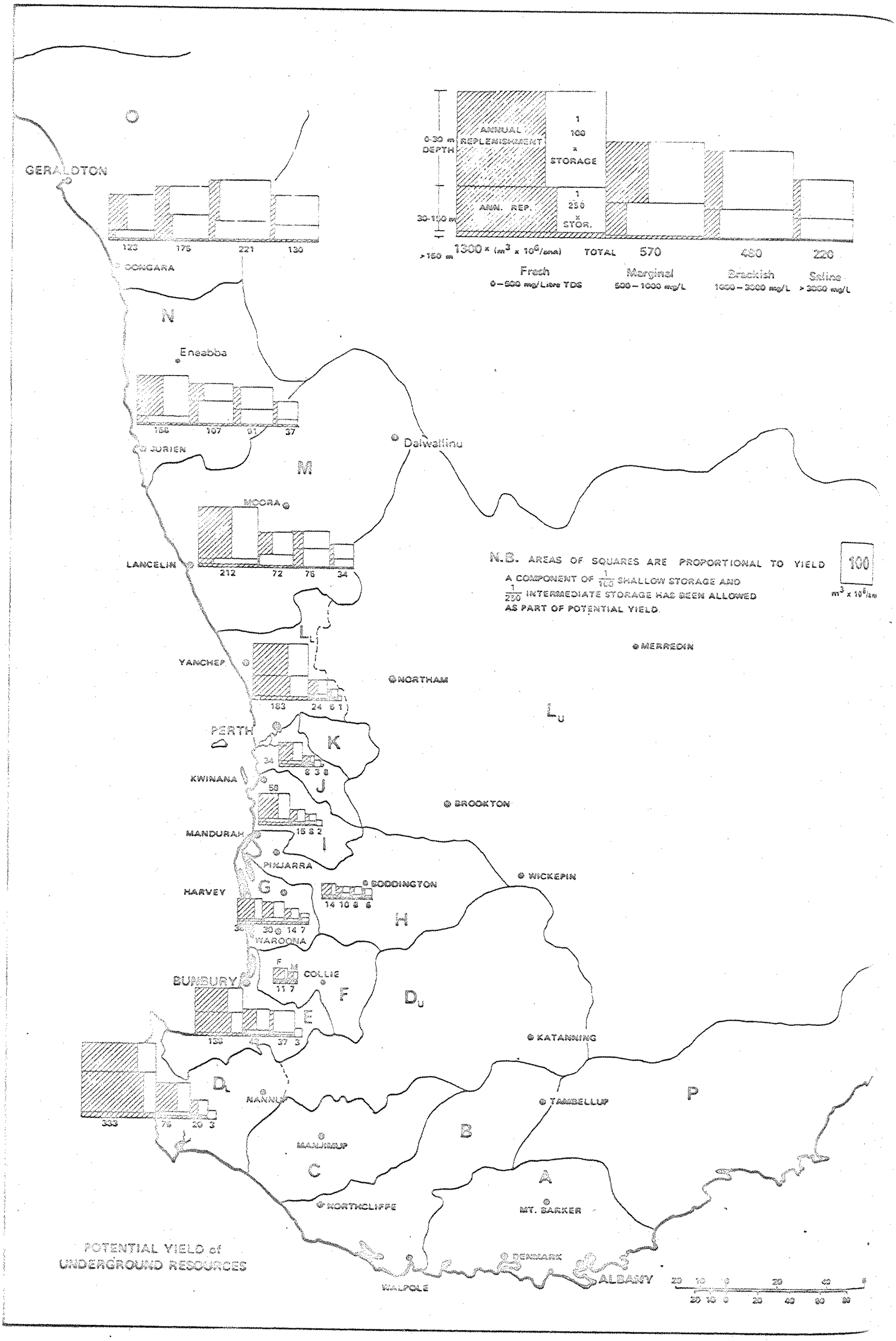

Fig. 4(3). Total potential yield of underground water sub regions D to O and key to sub regional diagrams.

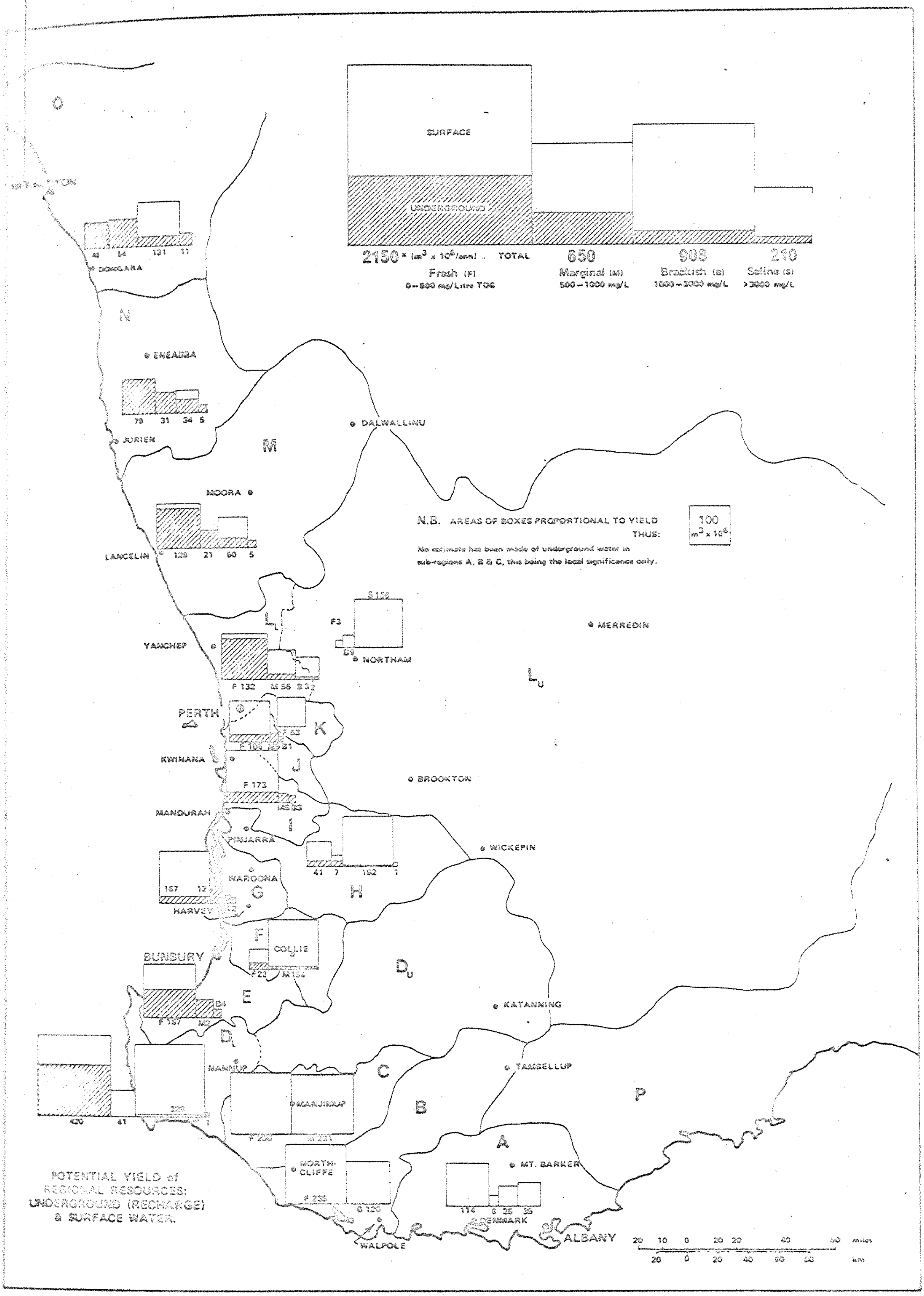

Fig. 4(4). Total potential yield, u/g recharge and surface water and key to sub regional diagrams.

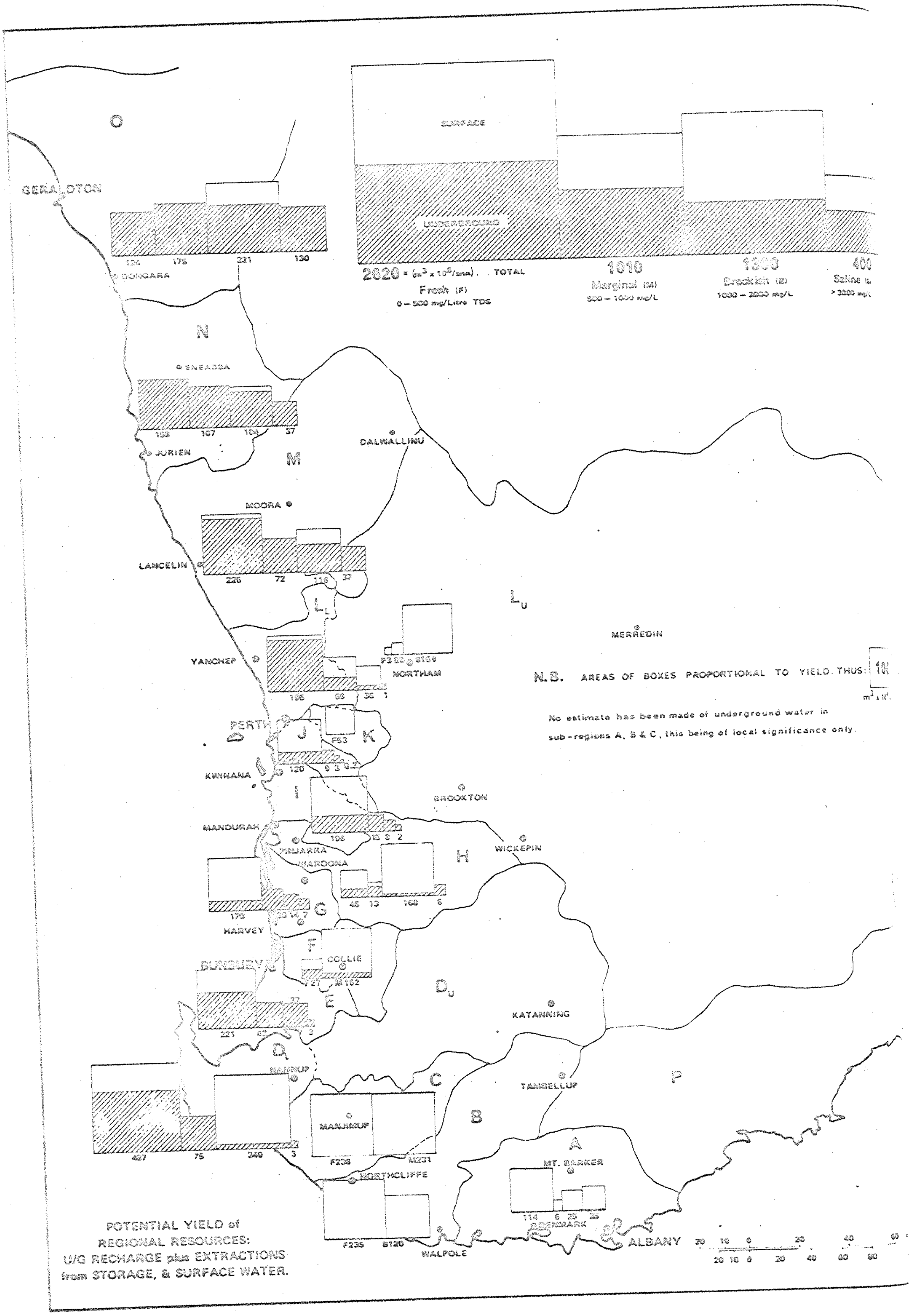

Fig. 4(5). Total potential yield, u/g recharge plus extractions from storage, and surface water and key to sub regional diagrams.

TABLE 4(1)

WATER RESOURCE INVENTORY - USABLE COMPONENT - BASINS B TO M

JURIEN - WALPOLE

All figures represent $10^6 \times m^3$/annum

RESOURCES	POTABLE			NON POTABLE			TOTAL
	Fresh 0-500 mg/l T.D.S.	Marginal 500-100 mg/l	Sub Total	Brackish 1000-3000 mg/l	Saline 3000 mg/l T.D.S.	Sub Total	
Surface Water Yield	1360	280	1640	670	30	700	2340
U/G Water Recharge	700	120	820	40	10	50	870
SUB TOTAL STEADY YIELD	2060	400	2480	710	40	750	3210
Mineable U/G	320	160	480	130	50	180	660
TOTAL USABLE (if supplemented by mining)	2380	560	2960	840	90	930	3890

(Fig. 4(3)). In addition, an assessment has been made of possible gains in yield of underground water if these sources are "mined." The "mining" component of the yield has been assumed on the basis of withdrawing the extractable volume over 100 years for aquifers down to 30 metres and over 250 years for aquifers from 30 to 150 metres. In the case of the shallow aquifers, the lowering of the water table by such "mining" could reduce evapotranspiration losses and increase the net recharge rate.

Surface Water

The surface water inventory is based on re-assessments of figures presented in the Usable Surface Water Resources of Western Australia, P.W.D. 1970. (Fig. 4(2)).

It should be emphasised that the inventory is based largely on reconnaissance selection of dam sites and approximate yield estimates, and may include sources which ultimately prove unsuitable for development. The underground water yield estimates are considered to have a particularly large range of potential error because of the highly approximate statistical method of resource estimation which had to be used for this assessment and the paucity of data in many basins including the important basins Moore and Blackwood.

In compiling this inventory, it has been assumed that a stationary resource situation prevails and that apart from the possible mining of some underground water, all resources will be regarded as unchanging. This is an optimistic simplification, because changes that are mostly detrimental, can be expected to occur for reasons such as:-

(i) Continued catchment clearing for agriculture and consequent increase in stream salinities;

(ii) Continued spread of Jarrah die-back and its consequent effects on salinity;

(iii) Possible pollution of underground water in localised areas such as near solid and liquid wastes disposal sites;

(iv) Possible allocation of some catchments or development sites to non-compatible uses, e.g. railways through dam sites or orchard developments in potential storage basins;

(v) Expansion of mining, the development of roads and powerline routes, and other catchment land uses, which although small compared to agricultural land use are an added pressure on catchments already under considerable stress.

Resources

The total usable resources of the region from Jurien to Walpole are summarised in Table 4(1) on the basis of type and quality.

TABLE 4(2)

COMPARISON OF ACTUAL AND POTENTIAL YIELD OF SOME W.A. RIVERS

	STORAGE $m^3 \times 10^6$	AVERAGE ANNUAL DIS-CHARGE $m^3 \times 10^6$	YIELD $m^3 x10^6$	YIELD M.G.D. (A.V.)	% REGULATION	YIELD / WELLINGTON YIELD
Mundaring Weir - Alone	76	57	23	14	40	0.23
Mundaring with 42 m.g.d. Pumpback	76	72	29.5	18	40	0.30
Mundaring with 42 m.g.d. Pumpback and Upper Helena	322	72	50	30	69	0.50
Canning Dam	93	65	46	28	71	0.46
South Dandalup	208	34	22	13	55	0.22
Serpentine and Pipehead	177	81	57	34	75	0.57
Murray (Potential Res.)	?	326	180	108	55	1.80
Logue	23.5)					
Harvey	8)	127	67	40	52	0.67
Stirling	55)					
Logue,	23.5)					
New Harvey, and	140)	127	98	59	77	0.98
Stirling (Potential)	55)					
Samson	9.1)					
Waroona	14.8)	32	20	12	63	0.20
Drakesbrook	2.3)					
Wellington	172	185	100	60	54	1
Wellington Plus Burekup (Potential)	?	220	154	92	70	1.54
Ferguson River Potential Site	31	19	14	8	74	0.14
St. John Brook	?	75	55	33	73	0.55
Donnelly River	?	170	120	72	71	1.20
Warren River	?	330	231	139	70	2.31
Deep River	?	175	120	72	69	1.20
Denmark	110	58	38	23	66	0.38
Ord	5 000 at F.S.L. 9 000 Effective	4 600	1 900	1 140	41	19.0
Fitzroy						
Dimond G.	11 000	1 800	950	450	53	7.50
Margaret R.	?	670	280	168	42	2.80
Leopold	?	410	170	102	41	1.70
Christmas	?	132	36	22	27	
TOTAL		3 012	1 436	742		12.36
Fortescue with conjunctive use	1 600	230	80	48	35	0.80
All South West Reservoirs	-	6 250	1 699	960 (Potable only)		16
All Kimberley Reservoirs	-	25 000	9 400	5 640		94

NOTE: The figures presented for Kimberley and Pilbara reservoirs are only for comparison. They have no bearing on planning in the South-West Region.

It is worth observing that the quality of 40% of the usable surface resources in Table 4(1) is marginal, brackish or saline, probably mostly as a result of clearing of catchments for agriculture. This observation emphasises that the assumption of a fixed resource inventory for the future may be rather optimistic.

Artificial Recharge of Groundwater Basins

Potential exists for the artificial recharge of underground aquifers. Three sources of recharge water are available, excess water over-flowing from hills reservoirs in winter, drainage water, and treated wastewater.

The M.W.S.S. & D.B. has already carried out one experiment on recharging the artesian aquifers with winter overflow water. Further experiments are planned during the next winter.

Drainage water may in time also be an attractive proposition for recharge as little or no pre-treatment may be required. Limited experiments of recharge of drainage water into the coastal limestone have been very successful.

However, there are problems. To get most benefit from recharged water it should be injected upstream of the groundwater extraction areas. Experience elsewhere has shown that recharge into fine sands similar to those that exist in these areas, is not necessarily a simple matter. Also the system of pumping stations and delivery mains needed to transfer the water to the recharge area would have to be sized to meet the fluctuations in run-off during the winter and would be expensive.

Treated sewage effluent is not such an attractive proposition. The amount of effluent available is relatively small, and would almost certainly need additional treatment before being used for recharge. Provided suitable recharge locations are found, the bacteriological problems are not severe, however, the nutrients in the water (nitrogen and phosphorus compounds) do pose considerable problems and they are relatively expensive to strip from the water.

Desalting

There is an unlimited supply of salt water available, however the costs of desalting are large and it is an energy intensive process. Multistage flash distillation is the most economical form presentl available to desalt seawater. With current energy costs this cann be seen as a viable alternative to natural water sources.

For some industrial requirements very pure water is needed, and i these cases desalting may be needed. However, these specific industrial requirements are not large enough to warrant a central ized desalting plant and would normally be met by ion-exchange treatment of water from the normal public supply.

Desalting of brackish water is also being investigated. However, when added to the cost of collection of the brackish water from its natural sources the costs are again high. There may be distinct possibilities for waters from low use factor desalination plants to be used conjunctively with those from conventional sources, such as hills reservoirs and groundwaters.

Importing Water

It has been suggested that water could be imported from the north-west of the State. While this is obviously technically feasible the capital cost of the pipeline alone makes it quite impracticable. Ignoring all costs other than the actual capital required for the pipeline itself, a conservative estimate to transport 30×10^6 m^3/annum from the Fitzroy area would be $2 200m, i.e. nearly $5.50/m.

Demands Considered in this Paper

Demands in the region are:-

(i) Urban
(ii) Industry
(iii) Private irrigation - parks and home gardens
(iv) Dairy industry irrigation
(v) Other irrigation - market gardens, etc.
(vi) Recreation
(vii) The environment.

No quantitative figures have been established for the latter two demands. Nevertheless they do impose a legitimate and increasingly significant demand on the water resources and the supply system. The cost of meeting these latter demands will largely be met by the consuming public either as real monetary costs or limitations on their uses for water.

In this paper only one base line pattern is discussed. This is for strong growth of Salvado, very modest achievements in decentralization, substantial expansion in bauxite mining, and other resource based industries of the region together with steady expansion of nickel mining in the Goldfields. The pattern also allows for growth of irrigation for whole milk production in the Collie/Harvey/Waroona area at a rate that would lag growth in whole milk production. However, studies presented at a recent symposium suggest that expansion of these irrigation schemes for whole milk production cannot be economically justified.

Table 4(3) gives a breakdown into major components of demand projected to 2002 assuming irrigation continues to expand. Assigning the year 2002 to this scenario implies a doubling time of 20 years for regional demand and 15 years (4.72% per year) for the Metropolitan Water System. This represents a slight slowing of growth in demand from current levels which correspond to a doubling time of about 12 years for the Metropolitan system.

TABLE 4(3)

DEMAND PROJECTIONS TO 2002 - SCENARIO B

BREAKDOWN TO MAJOR COMPONENTS

ASSUMES: High growth rate and Perth (Salvado) centred development with growth in whole milk production by irrigation

USE	DEMAND $m^3 x 10^6$/ann. 1972	DEMAND $m^3 x 10^6$/ann. 2002	DEMAND % OF TOTAL 1972	DEMAND % OF TOTAL 2002	AV. GROWTH RATE % PER YEAR
PERTH					
METROPOLITAN WATER BOARD	155	619	33.6	48.2	4.72
PRIVATE BORES (Domestic, Parks and Industry)	36	73	7.8	5.7	2.38
MISCELLANEOUS IRRIGATION	32	37	6.9	2.9	0.49
SUB TOTAL:	223	729	48.4	56.7	4.03
BALANCE OF REGION					
COLLIE-HARVEY-WAROONA IRRIGATION	151	246	32.8	19.1	1.64
MISCELLANEOUS IRRIGATION	31	68	6.7	5.3	2.65
G. & A.W.S. SCHEME	22	49	4.8	3.8	2.71
G.S.T.W.S. (Incl. Alwest, Muja & Local H'works)	10	52	2.2	4.0	5.65
BUNBURY - SCHEME & PRIVATE	12	50	2.6	3.9	4.87
OTHER URBAN & INDUSTRIAL	12	91	2.6	7.1	6.99
SUB TOTAL:	238	556	51.6	43.3	2.87
TOTAL:	461	1285	100	100	

Table 4(3) also shows that under this "baseline" scenario, the Metropolitan Water System, under the added impact of the Salvado proposal rises to a greater proportion of regional demand than at present.

Tables 4(4) and 4(5) show the population projections associated with Table 4(3). Work on the South-West Region Water Planning Study stopped in September 1973, but when it resumes alternative development patterns will be studied.

TABLE 4(4)

POPULATIONS OF STATISTICAL DIVISIONS

SCENARIO B

AREA OF STATISTICAL DIVISION	POPULATION 1971	POPULATION 2002	AVERAGE GROWTH RATE % PER ANNUM 1971-2002
South-West Division	77 504	202 090	3.14
South Agricultural Division	45 267	66 950	1.27
Central Agricultural Division	53 989	57 100	0.18
Northern Agricultural Division	42 653	77 000	1.92
East Goldfield Division	42 539	90 400 ++	2.46
Central Division	6 135	14 000 +	2.70
North-West Division	11 557	22 200	2.13
Pilbara Division	29 469	156 000	5.52
Kimberley Division	14 136	35 000	2.97
STATE EXCLUDING PERTH	323 249	720 740	2.62
PERTH DIVISION	701 392	1 920 000	3.30
STATE TOTAL	1 024 641	2 640 740	3.10

Notes: ++ Have included E. Murchison

\+ E. Murchison in E. Goldfields

TABLE 4(5)

POPULATIONS OF MAJOR CENTRES

SCENARIO B

CENTRE	POPULATION 1971	1991	2002	AVERAGE GROWTH RATE % PER ANNUM 1971-2002
Perth	701 392	1 390 000	1 920 000	3.30
Pinjarra	1 191	16 230	19 700	9.47
Mandurah	5 062	7 550	10 150	2.27
Collie	6 734	17 420	23 600	4.13
Bunbury (Incl. Alumina Town)	17 779	43 490	80 500	4.99
Manjimup	3 526	7 580	10 100	2.50
Albany (Incl. Alumina Town)	13 101	18 000	27 000	2.36

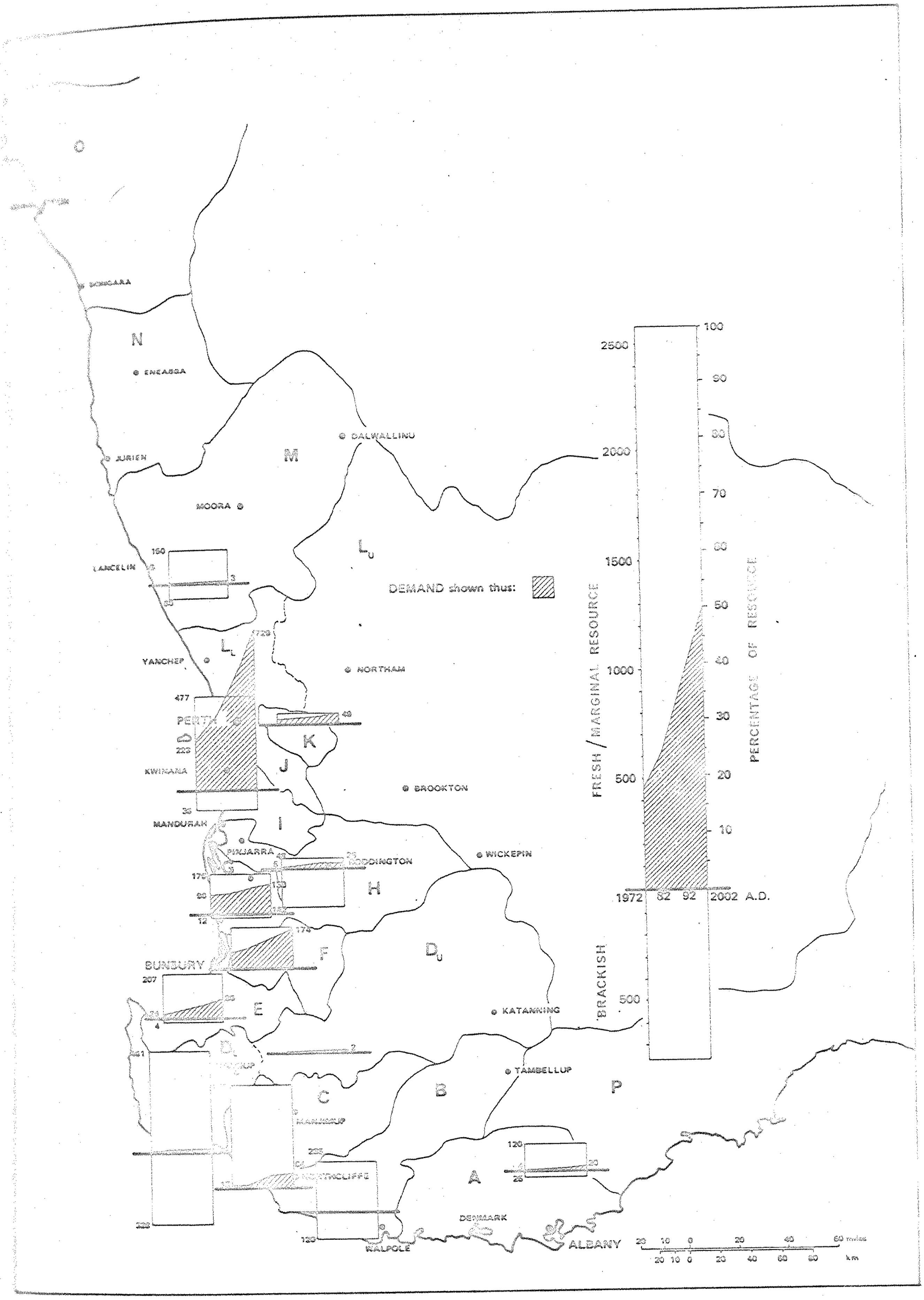

Fig. 4(6). Comparison of resources (excl. mining) with demand projection 'B_A' in million cubic metres per annum.

Overlay of Demand and Resources

Figure 4(6) depicts on a basin by basin basis the matching of basin demands and usable resources (without mining) up to the year 2002.

The following points will be evident from study of this diagram:-

(i) The Perth region's demand exceeds its usable fresh and marginal resources by the mid 1980's.

(ii) If irrigation growth is allowed in the Collie/Harvey basins these resources will be heavily committed except for a margin representing minor streams and the sub-region's underground resources. These minor resources are not very attractive for other than local developments.

(iii) North of the Moore River and up to Jurien Bay, there are indications of a large resource of underground water. With no apparent major growth in local demand this water could be available for the Metropolitan System.

(iv) In the south west corner, the Blackwood, Manjimup and Northcliffe Nornalup sub-regions have large fresh water resources which are coupled with the resources of more developed areas in excess of demands foreseen under the "baseline" demand scenario.

(v) In the total regional supply-demand diagram depicted on Fig. 4(6), we see that about 50% of the assessed usable resources are required by the year 2002. If growth continued exponentially beyond that time, then under the 20 year doubling time of these projections, the usable fresh and marginal resources would be committed by about 2020 to 2025.

Thus the time when lumped demand exceeds lumped resources is more than 50 years in the future and we seem far from the point of total commitment of natural water resources.

However, it is important to appreciate that well before that time, the increasing levels of utilization will bring substantial problems of redistributing water resources to match the demand and it will be necessary to consider the possible advantage of redistributing some demands to match resources.

Furthermore, the demand-supply diagram does not take account of environmental constraints which will undoubtedly be met and which may become substantial in the future. Nor does the diagram contemplate reduction of resources by salinity problems. Adding environmental needs as an additional component of the demand line and reducing the resource line with time becau[illegible] salinity etc., will obviously advance the date at which [illegible] be fully committed and add to the complexity of [illegible] ly. If mineable underground water had been inclu[illegible] it would tend to lift the resource line by 20% and partly offset these environmental factors.

Water Costs

Some attempt has been made to assess the cost of water supplied to various areas in the region. The figures quoted have been adjusted from earlier estimates to make some allowance for inflation. The approximate figures, which should not be used for any detailed analyses or comparisons, have been assessed as July 1975 prices. Interest rates have been assessed at 10% per annum, and the life of structures at 53 years.

Table 4(6) shows typical water costs.

Some figures have been calculated from past expenditure on works in the M.W.B. These are for schemes within the M.W.B. area. The costs have been separated into Source Works, Distribution, Reticulation and Servicing. These areas are defined as follows:-

(i) Source works include all dams, trunk mains, bores, collector mains, treatment plants, and service reservoirs. In the case of groundwater schemes it includes allowance for the cost of the special treatment.

(ii) Distributions mains are those over 250 mm, other than trunk mains, used for delivering water on demand to services, high level tanks and high level pumping stations.

(iii) Reticulation mains are the 50 mm to 210 mm mains along each street to supply individual services.

(iv) Servicing involves the supply of new services and meters to individual consumers.

The distribution of these costs is currently

Source works	63%
Distribution	13%
Reticulation	13.5%
Servicing	10.5%

The July 1, 1975 cost to supply "new" water is about $13 000/ha. Based on 8.15 services/ha, an average consumption of 730 m^3/an per service, and interest rates at 7% over 53 years, the cost of "new" water is currently 16c/m^3.

The actual cost of water is less than this figure because the "old" water supplied from established sources is much less.

The question of a dual water supply system, with poorer quality water for gardens and sanitation, is obviously impractical in Perth when the current capital cost of $1500 per service for supply is considered.

The Significance of Underground Water

The resource estimates in this paper show that underground water

TABLE 4(6)

VERY APPROXIMATE TYPICAL WATER COSTS

SOUTH-WEST REGION

1. Sea Water Distillation (10 x $10^6 m^3$/yr units) (Nov. 73 prices)

   Based on Nov. 73 fuel oil quotes:

Dual Purpose	37	ce
Single Purpose	50	ce

2. New South-West Sources Delivering to Metropolitan Boundary (July

   Surface Sources - Headworks and Mains to Boundary of Basin J.

Donnelly (basin C)	28	cen
Murray with diversion of Saline Water by dam and tunnel (basin H)	22	cen
Collie R. at Burekup (basin F)	18	cen
Wungong Brook (basin J)	14	cen
New Harvey (basin G)	15	cen

   Underground Water Near Perth - Headworks and Mains to Boundary (basin L)

Wanneroo (basin L)	9	cen
North of Moore River (basin M)	21	cen

   Distribution in Metropolitan Area

   A cost of distribution must be added to the above costs. Assume approximately 10 cents/m^3.

3. Water Prices

Irrigation Areas	(July 75)	0.34 to	cen
Perth	(July 75)	8	cen (ne
Melbourne	(June 74)	9	cent
Sydney & Adelaide	(June 74)	10.11	cen
W. Germany	(June 74)	20	cen

4. Water from North-West to Perth

   Capital Cost \$2200m. for 30 x $10^6 m^3$/annum (From Fitzroy area).

   i.e. \$5.50/m^3 excluding operating costs.

   The costs in Table 4(6) are for new large scale schemes deliver water to the boundary of the Metropolitan area.

comprises 38% of the available surface and underground water resources in the whole region. In the Perth sub-region, groundwater is an even more important component, being 42% of the available resources.

The groundwater schemes currently being developed are producing water virtually at the point of supply, thus there are considerable financial savings in the cost of trunk mains. In addition, although groundwater schemes have high operating costs, their demands on capital funds per unit of production are much lower than for surface water schemes.

It must be stressed that the supply of potable water is of major importance to this State, and underground water can contribute a major component to this supply. The study and understanding of the availability, effects of use, and allocation of the resource to the competing requirements of urban, industrial and agricultural needs, and the superimposed importance of environmental demands, needs the utmost co-operation, and understanding, of everybody.

DISCUSSION

Question (C. Malcolm, Department of Agriculture)

You mentioned the "importing of water" - would you define this please?

FIELD

Fitzroy, I suppose. Icebergs would be too.

Question (C. Malcolm)

Would Donnelly to Perth be imported?

FIELD

No, that's within the region.

Question (F. E. Lefroy)

In giving an estimate of Perth's future requirements for water you mentioned that 3½ times as much water will be needed in the year 2 000 as is needed now. You said this may be optimistic. In which way did you mean optimistic?

FIELD

It may be a lot more than 3½ times.

Question (Lefroy)

Using the Metropolitan Water Supply's current figures for rate of increase in water consumption Perth will need <u>8</u> times the amount of water it now has at the turn of the century.

FIELD

That could quite well happen, but there are a lot of factors that come into it. Firstly, public awareness of water shortage, and secondly, water gets more expensive. As the Water Board increases water rates the consumption drops. There are other factors, i.e.

more natural gardens if costs increase
lot sizes in Perth are decreasing
multiunit housing where not as much water is used on lawns

Question (Lefroy)

The consumption rate per person is increasing steadily and Perth is going to run out of water! This should be our message to the Premier.

Question (P. Browne-Cooper, Dept. of Environment)

Education of public is only just starting to take effect - hopefully the effect will be greater and water consumption will drop as the public became more aware

Question (Austin, Murdoch University)

Do you have any figures on the recycling of effluent?

FIELD

No, - figures at all.

Question (Don Collett, Public Works Department)

Perth is never going to run out of water, it will just become more and more expensive. We could desalinate the ocean if we are prepared to pay the price.

F. BROWNE-COOPER

We are concerned with the priorities. Do the water recreation areas go before we start desalinating the ocean.

Question (Harley, Geological Survey)

Have you thought of piping up underground water from the Bunbury sub-basin?

FIELD

Yes, we have, but it is more expensive than bringing water from the Donnelly or streams in that area, because not only do you have the pumping costs but it has to be treated. So 9c. per m^3 can be added to that of pumping.

Question (Harley)

Does the same apply to the Moore River?

FIELD

The critical factor becomes the distance the water is pumped. Bunbury is further. To supply the south-west it may be necessary to use a strategy of using "hills" water in one season and ground-water in another.

Question (Cochrane, Rangers Contracting)

Would you like to comment on the possibility of dual standard water supplies, whereby lower quality water would be used where high standards are not required, such as in industry?

FIELD

Investigations by the Metropolitan Water Board put the initial cost per service to a household at $1 500. To double this for dual systems does not seem logical.

Question (Cochrane)

What about dual supply for industry?

Editor's Note:

Subsequent to the symposium Mr. Field informed me of a trial scheme in one new suburb where dual water supplies are being installed.

FIELD

Often industry requires higher quality water than do domestic users.

Question (Passmore)

Can you tell us the cost of bringing effluent water up to drinking water standards, and what would be its salinity?

FIELD

No, I cannot answer that, as I said before. At present, we do a two-stage treatment, and presumably you would need at least three. Then either recycling into the groundwater or careful testing for contamination would be necessary.

Question (Passmore)

"... and the salinity?"

FIELD

"I don't know."

Question (Don Collett, Public Works Department)

For every cycle through the system recycled sewage increases in salinity by about 100 mg per litre.

Question (D. Williamson, CSIRO)

I think that the estimate of doubling the price for dual systems provides an over estimate of cost.

FIELD

Yes, I agree. I made a quick estimate, and even included the cost of the sources.

Question (Stephenson)

In the event that we will eventually be able to recycle water have you made any reservations of land to allow you to do this?

FIELD

No. I think this would be unacceptable to developers.

Question

In the event of severe droughts will the ground water system be able to cope with water supply?

FIELD

The pumps fitted have a capacity in excess of the projected requirement, and the actual reserve of ground water is very large.

Question (M. Coldwell, Metropolitan Water Supply)

I would like to comment that in the future technology will allow us to use desalination processes to cope with droughts.