Water Authority
of Western Australia

WATER RESOURCES DIRECTORATE

Collie Coal Basin
Water Resources Management Strategy

Authority use only

Report No.WG 60
July 1988

Water Authority
of Western Australia

WATER RESOURCES DIRECTORATE

Groundwater Branch

Collie Coal Basin
Water Resources Management Strategy

H. B. Ventriss

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COLLIE COAL BASIN

WATER RESOURCES MANAGEMENT STRATEGY

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INTRODUCTION

A water resources management strategy for the Collie Coal Basin has been developed based on considerations of the basin hydrology and hydrogeology, existing policies, statutory commitments and the implications for the parties affected by any strategy.

Groundwater is abstracted from the basin for the principal purposes of coal mine dewatering and for provision of process and cooling water for power generation. Ultimate power generation development within the basin has the potential to exceed the estimated sustainable groundwater yield of the basin and careful management of abstraction is therefore required.

Effluent from mine dewatering and power station cooling blowdown are discharged into branches of the Collie River which traverse the coal basin. These discharges are, in part, of a poorer quality than the longer term objectives for Wellington Reservoir and require management to ensure their impact is within acceptable criteria.

PREVIOUS MANAGEMENT ARRANGEMENTS

Previous management of groundwater abstractions and effluent discharges was effected through licences which were poorly coordinated and subject to ineffective conditions, particularly the groundwater abstraction licences. The level of management undertaken in the past has been, in part, the result of a lack of a clear policy framework. Continued management of the basin under the existing arrangements has the potential to result in unacceptable adverse effects upon both the groundwater and surface water resources of the basin.

There have subsequently been a number of policy decisions and commitments undertaken upon which a water management strategy can be formulated.

OBJECTIVES, POLICIES AND COMMITMENTS

In 1982, following a report from the Collie Coal Mines Rehabilitation Committee, Cabinet endorsed a number of land use objectives for the coal basin, which acknowledged coal mining as the primary land use but provided that full account be taken of the need for mining to be compatible with other land uses. The role of water was recognised within these other land uses. The primary land use objective was stated by Cabinet as:

> *"The Collie Basin contains Western Australia's only currently commercial coal field and for the foreseeable*

future is expected to retain its position of major importance in providing for the future energy needs of the State. Accordingly, coal mining must be designated to be the primary land use in the area but at the same time full account must be taken of the need for mining to be compatible with other important land uses.

The overall management objective for mining and rehabilitation in the Collie Coal Basin is to direct both coal mining and mine site rehabilitation in a manner that optimises coal recovery and the sustained use of the basin's other natural resources, and which is achieved at a reasonable cost."

Cabinet endorsed the water objective for the coal basin being to:

"Ensure that coal mining and other activities in the basin do not significantly diminish the quality and quantity of surface runoff and recharge to the groundwater system and that water resources are developed and utilised in the best interests of the State."

The Water Authority has as one of its primary corporate objectives:

"To ..... efficiently manage the State's water resources for the continuing benefit of the community."

This is based on a statutory requirement of the Water Authority Act 1984, which provides that *"..... the Authority is hereby charged, ..., with the duty of administering the right and interests in the Crown in and in relation to water in the State, of assessing, developing, utilizing and conserving water resources, ..."*.

Under the conditions covering environmental approval for the Harris Dam the Water Authority is committed to the *".... long term objective of returning the Collie River to a salinity level such that the quality of water supplied from Wellington Reservoir is suitable for domestic supplies."*

This condition of approval is a statutory commitment agreed to by the Water Authority to enable the Harris Dam project to proceed.

These objectives and conditions recognise the value of the regional water resources and that this value will increase with time as the resources become scarcer and competition for them increases. The quality of the water in Wellington Reservoir needs to be improved because there are existing end users of the water in the form of irrigators and industry that require available water to be of an appropriate quality for their use.

These considerations, policies, objectives and commitments provide the basis for a proposed water management strategy which is described below.

OTHER MANAGEMENT CONSIDERATIONS

While the current level of impact of effluent discharge can be considered to be relatively small and can possibly be tolerated, at least in the short term, the impact of second stage power generation is of an unacceptable magnitude. Therefore, the development of the next power station should set the time beyond which disposal of effluent of quality outside the long term objective for Wellington Reservoir, into the Collie River or its tributaries, should not be accepted.

In view of the statutory requirement to improve Wellington Reservoir salinities, it is appropriate that action be initiated now to improve the quality of any discharges which are of quality contrary to that requirement. The required action is discussed in the proposed strategy.

Deferral of action (to improve the quality of effluent discharge) beyond the time of the next stage of power generation on the argument that alternative management action, such as reforestation initiated now, will not have any significant ameliorating effect for a considerable number of years, should not be accepted. Argument for such deferral is based on comparison with a strategy of uncertain effectiveness, and with a strategy that only addresses part of the problem (salinity, not other polluting components). It is not reasonable to make comparison with what may be the least desirable strategy.

There are a number of possible management options to improve the effluent discharge quality, including pre-treatment before disposal and various off-catchment disposal options. Each will have to be evaluated in terms of technical and economic feasibility to determine the most acceptable solution. The preferred strategy from a Water Authority viewpoint is off-catchment disposal through a pipeline.

PROPOSED MANAGEMENT STRATEGY

The proposed water resources management strategy for the Collie Coal Basin is:

(i) Allocation of the groundwater resources of the Collie Coal Basin should primarily be for the generation of power in accordance with the stated basin land use priority. Groundwater may be allocated to other users for other purposes provided such allocation does not prejudice the priority use. Any other users granted a licence to abstract groundwater from the basin should be made aware that: there will be no guarantee of continuity of supply; that abstractions by other users are likely to lower groundwater levels significantly in the future; and that the user will have no right of redress against any adverse effects of use by other licensees. The needs of these other users will therefore only be met insofar as they do not reduce the availability of water for power generation.

(ii) Groundwater abstractions should be minimised in accordance with good water resources management. Dewatering effluent should be utilised for process and cooling water purposes preferentially to wellfield abstractions. Where Collie River 'run of river' water can be taken for power station requirements, this water should be taken preferentially to wellfield abstractions, but not preferentially to dewatering discharges. Groundwater abstraction and pollution control licence conditions should be coordinated and provide the statutory means of enforcing these requirements.

(iii) Pollution control licences should set effluent discharge quality criteria consistent with achieving the statutory water quality objectives for Wellington Reservoir. These criteria should allow no discharges with salinity in excess of 550 mg/L TDS to be discharged into the surface waters of the coal basin. Other water quality criteria should be set to protect both the potable quality of the Reservoir and the aquatic ecosystems of the stream channels into which discharges may occur.

(iv) Individual pollution control licences should be issued to each of the parties discharging effluent and each party should be required to individually meet the above water quality criteria. A number of single point discharges of an individual party can be aggregated for the purposes of comparison with the criteria where those discharges are flowing into a common reach of river such that the Water Authority is satisfied that such aggregation is acceptable.

(v) In addition to the provisions set out in (ii) above, conditions attached to groundwater abstraction licences should provide for:

(a) adequate monitoring by the licensees of all of their water abstractions, transfers and discharges and behaviour of the groundwater resource;

(b) transfer of the relevant monitoring data to SECWA; and

(c) periodic overall review of the performance of the groundwater resources of the coal basin by SECWA (through consultants) and reporting of the results of the review to the Water Authority.

(vi) Subdivision or urban development on the coal basin should be subject to sewerage conditions unless it can be clearly demonstrated that such development will have no adverse impact on the water resources.

(vii) Work continue to assist in quantifying understanding of the hydrology of the coal basin. This should include monitoring of all components of the water cycle within the basin.

In view of the statutory requirement to improve Wellington Reservoir salinities, it is appropriate that action be initiated now to improve the quality of any discharges which are of quality contrary to that requirement. The required timing for implementation of the strategy is that it be in place by the time of commissioning of the next stage of power generation, or December 31, 1995, whichever is the earlier.

The action requiring initiation referred to above, is expected to be the undertaking of a programme of investigations and feasibility and planning studies to ensure that implementation of the strategy is effected within the above timeframe.

There may be opportunity for interim management activities to be undertaken within the above strategy, and these should be negotiated with the respective parties to ensure their implementation can be effected with minimum cost and disruption to the priority activities within the coal basin.

Work should commence immediately on preparation of a draft Environmental Protection Policy under the Environmental Protection Act 1986, designed to protect the environment, in particular the quality of surface water flows, and to achieve protection of the beneficial uses of the Collie Coal Basin water resources. The water resources management strategy for the Coal Basin should be incorporated within the Environmental Protection Policy.

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COLLIE COAL BASIN

WATER RESOURCES MANAGEMENT STRATEGY

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COLLIE COAL BASIN

WATER RESOURCES MANAGEMENT STRATEGY

1. INTRODUCTION

This document is intended to provide a strategy for management of the water resources of the Collie Coal Basin to ensure that the interrelationships between activities and water resources in the basin can be addressed within a clear coordinated policy framework.

The principal activities within the coal basin are power generation and coal mining, and the water resource issues which evolve from these activities relate to: groundwater abstraction for coal mine dewatering; groundwater abstraction for power generation; and effluent disposal from both of these activities.

In recent years there have been a number of initiatives undertaken which have resulted in the definition of land and water objectives for the Coal Basin. The two principal initiatives are the Cabinet endorsed land use objectives of the Coal Basin, and the conditions of environmental approval for the Harris Dam.

The preparation of ongoing management strategies for the Coal Basin needs to take these factors into account, together with a consideration of the implications for the parties involved in coal production, power generation, and water management.

This document reviews current water resource management practices, identifies the factors that need to be accounted for in developing water management strategies for the future and recommends a strategy based on identified policies and objectives. The document also outlines work which will be required to follow.

2. BASIN HYDROLOGY

2.1. Basin Structure

The Collie Coal Basin consists of alternating sequences of Permian coal seams, shales and sandstones, which infill a basin in the crystalline rocks of the Archean shield.

The Permian beds are overlain by Recent and Tertiary sediments from zero to 18 metres thick.

The basin occupies an area of 230 km^2, and has the general form of two adjoining parallel lobes with a north west - south east alignment. The basin extends to a depth of 1500 m at its deepest point.

The Permian sediments occur as a dipping sequence and are strongly normally faulted. The faults often provide hydraulic connection between the sandstone aquifers of the basin allowing vertical transmission of groundwater.

2.2. Hydrogeology

The Collie Coal Basin contains the largest single groundwater resource in the south west of the State, east of the Darling Fault.

The hydrogeology of the basin is complex, both because of its geologic structure and the relationships between surface and groundwater regimes. The natural hydrogeological system has been considerably disturbed by activities within the basin, particularly mining and groundwater abstractions.

Groundwater occurs throughout the Basin and is characteristically of very low salinity and is a moderately acidic, sodium chloride type water. Deterioration of water quality through mining operations and associated groundwater abstractions is liable to occur as release and oxidation of iron sulphides and generation of acidic water occurs when sulphides and coal are exposed to air.

Groundwater in the basin is generally unconfined in the upper formations, but is hydraulically confined at depth. Hydraulic heads vary considerably over short vertical distances throughout the basin, being generally downward although upward heads do occur.

Recharge occurs from direct infiltration of rainfall over the basin and from infiltration from the tributaries and branches of the Collie River where surface permeability permits. Water is imported into the basin through surface flows in the Collie River. Lowering of water table levels through mine dewatering and wellfield abstractions is thought to have increased recharge.

Discharge from the basin occurs through evapotranspiration, groundwater contributions to stream baseflow and by abstractions from wellfields and mine dewatering activities. It has been

suggested that there is a component of outflow through fractures in the crystalline basement rocks underlying the basin, but this is likely to be quite small.

The streams which traverse the basin appear to vary from influent to effluent both spatially and temporally.

Streamflow yields from the basin are not substantially different from similar rainfall areas in the Darling Range.

2.3. Stream Hydrology

The Collie River traverses the coal basin in a generally westerly direction, with the basin occupying the central reaches of that river system. The four main tributaries of the Collie River converge within or very close to the basin.

The Collie River discharges into Wellington Reservoir approximately 20 km downstream of the western extremity of the basin. The coal basin occupies approximately 10% of the entire Wellington Reservoir catchment area.

The total surface water resource of the Collie River system is estimated to be about 180 mill.cu.m/yr. Wellington Reservoir has a storage of 185 mill.cu.m and can yield 107 mill.cu.m/yr.

As a result of clearing within the catchment, salinity in Wellington Reservoir has risen from a pristine level of about 250 mg/L TDS to the present level of approximately 890 mg/L. Salinity is still rising as a result of earlier clearing and a programme of reforestation is being undertaken to address the problem. It is anticipated that this will result in a mean annual salinity of about 850 mg/L TDS by the end of the first decade of the next century.

The contribution to rising salinity in the reservoir is from parts of the catchment area outside the coal basin. The surface yield of the coal basin has been good quality water (<200 mg/L TDS) and plays an important role in diluting the more saline inflows from outside the basin. Therefore, diminution of the quantity of runoff from the basin directly adversely affects the quality of water in Wellington Reservoir (Collie Land Use Working Group, 1987).

2.4. Water Balance

Numerous estimates have been made of the coal basin water balance, and as is usual with these estimates, the role of evapotranspiration is both dominant and difficult to quantify. However, recharge to the basin under pristine conditions has been estimated to be of the order of 10-20 mill.cu.m/yr.

At present, approximately 20 mill.cu.m/yr is being abstracted from the basin, with about 16 mill.cu.m/yr being supplied to Muja power station for cooling. The remainder is being discharged to the Collie River after treatment. Of the cooling water, about 9 mill.cu.m/yr is evaporated and the remainder discharged into the Collie River system (Collie Land Use Working Group, 1987).

Groundwater storage in the basin has been estimated to be about 6 750 mill.cu.m (Collie Land Use Working Group, 1987).

As abstraction from the basin increases in time, the water balance will be considerably modified. It can be expected that streams traversing the basin will become generally more influent as groundwater levels decline through mining of groundwater storage. Lowered water levels will also result in reduced evapotranspiration losses from the groundwater system. There needs to be considerably more work carried out to facilitate quantification of the effects of abstraction on the basin's groundwater resources.

2.5. Harris Dam

Construction of the Harris Dam is proceeding with the intention of providing an alternative good quality supply to the Great Southern Towns Water Supply scheme. By operation of Harris and Wellington Reservoirs conjunctively small improvements in quality of water supplied to the Collie Irrigation Area may be achieved in the short term.

3. COAL BASIN LAND USES

The following land uses within the coal basin have been identified in the Cabinet Policy on Land-use Objectives:

- Mining
- Infrastructure
- Water
- Forest resources
- Agriculture

Objectives related to these land uses were identified by the Collie Coal Mines Rehabilitation Committee and are discussed below. The full text of the Cabinet Endorsed Land Use Objectives is given in Appendix A.

3.1. Mining

As the Collie Coal Basin is Western Australia's only currently commercial coalfield, a high priority needs to be given to coal mining as a land use. Economic factors associate the need for power stations to also be located within the locality and power generation is therefore included as an integral part of the mining land use priority.

3.2. Infrastructure

Infrastructure as a land use relates directly to that required to support the mining and power generation activities within the basin. It includes the necessary townsite development, the associated social infrastructure and utilities such as transport, communications, services and public utilities. Such developments must ensure that sterilisation of extractable coal reserves is avoided.

3.3. Water

It is recognised that the coal basin is one of the State's major water sources. While the water resource has been developed to some extent there is potential for important further development in the future. It is therefore imperative that the resource be afforded the maximum protection to preserve its utility. It should also be recognised that the coal mining/power generation land use has a finite lifespan while water production can be expected to continue in perpetuity.

3.4. Forest resources

Although 75% of the basin is State Forest, timber production is not currently a major activity. However, the forest does have considerable recreational and nature conservation value. Future forest options include rehabilitation of the hardwood forest for both die-back resistant hardwood and softwood timber production. It is recognised that conservation of forests

within the basin has to fit within the constraints imposed by mining, water production and the recreational needs of the community.

3.5. Agriculture

The entire coal basin is included within the area subject to Country Areas Water Supply Act clearing control as applied to the entire Wellington Reservoir Catchment Area. However, licences to clear are issued as a matter of course because of the minimal opportunity for the basin to contribute to stream salinity through clearing of forest. Agriculture is not an attractive use of the basin because of the generally poor agricultural soils. A management objective is the minimal disruption of current farming activities.

4. CURRENT WATER RESOURCES MANAGEMENT

Water resources management in the Collie Coal Basin is currently effected through control of groundwater abstractions under the provisions of Section 26B of the Rights in Water and Irrigation Act 1914, and control of pollution through Part V of the Environmental Protection Act 1986.

4.1. Groundwater Abstraction

Groundwater is abstracted from the basin by:

- State Energy Commission of Western Australia (SECWA) from wellfields for use by the Muja power station for process and cooling water;
- Coal mining companies through mine dewatering requirements; and
- Other minor users.

The ultimate demands for water by SECWA for power generation are understood to be of the order of 38 mill.cu.m/yr. Work carried out by consultants to determine the capability of the basin to support this draw concluded the "safe yield" of the basin to be about 48 mill.cu.m/yr, provided some degree of moisture stress could be tolerated by the environment (Australian Groundwater Consultants, 1981).

The veracity of this "safe yield" estimate is in some doubt, but approval for SECWA to proceed with its power generation development plans was given on the basis that the proposed groundwater draw could be sustained for the project life by recharge and a component of groundwater storage depletion. That is, 38 mill.cu.m/yr is considered to be in excess of the long term sustainable yield, but can be accommodated in the short term by "mining" of the groundwater resource. It is expected that the depleted storage will replenish over a period following cessation of mining and power generation activities in the basin. The time period for this to occur has not been determined.

The SECWA water demands are being met by a combination of use of mine dewatering effluent and by abstraction from SECWA wellfields. This is expected to continue for the duration of the project.

As the coal basin lies within the Collie Groundwater Area proclaimed under the Rights in Water and Irrigation Act 1914 all the above abstractions are subject to licensing . However, while licences have been issued for the above abstractions, appropriate coordinated conditions which could facilitate proper management of these abstractions and of the resource have not been attached to those licences.

4.2. Effluent Disposal

Effluent is disposed of by both the coal mining companies and SECWA through discharge into the Collie River and its tributaries. Pollution control licences are required for such discharges and have conditions attached stipulating the water quality standards to be met by the discharges. These standards relate to pH, TDS, suspended solids, iron, manganese, surfactants, oil and grease and a requirement for all other components to meet drinking water standards. Further conditions require metering of all discharges by SECWA together with water quality analyses of all effluent and mine dewatering flows.

The mining company's effluent consists primarily of dewatering discharges from the mines, a portion of which is supplied to SECWA for power station cooling. Based on 1986 median measured discharges, the total discharge into the surface streams is 13.7 mill.cu.m/yr. Up to 8.7 mill.cu.m of mine water is currently directly discharged into the river annually of which some (Chicken Creek effluent) is pH corrected before discharge.

As the scale of mining increases, it can be expected that the dewatering discharge volumes will also increase.

Re-circulated power station cooling water eventually fails to meet SECWA water quality criteria and is discharged into the Collie River. The salinity of this blowdown water is about 1 500 mg/L.

Flyash effluent is also disposed of by SECWA. The quality of this effluent is of the order of 2 250 mg/L TDS.

The approach to effluent disposal in the coal basin has been to consider the coal mining and power generation as a single operation and all of the effluent discharges are aggregated for consideration against the discharge standards. Current policy is to allow a combined discharge salinity up to 850 mg/L TDS.

Dewatering effluent from Western Collieries activities is quite fresh and after minor treatment is taken in part by SECWA for cooling and process water. Chicken Creek (Griffin Coal) effluent, on the other hand, is of poor quality and its direct disposal into the Collie River is of concern. The effluent is of insufficient quality to meet the SECWA acceptance criteria for cooling water.

The nett average quality of all of the discharges into the Collie River is currently 775 mg/L.

While the preferential use of dewatering effluent rather than direct wellfield abstractions for cooling water will minimise total abstraction, the overall increasing water draw from the basin has the potential to adversely affect surface water quality and subsequently, the quality of water in Wellington Reservoir.

This potential is seen to be principally through lowering of groundwater levels as a result of abstraction and the consequent

reduction in fresh surface water flows. The mechanism for reduced streamflow is likely to be through delayed onset of winter streamflow because of the greater depths to saturation and the large soil moisture deficits that need to be overcome before streamflow occurs.

Direct groundwater contributions to streamflow will also decrease although such contributions are considered small. As the effect of mine dewatering on surface streamflows is indirect and is dependent upon difficult water balance computations involving evapotranspiration estimation from vegetation, quantification of the effects will be difficult to determine. However, the effects can be expected to be to degrade rather than improve water quality of the surface flows.

Superimposed over this will be the trend towards influent streams and potential re-circulation of salts within the groundwater basin, resulting in rising groundwater salinities and consequent rises in the salinity of dewatering discharges. This can be expected to result in an increased requirement for cooling water as higher salinities will progressively limit the opportunity for re-circulation within the power station(s).

5. ENVIRONMENTAL CONSIDERATIONS

Activities over the basin have the potential for significant environmental impacts. These impacts relate to groundwater and surface water pollution and impacts on natural ecosystems.

The impacts of effluent discharges on the integrity of the basin water resources have been discussed in the preceding section. However, non-point source pollution threats exist through inadequate sewerage facilities for urban developments in particular. The Collie Land Use Working Group addressed this concern in a strategy related to subdivision of land and extension of sewerage facilities. The potential water table declines through increasing groundwater abstractions have potential to affect the environment through moisture stress of vegetation dependent upon access to the water table , and the drying of wetlands.

Forest production is not a major land use within the basin but forest thinning may have some potential to enhance groundwater recharge and surface runoff. It is understood that the hydrogeology of the basin is such that forest thinning is unlikely to adversely affect surface water quality as occurs in the lower rainfall areas of the Wellington catchment.

The Collie Land Use Working Group report acknowledged the need for research to determine the effects of reforestation on groundwater behaviour. This research could be extended to consider general forest management, including thinning to induce additional recharge in appropriate areas. Some contribution by Department of Conservation and Land Management to this research may be a possibility.

The Environmental Protection Act 1986 provides for approval of Environmental Protection Policies (EPP) for protection of the environment, or for prevention, control or abatement of pollution, in situations where such may be necessary or desirable. An approved EPP has the force of law and provides a means of statutorily establishing measures designed to protect the environment or to achieve the beneficial use to be protected. Such a statutory policy would provide an adequate means of enforcing environmental and water management policies and strategies, after allowing for those policies and strategies to be be publicly reviewed.

6. MANAGEMENT STRATEGY CONSIDERATIONS

The principal means of imposing a water resource management strategy has been through the groundwater abstraction and pollution control licences and their attached conditions. To date, the licences issued have not been adequately structured to enable water management objectives to be effectively pursued. The groundwater abstraction licences, in particular, had inadequate conditions attached, which effectively allowed unlimited abstraction by the licensed parties with virtually no requirement for sound resource management. It is therefore essential that the licences for groundwater abstraction and pollution control be coordinated, and with appropriate conditions which will enable water resource management objectives to be achieved, while recognising the overall priorities of the coal basin.

The licences for all abstractions have currently expired, and an opportunity exists to renew the licences with appropriate conditions attached which can be aimed at facilitating the achievement of water management objectives.

A strategy for management upon which new licences and conditions will be based should take full account of existing statutory commitments and policies.

6.1. Policies and commitments

6.1.1. Water Authority Corporate Objectives

One of the Water Authority's primary corporate objectives is:

> *"To ..... efficiently manage the State's water resources for the continuing benefit of the community."*
>
> (Water Authority, 1987)

This is based on a statutory requirement of the Water Authority Act 1984, which provides that *"the Authority is hereby charged, ..., with the duty of administering the right and interests in the Crown in and in relation to water in the State, of assessing, developing, utilizing and conserving water resources, ..."*.

6.1.2. Harris Dam environmental approval

Environmental approval for the Harris Dam has committed the Water Authority to the *"long term objective of returning the Collie River to a salinity level such that the quality of water supplied from Wellington Reservoir is suitable for domestic supplies"*.

To meet this objective in the case of Wellington Reservoir water, the standards as set out in National Health and Medical Research Council/Australian Water Resources Council "Guidelines for drinking water quality in Australia", indicate a chloride level of 400 mg/L is the primary criterion which needs to be

met. This corresponds to a salinity of between 700 and 800 mg/L TDS. This commitment to domestic suitability of the water can be interpreted as achieving better than 400 mg/L chloride (740 mg/L TDS) in 19 out of 20 years. To achieve this target, inflow salinities of the order of 500 to 550 mg/L TDS will be required (c.f. current inflow salinities of 850 mg/L).

6.1.3. Cabinet endorsed land use objectives

As a result of the recommendations of the Collie Coal Mines Rehabilitation Committee, Cabinet endorsed a list of land use objectives for the Collie Coal Basin in 1982. These acknowledged coal mining as the primary land use, but provided that full account be taken of the need for mining to be compatible with other land uses:

> *"The Collie Basin contains Western Australia's only currently commercial coal field and for the foreseeable future is expected to retain its position of major importance in providing for the future energy needs of the State. Accordingly, coal mining must be designated to be the primary land use in the area but at the same time full account must be taken of the need for mining to be compatible with other important land uses.*
>
> *The overall management objective for mining and rehabilitation in the Collie Coal Basin is to direct both coal mining and mine site rehabilitation in a manner that optimises coal recovery and the sustained use of the basin's other natural resources, and which is achieved at a reasonable cost."*

The full text of the Cabinet endorsed land use objectives is included at Appendix A. With regard to water, the objective has been stated and endorsed by Cabinet as:

> *"Ensure that coal mining and other activities in the basin do not significantly diminish the quality and quantity of surface runoff and recharge to the groundwater system and that water resources are developed and utilised in the best interests of the State."*

The Collie Coal Mines Rehabilitation Committee stated the water supply objectives of the basin as:

"*(i)* *To ensure that any activities within the basin do not result in any form of pollution that could significantly diminish the quality of surface runoff and inflow to Wellington Reservoir.*

(ii) *To ensure that neither the quantity of surface runoff nor the quantity (volume) of recharge to the groundwater is significantly diminished.*

(iii) *To ensure that the underground water resources of the Collie Coal Basin are developed and managed in the best interests of the State as a whole.*

(iv) To ensure that no serious flooding, erosion or other unwanted effects result from river or stream diversion or restriction.

(v) To ensure that land that could be of use for any water supply development or distribution scheme is not unnecessarily used for any other purpose."

(Collie Coal Mines Rehabilitation Committee, 1981)

6.1.4. Collie Land Use Working Group

In respect of water resource management, Recommendation 9 of the Collie Land Use Working Group Report states:

> *"As a matter of principle, cooling water for power station use should be derived from mine dewatering operations, in preference to special borefields provided that it meets required water quality criteria."*
>
> (Collie Land Use Working Group, 1987)

These objectives and conditions recognise the value of the regional water resources and that this value will increase with time as the resources become scarcer and competition for them increases. The quality of the water in Wellington Reservoir needs to be improved because there are existing end users of the water in the form of irrigators and industry that require available water to be of an appropriate quality for their use.

6.2. Fundamental management concepts

The fresh nature of the coal basin groundwater resources and their contribution to lowering the salinity of inflows into Wellington Reservoir require that a particularly responsible approach is taken to their long term management.

It should be clearly recognised that dewatering is an essential component in allowing the basin priority land-use of coal mining to proceed. In this context, water is only of nuisance value to the mining companies and management of the resource from a yield viewpoint is of no interest to those parties. However, the major demand for water in the basin is for the present and future power stations. Therefore, apart from the Water Authority's statutory interest, the short term vested interest in ensuring adequate groundwater is available from the basin clearly rests with SECWA.

Two fundamental concepts need to be recognised in developing a longer term water resource management strategy for the Collie Coal Basin:

(i) abstractions from the groundwater resource need to be minimised to as great an extent as possible because potential demands exceed the long term sustainable yield of the basin groundwater resource; and

(ii) there is a requirement to manage the effluent discharges to ensure the quality of the groundwater resource is not adversely affected and to ensure the water quality objectives of Wellington Reservoir are achieved.

The approach to water quality management centres on the statutory commitment of the Water Authority to improving water quality in Wellington Reservoir. The longer term view of whether effluent discharges improve or degrade the overall quality of Wellington Reservoir in comparison to other inflows to the storage, should be considered from the viewpoint that, if the effluent quality is contrary to the committed water quality objective level for Wellington Reservoir, then action needs to be taken to ensure the effluent quality is improved. The argument that effluent discharges may be diluting current inflows should be considered on the basis that:

(i) management should be to meet the statutory requirement and not to the lowest common factor (which may or may not be the other inflows); and

(ii) the current salinities of discharges into the coal basin are equivalent to levels of clearing that would not be licensed because of the magnitude of their impact.

6.3. Off-catchment effluent disposal vs reforestation

Reforestation on the Wellington Reservoir catchment has been suggested as a possible means of mitigating against the undesirable water quality impacts of the effluent discharges into the Collie River. There are a number of considerations in respect of this option:

(i) There are significant costs associated with this option.

(ii) The beneficial impact of reforestation is long term.

(iii) There is uncertainty about the potential magnitude of salinity reductions which may occur as a result of any given level of reforestation.

(iv) Reforestation is a management option available to address the effects of agricultural clearing. Utilisation of this option to address the effects of mining and power generation will reduce the availability of options for the agricultural clearing problem.

The current level of effluent disposal is estimated to be having an impact of about 35 mg/L on Wellington Reservoir inflows. It is estimated that development of the next stage of power generation will have an impact of about 100 mg/L. While the current level of impact can be considered to be relatively small and can possibly be tolerated, at least in the short term, the impact of second stage power generation is of an unacceptable magnitude. Therefore, the development of the next power station should set the time limit beyond which time on-catchment disposal of effluent of quality outside the long term objective for Wellington Reservoir, should not be accepted.

In view of the statutory requirement to improve Wellington Reservoir salinities, it is appropriate that action be initiated now to improve the quality of any discharges which are of quality contrary to that requirement.

Deferral of off-catchment disposal beyond the time of the next stage of power generation on the argument that alternative management action, such as reforestation initiated now, will not have any significant ameliorating effect for a considerable number of years, should not be accepted. Argument for such deferral is based on comparison with a strategy of uncertain effectiveness, and with a strategy that only addresses part of the problem (salinity, not other polluting components). It is not reasonable to make comparison with what, for the reasons given above may be the least desirable strategy.

There may be other alternative long or short term options such as deep injection of poor quality effluent towards the base of the coal basin. Such options can be considered to be equivalent to off-catchment disposal. However, there will be technical problems which will mitigate against a solution such as deep injection, including the need for a detailed understanding of the hydraulics of the deep aquifers within the basin to ensure the injected effluent does not migrate to locations where its presence may be undesirable. The preferred strategy from a Water Authority viewpoint is off-catchment disposal through a pipeline.

6.4. Coordination of licences

If licences are to be used to implement a management strategy, it is essential that conditions attached to both groundwater abstraction and pollution control licences are coordinated, and the particular aspects that need to be coordinated are requirements for:

(i) preferential use of dewatering water by SECWA and a requirement on the mining companies to make such water available, including stipulation of water quality criteria;

(ii) adequate monitoring of all of the abstractions and discharges and behaviour of the groundwater resource, including handling of the monitoring data;

(iii) overall review of groundwater resource performance by SECWA (through consultants) and need to ensure that all relevant monitoring data is made available to SECWA to facilitate carrying out of this review.

In particular, licence conditions should be framed to include provisions as set out below.

6.4.1. Pollution control licences

Pollution control licence conditions should set standards for discharged effluents that ensure both the surface and groundwater resource quality is adequately protected.

In accordance with the water quality objectives of Wellington Reservoir, these licences should require the quality of the effluent to be compatible with those objectives. The effluent standards should also reflect the need to protect the aquatic ecosystems of the stream channels into which the effluent is discharged. The licences should acknowledge the time required to accommodate the water quality requirements, and should

require that action be taken to ensure the requirements can be met within a reasonable time frame.

Pollution control licences should also require monitoring of discharge rates and volumes and critical water quality parameters.

6.4.2. Groundwater abstraction licences

Groundwater licences should provide for:

(i) allowable abstraction rates;

(ii) preferential use of dewatering effluent by SECWA;

(iii) the requirement to make good groundwater supplies to other affected users if the Water Authority considers this appropriate;

(iv) requirements for monitoring of the effects of all abstractions and handling of the monitoring data;

(v) regular review (and reporting to the Water Authority) of the performance of the overall coal basin groundwater resource by SECWA (through competent consultants);

(vi) regular review of the efficacy of the monitoring programme (by SECWA's consultants);

(vii) the need for licensees to correct adverse or untoward effects of abstraction, at the discretion of the Water Authority;

(viii) periodic reassessment of groundwater availability and predicted effects of planned abstractions (by SECWA through consultants).

There may be opportunity to utilise 'run of river' Collie River flows for power station water requirements when effluent quality is inadequate for those needs. This use should be encouraged in preference to wellfield abstractions.

6.5. Water quality conflicts

There is a conflict in water quality criteria associated with preferential use of mine dewatering effluent for power station cooling. The criteria currently being set by SECWA for acceptance of dewatering effluent for cooling water are to some extent difficult to achieve without varying levels of treatment by either SECWA or the mining companies. The SECWA position is that if the criteria are to be modified to enable acceptance of poorer quality water, the criteria for effluent discharge to the surface water resources needs to be modified accordingly. In effect, SECWA is claiming that the Water Authority effluent discharge criteria are dictating the cooling water acceptance criteria.

Obviously, it is entirely inappropriate to modify the discharge criteria that will allow higher salt loads to be discharged into Wellington Reservoir if the water quality objectives for that

source are to be achieved. At the same time, generally unattainable criteria for cooling water acceptance will result in elevated groundwater abstraction levels and a generally poorer standard of groundwater (and possibly surface water) management. Therefore, if improved water management is to be achieved within the basin there will be additional costs for treatment of effluent for cooling water purposes that will need to be borne.

Off-catchment disposal of SECWA and other substandard quality effluent will negate the need for this treatment and should allow the cooling water acceptance criteria to be set at levels that can be met with much lower levels of treatment than currently required. This reduction in treatment costs can be used to offset the costs incurred by off-catchment discharge facilities. Further offsetting will be provided by improved water management of the basin through the reduced deterioration in quality of the groundwater resource and the reduced power costs associated with minimised groundwater pumping. Therefore it is apparent that in the interests of overall water resources management within the coal basin, off-catchment disposal of effluent should be pursued as a matter of priority.

Superimposed upon this is one of the basic principles of groundwater management that has been universally applied in this State that requires that a useable water resource should not be used to dilute an effluent to allow that effluent to meet discharge quality standards.

6.6. Groundwater modelling

The Collie Land Use Working Group report has recommended that:

> *"Additional hydrological and groundwater research including drilling, be undertaken by the Geological Survey and the Water Authority to improve the understanding of the hydrogeology, and to develop a mathematical model which predicts changes in quantity and quality of outflow for various abstraction rates and surface modifications."*
>
> (Recommendation 10, Collie Land Use Working Group, 1987)

There is a need for a model (quantified concept) of the groundwater resources of the coal basin to enable a representation of the understanding of the hydrology of the basin to be developed. It should be recognised however, that the complex nature of the detailed hydrogeology will make development of this model difficult to achieve, particularly without monitoring data of performance of the basin under stress. The process of developing a model will therefore need to be progressive, commencing with a simple lumped parameter water balance accounting model of the basin. Because of the limited existing data, this form of model cannot account for the spatial variations in hydrogeology and will not be able to be used in a real predictive capacity to address such issues as: quality of baseflow contributions to surface water flows; effects on groundwater quality of mining, dewatering and

infiltration of effluent discharges; evaluation of localised water level effects such as drying out of wetlands; et al. In view of the limited capability of such a model, its development should not be pursued as any matter of priority.

6.7. Water resources monitoring

6.7.1. Surface water

The Water Authority has operated surface water monitoring facilities in the basin and surrounding catchments, including stream gauging, climate and groundwater monitoring facilities for a considerable number of years. This is additional to quite significant efforts on the Collie River catchment in salinity research. Information from this work will be extremely valuable in any further development of a quantified concept of the basin's water resources. Consideration should be given to upgrading the surface water monitoring network where such work will assist in improving understanding of the basin hydrology.

6.7.2. Groundwater

SECWA have been monitoring the groundwater resource within the coal basin since 1977, and the monitoring network includes observation and production wells together with surface water gauge boards. The production well monitoring includes conventional bores together with mine drainage sumps.

Data collected by SECWA has spasmodically been forwarded to the Water Authority and entered onto the State Water Resources Information System.

The observation well network consists of a number of the investigation wells constructed throughout the basin by SECWA in carrying out its investigations of the potential of the coal basin groundwater resources. The network is not a specifically designed monitoring facility.

A review of the monitoring programme by Australian Groundwater Consultants was commissioned by SECWA in 1986. The review was undertaken with the objective of rationalising the monitoring effort consistent with obtaining adequate relevant data to enable regular competent reviews of the performance of the basin.

The review concluded that monitoring results were inadequate for a meaningful reappraisal of the basin's water resources, but that the combined abstractions of the mining companies and SECWA have not caused any significant depletion of the near surface groundwaters, except in proximity of the mines. The deeper aquifers have experienced significant local depressurisation.

The review noted that:

> *"..... the most disturbing finding of this review has been the disregard for monitoring pertinent data for the Shotts and Cardiff-South wellfields which are operated in effect without control. This is in breach of the*

abstraction licence requirements, and is also most unwise in view of the importance of these wellfields to SECWA. The monitoring data is required for wellfield management and for more general Collie Basin water resources management. SECWA surely must recognise the importance of this and see that the readings are taken regularly in future."

(Australian Groundwater Consultants, 1986)

6.7.3. General

It is imperative that water abstractions, transfers and discharges are adequately monitored if any meaningful understanding of basin performance is to be undertaken. Therefore any strategy must ensure there are provisions to require that this be conscientiously carried out by all parties.

Liaison has been established through discussions with the mining companies and SECWA that should facilitate transfer of available dewatering monitoring information to SECWA to augment the monitoring network available to SECWA. This information transfer can and should be enforced through conditions attached to groundwater abstraction licences. It is not clear that this will resolve the overall monitoring network upgrading requirements, and it is expected that additional monitoring facilities will need to be constructed or implemented.

Again, SECWA's interest in the sustained availability of water suggest that the cost of any additional monitoring facilities should be borne by SECWA. However, where the monitoring directly relates to dewatering activities, the mining companies should also be required to contribute. The implementation of contributions from the mining companies will need to be negotiated because of the existence of Agreement Acts between the State and the mining companies.

6.8. Hydrogeological investigations

The Geological Survey has proposed an investigation programme for the basin through extension of the existing groundwater monitoring network with a programme of drilling, sampling and testing a number of shallow and deep bores (Moncrieff, 1985). This work needs to be coordinated with any work required to be carried out by SECWA or the mining companies as a condition of their groundwater abstraction licences.

6.9. New power stations

It is imperative that a justifiable approach is taken to approvals for expansion of the existing power station or construction of new power stations within the coal basin, with regard to water resources management. Groundwater abstractions should be managed within the guidelines outlined in Section 6.4.2.

However, no additional effluent discharge of quality contrary to the long term objective for Wellington Reservoir should be permitted. This should be made clear to SECWA at the earliest

opportunity to ensure it can be accommodated in their planning for future works. This advice may also be a useful catalyst for development of a means of transporting effluent from the catchment in accordance with the longer term strategy.

6.10. Implications of the Harris Dam

It should be made clear that the Harris Dam does not provide an alternate source of water to Wellington Reservoir to the extent that the water quality improvement strategy needs to be reviewed. To the contrary, the Harris Dam has resulted in the imposition of a statutory commitment for the Water Authority to improve the water quality of Wellington Reservoir. The irrigation area is, and is expected to remain, a user of Wellington Reservoir water and the water quality objectives should remain aligned to that demand. Wellington Reservoir will also provide an important future regional source of domestic water supplies.

7. PROPOSED MANAGEMENT STRATEGY

A water resources management strategy for the Collie Coal Basin needs to be in accordance with:

(i) The 1982 Cabinet endorsed land use objectives of the coal basin with coal mining being recognised as a priority use:

"The Collie Basin contains Western Australia's only currently commercial coal field and for the foreseeable future is expected to retain its position of major importance in providing for the future energy needs of the State. Accordingly, coal mining must be designated to be the primary land use in the area but at the same time full account must be taken of the need for mining to be compatible with other important land uses.

The overall management objective for mining and rehabilitation in the Collie Coal Basin is to direct both coal mining and mine site rehabilitation in a manner that optimises coal recovery and the sustained use of the basin's other natural resources, and which is achieved at a reasonable cost.

(ii) The 1982 Cabinet endorsed water objective for the coal basin to:

"Ensure that coal mining and other activities in the basin do not significantly diminish the quality and quantity of surface runoff and recharge to the groundwater system and that water resources are developed and utilised in the best interests of the State."

(iii) The statutory responsibility and corporate objective of the Water Authority to manage and conserve water resources.

(iv) The statutory requirement of environmental approval for the Harris Dam which provides for the *"long term objective of returning the Collie River to a salinity level such that the quality of water supplied from Wellington Reservoir is suitable for domestic supplies."*

The proposed long term water resources management strategy for the coal basin is:

(i) Allocation of the groundwater resources of the Collie Coal Basin should primarily be for the generation of power in accordance with the stated basin land use priority. Groundwater may be allocated to other users for other purposes provided such allocation does not prejudice the priority use. Any other users granted a licence to abstract groundwater from the basin should be made aware that: there will be no guarantee of continuity of supply; that abstractions by other users are likely to lower groundwater levels significantly in

the future; and that the user will have no right of redress against any adverse effects of use by other licensees. The needs of these other users will therefore only be met insofar as they do not reduce the availability of water for power generation.

(ii) Groundwater abstractions should be minimised in accordance with good water resources management. Dewatering effluent should be utilised for process and cooling water purposes preferentially to wellfield abstractions. Where Collie River 'run of river' water can be taken for power station requirements, this water should be taken preferentially to wellfield abstractions, but not preferentially to dewatering discharges. Groundwater abstraction and pollution control licence conditions should be coordinated and provide the statutory means of enforcing these requirements.

(iii) Pollution control licences should set effluent discharge quality criteria consistent with achieving the statutory water quality objectives for Wellington Reservoir. These criteria should allow no discharges with salinity in excess of 550 mg/L TDS to be discharged into the surface waters of the coal basin.

(iv) Individual pollution control licences should be issued to each of the parties discharging effluent and each party should be required to individually meet the above water quality criteria. A number of single point discharges of an individual party can be aggregated for the purposes of comparison with the criteria where those discharges are flowing into a common reach of river such that the Water Authority is satisfied that such aggregation is acceptable.

(v) In addition to the provisions set out in (ii) above, conditions attached to groundwater abstraction licences should provide for:

(a) adequate monitoring by the licensees of all of their water abstractions, transfers and discharges and behaviour of the groundwater resource;

(b) transfer of the relevant monitoring data to SECWA; and

(c) periodic overall review of the performance of the groundwater resources of the coal basin by SECWA (through consultants) and reporting of the results of the review to the Water Authority.

(vi) Subdivision or urban development on the coal basin should be subject to sewerage conditions unless it can be clearly demonstrated that such development will have no adverse impact on the water resources.

(vii) Work continue to assist in quantifying understanding of the hydrology of the coal basin. This should include monitoring of all components of the water cycle within the basin.

In view of the statutory requirement to improve Wellington Reservoir salinities, it is appropriate that action be initiated now to improve the quality of any discharges which are of quality contrary to that requirement. The required timing for implementation of the strategy is that it be in place by the time of commissioning of the next stage of power generation, or December 31, 1995, whichever is the earlier.

The action requiring initiation referred to above, is expected to be the undertaking of a programme of investigations and feasibility and planning studies to ensure that implementation of the strategy is effected within the above timeframe.

There may be opportunity for interim management activities to be undertaken within the above strategy, and these should be negotiated with the respective parties to ensure their implementation can be effected with minimum cost and disruption to the priority activities within the coal basin.

To enable water and environmental management within the Coal Basin to be put on a statutory footing, work should commence immediately on preparation of a draft Environmental Protection Policy for the basin under the Environmental Protection Act 1986. This Environmental Protection Policy should be designed to protect the environment, in particular the quality of surface water flows, and to achieve protection of the beneficial uses of the Collie Coal Basin water resources.

8. REFERENCES

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APPENDIX A

CABINET ENDORSED LAND USE OBJECTIVES

CABINET ENDORSED LAND USE OBJECTIVES

The following land use objectives for the Collie Coal Basin were endorsed by Cabinet in 1982:

"The Collie Basin contains Western Australia's only currently commercial coal field and for the foreseeable future is expected to retain its position of major importance in providing for the future energy needs of the State. Accordingly, coal mining must be designated to be the primary land use in the area but at the same time full account must be taken of the need for mining to be compatible with other important land uses.

The overall management objective for mining and rehabilitation in the Collie Coal Basin is to direct both coal mining and mine site rehabilitation in a manner that optimises coal recovery and the sustained use of the basin's other natural resources, and which is achieved at a reasonable cost.

Mining

- *Coal Resource*
  Encourage the exploration and definition of the total coal resource and the efficient access to and exploitation of all "extractable" coal.

- *Safety*
  Provide a safe and stable environment for workers, residents and visitors.

- *Rehabilitation*
  Encourage the rehabilitation of all land previously affected by mining and associated activities.

- *Implement programmes of rehabilitation of current and future mining areas directed towards:*

  - *establishing stable land forms capable of supporting vegetation;*

  - *establishing stable vegetation in the form of:*

  (i) forest cover with timber potential;
  (ii) agroforestry;
  (iii) agriculture;
  (iv) natural forest; and
  (v) wetlands

  as required by commercial, community, recreational and final land form configuration considerations;

  - *improving and maintaining aesthetic, cultural and ecological values in the basin;*

  - *sustaining the water quality and water yield from the basin by restricting turbidity and the production of acidic waters.*

Infrastructure

- *Provide the necessary townsite development and expansion into areas which are not underlain by coal reserves or old mine workings.*

- *Provide for the industrial and social infrastructure associated with the development and use of the coal resource and other land uses.*

- *Provide adequate land for power stations, roads, services and public utilities, where this does not sterilise extractable coal reserves.*

Water

Ensure that coal mining and other activities in the basin do not significantly diminish the quality and quantity of surface runoff and recharge to the groundwater system and that water resources are developed and utilised in the best interests of the State.

Forest Resources

Conserve State Forest resources within the practical constraints imposed by mining, water production and the recreational needs of the community.

Agriculture

Minimise disruption to current farming activities."

APPENDIX B

DRAFT LICENCE CONDITIONS

DRAFT CONDITIONS

TO BE ATTACHED TO STATE ENERGY COMMISSION GROUNDWATER LICENCE TO DRAW GROUNDWATER FROM THE COLLIE COAL BASIN

1. The State Energy Commission (hereinafter referred to as 'the licensee') shall only draw water from the licensee's bores when water is not available from either run of river flows in the Collie River or from Western Collieries Ltd and Griffin Coal Mining Co. Ltd (hereinafter referred to as 'the mining companies') or when water from the river and mining companies is insufficient in quantity or of inadequate quality for the licensee's purposes, or with the written permission of the Water Authority for stipulated periods. For the purposes of this licence "water of inadequate quality" shall be as determined by the Water Authority from time to time and advised to the licensee and the mining companies in writing.

2. The total combined draw from the licensee's bores or wells shall not exceed six million kilolitres per annum, however, temporary variations of this amount will be considered if additional water is required on a temporary basis from time to time.

3. If in the opinion of the Water Authority the drawing of water from the licensee's bores or wells is considered to be adversely affecting the aquifer the Water Authority may reduce the amount that may be withdrawn.

4. Should the drawing of water from the licensee's bores or wells adversely affect other users the Water Authority may require the licensee to make good the supply to the affected users to the satisfaction of the Water Authority.

5. The licensee shall design a programme to monitor the behaviour of the underground waters of the Collie Coal Basin. This programme shall include the acquisition of relevant data on mine dewatering as made available from the mining companies.

6. This programme shall be submitted to the Water Authority for approval and subject to any amendments required by the Water Authority the programme shall be implemented by the licensee at his cost.

7. Every two years, commencing December 31, 1988, the licensee shall submit to the Water Authority a report containing:

   (a) the monitoring data collected to the time of reporting,

   (b) an assessment of the status and behaviour of the underground water resources of the Collie Coal Basin as determined from the monitoring data,

   (c) an assessment of the efficacy of the monitoring programme and recommendations for any desirable changes to the programme,

   (d) a plan and schedule of all production and observation bores owned or operated by the licensee on the subject land, giving bore construction, equipment fitted, status and location details.

8. The reporting frequency specified in Condition 7 above may be varied by the Water authority at any time. Six months notice of any such change shall be given to the licensee.

9. If at any time considered desirable by the Water Authority the licensee shall implement changes to the monitoring programme as directed by the Water Authority.

10. If at any time the monitoring indicates a possible need for prompt action to prevent or reduce the effects of the licensee on the underground water, the licensee shall immediately report this to the Water Authority and advise the corrective measures proposed.

11. Where the behaviour of the underground waters of the Collie Coal Basin is deviating from that expected, the Water Authority may direct the licensee to reassess the availability of groundwater from the basin and its expected ability to meet the water requirements of the licensee.

12. That approval of the Water Authority be obtained prior to the construction of additional or replacement bores or prior to the modification or refurbishment of existing bores.

AUTHORISED OFFICER
Dated

DRAFT CONDITIONS

TO BE ATTACHED TO COAL MINING COMPANY'S LICENCES TO DRAW GROUNDWATER FROM THE COLLIE COAL BASIN FOR THE PURPOSES OF COAL MINE DEWATERING

1. The licensee shall only draw sufficient water under this licence to enable safe and reasonable operation of the mine being dewatered.

2. The licensee shall make the water so drawn available to other parties (as determined by the Water Authority from time to time) preferentially to the discharge of water to surface water courses. The arrangements for this shall be the subject of negotiation and agreement between the Water Authority and the licensee.

3. If in the opinion of the Water Authority the drawing of water from the licensee's bores or wells is considered to be adversely affecting the aquifer or other users the Water Authority may reduce the amount that may be withdrawn.

4. Should the drawing of water from the licensee's bores or wells adversely affect other users the Water Authority may require the licensee to make good the supply to the affected users to the satisfaction of the Water Authority.

5. The licensee shall design and implement a programme to monitor the effects of the licensee's groundwater abstractions on the underground waters of the Collie Coal Basin.

6. This programme shall be submitted to the Water Authority for approval and subject to any amendments required by the Water Authority the programme shall be implemented by the licensee at his cost.

7. The licensee shall submit the monitoring data obtained under Condition 5 to the Water Authority at a frequency and in a form to be determined by the Water Authority from time to time. Such data may be made available to the State Energy Commission of Western Australia as agreed between the Water Authority and the licensee.

8. If at any time considered desirable by the Water Authority the licensee shall implement changes to the monitoring programme as directed by the Water Authority.

9. If at any time the monitoring indicates a possible need for prompt action to prevent or reduce the effects of the licensee on the underground water, the licensee shall immediately report this to the Water Authority and advise the corrective measures proposed.

10. That approval of the Water Authority be obtained prior to the construction of additional or replacement bores or prior to the modification or refurbishment of existing bores.

AUTHORISED OFFICER
Dated

DRAFT LIMITATIONS AND CONDITIONS

TO BE ATTACHED TO
ENVIRONMENTAL PROTECTION ACT 1986
PART B POLLUTION CONTROL LICENCE
FOR SURFACE DISCHARGES WITHIN THE COLLIE COAL BASIN

B1 Only waters generated by mine dewatering shall be discharged, in accordance with the undertakings given in ..... . Turbid waters shall pass through an effective settling basin before discharge.

B2 The nature and composition of surface discharges shall at all times conform to the following schedule -

(a) pH in the range 5.0 to 8.5.
(b) Total dissolved solids less than 550 mg /L.
(c) Suspended solids less than 80 mg/L.
(d) Oil and grease less than 5 mg/L.
(e) Iron less than 3 mg/L.
(f) Manganese less than 0.5 mg/L.
(g) Dissolved oxygen not less than 5 mg/L.
(h) Other constituents (including metals) less than the recommended criteria for potable use given in the NH&MRC/Australian Water Resources Council publication "Guidelines for Drinking Water Quality in Australia 1987".

B3 The licensee shall install and maintain meters which determine the cumulative quantity of mine dewatering discharges. Records of these discharges shall be made at monthly intervals.

B4 At quarterly intervals, the following information shall be determined by the licensee and forwarded to the Manager, Headworks and Treatment, Water Authority of W.A., Perth:

(a) Analysis results for representative samples of waters discharged including those parameters given in licence condition B2. Note: all samples shall be consigned to a NATA registered laboratory for analysis in accordance with current "Standard Methods for Examination of Water and Wastewater - APHA - AWWA - WPCF".

(b) Records of all cumulative discharge quantities at monthly intervals.

....
DELEGATED OFFICER APPROVAL DATE