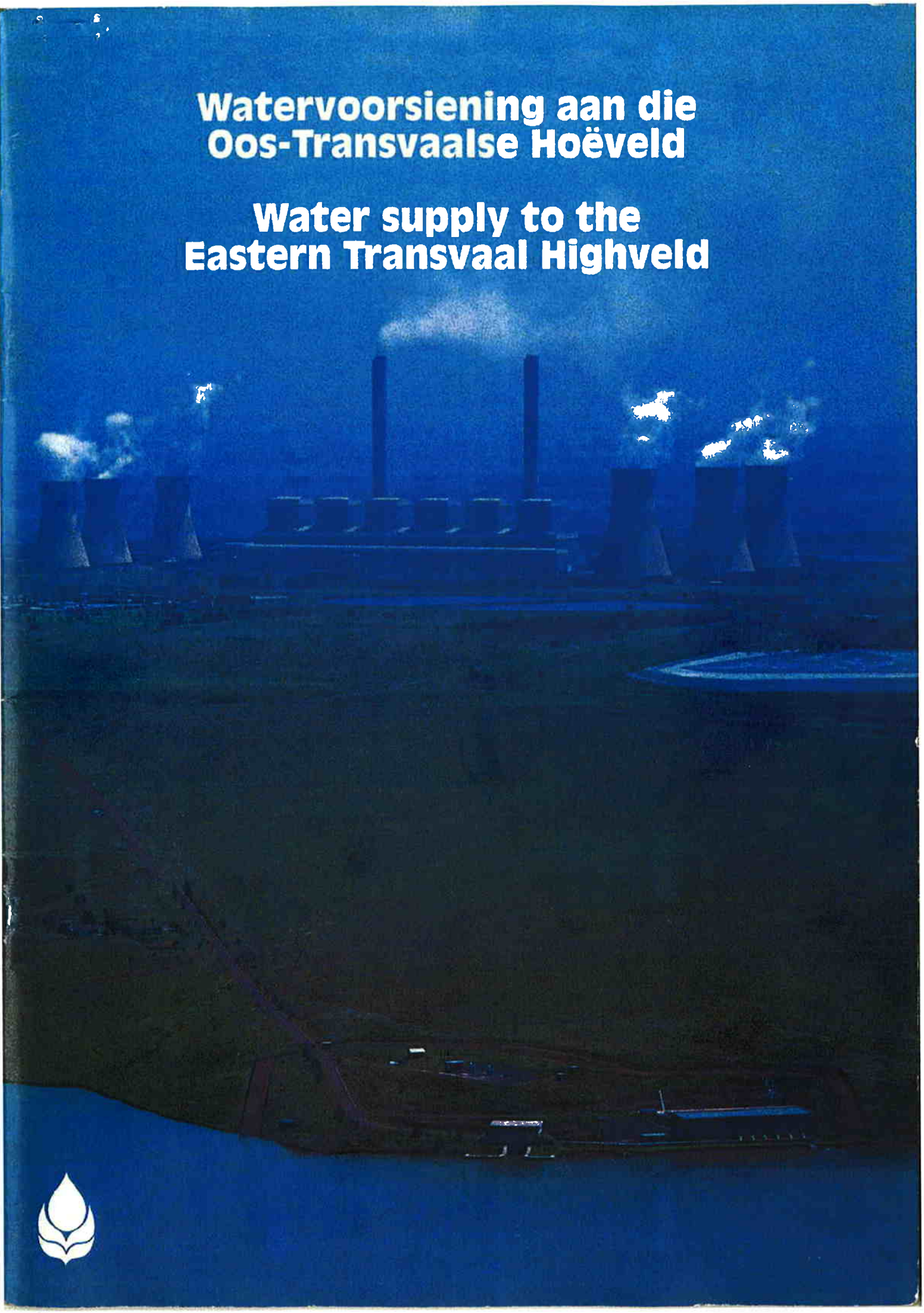
Watervoorsiening aan die Oos-Transvaalse Hoëveld

Water supply to the Eastern Transvaal Highveld



Die ontdekking van goud aan die Witwatersrand in 1886 het 'n invloei van mense meegebring wat deur die jare vermeerder het. En saam met die groei in bevolking en mynboubedrywighede, het die nywerheidsektor gedy.

Vandag is die Pretoria-Witwatersrand-Vereeniginggebied (algemeen bekend as die PWV-gebied) die polsslag van die Suid-Afrikaanse ekonomie. Daar word verwag dat dié gebied teen die jaar 2000 ongeveer 42% van die RSA se stedelike bevolking sal huisves en 56% van alle nywerheids- en 79% van alle mynbouproduksie sal lewer. Die energiebehoeftes van hierdie nywerhede en stede word hoofsaaklik bevredig uit die steenkoolvelde oos van Johannesburg, in die gebied wat bekend staan as die Oos-Transvaalse Hoëveld.

Verskeie groot termiese kragsentrales is deur Eskom naby die steenkoolvelde opgerig om te voorsien in die behoeftes van 'n snel ontwikkelende PWV-gebied. Die lewensvatbaarheid van 'n projek om steenkool om te skakel in 'n vloeibare brandstof en ander chemiese koolstowwe (carbo-chemical products) het aanleiding gegee tot die vestiging van twee sintetiese brandstofaanlegte, Sasol II en III, in dieselfde gebied.

Al hierdie nywerhede is vir hul voortbestaan afhanklik van 'n ander belangrike grondstof behalwe steenkool – WATER. Eskom, byvoorbeeld, gebruik van 0,7 tot meer as twee liters water (afhangende van die verkoelingsmetode wat gebruik word) vir elke krageenheid (1 kWh) wat deur sy termiese kragsentrales opgewek word.

The discovery of gold on the Witwatersrand in 1886 brought on an influx of people which increased over the years. And along with the increase in population and mining activities, the industrial sector thrived.

Today the Pretoria-Witwatersrand-Vereeniging area (referred to as the PWV area) is the heart of South Africa's economy – an area which by the year 2000 will accommodate 42% of the RSA's urban population and will produce 56% of all industrial and 79% of all mining output. The energy required by these industries and cities is mainly derived from the coalfields to the east of Johannesburg, in the area known as the Eastern Transvaal Highveld.

Some very large thermal power-stations were erected by Eskom in close proximity to these coalfields to provide for the energy demands of the rapidly developing PWV area. The viability of converting coal into liquid fuel and other carbo-chemical products also gave rise to the erection of two large synthetic fuel plants, Sasol II and III, in the same area.

Apart from coal, all these industries are dependent on one other essential resource to manufacture their product – WATER. Eskom, for example, uses from 0,7 to more than two litres of water (depending on the cooling method used) for every energy unit (1 kWh) produced at their thermal power-stations.

Beskikbaarheid van water

Met 'n gemiddelde reënval van 350 mm laer as die wêreldgemiddelde van 860 mm, is die grootste uitdaging vir Suid-Afrika se Departement van Waterwese om die balans te handhaaf tussen die beskikbare watervoorraad en die toenemende aanvraag en om die ontginning en aanvulling van die voorrade te beplan.

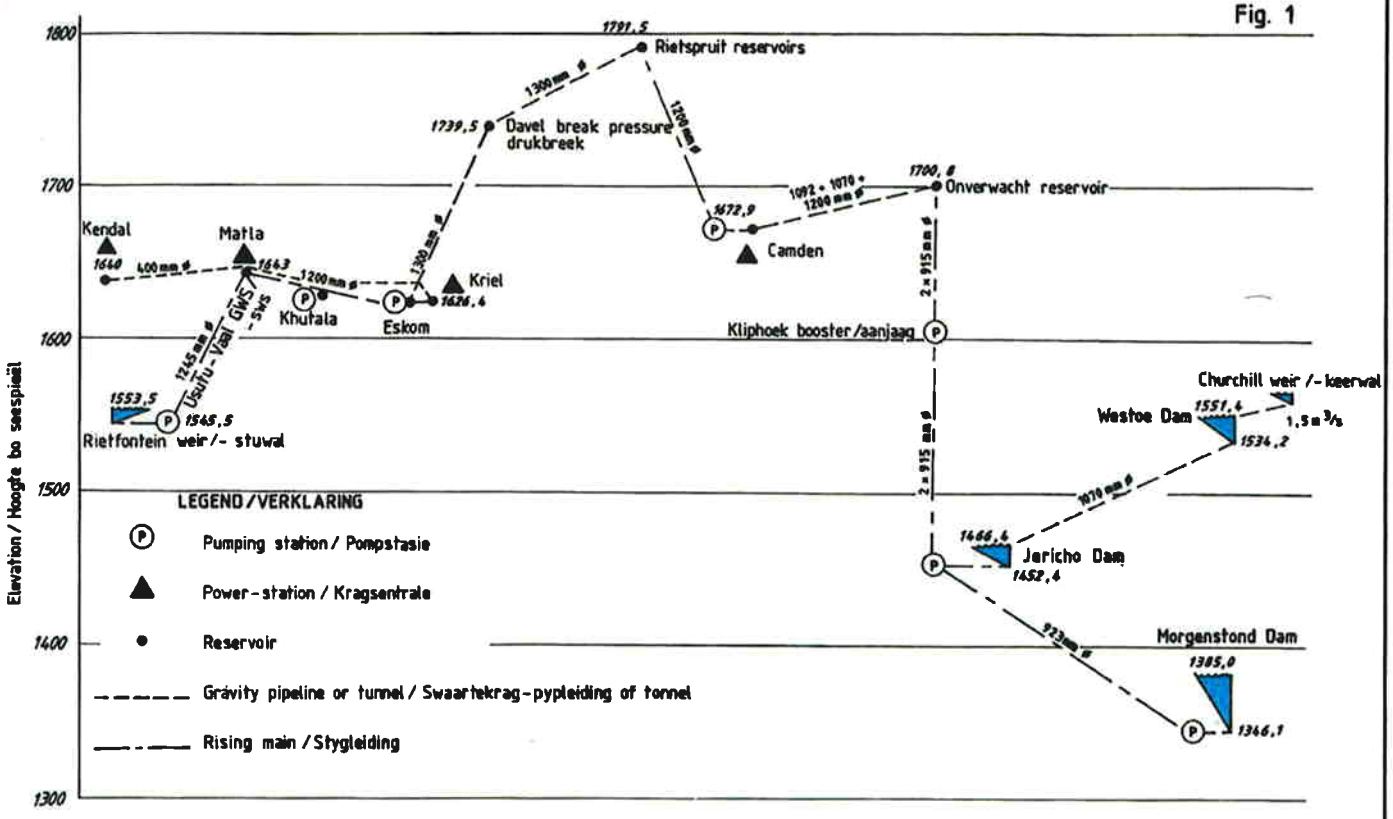
Water het relatief skaars geraak op die Oos-Transvaalse Hoëveld aangesien die grootste gedeelte van die beskikbare water reeds toegeken is aan plaaslike nywerheids-, huishoudelike en besproeiingsontwikkeling. Toe Eskom dus besluit om sy eerste groot 1 000 MW-kragsentrale in die sestigerjare op die steenkoolvelde te bou, moes die Departement hom dus tot aangrensende opvanggebiede wend vir water.

Availability of water

With an average rainfall of 350 mm less than the world average of 860 mm, the greatest challenge for South Africa's Department of Water Affairs is to maintain the balance between available water supplies and sharply rising demands and to plan the exploitation and augmentation of these supplies.

Water on the Eastern Transvaal Highveld has become scarce as all available water resources have been allocated for local industrial, domestic and irrigation use. When Eskom decided to build its first 1 000 MW major power-station on the coalfields in the 1960s, it thus became necessary to look at neighbouring catchments for water.

Fig. 1



USUTU RIVER GWS — **USUTURIVIER-SWS**

Schematic diagram of relative elevations — **Skematiese diagram van relatiewe hoogte**

Usuturivier-staatswaterskema

Die skema soos dit tans bestaan, is in vyf fases gebou en bestaan uit die Jericho-, Westoe- en Morgenstonddam en die Churchill-uitkeerwal. 'n Aantal pompstasies, pypleidings en die Westoetonnel maak die vervoerstelsel van dié skema uit. Die skema dra water vanaf die Usuturivieropvanggebied oor na die gebruikers in die Vaalrivieropvanggebied (Camden-kragsentrale en Ermelo-munisipaliteit) en die Olifantsrivieropvanggebied (Kriel-, Matla- en Kendal-kragsentrale en die dorp Davel).

Usutu River Government Water Scheme

The scheme as it exists today was built in five phases and consists of the Westoe, Jericho and Morgenstond Dams and the Churchill diversion weir. A number of pumping stations, pipelines and the Westoe Tunnel also form part of this scheme which transfers water from the Usutu River catchment area to users in the Vaal River catchment area (Camden Power-Station and Ermelo Municipality) and in the Olifants River catchment area (Kriel, Matla and Kendal Power-Stations and the town of Davel).

Fases waarin skema gebou is

Fase 1: 1964 – 1966

- Konstruksie van die Jerichodam in die Mpamarivier.
- Bou van 'n pompstasie onderkant die damwal en van 'n enkele stygleiding vanaf die pompstasie tot by twee balanseerreservoirs op die plaas Onverwacht op die waterskeiding tussen die Usutu- en die Vaalrivier-opvanggebied.
- Bou van een swaartekragpypleiding vanaf die Onverwacht-reservoirs na die Camden-kragsentrale en eindpuntreservoirs by Camden.

Fase 2: 1966 – 1968

- Verhoging van die Jerichodam met behulp van vyf radiaalsluise, elk 3,96 m hoog en 10,97 m breed.
- Konstruksie van die Westoedam in die Usuturivier waarvandaan water deur middel van die Westoetonnel (1,16 km lank) en 'n swaartekragpypleiding vanaf die tonneluitlaat tot in die Jerichodam gelei word.

Fase 3: 1969 – 1971

- Verhoging van die Westoedam met behulp van twee boepenssluise, elk 4,57 m hoog en 45,4 m breed.
- Verdubbeling van die pypleiding van die Jerichodam na die Camden-kragsentrale.
- Konstruksie van 'n derde reservoir by Onverwacht.

Fase 4: 1974 – 1981

- Konstruksie van 'n pypleiding vanaf die Camden- na die Kriel-kragsentrale en van 'n derde pypleiding tussen Onverwacht en Camden.
- Konstruksie van 'n derde reservoir by Camden en die reservoirs by Rietspruit en Davel.
- Bou van die Morgenstonddam in die Ngwempisirivier asook 'n stygleiding en pompstasie vir die oordrag van water na die Jerichodam.
- Vergroting van die Jericho-pompstasie en konstruksie van die Kliphoek-aanjaagpompstasie om die oordragvermoë van die Jerichodam na die Onverwacht-reservoirs te vergroot.

Fase 5: 1984 – 1990

- Konstruksie van die Churchill-keerwal in die Bonniespruit en 'n kanaal van 9 km om die water uit die Bonniespruit na die Westoedam uit te keer.
- Konstruksie van 'n vierde swaartekragpypleiding tussen Onverwacht en Camden.
- Verhoging van die Morgenstonddam deur middel van drie radiaalkruinsluise, elk agt meter hoog en nege meter breed en die bou van 'n onbeheerde oorloop.

Noodskema (1987)

- Word bespreek as deel van die Usutu-Vaalrivier-staatswaterskema – kyk bladsy 12.

Phases in which the scheme was built

Phase 1: 1964 – 1966

- Construction of the Jericho Dam on the Mpama River.
- Construction of a pumping station below the dam wall and a single rising main from the pumping station to two balancing reservoirs on the farm Onverwacht on the watershed between the Usutu and the Vaal River catchment areas.
- Building of one gravity pipeline from the Onverwacht reservoirs to the Camden Power-Station plus terminal reservoirs at Camden.

Phase 2: 1966 – 1968

- Raising of the Jericho Dam by means of five radial gates, each 3,96 m high and 10,97 m wide.
- Construction of the Westoe Dam on the Usutu River from where water is conveyed to the Jericho Dam by means of the 1,16 km long Westoe Tunnel and a gravity pipeline from the tunnel outlet.

Phase 3: 1969 – 1971

- Raising of the Westoe Dam by means of two fish-belly flap gates, each 4,57 m high and 45,4 m wide.
- Doubling of the pipeline from the Jericho Dam to the Camden Power-Station.
- Addition of a third reservoir at Onverwacht.

Phase 4: 1974 – 1981

- Construction of a pipeline from the Camden to the Kriel Power-Station and of a third pipeline between Onverwacht and Camden.
- Construction of the third reservoir at Camden and the Rietspruit and Davel reservoirs.
- Construction of the Morgenstond Dam on the Ngwempisi River as well as a rising main and pumping station for the transfer of water to the Jericho Dam.
- Enlargement of the Jericho Pumping Station and the construction of the Kliphoek Booster Pumping Station to increase the water transfer capacity from the Jericho Dam to the Onverwacht reservoirs.

Phase 5: 1984 – 1990

- Construction of the Churchill Weir on the Bonnie Brook and a 9 km long canal to divert water from the Bonnie Brook to the Westoe Dam.
- Construction of a fourth gravity pipeline between Onverwacht and Camden.
- Raising of the Morgenstond Dam by means of three radial crest gates, each eight metres high and nine metres wide and of an uncontrolled spillway.

Emergency Scheme (1987)

This scheme is discussed as part of the Usutu-Vaal River GWS – see page 12.

Werking van die skema

Die Westoedam se water vloei onder swaartekrag na die Jerichodam via die Westoetonnel en 'n pypleiding. 'n Pompstasie by die Morgenstonddam (wat gebou is om bykomende water aan Eskom se kragsentrales te voorsien) pomp ook water tot by die Jerichodam met behulp van 'n pypleiding. Die water word dan na die Onverwacht-reservoirs op die waterskeiding tussen die Usutu- en die Vaalrivier gepomp. Daarvandaan vloei die water onder swaartekrag deur vier groot pype, elk met 'n lengte van 17 km, tot by die Camden-reservoirs. 'n Gedeelte van hierdie water word deur die Camden-kragsentrale en -woonbuurt en die Usutu-steenkoolmyn gebruik.

Die res van die water word vanaf die Camden-pompstasie tot by die Rietspruit-reservoirs net suid van Ermelo gepomp, waarvandaan dit na die Davel-drukbreekreservoirs vloei. Die water vloei onder swaartekrag verder tot by die Khutala-reservoirs. (Onderweg is daar 'n aftappunt na die reservoir by die Kriel-kragsentrale.) Vanuit hierdie reservoirs word water met behulp van die Khutala-pompstasie na die Kendal-kragsentrale gepomp. Die Kuthala-reservoirs, pompstasie en pypleidings maak gesamentlik die Sentraal-Hoëveld-sws uit.

Surpluswater wat by die Kriel-kragsentrale beskikbaar is, kan na die Matla-kragsentrale geneem word deur middel van 'n pompstasie en pypleiding wat deur Eskom gebou is. Hierdie pypleiding kan ook water in die teenoorgestelde rigting, dit wil sê vanaf die Matla- na die Kriel-kragsentrale, vervoer in 'n noodgeval – soos wanneer 'n onderbreking van die watertoevoer vanaf die Usuturivier-sws sou voorkom. Die Khutala-pompstasie kan ook in 'n noodgeval met behulp van 'n verbindingspypleiding vanaf die Matla-reservoirs voorsien word. (Laasgenoemde reservoirs se water word normaalweg vanuit die Grootdraaidam via die Rietfontein-pompstasie voorsien – kyk Usutu-Vaalrivier-sws.)

'n Bestendige lewering van 254 027 m^3 water kan daagliks deur hierdie skema oorgedra word. Dit is 109% van die geprojekteerde behoefte vir 1995 en sal tot omstreeks die jaar 2010 in die toenemende nywerheids- en stedelike behoeftes in die stelsel se voorsieningsgebied kan voorsien.

Functioning of the scheme

Water flows by tunnel and gravity pipeline from the Westoe to the Jericho Dam. A pumping station at the Morgenstond Dam (which was built to supply additional water to Eskom's power-stations) also pumps water via a pipeline to the Jericho Dam. The water is then pumped from the Jericho Dam to the Onverwacht reservoirs on the watershed between the Usutu and Vaal Rivers. From this point the water flows under gravitation through four large pipes, each 17 km long, to the Camden reservoirs. A certain volume of this water is used by the Camden Power-Station, its residential area and the Usutu Colliery.

The remainder of the water is pumped by means of the Camden Pumping Station to the Rietspruit reservoirs south of Ermelo. From here the water gravitates to the Davel break-pressure reservoirs. The water continues to flow under gravitation to the Khutala reservoirs with an off-take along the way to the reservoirs at the Kriel Power-Station. The water is then pumped by means of the Khutala Pumping Station to the Kendal Power-Station. The Khutala reservoirs, pumping station and pipelines jointly comprise the Central Highveld GWS.

Surplus water that is available at the Kriel Power-Station can be conveyed to the Matla Power-Station by means of an Eskom pumping station and pipeline. The pipeline is also capable of transporting water in the opposite direction, i.e. from the Matla to the Kriel Power-Station in an emergency such as an interruption of the water supply from the Usutu River GWS. The Khutala Pumping Station can also receive water from the Matla reservoirs by means of a connecting pipeline during an emergency. (The Matla reservoirs are normally supplied from the Grootdraai Dam via the Rietfontein Pumping Station – see Usutu-Vaal River GWS.)

A reliable yield of 254 027 m^3 of water per day can be transferred by means of the Usutu River GWS. This constitutes 109% of the projected demand for 1995 and is sufficient to supply the increasing industrial and urban demand on the system until about the year 2010.

Bedryf van die skema

Die Usuturivier-sws is die Departement van Waterwese se mees gesofistikeerde watervoorsieningstelsel – al vier pompstasies word bedryf met behulp van 'n afstand-beheerde, rekenaarondersteunde telemetriestelsel vanuit 'n sentrale beheerkamer wat by die Jerichodam geleë is. Die twee hoofbeheerkleppe, voor die Davel- en die Krielreservoir, en die druktoring-beheerklep vir die Rietspruitreservoirs, word ook deur die telemetriestelsel beheer. Die verste klep word vanaf 'n afstand van nagenoeg 150 km beheer.

Operation of the scheme

The Usutu River GWS is the Department of Water Affairs' most sophisticated water supply system to date – all four of the pumping stations are remotely controlled by means of a computer-supported telemetry system from a centrally located control room situated at the Jericho Dam. The two main control valves, situated at the Davel and the Kriel reservoirs, and the pressure tower control valve for the Rietspruit reservoirs are also controlled by the telemetry system. The furthest valve is controlled over a distance of approximately 150 km.

Jerichodam

Die Jerichodam bestaan uit 'n saamgestelde wal met grondflanke en 'n sentrale massabetonoorloopgedeelte. Die wal is verhoog deur die toevoeging van vyf radiaalsluise, elk 3,96 m hoog en 10,97 m breed.

Die Jerichodam is só geleë dat dit aanvullingswater uit ander riviere in die Usutubekken kan ontvang – eerstens uit die Westoedam in die Usuturivier en tweedens uit die Morgenstonddam in die Ngwempisirivier. 'n Pompstasie is onderkant die damwal geleë.

DATA:

Jaar van voltooiing	1966 (verhoog 1968)
Doel	Watervoorsiening vir termiese kragsentrales, huishoudelike en nywerheidsgebruik
Rivier	Mpamaspruit
Opvanggebied	218 km^2
Gemiddelde jaarlikse afloop	23,6 miljoen m^3
Naaste dorp en provinsie	Amsterdam, Transvaal
Tipe	Saamgestelde wal met grondflanke en sentrale betonoorloop met vyf radiaalsluise
Bruto opgaarvermoë	59,3 miljoen m^3
Walhoogte bokant laagste fondament	23,4 m
Kruinlengte	1 170 m
Tipe oorloop	Radiaalsluise (beheerd)
Oorloopvermoë	835 m^3/s
Oppervlakte van dam by volvoorraadhoogte	989,7 ha
Geologie van terrein	Onverweerde tot totaal verweerde graniet
Eienaar, ontwerp en konstruksie	Departement van Waterwese

Jericho Dam

The Jericho Dam has a composite wall with earth flanks and a central mass gravity overspill section. The wall has been raised by adding five radial gates, each 3,96 m high and 10,97 m wide.

The Dam is ideally situated to receive augmentation water from other rivers in the Usutu basin – firstly from the Westoe Dam on the Usutu River and secondly from the Morgenstond Dam on the Ngwempisi River. A pumping station is situated below the Jericho Dam wall.

DATA:

Year of completion	1966 (raised 1968)
Purpose	Water supply for thermal power-stations, domestic and industrial use
River	Mpamaspruit
Catchment area	218 km^2
Mean annual run-off	23,6 million m^3
Nearest town and province	Amsterdam, Transvaal
Type	Composite wall with earth flanks and central concrete spillway with five radial gates
Gross storage capacity	59,3 million m^3
Wall height above lowest foundation	23,4 m
Crest length	1 170 m
Type of spillway	Radial gates (controlled)
Spillway capacity	835 m^3/s
Surface area of dam at full supply level	989,7 ha
Site geology	Unweathered to completely weathered granite
Owner, design and construction	Department of Water Affairs

Westoedam

Die Westoedam bestaan uit 'n saamgestelde wal met grondflanke en 'n sentrale massabeton-oorloopgedeelte wat verhoog is met behulp van twee boepenssluise, elk met 'n hoogte van 4,57 m en 'n breedte van 45,4 m. ('n Boepenssluis word laat sak om die water *bo-oor* te laat oorloop, terwyl die meer algemene radiaalsluis gelig word om water aan die *onderkant* deur te laat.)

Water word onder swaartekrag deur middel van die 1 160 m-lange Westoetonnel en die Westoe-Jericho-betonpypleiding van 15 km met 'n dravermoë van 2,15 m^3/s tot in die Jerichodam gevoer.

DATA:

Jaar van voltooiing	1968 (verhoog 1972)
Doel	Watervoorsiening vir termiese kragsentrales, huishoudelike en nywerheidsgebruik
Rivier	Usutu
Opvanggebied	531 km^2
Gemiddelde jaarlikse afloop	47,8 miljoen m^3
Naaste dorp en provinsie	Amsterdam, Transvaal
Tipe	Saamgestelde wal met grondflanke en sentrale betonoorloop met twee boepenssluise
Bruto opgaarvermoë	60 miljoen m^3
Walhoogte bokant laagste fondament	23 m
Kruinlengte	1 006 m
Tipe oorloop	Boepenssluise (beheerd)
Oorloopvermoë	1 680 m^3/s
Oppervlakte van dam by volvoorraadhoogte	725 ha
Geologie van terrein	Onverweerde tot totaal verweerde lawa
Eienaar, ontwerp en konstruksie	Departement van Waterwese

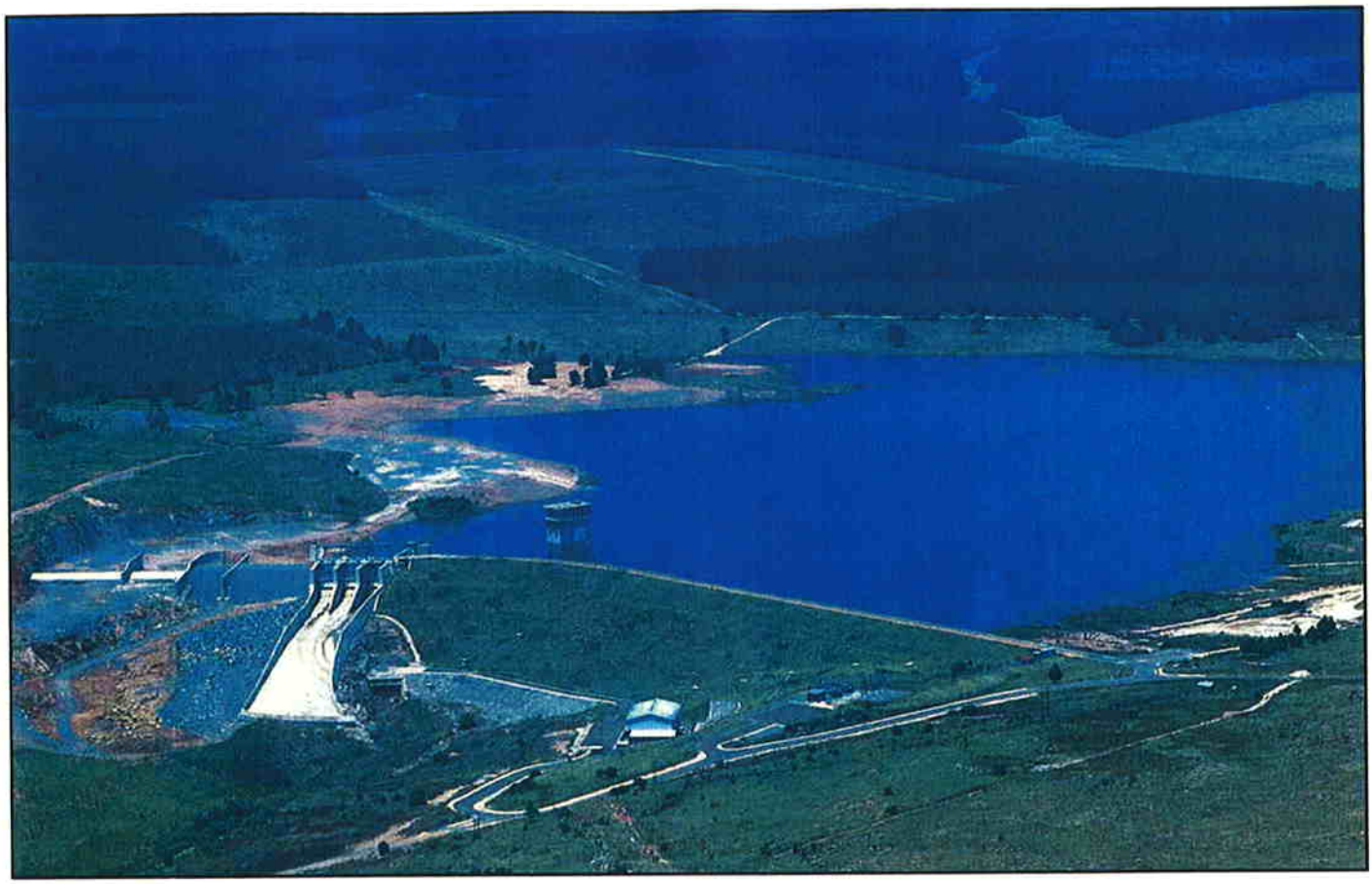
Westoe Dam

The Westoe Dam consists of a composite wall with earth flanks and a central mass gravity overspill section that was raised by means of two fish-belly flaps, each with a height of 4,57 m and a width of 45,4 m. (A fish-belly flap is lowered to allow the water to flow *over* the gate, whereas the better known radial gate is raised to allow the water to flow *underneath* the gate.)

The water is transferred under gravity into the Jericho Dam by means of the 1 160 m long Westoe Tunnel and the Westoe-Jericho concrete pipeline of 15 km and a carrying capacity of 2,15 m^3/s.

DATA:

Year of completion	1968 (raised 1972)
Purpose	Water supply for thermal power-stations, domestic and industrial use
River	Usutu
Catchment area	531 km^2
Mean annual run-off	47,8 million m^3
Nearest town and province	Amsterdam, Transvaal
Type	Composite wall with earth flanks and central concrete spillway with two fish-belly flaps
Gross storage capacity	60 million m^3
Wall height above lowest foundation	23 m
Crest length	1 006 m
Type of spillway	Fish-belly flaps (controlled)
Spillway capacity	1 680 m^3/s
Surface area of dam at full supply level	725 ha
Site geology	Unweathered to completely weathered lava
Owner, design and construction	Department of Water Affairs



Morgenstonddam

Die volvoorraadhoogte van die Morgenstonddam is in 1990 met sewe meter verhoog deur die installering van drie radiaalsluise op die oorloop, waardeur die aanvanklike opgaarvermoë van die dam van 45 miljoen m^3 tot 100,7 miljoen m^3 vermeerder is. 'n Onbeheerde oorloop is ook gebou om 'n vloed met 'n herhalingsperiode van 20 jaar te hanteer sonder dat die sluise in bedryf gestel hoef te word. Al die oorlope wat met sluise toegerus is, is op die regterflank geleë. Met die sluise heeltemal oop, sal 'n vloed wat gemiddeld een keer in 200 jaar verwag word, deurgelaat kan word. Om die hoofwal ten tye van 'n groter vloed te beskerm, is 'n noodoorloop tussen die radiaalsluise en die onbeheerde oorloop gebou.

Die pompstasie is stroom af van die damwal op die linkeroewer van die rivier geleë. Die stygleiding van die Morgenstonddam na die Jerichodam is 8,8 km lank en het 'n deursnee van 900 mm. Dié pompstasie en stygleiding kan 45,6 miljoen m^3 water jaarliks aan die Jerichodam lewer.

Die Morgenstonddam beskik tans oor geen ontspanningsgeriewe nie maar is die eerste Departementele dam wat gesoneer is om te verseker dat toekomstige ontwikkeling op 'n beplande en geordende wyse sal geskied.

DATA:

Jaar van voltooiing	1978 (verhoog 1990)
Doel	Watervoorsiening vir termiese kragsentrales, huishoudelike en nywerheidsgebruik
Rivier	Ngwempisi
Opvanggebied	546 km^2

Morgenstond Dam

The initial storage capacity of the Morgenstond Dam of 45 million m^3 was increased in 1990 to 100,7 million m^3 when the full supply level of the dam was raised by seven metres with the installation of three radial crest gates on the spillway. An uncontrolled spillway was also constructed to cope with a flood with a return period of 20 years without having to operate the gates. All gated spillways are situated on the right flank. With the gates fully open, the spillway will be able to pass a flood which can, on average, be expected once in 200 years. In order to protect the main wall against larger floods, an emergency spillway was built between the radial gates and the uncontrolled spillway.

The pumping station is situated downstream of the dam wall, on the left bank of the river. The rising main from the Morgenstond Dam to the Jericho Dam is 8,8 km long and has a diameter of 900 mm. The pumping station and the rising main are capable of delivering 45,6 million m^3 of water per annum to the Jericho Dam.

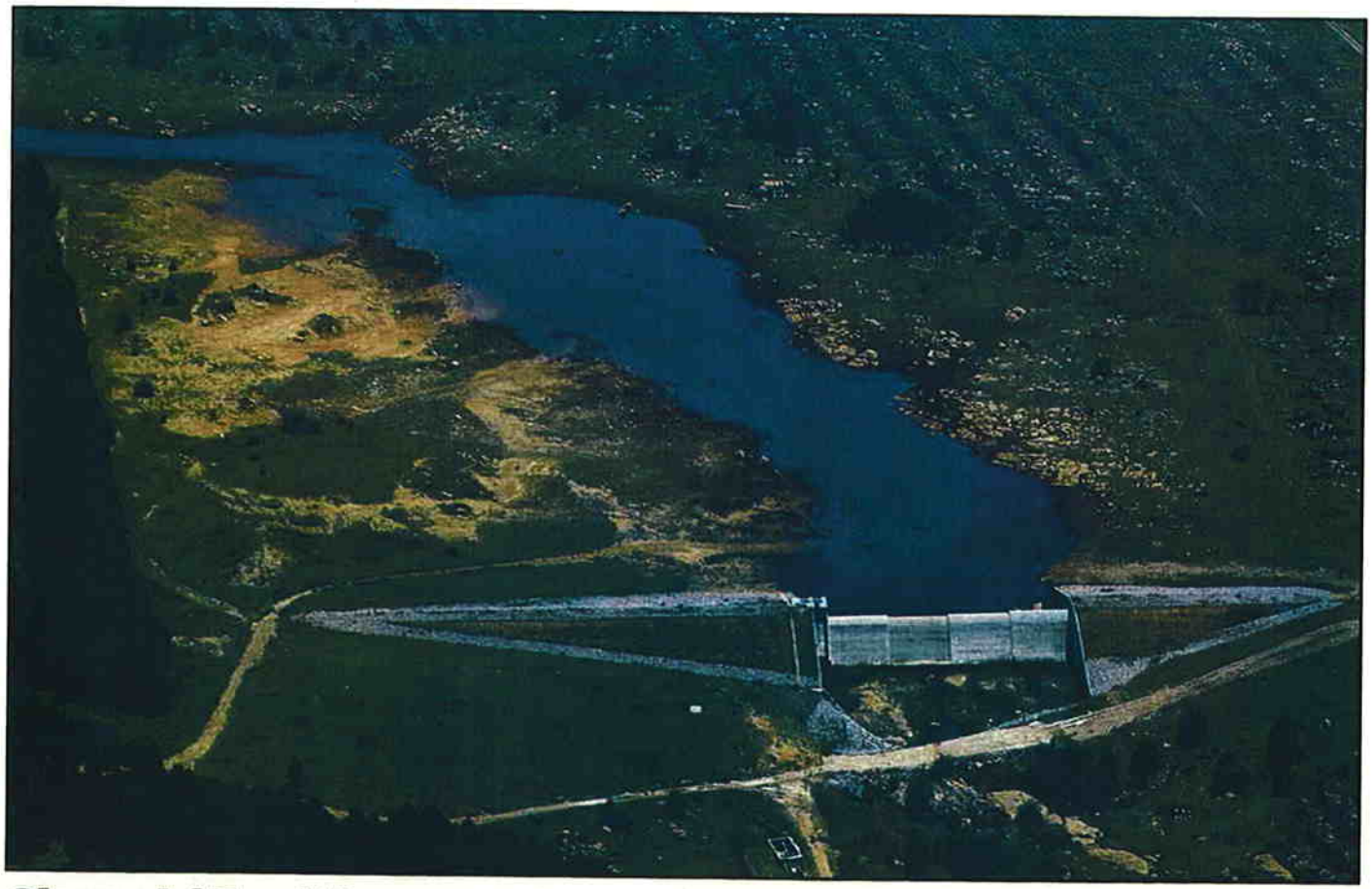
No recreational facilities are available at the Morgenstond Dam at present, but it is the first Departmental dam which was zoned to ensure that any future recreational development will take place in a planned and orderly manner.

DATA:

Year of completion	1978 (raised 1990)
Purpose	Water supply for thermal powerstations, domestic and industrial use
River	Ngwempisi
Catchment area	546 km^2

Gemiddelde jaarlikse afloop	56,3 miljoen m^3
Naaste dorp en provinsie	Amsterdam, Transvaal
Tipe	Grond met drie radiaalkruinsluise en onbeheerde oorloop
Bruto opgaarvermoë	100,7 miljoen m^3
Walhoogte bokant laagste fondament	44,5 m
Kruinlengte	574 m
Tipe oorloop	Drie beheerde radiaalsluise,'n onbeheerde oorloop en noodoorloop.
Hoofoorloopvermoë	1 500 m^3/s
Oppervlakte van dam by volvoorraadhoogte	982 ha
Geologie van terrein	Onverweerde gabbro
Ontwerp	International Orange River Consultants Consortium (Pty) Ltd en Departement van Waterwese
Konstruksie	Burton Construction en Departement van Waterwese
Eienaar	Departement van Waterwese

Mean annual run-off	56,3 million m^3
Nearest town and province	Amsterdam, Transvaal
Type	Earthfill with three radial crest gates and an uncontrolled spillway
Gross storage capacity	100,7 million m^3
Wall height above lowest foundation	44,5 m
Crest length	574 m
Type of spillway	Three controlled radial gates, an uncontrolled spillway and an emergency spillway
Main spillway capacity	1 500 m^3/s
Surface area of dam at full supply level	982 ha
Site geology	Unweathered gabbro
Design	International Orange River Consultants Consortium (Pty) Ltd and Department of Water Affairs
Construction	Burton Construction and Department of Water Affairs
Owner	Department of Water Affairs



Churchill-uitkeerwal

Die Churchill-uitkeerwal is in die Bonniespruit gebou om die Westoedam se water aan te vul. 'n Kanaal met 'n lengte van ongeveer 9 km kan water teen 1,5 m^3/s aan dié dam lewer.

DATA:

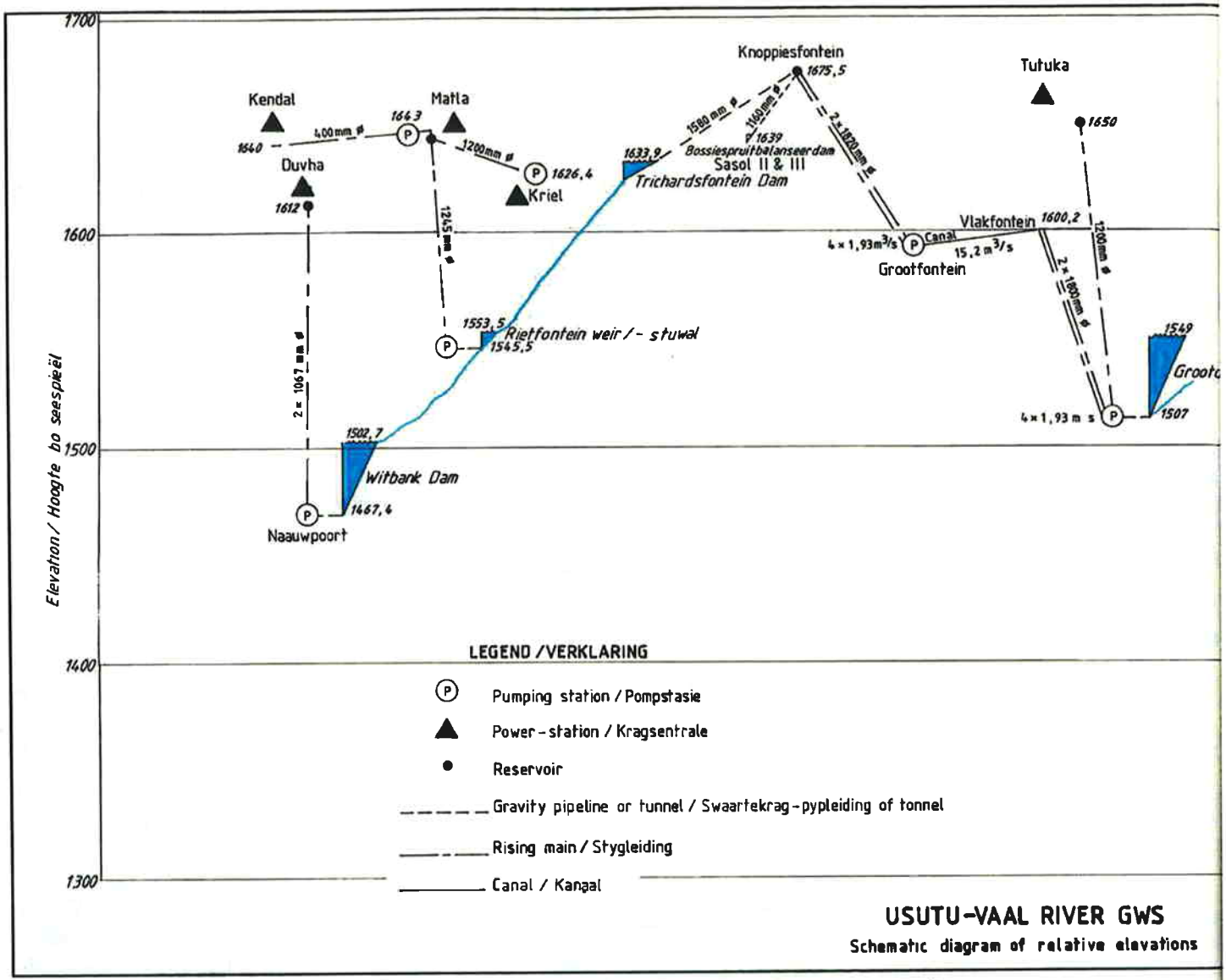
Jaar van voltooiing	1985
Rivier	Bonniespruit
Opvanggebied	119 km^2
Gemiddelde jaarlikse afloop	10,2 miljoen m^3
Geologie van terrein	Effens verweerde tot totaal verweerde graniet

Churchill Diversion Weir

The Churchill Diversion Weir was built on the Bonnie Brook to augment the water supply of the Westoe Dam. A 9 km long canal is able to supply water to this dam at a rate of 1,5 m^3/s.

DATA:

Year of completion	1985
River	Bonnie Brook
Catchment area	119 km^2
Mean annual run-off	10,2 million m^3
Site geology	Slightly weathered to completely weathered granite



USUTU-VAAL RIVER GWS

Schematic diagram of relative elevations

Usutu-Vaalrivier-staatswaterskema

Die toenemende vraag na water oorgedra vanaf die Usuturivier-sws, het die Departement van Waterwese genoodsaak om 'n ander waterbron te ontgin – die bolope van die Vaalrivier. Die gevolglike Usutu-Vaalrivier-sws is in twee fases gebou: die eerste waarin die bolope van die Vaalrivier gebruik is en die tweede waarin dié bolope weer aangevul is met water vanaf die Assegaairivier, 'n sytak van die Usuturivier, naby Piet Retief.

Fase 1: (1977 – 1981)

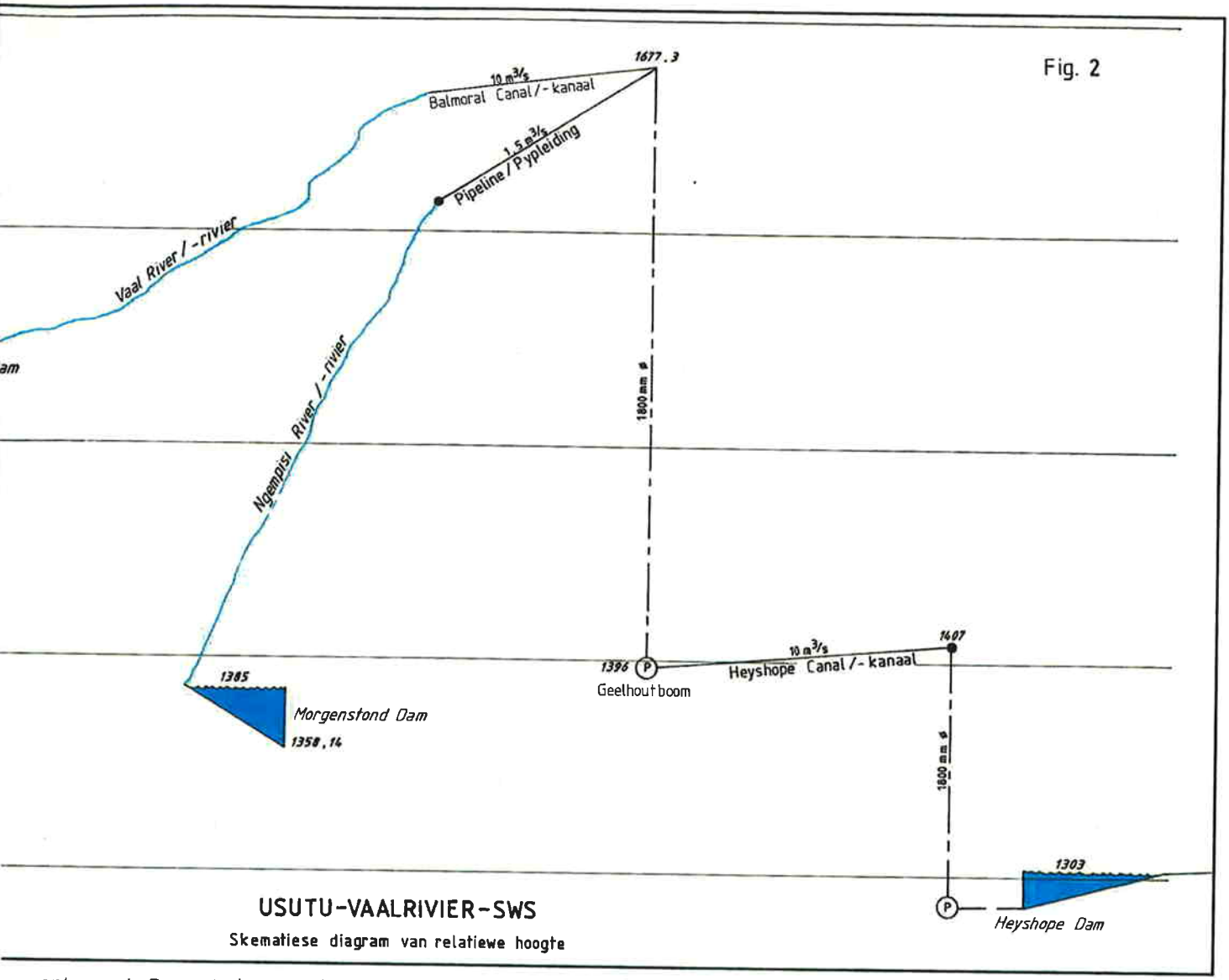
Hierdie fase het bestaan uit die konstruksie van die Grootdraaidam in die bolope van die Vaalrivier naby Standerton vanwaar water via 'n kanaal, twee pompstasies en twee pypleidings na die Trichardtsfontein-balanseerdam gepomp word. Water word uit die balanseerdam in die Trichardtspruit na die Rietfontein-stuwal losgelaat waar dit onttrek word om water aan die Matla-kragsentrale te voorsien. Die Kriel-kragsentrale ontvang sy water gewoonlik van die Usuturivier-staatswaterskema, terwyl die Matla-kragsentrale sy water gewoonlik van die Usutu-Vaalrivier-staatswaterskema

Usutu-Vaal River Government Water Scheme

The increasing demand for water transferred from the Usutu River GWS, necessitated the Department of Water Affairs to exploit another water source – the headwaters of the Vaal River. The ensuing Usutu-Vaal River GWS was built in two phases: The first utilising the headwaters of the Vaal River and the second supplementing these headwaters with water from the Assegaai River, a tributary of the Usutu River, near Piet Retief.

Phase 1 (1977 – 1981)

This phase comprised the construction of the Grootdraai Dam on the Upper Vaal River near Standerton from where water is pumped to the Trichardtsfontein balancing dam by means of two pumping stations, two pipelines and a canal. Required quantities of water are released from this balancing dam down the Trichardtspruit to the Rietfontein weir, from where it is pumped to the Matla Power-Station. The Kriel Power-Station normally receives water from the Usutu River Government Water Scheme, while the Matla Power-Station usually is supplied from the Usutu-Vaal River Government Water



ontvang. 'n Pompstasie en pypleiding tussen die Matla- en die Kriel-kragsentrale dien die tweeledige doel dat Matla van water voorsien kan word uit die Usuturivier-sws en dat die Kriel-kragsentrale weer uit die Usutu-Vaalrivier-sws van water voorsien kan word, sou daar 'n tekort aan water in een van die twee stelsels ontstaan.

Surpluswater vanuit die Trichardtsfontein-balanseerdam kan via die Rietfontein-stuwal in die Steenkoolspruit losgelaat word vanwaar dit na die Olifantsrivier en dan na die Witbankdam vloei. Die Duvha-kragsentrale kry sy water vanaf laasgenoemde dam via die Departement se Naauwpoort-pompstasie en van die Bo-Komatirivier-staatswaterskema (kyk Fig. 4). Indien water vanaf die Bo-Komati-stelsel om een of ander rede nie na die Duvha- en Hendrina-kragsentrale oorgedra kan word nie, kan water via die Naauwpoort-pompstasie aan albei kragsentrales voorsien word.

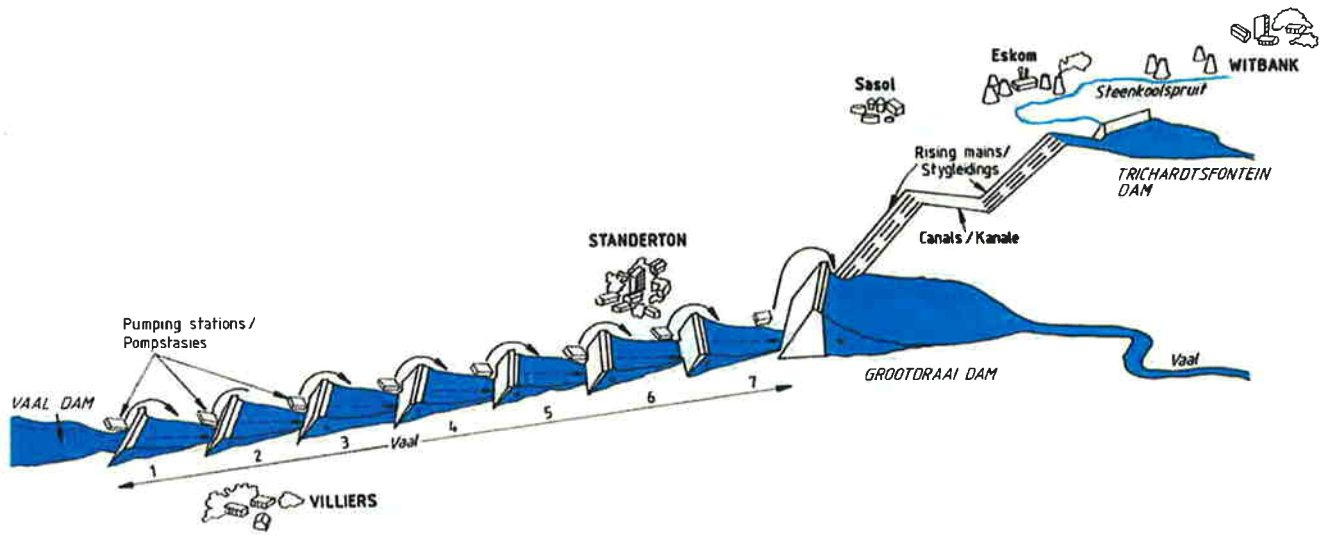
Die Usutu-Vaalrivier-sws voorsien ook die Tutuka-kragsentrale en Sasol II en III van water. Water vir Tutuka word direk uit die Grootdraaidam gepomp en water vir Sasol II en III word tussen die Grootfontein-pompstasie en die Trichardtsfontein-balanseerdam by die Knoppiesfontein-balanseer- en distribusiereservoir na die Bossiespruit-balanseerdam uitgekeer.

Scheme. A pumping station and pipeline between the Matla and Kriel Power-Stations serve the dual purpose of being able to supply Matla with water from the Usutu River GWS and the Kriel Power-Station with water from the Usutu-Vaal River GWS, should a shortage of water occur in any of the two systems.

Surplus water from the Trichardtsfontein balancing dam can be discharged into the Steenkoolspruit via the Rietfontein weir. The water then flows to the Olifants River which feeds the Witbank Dam. The Duvha Power-Station obtains its water from this dam via the Department's Naauwpoort Pumping Station and from the Upper Komati River Government Water Scheme (see Fig. 4). If for any reason the water supply from the Upper Komati system to the Hendrina and Duvha Power-Stations is interrupted, the Naauwpoort Pumping Station is able to supply water to both power-stations.

The Usutu-Vaal River GWS also supplies the Tutuka Power-Station and Sasol II and III with water. Water for Tutuka is pumped directly from the Grootdraai Dam and water for Sasol II and III is diverted to the Bossiespruit balancing dam at the Knoppiesfontein balancing and distribution reservoir which lies between the Grootfontein Pumping Station and the Trichardtsfontein balancing dam.

Fig. 3



GROOTDRAAI DAM EMERGENCY SUPPLEMENT SCHEME

Schematic portrayal

GROOTDRAAIDAMNOODAANVULLINGSKEMA

Skematiese voorstelling

Grootdraaidam-Noodaanvullingskema (1983)

Ernstige droogtetoestande in die opvanggebiede van die Komati-, Usutu-, en Bo-Vaalrivier gedurende die vroeë tagtigerjare het die Departement genoodsaak om nog 'n addisionele bron van water vir die Oos-Transvaalse Hoëveld te vind. Die enigste uitweg was om water vanaf die Vaaldam oor te dra om die Grootdraaidam aan te vul. Dit kon alleen gedoen word deur die vloei van die Vaalrivier om te draai – 'n vindingryke stuk ingenieurswese wat daartoe gelei het dat die Departement die Suid-Afrikaanse Instituut vir Siviele Ingenieurswese (SAISI) se nasionale toekenning vir die beste siviele ingenieursprojek in 1984 ontvang het.

Die noodaanvullingskema is binne 20 weke voltooi en het bestaan uit die bou van sewe stuwalle in die Vaalrivier, elkeen met 'n pompstasie aan die stroomafkant van die wal om die water vanaf die laerliggende "dam" na die hoërliggende "dam" te pomp. Die water is oor 'n totale afstand van 208 km vervoer met 'n verskil in statiese hoogte van 61,5 m tussen die Vaal- en Grootdraaidam.

Alhoewel die ingenieurswerk deur die Departement verrig is, het die konstruksie van die skema plaasgevind in noue samewerking met Eskom en Sasol wat, as die hoofverbruikers van die water, verantwoordelik was vir die finansiering van die skema. Eskom het ook al die nodige pompe voorsien en geïnstalleer.

Die hoeveelheid water wat vanaf die Grootdraaidam na die Trichardtsfontein-balanseerdam oorgedra kan word, is terselfdertyd verdubbel deur die verdubbeling van die vermoë van die bestaande twee stygleidings.

Grootdraai Dam Emergency Augmentation Scheme (1983)

Severe drought conditions in the catchment areas of the Komati, Usutu and Upper Vaal Rivers in the early 1980s compelled the Department to look for an additional source of water supply for the Eastern Transvaal Highveld. The only option was to transfer water from the Vaal Dam to augment the Grootdraai Dam. This could only be done by reversing the flow of the Vaal River – an engineering achievement which won the Department the award from the South African Institution of Civil Engineers (SAICE) for the best civil engineering project in 1984.

The emergency augmentation scheme was completed within 20 weeks and comprised the building of seven earth compacted weirs on the Vaal River, each with a pumping station on the downstream side to pump water from the lower-lying "dam" to the higher-lying "dam". The total distance along which the water had to be transported was 208 km at a static height difference of 61,5 m between the Vaal and Grootdraai Dams.

Although engineered by the Department, the scheme was constructed in close collaboration with Eskom and Sasol who, as the main users requiring this water, were responsible for the financing of the project. Eskom also supplied and installed all the necessary pumps.

The volume of water that can be transferred from the Grootdraai Dam to the Trichardtsfontein balancing dam was doubled simultaneously by doubling the capacity of the two existing mains.

Fase 2: (1982 – 1988)

Weens die verhoogde aanvraag na water vanaf die Grootdraaidam, is daar besluit om Grootdraai se water aan te vul met water vanaf die Assegaairivier, 'n sytak van die Groot-Usuturivier. Die Heyshopedam is toe in die Assegaairivier naby Piet Retief gebou. Water word vanaf hierdie dam via 'n pompstasie, 'n stygleiding en die Heyshope-kanaal ongeveer 100 m gelig en na die Geelhoutboom-balanseerdam gepomp. Die Geelhoutboom-pompstasie pomp water vanaf die balanseerdam met behulp van 'n stygleiding oor 'n verdere hoogte van nagenoeg 280 m na die Balmoral-kanaal op die waterskeiding. Hiervandaan vloei die water dan naby Ermelo in die Klein-Vaalrivier en uiteindelik in die Grootdraaidam in.

Noodskema (1987)

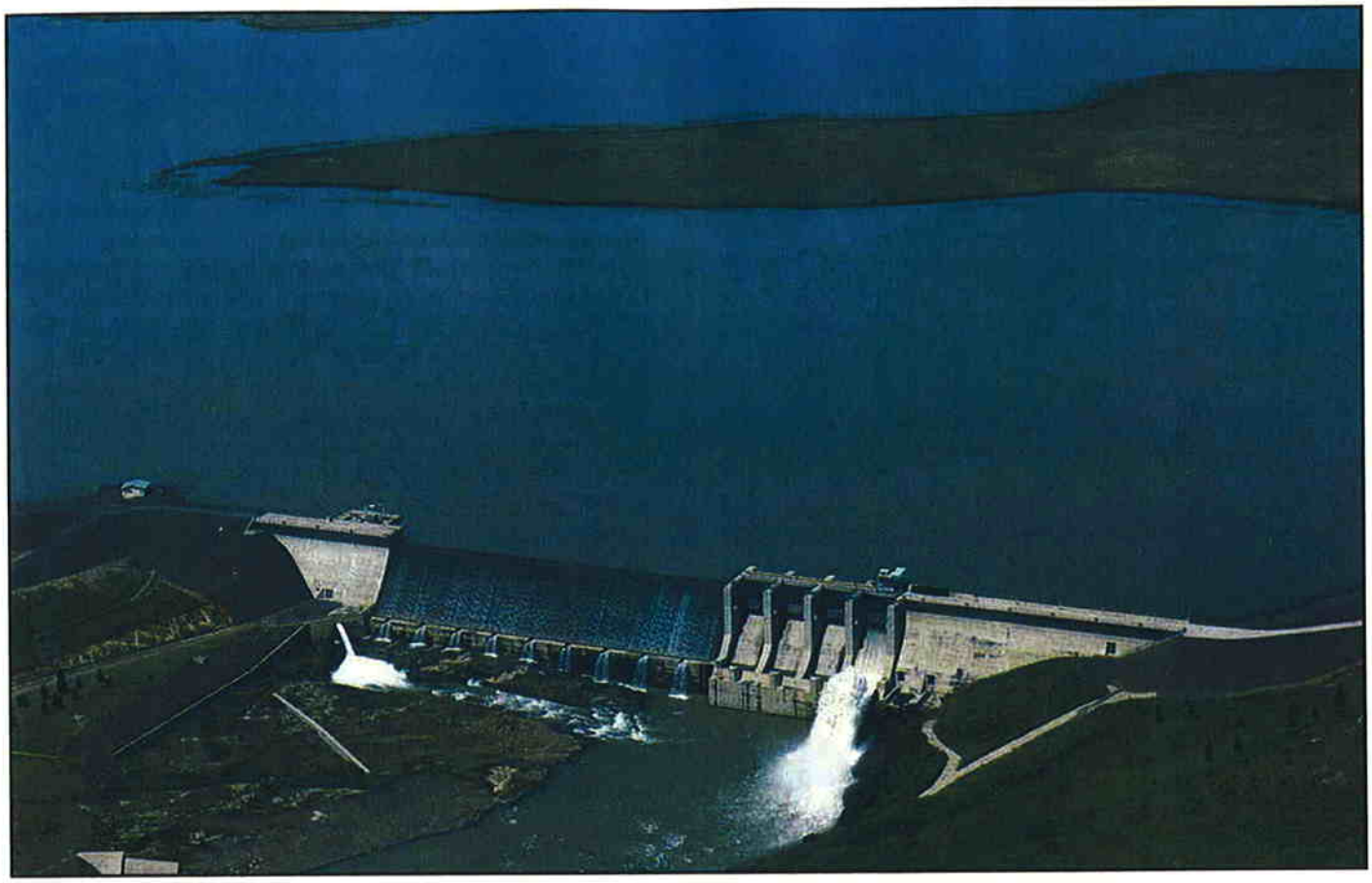
In 1987 was die drie damme in die Usuturivier baie leeg en het die Camden- en Krielkragsentrale 'n watertekort in die gesig gestaar. 'n Ongeveer vyf kilometer-lange noodpypleiding met 'n dravermoë van 1,3 m^3/s is in slegs drie maande vanaf die Balmoral-kanaal na die bolope van die Ngwempisirivier, wat na die Morgenstonddam vloei, gebou. Hierdeur is die watervoorsiening aan die Morgenstonddam genoegsaam aangevul om in die behoeftes van die kragsentrales wat daardeur bedien word, te voorsien.

Phase 2 (1982 – 1988)

Because of the increasing demand for water from the Grootdraai Dam, it was decided to augment Grootdraai's supply with water from the Assegaai River, a tributary of the Great Usutu River. The Heyshope Dam was consequently built on the Assegaai River near Piet Retief. Water pumped from this dam is raised about 100 m to the Geelhoutboom balancing dam via a pumping station, a rising main and the Heyshope Canal. The Geelhoutboom Pumping Station raises the water from the balancing dam via a rising main a further approximate 280 m into the Balmoral Canal on the catchment divide. From the canal the water flows into the Little Vaal River near Ermelo and eventually into the Grootdraai Dam.

Emergency Scheme (1987)

In 1987 the dwindling water supplies in the three dams on the Usutu River posed a threat to the water supply of the Camden and Kriel Power-Stations. An emergency pipeline, approximately five kilometres long with a carrying capacity of 1,3 m^3/s, was built in only three months from the Balmoral Canal to the headwaters of the Ngwempisi River which flows into the Morgenstond Dam. This pipeline ensured an adequate supply of water to the Morgenstond Dam to provide for the needs of its user power-stations.



Grootdraaidam

Bo en behalwe sy bydrae tot die gewone watervoorsiening, is die Grootdraaidam 'n belangrike komponent van 'n noodwatervoorsieningskema wat ten tye van waterskaarste die grootste gedeelte van Eskom se kragsentrales op die Oos-Transvaalse Hoëveld van water kan voorsien. Benewens die natuurlike afloop uit die bolope van die Vaalrivier, kan die Grootdraaidam ook 'n bykomende 100 miljoen m^3 water per jaar opgaar wat uit die Heyshopedam oor die waterskeiding gepomp word.

DATA:

Jaar van voltooiing	1982
Doel	Water vir kragopwekking en nywerhede
Rivier	Vaal
Opvanggebied	7 929 km^2
Gemiddelde jaarlikse afloop	534 miljoen m^3
Naaste dorp en provinsie	Standerton, Transvaal
Tipe	Saamgestelde grondwal met sentrale massabeton-oorloopseksie
Bruto opgaarvermoë	364 miljoen m^3
Walhoogte bokant laagste fondament	42 m
Kruinlengte	2 180 m
Tipe oorloop	Vier beheerde sluise, 'n onbeheerde oorloop en 'n noodoorloop
Oorloopvermoë	Onbeheerde oorloop: 3 854m^3/s Beheerde oorloop: 5 280 m^3/s Noodoorloop: 2 000 m^3/s
Oppervlakte van dam by volvoorraadhoogte	5 500 ha
Geologie van terrein	Onverweerde tot totaal verweerde doleriet met ondergeskikte sandsteen
Ontwerp	Watermeyer, Sogreah & Coyne
Konstruksie en eienaar	Departement van Waterwese

Grootdraai Dam

Over and above its contribution to normal water supply, the Grootdraai Dam is an important component of an emergency water supply scheme which can provide most of Eskom's power-stations on the Eastern Transvaal Highveld with water during times of water shortages. In addition to the natural run-off from the headwaters of the Vaal River, the Grootdraai Dam can also store an additional 100 million m^3 water per annum pumped over the escarpment from the Heyshope Dam.

DATA:

Year of completion	1982
Purpose	Water for power generation and industries
River	Vaal
Catchment area	7 929 km^2
Mean annual run-off	534 million m^3
Nearest town and province	Standerton, Transvaal
Type	Composite earthfill with central mass concrete spillway section
Gross storage capacity	364 million m^3
Wall height above lowest foundation	42 m
Crest length	2 180 m
Type of spillway	Four controlled gates, an uncontrolled spillway and an emergency spillway
Spillway capacity	Uncontrolled spillway: 3 854 m^3/s Controlled spillway: 5 280 m^3/s Emergency spillway: 2 000 m^3/s
Surface area of dam at full supply level	5 500 ha
Site geology	Unweathered to completely weathered dolerite with minor sandstone
Design	Watermeyer, Sogreah & Coyne
Construction and owner	Department of Water Affairs

Heyshopedam

Die water wat in die Heyshopedam opgegaar word is van 'n beter gehalte as dié van die Vaalrivier. Eskom verkies dus om, so ver moontlik, Usutu-water te gebruik.

Weens die ernstige droogte in die Vaalrivierstelsel gedurende die vroeë tagtigerjare, is die konstruksie van hierdie water-oordragskema bespoedig om dit ses maande vroeër as beplan in bedryf te stel.

DATA:

Jaar van voltooiing	1986
Doel	Wateraanvulling vir Grootdraaidam
Rivier	Assegaai
Opvanggebied	1 118 km^2
Gemiddelde jaarlikse afloop	147,5 miljoen m^3
Naaste dorp en provinsie	Piet Retief, Transvaal
Tipe	Grond
Bruto opgaarvermoë	463 miljoen m^3
Walhoogte bokant laagste fondament	26,5 m
Kruinlengte	1 030 m
Tipe oorloop	Tonneluitlaat en onbeheerde geutoorloop
Hoofoorloopvermoë	104 m^3/s deur tonnel 126 m^3/s in geutoorloop
Oppervlakte van dam by volvoorraadhoogte	4 500 ha
Geologie van terrein	Effens verweerde tot totaal verweerde kwartsiet, chert, skis en filliet
Ontwerp, konstruksie en eienaar	Departement van Waterwese

Heyshope Dam

Water stored in the Heyshope Dam is of a better quality than Vaal River water. Eskom therefore prefers the use of Usutu water whenever possible.

Due to the severe drought which prevailed in the Vaal River System in the early 1980s, the construction of this water transfer scheme was expedited to bring it into operation six months earlier than originally scheduled.

DATA:

Year of completion	1986
Purpose	Supplements Grootdraai Dam
River	Assegaai
Catchment area	1 118 km^2
Mean annual run-off	147,5 million m^3
Nearest town and province	Piet Retief, Transvaal
Type	Earthfill
Gross storage capacity	463 million m^3
Wall height above lowest foundation	26,5 m
Crest length	1 030 m
Type of spillway	Tunnel outlet and uncontrolled chute spillway
Main spillway capacity	104 m^3/s through tunnel 126 m^3/s in chute spillway
Surface area of dam at full supply level	4 500 ha
Site geology	Slightly weathered to completely weathered quartzite, chert, schist and phyllite
Design, construction and owner	Department of Water Affairs

Bossiespruit-balanseerdam

Die Bossiespruit-balanseerdam is in die Klein Bossiespruit gebou en dien as balanseerdam vanwaar water deur Sasol II en III onttrek word. Die dam ontvang byna al sy water van die Usutu-Vaalrivier-staatswaterskema via die Knoppiesfontein-pompstasie.

DATA:

Jaar van voltooiing	1978
Rivier	Klein Bossiespruit
Naaste dorp en provinsie	Secunda, Transvaal
Tipe	Grondwal met sentrale swaartekrag ogee-oorloop
Bruto opgaarvermoë	2,3 miljoen m^3
Walhoogte bokant laagste fondament	12 m
Oppervlakte van dam by volvoorraadhoogte	67 ha
Geologie van terrein	Matig tot hoogs verweerde doleriet en ondergeskikte skalie en sandsteen
Ontwerp, konstruksie en eienaar	Departement van Waterwese

Trichardtsfontein-balanseerdam

Die Trichardtsfontein-balanseerdam word slegs uit die Vaalrivier aangevul. Met sy ligging op die water-skeiding tussen die Vaal- en die Olifantsrivier, kan beide Eskom en Sasol in 'n noodgeval daaruit onttrek. Die distribusie van water vanaf die balanseerdam is so ontwerp dat meeste van Eskom se kragstasies wat afhanklik is van water van òf die Komatirivier- òf die Usuturivier-voorsieningstelsel, vanuit dié dam voorsien kan word in geval van 'n onderbreking in een of albei die stelsels.

DATA:

Jaar van voltooiing	1981
Rivier	Trichardtspruit
Naaste dorp en provinsie	Trichardt, Transvaal
Tipe	Grond
Bruto opgaarvermoë	15 miljoen m^3
Walhoogte bokant laagste fondament	21 m
Kruinlengte	1 070 m
Geologie van terrein	Onverweerde tot hoogs verweerde doleriet en ondergeskikte skalie
Ontwerp, konstruksie en eienaar	Departement van Waterwese

Bossiespruit Balancing Dam

The Bossiespruit balancing dam is built on the Klein Bossiespruit and serves as a balancing dam from where Sasol II and III obtain their water. The dam receives nearly all its water from the Usutu-Vaal River Government Water Scheme via the Knoppiesfontein Pumping Station.

DATA:

Year of completion	1978
River	Klein Bossiespruit
Nearest town and province	Secunda, Transvaal
Type	Earthfill with central gravity ogee spillway
Gross storage capacity	2,3 million m^3
Wall height above lowest foundation	12 m
Surface area of dam at full supply level	67 ha
Site geology	Moderately to highly weathered dolerite and minor shale and sandstone
Design, construction and owner	Department of Water Affairs

Trichardtsfontein Balancing Dam

The Trichardtsfontein balancing dam is only augmented with water from the Vaal River. As it is positioned on the watershed between the Vaal and the Olifants Rivers, both Eskom and Sasol can abstract water from this dam in case of emergency. The distribution of water from the balancing dam is designed in such a manner that most of Eskom's power-stations that are dependent on water from either the Komati River or the Usutu River supply system can be supplied from this dam in the event of an interruption in either or both of the systems.

DATA:

Year of completion	1981
River	Trichardtspruit
Nearest town and province	Trichardt, Transvaal
Type	Earthfill
Gross storage capacity	15 million m^3
Wall height above lowest foundation	21 m
Crest length	1 070 m
Site geology	Unweathered to highly weathered dolerite and minor shale
Design, construction and owner	Department of Water Affairs

Rietfontein-Stuwal

Die Rietfontein-stuwal dien as 'n opgaring- en balanseerdam in die Trichardtspruit vir die pompstasie wat water hiervandaan, via 'n pypleiding, aan die Matla-kragsentrale lewer. In tye van nood kan dit ook die Kriel-kragsentrale van water voorsien.

Water word vanaf die Trichardtsfontein-balanseerdam na die stuwal losgelaat. Vanaf die Rietfontein-stuwal vloei surpluswater na die Witbankdam. Hiervandaan kan dit na Duvha en ander kragsentrales gepomp word wat gewoonlik water vanuit die Kumatirivier-stelsel ontvang.

DATA:

Jaar van voltooiing	1983
Rivier	Trichardtspruit
Naaste dorp en provinsie	Kriel, Transvaal
Tipe	Grond met betonoorloop
Bruto opgaarvermoë	333 000 m^3
Walhoogte bokant laagste fondament	10 m
Oppervlakte van dam by volvoorraadhoogte	0,5 km^2
Ontwerp, konstruksie en eienaar	Departement van Waterwese

Rietfontein Weir

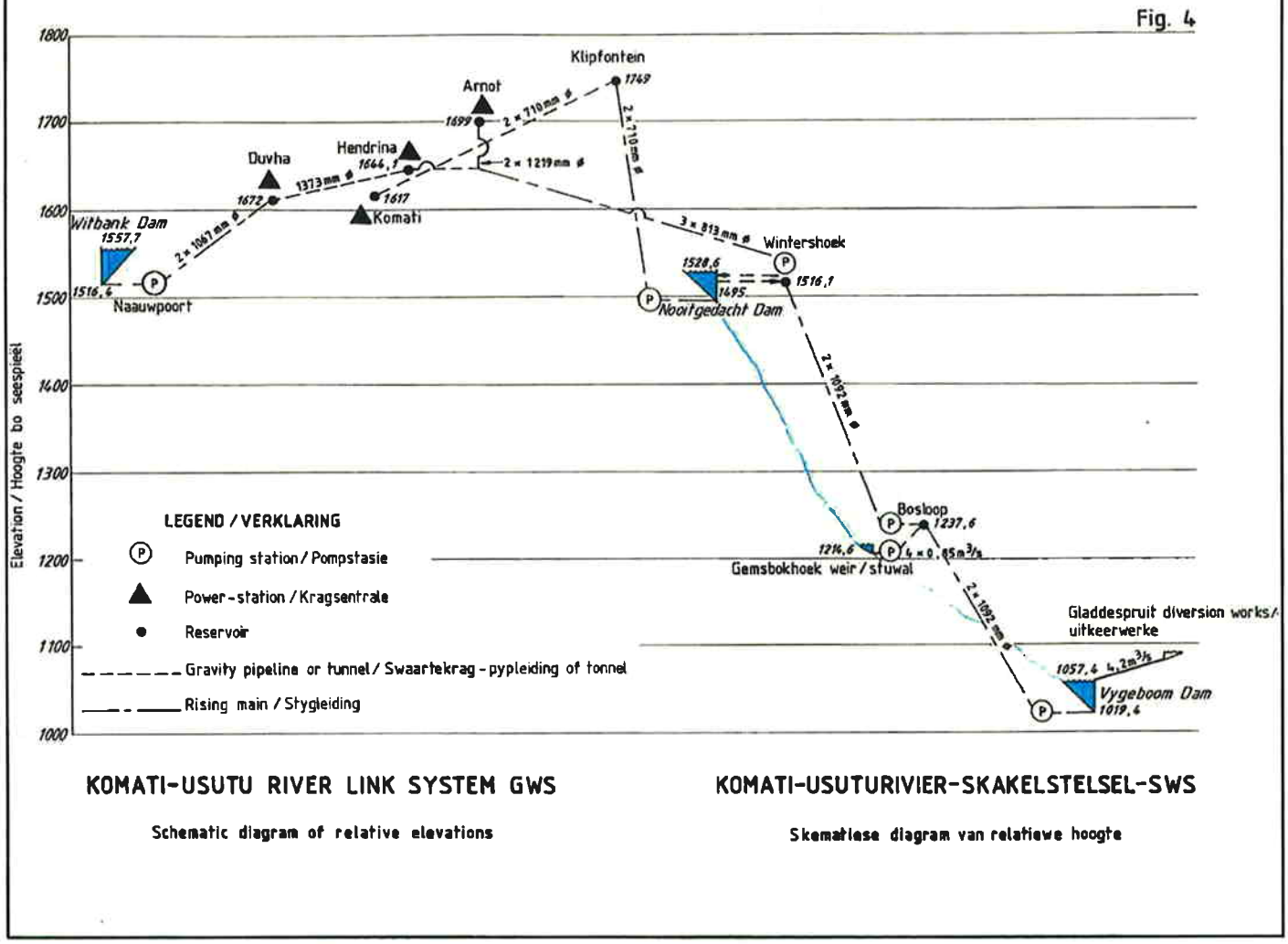
The Rietfontein Weir provides balancing storage in the Trichardt Spruit for the pumping station which supplies water through a pipeline to the Matla Power-Station. In an emergency, water can also be supplied to the Kriel Power-Station.

Water is released to the weir from the Trichardtsfontein balancing dam. Water discharged from the Rietfontein Weir flows on to the Witbank Dam. From here it can be pumped to Duvha and other power-stations normally supplied with water from the Komati River System.

DATA:

Year of completion	1983
River	Trichardt Spruit
Nearest town and province	Kriel, Transvaal
Type	Earthfill with concrete spillway
Gross storage capacity	333 000 m^3
Wall height above lowest foundation	10 m
Surface area of dam at full supply level	0,5 km^2
Design, construction and owner	Department of Water Affairs

Fig. 4



KOMATI-USUTU RIVER LINK SYSTEM GWS

Schematic diagram of relative elevations

KOMATI-USUTURIVIER-SKAKELSTELSEL-SWS

Skematiese diagram van relatiewe hoogte

Komati-Usuturivier-skakelstelsel-staatswaterskema

Die Komatirivierstelsel bedien Eskom se Komati-, Hendrina-, Arnot- en Duvha-kragsentrale. Die Nooitgedacht- en Vygeboomdam, sowel as die Gemsbokhoek-stuwal, is deur die Departement van Waterwese gebou om te voorsien in die behoeftes van hierdie kragsentrales en sekere dorpe in die gebied, asook om die riviervloei van die Komatirivier, stroom af van die damme, te stabiliseer. Die pompstasies en pypleidings is deur Eskom voorsien en word deur hulle bedryf om water aan hul kragsentrales te voorsien.

Duvha ontvang die grootste gedeelte van sy water vanaf die Bo-Komati-stelsel deur middel van die Hendrina-Duvha-swaartekragpypleiding. Die res van die water word verkry vanaf die Grootdraaidam vanwaar dit via die Trichardtsfontein-balanseerdam in die Witbankdam losgelaat word en dan deur die Naauwpoort-pompstasie na Duvha gepomp word.

Die wisselwerking tussen die waterbronne van die Komati-, Usutu- en Vaalrivierstelsel bring 'n hoër versekering van water aan Eskom se kragsentrales en ander watergebruikers op die Oos-Tranvaalse Hoëveld teweeg.

Komati-Usutu River link system Government Water Scheme

The Komati River system serves Eskom's Komati, Hendrina, Arnot and Duvha Power-Stations. The Nooitgedacht and Vygeboom Dams as well as the Gemsbokhoek Weir were constructed by the Department of Water Affairs to provide for the requirements of these power-stations, certain towns in the area and to stabilise the river flow in the Komati River below the dams. The pumping stations and pipelines linking the various dams and weirs were provided by Eskom and are operated by them for the supply of water to their power-stations.

Duvha obtains the greater percentage of its water from the Upper Komati system by means of the Hendrina-Duvha gravity pipeline. The balance of the water required is obtained from the Grootdraai Dam from where it is released to the Witbank Dam via the Trichardtsfontein balancing dam. It is then pumped to Duvha via the Naauwpoort Pumping Station.

The interaction of water resources of the Komati, Usutu and Vaal River systems provides a higher assurance of water supply to all Eskom's thermal power-stations and other water users on the Eastern Transvaal Highveld.

Nooitgedachtdam

Die Nooitgedachtdam is die boonste van die twee damme in die Komatirivier. Die Komati-kragsentrale onttrek water direk uit die dam met behulp van 'n pompstasie en die dorp Hendrina se water word ook vanuit hierdie bron verkry.

Die dam het 'n interessante trog-oorloop met ingeboude uitlaatpype wat slikdraende water kan aftrek, indien nodig.

Geen ontspanningsgeriewe is beskikbaar nie, behalwe vir dié wat aan private klubs behoort.

DATA:

Jaar van voltooiing	1962
Doel	Water vir kragopwekking, huishoudings en nywerhede
Rivier	Komati
Opvanggebied	1 569 km^2
Gemiddelde jaarlikse afloop	67 miljoen m^3
Naaste dorp en provinsie	Carolina, Transvaal
Tipe	Grond met betontrog-oorloop
Bruto opgaarvermoë	79 miljoen m^3
Walhoogte bokant laagste fondament	44 m
Kruinlengte	1 021 m
Tipe oorloop	Onbeheerd
Hoofoorloopvermoë	1 590 m^3/s
Oppervlakte van dam by volvoorraadhoogte	761 ha
Geologie van terrein	Onverweerde tot hoogs verweerde diabaas en horingfels
Ontwerp, konstruksie en eienaar	Departement van Waterwese

Nooitgedacht Dam

The Nooitgedacht Dam is the upper of the two dams on the Komati River. The Komati Power-Station extracts its water directly from the dam by means of a pumping station. The town of Hendrina also obtains its water from this source.

The dam has an interesting trough spillway with built-in outlet pipes that can discharge silt when necessary.

No recreation facilities are available, except for those belonging to private clubs.

DATA:

Year of completion	1962
Purpose	Water for power generation, domestic and industrial use
River	Komati
Catchment area	1 569 km^2
Mean annual run-off	67 million m^3
Nearest town and province	Carolina, Transvaal
Type	Earthfill with concrete trough spillway
Gross storage capacity	79 million m^3
Wall height above lowest foundation	44 m
Crest length	1 021 m
Type of spillway	Uncontrolled
Main spillway capacity	1 590 m^3/s
Surface area of dam at full supply level	761 ha
Site geology	Unweathered to highly weathered diabase and hornfels
Design, construction and owner	Department of Water Affairs

Vygeboomdam

Die Vygeboomdam is 53 km stroom af van die Nooitgedachtdam in die Komatirivier gebou. Die lewering van hierdie dam word verhoog met water uit die naburige Gladdespruit. 'n Keerwal in die spruit keer water uit in 'n kanaal met 'n dravermoë van 3,8 m^3/s na die Vygeboomdam. Water word vanuit die dam en die hoërliggende Gemsbokhoek-stuwal na die Wintershoek-pompstasie gepomp. Hiervandaan word die water na die Duvha-, Hendrina- Komati- en Arnot-kragsentrale gepomp.

Geen ontspanningsgeriewe is beskikbaar nie, maar heelwat private klubs maak van die wateroppervlak gebruik. Die dam lê ongeveer 10 km noord-oos van die Badplaas Vakansie-oord.

DATA:

Jaar van voltooiing	1971
Doel	Kragopwekking en besproeiing
Rivier	Komati
Opvanggebied	1 543 km^2 netto (Nooitgedacht uitgesluit)
Gemiddelde jaarlikse afloop	179 miljoen m^3 netto (Nooitgedacht uitgesluit)
Naaste dorp en provinsie	Badplaas, Transvaal
Tipe	Grond met beton sykanaaloorloop
Bruto opgaarvermoë	78,4 miljoen m^3
Walhoogte bokant laagste fondament	48 m
Kruinlengte	1 220 m
Tipe oorloop	Onbeheerd
Hoofoorloopvermoë	2 617 m^3/s
Oppervlakte van dam by volvoorraadhoogte	671 ha
Geologie van terrein	Onverweerde tot matig verweerde graniet-gneiss met diabaasgange
Ontwerp, konstruksie en eienaar	Departement van Waterwese

Vygeboom Dam

The Vygeboom Dam is situated 53 km downstream of the Nooitgedacht Dam on the Komati River. The yield of this dam is supplemented by water from the adjacent Gladdespruit where a weir diverts water into a canal with a capacity of 3,8 m^3/s which flows to the Vygeboom Dam. Water is pumped from this dam and from the Gemsbokhoek Weir to the Wintershoek Pumping Station. The water is then pumped to the Duvha, Hendrina, Komati and Arnot Power-Stations.

No recreation facilities are available, but the dam is situated about 10 km north-east of the Badplaas Holiday Resort. Many private clubs make use of the water surface.

DATA:

Year of completion	1971
Purpose	Power generation and irrigation
River	Komati
Catchment area	1 543 km^2 net (Nooitgedacht excluded)
Mean annual run-off	179 million m^3 net (Nooitgedacht excluded)
Nearest town and province	Badplaas, Transvaal
Type	Earthfill with concrete side-channel spillway
Gross storage capacity	78,4 million m^3
Wall height above lowest foundation	48 m
Crest length	1 220 m
Type of spillway	Uncontrolled
Main spillway capacity	2 617 m^3/s
Surface area of dam at full supply level	671 ha
Site geology	Unweathered to moderately weathered granite gneiss with diabase dykes
Design, construction and owner	Department of Water Affairs

Gemsbokhoek-stuwal

Water wat vanaf die Gemsbokhoek-stuwal na die Wintershoek-pompstasie gepomp word, kos minder as water wat vanaf die Vygeboomdam gepomp word as gevolg van die laer drukhoogte. Om dieselfde rede is water uit die Vygeboomdam duurder as dié uit die Nooitgedachtdam. Die onttrekking van water uit beide damme en die Gemsbokhoek-stuwal word geoptimiseer om die maksimum water teen die minimum koste te voorsien. Water uit die stuwal word dus eerstens gebruik om die Duvha-, Hendrina- en Arnot-kragsentrale te voorsien.

DATA:

Jaar van voltooiing	1973
Rivier	Komati
Naaste dorp en provinsie	Carolina, Transvaal
Tipe	Grond met betonoorloop
Bruto opgaarvermoë	133 000 m^3
Walhoogte bokant laagste fondament	6,3 m
Kruinlengte	214 m

Gemsbokhoek Weir

Water pumped from the Gemsbokhoek Weir is less expensive than water from the Vygeboom Dam because of the lower pumping head. For the same reason Vygeboom Dam water is more expensive than water from the Nooitgedacht Dam. Water abstraction from these two dams and from the Gemsbokhoek Weir is optimised to give maximum water supply at lowest cost. Water from the weir is therefore used preferentially to supply the Duvha, Hendrina and Arnot Power-Stations.

DATA:

Year of completion	1973
River	Komati
Nearest town and province	Carolina, Transvaal
Type	Earthfill with concrete spillway
Gross storage capacity	133 000 m^3
Wall height above lowest foundation	6,3 m
Crest length	214 m

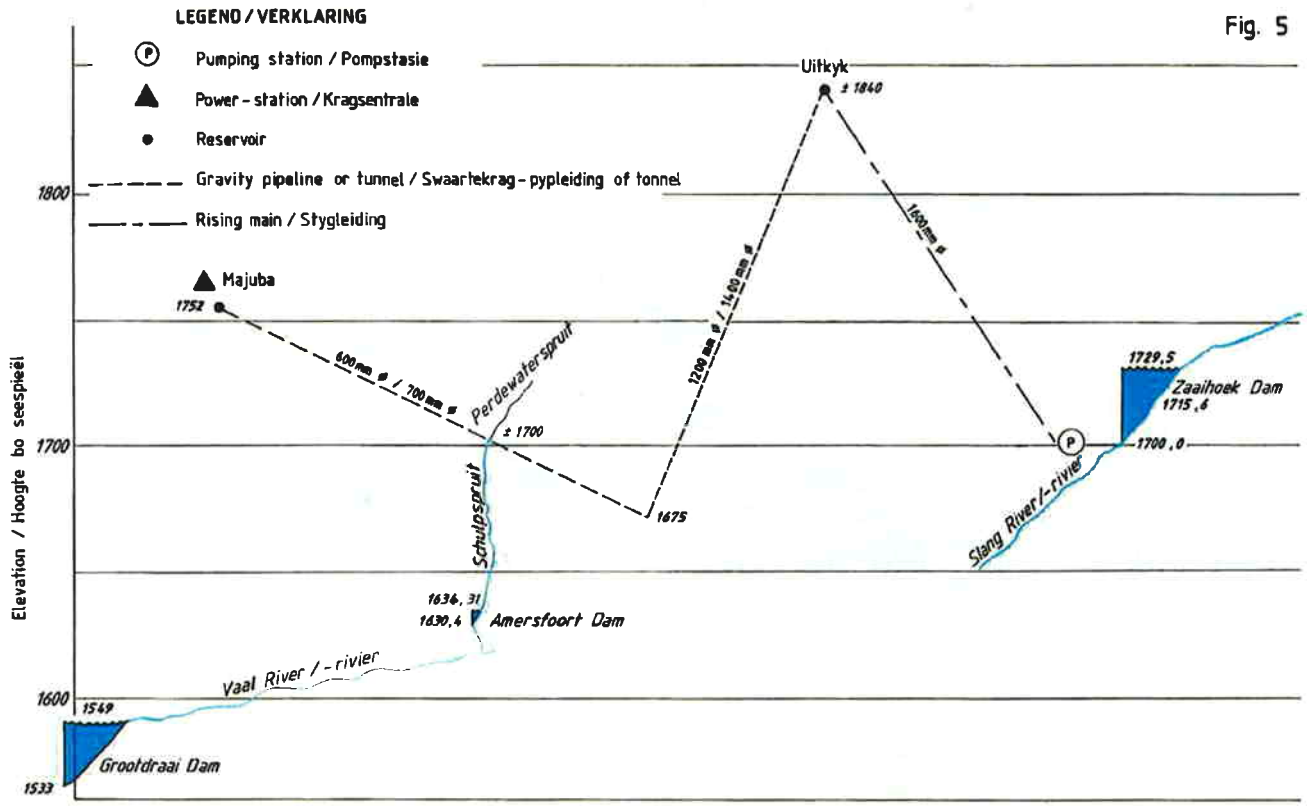


Fig. 5

SLANG RIVER GWS.

Schematic diagram of relative elevations

SLANGRIVIER-SWS

Skematiese diagram van relatiewe hoogte

Slangrivier-staatswaterskema

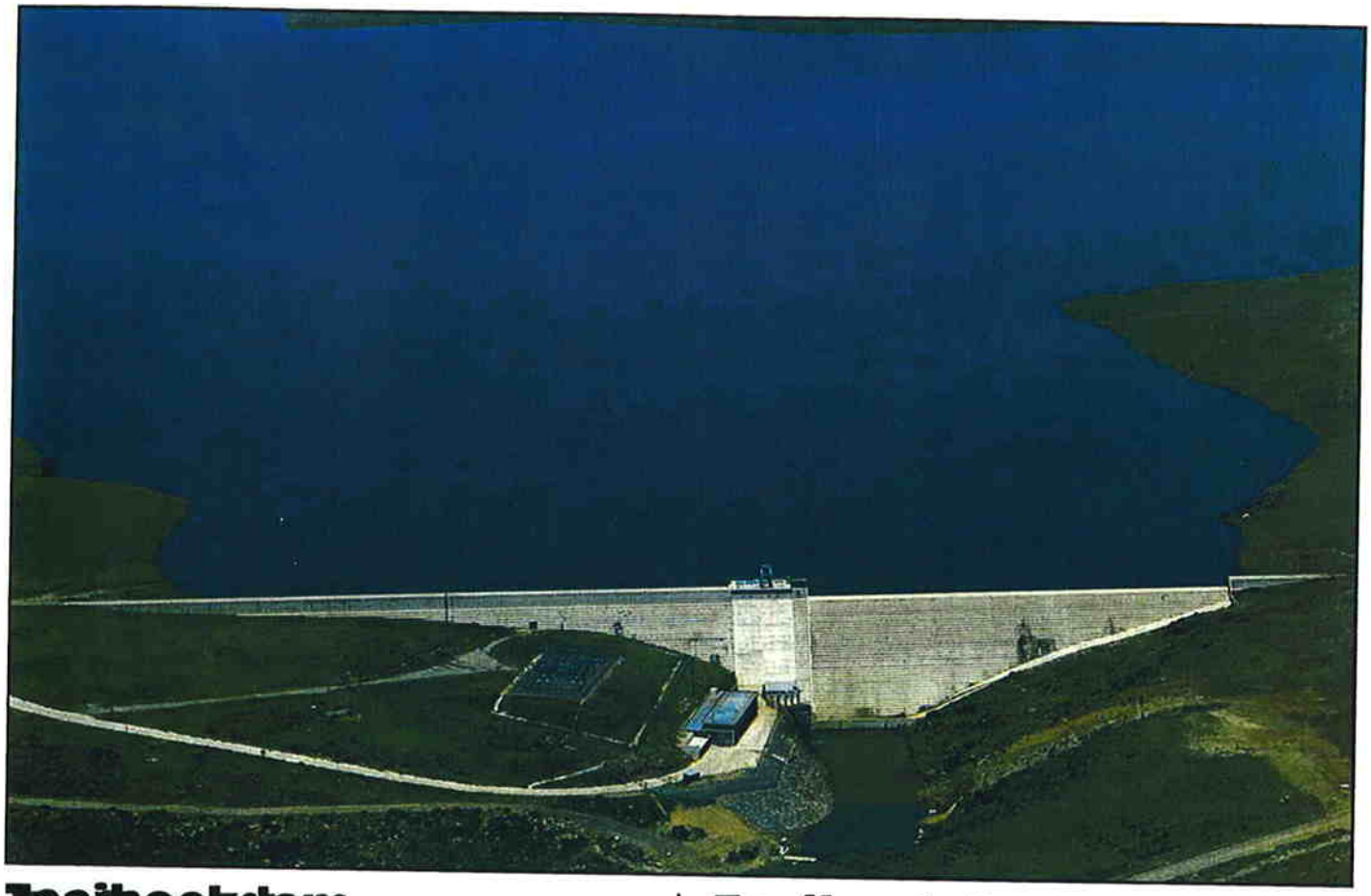
Konstruksie van die Slangrivier-sws het in 1985 'n aanvang geneem met die bou van die Zaaihoekdam naby Volksrust. Die doel van die skema is om water te voorsien aan Eskom se Majuba-kragsentrale, om die watervoorraad van Volksrust aan te vul, om die riviervloei stroom af van die dam te stabiliseer, en om verdere surpluswater aan die Vaalrivier-opvanggebied te voorsien.

Water vir Majuba, Volksrust en die Vaalrivier word vanaf 'n pompstasie by die Zaaihoekdam oor 'n afstand van 22 km deur middel van 'n stygleiding na die Uitkyk-reservoir oorgedra. 'n Swaartekragpypleiding vanaf die Uitkyk-reservoir voorsien water aan die balanseerdam by die Majuba-kragsentrale. Waar die pypleiding die Perdewaterspruit kruis, is 'n uitlaatstruktuur aangebring. Water kan hier uitgelaat word vanwaar dit in die Schulpspruit, oor die oorloop van die Amersfoortdam, na die Vaalrivier stroom op van die Grootdraaidam vloei.

Slang River Government Water Scheme

Construction on the Slang River GWS commenced in 1985 with the building of the Zaaihoek Dam near Volksrust. The purpose of the scheme is to supply water to Eskom's Majuba Power-Station, to supplement the daily water supply to Volksrust, to stabilise river flow downstream of the dam and to transfer additional surplus water to the Vaal River catchment.

Water for Majuba, Volksrust and the Vaal River is transported over a distance of 22 km from the pumping station at the Zaaihoek Dam by means of a rising main to the Uitkyk reservoir. A gravity pipeline from the Uitkyk reservoir provides water to a balancing dam at the Majuba Power-Station. A discharge point has been provided where this pipeline crosses the Perdewaterspruit. From the discharge point, the water can be released down the Schulpspruit, over the spillway of the Amersfoort Dam to the Vaal River upstream of the Grootdraai Dam.



Zaaihoekdam

Die hoofdoel van die Zaaihoekdam is om water te verskaf aan die Majuba-kragsentrale, wat teen 1999 ten volle in bedryf sal wees. Die dam se sekondêre doel is om die watervoorraad van die Vaalrivier aan te vul. Stroomafgebruikers soos Volksrust se hidro-pompskema, die Ngaganerivier-staatswaterskema en veeboere kan ook van water uit die dam voorsien word.

Die Zaaihoekdam is die eerste dam in Suid-Afrika waar die volskaalse gebruik van die rolbetonkonstruksiemetode op dambou toegepas is. Die stroomafaansig van die dam is daarom trapvormig om by die spesifieke konstruksiemetode te pas.

Aangesien die aanvraag na water op sekere tydstippe baie hoog sal wees en die watervlak voortdurend sal wissel, is die wateroppervlak nie geskik vir ontspanningsontwikkeling nie.

DATA:

Jaar van voltooiing	1988
Doel	Wateroordrag vir kragopwekking
Rivier	Slang
Opvanggebied	676 km^2
Gemiddelde jaarlikse afloop	90 miljoen m^3
Naaste dorp en provinsie	Wakkerstroom, Transvaal
Tipe	Rolbeton-swaartekrag
Bruto opgaarvermoë	193 miljoen m^3
Walhoogte bokant laagste fondament	46,3 m
Kruinlengte	527 m
Tipe oorloop	Onbeheerd
Hoofoorloopvermoë	2 500 m^3/s
Oppervlakte van dam by volvoorraadhoogte	1 245 ha
Geologie van terrein	Onverweerde tot effens verweerde doleriet
Ontwerp, konstruksie en eienaar	Departement van Waterwese

Zaaihoek Dam

The main purpose of the Zaaihoek Dam is to provide water for the Majuba Power-Station which will be in full operation by 1999. Its secondary purpose is to augment the water supply of the Vaal River. Downstream users, such as Volksrust's hydro pumping scheme, the Ngagane River Government Water Scheme and stock farmers, can also be supplied with water from this dam.

The Zaaihoek Dam is the first dam in South Africa where the full-scale use of the rollcrete construction method was applied in dam building. The downstream face of the dam is stepped to facilitate rollcrete placing.

The demand for water from the dam is expected to be high at times and the water level of the dam will vary considerably, making the water surface less suitable for recreation purposes.

DATA:

Year of completion	1988
Purpose	Water transfer for power generation
River	Slang
Catchment area	676 km^2
Mean annual run-off	90 million m^3
Nearest town and province	Wakkerstroom, Transvaal
Type	Rollcrete gravity
Gross storage capacity	193 million m^3
Wall height above lowest foundation	46,3 m
Crest length	527 m
Type of spillway	Uncontrolled
Main spillway capacity	2 500 m^3/s
Surface area of dam at full supply level	1 245 ha
Site geology	Unweathered to slightly weathered dolerite
Design, construction and owner	Department of Water Affairs

Die noodsaaklikheid van wateroordragskemas

Suid-Afrika is 'n semi-droë land waar waterbronne oneweredig versprei is in verhouding tot ekonomiese groeipunte. Wateroordragskemas is daarom onontbeerlik en die mees koste-effektiewe wyse waarop die waterbehoeftes van 'n ontwikkelende land soos dié van ons bevredig kan word.

In sommige gevalle moet water oor meer as 500 km vervoer word om te verseker dat ekonomiese groei en ontwikkeling nie gekniehalter word nie. Dit verg hoogs geskoolde mannekrag om hierdie skemas te beplan en te implementeer sowel as 'n groot aanvanklike kapitaaluitleg en 'n hoë onderhoudskoste om die oordrag van water te handhaaf.

Ten spyte van al hierdie koste en die koste verbonde aan die behandeling van water tot die verlangde standaard, bly water een van die goedkoopste gebruiksware wat voorsien in die basiese behoeftes van die mensdom.

Saamgestel en uitgegee deur Skakeldienste, Departement van Waterwese, Privaatsak X313, Pretoria, 0001 (1991).

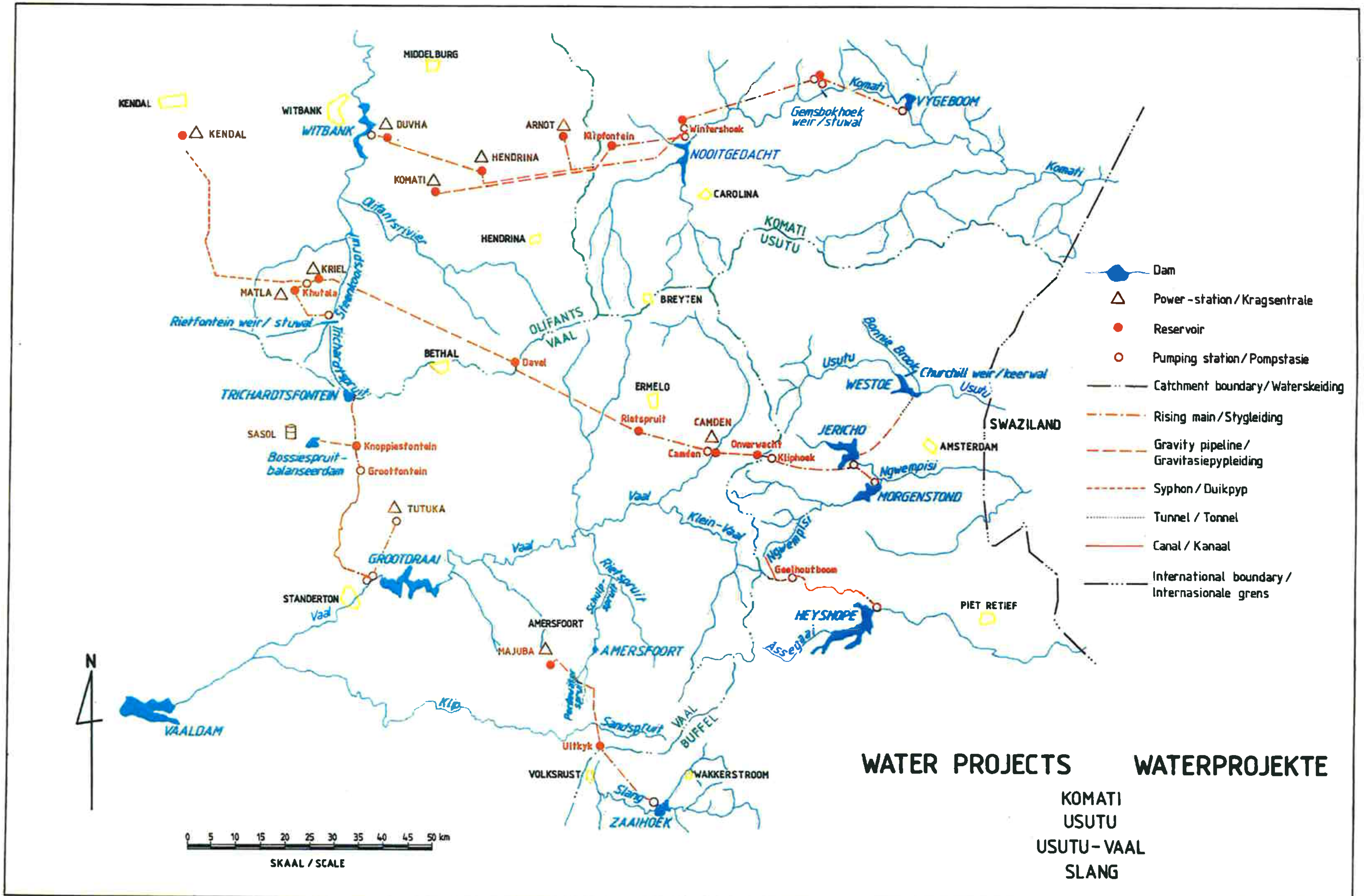
The necessity of water transfer schemes

South Africa is a semi-arid country in which water supplies are disproportionately distributed in relation to economic growth points. Water transfer schemes are therefore indispensable and the most cost-effective way to comply with the increasing water demands of a developing country such as ours.

In some cases water is transported more than 500 km to ensure that economic growth and development are not hampered. It requires highly skilled manpower to plan and implement these schemes as well as considerable initial capital outlay and major overhead expenses to maintain the transfer of water.

In spite of all these costs and the costs involved in treating water to the required standard, water remains one of the cheapest commodities fulfilling the basic needs of the human race.

Compiled and issued by Liaison Services, Department of Water Affairs, Private Bag X313, Pretoria 0001 (1991).


WATER PROJECTS
WATERPROJEKTE
KOMATI
USUTU
USUTU-VAAL
SLANG
Dam
Power-station / Kragsentrale
Reservoir
Pumping station / Pompstasie
Catchment boundary / Waterskeiding
Rising main / Stygleiding
Gravity pipeline / Gravitasiepypleiding
Syphon / Duikpyp
Tunnel / Tonnel
Canal / Kanaal
International boundary / Internasionale grens
KENDAL
WITBANK
DUVHA
ARNOT
HENDRINA
KOMATI
MIDDELBURG
Klipfontein
Wintershoek
NOOITGEDACHT
Gemsbokhoek weir / stuwal
VYGEBOOM
Komati
CAROLINA
KOMATI
USUTU
Olifantsrivier
KRIEL
MATLA
Khutala
Steenkoolspruit
Rietfontein weir / stuwal
Trichardtspruit
TRICHARDTSFONTEIN
BETHAL
OLIFANTS
VAAL
Davel
BREYTEN
ERMELO
Rietspruit
CAMDEN
Camden
Onverwacht
Kliphoek
JERICHO
WESTOE
Bonnie Brook
Churchill weir / keerwal
Usutu
SWAZILAND
AMSTERDAM
Ngwempisi
MORGENSTOND
SASOL
Knoppiesfontein
Bossiespruit-balanseerdam
Grootfontein
TUTUKA
GROOTDRAAI
STANDERTON
Vaal
Klein-Vaal
Geelhoutboom
HEYSHOPE
Assegaai
PIET RETIEF
AMERSFOORT
MAJUBA
Rietspruit
Schulp-spruit
Perdewaterspruit
Sandspruit
VAAL
BUFFEL
Klip
VAALDAM
Uitkyk
VOLKSRUST
WAKKERSTROOM
Slang
ZAAIHOEK
N
0 5 10 15 20 25 30 35 40 45 50 km
SKAAL / SCALE
Lithographed by Colorpress