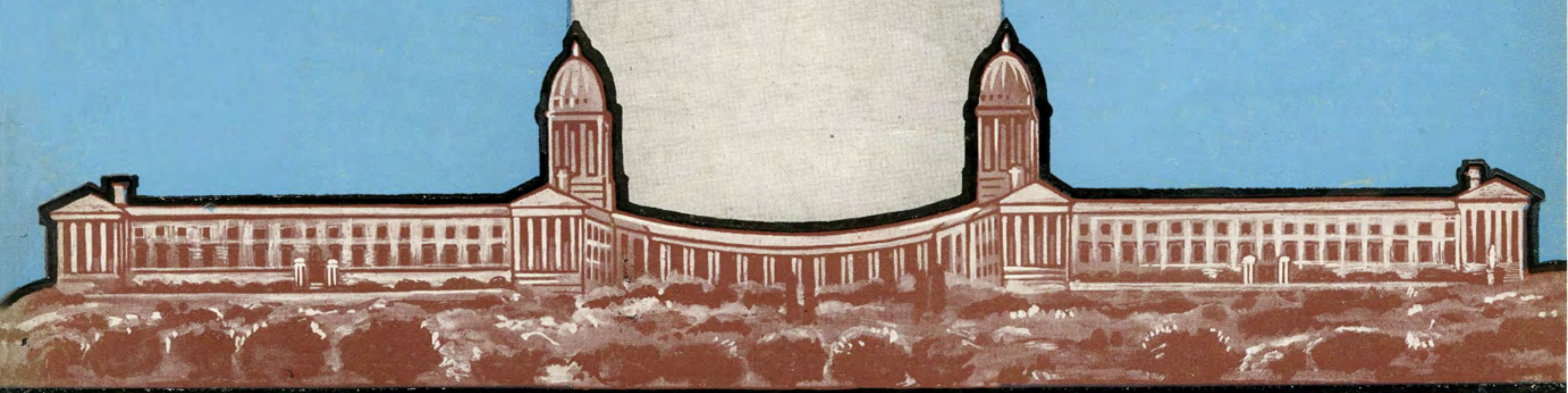
Vol. X. No. 67. JUNE : 1949.

PUBLIC WORKS OF SOUTH AFRICA



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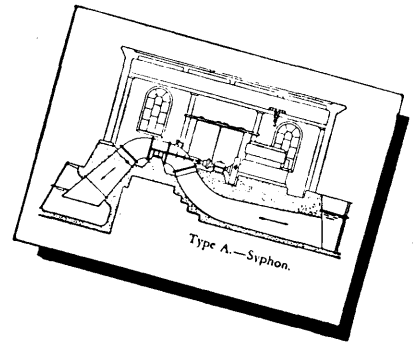

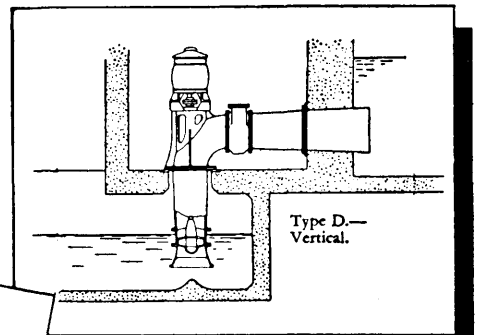

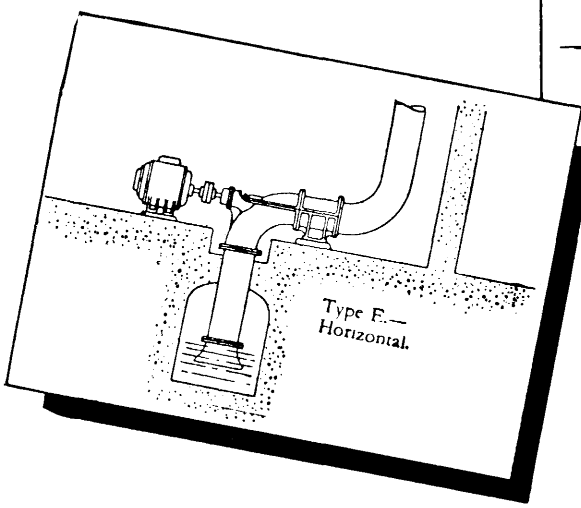

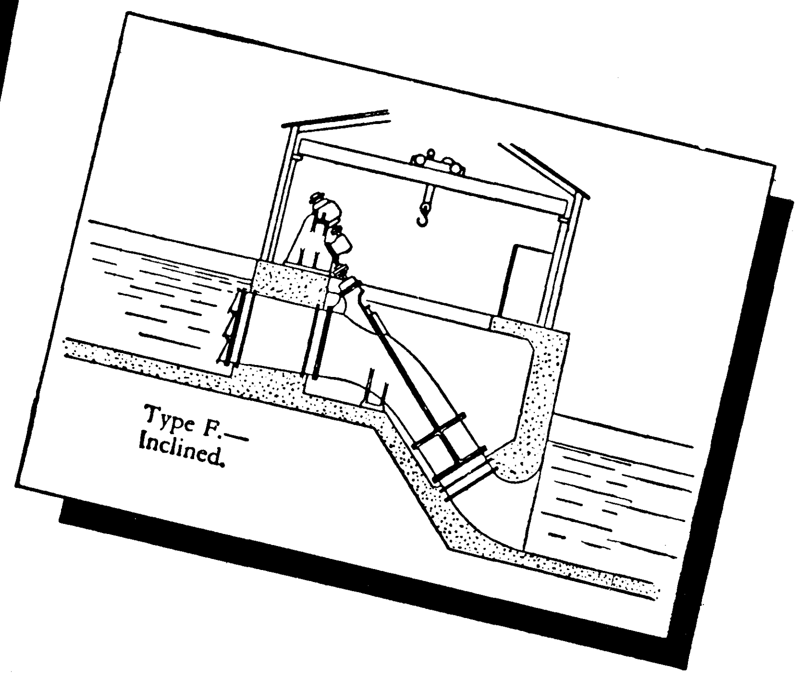

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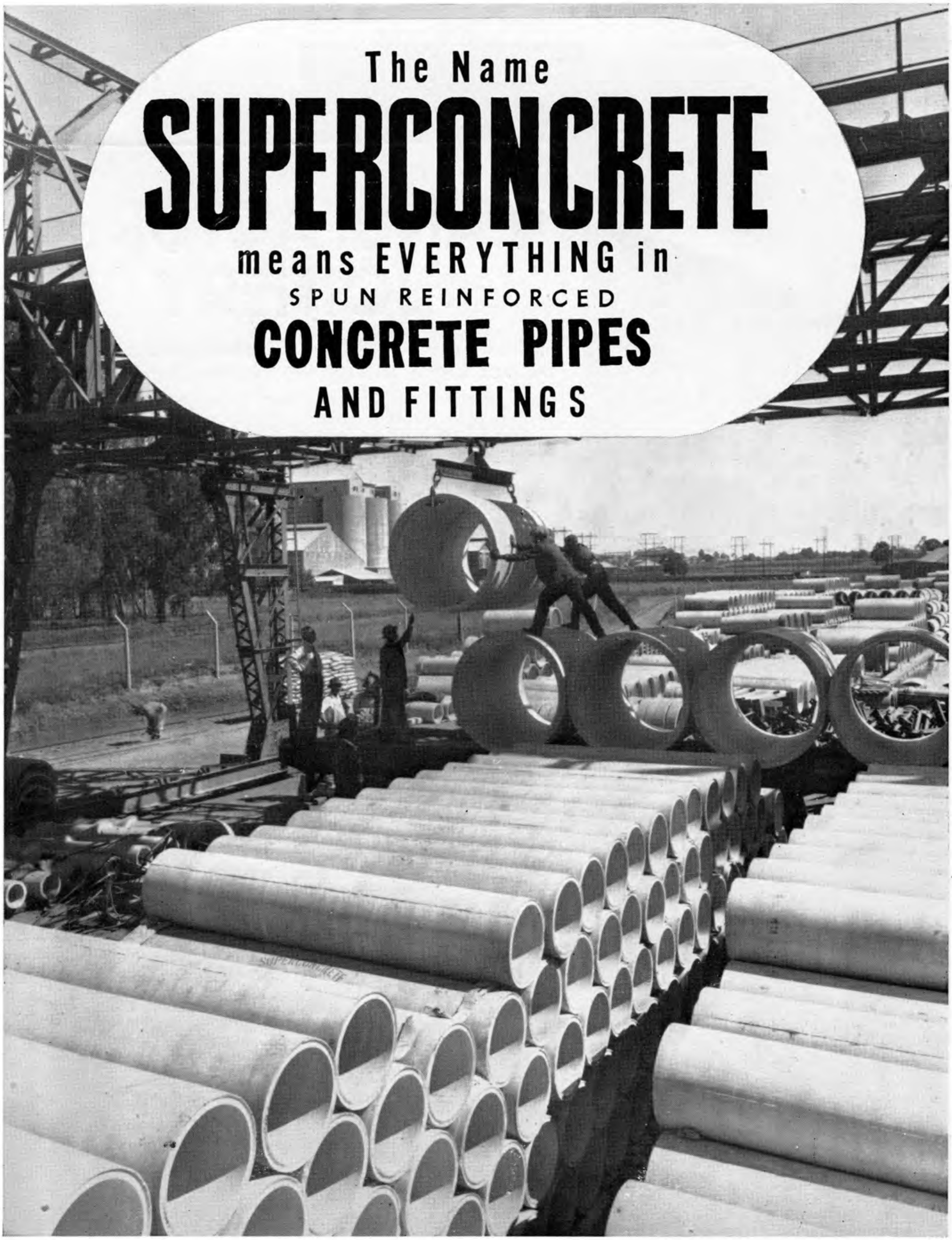
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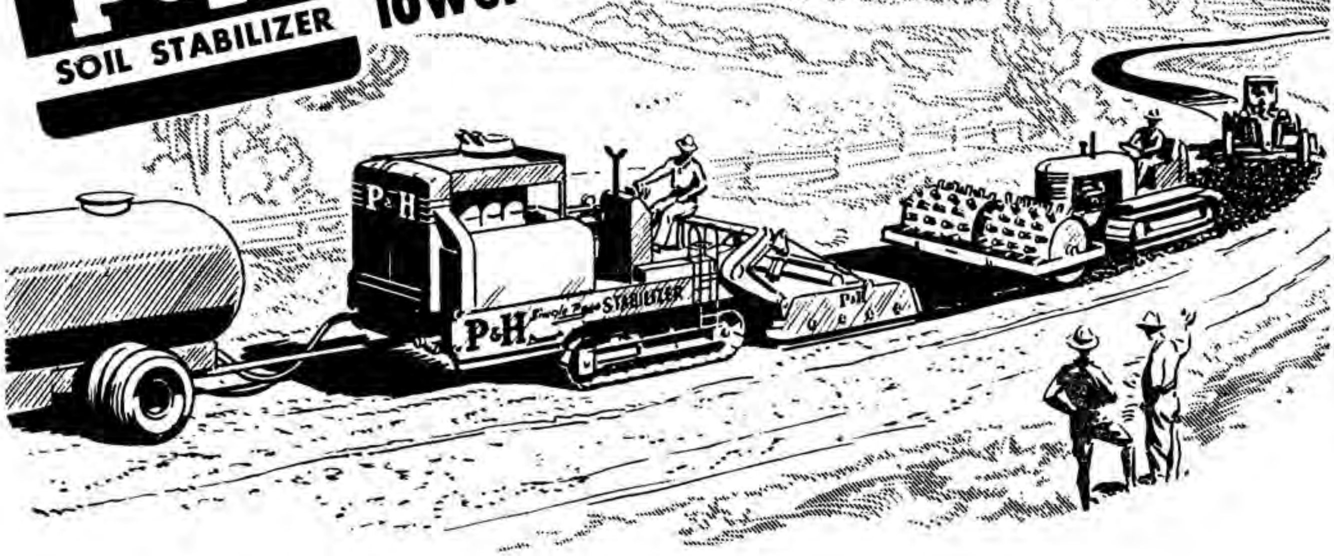

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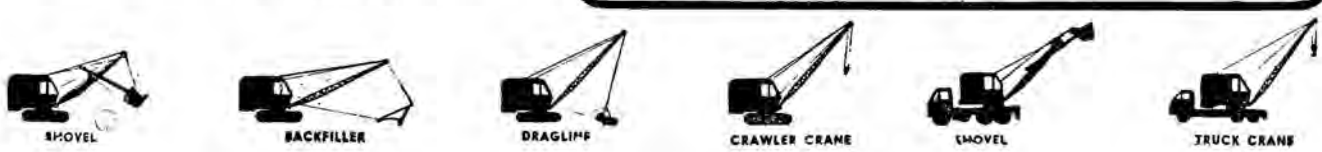

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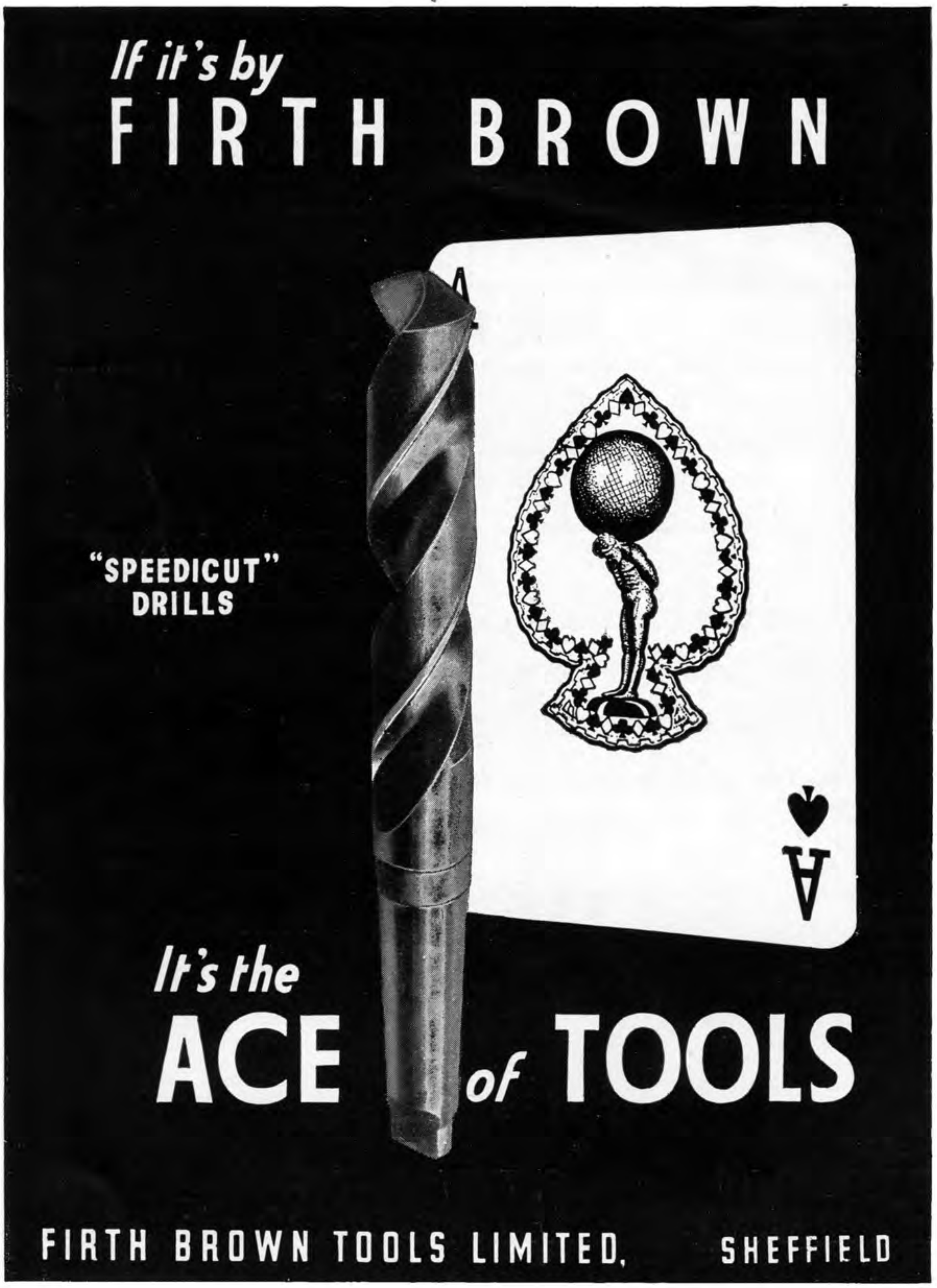
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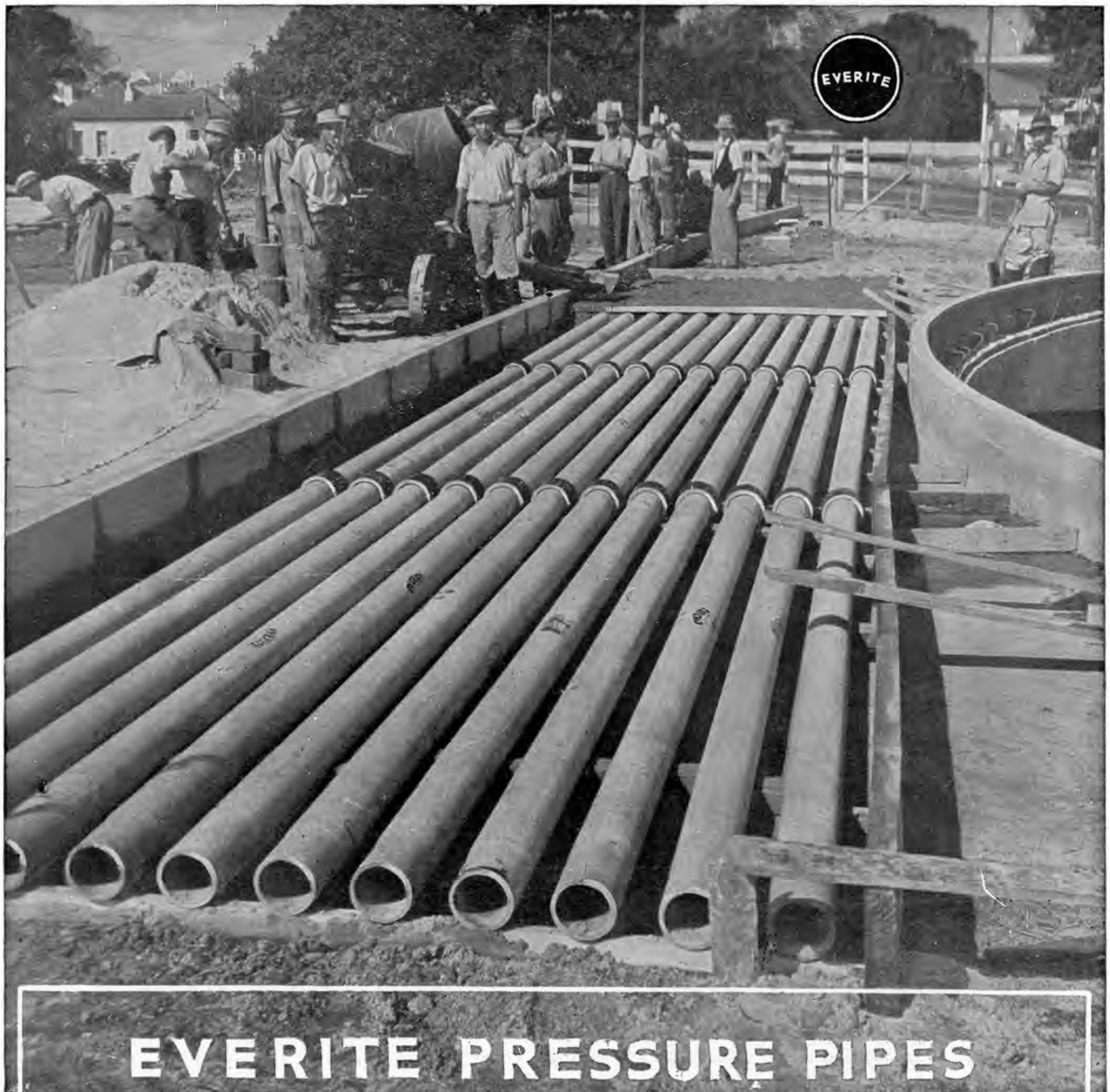
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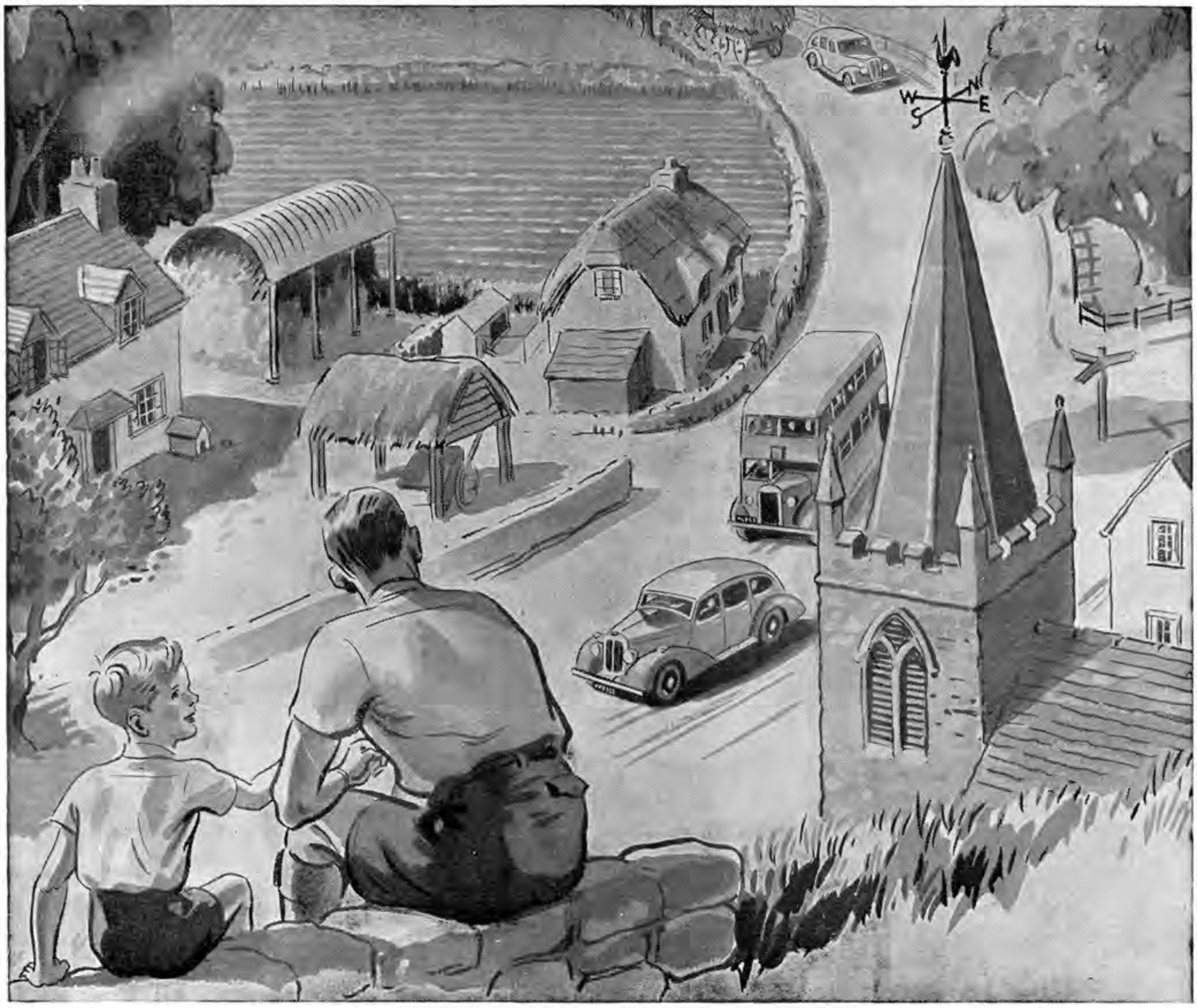
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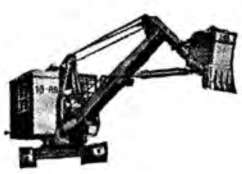

PUBLIC WORKS OF SOUTH AFRICA

PROPRIETORS: PUBLIC SERVICES PUBLICITY (PROPRIETARY) LIMITED, EDITORIAL OFFICES AND PUBLICITY DEPARTMENT: FIRST FLOOR, 92, MAIN STREET, JOHANNESBURG. TELEPHONES: 33-9606, 33-1505.

EDITOR:
W. R. GORDON, O.B.E. M.I.I.A. M. Inst. F.

PUBLIC WORKS OF SOUTH AFRICA, which is published monthly, is intended to keep the public up-to-date in regard to the engineering and building projects of the Central Government, the Provincial and Municipal Governments of Southern Africa and activities overseas.

VOLUME X • NUMBER SIXTY-SEVEN • JUNE 1949

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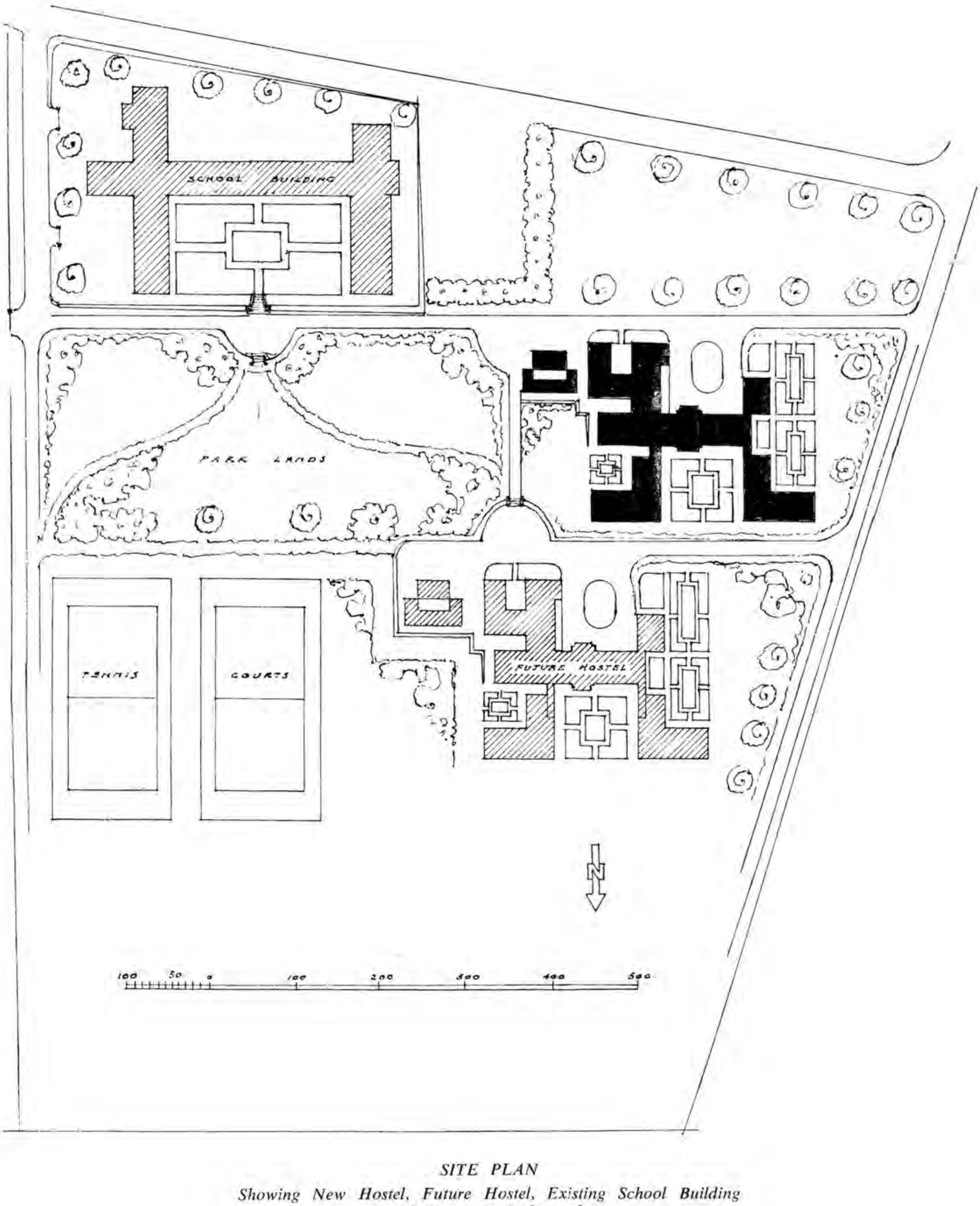


SITE PLAN

Showing New Hostel, Future Hostel, Existing School Building and Lay-out of Grounds.

KRUGERSDORP E.M. HIGH SCHOOL

NEW HOSTEL FOR BOYS AND GIRLS

THE buildings are designed to accommodate 40 girls and 40 boys, together with provision for a matron, assistant matron, two resident teachers, a superintendent, and a European domestic staff. The Native staff are accommodated in a separate building adjoining the hostel. It is proposed in the future to build a further hostel, for girls, when the present one will be utilised for boys.

Site and Siting of Buildings

The site for the Hostel adjoins the High School, which was completed eighteen months ago. The site is situated on the top of a slope to the north leading into a long valley and has a magnificent view of the Magaliesberg Mountains in the far distance.

It was originally intended to utilise to its fullest extent this view and also the northern aspect by designing the buildings in a long and almost continuous block. After various sketch plans had been prepared it was decided, however, that this was not a suitable type of plan, in view of the fact that when the second Hostel was built it would, owing to the restricted frontage of the site, blanket the view from the existing school.

It was also found that the extreme length of the building would cause difficulties in the administration and service. Again, the exposed nature of the site called for a certain amount of protection from wind. A final plan was therefore evolved which had the advantages of giving the domestic rooms and dormitories the full benefit of the superb view, and at the same time provided not only protection from cold winds, but better centralization of the administrative block, together with reduced frontage.

Planning

The whole of the administrative rooms including the boy scholars' study and recreation room are included in the ground floor of a central two-storeyed block. The main staircase leads from a hall around which are grouped the visitors' room, secretary's office and other administrative rooms. Accommodation for incoming and outgoing letters is provided for in the entrance hall.

On the first floor of this block are the girls' recreation room and study, whilst the remaining portion is occupied by the matron's flat, and the assistant matron and European staff bedrooms and communal lounge for the staff. Large linen stores and a housemaid's closet and cleaner's cupboard are provided.

From this main building the L-shaped double-storeyed dormitory wings are symmetrically planned on the northern side. The ablution rooms and lavatories adjoin the dormitories on each floor of the two blocks, the planning of which is identical excepting for slight variations in detail.

Kitchen Block

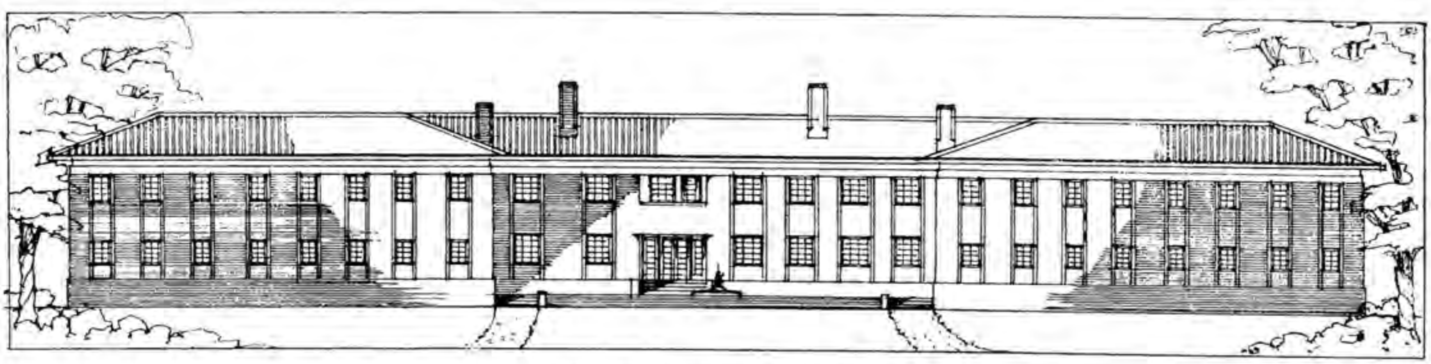
The kitchen and dining room block has been designed as a single-storey building on the south-east. The dining room leads straight off a crush hall, in which is also accommodated the main staircase. The dining hall will seat 100 persons. The kitchen block, apart from the kitchen itself, contains a complete range of stores, and has a baking room, cooling room and food preparation suite, linen store and entrance yard, which latter gives easy access for receiving stores and fuel.

Sick Bay

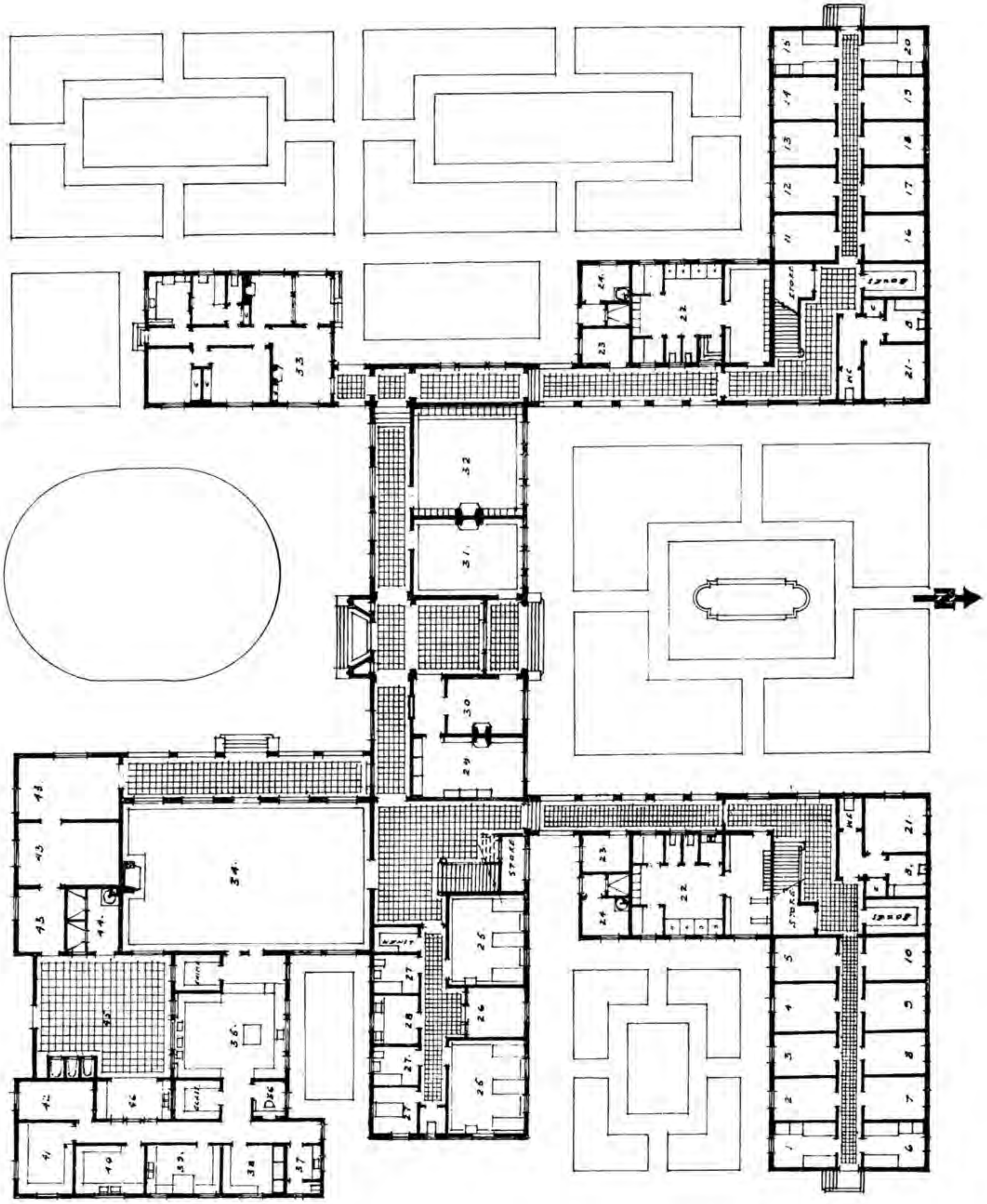
Accommodation for sick children is provided by two wards situated at the east end of the main block. A nurse's duty room, sluice room and two bathrooms with linen store, provide the necessary amenities to form a complete miniature hospital.

Superintendent's House

This is connected by a short covered corridor to the main building, and consists of a verandah, lounge, study, two bedrooms, bathroom and kitchen.



North Elevation facing Garden Court.



THE GROUND FLOOR.
(For legend see opposite page.)

Dormitory Blocks

Although it is the usual practice to leave the walls of the dormitory cubicles some 7 feet high to give cross ventilation, it was decided in this case that owing to the exposed nature of the site, it would be essential to close in each cubicle to the ceiling and provide doors. Each two-bedded cubicle leads on to a central corridor and ample ventilation for the summer months has been provided. An ancillary staircase leads from each first-floor dormitory to the ground floor, giving easy access from the dormitories and ablution rooms. A small suite for two resident teachers is provided in each block.

Ablution Rooms

These have been planned in close proximity to the dormitories on each floor, and consist of the usual lavatory accommodation, together with tiled shower baths, slipper baths, and washing basins.

Two music rooms are provided in these blocks, whilst the heating apparatus for hot water is situated in close proximity to the bathing facilities.

Construction and Finishings

The main walls, ground to first floor, are constructed in 15-inch brickwork and 11-inch cavity walls to the first floor above, finished externally with red facing brick, with ruled hollow joint and a plaster frieze at the eaves level of the roof.

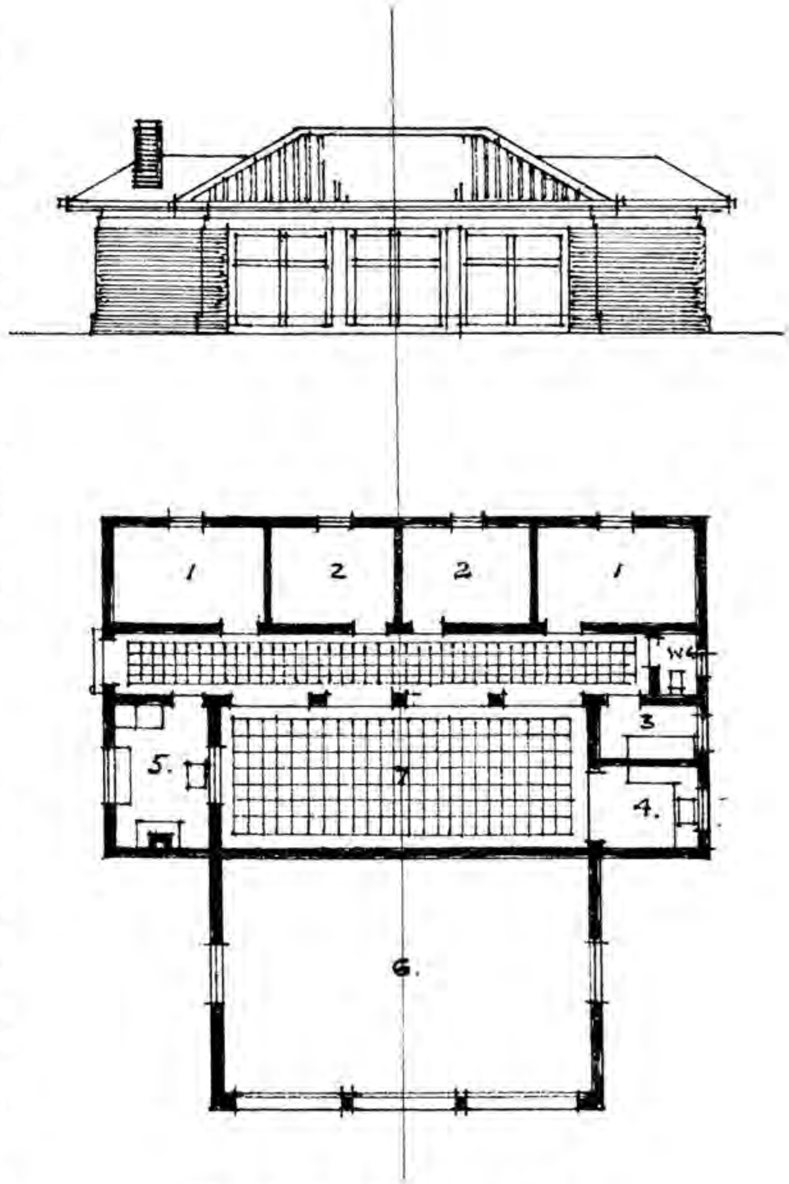
As a relief to the plain surfaces beyond the placing of openings, the windows have been slightly recessed, forming panels, linking the windows to ground and first floor as illustrated by the north elevation forming the main façade.

The first floor is constructed of reinforced concrete, and finished with a parquet hardwood block in basket pattern to all living rooms. There are tiled floors to the main corridors in red quarries and asphaltic tiles to ablutions, bathrooms, and the whole of the sick bay.

Dadoes have been finished partly in brick facings and partly in painted dadoes with glazed splash backs to baths, basins and sinks. The general decorative treatment in distemper and paints has been carefully considered, both from the point of view of maintenance and costs, so as to provide a more pleasing effect throughout.

The estimated cost of the completed buildings is £45,000.

The associated architects are H. Wolseley Spicer and Philip H. Logan, of Johannesburg.



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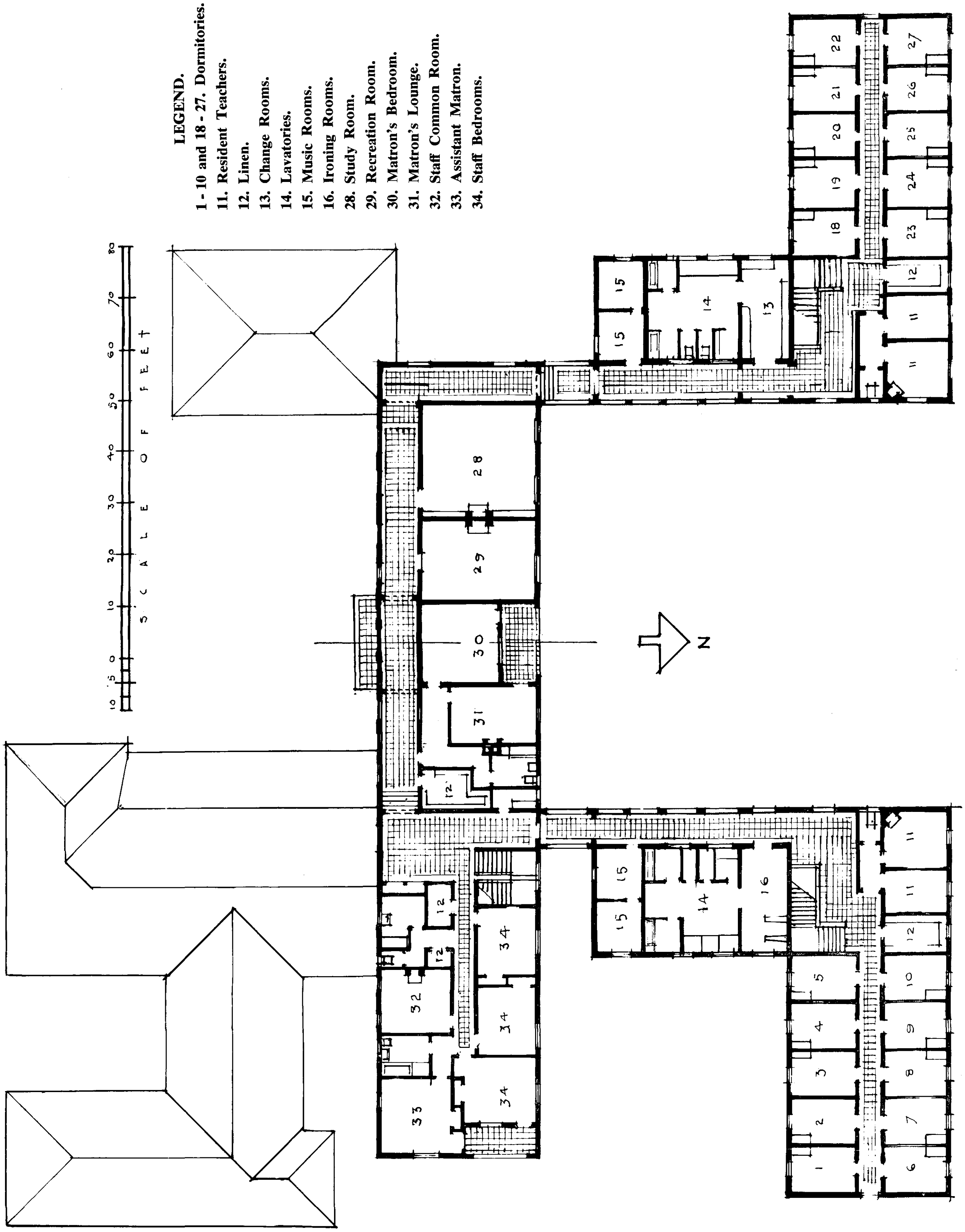
2. **Single Quarters.**
3. **Bathroom.**
4. **Laundry.**
5. **Kitchen.**
6. **Garage for 3 Cars.**
7. **Open Court.**

LEGEND: GROUND FLOOR.

Nos.
- 1 - 20. Dormitories.
- 21. Resident Teachers' Quarters.
- 22. Ablutions and Change Rooms.
- 23. Music Room.
- 24. Boiler Room.
- 25. Sick Bays — Boys and Girls.
- 26. Attendant.
- 27. Bathrooms — Boys and Girls.
- 28. Ablution.
- 29. Secretary.
- 30. Visitors.
- 31. Recreation.

Nos.
- 32. Students' Study Room.
- 33. Superintendent's House:
  - Lounge.
  - Study.
  - Stoep.
  - 2 Bedrooms.
  - Bathroom.
  - W.C.
  - Kitchen.
- 34. Main Dining Room.
- 35. Kitchen and Service.
- 36. Cook's Office.

Nos.
- 37. Staff Lavatory.
- 38. Cold Storage.
- 39. Bakery.
- 40. Vegetable Prep. Room.
- 41. Food and Storage.
- 42. Bulk Storage.
- 43. Fuel and Hostel Storage.
- 44. Boiler Room and Fuel.
- 45. Kitchen Court.
- 46. Cleaners' Stoep.



Krugersdorp Hostel — First floor plan.

HYDRO-ELECTRIC POWER POSSIBILITIES IN SOUTHERN AFRICA

By

D. F. Kokot, D.Sc.

Chief Planning Engineer, Irrigation Department.

In this interesting paper, read recently before the South African Institute of Engineers in Johannesburg, Dr. Kokot, of the Union Irrigation Department, outlines the possibilities of hydro-electric power in Southern Africa. While his conclusions, so far as the Union is concerned, are, necessarily, disappointing, he does suggest opportunities afforded, north of the Union, by the Zambesi and Cunene Rivers.

Unfortunately, however, as his survey reveals, where there is a present and potential demand for electricity there is no water. Conversely, where water is plentiful the local load for power is, at this period of our history, negligible. South Africa is, happily, blessed with ample supplies of coal suitable for power generation. Dr. Kokot shows clearly that it is to this source, and not to hydro-electricity at this stage, that the industries and people of the Union must look for the satisfaction of their power requirements.

SOUTH AFRICA, in common with many other countries in the world, is becoming conscious of the value of its natural resources and of the need to conserve these, or, if they are exploited, to do so to the best advantage. In a country so arid as ours, water conservation and utilization are matters of the greatest national importance and the spectacle of a river in flood has aroused in more than one mind the question whether the energy of the rushing waters cannot be harnessed and turned to the use of mankind. From this springs the question: Why is nothing done about it? And as often as not the question is an accusation. The matter is one of such importance in this age of machines, where electric power, cheap and abundant, is so essential to keep the wheels of industry turning that I shall in this address attempt not only to make an assessment of the power possibilities that appear to me to exist, but at the same time to answer the accusation why so little has as yet been done. For the Union of South Africa alone, as will presently become clear, the possibilities are rather meagre. To relieve a somewhat gloomy picture, I have therefore included the rivers of our northern neighbours, namely, the Cunene, the Okavango and the Zambesi.

Area of Survey

Although the area embraced in this survey is an immense one, covering upwards of one-and-a-quarter million square miles, a very large proportion of the area yields no useful run-off; much of it consists, indeed, of Kalahari sands where flowing water is seldom seen. Over this vast area the annual rainfall varies tremendously; on the west coast it is practically nil, on some high mountain peaks it rises to close on 200 inches per annum. For the Union the mean is only 17 inches per annum; over the catchment area of the Zambesi, it ranges from about 15 inches in the extreme south, to 50 on the Congo divide. With these great differences in the rainfall it follows that the rivers should show even greater differences, so that we have a complete range of types from those of the Kalahari which flow perhaps once in a generation, to such magnificent perennial rivers as the Zambesi and some of its tributaries.

In most cases the demand for power is a relatively steady one throughout the year and a river having a large steady flow would obviously be the most suitable one for supplying such power. As the flow fluctuates more from one time of the year to another, and as the flow from season to season becomes more erratic, so a river would become less suitable for power generation, and in South Africa, with its many erratic rivers, many must indeed be entirely useless for power purposes unless the flow can be stabilized by means of large storage works.

Let us first consider the possibilities without storage and see whether any of our rivers have sufficiently regular flows to justify harnessing them.

Union Rainfall

The rainfall over the greatest part of South Africa is markedly seasonal in character. Over a large part of the country something like 75 per cent of the total annual precipitation falls during the summer months; in a relatively small portion — the Western Province — a like amount falls during the winter months. This marked seasonal character in the rainfall is reflected in the flow of rivers. Eighty-two per cent of the run-off of the Orange River occurs during the six months from November to April. For the Vaal River, the position is even worse, partly because the Orange River at times receives a flow increment from snow during the winte months, whilst this does not apply to the former. In the Western Province the position is reversed; in the Breede River, for instance, only ten per cent of the year's run-off occurs during the six months from November to April. In all of these three important rivers the minimum run-off at times is practically nil.

There are a few perennial rivers in South Africa, notably the Letaba, the Blyde, the Komati, the Usutu and the Pongola, all rising in the Drakensbergen. But even in these relatively permanent rivers the run-off is still markedly seasonal in character, the Blyde and the Komati producing 73 and 75 per cent respectively of their run-off during the six months from November to April.

If power is to be developed from any of these rivers, without storage, it therefore follows that two alternatives are open to us: first, to base the capacity of the power plant on the minimum flow, which will generally be so small that it will be of questionable value, or, secondly, to instal a power unit for a flow considerably in excess of the minimum, say, for instance, for that flow which occurs at least half the time, and to use such power, as is available from time to time, in conjunction with that obtained from a thermal station. This means that the station will really have to be a thermal one, but arranged so that whenever possible it can be shut down and the work done by the hydro unit, thereby saving fuel.

Komati River Possibilities

In the Komati we have one of the most permanent rivers amongst those of any size; let us therefore examine its possibilities somewhat more closely. This river has been gauged since 1910 at a spot just west of the Swaziland border. These records show that the total annual run-off of the river is subject to very wide variation and although the mean flow is very substantial, the low flow has been as small as 20 cusecs. The following table shows the percentage of time, throughout the whole record, when the flow dropped below a given rate :—

Cusecs	Percentage of time when the flow fell below that in column 1 1909-1946	1931-1932
100	2.6	5.7
200	20.0	60.0
300	35.0	81.5
400	45.0	89.0
600	68.5	95.0
800	79.0	97.0
1,000	85.8	98.6

So far as is known a weir or series of weirs would have to be built to provide the necessary fall to generate power as the only substantial fall in the river, namely, at the Tonga Falls, is very low down in the valley near Komatipoort. Unless conditions are very favourable even the creation of an effective head of only 50 feet would cost quite a considerable sum.

In the following tables are shown how much current could be generated at such a station firstly for average flow conditions as arrived at from the gaugings for the period 1909 to 1946 and secondly for a bad season such as that of 1926-1927. It is assumed that the overall efficiency of the station will be 75 per cent and that the load factor will be 66.7 per cent; also that sufficient pondage will be available to smooth out daily fluctuations in demand. In this way, a station based on a mean flow of, say, 400 cusecs, would be so designed that it can use a flow of 600 cusecs during peak hours. Figures are in millions of kilowatt-hour units.

Flow in cusecs.	Station Rating Kw.	FLOW CONDITIONS			
		Mean : 1922-23 to 1945-46		Season : 1932-33	
		Output	Deficiency	Output	Deficiency
1,000	43,000	206	38	103	141
2,000	86,000	367	121	168	320
3,000	129,000	504	228	218	514
4,000	172,000	632	344	255	721
5,000	215,000	743	477	282	928

This table shows that even on what is probably our most reliable river, so far as low flow is concerned, power generation is beset by grave difficulties. If we build a station based on a flow of 400 cusecs, utilizing with the aid of pondage a maximum rate of flow of 600 cusecs, we have the following position :—

Mean annual power output over a long period	8.6 million units
Mean annual deficiency	2.2 million units
Output during a bad season, e.g., 1926-1927	5.9 million units
Deficiency during 1926-1927	4.9 million units

To maintain a steady supply of current, equivalent to the rated output of the station (1,900 kW), it would therefore be necessary to have an auxiliary thermal station which on an average would have to produce 2.2 million units per annum. But in a bad season such as 1926-27, it would have to produce 4.9 million units. As, however, the flow may for part of the year drop to practically nil — a flow as low as 20 cusecs has actually been recorded — it would be necessary to have the auxiliary station as big as the hydro station itself.

This would mean that there would be two complete stations, one hydro and one thermal, each with rated capacity of 1,900 kW., but that on an average 8.6 million units would be produced by the water and 2.2 by the thermal station.

It is beyond the scope of this address to go into the economics which would determine whether such a course would be sound, but it appears extremely doubtful whether the capitalized cost of the coal which would be saved would be as much as the extra capital cost which would be involved in having a duplicated power station.

Would Storage Assist ?

This is the picture without storage. Would the provision of a storage dam alter the position radically ? From the river flow records it would appear that the mean annual run-off of the Komati is slightly over 400,000 acre-feet per annum. By analysis of the mass inflow diagram it appears that we could rely on a steady continuous draught of 400 cusecs, from which could be produced annually 10.8 million units. Such a station, based on storage, would need no auxiliary thermal plant, but we should have to face the extra cost of building a storage dam. We would therefore have to balance the capital cost of a 1,900 kW. thermal station and the fuel costs of producing the 2.2 million units of electricity against the capital cost of the storage dam.

A dam with capacity equal to the mean annual run-off of 400,000 acre-feet would cost at least £1,500,000. A thermal station of 1,900 kW. would not cost more than £100,000. If we add the annual cost of fuel, say, £2,000 based on coal at 20s. per ton and capitalize this at £40,000, we arrive at a total cost of £140,000 for the thermal station against £1,500,000 for the storage dam. This rough calculation shows up at once that on a river such as the Komati the cost of stabilizing the flow of the river by means of storage would be prohibitively expensive. By using very much higher heads from which greater outputs could be obtained the comparison would, of course, become much more favourable. But even if we assume a head as high as 150 feet — which would not be obtainable from a 400,000 acre-feet storage dam without considerable extra cost — the comparison is still highly unfavourable to the hydro station.

The Orange River

Whilst the Komati River is an important one on account of its relatively high minimum flow, its total flow is not very great. From this point of view the Orange River is far more important, draining, as it does, nearly one-half of the whole Union and contributing almost one-third of the entire run-off. From the point of view of power generation it merits particular attention because in its lower reach, 75 miles west of Upington, it tumbles over the Aughrabies Falls in a drop of nearly 500 feet. This river has been gauged at the Falls, but only for low flows; higher up at Orange River Station it has been gauged for total flow. Figures for the latter station are, therefore, used in the following analysis. For low flows alone there is very little difference between the stations, accretions below the upper one being offset by evaporation losses and diversions. The flow of this river is disappointing, falling at times to a negligible amount.

The following table shows the flows during the period 1922-23 — 1945-46 :—

Cusecs	Percentage of time when the flow exceeded that given in first column.
1	99.5
5	99.4
10	99.3
50	98.8
100	96.6
250	91.8
500	84.2
1,000	72.4
2,000	59.3
5,000	44.6

Analysing these figures in the same way as for the Komati River, we arrive at the following table. In determining the output in kilowatt hours, it is assumed that a head of 450 feet will be available for power generation at the Falls. Outputs in the table are given in millions of kilowatt-hour units.

Flow in cusecs.	Station Rating kW.	FLOW CONDITIONS			
		Mean: 1909-1946		Mean: 1926-1927	
		Output	Deficiency	Output	Deficiency
200	950	5.1	0.3	4.8	0.6
300	1,420	6.8	1.3	5.4	2.7
400	1,900	8.6	2.2	5.9	4.9
500	2,370	9.8	3.7	6.1	7.4
600	2,850	10.7	5.5	6.3	9.9
800	3,800	12.4	9.2	6.5	15.1
1,000	4,750	13.2	13.8	6.6	20.4

If we based a station on a flow of 5,000 cusecs — allowing with pondage for using up to 7,500 cusecs during peak hours — we can see that, without storage, very serious shortages would be experienced, even on an average during a long period. In bad seasons the output for the whole season would amount to less than one-quarter of the rated output. But during part of a bad season the flow actually drops to practically nil, so that to maintain a steady output an auxiliary thermal power station equivalent to the water power one would be necessary.

With storage the position would be very substantially improved. By analysis of the mass inflow curve it was found that a continuous draught of 5,000 cusecs could be maintained from a storage dam with a capacity equal to the mean annual run-off. To achieve this, storage of 6,000,000 acre-feet would be required. Such a structure on the Orange River is very unlikely to cost less than £5,000,000. To use a continuous flow of 5,000 cusecs a 215,000 kW. station would be required. A thermal station of this size might cost in the neighbourhood of £6,000,000 and would require approximately 1 million tons of coal per annum costing — at the Falls — about £1,000,000. But then if we had to build a thermal station we should not do so at the Falls and coal would therefore not cost nearly so much. At the big power stations near Witbank and Vereeniging coal costs less than 5 shillings per ton.

From the two examples considered, it is abundantly clear that the large-scale development of water power without storage is anything but attractive, if only from the point of view of the irregularity of the flow of the rivers. There are some places where high heads could be employed, mostly

The Clark Dam, which serves the Tarraleah power station in Tasmania. This dam, which is on the Derwent River, has a storage capacity of 66,000 million gallons.

by tunnelling through mountains, as, for instance, by diverting the Blyde River and Orange River through the Drakensberg, the former at a point 25 miles north of Graskop and the latter 25 miles north-west of Matatiele. Likewise, the Riviersonderend could be diverted into the Bot River to obtain a head of close on 800 feet. Incidentally, the largest water power station in the Union is situated on the Sabie River not far from Graskop, where 7 million units are produced annually by a 1,350 kW. station. But unless storage dams are provided, the prospects remain unattractive. If storage dams are added the physical conditions can be very materially improved, but if the power plant has to bear the entire cost of storage, it still remains doubtful whether anywhere in South Africa current could be produced on a substantial scale at a price to compete with coal.

Only by building multiple-purpose storage dams and by charging little or nothing of the cost of the dam to the power plant can there be any hope of producing electricity from water power on a substantial scale at a price equal to that from thermal stations.

The Vaal Dam

We have at present only one locality in South Africa where an existing storage dam built for other purposes can possibly be used to produce electricity. That is on the Vaal River, where a large storage dam constructed 25 miles east of Vereeniging, supplies water to the industrial and urban areas of Vereeniging, the Witwatersrand and Pretoria and to the large irrigation scheme 360 miles downstream in the Hartz River Valley north of Warrenton. The present capacity of this dam is 872,000 acre-feet, equal to about 40 per cent of the mean annual run-off of the Vaal River. To supply water to the irrigation scheme and to various consumers along the course of the river — which will soon include the Odendaalsrus gold mining area — a fairly large and comparatively steady flow is released from the dam so that the Vaal River to Christiana is now practically a perennial stream. In the 360 miles from Vaaldam, the storage reservoir, to the Vaal-Hartz diversion weir, the river falls 850 feet. From the power point of view, the most favourable stretch of river is between Parys and De Wet's drift, where the fall is 360 feet in only 60 miles. By building a weir or weirs, and canals we might at the very most have available some 250 feet of effective head. We may assume that the flow of the river will never be less than 500 cusecs and that all or most of this can be passed through the power plant. In this way up to 70 million units of electricity could be generated from a station rated at about 8,000 kW.

The station could be operated in a number of ways. By working direct from the supply canal, without pondage, a steady base load could be supplied; with pondage the station could be operated as an independent unit providing both base and peak loads or it could, in conjunction with other supplies, be worked to meet peak loads only. Pondage at the end of the canal would result in some loss of head and would naturally add to the cost.

It is certain that the necessary weirs and canals to enable power to be generated will be very costly indeed, and in such close proximity to coal mines cannot, in the matter of cost, compete with thermal stations. There is a favourable factor, however, namely, that in the near future there will be a grid of transmission lines in the vicinity of the Vaal River and it is possible that electricity obtained from water power could be produced cheaply enough to justify the establishment of hydro-power stations to feed into this grid system. It is significant, however, that although the Rand Water Board has the right to develop power from the water released from Vaaldam — at a fairly steady rate of some 600 cusecs — it has failed to exercise this right. Valves for releasing water from the dam into the power plant have actually been installed and no costly works would be required beyond the actual turbines and generators. In this particular locality, where coal costs under 5s. per ton and where electricity is produced at a cost of one-sixth to one-ninth of a penny, it is not surprising, however, that the outlook for water power development is not promising. There are other localities in South Africa where no schemes have as yet been built, but where investigations so far carried out indicate some possibility of operating power stations in conjunction with other uses. In this connection, I wish to refer particularly to a project to divert the Orange River into the valley of the Great Fish River which flows past Cradock and discharges into the sea a few miles east of Port Alfred.

Orange — Great Fish Rivers Project

The project is an ambitious one and by far the biggest irrigation scheme which has so far been considered. Briefly, there are two considerations which render the plan attractive. Firstly, there is singularly little arable soil in the valley of the Orange River, so that there is little prospect of our being able to use the water of this river within its own watershed at anything like a reasonable cost. Secondly, a great deal of existing development in the Great Fish River and Sundays River valleys is threatened with extinction because the storage dams constructed there are silting up at an alarming rate. Bringing water from the Orange River will not only save all the development that has taken place, but it will enable tremendous further expansion to take place, both in agriculture and in industry.

The plan is to drive a 50-mile tunnel through the Suurberg, which forms the watershed between the Orange and the Fish west of Steynsburg. Water from the tunnel would flow into the existing Grass Ridge dam, which can be made into a very large reservoir at moderate cost, and then down the Fish River. Between Grass Ridge and Cradock, the river falls 650 feet and by a suitably constructed canal 500 feet of this could be made available for power generation at Cradock. A steady flow of 500 cusecs or even somewhat more could be reckoned on and with suitable pondage some 150-200 million units of electricity could be generated per annum. Further down the river, at Cookhouse, the plan is to divert water into the Sundays River valley. This involves only a very short tunnel and from the outfall of the tunnel to Lake Mentz a similar amount of current could be generated.

If the power units were not called upon to bear any portion of the cost of the tunnel or large storage dams, that is Grass Ridge and Lake Mentz, and bearing in mind that coal would cost 15s. per ton at Cradock, there is a very strong likelihood that hydro stations would be able to provide current more cheaply than thermal stations.

If the Orange - Fish tunnel scheme materializes and power can be produced as a by-product the matter becomes one of considerable importance, and the plan certainly deserves looking into carefully. At the present moment, this project is the most attractive multiple-purpose water-utilization scheme which is under investigation.

Sonderend and Bot Rivers

One other locality deserves especial mention. By a peculiar circumstance of topography the Riviersonderend lies at a much higher elevation than the Bot River so that from a storage dam on the former, situated close to where the Villiersdorp - Caledon road crosses the river, water could at small cost be diverted through a very short tunnel into the Bot River valley. By building a canal on a normal gradient from the tunnel outlet a fall of nearly 800 feet into the Bot River would soon be obtained. Situated at the furthest point from our coal mines and being close to a densely populated and highly developed area, this project deserves detailed examination. Conditions are not favourable for irrigation in the valley of the Sonderend, therefore there will be no serious clash of interests. More important, however, may be the need to reserve all the water for domestic and industrial purposes in and around Cape Town. A storage dam on the Riviersonderend would not be silted up rapidly as this river carries very little silt indeed. This is very important from the economic point of view because the reservoir would have a long life and repeated capital expenditure would be avoided.

Power not the Only Use for Water

So far the generation of electrical power by means of water has been dealt with as if there were no conflicting interests to oppose or prevent such use. The Union of South Africa is, however, so extremely poorly supplied with water that I cannot imagine that in any locality, under any circumstances, would the use of water to produce power to the detriment of primary users and irrigators be tolerated.

In the development of our industries, our town water supplies and our irrigated lands water will in many cases be the limiting factor. We simply cannot afford to use this water for power generation and thereby curtail or hamper that other development. After all, power can be produced in other ways, and generally more cheaply, but water is strictly limited by the scanty run-off obtained from our erratic and uncertain rainfall. If this viewpoint is accepted — and can anyone seriously contest it? — then there can be but few places where power could be developed without some detriment to other more important interests. Power development at the Aughrabies Falls would, for instance, have to be ruled out entirely for the simple reason that below the falls there is not the remotest chance that large-scale development, requiring a great deal of water, will ever take place. The ideal would be to use all the water of the Orange River before it reaches the falls, either for irrigation or for industrial purposes. If we generated power higher up the river, it would be less attractive through not having the natural fall and we would moreover be getting nearer to the sources of coal where cheap thermally-produced power could be made available.

Water Supplies Limit Population Growth

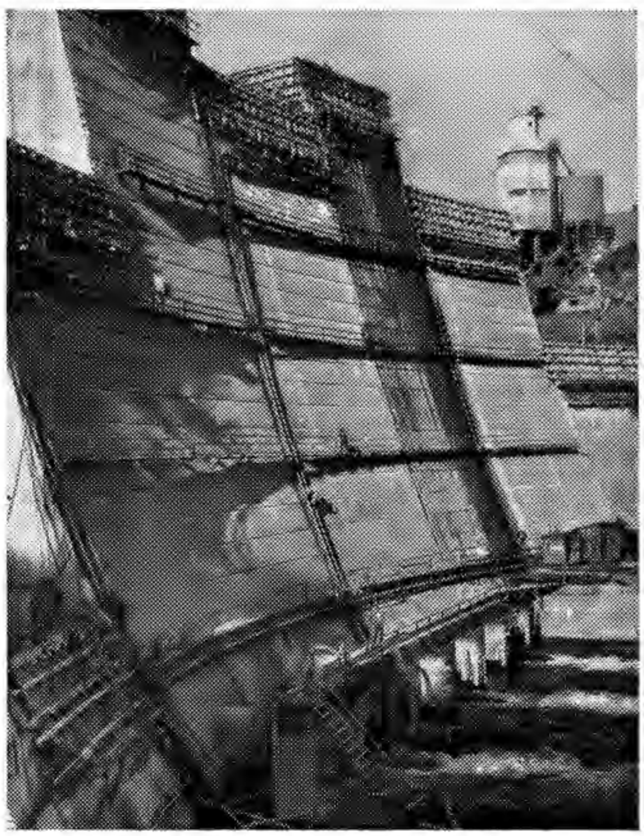
All investigators who have concerned themselves with the question of our water resources have pointed out how meagre they are and how essential it is to conserve and use them to the best advantage. We are to-day on the crest of a wave of prosperity coupled with a phase of generally good rainfall over South Africa as a whole and we are apt to think in terms of a vastly increased population sometime in the rosy future. It cannot be too strongly stressed, however, that in many localities the quantity of water available will be the final limiting factor in population growth and, of course, in production. Many rural areas are already fully populated — and in some cases even over-populated — and further increases founded on agricultural output cannot be expected. In many districts serious deterioration of the land has been due to over-population and the resultant urge to take more and more from the soil.

If the populations are to increase in these areas, it will have to be mainly on the basis of industries and not on farming, even allowing for very much improved agricultural methods. These industries will, however, require assured water supplies. Every drop of water will, therefore, have to be put to its best use, be that for agriculture or for industry. Power development simply cannot be allowed to compete with these two needs. The lack of water power facilities or the need to reserve the water for other purposes need not worry us, however, because South Africa is very fortunate indeed in having immense coal resources, although it is a pity that these are distributed almost entirely north of the Orange River. Coal does occur in the Cape Province, but of an inferior grade. Improved technique may, however, in the future open up a power use for these inferior coals. At any rate, coal can be conveyed to any part of South Africa at costs which are within economic limits. The conveyance of water to very distant points would generally render its cost prohibitive. This scarcity of water leads one to the inevitable conclusion that only where power can be generated in such a manner that no injury is done to agricultural or industrial interests can its use for that purpose be permitted. Even in a locality such as the Fish River, where I have indicated fairly favourable conditions for water power generation, there may be times when the two interests will clash. For instance, after heavy rain irrigation may not be necessary yet water may have to be released from storage for power generation. Or in a season of bad drought the mode of distribution for irrigation may be unfavourable for power purposes. The latter needs a steady stream, hour by hour and day by day. Irrigation is more seasonal in character and may, moreover, be carried out intermittently. Ample storage may to some extent minimize these difficulties, but storage costs money, and storage practically everywhere in South Africa is a rapidly wasting asset due to silting.

The normal function of a river is to carry water to the sea. In doing so, it also carries along the products of decomposition or of disintegration of the earth's crust. Where man has disturbed the harmony of nature as we have, to an alarming extent, done in South Africa, the rivers are heavily laden with these products. We are at the moment beginning — only just beginning — to wake up to the dangers, but until we have stopped talking about the problem and have achieved something worth while, our soil will continue to be carried to the sea and our storage dams will continue to silt up despite frequent enlarging, some day to stand there as monuments to the folly of this generation. Until we can bring the rate of soil erosion down to a figure more comparable with that which nature has ordained, it would be extremely unwise to snatch a fleeting dividend from dams constructed in our more silty rivers, particularly in the lower rainfall areas.

Siltation and Soil Erosion Dangers

In the Fish and Sundays River valleys siltation is robbing us annually of 7,400 acre-feet of storage on an original



The 199-foot high wall of the Clark Dam, Tasmania. The daily flow of 485 million gallons gives a normal output of 84,000 horsepower, though the total installed capacity is actually double this amount.

capacity of 288,200 acre-feet, and in only a few generations' time these repeatedly enlarged dams will present so big a surface area to the scorching sun that evaporation will, to all intents and purposes, render them useless for storing water. The monetary value of the storage lost each year by silting in the four big irrigation dams in these two valleys is roughly £46,000 on an original cost of £1,646,000, so that after twenty-five years of use their aggregate value has been reduced by nearly two-thirds. On one of these dams almost as much as the original cost is now being spent on restoring capacity lost by siltation. If the country abounded in good dam sites, we could perhaps console ourselves with the thought that the value of the water caught and distributed from our dams was so much that we could afford to build new dams every few generations. The tragedy of it is, however, that good sites are few and far between. When Vaaldam, on the Vaal River, becomes useless as a result of siltation, there is no other site on which to build a dam nearly so cheaply and efficiently. There is only one site on the Crocodile River like that on which Hartebeestpoort dam is built. A dam to replace Lake Mentz on the Sundays River would cost several times as much as the original dam. Such being the case, we cannot afford to use up our dam sites on projects to generate power. All sites should be jealously preserved for the more vital purpose of supplying water to the great industrial and agricultural centres of development.

A few examples will serve to bring out the paucity of our water-power resources compared with those of other countries. The total run-off from South Africa which appears as river flow is of the order of a mean of 30 million acre-feet per annum. If this water could all be impounded and released as a steady flow, it would amount to only 41,000 cusecs. When this figure is compared with the volume of water which discharges over the Niagara Falls, the poverty of our supplies is startlingly exposed. The mean flow at Niagara is over 200,000 cusecs and even the mean minimum monthly flow is 150,000 cusecs. The power plants at Niagara produced nearly 7,000 million units of electricity in 1927 (the last year for which I have been able to obtain figures), and at that stage the power resources had been far from fully exploited. In 1943-44, the total production of electricity in South Africa was 8,000 million units.

T.V.A. No Criterion

Tennessee Valley, in the United States of America, has often been quoted as an example of the high standard of development achieved by a system of multiple-purpose dams. No example could possibly be selected of an area more dissimilar in every respect from the Union. Rainfall in the Tennessee Valley varies from 40 to 80 inches per annum with a mean of over 50 inches for the whole area. No irrigation is practised and there is ample water for industrial use. The primary objective as authorized by the T.V.A. Act were navigation and flood control; power generation could only be carried on with due regard to these two objectives. From its 52-in rainfall, the Tennessee Valley produces a run-off of 23 inches, amounting to 1,200 acre-feet per square mile per annum. The Vaal River, with a catchment area of similar size and with a rainfall varying from about 15 to 30 inches, produces a run-off of only 60 acre-feet per square mile, only one-twentieth of that of the Tennessee Valley. These figures are given only to show that Tennessee Valley is vastly different from anything we have in South Africa. There, water must be drawn from the reservoirs to make room for the next floods and in its passage down the valleys, can be harnessed to produce power. Here, we have to hold as much water as possible in the reservoirs because we never know whether there is a drought just ahead. The Tennessee Valley with a catchment area of one-tenth of that of the Union, has a run-off of 60 per cent greater than that for the whole Union.

In Germany with its network of permanent rivers, water power has been developed to a high degree. Many of the weirs serve a dual purpose, they increase the depth of the water for transportation needs and the heads created at the weirs are turned to useful account in generating power. In 1927 the total output of electricity was 25,100 million units and of this total 3,800 million units, or 15 per cent, were produced by water power. But the rivers of Germany produce far more run-off than anything we have in South Africa. For twenty rivers for which figures are available, the run-off varied from 350 acre-feet per square mile per annum to 3,050 acre-feet.

Cheap Power Produced by Coal

In comparison with some other countries, South Africa lags well behind in the matter of supplying electricity throughout the land. In some localities this is not due to the sparseness of the population as, for instance, in the densely populated areas around Johannesburg and Pretoria, where there is ample scope for the extension of supplies to many homesteads only a few miles from the large cities. Outside such centres of dense population, however, there are very great difficulties in the way of bringing electricity to every farmhouse. Comparing again with the Tennessee Valley, we find that there the population density is roughly 100 per square mile, whereas in the Free State, roughly of the same extent as the Tennessee Valley, the population density is 4 Europeans and 14 Natives per square mile. Also the average size of a farm in the Nennessee is 37 morgen, whereas in the Free State it is 600 morgen. Yet even in the Tennessee a substantial number of farms are not yet linked to the electricity supply system.

Cheap power, *at the power station*, is not the answer to the problem. Even if the electricity were to be supplied free at the power station, the cost of transmission would still make it impossible for every farm to be linked up. In any case, water power can only in the most favourable localities be supplied at a cost to compete with coal. And there is the added disadvantage that the water-power station may have to be badly situated from the consumers' point of view. Our thermal stations produce very cheap power indeed. In 1945 the Klip Power Station sold current at just slightly over one-tenth of a penny comparing very favourably with the United States Bonneville tariff for firm power of 0.08d. When it is remembered that our plant has to be imported, the achievement is very gratifying indeed. The tariff for power sold by the Tennessee Valley Authority is two to three times as high as that for our three cheapest stations. Nowhere in South Africa is there any hope of producing power so cheaply in hydro stations. Small hydro power plants like those at Sabie, Umtata, Ceres and Barberton do, however, serve a useful purpose in making use of small permanent supplies of water, especially when the demand is too small to warrant the installation of steam plant and generators would have to be run by means of imported oil fuels.

Union Large-scale Hydro-electric Power Not Feasible

Disappointing as it may be, we must conclude that the generation of hydro-electric power on any substantial scale in South Africa is practically ruled out. Only in a very few favourable localities is such generation likely to be either physically or economically practicable. This is due mainly to the following considerations :—

(1) The flow of South African rivers is too erratic and too uncertain.

(2) Stabilization of the flow by means of storage dams will be very costly.

(3) Water is so scarce that what is available must be reserved for domestic use and for agriculture and industry.

(4) We have large reserves of coal and power can be cheaply produced in thermal stations.

Better Chances North of the Union

When we turn our attention to the rivers of the northern territories, the picture becomes very much brighter from the point of water supply. The Zambesi River and its tributaries and the Cunene carry immense volumes of water. In both the Zambesi and the Cunene there are high water-falls where, at first sight, it would appear that conditions are favourable for the generation of hydro-electric power. The Victoria Falls are 380 feet high, but allowing for the great height to which flood water rises in the gorge below the Falls, it would not be possible to use more than 320 feet of this. The mean flow of the Zambesi has been estimated at 38,000 cusecs, but at times it drops to a figure which must be well below 10,000 cusecs. Using a head of 320 feet, power plant of 20,000 kW. could be installed for each 1,000 cusecs diverted through the turbines.

If the beauty of the Falls are to be maintained at all times, it follows that the water available for power generation would occasionally be reduced to a very small figure. This position could be very materially improved by the provision of storage, so that a constant flow of some thousands of cusecs would be available for the power plant, and yet leave available water enough for the maintenance of the natural beauty of the Falls. The provision of storage would, however, be attended with considerable difficulties. For the first thirty-six miles above the Falls to Katombora, the river rises 127 feet ..... a gradient which is too steep to permit of economical storage. From Katombora upstream the gradient of the Zambesi becomes much smaller and economical storage becomes feasible. But the infall of the Chobe River (or Kwando) is just above Katombora, and its gradient is so small that water would dam up for a great distance and a very large extent of the Caprivi Strip would thus become inundated. Only if the economic benefits of the scheme were sufficiently attractive would the inundation of so large a tract of land be warranted.

Possibly a storage site higher up the Zambesi, above Katima Mulilo, could be found whereby the inundation of so much land could be avoided. The idea of storage above the Victoria Falls has much in its favour; it would ensure a constant flow of water for power generation and it would enable a more uniform flow of water to be maintained over the Falls. At present during the flood season so much water tumbles over them that they are to a large extent obscured by spray. With adequate storage and after allowing for the Falls, a steady flow of at least 25,000 cusecs could be made available for power generation. This would be enough to maintain a station with a capacity of half a million killowatts, generating in the course of each year some 3,000 million units of electricity. If more power were required, this could be generated at the storage unit and at one or two of the more favourable rapids from Katombora to the Falls.

At the present time, I can see no means of usefully employing this amount of electricity. A small quantity, not exceeding 30 million units, might be used to pump water for irrigation, and a small amount might be used for the secondary industries depending on agricultural produce, for instance, sugar mills, saw mills and oil-extracting plants, but this would be entirely insufficient to justify the establishment of a very large power station. For that matter, all the power required for these purposes could be generated without storage at Katombora by means of a low weir and using only a fraction of the flow of the Zambesi. With a head of only 20 feet, and diverting only 4,000 cusecs, 30 million units could be generated. Alternatively, of course, 30 million units could be generated at the Falls by using only 250 cusecs, but the current would have to be conveyed an additional distance of thirty-six miles to Katombora, because most of the land which might be irrigated lies above that point. The latter course would, however, almost certainly be the cheaper of the two.

The Chobe River, which in Angola is named the Kwando, and in between the Linyanti, joins the Zambesi at Kazungula, forty-four miles above the Victoria Falls. Its mean annual flow I have estimated at 4 million acre-feet. Of this quite considerable volume of water, twice as much as that of the Vaal River at Vaaldam, very little reaches the Zambesi, the bulk of it being dissipated in swamps mainly in the Caprivi Strip. The gradient of this river is very small indeed and power generation is most unattractive, especially in view of the fact that the Zambesi, not far away, offers much better scope. With power for pumping, derived from the Zambesi and also from the Okavango, the water of this river could be better employed for irrigating an enormous tract of land at present almost totally unproductive.

Okavango Possibilities

Further to the west from the Kwando is the Okavongo River, surely one of the most interesting rivers in Southern Africa. There is a good deal of evidence supporting the view that the Okavango was not very long ago a normal tributary of the Zambesi. To-day it contributes only an insignificant amount of water to the Zambesi, and that at long intervals, when it rises to an exceptional height in the flood season. The whole of its flow is evaporated in its own swamp area, and it can therefore be treated as an independent river. From the point of view of power development, the Okavango suffers from a serious drawback, namely, that its gradient is rather small and any power stations built on it would have very low heads except at one spot, the Popa Falls ,where there is a natural fall of at least 12 feet. A few years ago, I examined the evidence available regarding the flow of this river and I came to the conclusion that the flow of the Okavango was probably about 12 million acre-feet per annum or expressed as a mean flow, 16,500 cusecs. Like that of the Zambesi, the flow of this river is seasonal in character and the low flow falls well below the mean. We may, however, assume that the flow would seldom be less than 5,000 cusecs. If we had available 20 feet of fall, which could be obtained at the Popa Falls by means of a suitable weir, we should be able to generate about 50 million units of electricity in a year. The Okavango River is very sparsely populated, and at present there is no use whatever for electricity. If we could find a profitable use for the power, then an hydro-electric station might assume quite a promising aspect. It is submitted that all the power capable of being generated could be used to pump Okavango River water onto the arid lands along the river, thereby converting them into productive fields capable of feeding a very large population. At present, the entire flow of the Okavango is being uselessly dissipated in thousands of square miles of swamps.

One of the greatest needs of Southern Africa is to increase its agricultural production without at the same time demanding more from soil which has already been grievously over-taxed. I am convinced that the immense tract of land, bounded on the east by the Zambesi and on the west by the Okavango River, can play a vital part in meeting this need. The rainfall is, however, inadequate to produce anything except occasional meagre crops from soils which rapidly become exhausted unless properly treated. By irrigating the land, the whole picture can be changed and the arid lands can be converted into a veritable granary for Southern Africa. Irrigating by gravity will not be straightforward problem, but some of the major difficulties can be overcome by pumping. Power from the Zambesi and from the Okavango, linked across the Okavango Delta down to Lake Ngami, could be harnessed to lift water from the shallow rivers to the low-lying lands.

The Cunene River

The last of the great rivers in which we are interested is the Cunene. Its catchment area is almost entirely in Angola; in its lower reaches it forms the boundary between Angola and South West Africa. The total annual flow of this river is probably something between that of the Kwando and of the Okavango, say, 6 to 8 million acre-feet per annum. Without storage, the total flow is, however, not of great significance because the seasonal fluctuation is rather great and development based on the minimum natural flow would be very limited. The special significance of this river is that, in sharp contrast to the Okavango River, it has a very large fall. In the twenty-four miles just upstream of the Rua Cana Falls, the river drops some 500 feet ending in an additional drop of over 400 feet at the actual falls. The early Spring flow of the Cunene drops rather seriously, estimated by Kanthack to be about 500 cusecs. With pondage, this flow would be enough to operate an 18,000 kW. station using 380 feet of the vertical drop at Rua Cana. From such a station an annual output of 117 million units of electricity could be obtained. A station using 1,000 cusecs of flow would be available for some ten months of the year. Partial storage would ensure a steady flow of 1,000 cusecs, and if use could be found for the power, more could be generated in the section of the rapids above the Falls. Our neighbours in Angola are also interested in the Cunene and any exploitation of its resources would naturally have to be done on a basis mutually agreed upon. At the moment the barrier to development is the apparent lack of any use for power. As in the case of the Okavango, some of this could be used for pumping for irrigation, but this would not be enough to absorb more than a fraction of the power which could be produced. The region lying to the south and west of the Rua Cana Falls holds some promise of yielding minerals, and if payable bodies of ore are found there, it might open up the posibilities of using power from the Cunene.

Let us return for a moment to the Zambesi River. So far I have dealt with posibilities at, or above, the Victoria Falls.

Kariba Gorge Investigations

Some 300 miles below the Falls there is a gorge known as the Kariba Gorge. It is roughly eighty miles south-east of Lusaka, and 175 miles north-west of Salisbury. A plan to construct an immense storage dam in this gorge is at present being investigated by the Southern Rhodesian Government. The site for the projected dam is upstream of the Kafue River and as the area between this point and the Falls does not yield a high run-off, the volume of water available would be only slightly more than that which passes the Falls. A mean flow of 38,000 cusecs passing the Falls would, therefore, yield with accretions, say, 30 million acre-feet per annum. With storage this would yield a mean annual supply of about 25 million acre-feet, equivalent to a steady flow of 34,500 cusecs. The storage dam to control so much water would have to be fairly high; also head would be required for power generation. If 250 feet could be obtained for this purpose a station of roughly 700,000 kilowatts could be built, supplying an annual output of 4,700 million units of electricity.

Water but No Local Power Load

This analysis has revealed that in the Union of South Africa the posibilities of developing hydro-electric power are meagre in the extreme, but that on the Zambesi and Cunene Rivers there are possibilities on a scale commensurate with those in other well-favoured countries. The question at the moment is, however, what to do with the current, because the territories adjacent to the rivers are sparsely populated and unless use can be found for the electricity, it would be useless to build large dams and power stations with capital and man-power that could be put to such good use elsewhere.

There are abundant signs that the darkness over the continent of Africa is being slowly lifted. Europe has suffered grievous blows in two world wars following each other in quick succession, and the future of that continent is to-day shrouded in a fog of uncertainty. Her technicians and industrialists are turning their eyes to the virgin lands and untapped resources of this sub-continent. Along the Cunene, and along the Zambesi there is work for willing brains and hands, and we can only hope that detailed investigation and cost analysis will reveal that power can be produced so cheaply that these territories can enter the industrial field on a competitive basis.

NEW PROJECTS

AT the request of readers we are including a new feature, namely, new building projects in Southern Africa. Our object here is to provide as early advance information as possible. In so doing, it is more than likely that some of the information will be a long way ahead of actual building plans. That is ,however, unavoidable in the circumstances. We would appreciate readers keeping us posted with news about either fresh items or more up-to-date facts about those that have been published already in this feature. In this way, we can make it of more use to our readers.

Arcadia, Salisbury, Rhodesia: School for Coloured children.

Bergvliet: Pinelands Development Corporation building scheme, and a scheme for the building of 290 additional houses.

Bindura: Scheme to obtain water from the Mazoe River and a temporary project for pumping water from a local mine, until the permanent scheme is in operation.

Bloemfontein: Extensions to power station. Estimated cost, £2,416,000. A new turbo-alternator costing £78,000 and a boiler costing £125,000 have already been ordered.

Boksburg: Establishment of a Native hostel.

Bulawayo, Rhodesia: Hyde Park housing scheme to house 20,000 Natives.

Cape Town: A new abattoir and market. Estimated cost of the abattoir is between £1,250,000 and £1,500,000 and the market £500,000 to £750,000.

Durban: Emergency housing accommodation at Somtseu Road Location, £20,000.
Native houses at Umlazi Glebe Lands. Building to start in two months.
Improvements to City Hall stage. Estimated cost, £4,500.
Additional Sports Stands at Kingsmead.

East London: Erection of Laing Dam at Fort Murray. Estimated cost, £622,900.
New market and abattoir.

Elandsville: Proposed establishment of township to be known as "Elandshoek".

Greytown: Additional earth dam to carry 158,000,000 gallons of water, to be built above Merthley Lake. Estimated cost, £6,175.
Reconstruction of Durban Street. Estimated cost, £5,000.

Johannesburg: European Tuberculosis Hospital.
Road construction programme, 1949 - 50. Estimated cost, £355,000.
New electrical sub-station, carrying 32,000 volts, in Hillbrow.
Added sports facilities, including stadiums, warm water indoor swimming baths and Turkish foam and medicinal baths.

Paarl: Native housing scheme. Estimated cost, £225,000.

Parow: Establishment of a hospital.
Community centre, to include two halls, a clinic, crêche, bachelor flats, gymnasium, youth club and provision for indoor sports and games. Estimated cost, £50,000.
Road construction. Estimated cost, £24,198.

Pinetown: Proposed Water Supply to the Pinetown Regional Water Supply Corporation by the Durban City Council.

Port Elizabeth: Tuberculosis Hospital.

Pretoria: Hospital. School for Cripples.
New wing for City Hall, including parlours, reception rooms and office accommodation.
Construction of nursery factories at Marabastad for small industrial undertakings. Estimated cost, £30,000.
Addition of two wings to the Transvaal Museum in Paul Kruger Street with a view to more spacious accommodation.

Reunion: A bridge to carry the South Coast road over the Umlaas River Canal.

Saldanha Bay: Irrigation scheme to provide adequate supplies to Saldanha Bay, Langebaan and coastal points nearby from the Berg River. Estimated cost, £470,000.

Strand: Combined sewerage scheme for The Strand and Somerset West. Estimated cost, £47,300.

Vaal River: New water scheme and pumping station for the Rand Water Board. Estimated cost, £5,000,000.

Wilgehof: Housing scheme. Estimated cost, £189,075.

Wynberg (Cape): Establishment of a Civic Centre, on the Maynardville Estate.

Five aluminium schools are being built by the Kent County Council. This view depicts one of the six main classrooms at St. Paul's Cray, Orpington.

PUBLICATIONS RECEIVED

An Introduction to Public Administration, by E. N. Gladden, M.Sc. (Econ.), Ph.D. (Public Admin.), published by Staples Press Ltd.; 155 pp. including index. Price 12/6 (in England).

This slim volume of twenty-four chapters is, as its name implies, only an introduction to a very big and important subject. To overcome the very brevity of his own text Mr. Gladden has suggested, at the end of each chapter, books for further reading on the part of those interested.

The author, who has already written two other, fairly recent, books about the Civil Service, deals with central and local government and the relationship between the functions of the civil servant; the public corporation, whose scope is now being extended so much, especially in Britain, and the machinery of governmental economic planning.

Although the chapters on all the twenty-four subjects are short, Mr. Gladden makes good use of diagrams which freely and clearly illustrate his text. It is a pity, however, that the book is so short. Really, it can best be described as thought-provoking and the reader, who is able and so disposed to carry on the author's thought, where it leaves off, and to adapt parts of the book to Union conditions and problems, will derive benefit from it. The very brevity of the volume prevents it being used to any considerable extent as a reference book, but then, perhaps, Mr. Gladden, from the title he chose, never intended that.

Commerce and Industry; the Official Journal of the Department of Commerce and Industries, April, 1949. From the Government Printer, Pretoria. 165 pp. Price 6d.

This number contains the Annual Report of the Department. Those sections most likely to be of interest deal with the Board of Trade and Industries, the Registrar of Patents, Designs, Trade Marks, etc.; the Natural Resources Development Council; the Liquid Fuel and Oil Industry, Advisory Board; the Price Control Organisation; the Commodity Supply Division and the Electricity Control Board.

The Commercial Section covers employment, capital investment in companies, commodity prices, the volume of money in circulation and the volume of trade, both export and import. Naturally, at this moment when import control regulations are being imposed and the economic situation of the country varies from day to day, this historical review of 1948 loses value as compared with its usefulness during periods of economic tranquillity. Yet, some of the comparative figures are interesting. Taking 1938 as 100, the volume of electricity generated in the Union rose from 111 in 1939 to 147 during the average of the nine months January to September, 1948.

In secondary industry European employment rose from an index figure of 100 in 1939 to 139 during the months May to August last year. In the same period, non-European employment increased from 103 to 185. In mining, on the other hand, Europeans at work declined from an index number of 103 in 1939 to 97 in October, 1948, while Non-Europeans at the same time fell from 101 to 93.

On the financial front the money invested in new companies registered in 1938 was only £504,000. In 1946 and 1947 this sum rose to more than £8,000,000 in each year. These figures were, however, eclipsed in the single month of June, 1948, when £10,646,000 was invested in new firms. During the first ten months of last year over £60,000,000 capital for new concerns was registered, while close on £78,000,000 represented capital increases of existing firms. Of this total of £138,000,000 nearly £25,000,000 was raised for commercial undertakings and over £41,000,000 for secondary industries. The balance was spread over "services," finance, agriculture, mining and fisheries. While finance absorbed over £38,000,000 and mining nearly £15,500,000, agriculture and fisheries received by far the least in the seven different categories.

So far as commodity prices were concerned, taking 1938 as 100, the wholesale prices of Union-produced goods rose from 96.2 in 1939 to 162.4 in November, 1948. Over the same period imported goods increased from 100 to 206.9. Taking all goods into account, the rise was from 97.6 to 179.2.

While the volume of money in circulation in the Union was £106.4 million in 1939, it had risen almost four times to £421.2 million by 1947. The peak month last year was March, when the money circulating reached a total of £455.7 million. By the end of the year, however, it had fallen, by some £37 million, to £418.7 million.

Unfortunately, the latest figures for the number of factories in the Union relates only to 1945/6 when the total number of manufacturing establishments reached 11,351, as against 10,256 in 1938/39 — an increase of about 1,100 in the space of seven years. During the same period, however, the value of the gross output rose from just under £200 million to over £418 million — an increase of 109 per cent.

Bearing in mind the new import regulations it is interesting to note that in 1945/46 (again the latest year available)

Experiments on house-heating carried out by technicians of the Department of Scientific and Industrial Research at Abbot's Langley, Hertfordshire. The picture shows electric equipment to measure the amount of noise in the heat ducts in the walls.

the percentage of Union material in the products of certain industries was as shown in the table below.

Metal	66
Building	72
Stone and clay	64
Carpentry	60
Furniture	42

How far the Union is capable of supporting itself, on a minimum of imports at the present time, must remain a matter of conjecture until more up-to-date information is available.

It is clear, from the Report, that one factor militating against the import of cement into the Union during 1948 was the question of shipping freight rates. While the shipping lines wanted to increase their rate from 39s. 3d. W. to 55s. W. a compromise on 45s. W. was accepted. Even so, it is clear cement was not regarded as a very remunerative cargo.

A review of the activities of the Natural Resources Development Board indicates that in the present "controlled area" in the O.F.S. "no sub-division or change in the use of land can be effected without the prior approval of the Minister acting on the advice of the Council." While there is, so far, only one "controlled area," the Council is responsible, as a national body, for promoting the co-ordinated development and use of the natural resources of the whole country. Of the nine regional development associations now in existence, some are expected to amalgamate with others while some are expected to sub-divide their activities.

In the concluding section of that part of the Report which deals with the Board of Trade and Industries there are some excellent comments on "the need for increased efficiency" in industry. Not only does the Report say "nor is it, generally speaking, in the long-run interests of the country to increase protection at a time such as the present," but it later remarks: "It is not difficult to point out the main inefficiencies prevalent in large sectors of the Union's manufacturing industry."

Although much of this Report is taken up by the Fisheries Section, and the life and habits of female crawfish, there is much in it worth study by thinking people.

Post-war Britain, issued by the Central Office of Information, London. 197 pp. Received from United Kingdom Information Office, Johannesburg.

In an introductory note it is stated "this handbook contains factual and authoritative information about the United Kingdom, compiled from official and authoritative sources. It is not intended to be exhaustive, but to provide basic data on the main aspects of the national life which are within the field of Government action. It is a new and up-to-date version of 'Post-War Britain', 1946."

Apart from a genealogical tree of the Royal family, facing the contents page, there are no charts, diagrams or maps in this volume. But that aside, it is full of facts.

Under administration, central and local government, law and order, defence, town and country planning, as well as public corporations and nationalization are described. The section on economics, finance and industry includes a chapter on economic planning, as well as two others on rationing and industrial relations and welfare respectively. Under social services there are detailed descriptions of education and housing. In this latter subject reference is made to housing policy, state aid for housing and control of rents and prices.

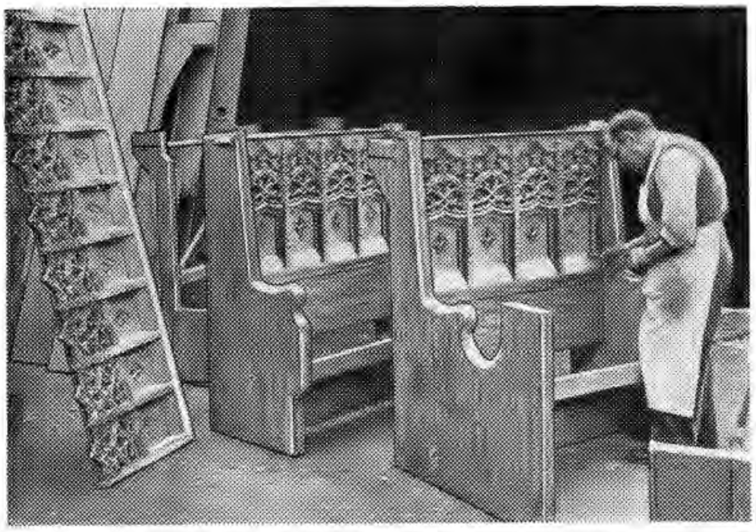
Inland transport and civil aviation receive attention in the section concerning communications. The last part of the book deals with food and agriculture, including forestry. There is a useful bibliography among the appendices.

Witwatersrand Land Titles Commission. Published by the Government Printer, Pretoria. Summary of Part II of Report. 27 pp. Price 3/-.

This summary has been published on account of the time required to print and translate the complete Report.

In an introductory note the terms of reference are set out. Then follows a chapter reviewing the history of leasehold tenure in the mining district of Johannesburg. Other chapters describe the progress of conversions of leasehold into freehold, 1909–48; conditions in township leases; the failure of site value rating to provide effective stimulus for conversion of leasehold titles; the basis for calculation of fair prices for conversion; townships in which leaseholders are denied facilities for conversion of titles; summary of objections to leasehold tenure; review of proposals made for state intervention and possible effects of compulsory conversion of leasehold titles, or of expropriation of freehold interests in leasehold townships, on township owners' liability to taxation.

The Recommendations of the Commission on the subject matter of each chapter are given.



Woodcarving for the new House of Commons Chamber is nearly ready. The craftsman shown here is putting final touches to the seats for the Press gallery.

Annual Report of the Commissioner of Inland Revenue for the Year 1947–48. Published by the Government Printer, Pretoria. 65 pp. Price 10/-.

Staff and office difficulties continue, as the Commissioner's covering letter to the Minister reveals, to "dog" the progress of the department, which is involved, too, in the endeavour to improve its system.

Last year, Income Tax provided 62.6 per cent of the inland revenue collected. The only other large proportions are interest on government loans (5.3%), stamp duties and fees (5.2%), transfer duty (4.5%) and departmental receipts (4.4%). Total collections during the year amounted to nearly £77,000,000, as compared with almost £24,000,000 ten years ago. During the intervening period income tax has borne a lower proportion of revenue (around 40 per cent), but the difference has, until this year, been mostly, if not quite, made up by excess profits duty.

Receipts from gold mining at £6,320,000 were almost exactly half those from the same source ten years earlier.

69 individuals and 407 companies returned incomes in

excess of £26,400 for the year ended 30th June, 1948. By far the bulk of taxpayers were assessed at between £400 and £1,000 per annum. While 925 companies paid tax, of which 38 were engaged in coal mining, there were, roughly, 136,000 married and 55,000 unmarried individual taxpayers.

To anyone concerned with where the Union's major business opportunities lie, the schedule showing the number of licences, in various categories by provinces must be a useful index. The same series of tables shows the number of tax assessments per town and the amount of income which was subject to both income and super tax.

Although the number of persons receiving assessments and the income subject to super-tax were greater in Cape Town than in Johannesburg, the latter city paid, in the aggregate, over £650,000 more tax than the former.

While it may not seem "exciting reading", there are thousands of interesting and useful facts in this report for those who take the trouble to extract them. It is a pity, for the sake of market research, that some of the more illuminating data is not summarised in diagrammatic form.

A new type of roof, made of aluminium, was shown at the recent British Industries Fair. With an 83-ft. diameter and a centre rise of 9 ft., six men can erect all the framework and weld all the shoes, down to the outer support ring, in a day.

London Housing. Published by St. Margarets Technical Press, Ltd. 63 pp. Price 10/-.

This most excellently produced booklet gives a comprehensive survey of the post-war work of the London County Council, in the direction of housing, flats and equipment. It is extremely well, if not to say copiously, illustrated with photographs, outline plans and several three-coloured maps.

In a foreword, Cyril H. Walker, O.B.E., Director of Housing and Valuer to the L.C.C., points out that the present need is for 200,000 houses, of which 80,000 are to replace those totally destroyed in the metropolitan area during the war. In the survey itself Walter Segal writes that 170,000 families, or half a million persons in the London region, need homes. Of the 200,000 dwellings, therefore, required, some 24,000 only have been prepared for occupation up to date. Close on 8,000, or a third of these, were merely reinstated after damage. Of the remainder, 8,200 have been permanent dwellings while 7,800 are only temporary structures. In addition some 11,000 permanent houses are in course of erection.

All but three of the schemes are north of the River Thames, five being to the east and six to the west of London proper. Apart from the somewhat meagre achievement, as compared with the great and urgent need disclosed, the individual designs are interesting and well worth study by anyone concerned with public housing schemes. Among the equipment services are descriptions, photographs and drawings of refuse hoppers and chambers for blocks of flats, drying rooms, plumbing details, fitted furniture and kitchen installations.

Code of Practice for the Application of Timber Preservatives. Published by the S.A. Bureau of Standards. 31 pp., English and Afrikaans. Price 5/-.

In their foreword to this code of practice the Bureau state: "The discovery, in recent years, that the European house borer *(hylotrupes bajulus)* is distributed in South Africa over a much wider area than had previously been believed, has brought home the extremely urgent need for proved methods of timber preservation. No less serious is the unprecedented spread of the West Indian drywood termite *(Cryptotermes brevis)*, while the common furniture beetles, such as the death-watch *(Anobium punctatum)*, and powder-post *(Lyctus brunneus)* as well as our indigenous white ants (termites) are as grave a menace as ever. In addition, the ever-present dry-rot and other forms of wood-destroying fungi continue to destroy vast quantities of valuable timber in all parts of the Union."

The code itself is divided into sections describing the preservatives recommended, methods of application and the process involved. Two tables summarise the "Processes and Preservatives Recommended for Various Species of Timber" and also "Recommended Penetrations and Absorptions (Retentions)."

Thirty-eighth Annual Report of the Controller and Auditor-General, Part III, 1947–48. Published by the Government Printer, Pretoria. 26 pp. Price 3/-.

This report is entirely taken up with Defence expenditure. It is interesting to note, however, that, among other Defence measures, the Union spent £31.6 million on lands, roads, buildings and hangars during the period 1940-47. Factories, including plant, cost £7.4 million and coastal defences and fortifications £3.8 million over the same seven years.

Report of the Director of Irrigation — 1st April, 1946, to 31st March, 1947. Published by the Government Printer, Pretoria. 27 pp. Price 3/-.

This department, like so many others in the Public Service, is suffering from a severe staff shortage. It is on this note that the report begins and the subject is referred to again later.

Total expenditure, during the year under review, on both revenue and loan accounts, was approximately £2,000,000.

There are chapters on the Hydrographic Survey, Reconnaissance and Silt Surveys and upon boring results. A number of tables give data as to the irrigation loans granted.

ABSTRACT OF GOVERNMENT REGULATIONS

FOR some years past the flow of government regulations, in South Africa as in other countries, has been voluminous. It is not easy for the professional man to keep abreast of laws, ordinances and regulations which may affect him. In South Africa, too, with four provincial administrations, as well as the Union Government, all, necessarily, issuing orders of various types covering wide fields of activity, the task is particularly difficult. Accordingly, we propose, from time to time, to publish abstracts of new regulations, with references as to where they may be found and read in full by those of our readers who are especially interested.

Streets and Building By-laws Amendment — Municipality of Pretoria. Province of Transvaal, Official Gazette, 20th April, 1949. Administrator's Notice 190.

Sections 70 and 102 of the Pretoria Municipality By-laws, published under Government Notice No. 1136, dated 12th September, 1903, are deleted and new clauses inserted. The effect of these is that while business premises within the central area of the city (defined in the notice) may be erected on the street boundary, other buildings in the central area and all business premises *outside* that area may not be erected within 12 feet of the street boundary.

Trade Mark Amendment Rules, 1949. Union Government Gazette, 6th May, 1949. Item 868.

These regulations are set out in an annexure which deals with renewals, assignments and transmissions of trade marks. The various types of forms to be used when applying for or renewing trade marks are shown in detail.

Building By-laws Amendment — Municipality of Johannesburg. Province of Transvaal Official Gazette, 25th May, 1949. Administrator's Notice No. 283.

New sections 66 and 67 are quoted. The first deals with foundations and the second with "offensive sites". No foundation to any external party or cross wall shall be less than twelve inches below the surface of the original ground, and if undisturbed and firm ground is not met with at that depth, the foundations shall be continued downwards to a point where such ground is obtained. Spreading foundations on filled ground, by means of suitably designed concrete footings or rafts shall be permitted within the loading limits prescribed.

No new building shall be erected on ground containing faecal, animal or vegetable matter until the approval of the Council has been obtained.

Municipality of Wolmaranstad — Building Regulations. Transvaal Provincial Gazette, 25th May, 1949. Administrator's Notice No. 284.

These regulations are too lengthy and detailed to summarise, but are worth study by anyone contemplating building within this particular municipal area.

TECHNICAL NOTES

New Airport Construction Method

AT the new Baltimore (U.S.A.) airport savings of nearly £400,000 are being made through the use of a 200-ton roller.

To handle planes weighing 100 tons and, possibly, increasing to 150 tons, normal methods of construction would have involved extremely thick concrete construction for the runways. When commissioned to construct this airport the engineers resolved to make use of every economy which modern soil mechanics made possible. Consequently, they studied and eventually adopted a method of compacting the sub-soil so that it would carry a heavy planeload with only a relatively light flexible surfacing.

The Baltimore airport is designed with three runways, two 6,500 ft. long and the third 8,000 ft. in length. The soil is non-plastic sandy material of which 5 to 25 per cent will pass through a 200-mesh sieve. The engineers decided it would be necessary to drive out the entrapped air in the sub-surface, which gave it such relatively light character. Much rolling, they were of opinion, was done too fast. If a heavy load were applied slowly and steadily, they believed, the air would have opportunity to escape and thus cause the soil to become dense and capable of carrying heavy loads.

To build a base, the sandy soil was to be laid in 8-inch lifts, each rolled four times with a sheeps-foot roller, applying a load of 685 pounds per square inch, or nearly three times the usual load. On top of this, when the fill was finished to grade, they applied the 200-ton super compactor. This huge roller, which carries its load on four 33-inch pneumatic tyres, each nearly a yard wide and eight feet high, is mounted with two wheels to the axle.

When the roller passed over areas in cut sections, the unit weight per cubic yard of the soil increased by 15 per cent. Extensive tests on the runways revealed high compaction in the soils to a depth of 4 to 5 feet, densities of 105 per cent or more on half the tests, as measured by the modified

Fifty-one new-type safety crossings have been laid in the Borough of Westminster, London. The road is sprayed with an adhesive on to which strips of plastic are laid. At least a year's wear is claimed from the plastic material.

The north portal of the Osplaats (No. 2) tunnel. In the background the Blue Train can be seen on the present main line.

AASHO standard and densities in excess of 100 per cent on four-fifths of all tests. The remainder were slightly less but approaching 100 per cent and most of these were on the finer materials.

The saving of nearly £400,000 was effected by eliminating the need for excavating all the cuts to 3 or 4 feet below grade and replacing and compacting the material in thin layers. The big super-compactor will remain the property of the City of Baltimore and is to be used to go over the entire runway at intervals to help keep the surface in good condition.

Progress on Hex River Tunnel Scheme

PENDING the delivery of all the modern tunnelling plant required for the driving of the main 8-mile tunnel through the Matroosberg, construction work on the improvements to the main line over the Hex River Pass has been concentrated largely on one of the three shorter tunnels included in the scheme.

Preliminary work on this tunnel, which passes through a small mountain spur, around which the existing railway line curves shortly before reaching Osplaats station, was started early in 1947. Much of the plant used for this work was transferred from the Cape Eastern main line, where a number of tunnels were recently completed and, while far more elaborate equipment is required for the 8-mile tunnel, this plant is proving satisfactory for the shorter tunnel approximately two-thirds of a mile in length. To date, this tunnel, which is partly on a curve of 3,300 feet radius, has been

A section of the new tunnel driving its way into the mountain side in a steady curve.

driven into the mountainside for a distance of 1,400 feet and more than 4,000 cubic yards of rock have been moved in the process.

United Nations Headquarters

SEVERAL interesting features have been embodied in the United Nations Headquarters on the 17-acre site, presented, by John D. Rockefeller and the City of New York, to the United Nations General Assembly in December, 1946.

The 40-storey Secretariat Building — the first structure to be started and scheduled for completion next year — will be approximately 500 feet high, 72 feet wide and 300 feet long. The wide east-west façades will be surfaced with blocks of black glass into which will be set thousands of aluminium window frames. The overall effect will be that of a gigantic grid. The building's north-south ends will be without windows and faced with 2,000 tons of Vermont marble.

An artist's impression of the new UNO headquarters.

The building will provide many modern facilities for the 4,200 internationally recruited staff of workers. Electric conveyors and pneumatic tubes to speed the handling of records and mail, twenty-one high-speed lifts and eight glass-enclosed escalators, are among the features. This tallest and largest structure planned for the imposing United Nations permanent home will be provided with indoor climate to the individual year-round taste of the occupants of each office.

A Carrier Conduit Weathermaster air-conditioning system will take in several million cubic feet of filtered outside air each hour. This air will be humidified or dehumidified according to season, conditioned to the proper temperature and distributed under pressure through small steel conduits to 4,000 individual Weathermaster units, built into the walls.

Close control of indoor climate can be attained during seasons so that during 52 weeks of the year the desirable temperature and humidity levels can be attained in each office. A person might want to have his office temperature several degrees higher or lower than the person next door. This can be obtained simply by turning a knob on the Weathermaster. This control modulates the flow of chilled or warm water to the coil in the unit.

LIBRARY ACCESSIONS

C.S.I.R. Information, in its present form, is a list of accessions to the Library and Information Division of the South African Council for Scientific and Industrial Research. Many of the publications listed were received from the Union's Scientific Liaison Offices in London and Washington.

The arrangement of the accessions list is alphabetical under subject headings. As far as practicable these headings have been kept uniform with those used in the **Industrial Arts Index,** a publication familiar to most searchers for technical information. The classification numbers follow the Universal Decimal Classification. Short annotations or abstracts have been added when the titles are not self-explanatory. Certain documents have already been handed on to institutions which have built up collections covering highly specialised fields. In such cases the name of the institution is given in this list, as the document in question is located there. Applications to borrow such items should be sent direct to the institute named, not to the C.S.I.R. Library.

Publications not in constant use by the departments of the C.S.I.R. may be borrowed through the post. **Enquirers should quote the number at the left-hand side of each item (e.g., 35/21)** and address their letters to: Library and Information Division, South African Council for Scientific and Industrial Research, P.O. Box 395, Pretoria. Telephone: 3-1261 (Ext. 42).

Documents should be returned to the Library by **registered post, packed flat.**

AIRPORTS. Runways.

35/3 CANADA. Department of transport.
Airport runway evaluation in Canada, by Norman W. McLeod. . . . . Ottawa, Department of transport, 1947. 121 p. maps, diagrs. Mimeographed.
629.139.811(71).

ARCHITECTURE.

35/7 ANDREAE, S. J. Fockema and E. H. Ter Kuile.
Duizend jaren bouwen in Nederland : deel I : de bouwkunst van de middeleeuwen ; Stad en dorp, door . . . . S. J. Fockema Andreae ; De architectuur, door . . . . E. H. Ter Kuile. Amsterdam, C. V. Allert de Lange, 1948. 386 p. 194 plates, plans.
71/73(492) (091).

35/8 YORKE, F. R. S.
The modern house . . . London, The Architectural Press, (1946). 221 p. illus. (photos), diagrs.
Main sections : Twentieth-century architecture ; Plan ; Wall and window ; Roof ; Houses, 1926-1944 ; Experimental and pre-fabricated houses.
728(19).

BUILDING.

35/13 STONE, W. J.
. . . . Building geometry . . . . London, Longmans, Green and Co., (1946). (Building craft series). 213 p. diagrs.
69 : 513

BUILDING by-laws

35/14 WITWATERSRAND. By-laws.
Reef uniform building and cinematograph by-laws (including by-laws relating to sub-divisions of ground) for the municipalities of Alberton, Benoni, Boksburg, Brakpan, Germiston, Johannesburg, Krugersdorp, Nigel, Potchefstroom, Randfontein, Roodepoort-Maraisburg, Springs. (Johannesburg). R.A. Ltd., 1946. 228p. tables.
69.009.182+779.5 (094.76).

BUILDING Specifications.

35/15 SMITH, T. Sumner.
Building specifications ; principles and practice . . . . London, Hutchinson's Scientific and Technical Publications (1948). 192 p. plans (1 folding).
69.001.3

CAPE TOWN foreshore.

35/16 UNION of South Africa. Ministry of Transport.
The Cape Town foreshore plan: final report of the Cape Town Foreshore Joint Technical Committee, June, 1947. (Pretoria), Government Printer, 1948.
xi, 125 p. front, illus., plates, plans (some col., one folding in flaps of back cover), tables.
25 x 20 cm.
711.421(687.11)

DESIGN

35/28 TEAGUE, Walter Dorwan.
Design this day: the technique of order in the machine age. . . London, The Studio publications (194?).
237 p., plates (photos), diagrs.
"What I have tried to do is to outline with reasonable clarity the technique that must be applied to the solution of any problem of design, whether it is a new motor car or a new city or a new environment". — Preface.
7.05 : 6.

ELECTRICAL heating

35/35 SMITH, Frank C.
Warming buildings by electricity: a practical treatise on modern direct and indirect methods for the use of electrical contractors, heating engineers, architects and electricity salesmen, etc. . . . . London, E. & F. N. Spon, Ltd., 1945
vii, 162 p. illus., tables, diagrs.
697.71.

ELECTRICAL wiring.

35/36 MARRYAT, H. Ed.
Electrical wiring and contracting . . . second edition. London, Sir Isaac Pitman & Sons, Ltd., 1946.
7v. illus., photos., tables, diagrs.
621.3

FLUORESCENCE.

35/42 HIRSCHLAFF, E.
Fluorescence and phosphorescence. . . London, Methuen & Co., Ltd. (1938). (Methuen's monographs on physical subjects).
vi., 130 p., diagrs.
535.37

FOUNDATIONS.

35/43 MINIKIN, R. R.
Piling for foundations . . . London, Crosby Lockwood & Son, Ltd., 1948.
viii., 196 p., illus., diagrs.
624.155

GIRDERS.

35/47 WASTLUND, Georg and Sten G. A. Bergman,
Buckling of webs in deepsteel I girders . . . . Stockholm, Royal Institute of Technology (1947). (Statens kommitte för byggnadsforskning, meddelanden nr. 8, 1947).
205 p., illus., tables, diagrs.
This publication contains the results of researches into buckling of webs, which have been conducted during the last few years at the Institution of structural engineering and bridge building of the Royal Institute of Technology, Stockholm.
624.075.2

GLASS

35/48 ANGUS-BUTTERWORTH, L. M.
The manufacture of glass . . . New York, Pitman publishing corporation, (1948).
xii., 274 p front. (col.), illus., tables.
666.1

35/49 HELDMAN, Julius D.
Techniques of glass manipulation in scientific research . . . New York, Prentice-Hall, inc., (c1946).
xii, 132 p. tables, diagrs.
681.3

HEAT

35/51 SNEEDEN, J.-B. O.
Applied heat for engineers . . . London. Blackie & Son, Ltd., 1947.
tii, 284 p. illus., tables, diagrs.
536.06 : 62.

HOUSING. Law. Great Britain.

35/53 HILL, H. A. and D. P. Kerrigan.
The complete law of housing; fourth edition . . . London, Butterworth & Co. (publishers), Ltd., 1947.
xLvi, 828, 52 p.
728.1(094.56) (42).

35/54 HILL, H. A. and D. P. Kerrigan.
Complete law of housing, supplement to the fourth edition, by John Montgomerie . . . London, Butterworth & Co. (publishers), Ltd., 1948.
ix, 45 p.
728.1(094.56) (42).

TENDERS INVITED

THE following are particulars of the more important tenders which have been invited up to the time of going to press for public works by Government Departments, Provincial Administrations and Municipalities. In each case the date by which the tender must be submitted is given. While every endeavour will be made to maintain accuracy in these columns it is pointed out that readers using this information do so entirely at their own risk.

BUILDING, ETC.:

Camfer, Cape Province: Erection and completion of five houses and outhouses. Documents may be inspected at the offices of the System Manager, Port Elizabeth, the District Engineer, Oudtshoorn, and the Station Master, Camfer Station. On payment of a deposit of £2.2.0 a copy of the tender form, specification and drawings may be obtained from the above-mentioned offices. Tenders returnable to: Chairman, S.A.R. Tender Board, as directed in the "Notice to Contractors," embodied in the tender documents. Due, 30/6/49. Tender No. 1949/1.

ELECTRICAL EQUIPMENT, ETC.:

City of Bulawayo (Electricity Department): Supply, delivery and erection at the 13th Avenue Power Station, of: One 350,000 lbs./hour electrically-driven boiler feed pump; one 350,000 lbs./hour steam-driven boiler feed pump; two 14,600 gallons/minute electrically-driven vertical spindle circulating pumps. Tender No. E.53/1949. Due, 30/8/49.

Section 2: Supply, delivery and erection of: Two 160,000 lbs./hour steam boilers, with associated superheaters, economisers, draught plant and auxiliary equipment which forms part of the second extension of the Power Station. Tender No. E.53/1949.

Three copies of contract documents on deposit of £5.5.0 — extra copies, £2.2.0 each. Town Clerk, Bulawayo.

Cape Town Municipality: Manufacture, supply and delivery of 30-ft. galvanised steel transmission poles. Specification 1557/49. City Electrical Engineer, Cape Town. Due, 20/7/49.

Electrically-operated vehicle-actuated traffic control equipment. Specification 1555/1949. City Electrical Engineer, Cape Town. Due, 29/6/49.

Pneumatic vehicle detectors for electrically-operated vehicle-actuated traffic control equipment. Specification 1556/1949. City Electrical Engineer, Cape Town. Due, 29/6/49.

Johannesburg: Electric tyre heaters. Tender No. C.115. S.A.R. Tender Board, 715, P.F.A.C. Building, 15 De Villiers Street, Johannesburg. Due, 4/8/49.

Electric motors and starters. Tender No. C.62. S.A.R. Tender Board, 715 P.F.A.C. Building, 15 De Villiers Street, Johannesburg. Due, 30/6/49.

ENGINEERING EQUIPMENT, ETC.:

Divisional Council of Carnarvon: Machinery: Item 1: One motor grader, approximately 22,000 lbs. weight (without attachments), with full Diesel engine complete with heavy-duty oilbath type air cleaner, crank case breather fitted with filter top, approximately 12-ft. blade, V-type scarifier, single-tandem drive, canopy top with screen and curtains, odometer, 10/12-ton jack, mechanical air pump and a full set of operator's tools contained in a lock-up steel box.

Item 2: One motor grader, same as above, but 18,000/20,000 lbs. weight.

Item 3: One mechanical loader with ¾ or 1 cubic yard struck capacity bucket, powered by full Diesel engine. Tenderers must quote the full specifications of any machine offered, including tools, jack, etc.
Additional attachments such as bulldozer blade, crane, canopy top, etc., to be quoted for as extras. Secretary. Due, 10/7/49.

South African Railways:

Johannesburg: Engine insulation. Tender B.363. S.A.R. Tender Board, 715 P.F.A.C. Building, 15 De Villiers St., Johannesburg. Due, 7/7/49.

Vacuum brake gear; metal parts. Tender No. B.373. S.A.R. Tender Board, 715 P.F.A.C. Building, 15 De Villiers St. Due, 30/6/49.

Oilburning train lamps and fittings. Tender No. D.105. S.A.R. Tender Board, P.F.A.C. Building, 15 De Villiers Street. Due, 30/6/49.

Woodworking machines. Tender No. C.259. S.A.R. Tender Board, Room 715, P.F.A.C. Building, 15 De Villiers Street. Due, 30/6/49.

Twelve grinding machines. Tender No. C.470. S.A.R. Tender Board, Room 715, P.F.A.C. Building, 15 De Villiers Street. Due, 30/6/49.

Asbestos cement or steel piping and fittings. Tender No. A.278. S.A.R. Tender Board, Room 715, De Villiers St. Due, 30/6/49.

Four lathes. Tender No. C.424. S.A.R. Tender Board, Room 715, P.F.A.C. Building, 15 De Villiers St. Due, 7/7/49.

Five boring and turning mills. Tender No. C.428. S.A.R. Tender Board, Room 715, P.F.A.C. Building, 15 De Villiers St. Due 7/7/49.

Wood-sawing machine. Tender No. C.360. S.A.R. Tender Board, Room 715, P.F.A.C. Building, 15 De Villiers St. Due, 14/7/49.

Vertical power press. Tender No. C.489. S.A.R. Tender Board, Room 715, P.F.A.C. Building, 15 De Villiers St. Due, 21/7/49.

Generating plant for De Aar. Tender N. C.103. S.A.R. Tender Board, Room 715, P.F.A.C. Building, 15 De Villiers Street. Due, 22/9/49.

Tender forms for the above may be obtained from the Chief Stores Superintendent, S.A.R., Park Chambers, Rissik Street, Johannesburg, or from any S.A.R. Stores Superintendent.

Kimberley Municipality: Supply, delivery and erection of a complete crushing plant and equipment. City Engineer, Kimberley. Due, 15/7/49.

Pietermaritzburg: 10-ton overhead travelling crane. Contract No. 16/49. Provincial Roads Engineer, P.O. Box 417, Pietermaritzburg. Due, 27/7/49.

Salisbury Municipality: Various non-metallic conduit fittings, V.I.R. wire, etc. Contract No. S.111/49. Stores Department, Salisbury. Due, 5/7/49.

HEATING EQUIPMENT, ETC.:

Johannesburg: Heating, ventilation and refrigeration equipment for Prospect. Tender No. C.378. S.A.R. Tender Board, Room 715, P.F.A.C. Building, 15 De Villiers St., Johannesburg. Due, 11/8/49.

HOSPITAL AND LABORATORY EQUIPMENT, ETC.:

Pietermaritzburg: Chemicals and laboratory apparatus to Natal Agriculture Research Institute, Pietermaritzburg. Tender No. S.O.3405. Due, 4/8/49.

ROADS:

Divisional Council of Beaufort West: Road plant: (1) One only motor grader, 15,000/18,000 lb. full Diesel engine with oil bath and cleaner, low-pressure pneumatic tyres (tandem drive), efficient breather filter and cooling system; 12-ft. mouldboard and blade, canopy top with side curtains, V-type scarifier, odometer, full set of operator's tools, including 8/10-ton hydraulic jack, type pump in lock-up toolbox on the machine and high-pressure greasegun.

(2) One only mechanical loader, mounted on a crawler-type tractor, powered by a 40/50 h.p. Diesel engine; bucket capacity approximately 1 cu. yard struck measure, with dumping clearance height of not less than 7 ft.

(3) One only Diesel truck, 8/10 tons net payload carrying capacity, equipped with heavy-duty all-steel (3/16-in.) hydraulic tipping body of not less than 5 cu. yds. struck capacity to the following dimensions: Inside width not less than 7 ft.; inside length not less than 11 ft. 6 in.; distance from cab-end of body (inside) to centre line of rear axle to be 7 ft. 2 in.; outside width of body not to exceed 8 ft. Suitable hook to be built into front end of body (inside) for hitching crawler tractor and loader (item 2 hereof) when transported by truck, and body to be fitted with cab protector.
Submission with tender of load distribution diagram and factory recommendations essential. Secretary. Due, 30/6/49.

SEWERAGE:

Borough of Margate: Sewerage and sewage disposal scheme: (1) Sewerage pipes and fittings. (2) Construction of sewers, rising mains and man holes. (3) Construction of sewage works and pumping station. (No. 1, deposit of £3.3.0, Nos. 2 and 3, deposit of £5.5.0 each.) Consulting engineer: J. P. Pike, 51, Alliance Buildings, Fox & Rissik Sts., Johannesburg. Due, 30/6/49.

TELEPHONES, ETC.:

Pretoria: Supply of office intercommunication sets to the Department of Transport. Tender No. S.O.3404. Union Tender and Supplies Board, P.O. Box 371, Pretoria. Due, 30/6/49.

Johannesburg: Telephone cable. Tender No. C.413. S.A.R. Tender Board, Room 715, 15 De Villiers Street. Due, 18/8/49.

Telegraph material. Tender No. C.411. S.A.R. Tender Board, Room 715, 15, De Villiers Street. Due, 14/7/49.

MISCELLANEOUS:

Johannesburg: Concrete poles. Tender No. C.412. S.A.R. Tender Board, Room 715, 15 De Villiers Street. Due 14/7/49.

Steam pressing machines. Contract No. 899. City Treasurer, Johannesburg. Due, 28/6/49.

Coal loader. Tender No. C.8625. S.A.R. Tender Board, Room 715, 15 De Villiers Street, Johannesburg. Due, 4/8/49.

S.A.R. Tender Alterations:

1. Tender No. C.143. Amendment No. 1. Electrical equipment. Quantities against Items 14 and 15 increased to 4,700 and 55,400 feet respectively.
2. Tender No. C.8533. Amendment No. 2. 97 Overhead electric travelling cranes. Amendment to specification. Also closing date extended to 7th July, 1949.
3. Tender No. C.8599. Amendment No. 1. Two electrically operated traverses. Amendment to specification.

Tenderers who have lodged tenders in respect of which amendments are notified, may amend such tenders or submit fresh offers before the closing dates of the tenders concerned.

Tender forms with full particulars may be obtained from the Chief Stores Superintendent, S.A.R., Park Chambers, Rissik Street, Johannesburg, or from any S.A.R. Stores Superintendent.

W. M. CLARK,
General Manager.

Johannesburg.

TENDERS ACCEPTED

AIR CONDITIONING AND CENTRAL HEATING:

Supply, delivery and erection of new air conditioning plant, automatic exchange extensions for Department of Public Works, Yeoville (Johannesburg). Tender No. 24/1/550. P.W.D./D.P.W. 186. Fulmark Engineering Co. (Pty.), Ltd., Johannesburg. £4,507.

Supply, delivery and erection of central heating installation, for Public Works Department, New Government Offices, Upington. Tender No. 24/1/1770 P.W.D./D.P.W. 187. Albert Vaux & Co. (Pty.), Ltd., Cape Town. £874.

Supply, delivery and erection of central heating installation, for Public Works Department, Hybrid Maize Production Office Block, Agricultural College, Potchefstroom. Tender No. 24/1/230. P.W.D./D.P.W. 189. Dawson and Fraser (Pty.), Ltd., Pretoria. £894.

BUILDINGS AND ALTERATIONS, ETC.:

Central dining room block, dormitory block, for 32 pupils and staff and two classrooms, store, chalet and workshops for panelbeating and spray-painting, for Public Works Department, Technical High School, Adelaide. Tender No. 24/1/1089. P.W.D./D.P.W. 170. Van der Leek, Sellmeyer and Co. (Pty.), Ltd., Bloemfontein. £31,941.

Groblersdal Junior High School, Middelburg: New Hostel. C. T. Oschger, Johannesburg, £54,500.

Additions to Randles Road Place of Safety and Detention for non-European Children, for Department of Public Works, Durban. Tender No. 24/1/1940 P.W.D./D.P.W. 168. Short and Macdonald, Durban. £7,695.

Laundry for pupils, additional kitchen and wash-up room accommodation, for Department of Public Works, Housecraft High School, Potchefstroom. Tender No. 24/1/1722 P.W.D./D.P.W. 177. C. J. Hartwell, Potchefstroom. £1,987-10-0.

Additions to East Street Men's Hostel: Additional laundry facilities. Tender No. 200/17, 82/136. For Pietermaritzburg Municipality. M. G. Cox. £495.

Twenty-five cottages in the Sub-economic Housing Scheme for Coloureds at Sparks Extension, for Durban Municipality. Tender No. B.1566. Messrs. J. A. Grant (Pty.), Ltd. £23,494-19-10.

Post, Public, Police Buildings, for Department of Public Works, Harrismith. Tender No. 24/1/1877 P.W.D./D.P.W. 178. J. Timmer, Bethlehem. £17,251-15-6.

COOKING EQUIPMENT, ETC.:

Cooking equipment for the Voortrekker Hospital, Kroonstad. Tender No. 24/1/1965 P.W.D./D.P.W. S.316. Associated Engineers Co., Ltd., Johannesburg. A. E. Barker, Ltd., Johannesburg. Bells Asbestos and Engineering (Africa), Ltd., Johannesburg. Hughes and Nicol (S.A.), Ltd., Durban. Benham's of S.A. (Pty.), Ltd., Johannesburg. Francis and Graham, Ltd., Durban.

ELECTRICAL EQUIPMENT, ETC.:

Electric elements for Public Works Department. Tender No. 24/1/1316 P.W.D./D.P.W. S.256. Phillips Denbigh (Pty.), Ltd., Wynberg. Contractor (Pty.), Ltd., Cape Town. Ballantine, Ltd., Pretoria.

Electrical material to the State Alluvial Diggings, Alexander Bay. Tender No. 25/1/303. S.O.3261. Johnson and Phillips (S.A.) (Pty.), Ltd., Johannesburg. Aberdare Cables of S.A., Ltd., Port Elizabeth. A.E.G. Engineering Co. (S.A.) (Pty.), Ltd., Johannesburg. C. E. Scott (Pty.), Ltd., Cape Town. Keen's, Johannesburg. Hubert Davies and Co., Ltd., Johannesburg. African Electric Props. N.M.K. (Pty.), Ltd., Johannesburg. The British General Electric Co., Ltd., Cape Town. Enfield Cables (Pty.), Ltd., Johannesburg. The S.A. General Electric Co., Ltd., Johannesburg.

ENGINEERING EQUIPMENT, ETC.:

Constant temperature soil tank equipment to the Stellenbosch–Elsenburg College of Agriculture. Tender No. 25/1/98 S.O.3277. Barlows (Cape), Ltd., Cape Town. £750.

Supply and delivery of cast iron pipes, valves and specials for the Humus Pumping Station at the New Disposal Works, Athlone, Cape Town. Tender No. A.102/48. Messrs. H. Incledon and Co., Ltd. £530-14-3.

Supply and delivery of one horizontal type air compressor for use at Albion Springs, Rondebosch, Cape Town. Tender No. A.2/49. Messrs. Broom and Wade. £114-5-6.

Stormwater drainage, Haviland Road, Durban. Tender No. B.1661. Messrs. Ray Norris (Pty.), Ltd. £4,556-2-6.

Stormwater drainage, Bristow Road, Durban. Tender No. B.1662. Messrs. Toop, Boniface McEwan (Pty.), Ltd. £5,947-4-0.

Supply and delivery of reinforcing steel and binding wire for the Chesterville Reservoir, Durban. Messrs. Wire Industries, Steel Products and Engineering Co. (Coastal), Ltd. £3,220-13-10.

Erection and installation of boiler part renewals for No. 7 Boiler, Port Elizabeth Municipality. Messrs. Babcock and Wilcox, Ltd. £6,592.

Supply and delivery of 30 cast iron pipes and valves to the Power Station, Port Elizabeth. Messrs. C. A. Parsons and Co. £1,655.

150 k.v.a. transformer for the Komani Hospital, Queenstown. Tender No. 24/1/391. P.W.D./D.P.W. S.323. R. T. Urquhart and Co. (Pty.), Ltd., Johannesburg. £299-10-0.

100 k.v.a. transformer for the Post Office, Queenstown. Tender No. 24/1/973. P.W.D./D.P.W. S.324. National Engineering (Pty.), Ltd., Johannesburg. £258.

Switchgear and equipment for Public Works Department. Hubert Davies and Co., Ltd., Johannesburg. £210.

Workshop plant for Public Works Department. Tender No. 24/1/1316. P.W.D./D.P.W. S.284. Acme Tool and Industries (Pty.), Ltd., Germiston. E. C. Normanton, Johannesburg. Roller Engineering Co., Johannesburg. Stansfield Ratcliffe and Co., Ltd., Pretoria. General Spares and Accessories (Wholesale) (Pty.), Ltd., Pretoria.

Steam engine to the Department of Forestry, Pretoria. Tender No. 25/1/1170. S.O.3225. Bough Engineering (Pty.), Ltd., Johannesburg. £2,792.

Duralumin and aluminium sheets to the Director-General of Air Force, Pretoria. Tender No. 25/1/1778. S.O. 3236. Aluminium Co. of S.A. (Pty.), Ltd., Johannesburg. Vickers and Metropolitan (S.A.) (Pty.), Ltd., Johannesburg. Atalanta Industries (Pty.), Ltd., Johannesburg.

Workshop machinery to the Chief Regional Officer, Queenstown. Tender No. 25/1/1829. S.O.3284. Geo. L. Kustner (Pty.), Ltd., Johannesburg. Hubert Davies and Co., Ltd., Johannesburg. Reunert and Lenz, Ltd., Johannesburg.

FIRE EQUIPMENT, ETC.:

Fire-fighting equipment to the Public Works Department, Pretoria. Tender No. 24/1/1950. P.W.D./D.P.W. S.329. H. Alers Hankey, Ltd., Johannesburg.

Fire appliances to the State Sawmills, George. Tender No. 24/1/1045. S.O.3280. W. D. Hearn and Co. (Pty.), Ltd., Cape Town. H. Alers Hankey, Ltd., Johannesburg. Associated Engineers Co., Ltd., Port Elizabeth. George Angus and Co. (S.A.), Ltd., Johannesburg. W. S. Thomas and Co. (Tvl.) (Pty.), Ltd., Johannesburg.

Laundry machinery required for Weskoppies Hospital, Pretoria. Tender No. 24/1/1902. P.W.D./D.P.W. S.319. R. T. Urquhart and Co. (Pty.), Ltd., Johannesburg. £267-12-6.

Two steam disinfectors for Tuberculosis Hospital, Umtata. Tender 24/1/910. P.W.D./D.P.W. S.320. R. T. Urquhart and Co. (Pty.), Ltd., Johannesburg. £827 each.

(Concluded on page 40.)

REFRIGERATION PLANT:

Supply, delivery and erection of refrigerating plant, etc., at the nurses' home, kitchen block and mortuary, T.B. Hospital, Umtata. Tender No. 24/1/1910. P.W.D./D.P.W. 185. S.A. General Electric Co., Ltd., Johannesburg. £3,088.

Supply, delivery and erection of refrigerating plant, body racks, etc., mortuary, Police Station, Hopetown. Tender No. 24/1/1944. P.W.D./D.P.W.·188. African Engineers, Kimberley. £508.

Supply, delivery and erection of refrigerating plant, Jubilee Home, Boksburg. Tender No. 24/1/1962. S.A. General Electric Co., Ltd., Johannesburg. £455.

Supply, delivery and erection of refrigerating plant, Kowie Hospital, Port Alfred. Tender No. 24/1/1564. P.W.D./D.P.W. 183. The City Electrical Contractor, Grahamstown. £442-11-0.

ROADS:

Road formation and hardening: Woodlands, Durban. First contract: B.1660. Messrs. Rush and Tompkins (S.A.) (Pty.), Ltd. £8,871.

Tarmacadamising of roads at S.A. Police College Depot for Public Works Department, Pretoria. Tender No. 24/1/1754. P.W.D./D.P.W. 172. Fowler Tarspraying Co., Ltd., Johannesburg. £937-8-4.

TELEPHONE EQUIPMENT, ETC.:

Automatic Exchange extensions, Jeppestown (Johannesburg) for Public Works Department. Tender No. 24/1/1587. P.W.D./D.P.W. 175. J. L. Gibson (Pty.), Ltd., Johannesburg. £7,150.

Intercommunication telephone system: City Treasurer's Department, Durban. Tender No. P.304. Messrs. Siemens Bros. and Co. (British), Ltd.

WATER SUPPLY AND IRRIGATION EQUIPMENT:

Centrifugal pump to the State Sawmills, George, for Public Works Department. Tender No. 25/1/1045. S.O. 3281. Stewarts and Lloyds of S.A., Ltd., Mossel Bay. £190-8-4.

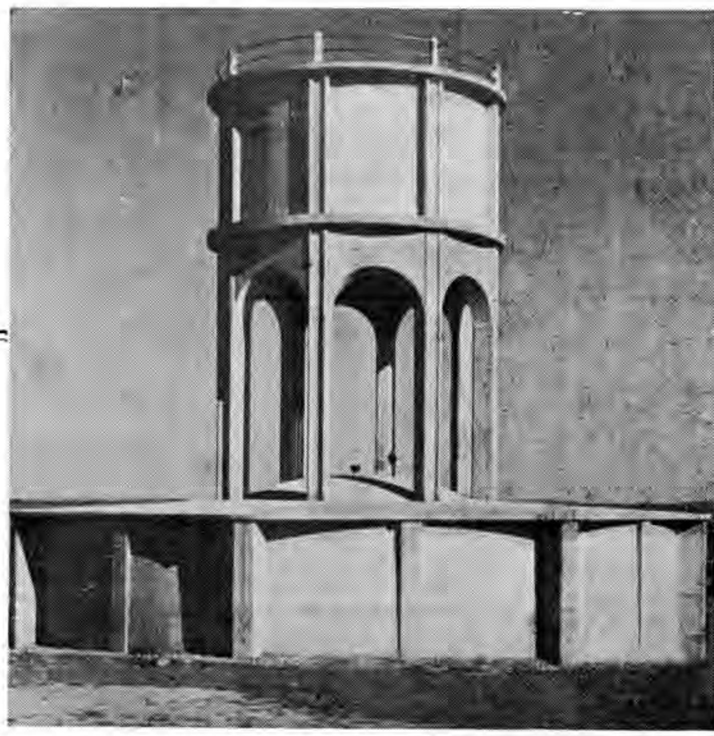
Boring for water at P.W.D. Nursery and Government Buildings, Bloemfontein, for Department of Public Works. Tender No. 13/1/229. Irr.528. F. P. Visser, Lindley.

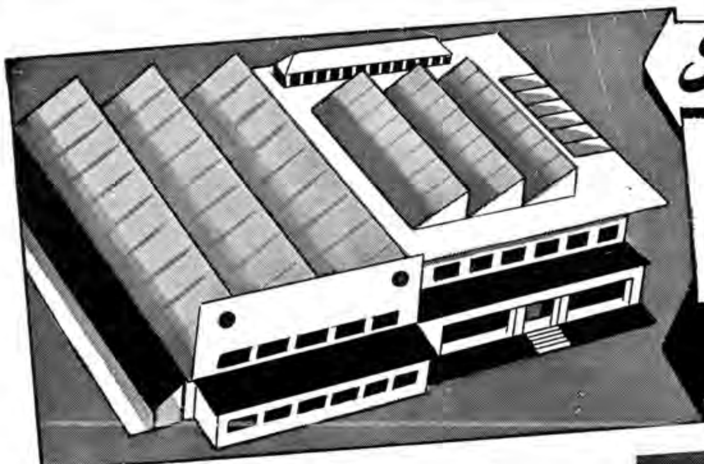
Pumping plant to the Sanatorium, Nelspoort. Tender No. 24/1/361. P.W.D./D.P.W. S.326. National Engineering (Pty.), Ltd., Johannesburg. The Griffin Engineering Co., Ltd., Johannesburg.

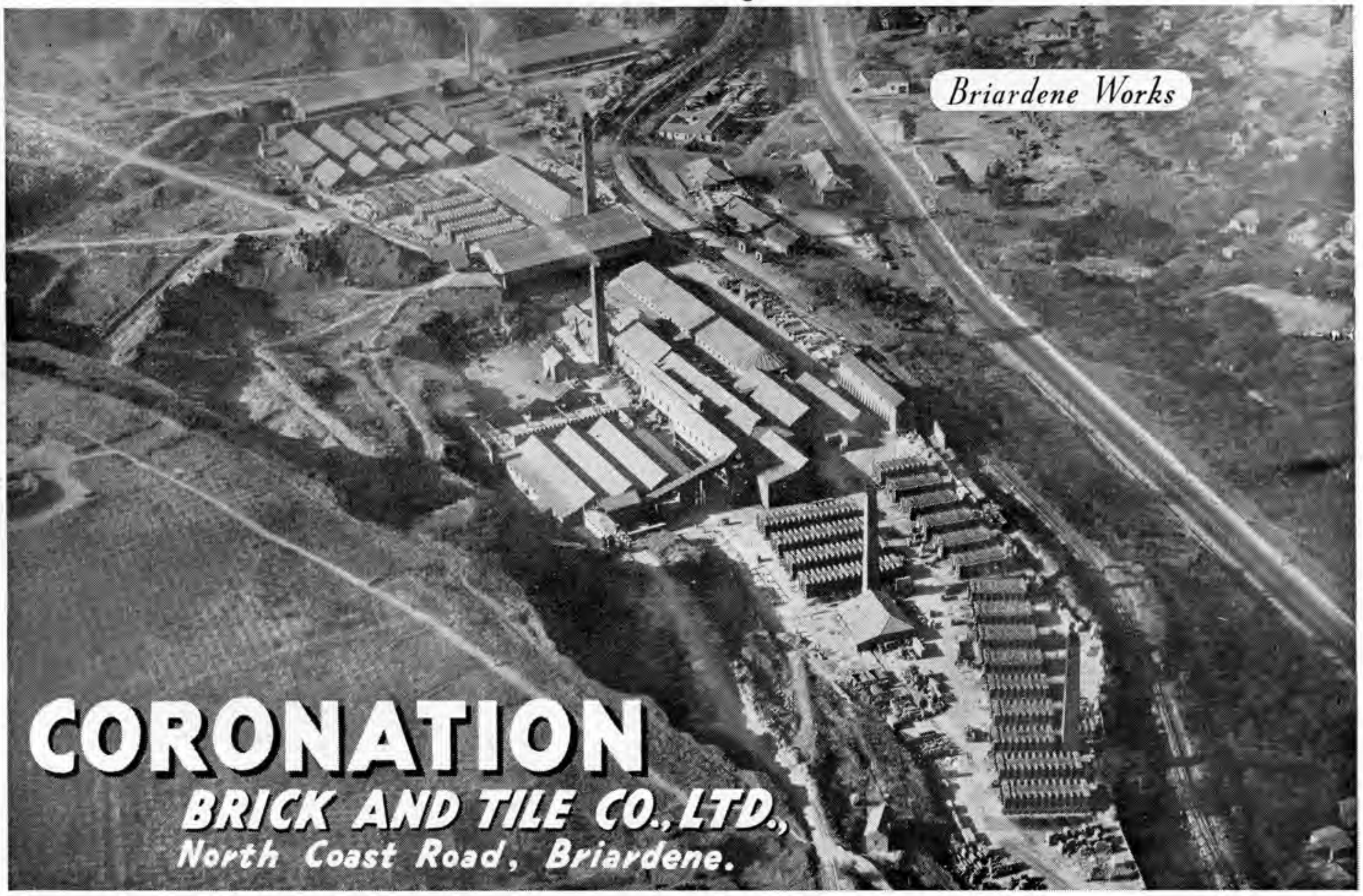
Pumping plant to the Bacteriological Laboratory, Onderstepoort. Tender No. 24/1/1541. P.W.D./D.P.W. S.322. National Transport and Engineering Supplies, Ltd., Johannesburg. Stewarts and Lloyds of S.A., Ltd., Pretoria.

Centrifugal pumps and engines to the Industrial School, Dewetsdorp. Tender 24/1/847. P.W.D./D.P.W. S.322. National Transport and Engineering Supplies, Ltd., Johannesburg. The Griffin Engineering Co., Ltd., Johannesburg. E. W. Tarry and Co., Ltd., Johannesburg.

Canvas hose and fittings for the Forestry Branch, Cape Town Municipality. Tender No. 1743. Messrs. W. D. Hearn and Co. £264-7-0.



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Printed by Caxton, Limited, Esselen Street, Pretoria, for the proprietors and publishers, Public Services Publicity (Pty.), Limited, Norwich Union Buildings, Main Street, Johannesburg.