



EAST AFR. PROT.

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Governor

388

Balfield

1915

11th May

BETWEEN FRONTIER DISTRICT WATER SUPPLY

Last previous Paper.

The Report and map by Mr. J. Parkinson. Steps will be taken to get in hand work recommended when transport difficulties can be overcome.

Box 17739

Part of Report (map) to adm. 22nd Sept 1915 5 Jan 1916

Mr. Balfield
Mr. Read

This states we are a practical and useful bit of work, although nothing striking has been found and the recommendations amount to an improvement and extension of the existing works. The report begins to the economic question, why so much of the prospective work being included as is necessary to explain the engineering side.

I think the report should be printed, together with the 3 small maps and sections (which can easily be reduced further photographically, if desired). It might be worth while first showing it to the

Next subsequent Paper

Box 44982

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EAST AFRICA PROTECTORATE

No. 388



GOVERNMENT HOUSE,
NAIROBI,
BRITISH EAST AFRICA.

May 11th 1915.

5336 - 20

Sir,

I have the honour to transmit herewith a copy of a report, with map, by Mr. J. Parkinson on the water supply of the Northern Frontier District.

Report
Map

2. Steps will be taken to put in hand the work recommended by Mr. Parkinson as soon as the transport difficulties can be overcome.

I have the honour to be,

Sir,

Your humble, obedient servant,

Alfred B. ...

GOVERNOR

THE RIGHT HONOURABLE

LEWIS HARCOURT, P.C., M.P.,

SECRETARY OF STATE FOR THE COLONIES,

DOWNING STREET,

LONDON, S.W.

28465

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C.O.
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~~EAST AFRICA PROTECTORATE~~

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May 11th 1915

53345

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H. G. B. B. B.

GOVERNOR

THE RIGHT HONOURABLE

LEWIS HARCOURT, P.C., M.P.,

SECRETARY OF STATE FOR THE COLONIES,

DOWNING STREET,

LONDON, S.W.

28155
21 JUN 15

Nairobi,
British East Africa.
17th. April 1915.

Sir,

Herewith I have the honour to forward a report on the Water Supply of the central and eastern parts of the Northern Frontier District of the British East Africa Protectorate.

CONTENTS.

1. Route taken,	2
2. General geological structure,	2
3. Existing types of wells,	3
4. Probable character of future wells, and estimate of costs,	3
5. Detailed account of route taken and recommendations as to sites,	
a) Archer's post to Merti,	6
b) Merti to Wa Jhir,	6
c) Wa Jhir to Moyali,	7
d) Moyali and neighbourhood,	7
e) Abyssinian frontier (Ranuti) to Archer's Post,	12
f) Moyali to Eil Wab,	15
6. Evaporation	18
7. Recent desiccation,	19

2.

1. ROUTE TAKEN.

The route taken was from Nairobi to Port Hall and Nyeri, thence, skirting the northern flank of Mt. Kenia, to Meru and northwards to Archer's Post on the Guaso Nyiro. This River was followed as far as the Lorian Swamp (to Arro Dima), thence the track north-eastward to Wajhir and Moyali on the Abyssinian frontier. From Moyali a journey was made to Eil Wak on the borders of Jubaland. The return to Archer's Post was from Moyali via Marsabit.

2. GENERAL GEOLOGICAL STRUCTURE.

For the purposes of this Report the District may be divided into two parts, as follows.

1) A westerly area which consists (a) of crystalline rocks, gneisses, schists and the like, or of country where these may be supposed to underlie the surface at a shallow depth, and (b) of lavas, both classes of rock containing water when reduced by weathering to a friable state and in the cracks and fissures which traverse them.

2) An easterly, and, on the whole, more favourable area which consists of such rocks as sandstones, calcareous sandstones and limestones.

This is part of the coastal belt of sediments, which thus assumes in the northern part of the Protectorate a much greater importance than in the neighbourhood of Mombasa.

In the sketch plan attached, the eastern area is shaded by dots.

See plan attached
- Supplementary Report
dated 26th February

3. EXISTING TYPES OF WELLS.

In many instances the wells of the District are merely holes dug in the sandy beds of dried-up rivers: e.g. on the Marsabit route, north of Archer's Post; at Moyali and wells adjacent to that Station on the Abyssinian frontier; at Buna, north of Wajhir.

Others, in country where such stream beds are less well developed or are absent, derive their supply from cracks and fissures in solid rock.

Several instances of these wells occur north of Wajhir (Ajoo and Dittailu) and on the flats below Moyali (Nangatt and Arittcha).

All these are found in the more westerly part of the District, the only wells which deserve the name are those dug in the eastern area of sedimentary rocks, viz. at Wajhir and Eil Wak.

Of these, the former are carefully made cylindrical excavations about 3 feet 6 inches in diameter and of a maximum depth of 45 feet: the latter are much larger and more irregular pits often 60 feet deep.

4. PROBABLE CHARACTER OF FUTURE WELLS and ESTIMATE OF COSTS.

With possible exceptions in the neighbourhood of Eil Wak, where a deep shaft might be sunk to tap some particular stratum, any wells put down in this District will be of depths probably not exceeding 100-150 feet.

Unfortunately, owing to lack of water within reasonable distance of the sites, boring is impossible and shafts of as small a cross sectional area as is consistent with the skill of native workmen will

have to be sunk.

The following is an estimate, as nearly accurate as I can frame for sinking a shaft 50 feet deep by 6 feet square, which will probably be a fair average, no account being taken of the cost of transport beyond Archer's Post, as this could probably be accomplished by local 'beasi' safari'.

Between Nairobi and Archer's Post, I am informed that no transport has especially to be engaged, the service being already in existence. I have, accordingly not included this item.

Picks, shovels, shear legs etc. for simple work have already been sent to the Northern Frontier District, the more complete set ordered in London is in the possession of the Department of Public Works. No further expenditure at present is incurred in this respect, but a galvanized iron tank containing 100 gallons and costing about R.20 should be provided for the working party.

Halls in rocks similar to those of Wajir will not require timbering.

The time occupied in putting down a shaft 50 feet deep by six feet square, untimbered, in ordinary soft alluvium and partially consolidated ash beds, such as would in all probability be found, would be three or four weeks.

A. Labour.

European foreman, R. 260 per month,
 Labourers, 9 at R. 12 per month,
 Carpenters, if necessary, R. 100 per month,
 Food for labourers at 12 cts a day. R. 490.40. £33.

B. Camp equipment.

Special equipment, complete, proposed
 on account of climate, present prices, R. 450. £3
 Carpenter's tent, water bottles,
 cooking pots, blankets etc. about 150. £11

C. Materials.

Allowing as an average for timbering
half the wall only.

750 ft. native timber at 21 cts. per
 sq. ft. by 10 ins. by 12. R. 152.
 200 ft. little by 2 ins. by 8 ins. 21
 R. 153. £10.

Note. I understand that sawn timber can be obtained
 at Mr. Barclay Cole's farm at 18 cents per sq. ft.

Handwritten notes:
 17/11/1906
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5. DETAILED ACCOUNT OF ROUTE TAKEN and
RECOMMENDATIONS AS TO SITES.

a) Wroher's Post to Marti.

For this stretch of the road dams are the simplest solution of the water problem.

The amount of surface soil is inconsiderable and the storage capacity accordingly may be neglected.

b) Marti to Arre Diga and thence to Wajhir.

On leaving Marti the conditions which obtain as far as Wajhir and beyond continue, lavas and the older crystalline rocks are left behind and the country opens out into a featureless plain.

The calcareous sands of Wajhir and the neighbourhood indicate the former existence of an expanse of fresh water of considerable magnitude; the detritus which accumulated therein buried the old and greatly worn surface of crystalline rocks and provided the reservoir capacity to which the present water supply of Wajhir is due.

The Wajhir beds are covered with sharp red sand, which, as these strata are practically horizontal, masks the outcrop, hence it can merely be inferred, though the inference is perfectly justifiable, that they extend beyond the area bounded by the wells.

The extent of the area formed by these sediments is all important, and it is to their delimitation that unfortunately no certain guide can, at first sight, be obtained.

As far as I can judge, it appears probable that,

thickness, say up to 70 feet of sediments may exist. Further information can only be obtained by sinking a few shallow pits, for incurring which expense the probability of finding water gives ample justification. Much useful knowledge will be deduced from the ground passed through: anything denoting the presence of crystalline rocks, such as angular fragments of quartz or of gneiss on the ground should be avoided.

If the hard underlying surface is struck, the well should be abandoned and another started in an easterly or westerly direction.

Recommendations.

From Arre Dine to Bahir is between 53 and 54 miles in a straight line, and I would recommend that, if the former settlement is to be maintained as a sub-station, a line should be cut to Arre (the most southerly of the Vajir group of wells) about 55 miles in a direct line, and that shafts be sunk at distances of, say, 17 and 37 miles upon it.

Near mile 17 an area of soft brown silt, less wooded than its surroundings, known as Berohi, would be suitable for a well. A short distance to the north of this place fragments of the Vajir liasaceous begin to appear in the surface soil.

A pit in the course of the Lak Bohal, about seven miles south of Berohi would be of interest.

From Bahir to Moyali.

The route taken was via the wells of Vaghalla, the last wells of the Vajir district in this direction, thence by the rain pools of Hashinle, leaving Beriffa

7.

thickness of up to 70 feet of sediments may exist. Further information can only be obtained by sinking a few shallow pits, for incurring which expense the probability of finding water is as ample justification. Much useful knowledge will be deduced from the material passed through. Anything denoting the presence of crystalline rocks, such as angular fragments of quartz or of gneiss on the ground should be avoided.

If the hard underlying surface is struck, the well should be abandoned and another started in an easterly or westerly direction.

Recommendations.

From Arre Bim to Vajhir is between 53 and 54 miles in a straight line, and I would recommend that, if the former settlement is to be maintained as a sub-station, a line should be cut to Arora (the most southerly of the Vajhir group of wells) about 55 miles in a direct line, and that shafts be sunk at distances of, say, 17 and 37 miles upon it. Near mile 37 an area of soft brown silt, less wooded than its surroundings, known as Berohi, would be suitable for a well. A short distance to the north of this place fragments of the Vajhir limestone begin to appear in the surface soil. A pit in the course of the Lar Baghai, about seven miles south of Berohi would be of interest.

a) Vajhir to Moyali.

The route taken was via the wells of Vajhalla, the last wells of the Vajhir district in this direction, thence by the rain pools of Hashinaw, leaving Gerifta

on the west, to join the more usual track near the hill known as Eil Lass.

Limestone fragments on the surface between Waghalla and Hashinnle are probably due to the northerly extension of the Waghir beds, but about six miles north of the most southerly pools (Hashinnle) indications of the rising of the underlying rocky floor are seen and continue at intervals, until eighteen miles north of Hashinnle the first outcrops of gneiss appear and extend to Buna and beyond. This stretch of country, from a few miles north of Hashinnle to near Korondil, is therefore unsuitable for wells.

At Debell, two days south of Moyali, surface soil and decomposed rock beneath afford sufficient reservoir capacity to allow of several wells obtaining water at a depth of about 40 feet.

These, on the southern side of the hill, are doubtless capable of extension.

Two more wells, yielding excellent water, are found a short distance to the north of these. They have, I believe, been sunk on lines of great rock crushing presumably originally following springs.

Recommendations.

I would suggest a well near Hashinnle, the necessary water being taken from Waghalla when the rain-pools had dried.

Areas of grey silt, both to the north and south of the hill known as Korondil, would be worth testing by shallow shafts, the men being supplied in the rains from the pools under the hill.

At Debell, the supply could doubtless be increased.

Between Debell and the foot of the Abyssinian escarpment the distance is not great and the ground on the whole unsuitable for sinking wells.

A few patches of black silt occur somewhere or ten miles north of Debell and again about five miles north of Misa. If water is necessary along this part of the route, these would be the best sites. The nearness of the crystalline rocks on all sides renders it improbable that the surface soil is very thick; if so, the success of the well would be dependent on the degree of decomposition of the underlying rock.

Some of these proposed wells I am forced to look upon as experimental, but failure should not be taken as indicative of the impossibility of obtaining additional supplies.

d) Moyali and the neighbourhood.

The wells which supply the Station, including those of Helali, three or four miles distant, are, with two exceptions, merely hollows dug in the sands and gravels of the adjacent valleys.

The position of Moyali, on the edge of the Abyssinian scarp, is naturally unfavourable for obtaining a constant and even fairly large output of water.

The valley heads near the Station, which provide the present supply for the white men, are small with steep sides and a steep fall, they contain but little alluvium and consequently have a rapid run-off and poor reservoir capacity.

The rate of evaporation is very high.

The two exceptions mentioned have been dug in the

rock forming the valley.

One, sunk by an Indian, on an unsuitable site, in decay-rotten gneiss, for a depth after passing through the surface soil of nearly twenty feet, gave about two buckets of water a day (end of December).

It is the only well worthy the name in the Station. The other is close at hand, dug in similar rock to a depth of four or five feet.

Further experiments of this kind so near the heads of valleys cannot be recommended.

On the other hand the wells of Holalt, which supply the greater part of the Station, are situated in the lower part of the valley at that name near its exit from the hills where it has a far larger cross sectional area and is of less grade than nearer the head, the consequence being that the quantity of alluvium which was collected is greater and the water storage proportionately increased.

This supply, I understand, is not known to fail.

The Holalt valley, at some distance from the Station, is obviously situated strategically, and I think the advisability of constructing a dam, as near the Station as possible, should be considered.

Stone is abundant in the neighbourhood and a suitable site could be found without difficulty.

It is very important that the rainfall of Holalt should be carefully kept.

Between Holalt here and Amutt, along the edge of the Abyssinian frontier, are a number of wells sunk either in alluvium, or, where the alluvium is

them into the underlying schists.

In the latter case the foliation (grain) of the schist is usually parallel or nearly so to the trend of the valley at the point where the well has been sunk (Ariticha, Mangatt).

The wells of Ramutt (2) in British territory have been dug in the alluvium of the valley and are obviously capable of improvement. They contain but little water, the requirements of 'safaris' proceeding to Marsabit being taken from wells higher up the valley in Abyssinian territory.

The thickness of alluvium in the Ramutt valley under the flank of Burrell is about 40 feet in one instance and certainly suggests that towards the centre of the flat a still greater thickness would be found.

If the depth of 40 feet the sand contained water. This is of interest in view of the fact that the majority of the valley heads between Mangatt and Ramutt are in Abyssinian territory and that these contain the present wells, e.g. Mutehi.

There appears to be no reason why a shaft sunk where any considerable valley, having a good catchment area, commences to broaden into the plain to the south of the scarp should not be successful. It should be noted that such a shaft will require timbering.

The number of producing wells along this part of the scarp shows that there is no scarcity of water in the neighbourhood.

e) Archer's Post via Marsabit to Renuft (Abyssinian frontier) taken from south to north.

Along this, one, if not the most important of the main routes of the District, the present water supply is derived from,

a) springs in the lavas and associated ash beds of the Marsabit volcano, and

b) from water collected in the sandy beds of the channels draining the eastern flank of the Mathews Range and the northern parts of Lololokwi and Oikanjo. This drainage system, which was doubtless formerly of very considerable importance, leaves the neighbourhood of the Marsabit road by a well-defined valley which can be seen stretching in an east-south-easterly direction from a point about half way between Merile and Laisalis.

The published map shows that the main line of drainage takes a south-easterly course to the west of the Meriti Plateau.

Water appears to be abundant in the sands of this system; thus, travelling from south to north, at the Kauro camp on the main channel one hole about ten feet deep in slightly consolidated sand afforded without delay sufficient water for my "safari" six days; also on the main channel, I understand and have no doubt that water may be obtained in abundance; at Langala, the next stopping place, the water is supplied by springs trickling at the rate of about 1,000 gallons a day (end of February).

Merile is on a large tributary to the principal Channel. Nearly all the holes in the sand contain-
-ed water.

At Laisamis two of the water holes are in rotten gneiss having penetrated the sands of the Lak ; of others, dug in the bed of a tributary, two are in rock for the last few feet, the remainder entirely in sand.

Here again there is no lack of water, for the holes are but a few feet deep.

It would be of great interest to follow up the main channel to the Gumbo Nyiro above Kerti and ascertain whether it is possible to obtain water for the whole distance.

In the event of a diagonal means of communication being required, I would call your attention to the possibility of locating one from Kerite to Kerti.

That the supply of water from the sandy channels of the Laisamis-Lauro system could be augmented is sufficiently obvious from the details given.

On the northern stretch of the road, i.e. from Masalit to Masuti, fresh wells might be sunk at the following localities taken from south to north with reasonable prospect of success.

- 1) On the northern flank of the Marsabit mass beds are found in considerable thickness. There, I understand, water is occasionally obtained. With a little labour this locality gives a good prospect of an auxiliary supply.
- 2) On the slopes of Seyrodell (Haro Deri of maps and about 19 miles in a direct line to the N.N.E of "Delanere's Nyere"). This is a conspicuous ash cone at the base of which a well is reported to have existed.

The ash beds are sufficiently porous to hold water.
 3) To the north of Herrodell, on the southern edge of the lava desert (Dido Gullgulle) a lak crosses the track, its neighbourhood rendered conspicuous by the presence of trees.

The catchment area is considerably less than that, for instance of the Lafamis lak, but in view of the great importance of finding water along the Marsabit-Noyali route an experimental shaft should be put down. A temporary supply, if nothing more, would be of great value in this position.

Turbi. I reached Turbi after dark and left before dawn. There was no water at the time of my visit. Such supply as there may be is "run-off" from the hill side and is purely temporary.

Between Turbi Hill and Ramit on the frontier, about eleven hours journey, I noted two localities which, in view of the need for an additional supply on the northern side of the lava desert should be further examined.

4) Six miles to the east of Turbi.

Here I found on the surface soil fragments of bivalve shells showing that this ground was once covered with water, and it is possible that underlying beds consisting of sediments deposited thereby might be found which would prove of sufficient thickness and capacity to provide a supply for at least part of the year. The question would not take long to settle; water for the well sinking party could be obtained from Turbi during and for a short time after the rains.

5) At a place called the "Laga", about five hours

from Ramutt, one or two rain-pools lingered when I passed early in February. A drainage system exists here which, though of no great importance, has a catchment area larger than appeared probable when the flatness of the country was considered. Examination of the topography followed by a few trial wells should prove successful in finding a temporary if not a permanent supply.

Summary:

To sum up the water question from Archer's Post to the Abyssinian frontier at Ramutt, the supply as far north as Laisanis presents no difficulty. From Laisanis to the pools at Ret (derived from springs in lava on the southern edge of Marsabit) is a waterless tract - the Kaisut - occupying eleven or twelve hours in transit, i.e. two days.

A well sunk south of the Kaisut, about half a day's journey north of Laisanis might be successful, but the country is not easy to judge and no definite opinion can be expressed as to the likelihood of success after only a short examination.

North of the Marsabit Mass suggestions have been made whereby a water supply might be obtained, a) at Herrodell and in the lak to the north of it, and b) between Turbi and Ramutt.

f) Moyali to Eil Wak.

This journey was not made from Wajhir, as I should have preferred, owing to the shortage of food for the men at that Station, which made it imperative that the Survey should proceed to Moyali as soon as possible.

For the first two days the route followed was a return upon the Wajhir trail to the wells at Debell, then in a general south-easterly direction to Buttellu (Bartullo of blue prints), which is part of an alternative route from Moyali to Wajhir.

Travelling at the ordinary "safari" rate, Ell Vak is five days from Buttellu. The trail is waterless throughout; although near Oghberali, reached at the end of the second day, one well was found which produced a cupful of water. Others probably exist in the neighbourhood, as two "manyattas" not far distant were occupied by Sukuye when I passed.

The Wajhir - Ell Vak trail is taken after leaving Oghberali; the first named locality being three days distant.

From Oghberali eastwards to Ell Vak, and I have no doubt farther, the conditions, given a tolerable rainfall, are distinctly favourable for obtaining water.

The accompanying east and west section, from Buttellu to Ell Vak shows, as far as I have been able to read it in so short a time, the structure of the country.

A few miles beyond Oghberali a coarse pebbly sandstone, occasionally very ferruginous and derived from the degradation of the crystalline rocks, forms an inconspicuous hillock (Gamba Hanesa) and farther eastwards a group of flat-topped hills.

Near and to the east of Gamba Hanesa old wells are found, associated with large mounds and ridges of earth, which are said to have been made by former inhabitants with the object of forming reservoirs. The wells at Oghberali and in the neighbourhood of

Gabba Hamosa are in lateritic rock; the deepest seen was 55 feet.

After crossing the flat known as Chukali Gboku a very poor exposure is found of a shelly limestone, so closely resembling the Upper Cretaceous Limestones of Southern Nigeria that it may provisionally be assigned to that age. This is followed by the flat-topped hills already mentioned which are crossed at a place called Lakka Dima, where the sandstones which form them are well exposed and from which they may be conveniently named.

The next rocks met with are the far younger Gypsiferous limestones of Ebi Nak.

Recommendations.

1) I conclude that the country from the Butelleu Hills to within a few miles of Oghberali is unsuitable for wells, but that these at Oghberali and to the east might be deepened and others constructed in their neighbourhoods with a considerable prospect of success.

2) I also recommend that in the event of water being obtained in reasonable quantities a shaft should be sunk at Chukali Gboku. Both here and at the dry wells east of Gabba Hamosa the Lakka Dima Sandstone should be entered if necessary.

NOTE. In the event of several wells being required within a radius of about a mile from an already established productive well, a hand boring rig could be employed with much saving of time and trouble. The cost of this gear for a 5 1/2 inch hole, including casing and rods to reach a depth of 100 feet would be £80-100.

6. EVAPORATION.

Throughout the whole of the Northern Frontier District evaporation is exceedingly heavy.

To measure this, tests were made at Wajhir, Archer's Post and Moyali by means of a pan one foot square provided for the purpose. This was painted a light brown and was buried in sand in the most exposed position obtainable. The amount of water lost during each twenty four hours was made up daily with a measuring glass.

At Archer's Post, a mean of seven tests, made during March gave an evaporation of 39.775 cub. ins. per sq. ft. per diem, of which rather more than half was lost between 11 a.m. and 5 p.m.

At Moyali tests were made altogether for 15 days giving a mean of 40.335 cub. ins. per sq. ft. per diem, this being at the rate of 102 inches per annum.

At Wajhir, three observations which give only an approximate figure, had a mean of 42.57 cub. ins., no less than 107½ inches per annum.

I greatly regret that the thermometer specially made for this work by Ross of Bond Street was either not sent or failed to arrive. But at Moyali the mean temperature by the Station thermometer for seven days was 70.8 at 6 a.m., the mean noon shade temperature for nine days, 83.2.

The observations at Moyali were taken in the middle of December & I am informed the hottest time in the year.

7. DESICCATION.

Evidences of recent desiccation were found almost throughout the District.

Leaving Kerti and proceeding towards the Lorian swamp, very numerous individuals of two species of freshwater shell, one of them now living in the Lorian, are seen scattered on the grounds, a distance of three or four miles from the River and some twenty miles west of the edge of the swamp. This old alluvium is now covered with scrub and low trees amongst which are ruined "manyattas" (kraals). The former swamp was clearly of far greater extent than its present day representative.

Near Kerti I found fragments of the hinge of the freshwater mussel and also broken examples of another bivalve lying on a plain of fine silt. Here also formerly a considerable body of water must have existed, the immediate neighbourhood is now waterless.

Similar evidence was found at Shukali Shefu, twenty miles west of El Fak, where calcareous nodules are found on a plain of fine brown soil. These show a well-marked concentric structure, are frequently hollow, or partially hollow, contain now and again very tubes and the shells of freshwater molluscs, both bivalve and univalve. At the present time the nearest water other than that of wells is the Lorian swamp, a distance of over 120 miles.

One more example is furnished by the great lake at Buna, north of Kajit on the track to Moyali.

The lak is interesting for containing ill-compacted
beds composed of angular quartz grains loosely cement-
ed by calcareous material.

Here also freshwater molluscs were found in quantity,
many of the shells having the shells still united
by the ligament.

Water is now obtained by digging in the sands of
the Lak.

The majority of the wells at Vajhir and many at
Eli Wat are now nonproductive. While this may be
due in part to recent falling off in the rainfall,
it seems probable that choking by the accumulation
of debris is largely responsible.

I have the honour to be,

Sir,

Your obedient servant,

The Hon.

The Chief Secretary,

The Secretariat,

Nairobi.