Report by Professor W.J. Simpson on sanitary matters in various West African colonies and the outbreak of plague in the Gold Coast.

WEST AFRICA.

REPORT

BY

PROFESSOR W. J. SIMPSON

ON

SANITARY MATTERS IN VARIOUS WEST AFRICAN COLONIES

AND THE

OUTBREAK OF PLAGUE IN THE GOLD COAST.

Presented to Parliament by Command of His Majesty.
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To the EARL of CREWE, Secretary of State for His Majesty's Colonies.

My Lord,

I have the honour to submit my report on the results of my mission to West Africa.

Introduction.

The despatches of the Secretary of State for the Colonies instructed me—

(1) To take control of the arrangements for combating the spread of bubonic plague on the Gold Coast.

(2) To discuss with the local authorities in the Colonies visited the quarantine laws in West Africa with the object of possible amendments in some particulars to bring them more into harmony with modern theory and practice.

(3) To visit some towns and other places in Sierra Leone, the Gold Coast, and Southern Nigeria, with a view to investigating their sanitary condition.

(4) To form an opinion by the best means at my disposal in regard to the effectiveness of the existing organization and equipment of the medical service of the Colonies from the point of view of public health and preventive medicine generally.

I have divided the report into two parts. Part I. gives details of the sanitary condition of some of the chief towns and trading centres. Part II.* deals with the outbreak of plague on the Gold Coast and a visit to Togoland with reference to sleeping sickness.

5[illegible] In this memorandum I propose to refer briefly to a few of the more important points in Part I. and Part II.; also to describe fully the progress made in coastal protective measures, in the direction of bringing them more into harmony with modern theory and practice, with suggestions to render the quarantine laws more effective and uniform; and, finally, to give the outlines of a special sanitary organization which I recommend for the West African Colonies, the existing organization and equipment of the West African medical staff being totally ineffective from the point of view of public health and preventive medicine generally.

I desire gratefully to acknowledge the very powerful assistance which I received from their Excellencies the Governors of the several Colonies. It was a privilege to meet Sir John Rodger, Major Bryan (for some time Acting Governor), Sir Walter Egerton, and Mr. Probyn, who, individually, took an active interest in my mission. Personally and through their officers every facility was given me to carry out my investigations, and I found unanimity in the need for, and anxiety to advance, the sanitary interests of the Colonies concerned.

Measures taken at Accra before my arrival.

(2) The primary object of my visit to West Africa being to deal with the outbreak of plague, I proceeded at once to Accra, arriving there on the 2nd of February. Already the Acting Governor had, on the advice of the Medical Department, acted with great

* Published separately by the Government of the Gold Coast.

promptness. A Public Health Committee had been formed, and the members had been active in inspecting and taking measures for cleansing the town, removing the sick, isolating contacts, and demolishing infected houses and destroying rats. A few days before my arrival they had induced the Chief Manche Kojo Ababio and the people of the worst affected part of Jamestown to vacate their houses and encamp about two miles out of town. Some 200 families were thus removed from a congested and insanitary quarter of Accra. This measure had an excellent effect and was an important factor in checking the disease at Accra. Deck passengers from Accra were also not permitted to be embarked on board any of the trading vessels.

Additional Measures after taking over Control.

(3) On my arrival I was appointed President of the Public Health Committee, and the following additional measures were put into force :—

(1) A laboratory was established for diagnostic purposes of human and rat plague and for the preparation of rat virus.

(2) Preventive inoculation by Haffkine's prophylactic was commenced at four inoculation stations.

(3) A land cordon was formed round Accra, extending from the Sakum river on the west to the village of Ningo on the east, and bounded on the north by the villages of Naawam, Nsaki, and Taimang.

No person who had slept within the municipal boundaries of Accra within the preceding fourteen days was allowed through this cordon without a passport bearing the impress of his or her thumb-mark and signed by a Government medical officer, stating that the bearer had been inoculated at least a week prior to the date of such passport.

(4) The inoculation of all deck passengers and other natives leaving Accra by sea at least a week prior to their departure and the fumigation of their clothing and effects.

(5) The fumigation of parcel-post mails.

(6) The supervision and inspection of all cargo shipped from Accra, and the fumigation of all sacks and coverings intended to contain cocoa and other produce.

Later, in order that persons fleeing from an infected place to evade the precautions should not embark on board ship from another port and thus possibly convey the disease, especially the pneumonic form, to other ports on the Gold Coast or to neighbouring colonies, British or foreign, no passengers were permitted to embark from a healthy port unless they could prove residence in it for at least five days and unless the medical officer was satisfied by examination that they were healthy. This effectually prevented strangers from embarking, and generally necessitated their inoculation before embarkation.

Extension of the disease 80 miles west of Accra, and the measures adopted.

(4) Before the cordon had been established infected persons had escaped from Accra and infected a number of the villages at some considerable distance. The most important of these were Brewa, Annamaboe, and Nianyano. Annamaboe and Nianyano had been infected by sick persons from Accra, and Brewa by sick persons from Annamaboe. Brewa is only seven miles from Cape Coast Castle, which is about 80 miles from Accra. The disease had therefore spread a considerable distance from its centre on the west, and there was imminent danger of Cape Coast Castle becoming infected.

Cape Coast is a larger town than Accra and has easy road communications with the gold mining districts and Ashanti. The situation was therefore a most critical one, for with any serious infection of Cape Coast there would have been great risk of an enormous extension of the disease.

Viewing the matter from this standpoint, and having completed the organisation of plague measures in Accra, I decided, with the concurrence of His Excellency the Acting Governor, Major Bryan, to leave the execution of the local measures to the Public Health Committee in Accra, and to Dr. Haran, my assistant, and to start for Brewa and Annamaboe. I remained at both places with Mr. Grimshaw, the Provincial Commissioner, Dr. Lorena, the Medical Officer, and Lieutenant Stokes, the officer commanding the troops at Cape Coast Castle, until satisfied that the disease had been stamped out.

At Annamaboe every assistance was given by the Chief, Amooney the Fifth. A land cordon was established round Brewa in order to prevent escape of anyone from the infected village. Inoculation of all the inhabitants was carried out and a

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temporary village was erected in which the inhabitants were comfortably housed until their huts were thoroughly cleansed and disinfected, and those that could not be disinfected were burnt. A market was arranged for on the sea beach so that plenty of food was brought in under supervision, no contact or direct communication being allowed with those who brought the food. Shortly after these measures had been introduced the outbreak ceased. There were 20 cases, 19 of which were pneumonic plague and fatal, and one bubonic which recovered.

Later, two cases of pneumonic plague occurred in Cape Coast, but the precautions taken were sufficient to prevent the spread of the disease. With the assistance of the Acting Provincial Medical Officer, Dr. Garland, and the Medical Officers of the Department, a policy of dealing with the different peripheral outbreaks was instituted, until gradually the whole of the plague was brought back within the Accra cordon and localised as much as possible at Accra and its environs.

Of the villages attacked Nianyano, about 12 miles from Accra, suffered the worst, 64 deaths occurring in a population of less than a thousand inhabitants. All the cases except one were pneumonic. Dr. Fisch of the Basel Mission distinguished himself by the energetic manner with which he combated this outbreak.

The Colony declared free of plague on May 1st, but a second outbreak in Accra on June 2nd.

(5) On May 1st the Colony of the Gold Coast was declared free of plague. On June 3rd, however, a fatal case of plague occurred in Accra, and in tracing its history it was ascertained that the deceased was a member of a family that had several deaths from plague in it. Residing in a village six miles from Accra, but within the cordon, the remainder of the family had fled to Accra to escape the disease. Two of them were infected at the time and died in Accra. It was the third which was discovered. Some of the previous deaths in the village had been heard of, but the medical officer who was sent had been deceived by the Chief and the people, and had reported the village to be free from plague. The disease thus imported into Accra assumed the same type as it had taken in all the villages on the Gold Coast, viz., the pneumonic type. Between the 3rd of June and the 26th there occurred in Accra and its neighbourhood 23 fatal cases of plague, and 12 fatal cases in the two outlying villages.

Third outbreak end of July.

(6) From this time onwards Accra remained free of plague until July 28th, when one case was reported followed by five other cases between this date and August 17th. All were pneumonic plague, and all more or less connected with one another. The infection was probably derived from clothing or some other article from an infected house. The outbreak was dealt with in a most excellent manner by Dr. Langley, the Principal Medical Officer, and Dr. Barker, the Medical Officer of Health for Accra.

Another but single fatal case of pneumonic plague occurred at Accra on October the 13th.

Recurrences under complete control.

(7) The several recurrences in Accra, where much surreptitious removal of clothes and other infected articles occurred during the epidemic before the cases were discovered or reported, are not more than might have been expected ; but the machinery for now dealing with these cases is so complete and in such good order under Dr. Barker, the able and energetic health officer, that they need not be feared. No infected rats have been discovered in Accra since the end of March, 1908. The special precautions now in force in Accra should be unremittently continued for at least another year. By that time it is hoped that the sanitation of Accra will have greatly improved, and there will not be the same fostering conditions existing for the prevalence of plague.

Total number of deaths : types of the disease.

(8) There have been altogether in the Gold Coast Colony 344 cases of plague, of which 300 were fatal.

In the first outbreak from January 5th to April 10th, there were 302 cases of plague in the Colony, of which 258 proved fatal ; 127 deaths occurred in Accra and 131 in other parts of the Colony. The outbreak in Accra was mainly bubonic and associated with a plague epizootic among rats, but the outbreak in the villages was, with the exception of three cases, entirely pneumonic, and with no mortality or infection of rats.

In the second outbreak from early in May to June 26th, there were 35 cases of

pneumonic plague in the Colony, all of which were fatal ; 23 of these occurred in Accra and 12 in the neighbouring villages. There was no rat infection connected with any of these.

In the third outbreak, from the 28th of July to the 17th of August, there were six cases of plague in Accra, all pneumonic and fatal.

Further details are given in the report on the outbreaks.

Popularity and success of inoculation against Plague.

(9) I might mention here the popularity with which preventive inoculation was received.

This measure of prevention was very much appreciated and sought after by the natives of West Africa, and I am glad to be able to record that not a single accident or ill effect followed the inoculations, of which some 35,000 were performed. This happy result was due to the great care and strictly antiseptic precautions with which the medical officers performed the operation. The protective effect of the inoculations even where the pneumonic plague prevailed appeared to be very marked. There were only four inoculated persons attacked with plague, all pneumonic ; one of these recovered, while the arrest of the disease in localities and villages after all the inhabitants were inoculated was frequently observed.

Rats and Parasites.

(10) Examination of the rats in the laboratory showed two species,

(*a*) Cricetomys Gambianus (Water-house).

(*b*) Mus Decumanus.

No specimen of mus rattus was brought to the laboratory, which would indicate its rarity.

The parasites found by Dr. Graham in and on the rat were of great variety and are of importance in that the flea alone has hitherto occupied sole attention as the only parasite possibly conveying infection. Numerous cutaneous parasites, cestodes, and nematodes were found, the names and descriptions of which are given in the report. The cestode Davainea (Guineensis) was found in 80 per cent. of the Cricetomys sp. Nov. Gambianus examined.

Results of Autopsies.

(11) The results of the post-mortem examination of a number of cases of plague are given.

Danysz Virus.

(12) Some interesting experiments are given of the exaltation in strength of Danysz virus which had lost its virulence in the voyage to the West Coast.

Experiments on Pigs.

(13) Some experiments were also made in feeding and inoculating pigs with plague material, but although the pigs lost weight, had a temperature for a few days, and looked sick, they did not take plague. Unfortunately the experiments could not be begun until near the end of the second outbreak. I should have liked to have carried them further. The quantities used for the first pigs were much smaller than those employed in China.

Coastal Protective Measures and Quarantine Laws.

Progress in the equipment of the chief seaports against epidemic diseases.

(14) Since the outbreak of plague much progress has been made towards the equipment of the chief seaports of West Africa with means to protect them against the importation of epidemic disease and the prevention of its extension. Freetown, Sekondi, Cape Coast Castle, Accra, Lagos, Forcados, and Calabar are now each provided with the requisite disinfecting machinery. Observation camps or isolation stations are also being established. At Freetown an excellent observation camp is in course of formation on the promontory on which the Lighthouse is built. It is admirably situated for the purpose, readily accessible from the river at Man-of-War Bay, well isolated from the town, and easily guarded. An isolation hospital is being constructed and there will be a camp

consisting of a number of separate huts to accommodate suspected persons kept under supervision and isolated in small groups so that if disease breaks out in one group the whole party will not be affected.

Similar permanent arrangements should be provided at two at least of the ports on the Gold Coast, viz., Sekondi and Accra. Sekondi needs them because it is the first chief port of call on the Gold Coast, and because it is the main gate through the railway to the interior of the country. Accra needs them also because it is the capital and because it is also having a railway constructed to the Hinterland. Accra, by the Quarantine Regulations of 1902 made in pursuance of Section 3 of the Quarantine Ordinance, 1901, is the only recognised quarantine station on the Gold Coast.

At Lagos a site has been selected for an observation camp on which will be erected buildings of a more or less permanent nature, including an isolation hospital close to it.

Forcados has a good isolation hospital but more ground is required for an observation camp.

Bonny, which is the entrance port to some of the important rivers, requires an observation camp and isolation hospital.

Calabar is preparing a site.

The selection and preparation of sites for isolation hospitals and for observation camps near the last three towns are attended with difficulties, because of the low lying and marshy banks of the creeks and rivers, and considerable expense will be involved in preparing a sufficient extent of area.

Northern Nigeria is protected by the different stations in Southern Nigeria, which should be taken into account in considering their cost.

Proper equipment at the Ports means abolition of Quarantine for Vessels and Cargo and substitution of Medical Inspection.

(15) The provision of disinfecting machinery and the establishment of observation stations and isolation hospitals remove the necessity for restrictions on merchandise or baggage suspected to be infected, and for the detention and isolation of the ship which used to be so detrimental to commerce, and which rendered the name of quarantine a cause of alarm to merchants and sailors. Medical inspection is the only restriction to which vessels from an infected port need now be subjected, and unless it is found to be infected the delay incurred by carrying out this precautionary measure and those relating to the passengers is short. The term quarantine is, under the modern system of treating infected ships and passengers from an infected port, a misnomer. The modern system where disinfecting apparatus, observation camp, and isolation hospital have been provided, is to take off the passengers as quickly as possible after medical inspection, to discharge the cargo, and not to detain the vessel unless it is infected and then only to disinfect it. There is no quarantine of the vessel, which formerly used to be detained for 40 days, and in later days for 10, 12, and 14 days. Under the most modern international agreement, viz., the Paris Convention of 1903, there is only a liability to quarantine of five days, should the ship be infected and should there be no observation camp and isolation hospital to which the passengers can be taken. It will be seen therefore that the adoption of this more modern system, of which the disinfecting apparatus, observation camp, and isolation hospital are an essential part, removes all quarantine from ships and substitutes medical inspection of passengers and crew and of the sanitary condition of the ship. It shifts the quarantine, if that term could be used, on to certain passengers landing from an infected ship or from a ship from an infected port. The restrictive measures do not involve onerous detention of shipping or interference with commerce.

Passengers are dealt with and not the ship.

(16) The passengers are dealt with and not the ship unless it is actually infected. Even in the case of plague as far as West Africa is concerned the spread of the disease by a vessel with rats from an infected port may be practically eliminated. For instance in the recent outbreak, Accra, the infected town, has only an open roadstead as a port at least a mile from the shore and its cargo is taken out in open surf boats. With the exception of a very few ports in Southern Nigeria such as Burutu, Warri, and Sapeli, the vessels when in West African ports are not alongside any quays or jetties. Disinfection at the infected port of the coverings used for the conveyance of certain merchandise and which possibly may have run the risk of exposure to contamination in the infected quarter of the town, combined with inspection of the cargo for rats as it is being embarked and disembarked, secures safety. Inoculation of the passengers at least seven days before leaving and medical inspection of them and disinfection of their baggage and other effects

prior to embarkation reduce the risk of carrying infection on board ship to a minimum, thereby protecting the shipping interests as well as the Colonies from the extension of the disease.

Much confusion regarding movement of vessels at first.

(17) The difference in the quarantine laws in Sierra Leone, Southern Nigeria, and the Gold Coast, the term quarantine, which has for captains and shipping firms an ominous meaning, and the rather vague information regarding the regulations which each Colony, British and foreign, on the West Coast of Africa had framed and were enforcing against the importation of plague, led at first to much confusion, controversy, trouble, and loss.

The case of the steamship Burutu.

(18) For instance at the beginning of the outbreak of plague the captain of the steamship "Burutu," because he was ordered on arrival at Freetown from Accra, an infected port, to the quarantine station preparatory to the necessary precautions being taken before landing and isolating native passengers and Kroomen, and because he considered the order unusual, the precautions unnecessary, and a waste of time for his ship, he preferred to take the passengers and Kroomen on to Liverpool rather than submit to the regulations.

In this instance no doubt the captain confused the restrictions to which his ship would be subjected under the antiquated quarantine laws of Sierra Leone under the Ordinances of 1882 and 1890, with those to be enforced by the more modern regulations framed under one of the provisions of the Ordinances.

Sierra Leone restrictions.

(19) The restrictions enforced at Sierra Leone consisted of the following precautionary measures :—

(1) Vessels arriving from a Gold Coast port anchor in the quarantine anchorage, which is about two miles from the wharf.

(2) All communication was prohibited, except to those that had special permits to do so. These permits were issued to the Agents, Customs, and Post Office, and to shippers of cargo, and to intending passengers.

(3) Cabin passengers were allowed to land, their names and addresses being taken for observation and their baggage disinfected.

(4) Krooboys and deck passengers landed and detained at the Lazaretto until the completion of the quarantine period of 12 days (this was afterwards reduced to eight days) from date of departure from last Gold Coast port of call.

(5) Vessels in quarantine were permitted to take passengers, stores, water, coal, and cargo.

(6) Packages of cargo were allowed to be landed subject to disinfection.

The regulations were not excessive considering the circumstances at the time except perhaps the inclusion of all the Gold Coast ports. There was even a certain amount of justification for this with ships carrying deck passengers, and the difficulty at the commencement of knowing how far the infection had extended along the coast not necessarily to ports but to localities near ports at which deck passengers could have been shipped. Later this possibility was prevented by no natives being allowed to embark on board from any port in the Gold Coast unless they had been in the port five days and were examined before embarkation by the Medical Officer.

The incident of the steamship Burutu led to misunderstanding and to alarm on the part of a number of the captains and of the local agents of the boating company, and some months elapsed before the effects disappeared.

The quarantine Ordinances for Sierra Leone were passed in 1882 and 1890 ; for the Gold Coast in 1901, and for Southern Nigeria in 1904. In each powers are given to make regulations and it is generally the regulations that govern the restrictions. In order to prevent future confusion the quarantine ordinances and regulations, amended to be in harmony with modern preventive medicine but conditioned to local circumstances, should be the same in all the British West African Colonies.

The most important local conditions to be taken into account are :—

(*a*) The close proximity of the ports to one another.

(*b*) The large number of deck passengers with their baggage and small articles of merchandise.

and (*c*) The ease with which in some instances a person from an infected port may readily reach by land a neighbouring healthy port and then embark.

The most modern and least irksome regulations against epidemics will cause inconvenience to shipping in West Africa.

(20) Whatever the regulations may be, even the most modern, there will always be some slight inconvenience to commerce when any serious epidemic breaks out in any of the British colonies in West Africa on account of their close proximity to one another and and on account of their comparative nearness to French, German, Portuguese, and Spanish colonies with which there are trade relations. Accra is only a day's voyage from Lagos and less than four days from Sierra Leone, and between these are French and German possessions.

The important point is to have regulations which will hamper trade and commerce as little as possible compatible with safety. There must always be medical inspection of passengers and crew of a ship from an infected port, and if, as on the West Coast, there are deck passengers they must be very carefully examined before being permitted to leave the ship, and this requires to be done whatever precautions may have been taken at the port of departure.

As a rule, provision must also be made for the temporary isolation of deck passengers on shore.

The risk of the conveyance of infection by deck passengers.

(21) The deck passengers are the people among whom infection is most likely to be conveyed from place to place, and they are the people also for whom surveillance after landing is rarely a satisfactory measure of protection for either the town or country. Names and addresses will be given, but it will be exceptional for them to be correct, and there are usually exceptional difficulties not belonging to European countries in finding and identifying this class of people, once landed. Thus control may be lost if deck passengers are landed and surveillance alone depended on.

If the deck passengers were eliminated, then, as far as the British Colonies were concerned, medical inspection, disinfection of personal effects, and surveillance are sufficient protection. But the refusal to receive deck passengers, however effective it may be for a short time, tends, when it has to go on for months or longer, to disorganize labour, commerce, and the economic conditions of the country.

The only other feasible method is to provide observation camps at the principal ports and to make regulations as regards the transportation of these passengers from an infected port or from an area of the province adjacent to the infected port. If the mail steamers have not the time to spare to be subjected to the careful inspection of their deck passengers, then arrangements might be made for deck passengers to travel only on the slower boats.

Regulations in Southern Nigeria and in Sierra Leone.

(22) The regulations which have been introduced into Sierra Leone and Southern Nigeria since the outbreak of the plague on the Gold Coast have more or less followed on the lines of the Paris Convention of 1903, except that on the production of a special certificate of inoculation by deck passengers in Southern Nigeria these deck passengers may, at the discretion of the medical officer, be admitted after medical inspection without being subjected to observation at an isolation station, while in Sierra Leone there is no medical inspection, and if the certificates are in order the ship is given free pratique. The regulations of 1902 at Accra, which is the only recognised quarantine station on the Gold Coast, were based on the Venice Convention of 1897. The following are the regulations for Southern Nigeria and for Sierra Leone.

SOUTHERN NIGERIA.

GAZETTE EXTRAORDINARY. JUNE 6TH, 1908.

Instructions as to the Treatment of Ships from Infected Ports.

1. Ships that do not go alongside a wharf and have no direct communication with the shore at Gold Coast ports will be relieved from restrictions as to the bringing of cargo and, if on medical inspection they are found free from disease, will be at once granted free pratique, and be subjected to no restrictions under the Quarantine Ordinance. The above only applies to ships bringing cargo alone and no passengers from ports on the Gold Coast declared infected.

2. Ships can bring passengers of any class from any Gold Coast port, except those declared infected, without being subjected to any restrictions in Southern Nigeria ports.

3 Ships bringing passengers from Accra and other proclaimed infected ports and entering any Southern Nigeria port will be subject to the following restrictions for the period of seven days from the time of departure from the last infected port :—

(*a*) Deck passengers will be placed under observation either on board or at an "isolation" station.

Deck passengers from Accra and other proclaimed infected ports (if any) may, at the discretion of the health officer, be allowed to land provided they are in possession of a certificate of inoculation and disinfection of clothing and effects in the form published in the "Gold Coast Gazette" of 11th February, 1908 :—

Form of Certificate.

I hereby certify that.....of..... whose signature or left thumb mark is hereto affixed and who is about to leave the port of Accra for the port of.....by the S.S.....(or by surf boat or canoe, as the case may be) was inoculated against plague on..... .....1908* the number of his inoculation certificate being....., that he is free from infection, and that his clothing and effects have been disinfected prior to embarkation.

Dated this day of , 1908.

Medical Officer of Health.

.....

Signature or left thumb mark of holder of Certificate.

.....

Signature and rank of witness.

* This date must be at least a week prior to the date of Certificate.

(*b*) The crew will be confined to the ship and only allowed to land under restrictions at the discretion of the medical officer of the port. The ship will be allowed to anchor in the harbour and to go alongside any quay.

(*c*) First and second class passengers who satisfy the medical officer that they have a definite residence and will attend daily at his office or other prescribed place for examination during the period of "surveillance" will be allowed to land and be subjected to "surveillance" until the expiration of seven days from date of leaving the infected port.

4. It must be clearly understood that ships arriving from infected ports should not be detained at any port if desirous of proceeding to another port, on arrival at which second port they will, however, be liable to the enforcement of the above regulations.

Surveillance means the recording of the names and address of each person and placing him or her under the obligation of appearing at the office of the medical officer, or at any other place that he may direct, every 24 hours until the period of surveillance expires.

Observation means the isolation of persons either on board the ship or in an isolation station until the expiration of the prescribed period.

5. It is the duty of medical and harbour officers to exercise every precaution to see that constant examination takes place with a view to the early detection of any unusual mortality amongst the rats on board a ship arriving from an infected port and any ship on board of which an unusual mortality of rats is discovered must be at once sent to a quarantine anchorage or outside the limits of the port, and all direct communication with the shore at once stopped.

6. In the event of a case of plague occurring on board the ship or in one of the persons under surveillance from that ship, the ship should at once be treated as an "infected" ship under the Paris Sanitary Convention

7. Subject to the above, officers should be guided by the provisions of Articles 20 and 21 taken from the Paris International Sanitary Convention of 1903.

THE SIERRA LEONE ROYAL GAZETTE (EXTRAORDINARY).

Vol. XXXIX. Saturday, August 8th, 1908. *No.* 1073.

ORDER IN COUNCIL.

By virtue of the powers conferred on the Governor-in-Council by Sections 5 and 6 of "The Quarantine Ordinance, 1882" it is HEREBY ORDERED :—

1. That Accra, on the Gold Coast, be declared an infected port within the meaning of the Ordinance.

2. That the quarantine period shall be eight days from the date of sailing from the last infected port.

3. That vessels that have arrived with cases of plague shall be placed in quarantine ; that all inoculated deck passengers shall be sent to the Lazaretto at Kissy under eight days' quarantine for observation. Cabin passengers shall be allowed to land under the same period of observation and their names and addresses taken by the harbour master and their baggage fumigated.

4. That vessels arriving with clean Bills of Health and having no cases of plague on board, and whose passengers from an infected port have been inoculated, and also producing certificates to that effect, and on producing another certificate showing that the cargo received on board from an infected port had been disinfected before shipment according to the Gold Coast Regulation, shall be given free pratique.

5. That vessels arriving with cargo and passengers from infected ports, without producing the necessary certificates, shall be treated as infected ships.

6. That vessels having called at infected ports, but not having taken on board passengers or cargo from that port shall be given free pratique.

7. That the Commissioner of Police be instructed to provide guards for the picket boat for vessels placed in quarantine.

8. That vessels that have called at Accra between the 30th of July and 6th of August be treated as infected ships.

9. That vessels placed in quarantine requiring stores, coal and water shall be permitted to receive them in quarantine.

10. That communications with vessels in quarantine shall only be permitted to the following :— Customs, Post Office, Shipping Agents, Shippers and Intending Passengers, for which a Special Permit shall be required.

The later Sierra Leone Regulations are not sufficiently protective.

(23) The Sierra Leone regulations are not, under existing conditions, sufficiently protective. No ship coming from an infected port should have its passengers, particularly its deck passengers, landed without a very thorough examination even when inoculated. Free pratique in the sense of allowing any one to leave the ship or permitting any one to go on board before the visit and inspection of the medical officer of the port should never be given to any vessel from an infected port. If there are deck passengers on board it should also be at the discretion of the medical officer, as in Southern Nigeria, whether some or all should be placed under observation for a period of seven days, dating from the time that the ship left the infected port.

The tendency to the pneumonic form of plague which characterised the later developments of plague at Accra, and against which it is possible inoculation may not exercise so high a protective power as in the case of the bubonic form, renders a proviso of this kind advisable. Other circumstances may also arise where such a power, to be used by the medical officer at his discretion, would be useful.

Paris Convention Classification of Ships.

(24) The classification of ships according to the Paris Convention is suitable when the infected port is six or seven days away from the healthy port of arrival, but it scarcely fits in with coastal and healthy ports that are less than five days, some only one or two days, distant from the infected port.

Article 34 of the Convention recognises this and provides that coastal traffic shall be dealt with by special regulations to be agreed upon by the countries concerned. According to the Paris Convention ships are classified as follows :—

(1) A ship shall be regarded as infected if there is plague or cholera on board or if there has been one or more cases of plague or cholera on board within seven days.

(2) A ship shall be regarded as suspected if there have been cases of plague or cholera on board at the time of departure or during the voyage but no further fresh cases within seven days.

(3) A ship shall be regarded as healthy, notwithstanding its having come from an infected port, if there has been no death from, nor case of, plague or cholera on board either before departure or during the voyage or on arrival.

If Freetown were infected ships from it would reach the Ivory and Gold Coast ports before the period of incubation was over and would come under coastal regulations ; while further away in the ports of Togoland, Dahomey, Southern Nigeria, and the Kameruns, they could all come under the regulations of the Paris Convention, and *vice versa*, ships from an infected port in the Kameruns if they visited on their homeward voyage Calabar or Forcados would come under coastal regulations, while by the time they reached Accra on the Gold Coast they would have been sufficiently long from the infected port as to come under the Paris Convention classification and rules. In the case of some of the more central colonies being infected, such as the Ivory Coast, the Gold Coast, Togoland, or Dahomey, the relationship of the ships coming from the infected ports would be coastal for the neighbouring colonies.

Coastal steamers in the foregoing sense might be all healthy ships according to the Paris Convention although they might have on board prospective cases of sickness which, owing to the short time that had elapsed between the time of their departure from an infected port and their arrival at a healthy one, had not yet developed but which would do later when on shore. The precautionary measures adopted for healthy ships under the Convention would not, under these circumstances, particularly in the case of deck passengers, secure safety. Fortunately in the case of bubonic plague preventive inoculation was able to give a high state of protection which removed this danger.

Uniformity of Port regulations would be a distinct advantage.

(25) The same preventive laws and regulations against the importation and spread of epidemic disease in Sierra Leone, the Gold Coast, and Southern Nigeria would be a benefit

and advantage to the Colonies concerned and also to the shipping. In framing regulations the following should be kept in view :—

1. When the infected port is more than six days distant from the healthy port to be protected then the regulations of the Paris Convention are applicable.
2. When the infected port is nearer, if the ship only carries first and second class passengers the terms of the Convention still are applicable, medical inspection and surveillance, however, being enforced in all cases. If, on the other hand, the ship carries deck passengers these should not only undergo a very careful medical examination but should also be kept under observation at an isolation station on shore for a period of seven days, counting from the time of departure from the last port.
3. If a deck passenger holds a certificate of inoculation against plague not more than three months old or obtained at least seven days before departure from an infected port as well as a certificate of health and of disinfection of effects immediately prior to embarkation, it should remain at the discretion of the Port Health Officer whether he will allow the passenger to pass without further restrictions as in the case when it is an outbreak of bubonic plague or subject him or her, as in the case of pneumonic plague prevailing, to surveillance or observation as he may deem necessary.
4. No ship unless it has a case of sickness on board or infected rats should be detained except for medical inspection of passengers and the necessary inquiries and proceedings as to passengers.
5. It should be compulsory on all captains, whether on mail or other boats that have come from an infected port or province declared to be infected, to keep an accurate register of the names of crew and passengers, their port of departure, and their destination, ready to be given in a certified form to the medical officer of the port on his arrival on board, and further to arrange for the passengers and crew to be ready for medical inspection. Want of accuracy in the passenger list and absence of any properly organised arrangement for the inspection have been often the cause of delay to the medical officer and the ship. The responsibility of furnishing a correct list properly filled up as to where each passenger has come from and where bound for should rest with the captain.
6. No person should be permitted on board or allowed to leave the ship until the medical inspection has been made, and until the medical inspector informs the captain.
7. Vessels arriving from an infected port or with an infectious disease on board from a port not declared to be infected should always come into port with the quarantine flag flying. The object of this is that the medical officer may have timely notice to board, that there shall be no delay to the ship caused by having to wait for his inspection.
8. Vessels arriving from places not declared infected should, during times of epidemic, be visited by the medical officer of the port, who should be furnished by the captain with a correct list of crew and passengers, with the port they embarked from and their destination. This list should include all deck passengers, who are likely to be the chief means of disseminating infectious disease. At other times it is sufficient for the harbour master or deputed visiting officer to ascertain in writing from the captain a statement that there is no actual or suspected sickness on board the vessel. In the case of vessels carrying a medical officer the statement would be that there is no actual or suspected disease of an infectious or contagious nature.
9. Surface boats, canoes, and other small boats should be registered, and their movements regulated at the time of an epidemic.
10. Ports sufficiently near to an infected port as to be easily reached by land should be placed under restrictions as regards native passenger traffic.
11. There is no need of quarantine boards. Once the rules and regulations are laid down by the Government they would be enforced and carried out by the medical officer of health of the port under the Sanitary Commissioner of the colony.
12. Penalties should be inflicted for breaking any of the rules and regulations.

Sanitary Condition of the Chief Towns and Trading Centres in Sierra Leone, the Gold Coast, and Southern Nigeria.

Registration of Deaths.

(26) In describing the insanitary conditions in a few of the principal towns and trading centres of West Africa and the measures for their removal I have omitted any statistical evidence to prove their effect on Europeans or natives. Reliable data are not forthcoming. In the case of Europeans the numbers are small, which render the fluctuations in death rates very large ; the daily strength is not known and the number of days of exposure are not obtainable. In addition to these there are cycles of healthy and unhealthy years. The sick rate among Europeans who spend twelve months on the coast and four months in Europe is a truer index of the unhealthy conditions to which they are exposed on the coast than the death rate. The latter deals with the destructive nature of the disease, which has undoubtedly been reduced by a more scientific and prompt treatment of an attack of sickness from disease and an earlier invaliding in cases which, if continued to be exposed to the climate, would probably succumb.

The data for compiling a sick rate are not available at present in a reliable form, but they might easily in future be collected. In Accra, where I resided for some time during the rains, I was very much impressed by the large number of Europeans who were at some time or another on the sick list. Probably the statistics derived from the Roman Catholic and Basel Missions would, if collected, give the best index of the effect on Europeans of residence in West Africa, as the members remain in the country for several years without coming to Europe.

Dr. Fisch of the Basel Mission, who has been on the Gold Coast for over 20 years with only four visits to Europe, informed me that from 1827, when the Mission started on the Gold Coast, to 1843, nearly all the missionaries died soon after their arrival, and up to 1886 no fewer than 33 per cent. died. Since then great care has been taken in the selection of their residences, two of the principal stations being in the Akwapim hills. The houses also have been removed from the vicinity of native huts and have been built in a more comfortable style and conformable to tropical requirements. Quinine is also periodically taken. These changes have reduced the mortality from 33 to 5 per cent.

The importance of good housing may be gathered from an experience of the Roman Catholic Mission from Alsace, and whose headquarters are at Lyons. The Mission first started in Saltpond in 1890. From December 29th, 1890, to 18th May, 1891, the members lived in a swish or mud hut with a thatched roof, situated in low town among the natives, quite near the sea, and about 100 yards from the lagoon. One father died during that time and the other fell ill. The Mission was discontinued at Saltpond, but returned in March, 1893, the residence being changed to upper town. This was also a swish hut with thatched roof and in the native town. In April, 1895, one of the fathers died and another father was taken so ill that he had to be sent home. Two fathers came in their place. They did not remain all the year round, but in the rainy season went to Elmina. One father died in Saltpond in April, 1898. Another father came in his place, and a new house was commenced to be built near the sea and away from native houses, and while the house was being built this father lived with a merchant close by. He remained well, but two other fathers who continued to live in the old house took ill and died in May, 1898, and a third in July, 1899.

Since the fathers have gone into their new house, which is well built, comfortable, and with a good verandah, away from the natives and near the sea, there have been no further deaths. A small dose of quinine is taken by each once a week.

The death-rates of Europeans now given in the annual reports of the medical officers are very different from the appalling death-rates recorded by the military surgeons of Sierra Leone and Cape Coast in the early half of the nineteenth century. A comparison of the figures might readily lead to the erroneous conclusion that there had been also an extraordinary improvement in the health conditions of the country, unless it is borne in mind that in the early days the death-rates relate in some instances to a mixed population of men, women, and children, to soldiers on expeditions, and to Europeans who lived out there without coming home, and, in Sierra Leone, to periodical epidemics of yellow fever. Further, it is to be remembered that personal hygiene in relation to the tropics was little understood in the older days, and that, although Cinchona bark was given in the treatment of fever, the causes of malaria were not understood, and the treatment by quinine was not invariably practised until the eighties, after Laveran's discovery of the malaria-parasite. Perhaps it might be more correct to say until after the work of Manson and Ross, at the end of the nineties. The conditions that have changed belong to the individual rather than to the locality. Thus, women are few on the Coast and of a higher

class, men serve only a year or eighteen months, medical treatment is early sought after when sick, invaliding is earlier resorted to, quinine is often taken as a prophylactic against fever, the mosquito net is almost invariably used for sleeping under, and most of the official quarters in three of the principal towns are segregated from the native town. There has been an advance in many respects in health matters within recent years, but the practical application of Manson's and Ross's investigations, having for its object the abolition of fever and of the conditions which breed malaria, has not progressed to any material extent. While those conditions remain, the Coast will always be a menace to the health of Europeans, some years being worse than others, reflected, perhaps, not so much in annual death-rates, but in sickness and incapacity to do good work.

In regard to natives, trustworthy statistics do not exist. In Freetown and Lagos there is registration of deaths, but the causes are only in a small percentage certified by medical men. In Freetown the deaths are no index as to which parts of the town are most unhealthy, as the addresses of the deceased are not given ; there is much work for a medical officer of health in this respect. In Lagos only the street is given. There are no numbers of blocks or of houses.

No compulsory registration of deaths on the Gold Coast.

(27) In the Gold Coast towns there is no compulsory registration of deaths. It is only since the outbreak of plague that every death in Accra has to be reported and the deceased examined by a medical man before a permit for burial is given. Previous to this there was registration when burial was to take place in particular cemeteries, but there was no compulsion to bury in these cemeteries. In other towns this system still exists. Burials often take place outside the towns in the bush. Thus it happens that were the death statistics to be collected and any conclusion drawn from them, it would be found that the Gold Coast towns are extremely healthy. For example, Cape Coast according to its vital statistics is one of the healthiest towns in the world. With its 25,000 or 30,000 inhabitants, its average number of deaths recorded during the past five years was less than 300 deaths a year, which is a death-rate of less than 10 or 12 per thousand per annum, according to the population taken.

In 1907 there were recorded 242 deaths, which is less than a death-rate of 10 per 1,000 per annum on the smaller population and 8 per 1,000 per annum on the larger. An examination of the register of burials showed there were no deaths of Mahomedans in June, July and August of 1907, only one in September, none in October, one in November, and none in December, although the Mahomedan community is a large one.

The Chaplain in Accra is the registrar-in-chief for the Gold Coast Colony. There is no registration of births in the Colony. When the New Health Department for the Colony is formed which is recommended later on, registration of deaths should be transferred to it, when the details can be worked out for the introduction of a proper system.

Improvement in certain Towns in housing of European Officials.

(28) Within recent years much has been done in Freetown, in Accra, in Lagos, and Calabar, to improve the conditions of life under which European officials live. The policy has been to provide a European quarter in order that the risk of malarial infection from the insanitary condition of native houses and from infected natives may be reduced.

The European merchants and traders might enjoy the same advantages, but hitherto with very few exceptions they have not availed themselves of the benefit to be derived from a health point of view of having their residences apart from their offices and stores, which are usually situated in the midst of insanitary native huts. If this arrangement does not suit mercantile firms then there should be a European business quarter in every town and trading centre, as at Lomé in Togoland, where all the European firms are together and away from native huts and houses.

At Freetown the erection of bungalows on the hill station, at Accra the placing of the bungalows in a special quarter, have materially contributed to the well being of the officials. At Calabar the same policy has been followed with the same result, and at Lagos, under difficulties which none of the other towns have had to encounter, the policy of providing comparatively comfortable bungalows for the officials has been steadily pursued. I shall have some criticism to pass on the bungalows as regards the narrowness of their verandahs, the omission of damp-proof courses, and their erection on land insufficiently raised when reclaimed from a marsh, which detract very much from the comfort and health which they were intended to secure, but this does not lessen the credit for the policy pursued, or alter the fact that where such a policy has been followed a great

improvement has been effected. The mistakes in having verandahs of 6 and 8 feet in width when they should be at least 12 feet, in omitting damp-proof courses in the walls, and in building on marsh land without the land being sufficiently raised and drained are not likely to be repeated when once attention is drawn to them.

With the exception of attacks of malaria there are few things more depressing and irritating to the nervous system and destructive to health than having to reside in a hot and badly ventilated house. Broad verandahs, lofty ceilings, and careful planning of the rooms to secure good through ventilation are requisites for a comfortable house in the tropics. What is being done in the towns mentioned is also beginning to be thought advisable for others, so that in time it will become general.

Improvement in storage and protection of water supply for European Officials.

(29) Connected with the provision of bungalows in a separate quarter attention has been paid to the storage of the water supply, and different devices have been employed to collect the water in mosquito protected tanks with the result that the occupants of the bungalows so situated enjoy a greater freedom than formerly from mosquitoes. Except in Accra the water tanks as a rule are too small.

Occasionally a mosquito-proof house and more frequently a mosquito-proof room are to be seen, but the provision of these is not so much due to any policy but to the individual notions of the occupant.

These improvements are limited to a few towns, so that the benefit of segregation is only enjoyed by the officials who are more or less stationary in them.

The precautionary measures elsewhere are more of a personal than a general character.

(30) The actual protection against malaria and its injurious results at present lies in most cases in

(*a*) the use of mosquito curtains.

(*b*) the more regular use of quinine. There are very few on the West Coast who if they get wet or chilled do not take 10 grains of quinine with the view of warding off an attack of fever.

(*c*) the adoption of habits of life more adapted to a tropical climate.

Where Europeans are congregated together such an event as happened on the Mantraim mining camp in 1903 would scarcely be likely to recur when out of 18 Europeans 16 were attacked with fever and 5 died. The only two who escaped were the two men who used mosquito curtains. Other factors exercise an important influence, viz., treatment by medical men trained in the London and Liverpool Schools of Tropical Medicine, and temporarily invaliding at an early period. But even with these improvements life in West Africa, except perhaps in the chief seaports and mining towns in communication with the railway, is one of hardship and endurance. Fresh meat is a rarity, tinned foods are the main provisions, and loneliness and discomfort are the chief features. If fever or ill health is added to these the strain on the nervous system affects even the strongest and manifests itself in the numerous breakdowns.

Public Health Measures have still to be undertaken.

(31) For prevention of disease reliance has been placed with few exceptions more or less on personal hygiene, which is excellent in its way, but personal hygiene will never make a town or trading centre or village healthy. Part I. gives details of the conditions existing in Freetown, Accra, and Lagos, and of some of the other trade centres in the Colonies. I have not considered it necessary to swell the bulk of this report by detailing the insanitary conditions which characterise all the towns and villages I visited, which amounted on the Gold Coast alone to over fifty. It is sufficient to say that they all more or less possess similar defects, varying only in their sites, which in some cases are healthy and in others unhealthy. The most common defects are water holes and ponds for water supply—good protected wells are rare ; pools which have been formed by excavations to obtain material for the construction of mud huts ; absence of good surface drainage, and consequent malarial conditions during the rains, unnecessary crowding together of huts in irregular clusters on too small a space when there is abundance of unoccupied land ; unhealthy plans of huts obstructing light and ventilation, though in this respect there are many exceptions, and the existence of rank vegetation close to dwellings. These conditions affect the native injuriously and in turn the European, for the latter only in a few large towns resides away from native dwellings. Most of the unhealthy conditions

mentioned can be prevented and can be easily remedied. But as in the large towns on which I have specially reported so it is in the small towns and villages; while there is no special health or sanitary department belonging to each Colony interested in and responsible for this work, and whose function it is to see that unhealthy conditions are removed and that similar ones are not permitted to arise, they will remain and continue to break up the health of Europeans who, by reason of their duties, have to visit or reside in these places. The climate of West Africa, particularly in the interior and away from the coast, is no worse and no more depressing than some other tropical regions, but the conditions everywhere are generally so primitive and insanitary that there is considerably more risk to the health of the European.

Systematic and continuous preventive measures in the interests of public health have still to be undertaken to protect the inhabitants, European and native, from the conditions which generate malarial fever and from the agents which convey disease. For the development of the country the health of the European is important, but no less so is that of the native, whose numbers have not yet recovered from the ravages of the slave trade, inter-tribal wars, and human sacrifices which the enlightened policy and administration of the British Government have abolished. A step further is now required, viz., to protect the natives from the ravages of disease. The comparative sparsity of population, which is the main drawback to West African advancement, can be met by rendering the conditions more healthy. This can only be effected by the creation of a special health service which has no other duties to perform than the superintendence, control, and direction of sanitary measures. No real, effectual, and steady campaign against malarial fever prevalence in West Africa has yet been begun. There are no mosquito brigades maintained throughout the year. Everything is spasmodic and cannot be different until there is a health administration with money to carry out this campaign.

Insanitary Conditions of Old Towns.

(32) Freetown and Calabar are the only coast towns that possess a public water supply. Others are dependent on shallow wells, ponds, water holes, rain water tubs, tanks, and underground reservoirs which are often unprotected. Numbers of these are open to defilement or are breeding places for mosquitoes. A good potable supply of drinking water in the different towns on the coast and one which could be used by the inhabitants without the necessity of storing for a long period in the houses would be accompanied by manifest advantages in that it would reduce the dysentery, intestinal diseases, and guinea worm which are now prevalent, and also reduce the mosquito breeding sources in the shape of tanks, pools, vats, tubs, and all the other contrivances for storing water in or near the house, and which, with every care, are seldom mosquito-proof and which could be done away with once a proper water supply was provided. Lagos has had in view a supply from a rivulet which an inspection even during the rains casts doubts on its sufficiency. The small size of the Ilo river, its marshy banks, liability to pollution, and its small volume at the time of droughts are matters for serious consideration before embarking on a scheme of this kind. Accra proposes to obtain a supply by the construction of a dam across a river close by, but the scheme at present is bristling with difficulties because the flooding of the valley and plain will form an extensive shallow reservoir in which tropical vegetation is bound to grow abundantly, and which will add very materially to the difficulties of filtration. These difficulties have been pointed out and are now being considered by the engineer as to the best manner in which they can be overcome.

None of the towns have any satisfactory arrangement for the removal of slop water and urine. The most usual practice is to throw both on to the compound or yard from the door, window, or verandah.

Ditches, water-courses, and drains are not maintained in order—Lagos and Calabar are about the only towns that might be excepted, where much has been done towards improvement in surface drainage. Excavations, low-lying ground, blocked water-courses with stagnant pools of water in them are to be seen in almost every town during the rains. Many of these conditions which make for fever prevalence are described in the report. They could easily be removed by an efficient sanitary administration.

Freetown enjoys the benefit derived from a good water supply and from fair scavenging, but it is in an unhealthy condition.

There are a great number of cesspools in a very bad condition and breeding mosquitoes; there is great crowding together of houses and huts in some portions of the town; there are pools almost everywhere in the rainy season, and the drainage question has still to be grappled with.

In Lagos, where Sir William Macgregor did so much in the reclamation of low-lying

and swampy ground, and Sir Walter Egerton has followed on similar lines, there is an immense amount of swamp to be filled up still, and it should be done in such a manner that the reclaimed land is permanently well raised and properly graded for efficient drainage. Some of the swamps that have been filled are not sufficiently raised by several feet and the reclaimed land is flat and not graded. Unless the flatness of level is removed and the ground so well raised and graded as to afford ample fall from all parts of the reclamation and at all times, even with the highest tide in the creek or lagoon, there is no opportunity of the reclaimed area being properly drained, and it remains a marsh during the rains, though not so apparent as before. It is, however, sufficiently a marsh as to be the breeding-ground of malaria.

This state of affairs is to be noticed in a number of the swamps reclaimed in Lagos Island and on the reclamations on which houses have been built.

Further, the land over reclaimed swamps is always liable to subside more or less, and if it is not well raised above the general level the sinkage causes depressions which reach below the level of the neighbouring sound ground, with the result that these depressions cannot be drained, thus adding to the unsatisfactory state of the ground. As an instance of this, I would refer to the Kokomaiko Swamp in Lagos, which was reclaimed in 1903, and in which a year later "an extensive depression appeared in the centre and deepest part of the former swamp to the extent of two or three feet in some parts." In order to remedy this, 40,000 trucks of sand from the Lagoon and Five Cowrie Creek were deposited in the central depression and the whole of the area was raised one foot, yet in 1907 it is reported "that the reclaimed area has shown a tendency to settle still further, but unevenly," and when I saw it on my visit to Lagos in the rains of 1908 it was still a marsh, with houses built on some of the drier parts. Mr. Bellamy, the Director of Public Works, in a report dated the 27th of July, 1907, referring to the sinkage in 1904, very properly remarks: "The incident was instructive as showing the treacherous nature of reclaimed ground and as proving that reclamation is not properly effected by veneering the surface of a swamp with a comparatively thin layer of soil, while it confirms the opinion expressed some three years ago as to the unwisdom of building upon reclaimed land or disposing of it for building purposes until a suitable length of time had elapsed for shrinkage or settlement due to compression of the substrata." "It was the practice formerly to sell all reclaimed land as soon as the filling had been done and the surface of the former swamp covered sufficiently to leave no trace of the original swamp. The important factor of shrinkage was ignored, and in many parts of the town the results of this precipitate action are evident in the swampy nature of compounds of houses built on such land. In such places the ground has settled frequently to such an extent as to prevent the proper drainage of large portions of the town, and the condition of these localities is of a character to call for their condemnation as being unsuitable for human occupation. If this could be done the dwelling-houses should be demolished and the area refilled."

The experience related in the reclamation of these marshes is only that which has been obtained elsewhere. In reclaiming of swamps in a new place there is the same repetition of mistakes, with the object, it is thought, of saving money. It cannot be too strongly emphasized that if, from economical considerations, the reclaimed land of marshes is not sufficiently raised and graded so as to be easily drained in every part, the money expended is not fully productive from a health point of view and the area thus imperfectly reclaimed remains an unhealthy area, though not to the same degree, and will ultimately cost, after the loss of many lives, a much larger sum of money to rectify the initial mistake than it would have if the land had been properly reclaimed at first. Reclamation of swamps needs to be done scientifically, which is not the case when the result is a flat surface that cannot be effectively drained, either with reference to itself or neighbouring ground; nor is it the case when a reclamation is effected on a patchwork or haphazard basis instead of being treated as a whole, and plans and gradings, roads, and storm-water drains and outlets worked out beforehand. The effective reclamation of the Lagos and Apapa swamps on a large and extensive scale, which is one of the most important measures required for improving the health conditions of the site of the town, should be pushed on by the use of dredgers specially set aside for that purpose. The method now adopted, viz., hand labour, is very primitive and slow and not calculated to raise the land to the requisite height.

The Director of Public Works reports in 1907 that "there is no doubt that reclamation by means of dredgings from the Lagoon would be the most expeditious and economical way of reclaiming swamps in Lagos, and the necessity for proceeding with this work would appear to justify the purchase of one or more suitable dredgers to be used exclusively for this work." A similar recommendation was made by Sir Henry McCallum, the Governor of Lagos, in 1897, and by Mr. Hawkins, the Deputy Director of Public

Works, in 1904. In view of the exceptionally marshy condition of Lagos Island and of part of the mainland between it and the sea, also of Apapa, where now the Marine Department is being established, and of Iddo Island, which is bound to be an important commercial centre, and, in view of a healthy site being the first consideration in the building of a town, these recommendations should be given immediate effect to. One or two of the most recent, powerful and best dredgers employed for reclamation purposes, and adapted to the requirements of Lagos and its neighbourhood, should be placed exclusively at the disposal of the Sanitary Department, and should not be taken away either for dredging the bar or reclaiming swamps in other parts of Southern Nigeria.

There are other towns and mud flats, such as Forcados, Burutu, Warri, &c., where reclamation of swamps and raising of the ground are necessary for development, and where probably the employment of a dredger would be of advantage, but for these another dredger should be requisitioned so that the routine work at Lagos may not be interrupted. A weekly record of the work done by the dredger should form part of the annual sanitary report.

Apart from the unhealthiness of the site there is the unhealthiness which arises in towns in the tropics from an inefficient sanitary administration; thus there is in Lagos, as in other towns, the same inattention to the laying out of streets and to the regulation of buildings and building plots; hence, except in the European and Brazilian quarter, the town is extremely congested and insanitary, and there are the insanitary conditions arising from an inadequate water supply, inefficient method of disposal of the sewage and refuse, and an insufficient surface drainage for the rapid disposal of the flood water.

In Accra, notwithstanding its exceptionally healthy site, the crowding together and congestion of the houses and huts in the plague-infected parts were so great and produced such a bad state of sanitation that no remedy short of demolition was of any use. The huddling together of the huts and houses excluded the possibility of efficient scavenging and drainage and brought about a condition wherein puddles containing urine and sullage water favoured the breeding of the larvæ of certain malarial-bearing anopheles.

The water-courses in Accra were blocked and out of level until Dr. Barker took them in hand. The water supply of the natives is obtained from wells and ponds often unprotected.

In Winneba the town is dotted over with large and small excavations, which in the rainy season are stagnant pools.

Repetition of Insanitary Condition in New Towns and Trading Centres.

(33) As trade increases and the country is being opened up, new towns are arising. Sekondi 10 years ago was a small village. Now it is an important town and a very badly laid out one, with insanitary native villages blocking the way to European expansion on healthy sites. The insanitary conditions productive of disease and malaria common to the old towns have sprung up here anew, and it will be costly to make it healthy and provide good sites for European houses. The same mistakes are being made in all the new trading centres that are arising that I have seen, and there is a repetition of the same insanitary conditions that render the old unhealthy. Little attention is paid to site, and if it is a bad site measures are not taken to improve it first; the clearance of bush is neglected, the huts are huddled together, and the houses irregularly arranged. The streets are not laid out, the water supply is not considered, puddles and ponds are not prevented from being formed near the houses, and drainage is not provided. Everything develops in a haphazard way, and with it malaria; and yet it is possible, and should be a guiding principle in sanitation, or preventive medicine, that no malaria shall be allowed to arise or exist in a new village or town, even in a malarious country. It costs little to prevent these insanitary conditions arising and to place the prospective village or town on proper sanitary lines and to maintain it on these lines, but it costs much to remove the insanitary conditions once they have been permitted to arise. In a few instances plans have been drawn out for a proposed village or town in West Africa, but immediately the authority interested in the subject has left they have been lost sight of or dropped and never carried out.

Sanitary Measures need only be Concentrated on the Towns, Villages, Rest-Houses, and Encampments.

(34) The large marshes away from the villages and towns have little to do with the unhealthiness of the coast. They are not the endemic producers of fever among the inhabitants. It is the condition of the towns and villages and trading centres and their immediate surroundings that are the factors in the causation of disease. Sanitation does

not involve the reclamation and drainage of the West African marshes, unless they are within or close to the town or village, but it concentrates itself down to attention to the towns, trading centres and villages, the rest-houses between them, and to the encampments. Sanitation of the villages away from the large centres is of the simplest kind and can easily be regulated through the head man or chief. The villages I have seen vary a good deal in their condition, some being cleanly, well built and healthy, others being much the reverse. The requirements are that the huts shall be regularly built and well apart from one another, that no pits shall be dug within 500 yards of the village, that the refuse shall be removed to a field at least 100 yards from the village and burnt, that latrines shall be located on the outskirts of the village, that the bush shall be cleared for at least 100 yards around the village, and that there shall be one or two wells in the vicinity.

Sanitation on the West Coast is simplified by the fact that there are no large towns as yet. There is plenty of land to spread out on except perhaps in Lagos, and even here there is abundance of land for extension on the mainland and of a better kind than that on the island. There is no economic reason for crowding together of houses and huts, and there is altogether a fictitious value given to the houses and land.

A different policy from that now pursued in West Africa will have to be inaugurated to bring the towns and trading centres into a healthy condition and maintain them in that state ; larger ideas will have to be entertained as to the amount of space for buildings, streets, and open spaces generally. There is too much cramping up at present. Complete control of streets, buildings, and open spaces must be substituted for the present regime which leaves to the primitive ideas of a primitive people the construction of their huts and houses on unsuitable sites and in such a manner as to be unhealthy. The result of absence of control is to be seen in the congested areas which are the characteristics of every native town left to itself. It is an expensive and extravagant regime because the later construction of streets for the purposes of traffic through these crowded areas is a costly matter because of the exaggerated and imaginary value which is attached to unhealthy shanties and land in West Africa. Even when these streets are made the interior of the blocks between them remains in an unhealthy state. In making regulations there is no need of introducing European types of dwellings for the the poorer natives ; in fact these are better avoided. If native dwellings are studied in the different Colonies there will be seen to be good and bad types amongst them, and it is for the health authorities to make a study of the best types of native huts and houses and work on these, always having in view plenty of light and air and space. I have seen many excellent types of huts in different villages which conform in most respects to healthy conditions and which can be well adapted. The worst houses are often erected in towns and trading centres by new comers and for new comers. It is the trading centres that more especially require close sanitary supervision because they bring together all sorts and conditions of people. As regards the richer natives, they build houses more or less of a European type, and those they do not occupy themselves they let to the traders and merchants. Thus in regulating the development of trade centres, it is to be borne in mind and particularly in regard to the Gold Coast that a house occupied by a merchant is built and owned by a native. Immediately it is seen that a station is likely to become a trade centre there is a rush to the place and as much activity in building houses by natives as there is in Europe with the speculative builder.

The requirements in New Centres.

(35) Some forethought requires to be expended on laying out villages and towns and providing for their extension and development and requirements, on sanitary lines. The following are requisite, viz. :—

(1) A plan providing for future development and a European business quarter if it is likely to become a trading centre.

(2) Assignment of building plots, regulation of their size and limitation of the number of houses or huts per acre of ground. A building plot 50 feet by 75 feet as originally planned in Sierra Leone may be taken as a fair sized house plot which will allow of space behind the single house for out offices and will prevent too many houses being erected on too limited a space.

(3) Alignment and regulation of streets and back lanes, and building laws which shall secure ample open space for each house or hut, and good light and ventilation for the rooms of the house or hut.

(4) A water supply protected from pollution and from mosquitoes.

(5) Regular and efficient scavenging and a safe disposal of the excreta and slop water.

(6) The efficient drainage of the area and the maintenance of its water ways in good condition.

(7) Freedom of the surroundings of the house and the village or town from rank vegetation or undergrowth.

(8) The interdiction and prevention of any pits or holes being dug, the offence being punishable summarily, and the selection of a spot, well outside the village or town, where the people may obtain material for their mud huts.

(9) The filling up of all pools, ponds, and low-lying ground and compelling the owners of the land to do it themselves or bear the expense.

(10) The maintenance of a small mosquito brigade to oil the pools, puddles, tanks, and cesspools which cannot be removed, and to remove the long grass and underscrub that harbour mosquitoes and the tsetse fly.

Requirements for existing towns and trade centres.

(36) None of the towns possess efficient building laws, nor drainage plans, nor maps showing future development and extension. In order to secure these I would recommend that each Government should follow the lines advised and adopted in Accra by an Order issued by His Excellency Sir John Rodger and published in the Gold Coast Extraordinary Gazette of July 8th, 1908.

EXTRACT FROM ORDER.

This Committee is appointed for the following objects :—

(*a*) to advise on the best means of remodelling those portions of the town which form insanitary areas owing to the crowding together of the huts and houses therein ;

(*b*) to plan out, on maps to be provided for the purpose, the improvements suggested ;

(*c*) to recommend, as far as possible, a plan for the future development of the municipal town of Accra on lines which will secure its extension and growth in accordance with a definite and improved method, so as to prevent the creation of insanitary areas ; and to suggest the procedure to carry the recommendations into effect.

3. For these purposes the Committee should formulate and send to the Governor, or other officer for the time being administering the Government of the Colony, a report embodying a scheme which should have in view, and, so far as local conditions will admit, should aim at, the following definite objects :

(i) A better division of the town into well-defined districts, business and residential, and the prevention of the erection of unsuitable buildings therein ;

(ii) An adequate provision of roadways, streets, and back lanes, open spaces and recreation grounds, and the reservation of sites for public and municipal requirements ;

(iii) Improved and adequate drainage of the municipal area ;

(iv) Efficient control over all building blocks and plots, and the limitation of the number of huts or houses per acre of plot, according to the class of building and the quarter of the town ;

(v) The regulation of sites for huts or houses, having regard particularly to the position of intended buildings with reference to streets and back lanes, and to the amount of each site to be left clear of buildings ;

(vi) The prescribing of the class of building to be erected in the several districts, having regard to other buildings in the vicinity, also of the height, width, and depth of the building, the size, lighting, and ventilation of rooms, the ventilation and air spaces around the building, the best means of rendering the building damp proof and rat proof, and the minimum cubic space per occupant.

The recommendations under heads (i), (ii), (iii), should be illustrated by maps, which will be provided for the purpose, one at least of which should be a contour map, and show existing drains and waterways and their relative position to suggested drains.

The Committee is at liberty to make any suggestions as to the alterations in existing Ordinances or Regulations required to make their recommendations effective."

(37) In a different category from the town, trading centre, and village are the camps formed for surveys and for construction work when a new railway is projected or in process of construction. A great amount of unnecessary sickness and malarial fever can be avoided by more careful selection and preparation of the sites of these camps, and by their erection on sanitary principles before railway work is commenced. It is none the more costly to do these things at the commencement, though unfortunately in a great many instances they are neglected. The engineer in charge should be held responsible for any undue sickness in the camp. There is a book of instructions issued by the Consulting Engineers for railways to their construction staff relating to their work. If a code of sanitary regulations were added to these instructions, the district engineers or engineers in charge would feel that they were more responsible for carrying out of the regulations and of the recommendations of the medical officers. At present it is considered that the doctor is there only to attend the sick, and any advice on sanitary matters is viewed with lack of interest and lack of sympathy. There are, of course, exceptions to this where the engineer is ready to have the recommendations of the medical officer carried out at once.

In another category are the gold-mining centres on the Gold Coast and in Ashanti. Here the reverse policy is noticeable. Many improvements are being introduced on the recommendations of the medical officers, and the health of the mining camps is viewed by the managers as being intimately associated with the prosperity of the companies.

A Special Health Organization requires to be created to improve the Insanitary Conditions.

The existing sanitary administration unable to effect or maintain permanent improvements.

(38) It would be unfair to conclude from the description of the conditions that exist that much has not been attempted to improve them by individual medical men and by the Government. The attempt to make the towns and villages of West Africa healthy under the existing system is a Sisyphean task, because of no comprehensive grasp of the many-sidedness of sanitation and the relation of each to one another, no very definite object in view, no special organization for the purpose, and no continuity. In the time unoccupied in the treatment of patients and in the study necessary to keep himself abreast of the times one medical man may take an interest in the condition of the drains, another in the abolition of pools, another in the construction of houses, another in the water supply, another in conservancy, while others may be more interested in research work or in medicine or in surgery, and do not pay attention to practical sanitation though interested in the causes which give rise to disease in the locality. A station may thus progress in several respects under one medical man and fall back under another, and the net result is little improvement or if there is improvement in any special quarter of the town there is deterioration in another. Even if continuity of policy could be obtained, which is impossible with the present regime, actual progress as a whole would be exceptional. At present it is no one's special duty to look after and be responsible for the public health. The West African Medical Staff is not equipped for that purpose. It has only recently been realized that no great advance in public health can be made without a special health department. My visit came at an opportune time, giving an impetus to ideas that had already been forming.

Reasons for creating a special sanitary organisation.

(39) The reasons for the creation of a special sanitary or health organisation may be summed up as follows :—

I. The insanitary condition of the coast towns and inland trade centres even where sanitary measures have been most active.

II. The imperative need of improvement in order to secure better health for the European officials and traders, and in order to preserve the African inhabitants, whose numbers have not yet recovered from tribal wars, slavery, and small pox.

III. The impossibility of effecting permanent and important improvements, and when effected maintaining them, without an organisation whose duty is to initiate and advise the Government as to improvements, and when sanctioned to see that they are properly carried out. Without an organisation no proper inspection of outstations and native towns can be systematically carried out, recommendations have not the weight they would otherwise possess, and money is wasted, full value being seldom obtained for the expenditure.

Owing to absence of a special sanitary administration drains are constructed that are useless or not as useful as they might have been for the money spent on them ; houses are built that are unhealthy or are trying to live in. Towns are allowed to grow up from villages without any forethought as to development and growth, the result being often a most insanitary condition that nothing but costly demolition will remedy or remove. Places become or continue to be malarious because there is no organisation or controlling agent to prevent it.

IV. To check and control the risk of importation of disease and its transportation from place to place, which increases with that movement of population, especially of traders and labourers, which has attended the great awakening of West Africa in trade activity. Apart from the prevalence of malaria and tuberculosis, other diseases such as yellow fever, sleeping sickness, small-pox, cerebro-spinal disease, and plague, have to be carefully watched, and measures taken to prevent their spread both by land and sea. Besides

this inter-provincial and inter-colonial risk of infection there are risks arising from the increasing trade of West Africa with European ports. Cholera is a disease from which West Africa has hitherto been free, and owing to the bad water supply in the country generally it is of the highest importance that every precaution shall be taken to prevent the introduction of a disease which would be more destructive than plague.

V. To insure a continuous policy.

Composition of proposed sanitary organisation.

(40) I recommend a sanitary organisation which shall consist of :—

(*a*) A special health department in each colony, small in its constituent numbers, whose members should be specially trained and whose whole time should be devoted to public health duties.

(*b*) The medical officers in each station, who are now designated health officers for the station, but who at present are under no expert guidance or control in sanitary matters.

The special health department in each colony would be best formed by making it a branch of the West African Medical Staff, separate in its functions and not transferable to other medical duties. The department in each colony should be under a Sanitary Commissioner, but, as the whole sanitary organisation includes the medical officers of the different stations in the colony who would have to be in sanitary matters under the control of the Sanitary Commissioner, it would be advisable, in order to prevent friction from a dual system of control, for the Sanitary Commissioner to be subordinate to the Principal Medical Officer as President of the Central Board of Health, but yet in sanitary matters to be recognised as the expert and as the responsible officer. The executive control of the health organisation should be completely under the Sanitary Commissioner.

It would be advisable that no medical officer of the West African Medical Staff should be eligible to enter the special health branch or department until he has been four or five years in the colony as an ordinary medical officer, and no officer should hold a public health appointment unless he holds or takes within a certain time of his appointment a diploma in public health and a diploma in tropical medicine and hygiene.

The pay of the department should be high so as to attract able officers and satisfy them with their prospects. When once in the department promotion should be in that branch up to the Sanitary Commissioner and not in the medical branch leading to the Principal Medical Officership.

More detailed account of the suggested organization.

(41) With this explanation I would suggest the following organization :—

1. A Sanitary Commissioner and Deputy Sanitary Commissioner for each Colony except Sierra Leone, which might be combined with the Gambia.
2. A central Board of Health for each Colony on which should be

   The Principal Medical Officer as President, }
   The Sanitary Commissioner, } Members.
   The Director of Public Works, }

   Under the Director of Public Works there should be a Sanitary Engineer whose duties are entirely and exclusively to carry out and supervise sanitary work.
3. The appointment of the principal medical officer as an ex-officio member of the Executive or Legislative Council to secure due consideration of sanitary measures advised by the Central Board of Health as well as medical matters.
4. Special health officers for certain towns and districts. Thus a health officer for Lagos and its suburbs, a health officer for Accra and the district behind it, a health officer for Cape Coast and its district, a health officer for Sekondi and its district including Tarquah, and a health officer for Freetown and its suburbs. These with their assistants would also form an organized port medical service.
5. The recognition of the medical officer of the station as health officer and in sanitary matters under the orders of the Sanitary Commissioner and Deputy Sanitary Commissioner.
6. The training of a subordinate medical service for the duties of assistant medical officers of health, medical inspectors, vaccinators, and sanitary inspectors and assistants in laboratories.
7. The appointment of young and qualified engineers in place of many of the fore-

men of works, at all events for sanitary work. The young engineers should have a training in sanitary work before appointment. Native assistant engineers might also be trained in West Africa.

8. The establishment in each Colony of a small laboratory for analysis of water, food and drink and for bacteriological examination relating to diagnosis and the prevention of disease and the appointment of special medical officers to them.
9. An Inspector General to co-ordinate the work and to link the whole with the Colonial Office.
10. A sanitary budget, for each province in each Colony.

Additional legal powers required.

(42) It is not sufficient for the different Colonies to possess a sanitary organization but in order to make that organization effective considerably greater powers than exist are needed to preserve the public health. Powers are required to pull down insanitary houses injurious to health, to fill up excavations and prevent them being formed, to treat all breeding places of mosquitoes as nuisances with penalties for their retention, and to compel owners of unoccupied land within municipal boundaries and for 400 yards beyond to keep it clear of undergrowth, long grass, and rank vegetation and to maintain it free of nuisance. Powers are also required for compulsory registration of deaths and to enforce good building laws. All plans of buildings to be inhabited or used as stores for food should be first approved of and sanctioned by the Health Authorities before permission is granted for erection, and this applies also to buildings intended for the accommodation of labourers and Krooboys because most of the buildings now erected in different localities on the Coast are overcrowded, dark, badly ventilated and very insanitary, which are conditions favourable to the development and spread of disease. It is not more costly to erect healthy buildings than unhealthy ones. Light and air are cheap.

Principal causes of dissatisfaction in the West African Medical Staff.

(43) The discontent in the West African Medical Staff is only remotely connected with the sanitary administration of the Colonies and requires separate consideration. The principal causes, as far as I could ascertain, are dissatisfaction with the pay after the first five years' service, the small pension obtainable by those who might not reach to the rank of senior medical officer, the poor prospects of advancement for the majority, and other minor matters connected with rank and the performance of the duties of administrative and political officers without recognition. My views on these matters were laid before the Committee which the Secretary of State for the Colonies appointed to enquire into this subject and they need not be repeated here. Improvements in the conditions of service are necessary if it is to become attractive and popular and compete at all with other Government services such as the Indian Medical Service, or the Naval Medical Service, or Royal Army Medical Corps. The formation of a special health service, with its laboratories for scientific work, will tend to open up a new avenue or branch in the service and will to that extent render it more attractive to those who take an interest in preventive medicine.

I have the honour to be,
My Lord,
Your obedient Servant,
W. J. SIMPSON, M.D.

March 4th, 1909.

PART I.

Freetown.

Situation.

(1) Freetown, the capital of Sierra Leone, is situated on the south side of the Sierra Leone River, near its mouth and in 8° 29′ 30″ N. latitude and 13° 9′ 17″ W. longitude. The river, whose banks are indented with little bays and are here generally some 40 to 50 feet in height, forms the northern boundary of the town, which lies on high ground about a mile in width, between the river and the slopes and flanks of the crescentic range of hills which shut the town in on its south, east, and west sides. Map I, photos. I and II.

Climate.

(2) It is this enclosure of the town on three sides by high hills obstructing the wind in certain directions, its proximity to the sea, and its tropical heat, that give to Freetown

its damp, oppressive, and enervating climate. The refreshing change in climate which is experienced on going from the town to the hills is very marked.

Configuration of Locality and Position of Hill Station and Barracks.

(3) Near the eastern horn of the crescent and joined on to the range by a low saddle or ridge rises a small hill of about 400 feet, which gradually slopes down to the river bank. This elevation, called Tower Hill, divides the crescent into two horse-shoe shaped valleys of unequal size, the western being the larger, and it is around this hill and in the wider valleys that the town is built.

The crescentic range is highest in its centre, culminating in Leicester Peak, which is nearly 2,000 feet high and gradually slopes to 700 and 900 feet at its eastern and western horns respectively. It is on the highest portion of the western crescent that the hill station for European officials has been built, while a little lower down on the same ridge are the barracks of the West African Regiment. On the eastern horn of the crescent, between 800 and 900 feet high, are the barracks of the West Indian Regiment, and low down on Tower Hill, close to the town, are the quarters of the European troops, consisting of artillerymen and engineers.

Location of European Troops Inferior from a health point of view to that of Native Troops.

(4) The position of both the West African and West Indian Native regiments is far superior from a health point of view to that of the European troops.

The Streams of Freetown.

(5) Leicester Peak with its spurs and ridges form the watershed from which arises the springs and streams that flow to the river through the valleys on either side of Tower Hill. Three huge streams called the Congo, George River, and the Ideo-roko or Sanders Brook, flow through the western valley and one large stream, Nicol's Brook, flows through the eastern. They are perennial streams, of not more than two to two and a-half miles long, and their channels are principally of granite and laterite, with huge boulders and rocks strewn in them in their upper reaches.

The Town built on Laterite of Different Degrees of Porosity.

(6) The hills mainly consist of granite, syenite, and basalt, with a covering of laterite. The valleys on which Freetown is built consist of laterite varying in hardness and porosity, and often fused into hard and dense rock covered usually by a thin layer of laterite soil. The soil generally, except in those instances where hard rock is exposed, is porous, and it is marvellous how soon after heavy rains the flood water disappears and the streets are perfectly dry. This condition exists in large areas of the town, more especially in that portion north of Tower Hill.

Marshy condition of some areas.

(7) But there are other areas, such as those near the foot of the hills, where the ground is full of springs and consequently always wet, and there are areas lower down in the flats where the soil is waterlogged and the drying up is exceedingly slow.

In the former case there is a continual oozing out of water from the ground, which flows down any near declivity and settles in pools where the surface may be uneven and where the laterite is harder and more impermeable. In the latter instance the water-logging is only increased by the rains, and there is no time between the showers for the locality to get dried. Indeed, so marshy do some localities become, as, for example, the grass fields which form a very large area of land in the Western Valley, that they are uninhabited and are used in the dry season as a rifle range and golf course. If this waterlogging, which is the cause of its marshiness, were removed a very valuable piece of land, which is useless at present besides being a danger to health, would become available for building purposes, and would materially assist in relieving the overcrowding that is taking place in some parts of the town.

In many places the loose soil, the detritus of the laterite and disintegrated rock of the hills, is so thin that the laterite rock below easily becomes denuded and water lodges in the depressions.

Central part of Freetown well laid out.

(8) Freetown, besides being the most picturesquely situated town of the British Colonies on the West Coast of Africa, is also the best laid out and most attractive

looking. It is laid out, particularly in the older and central quarter of the town, in regular parallelogram blocks 150 feet in width, with streets between them of 75 and 80 feet wide. The blocks were divided into plots of 50 by 75 feet, and on each of these was built a house. This arrangement gave space for ventilation through and around the house.

Departure from original plan.

(9) In the extension of the town this excellent plan has unfortunately been departed from. Streets and lanes, some as narrow as 15 feet, are to be met with.

The temporary subdivision lengthways of the plot by the owner, so as to give a frontage of 25 feet and a depth of 75 feet and allow of the erection of two wooden buildings not more than one storey facing the street in districts where one-storeyed buildings only are erected, would not have led to any injurious result, provided the owner was not allowed to sell the half plot and was obliged, in the event of desiring to erect a building of two or more storeys, to pull down the two temporary buildings and build on the original plot as it was before having been halved. This, however, has not been followed, and there are plots which have had buildings erected on them facing the street, and also behind those facing the street, with the result that in some quarters of the town, especially the eastern, the crowding together of the houses and overcrowding of the population have formed very insanitary areas where bad ventilation, bad drainage, foul cesspits, and other filth conditions foster malaria and other preventable diseases.

Size of original plots allowed a healthy growth of the town.

(10) The building plots of 50 feet frontage and 75 feet in depth where undivided, separate the houses in the street well from one another, allow of a style of house with windows on the four sides, and it secures a good space behind for out offices, the latrine with its cesspool being away at least 30 feet from the house. The houses have also, as a rule, an excellent masonry plinth of at least two feet in height, and the standard of building is distinctly higher than on the Gold Coast, though for some reason which I am unable to explain there is a disinclination to maintain in a good state of repair.

The more huts and houses erected on a plot, the more difficult the lighting of the rooms and the ventilation of the buildings become, the less efficient the cleansing and means for the disposal of the slop water, and the more impossible it is to have the cesspool situated sufficiently far from dwellings as not to be a nuisance and a danger to the occupants of the houses on the divided plots and of the surrounding houses.

No law to prevent sub-division of plots and no efficient building laws.

(11) There is no law to prevent subdivision of plots and subsequent sale of these divisions, and there are no building laws. The whole plot could be covered with buildings as long as they are not constructed of inflammable material. The only restrictions with regard to buildings at present in force are that no new building whose walls are of an inflammable material shall be placed nearer than 15 feet to any other building, and the front of every building abutting on a street shall be at least 10 feet from the centre line of such street. Obviously these are not sufficient to secure the healthy growth of a town. No street should be of less width than 40 feet. No plot should be permitted to be subdivided unless under the safeguards mentioned, and there should be a Building Act regulating the buildings and their relation to one another on a plot. The Mayor of Freetown was strongly of opinion that no half lots should be allowed to be sold.

Water Supply.

The present supply.

(12) The water supply was under the charge of the Government until 1905, when it was handed over to the Municipality. Before 1902, the greater part of the town was supplied from the Edeoroko stream, the water being taken from the same spot as that which now gives a supplementary supply.

The present supply for the town is derived from the Edeoroko, George, and Congo streams, dams being built across them to collect the water and allow of it being drawn off by pipes sufficiently screened to prevent the entrance of leaves, &c. From the dams the water is conveyed to a service reservoir on Tower Hill and thence by gravitation to the street mains. From these it is distributed to the stand pipes in the street and to taps in some of the better class houses.

Quantity not quite sufficient in the dry season.

(13) The quantity is more than ample throughout the rainy season, the overflow from the service reservoir discharging large volumes which run to waste. During the dry season, however, the supply dwindles down to 210,000 gallons per diem which in a population of nearly 40,000 means scarcity unless sufficient storage is provided. The existing service reservoir only holds 630,000 gallons, which at the present rate of consumption is scarcely two days' supply.

Methods to prevent shortage.

(14) To prevent shortage during the dry season it is possible either (*a*) to increase the quantity now conveyed into the reservoir by :—

(1) Taking more water from the Congo stream at a lower level (Mr. Copland's scheme),

(2) Damming the Lumley Street or Baboon river (Mr. Quill's scheme),

(3) Taking water from the Kissy Brook (Mr. Laing's scheme),

or (*b*) storage reservoirs, or (*c*) to do both *a* and *b*. If the storage reservoirs which Mr Chadwick recognised from the beginning as an essential part of his scheme and which were to store some 30 million gallons of water are to be still further postponed on account of financial considerations, then undoubtedly Mr. Quill's proposal for supplementing the existing supply by tapping the streams from the Sugar loaf mountain should be adopted. This would give, as shown by Mr. Quill, an additional supply of 150,000 gallons per day during the dry season, and could be effected at a comparatively moderate cost.

Quality good. Water is not filtered.

(15) The water derived direct from the hills is not filtered, being of excellent quality, and recently great care has been taken to protect the gathering grounds. Farms have been removed and cultivation stopped above the intakes.

It has also been realized that the deforestation which was taking place for the purpose of obtaining firewood and of clearings for cultivation was likely to have a very important effect in diminishing the quantity of water available by destroying the perennial character of the streams. When the gathering grounds are well covered rain falling on them finds its way slowly to the streams giving them a permanency which they lose when they are converted by clearances into torrential waterways in which the storm water which quickly runs to waste would otherwise have been available for use.

Protection of the gathering grounds.

(16) The gathering grounds require to be rigorously reserved in order to secure purity and permanency in the quantity of water. I had the advantage of going over the gathering grounds with His Excellency, Mr. Probyn, and with Mr. Unwin, the Conservator of Forests in Southern Nigeria, and it was agreed that the land which was required to be reserved for the water supply derived from the three above mentioned streams corresponded very much in extent with that which Mr. Unwin considered necessary for afforestation.

The only objectionable feature in the existing gathering grounds is a road which passes from the village of Regent to the hill station and which at one part passes close to the dam of the hill station. The road cannot very well be diverted, but the side of the road nearest to the intake should be well fenced to prevent people from going down to the stream or reservoir and polluting the water. There is a separate supply for the hill station and another for the military. The latter is well guarded. The hill station supply has been unfortunate, in that two storage reservoirs have been constructed for it and both leak and are apparently useless. The size of the respective reservoirs was not the determining factor in this leakage, for that at Tower Hill is an immense reservoir compared to them.

Drainage.

Different points of view of the drainage question.

(17) The drainage of Freetown has to be considered from several points of view.

1st. There are the springs at the foot of the hills and the rainwater from the hills draining into the plains or valleys.

2nd. There is the water-logging of the soil in the town flats away from the hills.

3rd. There is the condition of the existing surface drains, including the brooks in their lower reaches where they pass through the town.

Drainage at the foot of the hills rendered difficult by springs and by surface water from the hills.

(18) Most of the rain from the hills behind Freetown discharges itself into the streams already mentioned and into some other smaller ones, but a portion flows down over the surface to the foot of the hill, and if it has not worn a channel to convey it to one of the streams, it spreads over the ground, while another portion, sinking into the laterite on the slopes above, appears near the foot of the hills as springs. Both these factors, viz., the surface water from the slopes and the underground water forming the springs at the foot of the hills, cause the wetness and marshy state which occurs during the rains in many localities near the foot of the hills in the interior curve of the horse-shoe valleys (Map II.).

A ravine on the inner curve of the horse-shoe would have prevented this marshiness.

(19) A similar condition does not occur either on the west or on the east side of the large crescent, because the drainage from the hills, both surface and underground, is cut off by the Congo River on the west and by Nicols Brook on the east. If a similar deep ravine passed along the inner curve of the western valley or horse-shoe and joined on one side the Congo and on the other George's Brook, or, if depth allowed, the Edeoroko Brook, there would be no marshiness, for the springs would be tapped and the surface water caught and conveyed away to the other two streams and thence to the sea. As it stands, however, there is no natural ravine or waterway to intercept the flow of the water, and any drains that have been constructed which run at right angles to the hills and consequently parallel with the direction of the flow of the water from the hills have had no effect in preventing the wetness and marshiness. A good deal of work has been done in this direction in some localities, but the drains do not improve matters, though they are useful in other respects. They do not prevent the spring water from oozing out of the ground sometimes into the compounds of houses and forming pools wherever it meets with depressions or excavations in the rock (Photos. III and IV). Only an intercepting drain, which shall cut off the water coming down from the hills and catch the water from the springs at the foot of the hills and convey it into the brooks on either side, will have any effect on the wetness of this portion of Freetown.

Drainage rendered difficult by water-logging of soil.

(20) The large area which is uninhabitable in the western valley, particularly between George's River and the Congo River, owes its marshiness near the foot of the hills to the springs and surface water, but the flats lower down owe their marshiness to water-logging of the soil. This water-logging is due in a measure to the underground water which, not having escaped in springs, lodges in the subsoil of these flats while passing to the Sierra Leone River, and also in a measure to the constant soakings which the flats receive during the rains from the surface water from the higher ground pouring on to this lower ground and, after percolation, not being able to escape quickly enough, so that the level of the underground water gradually rises. Wells dug in some parts of this area show the water to be close to the surface. This water-logging prevents the rain which falls on the area itself percolating through the soil and draining away, with the result that the whole of the area is marshy during the rains, but quickly dries in the dry weather. Some attempts at drainage have been made, but, like much in the town, the drainage is not kept in a good condition even if it were constructed properly, with the result that much of the water in the drains is stagnant. This will be seen from Photo. V.

Removal of the water-logging.

(21) The water-logging can be removed by, first, an intercepting drain, second, improving the stagnant drains, and, third, having at the lower part a deep intercepting drain connected with one of the streams to give sufficient outlet to drain off the subsoil water. With the removal of the water-logging the rain that falls on the area can be dealt with by ordinary surface drainage and by the natural porosity of the soil when dry.

The Condition of the Existing Surface Drains.

Recent measures.

(22) In consequence of the interest which His Excellency the Governor, Mr. Probyn, has taken in the repair of streets and the drainage question of Freetown

more has been done with regard to these within recent years than for many years past. Thus :—

1. Several streets such as Westmoreland Street and the Wharf approach have been repaired.
2. Canalization of some of the principal streams was begun by Mr. Quill when in Freetown, masonry and concrete being used, but an exceptional flood one year, which damaged bridges and carried most things before it, destroyed much of the work.
3. A surface drainage scheme of streets using egg-shaped concrete drains made in Freetown has been devised.

The outfalls have been fixed by Mr. Quill and a rough estimate made for the principal streets of £89,000. It is proposed by Mr. Copland, the Director of Public Works, to make the egg-shaped sections of the drain by pressure.

Provisional estimate of cost to reconstruct drains shows a large expenditure involved.

(23) This estimate His Excellency the Governor has pointed out to me "must be taken as indicating one point only, viz., that the cost will be large and far beyond the powers of the Colony to carry out in any one year. Mr. Copland has not yet obtained the data required to make a reliable estimate for several reasons. (*a*) the practicability of making sections by pressure is not proved and the cost not known. (*b*) there is no information to show the savings which may result from the use of traction engines for transport purposes, and (*c*) no scheme has been settled from which an idea can be formed as to what land will have to be acquired compulsorily as a big item.

A small area will be dealt with this year, and from the experience gained it may be possible to advance a stage in the calculation of the total cost."

Much preliminary work and plans still needed before any new drains should be constructed.

(24) I agree with this point of view and would go further and say that, notwithstanding the bad condition of the drains which will afterwards be referred to, the time is not yet ripe for the laying down of any new drains, except as an experiment, until careful surveys have been made and the scheme of each district is considered as a whole together with those other factors which I have pointed out as rendering parts of Freetown marshy and malarious.

There should be a complete plan of the whole drainage scheme, and the requisite surveys and contours levels should be made and ascertained before commencement, and the plan should be made after taking into consideration all the factors. Then section by section can be taken up and gradually completed, the most important being done first. To proceed on any large scale with insufficient data would probably end in the whole of the £89,000 being spent and the malarial conditions of Freetown not having been much improved, because a large portion of it would be expended in quarters where the drains are bad but the soil is porous, while the substitution of new drains in other quarters on the exact lines of the existing drains would only effect a partial removal of the unhealthy conditions. A careful survey of some of the flatter districts will probably lead to the construction of shorter drains than those now existing.

Drains should not be unnecessarily large.

(25) There is another point in laying down these drains, and it is that the drains should not be unnecessarily large. They must be large where the quantity of storm water to be conveyed is, as in some instances, great, but these should be differentiated from others where the area to be drained is small, and where the slope is good. I noticed in Westmoreland Street, for example, where experimental drains are being laid down, where the extent of the area to be drained did not appear to be large and the fall was good, that the drains appeared as if they were being laid at a depth hardly required. The depth at which they were being laid demanded a good deal of excavation, shoring up and extra labour, all of which added to the cost of laying the drain without in any way increasing its utility. Photo. VI.

Photo. VII. shows water spread over a flat-bottomed square drain, and passing through a smooth semicircular 12 in. half pipe drain and only half filling it. This fact should be borne in mind in the construction of drains, for unnecessarily large drains have no advantage over drains sufficiently large, whereas they have the disadvantage of being more expensive.

A vast improvement in the condition of existing drains could be effected with a small expenditure rightly directed.

(26) Apart from the reconstruction of drains much could be done at small expenditure in maintaining them in a better state of repair, better levels, and in a more cleanly condition.

The Government are responsible for the maintenance and repair of the drains and the Town Council for keeping them clean. The result of this dual control is that they are neither kept clean nor in a state of repair, and there is no one responsible for this condition. With a few exceptions the drains, like the roads in parts of the town, are in an uncared-for condition, and it is only owing to the porous nature of the laterite in some parts that they are there kept free of water. Roads and drains are quite dry in some parts of the town a few hours after the heaviest rainfall.

The Town Council, when formed in 1894, refused to take the roads and drains over until they were put in a proper state of repair. According to the statements of the mayor and ex-mayor it is only within the last few years that any attention has been paid to them. The neglect does not belong to to-day but to a long series of years, and the effects can only be overcome by special and continuous effort systematically organized. It is impossible for the Director of Public Works, who is responsible, single handed, for all the public works in the Colony and Protectorate, to give that personal attention to the roads and drains in Freetown that their importance demands.

His Excellency the Governor, who visited every part of the town with me, and from whom I received much local information, agrees with the view that a sanitary engineer should be added to the department, and that money should be allotted separately for (*a*) the preliminary work connected with the surface drainage reconstruction scheme and for (*b*) the maintenance of the existing drains in a better state of repair and better levels, and that a sub-department should specially attend to the latter.

The condition of the drains.

(27) It is difficult to describe the condition of the drains except that they appear to have been constructed twenty or more years ago and that little has been done to them since once constructed. They have been generally left to themselves, much like some of the houses. As already stated the natural slope of Freetown, together with its porous soil, has in many places, in spite of the absence of levels and the obstructions and the dilapidated state of the drains, counteracted the injurious effects that would otherwise arise. But in the flat and also the more crowded parts of the town, want of care and of cleansing aggravate the unhealthy conditions. In Brookfields, for instance, on that area between Edeoroke and George's brooks, where the surface is rather flat and the drains contain many pools owing to obstruction by vegetation and irregularities caused by refuse or unevenness of ground, much could be done to remove puddles of stagnant water by groups of coolies under intelligent and trained supervision, with brooms, shovels, and other appliances and by the personal attention of the Sanitary Engineer and Health Officer. The Photos. VIII to XII will show the condition of the drains in different districts.

Photo. XIII shows an over-filled rubbish bin with the refuse falling into the drain and clothes being washed lower down. Systematic cleansing of drains and streets would have prevented this state of things.

Cesspools.

3,000 *Cesspools in Freetown.*

(28) There are some 3,000 cesspools in Freetown, mostly situated at the further end of the building plot. They have at least, when in this situation, and when there is only one house on the plot, the merit of being generally 30 to 40 feet away from the dwelling-house, but when the plot has been sub-divided and there are other buildings at the back the cesspool comes into dangerous proximity with the rooms.

Situations dangerous to health.

(29) I have seen under these circumstances cesspits within a few feet of bakehouses, of stores, of kitchens, of bedrooms, and of dwelling rooms. Obviously under such conditions cesspools are dangerous to health, and it is either a case of removal of the bakehouses, stores, kitchens, bedroom, or dwelling rooms if the cesspool was originally in its proper situation, and these have encroached on it, or it is the removal of the cesspool if a suitable situation is available. No cesspool, if permitted, should be within 25 or 30 feet of any of these, and then only under certain conditions which will be mentioned later.

Even if a pail system were substituted the latrines with the pails in them should not be nearer than this minimum distance to the places mentioned.

Subdivision of building plots disorganizes all arrangements for excreta disposal.

(30) It will thus be seen that the dividing up of plots and building on them causes something more than overcrowding and difficulties in drainage and scavenging, for it renders a satisfactory arrangement for the excreta of the different households an impossibility unless a water carriage system is introduced, which for Freetown as a whole, with its scant supply of water, its financial position, its varied population, and its crowded areas, is at present quite impracticable. This is an additional reason that a law should be introduced to prevent building plots from being divided.

Retention of cesspools, introduction of pail system, or adoption of both systems.

(31) The method of disposal of excreta and sulliage water in Freetown resolves itself into either the retention of cesspools under improved conditions or the introduction of a pail system or the adoption of both systems according to circumstances.

Disadvantages of a pail system, for the whole of Freetown.

(32) The introduction of a pail system for the whole of Freetown would involve a very large expense to the householders in buying a double set of pails, in maintaining the pails, which soon get worn and out of order, in filling up the existing cesspools, and constructing proper latrines for the pails. The system would also involve a large establishment maintained by a municipal rate for the daily removal of the soiled pails from every house and the substitution of clean pails at the time of removal. This establishment would have to be maintained, because in a population such as that of Freetown, with its 40,000 inhabitants, not brought up by custom as in some places to remove its own excreta, the laying of the burden of removing the night soil from the premises upon the servants of the household, or on the children, besides being very undesirable would also turn out to be most unsatisfactory. Private pail removal from houses is seldom satisfactory or efficient. A special establishment has to be kept for the purpose. Over 250 men would have to be specially employed in removing the pails in Freetown were the pail system introduced, and these would have to be supervised by well paid and trustworthy inspectors. About one third of the pails would require to be renewed every year.

Methods which may be adopted.

(33) For the present, then, and for many years to come until there is a very abundant supply of water, the situation resolves itself into an improvement in the cesspools for the native population, the use of the pail system with dry earth for the Europeans, who are a small community, as well as for any of the better class natives who may prefer it, also the adoption of the pail system for public latrines. When Freetown has such a water supply as was once proposed by Mr. Chadwick, as it may at some future time, and when its finances have recovered from the expenditure involved and are once more in a flourishing state, then the central part of the town might easily have a water carriage system, but it would be unsuitable for the rest of the town. There are only eight public latrines in Freetown. There should be at least forty.

Methods to reduce the risk to health due to cesspools.

(34) In some respects Freetown has not the disadvantages that would accrue to other towns with a cesspool system, viz., cesspools in an earthy soil, which favours the breeding of an enormous number of flies. It has a rocky soil which is more or less porous and with the abolition of wells, which should be compulsory, the danger of a contaminated water supply is removed. The underground water is undoubtedly polluted by the cesspools, as shown by the bacteriological analysis of the King Jimmy Valley and the Bobo Combo Springs by Professor Hewlett, samples of which I had sent to him.

The report is as follows :—

DEPARTMENT OF GENERAL PATHOLOGY AND BACTERIOLOGY, KING'S COLLEGE (UNIVERSITY OF LONDON).

SIR, Strand, W.C.

I BEG to report results of bacteriological examination of two samples of water received in sealed bottles (seal unbroken) on December 10th, 1908.

I. Labelled "Specimen of water taken from the King Jimmy Valley spring, Freetown, on the 20th November, 1908. R. H. Kennan, Ag. P.M.O.

1. The number of micro-organisms developing on a gelatine plate at 20°C. averaged 300 per cubic centimetre (about 16 drops).

2. The number of micro-organisms developing on an agar plate at 37°C. averaged 20 per c.c.
3. The *Bacillus coli* was present in every cubic centimetre.
4. The *B. enteritidis sporogenes* was present in 50 c.c., but not in 30 c.c.
5. Streptococci were found to be present in 4 c.c.

II. Labelled "Specimen of water taken from Bobo Combo Spring, Freetown, on the 20th November, 1908." R. H. Kennan, Ag. P.M.O.

1. The number of micro-organisms developing on a gelatine plate at 20°C. averaged 120 per c.c.
2. The number of micro-organisms developing on an agar plate at 37°C. averaged 8 per c.c.
3. The *Bacillus coli* was present in 3 c.c., but not in 2 c.c.
4. The *Bacillus enteritidis sporogenes* was present in 60 c.c., but not in 40 c.c.
5. Streptococci were not found.

Both samples are, in my opinion, grossly polluted. I base this opinion on the abundance of *B. coli* and on the presence of *B. enteritidis sporogenes* in relatively small quantities of the water. The numbers of organisms developing on gelatine and on agar plates are, it is true, small, but this is readily accounted for by the time which has elapsed since the samples were taken. As regards *B. coli* as evidence of fæcal contamination I may quote the following :—"As regards the multiplication of *B. coli* outside the animal body, and apart from its mere persistence, it cannot be said that this does not occur. . . . Under ordinary conditions, however, such as are met with in connection with the examination of water supplies, we find no evidence of multiplication (except where fæcal matter directly gains access to water), but, on the contrary, gradual decrease and extinction."*

R. Tanner Hewlett, M.D., F.R.C.P.,
Prof. of Gen. Pathology and Bacteriology,
King's College, London.

Prof. Simpson.

It would be safer for the outlets of these springs to be piped and the water from them conveyed into the river. The risk of the cesspool, even of a good type, lies in it being too near to the dwelling-house and to its being a breeding place for mosquitoes. But these can be lessened and removed by an enactment that no cesspool shall be nearer a dwelling-house, or room, bakehouse, kitchen or other place for preparing or storing food than 25 or 30 feet, and by securing arrangements whereby every cesspool shall have poured into it at least once in ten days a mixture of kerosine and petroleum or kerosine and cyllin or other duly attested larvicide. In Port Said a staff of men visit regularly the different districts of the town and pour a certain quantity of petroleum and kerosine into the cesspools. Photo XIV. shows the kind of cart used and the men and inspectors employed.

Kind of cesspools in use.

(35) The existing cesspools may be divided into shallow and deep, in good or bad situations, and in a dry or wet condition, and with good or dilapidated latrines above them. Photos XV.—XVII.

The shallow are not more than two or three feet deep, are often unprotected from flood water, and are apt to overflow during the rains. They require to be abolished, and cesspools of sufficient depth sunk in situations where they shall conform to the regulations relating to cesspits.

Essentials in the construction of a cesspool and latrine.

(36) All cesspools should have a coping of concrete round them of at least two feet in height above the general surface of the ground to protect them from flood water, and to protect them from overflowing ; sulliage water or bath water must enter at the top of this coping, which means that the plinth of the adjoining bathroom should be also at least two feet in height. The top or mouth of the coping which would form the floor of the latrine, which would be approached by steps, should be of concrete, and the seats of the latrine should be carefully constructed over the opening of the cesspool. The latrine should be well roofed to prevent rain from falling into it or the cesspool.

Wet and dry cesspools.

(37) There are other cesspools, sometimes in good at other times in bad situations, which contain water or are comparatively dry during both the rainy season and the dry. Dr. Kennan, in an investigation into this point, has drawn a plan (No. I.) showing the localities in which the cesspools contain water and in which they are comparatively dry. I reproduce this map. The black indicates streets in which the cesspools contain water. Speaking generally, they correspond with the streets or localities that have springs in them or are waterlogged. The dry correspond with the localities where the subsoil water is much lower, in some cases at least 50 feet. There may be some which are dry because they have been sunk in rock less pervious than the generally porous laterite. Many of those that now contain water will be more or less dry when the springs are cut off and the waterlogging of the locality dealt with.

* The Bacteriological Examination of Water Supplies, p. 143 (Savage).

Disposal of slop water in the cesspool.

(38) Most of the dry and also those that contain water have had the bath water and sulliage water of the house cut off from them, and these are disposed of either on the ground of the premises or allowed to flow into the surface drains in the street. There is no advantage in this—on the other hand they create a nuisance in the street drains. These waters might as well go into the cesspool. When they are disposed of on the ground or in surface drains, all of which are more or less irregular in level, they often form little pools which are offensive and at the same time are breeding places for mosquitoes. If they enter the cesspool they do not render the receptacle a worse breeding place for mosquitoes than they are already, while at least the breeding pool is concentrated and can be dealt with more easily. It is accordingly advisable that the sulliage water and bath water should be conveyed direct into the cesspool ; storm and rain water must be rigidly excluded.

Dr. Kennan's improved type of cesspool.

(39) Dr. Kennan has recommended an improved type of cesspool with which I entirely agree except that I do not think there is any necessity for the appliance proposed to keep out mosquitoes. No appliances of this kind will be effective except, perhaps, that at the top of the proposed ventilator. A much more efficient method for destroying mosquitoes in cesspools will be an establishment to pour some kerosine into each every ten days or once a fortnight. Every householder in good circumstances can have this done himself, and it should be a punishable offence if larvæ or mosquitoes are found in the cesspool or latrine premises. It is as important as keeping the latrine in a cleanly condition. For the poorer classes the same arrangement as exists in Port Said might be adopted. The cost of remodelling or of making a cesspool according to the pattern recommended by Dr. Kennan should be paid by the owner of the house.

Method of emptying cesspools.

(40) The cesspools should be emptied when possible by a pneumatic pump into carts provided with a small furnace for burning the gases drawn off from the cesspool during the process of emptying. Dr. Kennan proposes to fix a pipe permanently in the cesspool to which the pipe of the cart could be immediately attached. This is a very essential part of the equipment of a cesspool.

Disposal of excreta, &c., contents of cesspool.

(41) There is an excellent report by Dr. Forde, the Principal Medical Officer, on the cesspools of Freetown, dated October 10th, 1908, in which it is pointed out that a special jetty erected at a suitable site in King Tom could be used for dumping the excreta or contents of the cesspool into the river, the currents carrying it out to sea.

Collection and disposal of refuse.

(42) The collection of refuse will bear much improvement but these are matters of detail for the sanitary administration. Similarly the disposal of the refuse by throwing it into the river might be abandoned, with its attendant nuisance, and incineration substituted. A good beginning in this direction is the erection of an excellent incinerator.

Conditions favouring Malaria.

Summary of malarial conditions in Freetown.

(43) Malaria Fever in Freetown is one of the chief causes of its unhealthiness, which is worse in some years than in others. Anchylostomiasis is another source of ill-health. Both of them are preventable and can be removed by the abolition of conditions favourable for breeding mosquitoes and by proper attention to the storing and disposal of excreta. I am given to understand that the scavenging of the town with its removal of disused tins, pots, bottles, &c., has much improved since Professor Ross's visit, and that canalization as represented by cutting out small channels in the bed of the brooks or in the laterite rock to drain off some of the larger pools has also been carried out. Photos XVIII and XIX show canalization in some of the brooks which in many respects has proved useful. In the meantime further canalization on a large scale may be deferred until the other causes of malaria mentioned in this report are dealt with. A gang of coolies with brooms could do much to remove most of the objectionable pools formed on each side of the brook channels. It will be seen from this report that the conditions making for malaria in

Freetown are numerous and difficult to remove, particularly those brought about by its situation at the foot of high hills and the rocky nature of its surface. They can all be removed, but this will demand the expenditure of a good deal of money on the lines drawn out in this report. The contributing causes to the formation of pools and breeding of mosquitoes in Freetown may be summarised as follows :—

(1) The marshy condition of some localities near the foot of the hills, due to springs and surface water from the hills.
(2) The marshy condition of other localities on a lower level, due to water-logging of the soil.
(3) Defective condition of surface drainage, due to want of maintenance and repair and neglect of regular and systematic cleansing and levelling, also to the long drains cut out of the rock without sufficient attention having been paid to the best available fall for them.
(4) Cesspools.
(5) Wells.
(6) Irregularity of surface in the compounds of houses.
(7) Irregularity of surface on what would otherwise be the pavements between the front of the houses and the surface drains.

Measures to be taken for removal of 1 *and* 2.

(44) The removal of 1 and 2 can be effected by locating, by borings, the springs at the base of the hill, and the construction of contour intercepting drains along the line of them to tap and convey the water into the brooks as well as the construction of one or two main drains lower down, also of an intercepting character, to drain off the water-logging now existing. Plan II.

As the arrangement of these drains will be controlled by the superficial contour and the nature of the soil, the sectional strata of the locality will require very careful examination before any attempt is made to construct such drains. But if constructed on proper lines and with reference to the volume of water to be disposed of, they will remove the main cause of the swampiness and water-logging of the flat parts of Freetown, and at the same time remove one of the principal and permanent conditions favouring the breeding of mosquitoes. The requirements to improve the drains and cesspools have already been sufficiently dwelt upon. The wells should be closed.

Methods for the removal of pools in compound or front of house caused by irregularity of ground.

(45) The irregularity of surface in the compounds and in front of the house between it and the drain is often due to the denudation of the rock of the gravel and sand upon it. This is a household matter and the householder should be held responsible to get rid of these shallow pools by sweeping them out with a broom or by filling up the depressions so as to prevent pools forming in them during the rains. Many of the people have found the remedy themselves for their own frontages by laying down ballast of gravel and sand, others by putting down earth and then making a grass plot. Facilities should be given to householders for material to be obtained for this purpose free from the Government quarry. A measure of this kind systematically carried out and maintained would abolish an enormous number of breeding places for mosquitoes at the cost of a few workmen digging out and preparing the material in the quarry, the householder providing his own means of carriage.

Sanitary Administration.

The existing sanitary administration unsatisfactory.

(47) The existing arrangements for the sanitary administration of Freetown, as will be gathered from the foregoing report, are not satisfactory and scarcely admit of improvement on the present lines.

The duties are now divided between the Government and the Town Council, which has no European upon it as a special representative of the interests of European merchants. The Mayor and the Council perform their honourable duties with assiduity, but the sanitation of Freetown is too big a problem for them unaided successfully to grapple with.

They collect assessment rates, superintend the distribution of the water supply which has been handed over to them by the Government, they deal with buildings, with conservancy, lighting of streets, and with cemeteries, and they maintain the fire brigade.

The Principal Medical Officer is Health Officer and he has a seat on the Council; under him are a number of untrained native inspectors to see:—

(*a*) That the refuse is removed and disposed of.
(*b*) That bottles and tins are removed from premises.
(*c*) That notices are served to abate nuisances.
(*d*) That the markets are kept clean.
(*e*) And that other duties of a similar nature are carried out.

The Government, as stated, are responsible for the maintenance and repair of the drains. But it will be seen that the sanitation of Freetown consists of something more than the improvement of the surface drains and attention to conservancy. It is impossible for a Town Council which has about £2,500 a year to spend on sanitation to remove the causes of ill health, even supposing it to be a competent authority.

A whole-time health officer is required and a thoroughly trained sanitary engineer.

(48) Even if the money and the knowledge were forthcoming it is impossible for a Principal Medical Officer, whose time is largely taken up with the medical administration of the colony and Protectorate, to devote the time which is requisite for the constant inspection, attention to detail, and sanitary enquiries which a town of the size of Freetown, with its peculiar conditions, requires. It is necessary to have a whole-time medical officer of health with an efficient staff under him, and it is necessary also to have a thoroughly competent and well-trained sanitary engineer. The placing of these presents difficulties under existing arrangements. I would suggest that they should be both Government Officers lent to the Sanitary Committee of the Town Council. This Sanitary Committee might be re-organized and consist of the

Principal Medical Officer as Chairman.
The Director of Public Works.
The Financial Commissioner with the Government.
A representative of the European merchants.
The Mayor, as an *ex officio* member.
Two natives, one of whom should be a merchant, and
The Medical Officer of Health.

In view of the fact of the officers being lent and paid by the Government and in view of the large expenditure likely to be incurred by Government in removing insanitary conditions which would probably be best met by an annual contribution to the funds of the Sanitary Committee, the Local Government should be in a position to exercise some control over expenditure as well as over the general lines of policy and work.

With the sanitary administration re-organized it is unnecessary for me to enter into details regarding improvements in markets or the construction of a fish market, or into the reforms needed in registration, &c. These would all naturally follow. An annual report should be submitted.

Government Improvements and Requirements.

(49) The Government of Sierra Leone has completed the following very important works during the past eight years.

1. The construction of a hill station and a railway to it.
2. The increase of the water supply.

Excellent Hill Station.

The Hill station is the best on the British Coast of West Africa and the bungalows, though of wood, are the best built, and in many respects the most comfortable. There are certain minor defects with regard to rain water pipes and surface drains but these are easily remedied. The Principal Medical Officer has called attention to them. The bungalows provide accommodation for most of the officials in Freetown. Hitherto only one mercantile firm has taken advantage of this exceptionally healthy situation to build a residence on.

Protection of boundaries.

(50) Care should be taken that the boundaries of the hill station are well defined so that they may not be encroached upon by native houses and thus defeat one of the objects for which it was built. The Congo Brook in its lower reaches would on one side form a well-marked boundary, while higher up the stream the boundary of the gathering ground would protect the station from encroachment.

Accommodation in Freetown required for certain officers.

There are certain officials who always have to reside in Freetown. These are the Senior Medical Officer, the Medical Officer, the Commissioner and Assistant Commissioner of Police, the Collector and Assistant Collector of Customs, and the Superintendent of Police, for whom accommodation has still to be provided.

Uncomfortable Public Offices.

(51) The same observation as regards comfort of the hill station bungalows does not apply to the Government Public Offices in Freetown. The benefit of the bungalows is discounted to some extent by the discomfort which has to be endured during the day in the insanitary and dilapidated Public Offices. They are the poorest on the Coast, and the worst I have seen in any of the colonies. They have formed the subject of a recent report, so I need not enter into details. The Law Courts, Secretariat, Treasury, Audit, Post Office, Savings Bank, Law Offices of the Crown, and Chief Justice Chambers are all alike in this respect. Photo. XX.

Open space proposed as site for new offices should not be encroached on.

(52) The open space near Government House has been thought to be a good site for the new Public Offices, but I think it would be exceedingly inadvisable to encroach on this open space in the centre of the town.

Situation of the offices.

(53) The Public Offices are situated in two oblong blocks enclosed within Oxford Street on the north, Westmoreland Street on the south, Gloucester Street on the east, Trelawney Street on the west. The blocks are separated by George Street. Running north and south is the Secretariat, Treasury, Audit, and Printing Departments closely adjoining one another. On the east block are the Post Office, Savings Bank, Law Offices of the Crown, Chambers of the Chief Justice and Master of the Supreme Court, and the old premises of the Public Works Department now vacated. On the same block is the Nursing Home, which is leased. In the two blocks there are a few houses, some of which are in a dilapidated state. Plan III.

Suggested site for them.

(54) If it were possible to acquire these two blocks there could be built on them suitable Public Offices, including the law courts. Good Public Offices would, I think, be an example and an incentive to the inhabitants of Freetown to put and maintain their dwelling houses and other buildings in a better state of repair.

(55) In closing this report I desire to acknowledge the courtesy and cordial assistance I received from His Excellency the Governor and from all his officers. Dr. Kennan, who was placed at my disposal by Dr. Forde, the Principal Medical Officer, rendered me most valuable service, owing to his intimate acquaintance with every detail connected with the medical and sanitary administration of Freetown. I am also much indebted to Major Pearce, R.A.M.C., the senior military medical officer, for much information and assistance and for many valuable records which, although I have not made use of them in this report, were of great service to me in forming an opinion as to the health conditions of Freetown past and present.

Daru, Kenema, and Bo.

Visit to the Interior.

(1) I visited Daru, Kenema, and Bo for the purpose of seeing some of the stations in the interior of the Protectorate. It was an interesting journey, as it gave me the opportunity of seeing the people in the Protectorate, who are of a different type from the creoles in Freetown, and who, living under their chiefs, are busy in the ordinary pursuits of country life.

Daru.

The quarters of the West African Frontier Force.

(2) Daru is near the terminus of the railway and close to the Liberian frontier. The West African Frontier Force is stationed here, close to the broad and rapid Moa River. The situation for the troops is a healthy one, and the officers' quarters are erected on a slight elevation which slopes away on three sides and is favourable to good drainage.

The bungalows of the officers are of wood, and consist of two large rooms with a high, sloping roof of corrugated iron protected from the heat by a bamboo shelter, the roof of which consists of bamboo and palm leaves, and its supporting framework of wooden posts and iron girders.

The floor of the rooms is raised on a concrete plinth and each room is 21 feet wide, well lighted and ventilated. The verandah, made of compressed mud on three sides and cement on the fourth, is 12 feet in width. The eaves of the bamboo shelter overhang the low mud walls skirting the outside edge of the verandah, but are sufficiently high not to interfere with the light and ventilation of the rooms.

It is proposed to make the four sides of the verandah of cement and to face the mud walls with cement. This will improve the bungalows, which are excellent for the purpose for which they were designed and are comfortable and cool.

This type of bungalow, but with a higher plinth, would make a very good standard plan for rest-houses.

Kenema.

Housing at Kenema.

(3) Kenema is the chief town and Government station of the district over which Dr. Maxwell is the District Commissioner. Dr. Maxwell's residence is on a hill some 700 feet above sea level, from which there is a magnificent view of the surrounding country. It reminded me of the healthy and beautiful situations selected by the German Commissioners for their residences in Togoland. The house is built of stone, very comfortable, and with a wide verandah on three sides. The water supply is brought down in pipes from a higher hill behind, and not only serves the Commissioner's and Assistant Commissioner's house, which is a little lower down and also built of stone, but it is distributed in standpipes for the benefit of the people living in the plain below. The Government employees and court messengers are housed in lines consisting of a series of huts containing three rooms. They are round and arranged in regular lines. The huts are of a healthy type. The kitchens, removed from them by a broad way, consist of a line of sheds completely open on one side. The drainage and cleanliness are looked after. The whole arrangement is exceedingly good and reflects much credit on Dr. Maxwell.

At some little distance is the town, the huts of which, on the whole, are well built. The Mendis erect their huts of wattle. The framework is then roofed with palm leaves and the walls plastered with mud. The roof of wattle and palm leaves allows a space between it and the mud wall for ventilation, and in some of the huts there is cross ventilation. The Timanis use a slighter framework of wattle and construct the walls of sun-dried bricks. The cesspools which the Mendis use are generally carefully constructed, with a raised platform over them containing a small opening communicating with the cesspit, and the whole latrine is covered by a dome-shaped or bee-hive kind of structure that is ventilated. For the country the arrangement is good, and the cesspool can always be kept free of mosquitoes and flies by the periodical use of kerosine or other larvicide.

Bo.

Housing at Bo.

(4) Bo is the chief railway centre on the line being the halting place or terminus at which the Freetown and up-country trains meet. It has large railway works and a fairly large European community. It is here also the Bo school is established for the education of sons of native chiefs and of smart boys that a chief or the people of a chiefdom may recommend. The Europeans are not housed in the same comfortable way as on the hill station at Freetown. All the bungalows at Bo except the school, the judge's and the doctor's quarters are old and dilapidated, and were erected originally at Songa, then at Rotifunk and lastly at Bo. They were brought out from England for the temporary accommodation and shelter at night of railway employees engaged on outdoor work during the period of construction, and as such have been moved from place to place as required. These temporary shelters have, however, now become the dwelling houses of

the railway staff at Bo, and of the European officials who have since been stationed there. They are in no way suitable for dwelling houses in the tropics ; they are wrong in type and in structure. The floors and back and front wall are of wood while the end walls and roofs are of corrugated iron and canvas ; recently the canvas has been replaced by boarding but with little improvement. They are low roofed, with narrow verandahs, intensely hot, badly ventilated, and exceedingly uncomfortable, and having had to be patched they are frequently not rainproof. Those who dwell in them have to put up with vast discomfort, amounting to torture at times, which bears very hardly on the nervous system, and which can scarcely be realised except by those who have experienced it. The heat is rendered even greater by some of these wood and iron houses being so placed that their rooms are flooded with the direct rays of the sun during practically the whole day. Long narrow houses should not face east and west.

The District Commissioner's house is very wisely never occupied by him. When he comes to Bo on duty he prefers to live in a native hut which has been built for him and which is cooler and more comfortable.

The doctor's house, which is built on the same plan as the others, is most trying to live in because of the intense heat. The bringing from England of unhealthy types of houses does not confine its evils to the houses imported, but these types are copied, resulting in injury to those who have to live in them.

It is to be hoped that in any new railway that may be constructed in West Africa greater attention will be paid to the type of building erected for construction purposes, for, with every allowance even as temporary structures, these are not healthy even for the railway workers. Nor are they economical in the end, for it is usually expected that the Government shall take them over and make use of them. If this is done and these unhealthy structures are assigned as dwelling houses for officials, it means a great deal more invaliding and ill health than would be the case if the officials were housed in a healthy and comfortable dwelling.

This type should be condemned as unfit for human habitation. They may be suitable enough for accommodation in temperate climates but they are quite unsuitable for the tropics.

The Railway Shimbech at Bo at the 135¼ mile stone where a number of the native employees of the railway live is a most unhealthy spot. It is an irregular collection of dark and ill ventilated huts with pools around from excavations. It is evident that no control is exercised over the place. The huts should be pulled down, a healthy site selected, and the huts built in regular lines. No excavations should be permitted.

Water supply.

(5) The water supply is a great difficulty at Bo. The Europeans suffer from scarcity in the dry season, though the rainfall is over 100 inches. The station was selected without reference to a water supply, whereas a few miles down the railway there is a river which would have given an ample supply to a small town near it. A survey of the locality is stated not to have disclosed any source from which water can be taken. There is a spring in the native town from which the natives take drinking water, but it is not available for the European quarter.

Tanks capable of holding 400 gallons have been recently sanctioned for most of the houses, but these will not meet the requirements of the case. Each house should have, as at Accra, one or more tanks of the capacity of 7,500 gallons.

The objection to collecting rain water from the corrugated iron of the existing houses is that the iron bolts joining the iron sheets are covered with white lead to prevent leaking. This white lead is apt to contaminate the drinking water. Under the circumstances it would be better to remodel the houses that are not too dilapidated, widen the verandahs, do away with the iron roofs and put on a higher roof, and one similar to those in Accra.

The Bo School.

(6) It gave me much pleasure to visit the Bo School and see the very valuable and practical kind of instruction which is being given there. The education is intended to fit the sons of chiefs and of prominent men in the Protectorate to take their proper place among their people, to enable them to communicate in English with the Commissioner without an interpreter, and to teach them agriculture and other matters useful to them in their village life. By examining a few boys in their laboratory work I found that they were able to put into practice what they knew theoretically. The school is a large

two-storeyed building with class rooms and laboratory on the top storey and a carpenter's shop and work room on the lower. There is a large playground attached.

The boys live together in a village which has been specially laid out, and which consists of round huts with a broad street between. At the top of the street and across is a very large open shed or hut where the boys hold their meetings. (Photo.)

Each hut is in a separate compound of its own, which is fenced in with a small space in front and a large garden behind. Each hut contains five or six boys and is in charge of a boy who is the chief and is called the headman. This chief is responsible for the boys behaving themselves, bathing, and keeping themselves clean. He superintends the maintenance of the fence and gardens in good order. The boys take a great interest in the work, and I was shown some of the gardens by the boys themselves, who evidently take great pride in their work. In the gardens are cassava, pine apples, sugar cane, koko yam, &c.

The water supply for the boys' village is obtained from a well, the water of which is pumped by a hand pump into a 400-gallon tank in the street supplied with taps. There is an outdoor swimming pool. The latrines are on the pail system. The only suggestion I have to make is that there should be frequent and regular inspection of the kitchen, houses, and beds to improve the standard of cleanliness, and that there should be periodical medical inspection of the boys and the school generally.

THE GOLD COAST.

It is a pleasant duty for me to record that my work on the Gold Coast, both with regard to the introduction and carrying out of plague measures and the investigation into the sanitary condition of the different towns I visited, was lightened and facilitated by the enthusiastic and strenuous assistance I received from officials and representatives of the non-official community, both European and native. I have to thank Major Bryan, the Acting Governor, and later, His Excellency Sir John Rodger, the Governor, for the great personal interest taken by them in the plague measures, the promptitude with which all the machinery of the Government was set in motion and maintained under new and trying circumstances, and for the executive authority and support which made all the difference between success and failure. The same practical interest was taken by His Excellency in the proposed measures for the improvement of the health of the towns and leading centres on the Gold Coast, and in the proposals of a special sanitary department for the colony. He gave practical effect to the former in his order published in the Gold Coast Gazette of 1908, and I found His Excellency's views very strong on the importance of a sanitary organisation for the colony, with an Inspector-General of Sanitation for the several colonies.

I hope that the following description of the unsanitary conditions of towns and villages on the Gold Coast will not be taken as a condemnation or reflection on the policy or work of officials administrative or medical, but only as a reason for the need of an organised sanitary service to remedy existing conditions and to prevent similar ones arising in future.

Accra.

Situation.

(1) Accra, the capital of the Gold Coast, has a population of 20,000 inhabitants, is situated on the coast of the Gulf of Guinea, in latitude 5·32 north and longitude 0·12 west. Behind it is a vast undulating plain covered with grass, bush, and clumps of trees which in its undulations form a succession of hills and valleys until it ends in forest land near the foot of the Akwapim range. This range, beginning in low hills about 10 miles west of Accra, extends with gaps in it in a northerly direction some 20 miles and then rising from 1,000 to 1,400 feet forms a northern boundary. The result is that the plain of Accra is nearly half enclosed by hills on the land side.

Geology.

(2) The rock of this plain nearly to the foot of the hills, according to Mr. Ferguson's geological notes, consists of "micaceous sandstone and shales dipping seawards with irregular crops running N.E. and S.W. underneath Christianborg Castle and a fine white sandstone underneath James Fort useful for dripping stones. The micaceous sandstone is not unlike the massive shales of Paleozoic formations." There are signs of the strata having in places been subjected to disturbances and to heat and pressure. Earthquakes

are not unknown in Accra. The effect of these are seen in the dislocation of the layers of the rock in the quarries. There were slight shocks in 1906, and Dr. Horton in his "Physical and Medical Climate of the West Coast of Africa" describes several during his residence in Accra before it was made the capital. He says that "in 1861, 1862, and 1863, Accra on the Gold Coast was subject to repeated shocks of earthquakes. In August, 1862, a series of shocks was felt ; the first was so severe that it destroyed the whole of the stone buildings, and fortifications of Christiansborg Castle, Dutch Accra, and James Town."

Division of the Town.

(3) The town of Accra faces the sea and comprises James Town, Ussher Town, and Houssa Town on the west, Christiansborg on the east, and Viborg in the centre.

James Town, Ussher Town, and Houssa Town are inhabited chiefly by the native population, the two former, however, having in their midst the European merchants' quarters and stores, the Government schools, the police station and jail. Viborg is the European official quarter containing the public offices and buildings and the residences of the officials. Christiansborg is a large native village which is close to Christiansborg Castle, the residence of His Excellency the Governor.

Natural advantages counteracted by its insanitary condition.

(4) Accra possesses certain natural advantages which make for health. It is well raised above the sea level. Its soil is sandy and porous, its contours are such as to be favourable to drainage, its sea breeze is generally strong during the day, it has no rice fields, its rainfall is small, amounting to only from 20 to 30 inches, its vegetation is not so abundant or so difficult to keep down as in places where the rainfall is heavy, and it has no tsetse fly. Yet its insanitary condition counteracts many of these advantages. The native housing is bad and without order, the drainage is bad and unattended to, the conservancy is bad, and the breeding places for mosquitoes are numerous and malarial fever is prevalent.

Dr. Barker's report.

(5) I shall not enter into details regarding conservancy, but append Dr. Barker's report on the sanitation of Accra. I can confirm the facts stated there, as I devoted several days carefully inspecting the town with him. Although the report was submitted to the Town Council on May 10th it was not considered until near the end of September. Photo. 1 shows the condition of a dust bin close to Salaga market, and Photo. 2 shows a dumping ground for refuse close to James Town market ; the flies used to swarm from the one to the other. They are representative of the dirty condition of the native town.

Refuse collection and disposal.

The refuse should be disposed of by burning in cheaply-constructed incinerators similar to the two in use in Cape Coast Castle built by Dr. Barker, or to the one in use at Freetown, the ashes and clinker being used for filling up excavations.

Latrines.

The deficiency in public latrines and of the pails in them are shown in Dr. Barker's report. This should be remedied at once, and in any system of remodelling the town, to which reference will be made later on, provision should not only be made for public latrines but also for private ones.

Markets.

The two markets of the town are excellent structures and well adapted for their requirements. Their surroundings however are not kept clean, and the butchers' stalls are filthy and the meat on them is covered with swarms of flies. These stalls should not be of wood but of some impermeable material easily cleansed. Probably glass set in cement would be cheapest. The table on which the meat is chopped and divided must be of wood but it can be kept clean and renewed now and again. The Accra rules are excellent and ample power is given to enforce cleanliness, but the rules are not observed.

The accommodation of the Salaga market is insufficient, as will be seen from the Photo, 3, showing the fish being sold outside the market and exposed to the direct rays of the sun and covered with flies, which is not conducive to their wholesomeness. Numerous cases of intestinal disturbances are attributed to the condition of the fish.

Some of the fish is kept in large covered calabashes, which is a very sensible way of protecting them from flies. It is very important that the conditions under which the fish and meat are sold should be regularly and carefully supervised. The supply of good fish is one of the features of the coast towns, but much of it is rendered unfit for human consumption in the markets. Fresh fish is unobtainable up country, and there the fowl, stewed and roasted, has to be supplemented by tinned foods.

The fresh meat in the markets, though perhaps a little tough, would be wholesome and nourishing if it were sold under more cleanly conditions and carefully inspected and would displace in many places with advantage the imported meat from the ships, because in all the Gold Coast towns except Sekondi this imported meat has to depend for its preservation on the ice supplied also from the ship to replenish the ice chest. The ice frequently runs short and the meat decomposes. Tainted meat and tainted fish are very common causes of dysenteric diarrhœa among Europeans on the Gold Coast.

The ice, even with the most careful attention, does not last more than a few days, and in the smaller towns such as Saltpond the ice landed with the meat at Cape Coast has not infrequently melted by the time it arrives at its destination. The difficulties connected with the supply of ice are felt in the hospitals. There is no apparatus on the Gold Coast except Sekondi for making ice, and as a consequence patients suffering from a high temperature cannot be ice-packed and the usual comforts of other tropical regions in regard to cooling drinks and the keeping of food fresh are conspicuous by their absence.

Besides no ice factories there are no good factories for making soda water or other ærated drinks such as are common in other tropical countries. The result is that everything has to be brought in from abroad at a high cost, French and German ærated waters such as Perrier, Sauerbrunnen, and Teplitz being more or less generally used.

Housing.

Housing in the Native town.

(6) The houses in the native town are generally of the most primitive type, which, in itself, need not be unhealthy, if regulated. There are no type or standard plans of healthy huts to guide the builder, and beyond a few good streets constructed after a large fire some years ago and the alignment which these streets give to the huts and houses facing them, there is no orderly arrangement. In Jamestown and Usshertown the irregularity of the huts and houses in the interior of blocks between the streets might be likened to that formed if a cart load of bricks were overturned so that each brick would be on the ground.

The general features of these blocks are :—

1. The irregularity of the huts and houses in relation to streets and to one another.
2. The erection of huts or houses close up behind those that do face a street and the narrow entrance passages.
3. The dilapidated condition of large numbers of houses. Some are too dilapidated or in too ruinous a state to be inhabited.
4. The primitive and unregulated structure of the houses or huts. Some have thatched roofs, others have corrugated iron, but so crudely fixed that they often require large stones to keep them in position. Some have good plinths of cement and concrete while others have no plinth at all. Some are constructed of stone but the majority of mud.
5. The defective ventilation of the houses by reason of their closeness together is very defective quite apart from the structural internal arrangement of the rooms of the hut or house itself, which renders them dark.
6. The insanitary condition of the open spaces. There are often large open spaces between the clusters of huts, but the advantage of these open spaces, which have sometimes been formed by the falling down of mud huts during the rains, is annulled by the close grouping of the huts in relation to one another, and the open spaces themselves, by the unevenness of the ground, become breeding places for mosquitoes. Photos. 4 to 14.

A straggling congeries of huts, houses, and shanties.

(7) With the exception of a few good streets Jamestown and Ussher Town consist of a straggling congeries of huts, houses, and shanties huddled together and of open spaces with irregular heaps or mounds in them, the remains of huts which have fallen down and the earth of which has not been cleared away. These ruins become the refuge of rats or snakes and breeding places for mosquitoes during the rain.

The huts and houses in Houssa Town, though as primitive, have generally large compounds (Photo. 15) within which are the huts of several families. The compounds separate the group of huts well from one another, allowing generally a good air space to each. The dwellings are thus less crowded together than in any other part of the town.

Crowding together of huts or houses in Accra is not brought about by any difficulties in the way of expansion. There is abundance of available land ; behind the town is a plain where for miles there are practically no inhabitants. Similarly the style, lighting, and ventilation of the huts are not because the people cannot build good houses, but because they have not been directed and supervised. The Accra people are in demand elsewhere as carpenters and house-builders, and the type of house is higher in other places than that predominant in the capital. Even if it be granted that the Accra population cannot build houses, others who can are obtainable. There are the Krobos and others not far from Accra, who are excellent hut builders and who could under direction be employed.

Demolition and clearance the only remedy for the worst areas.

(8) The photographs will convey a better notion of the insanitary condition of Accra than any description. It was recognised that under such conditions plague had an excellent opportunity of becoming endemic, and that the only safe precaution was to make a clean sweep of the worst areas. This has been done as regards a portion of Jamestown, the area having been cleared of its huts. This is to be followed by levelling and grading the ground, the construction of new streets and back lanes through the area, and its re-arrangement.

Brief description of the conditions found on inspection.

(9) The condition of Usshertown, however, is just as insanitary, as will be gathered from the subjoined notes describing three areas, and this description applies to most of the others.

" Inspected Block 6. Behind one of the houses occupied by a European firm in this block is a series of quarters occupied by the servants, which consists of a narrow passage blocked at one end, and with rooms on either side. Behind them is a higher building so that these quarters get no sufficient light or ventilation. Adjacent to this is an arched way entering into a courtyard the house of which is crowded with people, and which has an exit consisting of another arched way much like a tunnel in appearance. Behind this is the high ground overlooking the beach, and which is covered with filth of every description and down which passes the drainage from the houses. The fault lies in houses being built almost back to back, with narrow passages between them. None of them secure the advantages of pure air owing to the want of space between them and the consequent absence of ventilation. This quarter, instead of having fine houses upon it made healthy by the sea breeze and having in front of them a pleasant view of the sea, is thus spoiled and disfigured and rendered unhealthy and nauseous to the senses."

Around and abutting against the walls of the premises of another European firm in another part of the block are a number of corrugated iron roofed structures, and where these do not abut they are not more than four feet away from the walls, the intervening space being covered with filth. The ground on three sides is packed with mud huts having corrugated iron sheets as roofs, which are kept in position by stones. The irregular arrangement and close packing render it impossible to drain, cleanse, or maintain in a sanitary condition.

Inspected Block 7. " The huts are built without order, their roofs consisting chiefly of sheets of corrugated iron retained in position by large stones. The thatched roofs of the original huts were destroyed by fire and replaced in this way without the congestion and bad arrangement being altered. Clearance of the huts and remodelling on health lines are the only methods to improve this insanitary area, for its existing condition renders it impossible to secure either effective drainage or cleansing."

Inspected Block 8. " Found street to consist of a series of dilapidated huts irregularly placed, with no means of drainage and covered with pots of every description containing water, also with fish-smoking ovens, stones, and puddles."

Proposed measures for improvement.

(10) His Excellency Sir John Rodger and the Public Health Committee, formed to assist in combatting the outbreak of plague, afterwards inspected some of the insanitary areas in the town with me. As a result of that visit, it was unanimously agreed that the existing condition could not be permitted to remain, that, under the powers of " The

Infectious Diseases Ordinance, 1908," the worst houses should be demolished, which would give more breathing space for the others, and that later no building should be permitted to be erected without reference to a plan of the town. It was also agreed that a careful survey of the town should be made and a map with the details of the survey upon it prepared. The improvements necessary in that part of the town already built on, as well as the proposals for the future development of the town with regard to streets, building plots, open squares, arrangement of houses, class of buildings in certain quarters, &c., could then be marked on the map and a duplicate copy kept in the office of the Public Works Department and in the municipal office.

Executive Committee formed to demolish huts in worst insanitary areas.

(11) To deal with the more immediate and pressing insanitary conditions relating to houses, an Executive Committee was appointed by His Excellency the Governor, consisting of the Principal Medical Officer as President, the Director of Public Works, the Secretary of Native Affairs, and the Commissioner of Police. This Committee was empowered to act under the provisions of "The Infectious Diseases Ordinance, 1908."

A Committee appointed to prepare schemes for the general improvement of the town on lines laid down by His Excellency the Governor.

(12) The machinery to effect the general improvement of the town was set in motion by the issue of an Order by His Excellency the Governor, Sir John Rodger, K.C.M.G., published in an extraordinary number of the Gold Coast Gazette on July 8th, 1908.

The Order "appoints the following persons to be a Committee to advise in manner hereinafter mentioned on the improvement of the town of Accra within the limits of the municipal area :—

The Director of Public Works, or officer acting (Chairman).
The Principal Medical Officer, or officer acting.
The Director of Surveys, or officer acting.
The Medical Officer of Health for Accra for the time being.
The Secretary for Native Affairs, or officer acting, as President of the Accra Town Council.
E. V. Collins, Esq., Official Member of the Accra Town Council.
T. Hutton Mills, Esq., and A. B. Quartey-Papafio, Esq., } Unofficial Members of the Accra Town Council.
The Agent, Messrs. F. and A. Swanzy, Ltd., and The Agent, Messrs. Pickering & Berthoud, } Members of the Accra Chamber of Commerce.
And Adolphus Reinhold, Second Grade Clerk in the Native Affairs Department, to be Secretary to the said Committee.

"2. This Committee is appointed for the following objects :—

(*a*) To advise on the best means of remodelling those portions of the town which form insanitary areas owing to the crowding together of the huts and houses therein ;

(*b*) To plan out, on maps to be provided for the purpose, the improvements suggested ;

(*c*) To recommend, as far as possible, a plan for the future development of the municipal town of Accra on lines which will secure its extension and growth in accordance with a definite and improved method, so as to prevent the creation of insanitary areas ; and to suggest the procedure to carry the recommendations into effect.

"3. For these purposes the Committee should formulate and send to the Governor, or other officer for the time being administering the Government of the colony, a report embodying a scheme which should have in view, and, so far as local conditions will admit, should aim at, the following definite objects :—

(i) A better division of the town into well-defined districts, business and residential, and the prevention of the erection of unsuitable buildings therein ;

(ii) An adequate provision of roadways, streets, and back lanes, open spaces and recreation grounds, and the reservation of sites for public and municipal requirements ;

(iii) Improved and adequate drainage of the municipal area :

(iv) Efficient control over all building blocks and plots, and the limitation of the number of huts or houses per acre of plot, according to the class of building and the quarter of the town.

(v) The regulation of sites for huts or houses, having regard particularly to the position of intended buildings with reference to streets and back lanes, and to the amount of each site to be left clear of buildings ;

(vi) The prescribing of the class of building to be erected in the several districts, having regard to other buildings in the vicinity, also of the height, width, and depth of the building, the size, lighting, and ventilation of rooms, the ventilation and air spaces around the building, the best means of rendering the building damp proof and rat proof, and the minimum cubic space per occupant.

" The recommendations under heads (i), (ii), (iii) should be illustrated by maps, which will be provided for the purpose, one at least of which should be a contour map, and show existing drains and waterways and their relative position to suggested drains.

" The Committee are at liberty to make any suggestions as to the alterations in existing Ordinances or Regulations required to make their recommendations effective."

The Committee is a strong one and the objects in view are clearly defined so that in the near future it is hoped there will arise a new Accra more worthy of the capital of the Gold Coast.

The Bungalows of European Officials.

(13) The official bungalows are good and are of the type seen in Photograph 16. Each bungalow is raised on a plinth of concrete about 2 feet in height and on pillars of about 10 feet in height let into this concrete. The bungalow itself, on these pillars, is constructed of wood with a verandah, usually on three sides, nine feet in width. The usual accommodation consists of three rooms, there being a centre room with door leading into the side rooms. Each room can, however, be entered separately from the verandah, as there are doors and windows facing both front and back verandah. At opposite ends of the back verandah is the pantry and bathroom, and down from the bathroom are the stairs leading to the latrine. The rooms have wooden ceilings with a ventilator in each, and the roof is a sloping one, consisting of wood covered with felt. The space between the ceiling and the roof is ventilated by protected openings into the verandah. The width of the rooms is usually about 18 feet. The doors have moveable fanlights above them for purposes of ventilation and the verandahs are protected by a frame, the lower part of which is boarded and the upper part filled with a series of moveable chics. Above the frame is an open space, which is protected from the rain by the eaves of the roof. Behind the bungalow, at a distance of about 50 feet, are the servants' quarters, consisting of a cook-room and an adjoining room, which, of course, is insufficient if the servants reside on the premises.

This kind of bungalow is of a very good type. The position of the latrine might be improved by placing it upstairs. Bathroom and latrine might form separate rooms jutting out at the back from the end of the verandah and approached from the verandah. For married people another room is required for comfort. It would add to the comfort of the house if the front verandah was broader.

It is worth considering whether more accommodation could not be given by having a plinth some three feet in height, and two masonry rooms with hall and pantry downstairs and the accommodation now provided in wood upstairs. This would give a larger and more useful house and one which would be suitable for married people, and probably not much more expensive than the present accommodation, with its expensive iron pillars supporting the wooden bungalow. Whatever the type of house, its aspect should not be so that the front verandah faces west. Photograph 17 shows the effect of such a situation, where the sun's rays are pouring into the front verandah at 5.30 p.m., rendering it impossible to sit in it with safety or comfort until the sun is setting.

Drainage.

General outline of the drainage areas of the town.

(14) The western part of the municipal area of Accra, which includes Jamestown, Usshertown, Houssatown, and the greater portion of Victoriaborg, has three main ridges, which divide it into three drainage areas. One of these slopes directly towards the sea, in front of the town, while the other two are valleys, which drain towards the lagoon on

the west. The first valley, which is nearer the sea, is triangular in shape, and is the natural drainage area of the larger portion of the existing town. The other valley, behind it, is of a horse-shoe shape and of greater extent and width. The curve of the horse-shoe, which is on the eastern side, is formed by a tongue of land which passes between the two ridges. This saddle divides the drainage areas of the west from those of the east, which includes Christiansborg and a small portion of Victoriaborg.

For the triangular area on the west there is one main drain constructed of masonry, beginning near the Salaga market and finally discharging itself into an earthen nullah before it reaches the lagoon. Into this main drain pass subsidiary drains from certain quarters, but the greater portion of the triangular area is undrained. The horse-shoe has no system of waterways. There are a few drains on the sides of the road in that portion east of Kimbo tank or Victoria reservoir, and when they are not blocked up, which is seldom, if one may judge from their condition during the several months I was in Accra, flood water finds its way into the tank by some specially-cut channels from them. West of the tank the ground is low-lying and flat, and there are no proper drains to carry off the water.

It becomes marshy after heavy rains and receives on occasion the overflow of the tank which has been specially arranged for by a masonry channel which discharges the flood water from the tank into this low lying area. The valley in its western extremity ends in the lagoon, but recently, owing to the construction of the railway embankment across the end of this valley, the outlet to the lagoon consists of three culverts under the railway.

Absence of contour and drainage maps.

(15) There is no contour map or plan showing the waterways or natural lines of drainage in Accra, and there has been no systematic attempt to drain it of its flood water. Doubtless this has been due to the very porous nature of the soil quickly absorbing the flood water and rendering the greater part of Accra dry within a few hours of a fall of rain.

Unsatisfactory state of the waterways and storm water drains.

(16) The waterways in Accra were in a most unsatisfactory condition. The importance to health of keeping them in good condition, free of vegetation, unblocked and properly graded and levelled does not appear to have been realized. The drains were practically left to take care of themselves. The undulatory nature of most of them in large part destroyed their utility, while it at the same time favoured the formation of stagnant pools during the rains. They were either choked up at the culverts with sand or in their course with weeds, or they were so irregular in their levels or ended in blind ends without an outlet that after rains puddles were immediately formed in them which bred mosquitoes. Dr. Graham and I found larvæ of mosquitoes in some of these pools four days after they had formed. It was not until Dr. Barker was appointed special health officer for Accra that any systematic attempt was made to clear and maintain the existing waterways in an effective condition, and so much headway had to be made up that it was impossible for him with the number of coolies at his disposal to make the headway necessary to prevent the drains from becoming injurious to health. Yet the cost of such a simple measure is small if done systematically through the year. It requires, however, for efficiency, care, supervision, and regular attention.

No storm water drains in some parts.

(17) Large areas, as has been stated with reference to the lower portions of the horse-shoe valley, have no properly dug out ditches or waterways, and the flood water has to find its way to the lagoon the best way it can; most of it sinks into the ground. It is fortunate that Accra has such a porous soil and so small a rainfall, otherwise it would be much more malarious than it is at present.

Order to prepare a map and plans.

(18) As will have been noted in the order of the Governor relating to the improvement of Accra, His Excellency has asked for a contour map to be prepared, showing existing drains and waterways and their relative position to suggested drains, also for the consideration of an improved and adequate drainage for the municipal area. The drainage of the storm water in Accra has no difficult obstacles to overcome, but it is necessary before anything is done that the contour maps ordered by His Excellency should be prepared and a comprehensive scheme worked out. The method adopted of

putting down a drain here or there without reference to a system completely worked out is generally ineffective, often leading to the construction of drains which discharge on to low lying ground without any proper outfall. No drain should be laid down unless it conforms to a general plan already carefully drawn out.

Water Supply.

Existing Water Supply.

(19) The water supply of Accra is dependent on wells the water of which is more or less brackish, on several ponds, the principal of which is the Akimbo tank, and on rain water collected from the roofs in large iron or masonry tanks in the case of Europeans, and in smaller tanks and tubs in the case of natives who can afford these. The majority of the poorer people go to the wells and ponds and store the day's supply in vessels in the compound of their huts. This source of supply is poor and inadequate. The sweet water wells are mostly some distance from the town, while the ponds get dried up or become extremely low towards the end of the dry season. The Akimbo pond (Photo. 18) in February when I arrived in Accra was a muddy pool with but a foot of water in its centre. In order to fill their vessels the women had to wade through the mud and stand in the water. Some of them were suffering from guinea-worm in the feet and legs, and a continual contamination of the water was going on. The photograph was taken during the rainy season. It shows women taking water from the Akimbo reservoir. Photo. 16 shows the back of a double bungalow for Europeans, with two iron tanks which receive the rain water from the roof. One is raised on a plinth about 3 feet high and the other on pillars.

The larger tank is about 12 feet square with sloping roof covered with felt for coolness. It contains 7,500 gallons. On two sides of the roof there is a square inlet into which is fitted a basket constructed of wire netting of about an inch mesh, and below it a mosquito wire netting. There is an overflow pipe situated at the side and near the top of the tank, which is also protected by mosquito netting.

The water is drawn from the tank by a tap which is situated at the side but at its lowest point. The water is conducted into the tank by two rain water pipes which receive the rain water from the gutters of the roof. These rain water pipes discharge over the netted baskets. Pools are apt to form during the rains around the plinth of the tank because there is no surface drain to carry away the water that falls from the roof of the tank on every side ; similarly other pools may form, owing to there being no surface drain around the house.

Method to improve the quality of the water from Victoria Reservoir.

(20) Until a public water supply has been introduced the remedies can only be of a palliative character directed to the conservation of the water in the tanks, the protection of wells and ponds, and the protection and purification of the water drawn from the Akimbo tank. Measures have already been taken as regards the water in the European bungalow tanks, the keys for opening the tanks being kept by the occupier. There is an excellent suggestion of Dr. Barker's for the treatment of these pond waters. It is that porous wells should be sunk into the Akimbo and similar tanks and that a pump be fitted on to each well and the water pumped into iron tanks, erected on pillars on the bank, and if shielded Berkefeld filters were put on the taps of the tank a supply of good water would be obtained at very little expense. In order that there shall be no waste from the iron tanks, arrangements should be made by which any waste or overflow passed back into the pond.

The method suggested would introduce a great improvement to those now existing. The women and girls would no longer fill their vessels from the Akimbo tank direct but draw the water from the taps on the iron tanks after it had been filtered. There might be four large tanks, each tank having a number of taps so that several women can fill their vessels at the same time from the same iron tank. The sides of the Akimbo tank would require to be raised and fenced so as to prevent people entering the tank, and the tanks should be filled regularly every morning by a special gang under the Sanitary Engineer.

Method to prevent it breeding mosquitoes.

(21) The tanks should also be oiled once a week to prevent their breeding mosquitoes. The Akimbo tank and others of a similar kind breed anopheles, and it is important they should be treated with oil. This cannot be done with the existing system of the women drawing the water direct from the tank.

The Proposed Public Water Supply for Accra.

A difficult problem.

(22) The problem of the introduction of a public water supply into Accra has proved to be a very difficult one to settle and has been a source of anxious consideration to the Government for many years. The scanty rainfall, the reported peculiar geological formation, and the cost of any scheme that would bring water from any great distance from the interior, have contributed to the difficulties. It has been recognised that the existing arrangements are most unsatisfactory, particularly for the native population. Those for Europeans have been much improved within recent years, especially since the introduction of the large iron tanks to each bungalow, and which are capable of holding 7,500 gallons of rain water collected from the roof.

Different proposals.

(23) There have been several proposals and investigations, but none so far have been successful.

In 1887 an inspection was made of the Aburi district in search of water by Mr. Payne, but the results were considered to be unsuccessful. Later there was the Humo or Densu river scheme, but this was dropped, owing to the quality of the water. In July, 1895, Mr. Anderson, the Director of Public Works, writes to Mr. Chadwick, the Consulting Engineer, stating that "as the Humo river scheme will now have to be abandoned owing to the water being condemned by the analyst some other scheme will have to be considered." Then came up quite a number of schemes. First of all that of an impounded reservoir at the back of Victoriaborg, then artesian wells, and then the Adjamenta Valley scheme.

Much time was wasted on the artesian well scheme, the result being that there was never any attempt to make a deep artesian well, because there was never any apparatus for the making of it. One bore well of a depth of 206 feet was made near the sea and seven bore wells of 30 to 114 feet were sunk in the valley some two miles north of Accra, and because the water from there was brackish further boring was abandoned. It should be understood, however, that these were not artesian wells. Mr. Anderson, the Director of Public Works at the time, quite understood this, and advocated a deeper boring, but for some reason it was never proceeded with. Because brackish water was obtained at a depth of 200 feet, this does not necessarily imply that at a lower depth, under an impermeable stratum, or at a distance further from the coast, fresh water may not be obtained. The brackishness may be due to faults in the strata from disturbances admitting of sea water, or it may be due to the strata dipping in an inland direction from the sea for some distance while the great fresh water-bearing strata behind may dip towards the sea. The data available at present are not sufficient to form either a negative or an affirmative opinion. Until a further geological survey of Accra and its neighbourhood with sections and deep borings showing the dip, nature, and depth of the permeable and impermeable layers is made it is impossible to say definitely whether fresh water is or is not obtainable of requisite quality and in sufficient quantities for drinking purposes.

Quite apart from the scheme of water supply that may be adopted for Accra, the question is an important one for the smaller towns on the coast and further inland, and it would be an advantage to the Government from other aspects as well as that of water supply to have a small expert establishment permanently engaged on geological surveys and on diamond drill boring. There has been no real investigation into the possibilities of a supply from artesian wells on the Gold Coast. It is a geological question combined with experience in artesian boring. A geologist with Australian experience would come to this kind of work with knowledge. From a survey not of a week or two but of a sufficient length of time to enable him to prospect and locate the outcrops and their inclination he would, as has been done in Australia, be able to locate the best places for boring with the best chances of success.

The Adjamenta scheme had advanced so much by the year 1900 that in reply to the Accra Chamber of Commerce the Government stated that "all the surveys have been completed in connection with a gravitation supply from the Adjamenta Valley, Aburi, but still there are some points of importance to settle before it has definitely been decided to proceed with the whole scheme." "The quality of the water has been favourably reported upon by the analyst." Fortunately this scheme, so promising, was not hurried on with, for it was found that owing to a succession of years of small rainfall "there would have been no supply obtainable from the Adjamenta Valley from June, 1905, to June, 1907."

In 1907 the Densu or Humo river was again turned to as a source for public water supply and a scheme submitted, to cost £123,000. Subsequent investigation with reference to the construction of the dam has raised the estimate to nearly £200,000.

(24) Apart from its cost the newly proposed scheme requires careful consideration before it is adopted, because there is a serious defect in it connected with its source.

The defect of the latest proposed scheme.

The quality of the Densu river water is favourably reported on by the analyst, who says "the water is soft and contains only a small amount of dissolved mineral matter. A moderate amount of organic matter of vegetable origin is present which should be removed to provide a potable supply," and then "having regard to the nature and amount of the impurities present in the water I am of opinion that it can be treated by aeration and filtration in such a manner as to purify it so that it is suitable for drinking purposes." There can be no doubt that the analyst's conclusion that the water of the Densu river can be purified satisfactorily by aeration and filtration is correct, that is, if it were taken from the river direct as the sample analysed was taken. But in order to obtain the quantity of water necessary the Densu river is to be impounded at a spot where the configuration of the ground does not naturally lend itself to the formation of a good reservoir.

The Densu after flowing through a wide grassy plain makes its way lower down through a gap between two converging hills which constitute parts of a range which runs more or less in a continuous line.

A shallow reservoir not suitable for the tropics.

(25) The damming of the river in its narrowest part of this gap will back the water along the lower sides of the diverging hills covered with bush and forest and flood the plain. The resulting reservoir will be a shallow one approaching more or less the nature of a marsh and will alter the quality of the water. The immense perimeter of the reservoir, instead of sloping down almost at once to a minimum depth of 10 or 12 feet, the incline being about 3 feet in every foot, will slope to the extent of 6 feet in the mile if as much as that. In this extensive shallow basin, subject to fluctuation, there will exist the conditions favourable to the growth of grasses and water weeds, particularly in the tropics, and unless provided against there will be considerable risk of a large portion of the reservoir becoming choked up and differing very little from an ordinary marsh or what looks at a distance a green meadow. The quality of a water from a source of this kind becomes affected by the rank vegetation in it, by the accumulation of organic matter that follows, and by the decay of the vegetation, while it is further deteriorated by the exceptional growth and amount of algæ which these conditions foster.

Analysis of the water of an adjoining marsh.

(26) In a neighbouring marsh, the Ansaman swamp, the quality of the water on analysis was :—

	Parts per 100,000
Total solids (mineral)	37·0 (18·0)
Ammonia free	·025
Albuminoid ammonia	·156
Oxygen consumed by organic matter	1·82
Chlorine	4·2
Nitrogen as nitrates	·01
Nitrous anhydride	—

The requisites for a reservoir in the tropics.

(27) If an impounded reservoir is to be constructed it should conform at least to the ordinary requirements that will prevent a storage reservoir in the tropics becoming a marsh or a nursery for an objectionable overgrowth of vegetation.

These requirements are :—

(1) That the site which is to be flooded shall be thoroughly cleared of trees, bush, and vegetation, everything being uprooted and removed.

(2) That a layer of soil from the bottom and sides of the reservoir shall be removed.

(3) That the reservoir shall be at least 10 or 12 feet deep at its shallowest part, and that the sides of the reservoir shall descend rapidly to that depth.

The difficulties connected with the filtration of a tropical surface water are sufficiently great with a good reservoir without adding to them those which would arise from one that is shallow and marshy, and which would require constant dredging to prevent it being choked up with vegetation. To secure a good reservoir with the present site will add considerably to the cost. This, with the amount that will have to be spent on overcoming the unforeseen difficulties connected with the construction of the dam, will nearly double the estimated cost of the scheme as originally drawn out.

Cost is an important consideration as other towns also require water supplies.

(28) Whether a small town the size of Accra can afford such a scheme is for the Government to consider. There are other towns on the Gold Coast which require water schemes, and it will be impossible to spend over them similar sums of money.

Possibility of supplying other towns from the same head works should be considered.

(29) If there is no escape from a costly scheme, could it not be one that would supply more than one town? I make this suggestion, not as a counter proposal to that of the Densu, but to indicate that there are still certain aspects for the question to be looked at before finally deciding on a scheme which is admittedly bristling with difficulties. A perusal of the papers giving the history of the proposed and possible water supplies does not convey the impression that the surveys have exhausted the possible sources of supply or have contemplated the possibility of providing other towns with the same water.

Should the Densu scheme be ultimately proceeded with, very great care will have to be taken to prevent villages springing up along the route of the Accra-Mangoase Railway, which might seriously contaminate the river water and the reservoir.

A further delay in deciding on a water supply for Accra, though inconvenient and to be deplored, is still, under the circumstances, advisable. The pollutions to which the Akimbo and other tanks are at present subjected can be prevented at a comparatively small cost, and would have to be incurred while waiting for the Densu scheme even if commenced at once. A public water supply will be a means of reducing the mosquitoes in Accra, because it will be possible to get rid of the tubs and other receptacles in which water is stored for long times. In that respect alone it will be a great boon. It will also remove the risk attaching to water-borne diseases if introduced, and of intestinal affections and guinea worm, which are prevalent among the native inhabitants of Accra, caused by the water from polluted ponds and wells. It will also remove the scarcity of water towards the end of the dry season, which is a very great hardship to all classes. On the other hand, unless it is associated with an effective surface drainage scheme, it will create a new source for malarial prevalence.

A water supply, though of very great importance, will not remove the main causes of malaria in either Accra or Winneba.

(30) Moreover it must be also borne in mind what it will not do, and that is, it will not abolish malaria from Accra, which is the chief cause of Accra being unhealthy. One hundred per cent. of the children were found in one locality of Accra to be suffering from the malarial parasite, but that was due to the anopheles that were found to be breeding in the pools, puddles, and drains, and unsanitary conditions existing in and around the premises and in the locality generally.

Malarial Conditions.

Causes favouring malarial prevalence in Victoriaborg.

(31) For European officials residing in Accra the conditions which formerly favoured the production of malaria in them have been much improved since their bungalows have been erected in a quarter well away from native huts and houses. There is not now the same risk of the direct passage of infected mosquitoes from adjoining native huts into their bungalows, yet the bungalows are not altogether free of mosquitoes, both of the culex and anopheline variety. There are several causes for this. Thus, the gutters, water-tanks and pools liable to form from the overflow of the tank or from the rain coming from its roof become, on occasion, breeding places for mosquitoes; then there are sometimes pits and tins behind the kitchen which the occupier of the premises has not observed and which, owing to there being no regular sanitary inspection, are not detected and dealt with. In the towns of the Panama Canal anyone with mosquito larvæ found on his premises is fined.

Then there are the pools formed in the ditches which are not kept cleared or are choked with vegetation. There are also the excavations which have been dug for various purposes and which during the rains have become filled with water. There are also puddles from depressions in the ground concealed by the long grass that has been allowed to grow during the rains quite near to the houses. Some of the pits and excavations are small and some are large. The largest near the official quarter is the Akimbo tank or Victoria reservoir, constructed over twenty years ago to provide a public water supply to the native population. There are other large ponds close by. The mosquitoes from these sources hide themselves during the day in the darkest part of the house, the favourite place being the latrine room on the lower floor, from which they can easily enter the bungalow in the evening.

Remedy.

(32) All these breeding grounds and hiding places for mosquitos are readily and easily dealt with, but it requires a trained and qualified inspecting staff and an establishment of coolies under the Medical Officer of Health, and a small expenditure. First, the occupier of the premises should be held responsible for their cleanliness ; he should also be held responsible that no larvæ-breeding conditions or mosquito hiding places exist within his compound. This entails on him a weekly inspection of his premises to see that they are maintained in a cleanly condition, that all disused tins or bottles are buried or removed by the conservancy men, that no long grass grows in his compound, that there are no places where water can lodge for several days, that the water-tank or other receptacles used for storing water shall have a small quantity of kerosine poured into them once a week, and that the latrine, if downstairs or badly lighted, shall have its windows protected by mosquito wire netting. These and other instructions might be issued in circular form to every occupier of a house in the European quarter, with a warning as to penalties for non-compliance. It should be ascertained by periodic inspection whether the breeding places have been attended to, and if after due warning the occupier continues to neglect carrying out the requisite measures, he should be prosecuted if later on larvæ are found on the premises.

Secondly, no occupant of a house is responsible for insanitary conditions outside his compound ; that falls on the sanitary authority, whose first duty is to prevent ; but if nuisances already exist it is an equally urgent duty promptly to take measures to have them removed. All malarial conditions come under the designation of nuisances injurious to health and should as a rule be treated summarily. If larvæ are found in a compound in the European quarter it is due to want of attention to certain simple rules, while if larvæ are found in Victoriaborg it is, considering the favourable situation of the locality, due to the neglect of employing systematically simple measures for the removal or treatment of the breeding grounds and hiding places of mosquitoes.

Causes for malarial prevalence in the native town.

(33) For the native part of Accra the description of the condition of housing and the insanitary state of the surroundings fully explain the presence of mosquitoes and the prevalence of malaria. The rain tubs, the water holes and wells, the accumulation in the compound of vessels of all kinds which contain during the rains sufficient quantities of water to breed mosquitoes, the holes and pits near by which have been excavated to obtain material for the building of the houses and are afterwards used for the disposal of refuse the huddling together of the huts in a pell-mell fashion and the want of scavenging and drainage give opportunities for puddles to form containing urine and slop water which have been thrown into the compound and which are favourable to the larvæ of certain anopheles.

Where the houses are crowded together as in Accra the throwing out of urine and slops into the compound or just outside the house produces a state of things much worse than if each house had a large compound and plenty of ground to absorb what is thrown on to it.

Outside the immediate environment of the huts and houses are the open spaces, undrained and unlevelled, where mosquitoes breed. There are also the large open spaces and tracts of unoccupied land within the municipal boundary covered with rank vegetation, undergrowth, and grass, which favour the harbouring of snakes, rats, insects, and mosquitoes, and which should be all cut down and cleared away. The owners of the land should be called upon to do this and to maintain it in a sanitary condition.

The district near the lagoon in the triangular drainage area is conspicuous for the number of excavations near the houses in the low lying part of it, and for the inefficiency of its drainage, though the main masonry drain of the town passes through a part of it.

This main drain ends in a sandy nullah, the bed of which is a series of uneven levels and pits, until it reaches a culvert under the railway embankment that skirts the lagoon. Here it dips down and then proceeds towards the lagoon at a higher level. In the pools in the course of this earthen drain were many anopheline larvæ. None were found in the lagoon itself. Along the town side of the railway embankment there are excavations and depressions, and the nature of the grass and vegetation indicate flooding and marsh-land at times.

Remedy.—Good and continuous sanitary administration properly organized.

(34) The lagoon plays a very small part, if it plays any, in the causation of the malarial prevalence of the western portion of the native portion of the town. The causes are nearer and are of such a nature that with good, well-devised, and energetic sanitary administration they can be abolished, and with their disappearance malaria will vanish. In the remodelling of the town a sufficient space should not only be allotted for each building plot, but space also for the provision of latrines well away from the house. The public latrines should also be increased in number and their site carefully selected. The use of kerosine and tar in these latrines should be encouraged to prevent them being infested with flies.

Sanitary Administration in Accra.

The Town Council of Accra and its failure as a sanitary authority.

(35) The authority is vested in a Town Council partly consisting of natives and Europeans, and the President is a high European official. Under the Town Council is a trained European sanitary inspector and several native assistants none of whom are trained, also a medical officer lent to the Town Council by the Government, but as he is also in private practice or has other Government duties he has little time to devote to details connected with the public health of the town. All the members of the Town Council are busy men, and the President is probably the busiest, with the least time to devote to Town Council work. When the sanitary inspector goes to England on leave for four months after every twelve, his work is carried out by an untrained native assistant. There is a constant change of the official element, owing to their services being required elsewhere or leave being due. This applies also to the President. During the five months I was on the Gold Coast there were four different Presidents of the Town Council. It is not surprising that under these circumstances Dr. Barker, who was, on my recommendation, appointed a whole time medical officer of health, could not get his report considered and a decision come to as to its contents, and it is not surprising that Accra is in the insanitary condition described. Further it is impossible under such a system for improvements to be made or permanently maintained ; nor can any one be held responsible.

(36) Under existing arrangements the Public Health Committee of the Town Council might be reconstituted so as to consist of the following persons :—

The Principal Medical Officer, Chairman,
The Director of Public Works,
The President of the Town Council,
The President of the Accra Chamber of Commerce,
The Commissioner of Police,
Two native members of the Town Council, and
The Medical Officer of Health.

Whoever is appointed Medical Officer of Health for Accra should also be Health Officer for the district of Accra. He should hold a Diploma in Public Health as well as a Diploma in Tropical Hygiene and Medicine, and it would be advisable for him to rank as a Senior Medical Officer. When on leave his duties should be performed by a junior travelling Medical Officer of Health. On his return he should be posted to the same town and district.

An annual report on the health conditions of the town and of the work done should be submitted to the Sanitary Committee by the Health Officer, and a copy with their remarks should be sent by the Committee to both the Sanitary Commissioner and the Central Board of Health within a month of its receipt. Also a copy of all special reports of the Health Officer or of the Sanitary Committee should be sent to the Sanitary Commissioner.

(37) I desire to record my high appreciation of the assistance rendered to me while I was in Accra by the officers of the Government and by the non-official members on the Public Health Committee. I am sure that, with Dr. Langley, the Principal Medical

Officer, as Chairman of the Committee, dealing with insanitary areas, and Captain Lees, as Chairman of the Committees for the improvement of the Town of Accra, a great advance will be made in the sanitation of Accra, and the work of the proposed new Health Department, when established, much facilitated.

INVALIDING, DEATH AND SICK RATE OF EUROPEANS IN ACCRA FROM YEAR 1898 TO 1907.

Year.	Official.			Non-Official.			Sick.		Official.			Non-Official.			Remarks.
	Strength.	Invalid.	Died.	Strength.	Invalid.	Died.	Official.	Non-Official.	Invaliding Rate.	Death rate.	Sick rate.	Invaliding Rate.	Death Rate.	Sick Rate.	
1898	107	4	1	72	3	1	111	13	37·38	9·34	1,037·38	41·66	13·88	180·55	In the case of officials the sickness of those treated in hospital and in their homes is included, whereas in case of non-officials only those treated in hospital are counted.
1899	109	7	3	70	6	4	94	14	64·22	27·52	862·38	85·71	57·14	200·0	
1900	106	3	—	107	8	4	90	20	28·30	—	849·05	74·76	37·38	186·91	
1901	106	3	3	100	5	4	96	30	28·30	28·30	905·66	50·0	40·0	300·0	
1902	40	6	1	108	7	2	147	28	150·0	25·0	3,675·0	64·81	18·51	259·25	
1903	32	6	1	115	4	3	89	24	187·5	31·25	2,781·25	34·78	26·08	208·69	
1904	32	5	—	133	9	1	96	20	156·25	—	3,000·0	67·66	7·51	150·37	
1905	48	9	3	128	7	5	45	17	187·5	62·50	937·50	54·68	39·06	132·81	
1906	59	8	3	68	8	2	82	20	135·59	50·84	1,389·73	117·64	29·41	294·11	
1907	63	4	—	95	9	2	103	20	63·49	—	1,634·92	94·73	21·05	210·52	

APPENDIX TO REPORT ON ACCRA.

REPORT ON THE SANITATION OF ACCRA.

Staff.

1. This consists at present of one inspector of nuisances, one 2nd class inspector, and three assistant inspectors and ninety-one boys.

The 2nd class inspector is engaged on the fumigation of houses and the three assistant inspectors are engaged as follows :—

(*a*) Inspecting latrines and dustbins.
(*b*) Supervising the scavengers in Accra Town.
(*c*) Supervising the scavengers in Victoriaborg and Christiansborg.

The work undertaken is the sweeping of the streets and removing the contents of the dustbins and the nightsoil from the latrines.

There are also twenty-eight men engaged as follows :—

6 for fumigating and filling rat-holes.
8 for disinfecting with the hand Clayton and white-washing fumigated houses.
14 for disinfecting with big Clayton.

These I consider too many and have reduced to twenty :—

6 for rat-hole work.
6 for white-washing and small Clayton machine.
8 for the big Clayton machine.

2. I find that the streets are ill-swept, the contents of the dustbins are not removed properly, and, further, that there is no proper place for the refuse to be conveyed to, nor is any process of dealing with it undertaken ; the refuse is merely taken to various holes in the town and dumped ; these holes are :—

(*a*) Close by the Salaga Market.
(*b*) At the western end of Horse Road.
(*c*) A little to the west of the James Town Market.
(*d*) Off the Akim Road, not far from Horse Road.

I consider that (*a*), (*c*), (*d*) should be closed and at least three or four feet of earth covered over the refuse there ; until quite recently the cliff close by Mr. Cheetham's house was used as a refuse ground, the refuse being merely thrown over it.

I suggest that (*b*) is kept open until proper refuse grounds can be set apart and swish destructors built, and then closed and covered with earth; these sites, (*a*), (*b*), (*c*), (*d*), should be prohibited for building purposes for ten years and should be marked with posts and notice boards, or the fact of their being old refuse grounds will be forgotten.

I suggest that sites for refuse grounds be:—

(*a*) At the side of the lagoon, west of James Town.

(*b*) Somewhere north of Accra, beyond Nathan Road or Grandville Avenue.

The latter site may be difficult to find suitably, as building has proceeded, so that annoyance may inevitably be caused to some.

The refuse from James Town and Division No. II. will go to the Lagoon site, and that from Division III. and Victoriaborg to site (*b*).

It will, I think, be easy to find a permanent site for Christiansborg; there are at present four, if not more, of a similar character and position to those in Accra; the alternative to site (*b*) is to have more mules and carts and have site (*b*) further away; or some method of throwing or conveying the refuse out to sea; or a collecting depôt and a light railway, and run the stuff out in trucks by hand labour along the foreshore, about a mile to the westward of the town, and have a refuse ground there and destructors. Combining it with a railway has been tried at Sekondi and did not work at all well; it must be a separate system.

3. For the purposes of efficient scavenging I have divided Accra into three divisions:—

I. West.—The lagoon.
South.—The sea.
East.—Bannerman Road and northwards to Nathan Road.
North.—Nathan Road or Grandville Avenue.

II. West.—Bannerman Road and northwards to Nathan Road.
South.—The sea.
East.—A line east of Messrs. Pickering & Barthoud, along King Street, west of Salaga Market, along Ogle Street, and northwards to Nathan Road.
North.—Nathan Road.

III. West.—The above east boundary of Division II.
South.—The sea.
East.—A line west of the P. W. D. Barrack Quarters and east of the Native Club, along Pagan Road, east of the Mosque, to Nathan Road.
North.—Nathan Road and a bit beyond, as the Upper Zonga goes beyond.

Christiansborg and Victoriaborg make another division—Division IV.

I propose to detail Eight boys to Division I.
Eight „ „ II.
Eight „ „ III.

and to apportion to each boy a certain amount of work, the inspector of the division to supervise this, together with the efficient emptying of the dustbins and the removal of the nightsoil from the latrines in his division, and to do no prosecution work, but to report pools and insanitary places, perhaps.

4. I append lists of the latrines and dustbins and their condition, which must be seen to be realised.

Mosquito Breeding Areas.

5. During the house to house inspection of the town I saw a great many water barrels; not one was properly protected against mosquitoes, and larvæ were present in them all; to serve notices on the occupiers of all the houses where these barrels are, then to inspect them to see if they have been complied with, summon where not, and, moreover, to re-inspect later those premises where the barrels are removed to see if they are brought back again—this being a common method of evading the law—is an enormous work for one man, as I have found that inspectors cannot be relied upon for this work; the law should be summary, as it is in Texas and, I believe, along the Panama Canal.

Anopheles-breeding pools also exist throughout the town, some of them being big ponds, some of them having actually been dug to get earth for mending the roads, whilst one, the biggest, has been dug for a public water supply!

Notices will be served on private owners, and there should be a gang to oil and drain or fill up pools on Government or municipal lands; Akimbo tank and a smaller one to the south-east of it should be dealt with, pending the settlement of the water question, by

a pump and oiling, and it has been suggested that a porous well might be sunk in these tanks, a pump fitted to these, and the partially-filtered water thus pumped into an iron tank on the bank; this, I am certain, would be a great improvement, and if a Berkfeld attachment were put on to the tap from the tank the supply would be excellent.

The same condition of pools applies to Victoriaborg and more so to Christiansborg, where large ponds and a number of smaller pools exist; anopheles larvæ are present in them.

Government lands.

6. A gang will be employed in clearing the Government lands systematically. A list of these is required as the inspector informs me he has none, nor does he know which they are, nor does he know what the men are doing.

Drains.

7. Many of the culverts are blocked and the earth drains choked up by grass and silt. New drains are required.

As far as possible the sweeper on each street will keep the drains clear, but probably other boys will be required, and I propose to use the mosquito gang for the earth drains, which are too long for the sweepers to deal with, and to dig other drains where required.

Cleaning rods are needed for the culverts.

Unauthorised refuse grounds.

8. These exist throughout the town, around every dustbin practically, the cliff in several places, around latrines, and on waste lands.

Mules.

9. The present system of conveying the night soil and refuse by mule carts is not working satisfactorily; the mules I have seen look sick—one is so; they crawl along, and I saw one having to be hauled along by the driver; but, as a mule cart conveys considerably more than a hand-cart and requires two boys to the latter's three, if the mules can be kept in good condition it is a much better system; but it broke down quite recently, and I am informed by the inspector this has happened six times before, so that a certain number of boys and carts have to be kept to supplement them; also the refuse is not taken out of the town.

As motor traction is so much used in Accra one wonders whether it would not be a better method.

Buildings, roads.

10. I understand that a scheme for new roads and regulation of buildings is proposed—it is badly needed for James and Ussher Towns. A surveyor ought to be appointed. Hitherto, I understand, one of the assistant inspectors has been doing this work; even if capable of it he cannot properly supervise his division and do other work.

The president, the health officer, and the surveyor should, I suggest, visit each site of a projected new building together before a permit is signed, and should all sign this permit, and offenders against the building regulations be severely dealt with.

Naming of streets and numbering of the houses are urgently required.

Staff.

11. Four assistant inspectors are required for the four divisions, and as transport allowance is granted to one of these, that one should be placed in charge of Victoriaborg and Christiansborg.

At present one is employed at plague work, and a headman of scavengers has had to be placed in charge of one division; unless he proves satisfactory another assistant inspector will be required.

Personally, I would prefer a real Kroo headman as overseer to each division to an assistant inspector. As a tentative arrangement one hundred and twenty-five boys will be required, as follows :—

Division I., II., III., IV.	=	50
Refuse grounds	=	4
Mule carts	=	14
Latrine cleaners	=	6
Government lands	=	18
Plague work	=	20
Mosquito gang	=	10
Cook and two headmen	=	3
		125

I do not count the slaughter-house keeper and market sweeper or stable boys in this number.

Latrines and dustbins.

12. Night soil is to be seen about the town, principally around the latrines and dustbins. There are no latrines near Bannerman Road and Asere Street and the Hausa Quarter. The number of pans requires making up. My list is not quite complete, the latrine on the cliff near the P. W. Barrack Quarters not yet having been seen, but, of the latrines seen, their capacity is 299 and the number of pans is 172, a deficiency of 127.

The night soil is taken to the beach at five places :—

(*a*) P. W. Barrack Quarters.
(*b*) Near the slaughterhouse.
(*c*) Ussher Fort.
(*d*) Accra Town Council Offices.
(*e*) Near the harbour works.

The washing out of latrines consists in a boy washing the seats and floor and sweeping the dirty water outside on to the ground, a doubtful benefit. The plan of building is not suitable, natives at present do not use seats in the European way ; they squat, consequently the seats get fouled. The plan of long bars, one bar padlocked for removal when the pans are changed, is, I think, the best way. Partitions may be put if desired, and foot-rests for the squatting position on them, unless some form of proper squatting latrine is built ; but they would be more expensive and require a caretaker. A pattern has been described to me by Professor Simpson, which is simple, easily cleaned, and has privacy, which most of the existing ones lack—it requires a caretaker.

I would suggest that latrines be raised above the ground a little more than the height of a pan, the floor inside sloping towards a drain on the outside of the walls, which drain would end at one corner where a pan might be placed when the latrine is washed out ; if inside, a drain is used as a urinal.

It is a question which material—corrugated iron well-tarred and whitewashed or painted at intervals, or wood treated the same way—lasts longer out here.

The dustbins are crowded together in certain areas and too far apart in others ; they are badly in need of repair, fowls can get into the concrete bins at all times, goats when the door is left open, which is mostly the case ; they lack concrete platforms in front, so that holes are dug in front by the scavengers in emptying the bins.

The iron bins have been neglected, hardly a door will shut down, and if the lid is not gone altogether it is either rusted in or off its hinges.

Properly looked after, the life of an iron bin appears to be about six to eight years.

Water supply.

13. The water supply of Accra consists of rain water collected from the roofs. I have seen one ground-collecting area also, which requires seeing to ; this is stored in tanks and barrels. There are also many wells ; the water from a number of these has been examined recently and an excess of chlorides found ; this may be due to sea water or also to urine contamination, and considering that the latrine accommodation is deficient, also I have seen no evidence that urine is emptied into the latrine pans, it is probable that the bulk of this material is emptied on the ground or in the drains.

The Akimbo tank I have mentioned. The collecting area for this is not protected from contamination in the slightest.

Considering the amount of dirt which must collect on the roofs—droppings of birds, 'eaves, dust blown up—it is surprising that separators are not used to reject the first flow from a roof. I have just seen a tank with half an inch of dirt lying on the top of the mosquito gauze and a few small weeds growing in it ; in another the mosquito protection box was the site of pigeon feathers, droppings, and vegetable matter, seeds and the like.

General.

14. The sanitary staff should not have anything else to do. A separate staff should be employed for engineering work.

I do not think that the clearing of bush and refuse from Government Officials' Compounds should be done by the regular sanitary staff ; surely this should be done by the special gang employed for clearing Government lands ; the refuse should only be found in the refuse boxes which are cleared by the scavengers ; at present I find that 32 men are working at Victoriaborg :—10 scavengers, 16 prisoners, and 6 latrine men, also inspector, warders, and headmen.

The staff should be under the health officer and all communications should come direct to him.

The working hours also appear to require some consideration. I understand that on Saturdays the scavengers are supposed to work from 6 a.m. till 2 p.m., eight hours ; then from this time to 6 a.m. on Monday morning the work ceases ; hence the accumulation of refuse during this period of 34 hours is never really coped with.

In Cape Coast the boys left off at 4 p.m. on Saturdays instead of 5 p.m., and they had to sweep the streets and empty the dustbins once on Sundays and could go home when they had finished, the work was usually done by 9 a.m., and done well.

This Report has been written after a week's investigation only and so is not meant to be complete, and some of the opinions may have to be modified, but the facts are what I have seen personally.

G. Laycock Barker.

Accra,
9th May, 1908.

LATRINES.

No.	Site.	Capacity.	Pans.	Condition and Construction.
I.	Victoriaborg near Mr. Muss' Bungalow.	4	2	One pan has rim, one without, five drums outside and one bucket.
II.	Christiansborg in Angle Labadi Road and Nathan Road, M.	8	5	Dirty inside and surroundings, two broken pans outside. Requires tarring and white-washing inside, never been done, white-washing outside. Two holes in iron sides, corrugated iron, has roof, swish floor raised 3 inches to 9 inches from ground.
III.	Christiansborg close to No. II. F. divided into two	1 { 5 2 { 5	3 4	Excrement on floor inside, dirty besides, five pans outside. Dirty outside, rags, &c., corrugated iron with roof. Requires tarring and white-washing inside and out and both sides of roof. Has a swish floor raised 6 inches above ground level.
IV.	Christiansborg E. by S. of Basel Mission Cemetery.	6	5	Fairly clean inside. Requires white-washing. Corrugated iron shed, has no roof.
V.	Christiansborg on right of continuation of High Street, Eastwards. M.	10	7	Two pans outside, one useless, two in bush close by useless, fairly clean inside, rags and paper, dirty around, corrugated iron shed, no roof, requires white-washing and roof.
VI.	Christiansborg close to No. V. F.	8	6	Two pans outside, one with water, pan in bush, useless, fairly clean inside, corrugated iron shed, no roof, requires white-washing and roof.
VII.	Christiansborg near Lagoon in Angle Nathan Road and Salem Street. M. and F.	6 4	— 4	Both wooden structure, no roof, concrete floor raised about 4 inches from ground, surrounded by bush, both clean, both require white-washing, both long seat, open under with round holes cut in, two pans outside last one.

No.	Site.	Capacity.	Pans.	Condition and Construction.
VIII.	Zonga on Right Pagan Road near upper Zonga and Nathan Road. M. F.	4 6	— —	Bush all round, excrement inside, no pans ever put there, built a little over a year, wooden structure, no roof.
IX.	Kroo House Latrine A.T.C. on Akim Road, left half-way Horse Road to Nathan Road.	4	2	Corrugated iron, no roof, dirty round, also bush and pools, built in a swamp.
X.	Zonga bush N. side Horse Road W. of Akim Road about ¼-mile from Horse Road. M.	20	5	Corrugated iron shed, no roof, earth floor, requires tarring and white-washing, dirty inside and out, excrement, pools near.
XI.	Zonga Bush W. of No. X. F.	20	5	Do., do., do., condition and structure.
XII.	Back of Horse Road a little past Bannerman Road on N. side. M. and F.	22	22	This is a wooden structure with raised louvred centre piece to roof, inside has division down centre in long direction, partitioned seats arranged on each side of partition leaving narrow way along outer walls, has concrete floor, female side was provided with lids to seats, only two remain, one or two of the seats are broken, the seats are filthy with excrement and urine, no lids have been provided for the male side. Requires white-washing and tarring.
XIII.	Horse Road next to No. 14 Dustbins. F. M.	6 6	4 3	Same structure as No. 12, but with seat open underneath, two lids, loose, only on F. side, concrete floor, runnel full of urine does not drain, and is used for what it is not intended. Male side three seats broken and taken away, both sides filthy inside. Requires white-washing and tarring.
XIV.	Government off., near P. W. D. work shops. M. in two parts	3 1	2 1	Requires tarring and white-washing.
XV.	On cliff between P. W. D. and Harbour Works, Winnebah Road. M.	10	7	Wooden structure, roof covered felt. Requires tarring and white-washing, dirty inside and around, has long seat with holes in it, no partitions.
XVI.	James Town Market. M. F.	6 6	5 6	Filthy inside, requires tarring and white-washing, roof requires repairing.
XVII.	W. of Hanson Garden House F.	10	8	East one concrete floor below level of ground, corrugated iron structures both
XVIII.	F.	10	8	filthy inside and out. Excrement round East one, Western one concrete floor above ground level two or three inches, requires tarring and white-washing, no roofs.
XIX.	S. W. of Nos. XVII. and XVIII. M.	10	10	Very dirty, excrement on seat, requires tarring and white-washing. Concrete floor above ground level, has roof.
XX.	Buko Square. F. ...	5	4	Just washed out. Pools on ground outside, doubtful benefit, very dirty all round, fresh excrement on ground around. Requires tarring and white-washing.
XXI.	W. of Salaga Market ...	20	8	Excrement on ground inside, concrete floor does not reach end, requires tarring and white-washing, wood and corrugated iron structure, concrete floor.
XXII.	Post Office Yard	5 4	1 2	Corrugated iron built against wall of yard, roof corrugated iron, floors concrete, floors dirty, two pans outside ; this latrine is divided into two, requires white-washing, seats dirty, urine on them.
		1	1	For Mr. Abbot, placed in a small cabbage garden in view of houses, there is no shelter round it.
XXIII.	In Ababio Square... ...	10	1	Wood structure concrete floor raised 2 inches to 4 inches requires tarring and white-washing inside, never been done, and white-washing outside. Dirty inside, clean around, grass and bottles though.

No.	Site.	Capacity.	Pans.	Condition and Construction.
XXIV.	Kotopaka. M. F. Female side barred up. Shut for seven months.	6 6	6 —	Wooden structure, louvred roof, concrete floor with raised outside edge and runnel sloping to catchpit, but when washed dirty water runs out of door on to ground and scavenger was ladling the dirty water from the catchpit on to ground outside. Refuse ground round outside.
XXV.	Harbour Works ... ... Mechanics' Labourers. M. F.	6 6 2	5 4 2	Wood walls and roof, concrete floor raised 3 inches to 6 inches, runnel choked, wooden structure, concrete floor raised 4 inches to 6 inches, runnel choked, bush and grass around, pans and refuse, floor dirty, require white-washing inside and out, one pan outside with water, and two pans useless.
XXVI.	Salaga Market M. S. E. of Market Sheds F.	7 7	4 4	Wooden structure, louvred roof, divided down long centre by partition, male one side female the other, concrete floor raised 2 inches to 4 inches, long seats with holes, open underneath, no partitions. Male—seat broken, dirty, urine in runnel, floor dirty. Female—floor and seat dirty, urine in runnel and on ground outside pools of it.
XXVII.	Falcon Cliff, behind Meyer and Richter.	6	2	Corrugated iron structure, earthern floor very uneven, holes where pans rest, dirty in and out, on edge of cliff, refuse thrown over cliff, no seats simply bar across.
XXVIII.	Fort Usher	8	4	Alley to it used as urinal, floor below ground level, drains to outside on to cliff, drain used as urinal, filthy inside.
XXIX.	On cliff near P. W. D. Barrack Quarters.			

Dust Bins.

I.—Concrete, latch missing, not clean round, better than others. 14/3/08.

II.—Concrete, door off, not too bad around but not clean, filth behind between it and King's Warehouse. 14/3/08.

III.—Iron bin, no lid no door, dirty on top, refuse not taken away but burned *in situ*, mound of debris around. 2/5/08.

IV.—Concrete, no latch, door soon requires repairing, roof wants tarring, dirty around. 2/5/08.

V.—Concrete, no latch on door, dirty round. 2/5/08.

VI.—Concrete, no door, roof requires tarring, dirty round, slight mound of refuse round. 2/5/08.

VII.—Concrete, door off the hinges, no latch, dirty round. 4/5/08.

VIII.—Concrete, door gone, refuse and excrement round, roof requires tarring. 2/5/08.

IX.—Iron bin, has door, only half put in, hole dug in street under it, no lid, excrement and refuse round it. 2/5/08.

X.—Concrete, no door, cleanest one yet, no fault to find with scavenging here. 15/3/08.

XI.—Concrete, no door, fairly clean around, small holes round want filling, has small concrete platform in front, about 4 feet 6 inches by 9 feet, 15/3/08.

XII.—Concrete, clean around, door has no latch. 15/3/08.

XIII.—Iron bin, lid rusted up, door only half in, excrement on ground, dirty on top, filthy around. 4/5/08.

XIV.—Concrete, no latch, door open, dirty around. 4/5/08.

XV.—Concrete, not swept at all cleanly around, top of door very dirty. 15/3/08.

XVI.—Concrete, door on, no latch, sill crusted with refuse so door will hardly shut, ground dirty around, but no mound of old debris, not properly swept up. 14/3/08.

XVII.—Iron bin, has door, shut down, could not see lid, pile of refuse on top, and on ground around; Quarcoopome stated not been emptied for 4 days. 4/5/08.

XVIII.—Concrete, door gone, rubbish heap around, old debris. 14/3/08.
XIX.—Concrete, door broken, third remaining, large mound of old debris around it. 12/3/08.
XX.—Iron bin, top and bottom doors gone, fresh excrement on ground near, used as latrine, debris around, bin full and flowing over, old debris on top, crusted on. 13/3/08.
XXI.—Iron bin, dirty around, Hansen Road, lid off, door gone, excrement around, top filthy. 7/5/08.
XXII.—Iron bin, door not in, top filthy, lid rusted in, not clean round. 4/5/08.
XXIII.—Iron, mound of refuse all round, burning refuse, bin full, one hinge of lid broken, door not in slots, but on top, signs of fires all round, ashes, &c. 13/3/08.
XXIV.—Iron, one hinge of lid broken, door on top not in slots, mound of old refuse, ashes round about, bin empty, tins around. 13/3/08.
XXV.—Iron bin, lid rusted in, door only half in, refuse on ground round, bottles, tins, probably never put in, top dirty. 9/5/08.
XXVI.—Iron, lid and door all right, door not in slots, bin only half emptied, mound of old debris around, holes near are being filled with refuse, bush near has collection bottles and tins in it, old fires also burning *in situ*. 15/3/08.
XXVII.—Iron, door half in, lid off, usual mound of old refuse round.
XXVIII.—Iron bin, door there but out, lid rusted in, top dirty, usual mound of refuse round, oblong holes near filled refuse, no earth on top. 9/5/08.
XXIX.—Iron bin, door gone, lid gone, top filthy, usual mounds of debris round. 2/5/08.
XXX.—Iron bin Hospital, dirty. 1/5/08.

Summary.

Iron Bins.

Clean and tidy Nil.
Lid gone or rusted in or broken hinge 14
Door not in or gone 14

Iron bins 15.

Concrete Bins.

Clean and tidy 3.
Door gone 7.
Door wants repairing 8.

Concrete 15.

Dust Bins, Christiansborg, 7/5/08.

I.—Iron bin, usual mound of refuse.
II.—Swish with corrugated iron roof, rubble floor cemented over, small platform in front, not swept clean round.
III.—Iron bin.
IV.—Iron bin, upside down.
V.—Iron bin, door half in, no lid, top encrusted with old dirt, usual mound of refuse round.
VI.—Iron bin, door half in, no lid, filthy on top, usual mound of refuse round, excrement also.
VII.—Iron bin, door not quite shut, lid rusted in, refuse all round.
VIII.—Iron bin, door half in, no lid, dirty on top, refuse around.
IX.—Iron bin, door half in, lid broken off, top filthy, not been cleaned for ages, usual mound of refuse round.
X.—Iron bin, door almost home, lid rusted up, filthy on top, half an inch of old refuse left inside, usual mound of refuse around, excrement around.
XI.—Iron bin, door not in, lid off one hinge, not so dirty round as others but not clean.

Sekondi.

The gateway to the interior.

(1) This town, now estimated to contain nearly 10,000 inhabitants, was, ten years ago, a small village. It derives its importance from its connection by railway with Tarkwa and Kumasi. The port has thus become the gateway to the interior of the country, supplanting Cape Coast, which formerly enjoyed that position.

It is needless for me, in reporting on the different towns, etc., on the Gold Coast, to repeat my remarks about town planning and building regulations, or about systematic plans for drainage and establishments for regularly oiling pools until they are filled up and for clearing away vegetation from drains and within municipal limits, because these are required for all and must form an integral part of the reforms to be inaugurated by the proposed sanitary organisation. I shall only touch on subjects of more or less local interest and which emphasise the need of a special Health Department.

Improvements.

(2) Sekondi is a place of hills and valleys, with two lagoons and some swamps. It is well off in possessing these hills, the material of which can be so easily obtained for filling up the swamps, and it should be a routine practice carried out regularly and systematically to fill up low-lying lands and swamps with the earth from the hills. The railway premises, which form a very extensive area near the centre of the town, were formerly a swamp, which has been almost completely reclaimed and drained by the railway authorities, and the portions of the swamp which still require to be reclaimed and drained are being undertaken by the general manager, Mr. Smith, who takes an interest in sanitation. The improvements effected on the extensive premises and buildings belonging to the railway have been of very great benefit to Sekondi. Thus, recently, a large portion of the Lagoon, which formerly came up to the railway swamp, has been filled up and a storm-water drain laid through its centre. This is a great improvement, for instead of the water in the Lagoon spreading up towards the town it is confined to a circumscribed area and will finally be abolished, for it is proposed when the reclamation is finished to fill up the rest of the Lagoon in a similar manner. There will probably be difficulties with the outfall, for the reclamation has not been considered sufficiently from this point of view. This difficulty could easily have been avoided if the general reclamation and drainage had been considered as a whole so as to have secured sufficient raising and grading of the ground, from the outfall to the highland behind. Instead of this it has been done more or less on a patchwork basis, and the several parts do not fit into one another satisfactorily. The reclamation has not been completed on the two sides of the main drain, and in its present condition it is full of puddles during the rains. This is to be rectified, and in doing so I would advise that the land on each side is well raised and graded in its approach to the high land on either side, so that afterwards this reclaimed land will be efficiently drained, which will not be the case if it is a large flat surface.

Material for reclamation.

(3) The material for the reclamations has generally been taken from the adjoining hills, but some has been taken from the road going past the hospital hill and some from low ground at the side of the road, so that in the process a comparatively good road, which must have cost a fair sum of money to construct, has been spoilt and excavations made at a lower level of the road, which are on the way to form a new marsh. It is this want of system and foresight which renders sanitary work expensive, bringing it into ill repute, and which leads to results in which one insanitary condition is got rid of by creating another.

Insanitary conditions due to want of sanitary organization.

(4) Before pointing out other sanitary defects in Sekondi it is necessary to state that the conditions to be found in this new town are not due to the fault of the officers that may be there for the time being, but to a system which lacks continuity and which does not provide special officers for sanitary work, which requires designing forethought, technical knowledge, and an appreciation of the ultimate objects to be aimed at. On my first visit to Sekondi Dr. Dugong, the Medical Officer of Health, had just left, and his place taken by Dr. Lefanu. The Municipal Engineer had fallen ill, and was ordered home. The District Engineer, Mr. Barclay, performed his duties.

On my second visit, less than four months afterwards, Dr. Lefanu had been transferred to another station and Dr. Carter was acting as Medical Officer of Health. The former District Engineer had gone and another was now in charge. Under the circumstances related, which are not exceptional, it is obvious that continuity of policy must be lacking and that no real progress can be made in sanitary matters.

It will explain how it is that the jail is built practically in a swamp when there is high land on three sides, and that money has had to be spent in endeavouring to improve a site on which the prison should never have been built. It also explains why the

European central portion of the town, notwithstanding plans laid down for development by Sir Matthew Nathan, is almost hemmed in by native settlements, and that there is no satisfactory site left for expansion and development without having to pass the native towns and take up land a couple of miles away ; also that the surface drains have often not the best levels and that the laying out of the streets and the arrangement of the houses in the native settlements is for the most part unsatisfactory, notwithstanding the endeavours of Mr. Philbrick, the Provincial Commissioner, who takes a practical interest in these matters.

Except on the railway enclosures and the surroundings of European and native houses, there is an immense amount of long grass and bush in and around Sekondi, and as there has been no survey of the place and no contour map has been made, the nature of the surrounding land is but inadequately known, which necessarily handicaps any scheme of draining, town planning and development. The extensive bush inside municipal limits is also for Sekondi a danger, because it gives shelter to the tsetse fly, which is one of the biting insects that have been found in the town, and it also harbours mosquitoes. It would be an advantage if small farms were encouraged and maize or ground-nut or other crops grown which would keep the outlying parts of Sekondi free of the rank vegetation which grows everywhere at present. Citronella grass is being tried as a plantation around the medical quarters at Palimé, Togoland. Owners of vacant land within municipal limits should be compelled to keep their land free of bush, under scrub and long grass, but trees should not be cut down.

Water supply.

(5) At present the inhabitants are dependent on rainwater collected in ordinary tubs or in iron or masonry tanks which may be above or under ground, and on shallow wells constructed by sinking barrels in the sand on the beach and on four public wells 25 to 30 feet deep, which are provided with pumps and mosquito-proof netting, and are open from 6 to 10 a.m. and again from 2 to 4 p.m.

The water supply is neither ample nor good, and the substitution of a public supply from the river Anankwan, by abolishing the barrels and wells in the native town, will materially contribute to the diminution of mosquito-breeding nurseries. Care, however, must be taken so to arrange the position of the stand-posts that the waste water shall flow into the masonry surface drains.

The proposed public water supply.

(6) The river Anankwan seems to be a very suitable source for the supply of drinking water to Sekondi, and, if the necessary precautions are taken in preparing the impounding reservoir, filtration should give an excellent supply. The water of the river during the rains is muddy and discoloured, but with storage much of this can be reduced. It might be considered whether pressure filters would be less costly for such a water. They have the advantage of taking up less room and being more easily cleaned. I would advise that the water supply for Sekondi should be proceeded with as soon as possible.

Drains and pools.

(7) Except a few masonry drains the other drains and ditches suffer from want of attention ; many of them are out of level, and pools form in them in the rains. The Essekada ditch (Photo. I), which is the main drain bringing the flood water down the Essekada valley, is in some parts in excellent order, but in others it has been neglected and allowed to be covered with rank vegetation, becoming a very productive breeding place for mosquitoes, like the swamps still existing on the railway premises. The railway authorities pour kerosine once a week into the numerous pools and puddles along that part of the railway line which is near the residential quarters of their employees. Improvement in drainage will not be effected until the whole of the drainage of Sekondi is under one authority. At present it is under three, viz., the Public Works Department, the Railway Department, and the Town Council. Now that it is proposed to introduce a public water supply, a well thought out system of drainage is absolutely essential. Many pools which add to the insalubrity of the town are to be seen in Houssa town, Lagos town, and Accra town. They can be readily filled up from the hills close by. (Photo. II).

Disposal of refuse.

(8) The mode of disposal of the refuse is to be improved, and a Meldrum's incinerator has been ordered to burn the refuse, which at present has to be removed by railway trucks from the town.

Proposed site for European residences.

(9) The land to the west of the second lagoon towards Tocurady and facing the sea has been purchased by the Government for future extension of the European Settlement. It is proposed to reach it by tramway. The physical configuration of the acquired site does not as it now exists lend itself to the erection of houses.

But if material from the top of the ridge were taken and the lowlying and marshy ground between the ridge and the sea filled up, graded, and drained, then a very delightful and healthy site away from natives would be obtained. This possibly might mean that a good deal of labour would have to be employed to render the site suitable and healthy, but to use it as it now stands without preparation would be harmful in the extreme.

Cold storage provisions.

(10) Sekondi possesses an excellent refrigerating plant for cold storage which at the time of my inspection was in good working order. If the other stages relating to the supply and distribution of food-stuffs from England were as good the arrangement would be a great boon to this part of the Coast. But unfortunately they are not. The process of handling to which some of the provisions are subjected between the refrigerator on board ship and the refrigerator on shore, and again between the latter and the cold storage shed at Tarkwa in the mining district, is most unsatisfactory and is sufficient to deteriorate and spoil their quality and at times to cause illness. It is not uncommon to see the meat taken out of the refrigerator on board ship and placed on the deck, some considerable time before arrival of the steamer at its destination, and there exposed, protected only by the cloth it is wrapped in, to the tropical heat of the sun. It is then put on the boats and exposed to the sun on its passage from the ship to the shore, and when put on shore it may be left some time before being placed in the refrigerator at Sekondi. Again, in its transit from Sekondi to Tarkwa there are no special refrigerating cars on the railway, so that notwithstanding packing with ice, the meat and other provisions are subjected to varying temperatures that affect them injuriously. The meat often arrives at Tarkwa soft, however hard it may have been before, and in this condition soon decomposes if it has not done so already. In Obuassi it often arrives in a worse condition, and in both places the doctors have had to attend cases of diarrhœa and vomiting which they attributed to the eating of tainted meat.

In connection with the supply of meat to the Coast, the complaint is very general that inferior meat is not infrequently sent out. I was not able to verify this personally, but the complaint is so general a one that I think it should be mentioned. It would be more satisfactory for everyone concerned—purveyors and consumers—if provisions for the Coast, especially meat and fish, were inspected by a medical man before and after they were brought on board the vessels at Liverpool and before the ship's departure.

(11) My thanks are due to Mr. Philbrick, the Provincial Commissioner of the Western Province, to Mr. Smith, General Manager of the railway, and to Dr. Beringer, the Senior Medical Officer, for their kind assistance in facilitating my enquiries.

Tarkwa and Obuassi.

The gold-mining centres on the Sekondi Railway.

(1) Tarkwa and Obuassi are goldmining centres, through which the railway passes from Sekondi to Kumasi. They are centres for the Taquah Corporation, Abbontiakoon, Wassau and Ashanti Goldfields Companies. The hills and valleys, which are the common features of each mining centre, have been cleared for some considerable distance around, and with the clearance and greater attention to sanitation there has been a considerable improvement in the health of the European employees in the mines.

The mining camps for Europeans are located on the hills, while those for natives are situated lower down in the valleys or in rising ground in the plains.

Appreciation of the necessity of good health conditions.

(2) That the best interests of the companies are subserved by a careful consideration for the health of the employees is very fully appreciated by the mining authorities at these centres, and practical effect is being given to this view by attention to housing and by the removal of conditions likely to be injurious to health.

During the last year or two bungalows of a better type have been built for Europeans,

in which there is cross ventilation of the rooms, with window and door on opposite sides, good wide verandahs and high rooms. There are still to be seen a few of the older type, without cross ventilation, which generally means back-to-back rooms, quite unsuitable for the tropics. These, however, are being altered, and the alteration should be a radical one in order that they shall approximate to the newest type, where in every part there is plenty of light and ventilation and yet ample protection of the rooms from the direct sun's rays and from rain. Darkness anywhere in a bungalow harbours mosquitoes. The bungalows are also being arranged to accommodate fewer people. No bungalow should be built to accommodate more than four men : two would be better.

Salutary effect of clubs for the men.

(3) Efforts are also being made to render the men comfortable in other directions. There is attached to the larger mines an excellent club, where the men can meet of an evening or when off work, where they can join in a game of cards or billiards, read the papers, periodicals, or books in the library, and on occasion enjoy a concert or theatricals.

By the social life these clubs engender, the managers of the mines have found them to be a powerful factor in reducing the tendency to excessive drinking, and I have no doubt, by affording amusement and recreation to the men, they create interests which dispel the monotony that otherwise attaches to a long West African evening with nothing to do. They foster self-respect, which is a very important factor in health conditions in West Africa. With improving sanitary conditions and regular use of the mosquito net, anything which lessens the excessive drinking among miners and leads them to be more cleanly and less careless in exposing themselves during the heat of the day to a tropical sun without proper protection of the head, or at night to the risks of malarial infection in the native town, is bound to make a marked difference. The greatest amount of sickness, in some of the mines at least, is among Italians, whose careless and uncleanly habits and mode of life render them specially liable to disease. It is the experience of the medical officers attached to the mines that the steadier a man is the better health he enjoys.

Good sanitary administration will make the mining centres healthy.

(4) For a tropical region the climate in the mining centres is good, and if Europeans will only adapt their habits more to the conditions of tropical life there is every reason to believe that, with the introduction into each of further sanitary improvements both on the hills and valleys, a mosquito brigade that shall wage a sustained and continuous campaign against the conditions productive of malaria, and good sanitary administration, supervision and control, these centres will become comparatively healthy for Europeans.

An essential part of the health administration in connection with the mines is to prevent the introduction of infectious and epidemic diseases, and for that purpose a careful watch should be kept on the health of all new arrivals into the camps, native and European, and into the small native towns that spring up in the vicinity of the camps, and which owe their existence to the mines.

Coming as the natives do from all parts of West Africa, British and foreign, there is always risk of their bringing sleeping sickness, cerebro-spinal fever, yellow fever, and a severe type of malaria with them. Recently there was a risk of plague being introduced.

There should be compulsory registration of deaths. A notice was issued to that effect at Tarkwa when plague prevailed in Accra, but some of the more educated natives objected, and declared that there was no power to issue such a notice.

Obuassi—and the need for stricter supervision.

(5) The native mining camps vary much in their sanitary condition, and even the best have a tendency to deteriorate. The best laid-out camp is that at Obuassi, which was originally planned and laid out by two officers of the Ashanti Goldfields Corporation, viz., Surgeon-Major Hickson, the medical officer, and Mr. Danne, the mining engineer. The streets were made first, drains were then cut, house plots were then formed, and then houses were permitted to be built. Each building plot was 30 feet long by 30 feet deep. The house had in front a roadway 18 to 20 feet wide, and at the back a roadway 12 feet wide. While under the management of the Ashanti Goldfields Corporation these lines were followed, but later the management came into other hands, and a very marked deterioration is going on. Recently, a Sanitary Committee has been formed, but this Committee so far does not appear to

have grasped the fact that it must demolish all the irregular huts that have been allowed to be built and which have created, and are fast creating, insanitary areas, and only allow developments on lines similar to those on which Obuassi was first planned out. Water is obtained from a pipe at the upper end of the village, which brings water from one of the hills beyond. There are also numerous wells.

The town of Obuassi has suffered a good deal from many changes of medical officers. Much more control is required over this growing town than is at present exercised. In addition, some of the Government buildings need attention, particularly the rest-house and the prison.

Condition of the rest-house and prison at Obuassi.

(6) The rest-house does not face the prevailing wind, and is situated in the cutting of a hill where it can get no proper ventilation. It is a bungalow of wood with an iron roof and no ceiling in the verandah. It has not been painted for years. There is no paving of concrete round the house, no drain, and the rain water sinks into the ground under the bungalow. It is an unhealthy site and unhealthy house, and has been the cause of several people's illness who have had the temerity to live there. It should be pulled down and a good bungalow erected elsewhere on one of the hills close by.

The prison consists of some corrugated iron sheds with mud floors. They are hot and stuffy shanties, and the sanitary surroundings are on a similar standard, with water barrels full of larvæ of mosquitoes in them.

Other native camps.

(7) The native camp of the Wassau mine at Adjah Bippo is the next best laid out camp. This was planned and laid out by Dr. Davidson, the medical officer of the mine. The house plots are not so large as at Obuassi. I prefer the size of the latter. A scavenging staff is employed by the mine to attend to the cleanliness of the camp. That this staff requires constant supervision is shown by the fact that when the Principal Medical Officer made an inspection in November of 1907 he found it in a very filthy condition. The drinking water of the European camp at the Wassau mine is condensed and filtered. Since 1903, after the introduction of condensed water, there has been no dysentery among the men except what has been contracted by them in the native town. Dr. Davidson has recently been put in sanitary charge of the mining camps of the Wassau, Abosso and Taquah mines. It is an arrangement calculated to be of great advantage to their public health. The workmen on the mines pay one penny a night for their huts and for this the sanitation of the camp is looked after. A staff of this kind should always include a couple of men at least as a mosquito brigade to fill up pools, oil others, and cut down grass and undergrowth. Dr. Moir, medical officer of the Abbontiakoon mine, which adjoins that of the Taquah, also takes much interest in the sanitary condition of the camps belonging to the mine.

Neither the Taquah and Abosso nor Abbontiakoon native camp is so well laid out as the original one at Obuassi. The usual type is back to back huts separated by a narrow passage and facing fairly broad streets. It is not a good plan, as the closeness of the huts interferes with their light and ventilation. The Taquah camp is in a state of transition. Huts are to be pulled down and the back to back huts displaced by streets and huts laid out on regular lines and with bettter ventilation. The interior arrangements are also to be supervised. The latter is necessary, for there is a great tendency on the part of the native to sub-divide the hut until light and ventilation are alike excluded. Care should be taken that none of these camps in their development extend in the direction of the European traders and European quarter of the town of Tarkwa. Every projected sanitary improvement should be well considered with reference to its relationship with others so that each may fit into the other, and it would be advisable for the Sanitary Commissioner to consult with the medical officer of health for the mines, so that the several schemes of housing, water supply, drainage, &c., of the different parts of Taquah shall fall into line with one another.

There should also be periodical sanitary inspection of all the mining centres by the new Health Department of the Government, and the health officers of the mines should be given the same powers as the health officers in other towns.

The native town of Tarkwa.

(7) The native town of Tarkwa, as distinguished from the native camp belonging to the mines, is situated on an undulated ridge the lower slopes of which on one side end in

swampy ground which is made the site of some native wells and washing places. The site of the town is a badly selected one, and evidently it was not prepared before being laid out. The result is it is an exceptionally difficult one for drainage, and the drains will be very costly to maintain. Houses near the top of the ridge have been so built that the level of the ground is above them, and the flood-water runs into them during the rains. These huts should be removed. At the bottom of the hill huts are erected too near to the swamp. The huts themselves are here irregularly built and dark in the interior. Streets were laid out and building plots marked out, but the latter have not been adhered to. Refuse is dumped on the low ground instead of being burnt. The bush is too near the town, extensive clearing should be made. This should be done at once, then a survey of the town and its surroundings should be made and the contours and levels taken. Until this is done no one is in a position to consider the drainage of the marsh lands. It will probably be found best to level down the higher ground, and with the material so obtained raise and level up the marsh, leaving a central channel in it to carry away the rain water. The raising should be at least 10 feet above its present level, which would probably necessitate the removal of the line of huts nearest it. It would be advisable to stop further building on this site, and after a thorough survey to select and prepare a more suitable site, even if it is a little further removed from the European quarter of Tarkwa.

Kumasi.

Officers' quarters not hygienic nor comfortable.

(1) Great changes have been effected in the Capital of Ashanti within recent years. Extensive clearings have been made in the older town, and where thick jungle existed only a few years ago, with great benefit to the health of the place. Dr. Rutherford, the Senior Medical Officer, takes a great interest in the sanitation of this town. The sanitary condition of Kumasi and of its buildings and water supply has been the subject of a recent report by the Principal Medical Officer, and I shall therefore only touch on one or two points. The officers' quarters are a very striking contrast to those in Calabar. In the latter place they are well built, comfortable, and healthy, but at Kumasi they are most unsatisfactory and unfit as permanent quarters. Instead of being well constructed and isolated bungalows to accommodate one or two officers, they are two-storied narrow blocks of buildings with offices and mess rooms below and rooms above for officers, four being assigned to each block, and each officer having one small room partitioned off from the others. The verandah is 6 feet wide and as the roof is of shingle it is unbearably hot. The conditions under which the officers are thus living are far from healthy and put on them an unnecessary strain. From a health point of view and that of fitness for active service comfortable and hygienic housing of the officers in times of peace is essential. The opposite conditions render the officers less able to undergo and withstand the exceptional hardships which they are likely to encounter in times of unrest and expeditions. Proper accommodation should be provided as soon as possible.

Surveys, town planning, and building regulations required for Kumasi.

(2) Kumasi is likely to become a large town, being the natural market of the country north of it, and signs of activity are already to be seen in the principal street. It is accordingly most important that the town should grow on a well defined plan and to secure this I recommend what I have done for the other towns, viz.: a survey, a town plan, and the enforcement of building regulations. That these are necessary there is already ample evidence. I made an inspection behind some of the broader streets, and I observed the same filling in of the open spaces, the same irregularity, and the same progress towards the formation of insanitary areas as has occurred in other places in West Africa. This deterioration should be at once checked and as practically Kumasi has still to be built great pains should be taken that it shall be made a healthy town.

Cape Coast.

Cape Coast cleaner than formerly.

(1) Cape Coast has been in a cleaner and healthier state since 1901 when 34 Europeans died. At a time of scare Dr. Barker was appointed Medical Officer of Health for the town with no other duties. The result of that appointment was a general cleaning up and a strict control over sanitary matters. By the provision of dustbins and public latrines and a vigorous enforcement of Ordinance No. 12 of 1892, called the Criminal

Code, particularly sections 137 and 138 with their sub-sections, and Ordinance No. 13 of 1892 called the Town and Public Health Ordinance, he succeeded in stopping the practice of throwing excreta and refuse into the street, and wrought a great change in the appearance, state of cleanliness, and health of the town. The town was divided into 4 divisions with an assistant inspector in each division to control the scavengers, and over all a Chief Inspector of Nuisances to supervise the work of the assistant inspectors. The organization formed by Dr. Barker has continued its work on the whole fairly well, with the result that though Cape Coast is a larger town than Accra it is much cleaner. In Accra the same powers exist but they are not enforced with any degree of vigour. It has also fewer pools and excavations in the ground than Accra, these having been systematically filled up. It has also two beehive-shaped refuse destructors which dispose of most of the refuse and which are suitable by reason of their cheapness, easy working, and efficiency for the disposal of the refuse in new trade centres. Each incinerator consists of a beehive-shaped structure 12 feet in diameter and about the same height in the interior. It has on the top a 9 inch drain pipe which acts as a chimney and an open door facing the prevailing wind. The walls consist of clay or swish and on the outside there is a layer of burnt bricks made of swish. The fire-bars are about 2 feet from the ground and consist of steel bars. They rest and are embedded on an inner wall of swish about 2 feet high. The refuse is thrown on to the grate and once lighted it requires no other fuel to keep it burning. The ashes are raked out and used for filling up adjacent swamp land. The material, steel bars, drain pipe, and labour being cheap, the destructor, which is of a Dutch oven design, was constructed under Dr. Barker's superintendence for £10 to £15.

Water supply.

(2) The water supply of Cape Coast, like most of the other towns, is unsatisfactory. There is a small public supply derived from two large underground reservoirs which receive the rain falling on a specially paved enclosure. The reservoirs have no pumps attached, the water being drawn at certain hours by metal buckets being let down into the reservoirs, through openings which are shut by wooden covers when not in use. It is a method which is apt to contaminate the water, and should be abandoned for that which is in use at Lagos for the racecourse wells, where a double action pump worked by a wheel is found most serviceable.

Water is also obtained from Government and private wells, all more or less liable to surface pollution, and from tanks above and underground receiving rain water from the roofs of houses. Very few of these are mosquito proof.

Photo. I shows one of these underground tanks at the Fantee school, which has been recently used as an isolation hospital. The tank is a good one, but has been placed in a deep hole which is undrained, with the consequence that the excavation becomes a pool during the rains and a breeding place for mosquitoes, besides making it very inconvenient to draw off water from the tank. The only remedy now is to fill up the pit into which the tank has been placed and attach to the tank a rotatory pump. It is one of the numerous examples constantly being met with in West Africa of ingenuity in constructing things in a wrong way owing to the work being carried out by foremen who have not the technical knowledge for the work, and illustrates the necessity of having as a part of the proposed new sanitary department trained sanitary engineers.

Many years ago it was proposed to obtain a public water supply for Cape Coast from the Sweet river five or six miles distant, but like so many other sanitary improvements on the Coast the proposal occupied attention now and again for several years, certain investigations were begun, and finally the whole scheme disappeared in 1900 and was forgotten. A public water supply for Cape Coast is a question which should be again brought up, and this should be done as soon as possible, for before any scheme of bringing water from the Sweet river or other source can be formulated much prolonged and systematic investigation is required. Previous investigations give no useful information, and it is a matter of beginning afresh.

Streets and buildings.

(3) There are some fine streets in Cape Coast, and the houses of the native traders facing these streets are generally well built and far superior to those in Accra, though in some other quarters there is not much difference; but the alignment of these streets has not been strictly adhered to, and encroachments have been made. For instance, Commercial Road, the principal street in Cape Coast, is moderately wide and straight at one end, while at the other it narrows down to a lane and actually has a house built across a part of the street. Then behind the main streets the houses are irregularly

placed in relation to one another, and are crowded together and reached only by narrow passages and lanes, as shown in Photo. II. In other quarters, such as Idam, the houses consist of a mass of flat-roofed mud huts two storeys in height and separated by narrow passages. Amanful is another part of the town consisting of a conglomeration of irregular placed huts. Freetown has also a collection of very primitive huts huddled together without arrangement. Many of these have been erected within recent years. One was being newly constructed at the time of my visit, another had fallen from dilapidation. Supervision in respect to the prevention of the erection of insanitary huts is practically nil. The Housa village at Kottokrabah has been also allowed to grow up to form an insanitary area. There is evidently no restriction as to the buildings that can be put on a piece of land. Thus in Intin Street, which was evidently a street with good houses on one side which had at a former time enclosed compounds or gardens behind them opening by gateways into Intin Lane, have only a few of these gardens left, the remainder having houses built on them, leaving no good open space between the front and back houses for ventilation.

On the outskirts of the town there have been marked out some very good roadways, but there is a tendency to neglect them and allow buildings on the road line, as in Photo. III, or bush to grow up to such an extent that the roadway becomes a narrow lane. Photo. IV.

There are no maps of the town with the houses and their sites. The consequence is that under present arrangements although permits are required before building a hut or house, this is no check to them being built without.

Houses of European officials not good.

(4) The few European officials that reside in Cape Coast are very indifferently housed, with the exception of the doctor, who lives on one of the hills on which the hospital is situated. It is in the best interests of the Government that its officials, in so trying a climate as West Africa, should be comfortably housed in order that they shall enjoy better health. The quarters at the east end of the Castle are becoming unfit for human habitation, owing to want of repair and painting. The Commanding Officer's quarters in the town are unfit for habitation, and none of the officials' residences could be said to be in a proper state of repair, or satisfactory as to either seclusion or quietness. They are in the centre of the town.

Excellent school buildings, but latrines require attention.

(5) The Government schools at Cape Coast are excellent buildings, well lighted, and ventilated and healthy, and of a type adapted for the tropics. The latrine buildings are also good, but the latrines themselves are of a most primitive kind and not such as to teach the children what kind of latrine they should use later in their homes. Some galvanized iron drums or cylindrical pails, the edges of which were irregular, were found in the latrines, on which the children sat without any seat when using them. Properly-constructed latrines, adapted to the squatting position, should be in all schools. It is anomalous having sanitary primers in school and then providing the scholars with arrangements in the latrines that can never be anything but dirty and unsuitable.

Surface drainage good, but not extensive enough.

(6) The surface drainage in Cape Coast, as far as it has been constructed, is superior to that seen in other towns on the Coast. The portion finished lacks periodical flushing, which is much needed. At the highest point of one of the main drains a flushing tank has been erected, and a pipe connects this tank with the sea, but, owing to a suitable pump having still to be provided, the expenditure on flushing arrangements has not hitherto been of advantage in cleansing the drain (Photo. V). There are many roads and streets requiring surface drains.

Insufficient number of public latrines.

(7) There are 29 public latrines, of which 22 contain altogether 432 pans. The latrines are not nearly sufficient for the number supposed to use them, and their paucity is complained of by the people generally. It would be advisable to erect ten new ones as soon as possible, and gradually increase them as may be found to be necessary. Many of the old latrines require repairing and all of them need periodical disinfection and cleansing of the walls inside and outside.

Sanitary administration.

(8) Dr. Savage has been Health Officer to the Town Council for about eighteen months, and along with the Chief Superintendent of Nuisances has continued to maintain well the policy inaugurated in 1902. A whole-time health officer is, however, required in order to meet the demands of Cape Coast and of some of the neighbouring villages and small towns in the district, and any such officer should come under the control of the Sanitary Commissioner.

STATISTICAL SUMMARY OF SICK, INVALIDED, AND DEATHS, WITH TOTAL STRENGTH, AMONG EUROPEAN OFFICIALS AND NON-OFFICIALS IN CAPE COAST FOR THE PAST SEVEN YEARS.

Year.	Officials.				Non-Officials.				Remarks.
	Total Strength.	Sick.	Invalided.	Deaths.	Total Strength.	Sick.	Invalided.	Deaths.	
1901	135	30	3	16	800	—	42	18	
1902	16	34	6	4	61	—	13	7	
1903	15	24	4	1	58	—	3	6	
1904	30	38	nil	1	50	—	nil	1	
1905	13	18	1	nil	37	—	7	nil	
1906	13	11	2	nil	42	—	2	2	
1907	35	9	2	nil	52	—	4	2	
Total ...	257	164	18	22	1,100	—	71	36	

W. LE FANU,
Medical Officer.

Winneba.

Rapid development of Winneba.

(1) Winneba, a few years ago a fishing village, has rapidly developed into an export centre for cocoa. By the mercantile community it is considered to be one of the small towns that is coming to the front. It has one good street in it, on the sides of which are being erected the principal buildings. There are other streets forming. No separate European quarter has been laid out and there is every indication that unless this new town is taken in hand at once, and considerable areas of land acquired, the same crowded and unsatisfactory condition of things will be repeated as at Sekondi. A European reservation might easily be provided by taking up the whole of the land south and west of the fort and Commercial Road up to the lagoon, while the land on the north side could be laid out and arranged for a native town.

Insanitary condition of the old and new parts.

(2) The old fishing village consists of irregular clusters of huts with thatched roofs separated from one another by narrow passages. Some huts are constructed with interior compounds, others not. Those which possess compounds have often the eaves of the thatch coming down to within 5 feet of the ground, which necessitates stooping to enter the hut, and which obstructs light and ventilation. The area is dotted over with shallow wells and pools. The main drain through the fishing town is like a small shallow rivulet 15 to 20 feet wide. In the newer portions of the town there are in the compounds behind the houses large excavations containing rain water.

The insanitary condition of this town from this cause alone is most extraordinary. The whole inhabited area in some parts more than others is honeycombed with exposed wells and pools close to the houses or inside the compounds of the houses. The condition is one which is not only productive of malaria, but also of intestinal disease, and is dangerous in the event of a water-borne disease being imported. The bath room water often drains into these pools and wells used for drinking water, and as slops and filth are thrown on the ground they frequently in the rains find their way into these reservoirs of water. There are no mortality statistics in this town.

Requirements.

(3) Winneba requires the following :—

(1) A survey plan showing the existing streets and houses and contour lines.
(2) The selection of a European reservation.
(3) The division of the rest of the town into business and residential quarters.
(4) The laying out of the town into streets, house lots, and reserved open spaces, and the regulation of the buildings on the house lots so as to secure ample space.
(5) The clearing away of most of the clusters of huts in the fishing village and remodelling the areas.
(6) The supply of drinking water by stand pipes in the street from water obtained from the river Ayensa.
(7) The filling up of the wells and pools and preventing others being formed.
(8) Surface drainage of the town on a well worked out plan.

Dodowah.

Dodowah ten years ago was a small village situated at the foot of the Akwapim hills some 26 miles from Accra. It is now an important trading centre. The scenery around it is beautiful, for the slopes of the hills and a fairly wide belt at their feet are covered with the oil palm, orange, mango, and papaya trees, and under the shade of the palm tree there are numerous plantations of the cocoa tree. Into Dodowah are therefore brought for the dozen European firms stationed there enormous quantities of cocoa, palm oil, and palm kernels. Besides the houses occupied by the European firms and some of the richer natives there are clusters of native houses built without reference to order, ventilation, or drainage. The mud for building the huts is obtained from excavations made in the immediate vicinity. During the dry weather refuse is thrown into them and during the rains they are pools swarming with mosquito's larvæ. Even in European compounds these excavations are to be seen.

The European firms only lease the land, and an annual rental of £50 to £60 a year is paid for the rent of the factories. Though the native landlords gain everything in this way they do not make the roads, nor do they contribute to the maintenance of drainage or a sanitary staff. The town has so far grown in a haphazard way and it is only recently that some attempt has been made to lay down surface drains. As these have been constructed without plan or technical knowledge the money has been wasted. The photo. I shows a surface drain in a street. The drain is badly made and wider at the commencement than lower down where it receives more water ; one drain meets another at a right angle and the receiving drain is higher than the discharging drain.

I attach Dr. Swan's report on the sanitary condition of Dodowah. It is stated that the district is a healthy one. This remark applies to the district and not to the town, where all the conditions are springing up which are destructive to health.

Plans should be drawn out at once to regulate its streets and buildings and control its development, also for an efficient drainage. The excavations should be filled up and rules should be made to prevent further excavations within a mile of the outskirts, and these rules should be vigorously enforced.

Report on Sanitary Condition of Dodowah by Dr. J. H. Swan, Temporary Medical Officer.

"The condition of Dodowah from a sanitary point of view is, I might say, nil. The streets are without a proper system of drainage, consequently during the rainy season they become undermined, and in the majority of cases are more like the beds of rivers than roadways. They are in a very bad state of repair, there being no system to lay proper roadways or drainage to protect same, consequently the result after a heavy rainfall is disastrous to the streets, owing to the water flowing in different channels, and undermining the ground to different depths, which allows the water to accumulate and form cesspools throughout the town. None of the streets have proper foundations, and from my examination seem to be the original tracks made through the bush, that never have been repaired, rolled, properly levelled, or dressed with broken stone. The native houses have no systematic arrangements, and are arranged in clumps with, in a good many instances, the backs of the buildings, with those accompanying nuisances close to the street thoroughfare. I noticed each house had a wash shed made of a sort of bamboo matting at either the side or back, with a small channel leading from same, and ending in a *cul de*

sac, these containing stagnant water probably mixed with urine, and human excrement, and remaining quiescent, owing to there being insufficient outlet, drainage, or means of escape, this causing stagnation of sewage about the road or street leading from each native house, which during heavy rainfalls spread into a very large area percolating the insufficiently protected native wells, and contaminating their only means of water supply with organic matter, the non-absorbed fluid remaining as unsightly and filthy pools for the breeding of mosquitoes and the propagation of disease in general. There are several large cesspools adjacent to the town, notably one on the road to Pram-Pram, which covers a large area quite close to the public road, where filth of every description is thrown in and the effluvia emanating from the collection of putrid matter is highly noxious, pervading the atmosphere for some distance in this locality ; this, in my opinion, should be filled in, together with a similar pool situated about fifty yards from where the meat for Europeans and natives is slaughtered.

"The latrine system (if it can be called one) employed here is very dangerous to public health. There are supposed to be latrines off different points of the town, but I must say the arrangements made are very crude indeed. The one situated to the south-west side of the town is nothing more or less than a filthy heap of putrid matter, quite close to the public road, where natives urinate and defecate indiscriminately ; no trench is dug, and the approach and effluvia from this latrine baffle description.

"Coming on to the south-east portion of the township immediately behind the Post Office and Court House is another heap where all sorts of rubbish are thrown, and a few paces further along is another latrine, where there has been an attempt at digging a trench, quite insufficiently large, which from its appearance had not been systematically filled in for months. Going on to the west side of the town there are four more latrines situated in the bush ; the approaches to these were in a disgraceful condition when I inspected them. Here again the trenches were much too shallow and small, and had not been filled in for, I should say, some months.

"The meat market is held in the market place, the meat being exposed to the sun's rays during the day on filthy wooden benches, where it is sometimes difficult to distinguish the meat owing to the enormous hordes of flies and other insects. There is no inspection of meat made, and any animal can be exposed for sale independently of what it died from ; consequently, diseases are liable to propagate not only amongst the natives, but also the white population. There is no slaughter house, all the animals being killed in the open south of the Hausa village ; and quite close to the road, on the west side of this space, about fifty yards away is a cesspool, already alluded to by me. Close to where the animals are slaughtered is a trench where the offal is thrown ; this is in a very filthy condition, and is not filled in daily. I think these defects, with the market arrangements, should be remedied as soon as possible.

"The present sanitary staff is, in my opinion, quite inadequate to cope with the sanitation and cleansing of the town, there being only one Sanitary Inspector, who doesn't know his duties or hasn't sufficient experience or energy to do same. He has a staff of three scavengers, also incompetent. I would suggest a staff of two Sanitary Inspectors and from fifteen to twenty scavengers.

"There is no compulsory notification of births or deaths, or recognised burial ground ; consequently bodies are buried in different parts of the bush, the only cemetery which could be designated one being in connection with the Basel Mission Chapel, and that is practically in the bush also.

"All the European factories are kept in a clean sanitary condition. Their water supply is rain water, caught in galvanized iron tanks, which is boiled and filtered before use. The latrine system employed by them is the dry one, the pail being removed daily to different parts of the bush.

"From investigations made here I find from the District Commissioner, Mr. Shee, and the traders, that the district is a comparatively healthy one, there being very few cases of malaria or other sickness amongst the Europeans. Mosquitoes do not abound in any great numbers ; they are mostly of the culex species, although I have seen one or two specimens of the anopheles and stegomyia."

Samanyah.

Samanyah, the capital of the Krobo district, has become another recent and busy trade centre not more than three years old. The same unhealthy conditions have been brought into being here, and malaria is being fast manufactured. The people are good house builders, but houses are permitted to be erected anywhere, and swish excavations, which in the rains become breeding places for mosquitoes, are everywhere.

It is of little importance in a small village whether the houses are irregularly dotted about, but when it becomes a large village or a trading centre where people flock in from different parts of the country and where each person builds his house or hut according to his own taste and on any piece of land without order or system, then a condition arises which renders the village or trading centre unhealthy.

Odorso and Mangoasee.

Odorso and Mangoasee, new trade centres opening up on account of the new railway to be built between Accra and Mangoasee, are beginning to follow on the old lines. Fortunately there are only a few houses in each at present, and if taken in hand at once and laid out the evils that exist in Dodowah and Samanyah can be avoided.

SOUTHERN NIGERIA.

Lagos.

Situation.

(1) The town of Lagos, the capital of Southern Nigeria, is about 2 miles from the sea and is built on an island situated in a large lagoon on the coast of the Bight of Benin in lat. 6°20′N. Lon. 3°30′E. The lagoon is connected by broad inland waterways with French territory on one side and with Forcados on the other.

Bar and harbour.

(2) The entrance into the lagoon from the sea is obstructed by a bar which while deep enough for smaller vessels is too shallow for ocean steamers. Owing to the bad surf which at times prevails and the shifting nature of the sands at the mouth of the lagoon the passage over the bar is a dangerous one. It is proposed by the construction of protecting moles and by dredging to make a harbour which will remove the danger, and which will allow of ocean steamers entering the lagoon. Once this is accomplished the town of Lagos, which is already the most progressive and advanced on the coast, will rapidly advance in size and in its commerce, not only because of its extensive waterways tapping rich and fertile tracts of land, but also because of its becoming the chief port for an immense territory behind it which is now being opened up by the railway to Northern Nigeria.

Great difficulties to be overcome to make Lagos healthy owing to site.

(3) The sanitation of Lagos and of the settlements on the islands and mainland close to it is accordingly of the highest importance. The difficulties to be overcome in rendering Lagos a healthy place are much greater than those at Freetown or Accra because of the peculiar situation and configuration of the island on which it is erected. Fortunately, however, the energy and enterprise displayed at Lagos are of such a character that there is no question as regards these difficulties being successfully overcome once they are thoroughly understood and the way is shown.

From map I the exact situation of Lagos island is seen in relation to the lagoon and sea coast, as well as to the mainland and the neighbouring network of creeks with their swamps and mangroves; its connection by Carter's bridge to Iddo island and then by Denton's bridge to the settlement of Ebutte Metta on the mainland is also seen. The lagoon itself is health-giving except where it receives the sewage and refuse of the town. Its broad expanse removes to a distance mangroves and swamps, which if nearer would render Lagos more unhealthy than it is and add enormously to the expense and difficulty of converting it into a habitable and healthy place. The conservancy of the lagoon and foreshore to keep them free of sewage and refuse, and quickly to remove the vegetation which is brought down at times from the creeks is essential in order that the great lung of Lagos shall bring pure air to the town. The prevailing day wind blows over the lagoon from the sea.

Description of island.

(4) The island of Lagos is a flat and low-lying sand bank covered with alluvial sand superimposed on black peaty mud of mangrove origin. The greater part is less than 10 feet above mean sea level, much of it less than 5 feet, and only a very small area as high as 20 feet. It is in the shape of a boot not more than 4 miles long and less than 2 miles at its widest part. Its total area is 3,376 acres. It is indented on its margin by

numerous swamps. These indentations narrow down the area of dry and solid land particularly at the narrowest or toe part of the island on the west where the present town stands.

A canal excavated during the Governorship of Sir William MacGregor divides the island into two unequal parts and forms the boundary between the western, which is the smaller and occupied by the town, and the eastern, which is much larger. The area of the western is 969 acres and that of the eastern 2,407. It is only during the past year or two that there has been any tendency to extend towards the east. The canal was constructed to facilitate boat communication from one side of the island to the other, to improve the surface drainage, and to make use of the spoil earth to raise the banks and to reclaim the swamps in the immediate neighbourhood. (Photo. No. I). From a health point of view if the canal is maintained in a good condition and prevented from silting up, it is a great success. Sir William MacGregor had in view a number of canals, making Lagos a Venice in the tropics.

Two things to be kept in view in considering the health of a town.

(5) Two things or conditions must be kept separately in view in considering the health of a town ; the first is the nature of the site ; the second is the provision of means whereby the population shall live under hygienic conditions. The latter implies the supply of pure water, removal of sewage and refuse and of conditions productive of nuisances, healthy development in regard to streets, building plots, houses, and open spaces to prevent congestion of houses and overcrowding of people and to allow of the free play of light and air, and the removal of flood water, which includes good surface drainage and the metalling of roads.

Thus a town may be situated on a healthy site and yet become unhealthy because of inattention to the latter condition. In this instance the several parts of only the second condition have to be provided for improvement. But in Lagos both conditions are bad, viz., the site and the ordinary sanitation, and both therefore have to be attacked.

Great activity in improving the conditions of the site.

(6) Great activity has been displayed during the past few years in improving the natural defects of the island as a site for a healthy town. In this respect much credit is due to the Government and to the officers actively concerned in carrying out these improvements, which comprise the elimination of many foul-smelling swamps and marshes, the construction of concrete surface drains, road making, metalling of streets, and clearance of an insanitary area occupied by the Housas. The largest works in this connection are the construction of MacGregor's canal, the building of the lagoon wall, and the reclamation of swamps.

A sea wall is gradually being built around that portion of the island west of MacGregor's canal and much money has been spent in reclaiming many swamps in this part of the island.

Map marked with lines showing swamps filled up, but there is an immense amount of swamp to be reclaimed.

Plan I. shows in marked lines the swamps already filled up, estimated to cover an area of 181 acres, and in dots the area of swamp, amounting to 103 acres, still to be filled up west of the canal. This estimate of swamp to be filled up only relates to what is marked on the map and does not include the extensive swamps on the island east of MacGregor's canal or on the mainland between the island and the sea, nor does it include the swamps at Apapa where the Marine Department has been established and where many Europeans will reside, nor the swamps near the railway quarters, nor on Iddo island. Owing to the situation and nature of the locality mentioned there is no getting away from swamps and the only thing to be done is to get them properly filled up as expeditiously as possible. A much larger sum than has hitherto been annually spent should be devoted to this work.

Doubts have been expressed as to the wisdom of the policy of having the Government buildings and officials' quarters in Lagos instead of some five miles up the railway line on high and salubrious land, but the expenditure already incurred leaves no choice other than to remain. Perhaps in the course of time, when the harbour is completed and Lagos is a seaport and the whole of the foreshore is wanted for mercantile purposes, then a change of this kind might be effected. In the meantime it is an advantage to everyone from a health point of view to have the Government located where it is, because the sanitary requirements of the place are more likely to be better understood and reforms more expeditiously and efficiently carried out.

Certain conditions required to make reclaimed swamps healthy and non-malarious.

(8) Of £40,000 spent on reclamation of swamps nearly £20,000 have been expended during the last four years. The noisome vapours which were believed to cause malaria were generally got rid of by filling up the swamp, but the discovery which has shifted the cause of malaria from miasma to mosquitoes demands something more. It requires that no depressions shall occur or be allowed to remain on the reclaimed area, that the surface shall not be flat, and that the whole area shall be thoroughly drained. These requisites can only be secured by the reclaimed land being permanently well raised, and with such a slope that drainage is easy from any part and at the outlet. This involves the permanent raising of the land several feet above the highest tide levels, with a further gradual rise as the distance is increased from the lagoon.

Very few of the reclaimed swamps in Lagos conform to this standard, and hence, though a comparison of the state of things before and after the swamps were reclaimed shows a vast improvement effected by the operations and a great reduction in the evil-smelling effluvia from swamps and marshes, which by themselves were fœtid, but were made worse by what was thrown into them, and also a great reduction in the abundance of mosquitoes—all of which counts towards better health conditions, yet the improvement has often stopped short there because of insufficient raising and grading of the ground, and although the change for the better is beyond dispute it has not succeeded in producing a healthy or non-malarious area. The importance of raising and grading is often seen where there are no depressions but where the land is low compared to the neighbouring land. In the rains, water is sometimes seen to well up on the low-lying lands in the form of springs, which form channels for themselves, flowing wherever the level of the ground permits. Shallow pools and ditches containing anopheline larvæ are the result. The raising and grading of the ground would abolish these, for although there would still be an underground stream it would not be a breeding place for mosquito larvæ.

Photographs showing conditions before and after reclamation.

(9) I reproduce here a number of photographs showing the conditions existing before and after the reclamations in two districts, which will convey a better impression of improvements that are being carried out than any description. The work at Alakoro and Elegbata represents a reclamation of about 17½ acres. (Photos. 2—13.)

Defects in the reclaimed areas.

(10) The work is good as far as it goes, but in some parts the area reclaimed does not even in its present condition lend itself to sufficient drainage, and to that extent it falls short of becoming a healthy site.

Moreover allotments adjoining the reclamations have often not been filled up by the owners to the level required by the terms of their grants and some roads are at a higher level than the house lots. The result is that though the roadway appears fairly good a visit inside the house compounds shows a marshy and unhealthy condition. The present Director of Public Works fully realized the importance and danger of the conditions mentioned. In one of his reports he says :—

> "It was the practice formerly to sell all reclaimed land as soon as the filling had been done and the surface of the former swamp covered sufficiently to leave no trace of the original swamp. The important factor of shrinkage was ignored and in many parts of the town, the results of this precipitate action are evident in the swampy nature of compounds of houses built on such land. In such places the ground has settled frequently to such an extent as to prevent the proper drainage of large portions of the town and the condition of these localities is of a character to call for their condemnation as being unsuitable for human occupation. If this could be done the dwelling houses should be demolished and the area refilled.
>
> "The worst cases are those where former swamp areas have been sold under Swamp Allotments and occupation has taken place before the filling was completed. It is however not unlikely that many occupants have not completed their titles and that the land is liable, in consequence, to confiscation. Whatever hardship this may impose on the individual the course would be justified in the interests of health and sanitation."

The remedy he suggests is the only one that can be adopted with any advantage and the more so, as will be shown later on, as the streets, lanes, and houses that have been allowed to spring up on them constitute unhealthy areas quite apart from the unhealthiness of the site.

Further I found in a number of instances that the compounds of the houses were being raised by the deposit of garbage and refuse from the streets instead of clean sand. (Photo. XIV.) Some of the refuse that was supposed to be taken into the middle of the Lagoon and dumped into the water was finding its way instead into the compounds and

was being used in the manner described. Practices of this kind can only lead to a very unhealthy state of things. They should be stopped by the enforcement of strict regulations and by regular inspection.

Reclamation better and more cheaply effected by the employment of dredgers and pumps.

(11) The reclamation of the swamps in Lagos and in the vicinity of the lagoon could be much more expeditiously and economically effected by the use of dredgers with appliances to pump the sand into the swamps to be filled up. In view therefore of the importance and extent of this work, the quicker, more profitable, and superior method should be adopted. Dredgers for this special purpose should be placed under the control of the New Health department and should not be permitted to be employed for other purposes.

Unhealthy sites produced by artificial excavations.

(12) Unhealthiness of site is produced in other ways than those described. Photo. XV shows the unhealthy situation of the new quarters for some of the European employees on the railway which are close to low-lying ground and to several ponds. The pond in front is one of a number of clay pits which were formerly excavated for material to make bricks. This is an example of the numerous instances where unhealthy conditions have been produced by want of forethought. First the excavations are made to supply bricks, then houses are built near these excavations, then it is recognised that the ponds are a nuisance and dangerous to health, and lastly a large expenditure has to be faced to fill up excavations which should never have been made in that situation. It is here that the value of an expert sanitary administration comes in to prevent such mistakes and such waste of money.

Unhealthy Conditions at Apapa.

(13) At Apapa where the Marine Department has been established there are artificially-made and natural swamps. Buoy beach is a low lying piece of land practically under water in the rains. It was formed by excavating the land on this side and taking the sand over to Lagos to fill up Kimberley swamp. Another swamp begins at the drain on the lagoon beach on the south side of Apapa dockyard and running westerly turns in a horse-shoe-shaped form to Ebute Metta creek, and again in the opposite direction to Badagry creek. Within the first horse-shoe the houses of the European officers and men of the marine are being erected. The mechanics' bungalow is less than 100 yards from the swamp on the south side, the senior marine and engineer offices are only about 20 yards from the swamp, the workshops are less. There is a small temporary bungalow of iron on concrete occupied by a European ; the roof is very low and the eaves of the palm thatch roof to keep off the heat come too far down on each side. The result is want of free circulation of air. The hut itself is badly ventilated and swarms at night with mosquitoes. In the bungalows there is no damp-proof course in the walls, no concrete or laterite paving round the house, and no surface drain to carry away the surface water. There is thick bush behind the houses which should be cleared away for at least 400 yards. A dredger daily at work on these swamps would get rid of them in a comparatively short time, and this should be done before any more houses are built in this unhealthy situation. It is a much easier, cheaper, and more healthy proceeding to prepare the land first and build afterwards than *vice versâ*.

Remarks on European houses for officials.

(14) There are in Lagos a number of comfortable houses for European officials, but others are not of a type most suitable for good ventilation, coolness, and protection from rain, which are very important factors in the comfort of a house in the tropics. In order that the types may be improved the following comments may be useful. The width of the verandah has a very important bearing on the comfort of the house in the tropics and should be broad, at least on one side of the house. A width of 6 or 8 feet is quite inadequate for the purpose either of protection from the sun or from the rain. Double these widths are required. Low-roofed verandahs of not more than 7 or 8 feet high are also a mistake. They are hot and do not afford the same protection from the sun's rays as those which are high and protected by screens. High ceilings for rooms and verandahs are essential for coolness. The verandah, though high, should be well protected against the direct rays of the sun. A portion of the verandah converted into a mosquito-protected room adds much to the comfort and healthiness of the house without interfering with its ventilation and coolness. A good damp-proof course is also necessary for the walls of the houses as well as for the foundations. A paving around the house 10 or 12 feet in width

in which there is a surface drain to carry away the rain water secures the immediate surroundings of the house from dampness and puddles.

Mr. Bellamy, the Director of Public Works, and Mr. Cummins, the Architect, have shown a great interest in designing bungalows and houses for the tropics, and I have had the advantage of consulting with them on the subject, also of being furnished with many of their plans and designs, which are excellent if the points I have mentioned are embodied in them.

No dwelling or building intended for human habitation should be erected until the site and plans receive the sanction of the Health Department.

The sanitary requirements of Lagos and its settlements apart from site.

(15) Having dealt with the unhealthiness of the Lagos site and that of its vicinity and the kind and method of reclamation required to render them healthy, I shall now turn to the sanitary problems of Lagos as a town, which are distinct from the site question. I shall not enter into details, for these must be left for the future sanitary administration, but there are six important things required for Lagos, viz. :—

(1) Clearance of its congested and unhealthy areas, raising and grading the ground where required, and rebuilding on sanitary lines.
(2) A Building Act.
(3) A public water supply.
(4) A system of sewerage and safe disposal of the sewage.
(5) A systematised plan for surface drainage, with arrangements for flushing.
(6) Destructors for the incineration of refuse.

Many congested and insanitary areas in Lagos.

(16) Lagos is well laid out in its European and Brazilian quarters, and in a few of the parts occupied by the better class natives, but the remainder, with the exception of a few good streets here and there, is very much congested and in many parts consists of a conglomeration of huts and houses and a labyrinth of narrow lanes.

The area between Carter's bridge and Ashogbon Lane, the Marina and Ashogbon Street, may be taken as a type of similar areas existing generally in Ebute Ero, Imagbo, and Eno Ewa. It is a mass of huts crowded together, intersected by narrow lanes where neither drainage nor scavenging can be effectually carried out. The huts are single storied, with different kinds of roofs, some of them being grass thatched, with badly lighted and badly ventilated rooms, and with the ground of the yards in puddles during the rains.

Another quarter, Isalagangan, is intersected with narrow and irregular lanes and although the houses are better built in some parts and only one storied now, yet it is at present an insanitary area and will be worse later on when two storied houses are built. There is no existing law to prevent these houses from being built higher. Generally it may be stated that the greater portion of the north western part of Lagos has been so built over with houses and huts indiscriminately packed together without plan or order that it forms one large congested and insanitary area, which nothing short of demolition of the huts and houses, raising and grading of the ground, and rebuilding on sanitary lines, will ever make healthy.

Plan of houses unhealthy.

(17) Even houses which are built in wider streets (Photo. XVI), and which appear from the frontage to be good, are often planned in such a manner as to be unhealthy. Thus Plan II represents the ground plan of a house in the Faji quarter. The entrance door, when opened, leads into a narrow passage 4 feet 2 inches in width and 18 feet in length, closed by a door which shuts it off from a small yard and washing place behind, which are completely closed in by adjacent buildings.

From the closed passage there is first a door leading into a room which faces the street and is lighted by a window. This is the only window in the house. Behind this room is a second, which only receives its light and air from the front room. It is used as a bedroom for the two occupants of the front room. Further down the passage is a second door leading into a room 8½ feet by 6½ feet and 10 feet high. It is inhabited by two persons. The only means of light and air is from the dark passage. Behind this

again is another room of a similar size occupied by one person. It also has no direct light or ventilation. In the yard is a kitchen and a surface channel covered by boarding passes from the yard through the passage and discharges into the street.

The planning gives three windowless rooms, and the house is devised to give the least amount of fresh air and light. It is not a cool house, for the three windowless rooms, when tested, were found to have a higher temperature than that of the open street in the shade, and the ventilation, when examined by the direction of currents, was practically nil. The relation of this house to its neighbours at the back exemplifies the filling up process that is going on and the unhealthy blocks that are springing up. Similar and worse constructed houses are common. For houses in the town no plan is sent in and no permission is required. When a fire has occurred, instead of taking advantage of the opportunity of improving the locality the same kind of unhealthy huts and houses are permitted to be rebuilt.

A good Building Act required.

(18) To prevent more insanitary houses being erected and more insanitary areas being created, the strict enforcement of a good Building Act is essential, and no person should be permitted to begin to build until the regulations are conformed to and the detailed plan of the house and site approved of by the Medical Officer of Health and the Sanitary Engineer, attested by their signatures on the plan.

The unoccupied portion of the island should be laid out on a definite plan and a map prepared showing the streets, building plots, proposed open spaces, number of houses per acre according to the class of house and quarter of the town, the arrangements for water supply, surface drainage, sewerage, and refuse disposal, provision for markets, public buildings, public latrines, &c. All these and other things connected with the development and extension of the town should be set out on a map by the Board of Health, a copy of which when approved should be in the Health Department for guidance and another copy in the office of the Central Board of Health. This town plan once approved of should not be deviated from under any circumstances except under the express approval and sanction of the Central Board of Health and the Government. To make such a map a careful survey of the island and town would be required.

There are over 500 acres of good land east of the canal on the Ikoyi plains belonging, I understand, to the Crown, which being entirely under control should be very carefully reserved for purposes of development.

In Ebute Metta an attempt has been made to lay out a part of it in regular lines which has secured excellent streets running at right angles to one another with blocks of 100 yards between them, but no regulations are enforced as regards the blocks between the streets, hence the interior of these which were intended as gardens and open spaces is in some instances being built upon behind the houses facing the streets, and in course of time as property becomes more valuable, each block, if not prevented, will gradually get covered with buildings and become an insanitary area. Regulations should be at once put into force to prevent this. The alignment of streets has also been limited to a portion only, so that the area outside the limit is in process of developing into an unhealthy area. The suggested map showing town plan with future developments and a Building Act are needed to prevent these haphazard and unhealthy developments.

Alignment of streets or laying out into blocks is not sufficient, but the details as to house plots and the amount of buildings erected on each plot have to be regulated.

A Building Act embodying regulations to control the formation of new streets, the alignment of the old and the erection of buildings and huts, should also fix the relation of neighbouring houses to one another to prevent them obstructing one another's light and ventilation, and should lay down the minimum amount of air space allowable for the circulation of air around each house. The open space at the back and between houses in the tropics requires to be at least double if not treble that in cold countries. No house plot should have more than half its area covered with buildings at the maximum, and no house should be allowed to be of greater depth than 40 feet unless it stands in its own grounds having ample space on every side and with lateral windows. No dwelling room should be permitted without window space for light and ventilation.

Report on a public water supply for Lagos.

(19) The provision of a public water supply for Lagos has already engaged the attention of the Local Government, with the result that the Ilo river has been recommended as the source from which the supply should be obtained.

My opinion on the Ilo river scheme was given in a memorandum to His Excellency the Governor of Southern Nigeria when I was at Lagos, and I now subjoin that memorandum, which is dated August 15th, 1908.

"After a careful inspection of the Ilo river I have the honour to submit the following report on the Ilo scheme for supplying potable water for Lagos and Ebute Metta.

2. I had intended to take a boat up stream from the proposed intake, but on arrival I found the river to be a shallow up-land streamlet with rising banks on one side and low, muddy and marshy ground for about 40 yards on its other side. It was impossible to use a boat or canoe.

3. The quantity of water obtainable from the Ilo streamlet above the Otta tract ford, which has been fixed as the site of the intake, is an engineering question and must ultimately be determined by the Water Engineers. I would note, however, that information which is usually required in these schemes, viz. :—

(*a*) Rainfall observations in different local areas of the gathering ground, and

(*b*) Successive gaugings of the streamlet through several dry seasons,

is not at present available. Mr. Osbert Chadwick, the Consulting Engineer, has called for these in his different reports, but as far as I can ascertain no regular, systematic and prolonged observations have been made which can be considered to furnish reliable *data*.

4. Mr. Chadwick in his report of September, 1906, writes "The question of the *permanent* sufficiency of the waters, however, rather turns upon the length of time the river has been studied and also upon the accuracy of the gaugings The gaugings under Mr. Hawkins's supervision are of course reliable, but he agrees with me that further studies should be made in this direction before the source of supply is finally settled upon, and I submit therefore that Mr. Hawkins should take up the work immediately upon his return to the Colony. The gauging should be continued as long as possible and the results should be sent home from time to time for consideration." Since this was written the only additional information, I understand, is that obtained in February and March, 1908, when Mr. Quill visited the Colony.

Some rainfall observations have been taken at the Otto station, about three miles from the intake, but they are stated to be unreliable. Taking them as they are, they show a rainfall of 56·5 inches in 1907, against 79·4 at Lagos. There should be several stations in the gathering ground and they should be under good supervision.

5. It was originally proposed to give a supply of 27 to 28 gallons per head per day counting the population at 50,000. This quantity would be a good supply, but not excessive for a tropical town. It is now proposed to reduce this quantity to 10 gallons per head per day, which is quite inadequate for a town of the character and size of Lagos and Ebute Metta.

Several years will elapse before the water works will be completed and by this time the town will have increased considerably. Few who visit Lagos will fail to notice the spirit of enterprise about the place and the evident signs of its becoming in the near future a very large town. A water supply should be provided which can keep pace at least with the development of the town for the next 20 or 25 years.

6. Assuming that the quantity after due investigation turns out to be sufficient to give 30 gallons per head per day, and that there is also a reserve sufficient to meet the developments of the town for the time stated, much remains to be done to secure its good quality.

There is in one of the plantations a spring which flows into the Ilo and which is shown by Mr. Blount's analysis to furnish pure water. It contained per 100,000 parts, free ammonia 0·010 and albuminoid ammonia 0·003, but on inspection the spring evidently supplies only a very small quantity of water. The amount could easily be gauged. The water of this spring could be used without filtration. On the other hand, the river water shows on analysis results not nearly so good in quality. In 1906 Mr. Blount analysed a sample taken from gauge 4. It contained per 100,000 parts, free ammonia 0·027, and albuminoid ammonia 0·013.

This result was confirmed by subsequent analyses by Mr. Ralston, Government Analyst, who in 1906 on a different date found the water at No. 4 gauge to give per 100,000 parts—

Free ammonia	0·0035
Albuminoid ammonia	0·015

Analyses by Mr. Ralston at other gauges gave the following results :—

No. of Gauge.	1906.		July, 1908, Afternoon.		August, 1908, Morning.	
	Free NH3.	Alb. NH3.	Free NH3.	Alb. NH3.	Free NH3.	Alb. NH3.
1	0·003	0·035	0·011	0·037	0·002	0·0025
2	0·085	0·023	0·005	0·032	0·002	0·011
3	0·045	0·023	0·004	0·0175	0·002	0·009
4	—	—	—	—	0·0015	0·010
5	—	—	0·006	0·0185	0·007	0·0115

No bacteriological examination of the water has hitherto been made.

7. The photographs appended show the kind of streamlet in question, some of the more obvious pollutions to which it is subjected by the inhabitants of Otta and other villages on its banks, also the rank vegetation on its sides. The marshy and muddy nature of the east bank is not shown.

8. From Mr. Quill's report of February, 1908, I see it is proposed to collect the water from a trench cut parallel with and below the bed of the river. It is not known yet whether this water is the same as that of the river, and for this purpose a series of analyses would be required, chemical and bacteriological, and in order to make these analyses the samples should be obtained from borings specially sunk.

9. From the above considerations the project seems to me to be in an immature state at present, requiring more *data*, both as regards quantity and quality of the water, before it can be safely undertaken. Of these *data* I would mention (*a*) extent of area of gathering ground; (*b*) rainfall observations over different parts of the gathering ground; (*c*) gauging of the river water during several dry seasons; (*d*) observations on the amount of evaporation near the marshy bank of the river; (*e*) borings at different parts to ascertain the nature of the soil and its retentiveness of water; (*f*) chemical and bacteriological examination of the river water once a fortnight, also of the water from the borings.

10. The gathering-ground is a good one though apparently small. It could easily be conserved, but for this purpose the whole of it above the intake on both sides of the river would have to be acquired, the smaller villages, of which there are only a few, would have to be removed, and the drainage from the town of Otta with its 2,000 inhabitants would have to be diverted to well below the intake and the inhabitants not allowed to take water above the intake.

I doubt if a supply of water from this source would ever be absolutely safe without filtration.

11. Mr. Chadwick is of opinion that probably a larger quantity of water would be available if the streamlet were impounded. If such a scheme were entertained the whole of the area which formed the artificial reservoir would have to be cleared of vegetation and every tree and plant uprooted, otherwise much difficulty might afterwards ensue in filtration owing to the large amount of vegetable matter in the water and the growth of *algae*.

12. A much more promising source as regards quality is the Iju river, and it is one which I should strongly advise the Government to look into before committal to the Ilo scheme. I had the advantage of inspecting the Iju with Mr. Bellamy, the Director of Public Works, Dr. Pickles and Mr. Ralston. Roughly one would estimate that it has about three times the volume of water of the Ilo. The Iju is a tributary of the Ogun river. Like the Ilo, it rises in Egba territory at the bottom of a ravine, where it forms a pool which overflows and issues as a streamlet. Unlike the Ilo, this streamlet at once acquires considerable volume, and rapidity of flow. The volume gradually increases until it reaches a bridge which connects Doherty's farm on one side of the stream to Williams's farm on the other. Below the bridge the stream is sufficiently deep and wide to be navigable by canoes with difficulty. It is joined later by a tributary from the left bank of the river. In the reach between the bridge and the tributary the bed of the river is very muddy and contains a very large number of trunks of trees in a state of decay. The banks are also muddy. The water, however, when undisturbed is clear. The tributary has a sandy soil and a rapid flow of water. The reach of the river Iju below this tributary widens out to about 15 feet and is of an average depth of 3 feet. The bed consists of good clean coarse sand and the volume and rapidity of flow continue to be good down to the lower bridge. Some photographs are appended of the river Iju at different reaches for comparison with those of the Ilo. The absence of fords on the Iju is much in its favour. On both sides of the river there are farms, which if the river were found suitable would have to be acquired. Before doing so, it would be necessary to make a survey of the gathering grounds down to the lower bridge to ascertain its size and nature and the highest point at which a reservoir could be constructed, to gauge the volume of water at different places, to take rainfall observations, to make borings, to determine the nature of the soil of the gathering ground, and to make careful chemical and bacteriological examination of the water at the site of the gauges. The Iju fortunately has not so many roads across it as the Ilo, and is therefore not so subject to contamination. Should the Iju be found suitable in all respects the whole of the gathering ground above the intake would have to be acquired. There is a large number of farms, the houses and steadings of which would have to be removed. The Government should make the whole into a Government reserve and place one or two Europeans in charge.

There would be no objection to the cocoa plantations and farms, which are not in immediate proximity to the river, being worked under the control of the Government, but for this to be allowed they would have to be in the possession of the Government.

The river itself above the intake would have to be thoroughly cleaned out and all logs of wood removed, and the banks of the river should be cleared of all thicket and forest for 100 yards on either side, and this cleared portion made into grass land, being first of all raised with good soil where necessary. The clearing of the banks would be a great sanitary improvement in another way. The banks here are infested with the Tetze Fly, and the clearing would remove this source of danger from their bites.

Should it be considered that instead of taking the water direct from the river an impounding reservoir was preferable, then before constructing this reservoir the area intended to contain the water should not only be thoroughly cleared of vegetation, but every tree and plant should be uprooted and where necessary the earth covered with good soil. It is only by this radical treatment that the difficulties which often arise in a tropical country in the filtration of impounded waters can be avoided. Of course borings would have to be made to ascertain if an impounding wall could be readily constructed.

13. It is doubtful whether any surface water would be found so pure and so free from possible accidental contamination that it would be suitable for Lagos without filtration. Moreover, water of this kind that has not been filtered often deteriorates in the pipes. The only supply that is safe without filtration is that obtained from underground sources by artesian or deep wells. Such water has undergone a natural filtration. The possibility of tapping such a source could only be determined by experimental boring with drills and by a survey of the geological formation of the high mainland behind Lagos. I understand that under the sandy and porous strata at Ebute Metta, at a depth of 70 feet, there is a stratum of blue clay, but of what thickness is unknown. Similarly, the nature of the strata underneath the blue clay, whether permeable or impermeable, is unknown.

I would suggest that while the other observations on the river waters are being made the Government Geologist should ascertain where the blue clay outcrops are and that experimental borings should be made at Ebute Metta as to the nature of the strata under the blue clay and the possibility of obtaining water, which if not in sufficient quantity might be useful as a supplementary source. There may or may not be a water-bearing stratum underneath, but this can only be determined by an experimental boring of sufficient depth."

Analyses of the waters of the Iju.

(20) Samples of the Iju river water and of its tributary were taken at the time of inspection from particular points and submitted to examination by the Government analyst. The results are as follows :—

Parts per 100,000—*by weight.*

———	Just above the 1st bridge.	100 yards below junction of tributary.	25 yards up tributary.	50 yards above junction of tributary.	At the 2nd bridge.
Total Solids	7·0	8·5	5·0	7·0	5·0
Mineral Solids	2·0	4·0	3·0	2·5	2·5
Ammonia, free	·0005	·0005	nil	·0005	·0005
Ammonia, albuminoid	·0075	·002	·005	·0015	nil
Chlorine	·8	·45	·65	·7	·75
Oxygen consumed by organic matter	·16	·16	·23	·06	·06
Nitrogen as nitrate	nil	nil	nil	nil	nil

These figures, so far as they go, show a high degree of purity, especially No. 5, which is water collected highest up the stream. "On examination all samples were found to be odourless and neutral to litmus. No. 5 was nearly colourless, while the others were slightly peaty coloured. The sediment showed sand and vegetable matter, with a few water organisms (infusoria, &c.) in all except No. 5."

Apparently no difficulty in obtaining a site for a reservoir.

(21) Rough surveys and inspections of the gathering grounds by the Director of Surveys and the Director of Public Works appear to indicate that there will be no difficulty in securing a suitable site for a service reservoir supplied from the river by pumping, from which the water would be conveyed by gravitation to Ebutte Metta and Lagos at such a pressure as to be amply sufficient for all purposes. Wherever the intake may be located in the river Iju, if it be decided to use it as a source for the water supply, I think it would be advisable to acquire not only the gathering grounds of the Iju river above it but also those of its tributary, for in future developments of Lagos and its near settlements or of "Greater Lagos" as recently named, it may be necessary to supplement the supply from the waters of the tributary.

Sewerage, drainage, and refuse destruction.

(22) The removal of sewage, of flood water, and of refuse were also dealt with in a memorandum dated August 25th, 1908. Since this memorandum was written I have come across a report by Dr. Rowland, Chief Medical Officer in 1894, in which he recommends the adoption of the Shone system of sewerage for Lagos and a report in 1897 by Mr. Wm. Maxwell Mackison, sanitary engineer, endorsing that recommendation. This recommendation shared the same fate as many others relating to sanitary matters in West Africa. It was never pursued any further and in time was forgotten. Continuity and progress in sanitary matters in West Africa will never be obtained until there is a Sanitary Commissioner in each Colony whose business it is to see that no projects of importance are forgotten until they are either introduced or displaced by better ones subserving the same purpose. After 14 and 11 years, respectively, have elapsed the Shone system is again independently recommended as the best for Lagos, and I would advise that Mr. Ault, the sanitary engineer who laid down the Shone system in Rangoon in 1886 and recently extended it in the same town, should be asked to visit Lagos and draw out a suitable sewerage scheme which will be ready by the time that the proposed water supply is completed.

For the removal of rain water a scheme should be devised by which half circular pipes of reinforced concrete or other material on both sides of the roadway should replace the wide concrete drains now in many of the roads, and by which arrangements should be made to flush them regularly and periodically from the lagoon, also by which the surface drains shall be so planned that their outlets shall not be obstructed either by silting-up of the lagoon on the foreshore or by any other cause.

The refuse should not be dumped into the lagoon. It is not a satisfactory mode of disposal, for a portion of it at times finds its way back to the foreshore and causes a

nuisance. Nor should it be taken to compounds of houses or other localities and there used for reclaiming marsh ground. The whole of the refuse should be burnt in one or more Horsfall destructors, and the clinker and ashes employed for filling in low lying land, road-making or other suitable purposes.

(23)

Memorandum of August 25th, 1908.

"I have the honour to submit a short memorandum on some of the more important points relating to the sanitation of Lagos.

2. In doing so I hope I may be permitted to congratulate the Government on the advance in sanitary matters of which there are many signs and which have been carried out in recent years. Of these I should like to mention first the excellent wells in the race-course and in many parts of the town, and particularly those from which the water is obtained by aero-motor pumps or windmills and the double action pumps; next I would mention the reclamation of many large and pernicious swamps, a work which, for Lagos especially, is of the highest importance; and thirdly, the recent introduction on a small scale, for one of the divisions of the town, of the removal of nightsoil and the disposal of it, which for the present is effective and free of nuisance, neither of which can be said of the older system which prevails in other parts of the town.

3. I have dealt with the proposed public water supply from the Ilo River, in a separate memorandum, in which it is pointed out that further investigations require to be made before a scheme for a permanent supply is undertaken and that the Iju River should be considered as an alternative scheme. In view of the latter recommendation it is advisable that the surveys, gaugings, analyses, and other necessary investigations should be begun as early as possible. Since writing this report I have seen the results of the Government analyst's examination of the water of the Iju River from certain sources in the river at which I considered it advisable to take samples and they are very favourable.

4. That a pure and ample supply of water is needed goes without saying and the necessity for such a supply will be felt more and more as the town increases in size. Householders to-day either keep a servant to fetch water from the race-course wells or pay threepence per pot twice each week or every nine or ten days to water carriers. Payment of the proposed water tax for a good and ample supply of water will not mean an increased sum to be paid by the householder, but on the contrary a considerable relief from the large annual sum now expended.

5. An ample supply of water to the town makes possible an efficient system of drainage for the sewage. The population of Lagos is estimated as being between 55,000 and 60,000. No commercial town larger than this can have its sewage efficiently removed or in such a manner as to be free of nuisances without a water carriage system. Lagos by its situation is bound to increase in population and when the harbour works are completed is likely to become a very large town. There are certain prejudices against a water carriage system of removal of sewage in the tropics, but these are due rather to the custom of seeing open drains and to an undue belief in the beneficial influence of the sun on evil smelling puddles. They have also been strengthened by early mistakes in the construction of sewers in some tropical towns, the worst mistake being the construction of large sewers to carry away rain water as well as sewage. One of the results was that during the heavy rains no sewer was large enough to carry off the rains, and in consequence the streets often became flooded with a mixture of sewage and rain water. Another result was that during the dry season there was an insufficient flow of sewage in the large sewers to keep them self-cleansing and hence they often became cesspools emitting offensive gases. This mistake is now avoided by using what is called the separate system, *i.e.*, the flood water is dealt with by surface drains and conveyed into the nearest water course, and the sewage water is removed by small underground drains that are self-cleansing and easily flushed, and the sewage is disposed of at the outfall according to the situation and circumstances of the locality.

Lagos is so flat that the ordinary system of underground drainage is inapplicable, but it can easily be drained on the Shone system in the less congested parts of the town and afterwards when these congested parts are cleared away and their areas properly laid out the system can be extended to them. The Shone system can be put down in one or several districts at one time and can be extended to others when required. The feasibility of linking of districts one by one when required on to the general plan of drainage drawn out for the whole town, is a feature which is convenient from a financial point of view and a distinct advantage in many other respects.

The principle on which the system is based is the collection of drainage from a given area or district into an underground station which contains a receptacle that gradually fills with sewage and which, when full, automatically opens a valve that admits compressed air manufactured at a central station and laid on by pipes to each receptacle. Immediately the compressed air enters the receptacle it closes the inlet admitting the sewage and ejects the contents into a pipe which joins a main pipe receiving sewage in a similar way from other receptacles in other districts, and the whole is ejected to the outfall.

The arrangements are simple, automatic, and out of reach of everyone except the Engineer in Charge; they are particularly adapted for flat places, and, in fact, could eject sewage up hill if required. The system has worked well in Rangoon during the past 20 years, and is now being extended there; it is in operation in some of the districts of Bombay, also in Karrachee and many other places. It could be introduced with ease into the European and better-class quarters of the native portion of Lagos. The public latrines in Lagos could be connected with the system, doing away with the nuisance attached to them, while in the congested portions of the native town, where it would be inadvisable to introduce the system until the areas were remodelled, depôts could be conjoined with the public latrines, where pails and pots could be emptied and the sewage ejected from these depôts into the common system.

As regards the disposal of the sewage thus dealt with the readiest, cheapest, and most effectual for Lagos would be its ejection into the sea at a suitable point, the pipes being taken across the five Cowrie Creeks either on or under the bridge.

6. The removal of flood water would, as now, be effected by surface drains discharging into the lagoon. As it is inevitable that they will receive for several years yet, as at the present time, sewage, arrangements should be made for the surface drains to be daily flushed with water from the lagoon. Regular flushing would very materially assist in removing the nuisance arising from their present condition, and which, with good reason, is very generally complained of by the merchants and others.

7. I have already referred to the excellent work done in the reclamation of swamps. No work is of greater importance in Lagos, and no pains or money should be spared in carrying out on an extensive scale the reclamation of the areas of swamp land that still remain in the occupied part of Lagos Island and also on that portion of the island and foreshore of the lagoon to which the town has not yet extended. Fortunately there is in the sand of the lagoon plenty of material available, and I would suggest that these reclamations could be done more cheaply and with greater expedition if a dredger adapted for the purpose was a part of the equipment of the Sanitary Board and was employed continuously at this work and at no other. In the process of reclamation the land should not be merely brought to the ordinary level, but should be well raised and graded to facilitate surface drainage. I would suggest also that no land should be permitted to be reclaimed by private enterprise unless under the most stringent regulations and subject to penalties on the owner in default. I have seen land in Lagos not only unsatisfactorily reclaimed as regards levels, but being privately reclaimed with garbage and refuse, which of course only leads to an unhealthy condition. All refuse should be burnt in a destructor and the clinker and ashes used for reclamation. When the swamps are reclaimed it is necessary that the new land shall be so planned out into streets, building plots and open spaces as to fall into line with the general scheme of development and extension of the town as laid down on the map with that object in view.

8. A building Act as already pointed out is urgently required to regulate the formation of new streets, the alignment of the old, the erection of houses and huts and other buildings, the relation of neighbouring houses to one another, and the minimum amount of air space that is permitted for the circulation of air around each house; also to prescribe the minimum size, cubic space, lighting, and ventilation of rooms, and the means of rendering houses damp-proof. No plan of house or hut should be passed without approval and sanction of Health Officer. The Health Board of Lagos should carefully frame a bill for the approval of the Government which will secure in the future healthy houses and healthy streets even in the most crowded part. The Board should also draw out a town plan embodying not only improvements in the congested parts of the town and on that already built on, but should also prepare on it a map of that part of the island not built on laying it out at least on the map in a manner that shall control its future development as regards districts, arrangement of streets, back lanes, building plots, class of house on building plots, limitation of the number of houses or huts per acre according to the class of building in the district or quarter of the town, and provision in every area or district except the business quarters of open spaces, recreation grounds, and sites for public buildings.

When such a map has been completed and approved of, a copy should be retained in the Health Office of the Government as well as in the Offices of the Lagos Board of Health for information and guidance, and no deviation from the plan should be permitted without careful consideration and the consent of the Health Authorities. The objects of such a map are that the policy in regard to extension and development of the town on sanitary lines shall be a continuous one notwithstanding change of officers and that insanitary areas shall not be allowed to spring up."

Registration of births and deaths.

(24) Registration of both births and deaths in Lagos and its district is in a more advanced state than in any of the towns in the Gold Coast or in Sierra Leone and is under the Principal Medical Officer for the Colony. No burial is allowed to take place until the death has been registered and a burial certificate obtained from the registrar.

Attached are some of the forms from which the vital statistics are compiled.

REGISTER OF BIRTHS FOR LAGOS, SOUTHERN NIGERIA. Volume Page.

No.	Date of Birth.	Place of Birth.	Whether Still-born.	Sex of Child.	Name, if any.	Name (and Surname) of Father.	Name (and Maiden Surname) of Mother.	Rank or Occupation and Address of Father (or in default) of Mother.	Signature, Description and Address of Informant.	Date of Registration.	Signature of Registrar.	Name, if any, added after Registration of Birth.

Certified to be a true copy of an entry in the Register of Births for Lagos, Colony of Southern Nigeria.

Given at the Registry Office, Lagos, this day of , 190 .

Principal Medical Officer and Principal Registrar.

Registrar of Vital Statistics, Lagos.

COLONY OF SOUTHERN NIGERIA.

REGISTER OF DEATHS FOR LAGOS. Volume Page.

No.	Date of Death.	Place of Death.	Whether Still-born.	Name and Surname.	Sex.	Age.	Rank or Occupation.	Abode.	Cause of Death.	Name of Certifying Medical Practitioner, if any.	Duration of Illness.	Place of Burial.	Signature, Description and address of Informant.	Date of Registration.	Signature of Registrar.

Certified to be a true copy of an entry in the Register of Deaths for Lagos, Southern Nigeria.

Given at the Registry Office, Lagos, this day of , 190 .

Registrar of Vital Statistics, Lagos.

THIS IS TO CERTIFY that *the death of*_____*late of Lagos, deceased, has been duly registered at Page*____*of Volume*____*of the Register of Deaths for this District, or that I am credibly informed that a child of*_____ *of*_____, *and*_____, *his wife, born on the*_____ *day of*_____, 190____, *was still-born*,* and I hereby give permission for interment of the body.

Given under my hand at Lagos, this_____day of _____, 190____.

_____,

Registrar of Vital Statistics.

Certificate granted_____M.

* Strike out such of the words in italics as may be inapplicable.

Sanitary administration in Lagos.

(25) There are for Lagos two medical officers of health and there is one for Ebute Metta. The three are in private practice and have their Government work as well ; none of them get any special pay for sanitary work.

The only medical officer who knows Lagos thoroughly is the Deputy Principal Medical Officer, Dr. Hopkins, to whom I am indebted for valuable information and assistance in inspecting the town and the other parts of the Colony I visited. The general complaint is the difficulty of getting anything done. This is not anyone's fault, but it is due to there being no special sanitary department with executive and controlling powers. Since a report of Dr. Hopkins which appeared in the ordinary course in the Government Gazette and which drew attention to the insanitary state of some of the wells in Lagos was resented and challenged, not because of its accuracy, but because of its appearance in the Gazette, there seems to have been a feeling of discouragement and loss of interest in sanitation. The report nevertheless had an excellent effect, for the wells were put into a sanitary condition in a very short space of time.

Dr. Hopkins received as health officer in 1899 a salary of £96 a year. In 1900 the allowance was divided into two, owing to an assistant medical officer being appointed who was also made visiting officer or medical inspector of ships. In 1901 the £48 for sanitary work relating to the town was abolished, the allowance of £48 for visiting ships being still retained. It is now 10s. a day for visiting ships until £48 is reached. The crossing of the bar is too disagreeable and at times too dangerous an undertaking for any medical officer to visit a ship out at sea unless it is absolutely compulsory. A policy of reduction of pay which tends in any way to render the medical inspection of ships inefficient is not only inadvisable from a health point of view, but is one which the Colony may have to pay dearly for should an epidemic disease be introduced.

Lagos is divided into four districts, each of which is in charge of a nuisance inspector who is vaccinator for the district as well. The removal of refuse and night-soil has been until recently under a Sanitary Engineer, who was an officer of the Public Works. The construction of roads and drains and the reclamation of swamps is under the Director of Public Works.

Recently the sanitary administration of the town has been changed. A Board of Health for Lagos with the Principal Medical Officer as President has been formed and a Medical Officer of Health and Sanitary Engineer have been appointed for the town whose duties are solely to be devoted to sanitation.

This is a great advance and if the Board of Health and its officers are given sufficient executive powers and are well supported by the Government through its Sanitary Commissioner and Central Board of Health much progress should be made.

Recommendations for sanitary administration of Colony.

(26) In connection with the sanitary administration of the Colony of Southern Nigeria I append the following memorandum to His Excellency the Governor of Nigeria which is dated September 1st, 1908.

"As a result of my visit to Southern Nigeria I have the honour to submit a brief memorandum relating to sanitary administration.

2. I observe that owing to the prosperous condition of the Colony and the great activity displayed everywhere that important towns and villages are springing up in many places. It is essential that these new places shall grow up on healthy lines and that the old shall be made more healthy. Further, with greater commercial activity and movement of labourers there is always greater risk and danger of introduction of epidemic diseases, and precautions have to be taken to prevent the admission of such diseases, or, if by accident admitted, measures require to be promptly taken to check, control, and stamp them out. Moreover, in order that there shall be a continuous policy for the sanitation of the Colony, and that the medical officers at each station though changed shall carry

on the work of their predecessors, and in order that the Government shall be advised on sanitary matters by experts whose duties are wholly devoted to health matters, there requires to be a sanitary administration.

3. For this purpose I recommend that there shall be a sanitary branch of the West African Medical Staff. For Southern Nigeria this should consist in the meantime of a Sanitary Commissioner, a Deputy Sanitary Commissioner, and a local Health Officer for Lagos. The medical officers of the different stations would be under the direction of the Sanitary Commissioner as far as sanitary matters were concerned, which should be defined in order not to cause any clashing with the instructions of the Principal Medical Officer.

Among sanitary matters should be included vaccination, isolation hospitals, quarantine stations, water supplies, drainage, disposal of sewage and refuse, the laying out of villages and towns, construction of houses and huts, the selection of sites for camps, new towns or villages, the clearing of bush and the filling up of swamps.

4. It should be understood that medical officers once entering the sanitary department would remain in that branch and their promotion would be to Deputy Sanitary Commissioner and Sanitary Commissioner, differing in this respect from the medical branch, in which promotion would lead to Deputy Principal Medical Officer and Principal Medical Officer.

To give unity to the service and prevent the disadvantages of dual control it should be understood that the Principal Medical Officer is the Chief.

5. There should be a Central Board of Health distinct from any local board of health, such as that proposed for Lagos. It should consist of the

Principal Medical Officer, President.
The Director of Public Works
The Sanitary Commissioner, or } Members.
Deputy Sanitary Commissioner
The Lagos Health Officer, Secretary, with an adequate Clerical Staff.

At this Board, which would meet quarterly or oftener if necessary, all the larger schemes and proposals of the Sanitary Commissioner should be carefully considered and discussed before advising the Government on them. The ordinary routine work relating to sanitation would be under the direction and orders of the Sanitary Commissioner without necessarily coming before the Board. The Sanitary Commissioner's and Deputy Sanitary Commissioner's time would be largely taken up in visiting the different stations in the Colony. An annual report on the sanitation of the Colony should be issued at the end of each financial year.

6. The pay of the Sanitary Commissioner might be £900 to £1,100 with 20 per cent. duty allowance—Deputy Sanitary Commissioner £700 to £900 with 20 per cent. duty allowance—Health Officer, Lagos, and Secretary of Central Board, £600 to £700 with 20 per cent. duty allowance. No private practice would be allowed, and no medical officer should hold any of these offices without possessing either at the time of appointment or within a certain period after appointment a special qualification in Public Health supplemented if possible with a diploma in tropical medicine and hygiene.

The Principal Medical Officer and Director of Public Works as members of the Central Board of Health should be paid something for their services. They will have much and important work to consider carefully, work out, and advise on, and payment will emphasize the responsibility of the Board."

Hospital at Lagos.

(27) The Lagos Hospital, especially the native portion, is the best on the Coast, and certainly contrasts well with any hospital for natives that I have seen in any of the British Colonies. It reflects great credit on those connected with its building and administration. The site is an excellent one facing the marina. The native hospital consists of a number of separate bungalows raised on iron pillars. Each bungalow consists of a very clean ward excellently maintained and with good cross ventilation, a lavatory and store-room at one end separated from the ward by a passage, and a nurses' room and small ward at the other end. Plan No. 4 shows the arrangements of the native wards.

The European hospital is in the same compound and consists of a two-storied building. On the lower storey are offices and stores. On the upper storey are the wards, which are mosquito-protected by wire gauze on the windows, doors, and ventilation openings. The wards had the appearance of comfort ; one contained two beds the others four beds. The arrangements are seen in Plan 3.

Besides the operating theatre, the arrangements of which are well up to the most modern scientific requirements, there is in a special building in the hospital grounds a small chemical and bacteriological laboratory where water analysis and work connected with the diagnosis of cases in the hospital are carried on.

The only premises which were at all unsatisfactory were the nurses' quarters. Originally built for two, they are occupied by four nurses, and the dining room is dark and dingy. It was formerly used as a bedroom, but was not found suitable. The kitchen is a room in the verandah, and renders the room adjoining it very hot and uncomfortable. It is also the kitchen for the European patients' food. There should be a large kitchen unconnected with the nurses' quarters. More rooms should be added to the building, and the dining room should be opened up. There is no need of three staircases. The site is good.

The Lunatic Asylum.

(28) The lunatic asylum is also well arranged. There are two excellent bungalows, one for male and the other for female patients. Each bungalow is enclosed in a large compound. Outside the walls of the compound is a large area of ground belonging to the asylum, and which is being converted into a garden. The disposal of the nightsoil might easily be arranged for in trenches in this garden.

(29) In closing this report I desire to acknowledge the valuable assistance I received during my stay in Lagos from Dr. Hopkins, the Acting Principal Medical Officer, whose intimate knowledge of the sanitary condition of Lagos very much facilitated my investigations. Dr. Hopkins also accompanied me to Porto Nuovo, Ibadan, Forcados, Burutu, Warri, Bonny, and Calabar, and I derived much advantage from the information he was able to give me. I am also indebted to the good offices of Mr. Bellamy, the Director of Public Works, who takes a very real interest in sanitary advancement, and who has done much in this direction for Lagos. The photographs of the condition of the Alakoro swamp, before and after reclamation, were taken by him. I would also mention Mr. Cotton, the Director of Surveys, who put himself to much trouble in having maps and plans prepared, and whose services I found extremely useful. Dr. Pickels and Mr. Ralston gave me most valuable assistance during my enquiries into the Ilo and Iju rivers as sources of water supply for Lagos. I have mentioned these officers because they were more closely connected with my work, but I should like to state that I received most courteous and ready assistance from every administrative and political officer that my duties brought me in contact with, and to these I desire to express my cordial thanks.

Forcados.

A mud flat.

(1) Forcados is a mud flat partially cleared of mangrove trees, on the banks of the Forcados river. It has been selected as a convenient place for the transhipment of cargo from ocean steamers to smaller branch boats which ply between Lagos and the different trading centres reached by the creeks and rivers and which in their turn bring produce to the ocean steamers. The steamers lie in mid stream and the branch boats come alongside them.

Process of reclamation.

(2) The swamps are in the process of being filled up with mud, cinders, and sand, and ditches and canals are being cut, partly to obtain mud for raising the land and partly for drainage purposes. As fast as solid ground is obtained by the filling up process, some buildings are erected. This appears to arise from the necessities of the case but one is struck by the permanent nature of some of the buildings, which admits of no further raising of the ground in their immediate vicinity should it be required. Roads are being made and divisions into plots on either side of the road is going on. The plots are below the roadways and the people themselves are supposed to clear and raise them before occupation. The Europeans do this but the natives do not, and apparently there is no compulsion, for many huts are already built on low and swampy ground. Unless this procedure is stopped and a different method adopted Forcados is bound to become a very unhealthy place, for if the site is not in the first instance made a healthy one the station will always remain unhealthy or require an enormous sum to remedy defects which should at the beginning be avoided.

Reclamation should follow a well considered plan.

(3) It should be determined to what extent land has to be raised and graded for effective drainage in all points, and at the outlets of the drains. This should be laid down on a plan and no hut or house permitted to be erected until the allotment conforms to the level on the plan. A system of canals so that water may flow through them freely is very suitable but they require to be maintained in good order, and surface drains discharging rain water into them should be several feet above high water level. The land must necessarily be higher than the level of the outlet of these drains and rise in proportion to the distance from them so that the flood water may readily get away and the land, even at its most distant part, be properly drained. The important works at Forcados to procure a healthy site are accordingly to cut the canals or ditches and systematically raise the land not only on the roads, but on the whole of the surface of the area proposed to be

reclaimed, which means Forcados. This reclamation should be done in such a manner that the outlet of the drainage shall be several feet above high tides and that the land shall gradually ascend to the parts farthest from these canals. In addition to this, huts and houses should have a plinth of at least two feet above the level of the ground.

Forcados in the process of making.

(4) The Photographs 1–5 show Forcados in the process of making and some of its conditions. It is a place where regular doses of quinine and careful attention to mosquito nets and mosquito-proof rooms are needed for protection against malaria. Forcados has its advantages in that meat and articles of food are obtainable direct from the ships and the monotony of tinned foods is not added to its malarial conditions, while a certain amount of intercourse with the captains, officers, and passengers of the vessels tends to relieve it of its deadly dulness.

Burutu.

Healthier site than Forcados.

(1) Burutu, the quarters of the Niger Trading Company, is not far from Forcados. It is on higher land and steamers come alongside its banks. The site is a healthier one than Forcados, but it also has low-lying ground and swamps behind the settlement.

Insanitary accommodation for some of the labourers.

(2) The accommodation provided for some of the labourers is of a very inferior and insanitary character and consists of large corrugated iron sheds divided and subdivided into very dark, badly ventilated, and unwholesome rooms, which are overcrowded. I understand this condition of things is going to be altered.

Warri.

Small and improving station.

Warri, 30 miles further up the river than Forcados, is a pretty little station and port with some excellent bungalows for the officials and good mercantile houses facing the river. Ships come up the river and moor alongside its bank. The European settlement is being laid out in a manner that should make it a pleasant and healthy station. The native portion of the town, which is higher up the river, is also being laid out in regular streets, and building plots have been allotted of 60 by 60 feet in size and others 60 by 120 feet.

Malarial conditions being fast created.

(2) The material for the huts and houses has, however, been frequently obtained by digging pits and excavations from the plots on which the huts or houses are to be erected, and the result is that each compound is malarial breeding. The arrangement of building-plots is good, but it is not sufficient unless the building of the huts or houses on these plots is regulated.

Supervision and regulations required.

(3) Thus the building material for the huts or houses should not be permitted to be supplied from the plots, otherwise the surroundings of the huts or houses become an area of excavations and pits, depositories for the refuse and filth of the huts, receptacles for drainage and rain-water and breeding *foci* of mosquitoes. Then the arrangement of the huts built on the plot should be subject to approval, and no erection allowed without a rough plan for huts and a more elaborate one for houses, and the plan should provide that at least half the plot should be unbuilt on and sufficient open space provided between the huts and houses of neighbouring plots to secure ample air space for ventilation.

Calabar.

Situation.

(1) Calabar, the old capital of the Oil Rivers Protectorate, is situated on the high land on the east, near the junction of the Cross and Old Calabar rivers; with the exception of Freetown its site is the most picturesque of any of the towns I visited on the West African Coast, and it is superior to Freetown in being naturally healthy. The soil

is of gravel and sand. The cliff rises almost abruptly from the river, having at its foot, between it and the water, a narrow strip of land on which are built the warehouses and residences of the traders. Photo. I. On the high land behind the cliff on undulating ground are the other European houses separated by a valley from Duketown or the native quarter.

Mercantile quarter close to the river.

(2) Formerly Europeans were not permitted to reside on shore, but lived in hulks on the river. This mode of life, though at times uncomfortably hot and oppressive, had its advantages for as no natives were permitted on board at night and as the hulk was in the flowing water the conditions were hostile to malaria and to that extent healthy. The hulk was for the merchants in many respects a healthier dwelling than the existing house next the factory buildings with natives alongside them at night.

The averseness of the traders to leave the low beach with its natives for the higher and healthier land immediately behind them is remarkable. It is not a matter of economy of time, for residential houses, with healthy sites, could easily be erected less than half a mile away. I met a young fellow in hospital recovering from black-water fever and on questioning him I ascertained that the only times he had been on the hill was when he was, as then, in hospital with fever.

I inspected with Dr. Chichester, the Senior Medical Officer of the station, some of the conditions in the mercantile quarter. They are not such as recommend it for residential purposes. Doubtless they have been brought about by the very limited strip of land immediately fronting the river, by increasing trade, and by the anxiety of the traders to have as many as possible of their imported labourers and others quite near at hand, but the conditions produced are none the less unhealthy and resolve themselves into too close proximity of the natives to Europeans, extremely insanitary housing of the natives, and much overcrowding. Photo. II. The conditions are bad for the Europeans who live down on the beach and they are bad for the natives, besides involving risk and danger should plague or other epidemic disease be imported into this quarter. Vigorous measures should be taken at once to prevent further insanitary buildings being added, to abate the overcrowding, to remove the bad sanitation inside the buildings and on the premises, and to introduce a more wholesome state of things.

Healthy conditions on the hill should be carefully maintained.

(3) The contrast on the hill is striking. There the European bungalows are well away from native houses, they are comfortable and substantial, their surroundings are good, and the view is as pleasant a one as is to be seen anywhere in the tropics. Photo. III. The conditions are decidedly healthy and if there were more stations on the West African Coast like Calabar on the hill life would be more comfortable and healthy. It is important that the conditions should remain healthy and for that purpose this side of the hill, which is separated from Duketown by a valley, should be reserved entirely for Europeans. There is a tendency to break this necessary rule. Thus what are named the Aro lines which were built by Government for some of their artizans and clerks are becoming a nuisance and a danger to the Europeans, for apparently they are no longer confined to Government employees, and other brick houses have not been prevented from being erected there in a promiscuous manner by outside squatters.

The original buildings were of brick, but many now existing are mud huts, low roofed, with windowless rooms which are pitch dark and most insanitary. (Photo. IV.) Similarly many of the brick huts are insanitary. It must always come to this unless very stringent control is exercised.

It would be better for these Aro lines to be removed altogether, and no natives except servants allowed to reside on the reservation, but if this is inconvenient at the present time, then at least all the mud huts and unauthorised brick huts should be pulled down and only those built by Government allowed to remain, but to be removed eventually, and no additional ones should be permitted to be erected, accommodation of a sanitary nature being provided elsewhere away from the European reservation. Similarly, more sanitary control should be exercised over the erection and maintenance of the police lines, which are far from being satisfactory.

No building should be erected without the Health Officer's written approval of the plans, and the amount of accommodation should correspond to the number that is to live in the hut. The jail is already on the reservation, but as it is a building whose inmates are completely under control it differs in this respect from the Aro lines. At present the jail is much overcrowded, but this is being remedied by extension of the jail premises.

It was first proposed to add to the buildings within the existing walls. When this was pointed out as being undesirable, the proposal was abandoned and more ground has been ordered to be taken over for the additions.

Water supply good.

(4) The water supply of Calabar is derived from a spring and is excellent in quality, having undergone a natural filtration. It is pumped up from the basin of the spring into four tanks, two of which, holding 40,000 gallons each, are raised on pillars on a hill close by, and two are underground tanks, holding 80,000 gallons each. The tanks on the hill supply the higher parts of Calabar and those underground the lower parts of the town.

The site of the spring is exposed to surface flooding, which is apt to deteriorate the quality of the water. After heavy rains the water is discoloured, and might under certain circumstances become seriously contaminated. (Photo. V.) The admission of surface water should be accordingly prevented, which can easily be done by the construction at the foot of the hill of a coping wall round the spring and a surface drain outside this coping to convey the flood water away in another direction. I understand Mr. Hawkins, the Provincial Engineer, is to draw up plans and estimates for this or a similar protection. The basin of the spring should also be divided into two parts in order that cleansing operations may be carried out without stopping the supply of water to the town. Greater pumping power also appears to be required.

Below the spring and outside its grounds there is a bathing pool. After bathing, the women fill their water vessels from the channel that supplies the bathing pool with water. It could be easily arranged that the overflow of the spring water was conveyed to near the pool and the vessels filled from the pipe.

Beyond the bathing pool is a swamp which should be drained, which is estimated to cost from £15 to £20.

There is another spring not far from that now supplying the town, which is near some reserved ground belonging to the Government. If the reservation were extended to the area of the latter spring it would probably serve as a very useful supply to Calabar in the future when more water will be wanted and save having to pay a large sum in compensation when, owing to extension of the town, the area had been built on, or was used for other purposes.

The quarters for the officers and old lines for the troops good, but the new lines insanitary.

(5) The officers' quarters and the men's barracks of the native troops are at some little distance from the European bungalows of the Civil Service. The officers quarters are the best I have seen on the Coast, while those at Kumasi are the worst. The appended plans I. II. and III. will show the style of building. The old lines for the troops are also very good, but the new lines that are being actually constructed are bad and insanitary. They are being erected too close to one another and one line has been built on a low-lying site when there was no need for it, and the rooms are insanitary from every point of view. They are a blot on the others and should be pulled down and built on proper sanitary lines.

Nursing home and native hospital good.

(6) The nursing home for Europeans is most comfortable. The Native hospital is also good, well designed and well ventilated. I was informed that it is proposed to extend it. If this is the case, more land should be taken up, in order to secure ample space. The grounds of the hospital are already cramped.

Improvements being carried out in Duketown.

(7) About ten thousand pounds have been spent within the past five years in the improvement of Duketown. The money has been expended in cutting roads through the principal parts of the town and constructing surface drains. It has effected a very great improvement. But it illustrates the large amount of money that improvements cost once crowded areas spring up in a locality. The conditions which necessitated this expenditure on Duketown were of long standing and could not have been prevented.

A survey of the town required.

(8) But it is important to prevent similar conditions arising in other parts of the town and for that purpose a survey of all the houses, lanes, and road-ways in Calabar,

should be made and plotted on a map, with the view of controlling, by building regulations and streets and open spaces, the growth of the town and its drainage.

The style of the old Calabar huts and houses good.

(9) The style of building and the plan of house of the inhabitants of old Calabar are of a very superior type, consisting usually of a series of huts with good central court-yards. When these court-yards are spacious, which is frequently the case, being sometimes over 24 feet square, the inhabitants live under good conditions and it only requires a little more light and ventilation arrangements for their sleeping rooms to make them very healthy dwellings.

A tendency to deteriorate.

(10) The tendency however is to contract the courtyards and I have seen some only a few feet wide, and these recently built. This is a distinct deterioration and there should be a minimum size for the courtyard below which it should not be allowed. In some houses there is no central compound but a small garden in front and a large compound behind. This is also an excellent arrangement.

It has been noticed that the old Calabar people who built the better houses are leaving Calabar and going into the country, and that they are being replaced by native strangers and native traders, who, in order to get more accommodation, subdivide, and build on, the courtyards, or who erect huts with neither compounds in the centre nor open spaces behind their huts. These conditions produce insanitary buildings.

Necessity for a town plan for purposes of control.

(11) These are the people who crowd into a town where trade is thriving and increasing, and who, unless carefully controlled, put up insanitary huts and shanties and very rapidly convert a healthy area into a hopelessly congested and insanitary one. It is an additional reason why a map should be prepared and the town laid out on a well conceived plan. There is no need in this plan of laying down only one style of hut or house. It is well to conform as nearly as possible to the two types I have mentioned, the one with a central courtyard and the other on a plot of ground with open space at the front and back, but the two will hardly go together side by side, and it is for the health authorities when planning out the town and its future developments to decide on what kind of hut, &c., is suitable for the given locality. The details of the same building Act cannot be adopted for every town in the Colony. The principles embodying light and air of the hut and sufficiency of space attached to the house or hut must be the same, but style and planning should be adapted to local circumstances, and local customs. Variety in these respects, while conforming to the best native customs, gives a character and interest to the several towns which a rigid uniformity would lack.

The public latrines are of an excellent type but more are needed.

Isolation or quarantine station.

(12) An isolation or quarantine station with a few native huts and hospital on it might be provided on the west bank of the river between the white beacon and the creek near flag point. The foliage on the bank here appears to indicate good ground or land that could with no difficulty be made suitable. This opinion was confirmed by inspection so far as the thicket would permit. Before deciding what portion is to be taken up it might be advisable to have some lines cut on this portion of the river bank at a distance of 100 yards apart to test the nature of the ground. I am informed by the Provincial Engineer that this could be done by about 15 men engaged on the work for a fortnight. When this is done the site selected should be cleared and prepared. In these isolation stations the huts should be small and well apart, in order that the party should be isolated in small groups, so that if disease breaks out in one group it will not affect the others, and prevent any but the affected group from being detained longer than necessary.

(13) I beg to acknowledge my obligations to Mr. Bedwell, the Provincial Commissioner, Dr. Chichester, the Senior Medical Officer, and Mr. Hawkins, the Provincial Engineer, for their assistance and kindness during my visit to Calabar.

APPENDIX.

TABLE shewing the rainfall of Lagos for 15 years, 1893–1907.

Month.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	Average.
January	·05	Nii	·71	8·14	·01	·49	1·00	1·40	1·25	Nil	Nil	1·85	·04	1·04	1·10	1·13
February	12·51	2·23	·79	1·14	1·59	·24	·20	3·80	Nil	1·82	3·41	1·17	1·04	2·18	·20	2·15
March	4·14	3·61	3·87	4·10	1·67	2·92	4·93	2·55	6·10	2·17	3·24	7·04	1·48	1·11	2·65	3·44
April	6·84	2·80	11·97	5·67	4·05	5·93	3·86	10·92	2·65	5·09	7·39	3·99	4·88	4·00	6·07	5·74
May	11·77	8·01	9·56	16·64	15·32	6·36	12·50	11·85	13·05	4·62	3·10	12·97	7·15	16·02	14·86	10·92
June	13·36	31·03	28·33	21·34	11·98	30·02	8·89	10·68	17·37	14·33	21·62	22·28	25·59	22·30	19·39	19·93
July	9·73	5·27	12·28	3·56	·63	10·25	13·73	17·05	29·92	5·90	8·75	12·27	13·25	15·90	20·08	11·90
August	4·04	·35	1·20	·58	·27	·93	22·48	1·10	7·65	·53	·69	·08	·49	1·68	1·29	2·89
September	7·39	3·43	2·89	·47	4·79	4·53	6·32	2·90	15·80	8·02	11·05	7·06	1·54	1·67	2·92	5·38
October	8·76	9·15	7·15	14·79	8·58	16·45	7·50	6·87	16·48	3·30	6·87	6·37	5·99	6·91	8·30	8·89
November	2·34	2·37	1·00	2·83	2·21	·91	·55	3·60	4·55	·16	4·11	·63	3·65	1·37	1·57	2·12
December	4·44	2·12	Nil	·09	Nil	1·17	1·90	1·25	Nil	Nil	1·23	·88	·01	·58	1·03	·98
Total	85·35	70·37	79·75	79·35	51·10	80·20	83·86	73·97	114·82	45·94	71·46	76·59	65·11	74·76	79·46	75·47

Survey Department,
Lagos.

E. P. COTTON,
Director of Surveys.
24/7/08.

Lagos Observatory { Latitude 6°·27′ N. / Longitude 3°·24′ E.

Month.	Absolute shade, Maximum.	Absolute shade. Minimum.	Average Maximum.	Average Minimum.	Rainfall in inches.
January	90°	70°	87°·5	76°·7	1·10
February	96°	71°	88°·1	75°·9	·29
March	91°·5	73°	89°·4	78°·8	2·65
April	91°	71°	87°·8	76°·6	6·07
May	92°	70°	87°·2	75°·4	14·85
June	89°	71°·6	84°·7	73°·7	19·39
July	86°	68°·5	81°·8	73°·3	20·08
August	84°·2	68°	81°·6	71°·5	1·29
September	88°	70°	83°·6	73°·1	2·92
October	88°	70°	84°·8	73°·1	8·30
November	89°·5	70°	87°·2	75°·3	1·57
December	94°	71°	88°·6	73°·9	1·03
Means	89°·9	70°·3	86°	74°·8	Total 79·46

Mean temperature for 1907 80°·4
Highest shade temperature 96° in February.
Lowest „ „ 68° in August.

These temperatures are somewhat the same for previous years.

E. P. Cotton,
Director of Surveys,
July 24th, 1908.

P.S.—The lowest temperatures are, I think, generally during the Harmattan.

E. P. Cotton,
July 24th, 1908.

TABLE shewing the Rainfall of Ibadan and Calabar 1902–1907.

Month.	Ibadan { Lat. 7°24′N. Long. 3°50′E.							Calabar { Lat. 4°58′N. Long. 8°19′E.						
	1902.	1903.	1904.	1905.	1906.	1907.	Average.	1902.	1903.	1904.	1905.	1906.	1907.	Average.
January	Nil	·96	1·50	Nil	·06	·07	·43	Nil	1·47	3·43	·42	·40	4·13	1·64
February	3·18	·05	Nil	·36	·96	Nil	·76	2·16	3·53	·42	·36	1·05	8·54	2·68
March	3·27	·53	6·49	6·75	2·35	3·25	3·77	15·30	·92	8·29	7·88	7·11	1·83	6·90
April	3·45	6·13	3·40	5·67	5·15	8·42	5·37	14·54	10·06	8·68	7·81	14·73	9·21	10·84
May	7·19	4·60	7·65	4·54	7·13	4·14	5·88	18·63	8·92	16·94	12·17	17·99	14·54	14·86
June	7·38	4·91	5·67	10·53	4·22	6·10	6·47	21·85	21·48	14·94	24·79	13·10	21·54	19·60
July	11·07	4·53	6·77	7·21	9·69	5·51	7·46	20·22	34·28	21·88	27·18	28·52	23·95	26·00
August	2·16	3·26	·34	·53	2·88	·47	1·60	22·53	27·32	26·21	37·07	18·37	9·39	23·48
September	5·54	5·21	4·61	7·20	8·90	5·45	6·15	10·77	11·81	22·44	19·85	24·68	15·23	17·46
October	6·54	7·12	9·53	4·06	3·17	4·08	5·75	17·74	10·02	5·56	18·94	19·34	13·09	14·12
November	·19	2·05	·01	·67	1·49	·77	·86	5·21	9·62	3·42	8·98	5·65	8·18	6·84
December	·35	·05	Nil	Nil	·14	Nil	·13	7·20	1·42	*	1·94	5·70	Nil	3·25
TOTAL	50·32	39·40	45·87	47·52	46·40	38·26	44·63	156·15	140·85	132·21†	167·39	156·64	129·68	147·67

Highest Shade Temp. 99° in March, 1907. | 96° in March, 1907.
Lowest Shade Temp. 62° in December, 1907. | 60° in December, 1907.
Mean Temp. in Shade 79°1′, 1907. | 77°9′, 1907.

* No records available.

† Records incomplete.

Note.—With regard to Ibadan and Calabar earlier records than those given cannot be relied upon. Harmattan at Lagos commences early in December and terminates early in February.

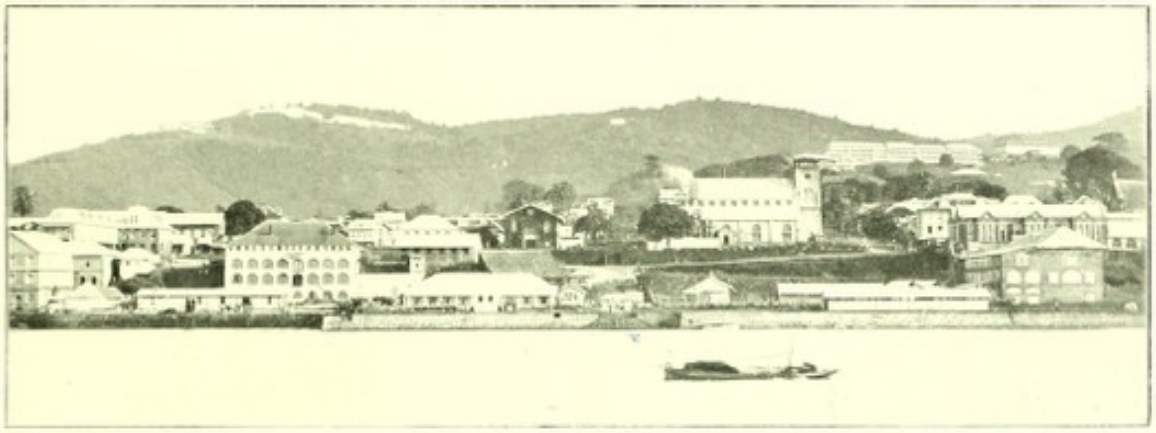
E. P. COTTON,

23rd July, 1908.

SIERRA LEONE.

Freetown.

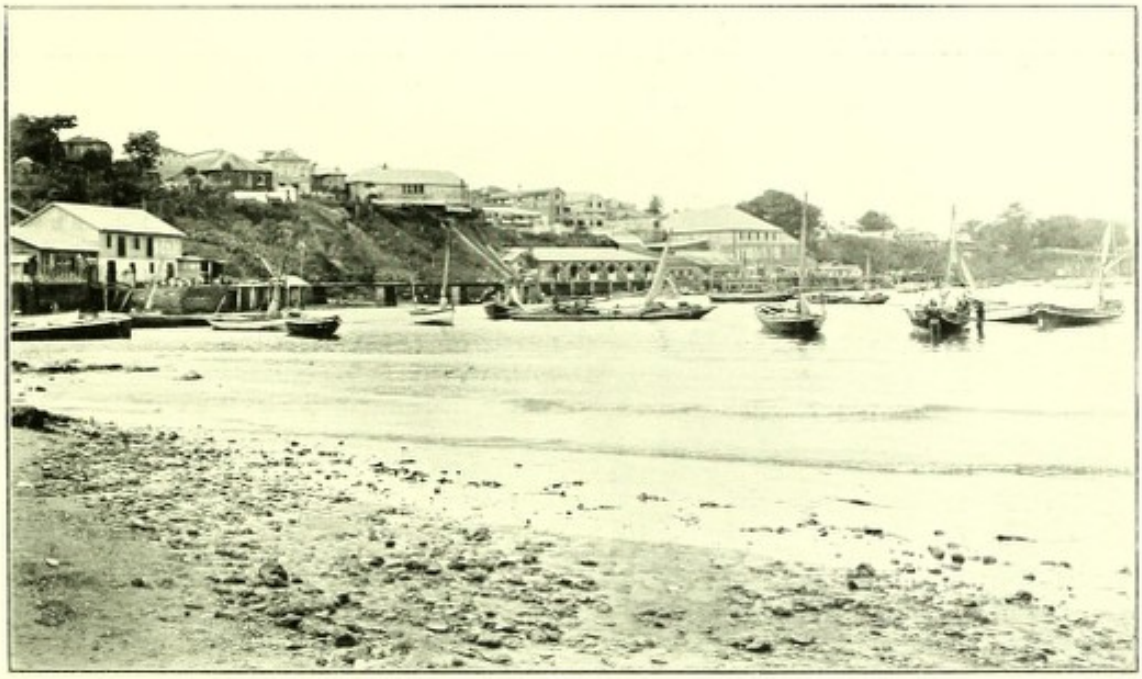
Photograph No. I.



View of the Harbour.
Illustrates general elevation over sea level.

[*See page* 22.

Photograph No. II.



To show height of general level above beach. Susan's Bay looking north-west.

[*See page* 22.

SIERRA LEONE.

FREETOWN.

Photograph No. III.

Rock pool in compound between dwelling house and cesspit.

[*See page* 26.

Photograph No. IV.

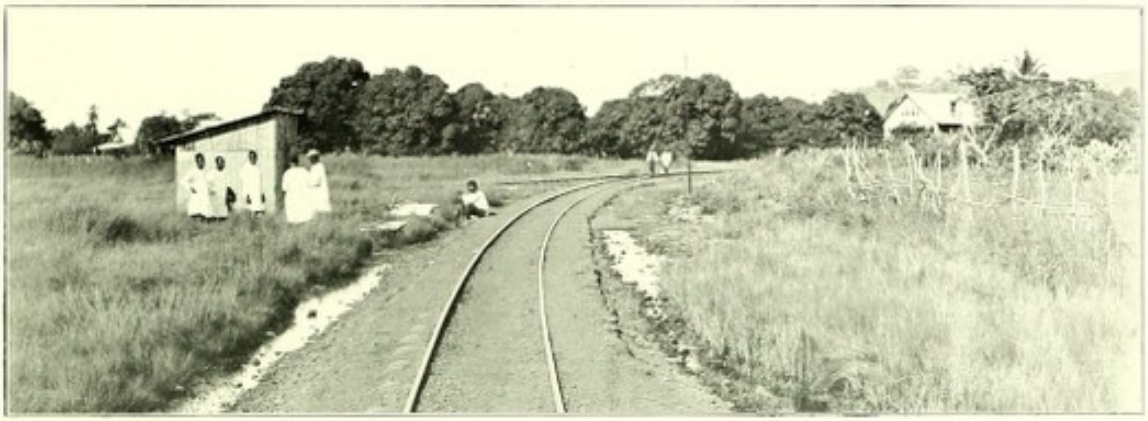
Rough rock drain—rock holes—drain dry above—spring lower down, making pool.

[*See page* 26.

SIERRA LEONE.

FREETOWN.

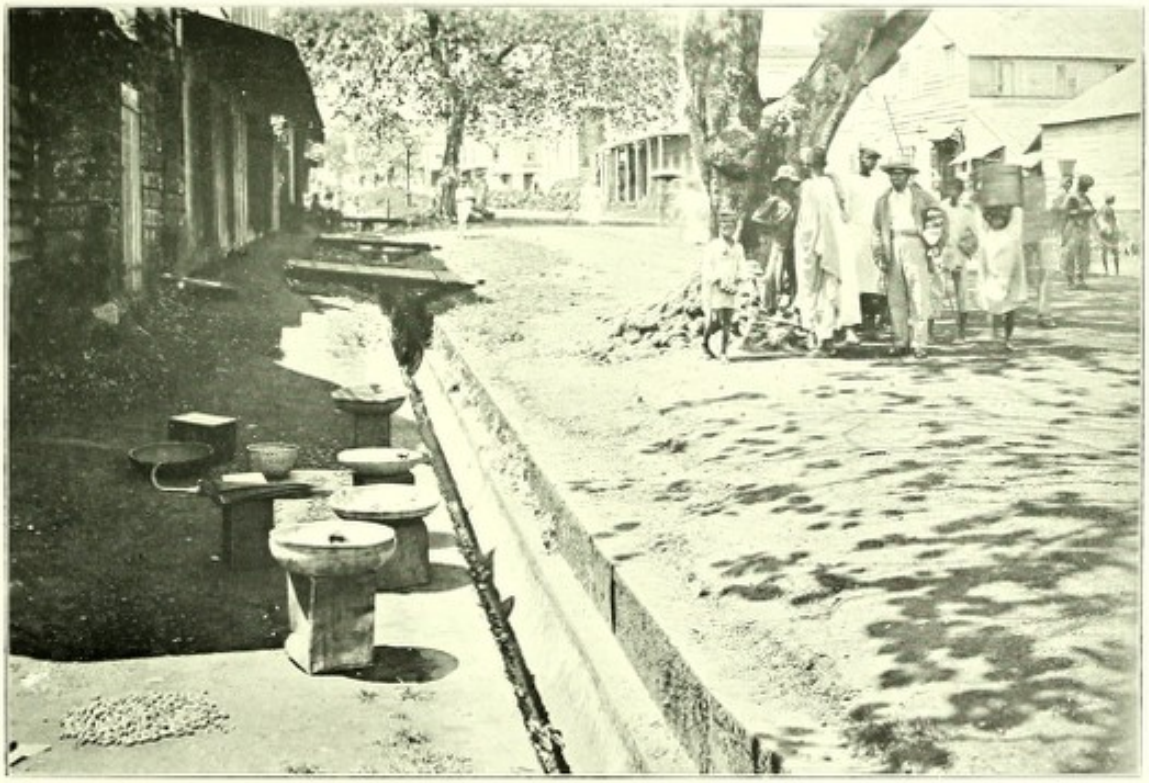
Photograph No. V.



Grass fields near golf course, showing stagnant drains on each side of railway.

[*See page* 26.

Photograph No. VI.



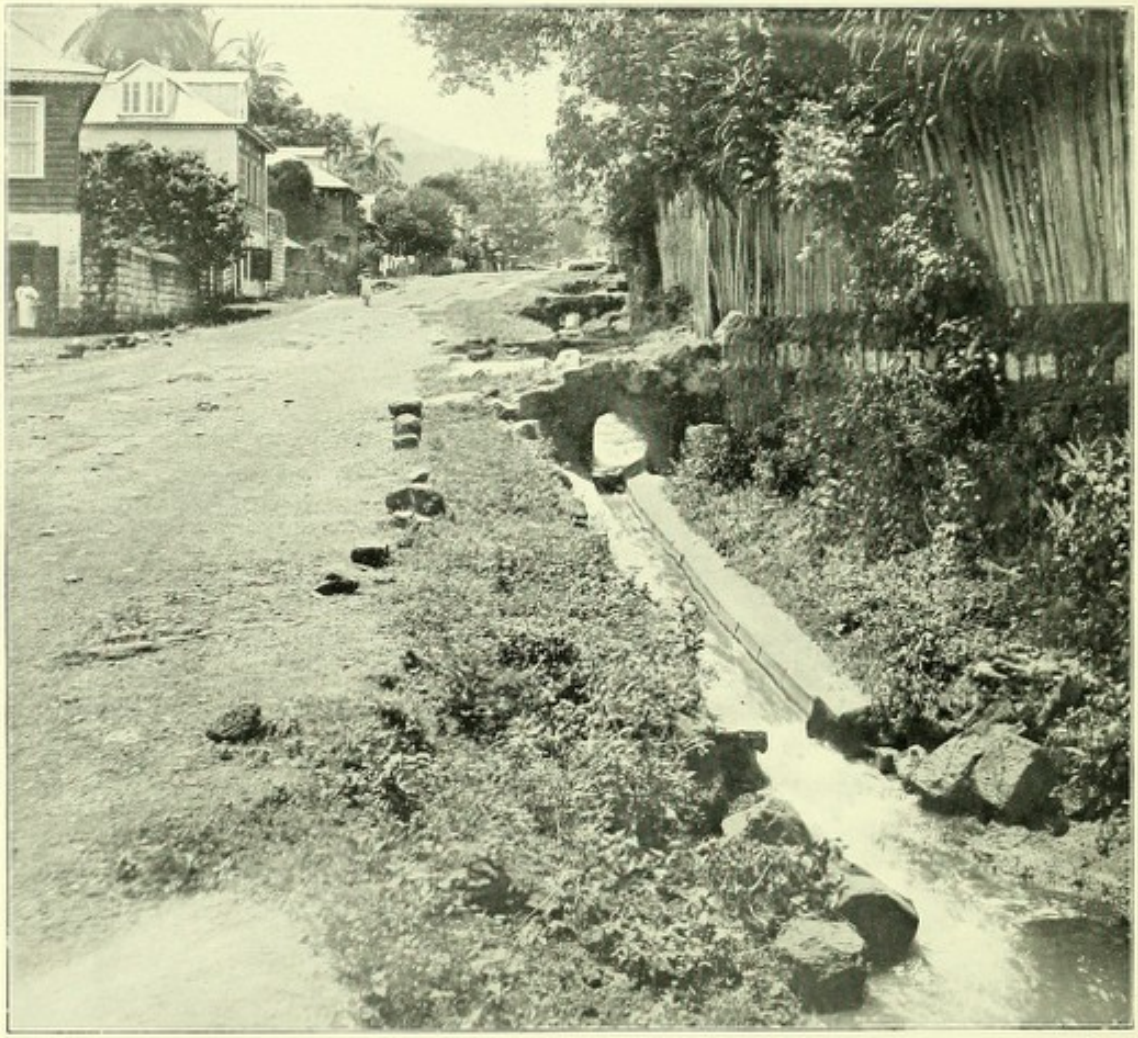
New half-egg shaped concrete drain at bottom of masonry drain on south side, Westmoreland Street, East End (constructed about six months): also at the back in the distance the men at work and the large mounds of excavated earth. Drain unnecessarily deep.

[*See page* 27.

SIERRA LEONE.

FREETOWN.

Photograph No. VII.



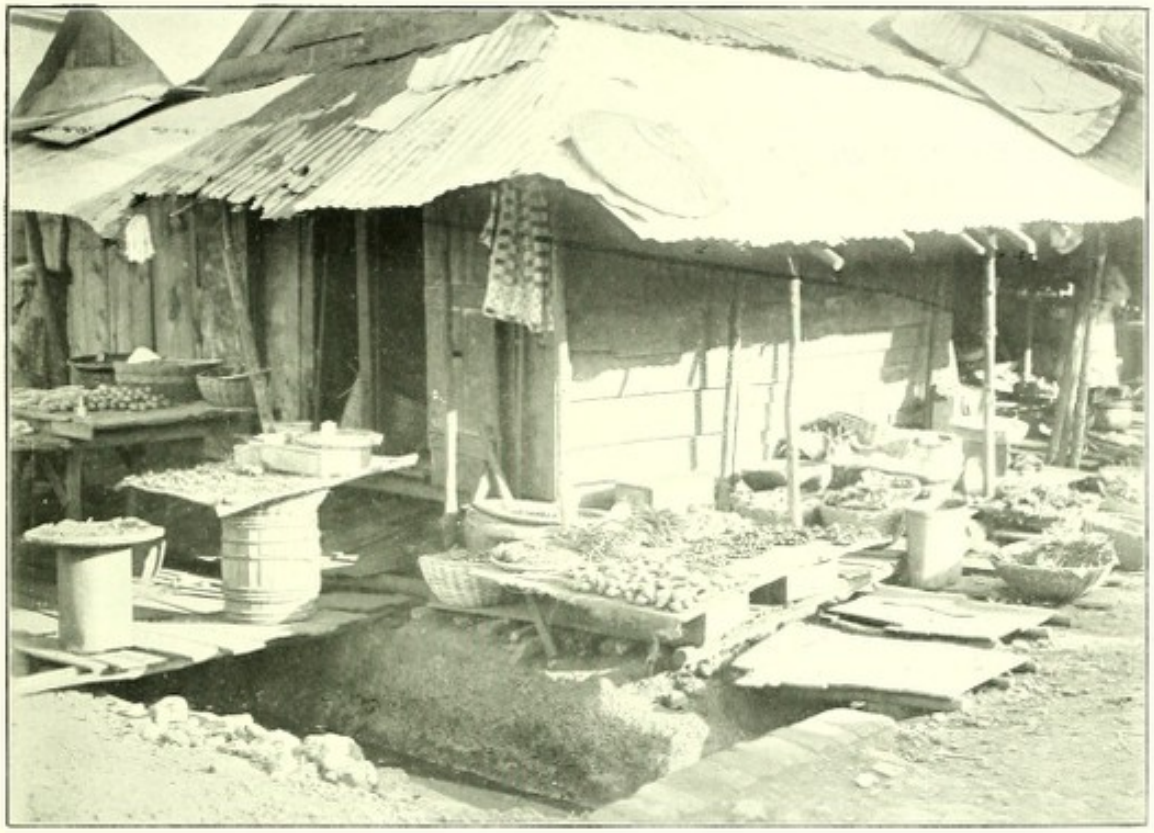
Street drain. Circular Road at junction with Regent Road, showing water spread over bottom flat square drain passing the smooth semicircular 12 in. half-pipe drain and only half filling it.

[*See page* 27.

SIERRA LEONE.

FREETOWN.

Photograph No. VIII.



35, King Street, at junction of Sackville Street, showing fish, vegetables, and other provisions exposed for sale over stagnant drains.

[*See page* 28.

Photograph No. IX.

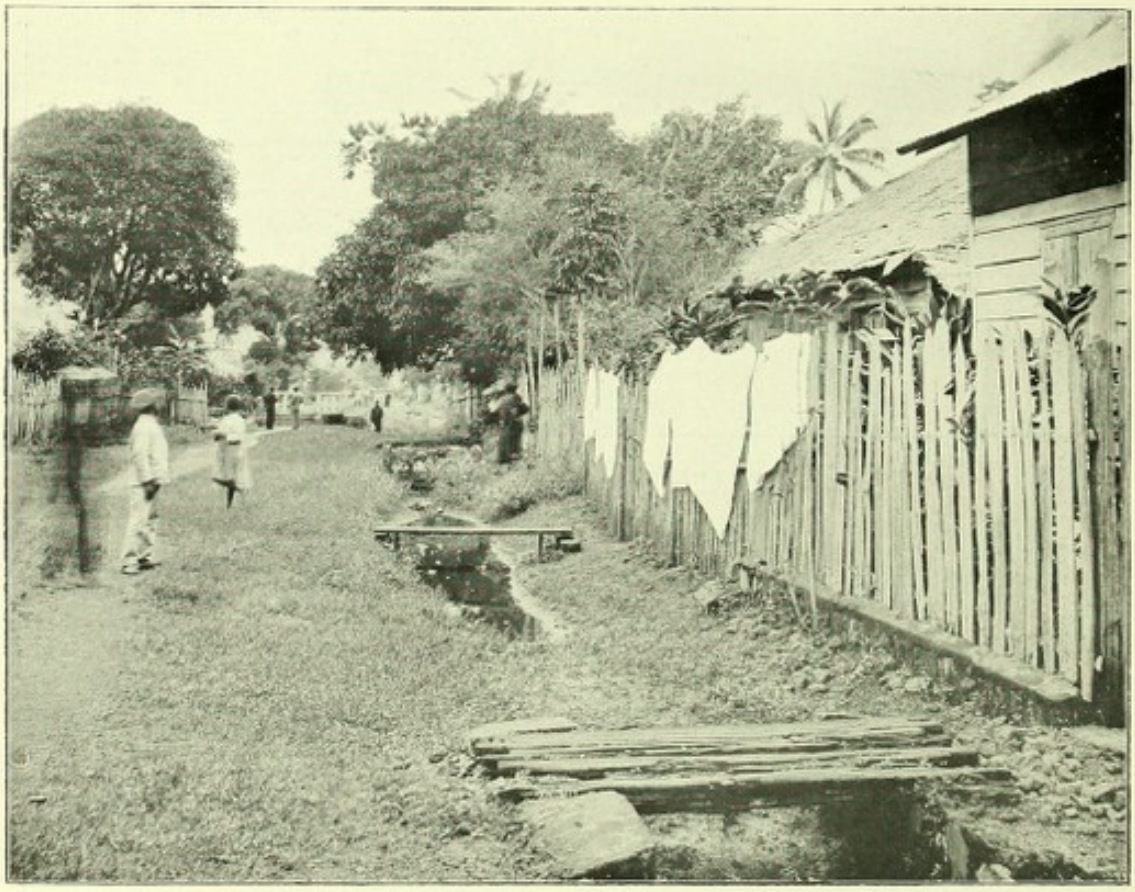
Little Kroo Street. Stagnant drain.

[*See page* 28.

SIERRA LEONE.

Freetown.

Photograph No. X.



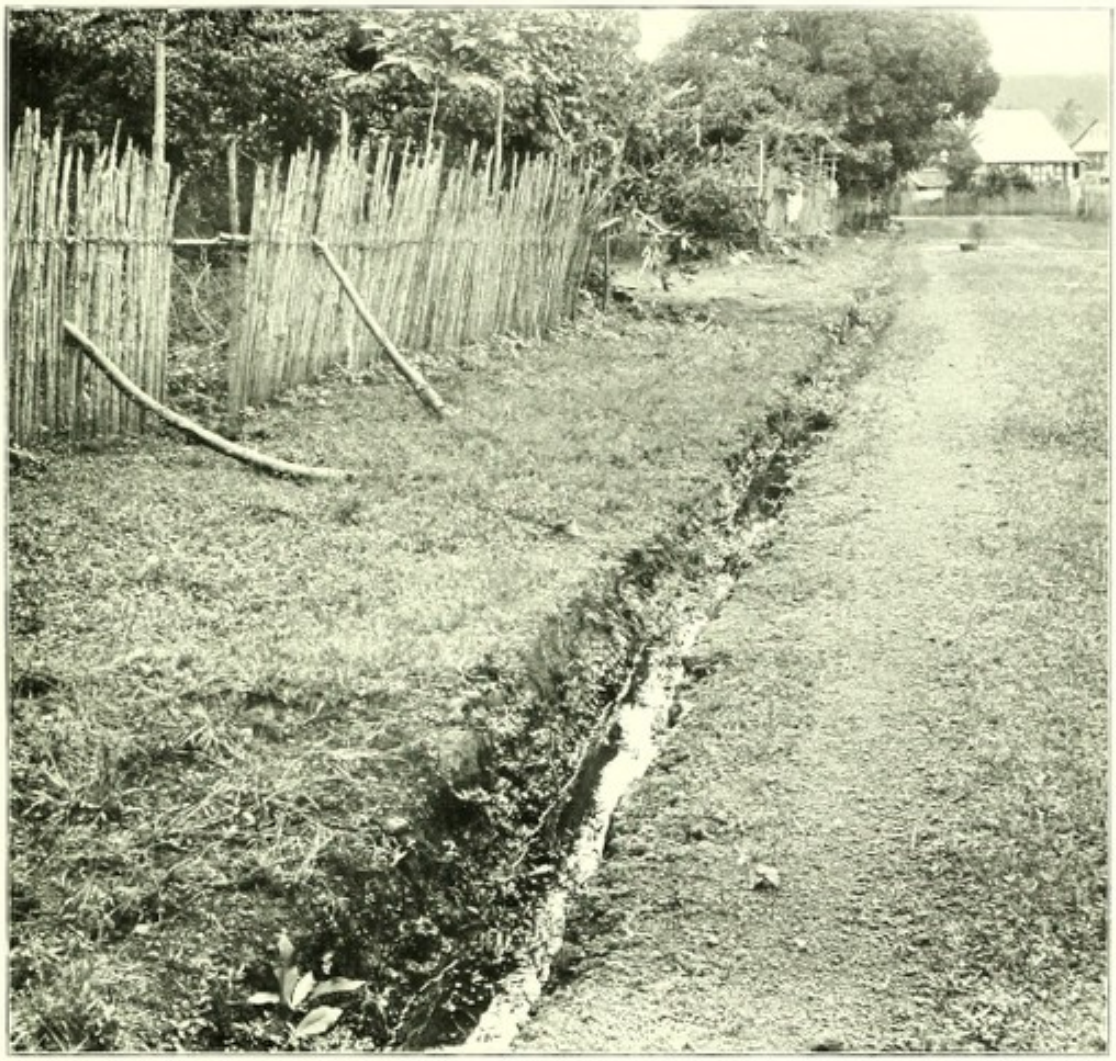
Drain showing stagnant water, owing to want of proper levelling. Sanders Brook quite close into which it was originally intended to flow.

[*See page* 28.

SIERRA LEONE.

FREETOWN.

Photograph No. XI.



Rough stagnant drain, with vegetation grown in it.

[*See page* 28.

Photograph No. XII.

Stand-pipe, Circular road, showing pool chiefly from waste water, gravel washings from left blocking culvert—the larger mound of gravel is material removed from culvert mouth.

[*See page* 28.

SIERRA LEONE.

Freetown.

Photograph No. XIII.

Overfilled rubbish bin—Circular road—washing in rough shut drain beyond.

[*See page* 28.

Photograph No. XIV.

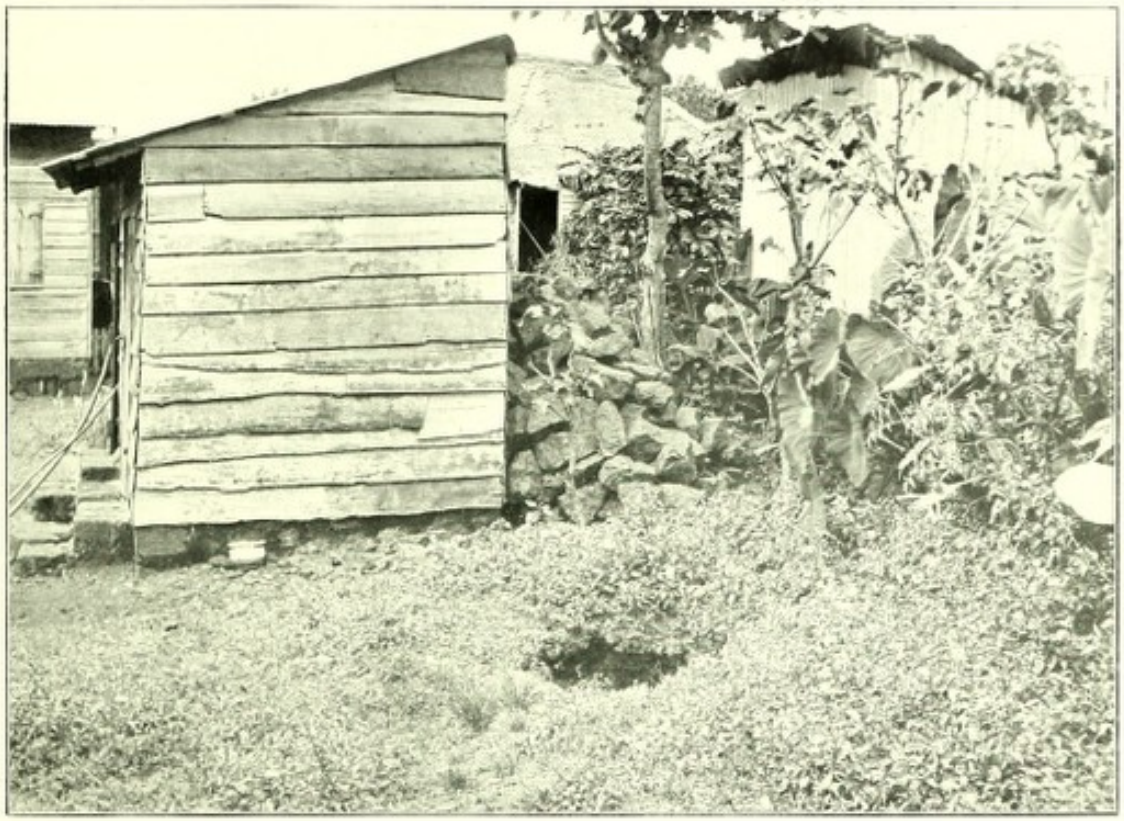
Establishment employed for pouring oil into cesspools at Port Said.

[*See page* 30.

SIERRA LEONE.

FREETOWN.

Photograph No. XV.



Cesspit shelter, with shallow well 2 ft. 6 in., about 6 ft. away; water in cesspit.
[*See page* 30.

Photograph No. XVI.

Cesspit by Sanders Brook, showing a shallow cesspit unprotected. Bamboo shelter and mat door.
[*See page* 30.

SIERRA LEONE.

FREETOWN.

Photograph No. XVII.

Dilapidated cesspit behind house, showing partly denuded rafters on roof, loose rubble coping, broken walls and floor, next to it a corrugated iron shelter over a cesspit with defective coping.

[*See page* 30.

Photograph No. XVIII.

Nicol's Brook, showing canalization by rock cutting at further side of bridge. On near side bridge clothes washing and rubbish.

[*See page* 31.

SIERRA LEONE.

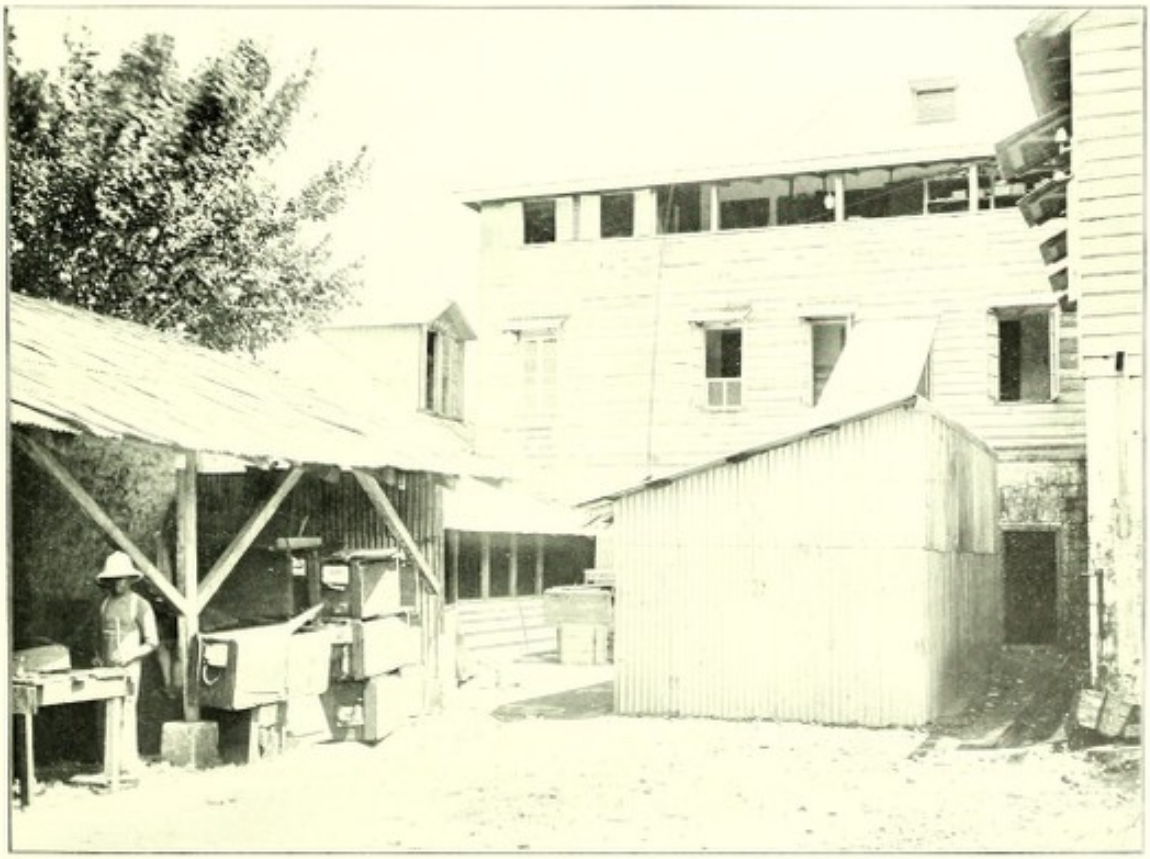
Freetown.

Photograph No. XIX.

Rock-cut channel in bed of Sanders Brook in dry season with irregularities in surface on both sides.

[*See page* 31.

Photograph No. XX.



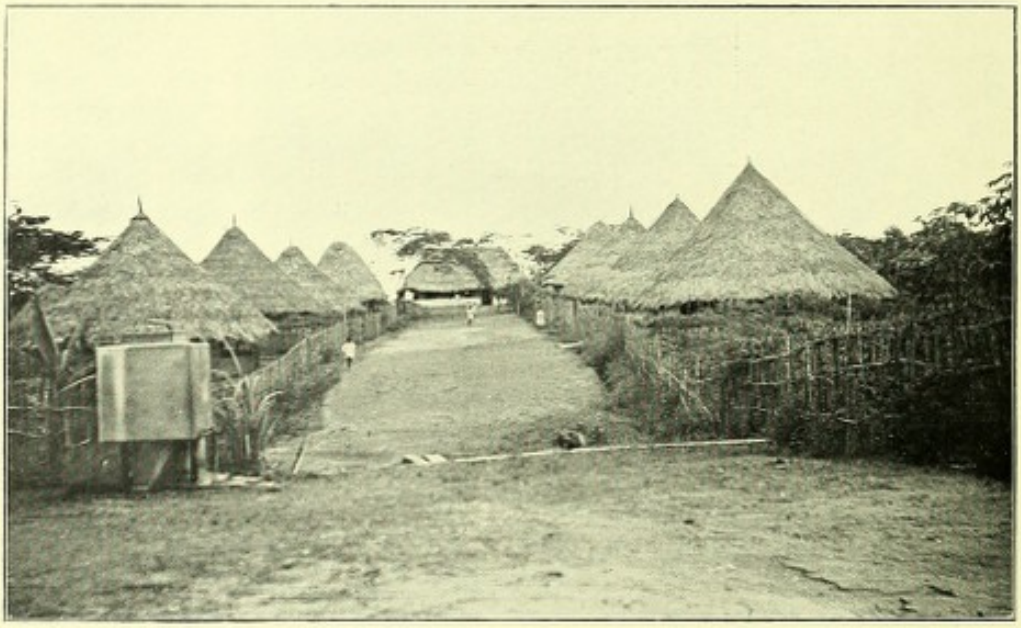
Back of G.P.O. Buildings, Crown Law Offices, Savings Bank, &c., from old Public Works Department yard. Latrine close to offices. Water tap of corner house to right.

[*See page* 34.

SIERRA LEONE.

Bo.

Photograph No. I.



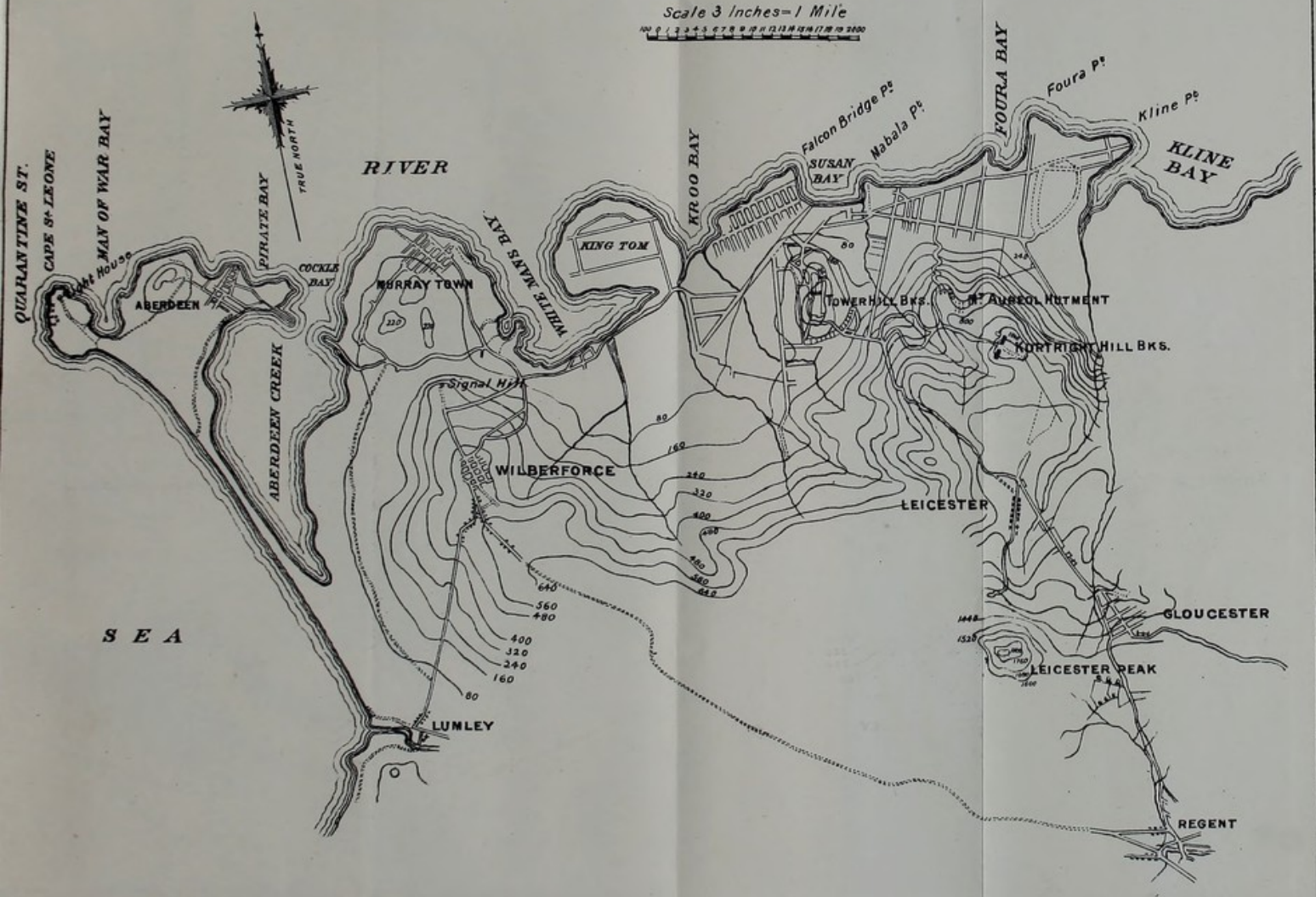
Bo School residential quarters.

[*See page* 37.

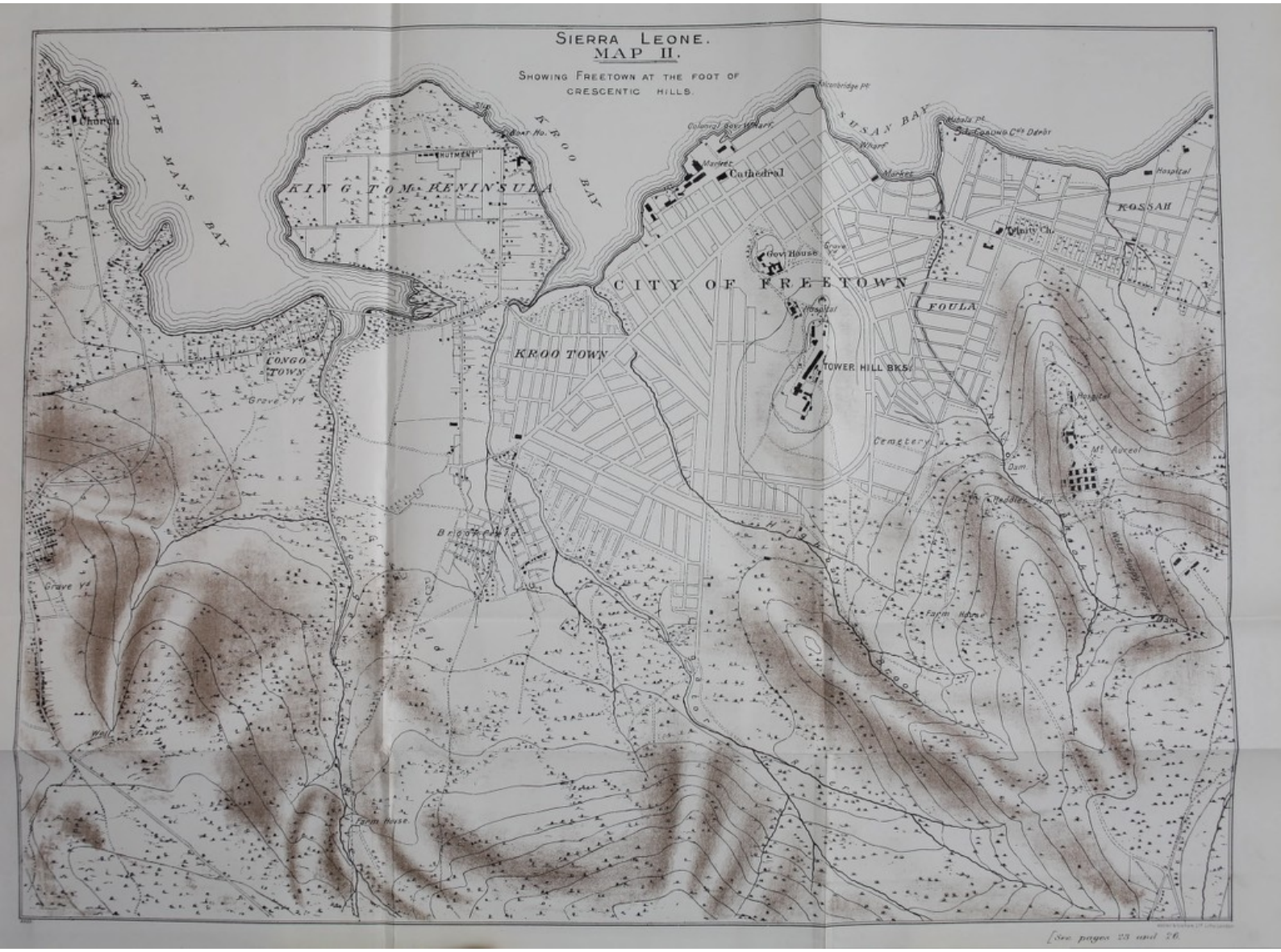
SIERRA LEONE

MAP I.

SHOWING FREETOWN AND ITS ENVIRONS.



See Pages 22 and 23



[See pages 23 and 26.

SIERRA LEONE.

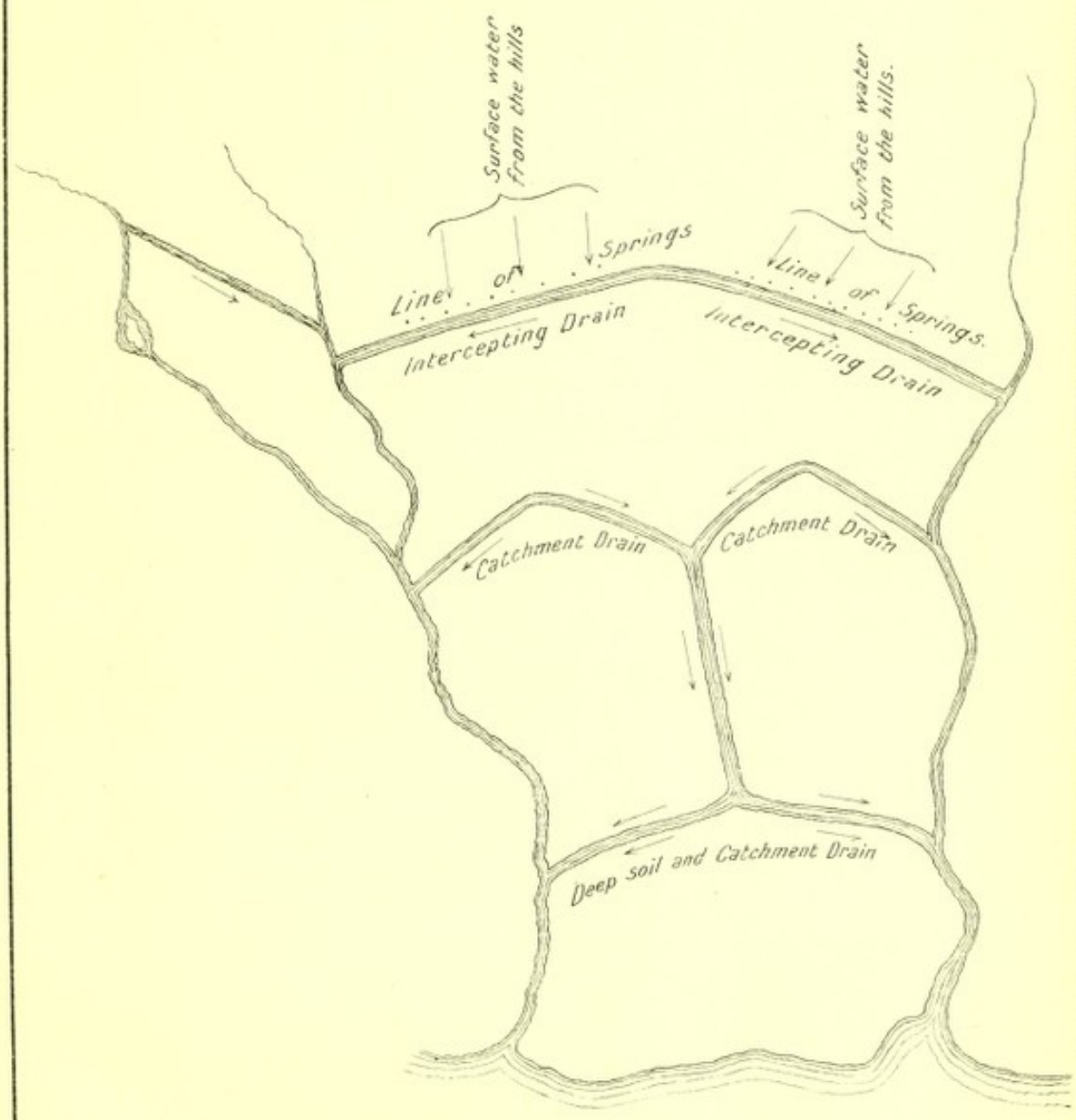
PLAN I.

FREETOWN.

SIERRA LEONE.
PLAN II.

FREETOWN.

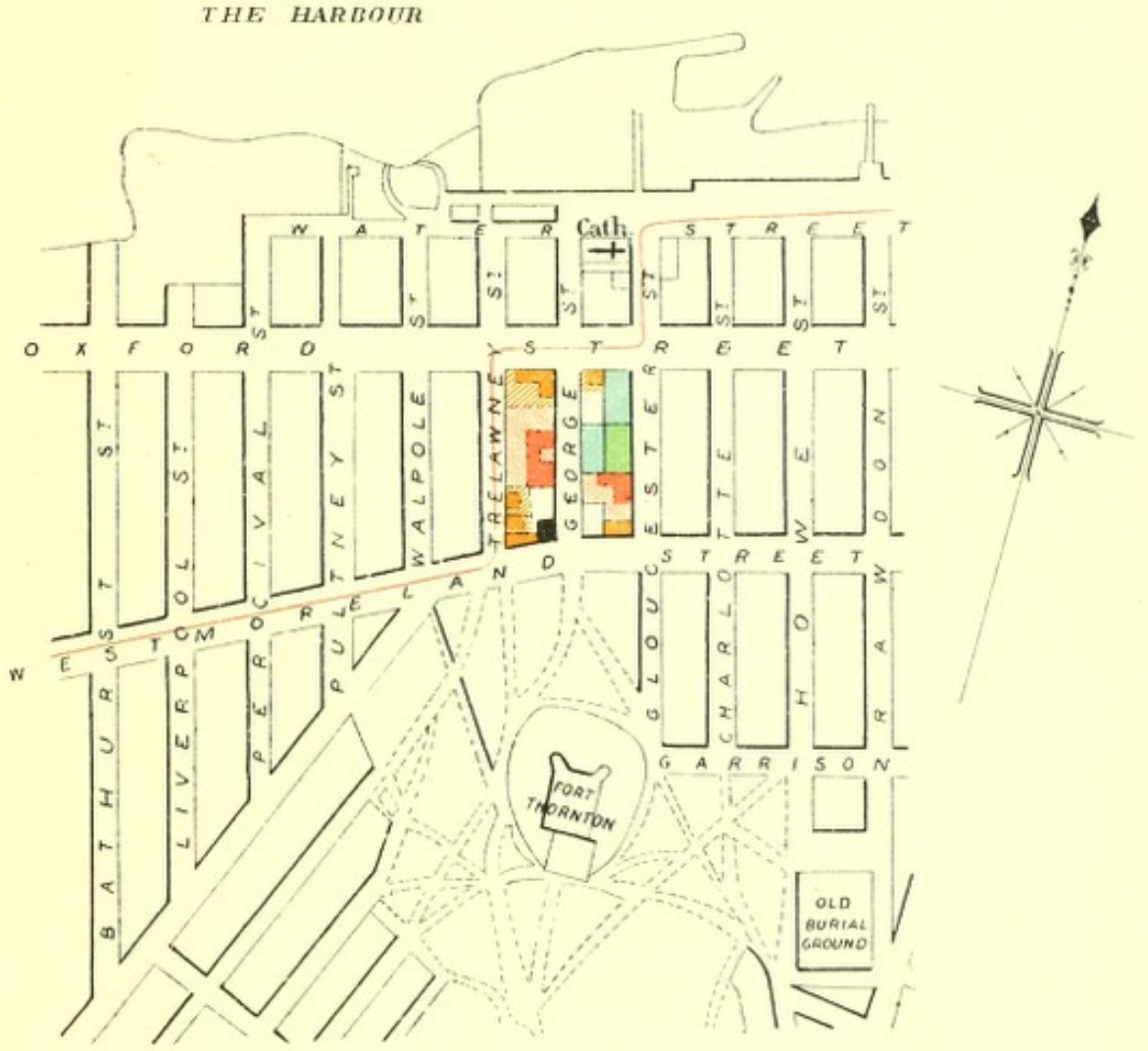
DIAGRAMMATIC PLAN OF INTERCEPTING DRAINS CUTTING OFF DRAINAGE FROM HILLS AND THE SPRINGS AT THE FOOT OF THE HILLS. ALSO DRAINS TO REMOVE WATER-LOGGING OF LOWER AREA.



[See Page 32.

2839.
Waller & Graham, Ltd. Litho. London.

SIERRA LEONE
FREETOWN.
PLAN III.



Plots in Oblong Areas about 150 to 160 ft. × 480 ft. each
Trelawney, George, & Gloucester St. about 80 ft. wide each

Key

Red = Govt. Plots.
Blue = Leased to Govt.
Brown = Native occupied
White = Unoccupied - vacant plots
Green = Govt. plot leased to Mission
Black = Native rented by S. M. O.

Secretariat, Treasury, Audit, Printing: Post Office, Savings Bk., Crown Law Off.
Supreme Ct. Offs., former P.W.D now vacant.
Nursing Home, proposed Rest House

[See Page 34.

GOLD COAST.

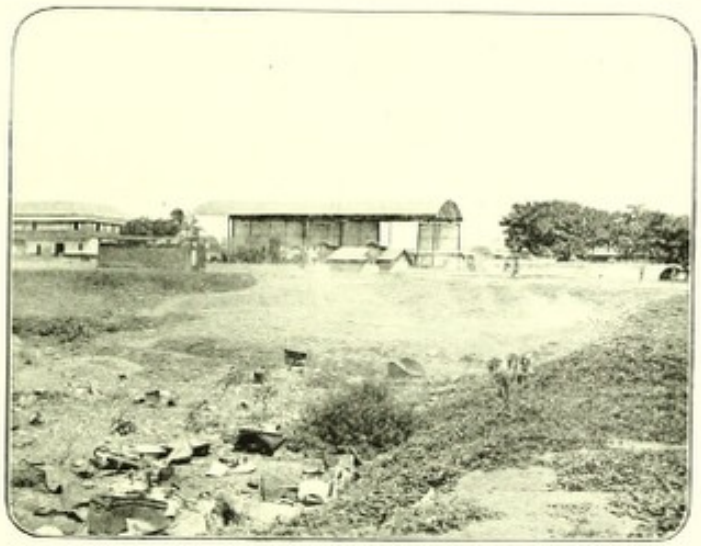
Accra.

Photograph No. 1.

Dustbin No. 11. Salaga Market.

[*See page* 38.

Photograph No. 2.



Jamestown Market and refuse ground.

[*See page* 38.

GOLD COAST.

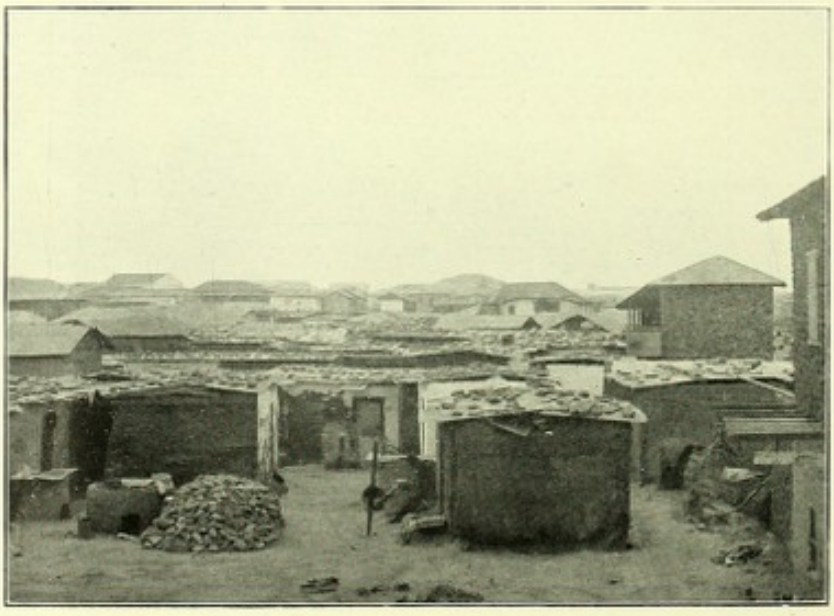
Accra.

Photograph No. 3.

Fish Market. Fish exposed to direct rays of sun.

[*See page* 38.

Photograph No. 4.



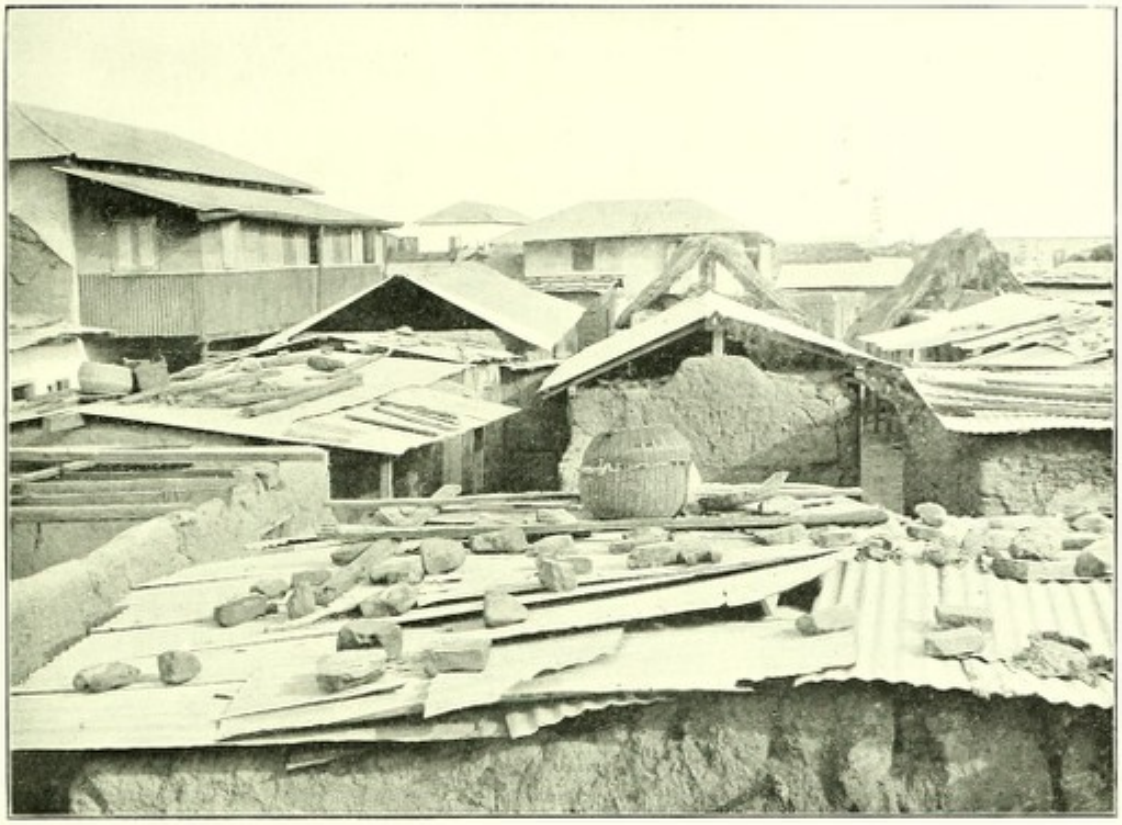
Crowded area of low swish huts with roofs of corrugated iron sheets kept in position by stones placed on the top. Huts built without regularity or order. No drainage possible.

[*See pages* 39 *and* 40.

GOLD COAST.

ACCRA.

Photograph No. 5.



An insanitary area, showing huts and houses crowded together without roadways or good compounds. Nothing but demolition of the huts and remodelling the whole area can render it healthy.

[*See pages* 39 *and* 40.

Photograph No. 6.

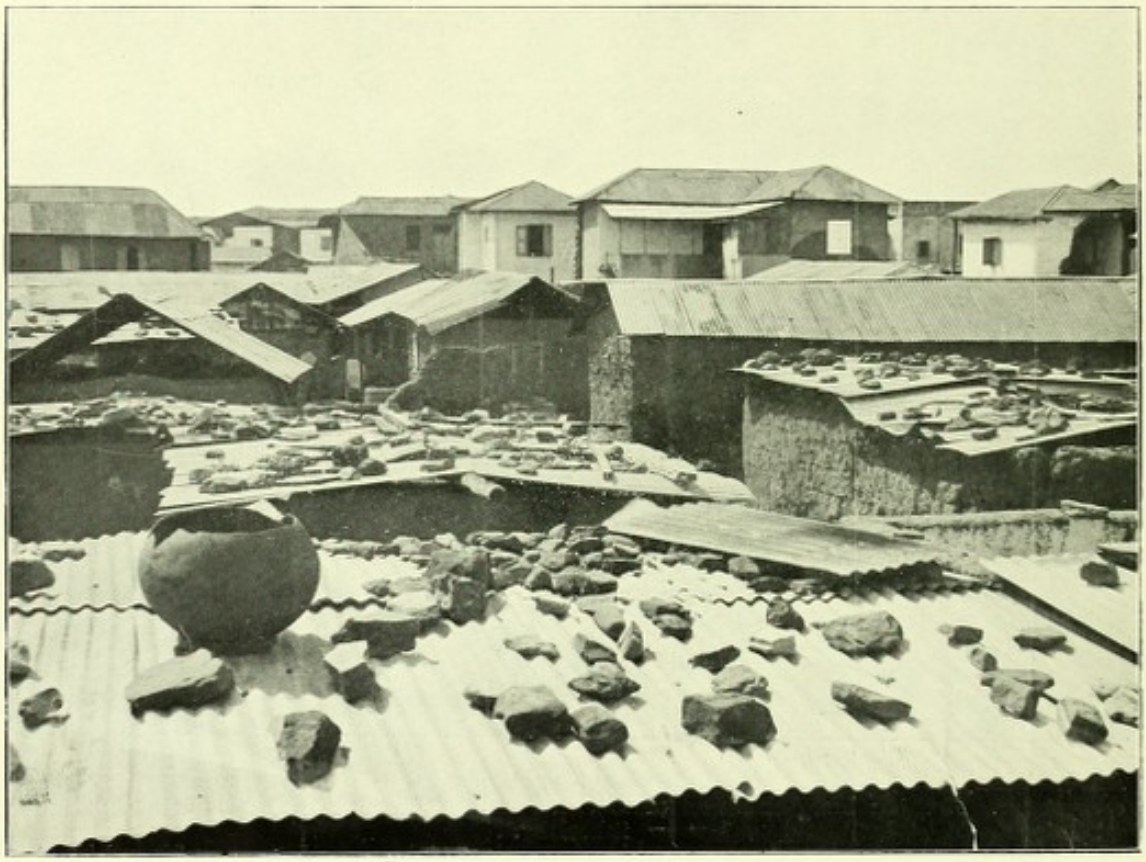
Part of a corrugated iron roof removed by a storm.

[*See pages* 39 *and* 40.

GOLD COAST.

Accra.

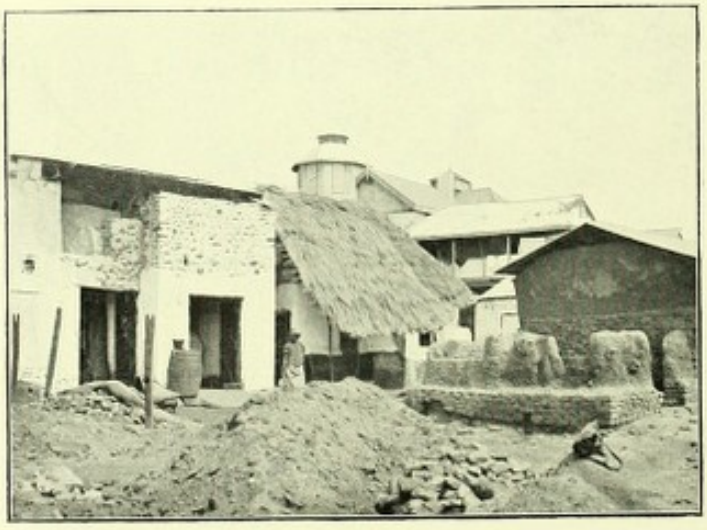
Photograph No. 7.



Vessel on roof with mosquito larvæ in its contained water.

[*See pages* 39 *and* 40.

Photograph No. 8.



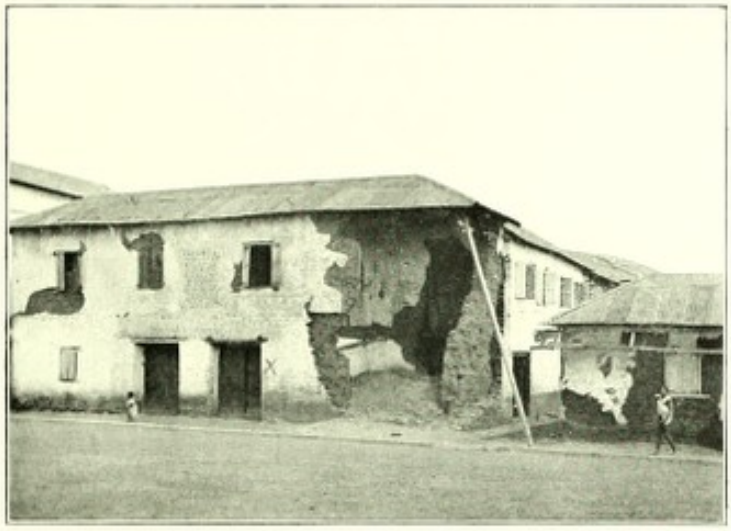
An open space in Jamestown which, owing to want of clearance and levelling, is a breeding place for malaria.

[*See pages* 39 *and* 40.

GOLD COAST.

Accra.

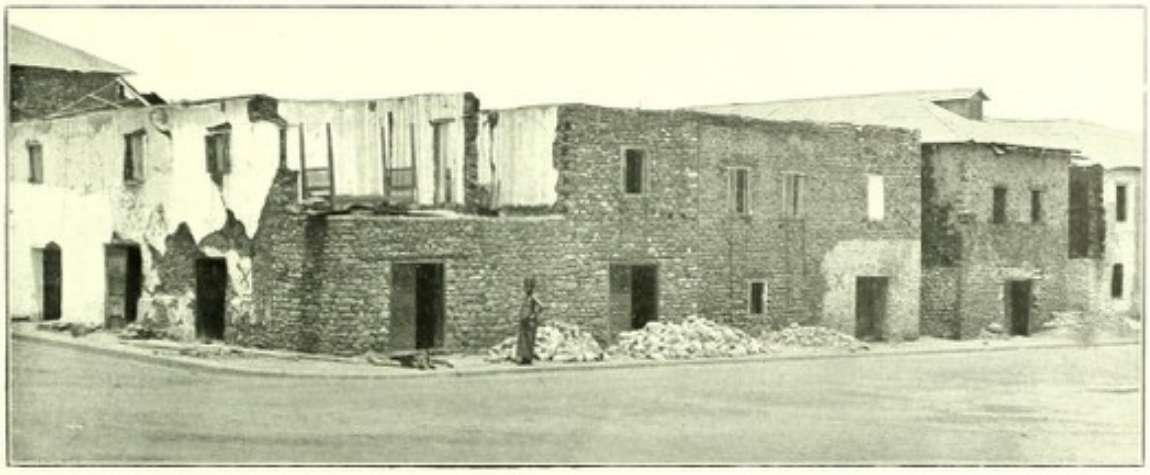
Photograph No. 9.



Dilapidated houses in principal street.

[*See pages* 39 *and* 40.

Photograph No. 10.



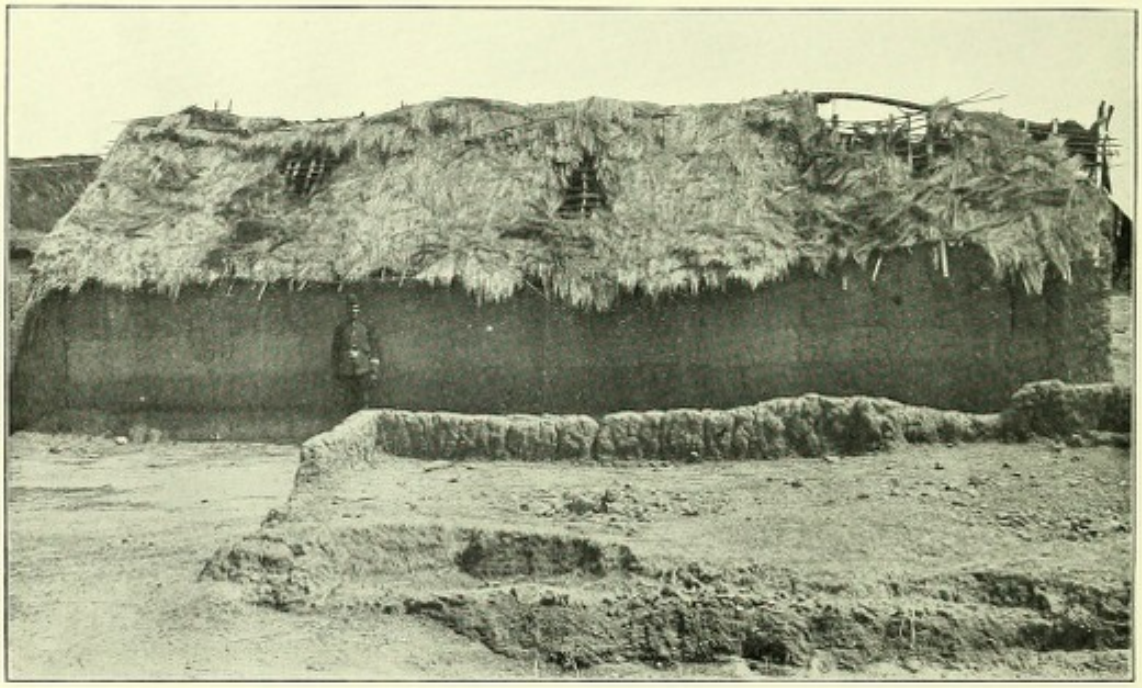
Dilapidated houses.

[*See pages* 39 *and* 40.

GOLD COAST.

Accra.

Photograph No. 11.



Dilapidated huts.

[*See pages* 39 *and* 40.

Photograph No. 12.

Thatched huts in Jamestown.

[*See pages* 39 *and* 40.

GOLD COAST.

ACCRA.

Photograph No. 13.

House behind hut approached by narrow passage. The X on door indicates a plague hut.

[*See pages 39 and 40.*

Photograph No. 14.

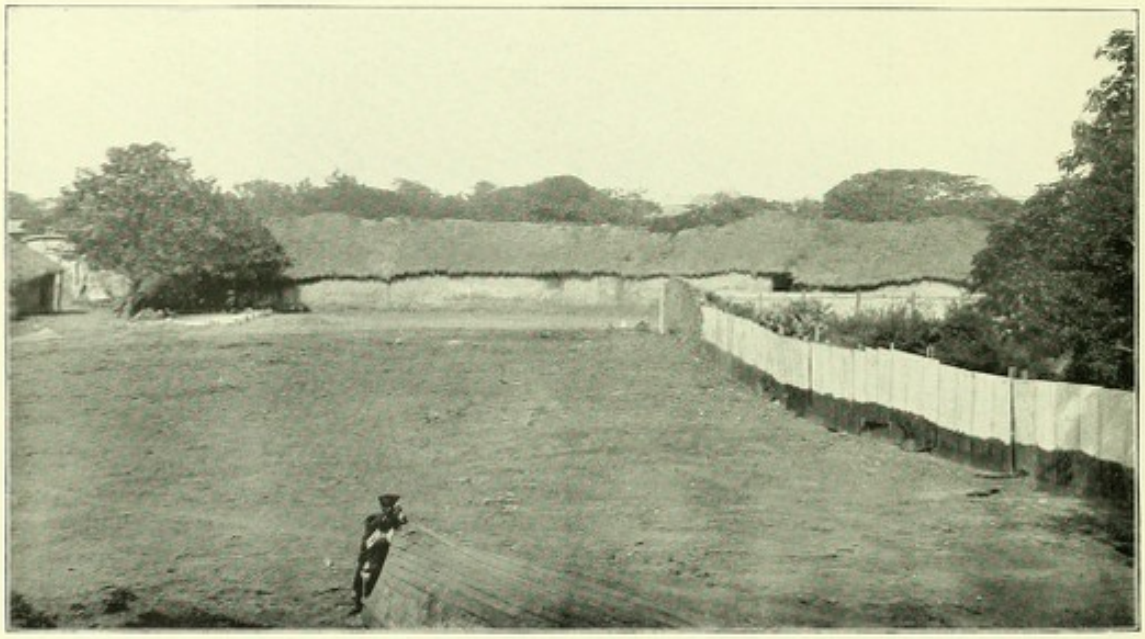
Condition of a courtyard common to two ranges of badly ventilated and badly lighted huts. No drainage, yard with many puddles during the rains.

[*See pages 39 and 40.*

GOLD COAST.

Accra.

Photograph No. 15.



Housas' huts and compound.

[*See page* 40.

Photograph No. 16.

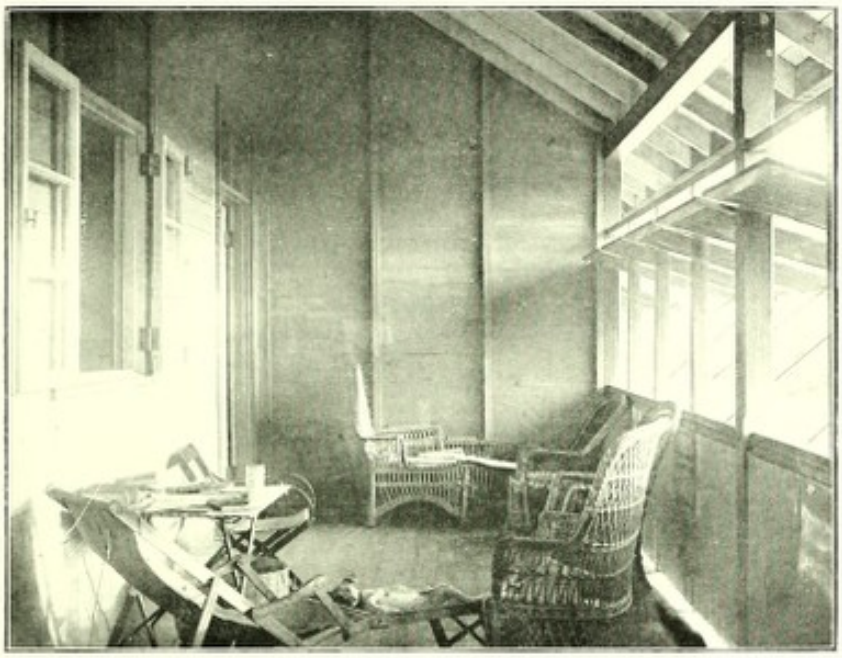
Bungalow, showing back, side, and tanks; sun on back; 9 a.m.

[*See page* 42.

GOLD COAST.

ACCRA.

Photograph No. 17.



Verandah on bungalow. Sun on it, 2.30 p.m., making it untenable except with helmet on. Other side to that shown in No. 16.

[*See page* 42.

Photograph No. 18.

Akimbo tank, or Victoria reservoir.

[*See page* 44.

GOLD COAST.

Sekondi.

Photograph No. I.

Essikadá main drain forming pool. Native-made footpath crosses it here. Woman standing in the pool. European hospitals to right on hill. Pipe at left base from a well for the railway yard water tank. The rank vegetation favourable to mosquitoes and tetze fly.

[*See page* 59.

Photograph No. II.

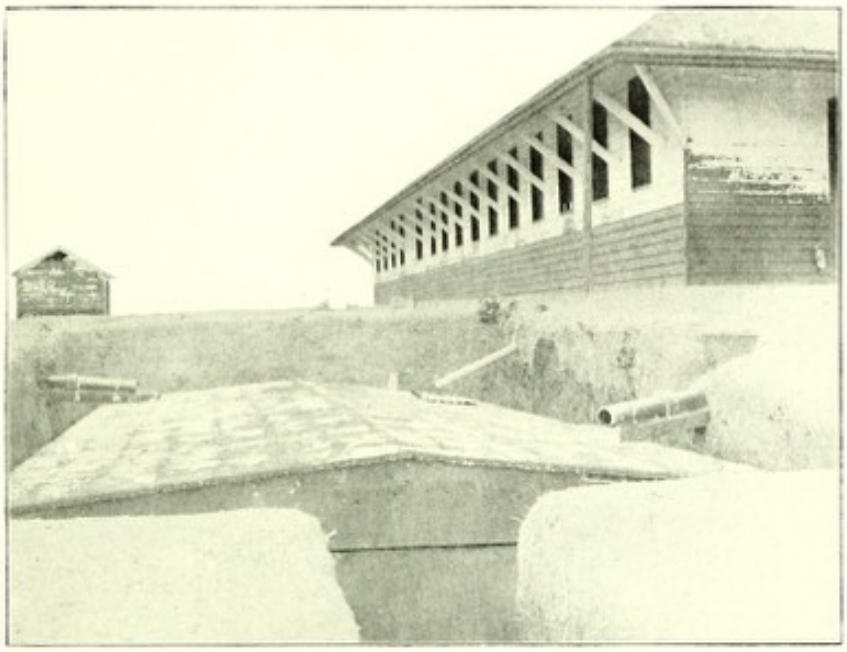
Series of pools in Hausa Town.

[*See page* 59.

GOLD COAST.

Cape Coast.

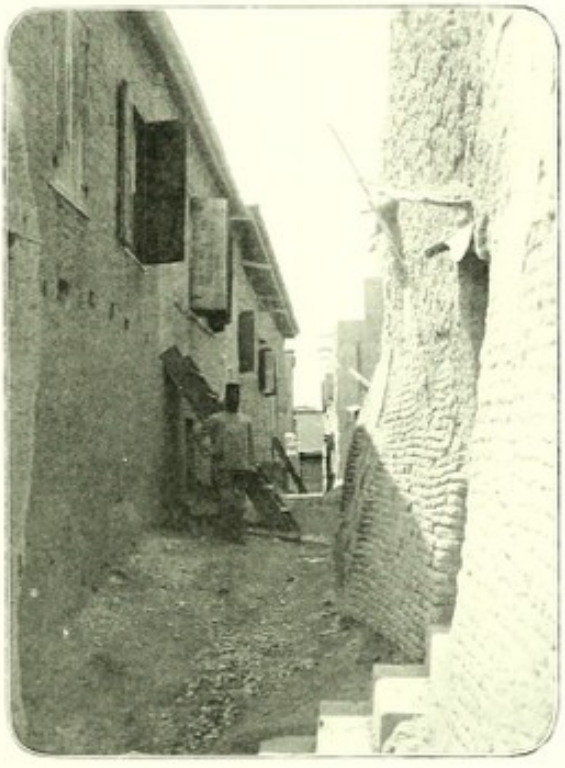
Photograph No. I.



Tank at Isolation Hospital or Fanti Schools. The cutting shown at bottom of photograph is not a drain—it ends abruptly just beyond. The tank is in an undrained hole, which is a breeding place for mosquitoes.

[*See page* 64.

Photograph No. II.



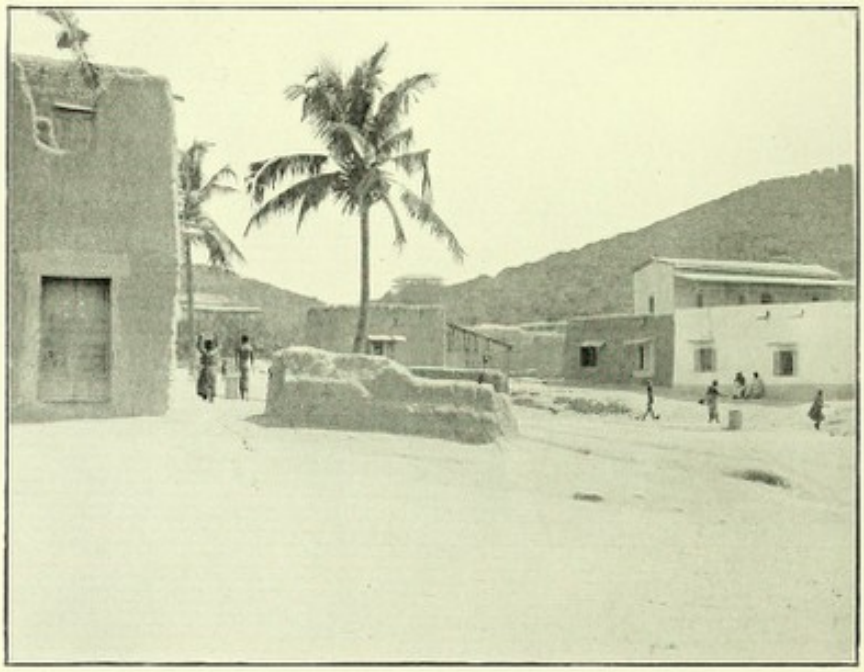
Alley behind Commercial Road.

[*See page* 65.

GOLD COAST.

Cape Coast.

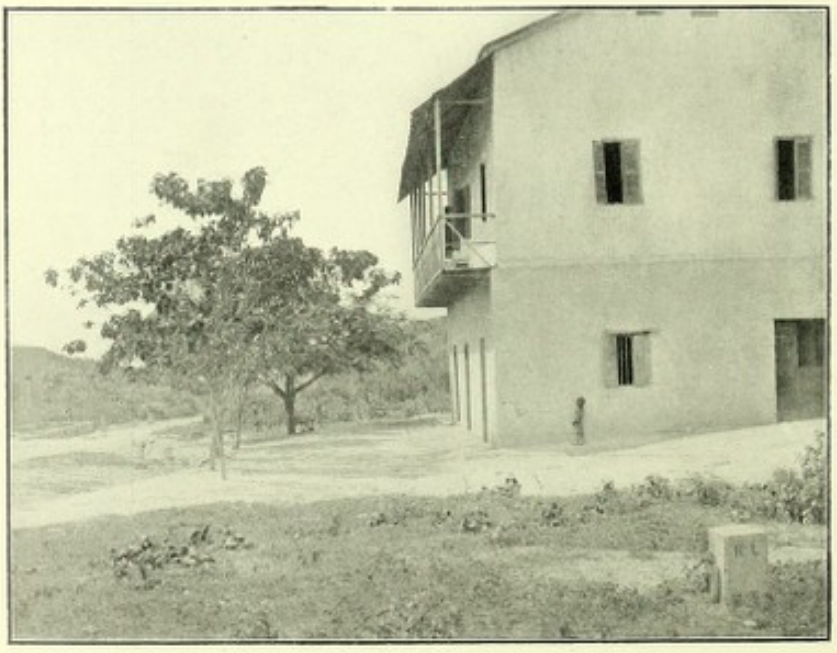
Photograph No. III.



Buckman's Road, showing buildings in road line.

[*See page* 65.

Photograph No. IV.



Hannah Street, showing bush in street, contracting the road to a narrow lane at one part.

[*See page* 65.

GOLD COAST.

Cape Coast.

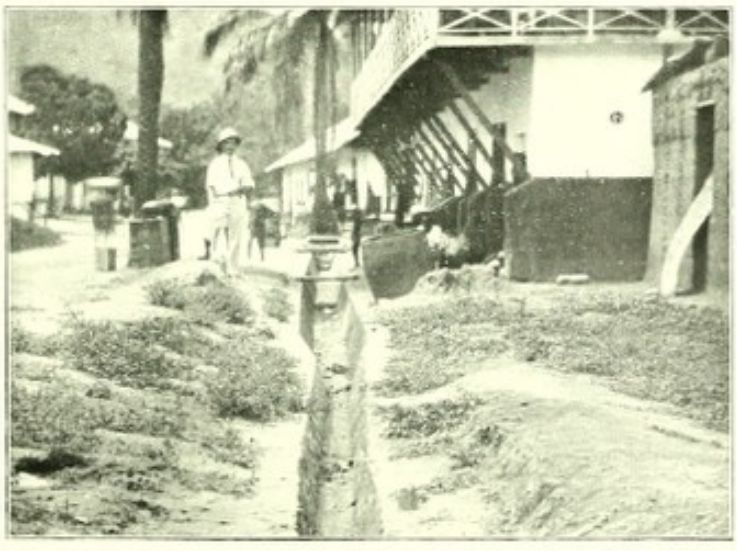
Photograph No. V.

Flushing tank at head of main drain.

[*See page 65.*

Dodowah.

Photograph No. I.



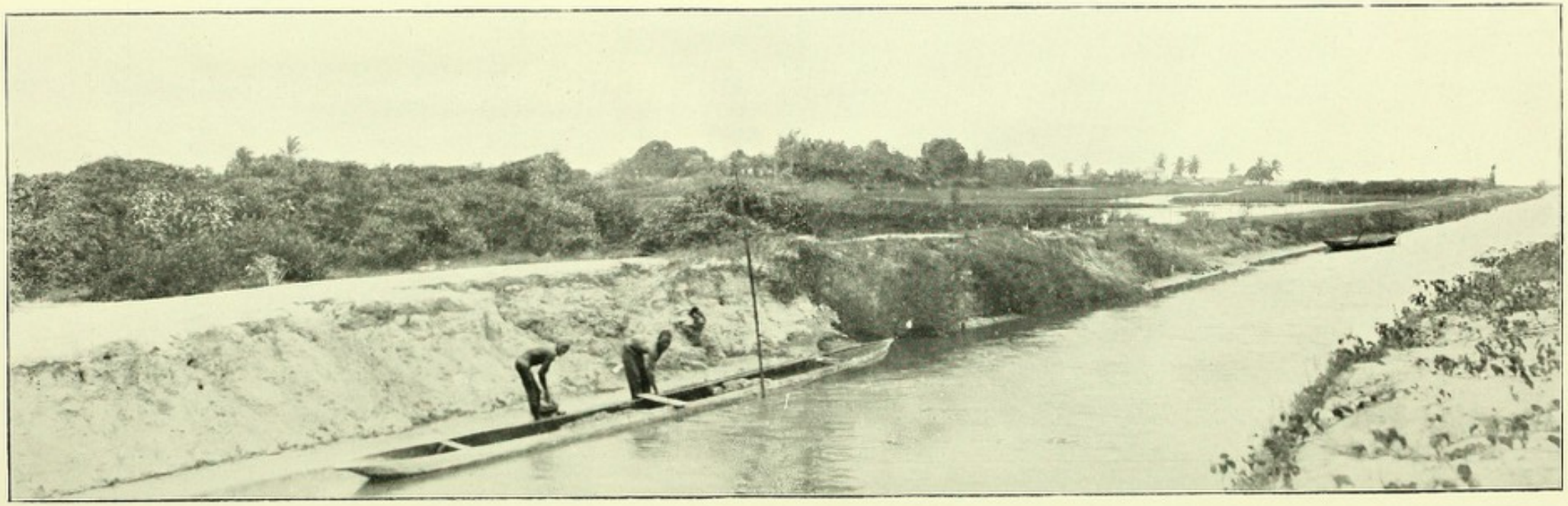
Surface drain at Dodowah, showing bad construction.

[*See page 67.*

SOUTHERN NIGERIA.

LAGOS.

Photograph No. 1.



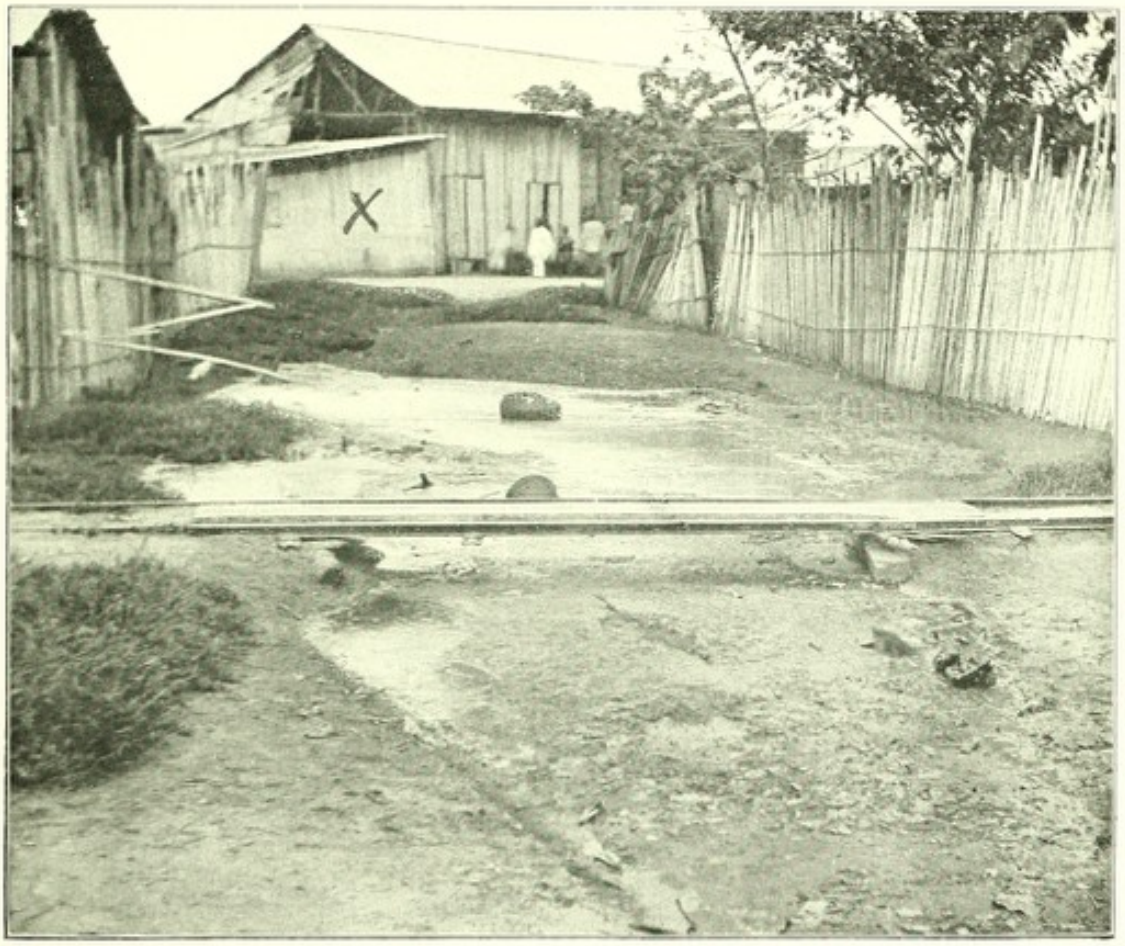
Macgregor's canal.

[*See page* 70.

SOUTHERN NIGERIA.

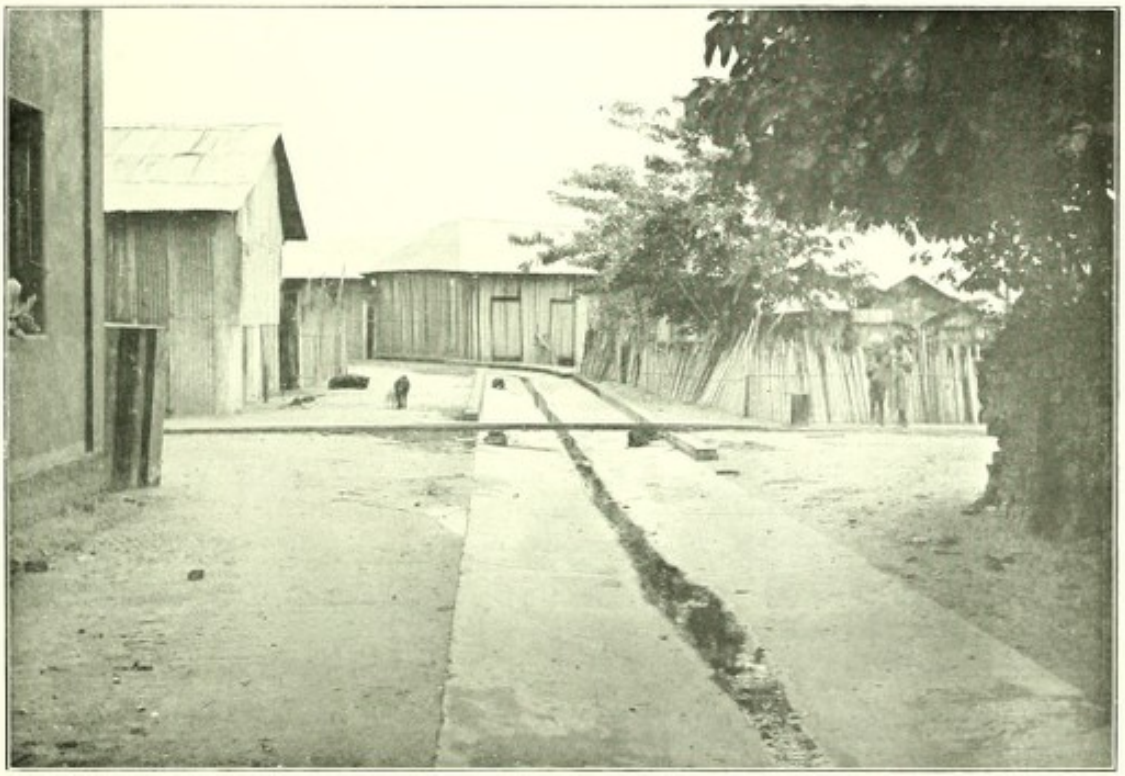
LAGOS.

Photograph No. 2.



Alakoro. Balogun Street West. 8 February, 1908. Condition of street before reclamation.
[*See page* 71.

Photograph No. 3.



23 June, 1908. The same as No. 2 after reclamation and drainage work completed.
[*See page* 71.

SOUTHERN NIGERIA.

Lagos.

Photograph No. 4.

8 February, 1908. Alakoro reclamation. Kossh Street before reclamation.

[*See page* 71.

Photograph No. 5.

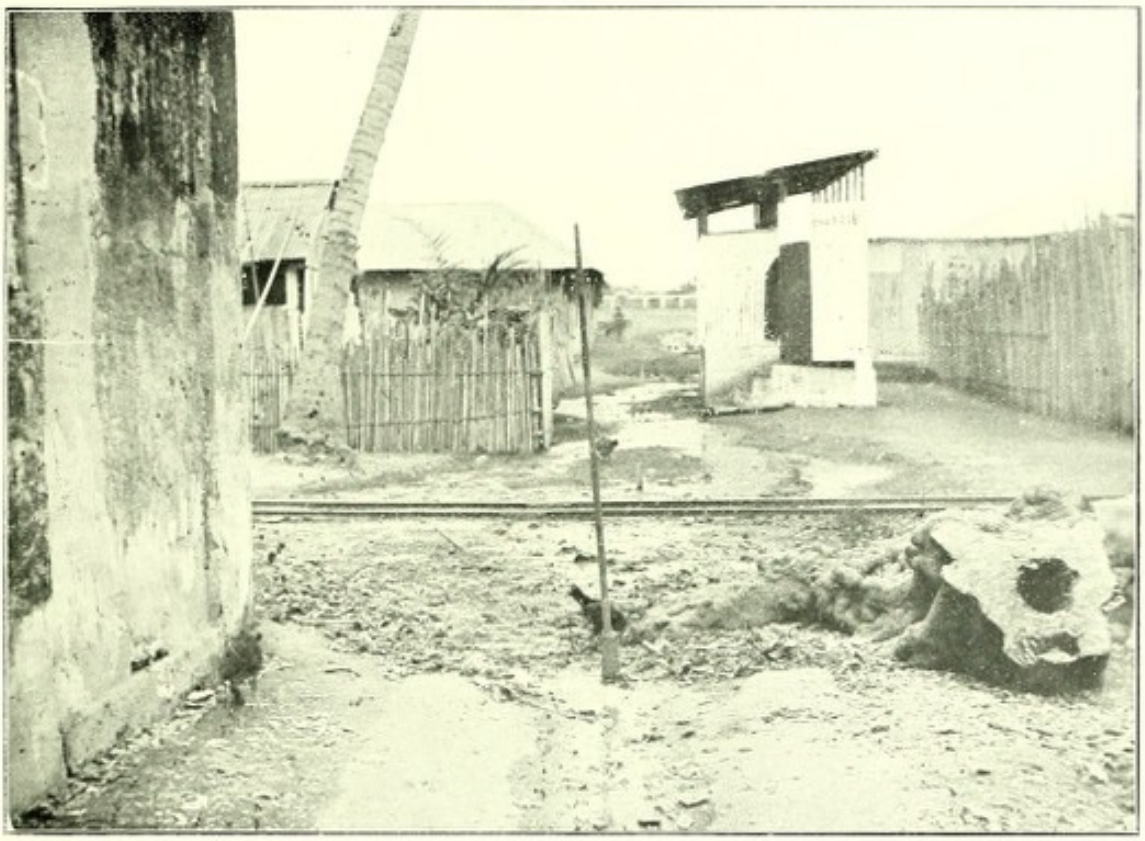
23 June, 1908. The same as No. 4 after reclamation and draining.

[*See page* 71.

SOUTHERN NIGERIA.

LAGOS.

Photograph No. 6.



8 February, 1908. Alakoro reclamation. Kossh Street, looking across Aflin Lane.

[*See page* 71.

Photograph No. 7.

23 June, 1908. The same as No. 6 after reclamation.

[*See page* 71.

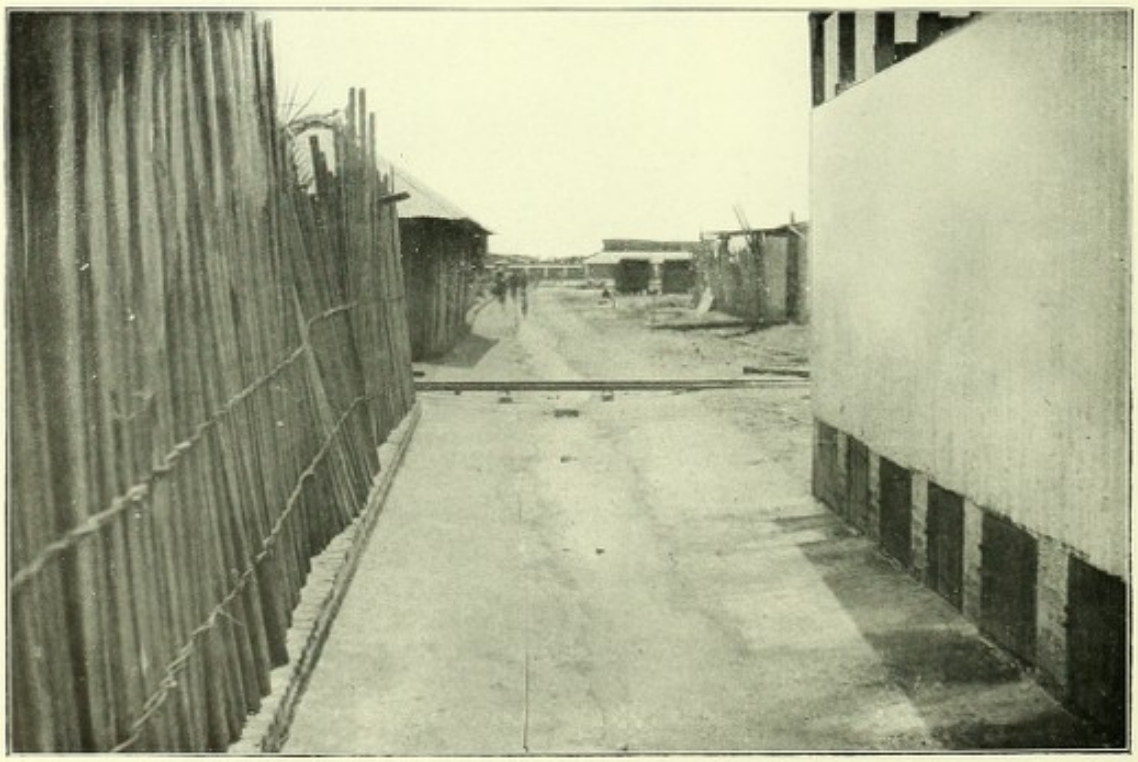
LAGOS.

Photograph No. 8.

8 February, 1908. Alakoro reclamation. Kossh Street from Affin Lane. *See* No. 4. The earthenware pot in the centre of Photograph No. 4 may be seen in the distance near the man standing with his arms akimbo in this view.

[*See page* 71.

Photograph No. 9.



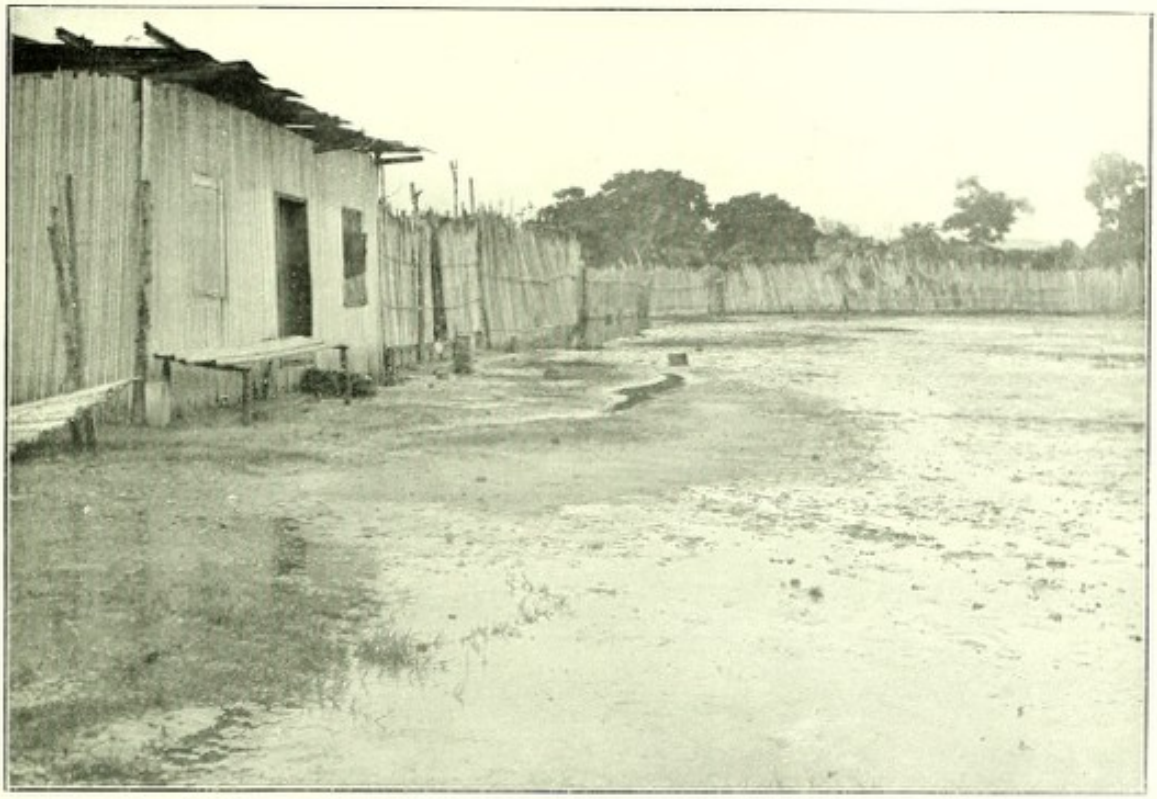
23 June, 1908. The same as No. 8.

[*See page* 71.

SOUTHERN NIGERIA.

LAGOS.

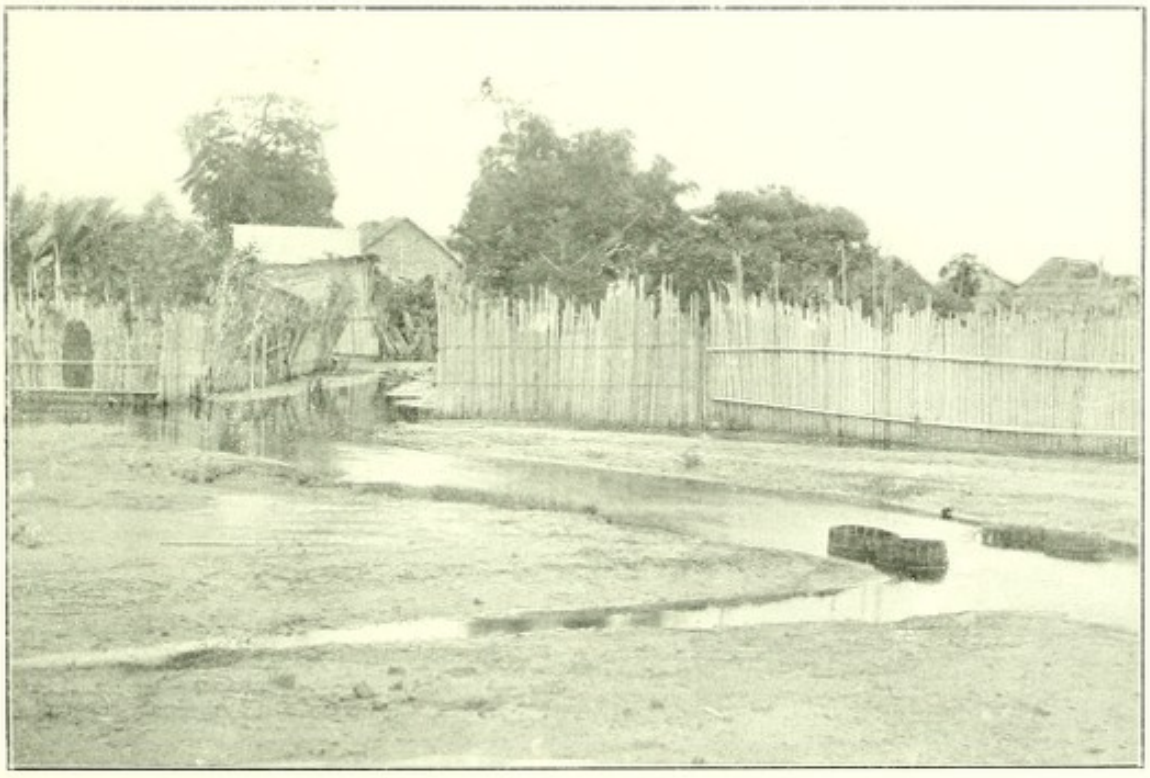
Photograph No. 10.



Alakoro reclamation, 13 July, 1908. Reclamation in progress.

[*See page* 71.

Photograph No. 11.



Alakoro Swamp, 13 July, 1908, under reclamation and since filled in (12 August, 1908).

[*See page* 71.

Photograph No. 12.

Edge of reclamation.

Alakoro Swamp, 13 July, 1908. This view appears in the distance in No. 13.

[*See page* 71.

Photograph No. 13.

Drain.

Drain.

Road under construction.

Drain.

Alakoro Swamp, 13 July, 1908. Since filled in (12 Aug. 1908). In the foreground the formation for new road from Customs to Carter Bridge and new surface drains.

[*See page* 71.

SOUTHERN NIGERIA.

Lagos.

Photograph No. 14.

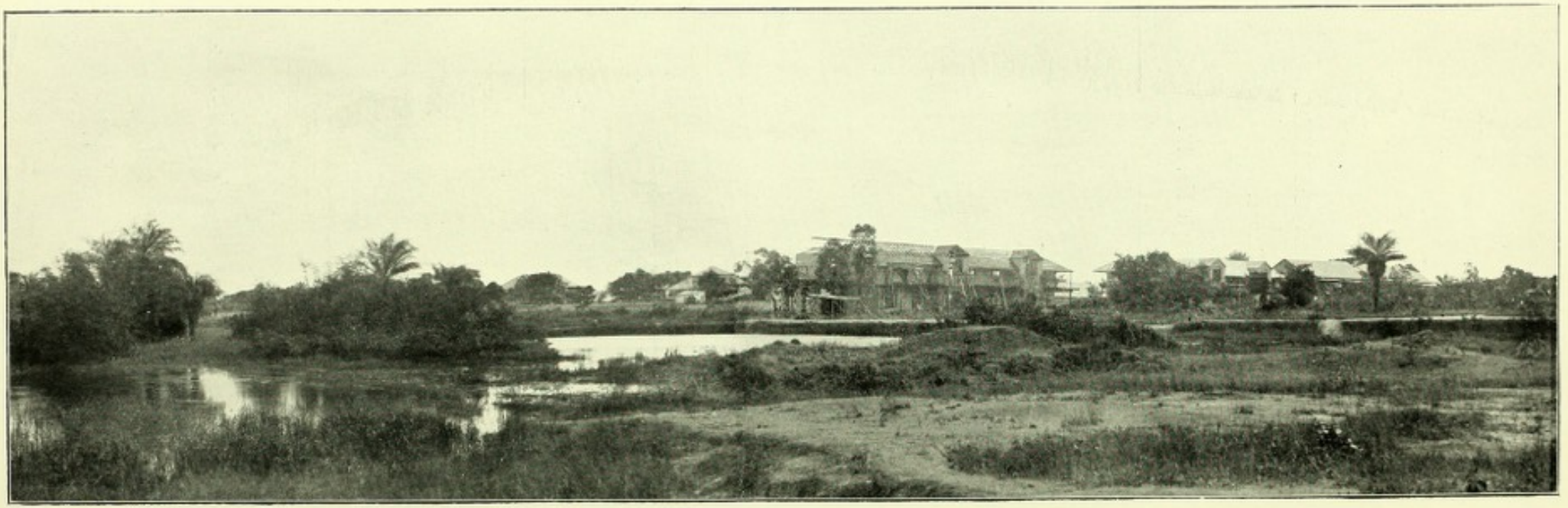
Swamp in compound of house being filled up with refuse.

[*See page* 71.

SOUTHERN NIGERIA.

LAGOS.

Photograph No. 15.



Showing marshy surroundings of new dwellings for railway employees.

[*See page 72.*

SOUTHERN NIGERIA.

LAGOS.

Photograph No. 16.

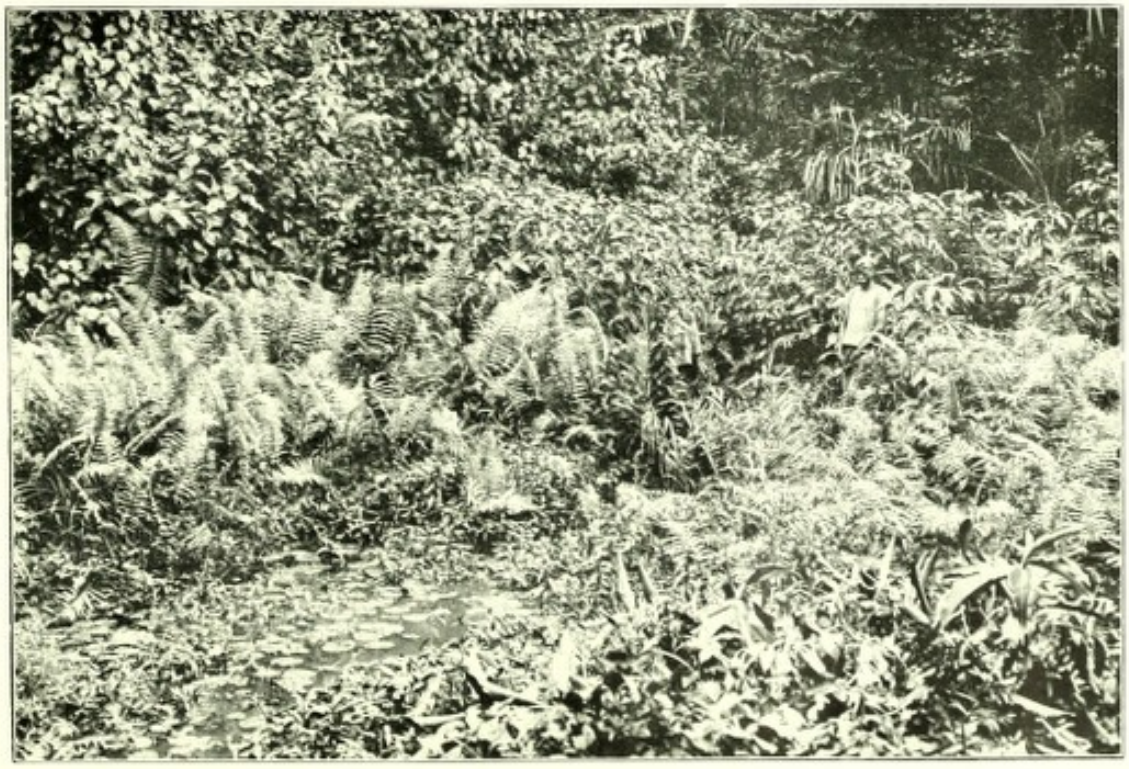
Badly planned house showing good frontage.

[*See page 73.*

ILO RIVER.

The Ilo River as a source for the water supply of Lagos.

Photograph No. 1.



Ilo River, looking up-stream from under the railway bridge: the two men near the centre of the photograph were placed to indicate the banks of the river, which are hidden by over-growing vegetation.

[*See pages 75 and 76.*

SOUTHERN NIGERIA.

ILO RIVER.

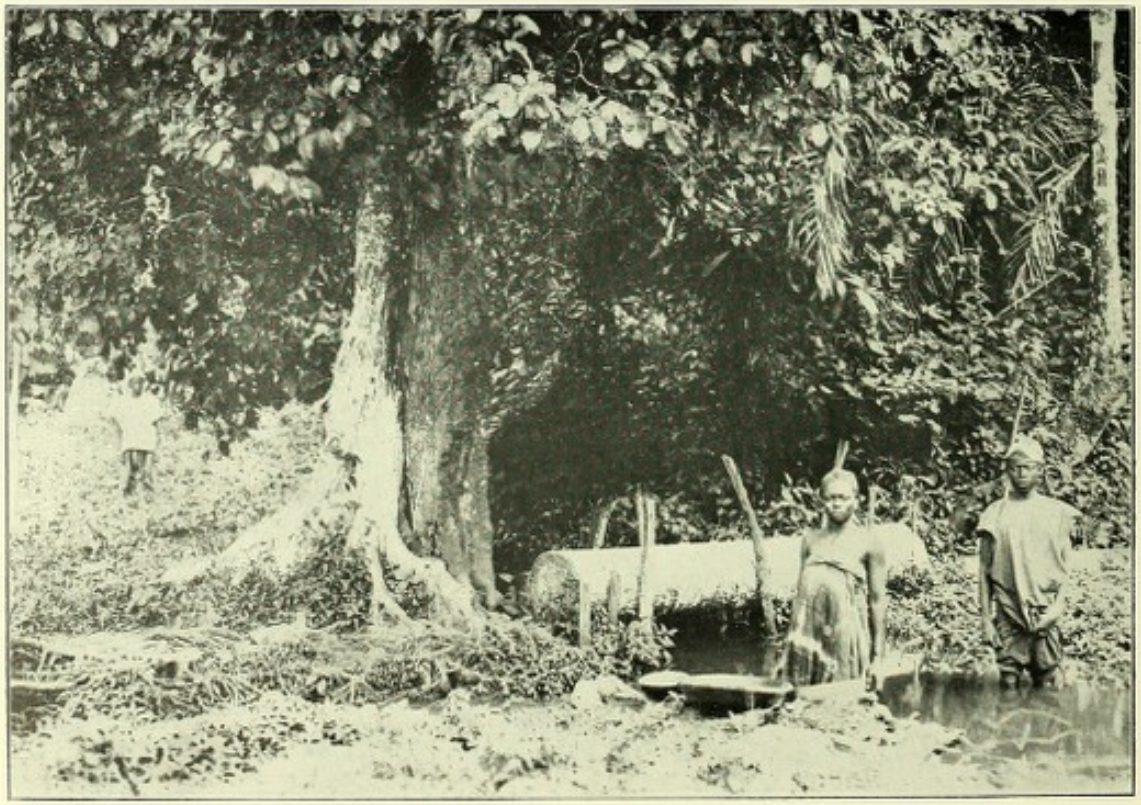
The Ilo River as a source for the water supply of Lagos.

Photograph No. 2.

Entrance to Ologe Village which drains into the river.

[*See pages* 75 *and* 76.

Photograph No. 3.



The river at No. 3 gauge.

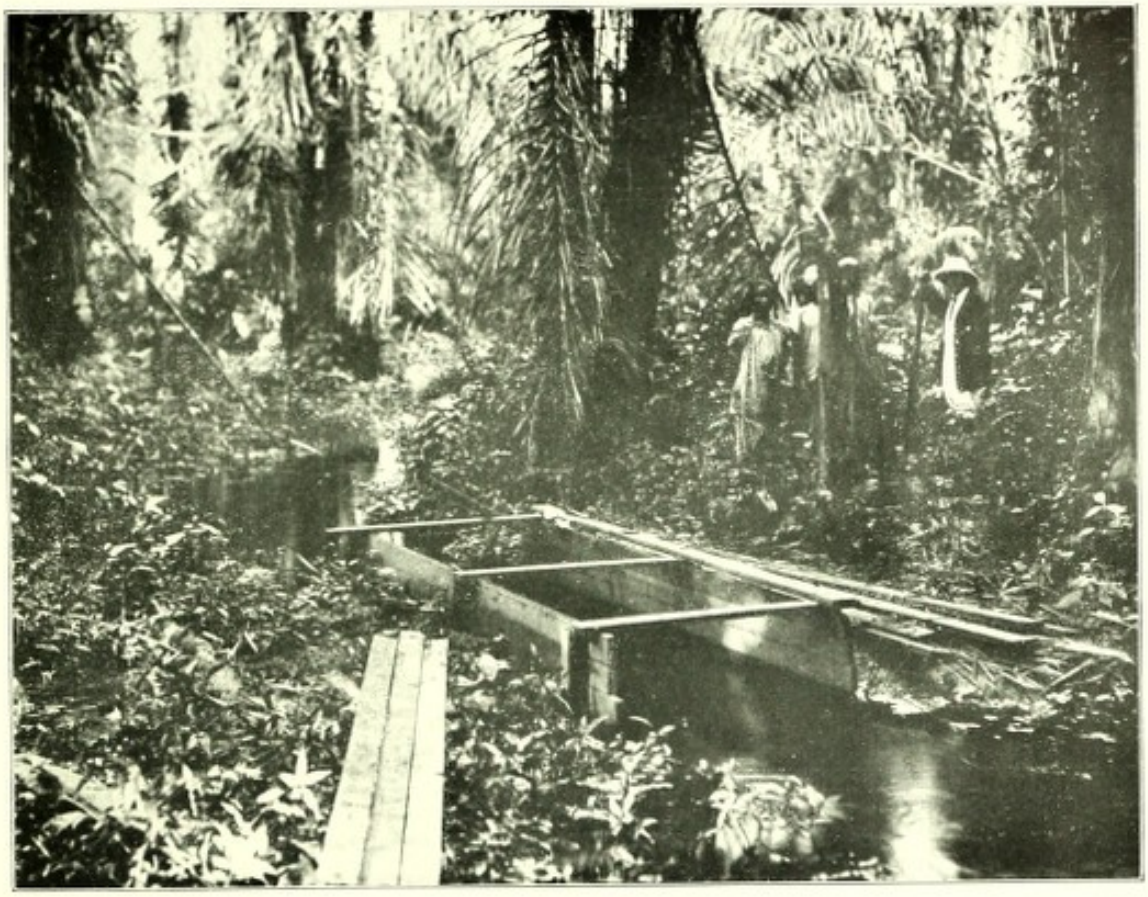
[*See pages* 75 *and* 76.

SOUTHERN NIGERIA.

ILO RIVER.

The Ilo River as a source for the water supply of Lagos.

Photograph No. 4.



Ilo River at No. 5 gauge, looking up-stream, taken from the Otta bank.

[*See pages 75 and 76.*

IJU RIVER.

The Iju River as a source of water supply for Lagos.

Photograph No. 1.

The pool at the source of the Iju River, near the 3rd bridge. The old woman at the back was washing herself and the white patches on her represent the lather of the soap.

[*See pages 75 and 76.*

SOUTHERN NIGERIA.

Iju River.

The Iju River as a source for the water supply of Lagos.

Photograph No. 2.

Iju River at "2nd bridge," looking down-stream. River bed at this point is muddy, into which a man sinks about 2 feet.

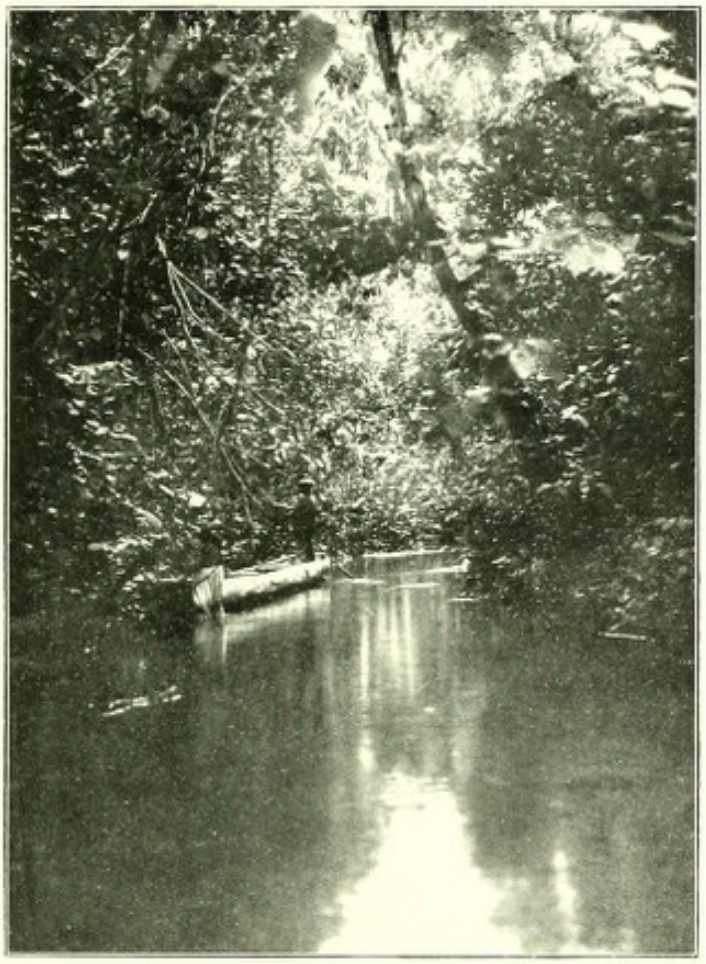
[*See pages 75 and 76.*

SOUTHERN NIGERIA.

Iju River.

The Iju River as a source of water supply for Lagos.

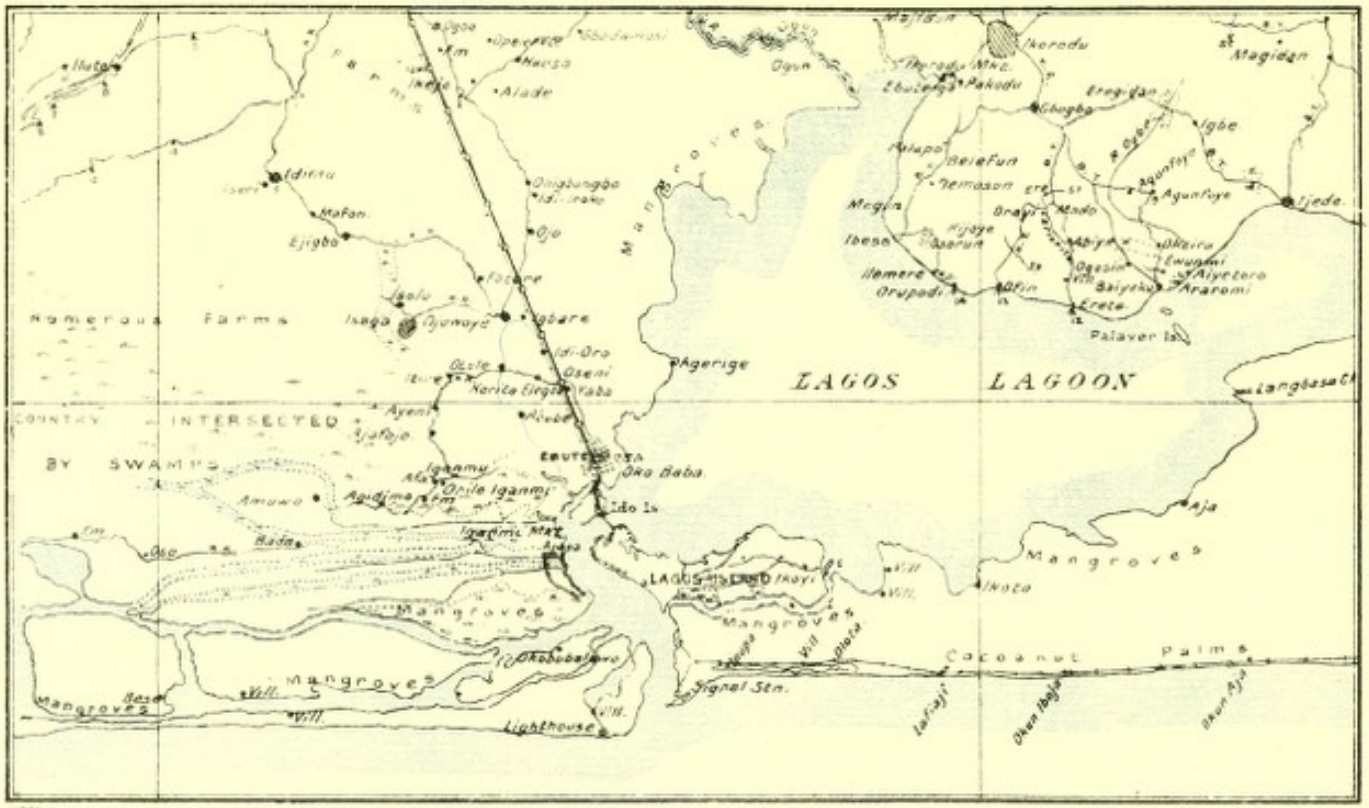
Photograph No. 3.



Iju River, looking up-stream, taken from a point in the river about 100 yards above the "1st bridge." River here broad and shallow with clean sandy bottom.

[*See pages 75 and 76.*

SOUTHERN NIGERIA.
LAGOS.
MAP. I.



Position of the Island of Lagos in relation to Lagoon, creeks, mainland, and sea.

[See Page 69.

SOUTHERN NIGERIA.
LAGOS.

PLAN I.

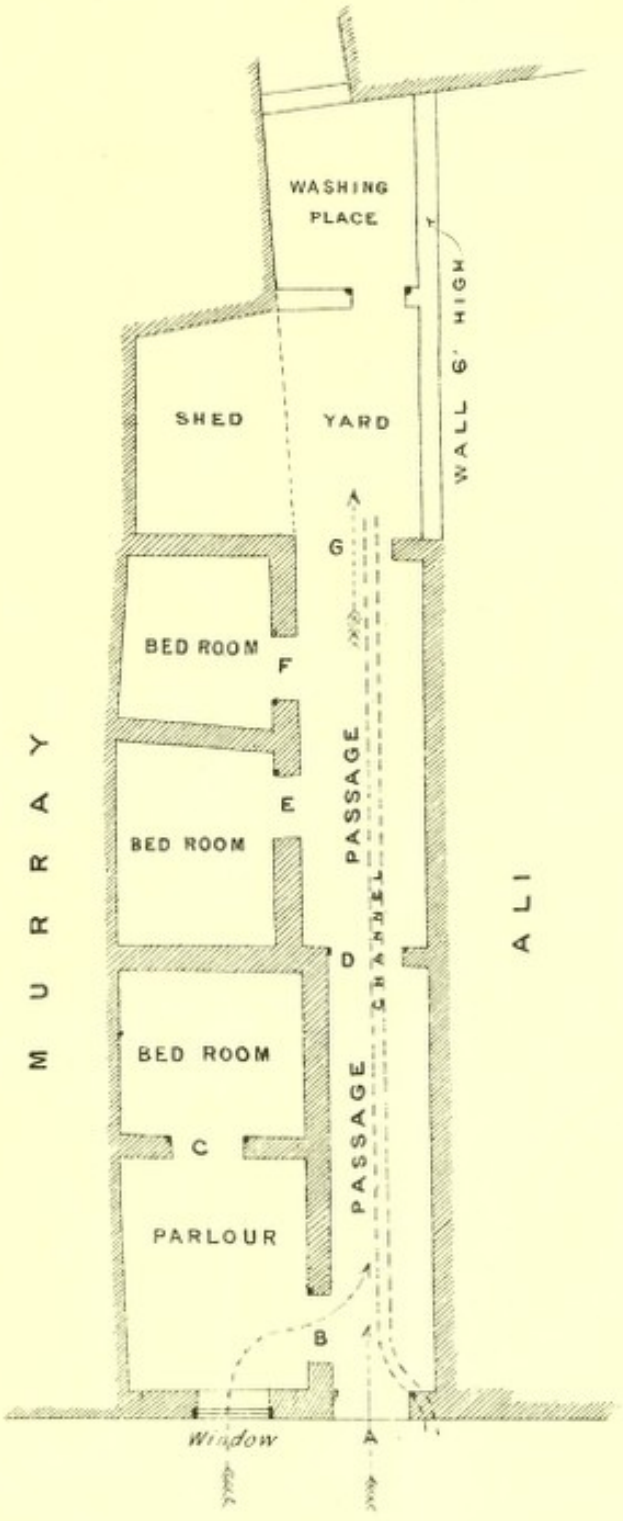
[See Page 70

Waller & Graham, Lith. London

SOUTHERN NIGERIA
LAGOS.

PLAN II.

GROUND PLAN OF PREMISES SHOWING BADLY LIGHTED AND BADLY VENTILATED ROOMS.



SCALE ⅛" 1 FT.

2839

[See Page 73

Waller & Graham Ltd. Litho London

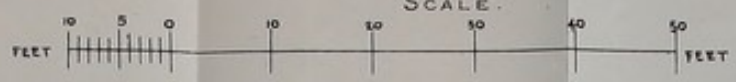
SOUTHERN NIGERIA.
LAGOS.

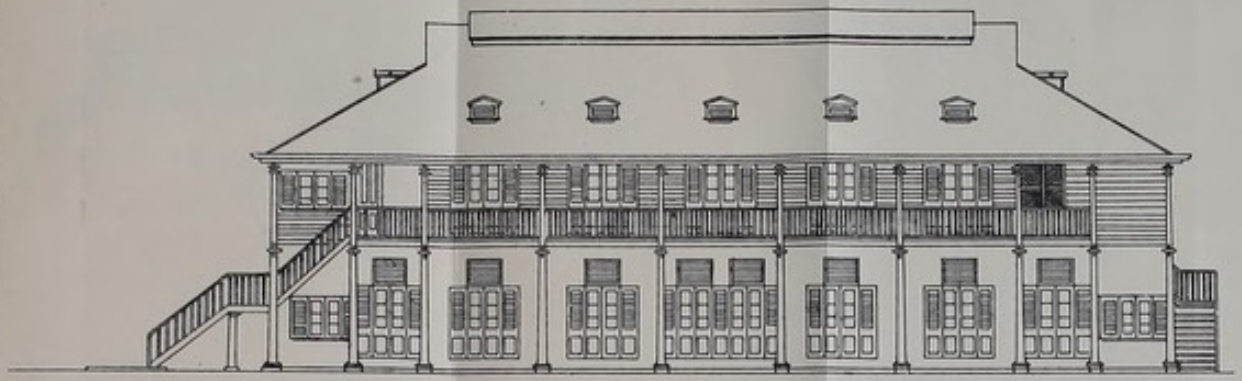
L.S.N.

N°. 3.

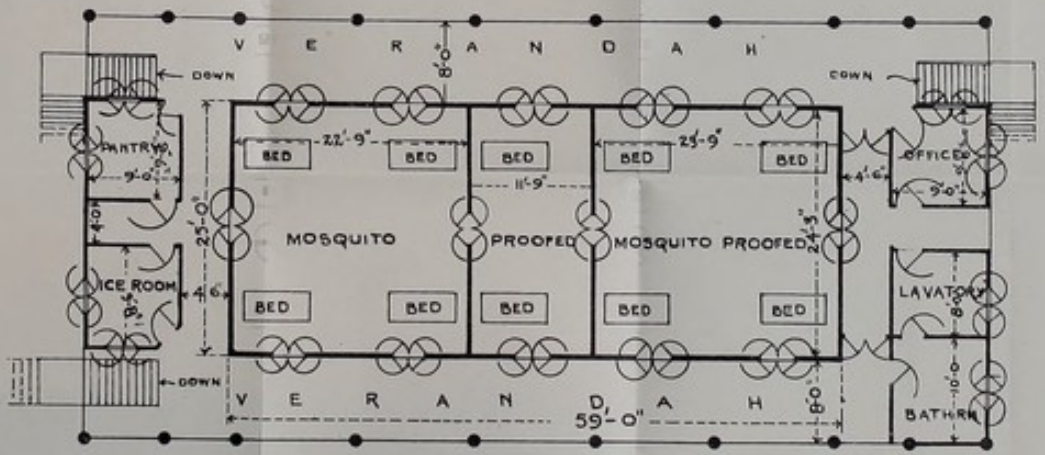
PLAN OF EUROPEAN HOSPITAL WARDS

SCALE.

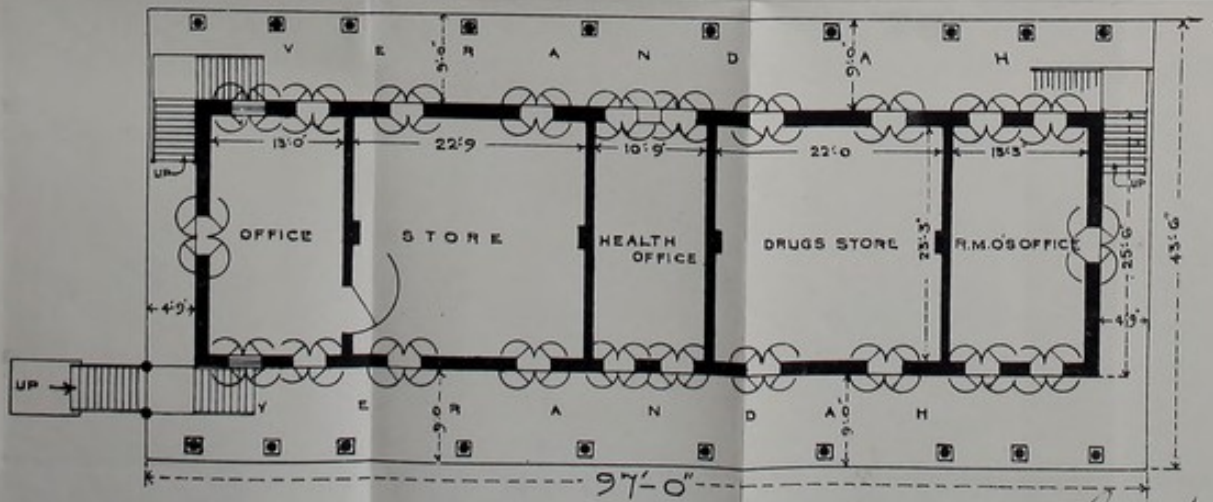




SIDE ELEVATION



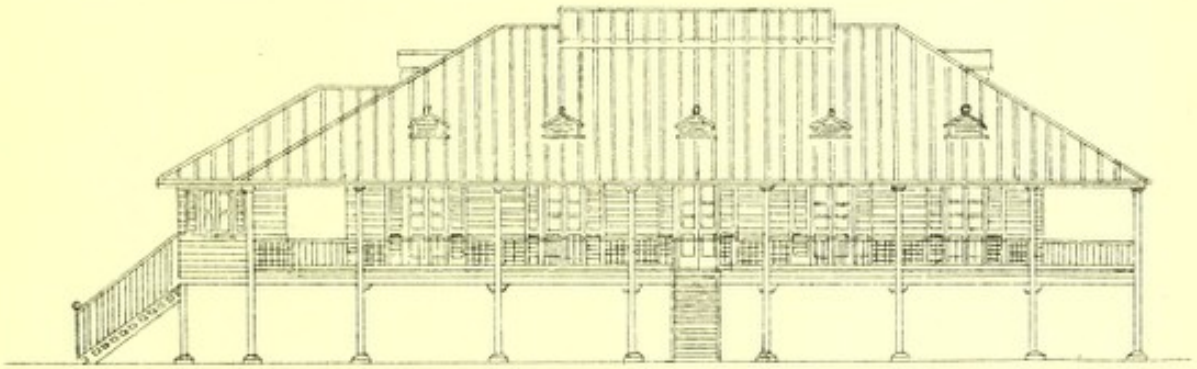
UPPER FLOOR PLAN



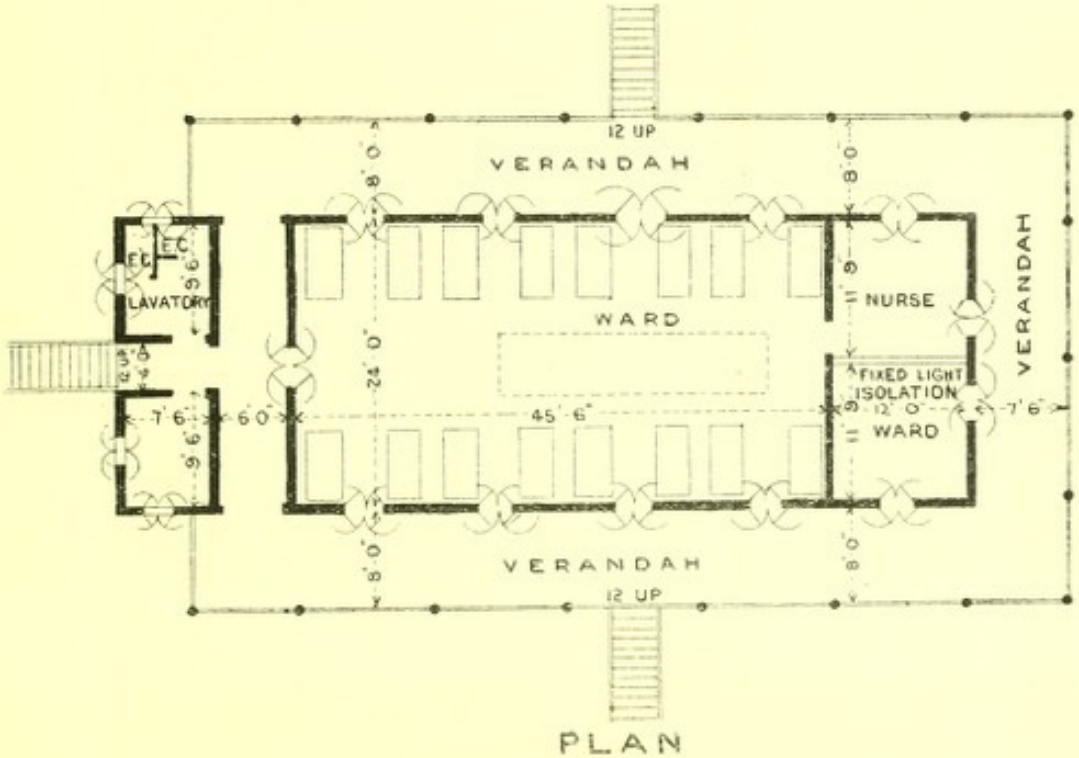
GROUND FLOOR PLAN

LONDON SCHOOL OF
LIBRARY
TROPICAL MEDICINE

SOUTHERN NIGERIA.
LAGOS
Nº 4.
HOSPITAL NATIVE WARD.



SIDE ELEVATION



PLAN

SCALE 1/16 INCH TO A FOOT.

10 5 0 10 20 30 40 50

[See Page 82.

SOUTHERN NIGERIA.

Forcados.

Photograph No. I.

Factory at Forcados and clerks' and artisans' dwellings in the distance.

[*See pages 83 and 84.*

Photograph No. II.

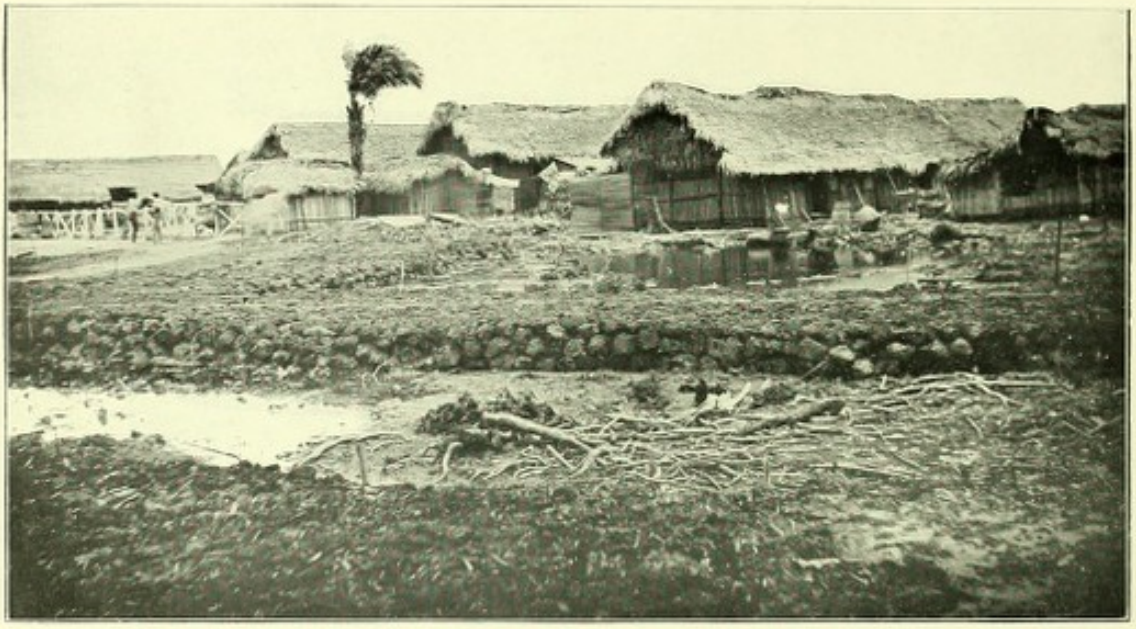
Forcados being cleared.

[*See pages 83 and 84.*

SOUTHERN NIGERIA.

Forcados.

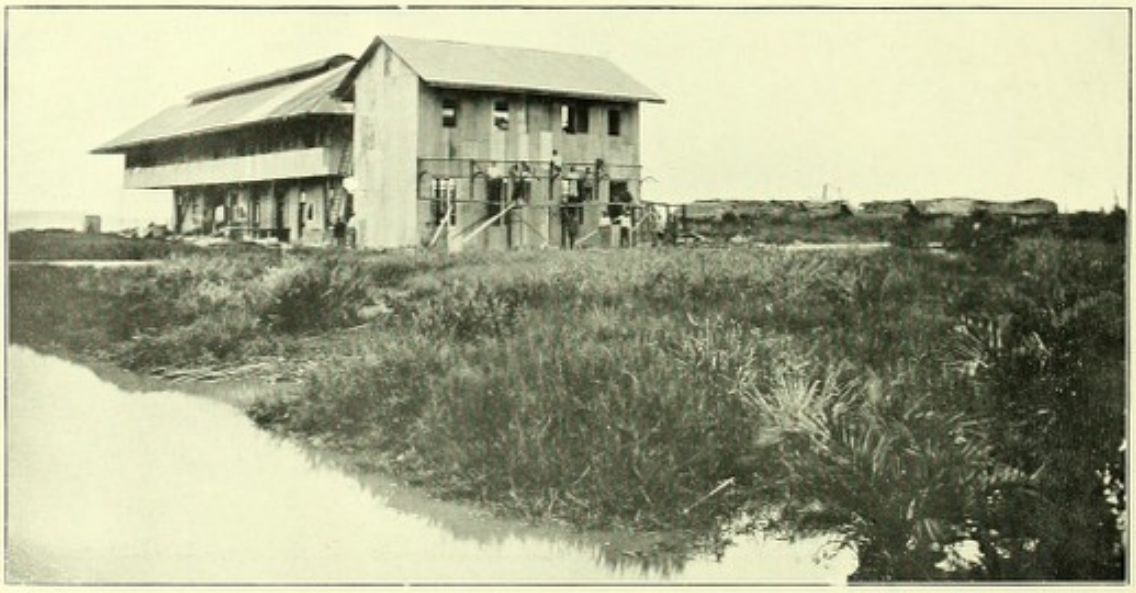
Photograph No. III.



Native huts.

[*See pages* 83 *and* 84.

Photograph No. IV.



Marine mechanics' dwellings. House constructed of wood and iron.

[*See pages* 83 *and* 84.

SOUTHERN NIGERIA.

Forcados.

Photograph No. V.

Government artisans' and clerks' quarters on reclaimed portion, showing ventilation shut out by mats and canvas.

[*See pages* 83 *and* 84.

Calabar.

Photograph No. I.

Landing stage and warehouses in the distance at the water's edge.

[*See page* 85.

SOUTHERN NIGERIA.

CALABAR.

Photograph No. II.

Native houses in close proximity to the factory.

[*See page* 85.

Photograph No. III.

European houses on the high land of Calabar.

[*See page* 85.

SOUTHERN NIGERIA.

CALABAR.

Photograph No. IV.

Aro lines, showing unauthorised buildings between lines.

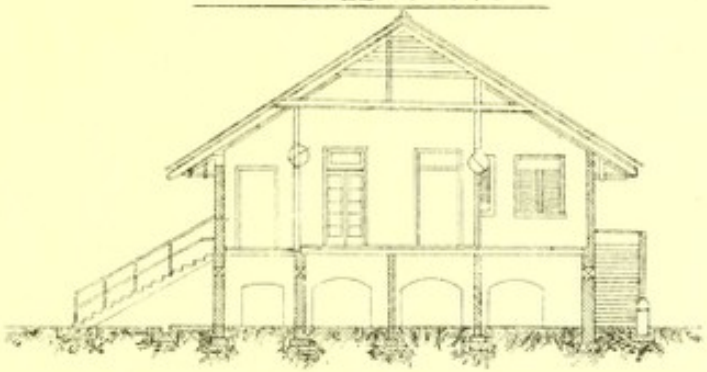
[*See page* 85.

Photograph No. V.

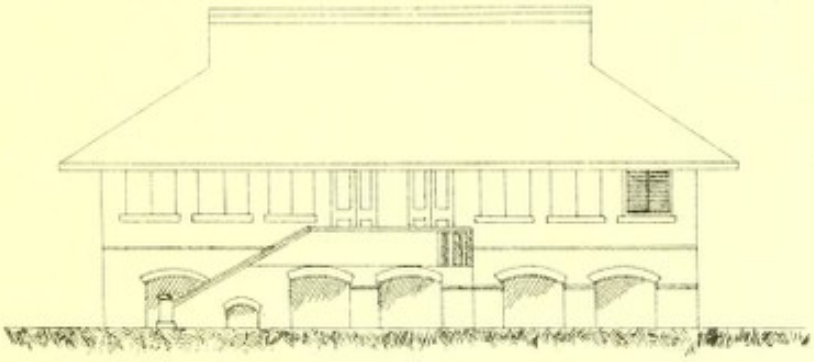
Calabar water supply, showing how spring can be contaminated by surface drainage.

[*See page* 86.

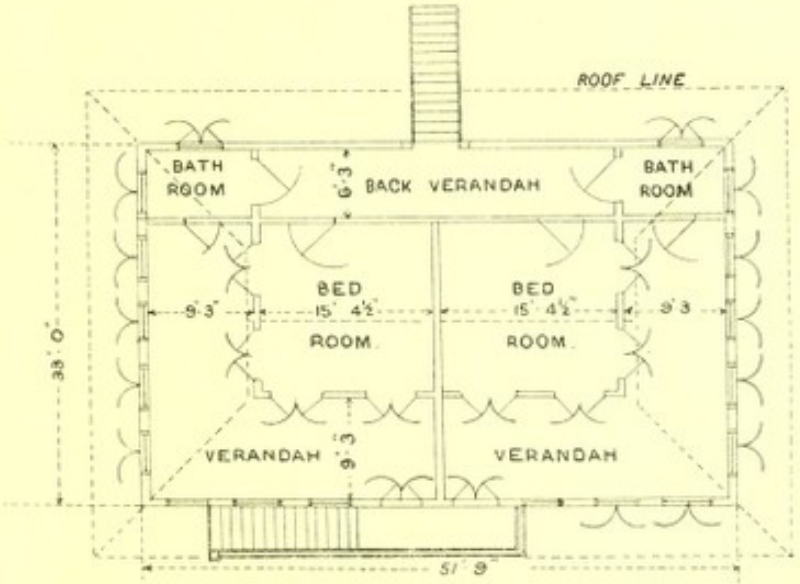
SOUTHERN NIGERIA
CALABAR.
PLAN I
OFFICERS' QUARTERS.
AT
NEW BARRACKS.
P.M.O's BUNGALOW TYPE.
SCALE 1/16 = 1 FT



SECTION.



FRONT ELEVATION.



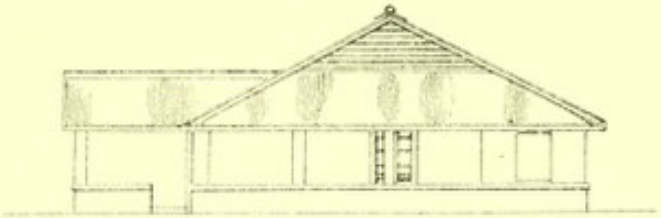
PLAN.

[See Page 86.

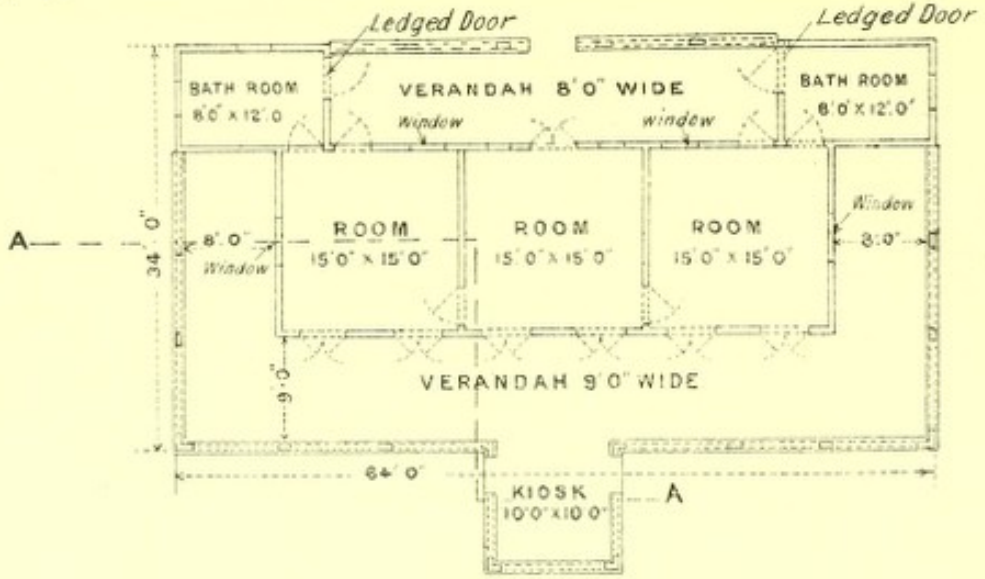
SOUTHERN NIGERIA
CALABAR.
PLAN II

OFFICERS' QUARTERS AT NEW BARRACKS CALABAR. (GARDEN HOUSE TYPE)

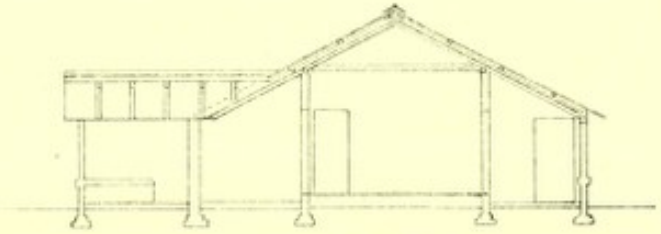
Scale 1/16 = One Foot



END ELEVATION



PLAN



CROSS SECTION.

HALF LONG SECTION

HALF FRONT ELEVATION.

2930

[See Page 86.

SOUTHERN NIGERIA.
CALABAR.
PLAN III.

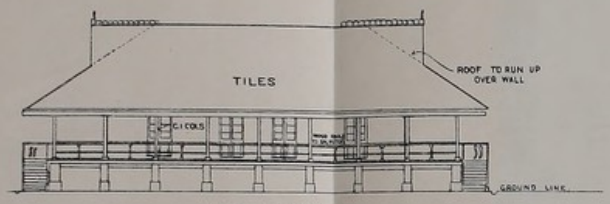
OFFICERS' QUARTERS.

DOUBLE BRICK BUNGALOW.

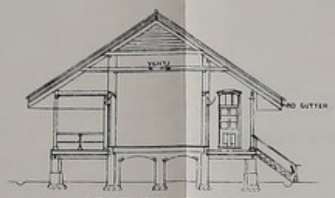
NEW BARRACKS.

OPEN VERANDAH TYPE.

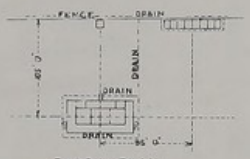
SCALE 1/16 = 1 FOOT.



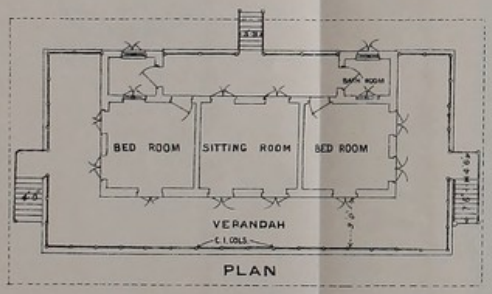
ELEVATION



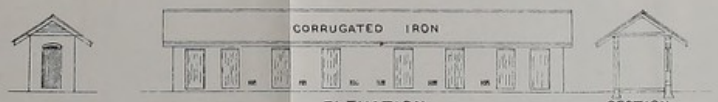
SECTION ON A.B.



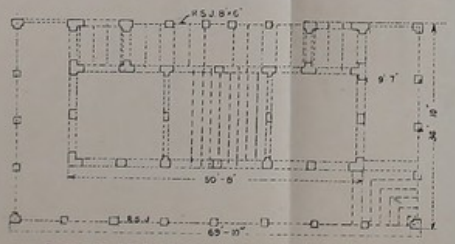
BLOCK PLAN
SCALE 100 FEET 1 INCH



PLAN



ELEVATION SECTION.



PLAN OF BRICK PIERS ARCHES, JOIST &c.

PLAN OF OUT-HOUSES.

See Page 86.