COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

RECORDS:

1967/56

WATER SUPPLIES FOR QUARANTINE SITES, WESTERN DISTRICT, PAPUA, 1966.

by

J.P. MacGregor

5928/65

WATER SUPPLIES FOR QUARANTINE SITES, WESTERN DISTRICT, PAPUA, 1966

by

J.P. MacGregor

Record 1967/56

Contents

SUMMARY

A survey which was carried out in November, 1966, of the water supply for 11 stations close to the West Irian border, in the Western District of Papua, is described. The country is low-lying and underlain in the south by clay and silt. Further north there is a thin, wide-spread gravel band which should prove to be a useful aquifer. Possible sources of water are (a) rainfall, which varies from 50 inches a year in the south to 230 inches a year in the north, (b) rivers, which are polluted, (c) springs from the gravel layer, and (d) wells and bores, which have had limited success in this area.

It is recommended that: (a) the development of water supplies for the quarantine sites should be co-ordinated with village and station improvement; (b) rainwater catchment and storage should be increased; (c) portable rainwater catchment and storage equipment should be purchased for emergency use; (d) wells should be sited close to the rivers in the southern area and (e) to the base of the gravel in the northern area; (f) some minor improvements should be carried out to the springs; and (g) further drilling should not be considered.

Detailed recommendations are presented for each station.

INTRODUCTION

The International Border between West Irian end the Territory of Papua and New Guinea approximately follows longitude 141°E. The Territory's Department of Public Health and Department of District Administration are concerned about the risk of infectious diseases in epidemic proportions spreading across the border, consequently several places have been chosen as sites for quarantine stations in the event of such an emergency. In the company of Dr. F. Tuza, Assistant Director (Preventive Medicine), and Mr. I. Lightfoot, Regional Health Official, of the Department of Public Health, a visit was made in November, 1966, to the quarantine sites and also to several government and mission stations close to the border (Plate 4). The purpose of the survey was to examine the suitability of the quarantine sites and to make detailed recommendations for the establishment of adequately protected water supplies for each station, to provide for a possible influx of infected people.

PHYSIOGRAPHY AND GENERAL GEOLOGY

The section of the border covered by the survey extends for about 250 miles north from the Torres Strait. The country is flat - more than 200 miles from the coast the stations are less than 100 feet above sea level. South of Lake Murray the low-lying country contains numerous lakes and rivers; the river banks are composed of silt and clay which have been deposited by flooding in the wet season. There is a considerable thickness of silt and clay and the deposits have a low permeability. One notable feature of the area is the presence of a lateritic surface on the few higher areas of land.

North of Lake Murray the country is slightly more elevated and has a better developed drainage. It also is underlain by clay and silt but there

is a widespread gravel band which is overlain by a thin clay layer. The gravel is up to 20 feet thick; in some plans it has a sandy matrix but generally it has a matrix of silt. In the northern part of the District it acts as the source of water for numerous springs at the contact between the gravel and the underlying clay.

SOURCES OF WATER

Rainfall

The annual rainfall in that part of the Western District visited increases northwards from the sea; it ranges from an average 50-55 inches at Weam, in the South, to over 230 inches a year at Ningerum, in the north (Appendix 1). All areas have a drier period between June and November which varies in intensity from an almost complete drought in the south to a lessening of the rain in the north.

Rainwater is collected from the galvanised iron roofs of European-style houses on the government and mission stations, and is stored in 1,000-gallon galvanised iron tanks. Several of the native-material buildings have small artificial catchments and 44-gallon drums for storage.

Rivers

The Western District is crossed by many slow-moving streams with associated large and small lakes. The main river system is the Fly River and its tributaries (Plate 4). All the stations visited were located close to a major river or lake, and the indigenous people normally use these rivers as their source of water for all purposes. The water in the rivers is polluted, especially so in the dry season when the water level drops and water moves very slowly. There is much illness owing to the poor quality of the river water.

Springs

In the north of the area several of the stations and villages obtain their supplies of water from springs at the base of the gravel layer described above. The springs produce a regular supply of water and rarely dry up. There is some risk of pollution from gardens close by and also contamination at the spring itself.

Wells

Few wells have been dug along the border; those dug have located clay and silt with low permeability. At the height of the dry season some wells have been sunk in the bottom of a dried up section of lake and have produced water for a time but the wells are lost during the next wet season.

Bores

In the course of a drilling programme carried out in the southern part of the Western District in 1964 9 holes were sunk to depths between 50 and 100 feet. Three of the bores produced good quality water. All the bores were in clay, with some thin silt and gravel bands in the successful

bores. The bore examined at Weam has not been equipped with a pump. It contained 33 feet of water, but it is not certain whether it would be able to maintain a constant supply under continued pumping.

DETAILED STATION SURVEYS

WEAM - Morehead Sub-district.

Location:

Co-ordinates 141°08'E, 8°37'S. Grid WR1547 (Plate 4).

Distance from Border:

8 miles.

Type of Station:

Category D airstrip, Administration patrol post, aid post, school and village. (Plate 1A).

Quarantine Site:

Site cleared on eastern side of airstrip.

Population:

170, including schoolchildren.

Rainfall:

About 50-55 inches a year, with dry season June to December (App. 1).

Existing Supply:

Rainwater catchment and tanks, unlined well in village and water from river. Two bores have been drilled, one in the village and one on the quarantine site but neither have been equipped with a pump. Weam Village Bore (E85, WD5) was drilled to 70 feet in clay about 50 yards from the river and was tested at 450 gallons per hour. In December, 1964 the static water level was 14 feet below the surface and in November, 1965, it was 20 feet. The hole was 62 feet deep. Weam Quarantine Site Bore (E86, WD6) was drilled in the quarantine area to 50 feet, in clay, and tested at 400 gallons per hour. In December 1964, the static water level was 5 feet below the surface, in November 1965, 17 feet and November 1966, 19 feet. The depth of the bore in November 1966 was 52 feet.

Geological Situation:

This section of the Western District consists of low-lying flat country underlain by thick clay and silt deposits. The rivers are entrenched in channels in the dry season but overflow their banks and spread over the surrounding area in the wet. The permeability of the silt and clay is low and large inflows of groundwater cannot be expected. However, the test results from the bores at Weam indicate ample water for hand pumps.

Rcommendations:

The two bores should be equipped with hand-pumps as soon as possible. If additional water is required a standard sanitary well should be dug about 40 yards from the river, to the south of the depression in the centre of the station (Plate 1A). The well would probably have to be 25-30 feet deep.

MOREHEAD - Morehead Sub-district.

Location:

Co-ordinates 141°38'E, 8°43'S. Grid WR7037 (Plate 4).

Distance from Border:

42 miles.

Type of Station:

Category A airstrip, Administration Sub-district headquarters, hospital and school. (Plate 1B).

Quarantine Site:

None.

Population:

200.

Rainfall:

Average rainfall about 75 inches a year, with dry season between June and November. (Appendix 1).

Existing Supply:

Rainwater tanks on station houses and hospital. Shallow, unlined wells in clay in small depression behind native-materials houses. In dry season from river.

Geological Situation:

The station is built on a laterite-capped clay plateau about 50-70 feet above the level of the river. Wells on the plateau have failed to obtain sizeable quantites of water. The small shallow wells collect water from local seepage in a depression in the station north of the airstrip. In general permeability in the clay is poor. The best chance of locating good groundwater supplies would be by sinking wells close to the river but above flood level.

Recommendations:

Three sites for standard sanitary wells were chosen within 40 yards of the river and above flood level (Plate 1B). It is recommended that at least one of them be sunk to prove the quality and quantity of ground water there. The wells would have to be about 25 feet deep. If the water is good

the wells should be equipped with a pump and the people encouraged to use the sanitary wells rather than the present polluted ones.

SUKI - Morehead Sub-district.

Location:

Co-ordinates 141°43'E, 8°03'S. Grid WS7910 (Plate 4).

Distance from Border:

48 miles.

Type of Station:

Private Cessna airstrip. Unevangelised Field Mission station, clinic and school. (Plate 1C).

Quarantine Site:

None.

Population:

200, including schoolchildren.

Rainfall:

Average rainfall about 85 inches a year, with dry season from June to November (Appendix 1).

Existing Supply:

Rainwater catchment and tanks. Shallow, unlined well below flood level; it is polluted.

Geological Situation:

The station is built on a low mound of laterite-capped clay surrounded by Suki Lagoon. The permeability of the clay is low but provides water flow into the existing well, which is below flood level and is liable to pollution. A properly protected well above flood level should give ample supplies of drinking water.

Recommendations:

The rainwater storage and catchment should be increased and this supply augmented by the construction of a standard sanitary well sited to the north of the existing well and above flood level (Plate 1C). The well would have to be about 15 feet deep.

PANGOA - Morehead Sub-district

Location:

Co-ordinates 141°30'E, 7°01'S. Grid WT5525 (Plate 4)

Distance from Border:

33 miles.

Type of Station:

Category C airstrip. No buildings. Mission authorities plan to establish an agricultural station. Lake Murray Buyers Society plan to erect a store.

Quarantine Site:

None.

Population:

Nil.

Rainfall:

Average rainfall about 125 inches a year with drier season between June and September (Appendix 1).

Existing Supply:

None.

Geological Situation:

Airstrip is constructed on a headland into Lake Murray and is underlain by silt and clay with probably low permeability. Any well will have to be sited close to the lake.

Recommendations:

When the buildings are constructed, care should be taken to install adequate rainwater storage. If additional drinking water is required a standard sanitary well should be sunk about 40-50 yards from the edge of the lake. If this is not successful it could be re-sited closer to the water, provided it is above flood level.

LAKE MURRAY - Morehead Sub-district

Location:

Co-ordinates 141°26'E, 6°49'S. Grid WT4848 (Plate 4).

Distance from Border:

30 miles.

Type of Station:

No airstrip, Administration patrol post, village and school.

Quarantine Site:

None.

Population:

250, including schoolchildren.

Rainfall:

No records but probably similar to Pangoa - about 125 inches a year.

Geological Situation:

The station was not visited but is known to be similarly situated to Pangoa. It will therefore be built on silt and clay close to the lake.

Recommendations:

Additional water supplies for drinking and cooking should be obtainable by sinking properly protected wells within 40 yards of the lake and above flood level. Flow into the wells will not be high owing to the nature of the soil but supplies sufficient for drinking should be obtained by a hand pump.

BOSET - Morehead Sub-district

Location:

141°06'E, 7°15'S. Grid WS1099 (Plate 4)

Distance from Border:

5 miles.

Type of Station:

Private Cessna airstrip. Montford Catholic mission station, hospital, school and village.

Quarantine Site:

Site cleared at western end of airstrip.

Population:

220, including school children.

Rainfall:

Rainfall averages about 90 inches, with a dry period from June to November (Appendix 1).

Existing Supply:

Rainwater tanks on mission station houses, otherwise from the lake, which is polluted. In the dry season, the lake level drops and pollution increases.

Geological Situation:

The station is built on a promontory into Lake Herbert Hoover. The airstrip is partly underlain by laterite and partly by red clay. The permeability of this clay is low. An auger hole sunk about 6 feet from the edge of the lake struck water at a depth of 9 feet.

Recommendations:

Because of the low permeability of the clay the flow of groundwater into a well would not be sufficient to supply the station. However, there may be a silty or sandy lens at shallow depth and it is recommended that a hole to a depth of about 25 feet be dug above flood level and as close to the lake as possible (Plate 2A). If there is sufficient flow into the well, it should be lined with either concrete pipes or fibreglass liners, sealed and fitted with a hand-pump. If the well is unsuccessful, the simplest alternative would be to increase the number of rainwater storage tanks on the station. The water from the lake would be suitable for drinking after boiling.

KIUNGA - Kiunga Sub-district

Location:

141°18'E, 6°07'S. Grid WU3324 (Plate 4)

Distance from Border:

20 miles.

Type of Station:

Category B airstrip. Administration Sub-district headquarters, hospital and school. Montford Catholic mission station, hospital and school.

Quarantine Site:

None.

Population:

600, including schoolchildren.

Rainfall:

Average rainfall about 180 inches spread throughout the year. (Appendix 1).

Existing Supply:

On government station, from roof catchment and storage tanks. In addition, there are several perennial creeks near the station. At the mission the supply is from rainwater catchment and storage, augmented from several nearby springs.

Geological Situation:

The Fly River is incised into the relatively flat country near Kiunga and several subsidiary streams have developed which flow throughout the year. The area is underlain by clay with sparse bands of fine sand and gravel. Auger holes No. 1 and 2 at the government station (Plate 2B) located water in fine sand at 10 and 12 feet respectively. Close to the mission a spring of good quality water flows from a band of fresh washed gravel in the bank of a creek about 20 to 30 feet below the level of the surrounding country. This gravel band may be wide-spread.

Recommendations:

With 180 inches of rainfall and adequate catchment and storage there should not be a shortage of drinking water. Additional tanks should be installed at the government station and mission where necessary. The new church should provide a considerable area of rainwater catchment. In order to provide protected drinking water supplies for people without adequate catchment and storage, it is recommended that two sanitary wells on the sites of auger holes Nos. 1 and 2 be sunk to a depth of about 20 feet and equipped with hand-pumps.

NINGERUM - Kiunga Sub-district

Location:

141°09'E, 5°41'S. Grid WU1673.

Distance from Border:

10 miles.

Type of Station:

Category C airstrip. Administration patrol post and aid post. Proposal to build a hospital and Unevangelised Field Mission station.

Quarantine Site:

None.

Population:

About 150, but will increase as the station is established.

Rainfall:

Average rainfall over 230 inches spread throughout the year. (Appendix 1).

Existing Supply:

The station is supplied from a spring in a nearby creek. There is no rainwater catchment at present but storage will be installed when iron-roofed buildings are constructed.

Geological Situation:

The station is built on a plateau about 120 feet above the Alice River. The plateau has a lateritic capping and is underlain by a thin band of clay, a prominent band of gravel and then more clay. The spring which supplies the station flows from the contact between the gravel and the underlying clay. There are several seepages at this level around the station.

Recommendations:

As rainwater catchment is constructed there should be no shortage of rainwater for drinking. The water from the spring is liable to pollution and it is recommended that a properly protected groundwater supply be obtained by sinking a sanitary well to the base of the gravel layer at the side of the recreation oval in the station (Plate 2C). The depth of the well should not be much more than 20 feet.

RUMGINAE - Kiunga Sub-district

Location:

141°17'E, 5°54'S. Grid WU3048 (Plate 4)

Distance from Border:

19 miles.

Type of Station:

Private Cessna airstrip. Unevangelised Field Mission station, hospital, school and village.

Quarantine Site:

None.

Population:

About 500, including schoolchildren.

Rainfall:

Average rainfall about 200 inches spread throughout the year (Appendix 1).

Existing Supply:

Rainwater from tanks on mission buildings. The school and village obtain their water from a spring, about 150 yards from the village, which flows throughout the dry season.

Geological Situation:

The station is built on a plateau about 60 feet above the Ok Mart River. The plateau is composed of the blue clay overlain by clayey gravel which contains some water. The spring referred to above flows from the contact between the gravel and clay.

Recommendations:

The drinking water supply for the station can be considerably improved by installing increased rainwater storage. The supply for the village can be protected by the sinking of a standard sanitary well about 50 yards upstream of the present spring on the eastern side of the gully (Plate 3A). The well should be sunk to the base of the gravel and should be lined with concrete or fibreglass, sealed and fitted with a hand pump. The water from this well would be protected from pollution from the surface.

TARAKBITS - Kiunga Sub-district

Location:

141°03'E, 5°37'S. Grid WU0579 (Plate 4).

Distance from Border:

3 miles.

Type of Station:

Private Cessna airstrip. Unevangelised Field Mission pastor, village and small school.

Quarantine Site:

None at present. One could be cleared close to airstrip.

Population:

120.

Rainfall:

No records kept, but probably well over 200 inches a year.

Existing Supply:

The villagers obtain their water from a spring on the opposite side of the airstrip from the village (Plate 3B).

Geological Situation:

The village and airstrip are built on a plateau about 100 feet above a bend in the Ok Awut River. The plateau is composed of clay with an upper band of gravel which is capped by a thin clay layer. The spring supplying the village flows at the junction between the gravel and the lower clay layer.

Recommendations:

To obtain a protected water supply for the village and proposed quarantine area it is recommended that a standard sanitary well be dug through the upper clay layer to the base of the gravel on the western (village) side of the airstrip. This well may have to be 25 to 30 feet deep. If the gravel has not been located at that depth the well should be repositioned on the eastern side of the airstrip close to the spring (Plate 3B).

ATKAMBA - Kiunga Sub-district

Location:

141°06'E, 6°04'S. Grid WU1130 (Plate 4).

Distance from Border:

6 miles.

Type of Station:

Private Cessna airstrip. Unevangelized Field mission station, aid post, school and village.

Quarantine Site:

Site cleared about 2 miles from airstrip - access is poor. Proposed alternative site chosen at southern end of airstrip.

Population:

250, including schoolchildren.

Rainfall:

Average rainfall about 160 inches spread throughout the year. (Appendix 1).

Existing Supply:

Rainwater catchment from station roofs. Village obtains supplies from creeks flowing into the Alice River.

Geological Situation:

The mission is about ½ mile from the airstrip and both are built on a plateau about 30 feet above the Alice River. The plateau is composed of clay, underlain by gravel and then a lower clay. Reasonable groundwater supplies should be obtained from the gravel.

Recommendations:

The station supplies can be improved by increasing the rainwater catchment and storage. Supplies for the village and the quarantine site can be obtained by sinking a standard sanitary well to the base of the gravel at the southern end of the airstrip (Plate 3C). The well would be about 20 feet deep and could be fitted with a hand-pump.

CONCLUSIONS

Existing water supplies at the quarantine sites are inadequate.

The rainfall is sufficient over most of the area to provide ample supplies of drinking water if sufficient catchment and storage is built.

In the south of the area visited there is a thick succession of fine-grained fluviatile deposits, with low permeability, which are poor aquifers.

In many areas in the north there is a gravel band near the surface which has a moderate permeability and should prove to be a good source of groundwater.

RECOMMENDATIONS

The policy of providing protected water supplies should be combined with the improvement of the water supplies to the adjacent stations and villages. In this way the villages will be able to make use of the good quality water and in the event of an emergency there will be a supply for the quarantine site.

The stations with existing catchment in the form of galvanised iron roofing should increase their rainwater storage as much as possible.

To cope with a possible large demand for water in one section of the border, consideration should be given to the purchase of a suitable large portable rainwater catchment and storage. This would consist of sheeting, polythene or a similar material, on a collapsible frame and a collapsible tank, and could be kept at the District or Regional Headquarters and flown into the area in an emergency.

Wells sited in the southern part of the area should be sunk close to the rivers and, if possible, above flood level. In this way the water from the rivers can be purified by the natural filtration of the soil. If it is not practicable to site the well above flood level the lining should be extended above the ground to prevent pollution from the surface. If sufficient quantities of water are not obtained from these wells as artificial filter or some means of treating the river water will have to be considered as an alternative.

In the northern part of the area, where the gravel is present standard sanitary wells should be constructed. These wells should be sunk to the base of the gravel layer and the lower sections of lining perforated. Owing to the lack of suitable aggregate it may be necessary to use fibre glass liners in some places.

The susubtibility to pollution of the springs at some villages could be reduced by fencing off the immediate area and channelling the spring water

through a pipe to a water point with a concrete drainage slab some distance from the spring.

The high cost of drilling and the low permeability of the sediments in the south of the District suggests that a further drilling programme would not be warrented in that area.

APPENDIX I

WESTERN DISTRICT STATIONS - RAINFALL

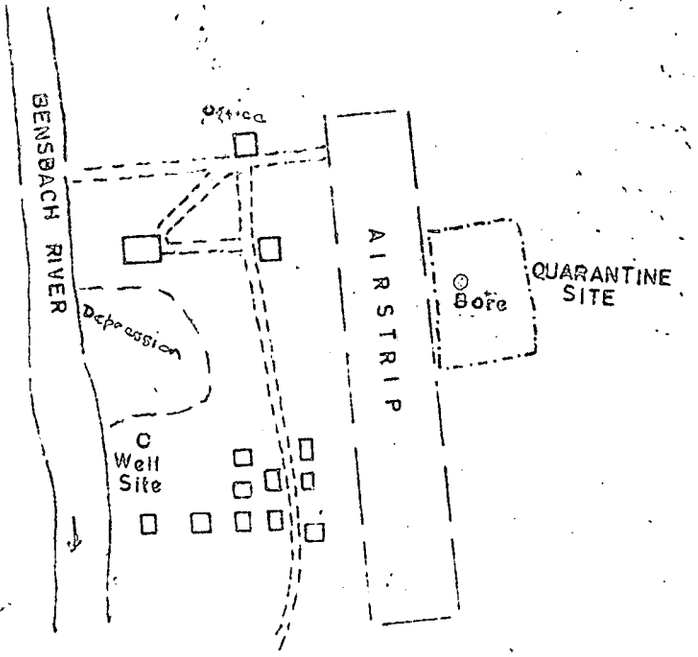
YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
WEAM													
1965	692	1370	1062	304	895		63						
1966	767	898	1371	179	517	148	55	238	36				
MOREHEAD													
1964	1609	525	1257	1043	1306	526	756	805	249	462	999	924	10796
1965	921	1170	1456	474	909	47	71	8	42	Nil	7	761	5866
1966	1286	1772	196	128	321	149	036	190	86				
SUKI													
1964	1445	1091	1704	937	854	368	788	736	315	830	936	596	10600
1965	830	2193	2193	261	879	61	48	11	32	121	58	1744	8431
1966	1339	885	1576	504	494	114	45	108					
PANGOA													
1964	1026	991	1887	1341	1199	466	920	1637	1017	1917	2366	881	15640
1965	1655	1842	2126	456	1130	147	37	44	128	18	44	1767	9344
1966	1463	2071	2639	225	832	378	102	348	391				
BOSET													
1965	726	1683	1758	225	1013	122	25	7	140	25	60	1577	7362
1966	1878	1867	2246	564	689	224	100	557	503				
KIUNGA													
1962							1203	1910	2892	2040	879	1655	
1963	3093	2690	2376	1403	1035	1382	721	2415	1686	548	436	818	18603
1964	1488	1334	2514	1285	1192	1093	2051	1821	1303	1433	2642	1048	19204
1965	1616	1981	3700	858	1920	589	148	43	243	389	513	1540	13540
1966	1442	1724	3009	1507	1616	1330	195	1458	1452	447			

APPENDIX I

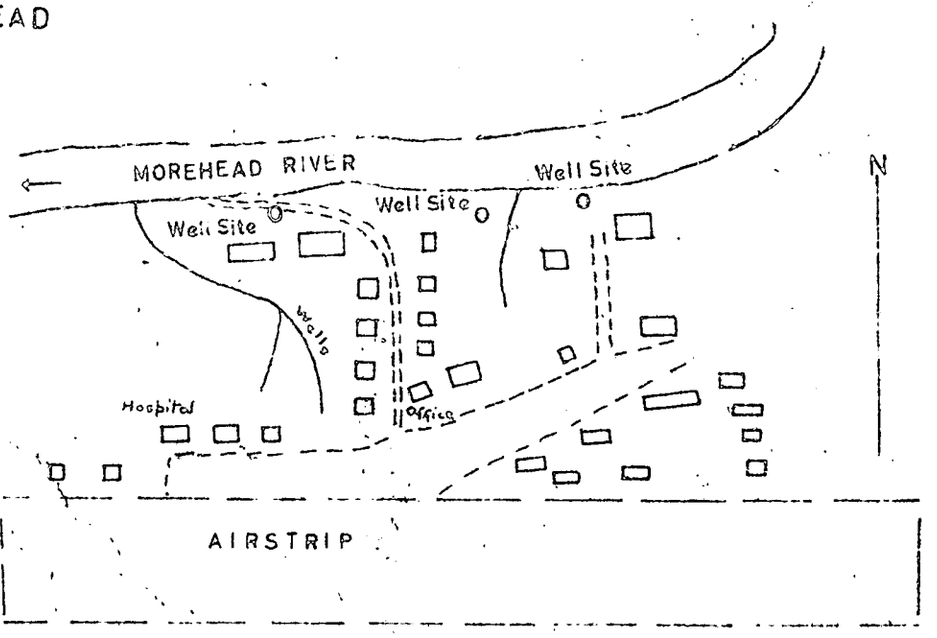
YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
						NINGERUM							
1965	762	2152	4572	1799	3109	1570	608	523	1348	658	806	1605	19512
1966	1839	1977	2860	3305	4581	3088	888	3820					
						RUMGINAE							
1964	1613	845	2988	2625	2287	1918	2039	2420	1816	1774	2334	1874	24527
1965	1042	1627	4141	1049	2182	919	301	163	530	361	783	1403	14501
1966	1219	1668	2773	2228	3089	2044	646	2491	1543				
						ATKAMBA							
1964	1019	1479	2722	1789	1582	1557	2072	2339	1194	2078	1630	993	20454
1965	1941	1524	3504	806	1176	791	55	85	293	649	694	1290	12808
1966	829	1684	2774	1476	1588	1220	236	1098	1141				

Plate 1

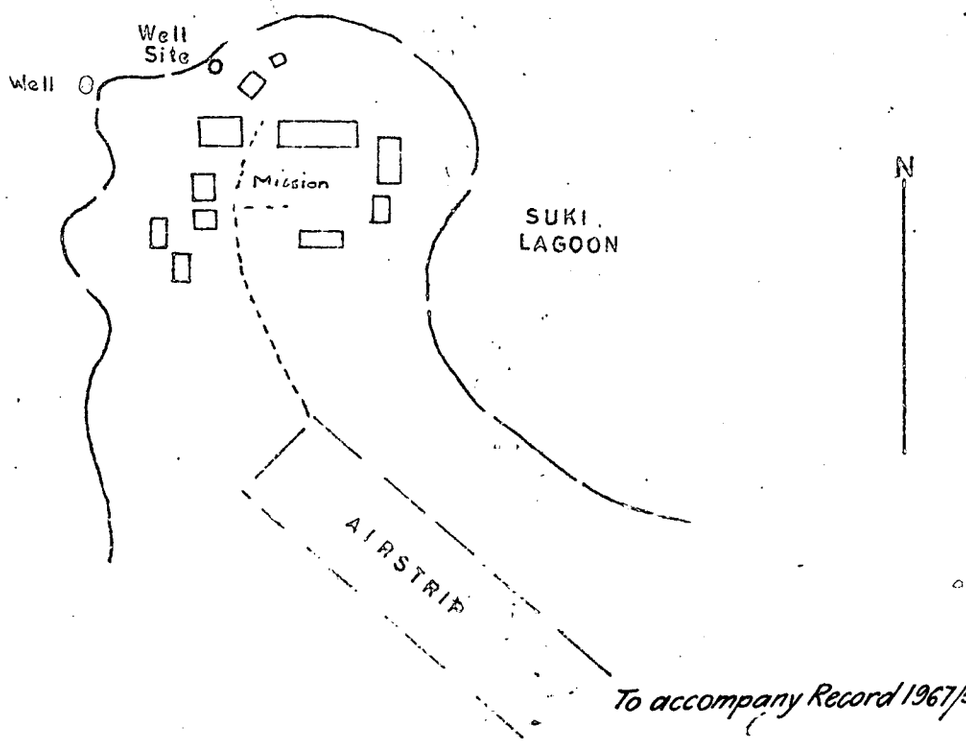
(a) WEAM



(b) MOREHEAD



(c) SUKI

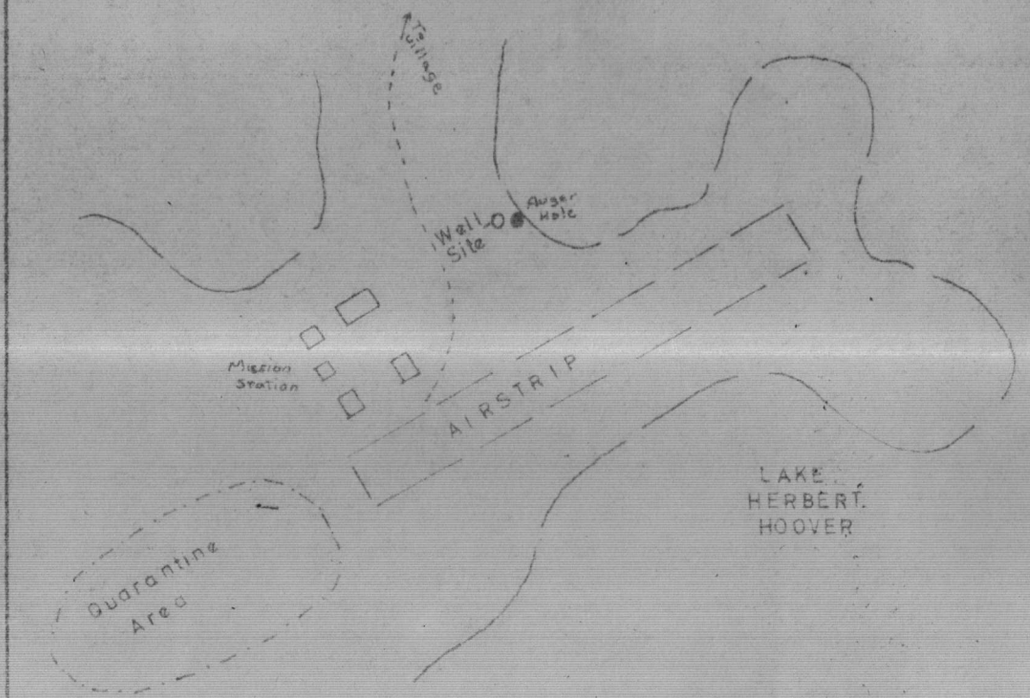


To accompany Record 1967/56

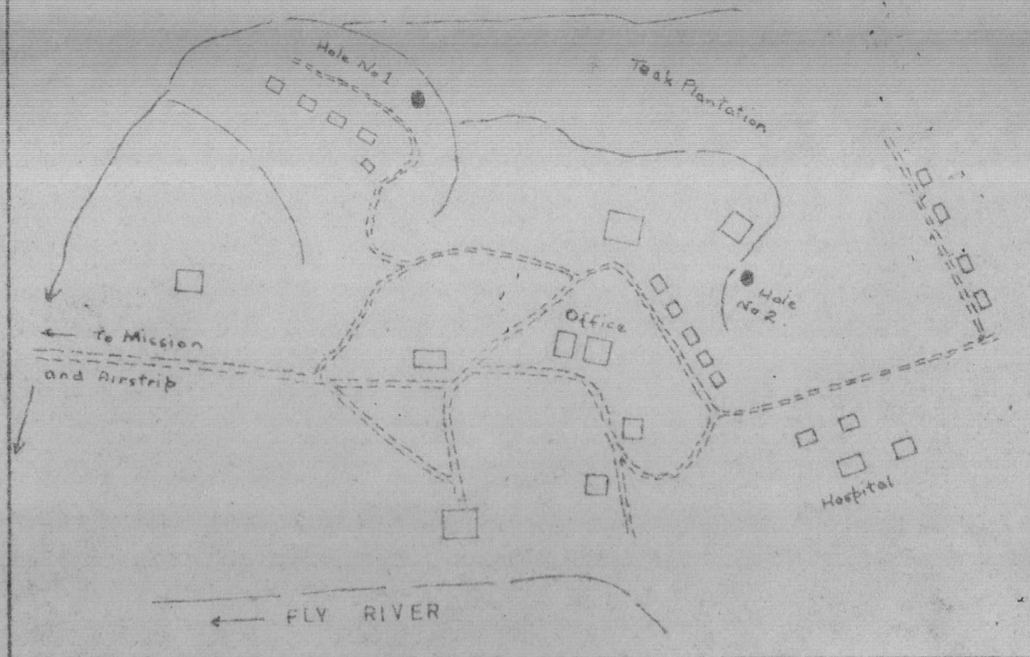
Geological Office Port Moresby 5.1.67 Not to Scale C54/A8/2

Plate 2

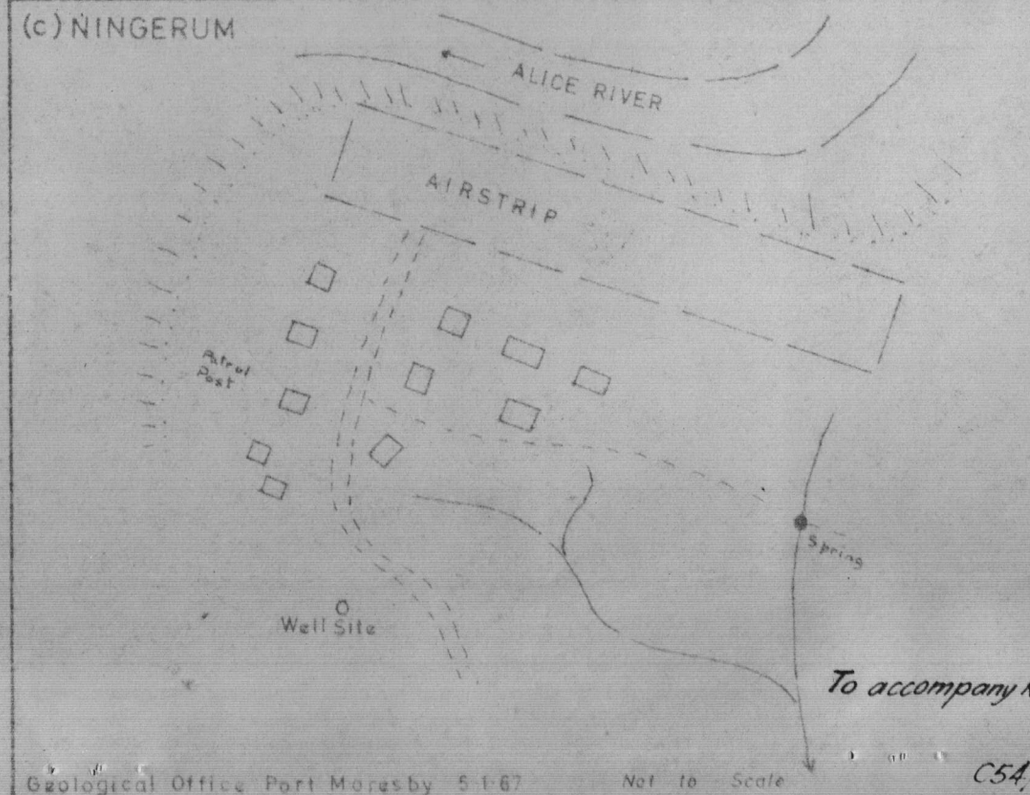
(a) BOSET



(b) KIUNGA



(c) NINGERUM

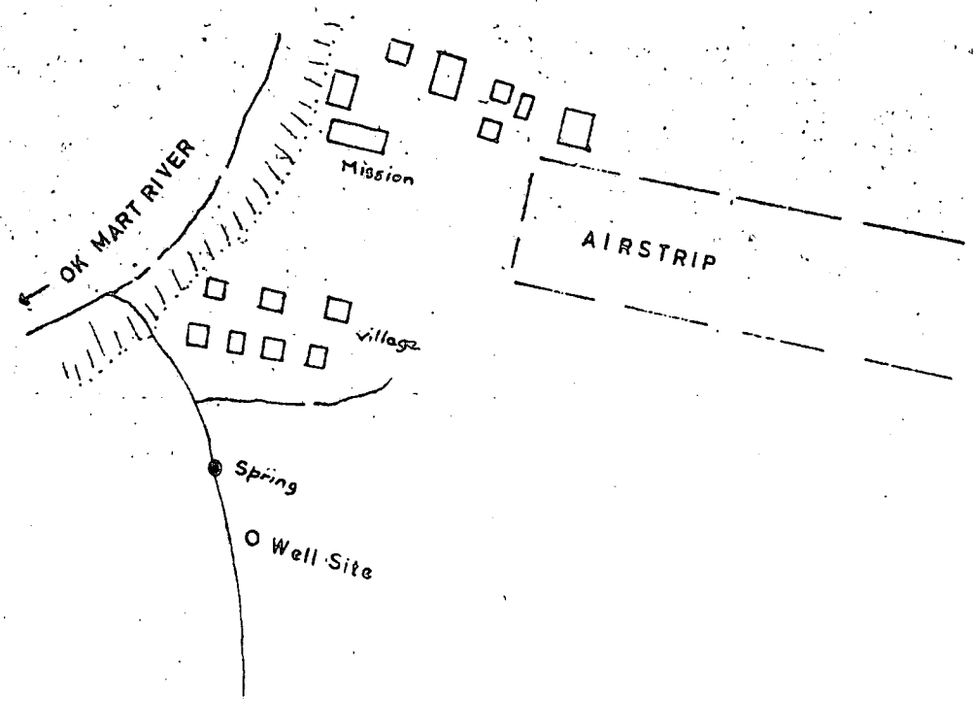


To accompany Record 1967/56

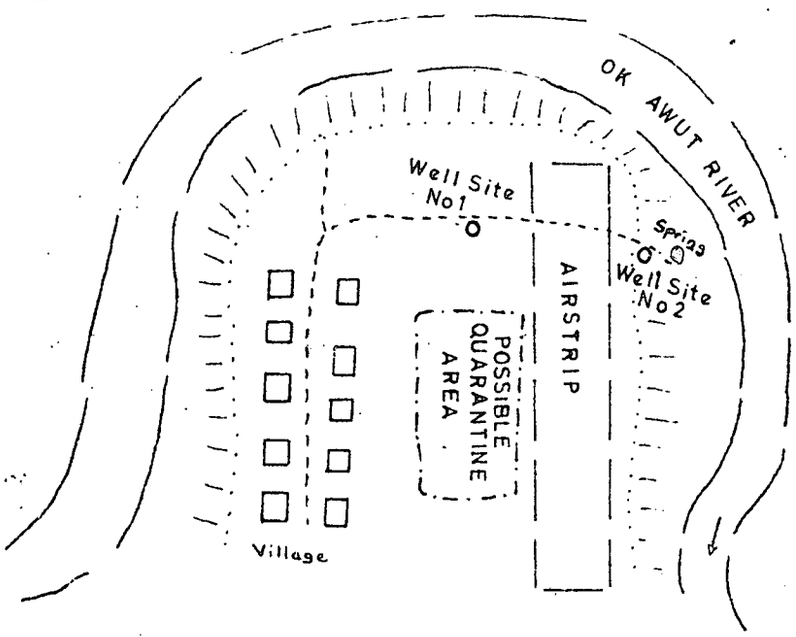
Geological Office Port Moresby 5-1-67 Not to Scale C54/A8/3

Plate 3

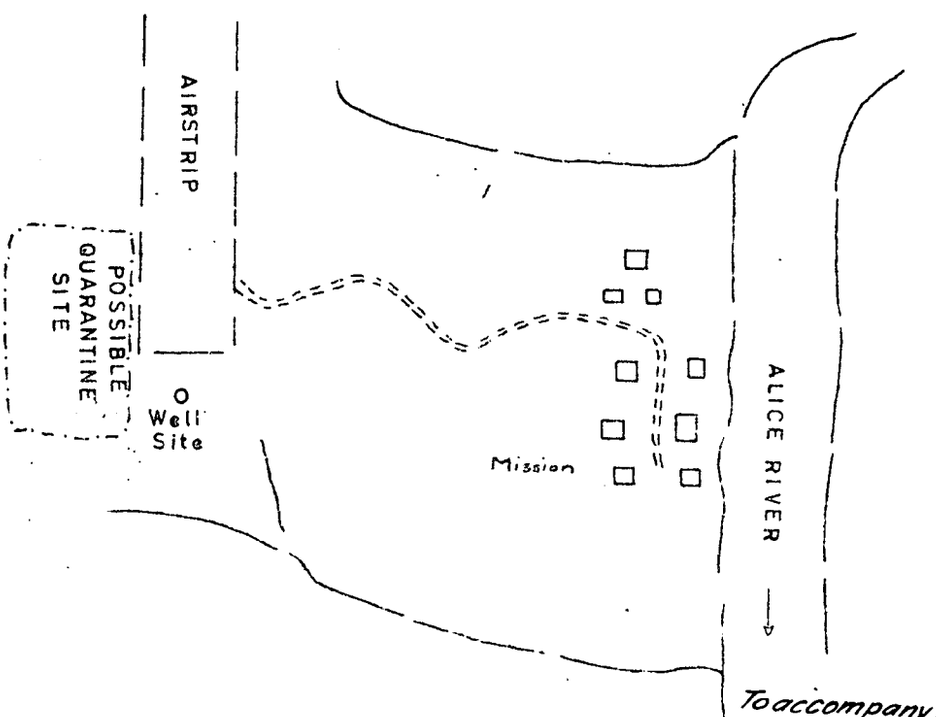
(a) RUMGINAE



(b) TARAKBITS



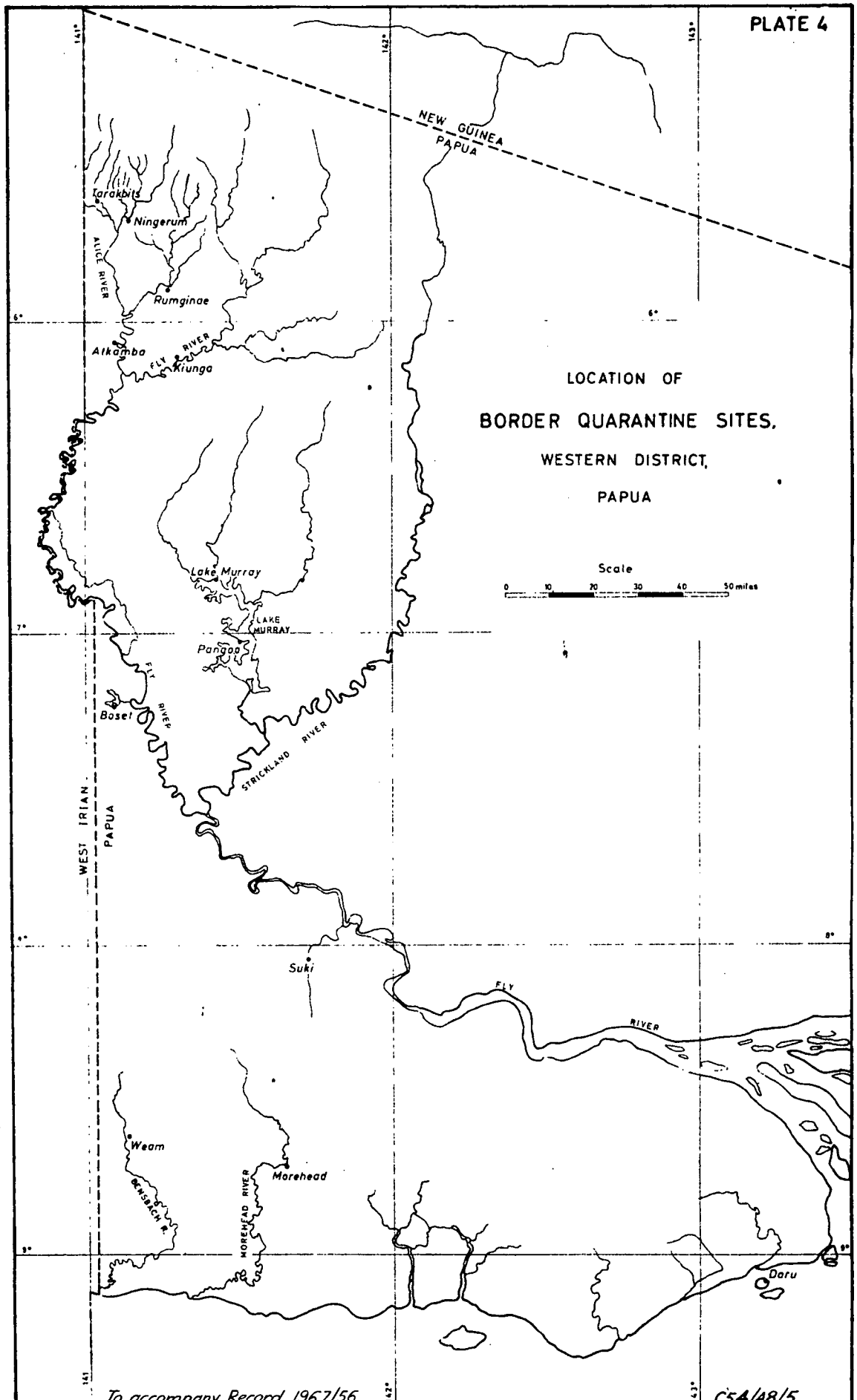
(c) ATKAMBA



To accompany Record 1967/56

Geological Office Port Moresby 5 1·67 Not to Scale C54/A8/4

PLATE 4



To accompany Record 1967/56

CS4/A8/5