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Report on Tarawa Atoll, Gilbert Islands

by

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INTRODUCTION

The author visited Tarawa Atoll, in the Gilbert and Ellice Islands Colony of the United Kingdom, from 22 to 30 August 1959 to amplify information available in the literature and to acquire firsthand and current knowledge of conditions and facilities on that atoll. This visit is only a small part of a program of collecting basic data about various parts of the Pacific Ocean which the U. S. Navy may use in its long term planning. The type of specific information which is of interest and utility to the Navy may also be of interest to the broader audience to which this report is disseminated.

Acknowledgment must be made here of the great assistance provided the author by the British authorities on Tarawa. Mr. Roy Davies, Acting Resident Commissioner, and his entire staff were most cooperative, and it was only through this helpfulness in supplying data and maps that accumulation of a considerable amount of information was possible in such a short time.

PHYSICAL DESCRIPTION

Location and Size

Tarawa is located in the Central Gilbert Islands, about 80 nautical miles north of the equator, at latitude 1°21′ N and longitude 172°56′ E (the coordinates of Betio Island, near the southwest corner of the atoll). Some 500 nautical miles separate Tarawa from Kwajalein, northwestward in the Marshall Islands, and Tarawa Atoll lies 650 nautical miles west of Howland Island and 235 nautical miles northeast of Ocean Island. Far to the northeast are Johnston Island (1,400 nautical miles) and Hónolulu (2,100 nautical miles). Other atolls of the Gilbert chain lie in close proximity, both southeast and northwest of Tarawa.

Tarawa Atoll approximates the shape of a right triangle with an east-west base some 15 nautical miles long, a northwest-southeast hypotenuse about 21 nautical miles long, and a north-south open side on the west bordered by reefs and coral heads rather than the islets which form the other two sides (figure 1). The Gilbertese islanders recognize the shape as resembling that of a typical lateen canoe sail, the upper yard of which is called Te Inaieta, the lower yard of which is called Te Inainano, and the tack of which (southeast corner of the atoll) is called Te Win Ei.

Although the circumference of the atoll is some 58 statute miles and the lagoon area is approximately 145 square statute miles, the total land area is estimated at only 7.7 square statute miles. The sea and lagoon are close together and often visible simultaneously from any location on an islet.

Topography

Tarawa is a typical Pacific atoll formed by a narrow strip of reef and islets surrounding a central lagoon (figure 2). Because of the general trend of wind and waves from easterly directions, the reef and land on this side are somewhat higher than on the leeward side, but in no case do elevations extend more than a few feet above sea level. The islets are narrow and occasionally sinuous, sometimes extending for miles in length but with widths measured in hundreds of yards. Channels separating islets are often bare at low tide, at which time motor vehicles can be driven

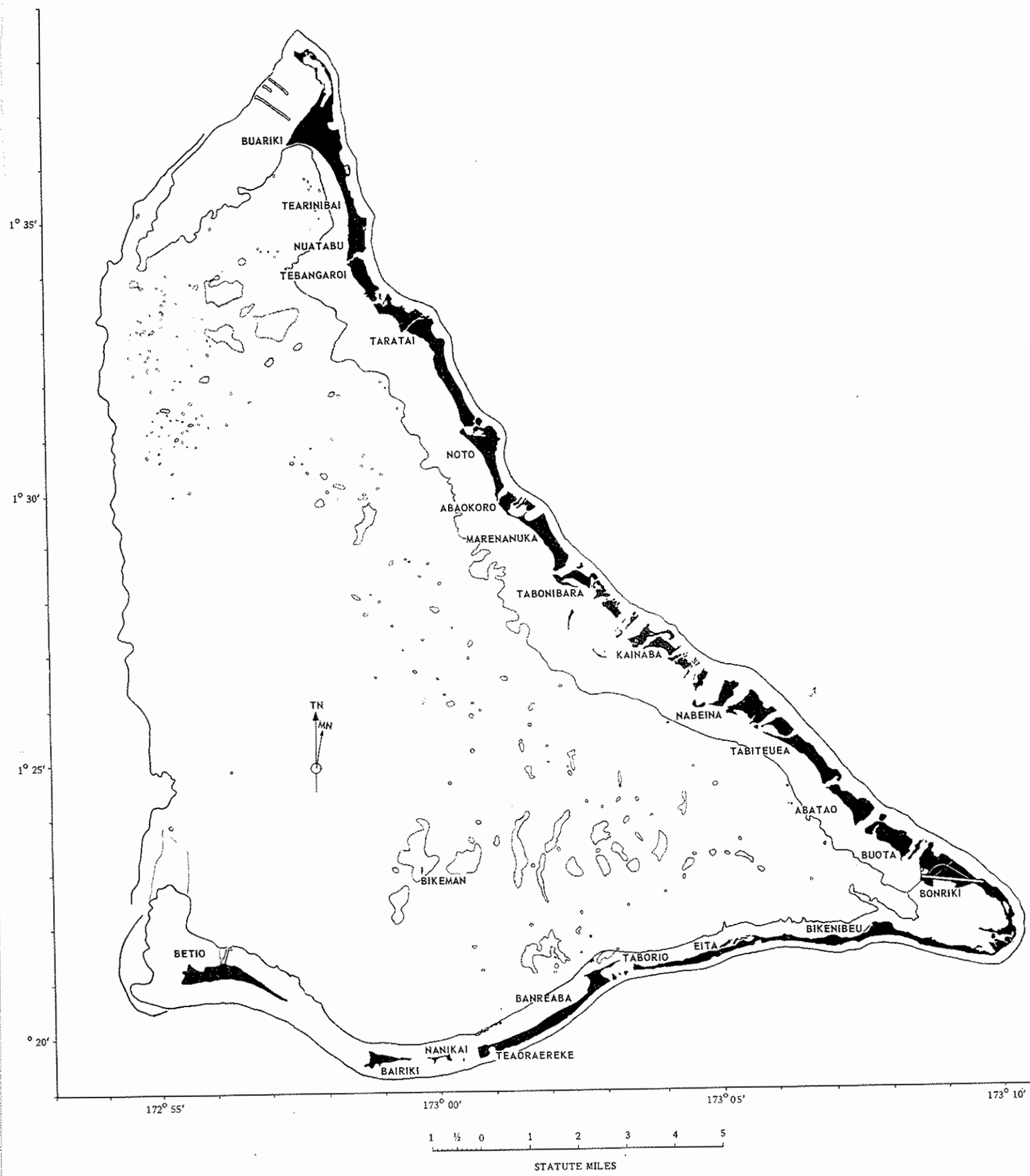
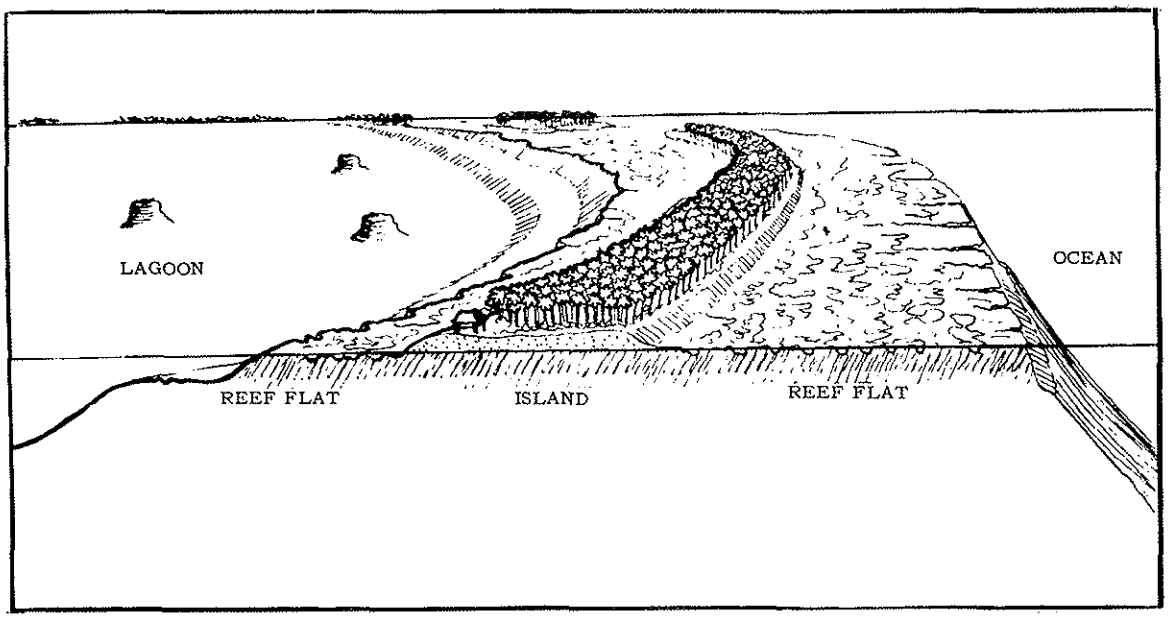


Figure 1. Map of Tarawa Atoll.



- - Taken from Atoll Research Bulletin No. 59.

Figure 2. Schematic Constitution of an Atoll.

around much of the atoll (figure 3). Bordering the land on both seaward and lagoon sides are continuous expanses of fringing reef, bare at low tide and covered with shallow water at high tide. These Tarawa reefs are often 400 to 700 yards wide on both the inner and outer sides of islands.

It should be noted that no type of rock other than limestone is exposed in the Gilbert Islands. The form of the rock may vary, however, from solid skeletons of corals cemented with various lime-secreting algae into a solid limestone platform, to sands and gravels created by erosion, comminution, and subsequent deposition of fragments of corals and algae.

Although hills are completely absent and maximum elevations above sea level are on the order of 20 feet, there is nevertheless a certain irregularity in atoll terrain (figure 4). Near the water on the ocean side, there typically is found a beach ridge, with steeper slopes toward the sea and more gentle declivities inland toward the center of the island. Elevations in the interior may be as little as 2 to 5 feet, from which a gentle slope again rises to a somewhat higher crest in the vicinity of the lagoon beach. Gradients on the lagoon side are gentle, and the slight elevation above the interior of the island is hardly noticeable. Even the slope down to the edge of the water, the inner side of the lagoon fringing reef, is quite gentle.

On the ocean sides of islands, beaches are moderately steep and are formed of fairly coarse gravel-sized fragments of corals thrown up by the waves. On the lagoon sides, beach materials are finer grained, often approaching a powdery sand in consistency. Where little wave action is found, as in Temaiku Bight within the southeast angle of the atoll, the sediments that accumulate are fine grained and form extensive flats of light-colored mud.

The reef flats that fringe the land on both ocean and lagoon sides of islets are formed by dead corals with thin layers of mud or debris spread over them and occasional boulders scattered about as relicts of storm waves in the past. Bare at low tide and often with a somewhat unpleasant

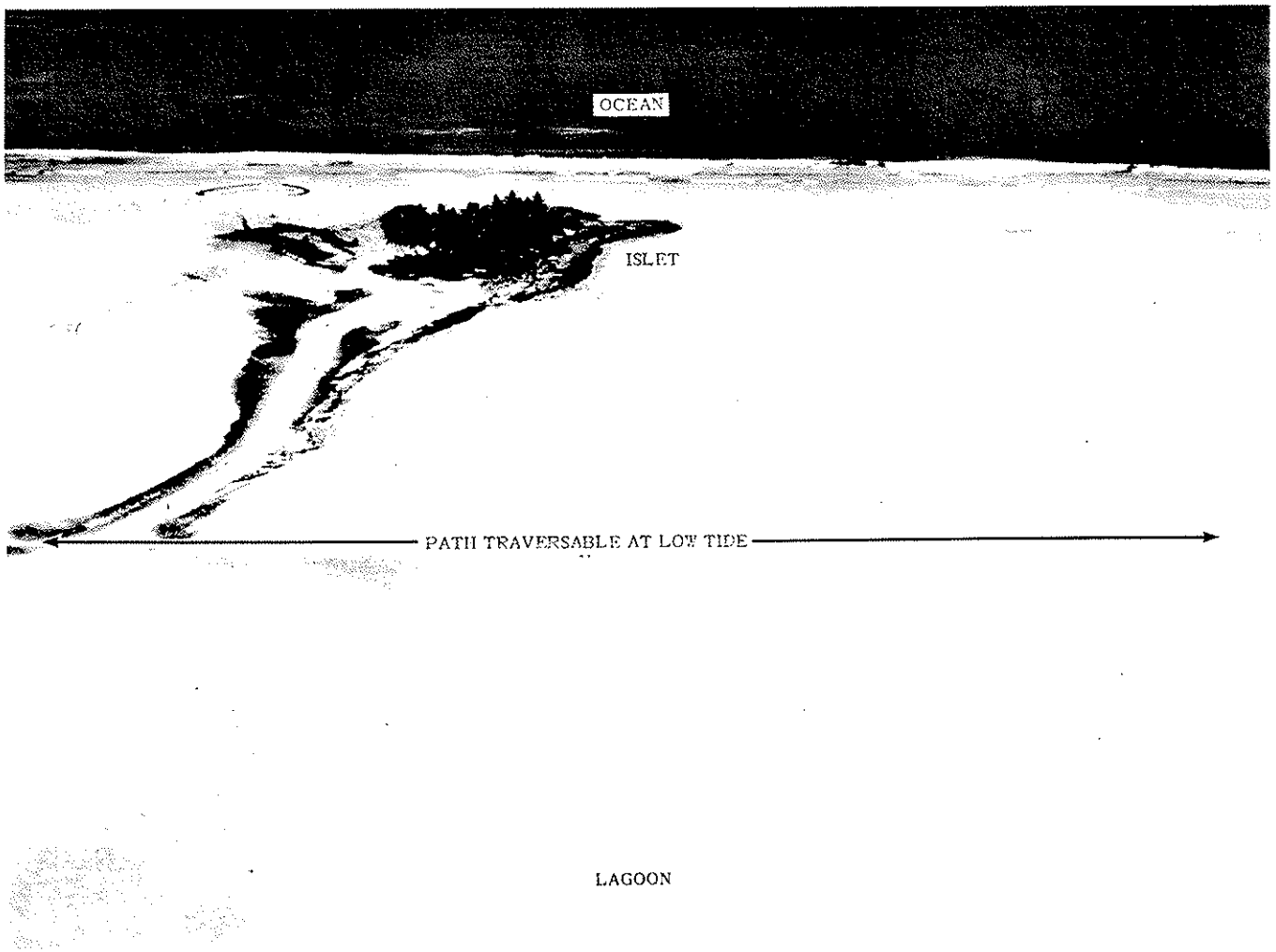
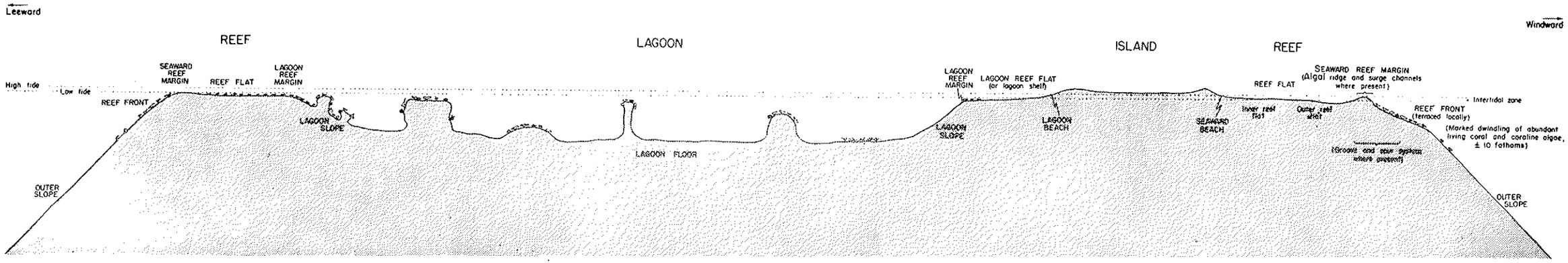


Figure 3. Aerial View of Islet Between Bairiki and Nanikai in Tarawa Atoll at Low Tide When Passage Between Islands Is Traversable by Motor Vehicles.



-- Taken from Atoll Research Bulletin No. 46.

Figure 4. Typical Conspicuous Features of an Atoll and Its Peripheral Reef.

smell from the decomposition of countless tiny organisms stranded by the low water, the reef flats are covered with several feet of water at high tide. Small wavelets ripple across them and lap up on the beaches after the main force of the waves is broken on the offshore reef slopes.

The oceanward reef margins drop off steeply into the depths, with slopes often as great as 45 degrees. Conditions for coral growth are optimal, and the offshore slope is blanketed with a profuse growth of many varieties. Elongated surge channels, oriented at right angles to the shoreline, give a striped appearance to the reef margin when viewed from the air. In the lagoon, the reefs drop off less steeply, and descend only a short distance to the bottom. The Tarawa lagoon has an average depth of only 6 to 8 fathoms.

Hydrography

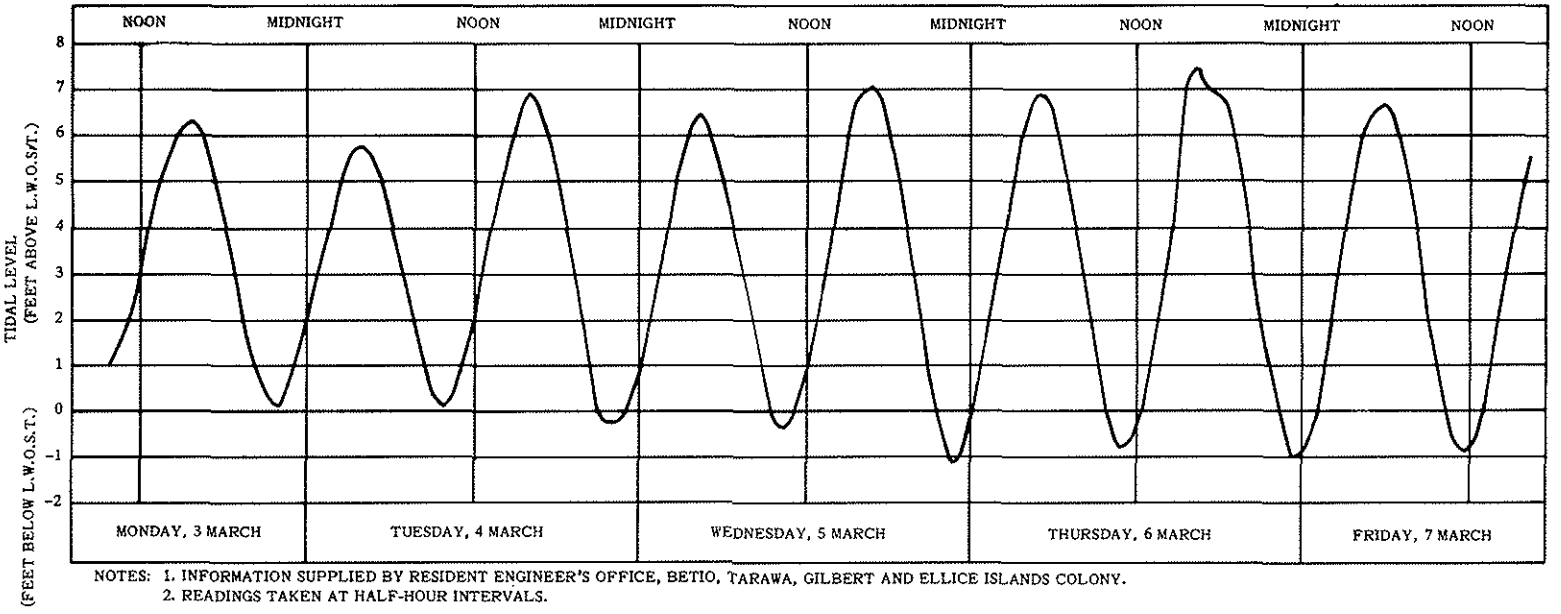
Offshore slopes, from the fringing reef down into deep water, are so steep around most of Tarawa that ships cannot possibly anchor. The exception to this statement is a small shelving area just off the lagoon entrance on the west side of the atoll in which ships can find anchorage.

The Tarawa lagoon is relatively shallow, in comparison with many atolls, and has depths ranging from a few fathoms to a maximum of about 12 fathoms in restricted areas. Many coral knolls rise near the surface, particularly in the portion of the lagoon southeast of Bikeman Island. The only part of the lagoon that is usable by ships and seaplanes lies southwest of a line drawn from Banreaba village (Eita Island) through Bikeman Island. Although in this area the most dangerous pinnacles have been marked, the HMS COOK, a Royal Navy survey vessel, is now resurveying all obstacles.

The average tidal range at Tarawa is about 4 feet, but the difference between high and low tides during spring tidal periods is 5.6 feet and during neaps is 1.8 feet (see figure 5). The datum used for the rather short periods of tidal measurement is a U. S. Coast and Geodetic Survey benchmark on Betio Island, on which the low water spring level is marked. The maximum tide measured thus far on Tarawa occurred on 11 December 1958 and reached 8.05 feet above datum; the minimum measured tide reached 1.0 feet below datum, thus indicating a maximum recorded tidal range of more than 9.0 feet. (An extremely low and irregular tide was a major contributory cause of the great number of casualties suffered by the U. S. Marines in their landing on Betio in November 1943.)

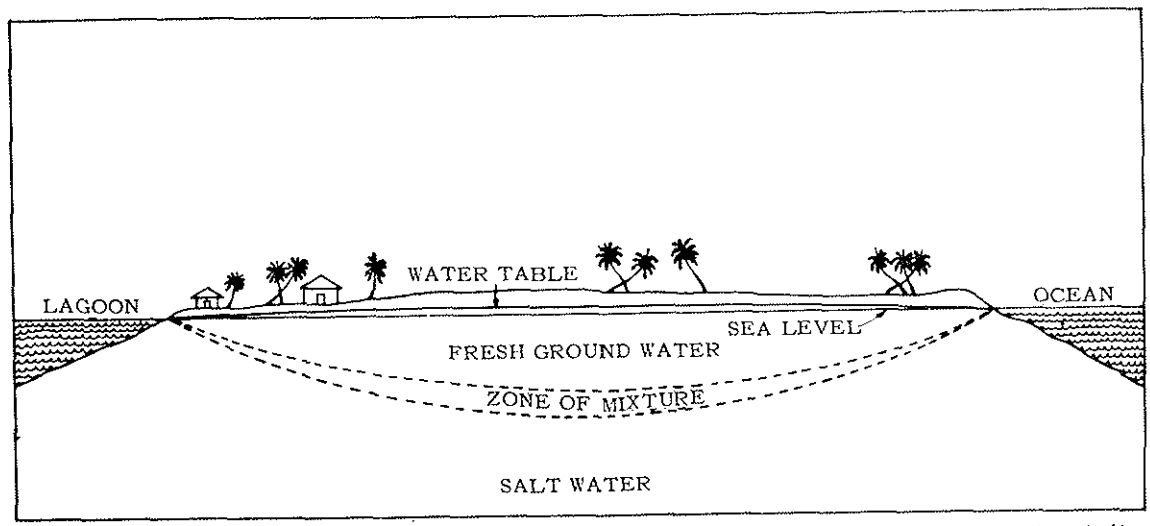
Little information is available on currents in the Tarawa area. It is known, however, that a coastwise current sets east on the south side of the lagoon, past Betio, Bairiki, and Teaoraereke, a fact documented by small spits built eastward from the Betio and Bairiki moles and, on a larger scale, by the long eastward-stretching spit shape of the two islets themselves. The current in the main entrance channel into the lagoon has a strength of 1.0 to 1.5 knots, changes in direction with the ebb and flow of the tide, but is no great problem to shipping since it follows the channel axis closely.

Because of the small size of islands, low elevation, and porosity of the coral bedrock, there is no surface stream anywhere on the atoll. The lens of fresh water which accumulates and floats above the salt water, as a ground water table on each islet, must be mentioned as an important source of fresh water (figure 6). The lens tends to be much thicker and to contain fresher water in the centers of islets, whereas on the lagoon and ocean sides and at the long narrow ends of islands, the lens tends to decrease in thickness and to contain a greater amount of brackish or salt water.



NOTES: 1. INFORMATION SUPPLIED BY RESIDENT ENGINEER'S OFFICE, BETIO, TARAWA, GILBERT AND ELLICE ISLANDS COLONY.
2. READINGS TAKEN AT HALF-HOUR INTERVALS.

Figure 5. Record of Tidal Level in Betio Harbor Basin for Period of 3 to 7 March 1958.



– – Taken from Military Geography of Northern Marshalls.

Figure 6. Idealized Section of the Ghyben-Herzburg (Fresh Water) Lens in an Oceanic Island.

Although excessive use of the fresh water may disturb the lens, and long periods of drought will cause it to gradually disappear, it must be emphasized as a significant source of water on islands notable for their water shortage.

Climate

Tarawa lies in close proximity to the equator and has a typical oceanic equatorial climate, characterized by mildness and uniformity of temperatures but a considerable variation in rainfall. Throughout the year, afternoon mean temperatures are in the high 80's and nighttime low figures are about 76 degrees; temperatures over 95 and under 68 almost never occur, and the very consistent easterly winds moderate the heat and provide a pleasant sensible temperature. The mean annual rainfall is 64 inches, a somewhat deceptive figure since the recorded range of annual rain is from 15 inches (1950) to 115 inches (1948); droughts are a matter of periodic concern in the Central Gilbert Islands.

Wind directions are generally from east or southeast, with speeds in winter (February) averaging 17 knots, in summer about 10 knots. Although many typhoons originate close by, to the north and west of the Gilberts, none has ever been recorded at Tarawa. Both overcast and cloud-free days are rare, and the normal situation is a scattered-to-broken system of tradewind woolpack clouds, often building up as thunderheads over lagoons or during the warmer afternoon period.

Biota

The vegetation of Tarawa may be described in simplest terms as a man-made forest of coconut palms, planted wherever they will grow. Without question, the coconut palm is the dominant and most characteristic plant on the atoll. Although in the interior the coconut palms grow vertically, reaching heights of 60 to 90 feet above the ground and casting such a dense shade that other plants

often grow beneath them only with considerable effort, along the ocean and lagoon shores they lean out toward the light in long and graceful curves, in places actually extending out over the water. Other plants, of course, are present on the atoll, one of the most characteristic being the salt bush, *Scaevola,* which occurs in profusion on the ocean beach ridges and to a lesser extent on the lagoon side or sparsely scattered among the coconuts. Pandanus, with its curious stilt-like maze of stems, is found where light is adequate; it provides both food and excellent thatch to the natives. A few larger trees such as *Pisonia* and *Calophyllum*, with its large symmetrical glossy leaves, are scattered through the interiors of the islets. Mangroves are found near the lagoon where mud flats provide a favorable situation; their intertwined stilt roots create almost impenetrable swamps.

The diagram of figure 7 illustrates some of these relationships, and appendix A presents details of the plants found on Tarawa.

Animal life on Tarawa, if domestic cats and dogs are excluded, is restricted to small lizards and rats, but fish of a wide variety are caught in the open ocean and particularly in the lagoon. A detailed listing of species is to be found in Randall* (1955).

Bird life on Tarawa is largely restricted to sea birds. Graceful white terns, noddies, gannets, and the piratical frigate-bird, long tailed tropic-birds, shearwaters, and petrels make up the dominant types. A few land birds migrate through the Gilberts and are to be seen occasionally.

OWNERSHIP AND POLITICAL STABILITY

Tarawa Atoll is a part of the Gilbert and Ellice Islands Colony of the United Kingdom. The colony, which is under the jurisdiction of the High Commissioner for the Western Pacific, at Honiara, Guadalcanal, is administered by a Resident Commissioner, whose headquarters are located in the Secretariat at Bairiki, Tarawa (figure 8). For administrative purposes, the colony is subdivided into four districts (Gilbert and Ellice Islands, Ocean Island, Line Islands, and Phoenix Islands), each of which is administered by a District Commissioner. The office of the District Commissioner for the Gilbert and Ellice Islands is maintained at Betio, .3 miles west of Bairiki.

The Resident Commissioner of the Colony, Mr. M. L. Bernacchi, was on leave at the time of the author's visit in August 1959. His office was occupied by Mr. R. Davies, Acting Resident Commissioner, whose regular position is Secretary to Government. Appendix B lists key personnel of the colony and their acting and regular positions in the government.

The Gilbert and Ellice Islands Colony has as much political stability as perhaps any colony under the British flag. Although a serious strike occurred on Ocean Island in 1948, no such incident has occurred since, and it would appear that political unrest may be considered nonexistent at Tarawa.

* See Selected Bibliography herein.

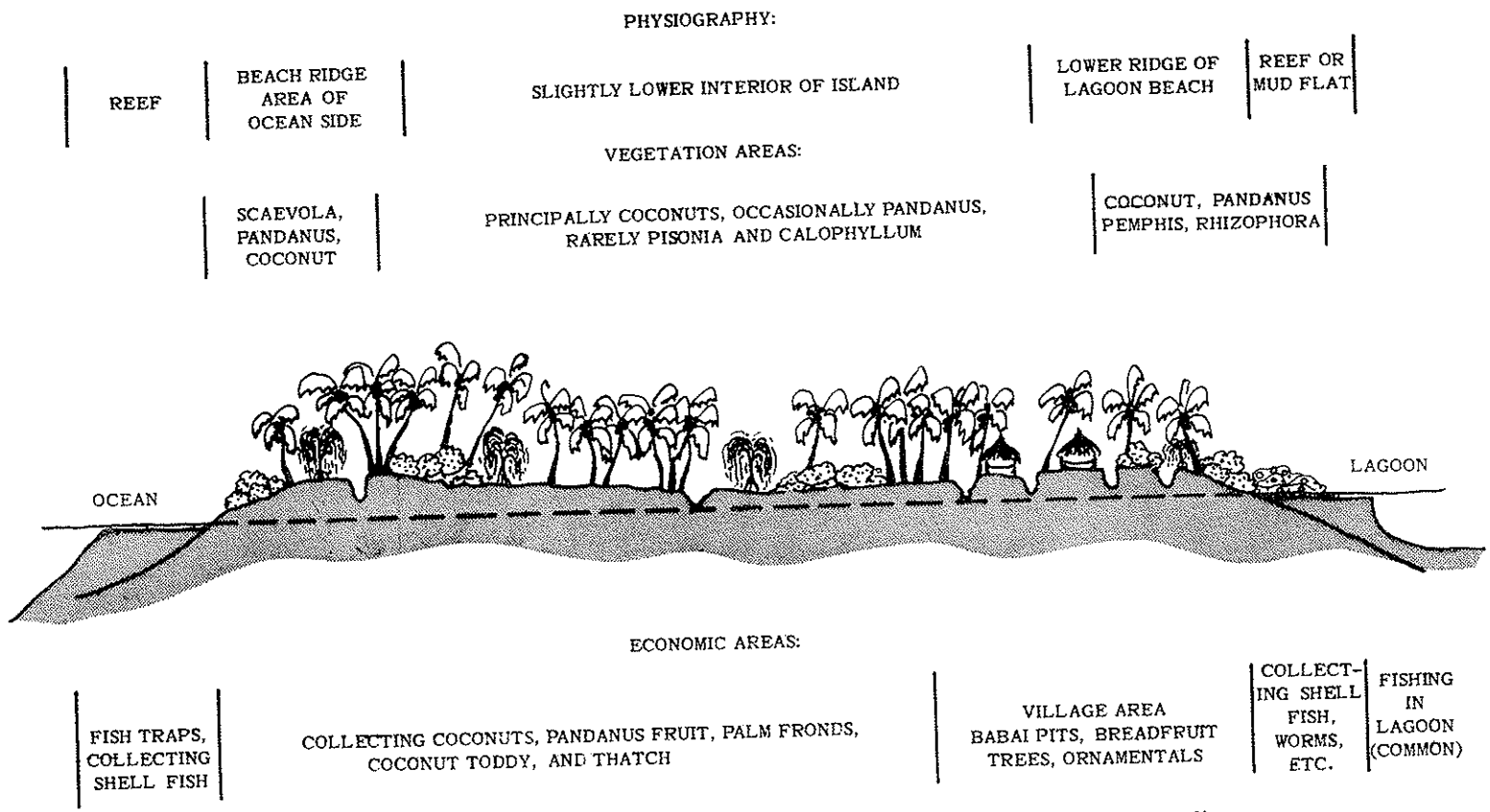


Figure 7. Physiognomic and Economic Cross-Section of a Typical Island in Tarawa Atoll.

Figure 8. Secretariat for Gilbert and Ellice Islands Colony (Headquarters of Resident Commissioner) at Bairiki on Tarawa Atoll.

POPULATION AND CULTURAL ATTITUDES

The Gilbert and Ellice Islands Colony is unusual because the Gilbert Islands are inhabited by Micronesian people whereas the Ellice Islands have a Polynesian population. The nearly 5,000 Polynesians are a minority in the colony as compared with the nearly 37,000 Gilbertese. With 576 Caucasians and some 81 Chinese added, the population of the colony at the end of 1958 was estimated at 42,546.

As the seat of government, Tarawa has had a notable influx of population, particularly since World War II, and now has a population of 7,125 persons, of whom 141 are Caucasians. Most of the population is Gilbertese, but a considerable number of Ellice Islanders also live on the atoll. The greatest concentrations of people, including most of the Caucasians, live on the southern rim of the atoll at Betio, Bairiki, or Bikenibeu. Figures 9, 10, and 11 are maps of these areas.

Details of the colony's population, by islands, and of population trends from 1931 to 1958 will be found in appendix C.

The available labor force in Tarawa and neighboring atolls is rather sizeable. Above the needs of the communities themselves, some 300 laborers are available from Tarawa alone, and with short notice it is possible to obtain 80 from Maiana, 250 from Abaiang, and 130 from Marakei, neighboring atolls. Perhaps 2 per cent of these persons are semiskilled and of use as carpenters, truck drivers, and such. Although the government itself cannot act as a recruiter of labor, a local trading firm (Schultz and Wilder) might take a contract for recruiting as it has done in the past. Unskilled labor is paid at the rate of 7 shillings per day (Australian currency, exchanged at $2.25 per pound) or £8/5/0 (8 pounds, 5 shillings, 0 pence) per month. For long-term labor a more usual arrangement is to pay 7 pounds per month and supply food and housing. A local part-Caucasian person is usually desirable as labor boss because of his understanding of local customs and work attitudes.

Certain Gilbertese cultural attitudes must be respected if good relations are to be maintained with local people. Most of these are matters of courtesy common to most cultures; other are localized attitudes. Natives are not allowed by law (voted by themselves) to drink alcoholic beverages; hence, it is both illegal and ill-mannered to offer a native a drink. Since large physical size and manual dexterity are greatly admired, it is persons with these qualities who are able to deal most satisfactorily with the Gilbertese. A series of other local attitudes that are important for the visitor to observe is emphasized by Sir Arthur Grimble (see appendix D), who learned them during years of experience in the area.

LAND USE AND OWNERSHIP

A typical traverse of an islet on Tarawa would show coconut and pandanus occupying positions from just landward of the ocean reef flat to the edge of the lagoon (figure 7). On the lagoon half of the islet, babai pits (similar to taro pits) are commonly interspersed with the trees, which here include breadfruit and some ornamental varieties.

Villages are characteristically on the lagoon side, as are the roads or tracks connecting them, and generally contain from 15 to 50 houses constructed from palm and pandanus (figure 12). Each

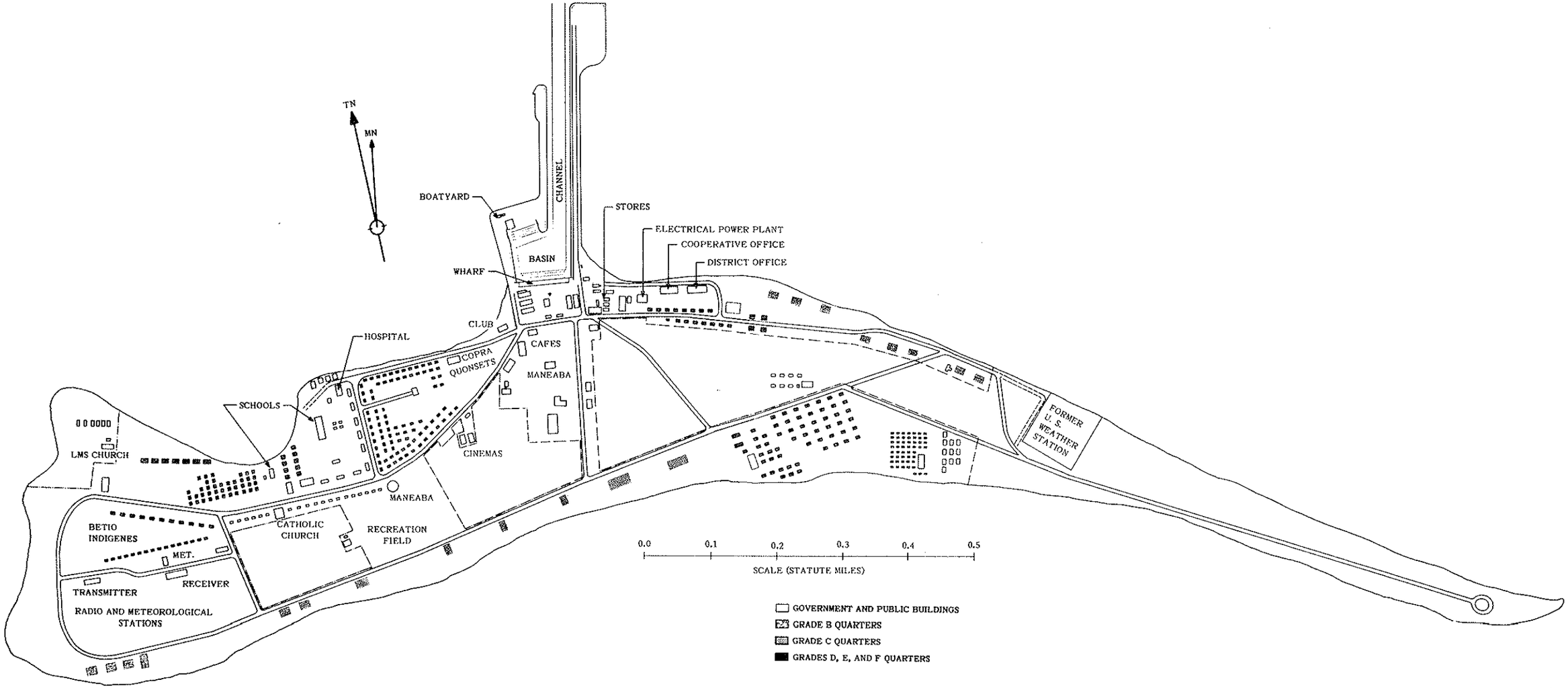


Figure 9. Map of Betio Area on Tarawa Atoll.

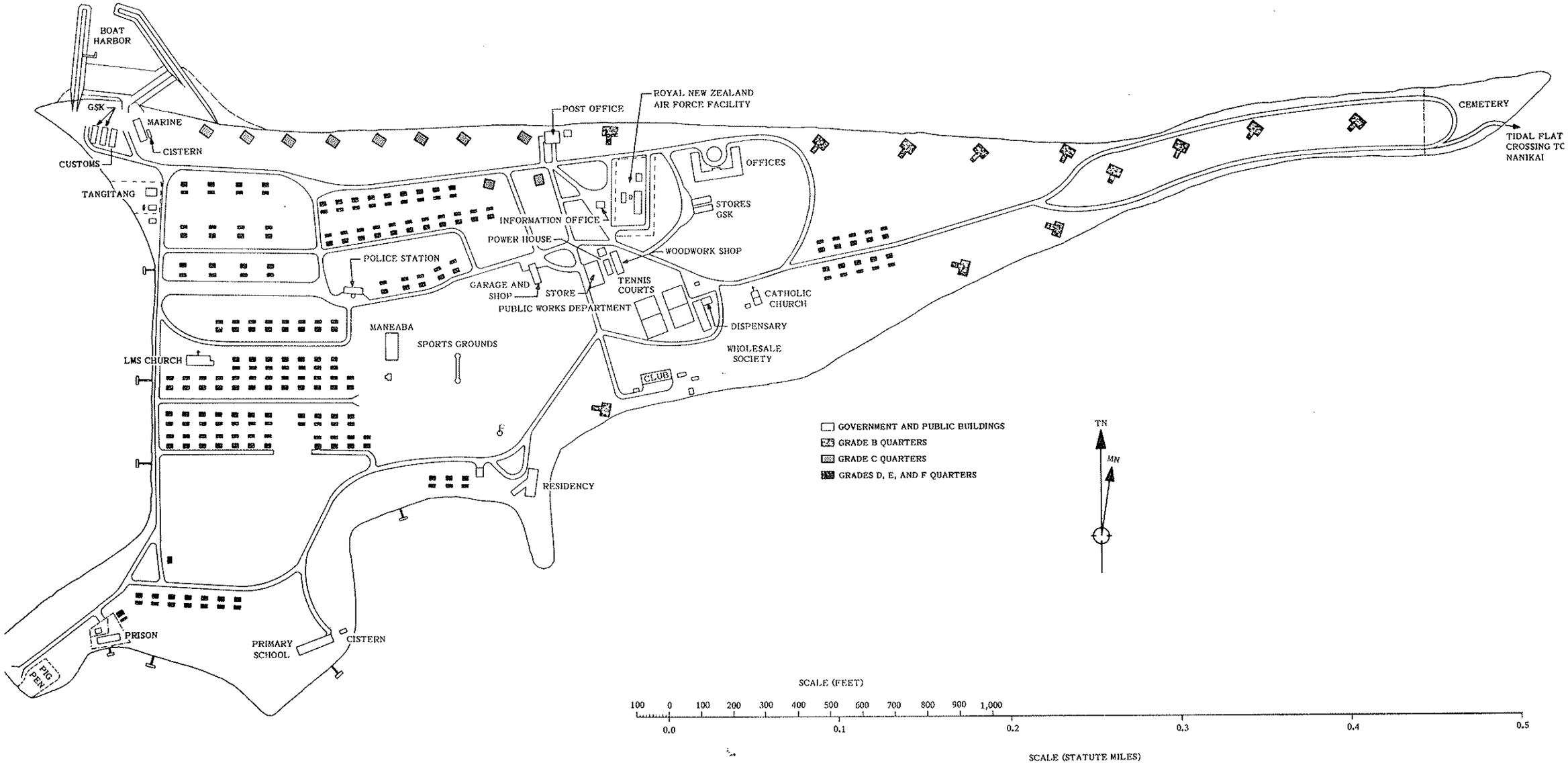


Figure 10. Map of Bairiki Area on Tarawa Atoll.

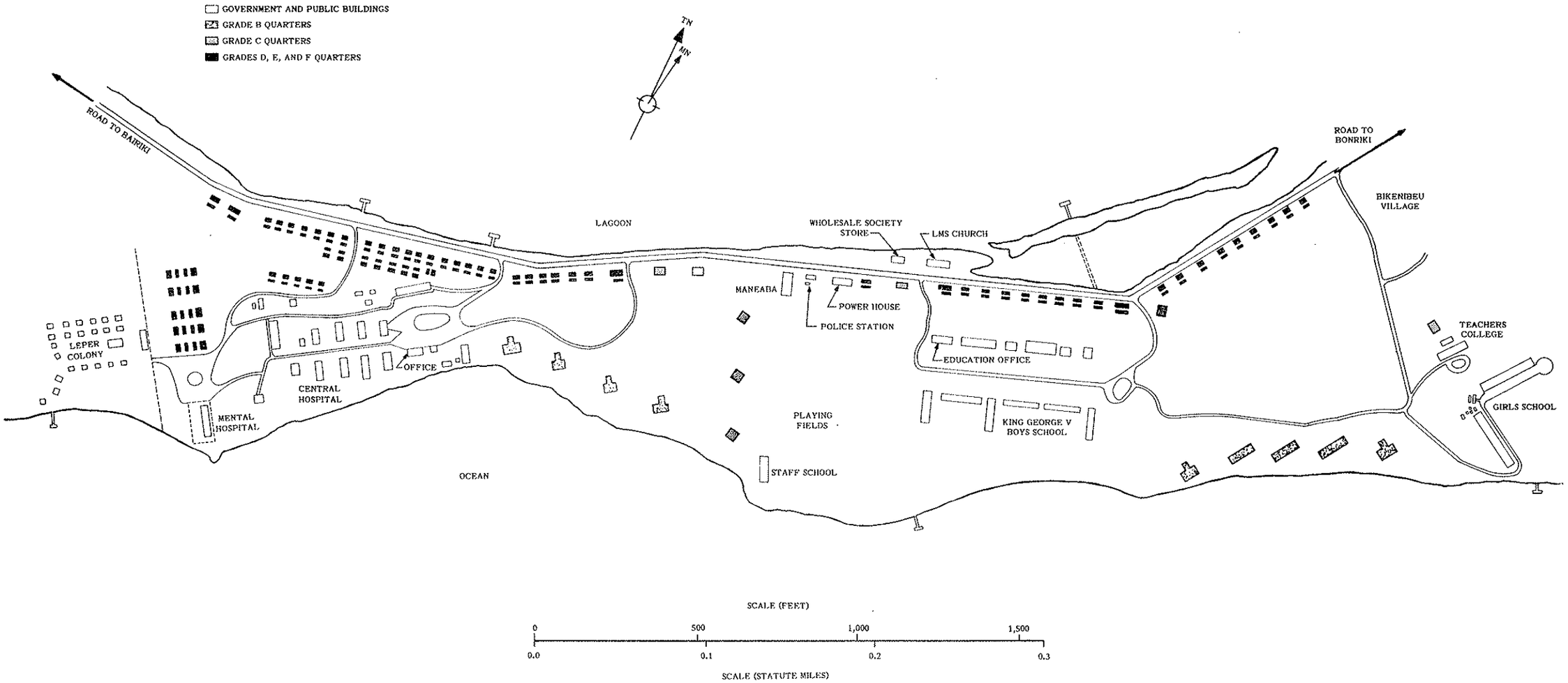
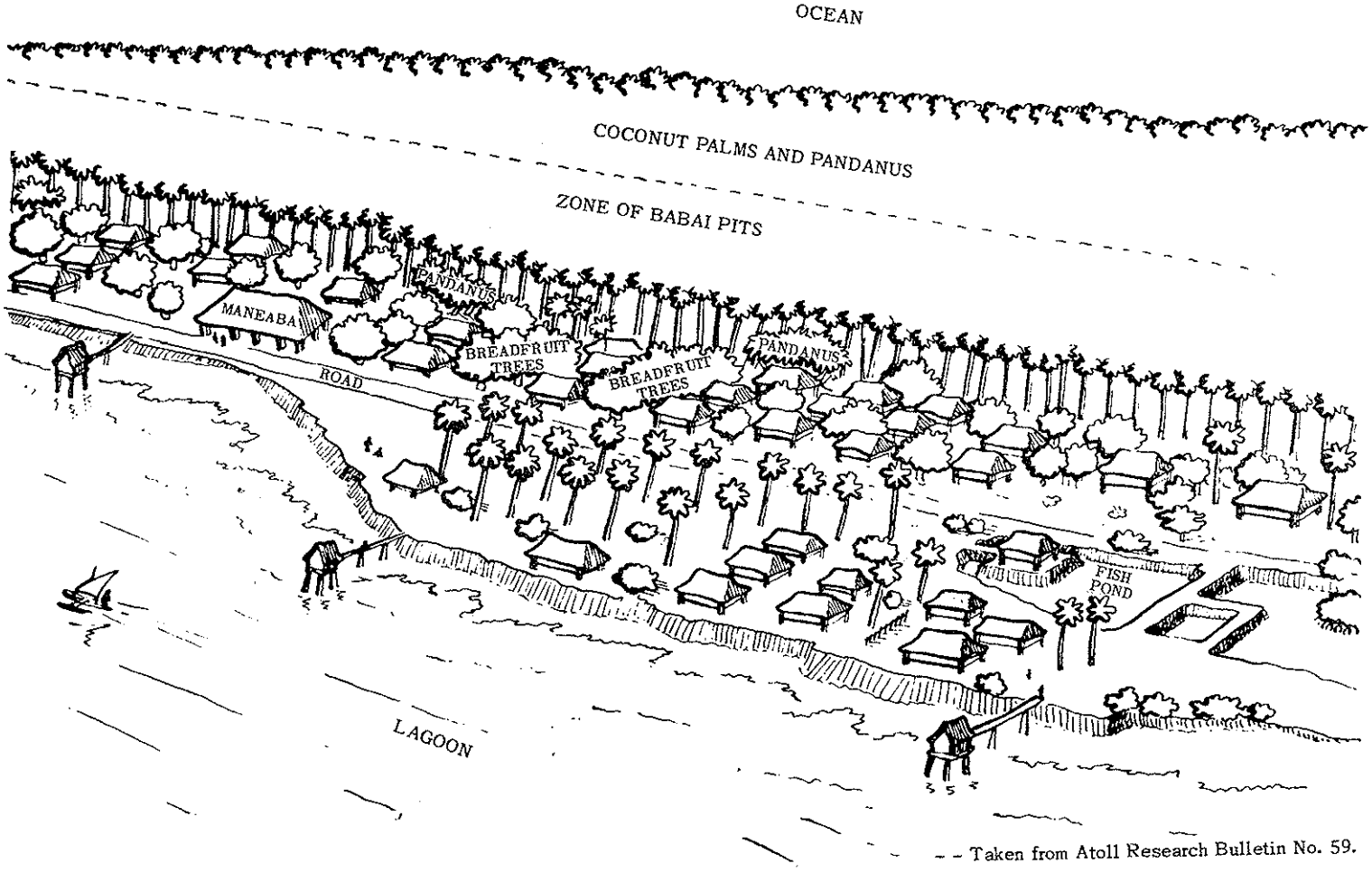


Figure 11. Map of Bikenibeu Area on Tarawa Atoll.



Taken from Atoll Research Bulletin No. 59.

Figure 12. Typical Village on Island in Tarawa Atoll.

house customarily shelters one family, while the maneaba or community house, the largest structure in the village, is the meeting place of the village leaders and is used for most manifestations of native group life. Less frequently it serves as a temporary shelter for visitors.

With large populations and small land areas, the Gilbert Islands have quite high population densities. Tarawa, for example, has a density of nearly 1,000 persons per square mile, and land is at a premium. Parcels of land are subdivided often, and a person may hold several tiny bits, scattered not only on various islets of an atoll but also on several different atolls. The typical organization of people into villages, with lengthy stretches of coconut woodland lying between, only serves to disguise a situation in which land is most valuable and often very difficult to acquire. Purchase of land is possible only for natives themselves, and litigation over land is the most common type of court action in the Gilberts.

Leasing of typical coconut land or bush land for governmental purposes is not a particularly difficult problem but does require a fair amount of time (measured in months). The normal rental fee is 3 pounds Australian per acre per year and, of course, is supplemented by payment for any damage such as the cutting of trees.

A considerable area of Tarawa is currently under lease to the British government. All of Bairiki and Nanikai Islands are leased, but the former is completely utilized by the Crown and most of the latter probably will be soon. About 60 per cent of Betio Island is leased, but most of the eastern spit, on which at present only scrub and a few coconuts grow, is unleased and vacant. In the Bikenibeu area, Crown leasehold extends from the leprosarium east to the school and training college area, while at Bonriki only the airstrip itself and the adjacent causeway are under Crown lease (figure 13).

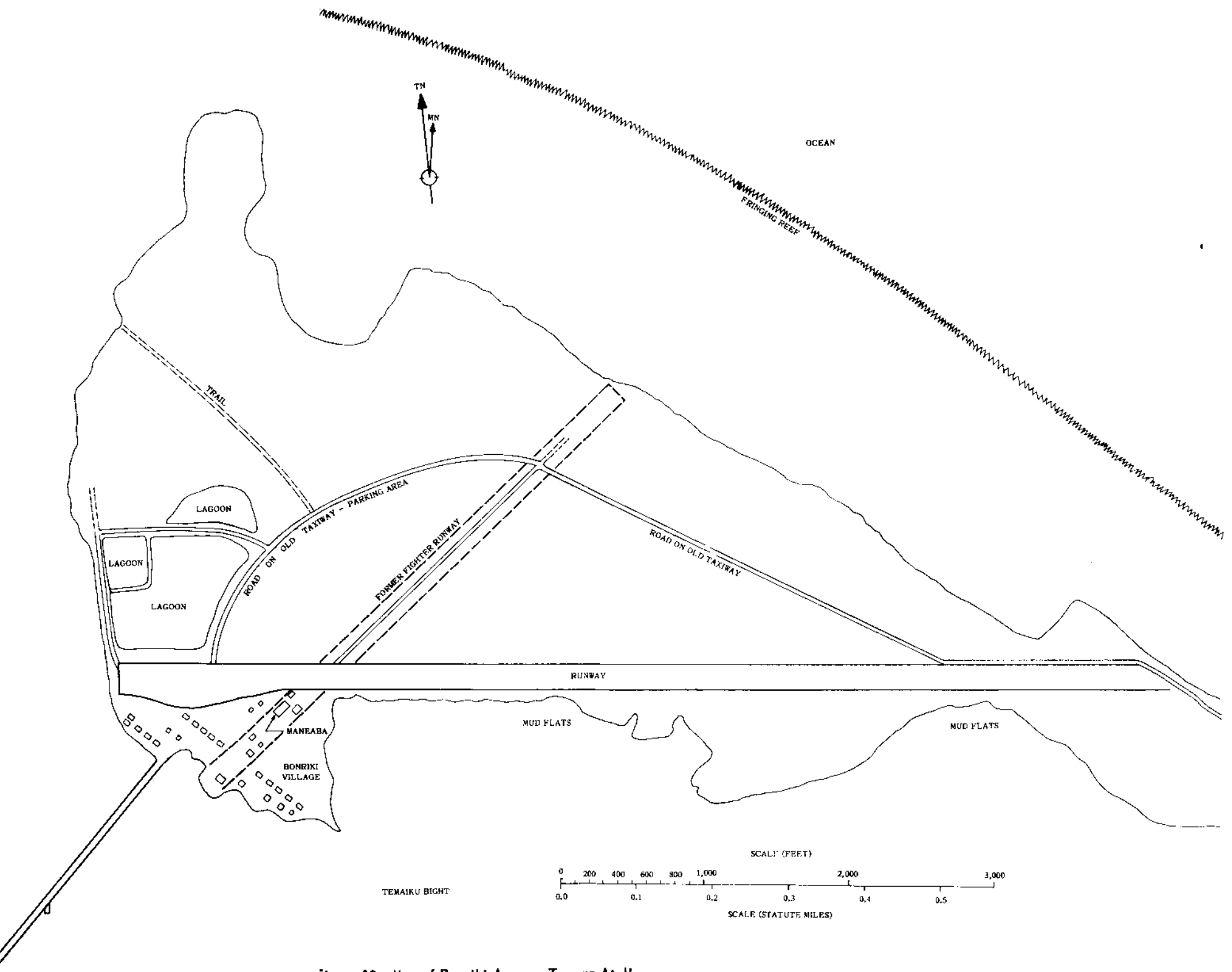
FACILITIES AVAILABLE

Transportation

Sea

Deep-draft vessels cannot enter the Tarawa lagoon but may find anchorage in 12 to 20 fathoms of water just west of the entrance; here they lie in what is normally the lee of the atoll in relatively quiet water. The entrance channel to the lagoon has a least width of 1,000 feet and is deep enough to permit vessels of 26-foot draft to enter the lagoon proper at any time; spring tides will permit vessels drawing 28 feet to enter. Pilotage is available and, although not mandatory, is usually taken by captains who do not have local knowledge. The channel itself and the anchorage area of some 4 square nautical miles west and southwest of Bikeman Island have buoys or beacons marking obstacles (chiefly coral pinnacles). No moorings exist, and vessels ride to their own anchors.

At present, all cargo from ships of any size is taken ashore in lighters. Six barges, three with flat tops and three open, are operated by the Wholesale Society and range in capacity from 20 to 40 tons. Some eight launches are in use by Government or Wholesale Society, of which three, with lengths of 22 to 35 feet and engines powered at 20 to 40 horsepower, are capable of handling the barges. With the use of the present system, it is estimated by the Marine Superintendent that the cargo-handling capacity of the port is about 500 tons per day.


TN
MN
OCEAN
FRINGING REEF
TRAIL
LAGOON
LAGOON
LAGOON
ROAD ON OLD TAXIWAY - PARKING AREA
FORMER FIGHTER RUNWAY
ROAD ON OLD TAXIWAY
RUNWAY
MANEABA
BONRIKI VILLAGE
MUD FLATS
MUD FLATS
TEMAIKU BIGHT
SCALE (FEET)
0 200 400 600 800 1,000 2,000 3,000
0.0 0.1 0.2 0.3 0.4 0.5
SCALE (STATUTE MILES)

The principal harbor at Tarawa is an artificial one on the north shore of Betio Island (figure 14). A major project for harbor improvement, which is well advanced, will result in an entrance channel

Figure 14. Aerial View of Betio Harbor (Looking Southeast).

95 feet wide and 10 feet deep and an inner area 13 feet deep alongside the dock (figure 15). Some 300 feet of dock faced with sheet steel piling will have this 13-foot depth alongside, permitting any colony vessel to remain tied up at any stage of the tide. When completed, the harbor area will be well lighted, will have power lines and a transformer on the dock, and will have water lines for docked vessels to fill their tanks. (The present system requires water to be taken offshore to ships in a 15-ton capacity water barge.) Only one small 1-ton mobile crane is available at present, and future plans call for ships to handle all cargo with their own gear.

Copra is the principal outgoing bulk cargo, and sugar and flour are the principal incoming bulk cargoes; all of these are packed in sacks and handled manually. Repair facilities include the Wholesale Society boatyard, which can overhaul vessels up to 35 feet in length and can perform woodworking operations, replace planking, and the like. The Government Workshop nearby, which has metal working equipment, can repair drive shafts and can overhaul engines (figure 16).

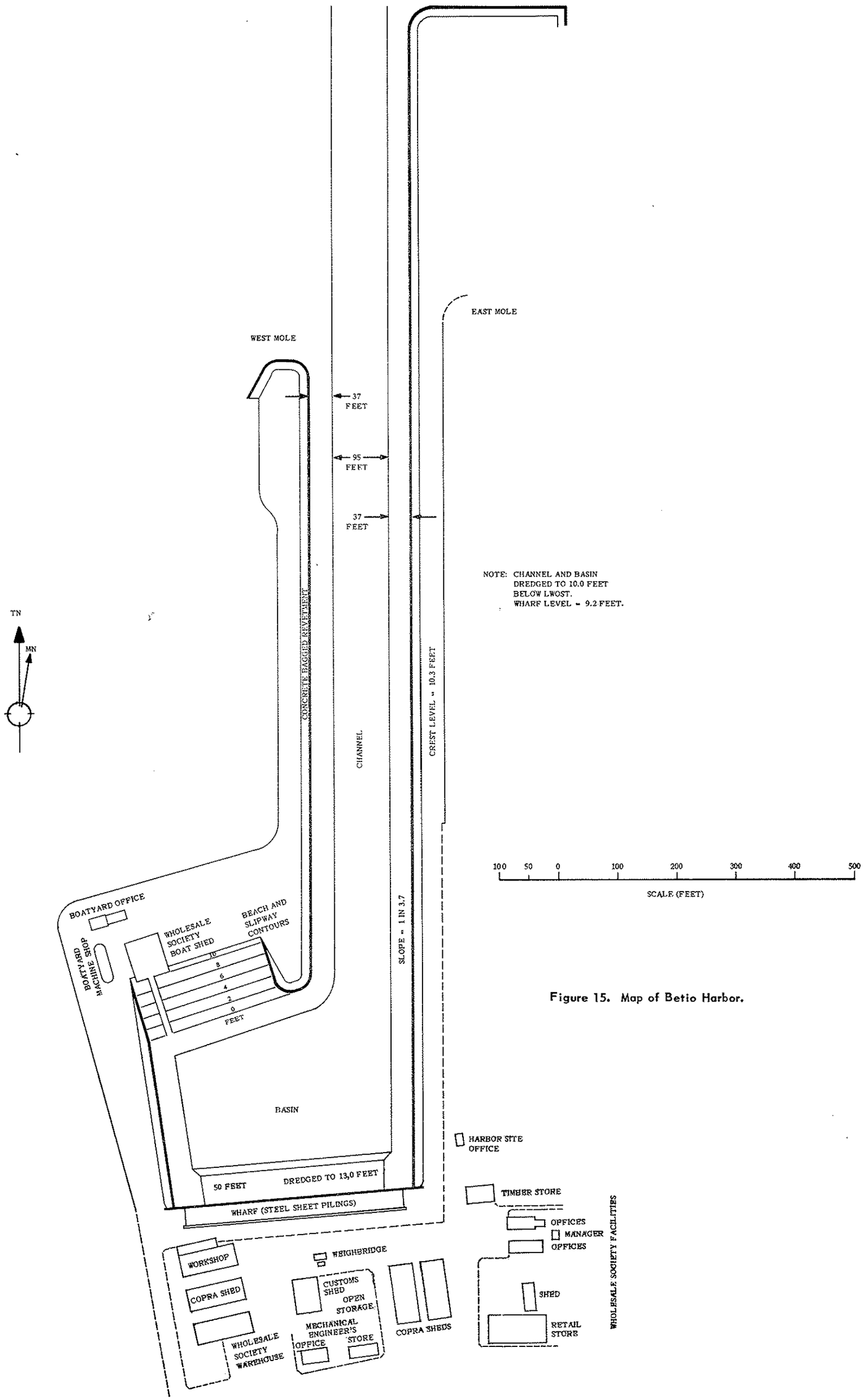


Figure 15. Map of Betio Harbor.

Figure 16. Boatyard and Ways Operated at Betio by the Wholesale Society.

Another portion of the harbor development scheme involves improvements to the boat harbor at the northwest corner of Bairiki Island (figure 17). Principal characteristics of the new harbor may be noted on figure 18. Since all connections between the colony headquarters at Bairiki and the district headquarters and the commercial activity at Betio require boat travel, a system of daily launch schedules, two boats each way, both in mornings and afternoons, has been set up to handle the traffic. A 1-shilling fee discourages joy-riders on the launches.

The mole extending into Temaiku Bight from near the west end of the Bonriki airstrip is now unused (figure 19).

Some nine ships, totalling 665 tons displacement, are in regular use in the colony for transportation among the islands (figure 20). They range in size from the 300-ton MOANA RAOI to the 10-ton FETUARO.

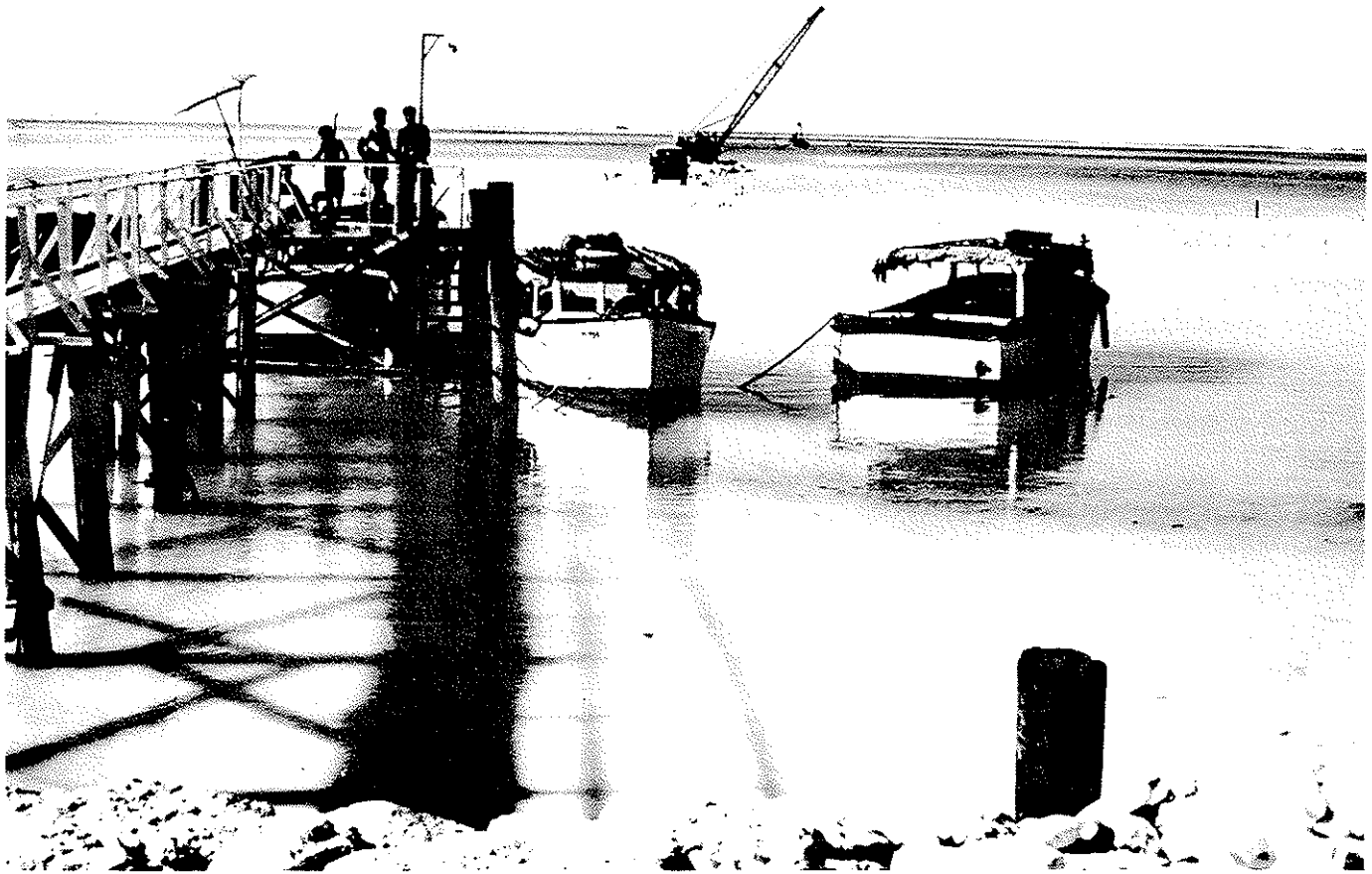


Figure 17. Boat Dock at Bairiki, With Launches Alongside and Dragline Working on Harbor Construction in Background.

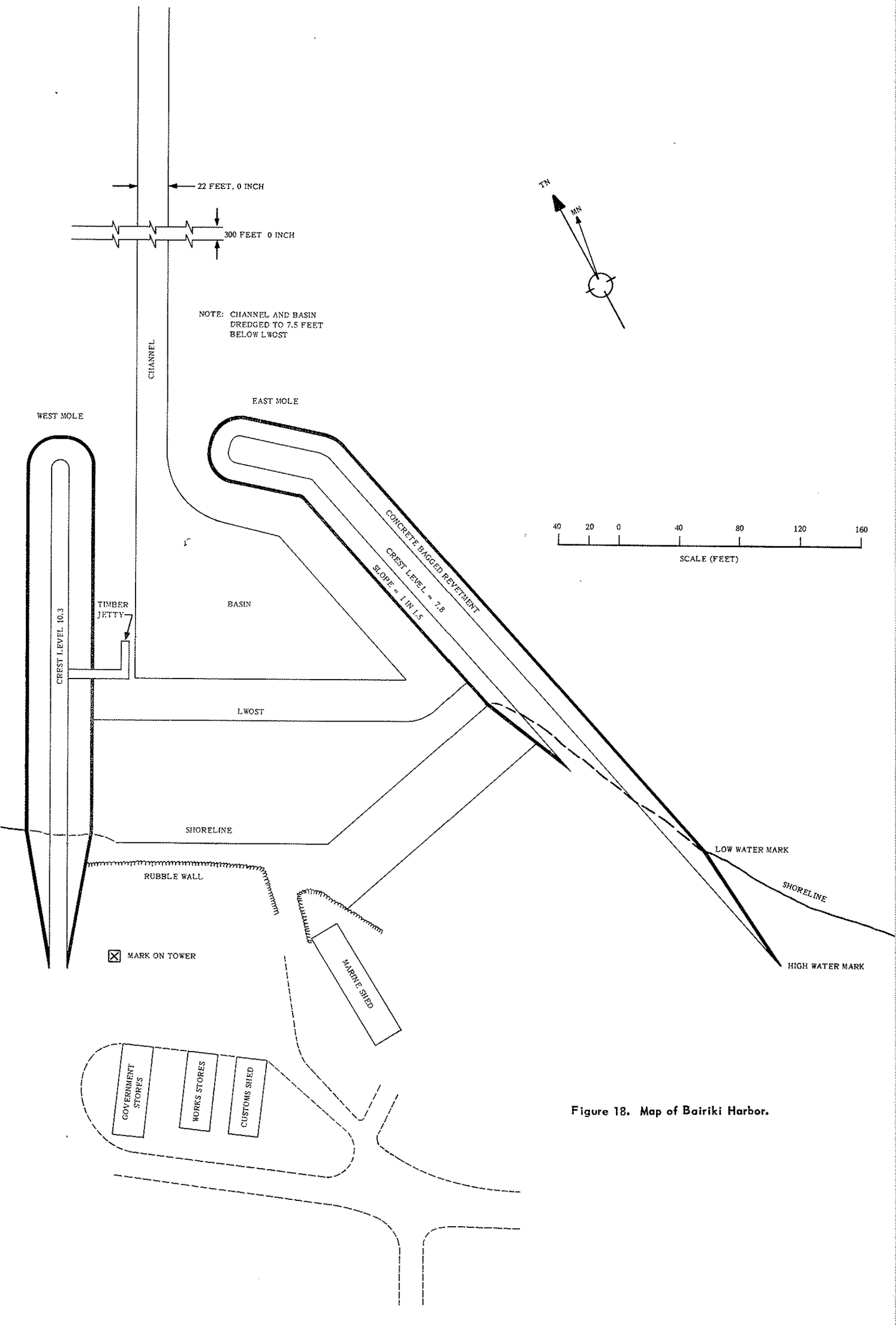


Figure 18. Map of Bairiki Harbor.

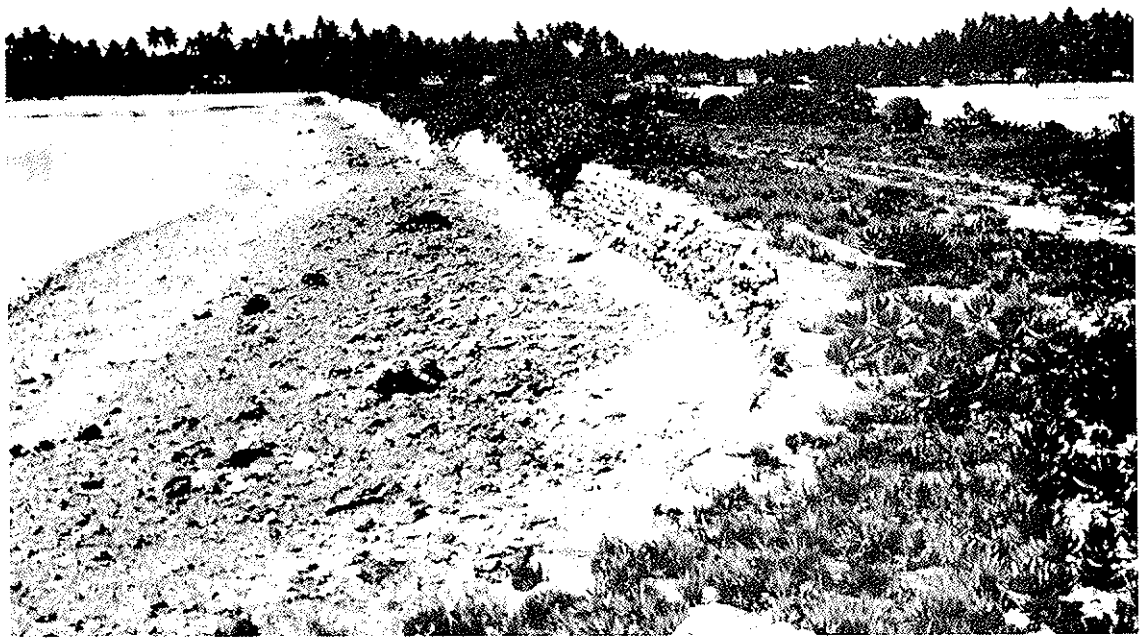


Figure 19. Unused Mole Near West End of Bonriki Airstrip (Looking Inland From Outer End of Mole in Temaiku Bight).

Figure 20. Interisland Transport Ships Operated by Gilbert and Ellice Islands Colony (From Left to Right: Nareau, Te Matapula, and Ninikoria).

Air

Of the several airfields constructed in the Gilbert Islands during World War II, only the one at Bonriki, near the southeast corner of Tarawa Atoll, remains today. All others, including the former Hawkins Field at Betio, have been replanted to coconuts and are completely unusable.

Bonriki Airfield today consists of one single runway, altitude 9 feet, oriented approximately east-west (97° - 277° true) (figure 21). The runway is 7,100 feet long, each end terminating at the water's edge without overrun. A certain amount of encroachment by coconuts and scrub has taken place along both sides of the runway, particularly about the center of the south side, but a clear width of 180 feet is still available for the entire length. The runway is made of compacted coral, which is still in good condition despite little maintenance since the war (figure 22). The bearing strength is unknown, but a 4-engine British aircraft landed on the strip in early 1959 and a Grumman UF-type amphibian aircraft landed on it three times in August 1959. American C-54's have used the field repeatedly in recent years.

The former fighter strip at Bonriki, extending northeast-southwest and intersecting the main runway, has been replanted in coconuts except for a poor road down the center. The southeast-northwest taxiway, which formerly connected the easterly portions of the two strips, and the extension of it, in a curve to west and south, which served as taxiway and parking strip, also have been replanted except for a 2-lane automobile road down the center (figure 23). Thus, except for a slightly wider area near the west end of the main airstrip, the airfield has no taxiways and no parking area (figures 24 and 25).

Except for wind socks at each end of the runway, the airfield has no other facility. Communications from aircraft to the island are with the radio station at Betio. When enough notice is given, a truck with soda-acid fire extinguishers is placed at the field to give some measure of fire protection. Again, when proper notice is given, small quantities of 100-octane aviation gasoline in drums can be made available at the field.

A seaplane landing area, used regularly by aircraft of the Royal New Zealand Air Force, is laid out in the lagoon to the north of Bairiki Island. A map of the system of buoys marking coral pinnacles and indicating the two principal directions for landing and takeoff is shown in figure 26.

Land

The road net on Tarawa consists of simple street networks at Betio and Bairiki and a road extending from Bonriki to Bairiki with interruptions at the channels between islands. For about two hours before and after each low tide, the water is low enough between islands for vehicles to cross, and it can be said that at these times a road extends for some 15 miles along the south side of the atoll (figure 27).

Most of the roads were constructed originally by the American forces during World War II. They consist of compacted coral, ranging from 16 to 24 feet in width. They have been maintained by use of a tractor-towed grader and toppings of reef mud in the chuck holes. The materials are tamped by hand because no roller is available. The slight amount of traffic gives so little wear that these rather simple maintenance methods suffice to keep the roads in good condition.

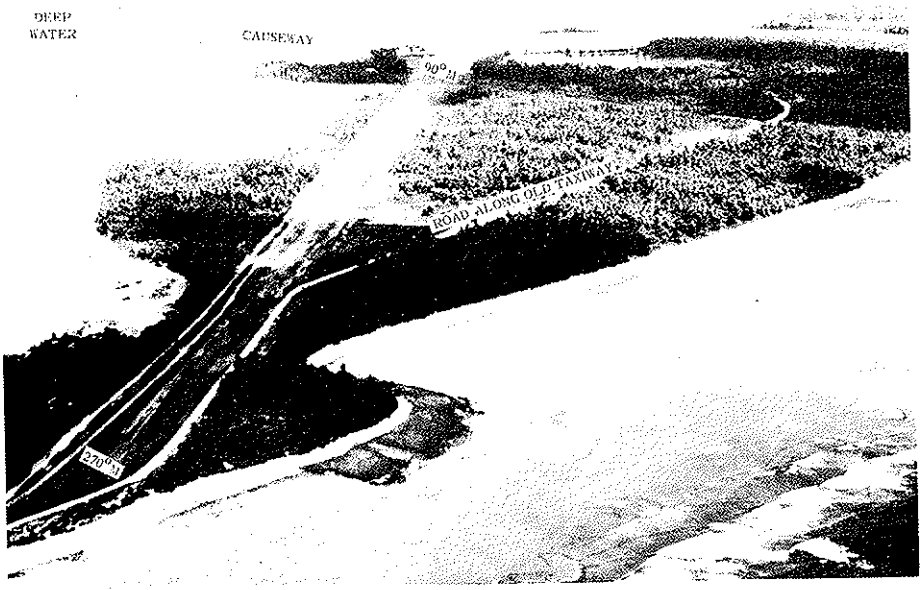


Figure 21. Aerial View of Bonriki Airfield.

Figure 22. Surface of Runway at Bonriki Airfield (Looking Eastward).

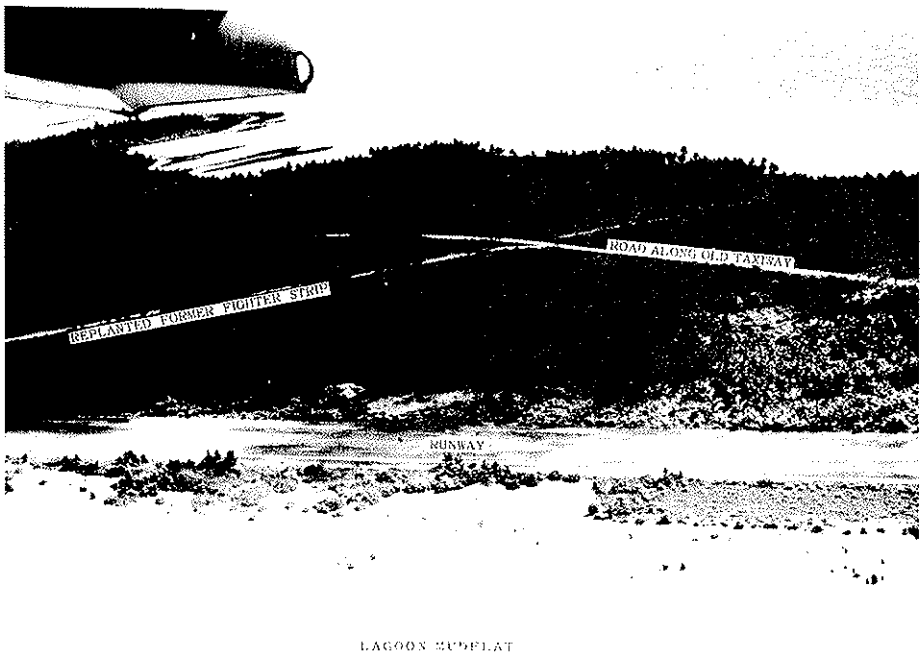


Figure 23. Central Portion of Runway at Bonriki Airfield (Looking Northward).

Figure 24. West End of Runway at Bonriki Airfield (Looking Northward).

Figure 25. Slightly Wider Area at West End of Runway at Bonriki Airfield (Looking Southeast) (Note Truck With Fire Extinguisher at Extreme Left).

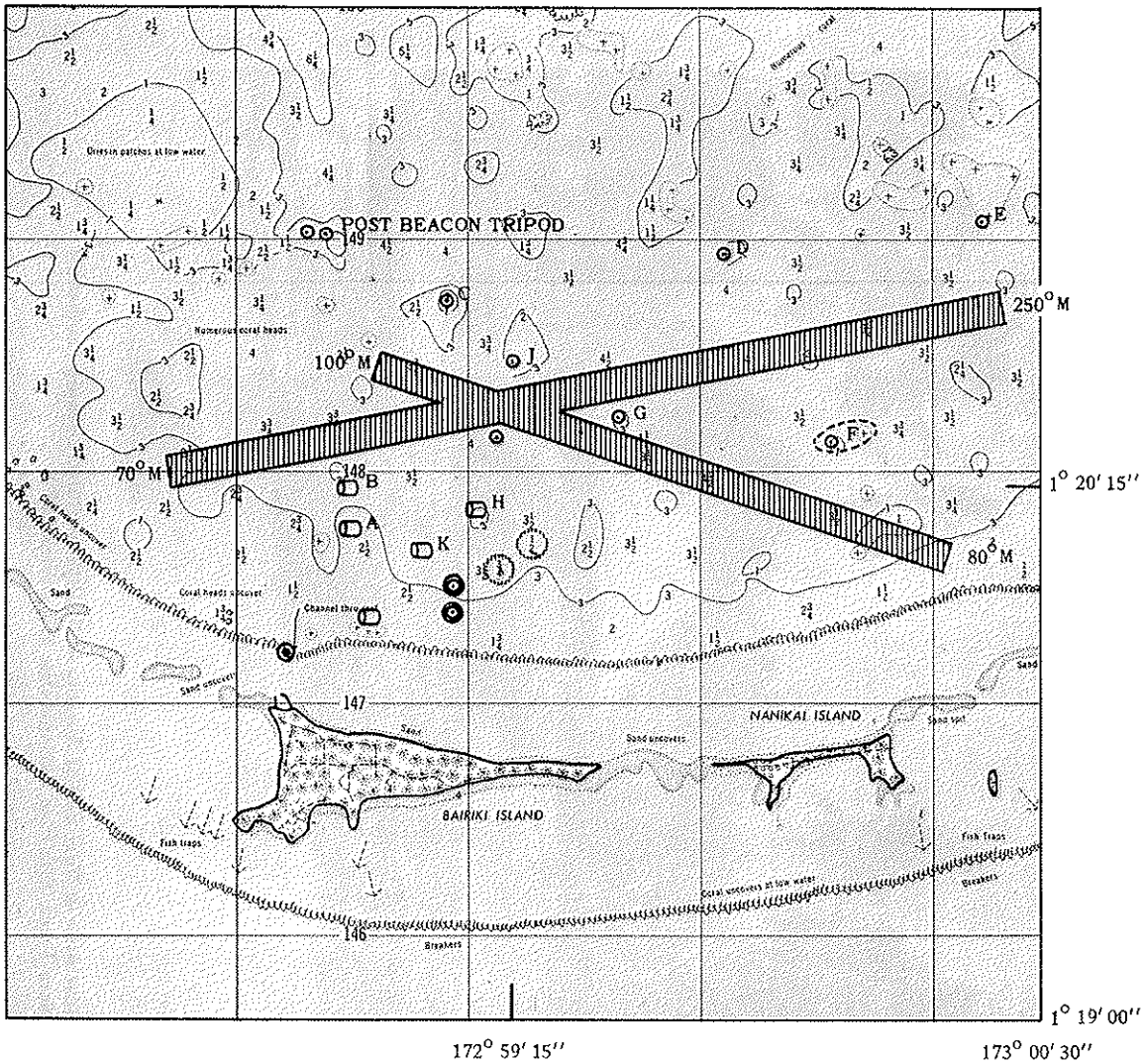


Figure 26. Map of Seaplane Landing Area North of Bairiki and Nanikai Islands Used by Royal New Zealand Air Force.

Figure 27. Land Rover in Passage Between Islands at Low Tide.

With the exception of 4 cars and 1 small truck at Betio, all vehicles on Tarawa are owned by the Government or the Wholesale Society. The vehicles are listed as follows:

	Total on Island	3-Ton Truck	Land Rover	Car	Small Truck	Ambulance
Betio	16	8	3	4	1	0
Bairiki	5	2	2	0	1	0
Bikenibeu	3	1	1	0	0	1
Total on Atoll	**24**	**11**	**6**	**4**	**2**	**1**

Maintenance of vehicles is performed at garages operated by the Wholesale Society or Government at Bairiki and Betio. The Government Machine Shop at Betio can rebuild engines and perform more complex repairs.

No true garage storage exists on the atoll, but shelters that keep off sun and rain exist for most vehicles. A gasoline pump at Betio and drums at Bairiki and Bikenibeu supply fuel.

Meteorology

All meteorological services for the colony are operated by the New Zealand Meteorological Service as part of its responsibilities with the South Pacific Air Transport Command, the over-all weather coordinating group for the South Pacific. Synoptic observations are made from 10 stations within the colony, of which Tarawa is one. Observations are made of temperature, pressure, pilot balloon flights (Tarawa and Funafuti only), rainfall, and visual observations of wind speed, direction, visibility, and cloud types. Among the instruments at Tarawa are a recording rain gage, recording barograph, and typical thermometers.

The colony staff consists of one European and 20 islanders; at Tarawa are the one European, three observers, and two trainees. The observation schedule (local times) calls for piball flights at 0530, 1030, 1630, and 2400; for synoptic observations at 0600, 0900, 1200, 1500, and 1800; and for climatic data at 0900.

A United States meteorological station was maintained on Tarawa intermittently during 1951, 1954, 1956, and 1958 by personnel of Joint Task Force SEVEN. During these periods, rawinsonde and radiosonde observations were taken two or four times daily. When the station was abandoned in 1958, all the equipment was removed and only the buildings were left at the location. The map (figure 28) and photographs (figures 29 and 30) present data on the past and present conditions of this station.

Communications

Radio communications in the Gilbert and Ellice Islands Colony are well developed, and regular schedules are maintained between Tarawa and Honiara, British Solomon Islands Protectorate, and with Nandi and Suva in Fiji. Within the colony, some 34 stations comprise a good communications net and provide for ship-to-shore or aircraft communications. On Tarawa, because of the necessity for maintaining good communications between individual islands, with their several government offices, a VHF system is maintained which connects Betio, Bairiki, and Bikenibeu. The HF transmitting and receiving stations for Tarawa are located at Betio, toward the west end of the island (figure 31). Considerable detailed technical information on the Tarawa radio communications is given in appendix E.

Very little telephonic communication is available on the atoll. Two 6-line intercom units are utilized between various offices in the Secretariat at Bairiki, and a few field telephones connect important points such as the Secretariat, Post Office, and dock area. Betio also has a few field telephones connecting similar locations.

Storage

No open bulk storage facilities are specifically laid out on Tarawa. Although a reasonable amount of space for storage is available, this space might not be in the immediate dock areas at Betio and Bairiki, because these areas are relatively congested. In the Bonriki area, ample open storage area is available close to the causeway and airfield.

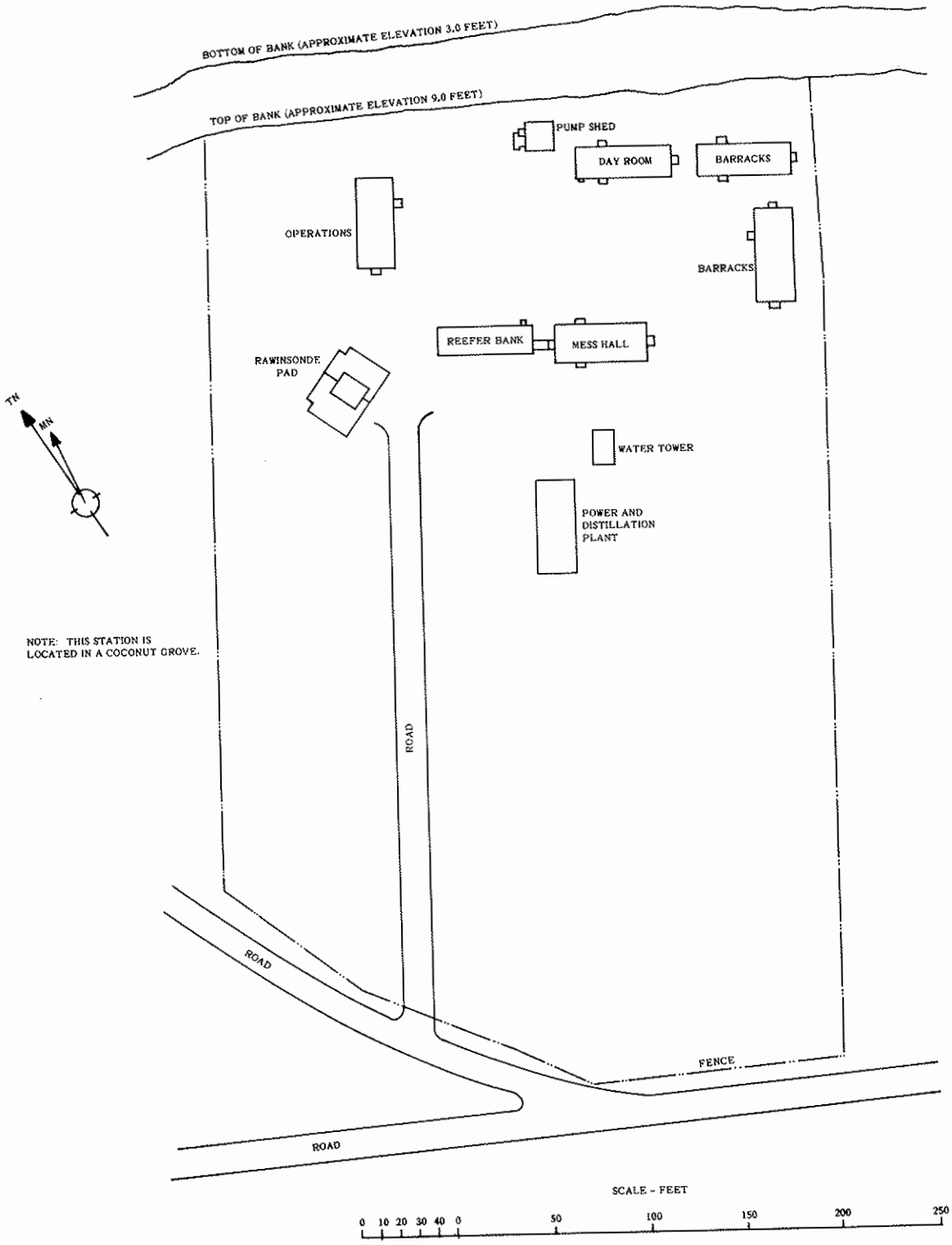


Figure 28. Map of U. S. Meteorological Station at Betio.

Figure 29. Aerial View of Meteorological Station at Betio.

Figure 30. Buildings in Meteorological Station at Betio.

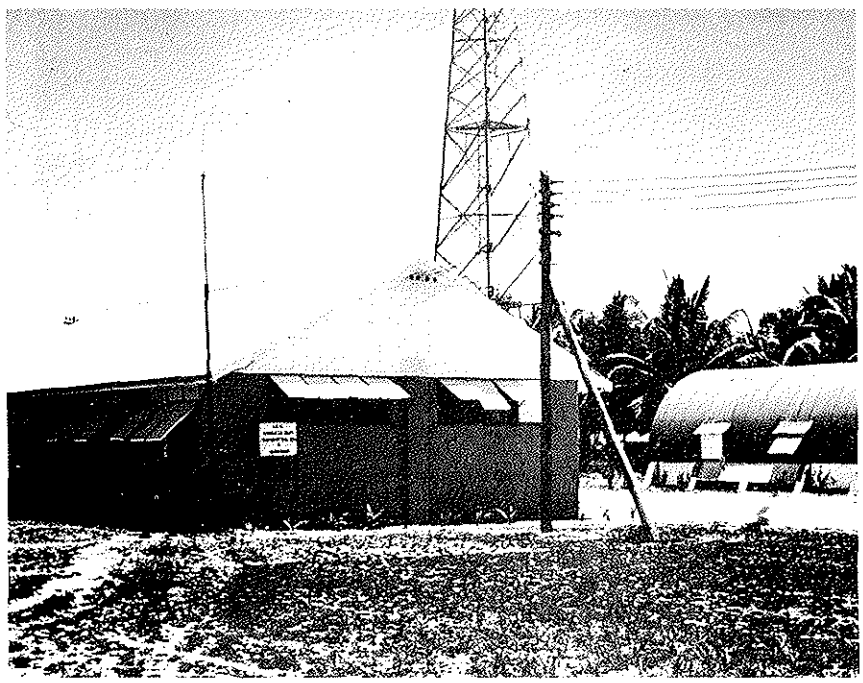


Figure 31. Transmitter Building at Betio.

Most covered storage or warehouse capacity on Tarawa is in the form of Nissen (Quonset-type) buildings (figure 32). At Bairiki, five large Nissen warehouses (24 by 60 feet) are used for governmental purposes, one covered shed (40 by 75 feet) is used for lumber storage, and a large Wholesale Society store and storehouse are combined. Storage facilities at Betio comprise eight large Nissen copra sheds or warehouses (40 by 100 feet), a customs shed (40 by 60 feet), about 10 smaller Nissen warehouses (20 by 100 feet), and a thatched timber storage area (about 30 by 50 feet). Most of this storage area is filled to capacity. Half or perhaps an entire copra shed (Nissen hut, 40 by 100 feet) might be made available temporarily in case of emergency.

Refrigerated storage on Tarawa is limited to two 150-cubic-foot reefers at Betio, housed in a 24-by-30-foot building. Another 300 cubic feet of storage is expected to be available by October 1959.

All petroleum products are now stored in drums at an open-storage area of 150 by 240 feet (figure 33). However, plans are being considered for bulk storage of POL near the harbor, including a 120,000-gallon tank for ship diesel fuel. Normal stocks of POL products in 55-gallon (U. S.) drums, are maintained as follows:

	55-Gallon Drums	5-Gallon Tins
100-octane aviation gasoline	200	
Aviation lubrication oil	6	
Automobile gasoline	300	
Kerosene	400	60

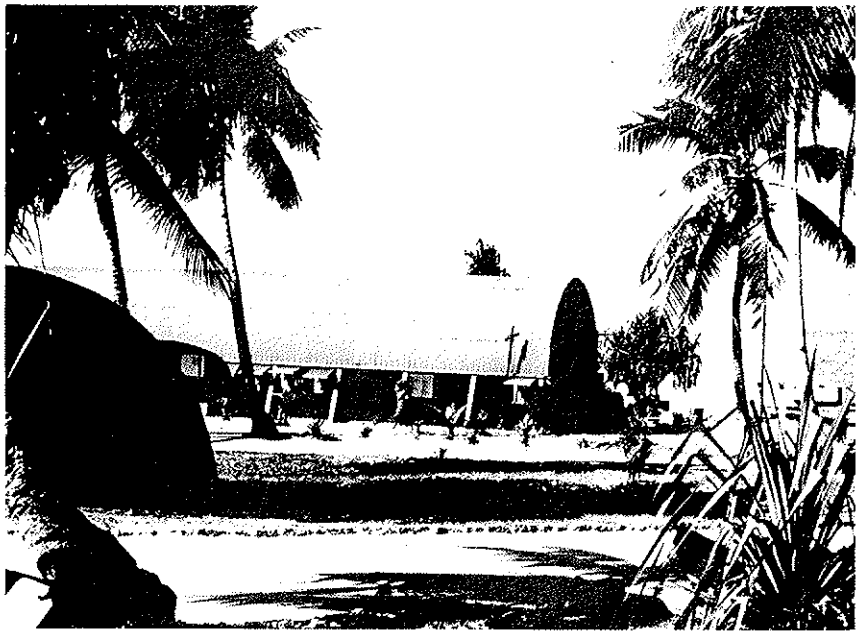


Figure 32. Nissen Building Used as Warehouse Near Dock at Bairiki.

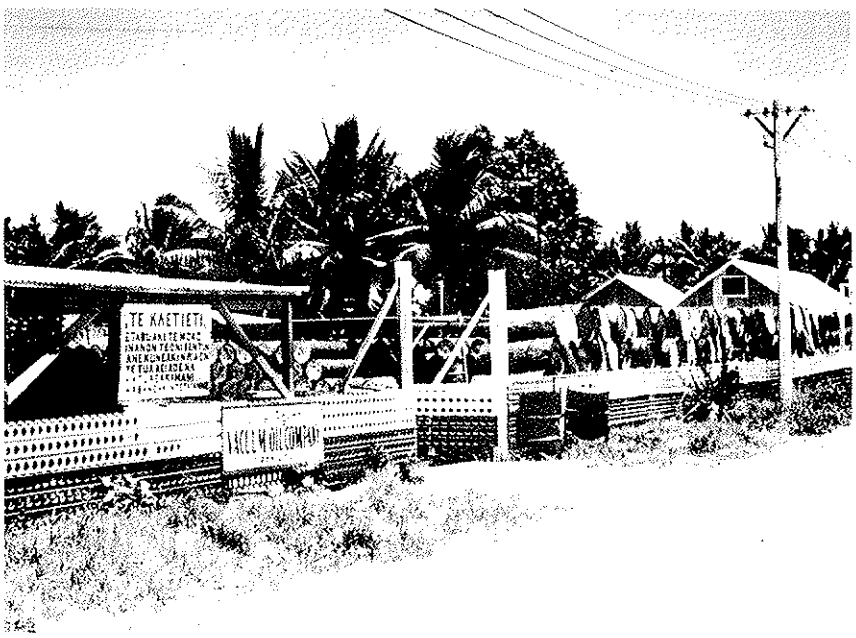


Figure 33. Open Storage Area for Petroleum Products at Betio.

	55-Gallon Drums	5-Gallon Tins
Ship diesel oil	2,000	
Ship lubrication oil	40	
Denatured alcohol	80	
Sundry specialized greases and oils		

Utilities

Water Supply

Water supply on Tarawa is a problem because of low and irregular rainfall, small land area, and lack of surface streams or lakes. The basic source of water is the freshwater lens which overlies the salt water in the substrata of each island. Wells are dug down to this water table. Some 300 wells in all serve the general population for all purposes in the three areas of Betio, Bairiki, and Bikenibeu. Well water is hard and tends to get progressively more brackish as a drought period persists. Water trucks, filled from the larger wells, distribute water to the individual government house tanks several times a week.

All drinking water for the Caucasian population is rainwater obtained from catchments on the individual houses. It is stored in an 800-gallon tank near each kitchen. Even this water is filtered and boiled before it is used by most Caucasians. Three large cisterns at Bairiki and Betio, which have a capacity in all of about 150,000 gallons, are used to store water obtained from the government catchment areas.

During the periods in which the U. S. Meteorological Station on Betio was occupied, all of the water used by the unit was distilled from sea water.

Electric Power Supply

The electrical systems installed on Tarawa have the following characteristics: 415 volts, 3 phases (or 240 volts, 1 phase), 50 cycles per second, with distribution on a 4-wire (3 phases plus neutral) main line. Transformers are available which can provide 110 volts for small loads.

Betio is provided with two 82-kilowatt Ruston generators. The peak load is estimated at a little more than 60 kilowatts, leaving one generator as standby. In addition, two 19-kilowatt Southern Cross generators are used as emergency standby equipment for the radio communications facility.

Bairiki has an 82-kilowatt main generator and a 69-kilowatt standby generator. Bikenibeu has an 82-kilowatt main generator, a 10-kilowatt standby generator for emergencies in the operating room at the hospital, and a 75-kilowatt generator on order which will be used as a standby.

In addition to the government offices, shops, docks, radio station, and other users, power is distributed to government housing at the three main government centers. Both Betio and Bairiki have service for about 18 hours per day; Bikenibeu has service for about 12 hours per day.

Sewage and Waste Disposal

Sewage from all Government Grade B (Caucasian) and Grade C (top native employees) housing is disposed of in individual septic tank systems, one for each house. All other persons on the atoll use latrines built out over the lagoon reef and connected by walkways to the shore. A septic tank system is installed at the site of the U. S. Meteorological Station.

Garbage is collected by truck twice a week and is burned on the reef. The unconsumed remains are carried off by the sea.

Maintenance Facilities

The principal maintenance facility is the Government Workshop located in the Betio dock area. Available equipment includes two metal lathes, a shaping machine, a vertical drilling machine, two grindstones, a valve grinder, an electric welding plant, and an oxyacetylene plant. The type of work accomplished here ranges from complete overhaul of diesel engines (up to 100 horsepower) to repair of vehicles and maintenance and repair of generators. Replacing parts is a problem because a relatively small stock is kept on hand.

The Wholesale Society (Betio) and the Government (Bairiki) have vehicle maintenance shops with compressors, grinders, battery-charging equipment, and grease racks or pits. The Wholesale Society boatyard at Betio and the Government carpenter shop at Bairiki have woodworking machines such a routers and planers.

Fire Protection

There is no formal group of personnel continuously on duty for fire protection. When an alarm is given, a group of laborers on each island assembles for fire-fighting under the supervision of a Caucasian. The two trucks (at Betio and Bairiki) which are used during the day for distribution of water to houses are left filled each night for use in an emergency. In addition, there are four 35-gallon extinguishers on wheels (2 at Bairiki, 1 each at Betio and Bikenibeu). As further protection, each Grade B house has two hand extinguishers (carbon tetrachloride and soda acid), and each Grade C house has a soda acid extinguisher. Among the smaller houses, a soda acid extinguisher is maintained for every 10 structures. Buckets are kept at hand in all main buildings. An alarm system is maintained. With the equipment outlined above, there have been few serious fires despite the apparent hazard of thatched roofs on most buildings.

Police Protection

Although the Superintendent of Police for the Colony is located on Ocean Island, the principal police officer for the Gilbert and Ellice Islands District, entitled Inspector of Police, has his headquarters on Tarawa. The forces for each of the main areas consist of: a Station Sergeant and 9 police at Betio; the Inspector, a Sergeant, and 15 police at Bairiki; and 1 policeman at Bikenibeu. A part-time local village policeman is stationed in each of the other villages on the atoll.

The principal jail for Tarawa, located at Bairiki, has a capacity of 21 male and 7 female prisoners at any one time.

Housekeeping Facilities and Personal Services

Quarters and Food Supply

Although the British have completed an appreciable program of construction of permanent housing on Tarawa, all housing is occupied and no facility is immediately available for even a small visiting party (figure 34). Some hundreds of houses have been built, but only 34 meet standards for occupancy by Caucasians. There is no hotel nor guest house of any description. Billeting of a visiting group would be difficult. Two qualifications to the above statements may be pointed out:

1. The buildings at Betio formerly occupied by the U. S. Meteorological Station are vacant at present and could provide shelter for an official party (figure 30). However, all equipment, bedding, messing, food, and the like would have to be brought in by the visiting group.
2. An official visiting party might be provided quarters, if plans were properly coordinated, at the Royal New Zealand Air Force facility at Bairiki (figure 35). These quarters were established for use by the crews of RNZAF aircraft which visit Tarawa approximately every two months on training flights. The facility, which has room for 6 officers and 15 enlisted men in two buildings, includes a separate cook and wash house (figure 36). Bedding and utensils are left in the buildings. All that is required of a visiting party is to supply its own food and to hire local labor as cooks and orderlies. If formal arrangements were made with the RNZAF at Lauthala Bay (near Suva), Fiji, it might be possible for a group to occupy these quarters between the periodic visits by the RNZAF.

Any visiting party of more than two persons would, at the least, have to supply its own food, and very probably would have to supply its entire bedding and messing needs.

Medical and Dental Care

The principal hospital for the Gilbert and Ellice Islands Colony is located at Bikenibeu, near the southeast corner of Tarawa Atoll. The staff is comprised of 5 Caucasians (2 doctors, 2 nurses, 1 pharmacist), 3 assistant medical officers (natives trained at the medical school at Suva, Fiji), 15 native nurses, 15 dressers (about the same as first aid men), and about 20 cooks, janitors, and other workers.

The hospital has beds for 6 Caucasian patients, 83 native patients, 15 mental patients, and, in an adjoining area, facilities for handling 70 leprosy cases. A fully equipped operating theater, X-ray machine, and facilities for simple laboratory tests comprise the major equipment at the hospital.

Operations such as appendectomies and hernias and maternity cases are routine for both Caucasians and natives, but more involved medical problems, so far as Caucasians are concerned, are handled by specialists in Australia or Fiji. An assistant medical officer, specialized in dentistry, does oral surgery and makes dental plates.

Laundry and Cleaning Services

No commercial drycleaning or laundry facilities exist on Tarawa. Local laundresses do all washing, houseboys do minor cleaning, and fancy cleaning is mailed to Australia or Suva for processing.

Figure 34. Grade D Government Housing Occupied by Gilbertese Couple in Foreground.

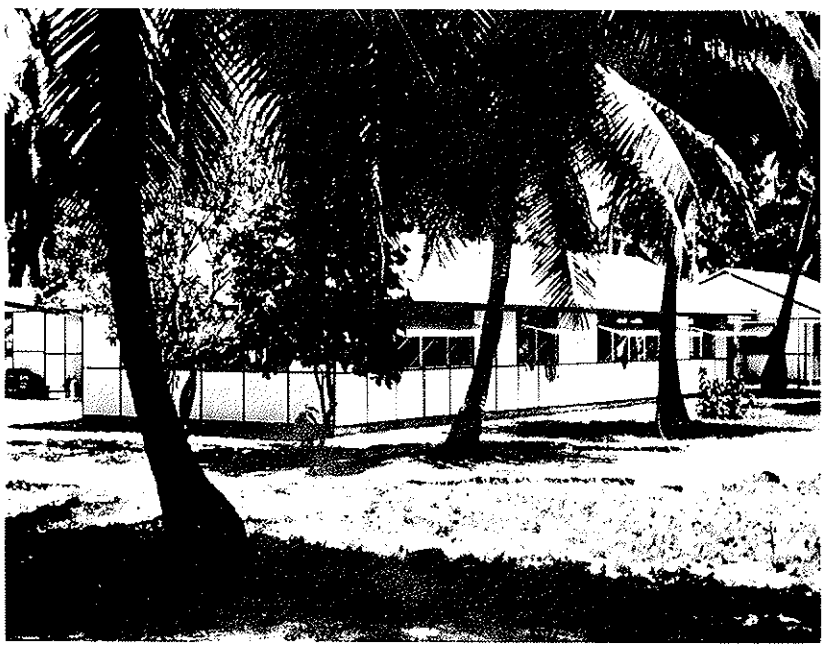


Figure 35. Royal New Zealand Air Force Quarters at Bairiki (Quarters for Enlisted Men in Center, With Officers' Quarters at Extreme Right and Cook House at Extreme Left).

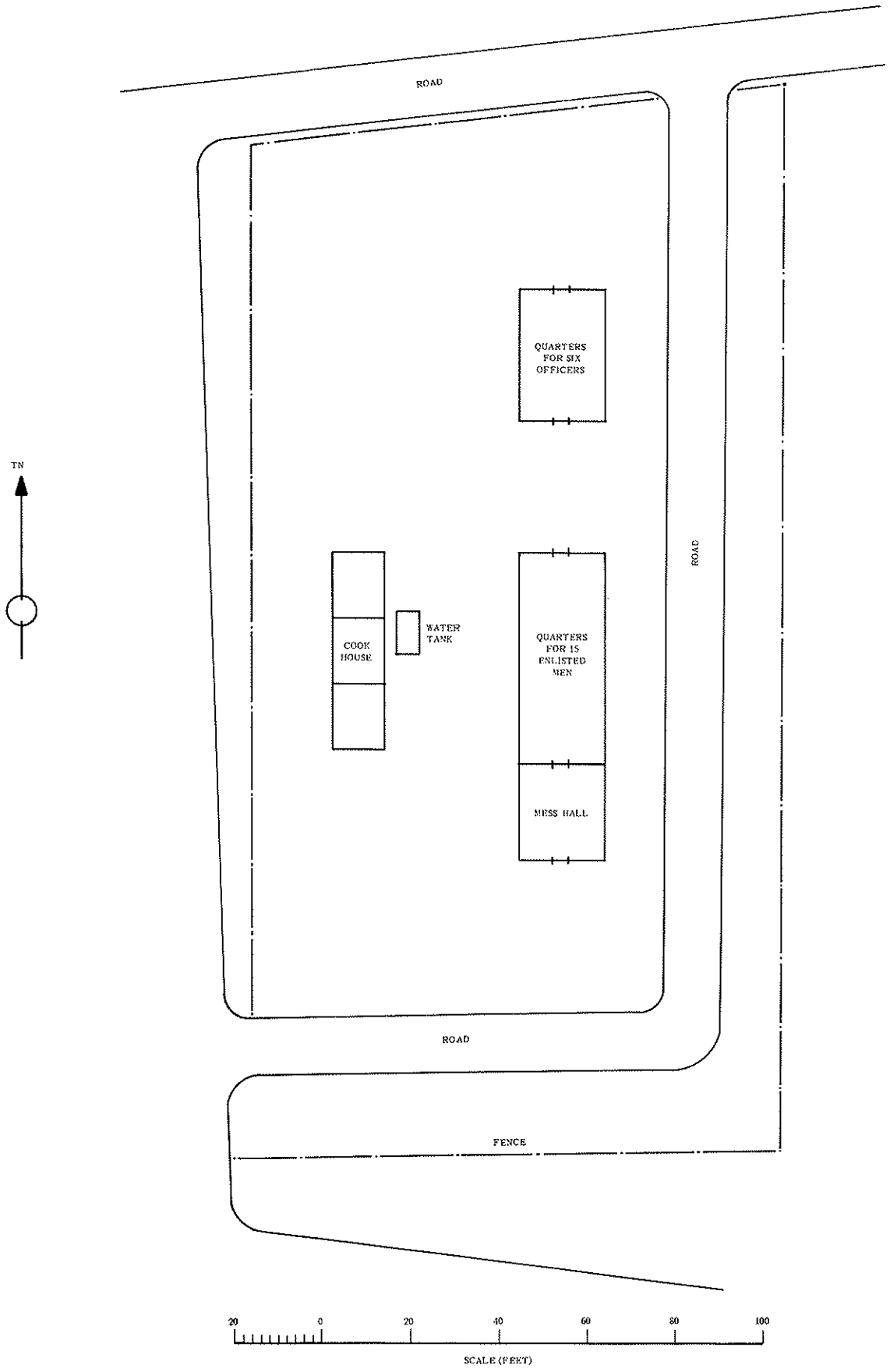


Figure 36. Map of Royal New Zealand Air Force Facility at Bairiki.

Religion

Although there are small congregations of perople who profess the Bahai, Church of God, and Seventh Day Adventist faiths, most of the population of Tarawa is divided approximately half and half between Roman Catholics and members of the London Missionary Society (closely related to Methodism).

A Catholic church is located in every village, and a small LMS church is located on every islet of the atoll. On Tarawa are a Catholic bishop, two priests, and about four nuns who are expatriates, and also Caucasian pastors of the Bahai and Church of God faiths. Native pastors represent the other religions.

Education

In Tarawa, no school is available which maintains European standards of education. Caucasian children, at about age 9, are sent off to boarding schools in Australia, New Zealand, or England.

The King George V School (figure 37) at Bikenibeu is the principal school for the colony. It provides secondary education to native boys from all over the colony. The Education Officer and Headmaster of the school are expatriates.

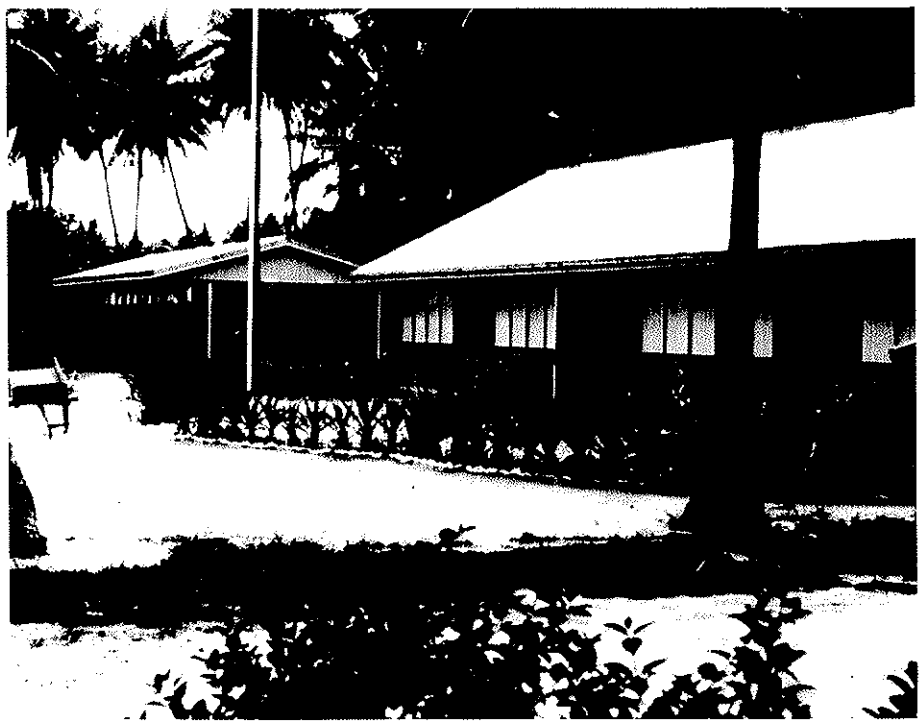


Figure 37. King George V School at Bikenibeu (Assembly Hall at Right and Administration Building at Left).

Recreation

Commercial recreation facilities are absent from Tarawa, with the exception of two open-air movie theaters at Betio and one at Bairiki. These theaters charge 12 cents admission and present programs dominated by old cowboy movies and adventure films. Caucasians have organized clubs at Betio and Bairiki which serve as focal points for social activities; each has a bar, billiards, darts, and other typical club facilities. Tennis courts are available at Betio and Bairiki, and sports grounds for cricket and rugby are located at these villages and at Bikenibeu. Fishing, sailing, and skin diving provide other recreational outlets.

Construction

Except for reef detritus used as aggregate for concrete, no construction material whatsoever is available at Tarawa. All cement, steel, and lumber are imported for specific jobs, and there is never any excess for casual purchase or use. Coral debris from the reefs is used to good advantage in concrete after it is washed and screened. Small (3/16-to-3/4-inch) and large (3/4-to-2-inch) sizes are used; fine particles and the few particles over 2 inches are discarded. Well water, fresh to brackish, is used in making concrete, but seawater can be used if necessary; in the latter case, the curing period is longer and the early strength of the concrete is lower.

All construction equipment has been imported for special purposes, principally for the harbor construction project. The equipment list comprises a 5/8-yard dragline, a 50-horsepower bulldozer with winch, 2 Morris 3-ton tippers, 4 concrete mixers (10-cubic-foot), a trailer-mounted compressor, and a diesel piling hammer. The piling hammer, a Delmay model D5, is used for driving the steel sheet piling for the Betio wharf.

Local construction costs can be roughly approximated from the cost of the Bairiki Secretariat (figure 8) which amounted to $37,000. The cost factor probably is 2.5 to 3.0 times that of Washington, D. C.

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APPENDIX A

VEGETATION OF GILBERT ISLANDS
(Source: Atoll Research Bulletin No. 59, pages 79, 80.)

With the exception of *Pemphis* stands and, of course, of the mangrove proper, no primitive vegetation types can be recognized today. The original formations have been so thoroughly modified by man that there is no trace left of them, especially as all these islands are rather densely populated.

Besides the coconut palm, which covers the largest area, some species may still have a certain density and show marked preferences for some habitats, but they form a secondary vegetation rather than ruins of former original types.

In many cases the primary components are now represented only by isolated specimens, which tend to disappear not only because of the growing prevalence of the coconut palm but also because the natives do not care to preserve or propagate them. This is the case for trees such as *Pisonia*, *Cordia*, etc. In some islands even valuable trees such as pandanus may be disappearing, as they are considered of minor importance in comparison with the commercial value of copra.

The Gilbert Islands offer today the following vegetation types:

I. Vegetation of the seaward side

Scaevola, more or less dense, forms an almost unbroken belt. Their density is always greater than that of other neighbouring plants. This species grows nearest to the shore. *Messerschmidia* in isolated specimens or small groups are found, most of them with twisted trunks. Their height does not exceed 3 m. *Pandanus*, are more or less numerous, but always as isolated individuals. The prevailing low plants are: *Lepturus*, which is very seldom found in the shaded central zone, and *Fimbristylis*. A few *Triumfetta* and *Cyperus* sometimes grow among them. The *coconut palm* begins in this zone, the first rows growing a little above high-water mark.

II. Vegetation of the interior

The area occupied by other species is usually conditioned by the density of the coconut palms. If these are very close together, we find only the following low plants: *Thuarea*, *Fimbristylis*, *Euphorbia* and gramineae of the genera *Stenotaphrum* and *Cenchrus*, with a few small *Scaevola* here and there. If the coconuts are less dense, there will be some tree species such as: *Pandanus*, *Guettarda* and *Morinda*; and in addition to the low plants already mentioned, *Boerhavia*, *Triumfetta*, *Fleurya*, *Sida*, *Dodonaea* and *Cassytha*. The grasses are almost all present and *Psilotum* and *Polypodium* occur here and there at the foot of the coconut trees. Of course the number of these plants and the area they cover vary with the degree to which the ground is tended. If the coconut palms are very sparsely planted, some trees such as *Cordia* and *Pisonia* may occur, though rarely nowadays.

Many low plants survive with difficulty in open areas while species such as *Sida fallax*, which seem to prefer strong sunlight, can achieve great extension there.

III. Vegetation of the lagoon side (area of roads and villages)

The roadsides being generally cleared to a certain width, few plants are to be found there except common grasses. On the other hand, the shrubs and trees of the interior may be found again between the cleared road zone and the edge of the lagoon, with the addition of small groups of *Messerschmidia* forming a narrow strip slightly in front of the coconut palms.

One plant will be found growing densely on sandy areas that are always damp below the surface through tidal seepage; this is *Fimbristylis*, which tolerates high salinity. On the contrary, *Scaevola, Guettarda* and *Lepturus* always grow above the level of the highest tides.

Village areas offer a very different aspect, due to the number of plants cultivated in their immediate vicinity and around the houses. Among food trees, in addition to coconut palms which are widely spaced, breadfruit trees predominate, and sometimes reach a large size. Pandanus trees are found in varying numbers, mostly around the village periphery, except in the southern islands where they are given the same choice locations as *Artocarpus*. Papaya trees are found in every village and are often very tall. Banana plants are sometimes a component of this vegetation, but are grown only in pits. Small pumpkin patches are seen around the houses in southern islands, generally side by side with numerous tobacco plants, while *Ficus tinctoria* is usually found a little behind the last houses. Tomatoes and sweet potatoes are very scarce and we saw them only on a few islands in the centre and north of the Gilbert Group.

One of the characteristics of the Gilbertese village is the great variety of ornamental plants. The most commonly found are *Crinum, Russelia, Mirabilis, Catharanthus* and *Pseuderanthemum*. The low plants considered as weeds vary in abundance, of course, according to the cleanliness of the village and are, in fact, rather scarce. *Euphorbia prostrata, Fimbristylis, Phyllanthus, Eragrostis* and *Digitaria* are most often seen.

In addition to village and roadside vegetation, the *Pemphis* type should be given special mention. This shrubby plant *(Pemphis acidula* Forst*)* forms thick stands, often spreading over large areas, just at the limit of the highest tides of the lagoon, and above the first depressions filled by high tides and occupied by *Rhizophora*. The latter may often cover large areas which are submerged at high tide.

APPENDIX B

KEY PERSONNEL OF GILBERT AND ELLICE ISLANDS GOVERNMENT

Name	Position in August 1959	Temporary Rank	Permanent Position	Permanent Rank	Location
Bernacchi, M. L.	*On leave*	-	Resident Commissioner	1	Bairiki
Davies, R.	Acting Resident Commissioner	1	Secretary to Government	2	Bairiki
Turpin, R.	Acting Secretary to Government	2	Administrative Officer, Class B	-	Bairiki
Roberts, R. G.	District Commissioner, Gilbert and Ellice Islands	3	District Commissioner, Gilbert and Ellice Islands	3	Betio
Rees, W. H.	Acting Chief Medical Officer	4	Medical Officer	-	Bikenibeu
Shaw, J. A.	Acting Accountant General	5	Accountant	-	Bairiki

APPENDIX C

POPULATION OF GILBERT AND ELLICE ISLANDS COLONY

Table C-1. Breakdown of Population in Gilbert and Ellice Islands Colony.
(Estimates as of 31 December 1958)

Location	Total	Native	Caucasian	Mongolian
GILBERT AND ELLICE ISLANDS DISTRICT:				
Makin	1,130	1,129	-	1
Butaritari	2,118	2,116	2	-
Marakei	1,790	1,787	3	-
Abaiang	3,234	3,226	8	-
Ta-awa	7,125	6,982	141	2
Maiana	1,359	1,358	1	-
Abemama	1,341	1,334	7	-
Kuria	541	540	-	1
Aranuka	571	571	-	-
Nonouti	2,143	2,140	3	-
Tabiteuea	3,266	3,261	5	-
Beru	1,968	1,965	3	-
Onotoa	1,542	1,542	-	-
Nikunau	2,011	2,008	3	-
Tamana	1,142	1,142	-	-
Arorae	1,551	1,551	-	-
Subtotal for Gilbert Islands	*32,832*	*32,652*	*176*	*4*
Nanumea	928	928	-	-
Nanumanga	513	513	-	-
Niutao	731	731	-	-
Nui	485	485	-	-
Vaitupu	822	822	-	-
Nukufetau	579	579	-	-
Funafuti	567	562	5	-
Nukulaelae	270	270	-	-
Niulakita	43	43	-	-
Subtotal for Ellice Islands	*4,938*	*4,933*	*5*	*0*
Total for district	*37,770*	*37,585*	*181*	*4*
OCEAN ISLAND DISTRICT:				
Total for district	*2,381*	*2,135*	*170*	*76*
PHOENIX ISLANDS DISTRICT:				
Canton[a]	368	179	189[b]	-
Hull	729	729	-	-
Gardner	183	183	-	-
Total for district	*1,280*	*1,091*	*189[b]*	*0*
LINE ISLANDS DISTRICT:				
Washington	305	304[c]	1	-
Fanning	436	401[c]	34	1
Christmas[d]	374	373	1[d]	-
Total for district	*1,115*	*1,078*	*36*	*1*
GRAND TOTAL FOR COLONY	**42,546**	**41,889**	**576**	**81**

a - *Condominium of United States and United Kingdom.*
b - Caucasian population in June 1956.
c - Including a few "mixed race".
d - Excluding military forces.

Table C-2. Population Trends in Gilbert and Ellice Islands Colony.

Racial Segment	1931		1947		1958[a]	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
Micronesians	28,946	85	29,923	83	36,956	87
Polynesians	3,668	11	5,006	14	4,933[b]	12
Mongolians	728	2	142	-	81	-
Caucasians	249	1	304	1	576	1
Mixed	231	1	565	2	?	
Total	**33,822**	**100**	**35,940**	**100**	**42,546**	**100**

a - Estimated by Government officials.
b - Total of Ellice Islands population, excluding 5 Caucasians.

APPENDIX D

SOME AVOIDANCES TO BE OBSERVED IN RELATIONS WITH NATIVES

(Source: Grimble, A. R. Instructions and Hints to District Officers. Suva: J. J. McHugh 1929.)

1. *Don't* expect to know the native until you have learned his home life. *Don't* expect to learn his home life except by constant hut-to-hut visitation. *Don't* expect to have any influence with the native until he knows that you know him.
2. *Don't* attempt to drive a native: lead him. *Don't* attempt to frighten him: he cannot be frightened physically.
3. *Don't* say anything that sounds like boasting or self-aggrandisement. There is a native proverb: "He owns no land, so his words are big."
4. *Don't* speak loud. There is another Gilbertese proverb: "A chief whispered: I swooned. A slave shouted: I awoke to laugh."
5. *Don't* reproach a native for bad manners until you are sure that you yourself are good-mannered according to his code.
6. *Don't* threaten or even speak of a native's head: it is sacred.
7. *Don't* point with extended finger: bend the finger and point with the knuckle.
8. *Don't* walk upright between two natives engaged in conversation. Bow the head, so as to clear their line of vision.
9. *Don't* forget to answer: "Te raoi" (peace!) if a native says "Ko raba" (thank you!).
10. *Don't* walk through a seated crowd without the preliminary courtesy: "E matauninga te aba?" (Are the people offended?). Say this and await the answer: "E aki matauninga, na rikai" (They are not offended, pass this way). Then proceed.

APPENDIX E

COMMUNICATIONS IN GILBERT AND ELLICE ISLANDS COLONY

The communications network in the Gilbert and Ellice Islands Colony consists of 34 stations, listed in table E-1. Regular contacts also are maintained with several other communications points outside the colony.

Communications equipment at Tarawa, which is the Government center of the colony, includes the transmitters detailed in table E-2, the receivers detailed in table E-3, and the VHF transmitter-receiver system described in table E-4. The test equipment at Tarawa, used to keep the communications equipment in good operating condition, is listed in table E-5.

The communications operations at Tarawa can be classified as point-to-point communications, shore/ship communications, ground/air communications, aircraft navigational aid, and local broadcasting service. The usage of equipment at Tarawa in these operations is described in tables E-6, E-7, and E-8.

The layout of receiving/operating positions, the staffing of receiving and transmitting stations, the stocking of spare units, and the maintenance of equipment at Tarawa are all simplified by an arrangement in which certain individual equipments are used at different times for different circuits, usually but not necessarily on the same frequencies. This arrangement is shown by the Tarawa radio schedules for 1 September 1959 detailed in table E-9. Although some circuits appear to be inadequately provided with night or secondary frequencies, local officials say that doubtless allocations would be available if the necessity arose or if the period of service were extended from the present 18 hours per day to 24 hours per day.

The normal working frequency for shore/ship communications is 4108.4 kilocycles, and the alternate frequency is 6282 kilocycles (which is limited to CW). The Pacific area small ships distress frequency is 2182 kilocycles. It should be noted that the Colony ships are not equipped to use the international distress frequency of 500 kilocycles.

Broadcasting in vernacular is limited at present to 1 hour per week on the frequency of 6050 kilocycles. One of the communications transmitters (radiating 200 watts) is borrowed for these broadcasts. The programs are tape recorded by the Information Office personnel at Bairiki, who have audio facilities and a Ferrograph (English) tape recorder. The taped programs are fed into the transmitter on Sundays from 1640M to 1715M (local time). The programs, which are half Gilbertese and half Ellice, include reports of colony news and local music. Although the reception is limited to the Gilbert and Ellice groups, reports are usually favorable. There are not very many private radio receivers outside Tarawa, but community listening is popular.

Broadcasting in English is scheduled for 2 hours per week on the frequency of 844 kilocycles. The program is broadcast by use of locally constructed studio equipment and a locally constructed low-power transmitter. The programs, which consist of local news reports, music, and British Broadcasting Corporation feature transcriptions, are presented on Fridays from 1930M to 2130M (local time). This low-power broadcasting station is located near the transmitting station for colony communications.

At the end of 1959, a new 2.5-kilowatt transmitter is being installed in the transmitting station, a remote studio is being installed on Betio, and another studio is being installed in the Information Office at Bairiki. This transmitter equipment, which is manufactured by Standard Telephones and Cables, Ltd. (Australian), will require a 3-phase AC power input. The associated audio equipment to be used in the remote studios is mostly manufactured by Amalgamated Wireless Austrasia, Ltd. (Australian) and PYE (English). A special high-angle radiation antenna, termed a vertical incidence array, will be used with this new transmitter. The radiation will be limited to the Gilbert and Ellice Islands, but a reliable service area is anticipated.

When this new broadcasting equipment is put into operation, the vernacular programs probably will continue to be recorded in most instances, but under better conditions. However, live programs from the new remote studio on Betio will be possible.

Although the studio equipment probably will be used to produce live programs for the English broadcasts, it is not proposed at present to use the new transmitter for the English service. Probably, the low-power transmitter will be moved to the transmitting station and the small building which now houses the low-power transmitter will be demolished.

Table E-1. Wireless Stations in Gilbert and Ellice Islands Colony. (Total of 34 Stations in Colony)

Station	Call Sign
Gilbert Islands (19 Stations):	
Headquarters, Tarawa	VSZ
Bairiki, Tarawa	VSZ 39
Bikenibeu, Tarawa	VSZ 40
Abaokoro, Tarawa	VSZ 38
Makin	VSZ 35
Butaritari	VSZ 32
Marakei	VSZ 34
Abaiang	VSZ 33
Maiana	VSZ 37
Abemama	VSZ 36
Kuria	VSZ 25
Aranuka	VSZ 26
Nonouti	VSZ 24
Tabiteuea	VSZ 23
Beru	VSZ 27
Onotoa	VSZ 29
Tamana	VSZ 30
Arorae	VSZ 31
Nikunau	VSZ 28
Ellice Islands (9 Stations):	
Nanumea	ZJU 22
Nanumanga	ZJU 27
Niutao	ZJU 24
Nui	ZJU 23
Funafuti	ZJU
Vaitupu	ZJU 25
Nukufetau	ZJU 28
Nukulaelae	ZJU 29
Niulakita	ZJU 26
Ocean Island (1 Station):	VQK
Phoenix Islands (3 Stations):	
Canton	ZIT
Hull	ZIT 23
Gardner	ZIT 25
Line Islands (2 Stations):	
Fanning	VQN 22
Christmas	VQN 23

Table E-2. Summary of Available Information on Transmitters at Tarawa.

Number On Hand	Type or Model	Manufacturer	Source	Input Power Required	Unmodulated Output Power to Antenna (Watts)	Antenna	Frequency Range		Usage
							(Megacycles)	(Kilocycles)	
2	AT14	T and S (Australian)	Purchased after World War II from Australian Air Force (wartime model)	240 volts AC 1-phase mains-operated	200	Hertz*	2 - 20	--	CW, MCW, voice
2	AT13	AWA (Australian)	Purchased in 1946 from Australian Air Force (wartime model)	--	200	Hertz*	2.5 - 20	--	MCW
1	12J50904	AWA (Australian)	Purchased in 1947 (postwar model)	--	500	Terminated "V", directed at Fiji; 600-ohm twin feeder	2 - 20	--	CW, MCW, voice
1	1J51020	AWA (Australian)	Purchased in 1947 (postwar model)	240 volts AC 1-phase mains-operated	100	Long wire, horizontal	2 - 20	330 - 520	CW, MCW, voice, navigational aid**
1	--	Local engineers	Constructed at Tarawa in 1950	--	50	Top-loaded long wire, horizontal	--	844	Voice***
1	--	STC (Australian)	Being installed at end of 1959	AC 3-phase	2,500	Vertical incidence array (special high-angle radiation)	--	--	Voice****

T and S = Thom and Smith, Ltd.
AWA = Amalgamated Wireless Australasia, Ltd.
STC = Standard Telephones and Cables, Ltd.

*Single-element, simple half-wave, horizontal Hertz antenna; delta-matched by a 600-ohm twin feeder and cut to proper length for the frequency used.

**Fitted with separate automatic keying unit, constructed at Tarawa, to transmit long dashes interspersed with identification "TW" as a navigational aid to aircraft in the Tarawa region.

***Used with locally constructed studio equipment.

****To be used with audio equipment manufactured by AWA (Australian) and PYE (English) and located in remote studios at Betio and at the Information Office at Bairiki.

Table E-3. Summary of Available Information on Receivers at Tarawa

Number On Hand	Type or Model	Manufacturer	Source	Components	Input Power Required	Antenna	Usage
5	AMR type 680X	Eddystone (English)	--	13 tubes, a rectifier, and voltage stabilizer	240 volts AC mains-operated	Hertz doublet, shielded feed	MCW'
1	AMR type C13500	AWA (Australian)	Purchased from wartime disposals	9 tubes and rectifier	240 volts AC mains-operated	Hertz doublet, shielded feed	CW
1	type RA-1B	Bendix (American)	Purchased from wartime disposals	8 tubes and rectifier	240 volts AC mains-operated	Long wire, horizontal	CW, MCW

AWA = Amalgamated Wireless Australasia, Ltd.

Table E-4. Summary of Available Information on Transmitter-Receiver at Tarawa

Number On Hand	Type or Model	Manufacturer	Input Power Required	Unmodulated Output Power to Antenna (Watts)	Antenna	Frequency Used (Megacycles)	Usage
1	FM type 30-SU-8C	Standard Telephones and Cables, Ltd. (Australian)	240 volts AC mains-operated	10	Ground plane mounted on mast 80 feet above surface of ground	74*	VHF FM voice**

* Same frequency used for both transmitting and receiving.

** Fitted with operator's control unit for two extensions at Betio, one to the public telephone booth at the Receiver Station and the other one to the District Office.

Table E-5. Test Equipment Used in Radio Workshop at Tarawa

Quantity	Equipment	Type or Model	Manufacturer	Testing Range
2	Multimeter	Model 8 Universal	Avo (English)	- -
1	Multimeter	University type MVA/2	- - (Australian)	- -
1	Insulation tester	Series 3	Megger (English)	- -
1	Signal generator	Type E2	Advance (English)	100 - 100,000 kilocycles
1	Signal generator	Type A51948	AWA* (Australian)	VHF (fixed frequency)
1	Audio oscillator	RC generator GM 2315/02	Philips (Dutch)	20 - 20,000 cycles per second
1	Oscilloscope	GM 5655/02	Philips (Dutch)	- -
1	Measuring bridge	Philoscop 11 type GM 4144/01	Philips (Dutch)	- -
1	Valve voltmeter	Electronic testmeter Mk 4	Avo (English)	- -
1	Valve tester	Type 160	Avo (English)	- -
1	Testmeter	- -	STC** (Australian)	VHF
1	Neutralizing meter	(for AWA transmitters)	AWA* (Australian)	- -
1	Frequency meter	Model BC221-M	Bendix (American)	125 - 20,000 kilocycles

* Amalgamated Wireless Austrasia, Ltd.

** Standard Telephones and Cables, Ltd.

Table E-6. Equipment Usage at Tarawa in Point-to-Point Communications.

Station		Type of Signal	Transmission			Reception		
Location	Call Sign		Type of Transmitter	Frequency (Megacycles)		Type of Receiver	Frequency (Megacycles)	
				Day	Night		Day	Night
Gilbert Outer Islands	VSZ + suffix	MCW	AT14*	6.9875	--	C13500	7.460	3.730
Ellice Islands	ZJU + suffix	MCW	AT14*	6.9875	--	C13500	7.460	3.730
Ocean Island	VQK	MCW	AT13**	11	--	680X	7.490	--
Phoenix Islands	ZIT + suffix	MCW	AT13**	11	--	680X	9.825	--
Line Islands	VQN + suffix	MCW	AT14*	6.9875	6.9875	C13500	7.460	3.730
Suva	VPD	MCW	AT13**	11	--	680X	13.395	5.800
Honiara	VQJ	MCW	AT13**	11	--	680X	11.568	--
Nauru	VKT	MCW	AT13**	11	--	680X	8.175	8.175
Nadi	ZQD	MCW	AT13**	11	11	680X	11.450	9.400
Nadi	ZQD	MCW	12J50904	16.0775	--	680X	15.600	--
Bairiki***	VSZ	VHF FM voice	30-SU-8C	74	74	30-SU-8C	74	74
Bikenibeu***	VSZ	VHF FM voice	30-SU-8C	74	74	30-SU-8C	74	74

* Same transmitter.
** Same transmitter.
*** Intra-Tarawa communications.

Table E-7. Equipment Usage at Tarawa in Shore/Ship Communications

Station	Type of Signal	Transmission			Reception		
		Type of Transmitter	Frequency (Kilocycles)		Type of Receiver	Frequency (Kilocycles)	
			Day	Night		Day	Night
Colony ships, overseas ships in area, or as required	MCW, voice	AT14	8790.2 4413.8	- - 4413.8			
	CW, voice				680X	4108.4 2182	4108.4 2182
	CW				680X	6282	6282
Overseas ships (international distress frequencies)	CW, MCW	1J51020	500 422 410	500 422 410	RA-1B	500 422 410	500 422 410

Table E-8. Equipment Usage at Tarawa in Ground/Air Communications, Aircraft Navigational Aid, and Local Broadcasting Service

Station	Type of Signal	Transmission			Reception		
		Type of Transmitter	Frequency (Kilocycles)		Type of Receiver	Frequency (Kilocycles)	
			Day	Night		Day	Night
Ground/air: All aircraft in area	MCW, voice	AT14 or 1J51020	13344.5 8845.5	5641.5 2945	680X	13344.5 8845.5	5641.5 2945
Navigational Aid: All aircraft in area as required	CW*	1J51020	375	375			
Local Broadcasting: Gilbert and Ellice Islands	Voice**	AT14	6050	6050			
Tarawa	Voice***	Local****	844	844			

* Automatically keyed to send long dashes interspersed with identification "TW."

** Vernacular programs.

*** English-language programs.

**** Constructed by local engineers for low-power (50 watts) operation.

Table E-9. *Tarawa Radio Schedules as of 1 September 1959*

Time		Type of Schedule *	Station	Frequency Used by Tarawa (Kilocycles)	
Local (M Zone)	Greenwich Mean			Transmission	Reception
0600	1800	C	Open VHF, local, and overseas shipping watches	74000 4113 500	74000 4108 500
0600	1800	WX	ZJU 22, 23, and 26; VSZ 27, 31, and 32	6987.5	7460 3730
0600	1800	WX	VQK Ocean Island	11000	7490 3745
0600	1800	C	Special schedule for Bairiki, Bikenibeu (priority only) VHF	74000	74000
0615	1815	C	ZJU Ellice subs	6987.5	7460 3730
0620	1820	WX	ZQD Nadi	11000 16077.5	9400 11450
0700	1900	C	VSZ send traffic list and traffic to Ellice subs	6987.5	7460 3730
0705	1905	WX	ZQD Nadi if no contact at 0620M	11000	15600
0730	1930	C	ZPD Suva	11000	13395
0800	2000	C	Watch-keeping this area until 1000M		500
0800	2000	C	Colony shipping	4413.8	4108.4
0800	2000	C	Bairiki and Bikenibeu worked on 6987.5 kilocycles when ZJU Ellice clear (until 0845M), then VSZ changes to 4413.8 kilocycles. Bairiki and Bikenibeu keep continuous watch on VHF during office hours.	6987.5 4413.8	3502.5 74000
0830	2030	C	Bairiki, Bikenibeu Sundays and holidays only	4413.8	3502.5

* C Commercial communications
WX Weather information

Table E-9. Tarawa Radio Schedules (Cont'd)

Time		Type of Schedule*	Station	Frequency Used by Tarawa (Kilocycles)	
Local (M Zone)	Greenwich Mean			Transmission	Reception
0855	2055	WX	VQK Ocean Island, ZJU Funafuti, VSZ 31 Arorae	6987.5	7460
			VQK Ocean Island		7490
0900	2100	C	VQK Ocean Island listens on 11000 kilocycles until 1000M	11000	7490
0900	2100	WX	ZQD Nadi	11000	15600
0900	2100	C	VSZ sends shipping notes and traffic list to Northern Gilberts, sends and receives traffic until 1015M	6987.5	7460
0905	2105	C	ZIT Canton listens for VSZ on 11000 kilocycles until 1000M (Pass priority Government and all private traffic for Christmas)	11000	9825
0915	2115	C	VPD Suva	11000	13395
0950	2150	C	VQJ Honiara (Sundays, holidays only priority traffic)	11000	11568
1015	2215	C	VSZ sends shipping notes and traffic list to Southern Gilberts, handles traffic until 1130M	6987.5	7460
1015	2215	WX	ZQD Nadi administration	11000	15600
1030	2230	C	VKT Nauru	11000	8175
1050	2250	C	VQJ Honiara (except Sundays and holidays)	11000	11568

* C Commercial communications
WX Weather information

Table E-9. Tarawa Radio Schedules (Cont'd)

Time		Type of Schedule*	Station	Frequency Used by Tarawa (Kilocycles)	
Local (M Zone)	Greenwich Mean			Transmission	Reception
1100	2300	C	VQK Ocean Island listens for VSZ until 1200M (except Sundays)	11000	7490
1130	2330	C	VPD Suva	11000	13395
1130	2330	C	VSZ 31 Arorae accepts priority traffic for Ellice weather subs	6987.5	7460
1150	2350	WX	VSZ 31 Arorae passes Ellice weather to Tarawa	6987.5	7460
1155	2355	WX	VSZ 32 Butaritari	6987.5	7460
1200	2400	C	Bairiki, Bikenibeu Sundays and holidays	4413.8	3502.5
1200	2400	WX	VQK Ocean Island	11000	7490
1200	2400	C	Watch-keeping this area until 1400M		500
1200	2400	C	Tarawa sends traffic list and exchanges traffic with Northern Gilberts until 1445M	6987.5	7460
1205	0005	WX	ZQD Nadi	16077	15600
1300	0100	C	Tarawa keeps special schedule Colony ships (urgent traffic only)	4413.8	4108.4
1305	0105	WX	ZQD Nadi for area forecast	16077	15600
1400	0200	C	VKT Nauru (except Saturdays, Sundays, and holidays)	11000	8175
1445	0245	C	ZIT Canton keeps watch on Tarawa for traffic until 1545M	11000	9825

*C Commercial communications
WX Weather information

Table E-9. Tarawa Radio Schedules (Cont'd)

Time		Type of Schedule*	Station	Frequency Used by Tarawa (Kilocycles)	
Local (M Zone)	Greenwich Mean			Transmission	Reception
1445	0245	C	Tarawa works VQK on 6987.5 kilocycles until weather is collected at 1445M (except Sundays)	6987.5	7490
1455	0255	WX	Tarawa collects weather from Ocean, Funafuti, and Arorae	6987.5	7460
			VQK Ocean Island		7490
1500	0300	C	Tarawa sends traffic list and subs, receives traffic from Southern Gilberts until 1730M	6987.5	7460
1500	0300	C	VQK Ocean Island keeps listening watch on Tarawa for traffic until 1600M (except Sundays)	11000	7490
1510	0315	WX	ZQD Nadi	16077	15600
1530	0330	C	VPD Suva	11000	13395
1600	0400	C	Tarawa works Colony shipping	4413.8	4108.4
1600	0400	C	Watch-keeping this area until 1800M		500
1600	0400	C	VQJ Honiara (except Saturdays, Sundays, and holidays)	11000	11568
1630	0430	C	Bairiki, Bikenibeu	4413.8	3502.5
1645	0445	WX	VQD Nadi administration (except Sundays)	11000	15600
1700	0500	C	VQK Ocean Island keeps watch on Tarawa until 1800M	11000	7490
1730	0530	C	VPD Suva	11000	13395

* C Commercial communications
WX Weather information

Table E-9. Tarawa Radio Schedules (Cont'd)

Time		Type of Schedule*	Station	Frequency Used by Tarawa (Kilocycles)	
Local (M Zone)	Greenwich Mean			Transmission	Reception
1800	0600	WX	Collection of subs weather until 1800M	6987.5	7460 3730
1800	0600	C	Special VHF schedule with Bairiki and Bikenibeu (urgent or priority traffic only)	74000	74000
1820	0620	WX	ZQD Nadi	11000	9400
1830	0630	C	VQN 23 Christmas Island	6987.5	7460 3730
1830	0630	C	ZIT Canton Island keeps listening watch for traffic until 1930M	11000	9825 7460
1900	0700	C	VPD Suva	11000	13395
1930	0730	C	ZJU Funafuti	6987.5	7460 3730
1945	0745	C	VKT Nauru (except Saturdays, Sundays, and holidays)	4413.8	8175
2000	0800	C	Watch-keeping this area until 2200M		500
2000	0800	C	Special VHF schedule with Bairiki and Bikenibeu (urgent or priority traffic only)	74000	74000
2000	0800	C	VQK Ocean Island keeps listening watch until 2200M	11000 6987.5	7490 3745
2200	1000	C	Special VHF schedule with Bairiki and Bikenibeu (urgent or priority traffic only)	74000	74000
2340	1140	WX	ZJU 26 Niulakita	6987.5	7460 3730

* C Commercial communications
WX Weather information

Table E-9. Tarawa Radio Schedules (Cont'd)

Time		Type of Schedule*	Station	Frequency Used by Tarawa (Kilocycles)	
Local (M Zone)	Greenwich Mean			Transmission	Reception
2345	1145	WX	Collection of weather from subs, including ZIT 25 Gardner Island	6987.5	7460 3730
2345	1145	WX	Collection of weather from VQK Ocean Island	6987.5	7490 3745
2400	1200	WX	ZQD Nadi	4413.8	9400

* C Commercial communications
WX Weather information